DISTRICTS SAMPLED AND COMPILED.

1. **NAIROBI SCHOOLS**
2. **STAREHE BOYS CENTER**
3. **MANGU HIGH SCHOOL**
4. **ALLIANCE GIRLS HIGH SCHOOL**
5. **HOMABAY**
6. **RACHUONYO**
7. **MIGORI**
8. **UGENYA/UGUNJA**
9. **KISUMU WEST**
10. **MATUNGU**
11. **BUTERE**
12. **KAKAMEGA EAST**
13. **NYATIKE**
14. **KHWISERO**
15. **TRANS NZOIA WEST**
16. **TRANSMARA**
17. **KAKAMEGA NORTH**
18. **MUMIAS**

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L.C.M

1. a) Find the greatest common divisor of the term. (1 mark)

   $144x^3y^2$ and $81xy^4$

   b) Hence factorise completely this expression $144x^3y^2-81xy^4$ (2 marks)
2. The GCD of two numbers is 7and their LCM is 140. if one of the numbers is 20, find the other number (2mks)
3. The LCM of three numbers is 7920 and their GCD is 12. Two of the numbers are 48 and 264. Using factor notation find the third number if one of its factors is 9. (3mks)
4. Find the least number of sweets that can be packed into polythene bags which contain either 9 or 15 or 20 or 24 sweets with none left over. (3mks)
5. A number n is such that when it is divided by 27, 30, or 45, the remainder is always 3. Find the smallest value of n. (2 mks)
6. A piece of land is to be divided into 20 acres or 24 acres or 28 acres for farming and leave 7 acres for grazing. Determine the smallest size of such land.

7. When a certain number ***x*** is divided by 30, 45 or 54, there is always a remainder of 21. Find the least value of the number ***x***

8. A number **m** is such that when it is divided by 30, 36, and 45, the remainder is always 7. Find the smallest possible value of **m**.

9. Find the L.C.M of $x^2 + x$, $x^2 – 1$ and $x^2 – x$

1. Integers

1. The sum of two numbers exceeds their product by one. Their difference is equal to their product less five. Find the two numbers. (3mks)
2. $3x – 1 > -4$

   $2x + 1\leq 7$

3. Find the value of ***x***

   $2^{(x-3)} \text{ x } 8^{(x+2)} = 128$

4. Evaluate $$\frac{-12 \div (-3) \text{ x } 4 – (-15)}{-5 \text{ x } 6 \ \div 2 + (-5)}$$
5. Without using a calculator/mathematical tables, evaluate leaving your answer as a simple fraction

   $$\frac{(-4)(-2) + (-12) \div (+3)}{-9 –(15)} \quad + \quad \frac{-20 +(+4) + -6)}{46- (8+2)-3}$$
6. Given that $\mathbf{P} = \begin{pmatrix} -2 & 3 \\ -1 & 4 \end{pmatrix}$ and $\mathbf{R} = \begin{pmatrix} -1 & 3 \\ 0 & 2 \end{pmatrix}$ and if $\mathbf{Z} = \mathbf{P}^{-1}\mathbf{R}$. Find **Z**

7. Evaluate $$\frac{-8 \div 2 + 12 \text{ x } 9 – 4 \text{ x } 6}{56 \div 7 \text{ x } 2}$$

2. Fractions

1. Simplify $\dfrac{125^{\frac{2}{3}} \div 3^{4}}{243^{-\frac{3}{5}}}$ (3 mks)

2. Simplify without using calculators and tables

$$\frac{5^{-\frac{1}{2}} \times 20^{\frac{1}{2}}}{64^{\frac{1}{2}} \times 3^{0} \times 5^{2}}$$ (3mks)

3. Evaluate without using a calculator. (3mks)

$$\frac{\left(1\frac{3}{7} - \frac{5}{8}\right) \times \frac{2}{3}}{\frac{3}{4} + 1\frac{5}{7} \div \frac{4}{7}\, of\, 2\frac{1}{3}}$$

4. A two digit number is such that the sum of the ones and the tens digit is ten. If the digits are reversed, the new number formed exceeds the original number by 54.
Find the number. (3 marks)

5. Evaluate $3/8\ \ of \left\{7\frac{3}{5} - \frac{1}{3}\left(1\frac{1}{4} + 3\frac{1}{3}\right) \times 2\frac{2}{5}\right\}$ (3mks)

6. Convert the recurring decimal $12.\dot{1}\dot{8}$ into fraction (3 mks)

7. Simplify $(0.00243)^{-\frac{2}{5}} \times (0.0009)^{\frac{1}{2}}$ without using tables or calculator . (3mks)

8. Evaluate without using tables or calculators (4mks)

$$\frac{\frac{6}{7}\, of\, \frac{14}{3} \div 80 \times -\frac{20}{3}}{-2 \times 5 + (14 \div 7) \times 3}$$

9. Mr. Saidi keeps turkeys and chickens. The number of turkeys exceeds the number of chickens by 6. During an outbreak of a disease, ¼ of the chicken and $^{1}/_{3}$ of the turkeys died. If he lost total of 30 birds, how many birds did he have altogether? (2mks)

10. Work out $\dfrac{8 \div 2 + 12 \times 9 - 4 \times 6}{56 \div 7 \times 2}$ (2mks)

11. Evaluate $\dfrac{-4 \text{ of } (-4 + -5 \div 15) + -3 - 4 \div 2)}{84 \div -7 + 3 - -5}$

12. (a) The recurring decimal $0.\dot{3}$ can be written as $\frac{3}{10} + \frac{3}{100} + \frac{3}{1000} + ...$

(i) Find the common ratio. (2mks)
(ii) Find an expression for the sum of n terms of this series. (3mks)
(iii) Find the 8th term of the series. (2mks)
(b) A ball is dropped from a height 30m above the ground and rebounds to ¾ of previous height continuously until it stops. Find the distance that the ball bounces when it hits the ground the 10th time. (Ans to 2 d.p). (3mks)

13. Evaluate $\dfrac{\frac{5}{6}\, of \left(4\frac{1}{3} - 3\frac{5}{6}\right)}{\frac{5}{12} \times \frac{3}{25} + 1\frac{5}{9} \div 2\frac{1}{3}}$ without using a calculator. (3mks)

14. Without using tables or calculators evaluate.

$$\frac{35 \div 5 + 2 \times -3}{-9 + 14 \div 7 + 4}$$ (4mks)

15. Without using tables or calculator, evaluate the following. (2 mks)

$$\frac{^-8 + (^-13) \text{ x } 3 - (^-5)}{^-1 + (^-6) \div 2 \text{ x } 2}$$

16. Without using tables or calculator evaluate (3 marks)

$$\frac{\sqrt[3]{13824} - 4}{3 + 4 \div 2 - 5 \times 7}$$

17. Express $1.9\dot{3} + 0.\dot{2}\dot{5}$ as a single fraction (3 marks)

18. Simplify

$$\frac{\tfrac{1}{2} \text{ of } \; 3\tfrac{1}{2} + 1\tfrac{1}{2}\,(2\tfrac{1}{2} - {}^{2}/_{3})}{\tfrac{3}{4} \text{ of } 2\tfrac{1}{2} \div \tfrac{1}{2}}$$

19. Evaluate :

$$\frac{{}^{2}/_{5} \div \tfrac{1}{2} \text{ of } {}^{4}/_{9} - 1{}^{1}/_{10}}{{}^{1}/_{8} - {}^{1}/_{6} \text{ of } {}^{3}/_{8}}$$

20. Without using a calculator or table, work out the following leaving the answer as a mixed number in its simplest form:-

$$\frac{\tfrac{3}{4} + 1{}^{2}/_{7} \div {}^{3}/_{7} \text{ of } 2{}^{1}/_{3}}{(\,{}^{9}/_{7} - {}^{3}/_{8}\,) \text{ x } {}^{2}/_{3}}$$

21. Work out the following, giving the answer as a mixed number in its simplest form.

$$\frac{{}^{2}/_{5} \div \tfrac{1}{2} \text{ of } {}^{4}/_{9} - 1\,{}^{1}/_{10}}{{}^{1}/_{8} - {}^{1}/_{16} \text{ x } {}^{3}/_{8}}$$

22. Evaluate ;

$${}^{3}/_{8} \text{ of} \left(7{}^{3}/_{5} - {}^{1}/_{3} \left(1\tfrac{1}{4} + 3{}^{1}/_{3} \right) \text{x } 2{}^{2}/_{5} \right)$$

23. Without using a calculator, evaluate:

$$\frac{1{}^{4}/_{5} \text{ of } {}^{25}/_{18} \div 1{}^{2}/_{3} \text{ x } 24}{2{}^{1}/_{3} - \tfrac{1}{4} \text{ of } 12 \div {}^{5}/_{3}}$$ Leaving the answer as a fraction in its simplest form

24. There was a fund-raising in Matisi high school. One seventh of the money that was raised was used to construct a teacher's house and two thirds of the remaining money was used to construct classrooms. If shs.300,000 remained, how much money was raised

3. Decimals

1. Without using mathematical tables or calculators, evaluate: (3 mks)

$$\frac{0.0168 \times 2.46 \times 7}{5.74 \times 0.112}$$

2. A two-digit number is such that the sum of the ones digit and the tens digit is 10. If the digits are reversed, the number formed exceeds the original number by 54. Find the number (3 mks)

3. Without using tables and calculators, evaluate

$$\sqrt[3]{\frac{0.032+0.0608}{1.28\times 0.4}}$$ (3mks)

4. Use a calculator to find;
 (a) 8754.3 x 53.84
 (b) 0.8341 + 8.72

 Hence find; $\sqrt[3]{\frac{8754.3 \text{ x } 53.84}{0.8341 + 8.72}}$

5. Express the recurring decimal below to a fraction 5.72 and leaving your answer in the form $^{a}/_{b}$ where **a** and **b** are whole numbers

6. Evaluate:- **0.38 x 0.23 x 2.7** without using tables or a calculator

7. Without using mathematical tables or calculator, evaluate:

$$\frac{0.084 \text{ x } 1.32 \text{ x } 3.5}{2.87 \text{ x } 0.056}$$

 Leaving the answer as a fraction in its simplest form.

8. Find without using a calculator, the value of :

$$\frac{12\sqrt{0.0625} - 12.4 \div 0.4 \text{ x } 3}{^{1}/_{8} \text{ of } 2.56 + 8.68}$$

4. Squares and square roots

1. Evaluate without using tables or calculators

$$\sqrt[3]{\frac{0.125\times\sqrt{64}}{0.064\times\sqrt{629}}}$$ (4mks)

2. Evaluate using reciprocals, square and square root tables only.

$$\sqrt{\frac{\left(445.1\times 10^{-1}\right)^{2}+1}{0.07245}}$$ (3mks)

3. Using a calculator, evaluate $\frac{\sqrt{(4.652\times 0.387)^{2}}}{0.8462}$ (3mks)

 (Show your working at each stage)

4. Use tables of reciprocals and square roots to evaluate

$$\sqrt{\frac{2}{o.5893}-\frac{1.06}{846.3}}$$ (3marks)

5. Use tables to find;
 a) i) 4.978^{2}
  ii) The reciprocal of 31.65
 b) Hence evaluate to 4.S.F the value of
  $4.978^{2} - {}^{1}/_{31.65}$

6. Use tables of squares, square roots and reciprocals to evaluate correct to 4 s.f

$$\frac{3}{\sqrt{0.0136}} - \frac{2}{(3.72)2}$$

7. Without using mathematical tables or calculator, evaluate: $\sqrt{\dfrac{153 \text{ x } 1.8}{0.68 \text{ x } 0.32}}$ giving your answer in standard form

5. Algebraic expressions

1. Simplify $\dfrac{3Z^2 - 12}{3-(1+Z)}$ (3mks)

2. Five year ago, a mother's age was four times that of her daughter. In four years to come, she will be 2 ½ times the age of her daughter. Calculate the sum of their present ages

3. Mutua bought 160 trays of 8 eggs each at shs.150 per tray. On transportation 12 eggs broke. He later discovered that 20 eggs were rotten. If he sold the rest at shs.180 per tray, how much profit did he make?
4. Simplify;
(a) $6a – 2b + 7a – 4b + 2$
(b) $\dfrac{2x-2}{2x} - \dfrac{3x+2}{4x}$

5. Simplify $\dfrac{6x^2y^2 + 13xy - 5}{3x^2y^2 - 13xy + 4}$

6. Given that $x + y = 8$ and $x^2 + y^2 = 24$
Find;
(a) the value of $x^2 + 2xy + y^2$
(b) Find the value of ; $2xy$
(c) $x^2 – 2xy + y^2$
(d) $x – y$
(e) Value of x and y

7. Simplify the expression.
$\dfrac{6x^2 + 35x - 6}{2x^2 - 72}$

8. Simplify the expression
$^2/_3\,(3x -2) – ^3/_4\,(2x -2)$

9. Simplify by factorizing completely:
$\dfrac{4y^2 - x^2}{2x^2 - yx - 6y^2}$
10. Simplify as far as possible.
$\dfrac{3}{x-y} - \dfrac{1}{x+y}$

11. By calculation, find the coordinates of the intersection of the graphs **$y = x^2 + 2x - 5$** and **$y = 3x + 1$**

12. Simplify:

(a) $\frac{\mathbf{y^2 + 2y}}{\mathbf{y^3 - y^2 - 6y}}$ **= ¼**

(b) hence solve:- $\frac{\mathbf{y_2 + 2y = ¼}}{\mathbf{y^3 - y^2 - 6y}}$

13. A rectangular field measures 63.9m by 104.6metres find the minimum number of poles to be erected for fencing if they are to be at most 2.4meters apart.

14. Factorize completely the expression
$75x^2 - 27y^2$

15. Every time an insect jumps forward the distance covered is half of the previous jump. If the insect initially jumped 8.4cm, calculate
(i) To the nearest two decimal places distance of the sixth jump
(ii) The total distance covered after the sixth jump

16. Simplify $\frac{P^3 - Pq^2 + P^2q - q^3}{P^2 + 2pq + q^2}$

17. Simplify the expression:- $\frac{9x^2 - 4y^2}{12x^2 + yx - 6y^2}$

18. Given that (x-3) $(Ax^2+bx+c) = x^3-7x-6$, find the value of A, B and C

19. a) solve for **y** in $8x(2^2)^y=6x2^y-1$
b) Simplify completely $\frac{2x^2-98}{3x^2-16x-35} \div \frac{x+7}{3x+5}$

20. Simplify the expression.:

$$\frac{4x^2 - y^2}{2x^2 - 7xy + 3y^2}$$

21. Simplify $\frac{P^2 - 2Pq + q^2}{P^3 - Pq^2 + P^2q - q^3}$

22. The sum of two numbers is 15. The difference between five times the first number and three times the second number is 19. Find the two numbers

23. Simplify the following expressions by reducing it to a single fraction
$$\frac{2x - 5}{4} - \frac{1 - x}{3} - \frac{x - 4}{2}$$

24. Simplify the expression:- $\frac{3a^2 + 4ab + b^2}{4a^2 + 3ab - b^2}$

6. Rates, Ratio and percentages

1. Mary has 21 coins whose total value is shs 72. There are twice as many five shillings coins as there are ten shillings coins. The rest are one shilling coins. Find the number of ten shillings coins that Mary has. (3mks)

2. (a) Divide $100cm^3$ in the ratio $\frac{1}{4}:\frac{1}{2}:\frac{1}{5}$ to the nearest whole number. (3mks)

(b) In a chemistry experiment, a boy mixed some acid solution of 45% concentration with an acid solution of 25% concentration. In what proportion should the two acids be mixed in order to get 100cm^3 of solution of 30% concentration. (3mks)

(c) (i) Two blends of tea costing sh 140 and sh 160 per kg respectively are mixed in the proportion of 2:3 by mass. The mixture is then sold at sh 240 per kg. Find the gain percent (2mks)

(ii) In what ratio should the two blends be mixed to get a mixture that costs sh 148 per kg. (2mks)

3. A cylindrical water tank is of diameter 14 metres and height 3.5 metres.

(a) Find the capacity of the water tank in litre. (3mks)

(b) Six members of a family use 20 litres each per day. Each day 80 litre are used for cooking and washing. A further 50 litres is wasted daily. Find the number of complete days a full tank would last the family. (3mks)

(c) Two members of the family were absent for 90 days. During this time, wasting was reduced by 20% as cooking and washing remained the same. Calculate the number of days a full tank would now last the family. (4mks)

4. The length of a rectangle is increased by 20% while the width is decreased by 10%. Find the percentage change in area. (2 mks)

5. (a) Divide 1000cm^3 in the ratio $\frac{1}{4}:\frac{1}{2}:\frac{1}{5}$, leaving your answer to the nearest 1 cm (3mks)

(b) In a Chemistry experiment, a boy mixed some acid solution of 45% concentration with an acid solution of 25% concentration. In what proportion should the two acids be mixed in order to get 100cm^3 of solution of 30% concentration? (3 mks)

(c) (i) Two blends of tea costing ksh. 140 and ksh. 160 per kilogram respectively are mixed in the proportion of 2:3 by mass. The mixture is sold at ksh. 240 per kilogram. Find the gain percent (2 mks)

(ii) In what ratio should the two blends be mixed to get a mixture that costs ksh. 148 per kilogram (2 mks)

6. Senjeni and Mkimwa entered into a business partnership in which they contributed ksh. 120,000 and ksh 150,000 every year respectively. After one year, Kuku joined the business and contributed ksh. 90,000.

(a) Calculate the ratio of their investment after 3 years of business (3mks)

(b) It was agreed that 30% of the profits after 3 years be used to cater for the cost of running the business, while the remaining would be shared proportionally. Calculate each persons share, if the profit made after three years was ksh. 187,000 (4mks)

(c) If each of them invested their shares back in the business, find their new individual investments at the beginning of the fourth year (3mks)

7. The population of elephants in Kenya's game reserves is 40,000 at present. If their population increase is estimated to be 30% every 10 years, calculate their population in 30 years time to the nearest 10. (3mks)

8. Fifteen men working for eight hours a day can complete a certain job in exactly 24 days. For how many hours a day must sixteen men work inorder to complete the same job in exactly 20 .days. (2mks)

9. Mwandime and Mwashuma working together do a piece of work in 22/5 days. Mwandime working alone takes 2 days less than Mwashuma. How long does it take Mwashuma to do the work alone. (4 mks)

10. 20 women working four hours a day take 12 days to complete a job. If 8 of the women wish to do the same for 12 days, how many hours a day would they have to do work? (2 marks)

11. If 5 men can erect 2 cottages in 21days, how many more men, working at the same rate will be needed to erect 2 cottages in the same period?

12. The length and width of a rectangular paper were measured to the nearest centimeter and found to be 18cm and 12cm respectively. Find the percentage error in its perimeter

in 6 hrs.

13. a) Two pipes **A** and **B** can fill a tank in 3hrs and 4 hrs respectively. Pipe **C** can empty the full tank
    i) How long would it take pipes **A** and **B** to fill the tank if pipe **C** is closed?
    ii) Starting with an empty tank, how long would it take to fill the tank with all pipes running?
    b) The high quality Kencoffee is a mixture of pure Arabica coffee and pure Robusta coffee in the ratio 1 : 3 by mass. Pure Arabica coffee costs shs. 180 per kg and pure Robusta coffee costs sh 120 per kg. Calculate the percentage profit when the coffee is sold at sh 162 per kg.

14. A number of nurses working at Sotik Health Centre decided to raise shs.144,000 to buy a plot of land. Each person was to contribute the same amount. Before the contributions were collected five of the nurses retired. This meant that the remaining contributors had to pay more to meet the target.
    (a) If there were **n** nurses originally, find the expression of the increase in contribution per person
    (b) If the increase in the contribution per person was shs.2,400, find the number of nurses originally at the health centre
    (c) How much would each person have contributed to nearest shilling if the 5 people had not retired
    (d) Calculate the percentage increase in the contribution per person because of the retirement

15. 3 taps **X,Y** and **Z** can fill a tank in 40 hours, 15 hours and 20 hours respectively. The three taps are turned on at 8.00a.m when the tank is empty for five hours then **Z** is turned off. After two hours tap **Y** is turned off. Work out ;-
    (a) The proportion of water in the tank after seven hours
    (b) The proportion of water in the tank after seven hours
    (c) The time the tank will be completely full

16. Jane and Philip working together can do a piece of work in 6 days. Jane working alone takes 5 days longer than Philip. How many days does it take Philip to do the work alone?

17. Sixteen men working 9 hours a day can complete a piece of work in 14 days. How many more men working 7 hours a day would complete the same job in 12 days?

18. A group of people planned to contribute equally towards buying land at a price of shs.180000. However 3 members of the group withdrew from the project. As a result, each of the remaining members were to contribute kshs.3000 more.
    (a) find the original number of members in the group
    (b) How much would each person have contributed if the 3 people had not withdrew
    (c) Calculate the percentage increase in the contribution per person caused by the withdrawal

19. Kori and Mue decided to start a business. Korir contributed shs.40,000 and Mue shs.64000. The two men agreed that in any year, 15% of the profit shall be divided equally between them and 20% of the profit will be used to meet the cost of running the business the following year. They also agreed to share the rest of the profit in the ratio of their contributions. The profit made after the first year was shs.43200.
    a) How much did they set aside towards the cost of running the business for the second year?*
    b) How much did Mue receive at the end of the first year?
    (c) Korir bought cows with his share of the profit. If each cow cost shs.1800, how many cows did he buy?

20. Given the ratio x : y = 2:3, find the ratio (7x – 3y) : (2x + 3y)

21. Abdul bought five bulls and thirty goats at an auction spending a total of Kshs.117000. His friend Ali bought four bulls and twenty five goats at the same auction and spent Kshs.22,250 less.
    (a) Find the cost of each animal at the auction
    (b) Abdul later sold all his animals at a profit of 40% per bull and 30% per goat. Ali sold all his animals at a profit of 50% per bull and 40% per goat. Determine who made more profit and by how much?

22. The cost of providing a commodity consists of transport, labour and raw material in the ratio 8:4:12 respectively. If the transport cost increases by 12% labour cost 18% and raw materials by 40%, find the percentage increase of producing the new commodity

23. A mother is now 2½ times as old as her daughter Mary; four years ago the ratio of their ages was 3:1. Find the present age of the mother

24. Sixteen men working at the rate of 9hrs a day can complete a piece of work in 14 days. How many more men working at the rate of 7 hours a day would complete the same job in 12 days

25. Two business partners, Kago and Beatrice contributed 90, 000/= and 120,000/= in order to start a business. They agreed that 25% of the profit made after end of the year will be put back into the business. They also estimated that 40% of the profit will cover salaries and other expenses for the year. The remainder would be shared between the partners in the ratio of their contributions. At the end of the first year the business realized a gross profit of shs.181,300.
    a) Calculate how much each received after end of the year.

    b) At the end of 2nd year the business realized the same gross profit as the previous year and the partners decided to dissolve the business and share everything . Determine how much money each received.

26. A number is such that the product of its digits is 24. When the digits are reversed, the number so formed exceeds the original number by 27. Find the number
27. The radius of a cylinder is increased by 30% while its height is decreased by 20%. Find the percentage change in the volume of the cylinder

28. Tap **A** fills a tank in 6 hours, tap **B** fills it in 8 hours and tap **C** empties it in10 hours. Starting with an empty tank and all the three taps are opened at the same time, how long will it take to fill the tank?

29. Sixteen men working 9 hours a day can complete a piece of work in 14 days. How many more men working 7 hours a day would complete the same job in 12 days?

30. Three businessmen Langat, Korir and Koech contributed shs.160,000, Shs.200,000 and shs.240,000 respectively and started a business. They agreed that 30% of the profit each year will go to expenses, 15% of the reminder would go back to the business. The rest of the profit would be shared in the ratio of their contribution. At the end of the first year, the business realized a profit of kshs.60,000.
    Calculate how much;
    (a) (i) Langat received
    (ii) Korir received
    (iii) Koech received

(b) Express what Korir received as a percentage of the total profit

31. The price of a book is increased by 25%.
    (a) In what ratio has the price increased?
    (b) What is the new price if the book was shs.400 before the change?

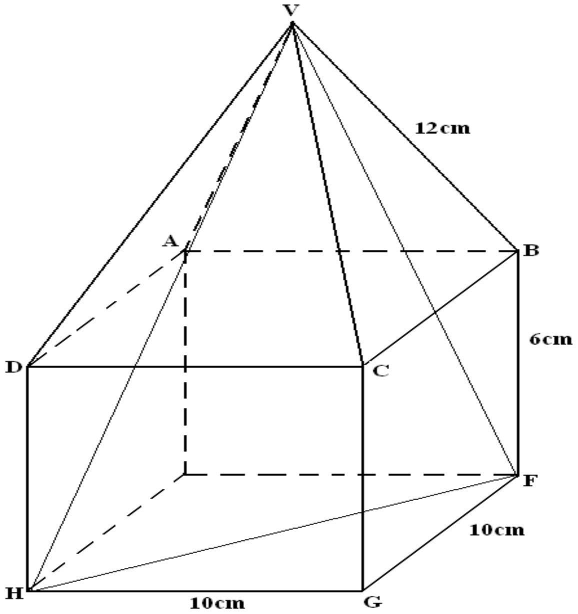
32. (a) A chemist added 120 liters of a solution A containing 25% alcohol to 180 liters of solution **B** containing 20% alcohol. What percentage of the resulting solution in alcohol?
    (b) He removed **X** liters of resulting mixture and added an equal amount of pure alcohol to the resulting mixture. If the new mixture contains 22% of the alcohol, find the value of **X**

33. The length and width of a rectangular paper were measured to the nearest centimeter and found to be 18cm and 12cm respectively. Find the percentage error in its perimeter

34. Given that a:b = 1: 2 and b:c = 3:4. Find a:b:c

7. length

1. Two coils which are made by winding copper wire of different gauges and length have the same mass. The first coil is made by winding 270 metres of wire with cross sectional diameter 2.8mm while the second coil is made by winding a certain length of wire with cross-sectional diameter 2.1mm. Find the length of wire in the second coil . (4 marks)
2. The figure below represents a model of a hut with HG = GF = 10cm and FB = 6cm. The four slanting edges of the roof are each 12cm long.



Calculate

a. Length DF. (2 mks)
b. Angle VHF (2 mks)
c. The length of the projection of line VH on the plane EFGH. (1 mk)
d. The height of the model hut. (2 mks)
e. The length VH. (1 mk)
f. The angle DF makes with the plane ABCD. (2 mks)

3. A square floor is fitted with rectangular tiles of periemeter 220 cm. each row (tile length wise) carries 20 less tiles than each column (tiles breadth wise). If the length of the floor is 9.6 m. Calculate:
   a. The dimensions of the tiles (6 marks)
   b. The number of tiles needed (2 marks)
   c. The cost of fitting the tiles, if tiles are sold in dozens at sh. 1500 per dozen and the labour cost is sh. 3000 (2 marks)

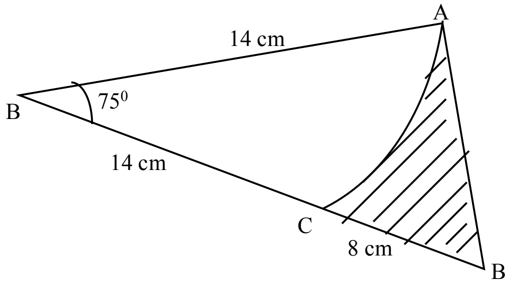
4. Simplify; by factorization:

$$\frac{15x^2 + xy - 6y^2}{5x^2 - 8xy + 3y^2}$$

5. Given the matrices M = $\begin{pmatrix} 3 & 0 \\ -1 & 4 \end{pmatrix}$, R = $\begin{pmatrix} -1 & 2 \\ 0 & 0 \end{pmatrix}$ and N = $\begin{pmatrix} {}^{2}/_{3} & 1 \\ 2 & 4 \end{pmatrix}$. Find the value of value of 3n + ½ (R-M)

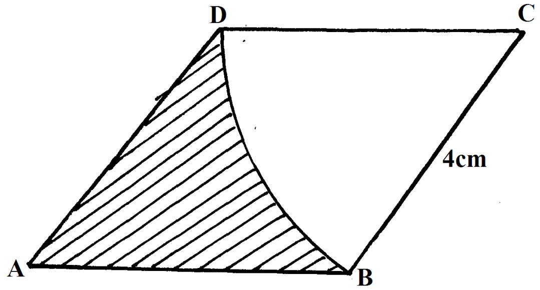
8. Area

1. Calculate the area of the shaded region below, given that AC is an arc of a circle centre B. AB=BC=14cm CD=8cm and angle ABD = 75^0 (4 mks)

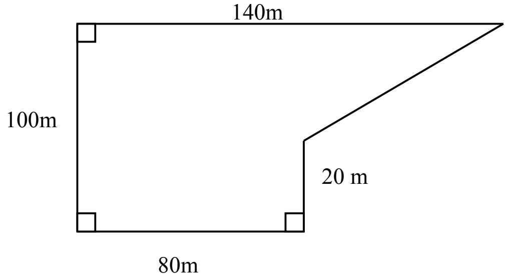


2 The scale of a map is 1:50000. A lake on the map is $6.16cm^2$. find the actual area of the lake in hactares. (3mks)

3. The figure below is a rhombus ABCD of sides 4cm. BD is an arc of circle centre C. Given that $\angle ABC = 138^0$. Find the area of shaded region. (3mks)

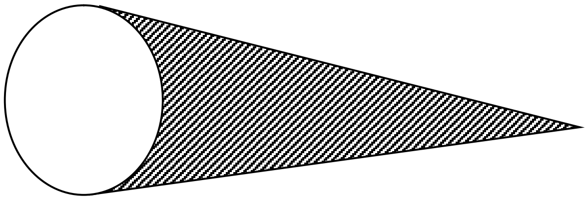


4. The figure below sows the shape of Kamau's farm with dimensions shown in meters



Find the area of Kamau's farm in hectares (3mks)

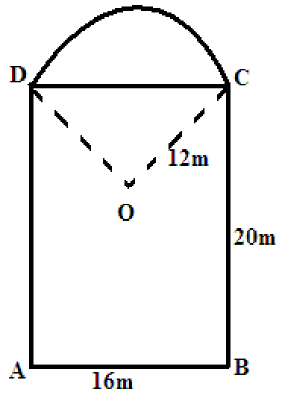
5. In the figure below AB and AC are tangents to the circle centre O at B and C respectively, the angle AOC = 60^0



Calculate

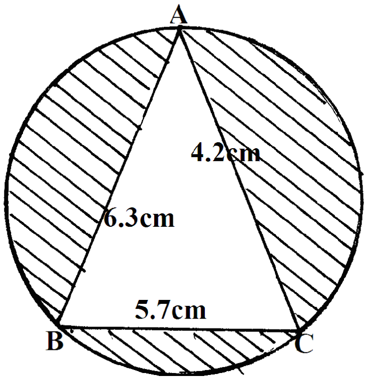
(a) The length of AC (2 marks)

6. The figure below shows the floor of a hall. A part of this floor is in the shape of a rectangle of length 20m and width 16m and the rest is a segment of a circle of radius 12m. Use the figure to find:-

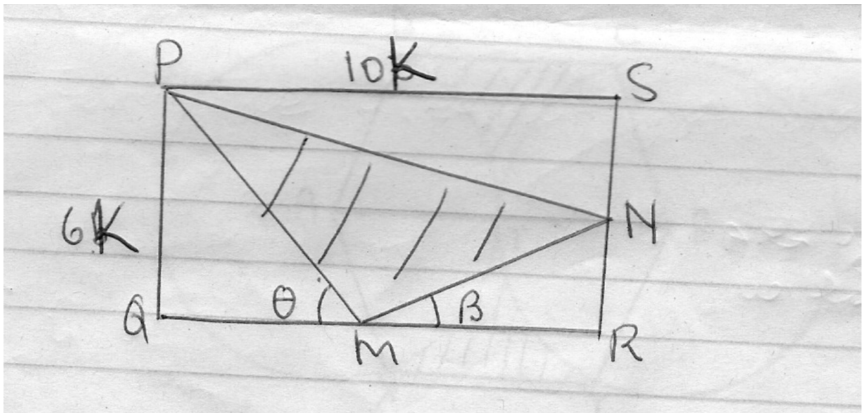


(a) The size of angle COD (2mks)
(b) The area of figure DABCO (4mks)
(c) Area of sector ODC (2mks)
(d) Area of the floor of the house. (2mks)

7. The circle below whose area is 18.05cm^2 circumscribes a triangle ABC where AB = 6.3cm, BC = 5.7cm and AC = 4.8cm. Find the area of the shaded part (4 mks)

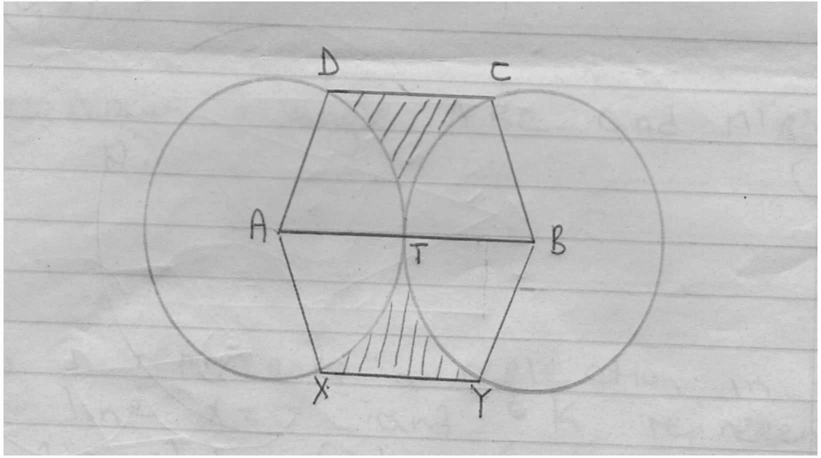


8. In the figure below, PQRS is a rectangle in which PS=10k cm and PQ = 6k cm. M and N are midpoints of QR and RS respectively



a) Find the are of the shaded region (4 marks)
b) Given that the area of the triangle MNR = 30 cm^2. find the dimensions of the rectangle (2 marks)
c) Calculate the sizes of angles θ and β giving your answer to 2 decimal places (4 marks)

9. The figure below shows two circles each of radius 10.5 cm with centres A and B. the circles touch each other at T



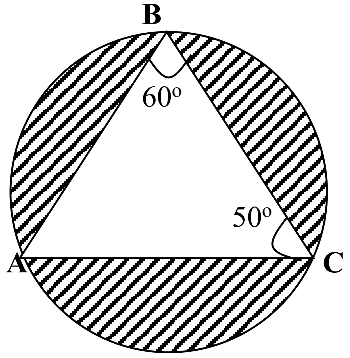
Given that angle XAD =angle YBC = 160^0 and lines XY, ATB and DC are parallel, calculate the area of:

d) The minor sector AXTD (2 marks)
e) Figure AXYBCD (6marks)
f) The shaded region (2 marks)

10. A student took the measurements of his classroom and gave the width as 7m and the length as 9m. If there is an error of 2% in each measurement, determine the greatest value of $\frac{\mathbf{x + y}}{\mathbf{x}}$ if **x** and **y** are the width and length of the classroom respectively.
Give your answer to 4 decimal places.

11. The floor of a room is in the shape of a rectangle 10.5 m long by 6 m wide. Square tiles of length 30 cm are to be fitted onto the floor.
(a) Calculate the number of tiles needed for the floor.
(b) A dealer wishes to buy enough tiles for fifteen such rooms. The tiles are packed in cartons each containing 20 tiles. The cost of each carton is Kshs. 800. Calculate
(i) the total cost of the tiles.
(ii) If in addition, the dealer spends Kshs. 2,000 and Kshs. 600 on transport and subsistence respectively, at what price should he sell each carton in order to make a profit of 12.5% (Give your answer to the nearest Kshs.)

12. The figure below is a circle of radius 5cm. Points **A, B** and **C** are the vertices of the triangle ABC in which $\angle ABC = 60^o$ and $\angle ACB = 50^o$ which is in the circle. Calculate the area of ΔABC)



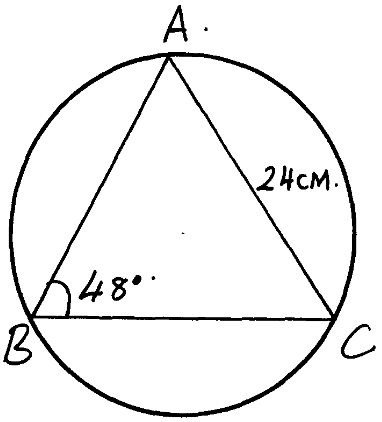
13. Mr.Wanyama has a plot that is in a triangular form. The plot measures 170m, 190m and 210m, but the altitudes of the plot as well as the angles are not known. Find the area of the plot in hectares

14. Three sirens wail at intervals of thirty minutes, fifty minutes and thirty five minutes.

If they wail together at 7.18a.m on Monday, what time and day will they next wail together?

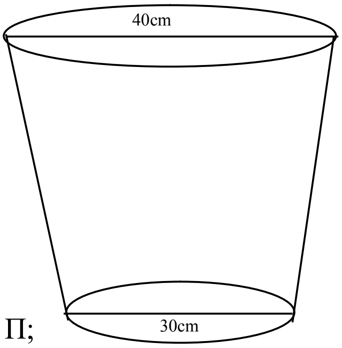
15. A farmer decides to put two-thirds of his farm under crops. Of this, he put a quarter under maize and four-fifths of the remainder under beans. The rest is planted with carrots. If 0.9acres are under carrots, find the total area of the farm

16. Find the area of the circle sector.



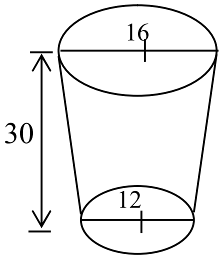
9. Volume and capacity

1. The figure below shows a bucket of depth 30cm used to fill a cylindrical tank of radius 1.2m and height 1.35m which is initially three-fifth full of water.



a) Calculate, in terms of Π;
   (i) The capacity of the bucket in litres (5mks)
   (ii) The volume of water required to fill the tank in litres (2mks)
   (iii) Calculate the number of buckets that must be drawn to fill the tank (3mks)

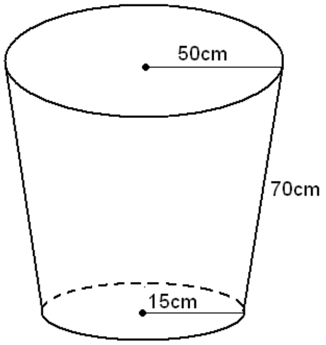
2. A bucket is in the shape of a frustum with base radius 12cm and top radius 16cm. The slant height of the bucket is 30cm as shown below. The bucket is full of water.
   (a) Calculate the volume of the water. (Take $\pi = 3.142$) (6 marks)



(b) All the water is poured into a cylindrical container of circular radius 12cm. If the cylinder has height 45cm, calculate the surface area of the cylinder which is not in contact with water. (4 marks)

3. The British government hired two planes to airlift football fans to South Africa for the World cup tournament. Each plane took 10 ½ hours to reach the destination.
Boeng 747 has carrying capacity of 300 people and consumes fuel at 120 litres per minute. It makes 5 trips at full capacity. Boeng 740 has carrying capacity of 140 people and consumes fuel at 200 litres per minute. It makes 8 trips at full capacity. If the government sponsored the fans one way at the cost of 800 dollars per fan, calculate:
(a) The total number of fans airlifted to South Africa. (2mks)
(b) The total cost of fuel used if one litre costs 0.3 dollars. (4mks)
(c) The total collection in dollars made by each plane. (2mks)
(d) The net profit made by each plane. (2mks)

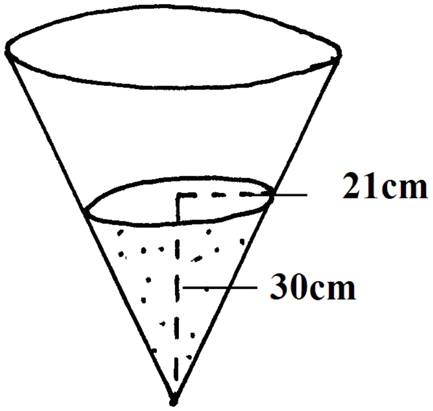
4. The figure below represents a part in form of a frustum of a right circular cover. The upper and the lower radii are 50cm and 15cm respectively. The slant height is 70cm.



a. Calculate the height of the pail. (5 cm)

b. Find the capacity of the pail to the nearest a litre. (5 mks)

5. Consider the vessel below



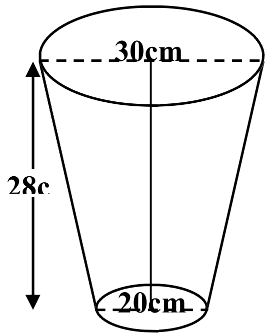
a) Calculate the volume of water in the vessel.
b) When a metallic hemisphere is completely submerged in the water, the level of the water rose by 6cm. Calculate:
i) the radius of the new water surface.
ii) the volume of the metallic hemisphere (to 4 s.f)
iii) the diameter of the hemisphere (10 mks)

6. A village water tank is in the form of a frustrum of a cone of height 3.2m.
The top and bottom radii are 18m and 24m respectively

(a) Calculate:
 (i) The surface area of the tank excluding the bottom
 (ii) The capacity of the water tank

(b) 15 families each having 15 members use the water tank and each person uses 65 litres of water daily. How long will it take for the full tank to be emptied

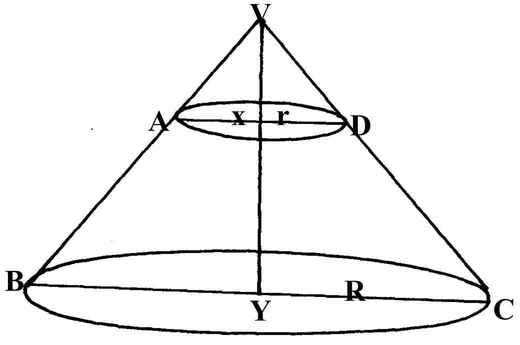
7. The diagram below shows a bucket with a top diameter 30cm and bottom diameter 20cm. The height of the bucket is 28cm
 (a) Calculate the capacity of the bucket in litres



(b) Find the area of the metal sheet required to make 100 such buckets taking 10% extra for overlapping and wastage

8. A rectangular water tank measures 2.6m by 4.8m at the base and has water to a height of 3.2m. Find the volume of water in litres that is in the tank

9. The figure alongside shows a cone from which a frustum is made. A plane parallel to the base cuts the cone two thirds way up the vertical height of the cone to form frustum **ABCD**. The top surface radius of the frustum is labeled **r** and the bottom radius is **R**



a) Find the ratio r:R
b) Given that r = 7cm, find R
c) If the height VY of the original cone is 45cm, calculate to the nearest whole number the volume of the frustum
d) The frustum represents a bucket which is used to fill a rectangular tank measuring 1.5m long, 1.2m wide and 80cm high with water. How many full buckets of water are required to fill the tank

10. Three litres of water (density1g/cm^3) is added to twelve litres of alcohol (density 0.8g/cm^3. What is the density of the mixture?

11. A rectangular tank whose internal dimensions are 2.2m by 1.4m by 1.7m is three fifth full

of milk.

(a) Calculate the volume of milk in litres

(b) The milk is packed in small packets in the shape of a right pyramid with an equilateral base triangle of sides 10cm. The vertical height of each packet is 13.6cm. Full packets obtained are sold at shs.30 per packet. Calculate:

(i) The volume in cm^3 of each packet to the nearest whole number

(ii) The number of full packets of milk

(iii) The amount of money realized from the sale of milk

12. An 890kg culvert is made of a hollow cylindrical material with outer radius of 76cm and an inner radius of 64cm. It crosses a road of width 3m, determine the density of the material used in its construction in Kg/m^3 correct to 1 decimal place.

10. Mass, weight and density

1. A squared brass plate is 2mm thick and has a mass of 1.05kg. The density of brass is 8.4g/cm. Calculate the length of the plate in centimeters. (3mks)
2. A sphere has a surface area $18cm^2$. Find its density if the sphere has a mass of 100g. (3mks)
3. Nyahururu Municipal Council is to construct a floor of an open wholesale market whose area is $800m^2$. The floor is to be covered with a slab of uniform thickness of 200mm. In order to make the slab, sand, cement and ballast are to be mixed such that their masses are in the ratio 3:2:3. The mass of dry slab of volume $1m^3$ is 2000kg. Calculate

   (a) (i) The volume of the slab (2mks)

   (ii) The mass of the dry slab. (2mks)

   (iii) The mass of cement to be used. (2mks)

   (b) If one bag of the cement is 50kg, find the number of bags to be purchased. (1mk)

   (c) If a lorry carries 10 tonnes of ballast, calculate the number of lorries of ballast to be purchased. (3mks)
4. A sphere has a surface area of $18.0cm^2$. Find its density if the sphere has a mass of 100 grammes. (3 mks)
5. A piece of metal has a volume of 20 cm^3 and a mass of 300g. Calculate the density of the metal in kg/m^3.
6. 2.5 litres of water density $1g/cm^3$ is added to 8 litres of alcohol density $0.8g/cm^3$. Calculate the density of the mixture

11.Time

1. A van travelled from Kitale to Kisumu a distance of 160km. The average speed of the van for the first 100km was 40km/h and the remaining part of the journey its average speed was 30km/h. Calculate the average speed for the whole journey. (3 mks)
2. A watch which looses a half-minute every hour was set to read the correct time at 0545h on Monday. Determine the time, in the 12 hour system, the watch will show on the following Friday at 1945h.

3. A watch which loses a half-minute every hour was set to read the correct time at 0445h on Monday. Determine the time in 12-hour system, the watch will show on the following Friday at 1845h

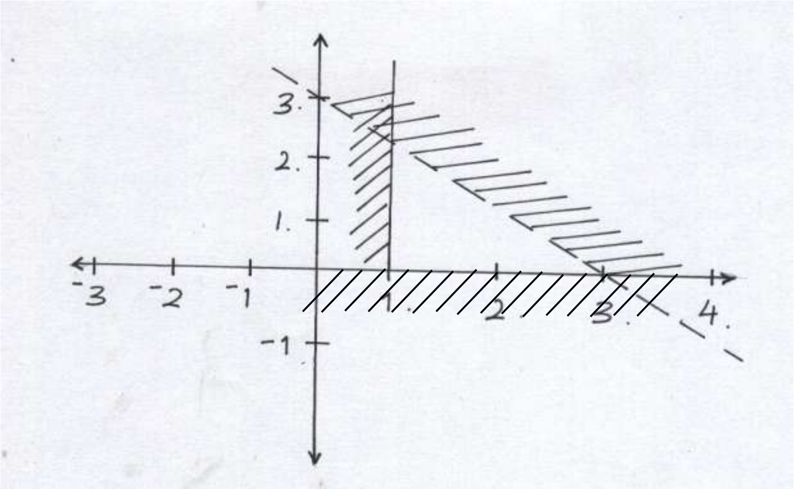
4. The timetable below shows the departure and arrival time for a bus plying between two towns **M** and **R**, 300km apart

Town	**Arrival**	**Departure**
M		0830h
N	1000h	1020h
P	1310h	1340h
Q	1510h	1520h
R	1600h	

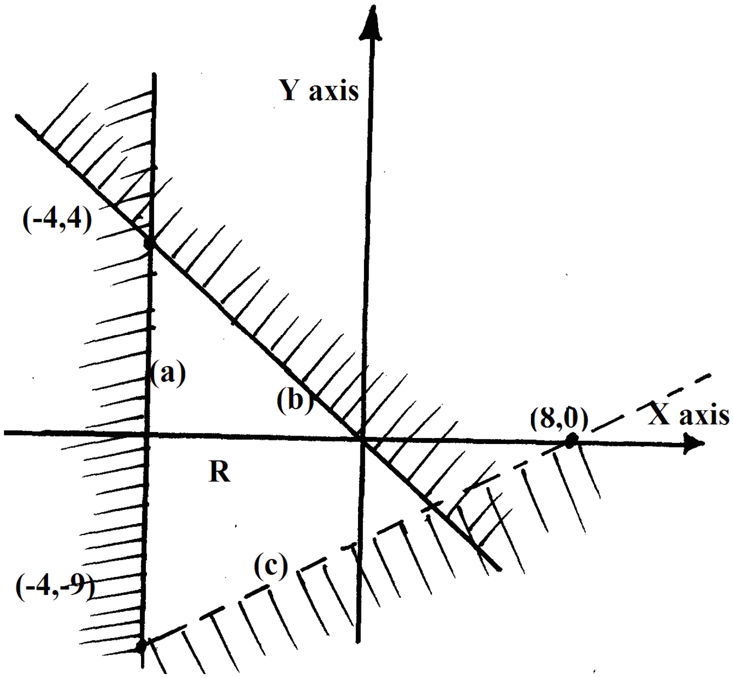
(a) How long does the bus take to travel from town **M** to **R?**
(b) What is the average speed for the whole journey?

12. Linear

1. Determine the inequalities that represent and satisfies the unshaded region (3 mks)



2. Write down the inequalities that satisfy the u shaded region in the figure below. (4mks)



3. Find all integral values that satisfy the inequality $2x + 3 \geq 5x – 3 > -8$. (3mks)

4. a) Find the range of values x which satisfied the following inequalities simultaneously. (2 mks)

$$4x – 9 \leq 6 + x$$
$$8 – 3x \leq x + 4$$

b) Represent the range of values of x on a number line. (1 mark)

5. Solve the inequality $-2x + 1 < x - 5 < 5 - x$ (2mks)

6. (a) Show by shading the unwanted region the area represented by $4y < x + 11$, $x \geq 1$, $x + y \leq 9$ and $5y > 3x - 3$ on the grid provided (8 mks)

(b) Calculate the area of the enclosed region (2 mks)

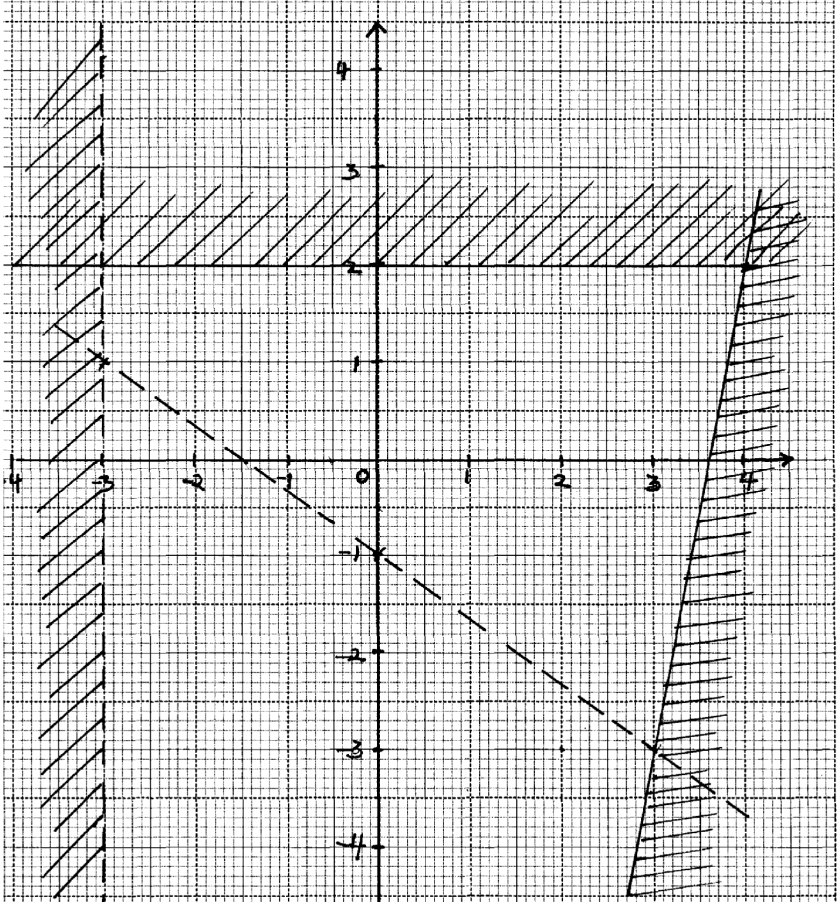
7. Solve the inequality below and write down the integral values that satisfy the equality $-3x + 2 < x + 6 \leq 17 – 2x$ (3 mks)

8. State all the integral values of a which satisfy the inequality

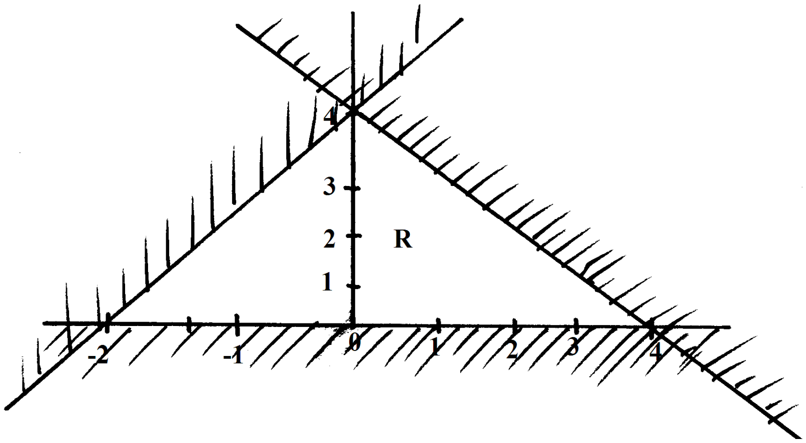
$$\frac{3a+2}{4} \leq \frac{2a+3}{5} \leq \frac{4a+15}{6}$$ (3mks)

9. Solve the inequality $\frac{1}{2}x - 2 \leq 3x – 2 < 2 + \frac{1}{2}x$ and state the integral values which satisfy this inequalities. (3 marks)

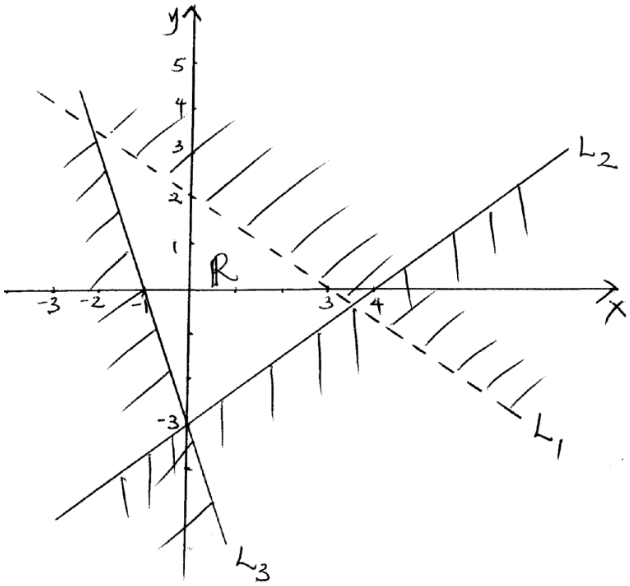
10. Write down the inequalities that satisfy the given region simultaneously. (3mks)



11. Write down the inequalities that define the unshaded region marked R in the figure below. (3mks)



12. Write down all the inequalities represented by the regions R. (3mks)

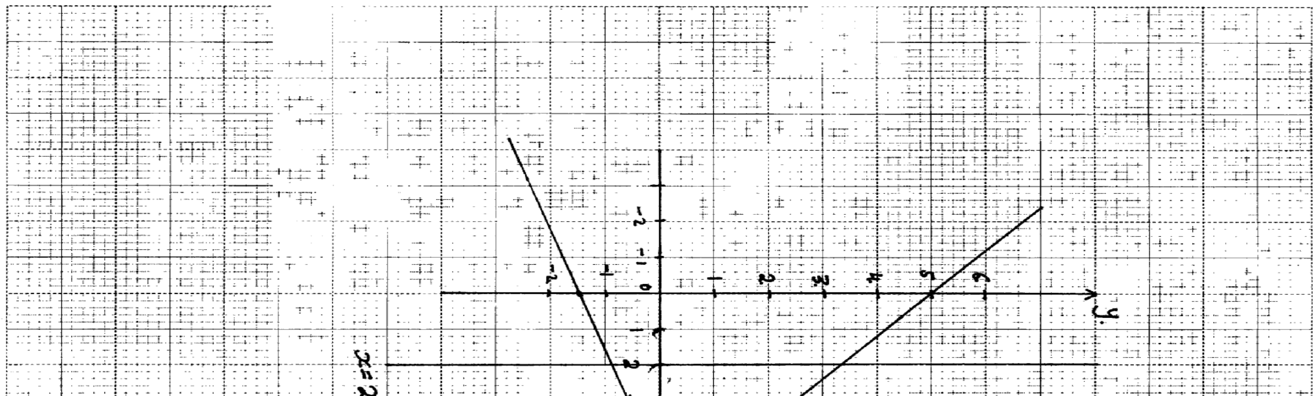


13. a) On the grid provided draw the graph of $y = 4 + 3x - x^2$ for the integral values of x in the interval $-2 \le X \le 5$. Use a scale of 2cm to represent 1 unit on the x – axis and 1 cm to represent 1 unit on the y – axis. (6mks)
b) State the turning point of the graph. (1mk)
c) Use your graph to solve.
(i) $-x^2 + 3x + 4 = 0$
(ii) $4x = x^2$ (3mks)

14. Solve the following inequality (3 marks)

$$\frac{2x}{3} - 5.5 \le 9.5 - \frac{3x}{4} \le \frac{x}{3} + 18$$

15. The diagram below shows the graphs of $y = {}^{3}/_{10}\,x - {}^{3}/_{2}$, $5x + 6y = 3$ and $x = 2$



By shading the unwanted region, determine and label the region **R** that satisfies the three inequalities; $y \geq {}^{3}/_{10}\, x - {}^{3}/_{2}$,
$5x + 6y \geq 30$ and $x \geq 2$

16. The cost of 7 shirts and 3 pairs of trousers is shs. 2950 while that of 5 pairs of trousers and 3 shirts is less by 200. How much will Dan pay for 2 shirts and 2 pairs of trousers?

17. Mr. Wafula went to the supermarket and bought two biros and five pencils at sh.120. Whereas three biros and two pencils cost him sh.114. Find the cost of each biros and pencils

18. A father is twice as old as his son now. Ten years ago, the ratio of their ages was 5:2. Find their present ages

19. List the integral values of **x** which satisfy the inequalities below:-
$2x + 21 > 15 - 2x \geq x + 6$

20. Find the equation of a line which passes through (-1, -4) and is perpendicular to the line:-
$y + 2x - 4 = 0$

21. John bought two shirts and three pairs of trousers at Kshs. 1750. If he had bought three shirts and two pairs of trousers, he would have saved Kshs. 250. Find the cost of a shirt and a trouser.

22. Express the recurring decimal 3.81 as an improper fraction and hence as a mixed number
23. Karani bought 4 pencils and 6 biro pens for shs.66 and Mary bought 2 pencils and 5 biro pens for shs.51
(a) Find the price of each item
(b) Ondieki spent shs.228 to buy the same type of pencils and biro pens. If the number of biro pens he bought were 4 more than the number of pencils, find the number of pencils he bought

24. Two consecutive odd numbers are such that the difference of twice the larger number and twice the smaller number is 21.Find the product of the numbers

25. The size of an interior angle of a regular polygon is $\mathbf{3x^{o}}$ while its exterior angle is $\mathbf{(x\text{-}20)^{o.}}$ Find the number of sides of the polygon

26. Five shirts and four pairs of trousers cost a total of shs.6160. Three similar shirts and

a pair of trouser cost shs.2800. Find the cost of four shirts and two pairs of trousers

27. Two pairs of trousers and three shirts costs a total of Shs.390. Five such pairs of trousers and two shirts cost a total of Shs.810. Find the price of a pair of trouser and a shirt

13.Equations

1. Solve the simultaneous equation (3 mks)

$$2x - y = 3$$
$$x^2 - xy = -4$$

2. A photograph is mounted on a frame that it leaves a uniform border at the bottom and at the top. At each side a uniform border which is half the border at the bottom is left.
If the side of the square photograph is 5cm and area of frame is $75cm^2$.
(a) Write down an equation for the area of the frame (simplified) (2mks)
(b) What are the dimensions of the frame? (4mks)
(c) What is the percentage area of the frame that is not covered by the photograph? (4mks)

3. Solve the equation $\frac{1}{4x} = \frac{5}{6x} - 7$ (3mks)

4. Factorize completely: $75x^2 – 27y^2$ (2mks)

5. Solve for x given that $\frac{x-3}{5} = 4 - \frac{x-2}{2}$ (3mks)

6. Solve for x and y in. (4mks)

$$2^{2x-3y} = 16$$
$$5^{x-2y} = 1$$

7. The attendance at a party consisted of 35 men, a number of women and some children. The number of women was one and a half times that of the children present.
   a) If there were a total of 65 participants, how many women attended the party? (2mks)
   b) During the party, each child took one bottle of soda, the men took two bottles each while some women took two and others three. Given that five crates each containing 24 bottles of soda were consumed, how many women took two bottles of soda? (6mks)
   c) Each crate of soda was bought for sh.432 plus a deposit of sh.10 per bottle incase it broke. How much money did the party organizers pay at the soda depot? (2mks)

8. Simplify the expression (3 marks)

$$\frac{p^2 - 4m^2}{2m^2 - 7mp + 3p^2}$$

9. During a certain ceremony goats and chicken were slaughtered. The number of heads (for both chicken and goats) was 45. The total number of legs was 100. Determine the exact number of goats and chicken slaughtered. (3 marks)

10. A tailor bought a number of suits at a cost of Sh. 57,600 from Ken-suit wholesalers. Had he bought the same number of suits from Umoja wholesalers, it would have cost him Sh. 480 less per suit. This would have enabled him to buy 4 extra suits for the same amount of money.
(a) Find the number of suits the tailor bought (4 marks)
(b) The tailor later sold each suit for Sh. 720 more than he had paid for it. Determine the percentage profit he made? (4 marks)

11. Use factor method to evaluate the following expression leaving your answer as a product of prime factors in power form.

$(13824 \times 0.000125)^{-\frac{1}{3}}$ (3mks)

12. Solve for x in the given equation. (3mks)

$64^{x} - 121 = 7 - 4^{3x}$

13. Given the 4x = 3y, evaluate $\dfrac{\frac{1}{3}x^{2} - 4xy + y^{2}}{4x^{2} + y^{2}}$ (4mks)

14. Find the value of y in the equation

$$\frac{243 \times 3^{2y}}{729 \times 3^{y} \div 2^{(2y-1)}} = 81$$ (4mks)

15. Factorise completely the expression

$45a^{2} - 20b^{2}$

and hence or otherwise find its value when a = 5 and b = 3 (3mks)

16. Simply $\dfrac{3^{n+3} - 3 \times 3^{n}}{4 \times 3^{n+2}}$ (3mks)

17. Find the value of M in the following equation. (3 mks)

$$\left(\frac{1}{27}\right)^{M} \text{X} \left(81\right)^{-1} = 243$$

18. Rotich bough 4 pencils and 6 pens for kshs. 184 and Kamau bought 3 pencils and 8 pens of the same type at kshs 222. Find the price of each item. (3 mks)

19. A 60m by80m parking lot is torn up to install a side walk of uniform width around its perimeter. The new area of the parking lot is two thirds of the old area. How wide is the side walk? (4 mks)

20. Mukku bought 4 text books and 3 novels at total cost of sh. 4250. if he had bought 2 text books more and one novel less, he would have spent sh. 250 less. On another occasion makku bought 3 text books and 3 novel at the same prices, find how much he spent in the second occasion. (4 marks)

21. A Kenyan businessman US$100 to a company in the United States of America. The Kenyan can either pay through his account in Kenya or through his account in the United Kingdom. Which method is cheaper and by how much? Give your answer in Kenya shillings given that;

1 US dollar = 76.84 Kenya shillings

1 Sterling Pound = 1.53 US dollars

1 Sterling pound = 115.70 Kenya shillings

22. Foreign exchange on 27/5/2010 was given as follows:.

Currency	**Buying** (Kshs)	**Selling** (Kshs)
1 Euro	84.15	84.26
1 Sterling pound	118.35	121.47

A tourist came to Kenya from London with 6000 Euros which he converted to Kenya shillings at a bank. While in Kenya he spent a total of Kshs.300,000 then converted the balance into sterling pounds at the Same bank. Calculate the amount in sterling pounds he received.

23. A Kenyan football fan visited South Africa from Kenya. He changed his currency from Kenya shillings to South African rand. The exchange rates in Kenya were as per the table below:-

Buying	**Selling**
9.9399	10.0166

He has a total of shs.2, 8000,265 and must spend 13 days. During his stay, he spent 8900 Rands on food and accommodation, 97,000 Rands on a return air ticket and 53689 Rands on entertainment. On his return, he converted the remaining amount into Kshs. How much did he receive to the nearest cents?

24. A French tourist changes 3000 Francs into Kenyan shillings at 1 Franc = Kshs.1.89. He spends shs.4695, then exchanges the remaining shillings back into Francs at 1 Franc =1.95. How many Francs does he receive?

25. Hamisi arrived in Nairobi from USA with 40 travelers cheques each with 75 US dollars. How much does she receive in Kshs from the bank on a day when 1 US dollar was equivalent to Kshs 81.40 and the bank charges commission at the rate of Kshs.100 per travelers cheque

26. A Kenya bank buys and sells foreign currencies as shown below

	Buying in Kshs.	**Selling in Kshs.**
1 Hong Kong dollar	9.74	9.77
1 South African rand	12.03	12.11

A tourist arrived in Kenya with 105,000 Hong Kong dollars and changed the amount to Kenya shillings. While in Kenya, she spent Shs.403,879 and changed the balance to South African rand before leaving for South Africa. Calculate the amount, in South African rand that she received

27. A Japanese tourist entered Kenya with Kshs.500,000 Japanese Yen which he converted to Kenya currency. While in Kenya, he spend Kshs.16200 in all. He then converted all the remaining money into Euros before leaving for Italy. If he carried out all his transactions at the Stanbic bank using rates shown below, calculate to the nearest Euro, how much money he left Kenya with. (***Do not use mathematical tables for this question)***

	Selling (Kshs	**Buying Kshs**
100 Japanese Yen	66.35	66.05
1 Euro	78.15	77.85

28. Do not use mathematical tables in this question. Equity bank buys and sells foreign currencies as shown:-

	Buying (Kshs.)	**Selling Kshs**.
1 US dollar	77.43	78.10
I South African Rand	9.03	9.51

A tourist arrived in Kenya with 5,600 US dollars and changed the whole amount to Kenya shillings while in Kenya he spend shs.201,367 and changed the balance to South African rand before leaving to S. Africa . Calculate the amount in S. African rand that she received

29. A tourist arriving from Britain had UK ₤ 9000. He converted the pounds to Kenyan shillings at a commission of 5%. While in Kenya he spent ¾ of his money. He exchanged the remaining to US dollars with no commission. Calculate to the nearest US dollars the amount using the exchange rate below.

Currency	**Buying Kshs.**	**Selling Kshs.**
1 US Dollar	63.00	63.20
1 UK Dollar	125.30	125.95

30. A company was to import goods worth Kshs.100,000 from U.K and changed the money to

Sterling pounds. The company later realized that it was cheaper to import the same goods from U.S.A and changed the sterling pounds to dollar. Unfortunately the transaction failed and the money was converted to Kenya shillings. How much money did the company end-up with, given that;
1 US dollar = Kshs.78
1 Sterling pound = Kshs.120
1 Sterling pound = 1.79 U.S dollar

31. A tourist arrives in Kenya from England with S.**£** 50,000 and uses the money to buy Kenya shillings. He quickly changes his mind and sells the Kenya shillings to get back his s**£**. How much money in S.**£** did he get? Use the table below

	buying	**selling**
1 Sterling pound	120.7131	120.9294

32. A Kenyan bank buys and sells foreign currencies at the exchange rates shown below:

	Buying (Kshs.)	**Selling (Kshs.)**
1 Euro	147.86	148.00
1 US Dollar	74.22	74.50

An American arrived in Kenya with 20000 Euros. He converted all the Euros to Kenya shillings at the bank. He spent Kshs.25100 200 while in Kenya and converted the remaining Kenya shillings into US Dollars at the bank. Find the amount in dollars that he received

33. Simplify;
(a) $6a - 2b + 7a - 4b + 2$

(b) $\frac{2x - 2}{2x} - \frac{3x + 2}{4x}$

14. Commercial arithmetic

1. Jane is a sales executive earning a salary of Ksh. 20,000 and a commission of 8% for the sales in excess of Ksh 100,000. If in January 2010 she earned a total of Ksh.48, 000 in salaries and commissions.
   a) Determine the amount of sales she made in that month (4 mks)
   b) If the total sales in the month of February and March increased by 18% and then dropped by 25% respectively. Calculate
      (i) Jane's commission in the month of February (3 mks)
      (ii) Her total earning in the month of March (3 mks)
2. Wekhomba bought a laptop in Uganda for Ush.1, 050,000. He then paid 60 US dollars as transportation charges to Kenya. On arrival in Kenya he paid duty and sales tax amounting to 55% of the cost in Uganda. He then gave it to a friend in Tanzania tax free. If the exchange rates were I US dollar = Ush 1016, 1Ksh = Ush 24.83 and Tsh 1 = Ksh 0.0714
   (a) Calculate the total expenses in Kenya shillings incurred by Wekhomba (3 mks)
   (b) Find the expenditure on transportation and taxes as a percentage of the total expenditure (2 mks)
   (c) What is the total value of the laptop in Tanzanian shillings (2 mks)
   (d) Find the overall increase in value of the laptop as percentage of the buying price (3 mks)
3. Wekesa deposited a certain amount of money in bank that paid compound interest at the rate of 20% P.A. Calculate to the nearest year the time he would have to wait for his investment to tripple. (3 mks)

4. A Kenya scholar to Japan exchanged converted Kenyan shillings to Yens. He received a total of 36,632.8 Yens. If the bank rates were as below, find how much to the nearest shilling he exchanged.

	Buying	selling	
100 Japanese Yens	Ksh 62.76	63.16	(2mks)

5. Ann bought 24 trays of eggs at sh 225 each. Each tray contains 30 eggs. 54 eggs got broken during transportation. At what price must he sell each egg in order to realize a profit of 22%. Answer to the nearest 1 shilling. (4mks)

6. A man invests Ksh 10000 in an account which pays 16% interest p.a. The interest is compounded quarterly. Find the interest earned after 1 ½ years to the nearest shilling. (4mks)

7. On Monday this currency exchange rate was

1 Euro (E) = Kshs.95.65
1 US dollar($) = Ksh.76.50

A gentle man Tourist decided to exchange half of his 2400E into Dollars.
Calculate to 2 decimal places the number of dollars he received. (3 marks)

8. A trader sold an article at sh.4800 after allowing his customer a 12% discount on the marked price of the article. In so doing he made a profit of 45% .

a) Calculate
   (i) the marked price of the article. (3 marks)

   (ii) the price at which the trader had bought the article (2 marks)

b) If the trader had sold the same article without giving a discount. Calculate the percentage profit he would
have made. (3 marks)

c) To clear his stock, the trader decided to sell the remaining articles at a loss of 12.5% (Calculate the price at which he sold each article. (2 marks)

9. A Kenyan businessman bought a washing machine in Europe at 500 Euros. On coming back, the Kenyan government imposed a 120% import duty and a 50% sales tax. He decided to sell the washing machine at a profit of ksh. 32,800.

Calculate
(a) Import duty (2 mks)
(b) Sales tax (2 mks)
(c) Percentage profit (3 mks)
(d) Selling price (3 mks)
Take 1 Euro € = 95 Kenya shillings

10. A farmer made a loss of 28% by selling a goat for Sh.1440. What percentage profit would he have made if he had sold the goat for Sh.2100? (3mks)

11. A drapper bought some shirts and some trousers from a wholesaler Y at Sh.200 per shirt and Sh.600 per trouser, spending a total of Sh.22, 000. If he had bought the same items from wholesaler X, he would have paid 25% more for a shirt and 15% less for a trouser and he would have spent Sh.700 more.

   b) Write a simultaneous equation to represent the above information.(1mk)
   c) Determine the number of each item he bought (3mks)
   d) He sold all the items as a profit of 50% per shirt and 30% per trouser. Find the total profit he made if he bought from wholesaler X. (3mks)
   e) Calculate to the nearest whole number, the percentage profit he made if he bought from wholesale Y (3mks)

12. Chepkurui imports rice from the United States at an initial cost of 500US Dollars per tonne. He then pays 20% of this amount as shipping costs and 10% of the same amount as custom duty. When the rice reaches Mombasa he has to pay 5% of the initial cost to transport it to Nairobi.

(a) Given that on the day of this transaction the exchange rate was 1US Dollar = Ksh 76.60, calculate the total cost of importing one tonne of rice up to Nairobi in Kenya Shillings (4mks)

(b) Chepkurui intends to make a profit of 20%. Giving your answer to the nearsest ten cents, calculate the price at which he must sell the rice per kilogram (4mks)

(c) If on the day that he completes the sale of this import he changes the total collection back to US Dollars at the rate of 1US Dollar = Ksh 78.20, calculate the actual profit that Chepkurui realized correct to three decimal places (2mks)

13. The purchase price of a TV consists of sh.4600 deposit and 8 equal monthly installments of sh.840. Given that the carrying charge is sh.2800. Find the cash price (3mks)

14. Three business partners Asha, Ogola and Jane contributed ksh.60,000, ksh.85,000 and ksh.105,000 respectively. They agreed to put 25% of the profit back into the business each year. They also agreed to put aside 40% of the remaining profit to cater for taxes and insurance. The rest of the profit would then be shared among the partners in the ratio of their contributions. At the end of the first year the business realized a gross profit of ksh.225,000.

d) Calculate the amount of money Jane received more than Asha at the end of the year (5mks)

e) Ogola further invested ksh.25,000 into the business at the beginning of the second year. Given that the gross profit at the end of the second year increased in the ratio of 10:9 and that 40% of it was shared, calculate Ogola's share of the profit at the end of the second year (5mks)

15. A man imported a vehicle at Shs. 600,000 and sold it at Sh. 1,080,0000. Find his percentage profit if he spent sh. 60,000 for clearing the vehicle from the port and a further sh. 40,000 for shipping. (3 marks)

16. A Kenyan tourist left Germany for Kenya through Switzerland. While in Switzerland he bought a watch worth 52 Deutsche marks. Find the value of the watch in:-
(a) Swiss Francs
(b) Kenya shillings (3 marks)
Use the exchange rates below
1 Swiss Franc = 1.28 Deutsche marks
1 Swiss Franc = 45.21 Kenya shillings

17. Juanita sold goods worth Ksh 95,000 and earned a total commission of Ksh 4,500. If the commission on the first Ksh. 50,000 was half of the total commission, what were the two rates of commission? (4mks)

18. Mr. Sitienei sold a house to Mr. Lagat at a profit of 10%. Mr. Lagat then sold it to Mr. Rotich at a profit of 5%. Mr. Rotich paid Ksh 110,000 more than Mr. Lagat for the house. Find how much Mr. Rotich paid for the house. (3mks)

19. A Kenya bank buys and sells foreign currencies as shown below.

	Buying (Ksh)	Selling Ksh
1 Euro	84.15	84.26
100 Japanese Yen	65.37	65.45

A Japanese traveling from France in Kenya with 5000 Euros. He converted all the 5000 Euros to Kenya shillings at the bank. While in Kenya, he spent a total of Ksh. 289850 and then converted the remaining Kenya shillings to Japanese Yens at the bank. Calculate the amount in Japanese Yen that he received. (3mks)

20. Kimani bought a car at kshs. 120,000. Its value depreciated by 8% per year for the first 2 years and by 12% per year for the subsequent years.

(a) Determine the value of the car after 6 years. (4 mks)

(b) After 6 years, the car was sold through an agent at 25% more than its value. If the sales price was to be taken as its value after depreciation, calculate the average monthly rate of depreciation for the six years. (6 mks)

21. Muthoni went to a shop and bought 50 packets of milk and 25 packets of salt all for Kshs.200.00. She sold the milk at a profit of 28% and the salt at a profit of 24% thereby making a net profit of Kshs.53.50. Find the cost price of a packet of milk and a packet of salt. (4 mks)

22. The cost of a camera outside Kenya is US$1000. James intends to buy one camera through an agent who deals in Japanese Yen. The agent charges him a commission of 5% on the price of the camera and further 1260 Yen as importation tax. How many Kshs. Will he need to send to the agent to obtain the camera, given that:- (3 mks)

1 US$ = 105.00 Yen.
1 US$ = Kshs.63.00

23. When shop keeper sells articles at sh. 240.50 each he makes a profit of 25% on the cost price. During a sale he reduces the price of each article by sh. 22.90. Calculate the percentage profit on an article sold at the sale price. (3 marks)

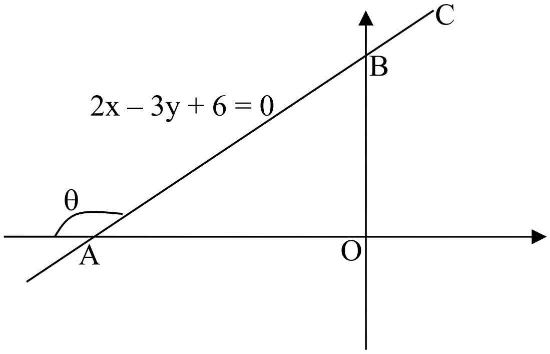
24. Factorise the expression $7x^2 - \frac{7}{4}(y+1)^2$ (2 marks)

25. In certain day the bank rates for changing dollars to shillings are given below.

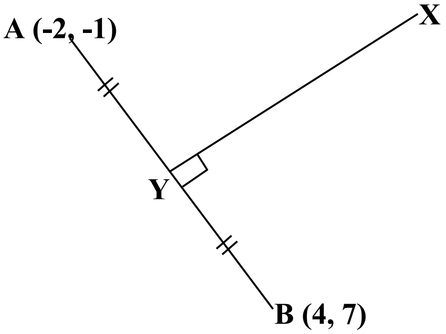
	Buying	selling
Dollar	78.43	79.25

An American tourist changed US dollar 1500 to shillings, but then had to return to U. S. A immediately and changed all the shillings back to dollars using the same rates. How much did he lose? (3 marks)

26. Find the angle θ in degrees from the figure below



27. In the diagram below, determine the equation of the line **XY** in the form **y = mx + c**

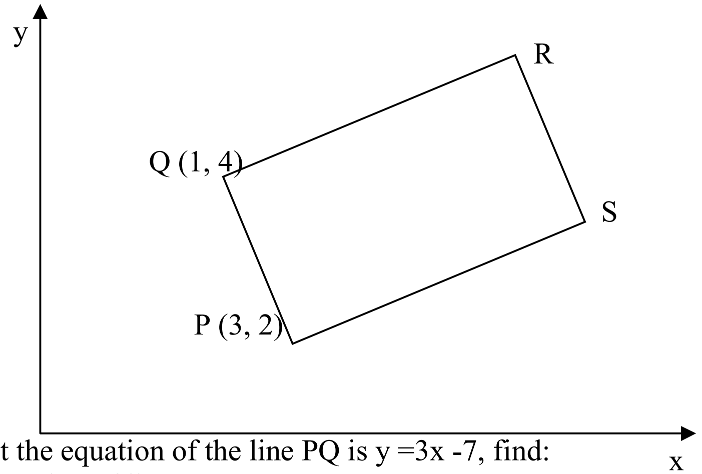


28. Find the equation of a line which passes through the point (2, 3) and is perpendicular to $y - 3x + 1 = 0$, giving your answer in the form $y = mx + c$

29. **T** is the mid-point of line **XY** where **X** is point (1,4) and **Y** is the point (-5, 10). Find the equation of a line, L_2 which is perpendicular to line **XY** and goes through point **T**

30. (a) On the grid provided below, plot points A(2,1) B(-4,3) and C(2,5)
    b) Given that the gradient of CD = -1 and CD =AD locate D and complete the quadrilateral ABCD
    (c) What name is given to quadrilateral ABCD?

31. In the figure below (not drawn to scale), **PQRS** is a rectangle and **P** and **Q** are the points (3, 2) and (1,4) respectively



Given that the equation of the line PQ is y =3x -7, find:
(a) The equation of line QR
(b) The coordinates of point **R**
(c) The coordinates of point **S**

32. OABC is a trapezium such that the coordinates of O, A , B and C are (0, 0), (2, -1), (4, 3) and (0, y)
    (a) Find the value of y
    (b) M is the mid-point of AB and N is the mid-point of OM. Find in column form
        (i) the vector **AN**
        (ii) the vector **NC**
        (iii) Vector **AC**
    (c) Hence show that A, N and C are collinear

33. Use ruler and a pair of compasses only in this question.
    (a) Construct triangle ABC in which AB = 7 cm, BC = 8 cm and ∠ABC = 60^0.
    (b) Measure (i) side AC (ii) ∠ ACB
    (c) Construct a circle passing through the three points A, B and C. Measure the radius of the circle.
    (d) Construct Δ PBC such that P is on the same side of BC as point A and ∠ PCB = ½ ∠ ACB, ∠ BPC = ∠ BAC measure ∠ PBC.

34. ABCD is a parallelogram with vertices A (1,1) and C(8,10). AB has the equation $4x - 5y = -1$ and BC has the equation $5x - 2y = 20$. Determine by calculation;
    (a) the co-ordinates of the point M where the diagonals meet
    (b) The co-ordinates of the vertices B and D

(c) the length of AB correct to 4 significant figures

35. The table shows corresponding values of x and y for a certain curve;

x	1.0	1.2	1.4	1.6	1.8	2.0	2.3
y	6.5	6.2	5.2	4.3	4.0	2.6	2.4

Using 3 strips and mid-ordinate rule estimate the area between the curve, x-axis, the lines x =1 and x =2.2

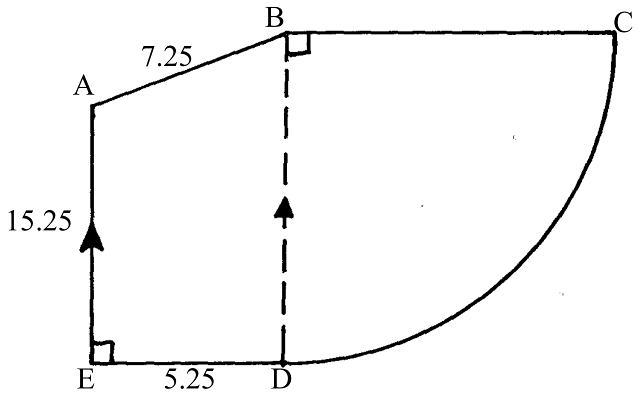
15. Coordinates and Graphics

1. A triangle ABC is formed by the points A (3,4), B (-7,2), and C (1,-2).
   (a) Find the coordinates of the mid-points k of AB and p of AC (1 mk)
   (b) Find the equation of the perpendicular bisector of the line kp (2 mks)
2. The size of an interior angle of a rectangular polygon is 6 ½ times that of its exterior angle. Determine the number of sides of the polygon.

3. The sum of interior angles of two regular polygons of sides n and n + 2 are in the ratio 3:4. Calculate the sum of the interior angles of the polygons with n sides

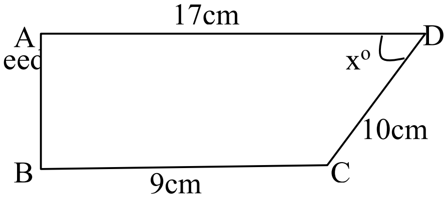
4 . The area of a rhombus is 60cm^2. Given that one of its diagonals is 15cm long. Calculate the perimeter of the rhombus.

5. In the figure below AE is parallel to BD. BC = BD, AB = 7.25cm, AE = 15.25cm and ED = 5.25 cm



Find the perimeter of the figure .

6. The figure below shows a trapezium ABCD in which side AB is perpendicular to both AD and BC. Side AD=17cm, DC=10cm

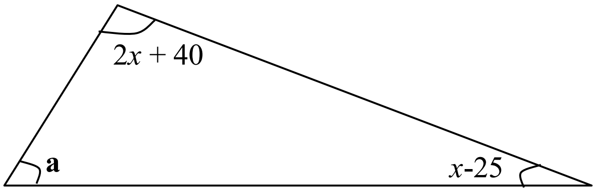


(i) What is the length of side AB

(ii) Find the value of **cos(90° – x°)** in the form $\frac{a}{b}$ where a and b are integers

7. The size of an interior angle of a regular polygon is **3x°** while its exterior angle is **(x-20)°.** Find the number of sides of the polygon

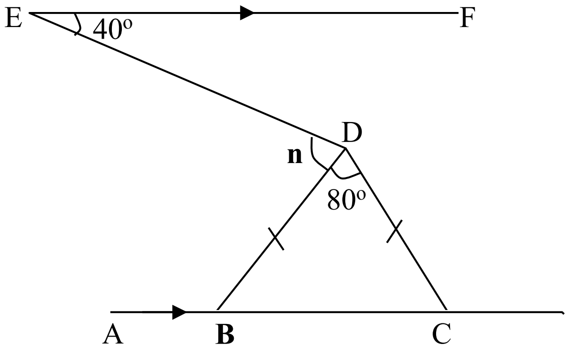
8.



In the figure above, angle **a** is half the sum of the other angles. Evaluate the triangle

9. The sum of the interior angles of an **n**-sided polygon is 1260°. Find the value of **n** and hence deduce the polygon

10. Giving reason, find the angle marked **n**

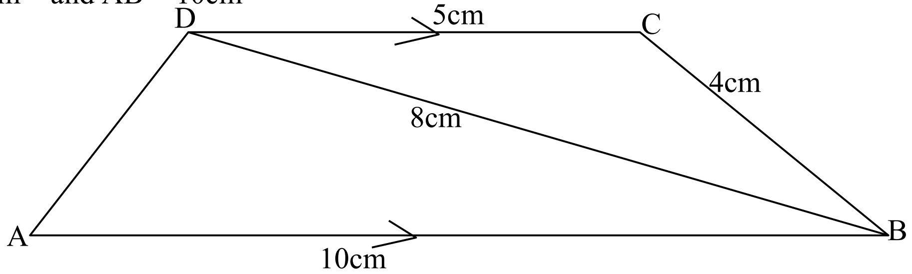


11. Solve for **y** in the equation $125^{y+1} + 5^{3y} = 630$

12. The interior angle of a regular polygon is 108° larger than the exterior angle. How many sides has the polygon?

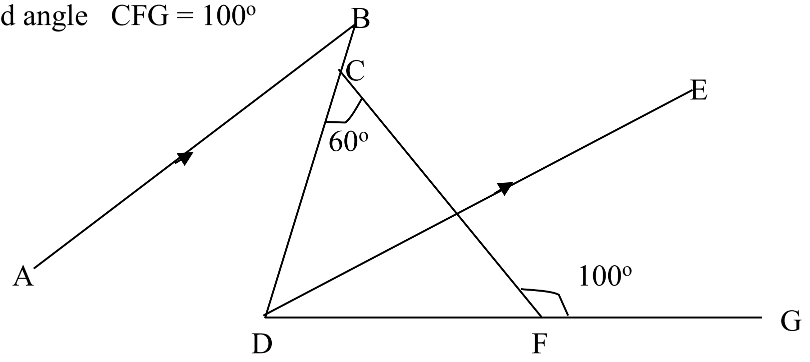
13. The interior angle of a regular polygon is 4 times the exterior angle. How many sides has the polygon

14. In the figure below ABCD is a trapezium with DC parallel to AB. DC = 5cm, CB = 4cm, BD = 8cm and AB = 10cm



Calculate:
(a) the size of angle BDC
(b) the area of triangle ABD

15. In the figure below, DE bisects angle BDG and AB is parallel to DE. Angle DCF = 60° and angle CFG = 100°

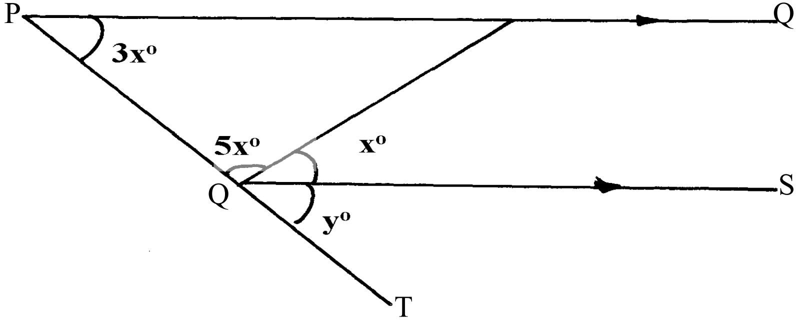


Find the value of angle:-
(a) CDF
(b) ABD

16. The size of an interior angle of a regular polygon is 4x°, while its exterior angle is (x – 30)°. Find the number of sides of the polygon

17. The sum of interior angles of a polygon is 1440°. Find the number of sides of the polygon hence name the polygon

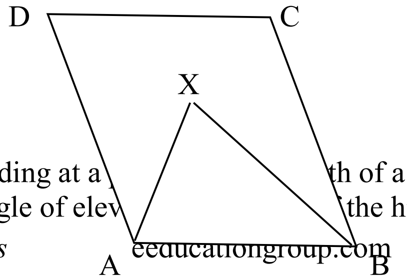
18. In the figure below PQ is parallel to RS. Calculate the value of **x** and **y**



19. The interior angle of a n-sided regular polygon exceeds its exterior angle by 132°. Find the value of n

16. Angles and Plane Figures

1. The sum of angles of a triangle is given by the expression $(2a+b)^0$ while that of a quadrilateral is given by $(13a - b)^0$. Calculate the values of a and b (4 mks)
2. The figure below represents a quadrilateral ABCD. Triangle ABX is an equilateral triangle. If $\angle ADX = 50^0$, find $\angle AXD$ with $\angle BAD = 90^0$ (2 mks)



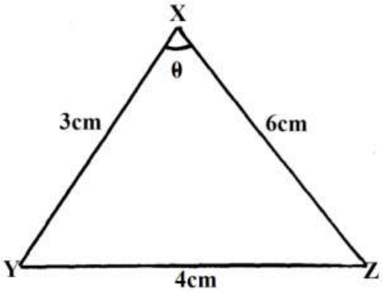
3. Wanjiku is standing at a th of a hill H on a level ground. From point P she observes the angle of elev the hill to be 67^0

(a) Calculate the height of the hill (3 mks)

(b) After walking 420m due east to the point Q, Wanjiku proceeds to point R due east of Q, where the angle of elevation of the top of the hill is 35^0. Calculate the angle of elevation of the top of the hill from Q (3 mks)

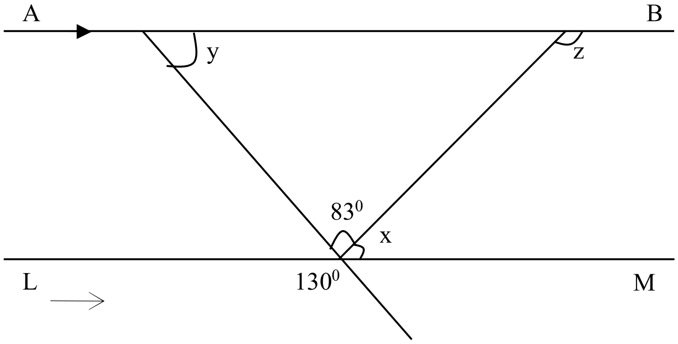
(c) Calculate the distance from P to R (4 mks)

4. In the triangle XYZ below, find the angle ZXY. (3mks)



5. The exterior angle of a regular polygon is equal to one-third of the interior angle. Calculate the number of sides of the polygon and give its name. (4 mks)

6. In the figure below, lines AB and LM are parallel.



Find the values of the angles marked x, y and z (3 mks)

7. From points A and B on a level ground the angles of elevation to the top of the building are 24^0 and 38^0 respectively. If the distance between A and B is 47m and that of B from the foot of the building is X;

(a) Form an expression for the height of the building

(b) Calculate the height of the building

(c) Find the difference in the distance between the top of the building and points A and B

8. The angle of elevation of the top of the tower from the foot of a building is 63.51^0. The angle of depression of the top of the building from the op of the tower is 18.43^0. The building and the tower are 30m apart. Find

a) The height of the tower (1mk)

b) The height of the building (2mks)

9. The exterior angle of a regular polygon is an eighth of the interior angle. How many sides does the regular polygon have? (3 marks)

10. The sides of a parallelogram are 4cm by 5cm and its area is $12cm^2$. Calculate its angles. (3 marks)

11. From a point 20m away on a level ground the angle of elevation to the lower window line is 27^0 and the angle of elevation to the top line of the window is 32^0. Calculate the height of the window. (3 marks)

12. A regular polygon has its exterior angle 18^0, and one of its sides 16cm. Calculate its area. (to 2 d.p) (3mks)

13. The angle of depression of a point A on the ground from the top of a post is 18^0 and that of another point B on the same line as A nearer to the foot of the post is 25^0. If A and B are 70m apart,

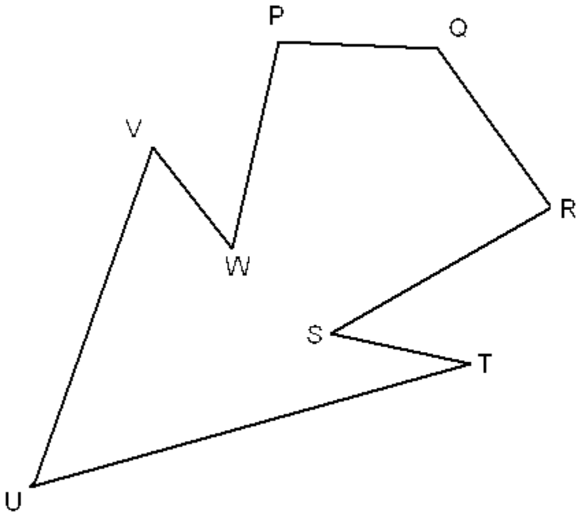
(a) Draw a sketch to represent positions of A and B. (2mks)

(b) Using your sketch calculate

(i) The height of the post from the ground level (Ans 1 d.p) (6mks)

(ii) The distance of point A from the foot of the post. (2mks)

14. The figure below shows an irregular polygon PQRSTUVW.
Calculate the sum of all the interior angles in the figure below.

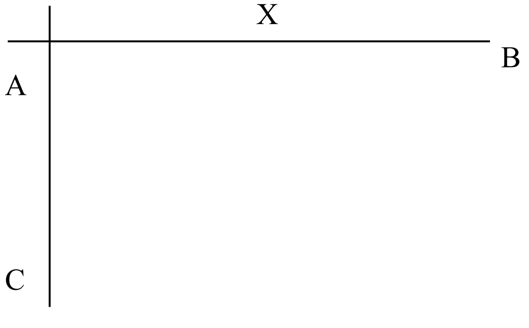


15. The angles of elevation from two points A and B to the top of a storey building are 48^0 and 57^0 respectively. If AB = 50m and the point A and B are opposite each other; Calculate;
a) the distance of point A to the building (2 mks)
b) the height of the building (2 mks)

17. Geometrical Constructions

1. Using a ruler and a pair of compasses only,
   a) Construct a triangle ABC in which AB = 9cm, AC = 6cm and angle BAC = $37½^0$
   c) Drop a perpendicular from C to meet AB at D. Measure CD and hence find the area of the triangle ABC
   d) Point E divides BC in the ratio 2:3. Using a ruler and Set Square only, determine point E. Measure AE.

2.



On the diagram, construct a circle to touch line AB at X and passes through the point C. (3 mks)

3. Using ruler and pair of compasses only for constructions in this question.
(a) Construct triangle ABC such that AB=AC=5.4cm and angle ABC=30^0. Measure BC (4 mks)

(b) On the diagram above, a point P is always on the same side of BC as A. Draw the locus of P such that angle BAC is twice angle BPC (2 mks)

(c) Drop a perpendicular from A to meet BC at D. Measure AD (2 mks)

(d) Determine the locus Q on the same side of BC as A such that the area of triangle BQC = $9.4cm^2$ (2 mks)

4. (a) Without using a protractor or set square, construct a triangle ABC in which AB = 4cm, BC = 6cm and $\angle ABC = 67½^0$. Take AB as the base. (3mks)
Measure AC.
(b) Draw a triangle A^1BC^1 which is indirectly congruent to triangle ABC. (3mks)
(c) Taking the mid point of AB as your centre of rotation (M). Find the triangle $A^{11}B^{11}C^{11}$ the image of $A^1B^1C^1$ after -90^0. (4mks)

5. Construct triangle ABC in which AB = 4.4 cm, BC = 6.4 cm and AC = 7.4 cm. Construct an escribed circle opposite angle ACB (5 mks)
(a) Measure the radius of the circle (1 mk)
(b) Measure the acute angle subtended at the centre of the circle by AB (1 mk)
(c) A point P moves such that it is always outside the circle but within triangle AOB, where O is the centre of the escribed circle. Show by shading the region within which P lies. (3 mks)

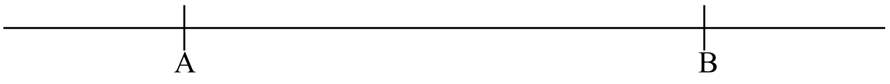
6. (a) Using a ruler and a pair of compasses only, construct a parallelogram PQRS in which PQ = 8cm, QR = 6cm and $\angle PQR = 150^0$ (3 mks)
(b) Drop a perpendicular from S to meet PQ at B. Measure SB and hence calculate the area of the parallelogram. (5 mks)
(c) Mark a point A on BS produced such that the area of triangle APQ is equal to three quarters the area of the parallelogram (1 mk)
(d) Determine the height of the triangle. (1 mk)

7. Using a ruler and a pair of compasses only, construct triangle ABC in which AB = 6cm, BC = 8cm and angle ABC = 45^o. Drop a perpendicular from A to BC at M. Measure AM and AC (4mks)

8. a) Using a ruler and a pair of compasses only to construct a trapezium ABCD such that $AB = 12cm$, $\angle DAB = 60^0$, $\angle ABC = 75^0$ and $AD = 7cm$ (5mks)
b)From the point D drop a perpendicular to the line AB to meet the line at E. measure DE hence calculate the area of the trapezium (5mks)

9. Using a pair of compasses and ruler only;
(a) Construct triangle ABC such that AB = 8cm, BC = 6cm and angle ABC = 30^0. (3 marks)
(b) Measure the length of AC (1 mark)
(c) Draw a circle that touches the vertices A,B and C. (2 marks)
(d) Measure the radius of the circle (1 mark)
(e) Hence or otherwise, calculate the area of the circle outside the triangle. (3 marks)

10. Using a ruler and a pair of compasses only, construct the locus of a point P such that angle APB = 60^0 on the line AB = 5cm. (4mks)



11. Using a set square, ruler and pair of compases divide the given line into 5 equal portions. (3mks)

12. Using a ruler and a pair of compasses only, draw a parallelogram ABCD, such that angle DAB = 75^0. Length AB = 6.0cm and BC = 4.0cm from point D, drop a perpendicular to meet line AB at N
a) Measure length DN
b) Find the area of the parallelogram (10 mks)

13. Chebochok deposited shs.120,000 in a financial institution which offered a compound interest at 8% p.a, compounded quarterly for 9 months. Find the accumulated amount by

the end of the period

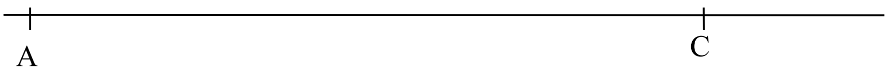
14. Using a ruler and a pair of compasses only, draw a parallelogram ABCD in which AB = 6cm, BC = 4cm and angle BAD = 60^{o}. By construction, determine the perpendicular distance between the lines AB and CD

15. Without using a protractor, draw a triangle ABC where $\angle CAB = 30^{o}$, AC = 3.5cm and AB = 6cm. measure BC

16. (a) Using a ruler and a pair of compass only, construct a triangle ABC in which angle ABC =37.5^{o}, BC =7cm and BA = 14cm
(b) Drop a perpendicular from A to BC produced and measure its height
(c) Use your height in (b) to find the area of the triangle ABC
(d) Use construction to find the radius of an inscribed circle of triangle ABC

17. In this question use a pair of compasses and a ruler only
a) Construct triangle PQR such that PQ = 6 cm, QR = 8 cm and <PQR = 135°
b) Construct the height of triangle PQR in (a) above, taking QR as the base

18. On the line AC shown below, point **B** lies above the line such that $\angle BAC = 52.5^{o}$ and] AB = 4.2cm. (***Use a ruler and a pair of compasses for this question***)



(a) Construct $\angle BAC$ and mark point **B**
(b) Drop a perpendicular from **B** to meet the line **AC** at point **F .** Measure **BF**

19. Juma paid shs.450 for a trouser after getting a discount of 10%. The trader still made a *profit of 25% on the sale. What profit would the trader have made if no discount was allowed?*

18. Scale Drawing

1. Three mountains Mikai, Kembo and Chaka in a village are situated in such a way that Kembo is 900m on a bearing of 120^{0} from Mikai. Mt. Chaka is 1200m on a bearing of 030^{0} from Kembo.
(ii) Draw a sketch showing the position of the three mountains (1 mk)
(iii)Calculate the distance of Mt. Chaka from Mt. Mikai (2 mks)
2. Shopping centres XY and Z are such that Y is 12km south of X and Z is 15kn from X. Z is on a bearing of N30^{0}W from Y. Calculate and give compass bearing of Z from X. (4mks)
3. Four telephone posts PQR and S stand on a level ground such that Q is 28m on a bearing of 060^{0} from P. R is 20m to the south of Q and S is 16m on a bearing of 140^{0} from P.
(a) Using a scale of 1cm represent 4m show the relative positions of the posts. (4mks)
(b) Find the distance and bearing of R from S. (3mks)
(c) If the height of post P is 15.6m. on a separate scale drawing, draw a diagram and determine the angle of depression of post R from the top of post P. (3mks)
(Same scale as above)
4. Alice chepchumba on her cycling practice cycled on a bearing of 120^{o} for 5.5km, then on a bearing of 200^{o} for 8km finally he turned northwards for 13.5km, by scale drawing determine her final position from starting point. (4 marks)
5. A surveyor recorded the measurement of field in a field book using lines AB = 260m as shown below.

	B	

	130	R40
	70	Q10
	50	P20
S50	10	
	A	

a) Use a suitable scale to draw the map of the field. (2 marks)

b) Find the area of the field. (2 marks)

6. (a) In a Safari rally drivers are to follow route ABCGA. B is 250km from A on a bearing of 075^0 from A. C is on a bearing of 110^0 from A and 280km from B. the bearing of C from D is 140^0 and at a distance of 300km. By scale drawing, show the position of the point A, B, C and D. (4 mks)

(b) Determine

(i) Distance of A from C (2 mks)

(ii) The bearing of B from C (1 mk)

(iii) The distance and bearing of A from D (3 mks)

7. Town X is 20km in the direction 060° from Y and Z is 30km in the direction 150° from Y. Using the scale 1cm represents 5km, find by scale drawing;

(a) the bearing of Y from Z

(b) the distance of X from Z (4mks)

8. A field was surveyed and its measurements recorded in a field book as shown below.

	F	
	100	
E 40	80	
	60	D 50
C 40	40	
	20	B 30
	A	

(a) Using a scale of 1cm to represent 10m, draw a map of the field. (4mks)

(b) Calculate the area of the field.

(i) in square metres. (4mks)

(ii) in hectares. (2mks)

9. A plane leaves town P to town Q on a bearing of 130^0 and a distance of 350km. it then flies to town R 500km away and on a bearing 060^0. Find by scale drawing the distance of R from P (3mks)

10. A surveyor recorded the following information in his field book after taking measurements in metres of a plot. The baseline is the straight line AH = 300m.

	H	
40 to F	250	100 to G
120 to D	200	
	180	80 to C
	100	60 to B
	A	

(a) Using a scale of 1cm to represent 20m, draw an accurate diagram of the plot. (5mks)

b) Use your diagram to calculate the actual area of the field in hectares (5mks)

11. Three town P,Q and R are such that P is on a bearing of 120° and 20 km from Q. Town R is on bearing of 220° and 12km from P
    a) Using a scale of 1 cm to 2 km, draw and locate the positions of the three towns. (3mks)
    b) Measure
        i) the distance between Q and R in kilometres. (2mks)
        ii) the bearing of P from R. (1mk)
        iii) the bearing of R from Q. (2mks)
    c) Calculate the area of the figure bounded by PQR. (2mks)

12. The area of a forest on a map whose scale is 1:50,000 is $17cm^2$. Calculate the area of the forest in hectares. (2 mks)

13. Four towns P, Q, R and S are such that town Q is 120km due east of town P. Town R is 160km due North of town Q. Town S is on a bearing of 330° from P and on a bearing 300 ° from R. use a ruler and a pair of compasses only for all your constructions.
    a) Using a scale of 1cm to represent 50km, construct a scale drawing showing the positions P, Q, R and S. (6 mks)
    b) Use the scale to determine
        i. The distance from town S to town P. (1 mk)
        ii. The distance from town S to town R. (1 mk)
        iii. The bearing of town S from town Q. (2 mks)

14. The actual area of an estate is 3510 hectares. The estate is represented by a rectangle measuring 2.6cm by 1.5cm on the map whose scale is l:n. Find the value of n (3 mks)

15. The following measurements were recorded in a field book of a farm in metres (xy = 400m)

	y	
	400	
C60	340	
	300	120 D
	240	100 E
	220	160 F
B 100	140	
A 120	80	
	x	

a) Using a scale of 1cm representing 4000 cm, draw an accurate map of the farm.
b) If the farm is on sale at Kshs.80,000.00 per hectare, find how much it costs. (10 mks)

16. Four points A, B, C and D are situated on a horizontal plane such that B is 250 m on a bearing of 070^0 from A. C is 325 m on a bearing of 150^0 from B. D is due west of C and on a bearing of 210^0 from B. (6 marks)
    a) Using a scale of 1 cm to 50 m draw an accurate drawing to show the position of A, B, C and D.
    b) Use your scale drawing fo find the :
        I. The distance between A and D (2 marks)
        II. The bearing of A from D (2 marks)

17. Town **X** is 13.5km from town **Y** on a bearing of 028°. A matatu leaves **y** at 7:35a.m towards a bearing of 080°. The matatu is at point **Z** due south of **X** at 8:55a.m
    (a) Calculate the average speed of the matatu from **Y** to **Z**
    (b) If the matatu continues on the same bearing, calculate the distance it covers from **Z**

when it is East of **X**

18. Three towns X, Y and Z are such that Y is 500km on a bearing of 315^o from X. Z is on a bearing of 230^o from X. given that the distance between Y and Z is 800km.

(a) using a scale of 1cm to represent 100km, draw a scale diagram to show the position of the Towns

(b) Find the bearing of;

(i) X from Z

(ii) Z from Y

(c) Use the scale drawing to find the distance from X to Z

19. Two aeroplanes **S** and **R** leave an airport at the same time. **S** flies on the bearing of 240^o at 750Km/h while **R** flies due East at 600Km/hr..

(a) (i) Calculate the distance of each aeroplane after 30minutes

(ii) Using a scale of 1cm to represent 50km make an accurate scale drawing to show the positions of the aeroplanes after 30minutes

(b) (i) Use the scale drawing to find the distance between the two aeroplanes after 30minutes

(ii) If each aeroplane landed after 30minutes and **S** received a signal to join **R** in 45minutes. Find its speed

(c) Determine the bearing of :

(i) **S** from **R**

(ii) **R** from **S**

20. The table below gives a field book showing the results of a survey of a section of a piece of land between A and E. All measurements are in metres.

	E	
D33	95	
	90	**F** 36
C21	70	
B 42	30	**G** 25
	25	**H** 40
	A	

(a) Draw a sketch of the land.

(b) Calculate the area of this piece of land.

21. Three towns A B and C are situated such that town A is 40km from B on a bearing of 280^o. C is 60km from B on a bearing of 130^o. Another town D is only 10km from C on a bearing of 210^o.

(a) Drawing accurately and using a scale of 1cm to 10km find the:-

(b) Distance from A to C and the bearing of A from C

(c) (i) Distance of B from D

(ii) Distance of A from D

(iii) Bearing of A from D

(iv) Bearing of C from D

22. A train left Naivasha for Nakuru at 1000hours. It traveled at an average speed of 45km/h and reached Gilgil after 40minutes. It then covered the remaining 50km in 1½ hours. A second train left Nakuru for Naivasha at 1015 hours and arrived at Gilgil at the same time as the first train arrived at Nakuru.

a) Using a scale of 1cm to represent 10minutes in the time axis and 1cm to represent 10km on the distance axis, draw on the same axes the graphs to show the movement of the two trains

b) use your graph to find;

i) the distance between Naivasha and Nakuru

ii) the time at which the train met

c) calculate the average speed, in km/h of the second train

23. On a certain map, a road 20km long is represented by a line 4cm long. Calculate the area of a rectangular plot represented by dimensions 2.4cm by 1.5cm on this map – leaving your answer in hectares

24. A port **B** is on a bearings of 080° from a port **A** and at a distance of 95km. a submarine is stationed at a port **D**, which is on a bearing of 200° from **A**, and a distance of 124km from **B**. A ship leaves **B** and moves directly southwards to an island **P**, which is on a bearing of 140° from **A**. the submarine at **D** on realizing that the ship was heading for the island **P**, decides to head straight for the island to intercept the ship.

(a) Using a scale of 1cm to represent 10km draw a diagram to show the positions of A,B,D, and P

(b) Hence;

Determine;

(i) the distance from **A** to **D**

(ii) the bearing of the submarine from the ship when the ship was setting off from B

(iii) the bearing of the island **P** from **D**

(iv) the distance the submarine had to cover to reach the island P

25. Use a scale of 1cm represents 50km in these questions. Five towns **A, B, C, D** and **E** are situated such that **A** is 200 km from **B** on a bearing of 050° from **E**. **C** is 300 km from **B** on a bearing of 150° from **B**. **D** is 350km on a bearing of 240° from **C**. **E** is 200km from **D** and the bearing of **D** from **E** is 100°

a) Draw the diagram representing the positions of the towns

b) From the diagram, determine;

i) The distance in km of A from E

ii) The bearing of D from B

26. Four towns **P, Q, R** & **S** are such that **P** is 280 km North of **R, S** is190 km from **R** on a bearing of 310° and **Q** is 240 km from **P** on a bearing of 105°.

a) Using scale of 1 cm rep. 50 km, locate the four towns.

b) Find; (i) distance **SQ**.

(ii) Bearing of **S** from **Q**.

(iii) The shortest distance between **P** and side **QR.**

27. Four ships are at sea such that a streamliner S is 150km on a bearing of 025° from a cargo ship **C**. A trawler **T** is 300km on a bearing of 145° from the cargo ship and a yacht **Y** is due West of **C** and on a bearing of 300° from **T**.

a) Using a scale of 1cm= 50km, draw on accurate scale drawing showing the positions of S, C, T and Y

b) By measurement from your scale drawing determine:

i) The distance and bearing of Y from S

ii) The distance ST

iii) The distance YT

28. A tea farm in Kakamega forest was surveyed and the results were recorded in the surveyors note book as shown below. The measurements are in meters

	250	**Y**
	240	D70
C80	170	

A60	70 50	B60
X	**0**	

Using a scale of 1: 25, draw the map of the plot and hence calculate the area of the plot in Hectares

29. The information below shows the entries in a surveyor's field book after a survey of a farm. XY = 280m is the baseline. All measurements are in metres

	280	**Y**
B 105	230	110E
	190	
	160	45E
A 100	90	
	40	95G
X	O	

(a) Use a scale of 1cm represents 20m to draw the map of the farm
(b) Estimate the area of the farm in hectares
(c) If the point **Y** lies due north of **X**, find correct to 1 decimal place, the :
(i) Bearing of **E** from **X**
(ii) Distance of **E** from **X**

30. The measurements of a flower garden were recorded in a surveyor's field book as shown.

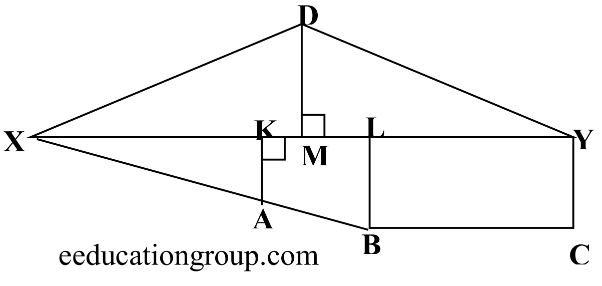
	250	Y
	240	D 70
C80	170	
	70	B 60
X	0	

Draw a sketch of the field and find its area. (Measurements are in m)

31. A map has a scale 1:40,000:
(a) Calculate the distance between two points on the ground if the corresponding distance shown on the map is 3.25cm
(b) Calculate the area in the map of woodland which occupies 36ha on the ground

32. Three scouts John, Peter and Samwel stand on three adjacent peaks of equal altitude on mountain range. The distance between John and Peter is 800metres and the bearing of Peter from John is 020°. The distance between John and Samwel is 1500metres, and the bearing of Samwel from John is 320°.
(a) Calculate the bearing of John from Peter
(b) **Calculate**:- (i) the distance
(ii) the bearing of Samwel from Peter

33. The figure below represents a surveyor's sketch of a plot of land. Calculate the area of the plot in square metres given that XY = 50m, XK = 20m, XM = 25m, XL = 35m, KA = 40m, MD = 38m and LB = YC = 60m.



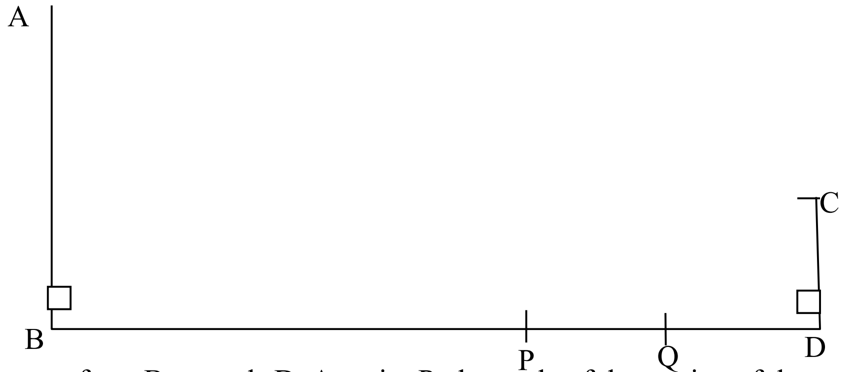
34. Two boats **P** and **Q** are located 30km apart; **P** being due North of **Q**. An observer at **P** spots a ship whose bearing he finds as S 56°E from **Q**, the bearing of the same ship is 038°. Calculate the distance of the ship from **Q** to 2 decimal places

35. A map is drawn to scale of 1:100,000. What area in km², is represented by a rectangle measuring 4.5cm by 5.4 cm

36. Two places **A** and **B** are 900km apart on the earth's surface. If **A** is due North of **B** and given that the latitude of **A** is 5°N. Find the latitude of **B**. (Take radius of the earth to be 6370km)

37. A car starts from rest and build up a speed of 40m/s in 1min 40seconds. It then travels at this steady speed for 5minutes. Brakes are then applied and the car is brought to rest in 2minutes.
(a) Draw a velocity-time graph to show the journey
(b) Use your graph to find;
  (i) the initial acceleration
  (ii) the deceleration when the car is brought to rest
  (iii) the distance traveled

38. The diagram below represents two vertical watch-towers AB and CD on a level ground. P and Q are two points on a straight road BD. The height of the tower AB is 20m and road BD is 200m

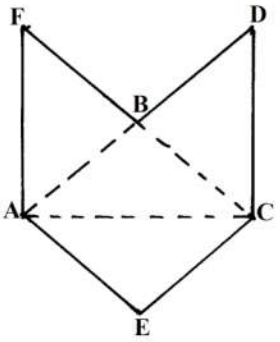


(a) A car moves from B towards D. At point P, the angle of depression of the car from point A is 11.3°. Calculate the distance BP to 4 significant figures
(b) If the car takes 5 seconds to move from P to Q at an average speed of 36km/.hr. Calculate the angle of depression of Q from A to 2 decimal places
(c) Given that QC = 50.9m, calculate;
  (i) the height of CD in metres to 2 decimal places
  (ii) the angle of elevation of A from C to the nearest degree

39. Town B is 180 km on a bearing of 050^0 from town A. Another town C is on a bearing of 110^0 from town A and on a bearing of 150^0 from town B. A fourth town D is 240 km on a bearing of 320^0 from A. Without using a scale drawing, calculate to the nearest kilometer.
(a) The distance AC
(a) The distance CD

19.Common solids

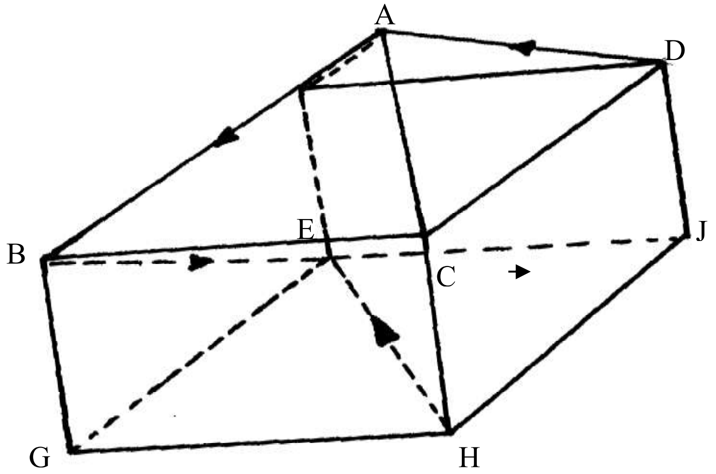
1. Below is a net of a model of a 3 – dimensional figure. The lengths AB = BC = AC = 6.0cm and lengths AF = FB = BD = CD = CE = AE = 8.0cm.



a) Sketch when the net is folded by taking ABC as the base and the height 5cm.

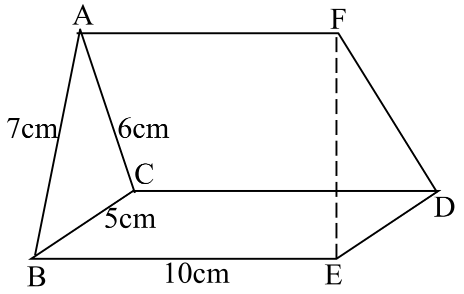
b) State the name of the figure sketched (3 mks)

2. The figure below represents a square based solid with a path marked on it



Sketch and label the net of the solid *

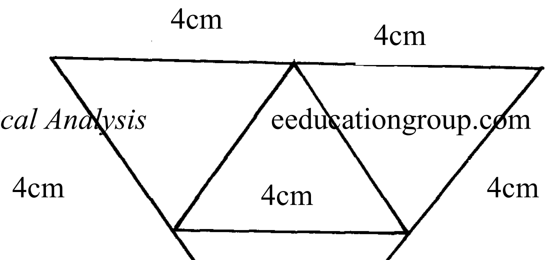
3. The below shows a solid prism:-



(a) Sketch the net of the prism above

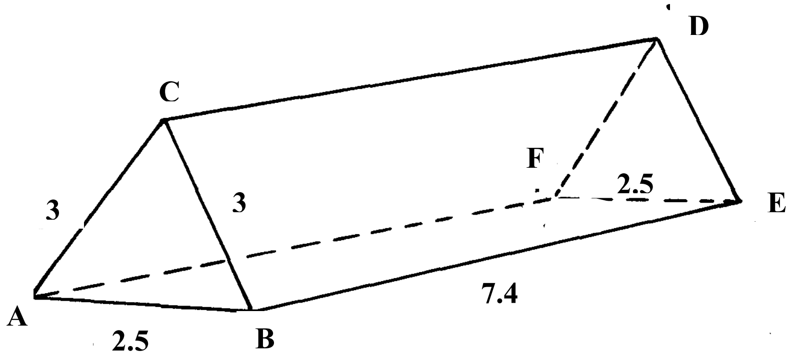
(b) Use the net in **(a)** above to calculate the total surface area of the material used in making the solid

4. Draw the solid whose net is shown below.



4cm 4cm

5. Sketch the net of the solid shown in the figure below, measurements are in centimeters



20. Indices

1. Evaluate the value of x in
   $81^{X+1} + 3^{4x} = 246.$

2. Solve for **y** in the equation:-
   $5^{(2y+1)} = 4(5)^{y+1} - 15$

3. Without logarithm tables or calculators, evaluate: $\frac{25^{3/4} \times 0.9^2 \times 2^2}{5^{5/2} \times 3^3}$ in the form A/B where A and B are integers

4. Find the value of x given that :
   $2^x=0.0625$ (x is an integer)

6. Find the value of x which satisfies the equation $16^{x^2} = 8^{4x-3}$

7. Solve the equation;
   $9^{x+1} + 3^{2x+1} = 36$

8. By letting **P** = 4^{-y} in the equation:
   $4^{-2y+1} - 3 \times 4^{-y} - 10 = 0$
   (a) Write the above equation in terms of **P**
   (b) Hence find the possible values of **y**

9. Solve for **x** in the equation.

10. In the expansion of $\left(\mathbf{ax - \frac{2}{x^2}}\right)^{\mathbf{6}}$ the constant term is 4860. Find the value of **a**.

21. Reciprocals

1. Use reciprocal, square and square root tables to evaluate, to 4 significant figures, the expression. $\sqrt{\frac{1}{24.56} + 4.346^2}$ (3 mks)

1. Use reciprocal table to evaluate giving your answer to three significant figures.
$\frac{10}{0.834} - \frac{3}{129.64}$

2. Find the reciprocals of the numbers 807 and 0.0591;
Hence evaluate $\frac{5}{807} + \frac{4}{0.0591}$

3. Use reciprocal tables to find the value of:
$\frac{1}{3}\left\{\frac{2}{0.\,6638} + \frac{5}{0.833}\right\}$

4. Find without using a calculator, the value of :
$$\frac{12\sqrt{0.0625 - 12.4 \div 0.4 \times 3}}{{}^{1}/_{8} \text{ of } 2.56 + 8.68}$$

5. Use tables of cubes, cube roots and reciprocal to find the value of:-
$$\frac{4}{(8.68)^3} + \left[\frac{5}{34.46}\right]^{1/3}$$

6. Determine the value of **a** for which $\frac{1}{127} + \frac{1}{11.5} = \frac{1}{a}$ Use mathematical tables only

7. Use tables of squares, square roots and reciprocals only to find the value of **x** correct to 4 significant figures: $\mathbf{x} = \sqrt{\frac{1}{3.593^2} + \frac{2}{0.526}}$

8. Use reciprocal tables to find the value of ;
$$\frac{1}{3}\left\{\frac{2}{0.6638} + \frac{5}{0.833}\right\}$$

9. Use tables of reciprocals only to work out;
$\frac{3}{0.6735} + \frac{13}{0.156}$

10. Using tables of squares, cube roots and reciprocals find the value of **x**.
$\frac{1}{x} = \frac{1}{0.002593^{1/3}} - \frac{1}{1.28^2}$

22. Common Logarithms.

1. The product of a and $\sqrt[3]{b}$ is 31.59. Given that logarithm of a is 2.6182. Find using logarithm the value of b. to 4 significant figures. (4mks)
2. Evaluate without using mathematical tables or calculators,
$2 \log_{10} 5 - \frac{1}{2} \log_{10} 64 + 2 \log_{10} 40.$ (3mks)

3. Use logarithm table to evaluate. (4 marks)

$$\sqrt[3]{\frac{(0.0246)^2 \text{ x } 142}{0.002 \text{ x } 1.14}}$$

4. Without using log tables or a calculator; solve (4mks)

$$\frac{\log \frac{1}{4} + \log 64}{\log \frac{1}{3^2} - \log \frac{1}{8}}$$

5. Solve for x given

$\left(\frac{1}{8}\right)^x .64^2 = 256$ (3 marks)

6. Use logarithms to evaluate $\frac{(0.6845)^2 \times (0.08416)^{\frac{1}{3}}}{0.005937}$ (4mks)

7. Use logarithms to evaluate (4 marks)

$$8.694 \div \left[(0.1267)^{\frac{1}{3}} \times 0.006974 \right]^{\frac{3}{4}}$$

8. Use mathematical table to evaluate.

$$\sqrt[4]{\frac{2849 \text{ x } 0.00574}{36.89 \div 0.023}}$$

9. Given that $y = Bx^n$. Make n the subject of the formula and simplify your answer

10. Without using mathematical tables or calculators evaluate: $6\log_2 64 + 10\log_3 (243)$

11. Find the value of x that satisfies the equation $\log (2x - 11) - \log 2 = \log 3 - \log x$

12. Use logarithms to evaluate to 3 significant figures

$$\frac{(0.5241)^2 \text{ x } 83.59}{\sqrt[3]{0.3563}}$$

13. Use logarithm tables in all your steps to evaluate:

$\sqrt[3]{\frac{38.32 \text{ x } 12.964}{86.37 \text{ x } 6.285}}$ leaving your answer to four decimal places

14. Make **L** the subject in :

$$H = \sqrt[3]{\left(\frac{3d\,(L - d)}{10L}\right)}$$

15. Using logarithm tables solve.

$$\left(\frac{6.195 \text{ x } 11.82}{}\right)^{¼}$$

83.52

16. Solve the simultaneous equation:-
$\text{Log}(x-1) + 2\log y = 2\log 3$
$\log x + \log y = \log 6$

17. Without using logarithms tables or calculator evaluate:-
$\frac{4}{5}\log_{10}32 + \log_{10}50 - 3\log_{10}2$

18. Use logarithms to evaluate:-
$\frac{6.598}{(0.9895)^2 \times 0.004974^{0.75}}$ and express the answer in standard form

19. Solve for **x** given that :- $\log(3x + 8) - 3\log 2 = \log(x-4)$

20. In this question, show all the steps in your calculations, giving your answer at each stage.
Use logarithms correct to 4 decimal places to evaluate:

$$\sqrt[3]{\frac{36.72 \times (0.46)^2}{185.4}}$$

21. Use logarithms to evaluate correct to 4 s.f

$$\left(\frac{\sin 44.5}{\tan 14.90 \times \cos 82}\right)^{\frac{1}{2}}$$

22. Without using logarithm tables evaluate:

$$\sqrt[3]{\frac{3.264 \times 1.215 \times \sqrt{12.25}}{1.088 \times 0.4725}}$$

23. Without using a calculator/mathematical tables, solve: $\text{Log}_8(x + 5) - \log_8(x - 3) = \text{Log}_8 4$

24. Use tables to calculate ;$(6.57^2 + 6.57) \div (7.92^2 \times 30.08)$(Give your answer to 4 decimal places)

25. If $\log_2 = 0.30103$, and $\log_3 = 0.47712$, calculate without using tables or calculators the value of $\log 120$

26. Solve for x in the following equation; $\text{Log}_2(3x - 4) = \frac{1}{3}\log_2 8x^6 - \log_2 4$

27. By showing all the steps, use logarithms to evaluate: $\frac{5.627 \times (0.234)^3}{(8.237)^{\frac{1}{2}}}$

28. Solve the logarithimic equation: $\log_{10}(6x - 2) - 1 = \log_{10}(x-3)$

29. In this question, show all the steps in your calculations, giving your answers at each stage.
Use logarithms, correct to 4 d.p to evaluate:-

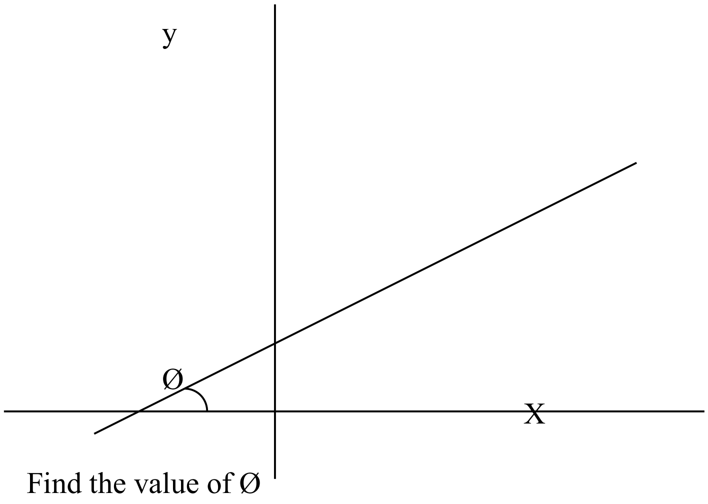
$$\sqrt[3]{\frac{(0.07526)^2}{1.789 + 4.863}}$$

30. Evaluate using logarithms

$$\sqrt{\frac{4.283 \times (0.009478)^2}{\text{Log } 9.814}}$$

23. Equations of straight lines

1. If the equation $RV = 3.2 + \frac{1}{4}V$, where R and V are variables, is re-arranged in form $y = mx + c$, determine the gradient and the y-intercept of the line drawn. (3 mks)
2. A straight line passes through A(-2,1) and B(2,-k). The line is perpendicular to a line 3y + 2x = 5. Determine the value of k. (3mks)
3. A line whose gradient is positive is drawn on the Cartesian plane and its equation is $x - y\sqrt{3} = -3$. Calculate the angle formed between the line and X axis. (3mks)
4. A straight line L_1 passes through P(2,1) and is perpendicular to straight line L_2, whose equation is 2y – x + 4 = 0. Find the equation of L_1. (3 marks)
5. Find the equation of a line passing through point (-3, 5) and perpendicular to the line 2y + x – 3 = 0, answer in the form of ay + bx + c = 0 (3mks)
6. A straight line through the points A(2,1) and B(4,m) is perpendicular to the line whose equation is 3y = 5 – 2x. Determine the value of m and the equation of line AB (4mks)
7. The straight line passing through the point (-3,-4) is perpendicular to the line whose equation is 2y+3x=1 and intersect the x-axis and y-axis at points P and Q respectively. Find the length of PQ. (4mks)
8. The gradient of a line L through points A(2x,4) and B(-1,x) is $^1/_7$. Find the equation of a line perpendicular to L through B. (3 marks)
9. A triangle has vertices A(2,5), B(1,2) and C(-5,1). Determine:
   (i) The equation of line BC. (2mks)
   (ii) The equation of the perpendicular from A to BC. (1mk)
10. The line y = 3x + 3 meets the line L_1 at the point (2, 9) and at a right angle.
    (a) Find the points at which the two lines intersect with the x – axis. (3mks)
    (b) Hence calculate the area bound by the two lines and the x – axis. (1mk)
11. A line with gradient -3 passes through the points (3, k) and (k, 8). Find the value of K and hence express the equation in the form ax + by = c where a, b and c are constants. (4 mks)
12. The straight line through the points D (6,3) and E (3, -2) meets the y – axis at point F. Find the co-ordinates of F (3 mks)
13. Find the obtuse angle the line y – 2x = 7 makes with the x – axis (2 mks)
14. The figure below shows a sketch a of a line 5y-3x = 15



Find the value of Ø (3 marks)

15. A solid right pyramid has a rectangular base 10cm by 8cm and slanting edge 16cm. calculate:
    (a) The vertical height
    (b) The total surface area
    (c) The volume of the pyramid

16. The line passing through the points A (-1, 3K) and B (K, 3) is parallel to the line whose equation is **$2y + 3x = 9$**. Write down the co-ordinates of A and B

17. Find the value of **a** if the gradient of the graphs of the function $y = x^2 - x^3$ and $y = x - ax$ are equal at $x = {}^1/_3$

18. Two perpendicular lines meet at the point (4,5). If one of the lines passes through the point (-2,1), determine the equation of the second line in the form $ax + by + c = 0$.

19. Find the equation of the line passing through (-5, 2) and with X-intercept as 3. Leave your answer in the form of **$Y = mX + C$**

20. (a) copy and complete the table below:

x	0	1	2	3	4	5	6
$y = 2x - 4$							
$y = 12 - 2x$							

(b) (i) On the grid provided and using the same axes, draw the lines $y = 2x + 4$ and $y = 12 - 2x$
(ii) Hence use your graphs to solve the simultaneous equations
$\frac{1}{2}x - \frac{1}{4}y = 1$
$x + \frac{1}{2}y = 6$
(c) By use of substitution method, solve the simultaneous equations;
$6x + 4y = 36$
$x + 3y = 13$

21. Find the equation of a line through point -2, 4 which is parallel to $3y =- 2x + 8$. Express your answer in the form $y = (mx + c)$

22. Determine the equation of a line passing through (-1, 3) and parallel to the line whose equation is $3x - 5y = 10$

23. On a certain map, a road 20km long is represented by a line 4cm long. Calculate the area of a rectangular plot represented by dimensions 2.4cm by 1.5cm on this map – leaving your answer in hectares

24. A straight line passing through point (-3,4) is perpendicular to the line whose equation is $2y-5x=11$ and intersects the x-axis and y-axis at the points P and Q respectively. Find the co-ordinates of P and Q

25. A triangle ABC is formed by the points A(3, 4), B(-7, 2) and C(1, -2)
    (a) Find the co-ordinates of the mid-points K of AB and P of AC
    (b) Find the equation of the perpendicular bisector of the KP

26. The equation of line L_1 is ${}^{-3}/_5x + 3y = 6$. Find the equation of a line L_2 passing through point T (1, 2) and perpendicular to line L_1

27. Determine the equation of a line passing through (-1, 3) and parallel to the line whose equation is $3x - 5y = 10$

28. A straight line through the points A (2, 1) and B (4, m) is perpendicular to the line, whose equation is 3y = 5-2x. Determine the value of **m**

29. Determine the equation of a line which is perpendicular to the line 2x + 3y + 4 = 0 and passes through P(1,1)

30. Koech bought 144 pineapples at shs.100 for every six pineapples. She sold some of them at shs.72 for every three and the rest at shs.60 for every two. If she made a profit of 40%; Calculate the number of pineapples sold at 72 for every three

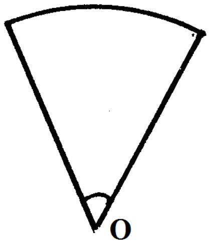
31. Solve the equation $\frac{x+2}{3} - \frac{x-1}{2} = 5$

24. Reflection and Congruence

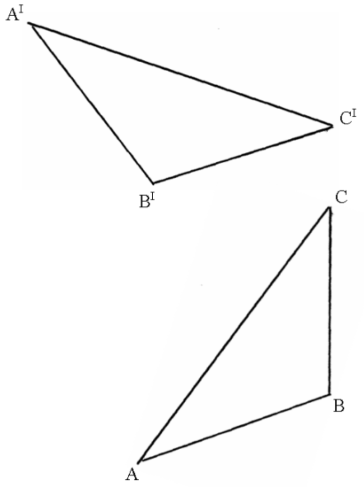
1. Given that A' (3, -3) is the image of A (-1, -5) under a reflection. Find the equation of the mirror line in the form of $ax + by + c = 0$ (4 mks)
2. Three planes **A**, **B** and **C** leave an airport **P** simultaneously at 9.30a.m. Plane **A** flies on a bearing of 070° from P at a speed of 400km/h. Plane **B** flies on a bearing of 290°at a speed of 500km/h. Plane C flies on a bearing of 162° from **P** at a speed of 300km/h. (***Use scale drawing for this questio***n)
   (a) Show by scale drawing, the relative positions of the 3planes A, B and C three hours after leaving airport P. (Use scale 1cm represents 200km)
   (b) After 3 hours, **B** turns and head straight to the current position of **A** at the same speed it had. Determine the scale drawing , the time it takes to reach this point, to the nearest minute
   (c) Determine the bearing and distance of **B** from **C** after the first 3 hours of flight after leaving **P**

25. Rotation

1. Triangle PQR has vertices P(3,2), Q(-1,1) and R(-3,-1).
   (a) Draw PQR on the grid provided. (1mk)
   (b) Under a rotation the vertices of $P^1Q^1R^1$ are $P^1(1,4)$, $Q^1(2,0)$ and $R^1(4,-1)$. Find the centre and angle of rotation using points P and Q. (4mks)
   (c) Triangle PQR is enlarged with scale factor 3 centre O(0,0) to give triangle $P^2Q^2R^2$. Draw triangle $P^2Q^2R^2$ and state its co-ordinates. (2mks)
   (d) Triangle $P^1Q^1R^1$ undergoes reflection in line y = -x to give triangle $P^3Q^3R^3$. Draw $P^3Q^3R^3$ and state its coordinates. (3mks)
2. The figure below shows part of a diagram of rotation symmetry order 3 about a point O. Complete the diagram. (3mks)



3. In the figure below, triangle $A^IB^IC^I$ is the image of triangle ABC under a rotation, centre O.

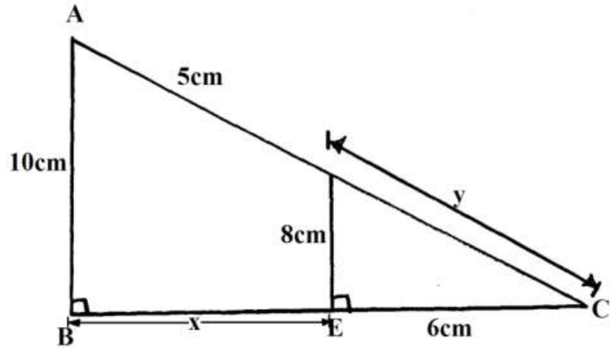


By construction, find and label the centre O of the rotation.
Hence, determine the angle of the rotation. (3mks)

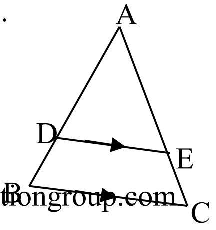
4. The ratio of the lengths of the corresponding sides of two similar rectangular water tanks is 3: 5. The volume of the smaller tank is $8.1m^3$. Calculate the volume of the larger tank

26. Similarities and Enlargement

1. Two tanks are similar in shape. The capacity of the tanks are 1,000,000 litres and 512, 000 litres respectively.
   - (a) Find the height of the smallest tank if the larger is 300cm tall (4 mks)
   - (b) Calculate the surface area of the larger tank if the smaller tank has a surface area of $1200m^2$ (3 mks)
   - (c) Estimate the mass of the smaller tank if the mass of the larger one is 800kg (3 mks)
2. Under an enlargement transformation point A(1,-4) is mapped onto $A^1(2,5)$ with scale factor 3. Find the centre of enlargement. (2mks)
3. In the figure below, AB is parallel to DE. Find the value of x and y. (3mks)

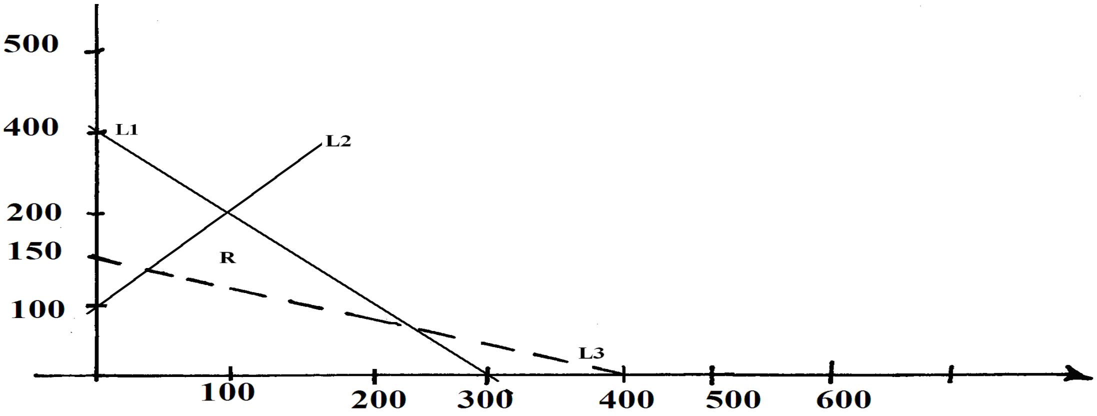


4. Two similar cans have different heights 8cm and the other one 10cm. If the surface area of the larger can is $480cm^2$, find the surface area of the smaller can. (3 marks)
5. The area of triangle ADE is $15cm^2$. Given that BD:BA = 1:3, and DE is parallel to BC. Find the area of triangle ABC in the figure. (3mks)



6. Triangle ABC has vertices at A(1, 4) B(2, 6) C(2,5). Its image under an enlargement has vertices at $A^1(3,2)$ $B^1(5,6)$ $C^1(5,4)$.
   (a) Find the centre and scale factor of the enlargement. (3mks)
   (b) Triangle ABC is given a rotation of -90^0 about the origin to get $A^{11}B^{11}C^{11}$. Write down the coordinates of $A^{11}B^{11}C^{11}$. (2mks)
   (c) $A^{11}B^{11}C^{11}$ is reflected on the line y + x = 0 to get $A^{111}B^{111}C^{111}$. Give the coordinates of the image $A^{111}B^{111}C^{111}$. (2mks)
   (d) Find a single matrix that maps $A^{111}B^{111}C^{111}$ onto ABC. Describe this single transformation. (3mks)

7. Give the inequalities which define the region R
   a)



(6mks)

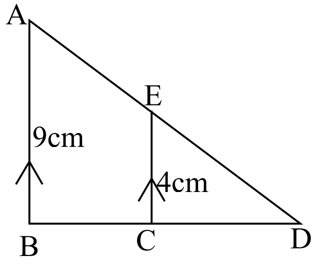
   b) Under enlargement with scale factor -3, the point P(3,6) is mapped onto $P_1(7,18)$. Find the centre of this enlargement and the image of the point $Q_1(1,1)$ under the same enlargement (4 mks)

8. The masses of two similar bars of soap are 343g and 1331g. If the surface area of the smaller bar is 196 cm^2. Calculate the surface are of the larger bar. (3 marks

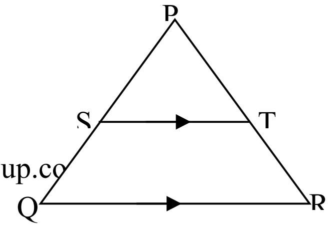
9. The image of P(0,2) under an enlargement with a scale factor 3 is P^1 (4,6).
   Find the co-ordinates of Q

10. A model of a building is made using a scale 1:500.
    (a) Find the height of a room (in meteres) in the building which is 5cm long on the model?***S*****
    (b) A room has a floor area of $36m^2$. What is the corresponding area on the floor of the model
    (c) A room has a volume of $120m^3$. What is the corresponding volume of the model in cm^3?***S*****

11. In the triangle ABD, BA is parallel, to CE, given that BA= 9cm, CE = 4cm and AE =3cm, find the length of DE



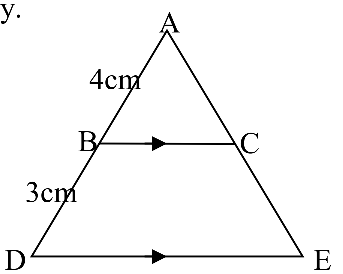
12. In the following figure, PR = 12cm, TR = 4cm and ST is parallel to QR. Given that the area of triangle PQR is $336cm^2$, find the area of quadrilateral QRTS



13. Two dogs regarded similar with the length in ratio 4:3:-
(a) If the bigger dog has a tail 64cm long, find the length of the tail of the smaller dog
(b) If the smaller dog requires 810g of meat per day how much meat per day does the bigger dog require

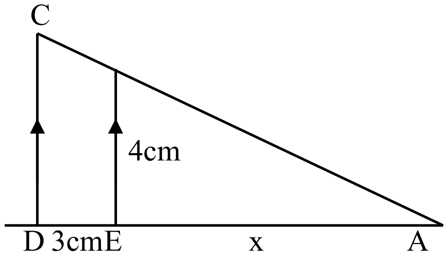
14. In the figure below, ADE is a triangle and BC is parallel to DE, AB, BD and BC are 4cm, 3cm and 8cm respectively.

Find the length of DE



15. The surface area of two similar bottles are 12cm² and 108cm² respectively. If the larger one has a volume of 810cm³. Find the volume of the smaller one

16. Given that the area of the trapezium CDEB is 15.6 cm^2, find the length EA marked X.



27. The Pythagoras theorem

1. The angle of elevation of the top of a tree from a point P on the horizontal ground is 24.5°. From another point Q, five metres nearer to the base of the tree, the angle of elevation of the top of the tree is 33.2°. Calculate to one decimal place, the height of the tree

2. A block of wood in the shape of a frustrum of a cone of slanting edge 30 cm and base radius 10cm is cut parallel to the base, one third of the way from the base along the slanting edge. Find the ratio of the volume of the cone removed to the volume of the complete cone.

28. The Trigometric Ratio 1

1. Given sin(90 - a) = ½ , find without using trigonometric tables the value of cos a (2mks)

2. If $\tan\theta = \frac{24}{45}$,find without using tables or calculator, the value of

$$\frac{\tan\theta - \cos\theta}{\cos\theta + \sin\theta}$$ (3 marks)

3. At point A, David observed the top of a tall building at an angle of 30°. After walking for 100meters towards the foot of the building he stopped at point B where he observed it again at an angle of 60°. Find the height of the building

4. Find the value of θ, given that ½ sinθ = 0.35 for $0^o \leq \theta \leq 360^o$

5. A man walks from point **A** towards the foot of a tall building 240 m away. After covering 180m, he observes that the angle of elevation of the top of the building is 45^o. Determine the angle of elevation of the top of the building from **A**

6. The table below gives a field book showing the results of a survey of a section of a piece of land between A and E. All measurements are in metres.

	E	
D33	95	
	90	**F** 36
C21	70	
B 42	30	**G** 25
	25	**H** 40
	A	

(a) Draw a sketch of the land.
(b) Calculate the area of this piece of land.

7. Solve for x in $2 \text{ Cos}2x^0 = 0.6000$ $0^0 \leq x \leq 360^0$.

8. Wangechi whose eye level is 182cm tall observed the angle of elevation to the top of her house to be 32^o from her eye level at point A. she walks 20m towards the house on a straight line to a point B at which point she observes the angle of elevation to the top of the building to the 40^o. Calculate, correct to 2 decimal places the ;
a)distance of A from the house
b) The height of the house

9. Given that cos A = $^5/_{13}$ and angle A is acute, find the value of:-
2 tan A + 3 sin A

10. Given that tan 5° = 3 + 5, without using tables or a calculator, determine tan 25°, leaving your answer in the form $a + b\sqrt{c}$

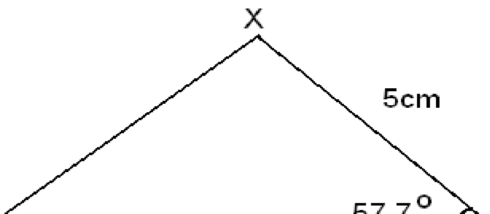
11. A student whose eye level is 182cm from the ground observed the top of their house at an angle of elevation of 32^o at point **A**. She walked for 20m towards the house along a straight road to a point **B**, where she observed the top of the building again at an angle of elevation of 40^o. Calculate correct to 2 decimal places the:-
(a) Distance of **A** from the house
(b) The height of the house

12. Given that $\tan \mathbf{x} = \frac{5}{12}$, find the value of the following without using mathematical tables or calculator:
(a) Cos x
(b) $\text{Sin}^2(90\text{-}x)$

13. If $\tan\theta = {}^8/_{15}$, find the value of $\frac{\mathbf{Sin\theta - Cos\theta}}{\mathbf{Cos\theta + Sin\theta}}$ without using a calculator or table

29. Area of a triangle

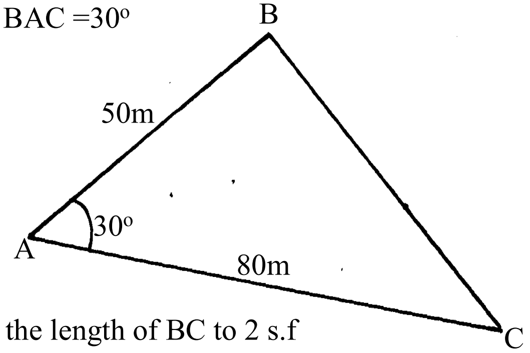
1. The sides of a triangle are in the ratio 3:5:6. If its perimeter is 56 cm, use the Heroes formula to find its area (4mks)
2. The figure below is a triangle XYZ. ZY = 13.4cm, XY = 5cm and angle xyz = 57.7^o



Calculate

g. Length XZ. (3mks)
h. Angle XZY. (2 mks)
i. If a perpendicular is dropped from point X to cut ZY at M, Find the ratio MY:ZM. (3 mks)
j. Find the area of triangle XYZ. (2 mks)

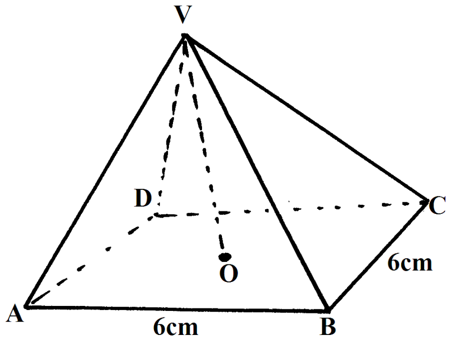
3. The figure below represents a triangular plot ABC. The lengths of AB = 50m, AC = 80m and angle BAC =30°



(a) Find the length of BC to 2 s.f
(b) Find the area of the plot in hectares
(c) The plot is fenced using 4 strands of barbed wire. The length of one roll of barbed wire is 600m and it costs shs.4000. Calculate;
(i) The length of fencing wire required
(ii) The number of complete rolls to be bought
(iii) The cost of the rolls

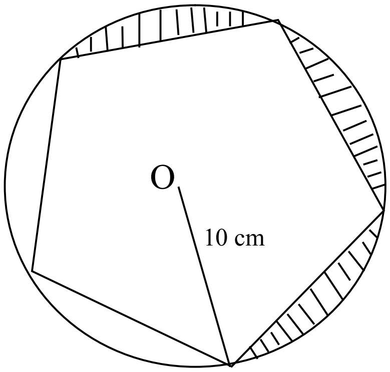
30. Area of polygons

1. The figure below is a squre based pyramid ABCD with AB = BC = 6cm and height VO = 10cm.



(a) State the projection of VA on the base ABCD. (1mk)
(b) Find the length VA. (3mks)
(c) Calculate angle between VA and plane ABCD. (2mks)
(d) Find angle between VCD and ABCD. (2mks)
(e) Calculate the volume of the solid (2mks)

2. The diagram below, not drawn to scale, is a regular pentagon circumscribed in a circle of radius 10 cm at centre O

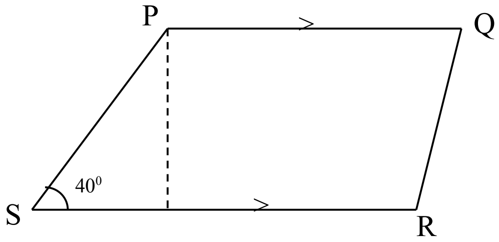


Find

(a) The side of the pentagon (2 mks)

(b) The area of the shaded region (3 mks)

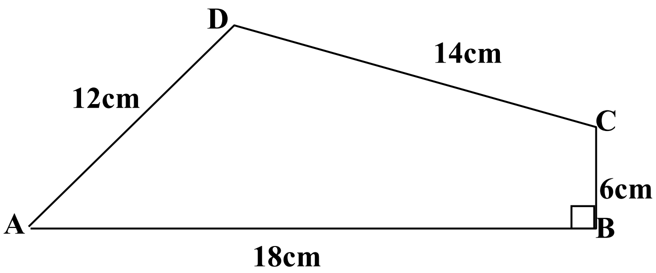
3. PQRS is a trapezium in which PQ is parallel to SR, PQ = 6cm, SR = 12cm, ∠PSR = 40^0 and PS = 10cm. Calculate the area of the trapezium. (4mks)



4. A regular octagon has an area of 101.8 cm^2. calculate the length of one side of the octagon (4marks)

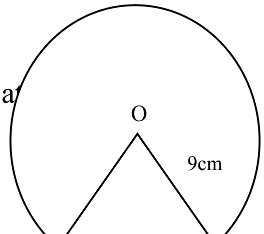
5. Find the area of a regular polygon of length 10 cm and side **n**, given that the sum of interior angles of **n : n –1** is in the ratio 4 : 3.

6. Calculate the area of the quadrilateral ABCD shown:-



31. Area of part of a circle

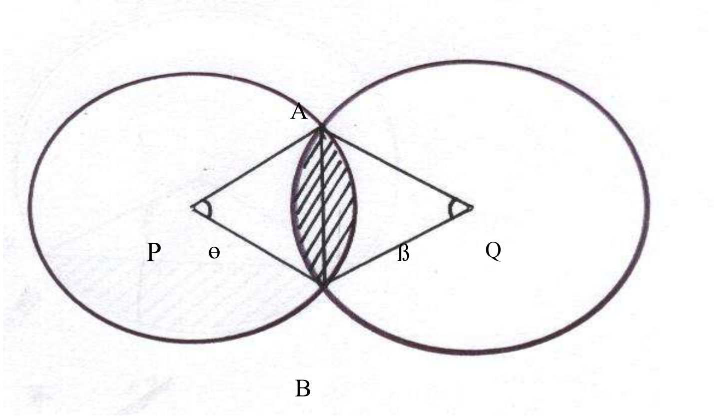
1. The figure below shows a circle of radius 9cm and centre O. Chord AB is 7cm long. Calculate the area of the shaded region. (4mks)



A B

O

2. The figure below shows two intersecting circles with centres P and Q of radius 8cm and 10cm respectively. Length AB = 12cm



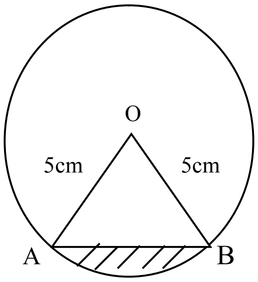
Calculate:

a) ∠ APB (2mks)

b) ∠AQB (2mks)

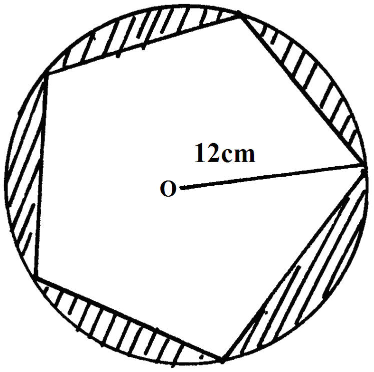
c) Area of the shaded region (6mks)

3.



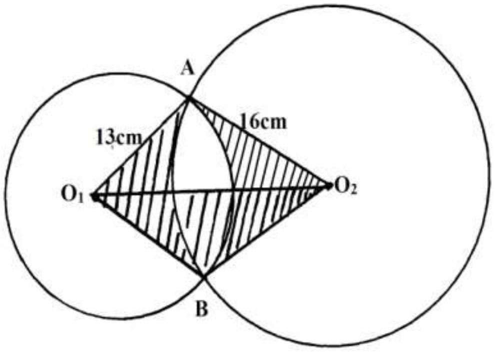
The diagram above represents a circle centre o of radius 5cm. The minor arc AB subtends an angle of 120^0 at the centre. Find the area of the shaded part. (3mks)

4. The figure below shows a regular pentagon inscribed in a circle of radius 12cm, centre O.

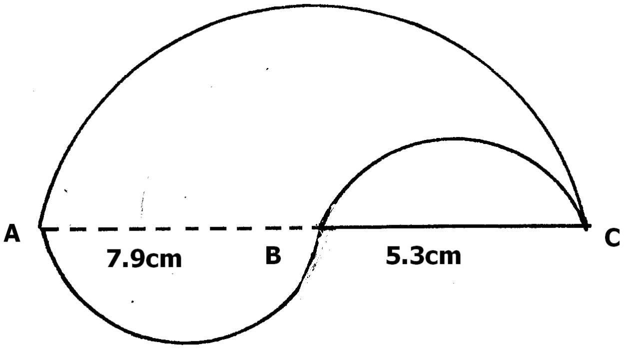


Calculate the area of the shaded part. (3mks)

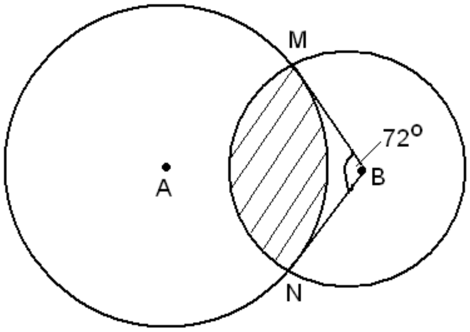
5. Two circles of radii 13cm and 16cm intersect such that they share a common chord of length 20cm. Calculate the area of the shaded part. $\left(\pi = \frac{22}{7}\right)$ (10mks)



6. Find the perimeter of the figure below, given AB,BC and AC are diameters. (4mks)



7. The figure below shows two intersecting circles. The radius of a circle A is 12cm and that of circle B is 8 cm.



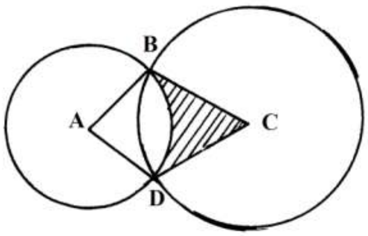
If the angle MBN = 72°, calculate

a) The size of the angle MAN

b) The length of MN

c) The area of the shaded region.

8.



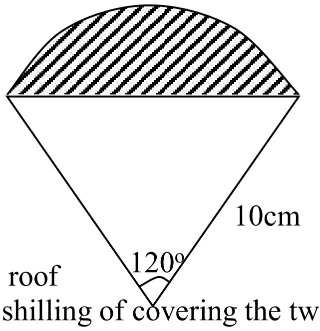
In the diagram above, two circles, centres A and C and radii 7cm and 24cm respectively intersect at B and D. AC = 25cm.

a) Show that angel ABC = 90^0

b) Calculate

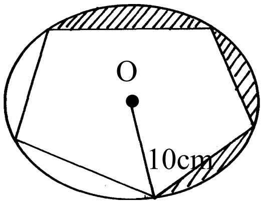
i) the size of obtuse angel BAD
ii) the area of the shaded part (10 Mks)

9. The ends of the roof of a workshop are segments of a circle of radius 10m. The roof is 20m long. The angle at the centre of the circle is 120° as shown in the figure below:



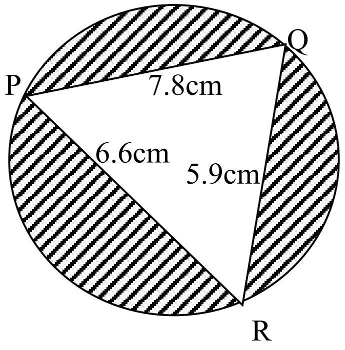
(a) **Calculate :-**
(i) The area of one end of the roof
(ii) The area of the curved surface of the roof
(b) What would be the cost to the nearest shilling of covering the two ends and the curved surface with galvanized iron sheets costing shs.310 per square metre

10. The diagram below, not drawn to scale, is a regular pengtagon circumscribed in a circle of radius 10cm at centre O



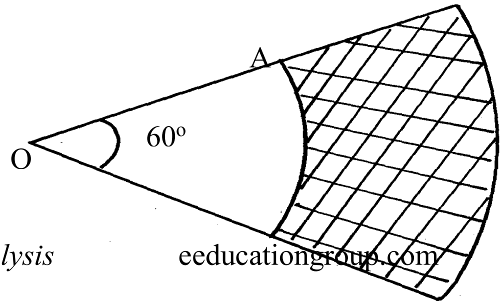
Find;
(a) The side of the pentagon
(b) The area of the shaded region

11. Triangle **PQR** is inscribed in he circle **PQ**= 7.8cm, **PR** = 6.6cm and **QR** = 5.9cm. Find:



(a) The radius of the circle, correct to one decimal place
(b) The angles of the triangle
(c) The area of shaded region

12. The figure below represents sector OAC and OBD with radius OA and OB respectively. Given that OB is twice OA and angle AOC = 60°. Calculate the area of the shaded region in m^2, given that OA = 12cm

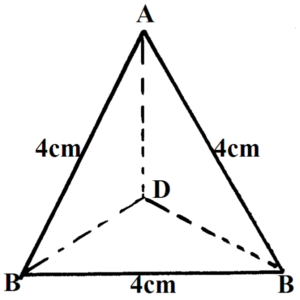


C

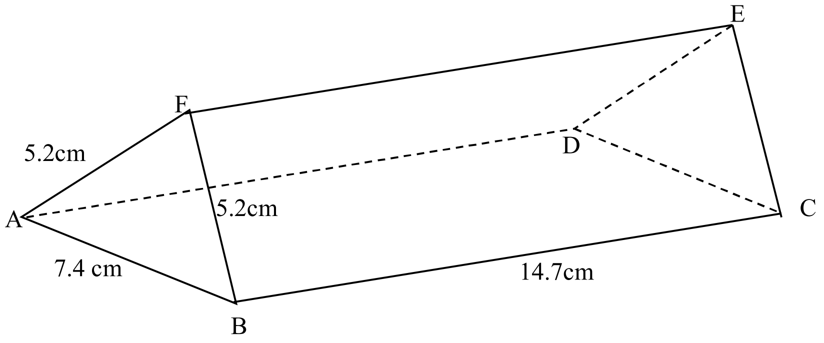
D

32. Surface Area of Solids

1. A swimming pool water surface measures 10m long and 8m wide. A path of uniform width is made all round the swimming pool. The total area of the water surface and the path is 168m^2
   (a) Find the width of the path (4 mks)
   (b) The path is to be covered with square concrete slabs. Each corner of the path is covered with a slab whose side is equal to the width of the path. The rest of the path is covered with slabs of side 50cm. The cost of making each corner slab is sh 600 while the cost of making each smaller slab is sh.50. Calculate
   (i) The number of the smaller slabs used (4 mks)
   (ii) The total cost of the slabs used to cover the whole path (2 mks)
2. The figure below shows a solid regular tetrapack of sides 4cm.
   (a) Draw a labelled net of the solid. (1mk)
   (b) Find the surface area of the solid. (2mks)

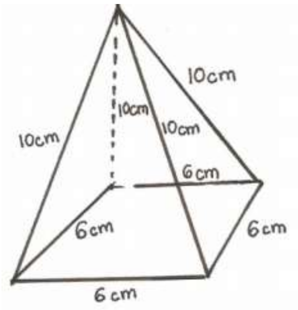


3. The diagram shows a right glass prism ABCDEF with dimensions as shown.

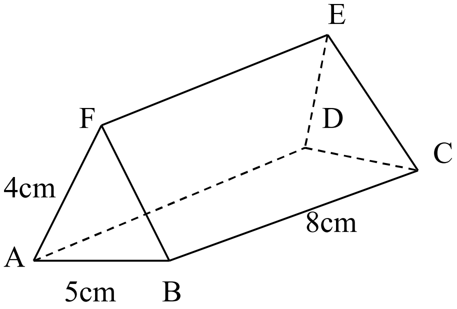


Calculate:
(a) the perimeter of the prism (2 mks)
(b) The total surface area of the prism (3 mks)
(c) The volume of the prism (2 mks)
(d) The angle between the planes AFED and BCEF (3 mks)

4. The base of a rectangular tank is 3.2m by 2.8m. Its height is 2.4m. It contains water to a depth of 1.8m. Calculate the surface area inside the tank that is not in contact with water. (2mks)
5. Draw the net of the solid below and calculate surface area of its faces (3mks)



6.

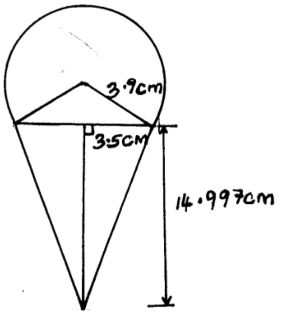


The figure above is a triangular prism of uniform cross-section in which AF = 4cm, AB = 5cm and BC = 8cm.

(a) If angle BAF = 30^0, calculate the surface area of the prism. (3 marks)

(b) Draw a clearly labeled net of the prisms. (1 mark)

7. Mrs. Dawati decided to open a confectionary shop at corner Baridi. She decorated its entrance with 10 models of cone ice cream, five on each side of the door. The model has the following shape and dimensions. Using $\pi = 3.142$ and calculations to 4 d.p.



(a) Calculate the surface area of the conical part. (2mks)

(b) Calculate the surface area of the top surface. (4mks)

(c) Find total surface area of one model. (2mks)

(d) If painting $5cm^2$ cost ksh 12.65, find the total cost of painting the models (answer to 1 s.f). (2mks)

8. A right pyramid of height 10cm stands on a square base ABCD of side 6 cm.

a) Draw the net of the pyramid in the space provided below. (2mks)

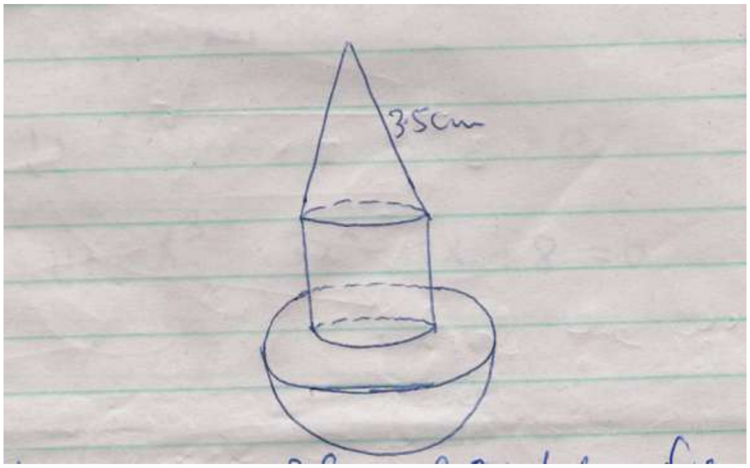
b) Calculate:-

   (i) The perpendicular distance from the vertex to the side AB. (2mks)

   (ii) The total surface area of the pyramid. (4mks)

c) Calculated the volume of the pyramid. (2mks)

9. The figure below shows a solid object consisting of three parts. A conical part of radius 2 cm and slant height 3.5 cm a cylindrical part of height 4 cm. A hemispherical part of radius 3 cm . the cylinder lies at the centre of the hemisphere. ($\pi = 3.142$)



Calculate to four significant figures:

I. The surface area of the solid (5 marks)

II. The volume of the solid (5 marks)

10. A lampshade is in the form of a frustrum of a cone. Its bottom and top diameters are 12cm and 8cm respectively. Its height is 6cm.Find;

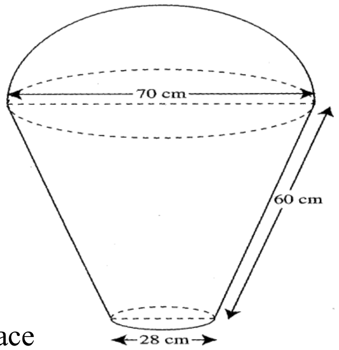
(a) The area of the curved surface of the lampshade

(b) The material used for making the lampshade is sold at Kshs.800 per square metre. Find the cost of ten lampshades if a lampshade is sold at twice the cost of the material

11. A cylindrical piece of wood of radius 4.2cm and length 150cm is cut lengthwise into two equal pieces. Calculate the surface area of one piece

12. The base of an open rectangular tank is 3.2m by 2.8m. Its height is 2.4m. It contains water to a depth of 1.8m. Calculate the surface area inside the tank that is not in contact with water

13. The figure below represents a model of a solid structure in the shape of frustrum of a cone with a hemisphere top. The diameter of the hemispherical part is 70cm and is equal to the diameter of the top of the frustrum. The frustrum has a base diameter of 28cm and slant height of 60cm.



Calculate :

(a) the area of the hemispherical surface

(b) the slant height of cone from which the frustrum was cut

(c) the surface area of frustrum

(d) the area of the base

(e) the total surface area of the model

14. A room is 6.8m long, 4.2m wide and 3.5m high. The room has two glass doors each measuring 75cm by 2.5m and a glass window measuring 400cm by 1.25m. The walls are to be painted except the window and doors.

a) Find the total area of the four walls

b) Find the area of the walls to be painted

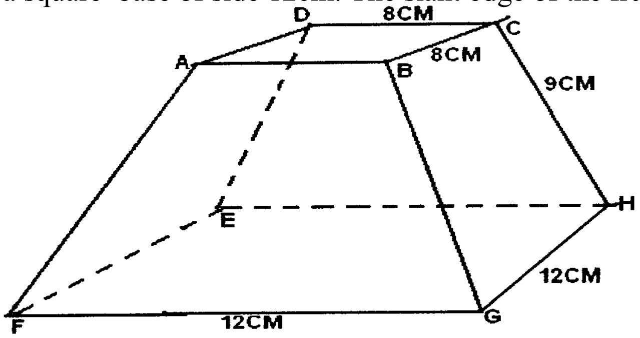
c) Paint **A** costs Shs.80 per litre and paint **B** costs Shs.35 per litre. 0.8 litres of **A** covers an area of 1m^2 while 0.5m^2 uses 1 litre of paint **B**. If two coats of each paint are to be applied. Find the cost of painting the walls using:

i) Paint **A**

ii) Paint **B**

d) If paint A is packed in 400ml tins and paint B in 1.25litres tins, find the least number of tins of each type of paint that must be bought.

15. The figure below shows a solid frustrum of pyramid with a square top of side 8cm and a square base of side 12cm. The slant edge of the frustrum is 9cm



Calculate:

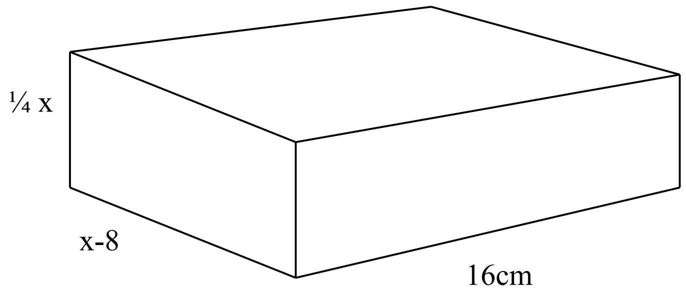
(a) the total surface area of the frustrum

(b) the volume of the solid frustrum

(c) the angle between the planes BCHG and the base EFGH.

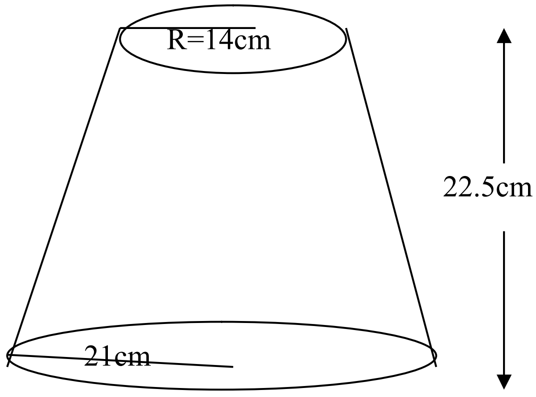
33. Volume of solids

1. Metal cube of side 4.4cm was melted and the molten material used to make a sphere. Find to 3 significant figures the radius of the sphere $\left(take\ \prod = \frac{22}{7}\right)$ (3 mks)
2. Two metal spheres of diameter 2.3cm and 3.86cm are melted. The molten material is used to cast equal cylindrical slabs of radius 8mm and length 70mm.
   If $^{1}/_{20}$ of the metal is lost during casting. Calculate the number of complete slabs casted. (4mks)
3. The volume of a rectangular tank is 256cm^3. The dimensions are as in the figure.



Find the value of x (3 marks)

4.

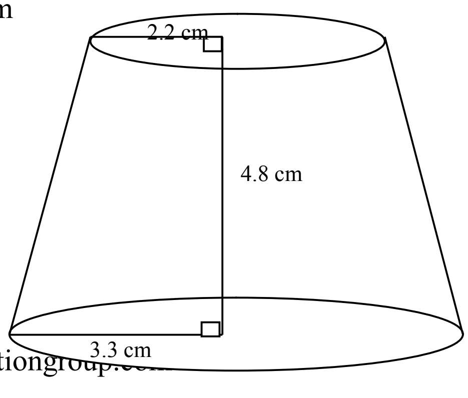


The diagram represent a solid frustum with base radius 21cm and top radius 14cm. The frustum is 22.5cm high and is made of a metal whose density is 3g/cm3 $\pi = 22/7$.

a) Calculate
   - (i) the volume of the metal in the frustrum. (5 marks)
   - (ii) the mass of the frustrum in kg. (2 marks)

b) The frustrum is melted down and recast into a solid cube. In the process 20% of the metal is lost. Calculate to 2 decimal places the length of each side of the cube. (3 marks)

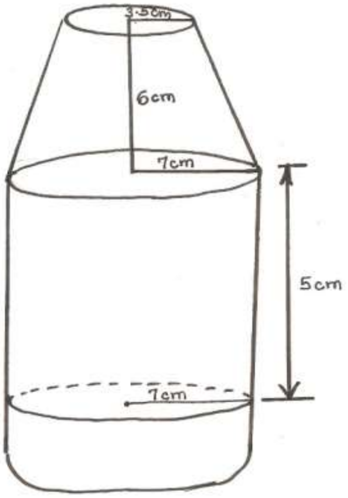
5. The figure below shows a frustrum



Find the volume of the frustrum (4 mks)

6. The formula for finding the volume of a sphere is given by $V = \frac{4}{3}\pi r^3$. Given that V = 311 and π=3.142, find r. `(3 mks)

7. A right conical frustrum of base radius 7cm and top radius 3.5cm, and height of 6cm is stuck onto a cylinder of base radius 7cm and height 5cm which is further attached to a hemisphere to form a closed solid as shown below

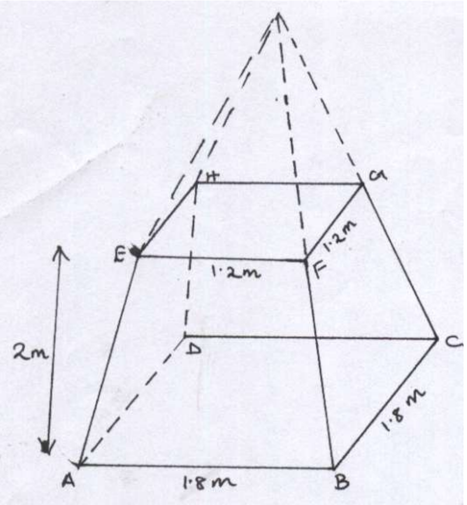


Find:

(a) The volume of the solid (5mks)

(b) The surface area of the solid (5mks)

8. A lampshade is made by cutting off the top part of a square-based pyramid VABCD as shown in the figure below. The base and the top of the lampshade have sides of length 1.8m and 1.2m respectively. The height of the lampshade is 2m



Calculate

a) The volume of the lampshade (4mks)
b) The total surface area of the slant surfaces (4mks)
c) The angle at which the face BCGF makes with the base ABCD. (2mks)

9. A solid right pyramid has a rectangular base 10cm by 8cm and slanting edge 16cm. calculate:

(a) The vertical height

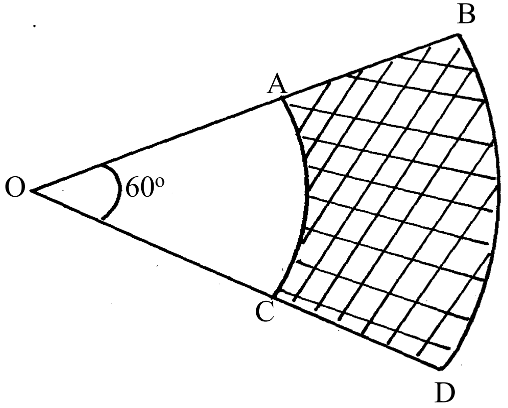
(b) The total surface area

(c) The volume of the pyramid

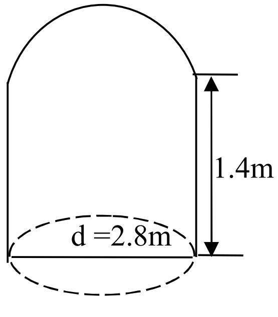
10. A solid cylinder of radius 6cm and height 12cm is melted and cast into spherical balls of radius 3cm. Find the number of balls made

11. The sides of a rectangular water tank are in the ratio 1: 2:3. If the volume of the tank is 1024cm^3. Find the dimensions of the tank. (4s.f)

12. The figure below represents sector OAC and OBD with radius OA and OB respectively. Given that OB is twice OA and angle AOC = 60^o. Calculate the area of the shaded region in m^2, given that OA = 12cm



13. The figure below shows a closed water tank comprising of a hemispherical part surmounted on top of a cylindrical part. The two parts have the same diameter of 2.8cm and the cylindrical part is 1.4m high as shown:-



(a) Taking $\pi = \frac{22}{7}$, calculate:

(i) The total surface area of the tank

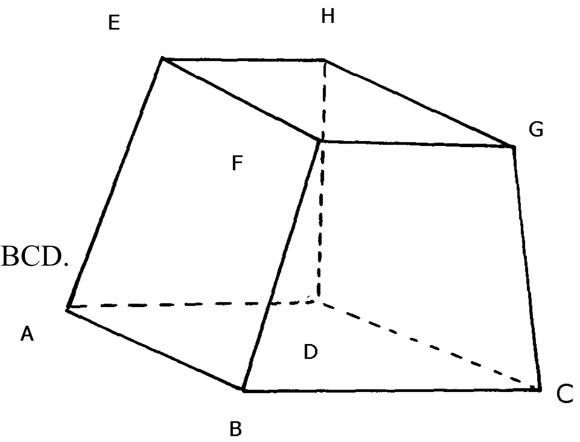
(ii) the cost of painting the tank at shs.75 per square metre

(iii) The capacity of the tank in litres

(b) Starting with the full tank, a family uses water from this tank at the rate of 185litres/day for the first 2days. After that the family uses water at the rate of 200 liters per day. Assuming that no more water is added, determine how many days it takes the family to use all the water from the tank since the first day

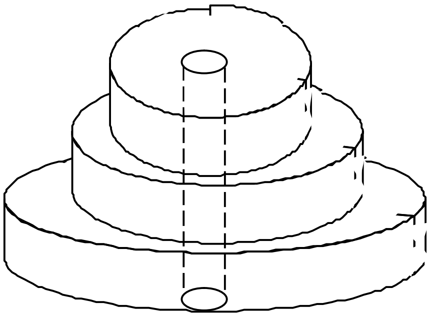
14. The figure below represents a frustrum of a right pyramid on a square base. The vertical height of the frustrum is 3 cm. Given that EF = FG = 6 cm and that AB = BC = 9 cm

Calculate;
a) The vertical height of the pyramid.
b) The surface area of the frustrum.
c) Volume of the frustrum.
d) The angle which line AE makes with the base ABCD.

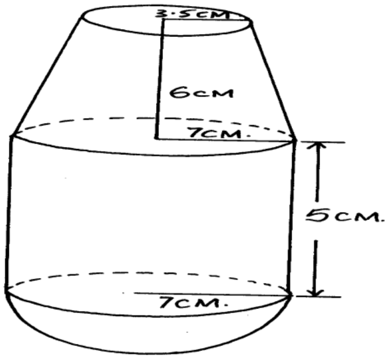


15. A metal hemisphere of radius 12cm is melted done and recast into the shape of a cone of base radius 6cm. Find the perpendicular height of the cone

16. A solid consists of three discs each of 1½ cm thick with diameter of 4 cm, 6 cm and 8 cm respectively. A central hole 2 cm in diameter is drilled out as shown below. If the density of material used is 2.8 g/cm^3, calculate its mass to 1 decimal place



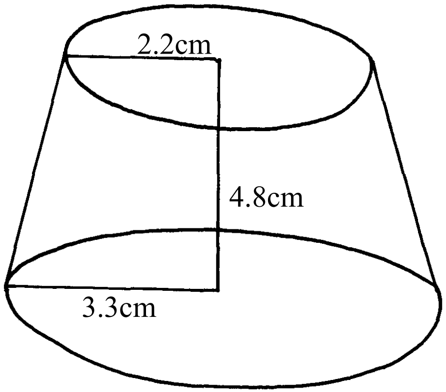
17. A right conical frustrum of base radius 7 cm and top radius 3.5 cm and height 6 cm is stuck onto a cylinder of base radius 7 cm and height 5 cm which is further attached to form a closed solid as shown below.



Find;
a) The volume of the solid.

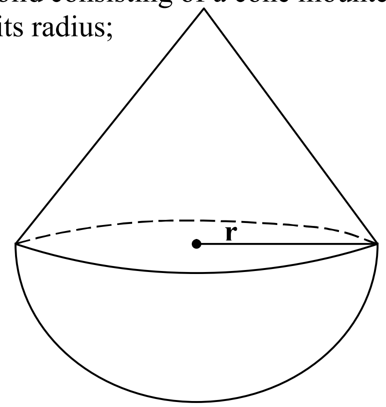
b) The surface area of the solid.

18. The figure below shows a frustrum



Find the volume of the frustrum

19. The diagram below shows a metal solid consisting of a cone mounted on hemisphere. The height of the cone is 1½ times its radius;

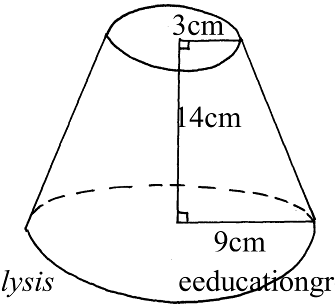


Given that the volume of the solid is 31.5π cm^3, find:

(a) The radius of the cone
(b) The surface area of the solid
(c) How much water will rise if the solid is immersed totally in a cylindrical container which contains some water, given the radius of the cylinder is 4cm
(d) The density, in kg/m^3 of the solid given that the mass of the solid is 144gm

20. A solid metal sphere of volume 1280 cm^3 is melted down and recast into 20 equal solid cubes. Find the length of the side of each cube.

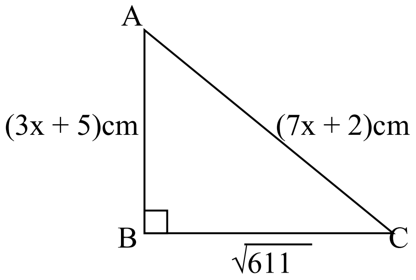
21. The figure below shows a frustrum cut from a cone



Calculate the volume of the frustrum

34. Quadratic equations

1. Given that $25x^2 - 20x + k$ is a perfect square. Find the value of k. (2 mks)
2. Simplify $\frac{2y^2 - xy - x^2}{2x^2 - 2y^2}$ (3mks)
3. Solve the following quadratic equation giving your answer to 3 d.p. (3mks)
$$\frac{23}{x} - \frac{1}{x^2} - 120 = 0.$$
4. Simplify (3 mks)
$$\frac{16x^2 - 4}{ve^2 + 2x - 2} \div \frac{2x - 2}{x + 1}$$
5. Simplify as simple as possible $\frac{(4x + 2y)^2 - (2y - 4x)^2}{(2z + y)^2 - (y - 2x)^2}$ (3 mks)
6. In a triangle ABC, angle B is 90°. Find the value of x and hence the area of the triangle



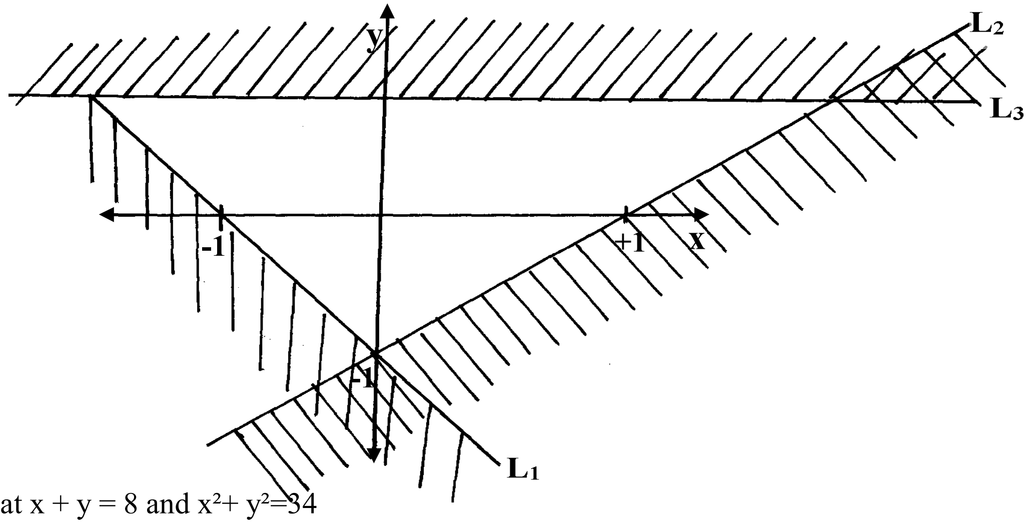
7. Solve the following inequalities and represent the solution on a number line hence state the integral values $\mathbf{7x - 4 \leq 9x + 2 < 3x + 14}$

35. Linear inequalities

1. Find without using a calculator, the value of :
$$\frac{12\sqrt{0.0625} - 12.4 \div 0.4 \times 3}{{}^1/_8 \text{ of } 2.56 + 8.68}$$
2. Solve and write down all the integral values satisfying the inequality.
$X - 9 \leq -4 < 3x - 4$
3. Solve the inequality and show the solution on the number line.
$3 - 2x \angle x \underline{\angle} \ \underline{2x + 5}$
4. Show on a number line the range of all integral values of ***x*** which satisfy the following pair of inequalities: $3 - x \leq 1 - \frac{1}{2}x$
$-\frac{1}{2}(x - 5) \leq 7 - x$
5. Solve the inequalities $\mathbf{4x - 3 \leq 6x - 1 < 3x + 8}$; hence represent your solution on a number line
6. Find all the integral values of **x** which satisfy the inequalities

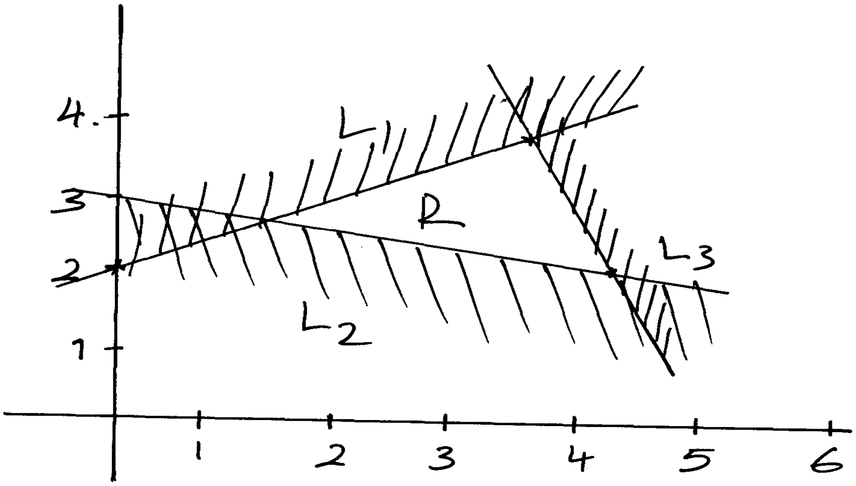
$2(2-x)< 4x -9< x + 11$

7. Find the inequalities that define the unshaded region



8. Given that $x + y = 8$ and $x^2+ y^2=34$
Find the value of:- a) $x^2+2xy+y^2$
b) $2xy$

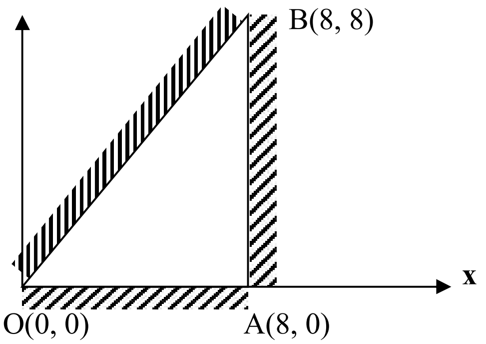
9. Find the inequalities satisfied by the region labelled **R**



10. The region R is defined by $x \geq 0$, $y \geq -2$, $2y + x \leq 2$. By drawing suitable straight line on a sketch, show and label the region R

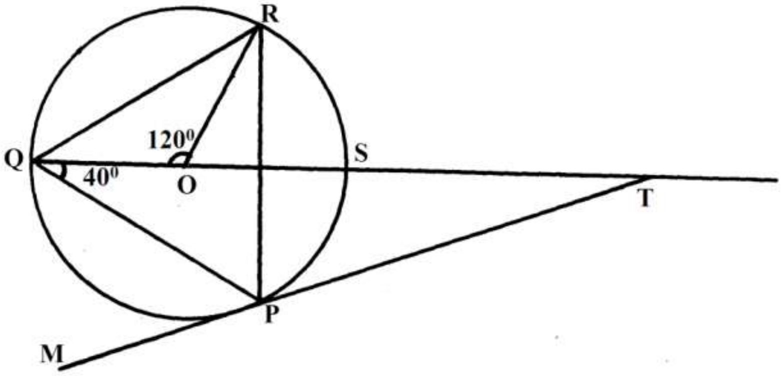
11. Find all the integral values of x which satisfy the inequality
$3(1+x) < 5x - 11 < x + 45$

12. The vertices of the unshaded region in the figure below are O(0, 0) , B(8, 8) and A (8, 0). Write down the inequalities which satisfy the unshaded region



36. Angle Properties of Circles

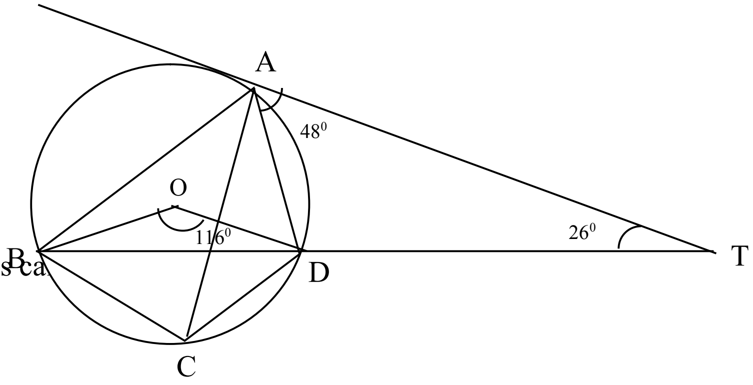
1. In the figure below PQR and S are points on the circumference of a circle centre O. The point TSO and Q lie on a straight line MPT is a tangent to the circle at P.



Find the values of the following angles stating reasons in each case.

(a) ∠SRP (2mks)
(b) ∠ORP (2mks)
(c) ∠RPT (2mks)
(d) ∠STP (2mks)
(e) ∠QPM (2mks)

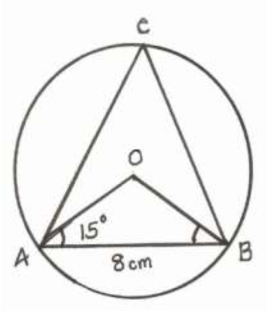
2. In the figure below, TA is a tangent to the circle ABCD with centre O. ∠ TAD = 48^0 and ∠ BOD = 116^0



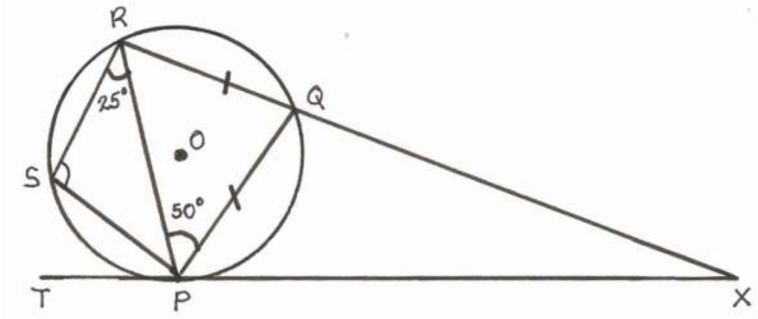
Giving reasons ca

a) ∠ ACD (2mks)
b) ∠ ABO (2mks)
c) ∠ ADO (2mks)
d) ∠ ACB (2mks)
e) ∠ ATB (2mks)

3. In the figure below AB = 8cm and O is the centre of the circle. Determine the area of the circle if ∠OAB = 15° (3mks)



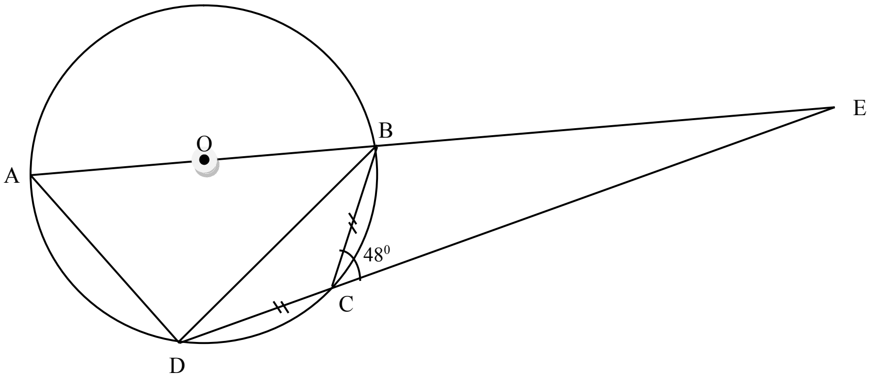
4.



The figure above is a cyclic quadrilateral PQRS. Given that TPX is a tangent at P and O is the centre of the circle and that RQX is a straight line with ∠RPQ = 50° and ∠PRS = 25°, giving reason in each case find:

(a)	angle PRQ	(2mks)
(b)	angle PSR	(2mks)
(c)	angle PXQ	(2mks)
(d)	angle TPS	(2mks)
(e)	angle POS	(2mks)

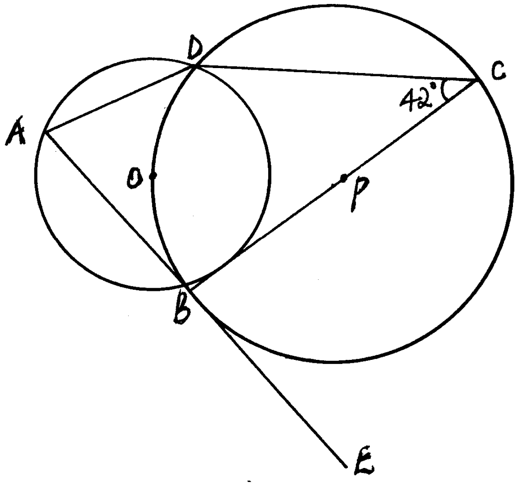
5. In the figure below ABCD is a circle with centre O. AB and DC meet at a point E outside the circle. DC = BC and $\angle BCE = 48^0$



Find the angles

a)	BAD	(1mk)
b)	BDC	(1mk)
c)	BEC	(1mk)

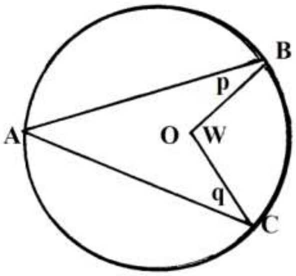
6. In the figure O and P are centres of intersecting circles ABD and DBC respectively. Line ABE is a tangent to circle BCD at B and angle BCD = 42^0.



Giving reasons determine the size of:

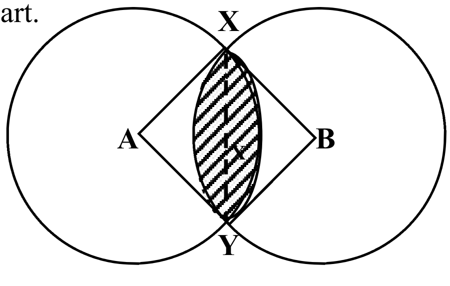
(a) Angle CBD. (2mks)
(b) Angle ODB. (2mks)
(c) Angle BAD. (2mks)
(d) Angle ABD (2mks)
(e) Angle ODA. (2mks)

7. In the figure below, O is the centre of the circle. Express the angle W in terms of angles p and q. (2mks)

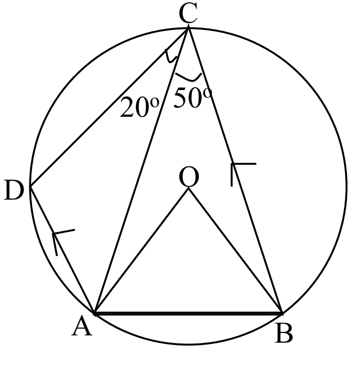


8. Two circles of radii 4cm and 6cm intersect as shown below. If angle XBY = 30° and angle XAY = 97.2°.

Find the area of the shaded part.
(Take = π $\frac{22}{7}$)

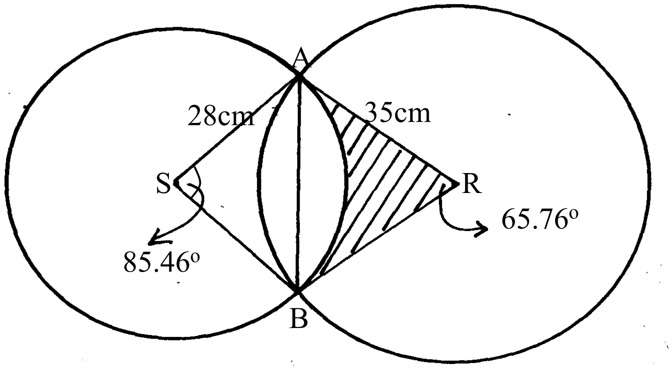


9. In the diagram, O is the centre of the circle and AD is parallel to BC. If angle ACB =50° and angle ACD = 20°.



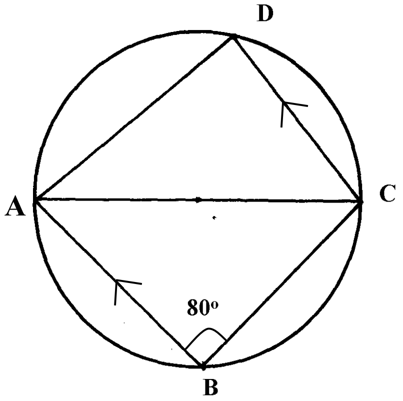
Calculate; (i) ∠OAB
(ii) ∠ADC

10. Two intersecting circles have centres S and R. Given that their two radii are 28cm and 35cm, their common chord AB = 38cm and angles ASB = 85.46° and ARB = 65.76°,



Calculate the shaded area

11. In the figure below ABCD is a cyclic quadrilateral in which AD = DC and AB is parallel to CD. Given that angle ABC = 80°, Find the size of:



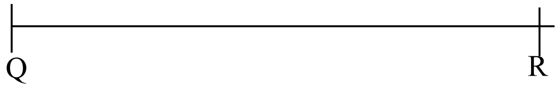
a) ∠DAC

b) ∠BAC

c) ∠BCD

12. Line QR = 6.5cm is given below:-(***Do not use a protractor for this question***)

(a) Draw triangle PQR such that **p** lies above line QR, ∠ PQR = 30° and PQ = 7cm



(b) By accurate construction on the diagram above, show the locus of a point which lies within the triangle such that:-

(i) T is more than 2.5cm from line PQ
and
(ii) T is not more than 4.5cm from Q
Shade the region in which **T** lies

(c) Lines QP and QR are produced to K and M respectively

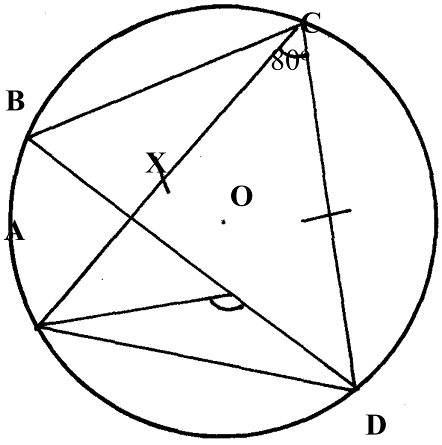
(i) Show by construction on the diagram above, the locus of a point C which is equidistant from each of the lines PK, PR and RM

(ii) With centre C and an appropriate radius, draw a circle to touch each of the lines PK, PR and RM only once

Measure the radius

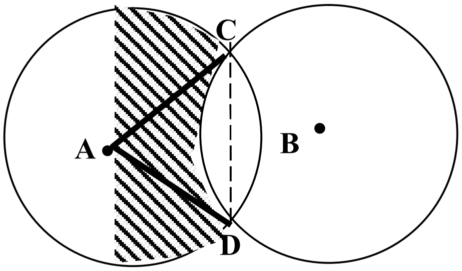
What name is given to the circle drawn in **(c) (ii)** with respect to triangle QPR

13. The figure below shows a circle centre **O** and a cyclic quadrilateral ABCD. AC = CD, angle ACD is 80° and BOD is a straight line. Giving reasons for your answer, find the size of :-



(i) Angle ACB
(ii) Angle AOD
(iii) Angle CAB
(iv) Angle ABC
(v) Angle AXB

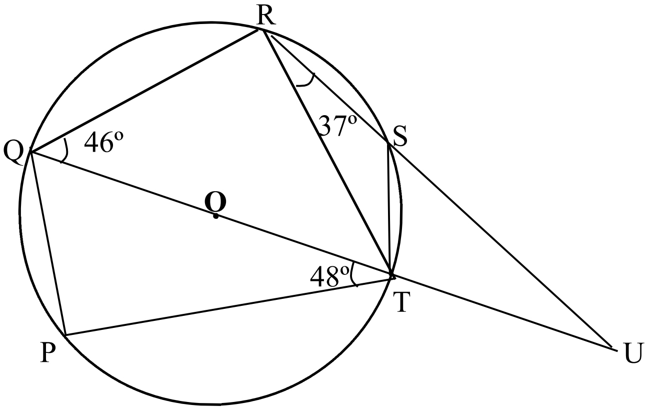
14. The figure below shows two circles of equal radius of 9 cm with centres A and B. Angle CAD = 80°



a) Calculate the area of:-

i) The sector CAD.
ii) The triangle CAD.
iii) The shaded region.

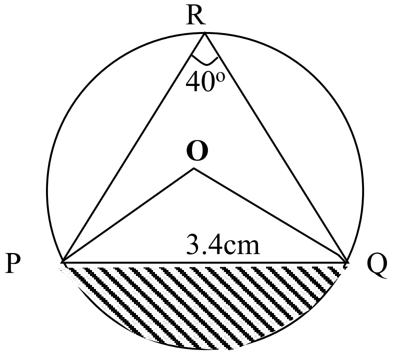
15. In the diagram below, ∠QOT is a diameter. ∠QTP = 48°, ∠TQR = 46° and ∠SRT = 37°



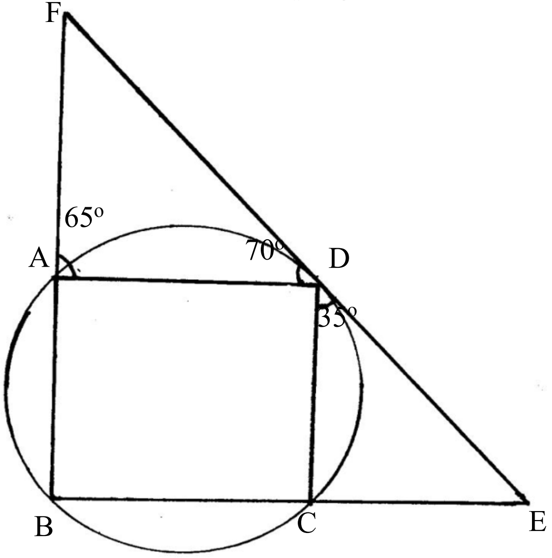
Calculate, giving reasons in each case:-

(a) ∠RST
(b) ∠SUT
(c) ∠ROT
(d) ∠PST
(e) Reflex ∠SOP

16. The diagram below shows a circle with a chord PQ= 3.4cm and angle PRQ=40^o. Calculate the area of the shaded segment.



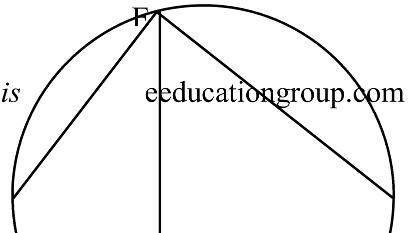
17. The figure below shows circle ABCD. The line EDF is a tangent to the circle at D. ∠ADF = 70^o ∠FAD = 65^o and ∠CDE = 35^o

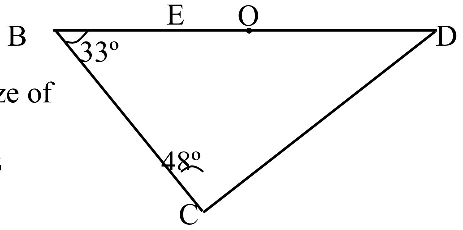


Find the values of the following angles, stating your reasons in each case

(a) ∠ABC
(b) ∠BCD
(c) ∠DCE
(d) ∠ACD

18. In the figure below BD is the diameter of the circle and O is the centre.





Find the size of
(a) ∠ADC
(b) ∠ AEB

37.Vectors

1. Given that $4p - 3q = \begin{pmatrix} 10 \\ 5 \end{pmatrix}$ and $p + 2q = \begin{pmatrix} -14 \\ 15 \end{pmatrix}$ find

a) (i) $\underset{-}{p}$ *and* $\underset{-}{q}$ (3 mks)

(iv) $|p + 2q|$ (3 mks)

(b) Show that A (1, -1), B (3, 5) and C (5, 11) are collinear (4 mks)

2. Given the column vectors $\mathbf{a} = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} \mathbf{b} = \begin{pmatrix} 6 \\ -3 \\ 9 \end{pmatrix} \mathbf{c} = \begin{pmatrix} -3 \\ 2 \\ 3 \end{pmatrix}$ and that $\mathbf{p} = 2\mathbf{a} - \frac{1}{3}\mathbf{b} + \mathbf{c}$

(c) (i) Express **p** as a column vector (2mks)

(d) (ii) Determine the magnitude of **p** (1mk)

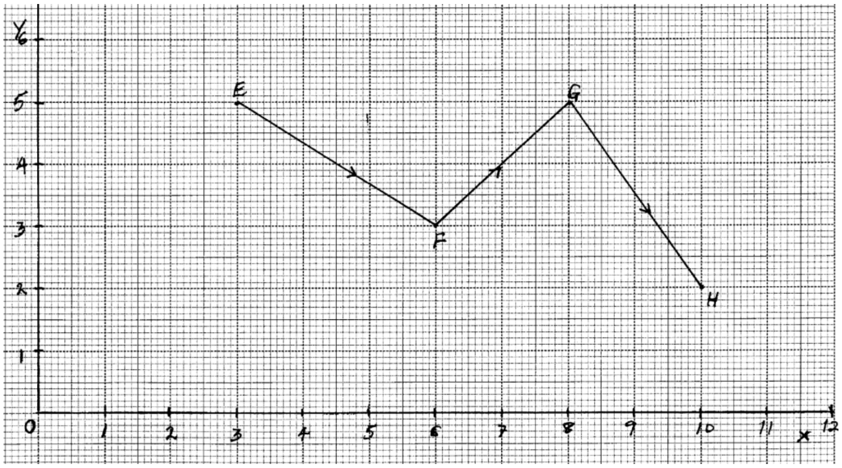
3. Given the points P(-6, -3), Q(-2, -1) and R(6, 3) express PQ and QR as column vectors. Hence show that the points P, Q and R are collinear. (3mks)

4. The position vectors of points x and y are $x = 2i + j - 3k$ and $y = 3i + 2j - 2k$ respectively. Find x y as a column vector (2 mks)

5. Given that $\underset{\sim}{\mathbf{a}} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \underset{\sim}{\mathbf{b}} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}, \underset{\sim}{\mathbf{c}} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ *and* $\underset{\sim}{\mathbf{P}} = 2\underset{\sim}{\mathbf{a}} + \underset{\sim}{\mathbf{b}} - 3\underset{\sim}{\mathbf{c}}$. *find* $\left|\underset{\sim}{\mathbf{p}}\right|$ (3mks)

6. The position vectors of A and B are $\begin{bmatrix} 2 \\ 5 \end{bmatrix}$ and $\begin{bmatrix} 8 \\ -7 \end{bmatrix}$ respectively. Find the coordinates of M which divides AB in the ratio 1:2. (3 marks)

7. The diagram shows the graph of vectors $\underset{\sim}{EF}$, $\underset{\sim}{FG}$ and $\underset{\sim}{GH}$.



Find the column vectors;

(a) $\underset{\sim}{EH}$ (1mk)

(b) $|\underset{\sim}{EH}|$ (2mks)

8. $\underset{\sim}{OA} = 2\underset{\sim}{i} - 4\underset{\sim}{k}$ *and* $\underset{\sim}{OB} = -2\underset{\sim}{i} + j - k$. Find $|\underset{\sim}{AB}|$ (2mks)

9. Show that P (4, 0 -4), Q (8, 2, -1) and R (24, 10, 11) are collinear. (3 mks)

10. Given that $\underset{\sim}{p}$ = 2i – j + k and q = i + j +2k, determine

a. $|p + q|$ (1 mk)

(b) $|\tfrac{1}{2}p - 2q|$ (2 mks)

11. Express in surds form and rationalize the denominator.

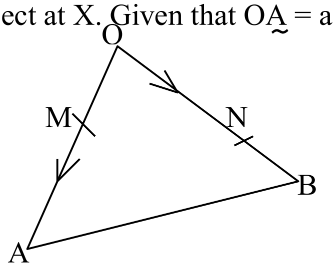
$$\frac{1}{\text{Sin } 60^o \text{ Sin } 45^o - \text{ Sin } 45^o}$$

12. If $\overrightarrow{OA} = 12\underset{\sim}{i} + 8\underset{\sim}{j}$ and $\overrightarrow{OB} = 16\underset{\sim}{i} + 4\underset{\sim}{j}$. Find the coordinates of the point which divides $\overrightarrow{\mathbf{AB}}$ internally in the ratio1:3

13. Find scalars **m** and **n** such that

$$\mathbf{m}\begin{pmatrix}4\\3\end{pmatrix} + \mathbf{n}\begin{pmatrix}-3\\2\end{pmatrix} = \begin{pmatrix}5\\8\end{pmatrix}$$

14. In a triangle OAB, M and N are points on OA and OB respectively, such that OM: MA = 2:3 and ON: NB = 2:1. **AN** and **BM** intersect at X. Given that $O\underset{\sim}{A}$ = a and $O\underset{\sim}{B}$ = b



(a) Express in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$

(i) BM

(ii) AN

(b) By taking **BX** = t and **AX** = **h AN**, where **t** and **h** are scalars, express **OX** in two different ways

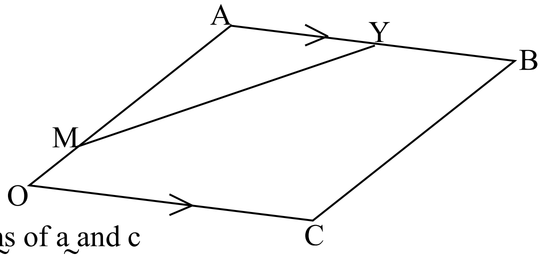
(c) Find the values of the scalars **t** and **h**

(d) Determine the ratios in which **X** divides :-

(i) **BM**

(ii) **AN**

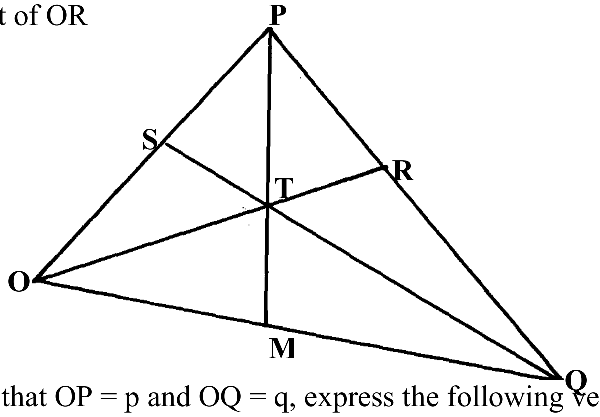
15. OABC is a parallelogram, M is the mid-point of OA and AX = $^{2}/_{7}$ AC, $O\underset{\sim}{A}$=a and $O\underset{\sim}{C}$= c



(a) Express the following in terms of $\underset{\sim}{a}$ and c
(i) MA
(ii) AB
(iii) AC
(iv) AX
(b) Using triangle MAX, express MX in terms of a and c
(c)The co-ordinates of A and B are (1, 6, 8) and (3, 0, 4) respectively. If O is the origin and P the midpoint of AB. Find;
(i) Length of OP
(ii) How far are the midpoints of OA and OB?

16. a) If A, B & C are the points (2, - 4), (4, 0) and (1, 6) respectively, use the vector method to find the coordinates of point D given that ABCD is a parallelogram.
b) The position vectors of points P and Q are **p** and **q** respectively. R is another point with position vector r = $^{3}/_{2}$ q - ½ p. Express in terms of P and q
(i) PR ~
(ii) PQ, hence show that P, Q & R are collinear.
(iii) Determine the ratio PQ : QR

17. The figure shows a triangle of vectors in which OS: SP = 1:3, PR:RQ = 2:1 and T is the midpoint of OR



a) Given that OP = p and OQ = q, express the following vectors in terms of P and q
i) OR
ii) QT
b) Express **TS** in terms of **p** and **q** and hence show that the points **Q, T** and **S** are collinear
c) M is a point on OQ such that OM = KOQ and PTM is a straight line. Given that PT: TM = 5:1, find the value of **k**

18. Given that a = , b = and c = and that p = 3q – ½ b +$^{1}/_{10}$c
Express **p** as a column vector and hence calculate its magnitude /P/ correct to two decimal places

19. In a triangle OAB, M and N are points on OA and OB respectively, such that OM:MA= 2:3 and ON:NB= 2:1. AN and BM intersect at X. Given that $O\underset{\sim}{A}$ = **a** and $O\underset{\sim}{B}$ = **b**

(a) Express in terms of **a** and **b**:-

(i) BM

(ii) $\underset{\sim}{A}$N

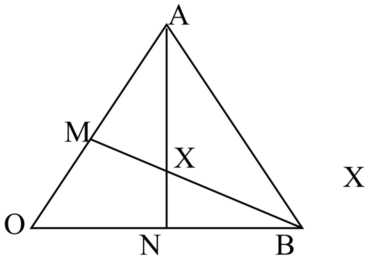
(b) Taking BX = kBM and AX =hAN where **k** and **h** are constants express OX in terms of

(i) **a, b** and **k** only

(ii) **a, b**, and **h** only

(c) Use the expressions in **(b)** above to find values of **k** and **h**

20. In the figure below OAB is a triangle in which M divides OA in the ratio 2:3 and N divides OB in the ratio 4:1. AN and BM intersects at X



(a) Given that OA = $\underset{\sim}{a}$ and OB = $\underset{\sim}{b}$, express in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$

(i) AN

(ii) BM

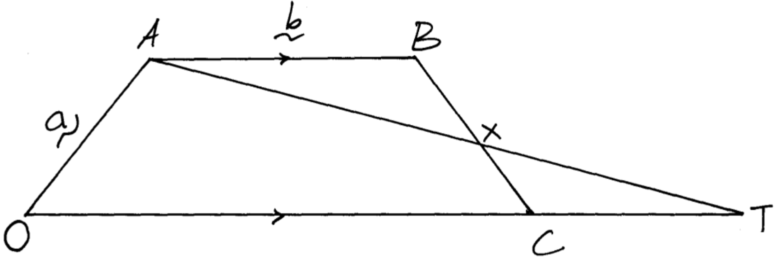
(iii) AB

(b) If AX = sAN and BX = tBM, where **s** and **t** are constants, write two expressions for OX in terms of **a**, **b**, **s** and **t**. Find the value of **s** and **t** hence write OX in terms of **a** and **b**

21. A student traveling abroad for further studies sets a side Kshs. 115800 to be converted into US dollars through a bank at the rate of 76.84 per dollar. The bank charges a commission of 2 ½ % of the amount exchanged. If he plans to purchase text books and stationery worth US$270, how much money, to the nearest dollar, will he be left with?

22. Given that:- r = 5i – 2j and m = -2i + 6j – k are the position vectors for R and M respectively. Find the length of vector RM

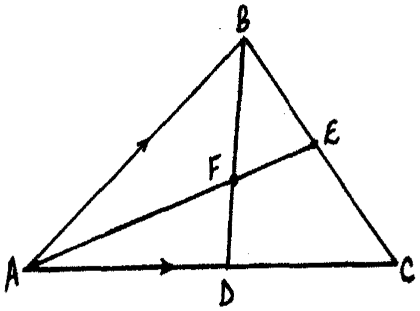
23. OABC is a trapezium in which OA = a and AB = b. AB is parallel to OC with 2AB = OC. T is a point on OC produced so that OC: CT = 2:1. At and BC intersect at X so that BX = hBC and AX = KAT



(a) Express the following in terms of a and b:-
(i) OB
(ii) BC
(b) Express **CX** in terms of a, b and h
(c) Express **CX** in terms of a, b and k
(d) Hence calculate the values of h and **k**

24. Given that **a** = **2i** + **j – 2k** and **b = -3i + 4j – k** find :-
| a + b|.

25. In the figure below, **E** is the mid-point of **BC**. **AD**:**DC**=3:2 and **F** is the meeting point of **BD** and **AE**



If **AB** = **b** and **AC** = **c;**
(i) Express **BD** and **AE** in terms of **b** and **c**
(ii) If **BF** =***t*****BD** and **AF** =***n*****AE**, find the values of ***t*** ad ***n***
(iii) State the ratios in which **F** divides **BD** and **AE**

26. The coordinates of point **O, A, B** and **C** are (**0, 0) (3, 4) (11, 6)** and **(8, 2)** respectively.
A point **P** is such that the vector **OP, BA, BC** satisfy the vector equation **OP = BA + ½ BC**
Find the coordinates of **P**

27. A point Q divides AB in the ratio 7:2. Given that A is (-3, 4) and B(2, -1).
Find the co-ordinates of Q

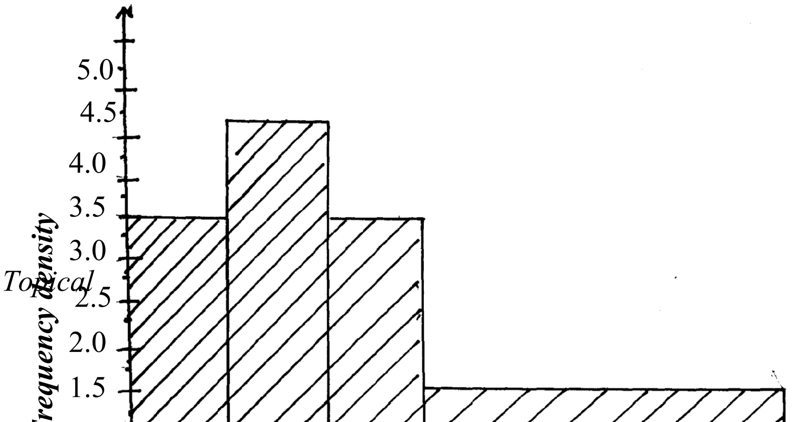
38. Representation of data

1. The height of 36 students in a class was recorded to the nearest centimeters as follows.

148	159	163	158	166	155	155	179	158	155	171	172	156
161	160	165	157	165	175	173	172	178	159	168	160	167
147	168	172	157	165	154	170	157	162	173			

(a) Make a grouped table with 145.5 as lower class limit and class width of 5. (4mks)

2. Below is a histogram, draw.



11.5 13.5 17.5 15.5 23.5

Length

Use the histogram above to complete the frequency table below:

Length	**Frequency**
11.5 ≤ x ≤13.5 13.5 ≤ x ≤15.5 15.5 ≤ x ≤ 17.5 17.5 ≤ x ≤23.5	

3. Wambui spent her salary as follows:

Food	40%
Transport	10%
Education	20%
Clothing	20%
Rent	10%

Draw a pie chart to represent the above information

4. The examination marks in a mathematics test for 60 students were as follows;-

60	54	34	83	52	74	61	27	65	22
70	71	47	60	63	59	58	46	39	35
69	42	53	74	92	27	39	41	49	54
25	51	71	59	68	73	90	88	93	85
46	82	58	85	61	69	24	40	88	34
30	26	17	15	80	90	65	55	69	89

Class	**Tally**	**Frequency**	**Upper class limit**
10-29 30-39 40-69 70-74 75-89 90-99			

From the table;

(a) State the modal class

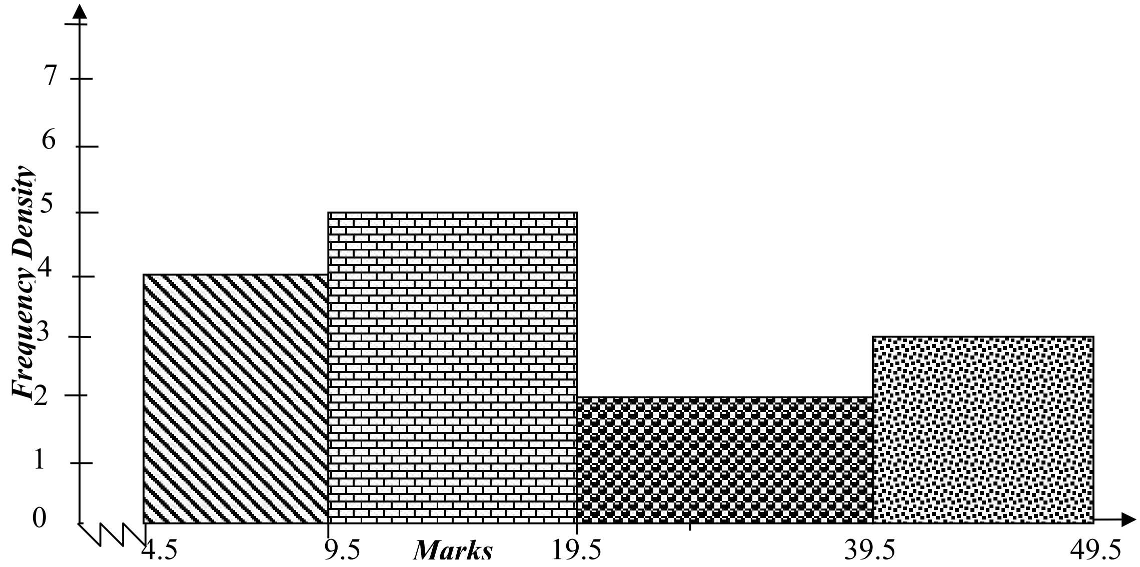
(b) On the grid provided , draw a histogram to represent the above information

5. The marks scored by 200 from 4 students of a school were recorded as in the table below.

Marks	41 – 50	51 – 55	56 – 65	66 – 70	71 – 85
Frequency	21	62	55	50	12

(a) On the graph paper provided, draw a histogram to represent this information.
(b) On the same diagram, construct a frequency polygon.
(c) Use your histogram to estimate the modal mark.

6. The diagram below shows a histogram representing the marks obtained in a certain test:-



(a) If the frequency of the first class is 20, prepare a frequency distribution table for the data
(b) State the modal class
(c) Estimate: (i) The mean mark
(ii) The median mark

7. The data below shows the number of sessions different subjects are taught in a week.
Draw a pie chart to show the data:

Subject	Eng	Maths	Chemistry	C.R.E
No. of sessions	8	7	4	3

8. The height of 50 athletes in Moi University team were shown below:

Height (cm)	150-159	160-169	170-179	180-189	190-199	200-209
Frequency	2	9	12	16	7	4

i) State the modal class
ii) Calculate the median height of the athletes

9. The table below shows the length of 40 mango tree leaves;

Length (mm)	Frequency	Cumulative frequency
118-126	3	3
127-135	4	7
136-144	10	17
145-153	12	29
154-162	5	34
163-171	4	38
172-180	2	40

(a) Determine the;
(i) Modal class
(ii) Median class

(b) Calculate; (i) the mean of the leaves
(ii) the median of the leaves

39. Measures of central tendency

1. The results of a mathematics test that a hundred students took are as shown below:-

Marks	No. of students
30-34	4
35-39	6
40-44	10
45-49	14
50-54	**X**
55-59	24
60-64	14
65-69	6

(a) Determine (i) the value of **X**
(ii) The modal class
(b) Calculate the mean
(c) The median

2. Without using logarithms or calculator evaluate:

$$2\log_{10}5 - 3\log_{10}2 + \log_{10}32$$

3. The table below shows heights of 50 students :-

Height (cm)	**Frequency**
140-144	3
145-149	15
150-154	19
155-159	11
160-164	2

(a) State the modal class
(b) Calculate the median height

4. In an experiment, the height of 100 seedlings were measured to the nearest centimeter and the results were recorded as shown below;

Height (cm)	20-24	25-29	30-34	35-39	40-44	45-49
Frequency	3	19	25	20	18	15

Calculate the median height

5. Given that x = -4 is a root of the equation $2x^2 + 6x - 2k = 0$; Find;
(a) the value of **k**
(b) the second root

Marks	60 – 62	63 – 68	69 – 73	74 – 80
Frequency	10	20	40	15

7. The table below shows the distribution of marks obtained by some candidates in a mathematics test

Marks	30-39	40-49	50-59	60-69	70-79	80-89	90-99

No. of candidates	2	3	10	12	8	3	2
c.f							

a) state the total number of candidates who sat the test
b) state the modal class
c) calculate the mean mark using an assumed mean of 64.5 marks
d) calculate the median mark

8. Find these statistics of the following data 4, 2, 2, 6, 1, 3, 4, 1, 4
a) Mode
b) Median
c) Mean

9. (a) The marks scored by a group of form two students in a mathematical test were as recorded in the table below:-

Marks	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency	1	2	4	7	10	16	20	6	3	1

(a) (i) State the modal class
(ii) Determine the class in which the median mark lies
(iii) Using an assumed mean of 54.5, calculate the mean mark

10. Six weeks after planting, the height of maize plants were measured correct to the nearest centimeter. The frequency distribution is given in the table below:

Height (x)	$0 \leq x < 4$	$4 \leq x < 8$	$8 \leq x < 12$	$12 \leq x < 16$	$16 \leq x < 20$
Frequency	3	8	19	14	6

Estimate the median height of the plants

11. Below are marks scored by student in maths talk in science congress.

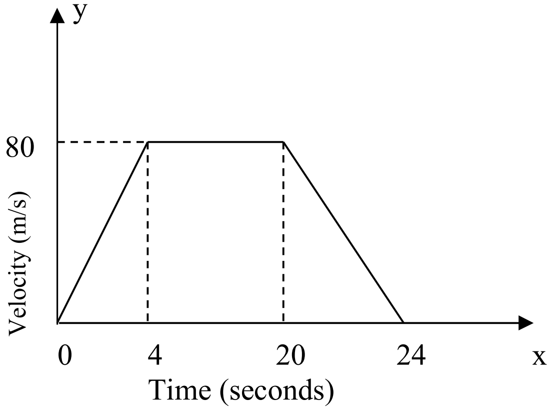
Marks	1 - 5	6 – 15	16 – 20	21 – 35	36 – 40	41 – 50
No. of students	1	3	6	12	5	3

Draw a histogram from the table above.

40. Linear motion

1. A passenger train travelling at 25km/h is moving in the same direction as a truck travelling at 30km/h. The railway line runs parallel to the road and the truck takes 1 ½ minutes to over take the train completely.
a) Given that the truck is 5 metres long determine the length of the train in metres. (6 marks)
b) The truck and the train continue moving parallel to each other at their original speeds. Calculate the distance between them 4 minutes and 48 seconds after the truck overtakes this train. (4 marks)
2. Two passenger trains A and B, 240m apart are travelling at 164km/h and 88km/h respectively approach one another on a straight railway line. Train A is 150 metres long. Determine the time in seconds that elapses before the two trains completely pass each other. (3mks)
3. A minibus covered a distance of 210km at an average speed of 90km/h. If it travelled ⅔ of the distance at a speed of 105 km/h, at what speed did it travel the rest of the distance? (3mks)
4. Two buses P and Q leave Kisumu at 7.30 am and 9.30 am respectively. If their speeds are 60km/h and 100km/h respectively, find when Q catches up with P. (3mks)

5. (a) A boat's speed in still water is 4km/h. It cruises in a section AB of a river whose speed downstream is x km/h. If the boat takes 2 hrs more in return journey and AB = 6km. find the value of x and the total duration of the journey (8mks)
   (b) The whole journey in (a) above ended at 3.34am. Find the departure time in 24 hour clock system (2mks)
6. The figure below is a velocity time graph for a car.

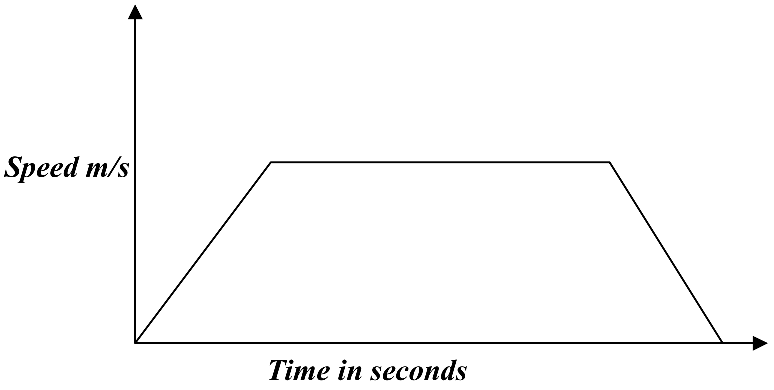


   (a) Find the total distance traveled by the car. (2 marks)
   (b) Calculate the deceleration of the car. (2 marks)
7. A bus started from rest and accelerated to a speed of 60km/h as it passed a billboard. A car moving in the same direction at a speed of 100km/h passed the billboard 45 minutes later. How far from the billboard did the car catch up with the bus? (3mks)
8. Nairobi and Eldoret are each 250km from Nakuru. At 8.15am a lorry leaves Nakuru for Nairobi. At 9.30am a car leaves Eldoret for Nairobi along the same route at 100km/h. Both vehicles arrive at Nairobi at the same time.
   (a) Calculate their time of arrival in Nairobi (2mks)
   (b) Find the cars speed relative to that of the lorry. (4mks)
   (c) How far apart are the vehicles at 12.45pm. (4mks)
9. A train whose length is 86 metres is traveling at 28 km/h in the same direction as a truck whose length is 10 metres. If the speed of the truck is 60 km/ h and is moving parallel to the train. Calculate the time it takes the truck to overtake the train completely. (3mks)
10. The distance between towns A and B is 360km. A minibus left A at 8.15am and traveled towards B at an average speed of 90km/hr. A matatu left B two and a third hours later on the same day and traveled towards A at an average speed of 110km/hr.
    a) i) At what time did the two vehicles meet?
    ii) How far from A did the vehicles meet?
    b) A motorist started from his home at 10.30am on the same day and travelled at an average speed of 100km/hr. He arrived at B at the same time as the minibus. Calculate the distance from A to his house. (10 mks)
11. A track traveling at 60 km/hr takes 1 hour 20 minutes more than a van traveling at 80 km/hr to cover the distance from Thika to Eldoret
    Calculate:
    a) The distance from Thika to Eldoret (2 marks)
    b) If the track leaves Thika at 2230 hrs and the van leaves Thika 30 minutes later, find the time the van catches up with the track (3 marks)
    c) At 2330 hrs a saloon car left Eldoret for Thika traveling at 120 km/hr and met the van at town K. find :
       III. The time they met (3 marks)
       IV. The distance between town K and the track at the time in C(I) above (2 marks)

12. Two motorists Kinyua and Nyaboke travelled between two towns K and M which are 580km apart. Kinyua started from K at 6.20 a.m and traveled towards M at 90km/hr. Nyaboke started from town M 1 $^2/_3$ hours later and traveled towards town K at an average speed of 120km/h. At a small shopping centre along the way, Kinyua had a snack and car check for 20 minutes before proceeding
   (a) (i) How far from town M did they meet?
   (ii) At what time did they meet?
   (b) A rally driver starts from town **M** going to town k at 9.30a.m. If he averages 180km/hr, Calculate the distance from **K** and the time when the rally driver overtook Nyaboke

13. The distance between two towns A and B is 150km. A car starts from town A at 10.00a.m and travels at an average speed of 80km/h towards B. A transit lorry travels from B at 10:15a.m towards town A at an average speed of 40km/h. At what time will the two vehicles meet?

14. The diagram below shows the speed-time graph for a bus traveling between two towns. The bus starts from rest and accelerates uniformly for 50seconds. It then travels at a constant speed for 150seconds and finally decelerates uniformly for 100seconds.



Given that the distance between the two towns is 2700m, calculate the ;
(a) maximum speed in km/h, the bus attained
(b) acceleration
(c) distance the bus traveled during the last 50seconds
(d) time the bus takes to travel the first half of the journey

15. A cyclist covers a distance of 45 kilometres at a speed of 10km/h and a further 45 kilometres at 15km/h. Find his average speed for the journey

16. A lorry left town **A** for town **B** 1¼ hours before a car. The lorry and the car are traveling in the same direction at 80kmh^{-1} and 120kmh^{-1} respectively. After the overtake, the car moved for $\mathbf{\frac{199}{800}}$ another hours before reaching town **B**. Calculate:
(a) The time the car took before overtaking the lorry completely
(b) The distance between the two towns
(c) The time the lorry will take to reach town **B** after the arrival of the car

17. A country bus left Nairobi at 10.45a.m and traveled towards Mombasa at an average speed of 60km/h. A matatu left Nairobi at 1:15p.m on the same day and traveled along the same road at an average speed of 100km/h. The distance between Nairobi and Mombasa is 500km.
(a) Determine the time of the day when the matatu overtook the bus

(b) Both vehicles continue towards Mombasa at their original speeds. How long had the matatu waited before the bus arrived?

18. Two passenger trains **A** and **B** which are 240m apart are travelling at 164km/h and 88km/h respectively approach on another one a straight railway line. Train **A** is 150m long and train **B** is 100m long. Determine the time in seconds that elapses before the two trains completely pass each other

19. A bus 5m long completely overtakes a trailer 15m long travelling in the same direction in 4.8. seconds. If the speed of the bus is 40 km/hr, determine the speed of the trailer in km/hr.

20. Find the LCM and GCD of the following numbers: $2 \times 3 \times 5^3$ and $2^4 \times 3^2 \times 5^2$.

21. A boat sails from a point A to a point B upstream, a distance of 30 km and back to A in 3hrs 12 min. The current in the river is flowing at 5km/hr. Determine the speed of the boat in still water.

22.. Two friends Ojwang and David live 40 km apart. One day Ojwang left his house at 9.00 a.m. and cycled towards David's house at an average speed of 15 km/h. David left his house at 10.30 a.m. on the same day and cycled towards Ojwang's house at an average speed of 25 km/h.

a) Determine ;

(i) The distance from Ojwang's house, where the two friends met.

(ii) The time they met.

(iii) How far Ojwang was from David's house when they met.

b) The two friends took 10 minutes at the meeting point and they cycled to David's house at an average speed of 12 km/h. Find the time they arrived at David's house.

23. Mr. Kamau left town **S** at 6.00a.m and travels at an average speed of 24km/hr towards **R**. Mrs. Ronoh left town **R** to town S 10minutes later and arrived at 7.00a.m. If distance **RS** = 42km , find;

(a) Where and when they will meet

(b) The time Kamau arrived at **R**

(c) If at 7.00a.m another traveler left **S** and travels towards R at speed twice that of Mrs. Ronoh, find where and when Mr. Kamau was overtaken by the traveler if so

24. A train 100m long travelling at 72km/hr, overtakes another train traveling in the same direction at 56km/hr and passes it completely in 54 seconds.

i) Find the length of the second train

ii) Find also the time they would have taken to pass one another if they had been traveling at these speeds in opposite directions

25. An unskilled worker may either walk to work along a route 5km to take a bus journey of 7km. The average speed of the bus is 24km/hr faster than his average speed. Taking the average walking speed as **x** km/hr;

(a) Write down expressions for time of the journey;

(i) When walking

(ii) When using the bus

(b) The journey by bus takes 36 minutes less than the journey on foot, find his walking speed

(c) Hence find the time he takes to talk to work

26. At 1.50 p.m. a matatu is traveling at 80 km/h and it is 40 km behind a motorcycle traveling at 60 km/h.

(a) After how long will the matatu overtake the motorcycle?

(b) At what time will the matatu overtake the motorcycle?

27. A bus left Nairobi at 8:00a.m and traveled towards Kisumu at an average speed of 80km/h. At 8.30a.m, a car left Kisumu towards Nairobi at an average speed of 120km/hr. Given that the distance between Nairobi and Kisumu is 400km, Calculate:-

(a) The time the car arrived in Nairobi

(b) The time the two vehicles met

(c) The distance from Nairobi to the meeting point

(d) The distance of the bus from Kisumu when the car arrived in Nairobi

28. Two trucks A and B travelling at 28km/hr and 26km/hr respectively approach one another on a straight road. Truck A is 10m long, while truck B is 15m long. Determine the time in seconds that elapses before the trucks completely pass each other

41.Quadratic expressions and equation 2

1. Complete the table below for the function $y = 2x^3 + 5x^2 - x - 6$ (2 mks)

x	-4	-3	-2	-1	0	1	2
$2x^3$	-128	-54			0	2	16
$5x^2$	80	45	20	5	0	5	20
-x	4	3			0	-1	
-6	-6	-6	-6	-6	-6	-6	-6
y	-50				-6	0	

(b) On the grid provided draw the graph $y = 2x^3 + 5x^2 - x - 6$ for $-4 \leq x \leq 2$. Use 2cm to represent 1 unit on the x-axis and 1 cm to represent 5 units on the y – axis (4 mks)

(c) By drawing a suitable line, use the graph in (b) to solve the

i. equation $2x^3 + 5x^2 + x - 4 = 0$ (2 mks)

ii. equation $2x^3 + 5x^2 - x + 2 = 0$ (2 mks)

2. The curve $y = 2x^2 - 6x + 9$ passes through the point P(2, 5)

(a) Determine the gradient function of the curve (1 mk)

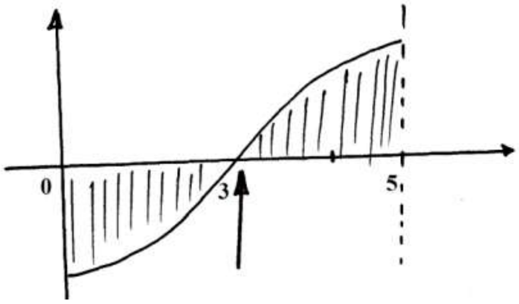
(b) Determine the coordinates and nature of the turning point of the curve (5mks)

(c) Find the equation in the form $y = mx + c$ of the

(i) Tangent to the curve at P (2mks)

(ii) Normal to the curve at P (2mks)

3. The sketch below represents the graph of $y = x^2 - x - 6$. Use the curve and five trapezia to estimate the area bounded by the x – axis, y – axis and the line x = 5. (3mks)



4. Draw the graph of y = 2x2 + x – 2 and use it to solve the equations (10 marks)

a) $2x^2 + x - 2 = 5$

b)$2x^2 + x - 5 = 0$

c)$2x^2 + 2x - 3 = 0$

5. Plot a graph of $y = 2x^2 + 3x - 5$, $-4 \leq x \leq 2$ by completing the table below.

x	-4	-3	-2	-1	0	1	2
$2x^2$		-18			0		
3x	-12			-3			6
-5							

y			-3			0	

Use your graph to solve
(i) $2x^2 + 3x - 5 = 0$
(ii) $2x^2 + 6x - 2 = 0$

6. Given the equation of a quadratic curve $y = x^2 + 5x - 3$
(a) (i) Complete the table below for the function $y = x^2 + 5x - 3$ for $-6 \leq x \leq 1$

x	-6	-5	-4	-3	-2	-1	0	1
y		-3	-7		-9		-3	3

(2mks)
(ii) Draw the graph of $y = x^2 + 5x - 3$ for $-6 \leq x \leq 1$ (3mks)
(b) (i) State the equation of the line of symmetry for the graph (1mk)
(ii) Use the graph you have drawn to solve the equations;
$x^2 + 5x - 3 = 0$ (1mk)
$x^2 + 4x - 2 = 0$ (2mks)
$x^2 + 5x - 3 = -3$ (2mks)

7. (a) Draw the graph of
$y = 2x^2 - x - 3$ for $-3 \leq x \leq 3$ (5 marks)
(b) Using a suitable line solve
$2x^2 - 3x - 50 = 0$ (5 marks)

8. (a) Draw the graph of $y = x^2 + 4x + 1$ for $-4 \leq x \leq 2$. (Show the table of values)
(b) On the same axis, draw line $y = 3x + 2$.
(c) Use the graph to solve the equations
(i) $x^2 + 4x + 1 = 0$
(ii) $x^2 + x - 1 = 0$

9. a) Draw the graph of the equation
$y = x^3 - 9x$ for $-4 \leq x \leq 4$
b) Use your graph to solve the following equations
i) $x^3 = 9x$
ii) $y - 5 = 0$
iii) $0 = x^3 - 13x - 12$ (10 Mks)

10. On the grid provided draw the graph of $y = x^3 - 3x^2 - 9x + 2$ for $-3 \leq x \leq 5$ (5 marks)
a) Use your graph to solve :
i. $x^3 - 3x^2 - 9x + 2 = 0$ (2 mark)
ii. $x^3 - 3x^2 - 6x + 8 = 0$ (3 marks)

11. (a) Use a convenient scale to draw the graph of $y = -x^2 + 5x - 3$ for the range $-2 \leq x \leq 6$
(b) Use your graph to determine the roots of the equation $5x - x^2 - 3 = 0$

(c) Use your graph to solve the equation $2x - x^2 + 3 = 0$ by drawing a suitable straight line

12. Find a quadratic equation whose roots are $2.5 + \sqrt{3}$ and $2.5 - \sqrt{3}$, expressing it in the form $ax^2 + bx + c = 0$ Where a, b and c are integers

13. Find the products of 17.3 and 13.8. Find also the percentage error in getting the product.

14. (a) Complete the table below for the equation :- $y = x^2 + 3x - 6$ for $-6 \leq x \leq 4$

x	-6	-5	-4	-3	-2	-1	0	1	2	3	4
y	12			-6			-6				22

(b) Using a scale 1cm to represent 2 units in both axes. Draw the graph of $y = x^2 + 3x - 6$

(c) Use your graph to solve:-

(i) $X^2 + 3X = 6$

(ii) $X^2 + 3X - 2 = 0$

15. (a) Complete the table for the function: $y = 2x^2 + 3x + 1$

x	- 4	-3	-2	-1	0	1	2	3
$2x^2$		18			0			18
$3x + 1$		-7			0			10
y		11			1	6		

(b) Use the table in **(a)** above to draw the graph : - $y = 2x^2 + 3x + 1$ for $-4 \le x \le 3$

(c) Use the graph in **(b)** to solve the equation :-

(i) $2x^2 + 4x - 3 = 0$

(ii) $x^2 + \frac{3}{2}x + 2 = 3$

16. A youth group decided to raise Ksh 480,000 to buy a piece of land costing Ksh. 80,000 per hectare. Before the actual payment was made, four of the members pulled out and each of those remaining had to pay an additional Kshs. 20,000.

(a) If the original number of the group members was **x**, write down;

(i) An expression of how much each was to contribute originally.

(ii) An expression of how the remaining members were to contribute after the four pulled out.

(b) Determine the number of members who actually contributed towards the purchase of the land.

(c) Calculate the ratio of the supposed original contribution to the new contribution.

(d) If the land was sub-divided equally, find the size of land each member got. (2 mk)

17. a) Draw the graph of $y = 2x^2 + x - 2$ given the range $-3 \le x \le 2$

b) Use your graph above to solve

i) $2x^2 + x - 2 = 0$

ii) $2x^2 + x - 3 = 0$

iii) $2x^2 + x - 5 = 0$

18. Three planes **A**, **B** and **C** leave an airport **P** simultaneously at 9.30a.m. Plane **A** flies on a bearing of 070° from P at a speed of 400km/h. Plane **B** flies on a bearing of 290°at a speed of 500km/h. Plane C flies on a bearing of 162° from **P** at a speed of 300km/h.

(***Use scale drawing for this questio***n)

(a) Show by scale drawing, the relative positions of the 3planes A, B and C three hours after leaving airport P. (Use scale 1cm represents 200km)

(b) After 3 hours, **B** turns and head straight to the current position of **A** at the same speed it had. Determine the scale drawing , the time it takes to reach this point, to the nearest minute

(c) Determine the bearing and distance of **B** from **C** after the first 3 hours of flight after leaving **P**

19. a) Use trapezoidal rule to find the area between the curve $y = x^2 + 4x + 4$, the x- axis and the co-ordinates x = - 2 and x = 1. Take values of x at intervals of ½ unit.

b) Use integration to find the exact area. Hence find the percentage error in your approximation.

20. a) Use trapezoidal rule to find the area between the curve $y = x^2 + 4x + 4$, the x- axis and the co-ordinates x = - 2 and x = 1. Take values of x at intervals of ½ unit.

b) Use integration to find the exact area. Hence find the percentage error in your approximation.

21. Draw the graph of $y = 2x^2 – 4x - 5$ for x between -3 and 5 on the grid provided
(a) State the line of symmetry for the graph
(b) State the range of values for which $2x^2 – 4x – 5 \leq 0$
(c) On the same set of axes, draw the graph of $y=2x +3$
(d) Determine the solutions to the equation: $2x^2 – 4x – 5 = 2x +3$

22. Complete the table below for the equation $y = 5 + 3x -2x^2$ by filling in the blank space

X	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5
Y	-9			3		6	6				-4	

(i) Use the values from the table above to draw the graph of $y = 5 + 3x -2x^2$ (3mks
(ii) Use the graph to:-
(a) Find the maximum point of the function $5 + 3x -2x^2$
(b) Determine the range of values and give the integral values which satisfy the inequality $5 + 3x -2x^2 \geq -2$

23. (a) Complete the table below for the function $y = 2x^2 + 4x – 3$

x	-4	-3	-2	-1	0	1	2
$2x^2$	32		8	2	0		
$4x – 3$			-11		-3		5
y			-3			3	13

(b) Draw the graph of the function $y = 2x^2 + 4x – 3$ and use your graph to estimate the roots of the equation $2x^2 + 4x – 3 = 0$.
(c) In order to solve graphically the equation $2x^2 + x – 5 = 0$, a straight line must be drawn to intersect the curve $y = 2x^2 + 4x – 3$. Determine the equation of this line, draw it and hence obtain the roots of the equation $2x^2 + x – 5 = 0$ to 1 decimal place.

24. a) Complete the table for the function $\mathbf{y = 1 – 2x – 3x^2}$ $\mathbf{-3 \leq x \leq 3.}$

x	-3	-2	-1	0	1	2	3
$\mathbf{-3x^2}$	-27		-3	0		-12	
-2x		4		0			-6
1	1	1	1	1	1	1	1
y	-20			1		-15	

b) Using the table above, draw the graph of $\mathbf{y = 1 – 2x – 3x^2}$ (Scale 1 cm represent 0.5 units on **x-axis** and 1 cm rep 2 units on the **y – axis** on the grid provided.
c) Use the graph in **(b)** above to solve.
(i) $\mathbf{1 – 2x – 3x^2 = 0}$
(ii) $\mathbf{2 – 5x – 3x^2 = 0}$

25. A quadratic equation $\mathbf{x^2 + ax – b = 0}$ has roots **1** and **-5** , determine the values of **a** and **b**

26. Find a quadratic equation whose roots are $1.5 + \sqrt{2}$ and $1.5 – \sqrt{2}$, expressing it in the form $ax^2 + bx + c = 0$, where a, b, and c are integers

27. If $a^2 + b^2 = 89$ and $a + b = 13$
(a) Find the values of;
(i) $a^2 + 2ab + b^2$

(ii) 2ab

(iii) $a^2 - 2ab + b^2$

(iv) a - b

(c) Determine the values of a and b

42. Approximation and errors

1. The length and breadth o a rectangular room are 15cm and 12 cm respectively. If each of these measurements is liable to 1.5% error, calculate the absolute error in the perimeter of the room (3 mks)
2. The length and width of a rectangle are stated as 18.5cm and 12.4cm respectively. Both measurements are given to the nearest 0.1cm.
   a) Determine the lower and upper limit of each measurement. (1 mark)
   b) Calculate the percentage error in the area of the rectangle. (3 marks)
3. The top of a table is a regular hexagon. Each side of the hexagon measures 50.0cm Find the maximum percentage error in calculating the perimeter of the top of the table (3mks)
4. A rectangular room has length 12.0 metres and width 8.0 metres. Find the maximum percentage error in estimating the perimeter of the room.

5. In this question mathematical tables or calculator should not used. The base and perpendicular height of a triangle measured to the nearest centimeters are 12cm and 8cm respectively; Find ;
   (a) the absolute error in calculating the are of the triangle
   b) the percentage error in the area, giving the answer to 1 decimal place

6. A rectangular plate has a perimeter of 28cm. determine the dimensions of the plate that give the maximum area

7. A wire of length 5.2m is cut into two pieces without wastage. One of the pieces is 3.08m long. What is the shortest possible length of the second piece?

8. The dimensions of a rectangle are 10cm and 15cm. If there is an error of 5% in each of the Measurements. Find the percentage error in the area of the rectangle.

9. Find the products of 17.3 and 13.8. Find also the percentage error in getting the product.

10. The mass of a metal is given as 14kg to the nearest l0g. Find the percentage error in this measurement.

11. Complete the table below for the functions y = cos x and y = 2 cos (x +30°) for 0° ≤ X ≤ 360°

X	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Cos X	1	0.87	0.5		-0.5	0.87	-1.0		0.5	0		0.87	1
2 cos (x+ 30°)	1.73		0	-1.0		-2.0	-1.73	-1.0		1	1.73	2.00	1.73

a) On the same axis, draw the graphs of y = cosx and y = 2 cos (x + 30°) for 0°≤ X≤ 360°

b) i) State the amplitude of the graph y = cos x°

ii) State the period of the graph y = 2cos (x + 30°)

c) Use your graph to solve

cos x = 2 cos (x + 30°)

12. Given that $8 \le y \le 12$ and $1 \le x \le 6$, find the maximum possible value of:

$$\frac{y + x}{y - x}$$

43. Trigometry 2

1. Solve the equation: (2 mks)

$$Sin\frac{5}{2}X = -\frac{1}{2} \text{ for } 0^0 \le X \le 180^0$$

2. (a) Complete the table below, leaving all your values correct to 2 d.p. for the functions y = cos x and y = 2cos $(x + 30)^0$ (2 mks)

X^0	0^0	60^0	120^0	180^0	240^0	300^0	360^0	420^0	480^0	540^0
cosX	1.00			-1.00		0.50				
2cos(x+30)	1.73		-1.73		0.00					

(b) For the function y = $2cos(x+30)^0$

State:

(i) The period (1 mk)

(ii) Phase angle (1 mk)

(c) On the same axes draw the waves of the functions y = cos x and y = $2cos(x+30)^0$ for $0^0 \le x \le 540^0$. Use the scale 1cm rep 30^0 horizontally and 2 cm rep 1 unit vertically (4 mks)

(d) Use your graph above to solve the inequality $2\cos(x + 30^0) \le \cos x$ (2 mks)

3. Find the value of x in the equation.

Cos(3x - 180°) = $\frac{\sqrt{3}}{2}$ in the range O° ≤ x ≤ 180° (3 marks)

4. Given that $\tan\theta = \frac{11}{60}$ and ɵ is an acute angle, find without using tables cos (90 – ɵ) (2mks)

5. Solve for ɵ if -¼ sin (2x + 30) = 0.1607, 0 ≤ ɵ ≥ 360^0 (3mks)

6. Given that Cos θ = $^5/_{13}$ and that $270^0 \le \theta \le 360^0$, work out the value of Tan θ + Sin θ without using a calculator or mathematical tables. (3 marks)

7. Solve for x in the range $0^0 \le x \le 180^0$ (4mks)

$-8 \sin^2 x - 2 \cos x = -5$.

8. If tan x° = $^{12}/_5$ and x is a reflex angle, find the value of 5sin x + cos x without using a calculator or mathematical tables

9. Find θ given that 2 cos 3θ -1 = 0 for 0° ≤ θ ≤ 360°

10. Without a mathematical table or a calculator, simplify: $\frac{\mathbf{Cos300^o\ x\ Sin120^o}}{\mathbf{Cos330^o - Sin\ 405^o}}$ giving your answer in rationalized surd form.

11. Express in surds form and rationalize the denominator.

$$\frac{1}{\text{Sin } 60^o \text{ Sin } 45^o - \text{ Sin } 45^o}$$

12. Simplify the following without using tables;

Tan 45 + cos 45sin 60

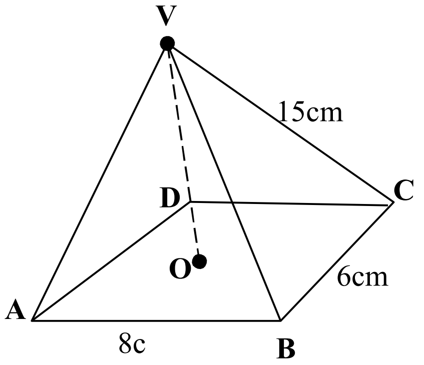
13. Simplify the following surds in the form of **a** $+\sqrt{b}$ **c** where **a, b,** and **c** are constants

$$\frac{5}{2\sqrt{2}-\sqrt{5}} \quad + \quad \frac{2}{2\ 2-\sqrt{5}}$$

14. John cycles from shopping centre **A** on a bearing of 120° for 5 km to shopping centre **B**. He then cycles on a bearing of 200^0 for 7 km to the shopping centre **C**. Calculate to 1 decimal place.
a) The direct distance from A to C.
b) The bearing of A from C.
c) Bearing of B from C.

44. Surds

1. Given that $Tan\theta = \frac{1}{\sqrt{5}}$ and θ is an acute angle, find without using tables or calculators, Sin (90 - θ), leaving your answer in simplified surd form. (2mks)
2. Given that $\sqrt{3} = 1.7321$, express in surd form, rationalize the denominator and then find the value of the expression below to 5 significant figures without using the calculator. (3mks)
$$\frac{2-\tan 60^0}{3-2\cos 30^0}$$
3. Simplify $(1+\sqrt{3})(1-\sqrt{3})$ and hence evaluate $\frac{1}{1+\sqrt{3}}$ to 3 significant figures given that $\sqrt{3} = 1.7321$. (3mks)
4. Without using mathematical tables or calculators, find the volume of a container whose base is a regular hexagon of side $\sqrt{3}$ cm and height $2\sqrt{3}$ cm (4 mks)
5. Simplify; $\frac{3}{\sqrt{7}-2} + \frac{1}{\sqrt{7}}$ leaving the answer in the form **a + b$\sqrt{\mathbf{c}}$** , where **a, b** and **c** are rational numbers
6. Given that:- $\frac{2+\sqrt{5}}{2-\sqrt{5}} - \frac{3+\sqrt{5}}{2+\sqrt{5}} = a + b\sqrt{5}$
Find the values of **a** and **b** where **a** and **b** are rational numbers
7. If:- $\frac{\sqrt{14}}{\sqrt{7}-\sqrt{12}} - \frac{\sqrt{14}}{\sqrt{7}+\sqrt{2}} = a\sqrt{7}+b\sqrt{2}$ Find the values of **a** and **b**, where **a** and **b** are rational numbers *
8. Rationalize the denominator $\frac{2-\sqrt{2}}{(\sqrt{2}-1)^3}$ and express your answer in the form of **a + c 2**
9. The figure below is a right pyramid with a rectangular base ABCD and vertex V.



O is the centre of the base and M is a point on OV such that OM = $^1/_3$ OV, AB = 8 cm, BC = 6 cm and VA = VB=VD = VC = 15 cm. Find ;
i) The height OV of the pyramid.

ii) The angle between the plane BMC and base ABCD.

10. Find the value of **y** which satisfies the equation

$$\text{Log}_{10} 5 - 2 + \log_{10}(2y + 10) = \log_{10}(y - 4)$$

11. Simplify the expression $\frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$ giving your answer in the for of a + b $\sqrt{c}$.

45. Further logarithms

1. Solve for x
   $125^{-x} \text{ x } 5^{2(x-2)} = 25^{(x+2)}$ (3mks)
2. Solve for y in the equation $(\log_3 y)^2 - \frac{1}{2}\log_3 y = \frac{3}{2}$ (3mks)
3. Find the value of x if $49^{x+1} + 7^{2x} = 350$ (3mks)
4. Find x in $2(4^x) - 10(2^x) + 8 = 0$ (4mks)
5. Solve for x in $2^{2x} - 18 \text{ x } 2^x = 40$ (3mks)
6. Evaluate without using mathematical tables. (3mks)
   $$2\log 5 - \frac{1}{2}\log 16 + 2\log 40$$
7. Given that $\log_{10} 3 = x$ and $\log_{10} 7 = y$, Express $\frac{\log_{10} 63}{\log_{10} 147}$ in terms of x and y. (3mks)
8. Find x if $3^{2x+3} + 1 = 28$ (2 mks)
9. If $\left(\frac{16}{9}\right)^{-3x+2} = \left(\frac{3}{4}\right)^{\frac{2}{3}}$,find the value of x (3mks)
10. In this question, show all the steps in your calculations, giving the answer at each stage. Use logarithms correct to 4 decimal places, to evaluate; $\frac{(1934)^2 \text{ x } \sqrt{0.00324}}{\text{Log } 746}$
11. The table below shows monthly income tax rates

Monthly taxable pay in KE	**Rate of the tax (Kshs/ E)**
1 – 342	2
343 – 684	3
685 – 1026	4
1027 – 1368	5
1369 – 1710	6
1710 and above	7

Mr. Kamau who is a civil servant earns a Monthly salary of Kshs.20000 and is provided with a house at a nominal rent of Kshs.700 per month

a) Taxable pay is the employee’s salary plus 15% less nominal rent. Calculate Mr.Kamau’s taxable pay

b) Calculate the total tax Mr. Kamau pays

c) Mr. Kamau is entitled to a personal relief of Kshs.600 per month. What was his net tax .

d) Mr. Kamau has the following deductions made on his pay;

Loan repayment of Kshs.2100 per month
NSSF Kshs.200 per month
WCPS calculated at 2 % of monthly salary

Calculate Mr. Kipchokes net pay

12. A man bought a matatu at Kshs.400,000 in January 1999. It depreciated at a rate of 16% per annum. If he valued it six months, calculate its value in January 2003

13. The table shows corresponding values of x and y for a certain curve;

x	1.0	1.2	1.4	1.6	1.8	2.0	2.3
y	6.5	6.2	5.2	4.3	4.0	2.6	2.4

Using 3 strips and mid-ordinate rule estimate the area between the curve, x-axis, the lines $x = 1$ and $x = 2.2$

14. Evaluate without using a calculator or mathematical tables.

$$\frac{\text{Log } 32 + \log 128 - \log 729}{\text{Log } 32 + \log 2 - \log 27}$$

15. Find the value of **x** that satisfies the equation:-
log (x+5) = log 4 – log(x+2)

16. Find the least number of terms for which the sum of the GP 100 + 200 + 400 + ……………….. exceeds 3100.

17. A two digit number is formed from the first four prime numbers.
a) Draw the table to show the possible outcomes, if each number can be used only once.
b) Calculate the probability that a number chosen from the digit numbers is an even number

18. Find the gradient of a line joining the centre of a circle whose equation is $\mathbf{x^2 + y^2 - 6x = 3 - 4y}$ and a point P(6,7) outside the circle..

19. A lady invests shs.10,000 in an account which pays 16% interest p.a. The interest is compounded quarterly. Find the amount in the account after 1½ hrs

20. Use logarithm tables to evaluate

$$\sqrt[3]{\frac{13.6 \cos 40^o}{63.5}}$$

21. Without using logarithms or calculator evaluate:

$$2\log_{10}5 - 3\log_{10}2 + \log_{10}32$$

22. Evaluate without using tables or calculators.
$\text{Log}\left(3x + 8\right) - 3 \log 2 = \log\left(x - 4\right)$

46. Commercial Arithmetic 2

1. The table below shows the rate at which income tax is charged for all taxable income.

INCOME	RATE IN EXCH TWENTY SHILLINGS
On the first shs.116 160	10%
On the next shs.109 440	15%
On the next shs.109 440	20%
On the next shs.109 440	25%
On all income over shs.444 480	30%

Mr. Nyongesa earns a basic salary of sh.54, 450 per month. He is housed by the company and therefore 15% of his monthly salary is added to the basic salary as a taxable income. He is also given taxable medical and transport allowances of shs.4,000 and shs.2,000 per month respectively. He is entitled to a family relief of sh.1, 100 per month.

(a) Calculate Nyongesa's annual taxable income (3 mks)

(b) Calculate his monthly P.A.Y.E after the relief (5 mks)

(c) If 20% of his basic salary goes towards deductions, determine his monthly income. (2 mks)

2. All employees of silver springs enterprises pay income tax at the rate shown in the table below.

Taxable income (p.a)	Rate sh. Per K£
1 – 3780	2
3781-7560	3
7561-11,340	4
11,341-OVER	5

Mr. Mooka earns a basic salary of sh.12,150 and a house allowance of sh.2800 per month. He is entitled to a family relief of sh.450 per month. A part from income tax the following deductions are also made from his monthly pay.

a) Servicing loan payment sh.450
b) Hospital fund sh.260
c) Sacco contribution sh.120

Determine Mr. Mooka's net monthly income. (10 marks)

3. The taxation rates for income earned in a certain year were as follows:

Income K£ p.a	Tax Rate Kshs. Per £
1 – 4512	2
4513 – 9024	3
9025 – 13536	4
13537 – 18048	5
18049 – 22560	6
Over 22560	6.5

After a personal relief of Kshs.1056 per month, Otieno paid tax amounting to Kshs.18,152 that year.

a) How much tax would he have paid if he did not have the personal relief (2 mks)

b) Find his taxable income in K£ that year (5 mks)

c) If Otieno receives allowances amounting to 18% of the taxable income. Calculate his monthly basic salary in Kshs. (3 mks)

4. Chepkemoi bought a new washing machine for Kshs.420,000. Its value depreciated over the next 5years at the following rates; 15%, 13%, 12%, 9% and 7%. For the next 6 years, the rate of depreciation remained constant at 5% then the rate of depreciation remained at 4% each. How long did it take for the value of the washing machine to be $^1/_3$ of its original value?

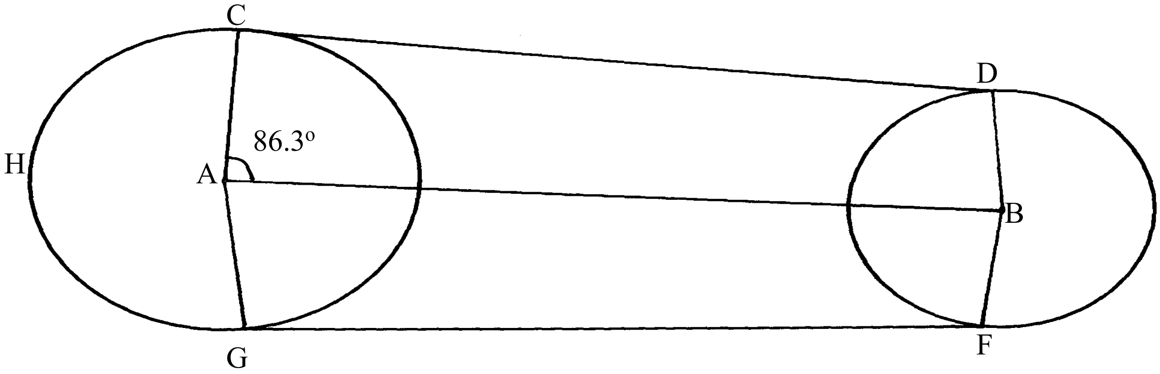
5. The table below shows income tax rates for the year 2006

Taxable income in shs. Pa	**Rate of tax in %**
1 – 120,000	10
120,001 – 240,000	15
240,001 – 360,000	25
360,001 – 480,000	35

Over 480,000	50

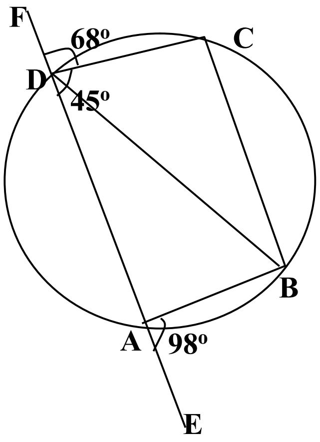
Nafula is married and claims a tax relief of shs.1,120 per month. She stays in a company house For which she pays a nominal rent of shs.1200 per month. She found that in a particular month, her employer deducted shs.4830 as tax. If she is entitled to a maximum insurance policy; relief of shs.600 per month. Calculate her monthly salary. (10mks)

6. The figure below represents two pulley wheels, centres A and B with a rubber band CDEFGHC stretched round them. Radius of wheel centre A = 16cm, AB = 30cm. CD, GF are tangents to the circles < CAB = 86.3°



a) calculate the length of the belt CD
b) Find the angle ABD
c) Find the length of the belt that would go round the pulleys (CDFGHC)

7. In the figure below, ABCD is a cyclic quadrilateral and BD is a diagonal. EADF is a straight line, ∠CDF = 68°, ∠ BDC = 45° and ∠ BAE = 98°.



Calculate the size of:
a) ∠ ABD.
b) ∠ CBD

8. A customer deposited Ksh.15,500 in a savings account. Find the accumulated amount after 3½ years if interest was paid at 16% per annum compounded semi-annually

9. A retailer mixes three types of rice, Bismatti costing shs.120 per tin with Pishori costing shs.150 per tin and Ahero rice costing shs.80 per tin in the ratio **x : 1 : 2** respectively. If he sells the mixture at shs.137.50 per tin making a profit of 25%. Calculate the value of **x**.

10. Ashanti is a saleswoman and earns a commission on sales based on the monthly rates shown in the table below:-

Sales (Kshs)	**Commission rate % of sales**
The first 5000	10%
The next 3000	15%
Sales above 8000	20%

In addition, she earns a basic monthly pay of Kshs.6700. During a certain month, she earned a total salary amounting to Kshs.8368. How much worth of sales did she make?

11. The table below shows the annual income tax rates for a certain year.

Total income per month in Kshs.	**Rates in Kshs. Per £**
1-10164	2
10165 – 19740	3
19741 – 29316	4
29317 – 33892	5
388983 and above	6
Automatic personal relief shs.1162	

Kiptoo earns a monthly salary of Kshs.25000. He is entitled to house and medical allowances of Kshs.12000 and Kshs.3000 respectively

Calculate:

(a) His taxable income per month

(b) His monthly tax payable

(c)His annual tax payable

12. A company employee earns a basic salary of Kshs.25,000 and is also given taxable allowances amounting to Kshs.10,480.

Monthly taxable income	**Rate in Kshs. /Pound**
1- 4350	2
4351 – 8900	3
8901 - 13455	4
13451 – 18005	5
18006 and above	6

Using the table of taxation above:-

(a) Calculate the employee's taxable income

(b) If the employee is entitled to a personal tax relief of Kshs.800 per month, determine the net tax

(c) If the employee was given 40% increase in his income, calculate the percentage increase in his income tax

13. A certain amount of money was invested at compound interest of 10% compounded

every two years for ten years. Given that the investor invested a total of 500,000/= at the end of the ten years, find the amount of money invested to the nearest shillings

14. The cash price of a T.V set is Ksh. 26,000. Linda bought the set on hire purchase terms by paying a deposit of Ksh. 6,000 and the balance by 24 equal monthly installments of Khs. 1,045.30. Find the compound rate of interest per year.

15. What would Kshs.15000 amount to after 3years at 16% per annum compounded quarterly?

16 . Income rates for income earned were charged as follows:

Income in Kshs. p.m	**Rate in Kshs. per sh.20**
1- 8400	2
8401- 18,000	3
18,001- 30,000	4
30,000 - 36,000	5
36,001 - 48,000	6
48,001 and above	7

A civil servant earns a monthly salary of Ksh.19,200. His house allowance is Ksh12,000 per month. Other allowces per month are transport Ksh.1300 and medical allowance Ksh.2300. He is entitled to a family relief of Kshs. 1240 per month.

Determine:

a) (i) His taxable income per month.

(ii) Net tax.

b) In addition, the following deductions were made

NHIF	shs. 230
Service charge	Kshs. 100
Loan repayment	Kshs. 4000
Co-operative shares of	Kshs. 1200.

Calculate his net salary per month.

17. Use the taxation rates in the table below to answer the questions that follow;-

Taxable income in K £ p.a	Rate % per K£
1-4500	10
4501-7500	15
7501 – 10500	20
10501 – 13500	25
13501 – 16500	30
0ver 16500	35

The manager of a certain company is entitled to a monthly personal relief of shs.3000 and her tax (PAYE) is kshs.9000 per month she is also deducted NHIF shs.350 per month, WCPS shs.800 per month and cooperative shares shs.1200 per month, **calculate**

(a) The managers total deductions per month

(b) Total tax per month

(c) The manager's annual gross salary

(d) The manager's monthly basic salary if her monthly allowance and medical allowances are 10000 and 2000 shillings

18. The table below shows the income tax for a certain year;

Monthly taxable income (Kshs.)	Tax rates (%)
1- 9680	10%
9681- 18800	15%
18801 – 27920	20%
27921 – 37040	25%

37940 and above	30%

In that year, Odero paid a net tax of Kshs.5,512 per month. His total monthly taxable allowances amounted to Kshs.15,220 and he was entitled to a monthly personal relief of kshs.1,162.
Every month the following deductions were made;
N.H.I.F Kshs.320
Union dues Kshs.200
Co-operative shares Kshs.7,500
(a) Calculate Odero's monthly basic salary in Kshs
(b) Calculate his monthly salary

19. (a) A car is worth shs.800,000 when new. During the first year it depreciates by 20% of its value and in the second it deprecates by 5% of its value at the start of the year. During the third, fourth and fifth year, depreciation rate is 10%. How much less will it cost at the end of the fifth year?
(b) Find by how much the compound interest will exceed simple interest on shs.3,000 for two years at 15% per year

20. The table below shows the income tax rates:

Income per month (K£)	**Rate in Kshs per £**
1 - 325	2
326 – 975	3
976 - 1300	5
1301 – 1625	6
Over 1625	7.50

Mr. Misoi is a public servant who lives in a government house and pays a nominal rent of Kshs.1,220 per month. He earns a basic salary of Kshs. 24,800 and a house allowance of Kshs.12,000 per month. He is entitled to a monthly relief of kshs.1620.
(a) Calculate his monthly;
  (i) Taxable income in K£
  (ii) Tax payable without relief
  (iii) Tax after relief
(b) Apart from the income tax. The following monthly deductions are made from his earnings
  -HELB loan repayment Kshs.2400
  - Health insurance fund Kshs.1200
  - 2% of Basic salary union fee

Calculate:- (i) the total monthly deduction made on Mr. Misoi's income
  (ii) Mr. Misoi's net income per month

21. Joseph bought a camera on hire purchase (H.P) term by paying a deposit of shs.7200 and cleared the balance in 24 equal monthly installments each of 1250.
(a) find the hire purchase price of the camera
(b) the hire purchase price of the camera is 24% higher than the cash price. Find the cash price of the camera
(c) Kangara took a loan from a financial institution and bought the camera with cash. He repaid the loan at 18% p.a compound interest at the end of the two years. Find the total interest paid by Kangara.

22. Income tax for all the income earned was charged at the rates shown.

Total Income p.a (K.£)	Rate in sh per K£
1 – 1980	2
1981 – 3960	3
3961 – 6440	5
6441 – 7920	7
7921 – 9900	9
Excess of 9900	10

(a) Wanyonyi earned a salary of Kshs.10,500 per month. In addition he was given a house allowance of Kshs. 6500 per month. He got tax relief of Kshs. 300 per month.

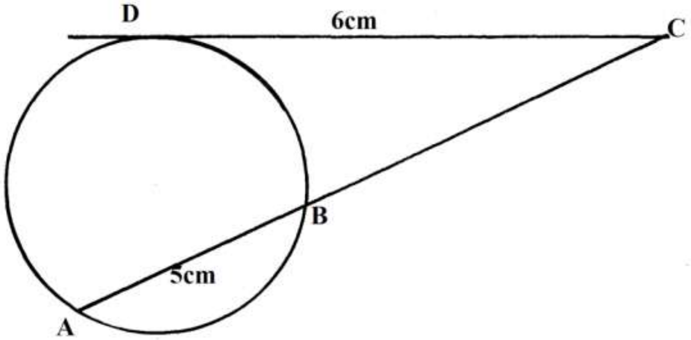
Find ; (i) His taxable income p.a

(ii) Income tax he pays per month.

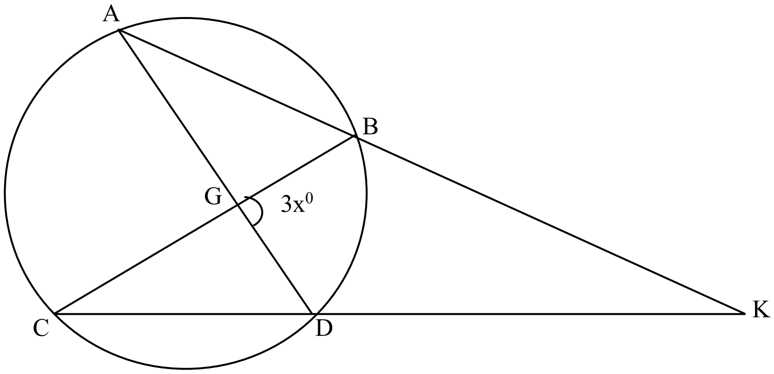
(b) A part from income tax the following deductions are made per month. NHIF of Kshs.320, widow and pension scheme of 2% of his gross salary. Calculate his net monthly pay.

47.Circles –chords and tangents

1. In the figure below not drawn to scale. DC is a tangent to the circle. DC = 6cm, AB = 5cm. Calculate BC. (3mks)



2.



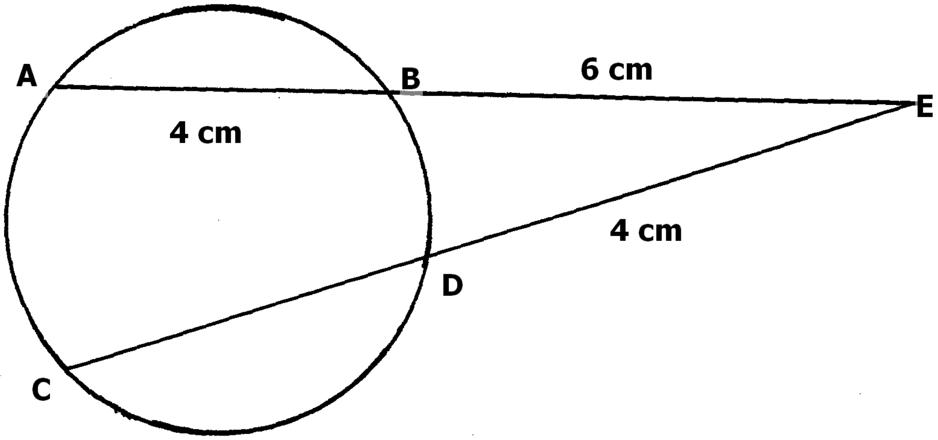
The figure above shows a circle in which chords AD and BC intersect at G. chords AB and CD produced meet at K.

(a) If $\angle BGD = 3x^0$ and $\angle CGD = 2x$, determine the size of $\angle BGA$ (2 mks)

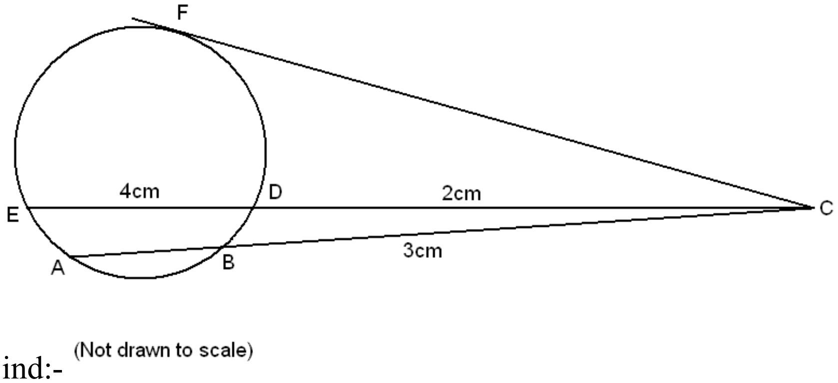
(b) Given that KB = 5 cm, KC = 15 cm and KD = 7 cm, determine the length of KA (3 mks)

(c) Giving reasons for your answer, show that triangle KDA and KBC are similar (5 mks)

3. The figure below shows a circle with secants ABE and CDE, If AB = 4cm and BE = 6 cm and DE = 4 cm. Find the length of CD. (2mks)



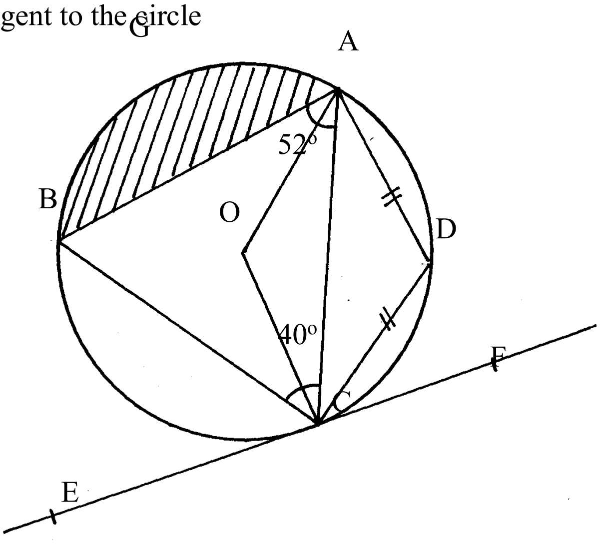
4. In the figure below, CF is a tangent to the circle. BC = 3cm, ED = 4cm and DC = 2cm.



Find:-

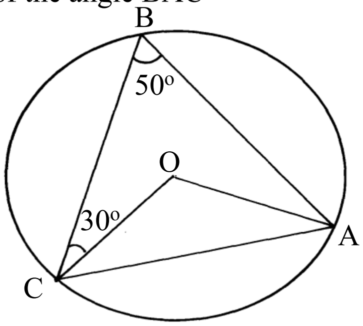
a. AB (2 mks)
b. FC (2 mks)

5. In the figure below angle BAC =52°, angle ACB = 40° and AD = DC. The radius of the circle is 7cm. EF is a tangent to the circle

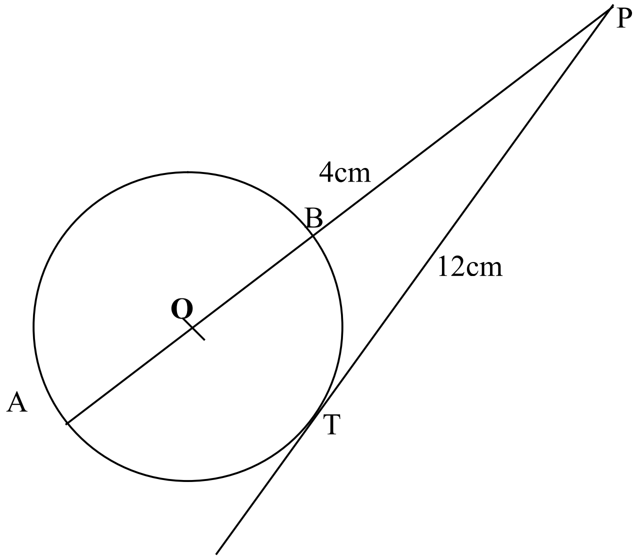


(a) Find; giving reasons
   (i) angle DCF
   (ii) angle AOB (obtuse)
(b) Calculate the area of the shaded segment AGB

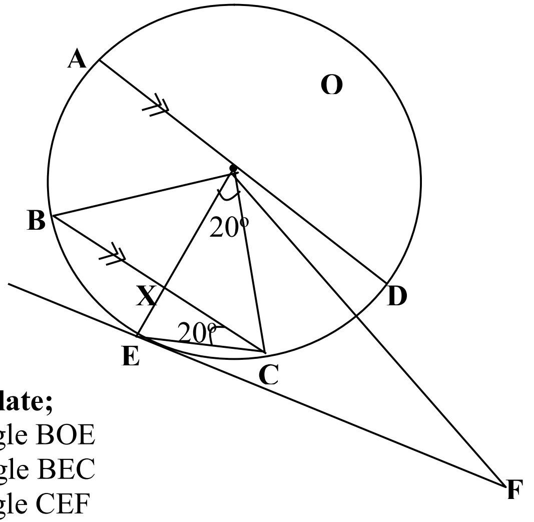
6. In the figure below, O is the centre of the circle. Angle CBA = 50° and angle BCO = 30°. Find the size of the angle BAC



7. In the given figure, O is the centre of the circle and AOBP is a straight line. PT is a tangent to the circle. If PT = 12cm and BP = 4cm. find the radius of the circle

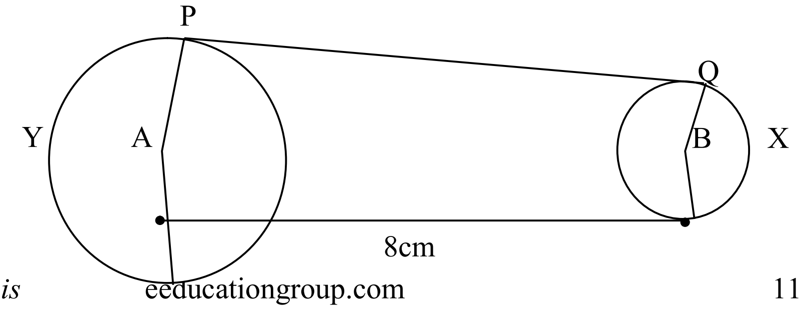


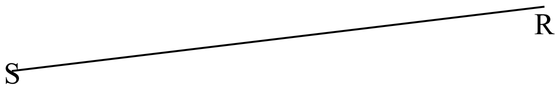
8. In the figure below AOD is a diameter of the circle cetre O. BC is a chord parallel to AD. FE is a tangent to the circle. OF bisects angle COD. Angle BCE = angle COE = 20° BC cuts OE at X



Calculate;
(a) angle BOE
(b) angle BEC
(c) angle CEF
(d) angle OXC
(e) angle OFE

9. The figure below shows two pulleys of radii 6cm and 4cm with centres **A** and B respectively. **AB** = 8cm. The pulleys are connected by a string PQXRSY

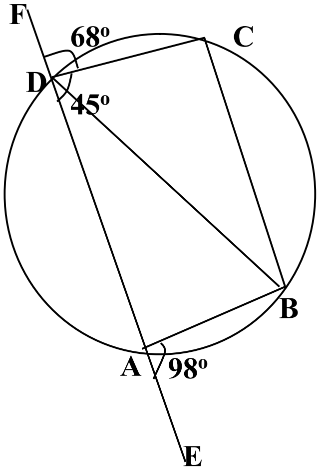




Calculate:
(a) Length PQ
(b) ∠PAS reflex
(c) Length of arc PYS and QXR
(d) The total length of the string PQXRSY

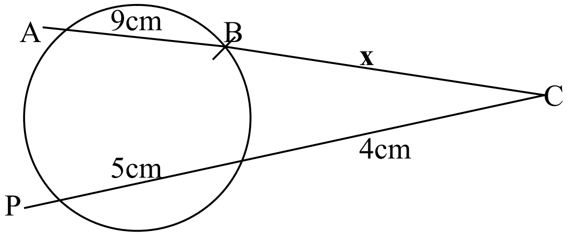
10. a) Two pipes **A** and **B** can fill a tank in 3hrs and 4 hrs respectively. Pipe **C** can empty the full tank in 6 hrs.
i) How long would it take pipes **A** and **B** to fill the tank if pipe **C** is closed?
ii) Starting with an empty tank, how long would it take to fill the tank with all pipes running?
b) The high quality Kencoffee is a mixture of pure Arabica coffee and pure Robusta coffee in the ratio 1 : 3 by mass. Pure Arabica coffee costs shs. 180 per kg and pure Robusta coffee costs sh 120 per kg. Calculate the percentage profit when the coffee is sold at sh 162 per kg.

11. In the figure below, ABCD is a cyclic quadrilateral and BD is a diagonal. EADF is a straight line, ∠CDF = 68°, ∠ BDC = 45° and ∠ BAE = 98°.

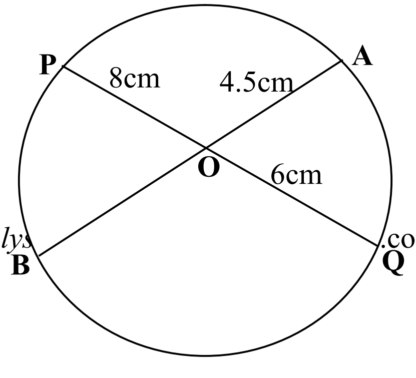


Calculate the size of:
a) ∠ ABD.
b) ∠ CBD

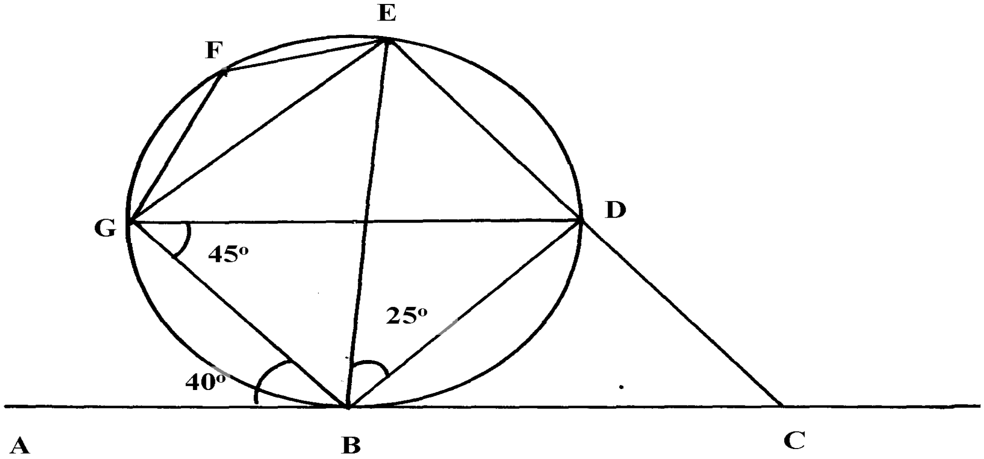
12. The figure below shows a circle centre O. AB and PQ are chords intersecting externally at a point C. AB = 9cm, PQ = 5cm and QC = 4cm. Find the value of **x**



13. The chords AB and PQ intersects internally at O. Given that the length of OP=8cm, OA= 4.5cm and OQ=6cm. Calculate the length of OB



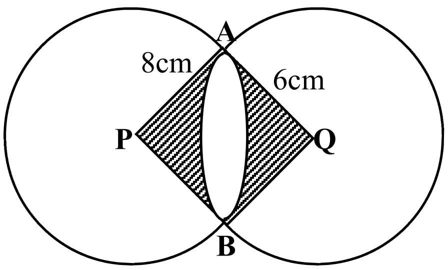
14. In the figure below ABC is a tangent to the circle at B. given that <ABG=40º, <BGD=45º, and <DBE=25º as shown below.



Find the sizes of the following angles giving reasons in each case:

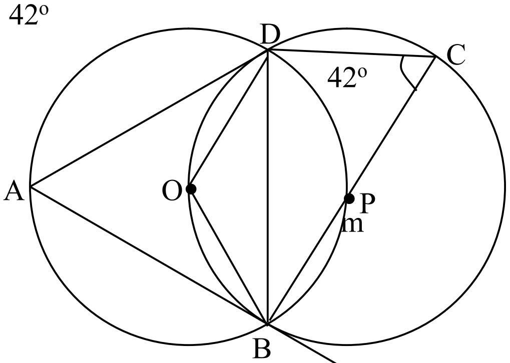
a) ∠BDG
b)∠DGE
c)∠EFG
d)∠CBD
e)∠BCD

15. The figure below shows two intersecting circles radii 8 cm and 6 cm respectively. The common chord AB = 9cm ad **P** and **Q** are the centres as shown:



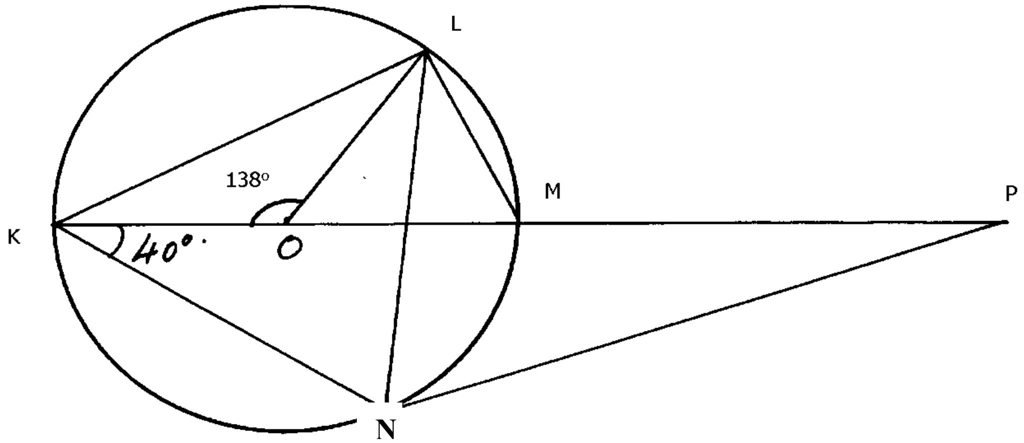
(a) Calculate the size of angles:-
  (i) ∠APB
  (ii) ∠AQB
(b) Calculate the area of the shaded region

16. The figure O and P are centres of two intersecting circles. ABE is tangent to circle BCD at B angle BCD is 42º



(a) Giving reasons for your answer, find:-
  (i) CBD
  (ii) DOB
  (iii) DAB
  (iv) CDA
b) Show that ΔADB is isosceles

17.

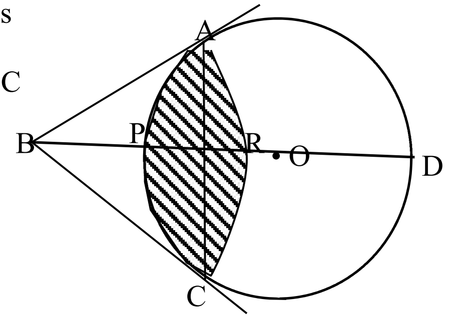


In the figure above K, M & P are points on a straight line. PN is a tangent of the circle centre O. Angle KOL = 130° and angle MKN = 40°. Find, giving reasons, the values of angles.

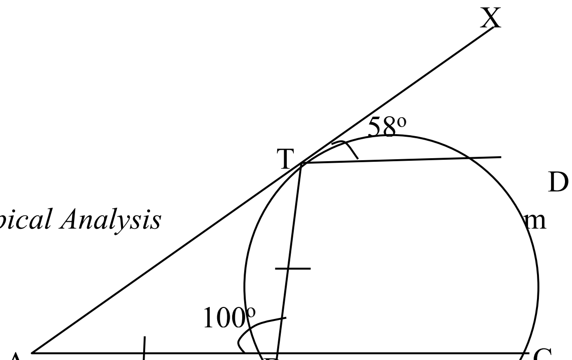
(i) ∠MLN
(ii) ∠OLN
(iii) ∠LNP
(iv) ∠MPN
(v) ∠LMO

18. In the diagram below, O is the centre of the circle of radius 8cm. BA and BC are tangents to the circle at A and C respectively. PD is the diameter and AC is a chord of length 8cm. Angle ADC = 120°. ARC is an arc of the circle, Centre B and radius 4.6cm

Calculate correct to 2 decimal places
(a) Angle ABR
(b) Area of sectors ABCR and OAPC
(c) Area of the shaded part



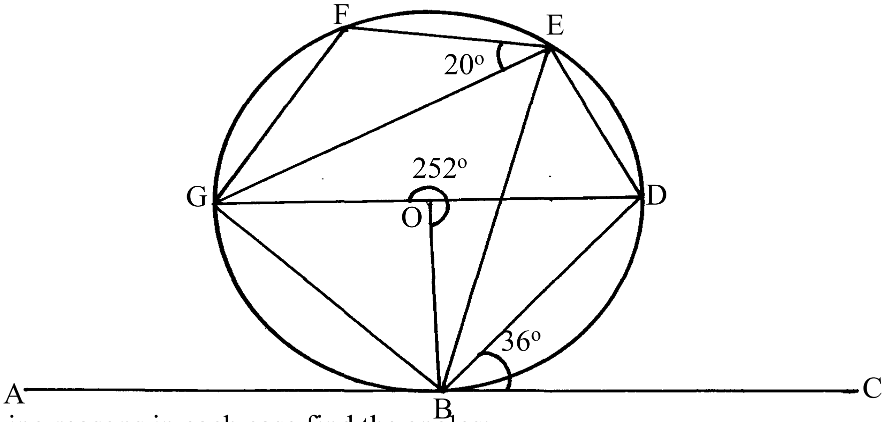
19. In the figure below, ATX is a tangent to the circle at point T, ABC is a straight line, angle ABT = 100°, angle XTD = 58° and line AB = line BT. C and D lie on the circle



Find by giving reasons, the value of angle:

(a) TDC
(b) TCB
(c) TCD
(d) BTC
(e) DTC

20. In the figure below, B, D, E, F and G are on the circumference of the circle centre O. A, B and C form a tangent to the circle at point B. GD is the diameter of the circle. Given that FG = DE, reflex angle GOB = 252°, angles DBC = 36° and FEG = 20°



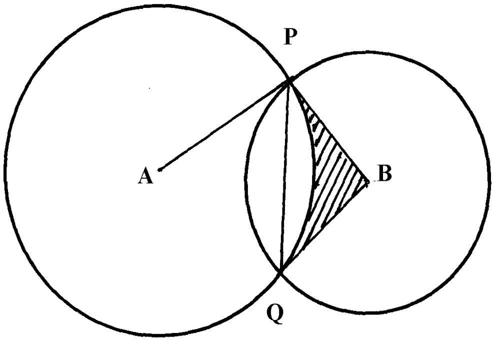
Giving reasons in each case find the angles:

a) GEB
b) BED
c) OBE
d) BGE
e) GFE

21. XYZ is a triangle in which x = 13.4cm, Z= 5cm and ∠XYZ =57.7°. Find:

(i) Length of XZ
(ii) The circum radius of the triangle

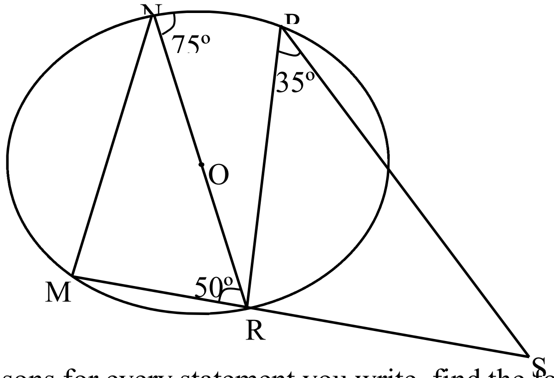
22. In the figure shown below, the centers of the two circles are A and B. PQ is a common chord to the two circles. AP = 6cm, BP=4cm and PQ =5cm



Calculate the area of the shaded region (take π as 3.142)

23. In the figure below NR is a diameter of the circle centre O. Angle PNR = 750^0 ∠ NRM = 50^0

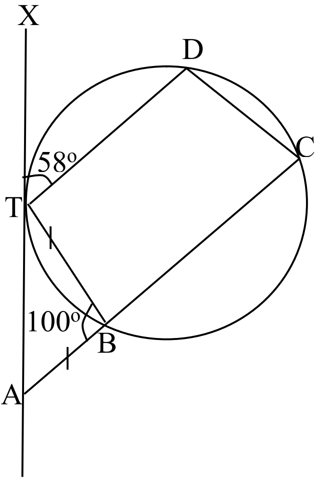
and ∠RPQ = 35^0. MRS and PQS are straight lines.



Giving reasons for every statement you write, find the following angles

(a) ∠ PQR
(b) ∠QSR
(c) Reflex ∠POR
(d) ∠ MQR
(e) ∠ PON

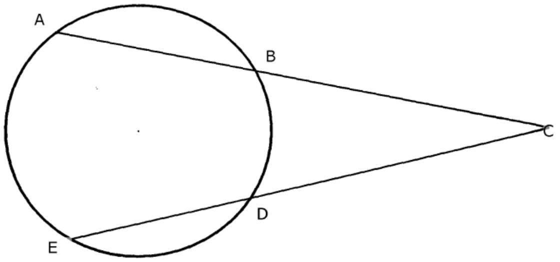
24. In the diagram below, ATX is a tangent to the circle at point T, ABC is a straight line, ∠ABT= 100°, ∠XTD = 58° and the line AB = BT



Find giving reasons the value of :

(a) ∠TDC
(b) ∠TCB
(c) ∠TCD
(d) ∠BTC
(e) ∠DTC

25.

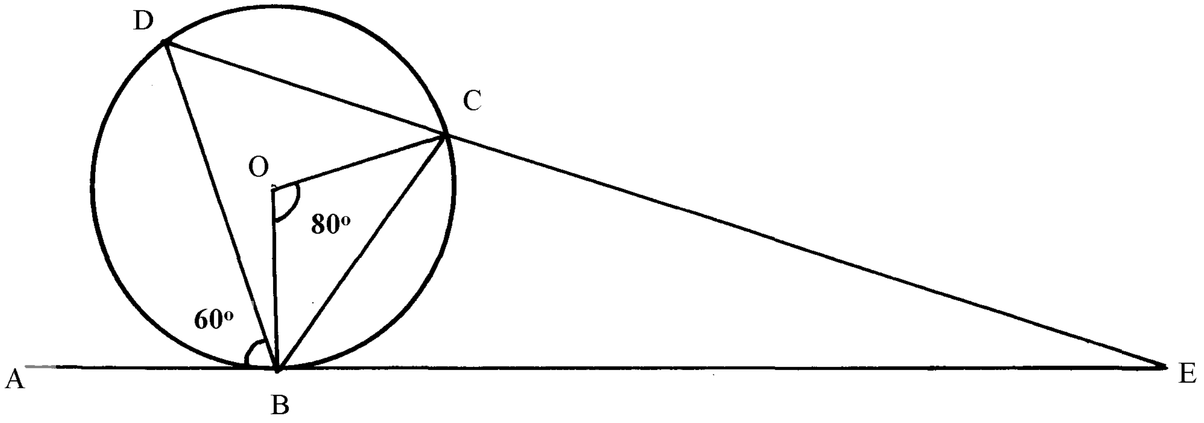


In the figure above AB = 6 cm, BC = 4 cm DC = 5 cm. Find the length DE.

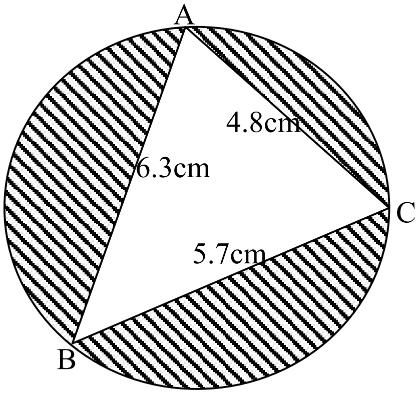
26. The eleventh term of an AP is four times the second term. If the sum of the first seven terms of the AP is 175, find the first term and the common difference

27. In the diagram below ABE is a tangent to a circle at B and DCE is a straight line.

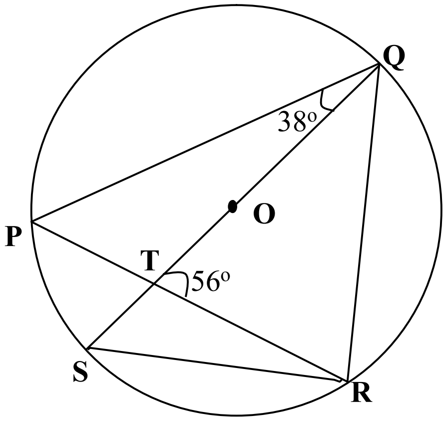
If ABD = 60°, BOC = 80° and O is the centre of the circle, find with reasons ∠BEC



28. The circle below circumscribes a triangle ABC where AB = 6.3cm, BC = 5.7cm and AC = 4.8cm. Find the area of the shaded part (use $\pi = 3.142$)



29.



(a) O is the centre of the circle and QOTS is a diameter. P, Q, R and S are points on the circumference of the circle. Angle PQS = 38° and angle QTR = 56°.
Calculate the size of ;

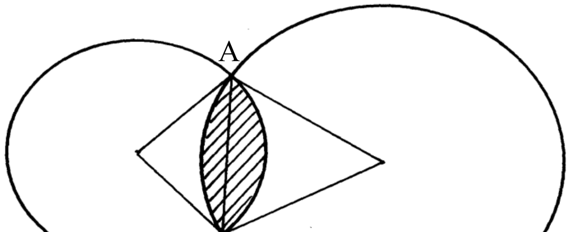
(i) $\angle PRQ$

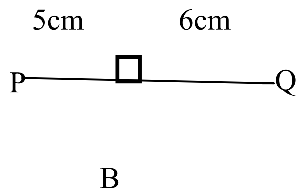
(ii) $\angle RSQ$

(b) Given that A varies directly as B and inversely as the cube of C and that;
A = 12 when B = 3 and C = 2. Find B when A = 10 and C = 1.5

(c) A quantity y is partly constant and partly varies inversely as the square of x.
The quantity y=7 when x=10 and y=5½ when x=20. Find the value of y when x=18

30. The figure below shows two intersecting circles with centres P and Q and radius 5cm and 6cm respectively. AB is a common chord of length 8cm. Calculate;



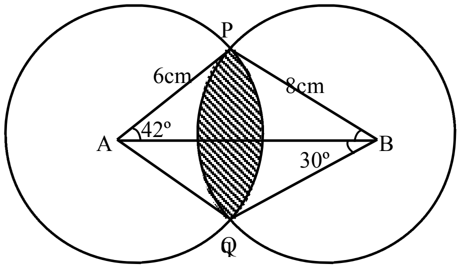


:

(a) the length of PQ
(b) the size of;
  (i) angle APB
  (ii) angle AQB
(c) the area of the shaded region

31. Triangle ABC is inscribed in the circle. AB= 7.8cm, AC 6.6cm and BC= 5.9cm. Find:
(a) The radius of the circle correct to one decimal place
(b) The area of the shaded region

32. The figure below shows two circles centres A and B and radii 6 cm and 8 cm respectively. The circles intersect at P and Q. Angle PAB = 42^0 and angle ABQ = 30^0.



(a) Find the size of ∠PAQ and PBQ.
(b) Calculate, to one decimal place the area of:
  (i) Sector APQ and PBQ.
(ii) Triangle APQ and PBQ.
(iii) The shaded area (take π $\underline{22}$)

33. The minute hand of a clock is 6.5 cm long. Calculate the distance in cm moved by its tip between 10.30 am. and 10. 45 a.m. to 2 dpl.

48. Matrices

1. Given that $A = \begin{pmatrix} 2 & 4 \\ 3 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 11 & 3 \\ 4 & 1 \end{pmatrix}$ find C such that B × C = A (3mks)

2. Use matrix method to solve the (3mks)
$3y + 2x = 13$
$2y - 3x = 0$

3. A matrix $P = \begin{pmatrix} 2 & -1 \\ -4 & 3 \end{pmatrix}$, $Q = \begin{pmatrix} a \\ b \end{pmatrix}$ *and* $R = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$. Find the values of a and b given that PQ = R. Using matrix method. (3mks)

4. A matrix A is given as $A = \begin{pmatrix} x & 0 \\ 5 & y \end{pmatrix}$
(i) Determine A^2 (1mk)

5. Two matrices A and B are such that

$A = \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$ $\quad B = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix}$

Given that the determinant of AB = 4, find the value of K. (3 mks)

6. Given that A is $\begin{pmatrix} 3 & 2 \\ 4 & -1 \end{pmatrix}$ and A $\begin{pmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{4}{11} & \frac{-3}{11} \end{pmatrix}$

Find the value of a and b in the expression: (3 mks)

$$\begin{pmatrix} 3 & 2 \\ 4 & -1 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 12 \\ 5 \end{pmatrix}$$

7. Solve for the unknowns given that the following is a singular matrix.

$$\begin{pmatrix} 1 & 2 \\ x & x-3 \end{pmatrix}$$

8. Given that $A = \begin{pmatrix} 1 & 5 \\ 3 & 7 \end{pmatrix}$ and $B = \begin{pmatrix} 7 & 3 \\ -4 & -2 \end{pmatrix}$ and that C = AB, find C^{-1}

9. $\underset{\sim}{B}$ is a matrix $\begin{pmatrix} 3 & 2 \\ 2 & 2 \end{pmatrix}$ and $\underset{\sim}{C}$ is the matrix $\begin{pmatrix} 9 & -3 \\ 2 & 1 \end{pmatrix}$

. If $\underset{\sim}{A}$ is a 2 x 2 matrix and $\underset{\sim}{A} \times \underset{\sim}{B} = \underset{\sim}{C}$. determine the matrix $\underset{\sim}{A}$.

10. An object of area 20 cm^2 undergoes a transformation given by the matrix $\begin{pmatrix} -1 & -2 \\ 4 & 3 \end{pmatrix}$ followed by $\begin{pmatrix} 2 & 3 \\ -1 & 2 \end{pmatrix}$ find the area of the final image.

11. Find the matrix B such that AB = I and $A = \begin{pmatrix} \mathbf{3} & \mathbf{2} \\ \mathbf{-1} & \mathbf{3} \end{pmatrix}$**.** Hence find the point of intersection of the lines **3x + 2y = 10** and **3y – 4 = x.**

12. Given that $\mathbf{P} = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix}$ find ;the matrix product PQ. Hence solve the simultaneous equations below:-

$2x – 3y = 5$
$- x + 2y = – 3$

13. Solve for ***x*** and ***y*** in the following matrix equation using elimination method

$$\begin{pmatrix} \frac{1}{2} & -\frac{1}{4} \\ \frac{2}{5} & \frac{1}{6} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$$

14. A triangle XYZ , X (-1, -1) , Y (-2, -4) Z (-6 , -9) is reflected in the line X axis followed by a reflection in line X= Y. Find the image of the final image

15. Triangle ABC is the image of triangle PQR under a transformation $\mathbf{M} = \begin{pmatrix} 2 & 4 \\ 0 & 2 \end{pmatrix}$ where P, Q, R map onto A, B, C respectively.

Given the points P (5, -1) Q (6, -1) and R(4, - 0.5) draw the triangle ABC on the grid provided.

b) Triangle ABC in (a) above is to be enlarged by scale factor 2 with centre at (11, - 6) to map onto A^{1}B^1 and C^1. Construct and label triangle A^{1}B^1 and C^1 on the same grid.

c) By construction, find the coordinates of the centre and the angle of rotation which can be used to rotate triangle A^{I}B^{I}C^I onto triangle A^{II}B^{II} C^{II} whose coordinates are (-3, -2) , (-3, -6) and

(-1, -2) respectively.

16. Triangle ABC with an area of 15 cm^2 is mapped onto triangle $A^IB^IC^I$ using matrix $M = \begin{pmatrix} 2 & -3 \\ 1 & 1 \end{pmatrix}$. Find the area of triangle $A^IB^IC^I$.

17. **T** is a transformation represented by the matrix $\begin{pmatrix} 5x & 2 \\ -3 & x \end{pmatrix}$ under **T** a square whose area is 10cm^2 is mapped onto a square of area 110cm^2. Find the possible values of **X**

18. Triangle $A^1B^1C^1$ is the image of Δ ABC under a transformation represented by the matrix $M = \begin{pmatrix} 3 & 2 \\ 9 & 5 \end{pmatrix}$

If the area of triangle $A^1B^1C^1$ is 54cm^2. Determine the area of triangle ABC

19. Find the matrix B such that AB = I and $A = \begin{pmatrix} \mathbf{3} & \mathbf{2} \\ \mathbf{-1} & \mathbf{3} \end{pmatrix}$**.** Hence find the point of intersection of the lines **3x + 2y = 10** and **3y – 4 = x.**

49. Formulae and variation

1. Make U the subject of the formula (3mks)

$$X = \frac{U^2V}{U^2 2W}$$

2. A quantity P varies partly as t and partly as the square of t. When t = 20, P = 45 and when t = 24, P = 60. Find P when t = 32. (4 mks)
3. A quantity V is partly constant and partly varies inversely as the square of W. If W = 2 when V = 14 and W = 3 when V = 9. write an equation connecting V and W and hence find V when W = 6. (4mks)
4. Given that $T = \frac{1}{2}\sqrt{\frac{2}{x+y}}$ express y in terms of T and X. (3mks)
5. Make t the subject of the formula. (3 marks)

$$x = \sqrt{\frac{1 + kt}{kt - 1}}$$

6. Three quantities P, Q and R are such that P varies directly as the cube of Q and inversely as the square of R.

   a) Given that P = 16 when Q = 2 and R = 3. Determine the value of R when P= 288 and Q = 4 (5 marks)

   b) Q decreases by 30% while R increases by 40%. Find the percentage decrease or increase in P. (5 marks)

7. Make P the subject of the formula in $x = \sqrt{\frac{y(p-y)}{p-1}}$ (3mks)
8. P varies directly as Q and inversely as the square root of R. Find the percentage decrease in P if Q decreases by 4 % when R increases by 44 % . (4mks)
9. Given that $q = \frac{m+1}{2m-1}$ express $\frac{3q-1}{3q+1}$ in terms of m in simplified form (3 marks)
10. P varies as the square of R. R. varies as the square of T. When P = 18, R = 3 and T = 5. Express

P in terms of T hence find P when T = 10.

11. Make r the subject of the formula.

$$v = \sqrt{\frac{r}{r+c}}$$

12. X varies as the cube of Y and inversely as square root of Z, X = 6 when Y = 3 and Z= 25.
    (a) Find;
        (i) An expression connecting X,Y,Z
        (ii) X when Y = 7 and Z = 9
        (iii) Y when X = 8 and Z = 16
    b) If Y is increased by 20% and Z is decreased by 36%, find the percentage increase in X

13. Make **b** the subject of the formula;

$$K = \frac{a\,b}{b - a}$$

14. Find a quadratic equation whose roots are $2.5 + \sqrt{3}$ and $2.5 - \sqrt{3}$, expressing it in the form $ax^2 + bx + c = 0$ Where a, b and c are integers

15. A quantity **Z** varies directly as the square of x and inversely as the square root of y. If **x** increases by 20% and **y** decreases by 36%, find the percentage change in **Z**

16. The fourth terms of a G.P is 48 and the seventh term is 384. Find the common ratio and hence calculate the sum of the first six terms

17. A quantity **P** varies directly as the square of **Q** and inversely as quantity **R**. If **P** = 2 when **Q** = 4 and **R**=6, find **P** when **Q** = 8 and **R**= 4

18. **B** varies partly as the square of **M** and partly as the inverse of **N**. **B,M** and **N** are such that when **M**=2, **N**= ½ , **B**=96 while when $\sqrt{M}$= 3 , **N**=2, **B** = 46. Write an expression for **B** in terms of **M** and **N**.

19. Solve for **x** and **y.**

$$\frac{3x}{y-1} = 1$$

$$(2x + 2) : (y - 5) = 1 : 2$$

20. Make **x** the subject of the formula.. $P = \left(\frac{x-1}{x+2}\right)$

21. Make **d** the subject of the formula given that:-

$$a^2 = \sqrt{\frac{1 + d^2}{b^2} + \frac{b}{3}}$$

22. **Z** varies jointly as the square of **x** and inversely as the square of **y**. When **x** = 10 and **y** = 4 then **z** = 15
    (a) Find **z** in terms of **x** and **y**
    (b) Find the value of **x** when **z** = 8 and **y** = 12

23. A quantity **R** partly varies as **n** and partly as the square root of **n**. When **n** = 9 **R** = 42 and when **n** = 25 **R** = 100. Find **R** when **n** = 16.

24. Make **b** the subject of the formula.

$$a = \frac{bd}{\sqrt{b^2 + d}}$$

25. **P** varies party as **Q** and partly as the square root of **Q**. When **Q** = 4, **P** = 22 and when **Q** = 9, **P** = 42. Find the value of **P** when **Q** = 25.

26. Make **C** the subject of the formula

$$\mathbf{b} = \sqrt{k-aC}$$

hence find the value of **C** when **K**= 1, **a** = 4 and **b** = 2

27. The velocity of water flowing through a pipe is inversely proportional to the square of the radius of the pipe. If the velocity of the water is 30cm/s when the radius of the pipe is 2cm. Find the velocity of water when the radius of the pipe is 4cm

28. Make x the subject of the formula

$$P = 3\sqrt{\frac{xy}{z+x}}$$

29. Three quantities **x**, **y** and z are such that **x** varies partly as y and partly as the inverse of the square of Z . When **x** = 6, **y** = 3 and z= 2. When x = 8, y = 5 and z= 1. Find the value of x when y = 10 and z= 8

30. The eleventh term of an AP is four times the second term. If the sum of the first seven terms of the AP is 175, find the first term and the common difference

31. The resistance of an electrical conductor is partly constant and partly varies as the temperature. When the temperature is 20°C, the resistance is 55 ohms. When the temperature is 28°C, the resistance is 58 ohms. Find the resistance when the temperature is 60°C

32. Expand $1 - \frac{1}{(2x)^{-1}}{}^{5}$ up to the term in x^3. Hence or otherwise evaluate $(0.98)^5$ to 4 d.p

50. Sequence and series

1. The six exterior angles of a hexagon form an arithmetic progression. if the smallest angle is 15^0, find the size of the biggest angle of the hexagon (3 mks)
2. An arithmetic progression whose first term is 2 and whose nth term is 32 has the sum of its first n terms equal to 557. Find n. (3mks)
3. Every time an insect jumps forward the distance covered is half of the previous jump. If the insect initially jumped 8.4 cm, calculate
   (i) To the nearest two decimal places the distance of the sixth jump (1 mk)
   (ii) The total distance covered after the sixth jump (2mks)
4. (a) An arithmetic progression is such that the first term is -5, the last is 135 and the sum of progression is 975.
   Calculate

(i) The number of terms in the series. (7 marks)

(ii) The common difference of the progression (2 marks)

(b) The sum of the first three terms of a geometric progression is 27 and the first term is 36. Determine the common ratio and the value of the fourth term. (4 marks)

5. The sum of the second and fourteenth terms of an arithmetic progression is 15 and sum of the fifth and sixth terms is 25. Find the first term and the common difference. (4 mks)

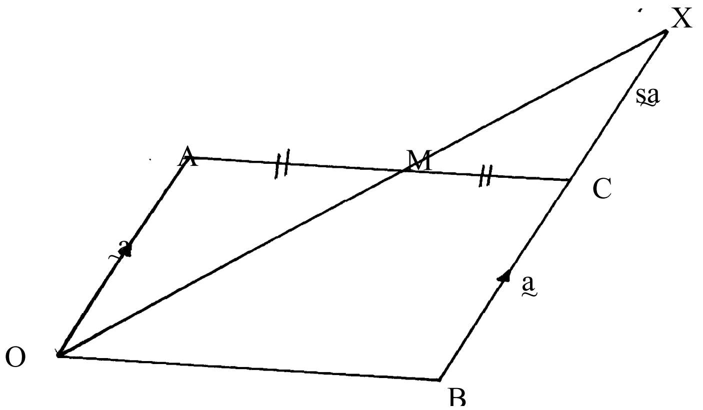
6. The area covered by Mau forest is 40,000 km^2 at present. If the human encroachment rate is estimated to be 2 % every 10 years. Calculate the area of the forest encroached in 30 years.

7. Three consecutive terms of geometric progression are 3^{2x+1}, 9^x and 81 respectively. Calculate:
(a) The value of x
(b) Find the common ratio
(c) Calculate the sum of the first 10 terms of this series
(d) Given that the fifth and the seventh terms of this G.P forms the first two consecutive terms of arithmetic sequence, calculate the sum of the first 20 terms of this sequence

8. How many terms of the sequence -12 + -10 + -8 .....should be added to give a sum of 338?

9. An arithmetic progression whose first term is 2 and whose nth term is 32 has the sum of its n terms equal to 357. Find **n**

10.



In the figure OACB is parallelogram in which M is the mid- point of AC and OM produced meets BC also produced at X.
Given OA = a and OB = b
a) Express OC in terms of a and b
b) Find the values of r and s such that OX = rOM and CX = sBC
c) Hence determine the ratio BC:BX

11. For the series **29 + 23 +..... + (-91),** find;
(a) The number of terms in the above series
(b) The sum of the series

12. (a) Given **that 5, a, b,** and **7** are in arithmetical progression, find the value of **a** and **b**
(b) If **5, P, Q ,** $^{135}/_8$ are in geometrical progression. Find the value of **P** and **Q**
(c) Prove that the sum of the first 12 terms of the first series in **(a)** is approximately equal to the sum of the first 6 terms of the second series **(b)** above

13. An aeroplane flew East for 640km then turned and flew on a bearing of 050°. After 2.5hrs flying at 324km/hr, it was necessary to fly to the original point because of technical hitch. How much shorter is it going to cover flying straight to the starting point than retracing its former route?

14. A ball falls vertically from a height of 15m. Each time it bounces back to 50% of the height achieved on the previous bounce. Find the distance covered after 6 such bounces

15. Find the sum of the first 51 terms of the series:-
-22, -19, -16..................................

16. Olunga saves shs.100 on his son's first birthday. He saves shs.200 on the second birthday and Shs.400 on the third birthday and so on doubling the amount on every birthday. How much will he be saving on the boy's 10th birthday.

17. A self-help group intended to purchase a dry cleaning machine worth shs.720,000.
The members were required to contribute equal amounts to pay for the machine.
The group recruited 20 more members consequently, each member paid shs.3000 less that what he would have contributed.
(a) find the original number of members
(b) find the amount required from each member to contribute after the recruitment

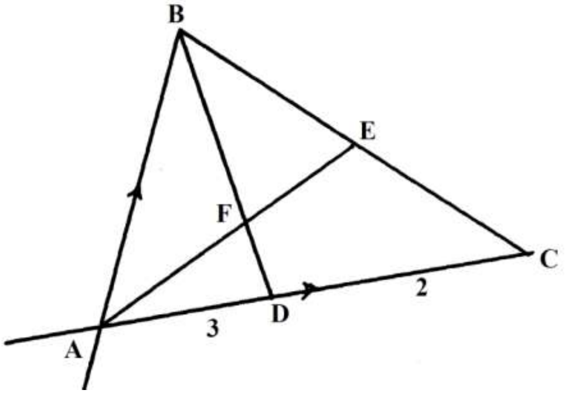
18. Find the number of terms in the following sequence
8, 4, 2, ½ …….., $^{1}/_{512}$

19. An arithmetic progression has the first term a and the common difference d
a) Write down the third, ninth and twenty fifth terms of the progression in terms of **a** and **d**
b) The arithmetic progression above is increasing and that the third, ninth and twenty fifth terms form the first three consecutive terms of a geometric progression. The sum of the seventh and twice the sixth terms of the arithmetic progression is 78.
Calculate:
i) The first term and common difference of the arithmetic progression
ii) The sum of the first nine terms of the arithmetic progression

20. The difference between the fourth and the seventh terms of an increasing arithmetic progression

51. Vectors 2

1. In the figure below E is the mid point of BC. AD:DC = 3:2 and F is the meeting point of BD and AE



If AB = $\underset{\sim}{b}$ and AC = $\underset{\sim}{c}$

(a) Express the following in terms of $\underset{\sim}{b}$ and $\underset{\sim}{c}$

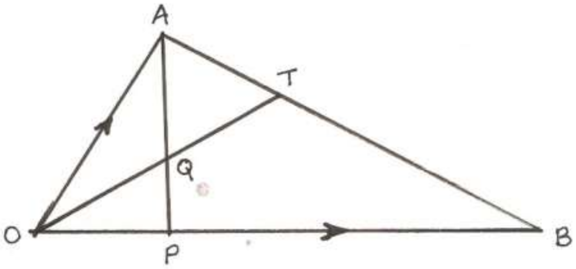
(i) $\underset{\sim}{BD}$ (1mk)

(ii) $\underset{\sim}{AE}$ (2mks)

(b) If $\underset{\sim}{BF} = t\underset{\sim}{BD}$ and $\underset{\sim}{AF} = n\underset{\sim}{AE}$ find the value of t and n. (5mks)

(c) State the ratio of BD to BF. (1mk)

2. In the figure below OA = a and OB = b. Points P and T divide $\overline{OB}$ *and* $\overline{AB}$ internally in the ration 2:3 and 1:3 respectively. Lines $\overline{OT}$ *and* $\overline{AP}$ meet at Q.



Find in terms of $\underset{\sim}{a}$ *and* $\underset{\sim}{b}$

(i) $\underset{\sim}{OT}$ (3mks)

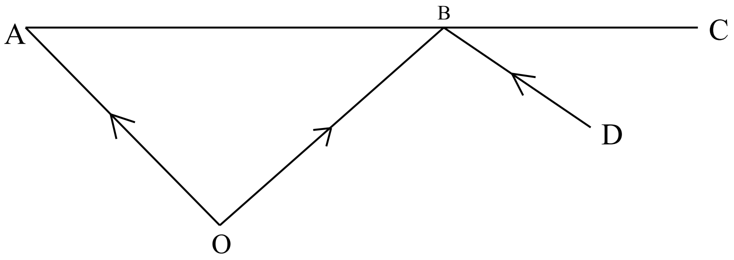
(ii) $\underset{\sim}{OP}$ (1mk)

(iii) $\underset{\sim}{AP}$ (1mk)

(iv) $\underset{\sim}{OQ}$ (5mks)

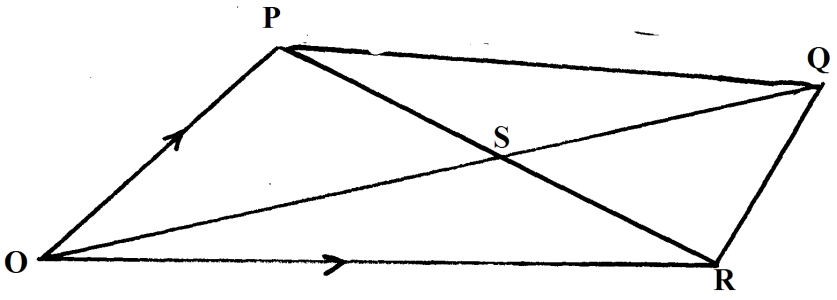
If OQ = kOT and AQ = hAP where k and h are constants express OQ in two different ways and hence find the values of h and k. (10mks)

2. In the figure below $\underset{-}{OA} = \underset{-}{a}$, $\underset{-}{OB} = \underset{-}{b}$ and DB is parallel to OA. C is on AB extended such that AB: BC = 2:1 and that OA = 3DB.



a) Express the vector BC in terms of **a** and **b.** (1mk)
b) Show by vector methods that the points O, D and C are collinear. (3mks)

4. In the figure below $\overrightarrow{OP} = \frac{1}{2}\underset{\sim}{a} + \underset{\sim}{b}$, $\overrightarrow{OR} = \frac{7}{2}\underset{\sim}{a} - \underset{\sim}{b}$, $\overrightarrow{RQ} = \frac{3}{2}k\underset{\sim}{b} + \frac{1}{2}m\underset{\sim}{a}$, where k and m are scalars 2PS = 3SR.



(a) Express as simply as possible in terms of $\underset{\sim}{a}$ *and* $\underset{\sim}{b}$ each of the following vectors.

(i) $\overrightarrow{PR}$ (1mk)

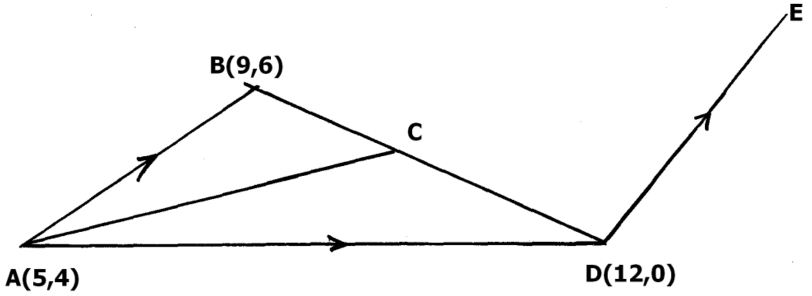
(ii) $\overrightarrow{PS}$ (1mk)

(iii) $\overrightarrow{OS}$ (1mk)

(b) Express $\overrightarrow{OQ}$ in terms of a, b, k and m. (2mks)

(c) If Q lies on $\overrightarrow{OS}$ produced with $\overrightarrow{OQ}$; $\overrightarrow{OS}$ = 5:4, find the value of k and m. (5mks)

5. In the figure below, DE = ½ AB and BC = 2/3 BD and the co ordinates of A,B and D are (5,4),(9,6) and (12,0) respectively.

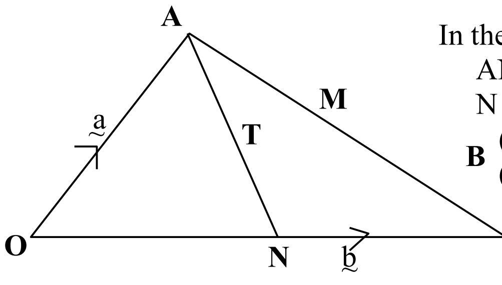


Find the vectors

(i) BD (1mk)
(ii) BC (1mk)
(iii) CD (1mk)
(iv) AC (2mks)

b) Given that AC = kCE; where k is a scalar,
Find
(i) the value of k (4mks)
(ii) the ratio in which C divide AE. (1mk)

6.



In the figure alongside $\overrightarrow{OA} = \underset{\sim}{a}$, $\overrightarrow{OB} = \underset{\sim}{b}$. T lies on AN such that AN : TN = 13:6. M lies on AB such that $\overrightarrow{AM}:\overrightarrow{MB}$=1:3 and N lies on OB such that OB:BN = 7:-5.~

B (a) Express in terms of a and b in the simplest form

(i) $\overrightarrow{AN}$

(ii) $\overrightarrow{AT}$

(iii) $\overrightarrow{AM}$

(b) Show that O, T and M are collinear and state the ratio of OT: TM

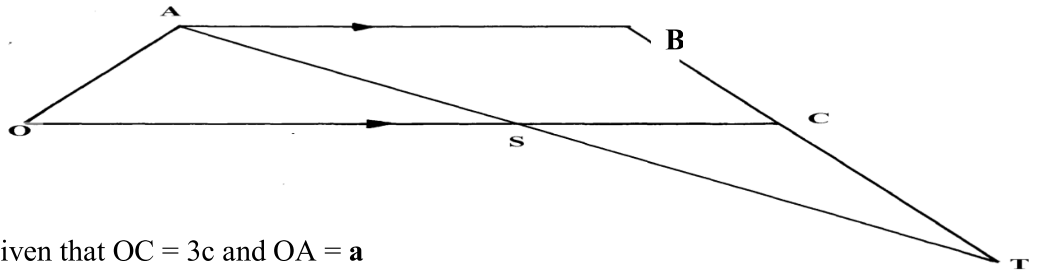
7. A point (-3, 4) divides **AB** internally in the ratio 3:5. Find the coordinates of point **A** given that point **B** is (6, -5)

8. Given that O is the origin, OA = 3i + 2j – 4k and OB = 6i + 11j + 2k. If **x** divides AB in the ratio1:2, find the modulus of OX to 2d.p

9. a) Expand $(2 - {}^{1}/_{5}x)^{5}$

b) Hence use the expansion to find the value of $(1.96)^{5}$ correct to 3 decimal places

10. In the figure OABC is a trapezium in which 3 AB = 2OC. S divides OC in the ratio 2:1 and AS produced meets BC produced at T



Given that OC = 3c and OA = **a**

(a) Express AS and BC in terms of **a** and **c**

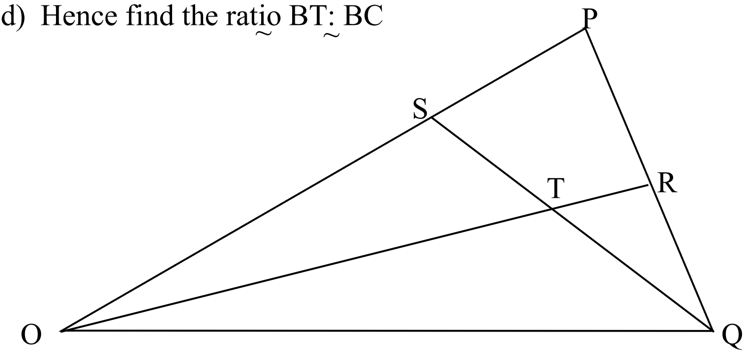
(b) Given further that AT = hAS and BT = KBC where h and k are constants

(i) Express AT in two ways in terms a, c , h and k

(c) The obtuse angle between the lines PQ

(d) Hence find the ratio BT: BC

11.



In the figure above, OPQ is a triangle in which OS = ¾ OP and PR: RQ = 2 : 1. Lines OR and SQ meet at T.

(a) Given that OP = P and OQ = q, express the following vectors in term of p and q

(i) PQ ☐ ☐ ☐ ☐

(ii) OR

(iii) SQ

(b) You area further given that ST = m SQ and OT = n OR. Determine the values of m and n

52.Binominial expansion

1. a) Using binomial expansion, determine the first five terms of the expansion: $\left(2 - {}^{1}\!/_{x}\right)^{8}$ (2mks)

b) Use the expansion above to evaluate $(1.75)^{8}$ (2mks)

2. (a) Expand and simplify the binomial expression $(2 + x)^5$ upto the term in x^3. (2mks)

(b) Use your expression to estimate $(1.97)^5$ correct to 4 s.f. (2mks)

3. (a) Expand $\left(1 - 3x\right)$

(b) use your expansion to estimate the value of $\left(0.997\right)$ Correct to 4 d.p.

4. (i) Expand $\left(5 + \frac{X}{2}\right)$ upto the term in X^3

(ii) Use your expansion to estimate the value of $\left(\frac{11}{2}\right)^{6}$ correct to one decimal place

5. (a) Expand **(3 + 2x)^{6}** up to the fourth term

(b) Use your expansion to estimate:- **$(3\sqrt{3})^{6}$**

6 Two dice are thrown once and their sum noted. Find the probability that the sum is odd

$5x$ 2

x -3

7. Find the length PR in a triangle PQR having PQ = 12cm, QR = 8.4cm angle QPR = 35^o and angle PRQ = 75^o leaving your answer correct to decimal places

8. (a) Use binomial expansion to evaluate $(2+\frac{3}{x})^5$ up to the fifth term

   (b) By expressing 9.5 in the form $(2 + \frac{3}{x})$, use the expansion in (a) above to calculate $(9.5)^5$ correct to 3 d.p

9. Use the expansion of $(x – 0.2)^5$ to find the exact value of 9.8^5

10. Solve for **x** in the equation;
    log (x + 24) = 2 log 3 + log (9 – 2x).

11. Expand $\left(1 + \frac{x}{12}\right)$ in ascending powers of **x** upto the fourth term.
    Use the four terms to evaluate $\left(\frac{5}{4}\right)^6$ to 4 decimal places.

12. (a) Expand and simplify the binominal expression $(1 + \frac{1}{2}x)^8$
    (b) Use the expansion up to the fourth term to evaluate $(1.05)^8$ to 2 decimal places

13. Expand $(3 + x)^4$ in ascending powers of x. Use the first three terms of the expansion to evaluate $(3.02)^4$, correct to 3 decimal places

53. Probability

1. During inter-school competitions, rugby and football teams from Ranje sec school took part. The probability that the rugby would win their first match was ⅛ while that the handball team could lose was $\frac{4}{7}$. Find the probability that;
   (a) Both teams won their first matches. (1 mk)
   (b) At least one team won the first match (3 mks)
2. Two identical baskets A and B contain white and red balls. Basket A contains 7 white balls and 3 red balls while basket B contains 5 white balls and 5 red balls. A bag is chosen at random and 2 balls picked from it one after another without replacement.
   (a) Illustrate this information using a tree diagram. (2mks)
   (b) Find the probability that:-
   (i) The 2 balls picked are of the same colour. (2mks)
   (ii) The two balls picked are of different colours. (2mks)
   (iii) Only one of the balls picked is red. (2mks)
   (iv) At least one white ball is picked. (2mks)
3. The probability that a girl goes to school by bus is $^1/_3$ and by matatu is ½ .If she uses a bus, the probability that she is late to school is $^1/_5$ and if she uses a matatu the probability that she is late to school is $^3/_{20}$. If she uses other means of transport, the probability of being late is $^1/_{20}$.
   a) Draw a probability tree diagram to represent this information. (3mks)
   b) What is the probability that she will be late to school. (3mks)
   c) What is the probability that she will be late for school if she does not use a matatu. (2mks)
   d) What is the probability that she will not be late to school. (2mks)
4. If a certain unfair coin is tossed, the chance of obtaining a tail is 25%. Find:-
   a) The probability of getting two heads when the coin is tossed twice. (2 mks)
   b) The probability of obtaining at least one tail when the coin is tossed twice. (2 mks)
5. A bag contains 3 black balls and 6 white ones. If two balls are drawn from the bag one at a time,find;
   (a) The probability of drawing a black ball and a white ball.

(i) Without replacement.
(ii) With replacement.
(b) Drawing two white balls.
(i) Without replacement.
(ii) With replacement.

6. A cupboard has 7 white cups and 5brown cups all identical in size and shape. There is a blackout in the town and Mrs. Bett has to select three cups one after another without replacing the previous ones.
(a) Draw a tree diagram for the information
(b) Calculate the probability that she chooses;
(i) Two white cups and one brown cup
(ii) Two brown cups and one white cup
(iii) At least one white cup
(iv) three cups of the same colour

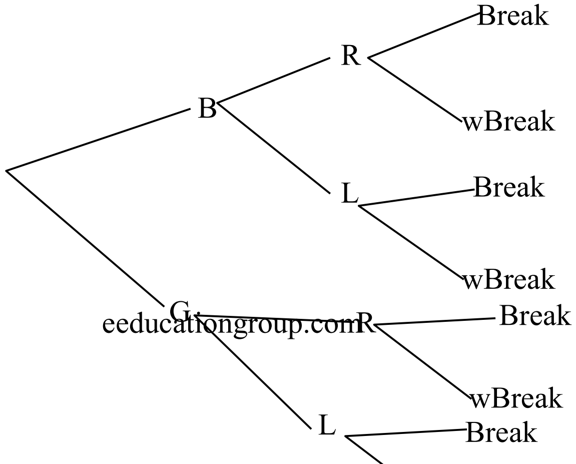
7. A two digit number is formed from the first four prime numbers.
a) Draw the table to show the possible outcomes, if each number can be used only once.
b) Calculate the probability that a number chosen from the digit numbers is an even number

8. The probability that a boy goes to school by bus is $^{1}/_{3}$ and by matatu is ½. If he uses a bus, the probability that he is late to school is $^{1}/_{5}$ and if he uses a matatu, the probability of being late is $^{3}/_{10}$. If he uses other means of transport, the probability of being late is $^{1}/_{20}$
(a) Draw a probability tree diagram to represent this information
(b) What is the probability that he will be late for school
(c) What is the probability that he be late for school if he does not use a matatu
(d) What is the probability that he is not late for school

9. One day during inspection in a certain secondary school, it was discovered that there was a probability of $^{2}/_{5}$ that a students had shaggy hair, if a student had shaggy hair, there was a probability of ½ that he had torn uniform. But if he had properly combed hair, there was a probability of ¼ that he had a torn uniform. If a student had torn uniform there was a probability of $^{4}/_{5}$ that he had unpolished shoes. Otherwise there was a probability of $^{3}/_{5}$ that he had polished shoes.
a) Represent this information in a probability tree diagram
b) Find the probability that:-
i) a student had all the three faults
ii) a students had exactly two faults
iii) a students had no faults at all

10. A shop is stocked with plates which are from two suppliers **A** and **B**. They are brought in the ratio of 3:5 respectively. 10% of plates from **A** are defective and 6% of plates from **B** are de

11. In a science class $^{2}/_{3}$ of the class are boys and the rest are girls. 80% of the boys and 90% of the girls are right handed and the rest are left handed. The probability that a right handed student will break a test-tube in any session is $^{1}/_{10}$ and the corresponding for the left handed student is $^{3}/_{10}$, their probability being independent of the student sex .
a) Complete the probability tree diagram given below



b) Using the tree diagram, find the probability that :
i) A student chosen from the class is left handed
ii) A test-tube is broken by a left handed student
iii) A test-tube is broken by a right handed student
iv) A test-tube is not broken in any session

12. Students who performed well in an examination are to be given an outing. A student has to throw two dice. If he gets a sum greater than 8, he gets a two-days outing, otherwise he gets a one day outing.
(a) Find the probability that a student gets a two-day outing
(b) A student who qualifies for a two-day outing throws a die and a coin to decide whether he gets pocket money for the two days or for only one day. If he gets a head and a multiple of 3 he gets pocket money for two days. Find the probability that he is given a two-day outing but given pocket money for only one day
(c) If a student gets a one-day outing, he throws a die to decide if he gets pocket money or not. If he gets a number greater than 4 he gets the pocket money. Find the probability that:-
(i) A student gets pocket money for two days
(ii) A student gets pocket money

13. A bag contains **6** red beads and **4** white ones. Two beads are selected from the bag at random without replacement.
(a) Draw a tree diagram to represent the above information.
(b) Calculate the probability that:
(i) Both beads are white.
(ii) Both beads are of the same colour.
(iii) At least a red bead is picked.
(iv) The two beads are of different colours.

14. A bag contains blue, green and red pens of the same type in the ratio 8:2:5respectively. A pen is picked at random without replacement and its colour noted.
a) Determine the probability that the first pen picked is;
(i) blue
(ii) either green or red.
b) Using a tree diagram, determine the probability that;
(i) the first two pens picked are both green.
(ii) Only one of the first two pens picked is red.
c) (i) Draw the probability space for the possible outcomes when a coin is tossed and a die thrown simultaneously
(ii) Determine the probability of getting a head and an even number.

15. A box contains five red balls and four black balls all identical. Three balls are drawn without replacement from the box at random;
(a) Draw a tree diagram to show the situation
(b) use the tree diagram to find the probability that;

(i) the balls picked are of the same colour
(ii) more red balls were picked
(iii) at least a black ball was picked
(iv) atmost 1 red ball was picked

16. A bag contains 10balls of which 3 are red, 5 are white and 2 are green. Another bag contains 12balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and then a ball chosen at random from the bag. Find the probability that the ball so chosen is red

17. In a certain science class $^2/_3$ of the class are boys and the rest girls. $^4/_5$ of the boys and $^9/_{10}$ of the girls are right handed, and the rest are left handed. The probability that a right handed student will break a test-tube in any session is $^1/_{10}$ and the corresponding probability for a left handed student is $^3/_{10}$, these probabilities being independent of the student's sex.
(a) Represent this information on a tree diagram
(b) Using the diagram above;
(i) determine the probability that a student chosen at random form the class is left handed
(ii) determine the probability that a student chosen at random from the class is right handed and will break a test tube in any session
(c) determine the probability that a test tube is broken in any session

18. A box contains 5 red biro pens, 4 black biro pens and 6 green biro pens. If three pens are picked once at random, find the probability that:
(i) all the biro pens are red
(ii) the biro pens are of the same colour
(iii) the biro pens are one of each colour
(iv) none of the biro pens is red

19. The probability that Chebet goes to bed on time ¾ . If she goes to bed on time, the probability that she wakes up on time is $^5/_6$, otherwise her probability of waking up on time is $^1/_3$.
(a) (i) Find the probability of Chebet getting to bed on time and waking up on time by use of diagram
(ii) Waking up late
(b) If Chebet wakes up late, her probability of getting to class on time is $^1/_5$ otherwise, her probability of getting to class on time is $^3/_5$.
(i) Find the probability of Chebet getting to bed on time and gets to class late
(ii) Getting to bed late and get to class on time

54. Compound proportions, mixtures and rates of work

1. Naliaka bought maize and beans from a wholesaler. She mixed the maize and beans in the ratio 5:3. She had bought the maize at sh.30per kg and the beans at sh.60 per kg. If she was to make a profit of 30%, what should be the selling price of 1kg of the mixture? (3 mks)

2. A carpenter makes two kinds of tables, hexagonal and rectangular. To make each hexagonal table requires 6 man-hours whereas rectangular ones require 3 man –hours each. The cost of the material for hexagonal table is sh.120 and shs.100 for the rectangular one. The profit obtained from a hexagonal table is sh.80 and a rectangular table is sh.60. The carpenter has to abide by the following conditions:
(i) A contract to supply at least 15 hexagonal and 10 rectangular tables per week.
(ii) Only 240 man-hours may be available in a week
(iii) His total weekly expenditure of all tables must not exceed shs.6,000
a) Write down all the inequalities to satisfy the three conditions above (3 mks)

(b) On the grid provided draw the inequalities in (a) above and shade the unwanted region. (4 mks)

c) Using a search line, determine:

(i) The number of hexagonal and rectangular tables to be made to maximize profit (2 mks)

(ii) The maximum profit acquired from selling the tables (1 mk)

3. A machine part is a pulley system with two wheels of radii 0.5m and 2m. The centres of the wheels are 4m apart.

(a) If a rope is tied around the wheels externally to complete the pulley, calculate it's length. (7mks)

(b) If the rope is tied internally round the pulleys, it is $1^1/_3$m longer than if tied externally. Calculate the length of the required to 4 significant figures. (3mks)

4. A coffee blender mixes grade A and B in the ratio 3:2 respectively. If grade A costs Sh.30 per kg and B Sh.25 per kg, at what price per kg should he sell the mixture in order to make a profit of 15%? (2mks)

5. John bought 3 brands of tea A,B and C. The cost price of the three brands were Sh. 25, Sh. 30 and Sh. 45 per kilogram respectively. He mixed the three brands in the ratio 5:2:1 respectively. After selling the mixture he made a profit of 20%.

(a) How much profit did he make per kilogram of the mixture? (4 marks)

(b) After one year the cost price of each brand was increased by 12%.

(i) For how much did he sell one kilogram of the mixture to make 20% profit? Give your answer to the nearest 5cts (3 marks)

(ii) What would have been his percentage profit if he sold one kilogram of the mixture at Sh. 40.25? (3 marks)

6. Three business partners Georgina, Gilbert and Akumu decided to buy a plot worth shs.510,000. They contributed shs.30000; as a deposit in the ratio 2:3:5 respectively. They paid the balance in two months by contributing equal amounts. After one year, they sold the plot for a profit of 20% and invested the initial capital in another business. The profit was shared in the ratio 1:2:3; respectively. Find how much each partner

(a) contributed towards the deposit

(b) paid to clear the balance

(c) received as a profit

7. Twelve men take 20days to complete a piece of work. How long would 16 men take to do the same piece of work?

8. Mr. Kitur bought grades of tea ; Grade A costs shs.109 per kg and a kg of Grade B costs shs.81.50. In what ratio must he mix the two grades in order to make a profit of 20% by selling the mixture at Kshs.112.80per kg?

9. Mogutu and Onacha working together can do a piece of work in 6days. Mogutu working alone takes 5days longer than Onacha. How many days does it take Onacha to do the work alone?

10. Given the curve $\mathbf{y = 2x^3 + ½x^2 – 4x + 1}$, find the equation of the normal to the curve at (1, -½)

11. **A** and **B** are connected by the equation **B = KA + M** where **K** and **M** are constants. The table below shows the values of **A** and corresponding values of **B**

A	1.5	3.0	4.5	6.0	7.5
B	8	11	14	17	20

a) Draw a suitable straight line on the grid provided

b) State the values of K and M, hence express B in terms of A

12. The latitude and longitude of two stations **P** and **Q** are (47°N, 25°W) and (47°N, 70°W) respectively. Calculate the distance in nautical miles between **P** and **Q** along the latitude 47°N

13. A coffee blender mixes 6 parts of types **A** with 4 parts of type **B**. If type A costs Kshs. 72 and type **B** costs him Ksh.66 per kg respectively at what price should he sell the mixture in order to make a profit of 5%. Give your answer to the nearest ten cent.

14. (a) (i) Paint **A** costs shs.150 per litre while **B** costs shs.160 per litre. In what proportion must **A** be mixed with **B** to produce a mixture costing shs.156 per litre
    (ii) What must be the selling price of the mixture if a profit of 12% is to be realized?
    (b) A cylindrical water tank can be filled to a depth of 2.1m by a pipe **P** in 2 hours. Pipe **Q** takes 7 hours to fill the tank to the same level. Pipe **R** can empty this amount of water in 6hours. Initially, the tank is empty. Pipes **P** and **Q** are turned on at 8.45a.m and pipe R at 9.45a.m. Find the depth of water in the tank at 11.45a.m

15 Two grades of tea leaves one costing sh.420 per kilogram and the other costing sh. 470 per kilogram are to be mixed in order to produce a blend worth sh.455 per kilogram. In what proportion should they be mixed?

16. The internal radius of a pipe is 0.35m. Water flows through the pipe at the rate of 45cm per second. Calculate the amount of water that passes through the pipe in 2 ¼ hours in litres

17. In 2000 the total cost of manufacturing an item was ksh1250 and this was divided among the costs of material, labour and transport in the ratio of 8:14:13. In 2003 the cost of material was doubled, labour cost increased by30% and transport costs increased by 20%
    a) Calculate the cost of manufacturing this item in 2003
    b) In 2004 the cost of manufacturing the same item was ksh1981 as a result of increase in labour costs only. Find the percentage increase in labour costs of 2004

18. Brand **A** tea costing Kshs.80 per kg is mixed with Brand **B** tea costing Kshs.100 per kg such that the mixture is sold at Kshs.114 making a profit of 20%. Find the ratio of **A:B**

19. In what proportion must teas of Kshs.76 and Kshs.84 per kg be mixed to produce a tea costing Kshs.81 per kg

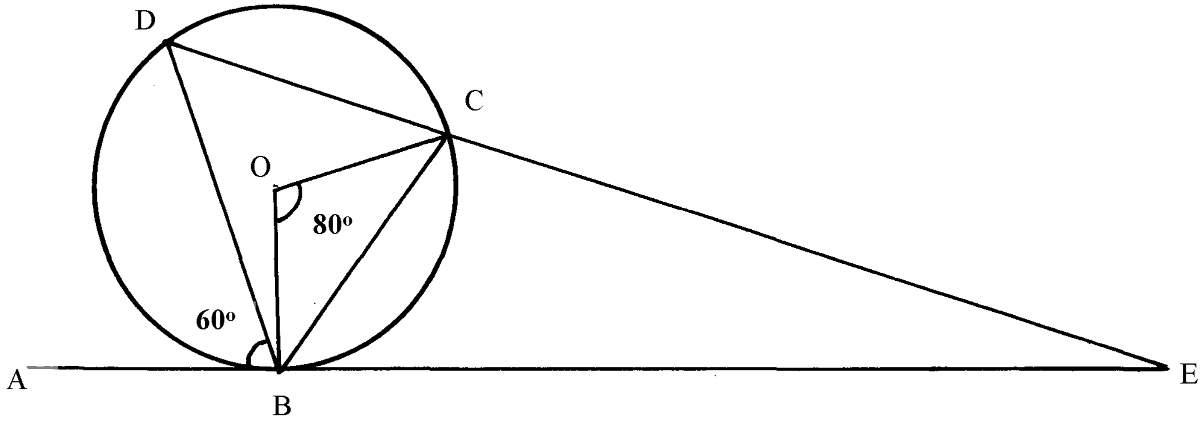
20. Onyango bought 3 brands of tea **P, Q** and **R**. the cost price of the three brands were shs.25, shs.30 and shs.45 per kilogram respectively. He mixed the three brands in the ratio 5:2:1 respectively After selling the mixture, he made a profit of 20%
    (a) How much, profit did he make per kilogram of the mixture?
    (b) After one year, the cost price each brand was increased by 12%.
    (i) For how much did he sell one kilogram of the mixture to maintain 20% profit. Give your answers to the nearest 5cts.
    (ii) What would have been his percentage profit if he sold one kilogram of the mixture at shs.40.25?

21. A mixture contains two powders X and Y with masses in the ratio 3:11. If the mixtures Cost Shs.6.70 per kg and powder x costs Shs.5.60 per kg. Find the cost of 1kg of powder Y

55. Graphical Methods

1. The equation of a circle is given as $2x^2 + 2y^2 - 8x + 5y + 10 = 0$. Find the radius of the circle and the coordinates of its centre. (3 mks)
2. The equation of a circle is given by $x^2 + 4x + y^2 - 5 = 0$. Find the centre of the circle and its radius.
3. The equation of a circle is $x^2 + y^2 + 6x - 10y - 2 = 0$. Determine the co-ordinates of the centre of the circle and state its radius

4. In the diagram below ABE is a tangent to a circle at B and DCE is a straight line. If ABD = 60°, BOC = 80° and O is the centre of the circle, find with reasons ∠BEC



5. Obtain the centre and the radius of the circle represented by the equation: $x^2 + y^2 - 10y + 16 = 0$

6. Complete the table below, for the function $y = x^3 + 6x^2 + 8x$

x	-5	-4	-3	-2	-1	0	1
x^3	-125		-27	-8		0	1
$6x^2$		96	54		6	0	6
8x	-40		-24			0	8
y			3	0		0	15

(a) Draw a graph of the function $y = x^3 + 6x^2 + 8x$ for $-5 \leq x \leq 1$ and use the graph to estimate the roots of the equation $x^3 + 6x^2 + 8x = 0$

(b) Find which values of **x** satisfy the inequality $x^3 + 6x^2 + 8x - 1 > 0$

7. Sketch the curve of the function $y = x^3 - 3x + 2$ showing clearly minimum and maximum points and the y – intercept.

8. Show that $4y^2 + 4x^2 = 12x - 12y + 7$ is the equation of a circle, hence find the co-ordinates of the centre and the radius

9. Two variables R and P are connected by a function $R = KP^n$ where K and n are constants. The table below shows data involving the two variables

P	3	3.5	4	4.5	5
R	36	49	64	81	100

(a) Express $\mathbf{R = KP^n}$ in a linear form

(b) Draw a line graph to represent the information above
(c) Find the values of constants **K** and **n**
(d) Write down the law connecting **R** and **P**
(e) Find the value of **P** when **R** = **900**

10. A circle of radius 3cm has the centre at (-2, 3) . Find the equation of the circle in the form of $x^2 + y^2 + Px + qy + c = 0$

11. In an experiment, the values of two quantities V and T were observed and the results recorded as shown below.

V	0	2	4	6	8	10
T	0.49	0.30	0.24	0.20	0.16	0.137

It is known that **T** and **V** are related by a law of the form $T = \frac{a}{b + V}$

where **a** and **b** are constants.

a) Draw the graph of $\frac{I}{T}$ against V
b) Use your graph to find;
  i) The values of **a** and **b**.
  ii) **V** when **T** = 0.38
  iii) **T** when **V** = 4.5

12. Find the equation of the tangent to the curve $y = 2x^3 + x^2 + 3x - 1$ at the point (1, -5) expressing you answer in the form $y = mx + c$

13. Given that :- $243 = (81)^{-1}$ x $(^1/_{27})^x$ determine the value of x

14. Show that $3x^2 + 3y^2 + 6x - 12y - 12 = 0$ is an equation of a circle hence state the radius and centre of the circle

15. (a) Fill in the table below for the function **$y = -6 + x + 4x^2 + x^3$ for $-4 \leq x \leq 2$**

x	-4	-3	-2	-1	0	1	2
-6	-6	-6	-6	-6	-6	-6	-6
x	-4	-3	-2	-1	0	1	2
$4x^2$			16			4	
x^3							
y							

(b) Using the grid provided draw the graph for **$y = -6 + x + 4x^2 + x^3$ for $-4 \leq x \leq 2$**
(c) (i) Use the graph to solve the equations:-
(i) $x^3 + 4x^2 + x - 4 = 0$
(ii) $-6 + x + 4x^2 + x^3 = 0$
(iii) $-2 + 4x^2 + x^3 = 0$

16. The table below shows the results obtained from an experiment to determine the relationship between the length of a given side of a plane figure and its perimeter

Length of side ι (cm)	1	2	3	4	5
Perimeter P(cm)	6.28	12.57	18.86	21.14	31.43

(a) On the grid provided, draw a graph of perimeter **P**, against ι

(b) Using your graph determine;

(i) the perimeter of a similar figure of side 2.5cm

(ii) the length of a similar figure whose perimeter is 9.43cm

(iii) the law connecting perimeter p and the length ι

(c) If the law is of the **form $P = 2k\iota + c$** where **k** and **c** are constants, find the value of **k**

17. In an experiment with tungsten filament lamp, the reading below of voltage (V) current (I), power (P) and resistance (R)were obtained. It was established that **P** was related to **R** by a law $P = a R^n - 0.6$. Where **a** and **n** are constants.

V	1.30	2.00	2.80	4.40	5.70
I	1.50	1.80	2.10	2.50	2.90
P	0.73	2.05	3.28	7.44	10.62
R	0.89	1.13	1.33	1.78	1.99

Plot a suitable line graph and hence use it to determine the value of **a** and **n**

18. Find the gradient of a line joining the centre of a circle whose equation is $\mathbf{x^2 + y^2 - 6x = 3 - 4y}$ and a point P(6,7) outside the circle..

19. a) Complete the table below for the function $\mathbf{y = -x^3 + 2x^2 - 4x + 2}$.

x	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**
$-x^3$	27	8		0		-8		
$2x^2$	18	8	2	0				
-4x		8		0				-16
2	2	2	2	2	2	2	2	2
y		26		2		-6		-46

b) On the grid provided below draw the graph of $\mathbf{-x^3 + 2x^2 - 4x + 2}$ for $\mathbf{-3 \le x \le 4}$.

c) Use the graph to solve the equation $\mathbf{-x^3 + 2x^2 - 4x + 2 = 0}$.

d) By drawing a suitable line on the graph solve the equation. $\mathbf{-x^3 + 2x^2 - 5x + 3 = 0.}$

20. Determine the turning point of the curve $y = 4x^3 - 12x + 1$. State whether the turning point is a maximum or a minimum point.

21. (a) Complete the table below for the equation of the curve given by $\mathbf{y = 2x^3 - 3x^2 + 1}$

X	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3
$\mathbf{2x^3}$	-16		-2		0		2		16		
$\mathbf{-3x^2}$	-12			0.75	0	-0.75					-27
1	1				1						
y	-27	-12.5			1						13.5

(b) Use the table to draw the graph of the function $\mathbf{y = 2x^3 - 3x^2 + 1}$

c) Use your graph to find the values of x for :-

(i) $y > 0$

(ii) The roots of the equation $2x^3 - 3x^2 + 1 = 0$

(iii) $2x^3 - 3x^2 = 9$

22. Find the radius and the centre of a circle whose equation is :
$2x^2 + 2y^2 - 6x + 10y + 9 = 0$

56.Matrices and Transformations

1. a) (i) On the grid provided, with the same scale on both axes, draw the square S whose vertices are (0, 0), (2, 0), (2,2) and (0, 2). (1 mk)

   (ii) Find the coordinates and draw the image T of S under the transformation whose matrix A maps a point (x, y) onto (x', y')

   where; $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2x - y \\ x + 2y \end{pmatrix}$ (3 mks)

   (iii) Draw the image U of S under the transformation whose matrix is

   $B = \begin{pmatrix} 2 & 1 \\ -1 & 2 \end{pmatrix}$ (2 mks)

   (b) (i) Find the product AB and draw the image V of S under the transformation whose matrix is AB (3 mks)

   (ii) Describe the single transformation that maps S onto V (1 mk)

2. On the grid provided, draw triangle PQR with P(2,3), Q(1,2) and R(4,1). On the same axes draw triangle $P^{11}Q^{11}R^{11}$ with vertices P^{11}(-2,3), Q^{11}(-1,2) and R^{11}(-4,1). (2mks)

   (a) Describe fully a single transformation which will map triangle PQR onto triangle $P^{11}Q^{11}R^{11}$. (1mk)

   (b) On the same plane, draw triangle $P^{1}Q^{1}R^{1}$ the image of triangle PQR under reflection in the line y = -x. (2mks)

   (c) Describe fully a single transformation which maps triangle $P^{1}Q^{1}R^{1}$ onto triangle $P^{11}Q^{11}R^{11}$. (2mks)

   (d) Draw triangle $P^{111}Q^{111}R^{111}$ such that it can be mapped onto triangle PQR by a position quarter about (0,0) (2mks)

   (e) State all pairs of triangles that are oppositely congruent. (1mk)

3. a) Given the transformation matrices

   $T1 = \begin{pmatrix} 2 & 1 \\ -1 & -2 \end{pmatrix}$ and $T2 = \begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix}$

   and that transformation T_1 followed by T_2 can be replaced by a single transformation T, write down the matrix for T. (3 marks)

   b) Find the inverse of matrix T (2 marks)

   c) The points A^{11}(7,-11), B^{11}(-7,-13), C^{11}(-8,16) and D^{11}(8,8) are the images of points A, B, C and D respectively under transformation T_1 followed by T2
   Write down the co-ordinates of A, B, C, and D. (5 marks)

4. A(3, 7), B(5, 5), C(3, 1), D(1, 5)

   a) On the grid provided in the next page, plot ABCD on a Cartesian plane (2mks)

   b) A'B'C'D' is the image of ABCD under a translation $T\begin{pmatrix} -6 \\ -9 \end{pmatrix}$. Plot A'B'C'D' and state its coordinates. (2mks)

   c) Plot A''B''C''D'', the image of A'B'C'D' after a rotation about (-1, 0) through a positive quarter turn. State its coordinates. (3mks)

   d) A'''B'''C'''D''' is the image of A''B''C''D'' after a reflection in the line y=x + 2. Plot A'''B'''C'''D''' and state its coordinates (3 mks)

5. A transformation represented by the matrix $\begin{pmatrix} -2 & 1 \\ 1 & 2 \end{pmatrix}$ maps P(0,0), Q(2,0), R(2,3) and S(0,3) onto P', Q', R', S'

   a) On the grid provided draw the quadrilateral PQRS and P'Q'R'S' (4mks)

b) (i) Determine the area of PQRS (1mk)

(ii) Hence or otherwise find the area of P'Q'R'S' (2mks)

c) A transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ maps P'Q'R'S' onto P''Q''R''S''.

Determine the matrix of transformation that would map P''Q''R''S'' onto PQRS (3mks)

6. A translator T maps P (8, -2) onto P^1 (-2, -3). Find the image of Q (6, -2) under the same translation. (3 mks)

7. The vertices of a triangle are A(2,5), B(4,3) and C(2,3). H represents a half turn rotation about the point (0,2).

a) Draw triangle ABC and A', B', C' under H (4 marks)

b) T represents a reflection in the lone x= 0 and K represent a translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$. Find the coordinates of A'', B'', C'' of A', B', C' under TK. Hence draw A'', B'', C'' (4 marks)

c) Describe a single transformation that maps ABC onto A'', B'', C'' (2 marks)

8. Given triangle ABC with vertices A (-6, 5), B(-4, 1) and C(3, 2) and that A(-6, 5) is mapped onto A^1(-6, -4) by a shear with y-axis in variant. On the grid provided below;

(i) draw triangle ABC

(ii) draw triangle $A^1B^1C^1$, the image of triangle ABC, under the shear

(iii) determine the matrix representing the shear

(b) Triangle $A^1B^1C^1$ is mapped onto $A^{11}B^{11}C^{11}$ by a transformation defined by the matrix $\begin{pmatrix} -1 & 0 \\ 3/2 & -1 \end{pmatrix}$

(i) Draw triangle $A^{11}B^{11}C^{11}$ on the same grid as ABC and $A^1B^1C^1$

(ii) Describe fully a single transformation that maps A^{11} $B^{11}C^{11}$

9. (a) Under a certain rotation A(2,0) is mapped onto A^1(-4, 2) and B(0,5) is mapped onto B^1(-9, o)

(i) On the grid provided plot the lines AB and A^1B^1 on the same axes

(ii) Hence determine by construction the co-ordinates of the centre and angle of rotation

(b) Under a quarter positive turn about the origin O, A^1 is mapped onto A^{11} and B^1 is mapped onto B^{11}. Determine the co-ordinates of A^{11} and B^{11}

(c) Describe fully a single transformation which would map A to A^{11} and B to B^{11}

10. A transformation **T** is represented by the matrix $\begin{pmatrix} \mathbf{0} & \mathbf{-1} \\ \mathbf{-1} & \mathbf{0} \end{pmatrix}$ and transformation **U** $\begin{pmatrix} \mathbf{0} & \mathbf{-1} \\ \mathbf{-1} & \mathbf{0} \end{pmatrix}$ by the matrix. Given that a rectangle has co-ordinates at A (1,2) B(6, 2), C(6, 4) and D (1, 4) and that under **T** the image of ABCD is $A_1B_1C_1D$ and under **U** the image of $A_1B_1C_1D$ is $A_2B_2C_2D_2$:

(a) Find the co-ordinates of $A_1B_1C_1D_1$ and $A_2B_2C_2D_2$

(b) On the grid provided, plot ABCD, $A_1B_1C_1D_1$ and $A_2B_2C_2D_2$

(c) Describe the transformation represented by:-

(i) U

(ii) UT

(d) If $A_2B_2C_2D_2$ were to be transformed by a transformation represented by the matrix to map onto $A_3B_3C_3D_3$. What would be the area of $A_3B_3C_3D_3$

11. The vertices of a quadrilateral are A(2,2) B(8,2) , C (8,6) and D(6,4) under a rotation the images of vertices A and D are A(0,8) and D1(-2, 12).

(a) On the grid provided and using the same axes draw the quadrilateral ABCD and the points A^1 and D^1

(b) Determine the centre and angle of rotation

(c)Locate the points B^1 and C^1 under the rotation and complete the quadrilateral

12. A translation maps the point P(5, -3) onto $P^1(2, -5)$

(a) Determine the translation vector T

(b) A Point R^1 is the image of R(-2, -3) under the same translation in (a) above, find the magnitude of P^1R^1

13. Triangle ABC has vertices at A(0, -1), B(4, 3)and C(2,2).

(a) Find the coordinates of image triangle $A^1B^1C^1$ of triangle ABC under translation vector $\begin{pmatrix}1\\-2\end{pmatrix}$

(b) Given that triangle $A^{11}B^{11}C^{11}$ is the image of triangle $A^1B^1C^1$ under an enlargement scale factor 3, centre O(0,0) , find the coordinates of A^{11}, $B^{11}$and C^{11}

(c) If the area of triangle $A^1B^1C^1$ is 24 cm^2, calculate the area of triangle $A^{11}B^{11}C^{11}$

(d) Find the matrix that maps triangle $A^{11}B^{11}C^{11}$ onto triangle ABC

14. a) The triangle ABC where A (2,-1) B (1, 2) and C (4, 4) is reflected in the line X = 4 to give triangle $A_1B_1C_1$. Draw the two triangles on the graph provided and state the co-ordinates of $A_1B_1C_1$

b) Draw the triangle A_2 (5,6), B_2 (2,7) and C_2 (0,4). Given that triangle $A_2B_2C_2$ is the image of triangle $A_1B_1C_1$ under rotation, determine the centre and angle of this rotation

c) Show the image of triangle $A_2B_2C_2$, under an enlargement centre (0, 6) scale factor -1

15. (a) Find the co-ordinates for the image of point **P(6, -2)** under the transformation defined by :-

$x^1 = x – 3y$

$y^1 = 2x$

(b) (i) A quadrilateral ABCD has vertices A(4, -3), B(2, -3), C(4, -1) and D(5, -4). On the grid provided, draw the quadrilateral ABCD

(ii) $A^1B^1C^1D^1$ is the image of ABCD under a rotation through +90° about the origin. On the same axes, draw $A^1B^1C^1D^1$under the transformation

` (c) $A^2B^2C^2D^2$is the image of under $A^1B^1C^1D^1$ under another transformation by the matrix $\begin{pmatrix}\mathbf{1} & \mathbf{-2}\\ \mathbf{0} & \mathbf{1}\end{pmatrix}$

(i) Determine the co-ordinates of $A^2B^2C^2D^2$ and plot it on the same axes

(ii) Describe the transformation that maps $A^1B^1C^1D^1$onto $A^2B^2C^2D^2$

(d) Find a single matrix of transformation that would map $A^2B^2C^2D^2$onto ABCD

16. (a) Triangle **XYZ** has vertices **X**(2, -1) **Y**(4, -1) and **Z** (4,2). Triangle XYZ maps onto triangle $X^1Y^1Z^1$ under transformation $T_1 = \begin{pmatrix}1 & -3\\ 0 & 1\end{pmatrix}$. Draw triangles XYZ and its image $X^1Y^1Z^1$ on the grid provided

(b) Another triangle $X^{11}Y^{11}Z^{11}$ is the image of $X^1Y^1Z^1$ after transformation $\mathbf{T_2} =$. Draw triangle $X^{11}Y^{11}Z^{11}$on the same set of axes

(c) Find the single transformation matrix **T** that maps triangle XYZ on to the final image $X^{11}Y^{11}Z^{11}$

(d) Given that the area of triangle XYZ is $15cm^2$, find the area of the triangle $X^{11}Y^{11}Z^{11}$

17. The quadrilateral A (2,1), B (4,1), C (4,4) and D (2,4) is mapped onto A'B' C'D' by a matrix M_1 such that A^1 (8,7), B^1 (14,7), C^1 (14,16) and D^1 (8,16) .

a) Draw both ABCD and A^1B^1 C^1D^1 on the same plane

b) Find the matrix of transformation that mapped ABCD onto A'B' C'D' and describe it fully

c) A^1B^1 C^1D^1 underwent another matrix transformation at N which is a translation that gave the image A^{11} B^{11} C^{11} D^{11}, Where A^{11} (7,9), B^{11} (13,9), C^{11} (13,18) and D^{11} (7,18). The transformation N is a translation . Find the translation

d) Draw A^{11} B^{11} C^{11} D^{11} on the same axes where ABCD and A^1B^1 C^1D^1 were drawn

18. a) On the grid provided. Plot the points A(2, -1) B (0, -3) C(2, -4) and D (4, -2) and join them to form a quadrilateral ABCD. What is the name of this quadrilateral?

b) The points A^1 (1, 2) B^1 (3, 0) C^1 (4, 2) and D^1 (2, 4) are the images of ABC and D under a certain transformation T_1. On the same grid draw quadrilateral $A^1B^1C^1D^1$ and describe transformation T_1 fully.

c) The points A^{11}(-2, -4) B^{11}(-6, 0) C^{11}(-8, -4) and D^{11}(-4, -8) are the images of $A^1B^1C^1D^1$ under transformation T_2. On the same grid draw quadrilateral $A^{11}B^{11}C^{11}D^{11}$ and describe the transformation T_2 fully.

d) On the same grid draw quadrilateral A^{111} B^{111} C^{111} D^{111}, the image of A^{11} B^{11} C^{11} D^{11} under a reflection in the x-axis. State the co-ordinates of A^{111} B^{111} C^{111} D^{111}.

19. The Points A^1B^1 and C^1 are the images of A(4, 1), B(0, -2) and C(-2, 4) respectively under a transformation represented by the matrix;

$$M = \begin{pmatrix} -1 & 1 \\ 2 & -3 \end{pmatrix}$$

(a) Write down the coordinates of A^1 B^1 and C^1

(b) A^{11} B^{11} and C^{11} are the images of A^1 B^1 and C^1 under another transformation whose Matrix is:

$$N = \begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$$ Write down the coordinates of A^{11} B^{11} and C^{11}

(c) Transformation **M** followed by **N** can be represented by a single transformation **P**. Determine the matrix for **P**

(d) A matrix **P** is given by $\begin{pmatrix} 8 & 7 \\ 4 & 5 \end{pmatrix}$

Find P^{-1}

20. Triangle $A^1B^1C^1$ is the image of triangle ABC under a transformation represented by matrix $T = \begin{pmatrix} 1 & 3 \\ 2 & 2 \end{pmatrix}$ If the area of triangle $A^1B^1C^1$ is 25.6cm^2, find the area of the object

21. A point P(2, -4) is mapped into P^1(4, 0) under a translation.
Determine the image of point Q(-1, 2) under the same translation

22. The points A (2, 6), B (1, 1), C (2, 3) and D (4,0) are the vertices of quadrilateral ABCD.
(a) On graph paper plot the points A, B, C, and D and join them to form quadrilateral ABCD.

(b) The points A, B, C and D are the images of A^1, B^1, C^1 and D^1 respectively under an enlargement centre the origin and scale factor -2. On the same grid draw the image quadrilateral A^1 B^1 C^1 D^1.

(c) The points A^{11} B^{11} C^{11} and D^{11} are the images of ABCD respectively under reflection in the x – axis. On the same grid, locate the pints A^{11} B^{11} C^{11} and D^{11} and draw the second image quadrilateral A^{11} B^{11} C^{11} D^{11}.

(d) Quadrilateral A^{111} B^{111} C^{111} D^{111} is the image of ABCD under a certain transformation T. Describe transformation T fully.

$$\begin{pmatrix} 5x & 2 \\ x & -3 \end{pmatrix}$$

23. T is a transformation represented by the matrix . Under T, a square of area $10cm^2$ is mapped onto a square $110cm^2$. Find the values of x

57. Statistics II

1. The table below shows the number of defective bolts from a sample of 40

No of bolts	0	1	2	3	4	5
Frequency	20	8	6	4	1	1

Calculate the standard deviation of the data above (4 mks)

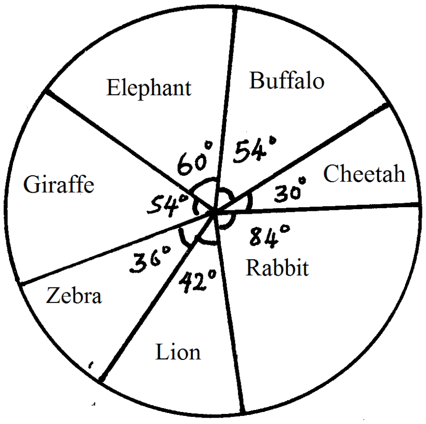
2. The table below shows the masses to the nearest kg of all the students of marigu-ini secondary. School.

Masses (kg)	No. of students
30-34	5
35-39	7
40-44	10
45-49	10
50-54	19
55-59	20
60-64	20
65-69	6
70-74	2
75-79	1

a) Taking the assumed mean A=52kg
Calculate:
(i) the actual mean mass of the students. (3 marks)
(ii) the standard deviation of the distribution. (3 marks)

b) Draw a cumulative frequency curve and use it to estimate the number of students whose masses lie
between 44.5kg and 59.5kg. (4 marks)

3. Sixty form four students in Tahidi high sat for a mathematics examination. Their marks were grouped into seven classes as follows: 30 – 34, 35 – 39, 40 – 44, 45 – 49, 50 – 54, 55 – 59, 60 – 64 and then named as cheetah, lion, zebra, rabbit, giraffe, elephant and buffalo respectively. The form 4 students population was then analyzed in the form of a pie-chart as shown below.



Using the information above

(a) Complete the table below.

Name	Marks	No. of students
Cheetah	30-34	
Lion	35-39	
Zebra	40-44	
Rabbit	45-49	
Giraffe	50-54	
Elephant	55-59	
Buffalo	60-64	

(2mks)

(b) Calculate the inter quartile range. (3mks)

(c) Using an assumed mean of 47, calculate the standard deviation of the data. (5mks)

4. At an agricultural Research Centre, the length of a sample of 50 maize cobs were measured and recorded as shown in the frequency distribution table below.

Length	8 – 10	11 – 13	14 – 16	17 – 19	20 – 22	23 - 24
No. of Labs	4	7	11	15	8	5

a) State the modal class and size. (2mks)

Calculate

b) the mean (3mks)

c) (i) the variance (3mks)

(ii) the standard deviation. (2mks)

5. The table below shows the masses to the nearest kg of a number of people.

Mass (kg)	50 – 54	55 – 59	60 – 64	65 – 69	70 – 74	75 – 79	80 – 84
Frequency	19	23	40	28	17	9	4

a)Using an assumed mean of 67.0, calculate to one decimal place the mean mass.

(b) Calculate to one decimal place the standard deviation of the distribution.

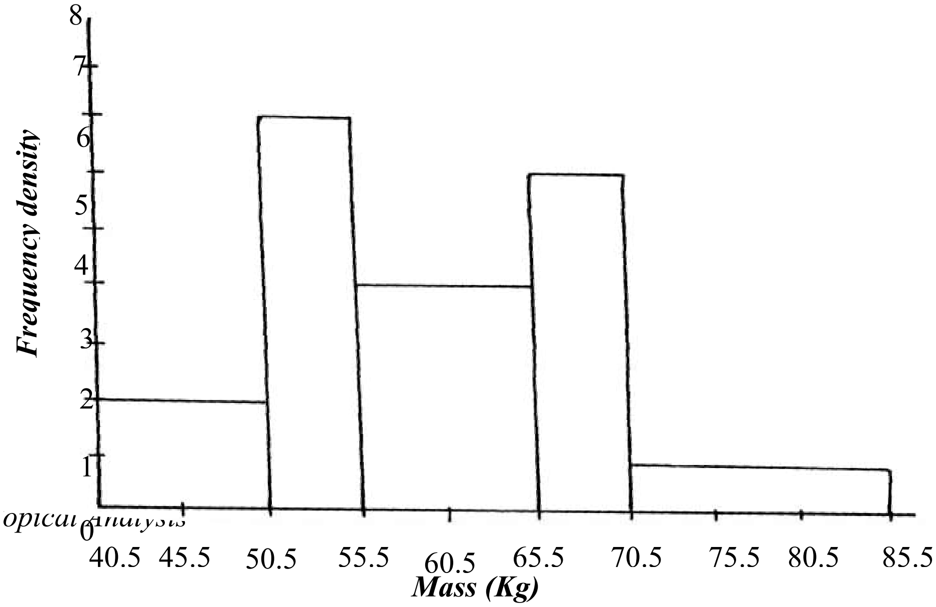
6. Use only a ruler and pair of compasses in this question;

(a) construct triangle ABC in which AB = 7cm, BC = 6cm and AC = 5cm

(b) On the same diagram construct the circumcircle of triangle ABC and measure its radius

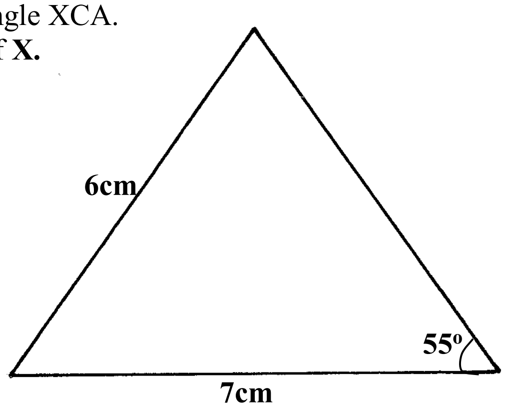
(c) Construct the tangent to the circle at C and the internal bisector of angle BAC. If these lines meet at D, measure the length of AD

7. Below is a histogram drawn by a student of Got Osimbo Girls Secondary School.



a) Develop a frequency distribution table from the histogram above.
b) Use the frequency distribution table above to calculate;
i) The inter-quartile range.
ii) The sixth decile.

8. ABC is a triangle drawn to scale. A point **x** moves inside the triangle such that
i) AX ≤ 4 cm
ii) BX > CX
iii) Angle BCX ≤ Angle XCA.
Show the locus of **X.**



9. The following able shows the distribution of marks of 80 students

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	1	6	10	20	15	5	14	5	3	1

(a) Calculate the mean mark
(b) Calculate the semi-interquartile range
(c) Workout the standard deviation for the distribution

10. The table below shows the marks of 90 students in a mathematical test

Marks	5-9	10-14	15-19	20-24	25-29	30-34	35-39
No. of students	2	13	31	23	14	**X**	1

a) Find **X**
b) State the modal class
(c) Using a working mean of 22, calculate the; i) Mean mark
ii) Standard deviation

11. (a) Using a ruler and a pair of compasses only construct triangle PQR in which PQ = 5cm, PR = 4cm and ∠PQR = 30°
(b) Measure; (i) RQ
(ii) ∠PQR
(c) Construct a circle, centre O such that the circle passes through vertices P, Q, and R
(d) Calculate the area of the circle

12. The ages of 100 people who attended a wedding were recorded in the distribution table below

Age	0-19	20-39	40-59	60-79	80-99
Frequency	7	21	38	27	7

a) Draw the cumulative frequency

b) From the curve determine: i) Median
ii) Inter quartile range
iii) 7th Decile
iv) 60th Percentile

13. The marks obtained by 10 students in a maths test were:-
25, 24, 22, 23, ***x*****,** 26, 21, 23, 22 and 27
The sum of the squares of the marks, $\Sigma x^2 = 5154$
(a) Calculate the: (i) value of ***x***
(ii) Standard deviation

(b) If each mark is increased by 3, write down the:-
(i) New mean
(ii) New standard deviation

14. 40 form four students sat for a mathematics test and their marks were distributed as follows:-

Marks	1 – 10	11-20	21- 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 – 90	91 - 100
No. of students	1	3	4	7	12	9	2	1	0	1

a) Using 45.6 as the working mean, calculate;
i) The actual mean.
ii) The standard deviation.

b) When ranked from first to last, what mark was scored by the 30th student?
(Give your answer correct to 3 s.f.)

15. The table below shows the distribution of marks scored by pupils in a maths test at Nyabisawa Girls.

Marks	11 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 – 90
Frequency	2	5	6	10	14	11	9	3

a)Using an Assumed mean 45.5, calculate the mean score.

b) Calculate the median mark.

c) Calculate the standard deviation.

d) State the modal class.

16. The table below shows the marks scored in a mathematics test by a form four class;

Marks	20-29	30-39	40-49	50-59	60-69	70-79	80-89
No. of students	4	26	72	53	25	9	11

(a) Using an assumed mean of 54.5, calculate:-
(i) The mean
(ii) The standard deviation

(b) Calculate the inter quartile range

58. Loci

1. Using a ruler and a pair of compasses only,
   a. Construct a triangle ABC such that angle ABC = 135°C, AB = 8.2cm and BC = 9.6cm
   b. Given that D is a position equidistant from both AB and BC and also from B and C
   i. Locate D
   ii. Find the area of triangle DBC.

2. (a) Using a ruler, a pair of compasses only construct triangle XYZ such that XY = 6cm, YZ = 8cm and ∠XYZ = 75°
   (b) Measure line XZ and ∠XZY
   (c) Draw a circle that passes through X, Y and Z
   (d) A point M moves such that it is always equidistant from Y and Z. construct the locus of M and define the locus
3. (a) (i) Construct a triangle ABC in which AB=6cm, BC = 7cm and angle ABC = 75°
   Measure:-
   (i) Length of AC
   (ii) Angle ACB
   (b) Locus of P is such that BP = PC. Construct P
   (c) Construct the locus of Q such that Q is on one side of BC, opposite A and angle BQC = 30°
   (d) (i) Locus of P and locus of Q meet at X. Mark ***x***
   (ii) Construct locus R in which angle BRC 120°
   (iii) Show the locus S inside triangle ABC such that XS ≥ SR

4 . *Use a ruler and compasses only for all constructions in this question.*
   a) i) Construct a triangle ABC in which AB=8cm, and BC=7.5cm and ∠ABC=112½°
   ii) Measure the length of AC
   b) By shading the unwanted regions show the locus of P within the triangle ABC such that
   i) AP ≤ BP
   ii) AP >3cm
   Mark the required region as **P**
   c) Construct a normal from C to meet AB produced at D
   d) Locate the locus of **R** in the same diagram such that the area of triangle ARB is ¾ the area of the triangle ABC.

5. On a line AB which is 10 cm long and on the same side of the line, use a ruler and a pair of compasses only to construct the following.
   a) Triangle ABC whose area is 20 cm^2 and angle ACB = 90°
   b) (i) The locus of a point P such that angle APB = 45°.
   (ii) Locate the position of P such that triangle APB has a maximum area and calculate this area.

6. A garden in the shape of a polygon with vertices A, B, C, D and E. AB = 2.5m, AE = 10m, ED = 5.2M and DC=6.9m. The bearing of **B** from **A** is 030° and **A** is due to east of **E** while **D** is due north of E, angle EDC = 110°,
   a) Using a scale of 1cm to represent 1m construct an accurate plan of the garden
   b) A foundation is to be placed near to CD than CB and no more than 6m from A,
   i) Construct the locus of points equidistant from CB and CD.
   ii) Construct the locus of points 6m from **A**
   c) i) shade and label **R** ,the region within which the foundation could be placed in the garden
   ii) Construct the locus of points in the garden 3.4m from AE.

iii) Is it possible for the foundation to be 3.4m from AE and in the region?

7. a) Using a ruler and compasses **only** construct triangle PQR in which QR= 5cm, PR = 7cm and angle PRQ = 135°
b) Determine < PQR
c) At P drop a perpendicular to meet QR produced at T
d) Measure PT
e) Locate a point **A** on **TP** produced such that the area of triangle AQR is equal to one-and – a - half times the area of triangle PQR
f) Complete triangle AQR and measure angle AQR

8. Use ruler and a pair of compasses only in this question.
(a) Construct triangle ABC in which AB = 7 cm, BC = 8 cm and $\angle ABC = 60^0$.
(b) Measure (i) side AC (ii) $\angle$ ACB
(c) Construct a circle passing through the three points A, B and C. Measure the radius of the circle.
(d) Construct Δ PBC such that P is on the same side of BC as point A and $\angle PCB = \frac{1}{2} \angle ACB$, $\angle BPC = \angle BAC$ measure $\angle$ PBC.

9. Without using a set square or a protractor:-
(a) Construct triangle **ABC** in which **BC** is 6.7cm, angle **ABC** is 60^o and $\angle$**BAC** is 90^o.
(b) Mark point **D** on line **BA** produced such that line **AD** =3.5cm
(c) Construct:-
   (i) A circle that touches lines **AC** and **AD**
   (ii) A tangent to this circle parallel to line **AD**

. Use a pair of compasses and ruler only in this question;
(a) Draw acute angled triangle **ABC** in which angle **CAB** = 37½ °, **AB** = 8cm and **CB** = 5.4cm. Measure the length of side **AC** (**hint 37½ ° = ½ x 75°**)
(b) On the triangle **ABC** below:
   (i) On the same side of **AC** as **B,** draw the locus of a point **X** so that angle **Ax C** = 52½ °
   (ii) Also draw the locus of another point **Y**, which is 6.8cm away from **AC** and on the same side as **X**
(c) Show by shading the region **P** outside the triangle such that angle **APC ≥ 52 ½°** and **P** is not less than 6.8cm away from **AC**

59.Trigometric ratios 3

1. Complete the table below by filling in the blank spaces.

X^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0	360^0
Cos x	1.00		0.50			-0.87		-0.87					
2cos½x	2.00	1.93					0.50						

(2mks)

On the grid provided, using a scale of 1 cm to represent 30^0 on the horizontal axis and 4cm to represent 1 unit on the vertical axis draw the graph of $y = \cos x^0$ and $y = 2 \cos \frac{1}{2} x^0$. (4mks)
(a) State the period and amplitude of $y = 2 \cos \frac{1}{2} x^0$ (2mks)
(b) Use your graph to solve the equation $2 \cos \frac{1}{2} x - \cos x = 0$. (2mks)

2. a) Complete the table below by filling in the blank spaces

x	-90	-75	-60	-45	-30	-15	θ	15	30	45	60	75	90
3cos2x-1	-40	-3.6		-1.0	0.5	1.6		1.6	0.5		-2.5	-3.6	-4.0

2sin (2x+30)	-1.0	-1.73		-1.73	-1.0	0		1.73	2.0		1.0	0	-1.0

b) On the grid provided, draw on the same set of axes the graphs of $y = 3\cos 2x - 1$ and $y = 2\sin(2x + 30^0)$for$-90^0 \le x \le 90^0$. Using a scale o 1 cm for 15^0 on axis and 2 cm for I unit on the y-axis (5mks)

c) State the period of $y = 3\cos 2x - 1$ (1mk)

d) Solve the equation $2\sin(2x + 30^0) - 3\cos 2x + 1 = 0$ (2mks)

3. Complete the table below by filling in the blank spaces.

x°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Cos x	1.00		0.5			-0.87°		-0.87°					
2 cos ½ x°	2.00	1.93				0.52			-1.00				-2.00

Using the scale 1 cm to represent 30° on the horizontal axis and 4cm to represent 1 unit on the vertical axis, draw on the grid provided, the graph of y = cos x° and y = 2 cos ½ x°

a) Find the period and amplitude of y = 2cos ½ x° (2mks)

b) Describe the transformation that maps the graph of y = Cos x° on the graph of y = 2 cos ½ x°.
(2mks)

4. The table below gives some values of y = sin 2x and y = 2 cox is the range given.
(a) Complete

X°	-225	-180	-135	-90	-45	0	45	90	135	180	225
y – sin $2x^3$	-1.0		1.0			0			-1.0		1.0
y = 2cos x^3	-1.4		-1.4			2.0			-1.4		-1.4

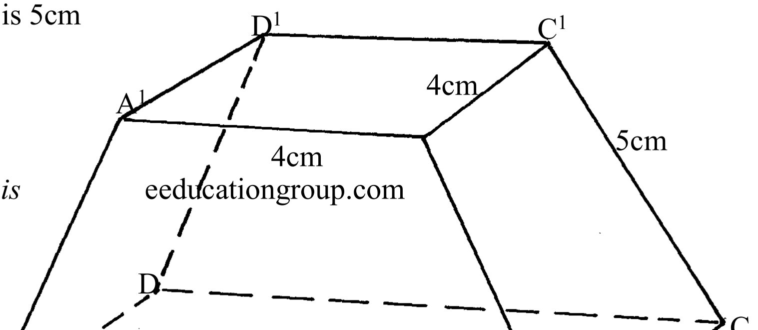
(b) On the same axes, draw the graphs of y = sin 2x and y = 2 cos x.
(c) Use your graph to find in values of x for which sin 2x – 2 cos x = 0.
(d) From your graph
(i) Find the highest point of graph y = sin 2x.
(ii) The lowest point of graph y = 2 cos x.

5. (a) Copy and complete the table below for y =2sin (x +15)° and y =cos(2x -30)° for 0° ≤ x ≤ 360°

x	0	30	60	90	120	150	180	210	240	270	300
y =2sin(x+15)											
y= cos(2x-30)											

(b) On the same axis draw the graphs:
y = 2sin (x + 15) and y = cos(2x -30) for 0° ≤ x ≤ 360°
(c) Use your graph to:
(i) State the amplitudes of the functions y = 2sin (x +15) and y= cos (2x -30)
(ii) Solve the equation 2sin (x+15) – cos (2x -30) = 0

6. The diagram below shows a frustum of a square based pyramid. The base ABCD is a square of side 10cm. The top $A^1B^1C^1D^1$ is a square of side 4cm and each of the slant edges of the frustum is 5cm



Determine the:
i) Altitude of the frustrum
ii) Angle between AC1 and the base ABCD
iii) Calculate the volume of the frustrum

7. (a) Compete the table below:
$y = 3\sin(2x + 15)^o$

x	-180	-150	-120	-90	-60	-30	0	30	60	90	120
y	0.8			-0.8			0.8		21		

(b) Use the table to draw the curve **$y = 3\sin(2x + 15)$** for the values **$-180^o \leq \theta \leq 120^o$**
(c) Use the graph to find:
(i) The amplitude
(ii) The period
(iii) The solution to the equation:-
$\sin(2x + 15)^o = {}^1/_3$

8. Make **q** the subject of the formula in $\frac{A}{B} = \sqrt{\frac{P + 3q}{q - 3p}}$

9. a) Complete the table below for the functions $y = \cos(2x + 45)^o$ and $y = -\sin(x + 30^o)$for $-180^o \leq x \leq 180^o$.

	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
y=Cos(2x + 45°)	0.71		- 0.97	-0.71			0.71		- 0.97			0.97	
y = -sin(x + 30°)	0.5	0.87			0.5			-0.87		-0.87			0.5

b) On the same axis, draw the graphs of $y = \cos(2x + 45)^o$ and $y = -\sin(x + 30)^o$
c) Use the graphs drawn in (b) above to solve the equation.

$$\cos(2x + 45)^o + \sin(x + 30)^o = 0$$

10. Without using tables or calculators evaluate $\frac{\mathbf{\sin 60^o \cos 60^o}}{\mathbf{\tan 30^o \sin 45^o}}$ leaving your answer in surd form.

11. (a) Complete the table below for the functions $y = 3\sin x$ and $y = 2\cos x$

X	0	30	60	90	120	150	180	210	240	270	300	330	360
3sin x			2.6	3			0	-1.5	-2.6	-3		-1.5	
2cosx		1.7	1.0			-1.7	-2	-1.0			1.0	1.7	2

(b) Using a scale of 2cm to represent 1 unit on the y- axis and 1cm to present 30° on the x-axis ,draw the graphs of y =3sinx and y = 2cosx on the same axes on the grid provided

(c) From your graphs:

(i) State the amplitude of y = 3sin x

(ii) Find the values of x for which 3sin x – 2cos x = 0

(iii) Find the range of values of **x** for which 3sin **x ≥ 2cos x**

12. (a) Fill in the following table of the given function:-

x	0	90	180	270	360	450	540	630	720	810
sin ½*x*	0			0.71					0	
3Sin (½*x* + 60)					-2.6					2.6

(b) On the grid provided draw the graph of the function **y = sin ½*x*** and **y = 3Sin (½*x* + 60)** on the same set of axes

(c) What transformation would map the function **y = sin ½ *x*** onto **y = 3 Sin (½ *x* + 60)**

(d) (i) State the period and amplitude of function : **y = 3 Sin (½*x* + 60**

(ii) Use your graph to solve the equation: **3Sin (½*x* + 60) – Sin ½*x* = 0**

13. a) Complete the table below giving your answer to 2 decimal places

x^o	0^o	30^o	60^o	90^o	120^o	150^o	180^o
$2\sin x^o$	0	1		2			
$1 – \cos x^o$			0.50	1			2

b) On the grid provided, using the same axis and scale draw the graphs of :-

$y = 2\sin x^o$, and y =1-cosx for

$0^o \leq x \leq 180^o$, take the scale of

2cm for 30^o on the x-axis

2cm for 1 unit on the y-axis

c) use the graph in **(b)**above too solve the equation $2\sin x + \cos x^o = 1$ and determine the range of values of for which $2 \sin x^o =1-\cos x^o$

14. Solve the equation **2 sin (x + 30) = 1 for 0 ≤ x ≤ 360.**

15. (a) Complete the table below, giving your values correct to 1 decimal place

x	**0^o**	**10^o**	**20^o**	**30^o**	**40^o**	**50^o**	**60^o**	**70^o**	**80^o**	**90^o**	**100^o**	**110^o**	**120^o**	**130^o**	**140^o**	**150^o**	**160^o**	**170^o**	**180^o**
10 sin x	**0**	**-**	**3.4**	**5.0**		**7.7**		**9.4**	**9.8**	**10**	**9.8**	**9.4**		**7.7**		**5.0**	**3.4**		**0**

(b) Draw a graph of y = 10 sin x for values of x from 0^o to 180^o. Take the scale 2cm represents 20^o on the x-axis and 1cm represents 1 unit on the y axis

(c) By drawing a suitable straight line on the same axis, solve the equation: -

500 sin x = -x + 250

16. Complete the table below for the functions y = cosx and y =2 cos (x 300) for θ≤x ≤ 3600

x	0^o	30^o	60^o	90^o	120^o	150^o	180^o	210^o	240^o	270^o	300^o	330^o	360^o
Cos *x*	1	0.87	0.5		-0.5	-0.87	-1.0		0.5	0		0.87	1
2 cos (*x* + 30^o)	1.73		0	-1.0		-2.0	- 1.73	-1.0		1	1.73	2.00	1.73

(a) On the same axis, draw the graphs of y cos x and y 2cos(x - 30) for O<x < 360°.

(b) (i) State the amplitude of the graph $y = \cos x^o$.

(ii) State the period of the graph $y = 2 \cos (x + 30°)$.

c) Use your graph to solve

Cos x = 2cos(x+30°)

17. Solve the equation $\sin(2\theta + 10) = -0.5$
for $0 \leq \theta \leq 2\pi^c$

18. Solve the equation
$4 \sin 2x = 5 - 4 \cos^2 x$ for $0° \leq x \leq 360°$

19. (a) Complete the table given below by filling in the blank spaces

X	0	15	30	45	60	75	90	105	120	135	150	165	870
4cos 2x	4.00		2.00	0	-2.00	-3.46	-4.00	-3.46	-2.00	0	2.00		4.00
2 sin (2x +30°)	1.00	1.73	2.00	1.73		0	-1.00	-1.73	-2.00	-1.73		0	1.00

(b) On the grid provided; draw on the same axes, the graphs of **$y = 4\cos 2x$ and $y = 2\sin(2x + 30^o)$ for $0^o \leq x \leq 180^o$**. Take the scale: 1cm for 15° on the **x-axis** and 2cm for 1unit on the y-axis

(c) From your graph:-

(i) State the amplitude of **$y = \cos 2x$**

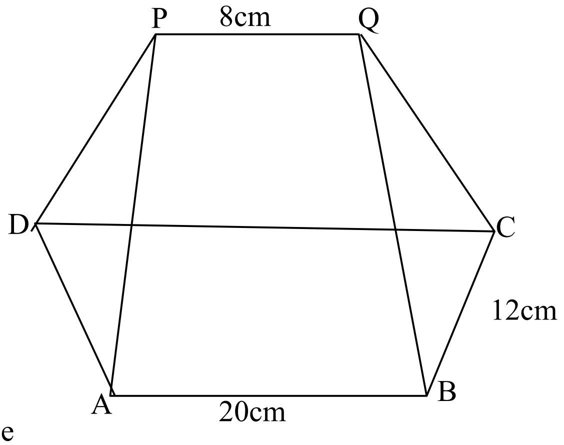
(ii) Find the period of **$y = 2\sin(2x + 30^o)$**

(d) Use your graph to solve:-

$4\cos 2x - 2\sin(2x + 30) = 0$

60. Three dimensional geometry

1. The figure below represents a plan of a roof with a rectangular base ABCD. AB = 20cm and BC=12cm. the ridge PQ = 8cm is centrally placed. The faces ADP and BCQ are equilateral triangles. **N** is the mid-point of BC



Calculate:

(a) QN

(b) The altitude of **P** above the base

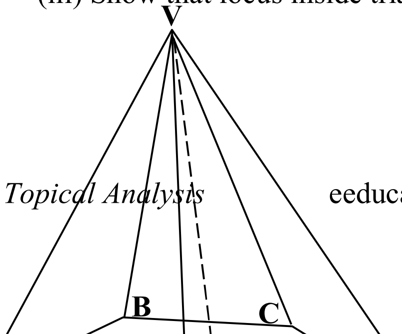
(c)The angle between the planes ABQP and ABCD

(d) (i) Locus P and locus Q meet at X. Mark X

(ii) Construct locus R in which angle BRC is 120°

(iii) Show that locus inside triangle ABC such that XS ≥ R

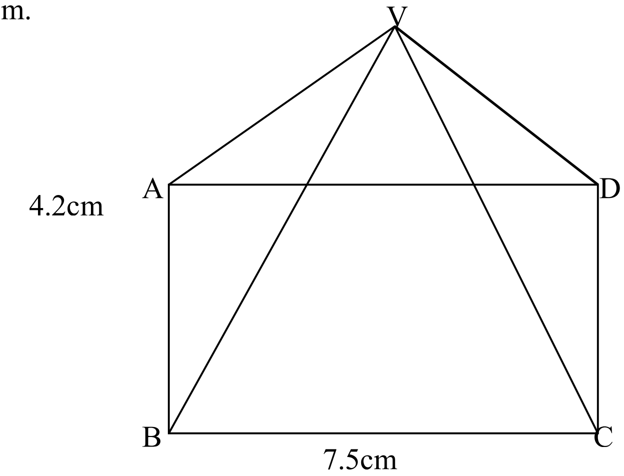
2.



The diagram alongside shows a right pyramid whose base is a regular pentagon of side 10cm.VA=B=VC=VD=VE=18.2cm and O is the centre of the pyramid. Calculate;

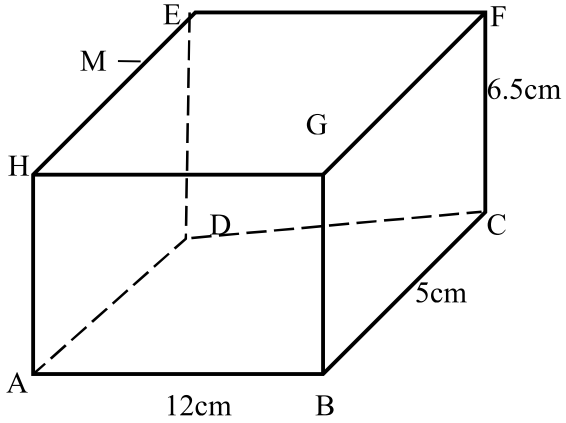
(a) height of the pyramid
(b) area of the pentagon
(c) angle between the face VAB and the base of the pyramid
(d) The pyramid is a container filled with orange juice. Calculate the amount of juice in it.
(e) find the surface area of the face VCD

3. The diagram below shows a right pyramid on a rectangular base ABCD measuring 7.5cm by 4.2cm.



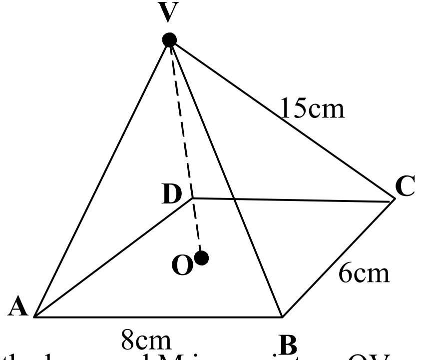
If the volume of the pyramid is $52.5cm^3$, **find**:-
(i) The height of the pyramid
(ii) The length of a slanting edge correct to 1decimal place
(iii) The angle between AV and CV
(iv) The obtuse angle between the edges AB and VD

4. The figure below is cuboid ABCDEFGH. AB = 12cm, BC=5cm, CF = 6.5cm



Calculate:
(a) the length BD
(b) the angle AF makes with the base ABCD
(c) the angle DHGC makes with the base ABCD
(d) **M** is the mid-point of HE. Calculate the length of line MC and the angle line MC makes with the base ABCD

5. The figure below is a right pyramid with a rectangular base ABCD and vertex V.

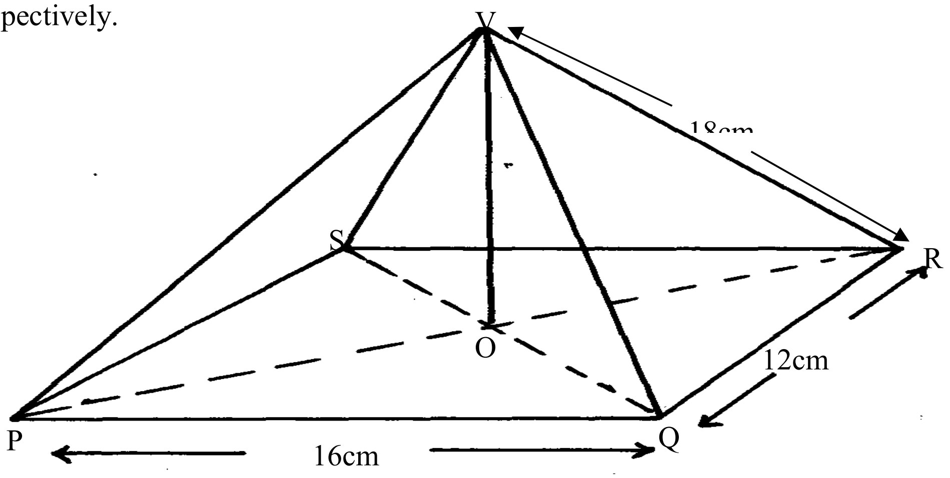


O is the centre of the base and M is a point on OV such that OM = $^{1}/_{3}$ OV, AB = 8 cm, BC = 6 cm and VA = VB=VD = VC = 15 cm. Find ;

i) The height OV of the pyramid.

ii) The angle between the plane BMC and base ABCD.

6. The figure below represents a right pyramid with vertex V and a rectangular base PQRS, VP=VQ=VR=VS=18cm, PQ=16cm and QR=12cm. M and O are the midpoints of QR and PR respectively.

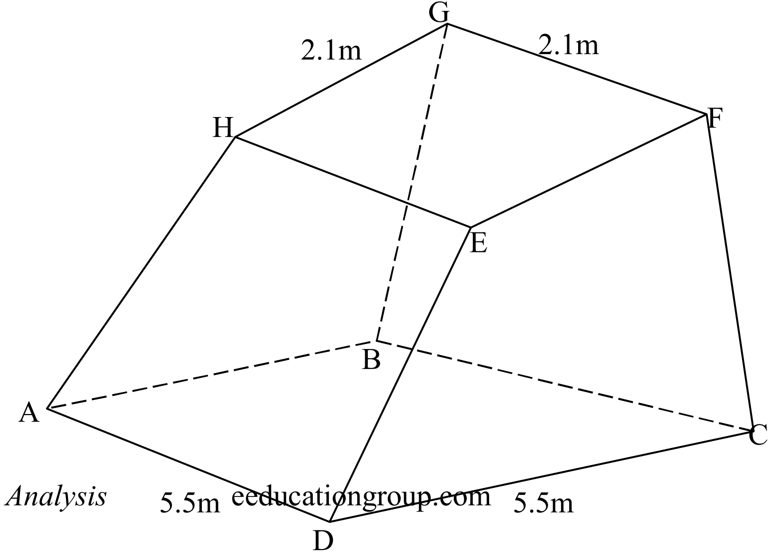


Find: a) the length of the projection of the line VP on the plane PQRS

b)the size of the angle between line VP and the plane PQRS

c) the size of the angle between plane VQR and PQRS

7. Mayoni Municipal Council wishes to construct a monument on the grounds. The monument is designed to be in the shape of a frustrum of a right pyramid. The base of the frustrum is a square of side 5.5meters while the top of the frustrum is a square of side 2.1cm

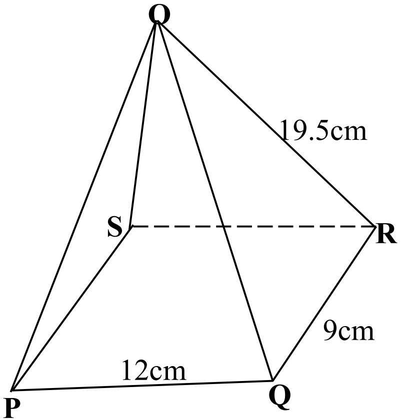


If the perpendicular distance between faces ABCD and EFGH is 7cm;

(a) find the surface area of the monument frustrum

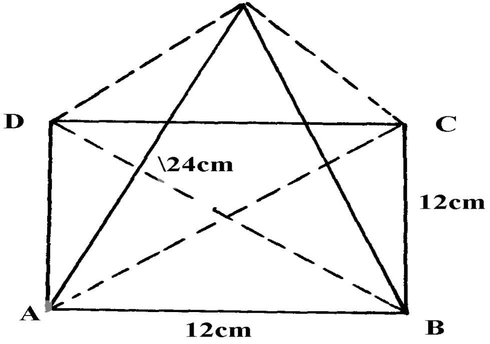
(b) The monument is to be painted on all surface excluding the base. Paint is sold in 4 litre tins each costing Kshs.640/=. It is estimated that an area 10m^2 is painted by ½ litre of paint, find the cost of painting the monument.

8. The figure below is a pyramid of a rectangular base PQRS of length 12cm and width 9cm. The slanting edge has a length of 19.5cm



(a) Determine the height of the pyramid
(b) The angle PO makes with base PQRS
(c) The angle POS makes with QOR
(d) The volume of the pyramid

9. The diagram below shows a right solid pyramid on a square base ABCD of side 12cm and slanting height of 24cm



Calculate;
a) To two decimal place the height (VO) of the pyramid
b) the volume of the pyramid
c) the total surface area of the pyramid

10. The base of a pyramid consists of a regular pentagon **ABCDE, 4.5cm** a side. The vertex of the pyramid is **V** and **VA = VB = VC = VD = VE = 6.4cm.**

(a) Sketch the general view of the pyramid
(b) Calculate:
  (i) The angle between **VA** and the base
  (ii) The angle between face **VCD** and the base

11. The positions o two towns A and B on earths surface are (60°N, 139°E) and (60°N, 41°W) respectively
    a) Find the difference in longitude between A and B
    b) Given that the radius of the earth is 6370km, calculate the distance between A and B in KM
    c) Another town C is 420km East of town B and on the same latitude A and B find the longitude of town C

61. Longitudes and latitudes

1. A globe representing the earth has a radius of 0.2m. Points P (60^0N, 140^0E) and Q (60^0N, 120^0W) are marked on the globe. If O is the centre of the latitude 60^0N, find the area of the minor sector OPQ (3 mks)
2. An aircraft flies from a point A ($1^0$15'S, 37^0E) to a point B directly North of A. The arc AB subtends an angle of 489^0 at the centre of the earth. From B the aero plane flies due west to a point C on longitude 23^0W. Take radius of the earth as 6370km.
   (a) (i) State the location of B (2 mks)
   (ii) Find the distance in km traveled by the aero plane between B and C (3 mks)
   (b) (i) The aeroplane left B at 1.00am local time. What was the local tie at C? (2 mks)
   (ii) If it maintained an average speed of 840km/h between B and C, at what local time did it arrive at C? (3 mks)
3. Points A and B lies on the same circle of latitude P^0N if A and B are on longitude 41^0W and 3^0E respectively and the distance between them is 1370nm. Calculate the latitude P. (2mks)
4. Points P(30^0N, 20^0W), Q(30^0N, 40^0E), R(60^0N, a^0E) and S(b^0N, c^0W) are four points on the surface of the earth. R is due North of Q ands is due West of R and due North of P.
   (a) State the values of a, b and c. (3mks)
   (b) Given that all distances are measured along parallels of latitudes or along meridians, and in nautical miles, find the distance of R from P using two alternative routes via Q and S. (4mks)
   (c) Two pilots start flying from P to R one along the route PQR at 400 knots and the other along PSR at 300 knots which one reaches R earlier and by how long? (3mks)
5. A plane leaves an airport P at 1030 hrs and flies due north at 800 km/h. After 2 hours of flight it turns and flies due west at the same speed and reached airport Q at 1415hrs
   a) Use scale drawing with a scale of 1 cm for 200km to find the shortest distance between the two airports (3mks)
   b) Measure and state the bearing of Q from P (1mk)
   c) If the local time at P is 1300hrs when it reached Q, find the local time at Q when it landed at Q. (2mks)
   d) If the plane started the return journey at 1700hrs and flew directly to P, if the arrival time at P was 1940hrs, determine the plane's average speed to the nearest kilometer. (3mks)
6. Calculate the shortest distance between X(40°N,80°W) and Y (40°N,100°E) in kilometers taking $\pi = \frac{22}{7}$ and Radius = 6371km. (Give your answer to the nearest whole number) (3mks)
7. The latitude and longitude of two stations **P** and **Q** are (47°N, 25°W) and (47°N, 70°W) respectively. Calculate the distance in nautical miles between **P** and **Q** along the latitude 47°N
8. A pane leaves an airport **P** (10°S, 60°E) and flies due north at 800km/hr. By taking radius of the earth to be 6370-km and 1 nautical mile to be 1.853km,
   (a) Find its position after 2hrs
   (b) The plane turns and flies at the same speed due West to reach **Q** longitude 12°W. Find the distance it has traveled due in West nautical miles

(c) Find the time it has taken

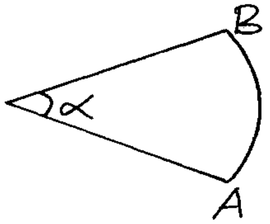
(d) If the local time at **P** was 1300hrs when it reached **Q**. Find the local time at **Q** when it landed at **Q**

9. Bot juice company has two types of machines, A and B, for juice production
Type A machine can produce 800 litres per day while type B machine produces 1600 litres per day.
Type A machine needs 4 operators and type B machine needs 7 operators
At least 8000 litres must be produced daily and the total number of operators should not exceed 41. There should be 2 or more machines of each type. Let x be the number of machines of type A and y the number of machines for type B,
a) Form all inequalities in x and y to represent the above information
b) On the grid provided below, draw the inequalities and shade the wanted regions
c) Use the grid in (b) to determine the least number of operators required for the maximum possible production

10. Points **R** and **S** are two points on the surface on a latitude 48°S. The two points lie on longitudes 30°W and 150°E respectively. By taking the earth's radius to be 6370km, calculate:
(a) The distance from **R** to **S** along a parallel of latitude.
(b) An aeroplane flies at an average speed of 2 80km/h from R to S along a great circle through the South Pole. Calculate the total time taken.
(c) The local time of R when the local time of R is 2.l5m.
(d)Another point Q is 600Nm North of R .Find the location of Q

11. A jet flies from 34^{o}N, 12^{o}E to (34^{o}E , 24^{o}E) in 1 ½ hrs. Find its average speed in knots
P and **Q** are two points on a geographical globe of diameter 50 cm. They both lie on a parallel latitude 50^o North. **P** has longitude 90^o West and Q has longitude 90^o East. A string **AB** has one end at point **P** and another at point **Q** when it is stretched over the North pole. Taking $\pi = 3.142$;
(i) Calculate the length of the string.
(ii) If instead the string is laid along the parallel of latitude 50^{o}N with **A** at point **P**, calculate the longitude of point **B**
(iii) State the position of **B** if the string is stretched along a great circle of **P** towards the South pole if point **A** is static at **P**.

12. Two points **A**(70^o, 15^{o}E) and **B** lie on the same circle of latitude on the earths surface.
Given that the shortest distance between the two points along the circle of latitude is 2133.6km.
Giving coordinates to the nearest degree, find the location of **B**.
(Take $\pi = \frac{22}{7}$ and radius of earth = 6380km)



13. The position of two towns **A** and **B** on the earth's surface are (36^{o}N, 49^{o}E) and (36^{o}N, 131^{o}W) respectively (Earth's radius =6370km and $\pi = {}^{22}/_{7}$):-
(a) Find the longitudinal difference between the two towns
(b) Calculate the distance between the towns:-
(i) Along a circle of latitude (in km)
(ii) Along the great circle in km and nautical miles
(c) Another town **C**, is 840km due East to town **B**. Locate the position of town **C**

14. **P, Q** and **R** are points on the surface of the earth such that **P** (60^{o}N, 20^{o}W), **Q** (60^{o}S, 20^{o}W) and **R**(60^{o}N, 80^{o}E) find:

a) The shortest distance between **P** and **Q** on the surface of the earth in kilometres and nautical miles(**nm**)
b) The length of latitude 60ºN and hence the length of the minor arc **PR** in kilometres
c) The distance from **P** to the North Pole

15. A jet flies from town **X** (50ºS, 20ºE) directly to **Y**(50ºS, 28ºW) and then due South for 1200m to **Z**
(a) (i) Find the latitude of **Z**
(ii) Calculate the distance XY along a parallel of latitude 50ºS in km
(b) (i) Given that the average speed of the jet is 400 knots, calculate the time taken to reach **Z** from **X** to the nearest 0.1hour
(ii) Find the time of arrival at **Z** given that the plane left **X** at 7.40a.m. Take $\pi = {}^{22}/_{7}$ and radius of the earth to be 6370km

16. A jet on a rescue mission left town A(35ºS, 15ºE) to town B(45ºN, 15ºE) and then to town C(45ºN, 45ºW). If 1o subtends 60nm and the radius of the earth is 6370km. Find;
(a) the distance in nautical miles from A to C via B correct to 4 s.f
(b) the distance in kilometers from A to B to the nearest km
(c) the jet flew at 840km/h from A to C. If the jet left town A at 8.15a.m, what time will it arrive at town C in local time

62. Linear programming

1. A tailoring business makes two types of garments A and B. Garment A requires 3 metres of material while garment B requires 2 ½ metres of material. The business uses not more than 600 metres of material daily in making both garments. It must make not more than 100 garments of type A and not less than 80 of type B each day.
(a) Write down four inequalities from this information. (3mks)
(b) Graph these inequalities. (3mks)
(c) If the business makes a profit of shs 80 on garment A and a profit of shs 60 on garment B, how many garments of each type must it make in order to maximize the total profit? (4mks)

2. A man bakes two types of cakes, queen cakes and marble cakes. Each week he bakes **x** queen cakes and **y** marble cakes. The number of cakes baked are subject to the following conditions; $30x + 20y \leq 4800$, $30x + 40y \geq 3600$ and $10x > 30y$
He makes a profit of shs.10 on each queen cake and shs.12 on each marble cake.
(i) Draw a graph to represent the above information on the grid provided
(ii) From the graph, determine how many cakes of each type he should make to maximize his weekly profit
(iii) Calculate the maximum profit
(iv) If he is to make a weekly profit of at least shs.600, find the least number of marble cakes he should bake

3. A company produces shirts and jerseys using two types of machines. Every shirt made requires 2 hours on machine **A** and 2 hours on machine **B**. Every Jersey made requires 3hours on machine **A** and I hour on machine **B**. In one day the time limit on machine **A** is 24hours but that on machine **B** is 12hrs. The number of Jerseys produced must not be more than the shirts produced in one day. The company makes a profit of shs.200 on each shirt and shs.200 on each Jersey. The company produces **x** shirts and **y** jerseys per day
(a) Write down four inequalities which must be satisfied by **x** and **y** and represent these inequalities on a grid
(b) Find the values of **x** and **y** which will give the company maximum daily profit and also state the maximum profit

4. A trader makes two types of chair, ordinary and special chairs. The cost of each ordinary chair is shs.300 while each special chair costs shs.700. He is prepared to spend not more than shs.21,000. It is not viable for hi m to make less than 20 chairs. Ordinary chairs must be less than twice the special chairs but more than 15. By taking the number of ordinary chairs as **x** and special chairs as **y**:
(a) Write down all the inequalities in **x** and **y**
(b) Draw the inequalities on the grid provided
(c) He sells a special chair at a profit of shs.140 while ordinary chairs at a profit of shs.120; Determine the maximum possible profit

5. A school has to take 384 people for a tour. There are two types of buses available. Type X and type Y. Type X can carry 64 passengers and type Y can carry 48 passengers. They have to use at least 7 buses.
a) Form all linear inequalities which will represent the above information .
b) On the grid provided, draw the inequalities and shade the un-wanted region.
b) The charges for hiring the buses are ;
Type X: shs.25,000
Type Y: shs.20,000
Use your graph to determine the number of buses of each type that should be hired to minimize the cost.

6. A shoe maker makes two types of shoes **A** and **B**. He takes 3 hours to make one pair of type **A** and **4** hours to make one pair of type **B**. He works for a maximum of 120 hours to make **x** pairs of type **A** and **y** pairs of type **B**. It costs him Kshs. 400 to make a pair of type **A** and Kshs.150 to make a pair of type **B**. His total cost does not exceed kshs.9000. He must make at least 8 pairs of type **A** and **12** pairs of type **B**.
(a) Write down four inequalities representing the information above
(b) On the grid provided represent the inequalities and shade the unwanted regions
(c) The shoe maker makes a profit of kshs.40 on each pair of type **A** and kshs.70 on each pair

7. A theatre has a seating capacity of 250 people. The charges are shs.100 for an ordinary seat and shs.160 for a special seat. It costs shs.16,000 to stage a show and the threatre must make a profit. There is never more than 200 ordinary seats and for a show to take place at least 50 ordinary chairs must be occupied. The number of special seats is always less than twice the number of ordinary seats.
a) taking **x** to be the number of ordinary seats and **y** the number of special seats , write down all the inequalities representing the information above.
b) On the grid provided, draw the graph to show the inequalities in **(a)** above
c) Determine the number of seats of each type that should be booked in order to maximize the profit.

8. A man sells two types of ice creams in cups and sticks. He can store less than ten packets in his cooling box. He sells more cups than sticks but less than 3 items as many cups as sticks. He also knows that he will sell more than 3 packets of sticks. His profit is shs.3.00 on a packet of cups and shs.2.00 on a packet of sticks.
(a) Form inequalities to represent the above information:
(Let x – packets of cups and
y – packets of sticks)
(b) On the grid provided graph the inequalities to satisfy the required condition
(c) How many packets of cups and sticks should the man put in his box to give him the highest profit?

9. A shopkeeper bought 50 pangas and 30 jembes :-

(a) From a wholesalers for shs.4,260. He had bought half as many jembes and 5 pangas less, he would have paid shs.1290 less. Had the shopkeeper bought form wholesaler **B**, he would have paid 10% more a panga and 15% less for a jembe. How much would he have saved if he had bought the 50pangas and 30 jembes from wholesalers **B**

(b) The price of a suit if marked at shs.5000. A discount

10. The games master whishes to hire two matatus for a trip. The operators have a Toyota which carries 10passengers and a Kombi which carries 20 passengers. Altogether 120 people have to travel. The operators have only 20litres of fuel and the Toyota consumes 4 litres on each round trip and the Kombi 1 litre on each round trip. If the Toyota makes **x** round trips and the kombi **y** round trips;

(a) write down four inequalities in x and y which must be satisfied

b) represent the inequalities graphically on the grid provided

(c) The operators charge shs.100 for each round trip in the Toyota and shs.300 for each round trip in the kombi;

(i) determine the number of trips made by each vehicle so as to make the total cost a Minimum

(ii) find the minimum cost

11. The velocity of a particle Vm/s moving in a straight line after t seconds is given by **$V = 3t^2 - 3t - 6$**. Find the distance covered by the particle between **t = 1** and **t =** 4seconds

63. Differentiation

1. A particle moves in a straight line from a fixed point. Its velocity Vm/s after t seconds is given by $V = 9t^2 - 6t + 2$ calculate the distance traveled by the particle during the 2nd second. (4 mks)

2. A body moves in a straight line in such a way that at any time, t seconds, its distance S metres from the starting point is given by $S = 8t - t^2$.

(a) How fast is the body moving at (3mks)

(i) t = 1 second

(ii) t = 3 seconds.

(b) What is the maximum displacement from the starting point that the body achieves. (4mks)

(c) Find the acceleration of the body. (1mk)

(d) After how long will the body be back to the starting point? (2mks)

3. Find the equation of the normal to the curve

$X^2 = 4y$ at the point (6,9) (3 marks)

4. The acceleration of a particle in $M5^{-2}$ is given by the expressions 3t –4

Find:-

(i) an expression for velocity Vms^1 (1 mark)

(ii) an expression for distance 5 metres from a fixed point O. Given that S=0 when V=3 and t=0 (2 marks)

5. A particle P moves in a straight line such that t seconds after passing a fixed point Q, its velocity is given by the equation

$2t^2 - 10t + 12$. find;

(a) The values of t when p is instantaneously at rest (2 marks)

(b) An expression for the distance moved by P after t seconds. (2 marks)

(c) The total distance traveled by P in the first 3 seconds after passing point O. (3 marks)

(d) The distance of P from O when the acceleration is zero. (3 marks)

6. (a) Find the derivative of

$y = (3x - 2x^2)(5 + 4x)$ (3mks)

(b) A diver leaps from a diving board 32m above the surface of a swimming pool. At time t second, his position h, above the surface of the swimming pool is given by $h = 32 + 16t - 16t^2$. Find:

(i) The time he took to hit the water surface. (4mks)

(ii) The velocity at which he hit the water surface. (3mks)

7. A particle moves such that **t** seconds after passing a given point **O**, its distance **S** metres from **O** is given by **S= t (t-2) (t-1)**

(a) Find its velocity when **t** = 2 seconds

(b) Find its minimum velocity
(c)Find the time when the particle is momentarily at rest
(d) Find its acceleration when **t** = 3seconds

8. The table below gives the values of x and y for the curve $y=x^2 +1$

X	0	1	2	3	4	5	6	7	8	9	10
y	1	2		10	17		37	50		82	

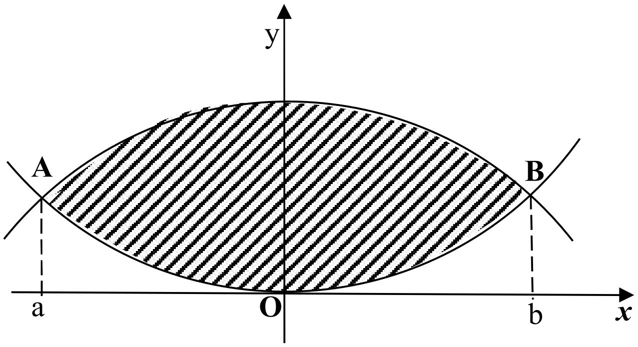
a) Complete the table
b) Use the mid- ordinate rule to estimate the area enclosed by the curve $y = x^2 + 1$.
Use five coordinates
c) Using integration, calculate the actual area in (a) above
d) Calculate the percentage error in the estimated area

9. The gradient function of a curve is given by the expression **2x + 1**. If the curve passes through the point **(-4, 6);** find the equation of the curve

10. A particle **P** moves in a straight line so that its velocity, Vm/s at time t seconds where $t \geq 0$ is given by $v = 28 + t – 2t^2$
Find;
(a) the time when **P** is instantaneously at rest
(b) the speed of **P** at the instant when the acceleration of **P** is zero
(c) Find the acceleration of **P** when the article is instantaneously at rest
(d) Find the distance covered by the particle during the 3rd second, when at t = 0 D = 5M

11. A particle **K** moves a long a straight line 50 cm long. At time **t** = 0, **k** is at **A** and **t** seconds later its velocity **vcm/s** is given by $\mathbf{v = 15 + 4t – 3t^2}$**.**
a) Write down the expression for;
i) The acceleration of **K** at time **t** seconds.
ii) The distance of **K** from **A** at time **t** seconds.
b) i) Find **t** when **K** is instantaneously at rest.
ii) How far is **K** from **A** at this time?
c) Find the period of time during which the acceleration of **P** is positive.

12. The diagram below shows the sketch of the curve $\mathbf{y = x^2}$ and $\mathbf{y = -x^2 + 8}$ intersecting at **A** and **B**:-



(a) Find the value of **a** and **b** hence find the coordinates of A and B
(b) Find the area enclosed by **x = a,** $\mathbf{x}$ **= b**, the axis and:-
(i) the curve $\mathbf{y = x^2}$
(ii) the curve $\mathbf{y = -x + 8}$

13. The distance from a fixed point of a particle in motion at any time **t** seconds is given by :-
$S = t^3 – {}^5/_2t^2 + 2t + 5$ metres
Find its:
(a) Acceleration after **t** seconds
(b) Velocity when acceleration is zero

14. A particle moves in a straight line. It passes through point **O** at **t = 0** with a velocity **v** = 5 m/s. The acceleration **a** m/s^2 of the particle at time **t** seconds after passing through **O** is given by
$a = 6t + 4$
(a) Express the velocity v of the particle at time t seconds in terms of t.
(b) Calculate the velocity of the particle when **t = 4.**
(c) (i) Express the displacement **s** by the particle after **t** seconds in terms of **t**.
(ii) Calculate the distance covered by the particle between **t = 1** and **t = 4.**

15 . The displacement **S** metres of a particle moving along a straight line after **t** seconds is given by.
$$S = 3t + \frac{3t^2}{2} - 2t^3$$
a) Find its initial acceleration
b) Calculate:
i) The time when the particle was momentarily at rest
ii) Its displacement by the time it came to rest momentarily
c) Calculate the maximum speed attained

16. Find the equation to the tangent to the curve:-
$y = 4x^3 - 2x^2 - 3x + 5$ at the point (2, 23)

17. A farmer wanted to make a trough for cows to drink water. He had a metal sheet measuring 240cm by 120cm and 1cm thick. The density of the metal is 2.5g/cm^3. A square of sides 30cm is removed from each corner of the rectangle and the remaining part folded to form an open cuboid.
(a) Sketch the sheet after removing the squares for the four corners, showing all the dimensions
(b) Calculate:-
(i) The area of the metal which forms the cuboid
(ii) The mass of the empty cuboid in Kilograms
(b) The cuboid is filled with water whose density is 1g/cm^3. Calculate the mass of the cuboid when full of water

18. A rectangular sheet of cardboard is 8cm long and 5cm wide. Equal squares are cut away at each corner and the remainder is folded so as to form an open box. Find the maximum volume

19. (a) Find the equation of the normal to the curve :- $y = x^3 - 2x - 1$ at (1, -2)
(b) Determine the nature of the turning points to the curve $y = x^3 - 3x + 2$; Hence in the space provided below, sketch the curve

20. A particle moves in a straight line so that its velocity, v/m/s at time t seconds where **$t \geq 0$** is given by **$v = 28 + t - 2t^2$**
Find:-
(a) The time when **P** is instantaneously at rest
(b) The speed of **P** at the instant when the acceleration of **P** is zero
(c) Given that **P** passes through the point **O** of the line when t = 0;
(i) Find the distance of **P** from **O** when **P** is instantaneously at rest

21. A particle moves such that **t** seconds after passing a given point **O**, its distance **S** metres from **O** is given by **$S = t(t-2)(t-1)$**
(a) Find its velocity when **t** = 2 seconds
(b) Find its minimum velocity
(c)Find the time when the particle is momentarily at rest
(d) Find its acceleration when **t** = 3seconds

64.Approximation of area

1. Find the area under the graph of $y = x^2 + x$ between $x = 1$ and $x = 3$. Using the mid ordinate rule with two trapezia. (3mks)
2. The table below shows some paired values of X and Y for a known curve.

X	0.0	0.2	0.4	0.6	0.8	1.0
Y	0.0	0.4	1.6	3.6	6.4	10.0

Estimate the area under the curve for the interval O<X<1 using

a) The mid – ordinate rule with five mid – ordinates. (4mks)

b) The trapezium rule with five Trapezia. (2mks)

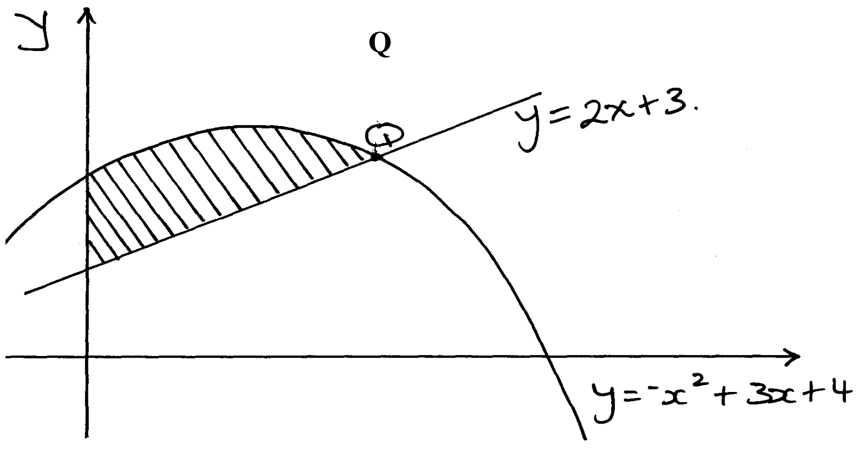
c) If the exact area is $^{10}/_{3}$ square units.
Calculate the percentage error in the two estimates. (4mks)

3. Use trapezoidal rule to estimate the area bounded by the curve **$y = 8 + 2x – x^2$ for $-1 \leq x \leq 3$** using 5 ordinates

4. (a) Using trapezoidal rule, estimate the area under the curve $y = ½ x^2 – 2$ between $x = 2$ and $x = 8$ and x-axis. Use six strips
(b) (i) Use integration to evaluate the exact area under the curve
(ii) Find the percentage error in calculating the area using trapezoidal rule

5. (a) Using trapezoidal rule, estimate the area under the curve $y = ½ x^2 – 2$ between $x = 2$ and $x = 8$ and x-axis. Use six strips
(b) (i) Use integration to evaluate the exact area under the curve
(ii) Find the percentage error in calculating the area using trapezoidal rule

6. The figure below shows the graphs of $y = 2x + 3$ and $y = -2x^2 + 3x + 4$



(a) determine the co-ordinates of Q, the intersection of the two graphs
(b) Find the exact area of the shaded region

5. The table below shows some values of the function; $y = x^2 + 2x – 3$ for $-6 \leq x \leq -3$

x	-6	-5.75	-5.5	-5.25	-5	-4.75	-4.5	-4.25	-4.0	-3.75	-3.5	-3.25	-3
y	21	18.56		14.06		10.06	8.25		5		2.25	1.06	0

(a) complete the table
(b) using the completed table and the mid-ordinate rule with six ordinates, estimate the

area of the region bounded by the curve; y = $x^2 + 2x - 3$ and the lines y = 0 , x = -6 and x = -3

(c) (i) by integration find the actual are of the region in **(b)** above

(ii) Calculate the percentage error arising from the estimate in **(b)**

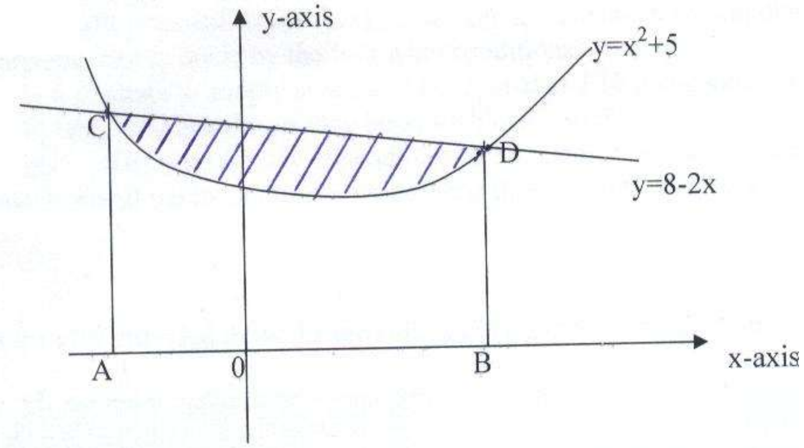
7. Complete the table below for y = $5x^2 - 2x + 2$. Estimate the area bounded by the curve, the x – axis, the lines x = 2 and x = 7 using the trapezoidal rule with strips of unit length.

x	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7
y	18			56.25	74		117			200.25	

6. Integration

1. The diagram below, not drawn to scale shows part of the curve y = x^2+5 and the line y = 8-2x. The line intersects the curve at points C and D. Lines AC and BD are parallel to the y-axis.

the y-axis



a) Determine the coordinates of C and D (4 mks)

b) Use integration to calculate the area bounded by the curve and the x- axis between the points C and D (3 mks)

c) Calculate the area enclosed by the lines CD, CA, BD and the x-axis (2 mks)

d) Hence determine the area of the shaded region (1 mk)

2. Evaluate:-

$$\int_{2}^{5} \frac{x^2 - 3x + 2}{x - 2}\, dx$$

3. Find the values of **a** which satisfy the integral

$\int_{0}^{a} (x^2 + 1)\, dx = 2a$

Answers section I & II

1. L.C.M

1.	a) G.C.D of $81xy^4$ and $144x^3y^2$ is $9xy^2$ $144x^3y^2 - 81xy^4$ $9xy^2(16x^2 - 9y^2)$ $9xy^2(4x - 3y)(4x + 3y)$	M1 M1 A1	
		3	
2.	Let the other number be x $LCM = \frac{Product\ of\ the\ two\ numbers}{GCD\ of the\ numbers}$ $140 = \frac{20\times x}{7}$ $x = \frac{140\times 7}{20}$ $= 49$	M1 A1	
		02	
3.	LCM = 7920 = 24x32x5x11 GCD = 12 = 22x3 48 = 24x3 264 = 23x3x11 X = 22x32x5 X = 180	M1 M1 A1	Factor notation GCD and LCM Factor notation 2numbers C.A.O
		03	
4.	$9 = 3\times 3$ $15 = 3\times 5$ $20 = 2\times 2\times 5$ $24 = 2\times 2\times 2\times 3$ $L.CM = 3^2\times 2^3\times 5$ $= 9\times 8\times 5$ $= 9\times 8\times 5$ $= 360 sweets$	M1 M1 A1	Correct factors Accept other alternative correct method for getting the L.C.M
		03	
5.	L.C.M = $\begin{array}{c\|ccc} 2 & 27 & 30 & 45 \\ 3 & 27 & 15 & 45 \\ 3 & 9 & 5 & 15 \\ 3 & 3 & 5 & 5 \\ 5 & 1 & 5 & 5 \\ & 1 & 1 & 1 \end{array}$ 2x33x5 = 270	M1	✓LCM

	= 270 + 3 = 273.	A1	
		02	

6.

2	*20,*	*24,*	*26,*	*28*
2	*10*	*12*	*13*	*14*
2	*5*	*6*	*13*	*7*
3	*2*	*3*	*13*	*7*
5	*5*	*1*	*13*	*7*
7	*1*	*1*	*13*	*7*
13	*1*	*1*	*13*	*1*
1	*1*	*1*	*1*	

Size of the land = (2^3 x 3 x 5 x 7 x 13) + 7) aces

= 10920 + 7 = 10,927 aces

7.

2	*30*	*45*	*54*
3	*15*	*45*	*27*
3	*5*	*15*	*9*
3	*5*	*5*	*3*
5	*5*	*5*	*1*
	1	*1*	*1*

Least volume of x = 2 X 33 x 5 + 21

= 270 + 21 = 291

8. *L.C.M. of 30, 36 and 45*

2	*30*	*36*	*45*	
2	*15*	*18*	*45*	
3	*15*	*9*	*45*	
3	*5*	*3*	*15*	
5	*5*	*1*	*5*	
	1		*1*	

L.C.M. = 2^2 x 3^2 x 5 = 180

The number m = 180 + 7 = 187

9. *$x^2 + x = x(x + 1)$*

$x^2 - 1 = (x + 1)(x – 1)$

$x^2 – x = x(x – 1)$

$x(x+1)(x – 1)$

$x^3 - x$

2. Integers

1.	Let the number be x and y		
	x + y = xy - 1	B1	
	y – x = xy - 5		
	x + y + 1 = xy	B1	
	y – x + 5 + = xy		
	x + y + 1 = y – x + 5		
	2x = 4 x = 2	B1	
	Y – 2 + 5 = 2y = y = 3		
		03	

2. $X > -1$
$X \geq 3$

3. $2x\ 2^3 \text{ x } 8^{\,x} \text{x } 8^2 = 128$
$2x \div 2^3 \text{ x } 2^3 x \text{ x } 8^2 = 128$
Let 2^x be y
$^{y}/_{8} \text{ x } y^3 \text{ x } 64 = 128$
$^{8y}/_{8} = 128/8$
$y^4 = 16$ M1
$y^4 = 24$ M1
$\therefore y = 2$ A1
$-5 \text{ x } 6 \div 2 + (-5)$

4. $-12 - 3 = 4$
$4 \text{ x } 4 + 15$
Numerator $16 + 15 = 31$
Denominator $-5 \text{ x } 3 + -5 = 31$
$-15 + -5$
$-15 + -5$
$= -20$
$\frac{31}{-20}$
$= -1\ ^{11}/_{20}$

5. $= \frac{(-8) - (-4)}{-9 + 15} + \frac{(-16) + (-6)}{46 - 13}$
$= \frac{-12}{6} + \frac{-22}{33}$
$= -2 - \frac{2}{3}$
$= -2\frac{2}{3}$

6. $P^{-1} = \begin{pmatrix} 4 & -3 \\ 1 & -2 \end{pmatrix}$
$-\frac{1}{5}\begin{pmatrix} 4 & -3 \\ 1 & -2 \end{pmatrix} = \begin{pmatrix} ^{4}/_{5} & ^{-6}/_{5} \\ ^{1}/_{5} & ^{1}/_{5} \end{pmatrix}$

$P^{-1} R = \begin{pmatrix} ^{-4}/_{5} & ^{-3}/_{5} \\ ^{-1}/_{5} & =^{2}/_{5} \end{pmatrix} \begin{pmatrix} -1 & 3 \\ 0 & 2 \end{pmatrix}$

$= \begin{pmatrix} ^{4}/_{5} & ^{-6}/_{5} \\ ^{1}/_{5} & ^{1}/_{5} \end{pmatrix}$

7. $\frac{-8 \div 2 + 12 \text{ x } 9 - 4 \text{ x } 6}{56 \div 7 \text{ x } 2}$
$= \frac{-4 + 108 - 24}{16}$

$\frac{80}{16} = 5$

3. Fractions

1	$\frac{(5)^{3\times\frac{2}{3}} \div 3^4}{3^{-\frac{3}{5}\times 5}} = \frac{5^2 \div 3^4}{3^{-3}}$ $= 5^2 \div 3^7$ $= \frac{25}{2187}$	M_1 M_1 A_1	Simplifying numerator simplify
2.	Num $\left(\frac{1}{5}\times 20\right)^{\frac{1}{2}}$ $= 4^{\frac{1}{2}}$ = 2 Denom. 8 x 1 x 25 = 200 $= \frac{2}{200}$ $\frac{1}{100}$	M1 M1 A1	Or equivalent 0.01
		03	
3.	$\frac{\left(\frac{10}{7}-\frac{5}{8}\right)\times {}^{2}/_{3}}{{}^{3}/_{4}+\frac{12}{7}\times {}^{7}/_{4}\times {}^{7}/_{3}}$ $\frac{\frac{45}{56}\times {}^{2}/_{3}}{{}^{3}/_{4}+1}$ $\frac{{}^{15}/_{28}}{{}^{7}/_{4}}$ ${}^{15}/_{28}\times {}^{4}/_{7} = {}^{15}/_{49}$	M1 M1 A1	✓ Application of bodmas Simplification of both numerators and denominator
		03	
4	Let the digits be x and y The number becomes xy = 10x +y and x + y = 10 Reserved yx = 10y + x (10y + x) – (10x + y) = 54 10y + x – 10x – y = 54 9y – 9x = 54 y – x = 6 y – x = 6 y + x = 10 2y = 16	M1 1M	Splitting of ones & tens and the reverse Solving of the simultaneous

	y = 8 x = 8-6 = 2 ∴ The number is 28	A1	eqn. Answer
		3	

5	$\frac{3}{8}\left(\frac{38}{5}-\frac{55}{36}\times\frac{12}{5}\right)$ $=\frac{3}{8}\times\frac{59}{15}$ $=\frac{59}{40} \qquad =1\frac{19}{40}$	M_1 M_1 A_1
6	$2.181818\ .....\times 100\ = 218.1818\ .....$ $2.181818\ .....\times 1......\quad 2.1818\ .....$ Difference = 216 Difference of multipliers = 100 – 1 = 99 Fraction $=\frac{216}{99}=\frac{72}{33}=\frac{24}{11}$	B1 M1A1 3

7	$\left(\frac{10^5}{3^5}\right)^{\frac{2}{5}}\times\left(\frac{3^2}{10^4}\right)^{\frac{1}{2}}$ $\frac{100}{9}\times\frac{3}{100}$ $\frac{1}{3}$	M_1 M_1 M_1 A_1 3	For +ve index
8.	$\frac{\frac{6}{7} of \frac{14}{3}\div 80\times -\frac{20}{3}}{-2\times 5+(14\div 7)\times 3}$ $\frac{4\div 80\times -\frac{20}{3}}{-2\times 5+2\times 3}$ $\frac{\frac{1}{20}\times -\frac{20}{3}}{-10+6}$	M1 M1 M1	

	$\frac{-1/3}{-4}$ $\frac{1}{3}\times\frac{1}{4}=\frac{1}{12}$	A1	
		04	
9.	Let the number of chicken be x Turkeys will be x + 6 ¼x + 1/3 (x + 6) = 30 ¼x + 1/3x + 2 = 30 7/12x = 28		
	= 48	B1	For 48
	Number of chickens = 48 Number of turkeys = 48 + 6 = 54 Total number of birds = 54 + 48		
	= 102	B1	For 102
		02	

11.	$\frac{-4 \text{ of } (-4 -3) + -3-2)}{-12 + 3 + 5}$		
	$\frac{-4 \text{ of } (-7-3-2)}{-4}$	M1	for -4
	$= \frac{48}{-4}$	M1	for 48
	= -12	A1	
		3	

12.	(a) (i) ratio		
	$r=\frac{3}{100}\div\frac{3}{10}$	M1	
	$r=\frac{3}{100}\times\frac{10}{3}=\frac{1}{10}$	A1 M1	
	$ii) S_n = \frac{\frac{3}{10}\left(1-\frac{1}{10}\right)^{n-1}}{1-\frac{1}{10}}$	M1	
	$S_n = \frac{\frac{3}{10}\left(\frac{9}{10}\right)^{n-1}}{\frac{9}{10}}$	A1	
	$S_n = \frac{3}{10}\times\frac{10}{9}\left(\frac{9}{10}\right)^{n-1}$		
	$S_n = \frac{1}{3}\left(\frac{9}{10}\right)^{n-1}$	M1	
	$iii) T_8 = \frac{3}{10}\left(\frac{1}{10}\right)^{8-1}$		
	$=\frac{3}{10}\left(\frac{1}{10}\right)^{7}$	A1	
	$=\frac{3}{10}\times\frac{1}{10^7}=\frac{3}{100{,}000{,}000}$	M1	

	(b) 1^{st} bounce 30m 2^{nd} ¾ x 30 = 22.5m 3^{rd} ¾ x 22.5 = 16.85m 4^{th} ¾ x 16.85 = 12.64m 5^{th} ¾ x 12.64 = 9.48m 6^{th} ¾ x 9.48 = 7.11m 7^{th} ¾ x 7.11 = 5.3325m 8^{th} ¾ x 5.3325 = 3.9993m 9^{th} ¾ x 3.9993 = 2.9995m 10^{th} ¾ x 2.9995 = 2.2496m ≅2.25 Or using formula $T_{10} = 30(\ ¾\ )^{10-1} = 30(\ ¾\ )^9$ = 30 x 0.07508 ≅2.2524m ≅ 2.25m	M1 M1 A1 2 d.p M1 A1	Every four Every four
13.	$\frac{\frac{5}{12}}{\frac{43}{20}} = \frac{25}{43}$	**M1** **M1** **A1**	For num For den
		03	
14.	$Numerator \rightarrow 7 + -6 = 1$ $Deno\min ator \rightarrow -9 + 2 + 4 = {}^{-}3$ $= -\frac{1}{3}$	**M1** **M1** **A1**	
		03	
15	$\frac{-8-39+5}{-1-3x2}$ $= \frac{-42}{-7}$ $= 6$	M1 A1 2	Numerators & Denominators
16	$\frac{\sqrt[3]{13824-4}}{3+2-35}$ $= \frac{\sqrt[3]{13824}-4}{-30}$ $13824 = \sqrt[3]{2^9 \times 3^3} = 2^3 \times 3^1 = 24$ $\frac{24-4}{-30} = \frac{-2}{3}$	M1 M1 A1	Simplified denominator $\sqrt[3]{\ }$ Method shown Show how to get factors of 13824
		3 marks	

17	$100r = 193.\dot{3}\dot{3}.....$ $10r = 19.\dot{3}\dot{3}......$ – – – – – – – – – – – – – – – $90r = 174$ $r = \frac{174}{90}$ $100r = 25.\dot{2}\dot{5}......$ $r = 0.\dot{2}\dot{5}......$ – – – – – – – – – – – $99r = 25$ $r = \frac{25}{99}$ $\frac{174}{90} + \frac{25}{99}$ $= \frac{2164}{990}$ $= 2\frac{92}{445}$	B1 B1 B1	
		3	

18. $\frac{1}{2} \text{ x } \frac{7}{2} = \frac{3}{2} \text{ x } 1\frac{5}{6} \quad \frac{3}{4} \text{ x } \frac{5}{2} \text{ x } X$

$\frac{7}{4} + \frac{3}{2} \text{ x } \frac{11}{2} \qquad = \frac{15}{4}$

$\frac{7}{4} + \frac{11}{4} = \frac{18}{4}$ B1

$\therefore \frac{18}{4} \div \frac{15}{4}$

$\frac{18}{4} \text{ x } \frac{4}{15} = \frac{6}{5} = 1\frac{1}{5}$ A1

19. $^{2}/_{5} \div \frac{1}{2}$ 0f $^{4}/_{9} - 1^{1}/_{10}$

$= {}^{2}/_{5} \div \frac{1}{2} X {}^{4}/_{9} - {}^{11}/_{10}$

$= {}^{2}/_{5} \text{ x } {}^{9}/_{2} - {}^{11}/_{10}$

$= {}^{9}/_{5} - {}^{11}/_{10} = {}^{18-11}/_{10} = {}^{7}/_{10}$

$^{1}/_{8} - {}^{1}/_{6} X {}^{3}/_{8} = {}^{1}/_{8} - {}^{1}/_{16}$

$= {}^{2-1}/_{16} = {}^{1}/_{16}$

$\frac{^{2}/_{5} \div \frac{1}{2} \text{ 0f } ^{4}/_{9} - 1^{1}/_{10}}{^{1}/_{8} - {}^{1}/_{6} \text{ of } ^{3}/_{8}} = \frac{^{7}/_{10}}{^{1}/_{16}}$

$= {}^{7}/_{10} X {}^{16}/_{1}$

$= {}^{56}/_{5} = 11^{1}/_{5}$

20. BODMAS

$^{3}/_{7} X {}^{7}/_{3} = 1$

$^{9}/7 X 1 = 9/7$

$\frac{3}{4} + {}^{9}/_{7} = 21 + 36 = 57$ M1

28 28

$^{9}/_{7} - {}^{3}/_{8} = 72 - 21 = 51 \text{ x } {}^{2}/_{3} = {}^{17}/_{28}$ M1

$^{57}/_{28} \text{ x } {}^{28}/_{17} = 3\,{}^{6}/_{17}$ A1

21. $\frac{\frac{2}{5} \times \frac{9}{2} - \frac{11}{10}}{\frac{1}{8} - \frac{1}{16}}$

$= \frac{7}{10} \times \frac{16}{1}$

$= \frac{56}{5} = 11\frac{1}{5}$

22. $\frac{3}{8}(\frac{38}{5} – \frac{55}{36} \times \frac{12}{5})$

$\frac{3}{8} \times \frac{59}{15} = \frac{59}{40} = 1\frac{19}{40}$

23. Numerator

$\frac{(\frac{9}{5} X \frac{25}{18}) \div \frac{5}{2} X 24}{\frac{7}{3} - (\frac{1}{4} \times 12) \div \frac{5}{3}}$

$\frac{9}{5} \times \frac{25}{18} = \frac{5}{2} \div \frac{5}{3} \times 24$

$\frac{5}{2} \times \frac{3}{5} \times 24 = 36$

$7/3 – \frac{1}{4} \times 12 \div 5/3$

$7/3 – 3 \times 3/5$

$\therefore \frac{36}{\frac{8}{15}} = 67.50$

$= 67\frac{1}{2}$

$\frac{7}{3} – 3 \times \frac{3}{5}$

24. Let X be money raised

Teachers house $= \frac{1}{7} x$

Classrooms $= \frac{2}{3} \times \frac{6}{7} = \frac{4}{7}x$

Remainder $= \frac{1}{3} \times \frac{6}{7} = \frac{2}{7}x$

$\frac{2}{7} x = 300000$

$x =$ Shs.1050000

4. Decimals

1	$\frac{0.0168 \times 2.46 \times 7}{5.74 \times 0.112}$ $\frac{0.0003 \times 0.03}{0.01 \times 0.002}$ $\frac{0.3 \times 3}{2} = 0.45$	M_1 M_1 A_1	÷ 0.41 or 4.1 or 41 ✓attempt to simpify
		3	
2	$x + y = 10$ $(10y + x) - (10x + y) = 54$	M_1 M_1	

	$-9x+9y=54$ $-x+y=6$ $x+y=10$ $2y=16$ $y=8$ $-x+8=6$ $-x=-2$ $x=2$: No. is 28	A1	
3.	$\sqrt[3]{\frac{0.064}{0.512}}$ $\sqrt[3]{\frac{64}{512}}$ $\sqrt[3]{\frac{1}{8}}$ $\frac{1}{2}$	M1 M1 A1	

4. a) 471331.512

b) 7.273352

c) 40.16649692

5. Let r = 5.722222………………..
10r = 57.22222……………….
100r = 572.22222…………..
100r = 572.2222……………
10r = 57.222 ………….
90r = 515

6. $\frac{38 \times 23 \times 27 \times 100 \times 100000}{114 \times 575}$
= 36 For elimination of decimals For correct answer only

7. $\frac{\cancel{84} \times \cancel{132} \times \cancel{35}}{\cancel{287} \times \cancel{560}}$
41 4 ~~16~~

= $\frac{99}{41}$
1

8. $\frac{12 \times 0.25 - 12.4 \div 0.4 \times 3}{⅛ \text{ of } 2.56 + 8.68}$
$\frac{3 - 31 \times 3}{0.32 + 8.68}$
$\frac{-90}{9}$
= -10

5. *Squares and square roots*

1.	$\sqrt[3]{\frac{0.125\times\sqrt{64}}{0.064\times\sqrt{629}}}$ $=\sqrt[3]{\frac{0.125\times 8}{0.064\times 27}}$ $=\sqrt[3]{\frac{0.5^3\times 2^3}{0.4^3\times 3^3}}$ $=\frac{0.5\times 2}{0.4\times 3}$ $=\frac{1.0}{1.2}$ $=\frac{1\times 10}{1.2\times 10}$ $=\frac{10}{12}$ $=\frac{5}{6} \quad = 0.83(2dps)$	M1 M1 M1 A1	
		04	
2.	19.901x10^2 19.901+1=1991.1 $\frac{1991.1}{0.07245}$ 1991.1 x 0.1380 x 10^2 = 165.77	**M1** **M1** **A1**	For ✓ square For✓ rec
		03	
3.	$\frac{\sqrt{(1.800324)^2}}{0.8462}$ $\frac{1.800324}{0.8462}$ 2.127539589 $\simeq 2.128$	**M1** **M1** **A1**	$\frac{\sqrt{3.241166505}}{0.8462}$
		03	
4.	$2\times 10\times 0.01697\times -1.06\times 0.1182\times 10^{-2}$ $= 3.393$ $= \sqrt{3.393}$ $= 1.842$	B1 B1 B1	Both reciprocals

5. *(a) (i) 24.78*
(ii) 0.0316

(b) $24.78 - 0.0316 = 24.75$ M1 A1

6. $3 \times \frac{1}{1.36 \times 10^{-2}} - 2x \frac{1}{13.84}$

$3 \times 8.575 - 2 \times 0.07224$
$= 25.725 - 0.14448$
$= \underline{25.58052}$
$= \underline{25.58}$

7. $\frac{153 \times 1.8}{0.68 \times 0.32}$

$\sqrt{\frac{158 \times 1.8 X 10000}{0.68 \times 0.32 X 10000}}$

$\sqrt{\frac{158 \times 18000}{68 \times 32}} = \sqrt{\frac{9 \times 9000}{4 \times 16}}$

$\sqrt{\frac{9 \times 9 \times 10^3}{4 \times 16}} = \frac{9 \times 1\ 0^{3/2}}{8}$

$1.125 \times 10^{3/2}$

6. Algebraic expressions

1.	$\frac{3Z-12}{3-(1+z)} = \frac{3(Z^2-4)}{3-1-Z}$ $= \frac{3(Z-2)(Z+2)}{2-Z}$ $= \frac{3(Z-2)(Z+2)}{-1(Z-2)}$ $= -3(Z+2)$	M1 M1 A1	
		03	

2. Let the daughter's age 5yrs ago be x
Mother 4x
come;
Daughter = x + 9
Mother = 4x+ 9
$4x + 9 = \frac{5}{2}(x + 9)$
$4x + 9 = 2.5x + 22.5$
$1.5x = 13.5$
$x = 9$
Mother = 41yrs
14 + 41 =55

3. B.P = 160 x 50 = 24000

$S.P = \frac{((160 \times 8) - (20 + 12))}{8} \times 180$

$= 28080$

$Profit = 28080 - 24000 \quad = Shs.4080$

4. a) $6a + 7a - 2b - 4b + 2$

$= 13a - 6b + 2$

b) $\frac{2x - 2}{2x} - \frac{3x + 2}{4x} = \frac{2(2x - 2) - (3x + 2)}{4x}$

$= \frac{4x - 3x - 4 - 2}{4x}$

$= \frac{x - 6}{4x}$

5. $6u^2y^2 + 13uy - 5 = (2uy + 5)(3xy - 1)$

$3u^2y^2 - 13uy + X = (uy - 4)(3xy - 1)$

$\frac{(2xy + 5) \quad (3xy - 1)}{(uy - 4) \quad (3xy - 1)}$

$= \frac{2xy + 5}{Uy - 4}$

6. a) From $x + y$ and $x^2 = y^2 = 34$

$X = 8 - y$

Substituting for x in $x^2 - y^2 = 34$

$(8 - y)(8 - y) + y^2 = 34$

$64 - 8y - 8y + y^2 + y^2 = 34$

$64 - 16y + 2y^2 = 34$

$2y^2 - 16y + 64 - 34 = 0$

$2y^2 - 16y + 30 = 0$

$y^2 = 8y + 15 = 0$

$y(y - 3) - 5(y - 3) = 0 \quad (y - 5)(y - 3)$

y is either 5 or 3

but $x - y = 8$

x is either 5 0r 3

$\therefore x^2 + 2xy + y^2 = 32 + 2 \times 3 \times 5 + 25$

$= 9 + 30 + 25 = 64$

b) $2xy = 2 \times 3 \times 5 = 30$

c) $x^2 - 2xy + y^2 = 9 - 2 \times 3 \times 5 + 25 = 4$

d) $x = y = 8$ and $x^2 + y^2 = 34$

$x = 8 - y$

$(8 - y)^2 + y^2 = 34$

$y^2 - 8y + 15 = 0$

$y^2 - 3y - 5y + 15 = 0$

$y(y - 3) - 5(y - 3)$

$(y - 3) = o \quad y = 3$

$(y - 5) = 0 \quad y = 5$

$x + 3 = 8, x = 5$ or $x + 5 = 8$

$x = 3$

$\therefore$ x is either 3 or 5

y is either 3 0r 5

7. $\frac{6x^2 + 35x - 6}{2x^2 - 72}$

$= \frac{6x(x -+ 6) -1(x + 6)}{2(x^2 - 36)}$

$= \frac{(6\cancel{x - 1})\ (x + 6)}{2(x \cancel{- 6)}\ (x + 6)}$

$= \frac{6x - 1}{2(x - 6)}$

8. $^2/_5\ (3x -2) - ¾\ (2x -2)$

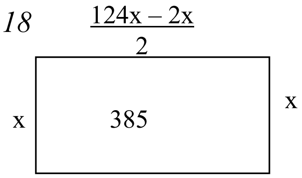
$= \frac{8(3x-2) -9(2x-2)}{12}$

$= 24 x -16 - 18x + 18$

$= \frac{6x + 2}{12}$

$= \frac{2(3x +1)}{12}$

$= \frac{3x + 1}{6}$



9. Numerator:

$4y^2 - x^2 = (2y +x)\ (2y - x)$

Denominator :

$2x^2 + 4yx + 3yx - 6y^2$

$= (2x^2 - 4yx) + (3yx - 6y2)$

$= 2x(x-2y) + 3y(x-2y)$

$= (2xx+3y)\ (x-2y)$

Combining : $\frac{(2y + x)\ (2y-x)}{(2x+3y)\ (x-2y)}$

$- \frac{2x + 3y}{2y + x}$ or $\frac{-2x -3y}{2y + x}$

10. $\frac{3(x + y) - (x -y)}{X^2 - y^2}$

$= \frac{3x + 3y - x + y}{x^2 - y^2}$

$= \frac{2(x +2y)}{x^2 -y^2}$

11. $x^2 + 2x - 5 = 3x +1$

$x^2 - x - 6 - 6 =0$

$(x+2)\ (x-3) = 0$

$x =-2$ or $x = 3$

When $x =-2$, $y = 3x - 2 + 1 = -5$ Point $(-2, -5)$

When $x = 3$, $y = 3x\ x\ 3 +1 = 10$ Point $(3, 10)$

12. (a) $\underline{y(y + 2)}$

$y(y^2 - y -60$

$$\frac{y(y+2)}{y(y^2 - y-6)} = \frac{y + 2}{(y+2)\ (y-3)}$$

(b) $\frac{y + 2}{(y + 2)\ (y-3)} = \frac{1}{4}$

$4y + 8 = y^2 - y - 6$

$y^2 - 5y - 14 = 0$

$(y-7)(y+2)= 0$

$y=7$

$y=-2$

13. $\frac{104.6}{2.4} = 44 \times 2$

$\frac{63.9}{2.4} = 26 \times 2$

$= 88 + 54= 142$

14. $3 (25 x^2 - 9y^2)$

$3 (5x + 3y) (5x - 3y)$

15. i) $d = 8.4$ $\qquad$ $r = \frac{1}{2}$

6th jump $= 8(\frac{1}{2})^{6-1}$

$^{8.4}/_{32}$

$= 0.2625 = 0.26cm$

ii) $56 = \frac{9.4 (1 - (\frac{1}{2}) 6}{1 - \frac{1}{2}}$

$= \frac{8.4 \times 63 \times 2}{64}$

$= 16.54$ cm

16. Factorizing the numerator

$= p(p^2 - q^2) + q(p^2-q)$

$= (p+q) (p^2-q^2)$

$= (p+q) (p+q) n(p-q)$

Factorising the denominator

$(p+q) (p+q)$

$\frac{\text{Numerator}}{\text{Denominator}} = p - q$

17. $\frac{(3x + 2y) \ (3x - 2y)}{(3x + 2y) \ (3x - 2y)}$

$\frac{3x + 2y}{4x + 3y}$

18. $(x - 3) (AX^2 +BX + C) = x^3 - 7x - 6$

$AX^3 + BX^2 +CX - 3AX^2 - 3BX - 3c = x^3 - 7x - 6$

$A = 1$

$B - 3A = 0$

$B - 3 \times 1 = 0$

$B = 3$
$-3c = -6$
$c = 2$

19. a) $8(2^2)^y = 6 \times 2^y - 1$
$\text{let } t = 2^y$
$8t^2 = 6t - 1$
$8t^2 - 4t - 2t + 1 = 0$
$(4t - 1)(2t - 1) = 0$
$t = ¼ \text{ or } ½$
$\therefore t = 2^y = ¼ = 2^{-2}$
$\therefore y = -2$
$0r \quad t = 2^y = ½ = 2^{-1}$
$\therefore y = -1$
$\therefore y = -2 \text{ 0r } -1$

b) $\text{Numerator} = 2x^2 - 98$
$= 2(x^2 - 49)$
$= 2(x+ 7)(x -7)$
$\text{Denominator} = 3x^2 - 16x - 35$
$= 3x^2 - 21x + 5x - 35$
$= 3x(x -7) + 5(x - 7)$
$= (x - 7)(3x + 5)$

$$\therefore \frac{2x^2 - 98}{3x^2 - 16x - 3} \div \frac{x + 7}{3x + 5} = \frac{2(x + 7)(x - 7)}{(3x + 5)(x - 7)} \times \frac{(3x + 5)}{(x + 7)}$$

$$= 2$$

20. $\dfrac{(2x- y)\ (2x + y)}{(x -\checkmark 3y)(2x - y)}$ √ √

$\dfrac{2x + y}{x - 3y}$ √

21. $P^2 - 2pq + q^2 = (p-q)^2$
$P^3 - pq^2 + p^2q - q^3$
$= p(p^2-q^2) + q(p^2 - q^2)$
$= (p+ q)(p^2-q^2)$

$$\frac{(p - q)^2}{(p+ q)(P^2 - q^2)} = \frac{(p - q)^2}{(\cancel{p}+q)^2 (p-q)} \checkmark$$

$$= \frac{p- q^1}{(p + q)^2}$$

22. Let the numbers be a and b
$a + b = 15 - x3$
$5a - 3b = 19 \times 1$

$3a + 3b = 45$
$\underline{5a - 3b = 19}$
$8a = 64$
$a = 8$
$b = 7$

4 3 2

23. $\frac{3(2x-5) - 4(1-x) - 6(x-4)}{12}$

$\frac{6x - 15 - 4 + 4x - 6x + 24}{12}$

$\frac{4x - 5}{12}$

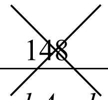
24. $\frac{3a^2 + 4ab + b^2}{4a^2 + 3ab - b^2} = \frac{3a^2 + 3ab + ab + b^2}{4a^2 + 4ab - ab - b^2}$

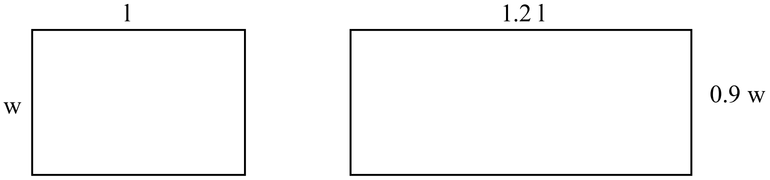
$= \frac{3a(a+b) + b(a+b)}{4a(a+b) - b(a+b)}$

$= \frac{(3a+b)(a+b)}{(a+b)(4a-b)}$

$= \frac{3a + b}{4a - b}$

7. Rates Ratio and percentages

1.	Let ten shillings coins be t		
	∴ five shilling cion 2t		
	∴ one shilling coins 21 – 3t	**B1**	
	(10xt) + (5x2t)+1(21-3t)=72		
	20t+21-3t = 72	**M1**	
	17t = 51		
	t = 3	**A1**	
		03	
2.	(a)		
	¼ : ½ : $^{1}/_{5}$ = 5 : 10 : 4		
	¼ = $^{5}/_{19}$ x 1000 = 263	**B1**	
	½ = $^{10}/_{19}$ x 1000 = 526	**B1**	
	$^{1}/_{5}$ = $^{4}/_{119}$ x 1000 = 710	**B1**	
	(b) Let volume of 45% concentration be x		
	Therefore 25% wwill be (100 – x)		
	$\frac{0.45x + 0.25(100 - x)}{100} = 30\%$	**M1**	
	0.45x – 0.25x + 25 = 30		
	0.20x = 5.0		
	$x = {}^{50}/_{2}$		
	x = 25cm^3	**A1**	
	vol of 45% = 25cm^3		
	vol of 25% = 75cm^3		
	ration 1 : 3	**B1**	
	(c) (i) Cost of 1 kg mixture		
	$^{2}/_{5}$ x 140 + $^{3}/_{5}$ x 160	**M1**	
	152		
	Profit = 240 – 152		
	= sh 88		
	Gain $^{88}/_{152}$ x 100 = 57.9%	**A1**	
	(ii) 140 160		
		**B1**	Follow through for alternative

	12 8 3 : 2	B1	
		10	
3.	(a) $V = \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 3.5$ $= 539m^3$ $= 539000000cm^3$ $capacity = \frac{539000000}{1000}$ $= 539{,}000litres$ (b) Daily use (6 x 20) + 80 + 50 = 250L No. of days = $\frac{539000}{250}$ = 2156 days (c) 1st 90 days 4 members (4 x 20) + 40 + 80 = 200L Water used in 90 days = 90 x 200L = 1800L Rem in tank 539000 – 1800L = 537,200 No. of days to use 537200L = $\frac{537200}{250}$ = 2148.8 Total days = 2148.8 + 90 = 2238 days	M1 A1 B1 B1 M1 A1 M1 M1 M1 A1	
		10	
4.	 $\%\Delta = \frac{1.2 \times 0.9l - wl}{wl} \times 100$ $= (1.08 - 1)100$ $= 8\% \quad increase$	M_1 $\frac{A_1}{2}$	
6.	(a) Senjeni = 120000x 3years = 360000 Mkimwa = 150000 x 3years = 450000 Kuku = 90000 x 2 years = 180000 Ratio of Constribution Mkimwa Senjeni Kuku 450000 : 360000 : 180000 5 : 4 : 2 (b) Amount to be shared $\frac{70}{100} \times sh187000$ Sh 130,900 Kuku's share = $^2/_{11}$ x sh 130900 = sh 23800 Mkimwa's share = $^5/_{11}$ x 130900 = sh 59500	M1 M1 M1 M1 M1 M1 M1	

	Senjeni's share = $^{4}/_{11}$ x sh 130900 = sh 47600 (c) Mkimwa = sh 450000 + sh 59500 = sh 509500 Kuku = sh 180000 + sh 23800 = sh 203800 Senjeni = sh 360000 + sh 47600 = sh 407600	M1 M1 A1	
		10	
8.	*M* *Hrs* *Days* 15 8 24 16 ? 20 Number of hours reduces in ratio 15:16 from increase in the number of men. No. of hrs increase in ratio 24:20 from reduction in the days $\frac{15}{16}\times\frac{24}{20}\times 8$ 3×3 $= 9\, hrs$	**M1** **M1** **A1**	Both ratio
		03	

9.	Mwashuma takes X days Mwandime takes X – 2 days $\frac{1}{x} + \frac{1}{x-2} = \frac{5}{12}$ $5x^2 - 34x + 24 = 0$ $x = \frac{34 \pm 26}{10}$ $= \frac{60}{10}$ or $\frac{8}{10}$ Ignore $= 6$ Mwandime 6 – 2 = 4 days	M1 M1 M1 A1 4

10	$=\frac{4\times 20}{8}=$ 10 hours	M1 A1	

11. *Men cottages days*

5 2 21

x 6 21

$x = \left(\frac{6}{2} x \frac{21}{21} x 5\right) = 15$

more men = 15 – 5 = 10

12. *a) i) In 1 hr; Tap A fills* $^{1}/_{3}$

13. *Max Perimeter* $= 2(18.5 + 12.5)$
$= 62$ *cm*
Working Perimeter $= 2(18 + 12)$
$= 60$ *cm*
% error $= \frac{2}{60} \times 100 = 3.33\%$
B $- \frac{1}{4}$
Capacity filled in 1 hr $= \frac{1}{3} + \frac{1}{4}$
$= \frac{7}{12}$
$\frac{7}{12} = 1$ *hr*
$1 = 1 \times 1 \times \frac{12}{7}$
$= 1\frac{5}{7}$ *hrs.*
ii) $\frac{1}{3} + \frac{1}{4} - \frac{1}{6} = \frac{5}{12} \Rightarrow$ *in one hr*
$\frac{5}{12} = 1$*hr*
$1 = 1 \times 1 \times \frac{12}{5}$
$= 2\frac{2}{5}$ *hrs*

14. (a) $\frac{144000}{n-5} - \frac{144000}{R}$
$= \frac{720,000}{n(n-5)}$

(b) $\frac{720,000}{n(n-5)} = 2400$
$300 = n(n-5)$
$n^2 - 5n - 300 = 0$
$(n-20)(n+15) = 0$
Either $n = 20$, $n = -15$ $m = 20$

(c) *contributed* $= \frac{144000}{20} = 7200$
(d) *% increase* $= \frac{2400}{7200} \times 100 = 33.33\%$

15. (a) *In 1 hour* $\frac{1}{40} + \frac{1}{15} + \frac{1}{20}$ *of the tank will be filled*
$= \frac{17}{120}$
In 5 hours $= \frac{17}{120} \times 5$
$= \frac{17}{24}$
(b) *In two hours taps x and y*

$\left(\underline{1} + \underline{1}\right) \times 2$ *of the tank to be filled*

40   15

$= \frac{11}{60}$

In 7 hours = $\left(\frac{11}{60} + \frac{17}{24}\right)$

$= \frac{107}{120}$

(c) Remaining fraction = $1 - \frac{107}{120}$

$= \frac{13}{40}$

In $\frac{1}{40}$ hour proportion, time taken

$= \frac{13}{120}$ x 40h

$= 4\ ^{1}/_{3}$

Time taken = $7 + 4\ ^{1}/_{3}$ = 11 hrs 20 min.

Tank will be full at 8.00 + 11hrs 20 min

1920 hrs or 7.30 p.m

16. Let Philip take x days to finish the job alone.

$\frac{1}{x} + \frac{1}{x+5} = \frac{1}{6}$

$6(x + 5)\ 6x = x(x + 5)$ √

$6x + 30 + 6x = x^2 + 5$

$x^2 - 7x - 30 = 0$

$(x - 10)(x + 3) = 0$ √

$x = 10$ and $x = -3$

17.

16	9	14
X	7	12

$X = 16 \times \frac{9}{7} \times \frac{14}{12}$

= 24men

Extra men = 24 -6

= 8men

18. a) Let the original no. of people be x

Originally each would contribute

$\frac{180000}{X}$

New contribution per person

$\frac{180000}{X - 3}$

$\frac{180000}{X - 3} - \frac{180000}{x} = 3000$

$180000x - 180000x + 540000 = 30000 - 9000$

$30x^2 - 90x - 5400 = 0$

$3x^2 - 9x - 540 = 0$

$X^2 - 3x - 180 = 0$

$(x- 15)\ (x + 12) = 0$

$X = 15$ or -12

Original number of people 15

b) $\frac{180000}{15} = \frac{180000}{15}$

c) *Original contribution per person*

Shs.12000

New contribution per person

$= \frac{180000}{12} \qquad = 15000$

% increase

$\frac{15000 - 12000}{12000} \times 100\%$

$\frac{3000}{12000} \times 100\%$

$= 25\%$

19. a) *cost of running the business*

$\frac{20}{100} \times 43200$

$=$ Shs.8640

b) *15% of profit*

$\frac{15}{100} \times 43200 \quad =$ Shs. 6480

Rest of the profit

$= 43200 - (8640 + 6480) = 28080$

Ratio of contribution

$40000 : 64000$

$5 : 8$

Mue received

$\frac{1}{2} \times 6480 =$ Shs.3240

${}^{8}/_{13} \times 28080 =$ Shs. 17280

$=$ Shs.20320

c) *Konie received*

Shs.$3240 + 10800 = 14040$

$\frac{14040}{1800} \qquad = 7.8$

$= 7$ cows

20. $(7x - 3y) : 2x + 3y$

$x= 2 \qquad y= 1$

$14 - 9 : 4+ 9$

$5 : 13$

21. a) B ___ bulls

G ___ Goats

$5B + 30G =$ Kshs.117000 ………. Equation (i)

$4B + 25G =$ Kshs.(117000 – 22250)

$4B + 225G =$ Kshs.94750 ………… Equation (ii)

From equation (i) $5B + 30G =$ Kshs.117000 (dividing through by 5)

$= (B + 6G = 23400) \times 4$

$= 4B + 24G = 93600$ …………..(iii)

Equation (ii) – q(iii) $= 4B + 24G = 94750 -$

$\underline{4B + 24G = 93600}$

$G = 1150$

$\therefore$ 1 goat costs Kshs.1150

Substituting in (i)

$5B + 30\,(1150) = 117000$

$5B + 34500 = 117000$

$5B = 825000$

$B =$ Kshs.16500

b) Abduls selling price

Bull $^{140}/_{100} \times 16500 = 23100 \times 5 =$ Kshs.115,500

Goat $^{130}/_{100} \times 1150 = 1495 \times 30 =$ Kshs.44850

Total $44850 + 115500 =$ Kshs.160350

= Kshs.160350

Ali's selling price

Bulls $^{150}/_{100} \times 16500 = 24750 \times 4 =$ Shs.99000

Goats $^{140}/_{100} \times 1150 = 1610 \times 25 =$ Shs.40250

Total $99000 + 40250 =$ Kshs.139,250

Profit made

Abdul ________ Kshs. (160350 – 117000) = Kshs.43350

Ali __________ Kshs. (139250 – 94750) = Kshs.44500

Ali made more profit by Kshs.1150/=

22. Original costs

$T = {}^{8}/_{24}\, x = {}^{x}/_{3}$

$L = {}^{4}/_{24}x = {}^{x}/_{6}$

$R = {}^{12}/_{24}x = {}^{x}/_{2}$

New $T = {}^{x}/_{3} \times 1.12 = 0.3733x$

$L = {}^{x}/_{6} \times 1.18 = 0.1967x$

$R = {}^{x}/_{2} \times 1.4 = 0.7x$

Therefore % change

$\underline{(0.3733x + 0.967x + 0.7x})$ – x x 100

X

$= 0.27 \times 100$

$= 27\%$

23. *Let Mary's yrs be x*

Mothers age = $2\frac{1}{2}x$

4yrs ago Mary was $x - 4$

4yrs ago mother was $2\frac{1}{2}x - 4$

$$\frac{2\frac{1}{2}x - 4}{x - 4} = \frac{3}{1}$$

$^{5}/_{2}\,x - 3x = -12$

$-\frac{1}{2}x = -12$

$x = 24$*yrs*

mother's age is $= (^{5}/_{2} \times 24)$

$= 60$*yrs*

24. $$\frac{16 \times 9 \times 14}{7 \times 12}$$

$= 24$

Extra men $= 24 - 16$

B1= 8more men

25.. *Ratio* $K : B = 3 : 4$

a) Kongo got $\frac{3}{7} \times \frac{35}{100} \times 181300 = 27195/=$

Beatrice got $\frac{4}{7} \times \frac{35}{100} \times 181300 = 36260/=$

b) Kongo got $\frac{3}{7} \times \frac{60}{100} \times 181300 + 9000$

$= 136{,}620/=$

Beatrice got $\frac{4}{7} \times \frac{60}{100} \times 181300 + 120000$

$= \underline{182{,}160/=}$

26. *Let no. be mn*

$M + n = 9 \ldots (i)$

$10m + n$*, reversed* $10n + m$

$10n + m - 10m + n = 27$

$1n - 9m$

27. $V1 = \pi r^2$

h

$R = 130r = 1.3r$

$H = \frac{80h}{100} = 0.8h$

$V_2 = \pi R^2 h = (1.3r)^2 \times 0.8h$

$= 1.352V_1$

$\% \text{ change} = \frac{V_2 - V_1}{V_1} \times 100$

$= \frac{(1.352 - 1)\,V_1}{V_1} \times 100$

$0.352 \times 100 = 35.2\%$

28. In 1hr both fills = $1 + 1 - 10 = 23$

Tina to fill = $120 = 5\ 5/23$

5hrs 13min

29.

16	9	14
X	7	12

$X = 16 \times \frac{9}{7} \times \frac{14}{12}$

= 24men

Extra men = 24 -6

= 8men

30. a) Expenses $= \frac{30}{100} \times 600{,}000$

= sh. 180,000

Business $= \frac{15}{100} \times 420{,}000$

= sh. 63,000

Rest of profit = 357,000

Ratio 160 : 200 : 240

4 : 5 : 6

(i) Langat received = sh $\frac{4}{15} \times 357{,}000$

= sh 95,200

(ii) Korir received = sh $\frac{5}{15} \times 357{,}000$

= sh119,000

(iii) Koech received = sh $\frac{6}{15} \times 357{,}000$

= 142,800

(b) % $= \frac{119,\ 000}{600{,}000} \times 100$

= 19.83

31. a) 125 :100 = 5:4

b) $^{5}/_{4} \times 400 = 500$

32. Alcohol A $= {}^{25}/_{120}$

$= 30\text{cm}^3$

Alcohol in B $= {}^{20}/_{100} \times 180$

$= 36\text{cm}^3$

Results $= \frac{36 + 30}{120 + 180}$

$= \frac{66}{300} \times 100$ =22%

Remaining = 300-x

Volume of alcohol = $(300 - x) \times {}^{22}/_{100} = 66 - 0.22x$

Total volume of alcohol = $66 - 0.22x + x$

$= 66 + 0.78x$

% alcohol = $\frac{\underline{66 + 0.78x \times 100}}{300} = 35$

$= 66 + 0.78x = 105$

$0.78x = 39$

$x = 50$

33. *Max Perimeter* $= 2(18.5 + 12.5)$

$= 62$ *cm*

Working Perimeter $= 2(18 + 12)$

$= 60$ *cm*

% error = $\underline{2}$ X 100 = 3.33%

34. $a : b = 1:2$

$b : c = 3:4$

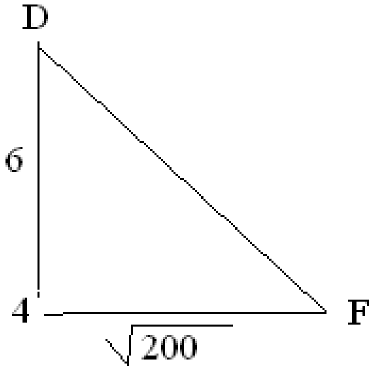
$a:b = 3:6$

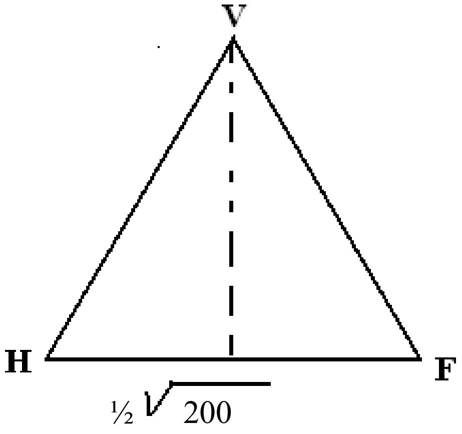
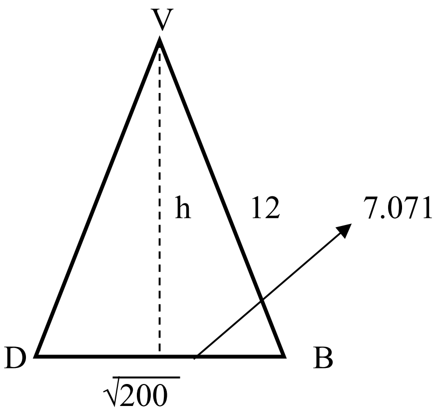
$b:c = 6:8$

$\therefore a:b:c = 3:6:8$

8. Length

1.	Mass = Density x volume But Density is constant.	M1	
	x y	M1	
	Vol (270000 x 2.8): x2.1	M1	
	= $\frac{\underline{270000}}{2.1}$ x 2.8 = 360m	A1	
		4	

2. a.)			
	DF$_1$ = $\sqrt{6^2 + (\sqrt{200})^2}$	M1	
	= 15.362291	A1	

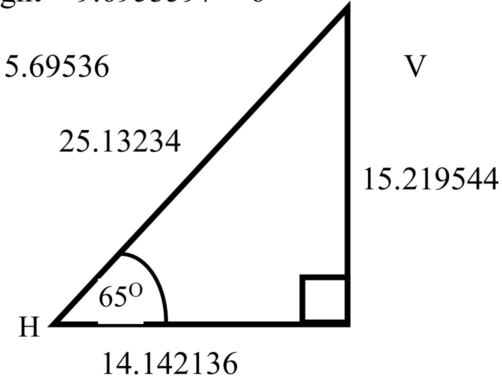
b.)			
	$\sqrt{144 - ½\sqrt{200}^{2}}$		
	= 9.6953597	M1	
	$\frac{6}{+\ 15.\ 6953597}$		
	Tan Θ = $\frac{15.6953597}{7.0710678}$	A1	
	= 2.219659		
C.	Θ = 65.747499°		
	½ HF	B1	
	½ x √200		
	= 7.0710678		
d.		M1 B1	

e.

$\sqrt{144-50} = 9.6953597$

Height = 9.6953597 + 6

= 15.69536



$$\sqrt{14.142136^2 + 15.219544^2}$$

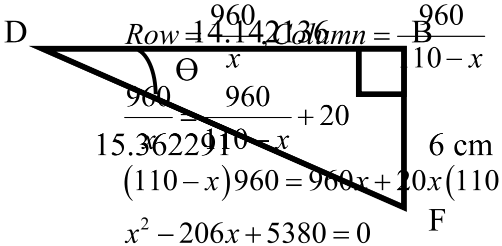
= 25.13234

B1

∠ BDF

3

f.



$Row = \frac{960}{x}, Column = \frac{960}{110-x}$

$\frac{960}{x} = \frac{960}{110-x} + 20$

$(110-x)960 = 960x + 20x(110-x)$

$x^2 - 206x + 5380 = 0$

$\frac{\Theta}{6} = \frac{90}{15.362291}$

$x^2 - 30x - 176x + 5380 = 0$

$x(x-30) - 176(x-30) = 0$

$\Theta = \frac{90 \text{ X } 6}{15.362291}$

$(x-30)(x-176=0)$

$x = 176$

= 35.15°

or

$x = 30$

Dimensions 30 by 80 cm

M1

No of tiles =

$$\frac{960\times960}{30\times30}$$

$= 384$

A1

10

Cost =

$$\frac{364}{12}\times1500+3000$$

$= sh.483000$

		10	

4. $\frac{3x + 2y)\ (5x - 3y)}{(5x - 3y)\ (x-y)}$

$= \frac{3x + 2y}{x - y}$

5. $3N + ½ (R-M)$

$$= 3\begin{pmatrix}2/3 & 1\\ 2 & 4\end{pmatrix} + ½\begin{pmatrix}-1 - & 2\\ 0 & 0\end{pmatrix}\begin{pmatrix}3 & 0\\ -1 & 4\end{pmatrix}$$

$$= \begin{pmatrix}2 & 3\\ 6 & 12\end{pmatrix} + ½\begin{pmatrix}-4 & 2\\ 1 & 4\end{pmatrix}$$

$$= \begin{pmatrix}2 & 3\\ 6 & 12\end{pmatrix} + \begin{pmatrix}-2 & 1\\ 0.5 & -2\end{pmatrix} = \begin{pmatrix}0 & 4\\ 6.5 & 10\end{pmatrix}$$

9. Area

1	$\frac{1}{2}\times 14\times 22\sin 75^0 - \frac{75}{360}\times\frac{22}{7}\times 14\times 14$ $7\times 22\sin 75 - \frac{55\times 7}{3}$ = 20.42	M_1 M_1 M_1 A_1	
2.	LSF 1 cm rep 50000cm 1cm rep 500m ASF 1cm2 rep 250000m2 Area = $\left(\frac{6.16\times 250000}{10000}\right)$ = 154ha	B1 M1 A1	ASF given
		03	
3.	Area = 4 x 4sin 420 - $\frac{42}{360}\times\frac{22}{7}\times 4\times 4$ = 10.71 – 5.867 = 4.796	M1 M1 A1	✓area of rhombus & sector ✓difference in area
		03	

5. (a) Tan $60^0 = \frac{AC}{5cm}$ M1

AC = 8.6605CM A1

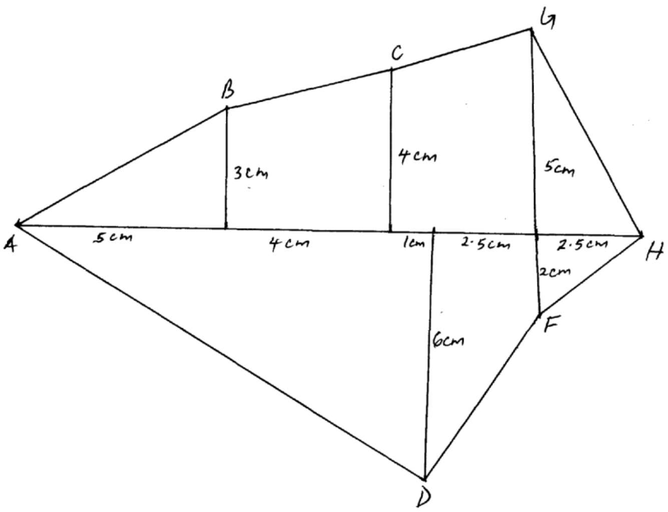
(b) A = ½ x 5 x 8.6605 M1

A = 21.65125 A1

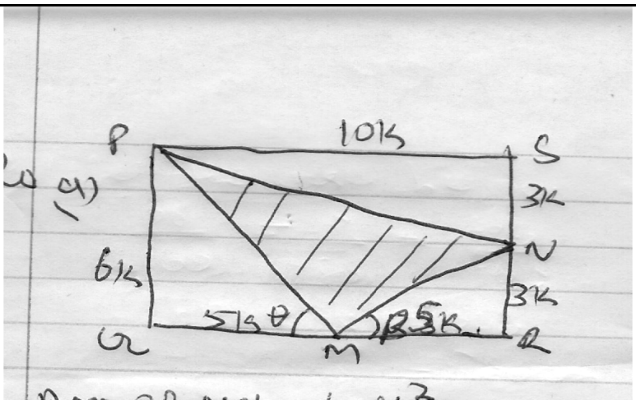
(b) $^{60}/_{360}$ x πr^2

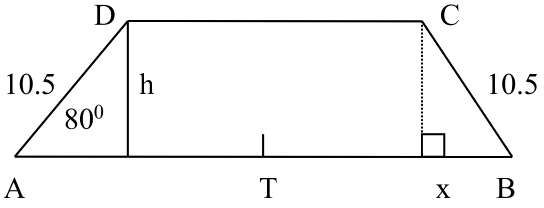
$^{60}/_{360}$ x 3.142 x 25 M1

= 13.091cm^2	A1
(d) Area of shaded part	
Δ COA = Δ OBA, sector OCD = OCB	
21.65 x 2 = 43.3025cm^2	M1
13.091 x 2 = 26.182cm^2	M1
∴ Area of shaded part	
43.3025 – 26.182	M1
= 17.11225cm^2	A1
	10

6.	 ½ x 200 x 120 = 12,000 160 x ½ x 50 = 4000 ½ x 50 x 40 = 1000 ½ x 50 x 100 = 2500 ½ x 180 x 70 = 6300 ½ x 140 x 80 = 5600 ½ x 100 x 60 = 3000 34400m^2 = 3.44ha	**B1** **B1** **B1** **B1** **B1** **M1** **M1** **M1** **A1** **B1**	For AH for✓ offset ✓div for AH Offsets ⊥to AH Complete diagram
		10	

7.	$S = \frac{5.7+4.2+6.3}{2} = 8.1$ $= \sqrt{8.1(8.1-5.7)(8.1-4.2)(8.1-6.3)}$ $= \sqrt{8.1 \times 2.4 \times 3.9 \times 1.8} = 11.68$ $Shaded\ area = 18.05 - 11.68$ $= 6.368 cm^2$	B1 M1 A1 B1	
		04	

8	 Area of the rectangle= 60k^2 Area of unshaded part parts $= \frac{1}{2}6k \times 5k + \frac{1}{2} \times 15k^2 + \frac{1}{2} \times 30k^2$ $= 15k^2 + 7.5k^2 + 15k^2$ $= 37.5k^2$ Area of shaded part = 60k^2 – 37.5k^2 = 22.5k^2 b) $\frac{1}{2} \times 15k^2 = 30$ $k^2 = \frac{30 \times 2}{15}$ $k = 2$ Dimensions = 20m by 12 cm $\tan\theta = \frac{12}{10}$ $\theta = 50.19^0$ $\tan\beta = \frac{6}{10}$ $\beta = 30.96^0$	M1 M1 M1 A1 M1 A1 M1 A1 M1 A1	

		10	
9	a) = $\frac{160}{360}\times\frac{22}{7}\times10.5^2$	M1	
	$=154cm^2$	A1	
			
	$\sin 80=\frac{h}{10.5}$ $h=10.5\sin 80=10.34cm$	B1	
	$\cos 80=\frac{x}{10.5}$ $x=10.5\cos 80=1.823$	B1	
	$lengthCD=21-(1.823\times2)$	M1	
	$=17.354$	A1	
	Area of AXYBCD $=\frac{1}{2}\times10.34(17.354+21)\times2$	M1	
	$=396.58cm^2$	A1	
	b) Area of the shaded part = 396.58-154	M1	
	= 88.58 cm^2	A1	
		10	

10. *M x m value* $=\frac{2.655+6.415}{6.405-2.655}$

$=\frac{9.07}{3.75}$

= 2.4187

11. *(a) Number of tiles to cover the room* $=\frac{10.5 \times 6}{0.3 \times 0.3}$

= 700 tiles

(b) (i) 15 x 700 tiles

15 x 700 cartons

20

$$Cost = \frac{15 x 700}{20} x 800$$

Cost = Kshs. 420,000

(ii) Other expenses = 2000 + 600 = 2600/=

Total expenses = Kshs. 420,000 + 2600
= Kshs. 422600

$$Selling\ price = \frac{112.5}{100} x 422600$$

= Kshs. 475, 425

$$Selling\ price\ per\ tile = \frac{475,425}{525 x 20}$$

= 45.27

= Kshs. 45.00

12. $\frac{AC}{Sin\ 60^o} = 10 = AC = 8.66$

$\angle A70^o$, $\frac{BC}{Sin\ 70^o} = 10 = BC = 8.91$

Area = ½ x 8.66 x 8.91 sin 50^o
= 27.28

13. S = ½ (170 + 190 + 210)

S = 285

$\sqrt{Area = 285 (285 – 170) (285 – 190) (285 – 210)}$

$\sqrt{= 2865 x 115 x 95 x75}$

$= \frac{15281m^2}{10,000}$

= 1.528ha

14. LCM of 30, 50 and 35 mins

$$\left.\begin{array}{l}30 = 2 x 3 x 5\\ 35 = 5x 7\\ 50 = 2 x 52\end{array}\right\} \text{L.C.M} = 2 x 3 x 5 = 1050$$

Into hrs $(\frac{1050}{60})$ hrs = 17.5hrs

$$\text{Next wail together at}\quad \begin{array}{r} 7:18\\ +\ \underline{17:30}\\ 24:48\end{array}$$

= at 1. 48 a.m on Tuesday

15. Maize – $\frac{1}{4} x \frac{2}{3} = \frac{1}{6}$

Remainder – $\frac{2}{3} – \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$

Beans – $\frac{4}{5} x \frac{1}{2} = \frac{2}{5}$

carrrots – $\frac{1}{5} x \frac{1}{2} = \frac{1}{10}$

Let total area of farm be x acres

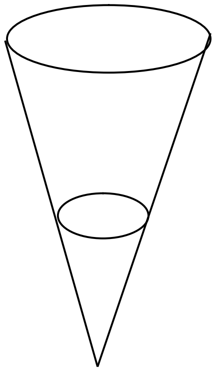
$\frac{1}{10}x = 0.9$

x = 0.9 x 10 = 9acres

10. Volume and capacity

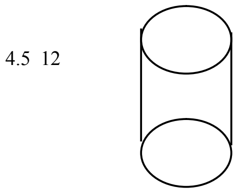
1.	$\frac{1}{2}\times 14\times 22\sin 75^0 - \frac{75}{360}\times\frac{22}{7}\times 14\times 14$ $7\times 22\sin 75 - \frac{55\times 7}{3}$ = 20.42	M_1 M_1 M_1 A_1	
		4	
2.	LSF 1 cm rep 50000cm 1cm rep 500m ASF 1cm2 rep 250000m2 Area = $\left(\frac{6.16\times 250000}{10000}\right)$ = 154ha	B1 M1 A1	ASF given
		03	
3.	Area = 4 x 4sin 42^0 - $\frac{42}{360}\times\frac{22}{7}\times 4\times 4$ = 10.71 – 5.867 = 4.796	**M1** **M1** **A1**	✓area of rhombus & sector ✓difference in area
		03	
4.	a) (i) $\frac{30+h}{h} = \frac{40}{30}$ h = 90 $\frac{1}{3}$ Π × 1600 × 120 − ⅓ Π× 900 × 90 (64 000 Π − 27 000) ÷ 1000 37 Π litres (ii) Volume of water = $\frac{2}{5}\times\prod\times 1.44\times 1.35$ =777.6 Π litres b) $\frac{777.6\prod}{37\prod}$ = 22	M_1 A_1 M_1 M_1 A_1 M_1 A_1 M_1 M_1 A_1	Divide by 1000 Mult by 1000

5. 16 12



$\frac{12}{16} = \frac{L}{30 + L}$		
L = 90	B1	for 90
$h = \sqrt{90^2 - 12^2}$ = 89.2		
$H = \sqrt{120^2 - 16^2}$ = 118.9	B1	for both 89.2 1189
Vol. big core = $^1/_3$ x 3.142 x 16^2 x 118.9	M1	
31879.151		
Small cone = $^1/_3$ x 3.142 x 12^2 x 89.2	M1	
= 13452.789		
∴ Volume of water		
31879.151 – 13452.789	M1	
= 18426.3645	A1	

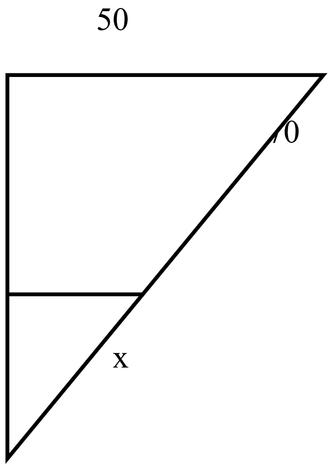
(b)



3.142 x 12^2 x h=		
18426.364	M1	
h = 40.73	A1	
S.A = 2 x 3.142 x 12 (45 – 40.73)	M1	
= 321.99cm^2	A1	
	10	

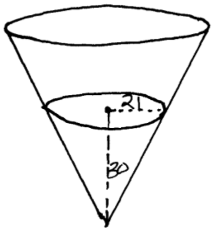
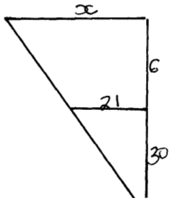
6.	(a) (300x5) + (140x8)	M1	
	= 1500 + 1120		
	= 2620fans	A1	
	(b) Cost of fuel		
	Boeng 747		
	= 120x10.5x60x5x2x0.3	M1	
	=226800 dollars	A1	
	Boeng 740		
	= 200x10.5x60x8x2x0.3	M1	
	=604,800 dollars	A1	
	(c) Total collection		
	Boeng 747		
	= 300x5x800	B1	
	= 1,200,000 dollars		
	Boeng 740		

	= 140x8x800 = 896,000 dollars (d) Net profit Boeng 747 = 1200000 – 226800 = 973,200 dollars Boeng 740 = 896,000 – 604,800 = 291,200 dollars	 B1 B1 B1	
		10	

7. a.)		
	$^{50}/_{15} = ^{70 + x}/_{x}$	M1
	50x = 15(70 + x) 50x = 1050 + 15x 35x = 1050 = 30 cm	 A1
	Total height = $\sqrt{100^2 - 50^2}$	B1
	= $\sqrt{7500}$ = 86.60am	M1
	$\frac{50}{15} = \frac{86.60}{Y}$ Y = $\frac{86.6 \text{ X } 15}{50}$ = 25.98	A1
	Height = 86.60 – 25.98 = 60.62	A1
b.)	Volume = ($^1/_3$ x $^{22}/_7$ x 50^2 x 86.60) – ($^1/_3$ x $^{22}/_7$ x 15^2 x	 M1

	25.98) = 1/3 x 22/7 (216500 – 5845.5) = 220685.67am3 = 221litres	M1 M1 A1 10

8.	a)		

	 $volume = \frac{\pi}{3} r^2 h$ $= \frac{3.142}{3} \times 21 \times 21 \times 30$ $= 13856.22 cm^3$ b)  $\frac{x}{21} = \frac{36}{30}$ $x = 25.2cm$ ii) New volume = $^1/_3$ x 3.142 x 25.2 x 25.2 x 36 = 23943.55cm^3 Volume change = 23943.55 – 13856.22 = 10087.33cm^3 iii) 2/3πr^3 = 10087.33 r^3 = 10087.3 x $^3/_2$ x $^1/_\pi$ r^3 = 4815.72 r = $\sqrt[3]{4815.72}$ r = 16.89cm diameter = 16.89 x 2 = 33.78cm	M1 A1 M1 A1 M1 A1 B1 M1 A1 B1	Attempt ✓vol of hemisphere
		10	

9. *L.s.f.* $= \frac{18}{24} = \frac{3}{4}$

A.s.f $= \frac{9}{16}$

v.s.f $= \frac{27}{64}$

$\frac{h}{3.2} = \frac{3}{4} \Rightarrow 4h = 3h + (3 \times 3.2)$

$h = 9.6$

(i) surface area of small cone:

$L = \sqrt{9^2 + 9.6^2} = 13.16m$

S.A = (3.142 x 9 x 13.6) = 384.581

Curved area of frustrum

$= \frac{7}{1} x \frac{3.142 x 9 x 13.16}{9}$

$= 289.4$

Top area $= (3.142 x 9^2) = 254.5cm$

$\therefore$Total area $= 543.9m^2$

(ii)Volume of smaller cone $= \frac{3.142 x 9^2 x 9.6}{3}$

$= 814.41$

Volume of frustrum $= \frac{(37 x 814.41)}{27}$

$= 1116.043m^3$

$= 1116043L$

Litres used per day= (15 x 15 x 40) + (116 x 65)= 16540L

No. of days $= \frac{1116043}{16540} = 67.5$days

10. L.S.F $= \frac{3}{2} = \frac{28 + h}{h}$

$56 + 2h = 3h$

$h = 56cm$

Volume $= 1/_3\ r^2H – 1/3r^2h$

$={}^1/_3 x {}^{22}/_7 x 15x 15x56 -{}^1/_3 x {}^{22}/7 x 10 x 10 x 28$

$= 13200 – 29331/_3$

$= 10.2667$litres

(b) Slant height = 152 + 562 = 3361

= 57.97cm

Curved surface – RL – rl

11. $2.6 x 4.8 x 3.2 = 39.936m^3$

$1m^3 = 1000$litres

$39.936m^3 = 39.936 x 1000$

= 39936 litres

12. The top surface of the frustrum is-2/3 way up the vertical height of the original one.

$\Rightarrow VX: XY = 1/3h: h = 1:3$

Using similar triangle we have

$\frac{R}{R} = \frac{VX}{VY} = \frac{1}{3}$

$R:R = 1:3$

$\frac{r}{R} = \frac{1}{3} \Rightarrow R = 3r$

$R = 3x7 = 21cm$

(c)height of removed cone is ${}^1/_3$ height of original cone

$h = {}^1/_3 x 45 = 15cm$

volume of removed cone $= {}^1/_3\ r^2h$

$= 1 x \frac{22}{7} x 7 x7 x15$

$= 770cm^3$

Now L. S. F $= {}^1/_3$

V. S. F= $({}^1/_3)^3 = {}^1/_{27}$

Hence ratio of volumes = 1:27
Volume of original cone = 27x Vol. of small cone
$= 770 \times 27 = 20790cm^3$

Capacity of frustrum
= vol. of original cone – vol. of removed cone
$= 20790 – 770 = 20020cm^3$
$\frac{20200}{1000} = 20\ l$

(d) capacity of tank = $\frac{150 \times 120 \times 80}{1000} = 1440l$
No. of buckets = $\frac{1440}{20} = 72$buckets

13. Mass of water = $1 \times 3000\ cm^3 = 3000\ g$
Mass of alcohol = $0.8 \times 1200 = 9600g$
Mass of mixture = 12,600g
Volume of mixture = $15,000\ cm^3$

Density of mixture = $\frac{12600}{15000}$
$= \underline{0.84g/cm^3}$

14. (a) Vol. of tank = $22 \times 144 \times 1.7 = 5.236$
Vol. of milk = $^3/_5 \times 5.236 = 3.146m^3$
Vol. in liters = $3.1416 \times 1000 = 3141.6$litres

(b) (i) Vol. of packet $(^1/_3 \times 10 \sin 60) \times 13.6$
$= 26.97 \times 13.6$
$= 3.66.75cm^3$
$= 367cm^3$

(ii) No. packets = $\frac{(3141.6 \times 1000)}{367}$

(iii) Amount = 8560.2×20
= 171204.3597
= Shs.171,204.40

15. Volume of culvert
$= {}^{22}/_7 (76^2 – 64^2) \times 300 \times 10^{-6}$
$= {}^{22}/_7 \times \frac{1680 \times 300}{10000000000}$
$= 1.584m^3$

11. Mass, weight and density

2.	$4 \times 3.142 \times r^2 = 18$ $\longrightarrow R \simeq 1.197$ Vol. = $^4/_3 \times 3.142 \times 1.197$	**M1**	

	= 7.185cm^3 Density = $\frac{100}{7.185}$ = 13.92g/cm^3	**M1** **A1**	
		03	
3.	(a) (i) 800 x 0.2 = 160m^3 (ii) 160 x 2000 = 320,000kg (iii) Cement = $^2/_8$ x 320,000 = 80,000 (b) Bags = $\frac{80,000}{50}$ = 1600 (c) Ballast = $^3/_8$ x 320,000 = 120,000 tonnes = 120 lorries	**M1** **A1** **M1** **A1** **M1** **A1** **B1** **B1** **M1** **A1** **B1**	
		10	
4.	$4\pi r^2 = 18$ $4 \times \frac{22}{7} \times r^2 = 18$ $r = 1.197cm$ $vol = \frac{4}{3} \times \frac{22}{7} \times 1.197^3$ $= 7.187cm$ $D = \frac{m}{v} = 100g / 7.187cm^3$ $= 13.91g / cm^3$	B1 B1 B1	
		03	

5. Density = $\frac{30\cancel{0} \times \cancel{1,}000,000}{\underset{1}{\cancel{2}}\cancel{0} \times 1\cancel{000}}$

=15,000 kg/m^3

6. $D = \frac{M}{V}$

Mas = $D \times V$

= $\frac{1g}{cm^3}$ *x 2500cm^3*

= 2500g...(i)

Mass = 0.8 x 8000

= 6400g ....(ii)

total mass = (2500 + 6400)g

= 8900g

Density of mixture = $\frac{8900g/cm^3}{10500}$

12. Time

1	$T=\frac{100}{40}+\frac{60}{30}$ $=2.5hrs+2hrs$ $=4.5hrs$ Average speed $=\frac{160}{4.5}km/h$ $=35.56km/h$	M1 M1 A1	✓exp for total time

2. Time between Monday 0545hr and Friday 1945
= 4x 24 + 14 = 110 hrs
Time lost = 0.5 x 110 = 55 min.
Time in 12 hr system
(1945 – 55 – 1200)
6.50 p.m.

3. Time between Monday 0445h and Friday 1845h
= 4 x 24 + 14 = 110h
Time lost = 0.5 x 110
= 55min
Time shown in 12 hour system
1845 – 55 = 1750 h
= 5.50 p.m

4. (a) 1600h – 830h = 7hrs 30min or 7 ½ hours

(b) Average speed $= \frac{300}{7\frac{1}{2}}$
= 40km/h

13. Linear

1	(0,3), (3,0) $\frac{3-0}{0-3}=-1$ $\frac{y-0}{x-3}=-1 \quad y=-x+3$ $y<-x+3$ $x\geq 1$ $y\geq 0$	B1 B1 B1	
2.	(a) x ≥ -4 (b) y = -x y + x ≤ 0 (c) Grad = $\frac{0-^-9}{8-^-9}$ = ¾ y = mx + c 0 = ¾ (8) + c c = -6 y = ¾ x – 6	B1 B1 M1 M1	

	$y - \frac{3}{4}x > -6$		
		04	
3.	$2x + 3 \ge 5x - 3$ $-3x \ge -6$ $x \le 2$ $5x - 3 > -8$ $5x > -5$ $x > -1$ $-1 < x \le 2$ Integral values 0,. 1, 2	B1 B1 B1	
		03	
4.	a) $4x - 9 < 6 + x$ $x < 5$ $8 - 3x < x + 4$ $1 < x$ b) $1 < x < 5$	M1 M1 A1	
5.	$-2x + 1 < x - 5$ $-3x < -6$ $x > 2$ $x - 5 < 5 - x$ $2x < 10$ $x < 5$ $\therefore 2 < x < 5$	M_1 $\underline{A_1}$ 2	
7	$-3x + 2 < x + 6$ $x > 1$ $x + 6 \le 17 - 2x$ $x \le 3\frac{2}{3}$ 2, 3	B_1 B_1 $\underline{B_1}$ 3	
8.	$\frac{3a+2}{4} \le \frac{2a+3}{5} \le \frac{4a+15}{6}$ $\frac{3a+2}{4} \le \frac{2a+3}{5}$ $5(3a+2) \le 4(2a+3)$ $15a + 10 \le 8a + 12$ $7a \le 2$ $a \le 0.2857$ $\frac{2a+3}{5} \le \frac{4a+15}{6}$ $6(2a + 3) \le 5(4a + 15)$ $-8a/-8 \le 57/-8$ $a \le -7.125$; $-7.125 \le a \le 0.28$ Integral values -7, -6, -5, -4, -3, -2, -1	1 M1 B1 B1	
		03	

9. $\frac{1}{2}x - 2 \le 3 - 2$; $3x - 2 < + \frac{1}{2}x$

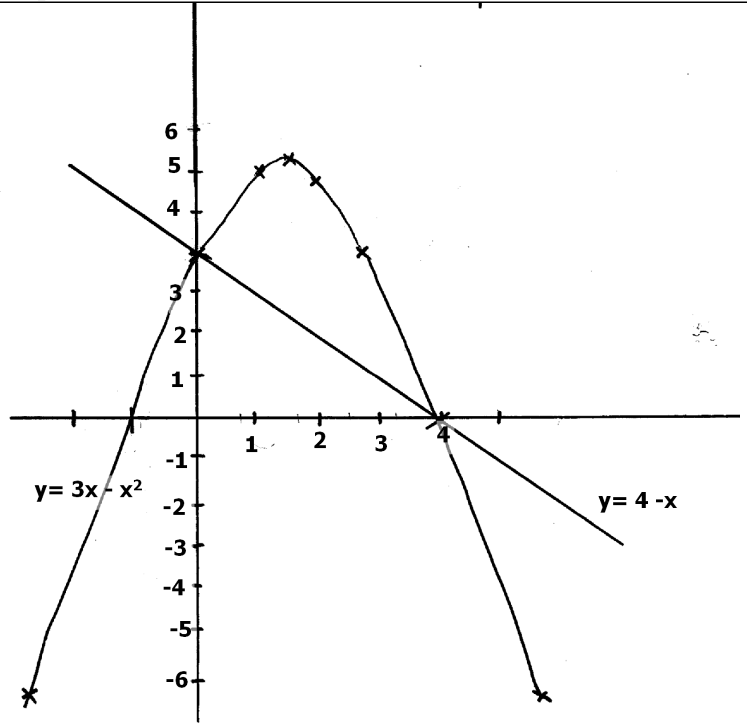
$O \leq {}^{7}/_{2}x$ $\qquad$ ${}^{5}/_{2}x < 4$

$O \leq x$ - B1 $\qquad$ $x < {}^{8}/_{5}$ $\qquad$ B1

$x = 0, 1$ $\qquad$ A1

3

<table>
<tr><td>10.</td><td>$y \leq 2, x > -3$
(3,-3) & (-3,1)
$M = \frac{1+3}{-3-3} = \frac{4}{-6} = \frac{-2}{3}$
$y = -\frac{2}{3}x + c$
$-3 = \frac{-2}{3} x^{3} + c$
$-3 = -2 + c$
$c = -1$
$y = {}^{1}/_{3}x - 2$, inequality $y < {}^{1}/_{3}x - 2$ Equn $y = -\frac{2}{3}x - 1$
(3,-3) & (4,2)
$M = \frac{2 - -3}{4-3} = \frac{5}{1} = 5$ Equn $y > -\frac{2}{3}x - 1$
$Y = 5x + c$
$-3 = 5(3) + c$
$-3 - 15 = c$
$C = -18$
$Y = 5x - 18$ inequality $y \geq 5x - 18$</td><td>B1
B1
B1</td><td>Both
B0 if any one is wrong
For □ Ineq</td></tr>
<tr><td></td><td></td><td>03</td><td></td></tr>
<tr><td>11.</td><td>$-4x + 2y \leq 4$
$y \geq 0$
$x + y \leq 4$</td><td>B1
B1
B1</td><td></td></tr>
<tr><td></td><td></td><td>03</td><td></td></tr>
<tr><td>12.</td><td>$3y + 2x \angle 6$
$4y - 3x \geq -12$
$y + 3x \geq -3$</td><td>B1
B1
B1</td><td></td></tr>
<tr><td></td><td></td><td>03</td><td></td></tr>
<tr><td>13.</td><td><table><tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>1.5</td></tr><tr><td>Y</td><td>-6</td><td>0</td><td>4</td><td>6</td><td>6</td><td>4</td><td>0</td><td>-6</td><td>6.255</td></tr></table></td><td>B2
S1
P1
C1
L1</td><td>For all values ✓</td></tr>
</table>

<table>
<tr><td></td><td>

b) turning point 1.5, 6.25
c) i) Line y = 0 x =
$^-1$ or x = 4
x = -1 or x = 4
ii) $4 + 3x - x^2 = y$
-
$4x - x^2 = 0$
$4 - x = y$
<table><tr><td>x</td><td>0</td><td>4</td></tr><tr><td>y</td><td>4</td><td>0</td></tr></table>
x = 0 or x = 4</td><td>B1
B1
B1
B1</td><td></td></tr>
<tr><td></td><td></td><td>10</td><td></td></tr>
</table>

<table>
<tr><td>14</td><td>$\frac{2x}{3}+\frac{3x}{4}\le 9.5+5.5$
$\frac{8x+9x}{12}\le 15$
$17x\ge 180$
$x\le\frac{180}{17}$
$-\frac{x}{3}-\frac{3x}{4}<18-9.5$</td><td>M1</td><td></td></tr>
</table>

	$\frac{-4x-9x}{12} < 8.5$ $-\frac{13x}{12} < \frac{17}{2}$ $-13x < 102$ $x > -\frac{102}{13}$ $-\frac{102}{13} < x \leq \frac{180}{17}$ $-7\frac{11}{13} < x \leq 10\frac{10}{17}$	M1 A1	
		3marks	

15. *The diagram below shows the graphs of*

$Y = \frac{3}{10}x - \frac{3}{2}$, $5x + 6y = 30$ and $x = 2$

By shading the unwanted region, determine and label the region R that satisfies the three inequalities;

$Y \geq \frac{3}{10}x - \frac{3}{2}$, $5x + 6y \geq 30$ and $x \geq 2$ (2 mks)

L_1 $y = \frac{3}{10}x - \frac{3}{2}$ at (0, 0)

*$0 \geq 2$ **

Picking P(0,0)

$0 \geq -\frac{3}{2}$

L_2 $5x + 6y = 30$

At (0, 0) $5x + 6y \geq 30$

*$0 \geq 30$ **

16. *$7s + 3t = 2950$ ………………….(i) x 5*

$3s + 5t = 2750$ …………………..(ii) x 3

$35s + 15t = 14750$

$\underline{9s + 15t = 8250}$

$26s = 6500$

$s = 250$

$t = \frac{2750 - 3(250)}{5} = 400$

$2t + 2s = 2(400) + 2(250)$

= shs. 1,300

17. *Let the cost of a biro be b*

Pencil be p

$2b + 5p = 120$ x 3

$3b + 2p = 114$ x 2

$6b + 15p = 360$

$\underline{6b + 4p \quad = 228}$
$11p = 132$
$P = 121$
$2b + 60 = 120$
$2b = 60$
$b = 30$
∴*The cost of 1 biro is 30/=*
The cost of 1 pencil is 12/=

18. *Let son's present age be n yrs*
Father's age is 2n yrs
Ten years ago: son's age $\Rightarrow n - 10$
Father's age $\Rightarrow 2n - 10$
Son's present age = 30yrs
Father's present age = 2x 30 = 60yrs

19. $2x + 21 > 15 - 2x$
$4x > 0.6$
$x > -1\frac{1}{2}$
$\Rightarrow -1\frac{1}{2} < x \leq 3$
Values are $-1, \ 0, \ 1, \ 2, \ 3.$

$15 - 2x \geq x + 6$
$-3x \geq -9$
$x \leq 3$

20. $y = -2x + 4$
gradient of h line is ½
Equation $\frac{y + 4}{x + 1} = \frac{1}{2}$
$2y + 8 = x + 1$
$2y - x + 7 = 0$

21. $2s + 3t = 1750$
$3s + 2t = 1500$
$4s + 6t = 3500$
$9s + 6t = 4500$

$2t = 1500 - 600$
$t = 450$

$5s \quad = 1000$
$s \quad = 200$
Shirt = sh 200
Trouser = sh 450

22. *Let* $r = 3.818181\ldots$
$100r = 381.818181$
$99r = \frac{378}{99} = \frac{42}{11}$
$= 3\frac{9}{11}$

23. (a) *Let cost of pencils be x and biro pens to be y*
$4x + 6y = 66$
$2x + 5y = 51$

$4x + 6y = 66$
$4x + 10y = 102$
$4y = 96$
$y = 24$

Correct substitution
$\therefore x = 3$
Pencils = shs.9
Biro pens = 3

(b) $9p + 3b = 228...(i)$
$b – y = 4$
$b = 4 + r$ ....(ii)
substituting for b in ....(i)
$p^2 + 5p – 288 = 0$

$p = \frac{-5 \pm \sqrt{25} – 4 x 1 x -228}{2 x 1}$
P = 13 (to the nearest whole no.)
$b = 4 + 13 = 17$

24. $3x – 2 (x + 2) = 21$
$X = 25$
Large No = 25 + 2 = 27
$\therefore$ *product = 25 x 27 = 695*

25. $x -20 + 3x = 180^oC$ **Attempt to get x by using $\iota + e = 180^o$**
$4x = 200$ **$e = \frac{(2n-4)90}{n}$**
$x = 50^o$
number of sides

26. $5x + 4y = 6160$
$\underline{4(3x + y = 2800}$
$-7x = - 5040$
$x = 720$
$y = 640$
$4(720) + 2(640) = 4160$

27. $2x + 3y = 390$
$5x + 2y = 810$
$15x + 6y = 2430$
$\underline{4x + 6y = 780}$
$11x = 1650$
$x = 150$
A pair of trouser =sh150
A shirt = sh30

14. Equations

1	$2x – 3 = y$ $x^2 - x(2x - 3) = -4$ $x^2 - 2x^2 + 3x = -4$ $-x^2 + 3x + 4 = 0$ $x^2 - 3x - 4 = 0$ $-4, +1$	M_1 M_1 A_1	✓partial fact or equivalent ✓both answers of x or y

	$x^2-4x+x-4=0$ $x(x-4)+1(x-4)=0$ $(x+1)(x-4)=0$ $x=4$ $x=-1$ When $x=4y=5$ $x=-1y=-5$	B_1	✓both answers
		4	
2.	Length of the frame (x + x + 5) = (2x + 5)		
	Width of the frame (½ x + ½ x + 5) = (x + 5)	B1	Dimension with unknowns
	Area = (2x + 5)(x + 5)		
	(a) 75 = 2x2 + 10x + 5x + 25	M1	
	2x2 + 15x – 50 = 0	A1	
	(b) 2x2 + 15x – 50 = 0		
	2x2 + 5x + 20x – 50 = 0		
	x(2x – 5) + 10(2x – 5) = 0	M1	
	(x + 10)(2x – 5) = 0		Factorization
	x = -10 or 2 ½	A1	
	length (2 x 5/2 + 5) = 10cm	B1	
	width (5/2 + 5) = 7.5cm	B1	
	(c) Area not covered = area of frame – area of photo		
	= 75 – 25	M1	
	= 50cm2		Difference in area
	% area = 50/75 x 100	M1	
	= 66.67%/66 2/3%	A1	
		10	
3.	$24x\left(\frac{1}{4x}\right)=24x\left(\frac{5}{6x}\right)-7(24x)$	M1	Multiplication by LC.
	$6=20-168x$	M1	
	$\frac{-14}{-168}=x$		
	$\frac{1}{12}=x$	A1	
4	3(25x2 – 9y2)	M1	For 3 out
	3(5x – 3y) (5x + 3y)	A1	
		2	
5.	$\frac{x-3}{5}=4-\frac{x-2}{2}$		
	$10\left(\frac{x-3}{5}\right)=10\times4-10\left(\frac{x-2}{2}\right)$	M1	
	2(x – 3) = 10(4) – 5(x – 2)	M1	
	2x – 6 = 40 – 5x + 10		
	7x = 56		
	x = 8	A1	
		03	

8. $\frac{(p + 2m)(p - 2m)}{2m - p\ m - 3p}$ B1 √ factors for numerator

B1 √ factors for denominator

$= \frac{-\ p + 2m}{m - 3p}$ B1

3

9. Let of goats be a

.” .” chicken be b

$\left.\begin{array}{l} a + b = 45 \\ 4a + 2b = 100 \end{array}\right\}$ B1 for both equations

$a + b = 45$

$\underline{-2a + b = 50}$ M1 method for solving any of the unknown

$-a = -5$

$a = 5$

$b = 40$

$\left.\begin{array}{l} \text{Goats were } 5 \\ \text{Chicken were } 40 \end{array}\right\}$ A1

3

10. Ken – suit;

Let the number of suits bought be x and the cost per suit be y

Then $xy = 57600$

$y = \frac{57600}{x}$ M1 Eq

Umoja

No. of suits bought is $(x + 4)$

Cost per suit is $(y - 480)$

$= P(x + 4)(y - 480) = 57600$ M1 Eq

$y = (x + 4)(\frac{57600}{x} - 480$ M1 Sub of y

$- 480x^2 - 1920 + 230400 = 0$

$x^2 + 4x - 480 = 0$ M1 formation of quadratic eq

$(x - 20)(x + 24) =$ M1 fact

No of suits = 20 A1

(b) Cost per suit = $\frac{57600}{20}$ M1 exp of cost

Sh. 2880 A1

Profit per suit = Sh. 720

$\therefore$ % profit = $\frac{720}{2880}$ x 100 M1 exp

= 25% A1

10

11.	13824 = 2^9 x 3^3 0.000125 = $\frac{1}{8000}$ = $\frac{1}{2^6 x 5^3}$ $\therefore = \left(\frac{2^9 \times 3^2}{2^6 \times 5^3}\right)^{-\frac{1}{3}}$ $= \left(\frac{2^6 \times 5^3}{2^9 \times 3^3}\right)^{\frac{1}{3}}$ $= \left(\frac{5}{2 \times 3}\right)$	M1 M1 A1	Reciprocal Prime products
		03	
12.	$64^x + 4^{3x} = 128$ $(4^3)^x + 4^{3x} = 128$ $4^{3x} + 4^{3x} = 128$ $2(4^{3x}) = 128$ $4^{3x} = 64 = 4^3$ $\therefore 3x = 3$ X = 1	M1 M1 A1	
		03	
13.	$4x = 3y \Rightarrow y = {}^4/_3\, x$ $\frac{\frac{1}{3}x^2 - 4x\left(\frac{4}{3}x\right) + \left(\frac{4}{3}x\right)^2}{4x^2 + \left(\frac{4}{3}x\right)^2}$ $= \frac{\frac{1}{3}x^2 - \frac{16}{3}x^2 + \frac{16}{9}x^2}{4x^2 + \frac{16}{9}x^2}$ $= \frac{-\frac{29}{9}}{\frac{52}{9}} \qquad = -\frac{29}{52}$	**M1** **M1** **M1** **A1**	x = ¾ y For ✓subst For ✓ num For ✓ den
		04	
14.	$\frac{3^5 \text{ x } 3^{2y}}{3^6 \text{ x } 3^{y-2y+1}} = 3^4$ $\frac{3^{5+2y}}{3^{7-y}} = 3^4$ y = 2	**M1** **M1** **A1**	For ✓ factorization For ✓ simplification

		03	
15.	$5(9a^2-4b^2)$ $5(3a-2b)(3a+2b)$ $When\ a=5; b=3$ $=5(3\times5-2\times3)(3\times5+2\times3)$ $=5(15-6)(15+6)$ $=5\times9\times21$ $=945$	**B1** **M1** **A1**	For ✓ simplied factorization ✓ substitutes and simplification
		03	
16.	$\frac{3^3\times3^n-3\times3^n}{4\times3^2\times3^n}$ $\frac{3^n(27-3)}{3^n\times36}$ $\frac{24}{36}$ $\frac{2}{3}$	**M1** **M1** **A1**	Condone 0.667
		03	

17.	27^{-m} x $\frac{1}{81}$ = 243 $(3^3)^{-m}$ x $\frac{1}{3^4}$ = 3^5 $3^{-3m-4} = 3^5$ - 3m – 4 = 5 - 3m = 9 m = -3	M1 M1 $\underline{\text{A1}}$ 3	Exp. in powers of 3 Equating powers of 3

18.	4p + 6q = 184….x3 3p + 8q = 222….x4 12p + 18q = 552 12p + 32q = 888 $\frac{\cancel{14}q}{\cancel{14}} = \frac{336}{14}$ q = 24 4p + 144 = 184	M1 M1	Formation of Equation Elimination of p or q or equivalent

	$4p = 40$ $P = 10$	A1 3	In both

19.	Old area = 80 x 60 = 4800m^2	M1	✓old area
	New area = $(80 – 2x)(60 – 2x) = 2$		
	$\Rightarrow 4x^2 – 280x + 4800 = 2/3 \times 4800$	M1	✓ exp
	$4x^2 – 280 + 1600 = 0$	M1	✓solving
	X = 6.28m	A1	CAO
		04	

20	$4t + 3n = 4250$ $6t + 2n = 4000$	B1	2 equations
	$3t + n = 2000$ $9t + 3 = 6000$ $4t + 3n = 4250$	M1	solving
	$5t = 350$ $n = 2000 - 1050$ $= 950$	A1	For t and n
	$3 \times 350 + 3 \times 950 = 3900$	B1	

21. Through A/C in Kenya
1000000 X 76.84 = Shs.7684000
through A/C in UK
$\frac{1000000}{1.53} \times 115.70$ *= Shs.7,562,091.15*
Through UK less by
768400 – 7562091.85 = 121,908.85

22. 6000 turn ______ 6000 X 84.15
= Kshs.504900
Balance = 504900 – 300000
= 204900
∴ sterling pound = $^{204900}/_{121.47}$
= 1686.8

23. In Rand = $\frac{2800265}{10.0166}$ *= 279562.4264*

Expenses = (115,700 + 97000 + 53689)
= 266389 Rand
Remainder = 279562.4264
<u>266,389.000</u>
13, 174.4264
Amount in Kshs. = 13174.4264 x 9.9399
= 130,942.50

24. *Kshs. (3000 x 1.89) = 5670*
Remain = 5670 – 4695 = 75
Francs = $\left(\frac{975}{1.95}\right) = 500$

25. *Amount in dollars = 75 x 40 = 3,000*
Amount in Ksh = 3000 x 81.40 = 244,200/=
Less commission <u>4,000</u>

Total received sh 240,200

26. *Hong Kong 8105,000 x 9.74 = ksh.1022700*
Amount spent in Kenya = 403879
Balance = 1,022,600 – 403,879 = 618,821
Amount in South Africa = $\frac{618821}{12.11}$ *= 51100rands*

27. *500000 J yen into Kshs.=* $\left(\frac{500000}{100} \times 66.5\right)$
= Kshs. 330,250
Amount spend in Kenya= Kshs. 16200
Remained with Kshs. (330250 – 16200)
= Kshs. 314,040
Kshs. 314040 into Euros:
$= \left(\frac{314040}{78.15}\right)$
= 4,018.554063Euros
He left Kenya with = 4,019 Euros (nearest Euro

28. *1 \$ ——— Kshs. 77.43*
5600\$ = (5600 x 77.43)
= 433608
Spent 201,367
Remainder = (433608 – 201367)
= 232241
1SR ______shs.9.51
Shs.232241
$\left(\frac{1 \times 232241}{9.51}\right)$
= shs.24420.715

29. *1UK £ = 125.30*
9000 UK £ = 125.30 x 9000

= 1,127,700

Commission = 5/100 x 1,127,700 = 56,385

He got 1,071,315

Expenditure = ¾ of 1,071,315 = 803,486.25

Amt. left = 267,828.75

In US \$ = $\frac{267,828.75}{63.20}$

= 4237.7966 *≃ 4237 US \$*

30. *1 sterling pound = Kshs.120*

? = Kshs.100000

$^{100000}/_{120}$ *= 833.3 sterling pounds*

1 sterling pound = 1.79 U.S dollars

833.3 = ?

= 833.3 x 1.79 = 1491.7 dollars

1 U.S dollar = Kshs.78

1491.7 dollars = Kshs?

1491.7 x 78 = 116350 Kenya shillings

31. *Amount received in Kenya shillings*

$= \frac{\Sigma 50,000 \text{ x Shs.}120.7131}{\Sigma}$ *= Kshs.6035655*

Amount received in sterling pound

$= \frac{1\Sigma \text{ x Kshs.}6035655}{120.9294}$ $= \Sigma 49910.568$

32. *Sh(20000 x 147.86) = sh.2957200*

To US Dollars = $\frac{44700}{74.5}$ *= 6000*

He received 6000 US Dollars

33. *a)* $6a + 7a - 2b - 4b + 2$

$= 13a - 6b + 2$

b) $\frac{2x-2}{2x} - \frac{3x+2}{4x} = \frac{2(2x-2)-(3x+2)}{4x}$

$= \frac{4x - 3x - 4 - 2}{4x}$

$= \frac{x-6}{4x}$

15. Commercial arithmetic

1	(a) 48, 000 – 20, 000 = 28, 000	M_1	
	$\frac{8}{100}x = 28,000$ $x = 28,000 \times \frac{100}{8}$	M_1	
		M_1	✓exp
	= Ksh. 350, 000 Sales 350, 000 + 100, 000 = 450, 000	A_1	
	(b) (i) Sales in February	M_1	

	$\frac{118}{100}\times 450,000$ $= Ksh.531,000$ $531,000-100,000$ $431,000\times\frac{8}{100}$ $=34,480$ (ii) $\frac{75}{100}\times 531,000$ $= Ksh.398,250$ Commission $298,250\times\frac{8}{100}$ $= Ksh.23,860$ $= Ksh.23,860+20,000$ $= Ksh.43,860$	M_1 A_1 M_1 M_1 A_1	
2	Total expense (a) $InUsh.1050000+60\times Ush1016+\frac{55}{100}\times 1050000$ $=1050000+60960+577500$ $=Ush1688460$ $\frac{1688460}{24.83}$ In Ksh. $Ksh.68000.81$ (b) $\frac{60960+577500}{1688460}$ $= 37.81\%$ (c) $Ksh.\frac{68000.81}{0.0714}$ $= Tsh952,392.30$ (d) $\frac{68000.81-\frac{1050000}{24.83}}{\frac{105000}{24.83}}\times 100$ $= 60.81\%$	M1 M1 A1 M1 A1 M1 A1 M1 M1 A1	✓exp ✓attempt to simplify
3	A = 3P $\therefore 3P = P\left(1+\frac{20}{100}\right)^n$ 3 = (1.2)n $\log 3 = n\log 1.2$	M1 M1 A1	

	$n=\frac{\log 3}{\log 1.2}$ $=6.0254$ $\therefore 6 years$		
		3	
4.	100 Yens = 63.16 (Bank sold Yen) 36632.8 Yen = $\left(\frac{36632.8\times 63.16}{100}\right)$ = 23137.27648 = ksh 23137.	M1 A1	
		02	
5.	No of good eggs = 24 x 30 – 54 = 666 Total cost = 24 x 225 = shs 5400 Cost with profit of 22% expected = $\left(\frac{122}{100}\times 5400\right)$ = 6588 New price per egg = $\frac{6588}{666}$ = 9.892 = sh 10.00	M1 M1 M1 A1	
		04	
6.	$A=P\left(1+\frac{r}{100}\right)^n$ $n=6\ r=4\%\ p=10,000$ $A=10,000\left(1+\frac{4}{100}\right)^6$ $=10,000(1.04)^6$ $=12,653.19$ $\text{int} erest=12,653-10,000$ $=sh.2,653$	M1 A1 M1 A1	
		04	
7	½ of 2400E = 1200E In ksh. = 1200E x 95.65 = Ksh.114,780 Number of dollar = Kshs.114,780 76.50 = sh1500.39	M1 M1 A1	
		3	

8	SECTION B (50 MARKS) Selling price = 88/100 of marked price (a)

	(i) 4800 = 88/100 of m.p 4800/88 x 100 = m.p = sh.5454.54 (ii) 145/100 of buying price = 4800 buying price = $\frac{48000 \text{ x } 100}{145}$ = 3310.34 (b) $\frac{5454.54 - 3310.34}{3310.34}$ x 100 = 0.6477 x 100 = 64.77% C) $\frac{87.5}{100}$ of 3310.34 = 2,896.55		
10	$\frac{100}{72}\times 1440 = 2000$ $\frac{100}{2000}\times 100$ 5%	M_1 M_1 A_1 3	
11	200s + 600t = 22 000 250s + 510t = 22 700 1000s + 3000t = 110 000 1000s + 2040t = 90800 960t = 19 200 t = 20 s = 40 (0.5 × 200 × 20) + (0.3 × 510 × 40) 2500 + 6120 = 8620 $(0.5\times200\times20)+(0.3\times600\times40)$ 2000×7200 $\frac{9200}{48000}\times100$ % 19%	B1 M1 A1 B1 M1 M1 A1 M1 M1 M1	For both Elim For shorts For trousers
12.	(a) Cost of tonne of rice is US $ 500 Shipping cost of rice = 20/100 x US$ 500 = US$ 100 Transport to Nairobi = 5/100 x US$ 500 = US$ 25 Custom duty = 10/100 x US$500 = US$ 500 = US$ 50 Total cost in dollars = 500 + 100 + 50 + 25 =	 B1 B1 B1 A1 B1	

	US$ 675 Converting this to ksh = 76.60 x 675 = ksh 51705 (b) To make profit of 20% he must sell rice at 120% of the cost price per tonne Selling price of a tonne of rice = 120/100 x sh 51705 = ksh 62046 1 tonne has 1000kg, selling price of 1kg of rice = 62.046 = sh 62.00 (c) Total collection = sh 62046 in US dollars this becomes $= \frac{62046}{78.20}$ = US$ 793.4271 Actual profit = US$ 793.4271 – 675 = 118.4271 Actual percentage = 118.4271/625 x 100 = 17.545%	B1 B1 B1 B1 A1	
		10	

15.	Total exp = 600000 + 100000	M1
	= Sh. 700000	
	Profit = 108000 – 700000	
	% profit = $\frac{380000}{60000}$ x 100	
	$63^1/_3$ %	A1
		3
16.	(a) Swiss Franc = $^{52}/_{1.28}$	M1
	= 40.625	A1
	(b) Kenya shillings = 40.625 x 45.21	
	= 1837	B1
		3

17.	Let the rates be x% and y% respectively $\frac{x}{100}$ x 50000 = 2250 $\frac{y}{100}$ x 45000 = 2250 $\therefore$ x = 4.5% y = 5%	M1 M1 A1	
		03	
18.	Sitienei – x Lagat – 1.1x Rotich – 1.155x Diff = 1.155x – 1.1x = 0.55x = 110,000 X = 2,000,000 Rotic paid 1.155 x 200,000 = 231000	M1 M1 A1	
		03	
19.	5000 x 84.15 = sh. 420750	**M1**	

	420750 – 289850 = sh. 130900 Amount = $\frac{130900}{65.45}$ x 100 = 200,000 Japanese Yen	**M1** **A1**	
		03	

20 a.)		M1	
	$A = 1200000\ (1 – {}^{8}/_{100})^{2}$		
	$1200000\ (0.92)^{2}$	M1	
	= 1,051,680		
	$1015680\ (1-{}^{12}/_{100})^{4}$ $1015680\ (0.88)^{4}$	M1	
	= 609098.58	A1	
b.)	${}^{125}/_{100}$ x 609098.58	M1	
	= 761373.23	A1	
	$761373.23 = 1200000(1- r/_{100})^{72}$		
		M1	Follow thro' if A1 is missing
	$(1/\ {}^{r}/_{100})^{72} = 0.6344776$		
	${}^{72}/_{72} \log (1- r/_{100}) = {}^{-0.1975836}/_{72}$		
		M1	
	$\text{Log}(1- {}^{r}/_{100}) = {}^{-}\ 0.0027442173$		
	$1-{}^{r}/_{100} = 0.9937011$	M1	
	${}^{r}/_{100} = 0.0062988$ r = 0.62988 % p.m.	A1 10	
			A1√ if A above is lost.

21.	50x + 25y = 200 2x + y = 8…….(i)	M1	✓eqn (i)

	$50x+\frac{28}{100}+\frac{24}{100}\times 25y=53.50$ $14x+6y=53.50$ $\therefore 2x+y=8$ $14x+6y=53.50$ $\therefore 2x+y=8$ $14x+6y=53.50$ $\therefore y=2.50, x=2.75$ $milk = Ksh.2.75,\ salt = Ksh.2.50$	M1 M1 A1	✓ eqn (ii) ✓ solving ✓ both
		04	
22.	Yen = 1000 x 105 x $\frac{105}{100}$ + 1260 = 111510 Yen Ksh = 111510 x $\frac{63}{105}$ = Ksh. 66906	M1 A1 B1	
		03	
23	$C.P=\frac{240.50}{125}\times 100$ $=sh192.40$ R.P 240.50 – 22.90 = Sh 217.60 % profit = $\frac{217.60-192.40}{192.40}\times 100$ $=13.1\%$	M1 M1 A1	
		3	
24	$7\left[x^2-\frac{1}{4}(y+1)^2\right]$ $=7\left(x-\frac{1}{2}(y+1)\right)\left(x+\frac{1}{2}(y+1)\right)$ When x = 5 and y = 8 $7\left(5-\frac{9}{2}\right)\left(5+\frac{9}{2}\right)$ $=7\times\frac{1}{2}\times\frac{19}{2}$ $=33.25$	B1 B1 B1	
		3	
25	$1500\times 78.43=sh.117645$ $\frac{117645}{79.25}=\$1484.5$ $loss:1500-1484.5=\$15.5$	M1 M1 A1	
		3	

26. $2x - 3y + 6 = 0$

$-3y = -2x - 6$

$y = \frac{2}{3}x + 2$

When $y = 0$ $x = -3$

$x = 0$ $y = 2$

∴ Co-ordinate of y – intercept is (0,2)

” ” x – intercept is (-3,0)

$\therefore \angle CAO = \tan^{-1}\frac{2}{3}$

$= 33.69^o$

$\therefore \angle\theta = 180 - 33.69^o$

$= 146.31^o$

27. Point y $\left(\frac{4 + -2}{2}, \frac{7 + -1}{2}\right) = (1, 3)$

grad AB $= \frac{7 + 1}{4 + 2} = \frac{8}{6}$

grad xy $= -\frac{3}{4}$

grad xy $= -\frac{3}{4}$

$\frac{y - 3}{x - 2} = -\frac{3}{4}$

$y = -\frac{3}{4}x + \frac{15}{4}$

28. $Y = 3x - 1$

$M = 3$

$M_1m_2 = -1$

$M_2 = -\frac{1}{3}$

$\frac{y - 3}{x - 2} = -\frac{1}{3}$

$3y - 9 = -x + 2$

$\frac{3y}{3} = \frac{-x}{3} + \frac{11}{3}$

$Y = \frac{x}{3} + \frac{11}{3}$

29. Pt T is $\frac{1 + 5}{2}, \frac{4 + 10}{2} = (-2, 7)$

grad. of grid xy $= \frac{10 - 4}{-5 - 1} = \frac{14}{-6} = \frac{-7}{3}$

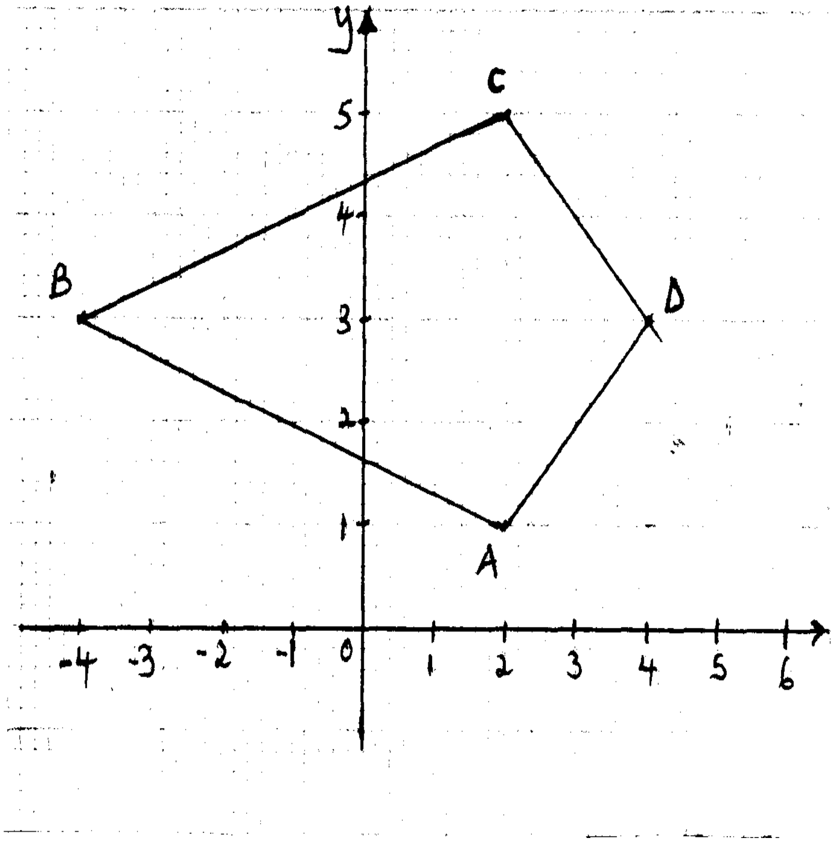
$\therefore$grad of $L_2 = \frac{3}{7}$

Take a general pt P(x,y) on L_2

$\Rightarrow \frac{y - 7}{x - 2} = \frac{3}{7}$

$$\left.\begin{aligned} &\Rightarrow 7y - 49 = 3x + 6 \\ &\quad 7y = 3x + 55 \\ &\text{Or } y = \underline{3x} + \underline{55} \end{aligned}\right\} \qquad \textbf{Equation of } \boldsymbol{L_2}$$

30. a, b



(c) Name : a kite

31. *(a) Grad of line QP = $\frac{4-2}{1-3} = \frac{2}{-2}$ = -1*

Grad of line QR = 1

Take a pt Q(1,4) and T(x,y) on line QR

$\frac{y-4}{x-1} = 1$

y – 4 = x -1

y = x + 3 .....equ. of QR

(b) y= x+3 ...(i) Equ of QR

y = 3x -7 ...(ii) Equ. of Pr

Solving simultaneously ;:

x +3 = 3x -7

2x = 10

x = 5

Substituting ; y = 8

∴R is the pt (5,8)

(c) $\underset{\sim}{PS} = \underset{\sim}{QR} = \begin{pmatrix}5\\8\end{pmatrix} - \begin{pmatrix}1\\4\end{pmatrix} = \begin{pmatrix}4\\4\end{pmatrix}$

$\underset{\sim}{OS} = \begin{pmatrix}3\\2\end{pmatrix} + \begin{pmatrix}4\\4\end{pmatrix} = \begin{pmatrix}7\\6\end{pmatrix}$

S is the point (7,6)

32. a) Gradient OA = Gradient of CB

$\frac{-1-0}{2-0} = -\frac{1}{2}$

Gradient of CB

$\frac{y-3}{0-4} = -\frac{1}{2}$

$2y - 6 = 4$

$2y = 10$

$y = 5$

b) i) $AN = ON - OA = \frac{1}{2}OM - OA$

$OM = OA + \frac{1}{2}AB = (2) + \frac{1}{2}(2)$

$= 3$

$AN = \frac{1}{2}\begin{pmatrix}3\\1\end{pmatrix}\begin{matrix}-2\\-1\end{matrix} = \begin{pmatrix}\frac{1}{2} & -\frac{1}{3}\end{pmatrix}$

$= \frac{1}{2}$

ii) $NC = OC - ON$

$= \begin{pmatrix}0\\5\end{pmatrix} - \begin{pmatrix}\frac{3}{2}\\\frac{1}{2}\end{pmatrix} = \begin{pmatrix}-\frac{3}{2}\\\frac{1}{2}\end{pmatrix}$

iii) $AC = OC - OA = \begin{pmatrix}0\\5\end{pmatrix} - \begin{pmatrix}2\\-1\end{pmatrix} = 2\begin{pmatrix}-1\\3\end{pmatrix}$

c) $AN = \frac{1}{2}\begin{pmatrix}-1\\3\end{pmatrix}$

$NC = \frac{3}{2}\begin{pmatrix}-\frac{1}{3}\end{pmatrix}$

$4AN = AC$ And A is a common point hence A, N, C lie on a straight line.

33. a) Δ ABC line AB = 7 cm and BC = 8 cm.

Construction of ∡60°

(b) AC = 7.6 ± 0.1 and

∡ACB = 53 ± 1°

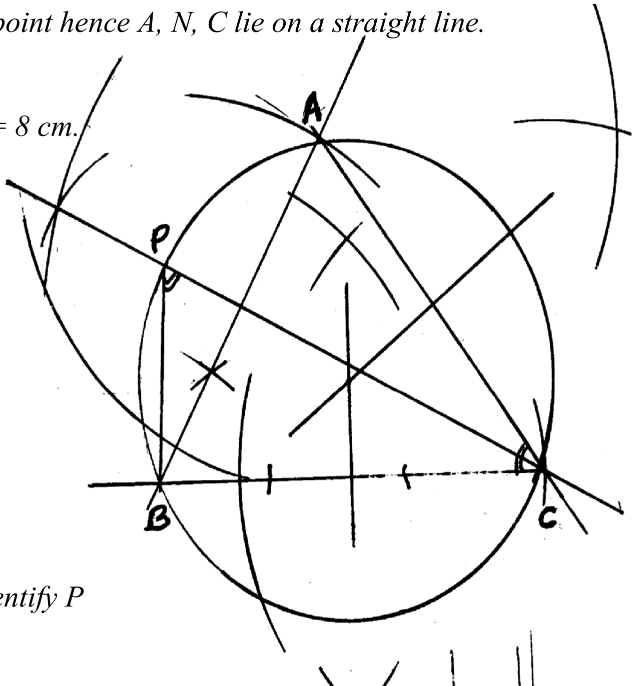
(c) 2 sides bisector <u>1</u>

Circle drawn radius 4.4. ± 0.1

(d) Bisect ∡ACB

Bisection line to cut the circle to identify P

∡PBC measure ≡



AB= 7cm, BC = 8cm | B1
B1 | check

(a) $AB = 7\ cm$, $BC = 8\ cm$

$\measuredangle ABC = 60^o$

(b) $AC = 7.6 \pm 0.1\ cm$

$\measuredangle ABC = 53^o \pm 0.1$

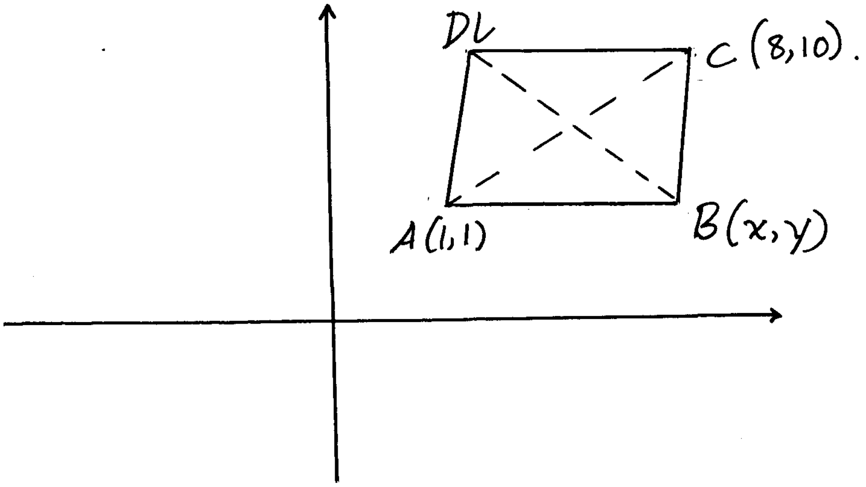
(c) Perpendicular bisectors of any two sides.
Circle drawn
Radius = $4.4. \pm 0.1.$ cm

(d) $\measuredangle ACB$ bisected
Bisection line drawn to cut circle at P

$\measuredangle BPC = \measuredangle BAC = 67^o$

$\measuredangle PBC = 88 \pm 0.1^o$

34.



$$M\left(\frac{1+8}{2}, \frac{1+10}{2}\right) = M(4.5, 5.5)$$

b) $AB: 4x - 5y = -1 \times 2$
$BC: 5x - 2y = 20 \times 5$
$8x - 10y = -2$
$\underline{25x - 10y = 100}$
$-17x = -102$
$x = {}^{102}/_{17} = 6.0$
$24 - 5y = -1$
$5y = -25$
$Y = 5$
$\therefore \underline{B(6,5)}$

$\frac{x + 6.0}{2} = 4.5$ $\qquad x = 3$

$\frac{y+5}{2} = 5.5 \qquad y = 6$

$\therefore$ D (3,6)

c) $AB = \sqrt{(16-1)^2 + (5-1)^2}$

$\sqrt{25+16}$

$\sqrt{41} = 6.40$ (units)

35. Mid ordinate

Area = 1.2 (6.2 + 4.3 + 2.6)

= 15.72

16. Coordinates and graphics

1.		
	(i) $k\left(\frac{3-7}{2},\frac{4+2}{2}\right) = (-2,3)$ $p\left(\frac{3+1}{2},\frac{4-2}{2}\right) = (2,1)$	B1 for both p and k ✓
	(ii) $G_1 = \frac{3-2}{-2-2} = \frac{-1}{2}$ $G_2 = 2$ Mid $p + kp = \left(\frac{-2+2}{2},\frac{3+1}{2}\right) = (0,2)$ $\therefore equation \quad y = 2x + c$ $when \quad x = 0, y = 2, then \quad c = 2$ $hence, \quad y = 2x + 2$	B1 for both G_1 and G_2 ✓ r identified $\frac{B_1}{3}$

2. Let the exterior ∠ be x

6.5x + x = 180

$7.5x = 180^0$

x = 24

No. of sides = $\frac{360}{24}$

= 15 sides.

3. $\frac{(\cancel{2}n-4)\,90}{(2(n\cancel{-}2)-4)90} = \frac{3}{4}$

$\frac{2n-4}{2n} = \frac{3}{4}$

8n – 16 = 6n

2n = 16

$n = 8$

$(2(8) – 4)\ 90$

$= 12 \times 90 = 1080$

4. $\frac{15}{2}\,\frac{b}{2} = 60$

$15b = 60 \times 4$

$b = 16cm$ (diagonal)

└ $\Rightarrow \quad = \sqrt{8^2 + 7.5^2}$

$\therefore per = 4\ \sqrt{8^2 + 7.5^2}$

$= 43.86cm$

5. $x^2 = 7.25^2 – 5.25^2$

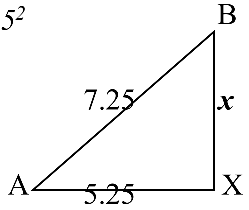
$x = \sqrt{}7.25^2 – 5.25^2$

$= 52.5625$

$\underline{27.5625} \quad -$

$\sqrt{25}$

$= 5cm$



$BC = 15.25 + 5 = 22.25cm$

Arc $CD = {}^{90}/_{360}\ X\ 3.142\ X\ 2\ X\ 22.25$

$= 34.65475$

Perimeter $= AB + BC + CD + DE + EA$

$= 15.25 + 7.25 + 22.25 + 34.95 + 5.25$

$= 84.95cm$

6. $AB^2 = 10^2 – 8^2 = 100 – 64$

$AB^2 = 36$

$AB = 6cm$

$Cos\ (90^o – x^{o)}\ {}^8/_{10} = {}^4/_5$

Attempt to get x by using $\iota + e = 180^o$

$e = \frac{(2n-4)90}{n}$

number of sides

7. $x - 20 + 3x = 180^oC$

$4x = 200$

$x = 50^o$

8. $2x + 40 + x – 25$

$3x + 15 + 9 = 180$

$3x + 15 = 29$

$9 = ½\ (3x + 15)$

$3x + \frac{3x}{2} = 180 - 15 - \frac{15}{2}$

$x = 35^o$

$x = 35 = 10^o$

$½\ (10 + 110) = 60^o$

9. $\frac{1260}{90} = 14rt\ \angle s$

Sum of interior $\angle s$

$(2n - 4)\ rt\ \angle s$

$2n-4 = 14$

$n = 9$ 9 sided polygon

10. $N = 50 + 40 = 90^o$

Alternative angles

11. $5^{3(y+1)} + 5^{3y} = 630$

Let $x = 5^{3y}$

$5^3 \text{ x } 5^{3y} + 5^{3y} = 630$

$125x + x = 630$

$x = 5$

$5^{3y} = 5^1$

$3y = 1$

$y = {}^1/_3$

12. $\frac{360}{n} + 108 = 180 - \frac{360}{n}$

$360 + 108n = 180n - 360$

$-72n = -720$

$n = 10$

13. Let exterior angle be x

$\frac{4x}{4} = \frac{180^o}{4}$

$x = 45^o$

$n = \frac{360}{\text{Exterior angle}}$

$n = \frac{360}{45}$

$= 8\text{sides}$

14. a) Let < BDC = ø

$A^2 = 5^2 + 8^2 - 2 \text{ x } 5 \text{ x } 8 \cos ø$

$\cos ø = \frac{89 - 16}{80} = \frac{73}{80} = 0.9125$

$Ø = 24°9_{1} \qquad {}_{1} {}^{=} 24° 8$

b) Area of ABD

$= ½ \text{ x } 8 \text{ x } 10 \sin 24°9^1$

$= 40 \text{ x } 0.4091$

$= 16.36\text{cm}^3 \qquad 16.37 \qquad 16.38$

15. (a) $\angle CDF = 100-60=40^o$ (exterior angle of a Δ)

(b) $\angle BDE = 20^o$ (DE is bisector of BDG)

$\therefore \angle ABD = 20^o$ (alternate angles)

16. $4x + x - 30 = 180$

$5x = 210°$

$x = 42$

$(x - 30)n = 360°$

$12n = 360°$

$n = \frac{360°}{12}$

$n = 30$

17. $180(n-20) = 1440$

$n- 2 = \frac{1440}{180} = 8$

$n = 10$

Decagon

18. $<PQR =<SRT = x$ *(Alt <SPQ //RS)*

$\therefore 5x + 3x + x = 180°$ *<'s of Δ*

$9x = 180°$

$X = 20°$

$\therefore 5 \times 20 + y = 180$

$y = 180 - 120 = 60$

19. *Let the interior ∠ be x and exterior be y*

$\therefore x + y = 180$

$+$

$\underline{x - y = 132}$

$2x \quad = 312$

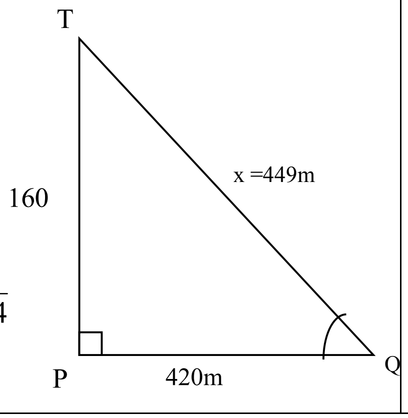
$x = 156$

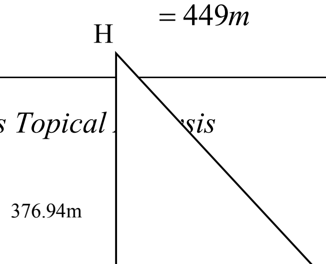
$y = 180 - 156 = 24^o$

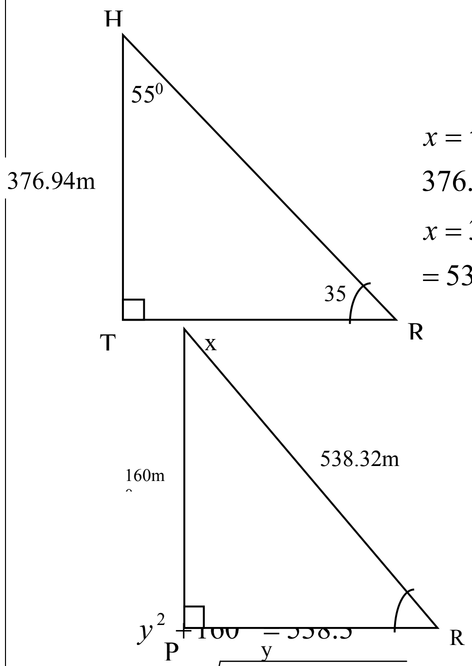
No. of sides (n) $= \frac{360^o}{24} = 15$

= 15 sides

17. Angles and Plane figures

1	$2a+b=180$ $13a-b=360$ $15a=540$ $a=\frac{540}{15}=36$ $72+b=180$ $b=180-72-108^0$	M1 M1 M1 A1	✓formation of the equations ✓attempt to solve
2	$\angle XAD=30^0$ $180-(50+30)$ $=180-80=100^0$	B1 B1	
3	$\frac{h}{100}=\tan 67^0$ $h = 160 \times \tan 67^0$ $= 376.94m$  $x^2=\sqrt{160^2+420^2}=\sqrt{25600.1764}$ $=449m$	M1 M1 A1	



	$\frac{376.94m}{449m}$ Tan ɵ = = 0.8395 $\vartheta = 40^0$	M_1
	 $x = \tan 55^0$ 376.94 $x = 376.94 \times \tan 55^0$ $= 538.32km$	M_1 A_1 M_1 M_1
	$y^2 + 160 = 538.3$ $y^2 = \sqrt{538.32^2 - 160^2}$ $y = \sqrt{264{,}188.4224}$ $= 513.99m$ $\approx 514m$	M_1 A_1

4.	$aA^2 = b^2 + c^2 - 2bc \cos A$ $4^2 = 3^2 + 6^2 - 2 \times 3 \times 6 \cos \theta$ $-29 = -36\cos \theta$ $\frac{-29}{-36} = \cos \theta$ $36.34^0 = \theta$	**M1** **M1** **A1**	Substitution Attempt to simplify
		03	

5.	$\frac{1}{3}\left(\frac{180(n-2)}{n}\right) = \frac{360}{n}$ $180n - 360 = 1080$ $180n = 1440$ $n = 8$ The polygon is an octagon	M_1 M_1 $\frac{A_1}{3}$

6.	$y = 180^0 - 130^0 = 50^0$ $x = 180^0 - (50^0 + 83^0) = 47^0$ $z = 180^0 - 47^0 - 133^0$	B1 B1 B1 3

9. Let the ex < be x^0

In < $8x^0$

$x + 8x = 180$………….. M1

$x = 20$

No of sides = $\frac{360}{20}$ M1

= 18 sides A1

3

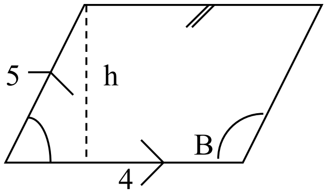
ALT

n = No. of sides

$\left(\frac{n-2}{n}\right) 180 = 8\left(\frac{360}{n}\right)$ M1M1

n = 18 sides A1

10.



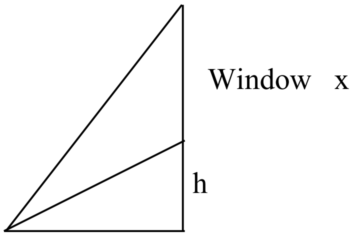
Area = 5 x sin α = 12 M1

α = 36.87^0 A1

B = 143.13^0 A1

3

11.5^0 27^0



Tan 27^0 = $\frac{h}{20}$ M1

h = 10.19m

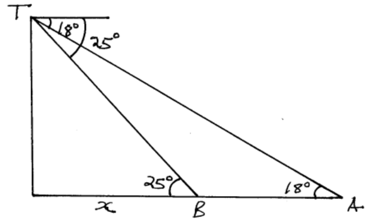
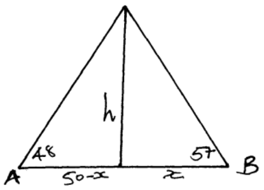
Tan 32^0 = $^x/_{20}$ M1

x = 12.50m

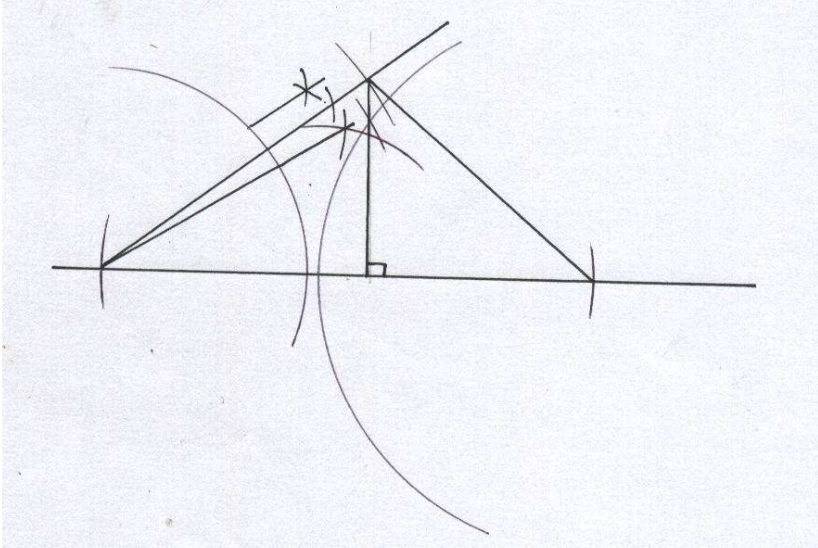
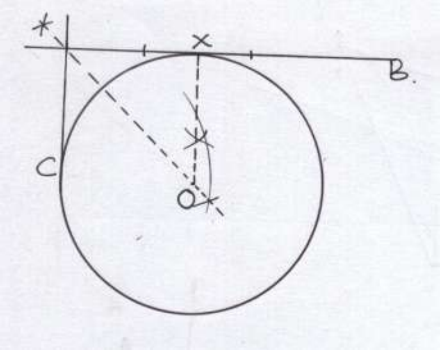
Window height = 2.31m A1

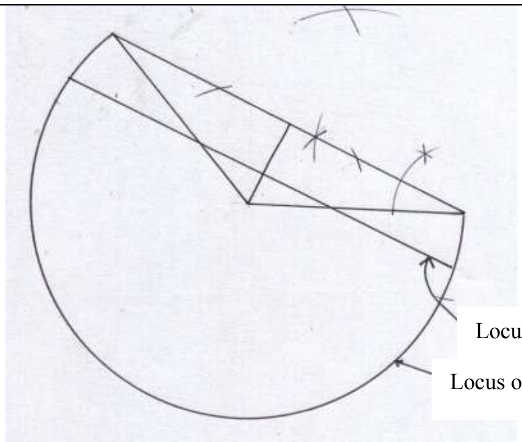
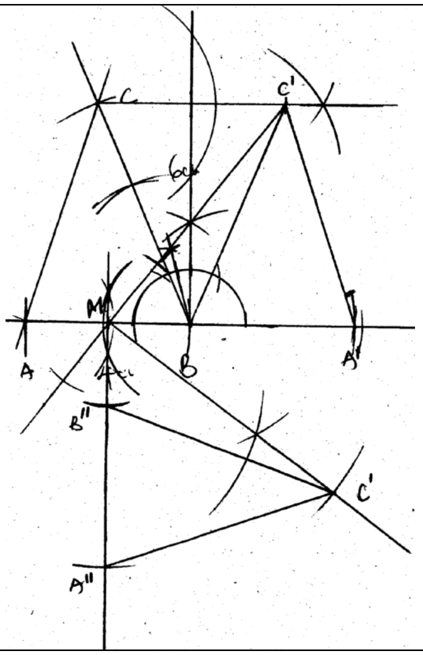
3

12.	$\frac{360^0}{n} = 18^0$ $n = \frac{360^0}{18^0}$ = 20 sides Area = (½ x 16 x $^{16}/_2$ tan 81^0) x 20 = (8 x8 x 6.3138) x 20 = 8081.66cm^2	B1 M1 A1	
		03	
13.	(a)	B2	

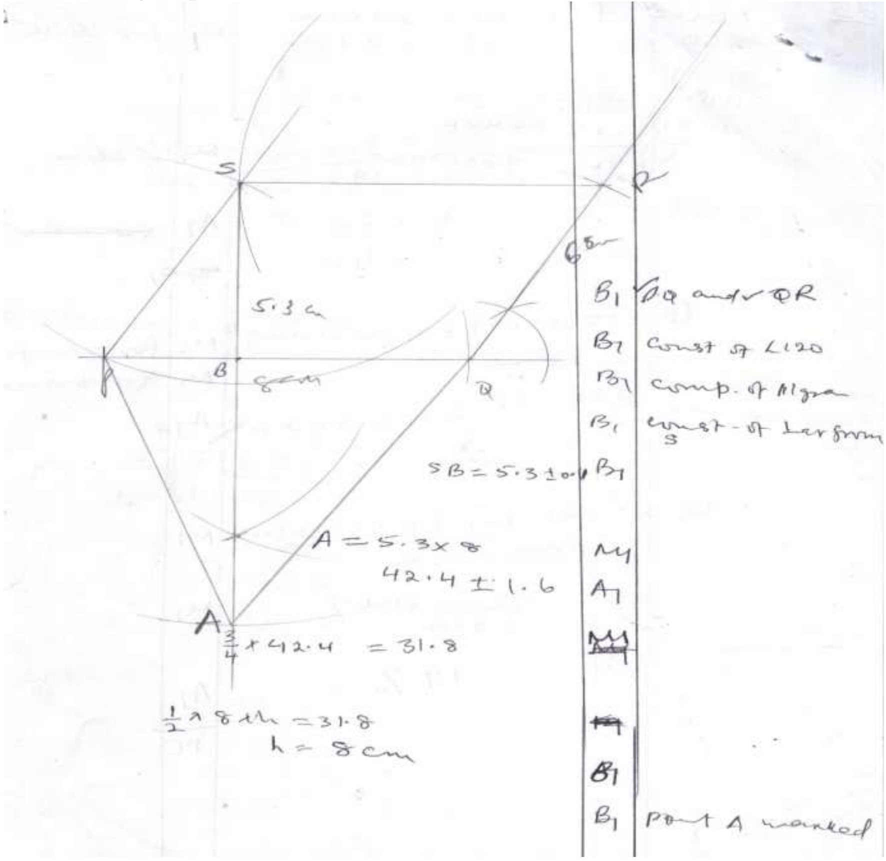
	 Sketch (b) i) $\frac{h}{x} = \tan 25^0 \Rightarrow h = x \tan 25$ $\frac{h}{x+70} = \tan 18^0 \Rightarrow h = \tan 18(x + 70)$ Equating the two equations $x \tan 25^0 = x \tan 18^0 + 70 \tan 18^0$ $x(\tan 25 \tan 18^0) = 70 \tan 18^0$ $x = \frac{70 \tan 18^0}{\tan 25^0 - \tan 18^0}$ $x = \frac{22.744}{0.1414} = 160.8$ h = 160.8tan 25 = 75m (c) Distance of A to the front of post = x + 70 = 160.8 + 70 = 230.8m	M1 M1 M1 M1 M1 A1 B1 M1 A1	
		10	
14.	{2(8) - 2} x 90 14 x 90 1260^0	M1 A1 2	
15.	 $\tan 57^0 = \frac{h}{x} \Rightarrow h = x \tan 57^0$ $\tan 48^0 = \frac{h}{50-x} h = (50 - x) \tan 48^0$ $x \tan 57^0 = (50 - x) \tan 48$ $1.53986x = 55.53 - 1.1106x$ $x = 20.95$ $distance = 50 - 20.95 = 29.045m\ or$ $20.95m$ $h = x \tan 57 = 20.95 \tan 57$ $= 32.26m$	M1 A1 M1 A1	
		04	

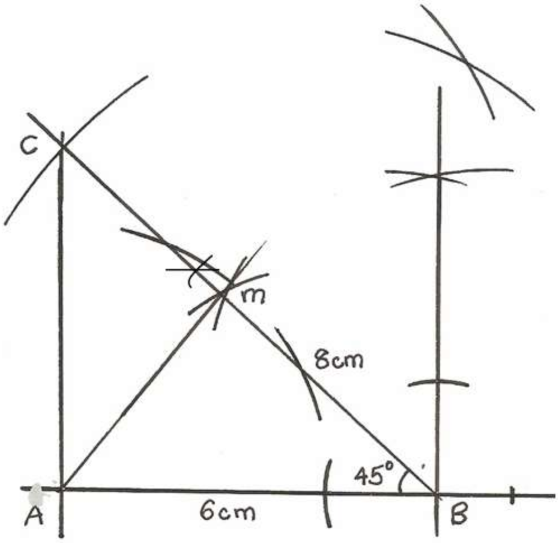
18. Geometrical constructions

1	 $CD = 3.7cm \pm 0.1$ Area of $\Delta ABC = \frac{1}{2} \times 9 \times 3.7cm$ $= 16.65cm^2$ AE=	B_1 B_1 B_1 B_1 B_1 B_1 M_1 A_1 B_1 B_1	✓conct 30^0 ✓conct 15^0 ✓AB 9cm ✓AC 6cm ✓ΔABC ✓CD Loci of E For AE
2		B_1 B_1 B_1	✓construction of 90^0at x ✓bisection of line XC and location of centre O ✓circle drawn

		3	
3	 BC = 9.4cm (± 0.1) AD = 2.7cm (± 0.1)	B1 B1 B1 B1 B1 B1 B1 B1 B1 B1	✓length AB = 5.4cm ✓construction of 300 at B ✓location of C and ABC △ ✓length of BC stated ✓identification of A as centre ✓Locus of P drawn. (Bo if circle completed) ✓dropping of perpendicular ✓length AD stated ✓his height ✓locus of Q drawn
		10	
4.		B1 B1 B1 B1 B1 B1 B1 B1 B1 B1	<67½0 constructed ABC complete AC = 5.7 ±0.1 C1Drawn A1Drawn A1BC1 completed Locating M (midpoint M of AB) B11 and A11 rotated C1 rotated A11B11C11 completed
		10	

6.



7.	 AM = 4.2cm, AC = 5.6cm (±0.1cm)	B1 B1 B1	Construction of 45° ΔABC ⊥ dropped from A to BC
		04	

9. (a) $\tan 60^0 = \frac{AC}{5cm}$ M1

AC = 8.6605CM A1

(b) A = ½ x 5 x 8.6605 M1

A = 21.65125 A1

(b) $^{60}/_{360}$ x πr^2

$^{60}/_{360}$ x 3.142 x 25 M1

= 13.091cm^2 A1

(d) Area of shaded part

Δ COA = Δ OBA, sector OCD = OCB

21.65 x 2 = 43.3025cm^2 M1

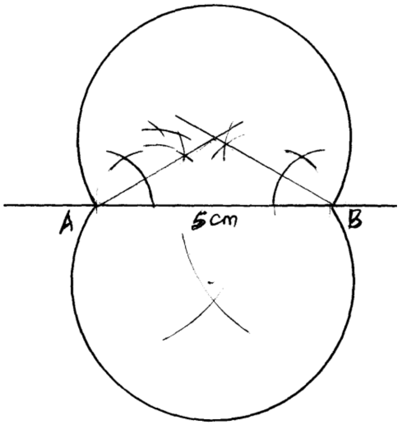
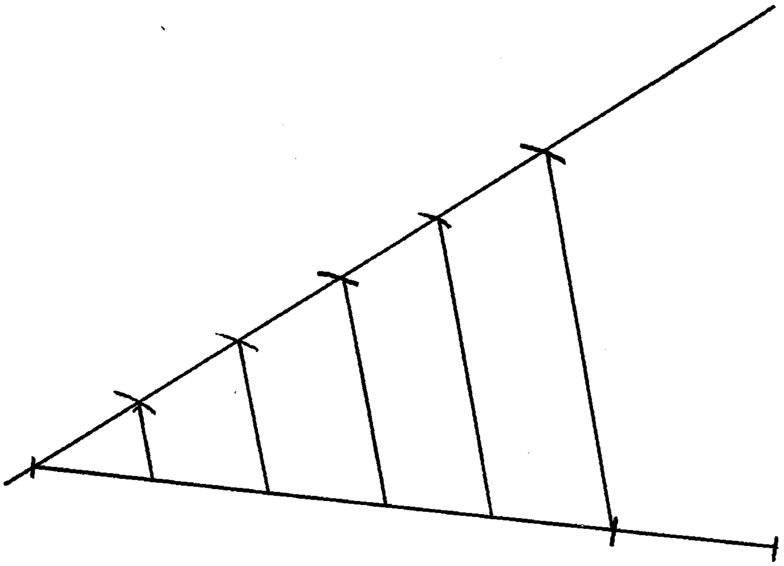
13.091 x 2 = 26.182cm^2 M1

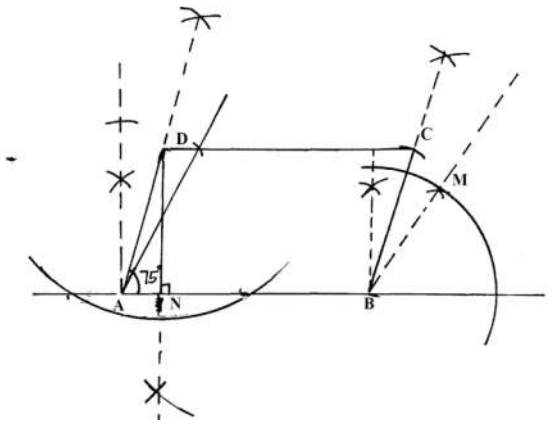
$\therefore$ Area of shaded part

43.3025 – 26.182 M1

= 17.11225cm^2 A1

10

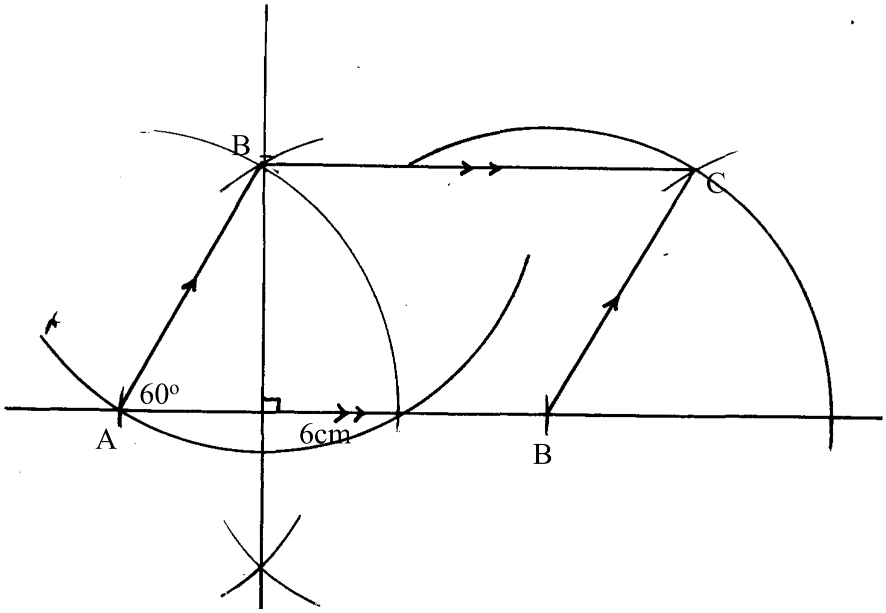
10.	 Constant angle locus	B1 B1 B1 B1	Const of 30^0 at A Const. of 30^0 at B For one arc constructed For lower arc constructed.
11.		**B1** **B1** **B1**	A line drawn slunt to touch the given line at one end. Subdivided to 5 equal Sections Parallel lines drawn from slunt line to touch the given line .All complete
		03	

12.	 a) length of ON = 3.9cm b) Area = 6x3.9 = 23.4cm^2	B1 B1 B1 B1 B1 B1 B1 B1 B1 A1	Both 90^0 & 60^{0}at A 75^0 at A 90^0&60^0 at B 75^0 drawn at point B Both AB=6cm and BC = 4cm Parallelogram completed ⊥ drawn
		10	

13. $A = 120000 (1 + {}^{8}/_{100} \times ¼)^3$

$120000 (1.02)^3 \quad = 127344.95$

14.

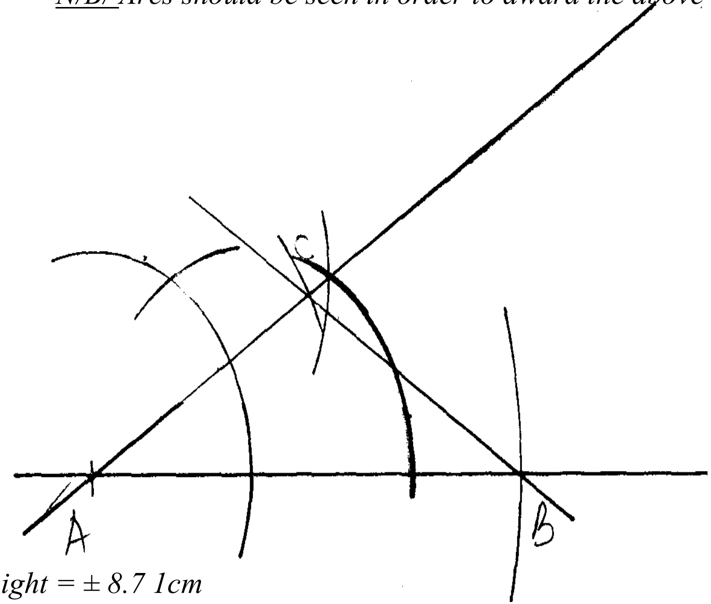


15. *BC = 3.5 cm ± 0.1* B_1

B1 construction of ∠CAB.

B1 completion of triangle.

N/B/ Arcs should be seen in order to award the above marks.



16. *Height = ± 8.7 1cm*

(½ x 7 x 8.7) $30.45cm^2$

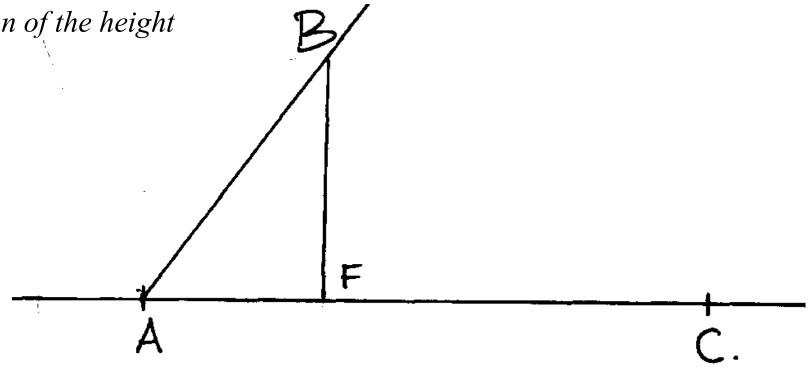
2 ±1cm

17. *Give 1m of correct and complete triangle*

Correct angle

Correct construction of the height

18.



19. *Marked price = $\frac{100}{90}$ x 450 = shs.500*

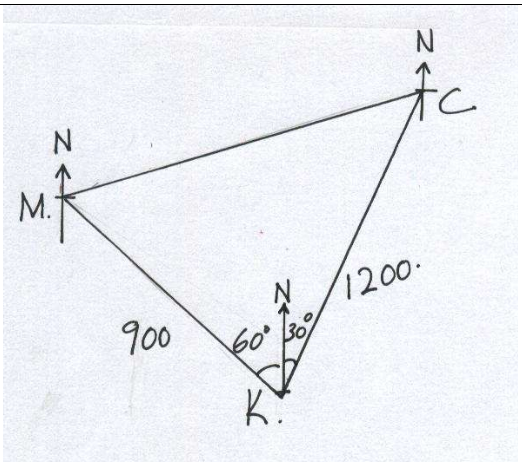
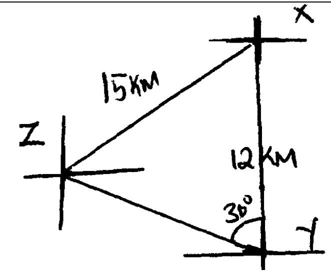
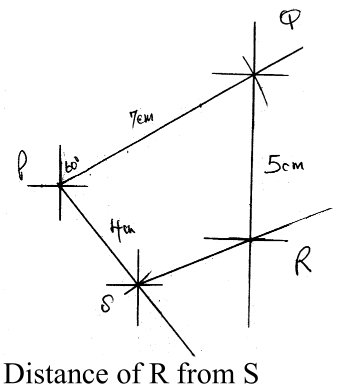
Cost = $\frac{100}{25}$ x 450 = shs.360

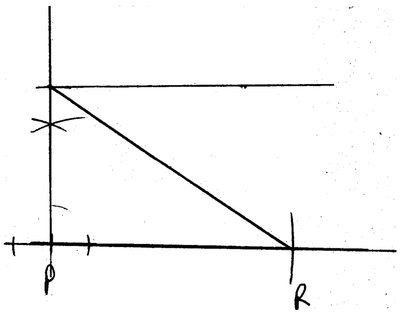
Profit = 500 – 360

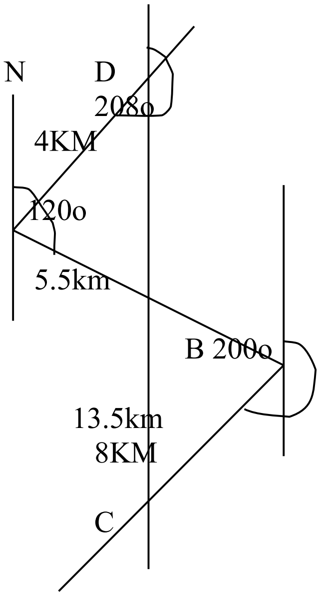
= shs. 140

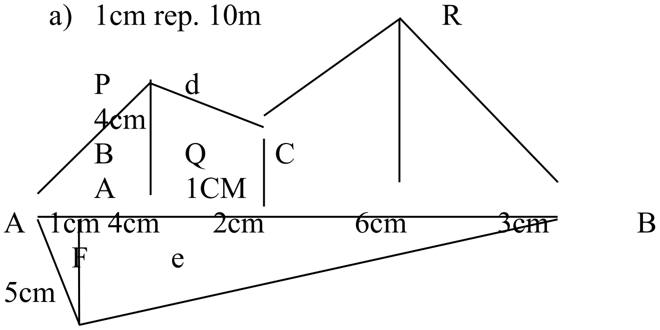
19. Scale drawing

1	(i)	B_1	✓sketch not on scale

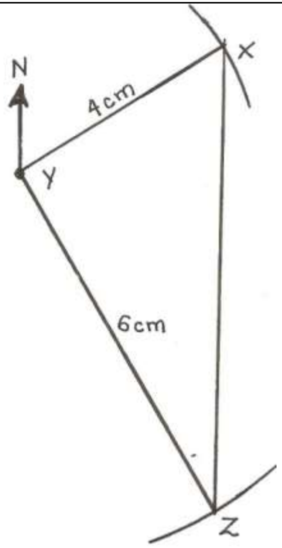
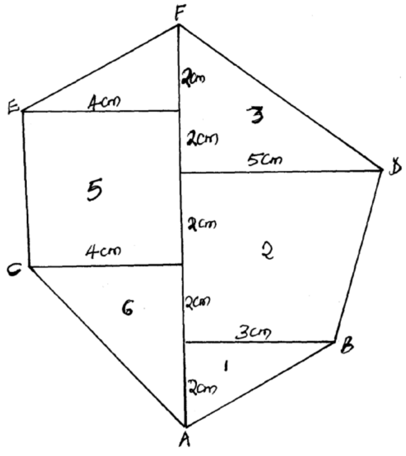
	 (ii) MC $= \sqrt{1200^2 + 900^2}$ $= \sqrt{1440000+810000}$ $= \sqrt{2250000}$ $= 1500m$	M1 A1 3	
2.	 $\frac{Sin30^0}{15} = \frac{SinZ}{12}$ Sin Z = 0.4 <Z = 23.580 <x = 1800 – 300 – 23.58 = 126.420 Compass bearing N53.580W	M1 A1 M1 A1	
		04	
3.	 Distance of R from S 3.8cm ±0.1 3.8 x 4 = 15.2m Bearing of R from S 0680 ±10	B1 B1 B1 B1 B1 B1 B1	600 bearing from P and 7cm drawn South of Q and 5cm drawn from P 1400 bearing from P and 4cm drawn Completed diagram.

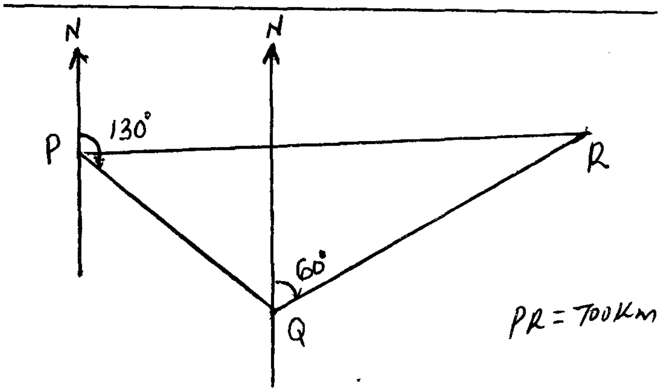
<table>
<tr>
<td></td>
<td>

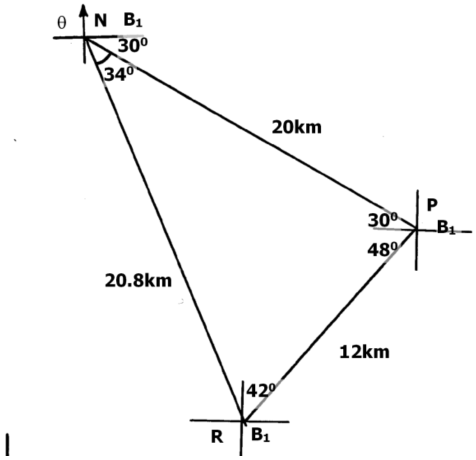
Angle of depression = 330</td>
<td>B1
B1
B1</td>
<td>Award of 3 digits only
Posts P drawn
Position P and R shown and triangle completed
Angle of depression given</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1cm represent 1km


Bearing 030o 4km from starting point</td>
<td>1M
1M
1M
A1</td>
<td>Bearing of starting point A
Use of scale correctly and plotting of points
Use of bearing correctly</td>
</tr>
<tr>
<td>5</td>
<td>a) 1cm rep. 10m


b) Area</td>
<td>B1
B1</td>
<td>Correct scales
Correct drawing</td>
</tr>
</table>

	A = ½ x 5 x 2 = 5cm2 B = ½ X 2(2+ 1) = 3cm2 C = ½ x 6 (1+4) = 15cm2 D = ½ x 3 x 4 = 6cm E= ½ x 5 x 15 = 75/2 = 37.5 f = ½ x 1 x 5 = 2.5 Total = 69cm2 Area = 69 x 100~~0000~~ 1~~0000~~ = 690m2	M1 A1	
7.	 (a) 324o (b) (7.2 x 5)km = 36km	B1 B1 B1 B1	Z accurately located wrt Y X accurately located wrt Y Bearing of X from Z Distance of X from Z
		04	
8.	(a) 	S1 B1 B2 B1	Scale Base line Offsets (all – offsets) A want B1 for at least 2 ✓

	(b) Area1 = ½ x 2 x 3 = 3cm2 Area2 = ½ x 4(5+3) = 16cm2 Area3 = ½ x 5 x 4 = 10cm2 Area4 = ½ x2x4 = 4cm2 Area5 = 4 x 4 = 16cm2 Area6 = ½ x 4 x 4 = 8cm2 Total area = (3+16+10+4+16+8)cm2 = 57cm2 Actual area = (57x100)m2 = 5700m2 (c) 10,000m2 = 1ha 5700m2 = ? 1 x 5700 10,000 = 0.57ha	B1 M1 A1 M1 A1	(3 areas) (3 areas) Addition of all six areas
		10	
9.		B1 B1 B1	For North line at 600 may be simplified ✓lacation of R ✓for 700km ± 10km
		03	
10.	(a) Sin θ = 8/12 DOC = 41.81 x 2 = 83.620 (b) Area of ΔAPCO = (16x20) – (½ x 122x sin 83.62) = 320 – 71.15 = 248.45 (c) 83.62 x 22 x 122 360 7 = 105.09cm2 (d) 248.45 – 105.09 = 353.54	M1 M1 A1 M1 M1 A1 M1 A1 M1 A1	
		10	

11.	 $1\ cm = 2km$ $20km = 10cm$ $12km = 6cm$ $i)10.4cm = \times 2 = 20.8km$ $ii)\ 042°$ $iii)\ 154°$ $c) Area\ of\ PQR = \frac{1}{2}ab\sin C$ $= \frac{1}{2}\times 20\times 12\sin 78°$ $=120\times 78°$ $=117.38km^2$	B1 B1 B1 M1A1 B1 B2 M1 A1	Locating Q Locating P Locating R
		10	

12.	1:50,000 L.S.F. 1:25,000,000 A.S.F. 17cm2: 425000000 cm^2 42500 m^2 $\frac{42500}{10,000}$ = 4.25 ha	M1 A1 2	

13.

Positions

Q	B1
R	B1
S	B1

<

Const 300 B1

$\angle 330$ B1

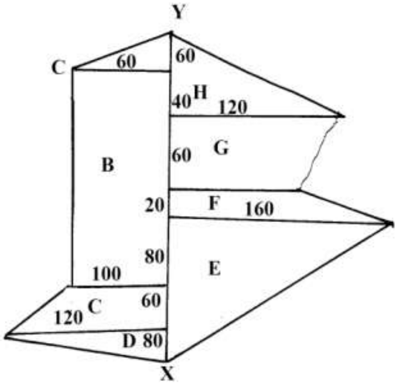
Scale B1

b.) i. 7.8 x 50 = 390 km. B1

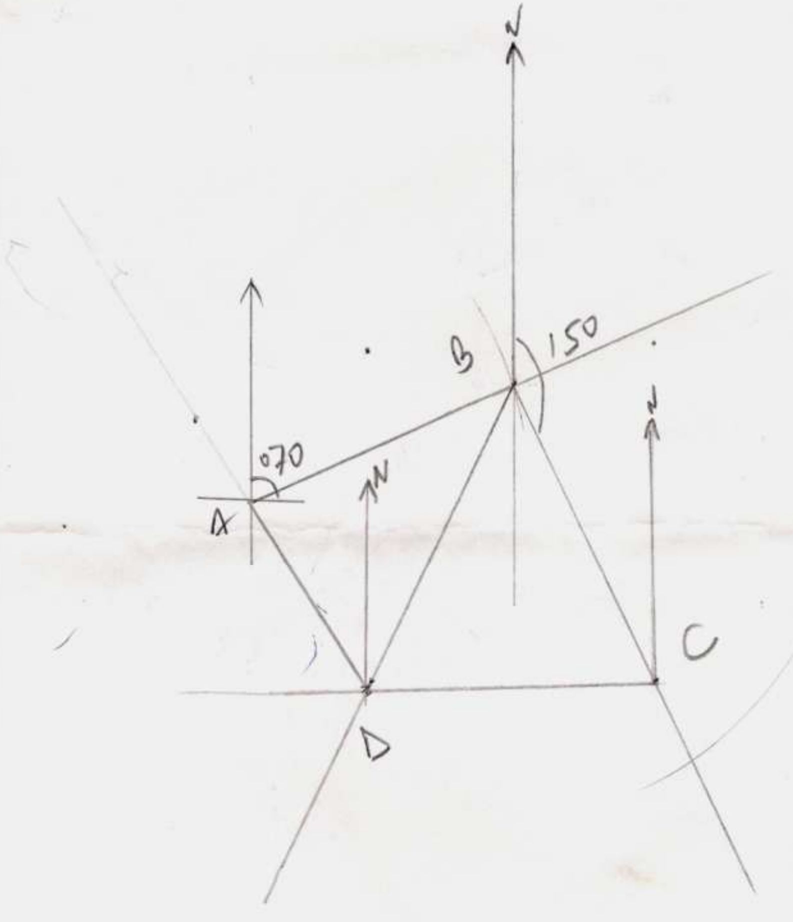
ii. 7.10 x 50 = 355 km B1

iii. 320^0 B2

10

14.	Area = $35100000m^2$ = $351000000000cm^2$ Area = 2.6x1.5 = $3.9cm^2$ Scale = 3.9:351000000000 = 90000000000 $\therefore$ n = $9x10^{10}$	M1 A1 B1	✓ finding area ✓area (actual)
		03	
15.	 Areas.	B3 M1 M1	3 for at least 6. 2 for at least 4, 1 for at least 2

	$A = \frac{1}{2} \times 60 \times 60 = 1800m^2$ $B = \frac{(60+100)}{2}200 = 16000m^2$ $C = \frac{(100+120)}{2}60 = 6600m^2$ $D = \frac{1}{2} \times 120 \times 80 = 4800m^2$ $E = \frac{1}{2} \times 160 \times 220 = 17600m^2$ $F = \frac{(160+100)}{2} \times 20 = 2600m^2$ $G = \frac{(100+120)}{2}60 = 6600m^2$ $H = \frac{1}{2} \times 120 \times 100 = 6000m^2$ Total area = 62000m^2 = $\frac{62000}{10000}$ = 6.2ha 1ha = 80,000 6.2ha = 80000 x $\frac{6.2}{1}$ = ksh 496,000.00	M1 M1 B1 M A1	
		10	

16	 i) AD = 3.5 ± 0.1 × 50 = 175 ± 5 M. ii) BD = 5.2 ± 0.1 × 50 = 260 ± 5 M iii) Bearing of A from D 323° ± 1°	B1 B1 B1 B1 B1 M1 A1 M1 A1 B1	Locating A Locating B Locating C Locating D North at D
		10	

17. a) $\frac{YZ}{\text{Sin } 28^o} = \frac{13.5}{\text{sin } 100^o}$

Duration of travel = 8:55a.m – 7.35a.m

$= {}^4/_3$

Speed = $\frac{6.436}{{}^4/_3}$

= 4.827km/hr

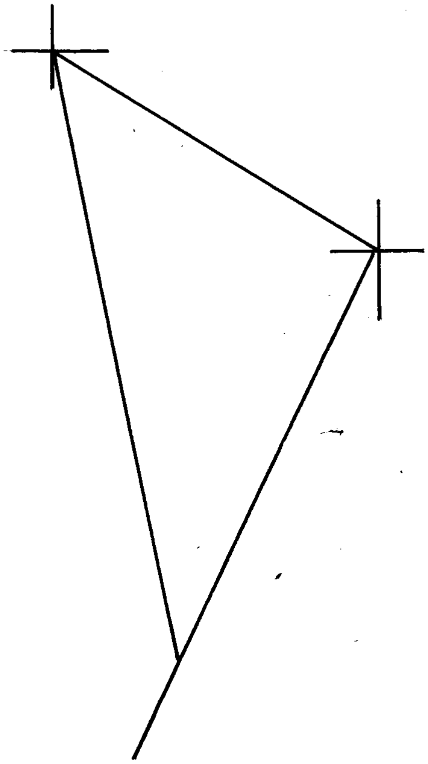
(b) $\frac{13.5}{\text{Sin } 10^o} = \frac{6.436 + ZQ}{\text{Sin } 118^o}$

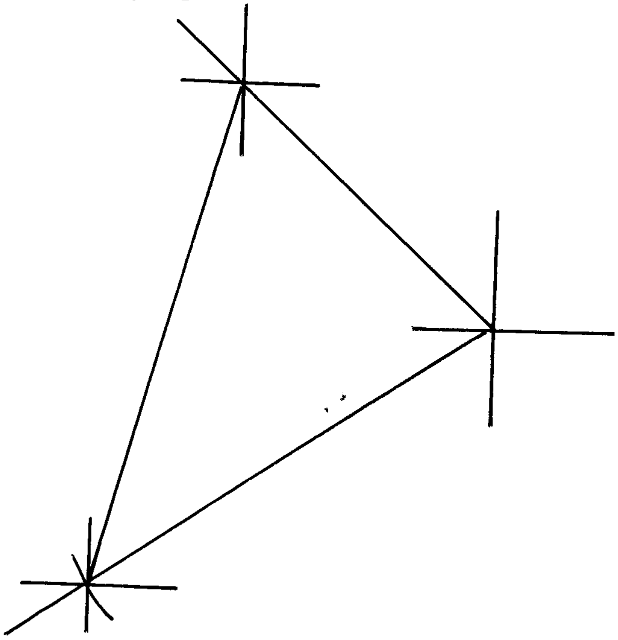
$6.436 + ZQ = 13.5 \times \sin 118^o = 68.659$

$ZQ = 68.659 - 6.436$

$= 62.223$

18. 1cm rep 100km





b) i) 049 ± 1

ii) 190 ± 1

c) 6.7± 0.1

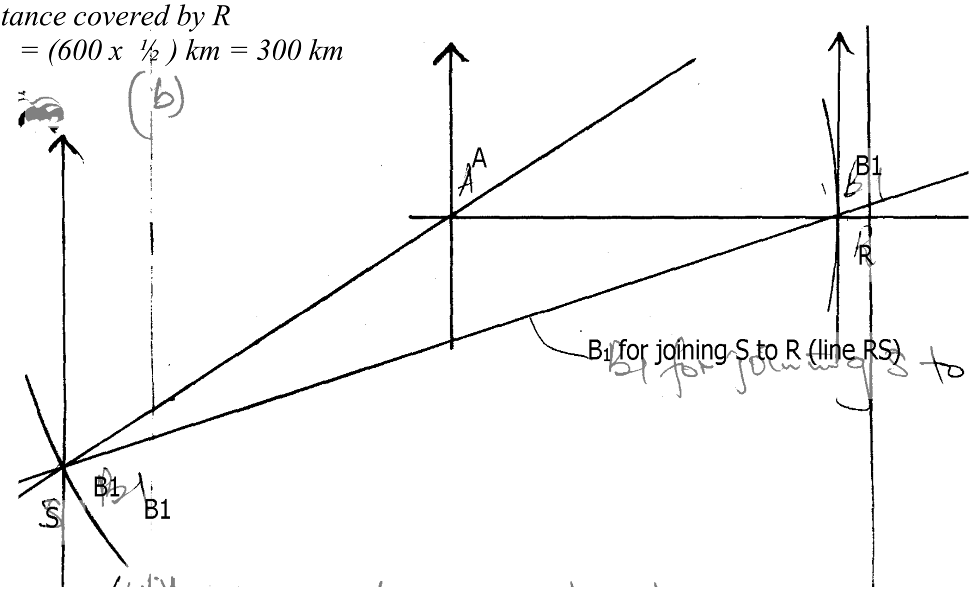
670 ± 10

19. *a) (i) Distance covered by s*

= (750 x ½)km = 375 km

Distance covered by R

= (600 x ½) km = 300 km



(b) (i) Distance between the two aeroplanes

= 12.5 x 50 = 625 ± 5 km

(ii) Speed = $\left(\underline{625} \times 60 \right)$ *km/hr*

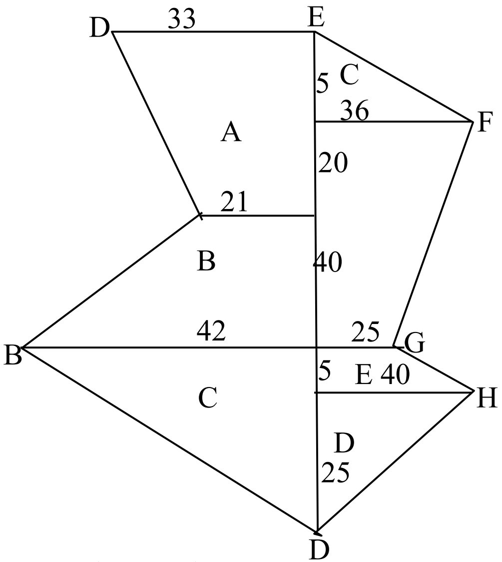
45

= 833 $^1/_3$ km /h

(c) (i) Bearing of S from R = 225^o

(ii) The bearing of R from S = 72^o

20.



Area A: ½ x 25 (33 + 21) = 675

Area B: ½ x 40 (21 x 42) = 1260

Area C: ½ x 30 x 42 = 630

Area D: ½ x 25 x 40 = 500

Area E: ½ x 5 (40 + 25) = 162.5

Area F: ½ X 60 (25 + 36) = 1830

Area G: ½ x 5 x 36 = 90 √

= 5,147.5m^2

21. *A to C = 96 ± 1 km*

Bearing = 300^o

(i) *62 ± 1km*

(ii) *97 ± 1 km*

a. 304^o

030^o

22. *Graph*

b) i) 80 km

ii) 11.06a.m

c) Average speed of the 2nd train

Time taken = 80 ÷ $1^{11}/_{12}$ = $\frac{80 \times 12}{23}$

= 41.74km/h

23. *L.S.F = $\frac{4}{2000000}$ = $\frac{1}{500000}$*

A.S.F = $\frac{1}{\ }^{2}$ = $\frac{1}{\ }$

5×10^5 2.5×10^{11}

Area of rectangle $= (2.4 \times 1.5)\ cm^2$

$= 3.6cm^2$

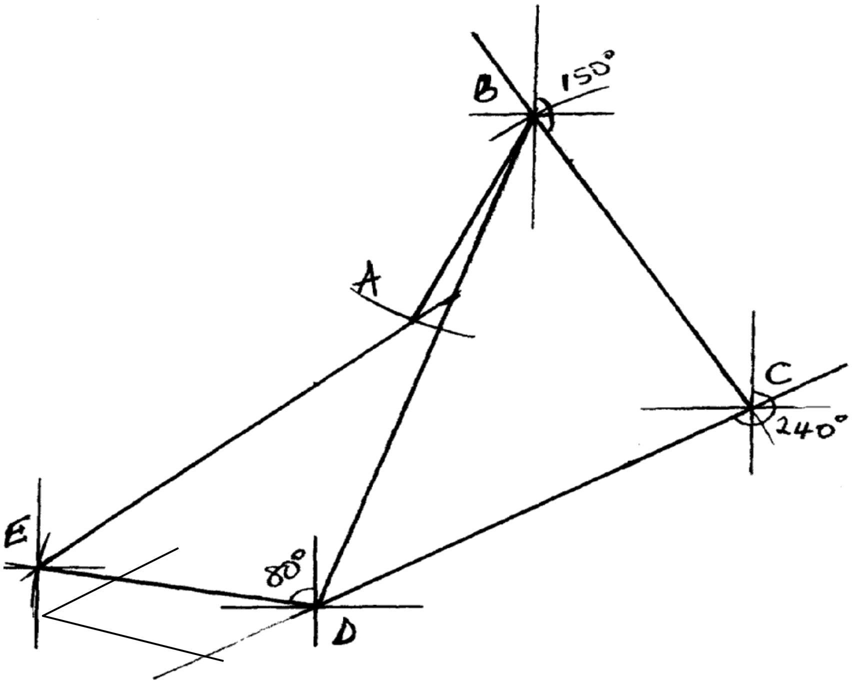
Actual area $= \frac{3.6 \times 2.5 \times 10^{11}}{100 \times 10000}$ *ha*

$= 9 \times 10^5$

$= 900{,}000ha$

24. *a)* Δ *ABD √ly constructed*
Δ *ABP*
b) i) AD = 4.5 + 0.1cm
Distance A + D
= 4.5 X 10 = 45km
ii) Bearing of (i) from B
= 241 + 1
iii) Bearing P from D
= 123 = 2
iv) Dp = 12.9 + 0.2 am
Distance D + P = 12.9 X 10
= 129 km

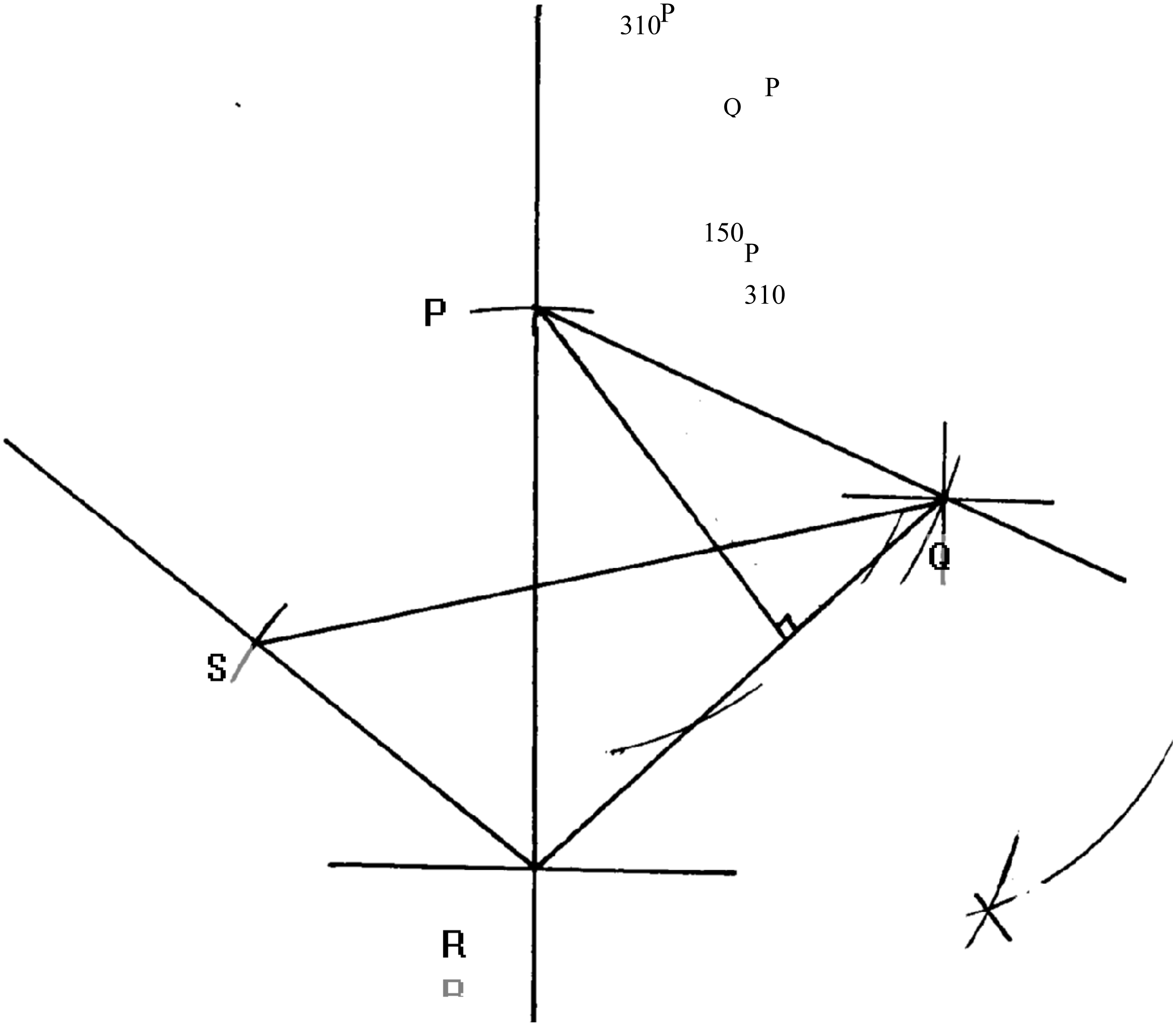
25. *a)*



b) i) 6.8 + 0.1cm
Distance Ae = 340 + 5 km

ii) 180 + 18 = 198 + 2

26. *a)*



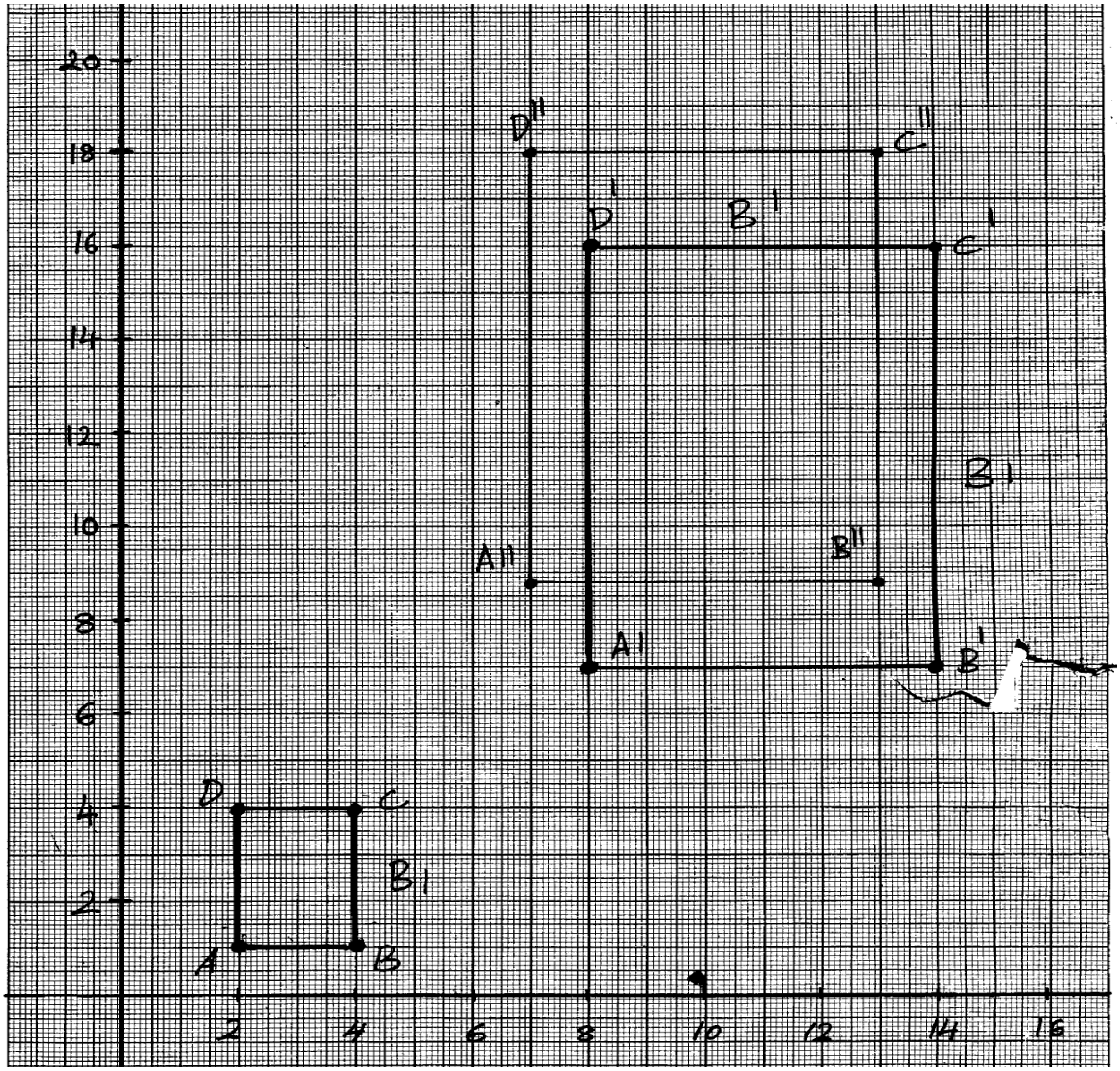
b) (i) *SP = 7.8 x 50 = 390 km ± 5 km*
(ii) *S & Q = $255^o \pm 1^o$*
(iii) *4 x 50 = 200 km + 5 km*

27. *(a) Scale = 50km*
Drawing accurately<NCE = 25^o
<NCT = 145^o
<NTY = 90^o
Lines drawn //

(b)By measurement:
(i) Distance SY = 6.9 x 50 = 345± 5km
Bearing Y For S = 360^o – 114 = 246±1^o
(ii) distance ST = 7.9 x 50 = 39.5 ±5km

(iii) *distance YT = 9.8 x 50 = 490 5km*

28.



XY = 250m

Area of A = ½ x 50 x 60 = 1500m²

B = ½ x 70 x 60 = 2100m²

C = ½ (60 +80) x 120=11050m²

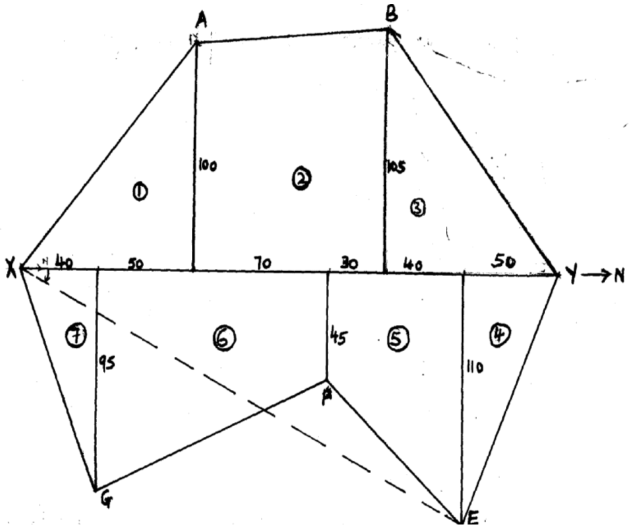
D = ½ x 80 x 80 = 3200m²

F = ½ x 10 x 70 = 350m²

Total area = 26600m²

Ha = $\frac{26600}{10,000}$ = 2.66ha

29.



(b) Total area = area (1) + (2) + (3) + (4) +(5) + (6) + (7)

Area (1)= $\frac{1}{2} \times 90 \times 100 = 4500m^2$

(2) = $\frac{(100 + 105)}{2}10 = 10250m^2$

(3) = $\frac{1}{2} \times 90 \times 105 = 4725m^2$

(4) = $\frac{1}{2} \times 50 \times 110 = 2750m^2$

(5) = $\frac{1}{2} \times (110 + 45)70 = 5425m^2$

(6) = $\frac{(45 + 95)}{2}\ 120\ 8400m^2$

(7) = $\frac{1}{2} \times 40 \times 95 = 1900m^2$

Total area = $37,950m^2$

In hectares = $\frac{(37950)}{10,000}$ ha = 3.795ha

(c) (i) bearing of E from x is 0.25 ± 1°

` *(ii) Distance Ex = (12.8 0.1 x 20m) = 256 ± 2m*

30. Area A = $\frac{1}{2} \times 170 \times 80 = 6800$

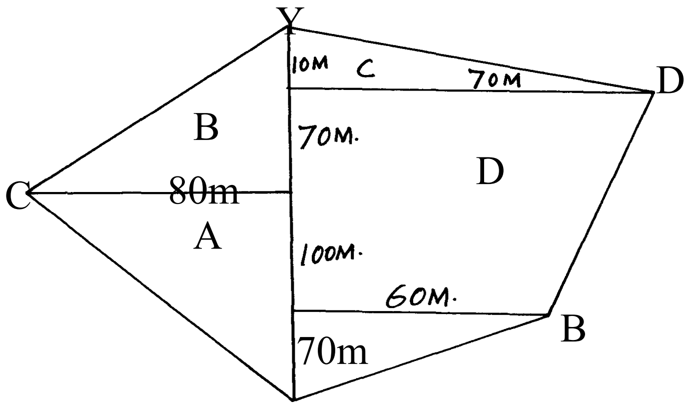
B = $\frac{1}{2} \times 80 \times 80 = 3200$

C = $\frac{1}{2} \times 10 \times 70 = 350$

D = $\frac{1}{2} \times 170 \times 130 = 11050$

E = $\frac{1}{2} \times 70 \times 60 = \underline{2100}$

Total = $23,500\ m^2$



31. (a) L.s.f = $\frac{1}{40,000}$

$\frac{1}{40,000} = \frac{3.25}{x}$

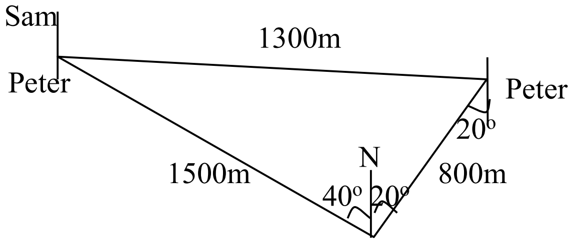
x = 130,000cm

(b) A.s.f $= \left(\frac{1}{40,000}\right)^2$

$\left(\frac{1}{40,000}\right)^2 = \left(\frac{x}{36,000,000}\right)$

x = $0.0225cm^2$

32.



(a) bearing = 180 + 20 = 200°

(b) $a^2 = 1500 +$

$a^2 = b^2 + c^2 - 2bc \cos A$

$a^2 = 1500^2 + 800^2 - 2 \times 1500 \times 800 \cos 60$

$= 2250000 + 640000 - 1200000$

$= 1690000$

$\therefore a = 1300m$

(c) $\frac{1300}{\sin 60} = \frac{1500}{\sin c}$

$1300 \sin c = 1500 \sin 60$

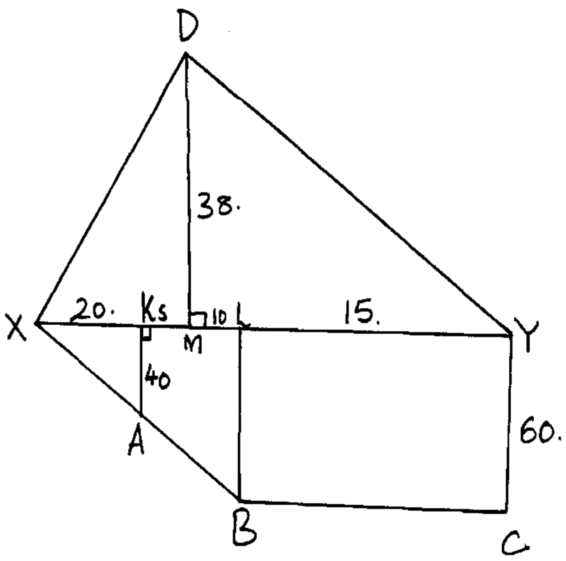
$\sin c = \frac{1500 \sin 60}{1300}$

$= 0.9993$

$\therefore c = 87.79^o$

$c = 87.80$

33.



. $A \text{ of } \Delta XYD = \frac{1}{2} \times 50 \times 38 = 950m^2$

$A \text{ of } XBCY = \frac{1}{2}(50 + 15)\, 60$

$= \frac{1}{2} \times 65 \times 60$

$= 1950m^2$

$\text{Total } A = (950 + 1950)m^2$

$= 2900m^2$

34. B1 for 86^o

$\frac{30}{\sin 86^o} = \frac{Q5}{\sin 56^o}$

$QS = \frac{30 \sin 56^o}{\sin 86^o}$

$= 24.93km$

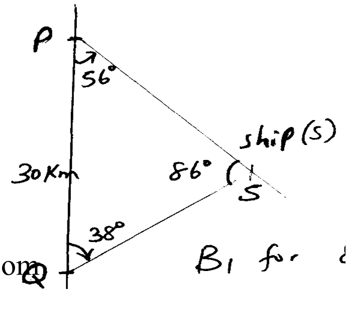
35. 1cm for 100000cm

$1cm^2 = (100000cm)^2$

$\text{Area} = 5.4 \times 4.5 \times 100000\ cm^2$

$= \frac{5.4 \times 4.5 \times 100000 \times 100000 Km^2}{100000 \times 100000}$

$= 24.3km^2$



36. $\frac{\theta}{360} \times \frac{22}{7} \times 6370 \times 2 = 900$

$= \frac{900 \times 360 \times 7}{22 \times 6370 \times 2}$

$= 8.1^o$

Latitude of B $= 8.1^o - 5^o$ N

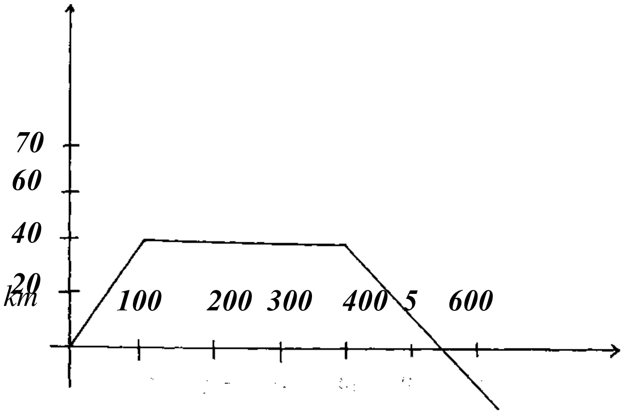
$= 3.5^o$ S

37. i) acc $= \frac{40 - 20}{100 - 50}$

$= {}^{20}/_{50}$ $= 0.4 m/s$

ii) $\frac{20 - 40}{460 - 400} = \frac{-20}{60}$ $= 0.3333 \ m/s^2$

iii) Area $= ½ (520 + 300) \times 40 \times {}^{1}/_{1000}$ $= 16.4$ km



38. a) $\tan 11.3 = \frac{200}{x}$

$x = \frac{200}{\tan 11.3}$ $= 100.1m$

b) $\frac{(36 \times 1000)}{60 \times 60}$ m/s

D = (10 x 5) 50m Tan θ = 7.590

< of depression = 7.590

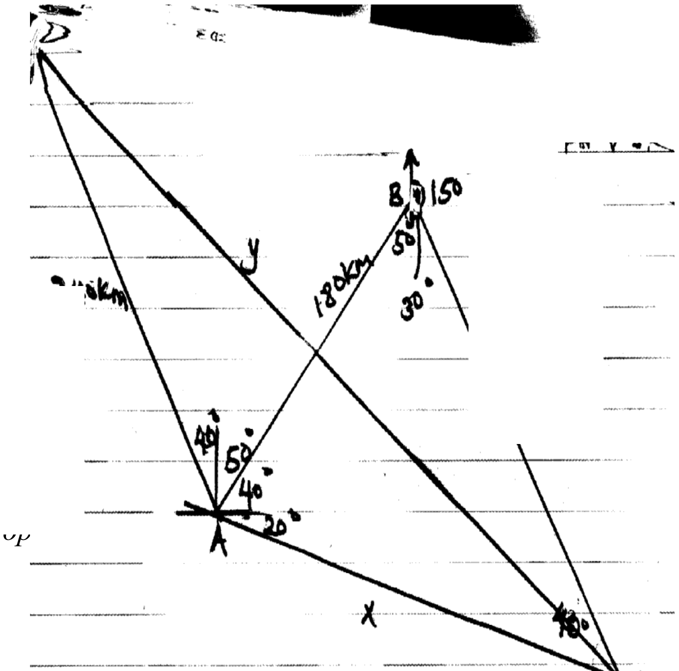
c) i) $\sqrt{50.9^2 - 49.9^2}$ $= 10.04cm$

ii) $\tan \theta = \frac{10.04}{200}$

$= 2.874°$

$= 3°$

39. a) Make a sketch to show positive of A, B, C and D



For √ sketch
For √ exp. of x
For √ ans.
For √Sub.
√cos 150
For taking sq. root.
For exp. of BC

Use sine rule in ΔABC

$$\frac{X}{Sin\ 80^o} \quad \frac{180}{Sin\ 40^o} \Rightarrow x = \frac{180 \sin 80^o}{\sin 40^o}$$

$$= 275.8$$

Hence $AC = 276$ *km*

(b) Use the cosine rule in Δ AD when $\angle DAC = 150^o$

$$y^2 = 240^2 + 276^2 - 2 \times 240 \times 276 \cos 150^o$$

$$= 576000 + 76180 - 132\ 480\ (-\cos 30^o)$$

$$= 133776 + 114731 \quad = 248507$$

$$y = \sqrt{248507}$$

$$= 498.5$$

Hence $CD = 499$ *km*

(c) Using sine rule in ΔABC we have

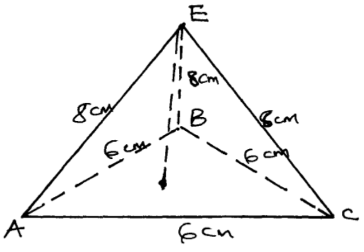
$$\frac{BC}{Sin\ 60^o} = \frac{180}{\sin 40^o}$$

$$BC = \frac{180 \sin 60}{Sin\ 40}$$

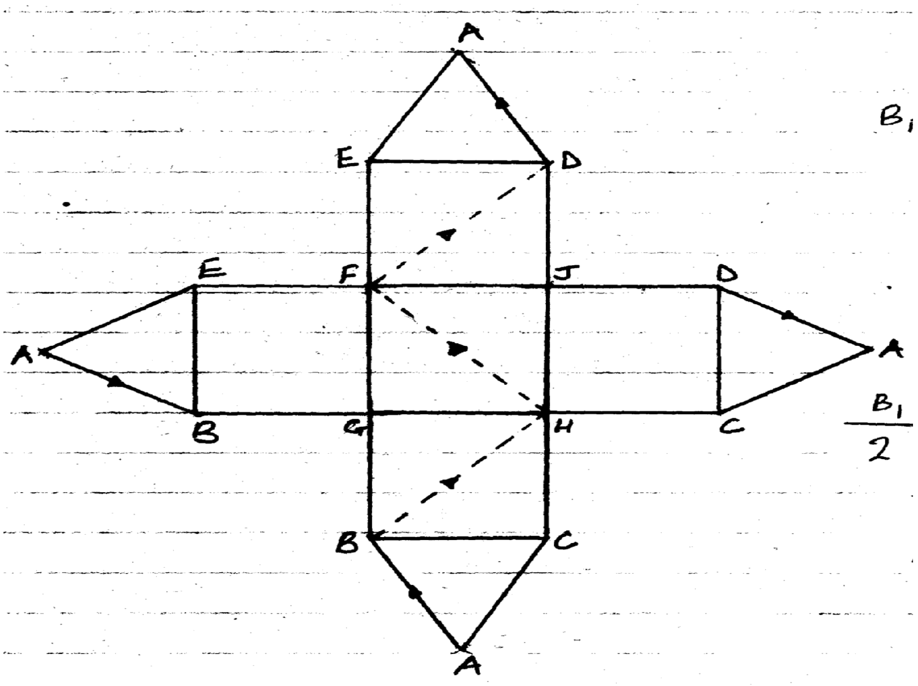
$$= 242.5$$

$$= 243 \text{ km}$$

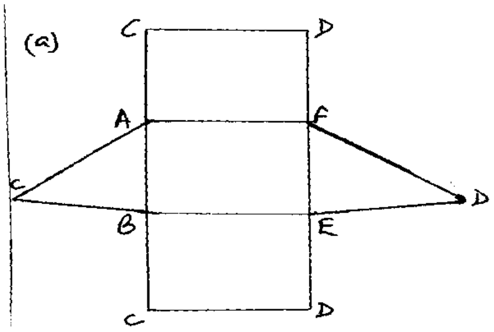
20. Common solids

1.	a)  b) The figure is tetrahedron	B1 B1	Sketch completed and the lines dotted.
		02	

2. *Sketch of the net of the solid (not free hand) base n\must be square, other lengths must be within. Labeling of all verticals with the path correctly shown. AB and DA may be shown one.*



3. *(a)*

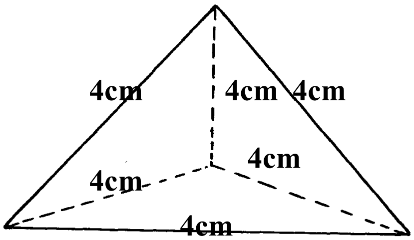


(b) Total surface area

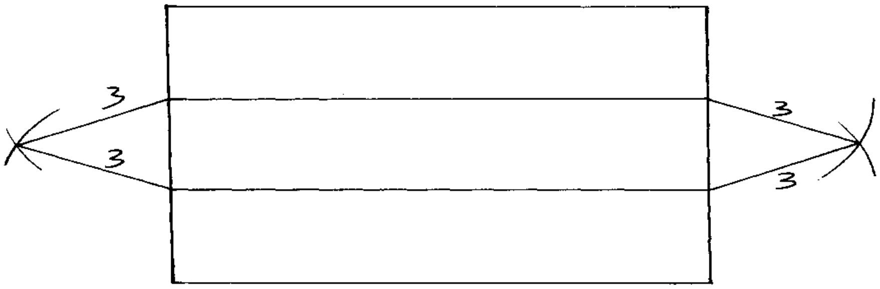
$= 2\sqrt{9 x 3 x 4 x 2} + 10 (6 + 5 + 7)$

$= 29.39 + 180 = 209.4cm^2$

4.



5.



21. Indices

1. $3^4 \text{ x } 3^{4x} + 3^{4x} = 246$

$3^{4x} (81 + 1) = 246$

$$\frac{\cancel{82} \text{ x } 3^{4x}}{\cancel{82}} = \frac{\overset{3}{\cancel{246}}}{\cancel{82}}$$

$3^{4x} = 3^1 \ \overset{1}{\surd}$
$4x = 1$
$x = \frac{1}{4}$

2. $5^{2y} x5^1 = 4^{(5y+1)} – 15$
$5^y \text{ x } 5^y \text{ x } 5^1 = 4 \text{ x } 5y \text{ x } 51 – 15$
Let $5y = t$
$5t^2 = 20t – 15$
$t^2 = 20t – 15$
$t^2 – 4t + 3 = 0$
$(t-1) (t-3) = 0$
$t = 1$ or 3
$5y = 1= 5^o$
Or $5y = 3$ $y = \frac{\log 3}{\log 5} = 0.6826$

3. $CBD = 90 - 42 = 48^o$
Angle of triangle add to 180^o
$DOB = 180^o – 42 = 138^o$
Opposite angles of cyclic quadrilateral add to 180^o

$DAB = \frac{138^o}{2} = 69^o$
Angle at circumference is half the nagle substended at centre by same chord

CDA
$ABD= 90 – 48 = 42o$
$ADB = 180 –(69+42)$
$180-111=69^o$
$CDA = 90 + 69^o \qquad = 159^o$
Show ΔADB is asoccesters

$\angle DAB = 69^o$

$\angle DAB = 69^o$

$\angle ADB = 69^o$

$\angle ABD = 42^o$

So two angles are equal hence it is asoccesters

4. $25^{3/4} = (25^{1/2})^{3/2} = 5$

$0.9^2 = (^9/_{10})^2 = ^{92}/_{100}$

$2^2 = 2^2$

$$\frac{(\sqrt{5})^3 \text{ x } 9^2 \text{ x } 2^2}{(\sqrt{5})^5 \text{ x } 10^2 \text{ x } 3^3}$$

$$\frac{3 \text{ x } 4}{(\sqrt{5})^2 \text{ x } 10^2}$$

$$\frac{3}{5 \text{ x } 25} = \frac{3}{125}$$

5. $2^x = 0.0625 = \frac{625}{1000}$

$2x = \frac{1}{16} = 2^{-4}$

$\therefore x = -4$

6. $16x^2 = 8^{4x-3}$

$2^{4x2} = 2^{3(4x-3)}$

$= 4^{x2} = 12x - 9$

$= 4^{x2} - 12x + 9 = 0$

$(2x-3)^2 = 0$

$2x-3 = 0$

$x = 1.5$

No	Log
5.627	0.7503
$(0.234)^3$	T. 3692 x 3 2.8579
8.237	0.4779 $\frac{0.9158}{2}$
$2.399 \text{ x } 10^{-3}$	3.3800
	= 0.002399

7. $9^{x+1} + 3^{2x+1} = 36$

$3^{2x+2} + 3^{2x+1} = 36$

$3^{2x(9+3)} = 36$

$3^{2x} = 3^1$

$2x = 1$

$x = ½$

8. (a) $4p^2 - 3P - 10 = 0$

(b) $4p^2 - 8p + 5p = 0$

$(4p + 5)(p-2) = 0$

$p_1 = {}^{-5}/_4,\ p = 2$

When $y = {}^{-5}/_4$,

$4^{-y} = \frac{-5}{4}$

$y = \frac{\log_4 (-5)}{2}$

$P = 2$

$4^{-y} = 2$

$2^{-2y} = 2^1$

$y = {}^{-1}/_2$

9.

$$\frac{1}{16^x} = \frac{1}{32}$$

$$\left(\frac{1}{2^{4x}}\right)^{x - ¼} = \frac{1}{2^5}$$

$$2^{-4x^2 + x} + x = 2^{-5}$$

$-4x^2 + x + 5 = 0$

$4x^2 - x - 5 = 0$

$4x^2 - 5x + 4x - 5 = 0$

$x(4x - 5) + 1(4x - 5) = 0$

$x = -1$ or $x = \frac{5}{4}$

10. $15 (ax)^4 ({}^{-2}/_{x^2}) = 4860$

$60a^4 = 4860$

$a^4 = 81$

$a = 3$

22. Reciprocals

1	$\sqrt{\frac{1}{2.456} \times 0.1 + 4.346^2}$	B_1	✓reciprocal
	$\sqrt{0.04072 + 18.888}$	B_1	✓square
	$\sqrt{18.929}$	B_1	✓square root
	4.3509		

2. $\frac{10}{0.834}\ 1 \quad \frac{-3}{129.64}\ 1$

$(10 \times 1.199) - (3 \times 0.007713)$

$11.99 - 0.923139$

11.966861

12.0

3. $807 \longrightarrow 0.001239$

$0.0591 \longrightarrow 16.92$

$5(0.001239) + 4(16.92)$

$= 67.69$

4. $^{1}/_{3}\ \{ 2 x 1.5065 + 5 x 1.2004\}$

$^{1}/_{3}\ (3.013 + 6.002)\ (0.3333)$

$= 9.015 x 0.3333$
$= 3.005$ (3 dp)

5. $$\frac{12 x 0.25 - 12.4 \div 0.4 x 3}{\frac{1}{8} \text{ of } 2.56 + 8.68}$$
$$\frac{3 - 31 x 3}{0.32 + 8.68}$$
$$\frac{-90}{9}$$
$= -10$

6. $$\frac{4}{(8.68)^3} + \frac{5}{34.46}^{\,1/3}$$
$$\frac{4}{653.97} + (0.1451)^{1/3}$$
$4(0.1529) + 0.5255$
$0.6116 + 0.5255 = 1.1371$

7. $\frac{1}{a} = 0.007874 + 0.0869$
$= 0.9483$
$a = 10.55$

8. $3.5932 = 12.91$
$$\Rightarrow \left(\frac{1}{1.291 x 10}\right) + 2\left(\frac{1}{5.26 x 10^{-1}}\right)$$
$= (0.7746 x 10^{-1}) +290.1901 x 10)$
$= 0.07746$
$+ \underline{3.802}$
3.87946

$\sqrt{3.87946} = \sqrt{3.879}$

$= 1.9695$
$= 1.970$(4s.f)

9.

No	s.f	rec
0.6638	$6.638 x 10^{-1}$	0.1500 x 10 = 1.5000
0.833	8.33 x 10-1	0.1200 x 10 = 1.200

$= {}^{1}/_{3}\ (2\ (105) + (1.2))$
$= {}^{1}/_{3}\ (3 + 6)$
$= {}^{1}/_{3} x 9 = 3$

10. $3x1.485 + 13x6.410$
$= 4.455 + 83.33$
$= 87.785$

ALT

$$^{30}/_{6.735} + {}^{130}/_{1.56} = 30 \times 0.1485 + 130 \times 0.641$$
$$= 4.455 + 83.33$$
$$= 87.785$$

23. *Common logarithms.*

<table>
<tr><td>1.</td><td>Log 31.59   1.4996
Log a   2.6182
Log b^{1/3} $\bar{2}8.814$
3
Log b $\bar{4}.6442$
b = 0.0004407
b = 0.0004</td><td>M1

M1
A1
B1</td><td>Subt b logs

Multip by 3</td></tr>
<tr><td></td><td></td><td>04</td><td></td></tr>
<tr><td>2.</td><td>$\log_{10}25 - \log_{10}4 + \log_{10}1600$
$\log_{10}\left(\frac{25}{4}\times 1600\right)$
4</td><td>M1
M1
A1</td><td></td></tr>
<tr><td></td><td></td><td>03</td><td></td></tr>
<tr><td>3</td><td><table>
<tr><td>No.</td><td>Std. form</td><td>Log</td></tr>
<tr><td>$(0.00246)^2$</td><td>$(2.46 \times 10^{-2})^2$</td><td>2.3909</td></tr>
<tr><td>142</td><td>1.42×10^2</td><td>x 2
4.7818
+2.1523
2.9341</td></tr>
<tr><td>0.002</td><td>2.0×10^{-3}</td><td></td></tr>
<tr><td>1.14</td><td>1.14×10^o</td><td>3.3010
+0.0569
3.3579

2.9341
-3.3579
1.5762
1.5762
3</td></tr>
<tr><td>3.3527</td><td>3.3527×10^o</td><td>0.5254</td></tr>
</table></td><td>1M
1M
1M
A1</td><td>Correct logs addition
Correct logs addition
Correct logs substractions
Correct answer</td></tr>
<tr><td></td><td></td><td>4</td><td></td></tr>
<tr><td>4</td><td>$\dfrac{\log\left(\frac{1}{4}\times 64\right)}{\log\left(\frac{1}{32}\div\frac{1}{8}\right)}$
$\dfrac{\log 2^4}{\log 2^{-2}}$
$\dfrac{4\log 2}{-2\log 2}$
-2</td><td>M_1
M_1
M_1
A_1
4</td><td></td></tr>
</table>

5. $\left(\frac{1}{2^3}\right)^x \cdot \left(2^6\right)^2 = \left(2^4\right)^2$ M1 for writing in index form

$2^{-3x}.2^{12} = 2^8$

$12 - 3x = 8$ M1

$x = {}^4/_3$

$= 1\ {}^1/_3$

3

6.	No. std form log		
	0.6845^2 $6.845\text{x}10^{-1}$ $\bar{1}.8354\text{x}2$ $\bar{1}.6708$ $\bar{1}.6708$ 0.08416 $8.416\text{x}10^{-2}$ $\underline{\bar{2}.9252}$ 3 $\bar{1}.6417$ $\underline{\bar{1}.6417}$ + $\bar{1}.3125$ 0.005937 $5.937\text{x}10^{-3}$ - $\underline{\bar{3}.7736}$ $3.459\text{x}10^{-1}$ $\longleftarrow$ $\bar{1}.5389$ 0.3459	M1 M1 M1 A1	
		04	

7	Number	log		
	8.694	0.9392	M1	All logs
	0.1267	$\bar{1}.1028\times\frac{1}{3}=\bar{1}.7009$		
	0.006974	$\bar{3}.8434$	M1	+ - x of logs
		$\bar{3}.5443\times\frac{3}{4}$	M1	$\div\times of\ \log s$
		$\bar{1}.3861\times3=\bar{2}.1583$		
		0.9392		
		$\bar{2}$'1583		
		2.7809	A1	
	6.039×10^2			
	602.9			
			4 marks	

8.

No.	*Log*	
2849	*3.4547* +	***All logs read correctly***
- *0.00574*	*3. 7589*	
1.2136		
- *36.891.1*	*1. 5669*	***Correct Addn /subst. of logs.***
0.023	*2.3617*	
	3.2052	

-

2. 0084 x ¼

3.178 x $\bar{1}0^{-1}$ ← 1. 5021

→ 0.3178

9. Log y = log B + n log x

n log x = log y – log B

$n = \frac{\text{Log } (^{y}/_{B})}{\text{Log } x}$

10. = 6 $\log_2 4$ + 10 $\log_3 3$

= 12 $\log_2 2$ + 10 $\log_3 3$

= 12 + 10

11. Log $\frac{2x - 11}{2} = \frac{\log 3}{x}$

(2x – 11) = $^3/_x$

$2x^2$ _ 11x -6 = 0

(2x + 1) (x – 6) = 0

x = - ½ or 6

x = 6

12.

No.	Log
0.5241	T.7194
$(0.5241)^2$	T.7194x2
	T.4388 +
83.59	1.9222
	1.3610
0.3563	T.5518
3√0.3563	(3+2.5518) ÷3
	T.8506
	0.3610 –
	1.8506
3.239×10^1	1.5104
= 32.4	

13.

No.	Log
38.32	1.5834 +
12.964	1.1127
	2.6961
86.37	1.9364
6.285	0.7783
	2.7347
-	1.9587

$\frac{-\bar{3} + 2.9587}{3}$ = 1.9866

= 0.9695

14. $H^3 \underset{\sim}{} = \frac{3d(L-d)}{10L}$

$\sim 3dL - 10H^3L = 3d^2$

$\sim L(3d - 10H^3)\ 3d^2$

$\sim L = \frac{3d^2}{3d - 10H^3}$

15. No. Log

6.195 0.7920

11.82 $\underline{1.0726}$

1.8646

83.52 $\underline{1.9218}$

$\bar{1}.9428 \times \frac{1}{4}$

$\frac{\bar{4}. + 3.9428}{4}$

0.9676 $\bar{1}.9857$

16. Log $y^2(x-1) = \log 9$ $y^2(x-1) = 9$ ....(1)

log (xy) log 6 xy = 6 2

from (2) $x = {}^6/_y$

substitute in (1) $y\frac{(6-1)}{y} = 9$

$6y - y^2 = 9$

$y^2 - 6y + 9 = 0$

$(y-3)^2 = 0$

$y = 3$

$\therefore x = 2$

5

17. ${}^4/_5 \log_{10}25 + \log_{10} 25x2 - \log 10$

$4 \log 2 = \log_{10} 25x2 - 3\log 2$

$2 \log 10 + 2 \log 5$

Log 10 x 100

18.

NO	LOG
0.9895 →	$\bar{1}.9954$
$(0.9895)^2$ →	1.9954 x 2
	1.9908
0.004974 →	$\bar{3}.6968$
	$3.\bar{6}876 \div 4$
	1.4219 x 3
6.598	2.2657
	0.8195 –
	2.2657
$3.579\ X10^2$ ←	2.5538
OR 357.9	

Use sine rule

19. $\text{Log } 3x + 8 - \log 8 = \log (x-4)$

$\text{Log } \left(\frac{3x + 8}{8}\right) = \log (x-4)$

$3x + 8 = x - 4$

$3x + 8 = 8x - 32$

$5x = 40$

20.

No.	Log
36.72 $\longrightarrow$	1.5649
0.46^2 $\longrightarrow$	2(T.6628)
	$\underline{T.3256}$
185.4	0.8905
	$\underline{2.2682}$
	$\bar{2}.9223 \times \frac{1}{3} = \frac{\bar{3}}{3} + \frac{1.6223}{3}$
3.474×10^{-1}	
Or 0.3474	$\bar{1}.5408$

21.

No		Log
Sin 44.5		1.8457
Tan 14.9	1.4250	2.5686 -
Cos 82	1.1486 +	
	$\frac{1.2772}{2}$	
10 x 4.351	___________ 0.6386	

22. From square roots 12.25 = 3.5

$\frac{3.264 \times 1.215 \times 3.5\sqrt{\times 107}}{1.088 \times 0.4725 \times 107}$

$\frac{3264 \times 1215 \times 35}{1088 \times 4725}$

$\sqrt{27} = 3$

23. $\text{Log}_8 (x + 5) - \log_8 (x - 3) = \text{Log}_8 4$

$\text{Log}_8 \left(\frac{x + 5}{x - 3}\right) = \log_8 4$

$\frac{x + 5}{x - 3} = 4$

$4x - 12 = x + 5$

$3x = 17$

$x = 17 = 5^2/_3$

Or $\log_8 \frac{x + 5}{x - 3} = \frac{2}{3}$

$8^{2/3} = \frac{x + 5}{x - 3}$

$2^3(^2/_3) = \frac{x + 5}{x - 3}$

$$2^2 = \frac{x+5}{x-3} \Rightarrow 4 = \frac{x+5}{x-3}$$

$$4x - 12 = x + 5 \Rightarrow 3x = 17$$

$$x = \frac{17}{3} = 5^2/_3$$

24.

No 6.57^2 4.317×10^1 $43.17 + 6.57$ 49.74 $(7.92)^2$ $\underline{30.08}$ 2.636×10^{-2}	Log 0.8176 $\underline{\quad 2x}$ $\underline{1.6352}$ 1.6967 0.8987 $\underline{\quad X2}$ 1.7974 1.4783 + $\underline{3.2757}$ 2.4210 = 0.02636 = 0.0264 (4 d.p)
No 6.57^2 4.317×10^1 $43.17 + 6.57$ 49.74 $(7.92)^2$ $\underline{30.08}$ 2.636×10^{-2}	Log 0.8176 $\underline{\quad 2x}$ $\underline{1.6352}$ 1.6967 0.8987 $\underline{\quad X2}$ 1.7974 1.4783 + $\underline{3.2757}$ 2.4210 = 0.02636 = 0.0264 (4 d.p)

25. Log 120 = log 4 + log 3 + log 10
 = log22 + log3 + log 10
 = 2log2 + log3 + log 10
 = 2(0.30103) + 0.47712 + 1
 = 2.07918

26. $Log_2 (3x - 4) = {}^1/_3\ lo_2\ 8x^6 - log_2 4$

$Log_2 (3x - 4) = log_2 (2^3x^6) \quad - log_2 4$

$Log_2 (3x - 4) = log_2 2x^2 - log_2 4$

$Log_2 (3x - 4) - log_2 \left(\frac{2x^2}{4}\right)$

$= 3x - 4 = \frac{2x^2}{4}$

$2x^2 - 12x + 16 = 0$

$x^2 - 6x + 8 = 0$

$x - 2x - 4x + 8 = 0$

$(x - 2)(x - 4) = 0$

$x = 2$ or $x = 4$

27.

No	Log
5.627	0.7503
$(0.234)^3$	T. 3692
	$\underline{\ \ x\ 3}$
	2.8579
8.237	0.4779 $\quad \frac{0.9158}{2}$
2.399×10^{-3}	3.3800
	= 0.002399

28. Det 2 - -3 = 5

Area of $A^1B^1C^1 = 5 \times 15$

$= 75\ cm^2$

29. $Log10(6x-2) - log10 = log10(x-3)$

$Log\ \frac{(6x-2)}{10} = log\ (x-3)$

$\frac{6x-2}{10} = x - 3$

$6x - 2 = 10x - 30$

$x = 7$

30.

No.	Log
0.07526^2	$\bar{2}.8766 \times 2 = \bar{3}.7532$
6.652	0.8230 = 0.8230
	4.9302

$\frac{4.9302}{3} = 6 + \frac{2.9302}{3}$

$= 2.9767$

Antilog $= 9.4776 \times 10^{-2}$

= 0.094776(accept 0.09478)

No.	Log
4.283	0.6317
0.009478^2	$\bar{3}.9767 \times 2$ +
	$\bar{5}.9534$
	$\bar{4}.5851$ -
Log 9.814	$\bar{1}.9964$
	$\bar{4}.5887 \div 5$
2.0785×10^{-1} ←	$\bar{1}.3177$

= 0.20785

24. Equations of straight lines

1	$RV = 3.2 + \frac{1}{4}V$ $R = \frac{3.2}{V} + \frac{1}{4}$ $Gradient = 3.2$ $y - \text{int}ercept = \frac{1}{4}$	B_1 B_1 B_1	
		3	
2.	$y = -\frac{2}{3}x + \frac{5}{3}$ $Grad\ of \perp line \frac{3}{2}$ $\frac{3}{2} = \frac{1+k}{-2-2}$ $2k = -14$ $k = -7$	B1 M1 A1	 Equating to grad
		03	
3.	$-y\sqrt{3} = -x - 3$ $y = \frac{1}{\sqrt{3}}x + 3$ $grad = \frac{1}{\sqrt{3}}$ $= 0.5774$ $Tan^{-1}0.5774 = 30^0$	M1 M1 A1	
		03	

1. a) Length of diagonal = √ $10^2 + 8^2$
= √164

Vertical height = √16^2 – $\left(\frac{\sqrt{164}}{2}\right)^2$ = 14.66cm

b) Height of the slant surfaces

$\sqrt{16^2 - 4^2} = \sqrt{240}$

$\sqrt{16^2 - 5^2} = \sqrt{231}$

Area of slant surfaces

$(\frac{1}{2} \text{ x } 8 \text{ x } \sqrt{240} \text{ x } 2) = 124.0\ cm^2$

$(\frac{1}{2} \text{ x } 10\text{x } \sqrt{231} \text{ x } 2) = 152.0cm^2$

Area of the rectangular base= $8 \text{ x } 10 = 80cm^2$

Total surface area = $\underline{356cm^2}$

c) *Volume*

$= (\frac{1}{3} \text{ x } 80 \text{ x } 14.66) = 391.0cm^3$

2. *Gradient of line AB* = $\frac{3 - 3k}{K + 1}$

Equation of other line can be written as

$Y = -\frac{3x}{2} + \frac{9}{2}$

$\therefore$ *its gradient* = $^{-3}/_{2}$

Hence $\frac{3 - 3k}{K + 1} = -\frac{3}{2}$

$6 - 6K = -3k - 3$

$-3K = -9$

$K = 3$

$A(-1, 9), \quad B(3,3)$

3. $M_1 = 2x - 3x2$

$M_2 = 1 - 2ax$

$M_1 = M_2$ *at* $x = {}^1/_3$

$2x - 3x^2 = 11 - 2ax$

${}^2/_3 - 3\,({}^1/_3)^2 = 1 - 2ax{}^1/_3$

${}^2/_3 - {}^1/_3 = 1 - {}^2/_3\, a$

$-{}^3/_2 = -{}^2/_3 a$

${}^9/_4 = a$

4. $M1 = \frac{5 - 1}{4 - -2} = \frac{4}{6} = \frac{2}{3}$

$M2 = {}^{-3}/_2$

i.e. ${}^{-3}/_2 = \frac{y - 5}{x - 4}$

$2\,(y - 5) = -3\,(x - 4)$

$2y - 10 - \ -3x + 12$

$3x + 2y - 22$

5. *Points* $(3, 0)$ *and* $(-5, 2)$

$M = -\frac{1}{4}$

$y - 0 = -\frac{1}{4}$

$x - 3$

$y = -\frac{1}{4}x + \frac{3}{4}$

7. *Grad* = $\frac{2}{3}$

$\frac{y - 4}{x + 2} = \frac{2}{3}$

$y = \frac{2}{3}x + \frac{16}{3}$

8. $3y - 5x = 4$ 0r equivalence

$5y = 3x - 10$

$y = \frac{3}{5}x - 2$

$\therefore$ Gradient $= \frac{-5}{3}$

$5 = \frac{y-3}{x+1}$

$3y - 9 = 5x - 5$

9. $L.S.F = \frac{4}{2000000} = \frac{1}{500000}$

$A.S.F = {\frac{1}{5 \times 10^5}}^2 = \frac{1}{2.5 \times 10^{11}}$

Area of rectangle $= (2.4 \times 1.5)\ cm^2$

$= 3.6cm^2$

Actual area $= \frac{3.6 \times 2.5 \times 10^{11}}{100 \times 10000}$ ha

$= 9 \times 10^5$

$= 900,000ha$

10. $2y - 5x = 11$

$Y = {}^5/_2\, x + {}^{11}/_2$

$g = {}^5/_2$

${}^5/_2 m = -1$

$M = -{}^2/_5$

$\frac{Y-4}{X+4} = -{}^2/_5$

$5y + 2x = 14$

$P(x,o)$

$5 X o + 2x = 14$

$X = 7$

$Q(o, y)$

$5y + 2 X o = 14$

$Y = 2.8$

$P(7,0)$

$Q(0, 2.8)$

11. i) $K\left(\frac{3-7}{2}, \frac{4+2}{2}\right) \quad (-2, 3)$

$P\left(\frac{3+1}{2}, \frac{4-2}{2}\right) = (2,1)$

ii) $K_1 = \frac{3-1}{-2-2} = -\frac{1}{2}$

$= 2$

12. Gradient of L1 $= {}^1/_5$

Gradient of L2 = -5

$Y = mx + c$

$2 = -5\ (1)\ t\ c$

$2 = -5tc$

$C = 7$

Epuding L2

$Y = -5x + 7$

13. $3y - 5x = 4$ 0r equivalence

$5y = 3x - 10$

$y = \frac{3}{5}x - 2$

$\therefore \text{Gradient} = \frac{-5}{3}$

$5 = \frac{y-3}{x+1}$

$3y - 9 = 5x - 5$

14. $\text{Gradient} = g = \frac{m-1}{4-2} = \frac{m-1}{2}$

$3y = 5 - 2x$

$y = {}^{5}/_{3} - {}^{2x}/_{3} \qquad g_1 = {}^{-2}/_{3}$

$g \times g1 = \frac{m-1}{2}\ \frac{-2}{3} = -1$

$-2(m - 1) = -6$

$-2m + 2 = -6$

$-2m = -8$

$M = 4$

15. $L_1\ y = -\frac{2}{3}x - \frac{4}{3}$

$M_1 = -\frac{2}{3}$

$M_2 = \frac{3}{2}$

$L_2\ \ y = \frac{3}{2}x + c \quad x = 1, y = 1$

$1 = \frac{3}{2} + c$

$c = -\frac{1}{2}$

$L_2\ \ y = \frac{3}{2}x - \frac{1}{2}$

16. $BP = \text{shs. } \frac{144}{6} \times 100$

$SP = \text{shs. } \underline{140} \times \underline{144} \times 100$

100 6

Let pineapples sold at shs. 72 for every shs. 3 be x

∴ At shs. 60 for every 2 will be 144 – x

$\frac{x}{3} \times 72 + \frac{144-x}{3} = 3360$

$24x + 30(144 - x) = 3360$

$-6x = -960$

$x = 60$

17. $\frac{x+2}{3} - \frac{x-1}{2} = \frac{5}{1}$

$2(x + 2) - 3(x - 1) = 30$

$22x + 4 - 3x + 3 = 30$

$-x + 7 = 30$

$-x = 23$

$x = -23$

25. Reflection and congruence

1	Mid point (1, -4) $\frac{-3--5}{3--1} = \frac{2}{4} = \frac{1}{2}$ Grd of mirror line = -2 $\frac{y+4}{x-1} = -2$ $y + 4 = -2x + 2$ $y + 2x + 4 - 2 = 0$ $y + 2x + 2 = 0$	B_1 B_1 M_1 A_1	

1. (a) *Dist. traveled in 3hrs* *s. drawing*

Plane A – 400 x 3 = 1200km – cm

Plane B – 500 x 3 – 7.5cm

Plane C – 300 x 3 = 900km – 4.5cm

(b) Dist. BA = 12.8 0.1 x 200 = 2560km 20km

$T = \frac{D}{S} = \frac{2560}{500}$ *hrs*

= 5.12hrs of 5hrs, 7.2mns

≈ 5hrs, 7min (nearest min)

(c) Bearing of B from C = $360^o - 20^o = 340^o$

Dist. BC = (10.9 ± 0.1 x 200)km

= 2180km ± 20km

26. Rotation

1. *V.S.F =* $3^3 : 5^3 = 27 : 125$

Volume of larger tank = $\underline{8.1 \times 125}$

27
= 37.5m³

27. Similarities and enlargement

1	(a) $512000:1000000$ $512:1000$ $64:125$ $4^3:5^3$ L.S.F 4:5 $5 \equiv 300cm$ $\therefore 4 \equiv \frac{4\times300}{5} = 240cm$ (b) $25 \equiv 1200m^2$ $16 = \frac{16\times1200}{25}m^2$ $= 768m^2$ (c) $64 \equiv 800kg$ $\therefore 125 \equiv \frac{125 \times 800}{64}$ $\equiv 1562.5kg$	M1 M1 M1 A1 B1 M1 A1 B1 M1 A1	✓A.S.F ✓ex ✓V.S.F
2.	Centre (x,y) A(1,4) A1(2,5) $3\begin{pmatrix}1-x\\-4-y\end{pmatrix}=\begin{pmatrix}2-x\\5-y\end{pmatrix}$ 3 – 3x = 2 – x x = ½ -12 – 3y = 5 – y y = -8 ½ centre (½ , =8 ½)	M1 M1 A1	
		03	
3.	$\frac{10}{5} = \frac{x+6}{6}$ ✓ 60 = 5x + 30 30 = 5x 6 = x ✓ $\frac{10}{5} = \frac{5+y}{y}$ 10y = 25 + 5y 5y = 25 Y = 5 ✓	M1 A1 B1	Application of L.S.F

1. *E.S.F* = $\frac{4-x}{0-x} = 3$

$4 - x = -3x$

$2x = -4$

$x = -2$

$\frac{6 - y}{2 - y} = 3 \longrightarrow 6 - y = 6 - 3y$

$-2y = 0$

$y = 0$

Centre of enlargement

$= (-2, 0)$

2. a) L.S.F = 1:500

Height in cm = (500 x 5)= 2500cm

$\therefore$ Height in m = $^{2500}/_{100}$ = 25m

b) A.S.F = 1:250000

= 1:25 (in m^2)

$\therefore$ if 25 = 36

$= (^{36}/_{25})m^2$ $= 1.44m^2$

c) V.S.F = 1:500

$1:125m^3$

Corresponding volume

$= (^{125}/_{120})m^3$

$= 1.042\ m^3$ $= 10420cm^3$

3. Let DE = x cm

$\therefore AD = 3 + x$

$\frac{3 + x}{x} = \frac{9}{4}$

$12 + 4x = 9x$

$x = 2.4$ cm

DE = 2.4

4. L.S.F $= \frac{12}{8} = \frac{3}{2}$

A.S.F $= \frac{9}{4} = \frac{336}{x}$

$x = 149^1/_3cm^2$

Area of QRTS $= 336 - 149^1/_3$

$= 186^2/_3cm^2$

5. (a) $\frac{4}{3} = \frac{64}{x}$

$x = 48cm$

(b) $¾ = \frac{810}{y}$

$\frac{27}{64} = \frac{810}{y}$

$27y = 810 \times 64$

$y = 1920$grams

6. ΔABC is similar to ΔADE

$DE = \frac{7}{4}$

$DE = \frac{(7x8)}{4}cm$

$= 14cm$ $\qquad\qquad = {}^{-7}/_{23}$

7. Area scale factor = 12: 108

$= 1: 9$

Linear scale factor = $\sqrt{1} : \sqrt{9}$

$= 1 : 3$

Volume scale factor = $1^3 : 3^3$

$= 1 : 27$

Volume of the smaller cone = $\frac{810cm^3 \times 1}{27}$

$= 30cm^2$

8. ½ h (a + b) = Area of trap.

$\frac{1}{2} x\ {}^3 (DC + 4) = 15.6$

$DC + 4 = \frac{15.6 \times 2}{3}$

$DC = 6.4$

$\frac{DC}{BE} = \frac{DA}{EA}$

$\therefore \frac{3 + x}{x} = \frac{6.4}{4}$

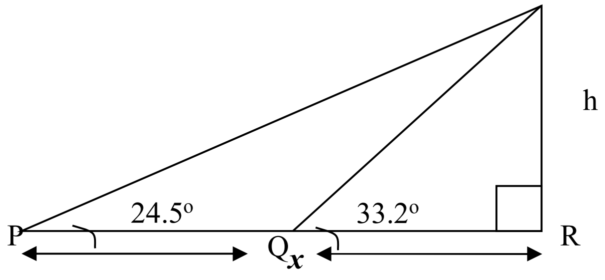
$12 + 4x = 6.4\ x$ √

$2.4x = 12$ √

$x = 5cm$

28. The Pythagoras theorem

1.



From Δ PTR, $\tan 24.5° = {}^{h}/_{x}$ ___ x ____ ${}^{h}/_{\tan 24.5°}{}^{\circ}$

From ΔQTR, $\tan 33.2° = {}^{h}/_{x-5}$ ___ $x = {}^{h}/_{\tan 33.2°}{}^{\circ} + 5$

$\therefore {}^{h}/_{\tan 24.5}{}^{\circ} = {}^{h}/_{\tan 33.2°}{}^{\circ} + 5$ ___ ${}^{\circ}\,{}^{h}/_{\tan 24.5}{}^{\circ} - {}^{h}/_{\tan 33.2°}{}^{\circ} = 5$

$h\ [{}^{1}/_{0.4557} - {}^{1}/_{0.6544}] = 5$

$h = (2.194 - 1.528) = 5$

$h = {}^{5}/_{0.666} = 7.508$

$\therefore$ height = 7.5m

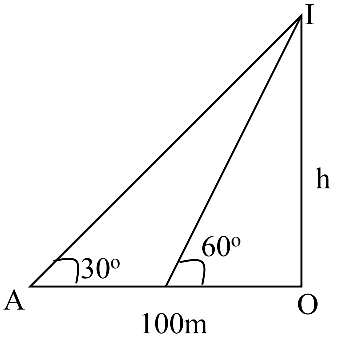
2. $L.S.F = \frac{2}{3}$

$V.S.F. = \left(\frac{2}{3}\right) = \frac{8}{27}$

Ratio = 8 : 27

29. The trigometric ratio 1

1.



$Tan\ 30^o = \frac{x}{100+y}\ x$

$x = (100 + y)\tan 30^o$

$(100 + y)\tan 30^o = y\tan 60^o$

$Tan\ 60^o = \frac{x}{y} = x = y\tan 60^o$

$(100 + y)\ 0.5774 = 1.1732y$

$57.74 = 1.155y$

$y = \frac{57.74}{1.155}$

$y = 49.99 \equiv 50m$

$\therefore x = 50\tan 60$

$x = 86.6m$

2. $Sin\ \theta = 0.70$

$\theta = 44.43°, 135.57°$

3. (a) (i) Area of triangle $A^1B^1C^1 = ½ \times 4 \times 4$

$= 8$ sq. units

(b) (ii) Reflection in the line $y = x$

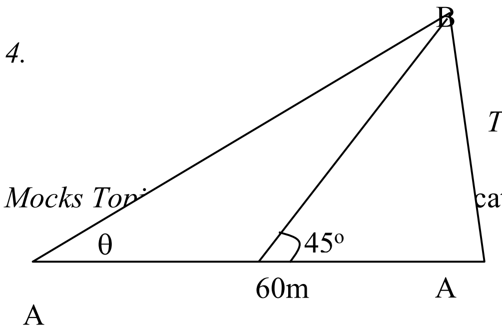
(c) combine transformation = $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$

$\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$

$Det\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix} 0 - 2 \times 2 = -4$

Inverse transformation = $-\frac{1}{4}\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix} = \begin{pmatrix} 0 & ^{-1}/_{2} \\ ^{-1}/_{2} & 0 \end{pmatrix}$

4.



$Tan\ 45 = \frac{AB}{60}$

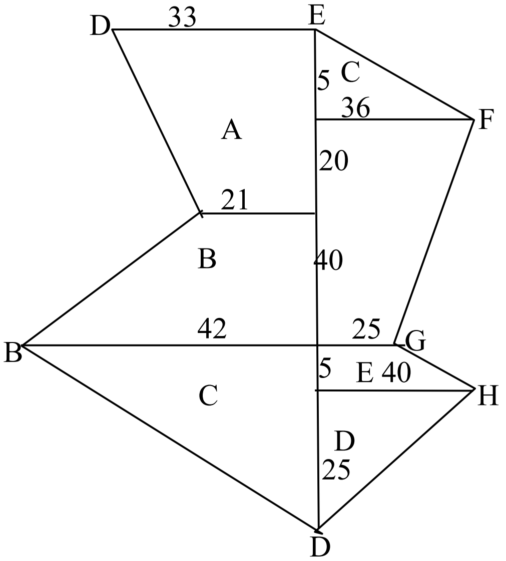
$AB = 45$

$\tan \theta = \frac{\underline{45}}{240}$

$= 0.1875$

$\theta = 10.62^o$

5.



Area A: ½ x 25 (33 + 21) = 675

Area B: ½ x 40 (21 x 42) = 1260

Area C: ½ x 30 x 42 = 630

Area D: ½ x 25 x 40 = 500

Area E: ½ x 5 (40 + 25) = 162.5

Area F: ½ X 60 (25 + 36) = 1830

Area G: ½ x 5 x 36 = 90 √

$= 5,147.5m^2$

6. ∴ Philip takes 10 days.

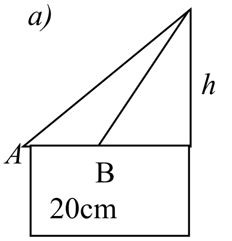
$2\cos 2x = 0.600$

$\cos 2x = 0.3000$

$2x = 72.5^o, 287.5$

$x = 36.25^0, 143.75$

7. a)



$\tan 32 = \frac{\underline{h}}{20 + x}$

$h = (20 + x) \tan 32^o = 12.498 + 0.6249x$

$\tan 40^o = {}^h/_x$

$h = x \tan 40^o = 0.8391x$

$0.8391x = 12.498 + 0.6249x$

$0.8391x – 0.6249x = 12.498$

$0.2142x = 12.498$

$x = \underline{12.498} = 58.35m$

0.2142

$\therefore$ *The distance of A from the house*

$= (20 + 58.35)m \quad = 78.35$

b) $h = x \tan 40^o = 58.35 \times 0.8391 \quad = 48.96m$

$\therefore$ *The total height of the house*

$= 1.82m + 48.96m \quad = 50.78m$

11. $\tan 32^o c = \frac{h}{20 + x}$

$h = (20 + x) \tan 32^o$

$\tan 40^o = \frac{h}{x}$

$h = \tan 40^o$

$\therefore x \tan 40^o = (20 + x) \tan 32^o$

$0.8391x = (20 + x)\, 0.6249$

$0.8391x = 12.498 + 0.6249x$

$0.8391x - 0.6249x = 12.498$

$x = 58.35m$

$20 + 58.35 = 78.35m$

(b) *The height of the house*

$\text{Tan } 40^o = \frac{h}{58.35} = h = 58.35 \tan 40^o$

$h = 58.35 \times 0.8391$

$h = 48.96 + 1.82$

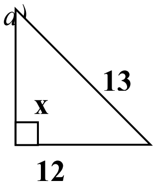
$h = 50.78$

12. $\frac{24}{\text{Sin } 48} = 2R \quad \Rightarrow R = 16.15 \text{ cm}$

$\text{Area} = 3.14 \times 16.15^2$

$= \underline{819.26 \text{ cm}^2}$

13. a)



Hyp = $\sqrt{5^2 + 12^2}$

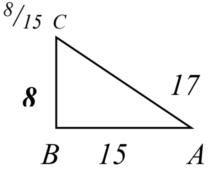
= 13

cos x = $^{12}/_{13}$

(b) Sin2990-x)

= $(^{12}/_{13})^2 = {}^{144}/_{169}$

]14. Tan θ = $^{8}/_{15}$



$AB^2 = 8^2 + 15^2$

AB = $\sqrt{289}$ = 17

Sin θ = $^{8}/_{17}$, cos θ = $^{15}/_{17}$

$\frac{\text{Sin } \theta - \cos \theta}{\text{Cos } \theta + \sin \theta} = \frac{^{8}/_{17} - {}^{15}/_{17}}{^{15}/_{17} + {}^{8}/_{17}} = {}^{-7}/_{17} \times {}^{17}/_{23}$

= $^{-7}/_{23}$

30. Area of a triangle

1. a) $BC^2 = 50^2 + 80^2 - 2 \times 50 \times 80 \cos 30$

= 2500 + 6400 – 6928.20 = 1971.8

∴ BC = $\sqrt{1971.8}$

= 44.40m

= 44m

b) Area of the plot

= ½ x 50 x 80 x sin30 = 1000m^2

= $\frac{(1000)}{10000}$ ha

= 0.01ha

c) i) Length of wire required

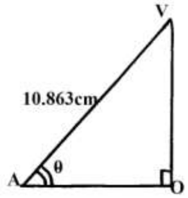
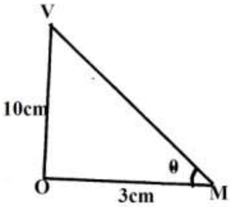
= (50 + 80 + 44) x 4 = 696m

ii) Complete rolls to be bought = 2

iii) Cost (2 x 4000) = Shs.8000

31. Area of polygons

1.	(a) AC (b) AC = $\sqrt{6^2 + 6^2}$ = $\sqrt{72}$ = 8.485 $\bar{A}O$ = ½ x 8.485 = 4.243 VA = $\sqrt{4.243^2 + 10^2}$ = $\sqrt{118.003}$	**B1** **M1** **M1**	

	= 10.863.	**A1**	
	(c) 		
	Cos θ = $\frac{4.243}{10.863}$	**M1**	
	Cos θ = 0.39059		
	θ = 67.01^0	**A1**	
	(d) 		
	Tan θ = $^{10}/_3$	**M1**	
	θ = 73.30^0	**A1**	
	(e) Vol = $^1/_3$ x 6 x 6 x 10	**M1**	
	= 120cm^3	**A1**	
		10	

1. $$\frac{180(n-2)}{180(n-1-2)} = \frac{4}{3}$$

540n – 1080 = 720n – 2160

720n – 540n – 2160 – 1080

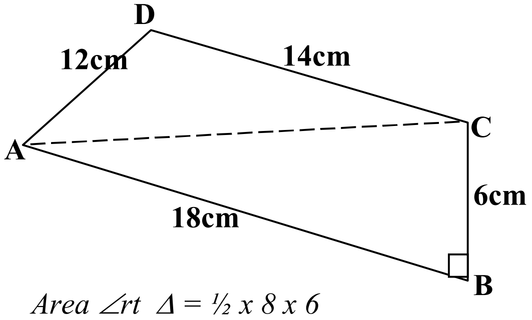
180n = 1080

n = 6

Area of hexagon = 6 (½ x 10 x sin 60)

= 6 x 43.30 = 259.81 cm^2

2.



Area ∠rt Δ = ½ x 8 x 6

$$S = \frac{12 + 14 + 10}{2}$$

$$A = \sqrt{18(18-12)(18-14)(18-10)}$$

$= 18 x 6 x 4 \ x 8$

$= \sqrt{3456}$

$= 58.79$

Total area $= 24 + 58.79 = 82.79$

32. Area of part of a circle

1. (a) $A = \frac{120}{360} x \pi x 10^2 - \frac{1}{2} x 100 x 10 \sin 12$

$= 104.72 - 43.30 = 61.42m^2$

(b) (ii) $\frac{120}{360} x 2 x 10 x 20$

$= 418.9m^2$

(b) Total area $= 61.42 + 61.42 + 418.9$

$= 541.74m^2$

Cost $= 541.74 x 310 = 167{,}939$

2. a) $\cos 54° = {}^{x}/_{10}$

$X = 5.878$

$\therefore$ size $= 2 x 5.878 = 11.756$

Area of $\Delta = \frac{1}{2} x 10^2 \sin 72° = 47.55$

Total area of Δs $= 47.55 x 5 = 237.8cm2$

b) Area of circle $= {}^{22}/_{7} x 10 x 10 = 314.8$

Shaded region $= {}^{3}/_{5} (3.143 - 237.8)$

$= 45.9cm^2$

3. (a) $7.8^2 = 6.6^2 + 5.9^2 - 2 x 6.6 x 5.9 \cos R$

$\cos R = \frac{6.6^2 + 5.9^2 - 7.8^2}{2 x 6.6 x 5.9}$

$= \frac{78.37 - 60.84}{77.88}$

$= 0.2251$

$\angle R = 77^o$

$\frac{7.8}{\sin 77} = 2r$

$r = \frac{7.8}{2 \sin 77}$

$= 4 cm$

(b) $\frac{5.9}{\sin p} = \frac{7.8}{\sin 77}$

$\sin P = \frac{5.9 \sin 77}{7.8}$

$= 0.7370$

$\angle P = 47.5^o$

$\angle Q = 180 - (77 + 47.5) \quad = 55.5^o$

(c) Area of shaded region

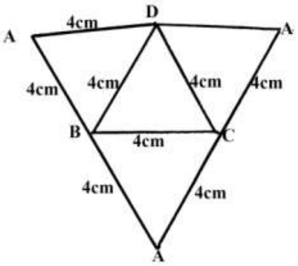
$= 3.142 \times 4^2 - ½ \times 6.6 \times 5.9\sin 77$

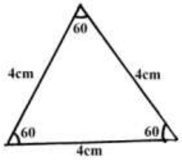
$= 50.27 - 18.97 = 31.30$

4. $(^{60}/_{360} \times ^{22}/_7 \times 24 \times 24) - (^{60}/_{360} \times ^{22}/_7 \times 12 \times 12)$

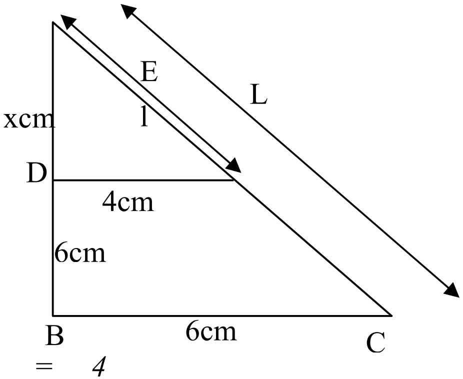
$301.71 - 75.43 = 226.26$

33. *Surface area of solids*

1	(a) $(10+2x)(8+2x)=168$ $80+20x+16x+4x^2 = 168$ $4x^2+36x-88=0$ $x^2+9x-22=0$ $p=-22$ $s=9$ $-2,11$ $x^2-2x+11x-22=0$ $x(x-2)+11(x-2)=0$ $(x+11)(x-2)=0$ $\therefore x=2$ $2m$ (b) (i) Area of the path $168-80=88m^2$ Area of the path excluding corners $88-4\times 4m^2$ $=88-16$ $=72m^2$ No of slabs $=\frac{72\times 100\times 100}{50\times 50}$ $= 288$ (ii) $4\times 600+288\times 50$ $=2400+14400$ $=Ksh.16800$	M_1 M_1 M_1 A_1 M_1 M_1 M_1 A_1 M_1 A_1	✓equation ✓quad equation ✓partial fact ✓exp. for area path ✓exp. for area of the slabs excluding corners ✓exp for No. of slabs ✓exp total cost
2.	 S.A = ½ x 4 x 4 sin 60 x 4 = 27.713cm2	B1 M1 A1	

			
		03	

1. (a)



$\frac{x}{x+6} = \frac{4}{6}$

$6x = 4x + 24$

$x = 12$ cm

$L = \sqrt{12^2 + 4^2}$

$= \sqrt{160}$

$= 12.65$ (2 d.p)

$L = \sqrt{18^2 + 6^2}$

$\sqrt{360}$

$= 18.97$

$SA = \pi(RL - rL)$

$= 3.142 (6 \times 18.97 - 4 \times 12.65)$

$= 3.142 \times 63.22 = 198.64 \text{ cm}^2$

(b) Cost of material for one lamp shape

$= \frac{198.64}{10000} \times 800$

$=$ Sh15.90

Cost of 10 lamp shape $= 2 \times 10 \times 15.90 =$ sh 318

2. *Area of the remaining cross-section*

$= 4.22 \times \pi$

$= (17.64\pi)\text{cm}^2$

Area of the curved surface

$= (8.4\pi x 150$

$= \frac{1260\pi \text{ cm}^2}{2}$

Area of the flat surface

$= (150 \times 8.4)cm^2$

$=1260cm^2$

Total area $= (1260 + 630\pi + 17.64\pi$

$= (1260 + 647.64\pi)cm^2$

$= 3295cm^2/\ 3295.44cm^2$

3. Surface area $= 2(0.6 \times 2.8)m^2 + 2(0.6 \times 3.2)m^2$

$= (3.36 + 3.84)m^2$

$= 7.2m^2$

4. a) Area of hemispherical part

$= \frac{1}{2} X\ 4\ UR^2$

$= 2\ X\ ^{22}/_{7}\ x\ 35\ X\ 35$

$= 7700cm^2$

b) Slant height for original cone

$$\frac{L}{L - 60} = \frac{35}{14}$$

$L = 100cm$

c) Surface area of frustrum

$= URL - url$

$= ^{22}/_{7}\ X\ 35\ x\ 100 - ^{22}/_{7}\ x\ 14\ X\ 40$

$= 11000 - 1760 = 9240\ cm^2$

d) Area of base

$^{22}/_{7}\ X\ 14^2 = 616\ cm^2$

e) Total surface

$= 7700 + 9240 + 616 = 17556cm^2$

5. a)$TA = 2\ X\ 6.8\ X\ 3.5 + 2\ X\ 4.2\ X\ 3.5m^2$

$= 47.6 + 29.4\ m^2 \qquad = 77m^2$

b) $77 - (^{75}/_{100}\ X\ 2.5\ X\ 2 + ^{400}/_{100}\ X\ 1.25)m^2$

$77 - (3.75 + 5)\ m^2$

$77 - 68.25\ m^2 = 8.75m^2$

c)i) Cost of paint A

$= 68.25\ X\ 0.8\ X\ 80 =$ Kshs.43681

ii) Cost of paint B

$$\frac{68.25\ X\ 35}{0.5}$$

= Kshs.4777.5

d) No of tins

$$= \frac{54.6\ X\ 1000}{400}$$

$= \underline{136.5}$ = 137 tins

No. of tins

$$= \frac{136.5}{1.25}$$

$= 109.2$ = 110 tins

6. *Top surface area* = $8x8 = 64cm^2$

Bottom surface area = $12x12 = 144cm^2$

Height of slanting faces

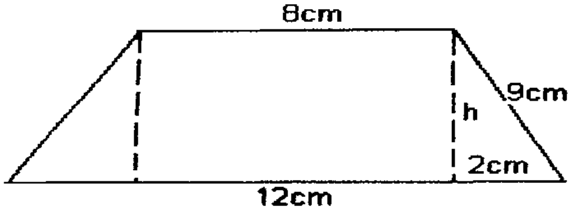
$H = 9^2 - 2^2 = 8.775cm$

Area of slanting face = $\frac{1}{2}(12 + 8) x 8.775 x 4$

$= 351cm^2$

$T.S.A = 64 + 144 + 351 = 559cm^2$

For both
Attempt to solve area for slant face



$^1/_8 = {}^{1+9}/_{12}$

$1 = 18$

$D = \frac{1}{2}\sqrt{12^2 + 12^2} = 8.485$

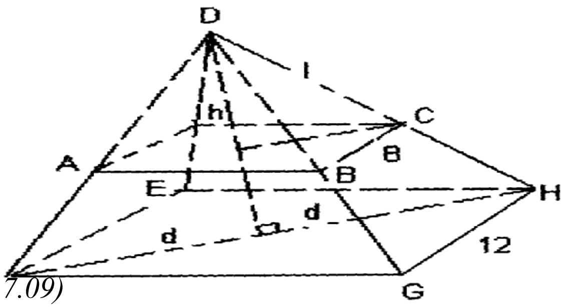
$H = \sqrt{27^2 - 8.485^2 = 25.63}$

$^h/_{25.63} = {}^8/_{12}$

$h = 17.09cm$

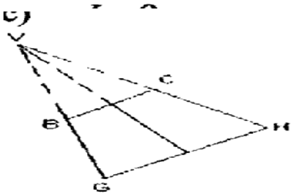
$v = ({}^1/_3 x\ 12 x\ 12 x\ 25.63 - ({}^1/_3 x\ 8 x\ 8 x\ 17.09)$

$= 865.7cm^2$



(c) $Tan\ \theta^{25.63}/_6 = 4.272$

$\theta = 76.82^o$



34. Volume of solids

1	Volume of cube = 4.4×4.4×4.4 Volume of sphere $\frac{22}{7} \times r^3 = 4.4 \times 4.4 \times 4.4$ $r^3 = 4.4 \times 4.4 \times 4.4 \times \frac{7}{22} \times \frac{3}{4}$ $r^3 = 20.328$ $r = 2.73cm$ (3 s.f)	M_1 M_1 A_1	
2.	Vol. of sphere =	M1	Follow through of $\frac{22}{7}$ as π is

	$\frac{4}{3}\pi r^3 + \frac{4}{3}\pi r^3$		used
	$= \frac{4}{3} \times \frac{22}{7}(2.3^3 + 3.86^3)$	M1	
	$= \frac{88}{21} \times 69.679456$ $= 291.990$		
	Remaining material	M1	
	$\left(\frac{19}{20} \times 291.990\right)$	A1	
	$= 277.297$ No of slabs = $\frac{277.297}{3.142 \times 0.8^2 \times 7}$ $= 19.699$ $= 19\,slabs$		
		04	

1. a) Length of diagonal = $\sqrt{10^2 + 8^2}$
$= \sqrt{164}$

Vertical height = $\sqrt{16^2 – \left(\frac{\sqrt{164}}{2}\right)^2}$
$= 14.66$cm

b) Height of the slant surfaces
$\sqrt{16^2 – 4^2} = \sqrt{240}$
$\sqrt{16^2 – 5^2} = \sqrt{231}$
Area of slant surfaces
$(\frac{1}{2} \times 8 \times \sqrt{240} \times 2) = 124.0\text{ cm}^2$
$(\frac{1}{2} \times 10 \times \sqrt{231} \times 2) = 152.0\text{cm}^2$
Area of the rectangular base= $8 \times 10 = 80\text{cm}^2$

Total surface area = $\underline{356\text{cm}^2}$

c) Volume
$= (\frac{1}{3} \times 80 \times 14.66) = 391.0\text{cm}^3$

2. Volume of the cylinder
$= (\frac{22}{7} \times 6 \times 6 \times 12)\text{cm}^3 = 1357.71\text{cm}^3$
Volume of a sphere
$= (\frac{4}{3} \times \frac{22}{7} \times 3 \times 3 \times 3)\text{cm}^3 = 113.14\text{cm}^3$
$\therefore$ No. of spheres formed
$= \frac{1357.71}{113.14\text{cm}^3}$
= 12 spheres

3. Let the smaller length be x cm
$\therefore$ Dimensions are x, 2x, 3x
$x \;.\; 2x \;.\; 3x = 1024$

$6x^3 = 1024$

$x^3 = \frac{1024}{6}$

$x = 3\sqrt{\frac{1024}{6}}$

Dimensions are 5.547, 11.09, 16.64

4. $(^{60}/_{360} x\ ^{22}/_{7} x\ 24 x\ 24) – (^{60}/_{360} x\ ^{22}/_{7} x12 x\ 12)$

$301.71 – 75.43 = 226.26$

5. (a)(i) $2\pi rh + 2r\pi^2 + \pi r^2$

$= 2 x 22/7 x 1.4 x 1.4) + 2 x 22/7 x 1.42) + (22/7 x 1.42)m^2$

$= (12.32+ 12.32 + 6.16)m^2= 30.8m^2$

OR $r(2h + 2r + r)$

$= 22 x 1.4 (2x 1.4 + 3(1.4)= 30.8m^2$

(ii) shs. (75 x 30.8)= Shs.2,310

(iii) Total vol.

$= ^{22}/_{7} x 1.42 x 1.4) + (½ x\ ^{4}/_{3} x\ ^{22}/_{7} x 1.42)m^3$

$= 8.624\ \ 4.106 = 12.7306m^3$

capacity = (12.7306 x 1000)liters= 12730.6litres

(b) First 2days = 185 x 2 = 370litres

Remaining amount = (12730.6 – 370)liters

= 12360.6litres

Days to use = $\frac{12,360.6}{200}$

= 61.803days

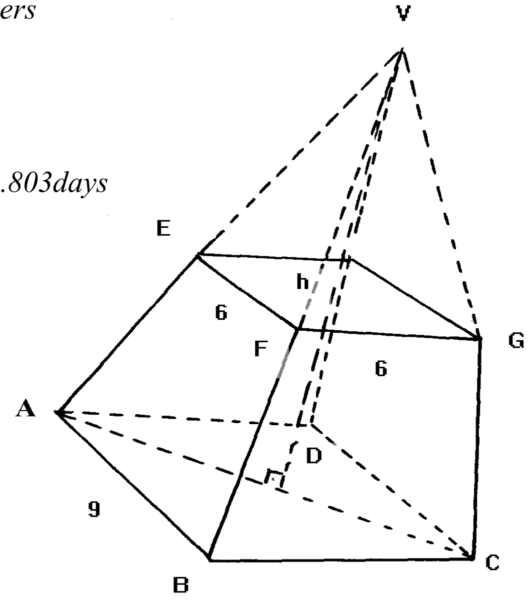
In all it takes = (61.803 + 2)days = 63.803days

6. a) $\frac{h + 3}{h} = \frac{9}{6}$ √

$6h + 18 = 9h$

$h = 6$ cm√

height = $\underline{6 + 3 = 9 \text{ cm}}$



b) Base = 9 x 9 = 81 cm^2

Top = 6 x 6 = 36 cm^2

Sides = 3.67 x 15 x ½ x 4

= 110.15 cm^2

Total = $\underline{227.15 \text{ cm}^2}$

c) Vol. of bigger = $^1/_3$ x 81 x 9

= 243

Vol of smaller = $^1/_3$ x 36 x 6

= 72

Vol. of√frustrum = $\underline{171 \text{ cm}^2}$

d) $\sin \theta = \frac{9}{11.02}$

$\theta = \underline{54.8^o}$

7. Volume of a hemisphere

$\frac{2\pi r^3}{3} = \frac{2}{3} \times \frac{22}{7} \times 12 \times 12 \times 12$

$= \frac{176}{7} \times 144$

$= 3620.571429 = 3620.57$

Volume of a cone

$^2/_3\pi r^2 h$

$\frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \ \times h = 36.20.57$

$\frac{6 \times 44h}{7} = 3620.57$

$264h = 3620.57 \times 7$

$h = \frac{3620.57 \times 7}{264}$

$= 95.9981 \ = 95.998$

8. $V = \left(\frac{22}{7} \times 2 \times 2\ 1.5\right) + \left(\frac{22}{7} \times 3 \times 3 \times 1.5\right) + \left(\frac{22}{7} \times 4.4. \times 1.5\right)$

$= \frac{132}{7} + \frac{297}{7} + \frac{528}{7}$

V of hole $= \frac{22}{7} \times 1 \times 1\ 4.5$

$= \frac{99}{7}$

$V = \frac{957}{7} - \frac{99}{7} = \frac{858}{7}$ $= 122.57\ cm^3$

Mass = 2.8 x 122.57

= 343.196g

≃ 343.2g

9. Volume of hemisphere $= \cancel{\frac{1}{2}} \times \frac{\cancel{4}}{3} \times \frac{22}{\cancel{7}_1} \times \cancel{7} \times 7 \times 7$

$= 718.67\ cm^3$

Vol. of cylinder $= \pi r^2 h = \frac{22}{\underset{1}{\cancel{7}}} \times \overset{1}{\cancel{7}} \times 7 \times 5 = 770\ cm^3$

Vol of frustrum $= {}^1/_3 \times \frac{22}{7} \times 7 \times 7 \times h_1 -$

${}^1/_3 \times \frac{22}{7} \times 3.5 \times 3.5 \times h_2$

Height of cone $\Rightarrow \frac{h_1}{h_2} = \frac{7}{3.5}$ but $h_1 = h_2 + 6$

$\frac{h_2 + 6}{h_2} = \frac{7}{3.5} \Rightarrow 7h_2 = 3.5h_2 + 21$

$3.5\ h_2 = 21$

$h_2 = 6\ cm$

$h_1 = 12\ cm$

1 4

$$\therefore \text{Vol. of frustrum} = {}^{1}/_{3}\ \cancel{x}\ \frac{22}{7}\ x\ 7\ \cancel{x}\ 7\ x\ 12\ -$$

$$\underset{1}{{}^{1}/_{\cancel{3}}}\ x\ \frac{\overset{11}{\cancel{22}}}{\underset{\cancel{2}}{\cancel{7}}}\ x\ 3.5\ x\ \underset{1}{\cancel{3.5}}\ x\ \overset{2}{\cancel{6}}$$

$= 616 – 77 = 539\ cm^3$

Total volume $= 718.67\ cm^3 + 770cm^3 + 539\ cm^3$

$= 2027.67\ cm^3$

a) S.A of top $= \pi r^2\ \frac{22}{7}\ x\ 3.5\ x\ 3.5 = 38.5\ cm^2$

S.A of curved part of frustrum $= \frac{\cancel{22}}{7}\ x\ 7\ x\ 13.89\ \ -$

$\frac{22}{7}\ x\ 3.5\ x\ 6.945$

$$\begin{array}{r} 305.580 \\ -\ \ 76.395 \\ \hline 229.185\ cm^2 \end{array}$$

S.A of curved part of cylinder $= 2\pi r\ x\ h = \cancel{2}\ x\ \frac{22}{\cancel{7}}\ x\ 7\ x\ 5$

$= 2220\ cm^2$

S.A of hemisphere $= ½\ x\ 4\ \pi r^2 = \frac{\cancel{22}}{7}\ x\ 7\ x\ 7 = 308\ cm^2$

Total S.A = $\underline{795.685\ cm^2}$

10. L/S.F $= {}^{2.2}/_{3.3} = {}^{2}/_{3}$

${}^{4.8}/_{4.8\ +\ h} = {}^{2}/_{3}$

$h = 24$

volume of smaller cone

${}^{1}/_{3}\ x\ {}^{22}/_{7}\ x\ 2.2\ x\ 2.4$

$= 12.169$

Volume of large cone

${}^{1}/_{3}\ x\ {}^{22}/_{7}\ x\ 3.3\ x\ 3.3\ (4.8 + 2.2)$

$\therefore$ V of frustum

$82.14 – 12.17 = 69.97\ cm^3$

11. (a) Volume $= \frac{2}{3}\ \pi r^3 + \frac{1}{3}\pi\ r^2\ x\ \frac{3}{2}\ r = 31.5\pi$

$4r^3 + 3r^3 = \underline{31.5\ x\ 6}$

$r = \sqrt[3]{\frac{31.5\ x\ 6}{7}}$

$= 3cm$

(b) slant height of con $= \sqrt{4.5^2 + 3^2}$

$= 5.408cm$

Surface are $= 2\pi\ x\ 3^2 + \pi\ x\ \ 3\ x\ 5.408 = 107.5cm^2$

(c) $\text{Height} = \frac{31.5}{4^2\pi}$

$= 1.969cm$

(d) $\text{Density} = \frac{144}{231.5\pi}$

$= 1.46g/cm^3$

12. Volume of cube side x cm = $(xcm)^3$

$\therefore\ x^3cm^3 = \frac{1280}{20} cm^3$

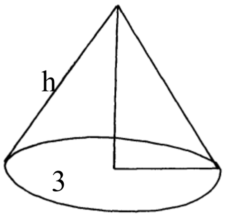
$x = \sqrt[3]{\frac{1280}{20}}$

$= \sqrt[3]{64}$

$= 4\ cm$

13.

$^9/_3 = {}^{14 + h}/_h$



$9h = 42 + 3h$

$6h = 42$

$h = 7$

volume of the frustrum $= (^1/_3 \times {}^{22}/_7 \times 9 \times 9 \times 21)cm^3$

$= (^1/_3 \times {}^{22}/_7 \times 3 \times 3 \times 7)cm^3$

$= 1782 – 66 = 1716cm^3$

35. Quadratic equations

1	$25x^2 - 20x + k = (5x - c)^2$ $= 25x^2 - 10cx + c^2$ $-20x = -10cz$ $c = 2$ $k = c^2 = 2^2$ $\therefore k = 4$	M_1 A_1	Comparing terms or equivalent $c = \frac{b^2}{4a}$ $k = \frac{(-20)^2}{4 \times 25}$
		2	

1. $(3x + 5)^2 + (\sqrt{611})^2 = (7x = 2)^2$

$(9x^2 + 30x + 25) + 611 = 49x^2 + 28x + 4$

$-40x^2 + 2x + 632 = 0$

$20x^2 - x = 316 = 0$

$x = \frac{1 \pm \sqrt{2581}}{40}$

$= \frac{160}{40}$ OR $x = 4$

$\text{Area} = (\frac{1}{2} \times \sqrt{611} \times 17$

$= 210.1cm^2$

2. $7x - 4 \le 9x + 2$

$\frac{-6}{2} \le \frac{2x}{2}$

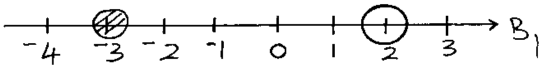
$-3 \le x$

$9x + 2 < 3x + 14$

$6x < 12$

$x < 2$

$\therefore -3 \le x < 2$



Integral values are -3, -2, -1, 0 and 1

36. Linear inequalities

1. $\frac{12 \times 0.25 - 12.4 \div 0.4 \times 3}{⅛ \text{ of } 2.56 + 8.68}$

$\frac{3 - 31 \times 3}{0.32 + 8.68}$

$\frac{-90}{9}$

$= -10$

2. $x - 9 \le -4 < 3x - 4$

$x - 9 \le -4$

$x \le 5$

$3x - 4 > -4$

$3x > 0$

$x = 0$

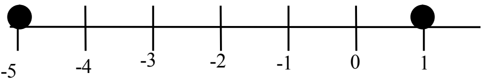
$0 > x \le 5$ √

$\{1, 2, 3, 4, 5\}$ √

3

3. $x > 3 - 2x$

$x \le \frac{2x + 5}{3}$



$3 - 2x < x$

$-2x < x - 3$

$-3x < -3$

$x < 1$

$2x + 5 \ge 3x$

$-x \ge 5$

$x \le -5$

$-5 \le x < 1$

4. $3 - X \le 1 - ½X$

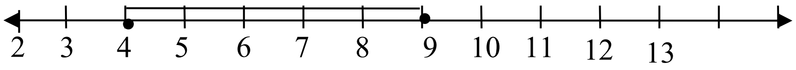
$3 - 1 \le X - ½X$

$2 \le ½X$

$X \ge 4$

$-x + 5 \le 14 - 2x$

$2x - x \le 14 - 5$
$x \le 9$
$4 \le X \le 9$



5. $4x - 3 \le 6x - 1$
$-2x \le 2$
$x \ge -1$

$6x - 1 < 3x + 8$
$3x < 9$
$x < 3$

$-1 \le x < 3$

6. $2 (2-x) < 4x - 9$

$4 - 2n < 4x - 9$

$4 + 9 < 4x + 2n = 13 \; 6x$

$= {}^{13}/_{6} < n$ $\qquad = 2^{1}/_{6} < n$

and $4x - 9 < x + 11$

$4n - n < 11 + 9$

$3n < 20$

$x < {}^{20}/_{3} = < {}^{2}/_{3}$
Integral values 3, 4, 5, 6

7. $L_3 : y \ge 1$
$L_1 : y + x \ge -1$
$L_2 : y - x$

8. a) $x^2 + 2xy + y^2 = x^2 + xy + xy + y^2$
$= x(x + y) + y(x + y)$
$= (x + y)(x + y)$
$\therefore (x + y)^2 = 8 \times 8 = 64$

b) $x^2 + 2xy + y^2 = 64$
$(x^2 + y^2) + 2xy = 64$
$34 + 2xy = 64$
$2xy = 30$

9. Equation of L1
$(3.5, 4) \; (0, 2)$
$\frac{y-2}{x-0} = \frac{2}{3.5-0}$
$3.5y - 7 = 2x$
$\therefore y = {}^{4}/_{7}x = 2x$
Inequality of

Equation of L2
$(0, 3) \quad (4, 2)$
$\frac{y-2}{x-4} = \frac{3-2}{0-4}$
$-4(y-2) = x-4$
$-4y + 8 = x - 4$
$-4y = x - 12$
inequality $y \ge -\frac{1}{4}x + 3$
$4y \ge -x + 12$

Equation of L3
$\frac{y-2}{x-4} = \frac{2}{-0.5}$
$-0.5(y-2) = 2(x-4)$
$-5y + 1 = 2x - 8$
$-5y = 2x - 9$
$y = -4x + 18$
in equality $y \le -4x + 18$

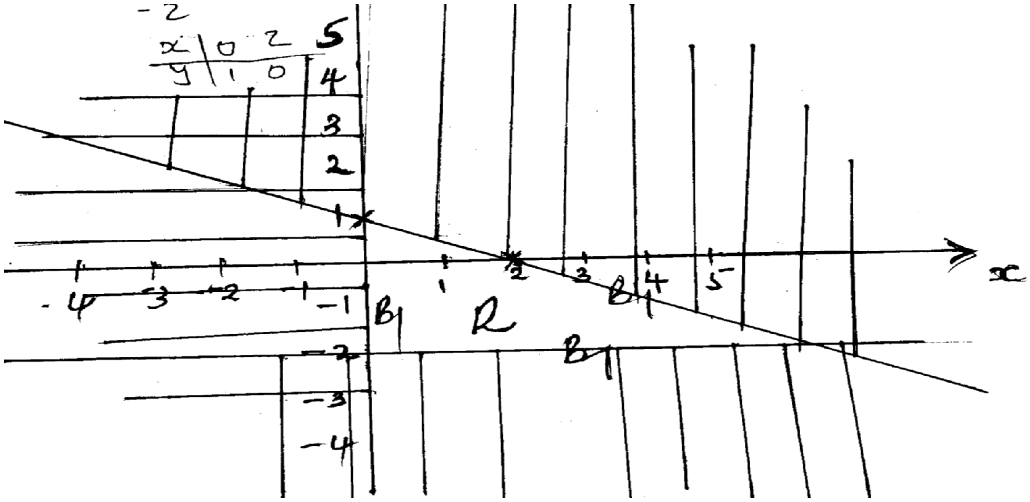
$y \leq {}^{4}/_{7}x + 2$

Or $7y\ 4x + 14$

10. *Lines to be drawn* $x = 0$, $y = 2$

$2y + x = 2$

x	0	2
y	1	0



11. $3(1 + x) < 5x – 11$

$3 + 3 x) < 5x – 11$

$-2x < - 14$

$x > 7$

$5x – 11 < 45$

$5x < 56$

$x < 11.2$

Integral values are 8, 9, 10, 11

12. $y \leqslant x$

$x \leqslant 8$

$y \geqslant 0$

37. Angle properties of circles

1.	<QRO = 30^0 Base angles of isosc. Triangle		
	<ROT = 100-120 = 60^0 <s on straight line		
	<ROT = 60^0		
	<ORP = 60^0 Base angles of Isoc triangle		
	<QRS = 90^0 diameter subtended right angle at the circumference		
	(a) <SRQ = $90^0 – 30 - 30^0$		
	$= 30^0$	**B1**	
	<QRO + ORP + SRP = 90^0	**B1**	
	Diam. Subt 90^0 at circumference		
	(b) ORP = 60^0 Base angle of isosceles triangle	**B1 B1**	
	(c) OP to MPT <OPT = 90^0	**B1**	
	Radius meets tangent at 90^0		
	<RTP = 90^0 - <OPR		

	$= 90^0 - 30^0$	**B1**	
	$= 60^0$		
	(d) <STP = 180^0 - <OPT 90^0 - <POT 60^0	**B1**	
	Angle sum of triangle	**B1**	
	$= 30^0$		
	(e) <QPM = <QRP = 60^0	**B1**	
	Angles in alternate segment	**B1**	
		10	
2.	<QRO = 30^0 Base angles of isosc. Triangle		
	<ROT = 100-120 = 60^0 <s on straight line		
	<ROT = 60^0		
	<ORP = 60^0 Base angles of Isoc triangle		
	<QRS = 90^0 diameter subtended right angle at the circumference		
	(a) <SRQ = $90^0 – 30 - 30^0$		
	$= 30^0$	**B1**	
	<QRO + ORP + SRP = 90^0	**B1**	
	Diam. Subt 90^0 at circumference		
	(b) ORP = 60^0 Base angle of isosceles triangle	**B1 B1**	
	(c) OP to MPT <OPT = 90^0	**B1**	
	Radius meets tangent at 90^0		
	<RTP = 90^0 - <OPR		
	$= 90^0 - 30^0$	**B1**	
	$= 60^0$		
	(d) <STP = 180^0 - <OPT 90^0 - <POT 60^0	**B1**	
	Angle sum of triangle	**B1**	
	$= 30^0$		
	(e) <QPM = <QRP = 60^0	**B1**	
	Angles in alternate segment	**B1**	
		10	

1. *Area of* $\Delta AXY = \frac{1}{2} x 4^2 x \sin 97.2^0$

$= 7.94 cm^2$

Area of sector AXY $= \frac{97.2}{360} x \pi x 4^2$

$= 13.57 cm^2$

Area of shaded part $= 13.57 – 7.94 = 5.63 cm^2$

Area of $\Delta BXY = \frac{1}{2} x 6^2 \sin 30$

$= 9 cm^2$

Area of sector BXY $= \frac{30}{360} x \pi x 6^2$

$= 9.42 cm^2$

Area of shaded part

$= (9.42 – 9) cm^2 = 0.42 cm^2$

Area of shaded region $= (5.63 + 42) cm^2 = 6.05 cm^2$

2. (i) $\angle AOB = 2 \angle ACB$

$= 100^o$

$\angle OAB = \frac{180-100}{2}$ *Base angles of Isosceles* Δ

$= 40^0$

(ii) $\angle ADC = 180^0 - 70^0$

$= 110^0$

3. $\frac{2}{5} \div \frac{1}{2}\ 0f\ \frac{4}{9} - 1\frac{1}{10}$

$= \frac{2}{5} \div \frac{1}{2} X \frac{4}{9} - \frac{11}{10}$

$= \frac{2}{5} x \frac{9}{2} - \frac{11}{10}$

$= \frac{9}{5} - \frac{11}{10} = \frac{18-11}{10} = \frac{7}{10}$

$\frac{1}{8} - \frac{1}{6} X \frac{3}{8} = \frac{1}{8} - \frac{1}{16}$

$= \frac{2-1}{16} = \frac{1}{16}$

$$\frac{\frac{2}{5} \div \frac{1}{2}\ 0f\ \frac{4}{9} - 1\frac{1}{10}}{\frac{1}{8} - \frac{1}{6}\ of\ \frac{3}{8}} = \frac{\frac{7}{10}}{\frac{1}{16}}$$

$= \frac{7}{10} X \frac{16}{1}$

$= \frac{56}{5} = 11\frac{1}{5}$

4. a) DAC =DCA = ½ (180 – 100) (base sios $= 40^o$

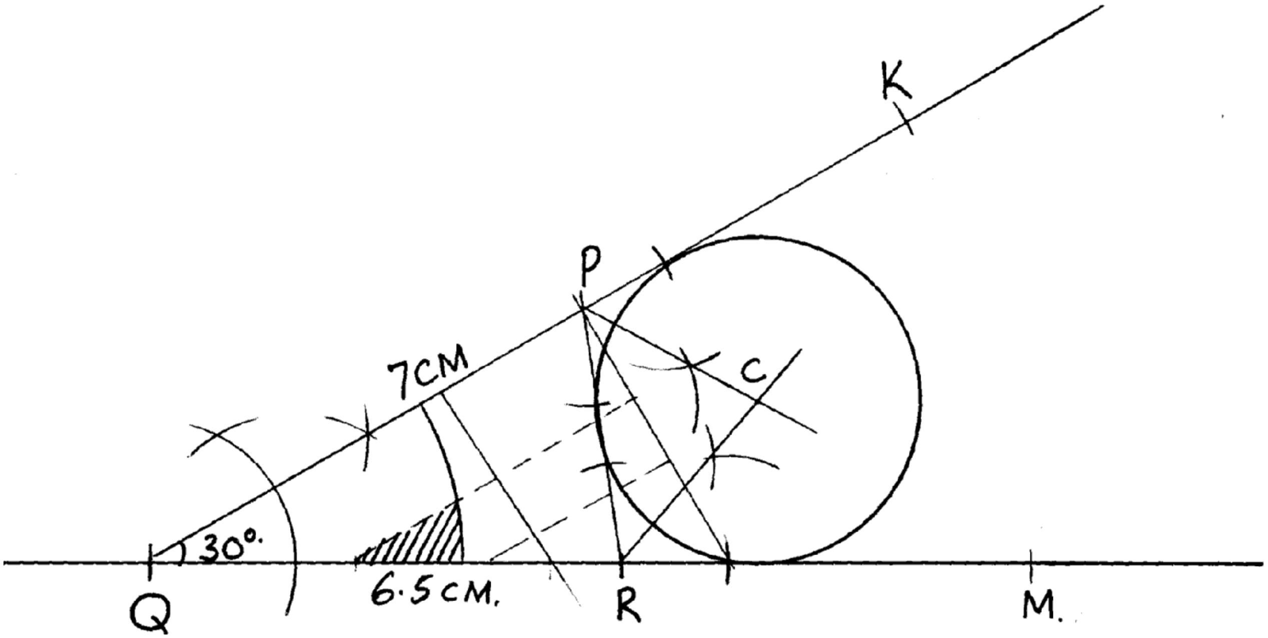
(b) BAC = DCA alt ,∠s AB//AD)

$= 40^o$

(b) DAB = DAC + BAC = 40 + 40 = 80^o

BCD = $180^o - 80^o$

$= 100^o$



5. c) (ii) Radius = 2.3 ± 0.1cm

Name of QPR : Escribed circle

6. (i) $\angle ACB = 10^o$ (∠s subtended by chord AB)

(ii) $\angle AOD = 160^o$ (∠ at centre line at circumference)

(iii) $\angle CAB = 40^o$ (∠s subtended by chord AB)

(iv) $\angle ABC = 130^o$ (Opposite $\angle$s of cyclic quadrilateral)

(v) $\angle AXB = 60^o$(sum angle of triangle

7. i) $\frac{80}{360} \times \frac{22}{7} \times 9 \times 9$

$= 63.6429\ cm^2$

ii) ½ ab Sin C

$= \frac{1}{2} \times 9 \times 9 \text{ Sin } 80^0$

$= 39.8847\ cm^2$

iii) $\frac{180}{360} \times \frac{22}{7} \times 9 \times 9$

$= 127.2857\ cm^2$

Segment: $63.6429 – 39.8847$

$= 23.7582 \times 2 = 47.5164\ cm^2$

$\therefore 127.2857 – 47.5164$

$= 79.7693cm^2 = 79.77\ cm^2$

8. (a) $\angle RST = 180^o – 46^o$ Opposite angel in cyclic quadrilateral

$= 134^o$

(b) $\angle SUT = 180^o – 46^o – 27^o$ (Sum of angles in a traingle QRU)

$= 180^o – 173^o = 7^o$

(c) $\angle ROT = 2 \times 46^o$ (angle substended by chord RT at the centre

$= 92^o$

(d) $\angle PST = 180^o – 37^o – 48^o – 53^o$

Sum of angles in a triangle PST

(e) Reflex $\angle SOP = (2x\ 37^o) + 2x\ 42^o) = 158^o$

Angle subtended chord at centres is twice angle at circle

9. $\angle POQ = 80^o$

Radius $= \frac{1.7}{\text{Sin } 40} = 2.645cm$

Area of the triangle $= \frac{1}{2} \times 2.645^2 \sin 80 = 3.445cm^2$

Area of the sector $= (\frac{80}{360} \times \pi \times 2.645^2) = 4.884cm^2$

Area of the shaded segment $= (4.884 – 3.445) = 1.439cm^2$

10. a) $\measuredangle BDC = 90^o - 33^o$, 3^{rd} angle of

$= 57^o \Delta BCD$, $\measuredangle BCD = 90$.

$\measuredangle ADC = \measuredangle ADB + \measuredangle BDC$

$= 48^o + 57^o = 105^o$

b) Consider Δ BCE

$\measuredangle$ AEB is an exterior opposite angle

$\therefore \measuredangle AEB = 33^o + 48^o = 81^o$ √

38. Vectors

1	$\begin{pmatrix}3\\2\\-2\end{pmatrix}-\begin{pmatrix}2\\1\\-3\end{pmatrix}=\begin{pmatrix}1\\1\\1\end{pmatrix}$	M_1 A_1	✓exp
2	(a) (i) 4p – 3q = $\begin{pmatrix}10\\5\end{pmatrix}\times 1$ P + 2q = $\begin{pmatrix}-14\\15\end{pmatrix}\times 4$ $4p-3q=\begin{pmatrix}10\\15\end{pmatrix}$ $4p+8q=\begin{pmatrix}-56\\60\end{pmatrix}$ -11q = $\begin{pmatrix}66\\-55\end{pmatrix}$ q = $\begin{pmatrix}-6\\5\end{pmatrix}$ $p+2\begin{pmatrix}-6\\5\end{pmatrix}=\begin{pmatrix}-14\\15\end{pmatrix}$ $p+\begin{pmatrix}-12\\10\end{pmatrix}=\begin{pmatrix}-14\\15\end{pmatrix}$ $p=\begin{pmatrix}-2\\5\end{pmatrix}$ $q=\begin{pmatrix}-6\\5\end{pmatrix}$ and $p=\begin{pmatrix}-2\\5\end{pmatrix}$ (ii) |p + 2q| $=\begin{pmatrix}-2 & + & -12\\5 & & 10\end{pmatrix}$ $\begin{pmatrix}-14\\15\end{pmatrix}=\sqrt{(-14)^2+(15)^2}=\sqrt{196+225}=\sqrt{421}=20.52$ (b) $\vec{AB}=\begin{pmatrix}5\\3\end{pmatrix}-\begin{pmatrix}-1\\1\end{pmatrix}=\begin{pmatrix}6\\2\end{pmatrix}$ $\vec{BC}=\begin{pmatrix}11\\5\end{pmatrix}-\begin{pmatrix}5\\3\end{pmatrix}=\begin{pmatrix}6\\2\end{pmatrix}$ $AB=kBC$ $AB=1BC$ B (3, 5) is common AB is a scalar multiple of BC. Hence A (1, -1), B (3,5) and C (5, 11) are collinear	M_1 M_1 A_1 A_1 M_1 A_1 B_1 B_1 B_1 A_1	Scalar 1 Correct pt B

3	i) $\underset{-}{P} = 2\begin{pmatrix}1\\-2\\1\end{pmatrix} - \frac{1}{3}\begin{pmatrix}6\\-3\\9\end{pmatrix} + \begin{pmatrix}-3\\2\\3\end{pmatrix}$	M1	
	$= \begin{pmatrix}2\\-4\\2\end{pmatrix} - \begin{pmatrix}2\\-1\\3\end{pmatrix} + \begin{pmatrix}-3\\2\\3\end{pmatrix}$	A1	
	$= \begin{pmatrix}-3\\-1\\2\end{pmatrix}$	B1	
	ii) $\lvert P\rvert = \sqrt{9+1+4}$ $= \sqrt{14} = 3.742$		
		3	
4.	$\underset{\sim}{PQ} = \begin{pmatrix}-2\\-1\end{pmatrix} - \begin{pmatrix}-6\\-3\end{pmatrix} = \begin{pmatrix}4\\2\end{pmatrix}$	B1	
	$\underset{\sim}{QR} = \begin{pmatrix}6\\3\end{pmatrix} - \begin{pmatrix}-2\\-1\end{pmatrix} = \begin{pmatrix}8\\4\end{pmatrix}$	B1	
	$2\underset{\sim}{PQ} = \underset{\sim}{QR}$ multiples of each other Q is common point hence PQ and R are collinear	B1	
		03	

1.

$\sin 60 = \sqrt{3}/2$

$\sin 45 = 1/\sqrt{2}$

$$\frac{1}{\frac{\sqrt{3}}{2}\,\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}}$$

$$= \frac{1}{\frac{\sqrt{3}}{2\sqrt{2}} - \frac{1}{\sqrt{2}}}$$

$$= \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{2}$$

$$= \frac{\sqrt{6} - 2\sqrt{2}}{4}$$

2. $\underset{\sim}{OP} = \underset{\sim}{OA} + \frac{1}{4}\underset{\sim}{AB}$

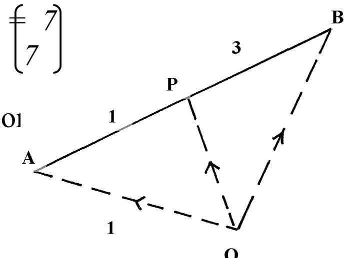
$= \underset{\sim}{OA} + \frac{1}{4}(\underset{\sim}{OB} - \underset{\sim}{OA})$

$= \underset{\sim}{OA} + \frac{1}{4}\underset{\sim}{OB} - \frac{1}{4}\underset{\sim}{OA}$

$= \frac{3}{4}\underset{\sim}{OA} + \frac{1}{4}\underset{\sim}{OB}$

$= \frac{3}{4}\underset{\sim}{OA} + \frac{1}{4}\underset{\sim}{OB}$

$= \frac{3}{4}\begin{pmatrix}12\\8\end{pmatrix} + \frac{1}{4}\begin{pmatrix}16\\4\end{pmatrix} = \begin{pmatrix}3\\6\end{pmatrix} + \begin{pmatrix}4\\1\end{pmatrix} = \begin{pmatrix}7\\7\end{pmatrix}$



3. $m \begin{matrix}4\\3\end{matrix} + n \begin{pmatrix}-3\\2\end{pmatrix} = \begin{pmatrix}5\\8\end{pmatrix}$

$4m - 3n = 5$ ……….. (i) x 2

$3m + 2n = 8$ ……….(ii) x 2

$8m - 6n = 10$

$\underline{9m + 6n = 24}$

$17m \quad = 34$

$m = 2$

$4 \times 2 - 3n = 5$

$-3n = -3$

$n = 1$

$\therefore m = 2, n = 1$

4. (a) (i) $BM = \frac{2}{5}a - b = \frac{1}{5}(2a - 5b)$

(ii) $AN = \frac{2}{3}b - a = \frac{1}{3}(2b - 3a)$

(b) $BX = \frac{t}{5}(2a - 5b)$

$AX = \frac{h}{3}(2b - 3a)$

$OX_1 = OB + BX = b + t\,(\frac{2}{5}a - 5b)$

$= (-t)b + \frac{2}{5} + a$

$OX = OA + AX = a + h\,(2b - 3a)$

$= (1-h)a + \frac{2}{3}hb$

(c) $OX_1 = OX_2$

$\frac{2}{5} + a + (\frac{1}{3} - t)b = (1-h)a + 2hb$

$\frac{2}{5}t = 1 - h$ ....(i)

$(1 - t) = \frac{3}{4}h$ ....(ii) $\quad t = \frac{5 - 5h}{2}$

$1 - (\frac{5 - 5h}{2}) = \frac{2}{3}h = 11h = 9$

$h = \frac{9}{11}$

$t = \frac{5 - 5}{2}\begin{pmatrix}\frac{9}{11}\end{pmatrix} = \frac{5}{11}$

(i) BX : XM = 1:10

(ii) $AX: XN = 3:8$

5. a) i) $MA = ½ a$

ii) $AB = a$

iii) $AC = a + c$

iv) $AX = {}^{2}/_{7}\, AC = {}^{2}/_{7}\,(-a + c)$

b) $MA = ½ a$
$AX = {}^{2}/_{7}\, c – {}^{2}/_{7}\, a$
$MX = ½ a + {}^{2}/_{7} – {}^{2}/_{7}\, a$
$= {}^{3}/_{14}\, a + {}^{2}/_{7} c$

Co-ordinates of P $= \left(\frac{1 + 3}{2}, \frac{6 + 0}{2}, \frac{8 + 4}{2}\right)$
$= (2, 3, 6)$

$/OP/ = \sqrt{2^2 + 3^2 + 6^2}$
$= \sqrt{4 + 9 + 36}$
$= \sqrt{49} = 7$ units

c) Co-ordinates of O (0,0,0)
Co-ordinates of A (1, 6, 8)
Mid points of AO $= \left(\frac{1 + 0}{2}, \frac{6 + 0}{2}, \frac{8 + 0}{2}\right)$
$= (0.5, 3, 4)$

6. a) $AB = DC \Rightarrow 1 – x = 2 \Rightarrow x = -1$
$6 – y = 4 \Rightarrow y = 2$
$\therefore D = \underline{(-1, 2)}$

b) (i) $\overrightarrow{RQ} = \underset{\sim}{Q} – \underset{\sim}{R} = q – \left(\underset{\sim}{{}^{3}/_{2}}q - ½ p\right)$

$= \left(-½ \underset{\sim}{q}\right) \underset{\sim}{-} p \left(= ½ \underset{\sim}{p}\right) \underset{\sim}{–} q$ √

(ii) $\overrightarrow{PR} \underset{\sim}{=} {}^{3}/_{2} \underset{\sim}{q} \underset{\sim}{-} ½ p – P$ √

$= {}^{3}/_{2} \left(\underset{\sim}{q} \underset{\sim}{-} p\right)$

${}^{3}/_{2} \underset{\sim}{q} = - ½$ Also $-{}^{3}/_{2} \underset{\sim}{p} = ½ \underset{\sim}{k}p$
$\Rightarrow k = -3$ $\Rightarrow k = -3$
Hence P, Q, R, Q Collinear.

(iii) $\overrightarrow{P\underset{\sim}{Q}} = q - p$, $\underset{\sim}{QR} \underset{\sim}{=} ½ (q – P)$

$PQ : QR = 2 : 1$

7. (a) PQ = PO + OQ = -p + q

Or = OP + PR = P + 2/3 PQ

= P + 2/3 (-p+q)

= $^{1}/_{3}p + ^{2}/_{3}q$

QT = QO + OT = -q + ½ OR since OT = TR

= -q + ½ ($^{1}/_{3}p - ^{2}/_{3}q$)

= $^{1}/_{6}p - ^{2}//_{3}q$ OR $^{1}/_{6}$ (p-4q)

(b) TS = TO + OS = - ½ OR + ¼ OP

= - ½ ($^{1}/_{3}p + ^{2}/_{3}q$) + ¼ p = $^{-1}/_{6}p - ^{1}/_{3}q$ + ¼ p

= $^{1}/_{12}p - ^{1}/_{3}q$ or $^{1}/_{12}$(p-4q)

QT: TS = $^{1}/6$(p-4q): $^{1}/12$(p-4q) = $^{1}/6$:$^{1}/12$ = 2:1

∴QT = 2TS OT//TS but T is a common point hence Q, T, S are collinear

(c) Vector OT can be expressed in 2 ways

1^{st} OT = ½ OR given

= ½ ($^{1}/_{3}$ P + $^{2}/_{3}q$) = $^{1}/_{6}q + 1/_{3}q$………..(i)

2^{nd} using OPT

OT = OP + PT = P + $^{5}/_{6}$PM

But PM = PO + OM = -P +KOQ = -P +Kq

OT = P + $^{5}/_{6}$ (-P +kq)

= P – $^{5}/_{6}$kq

= $^{1}/_{6}p + n^{5}/_{5}kq$…………………(ii)

Aqn (i) and (ii) represent the same vector OT

$^{1}/_{6}p + ^{1}/_{3}q = ^{1}/_{6}p + ^{5}/_{6}kq$…………….(iii)

Comparing coefficients of q in eqn (iii) have$^{5}/_{6}k = ^{1}/3$

15k = 6

8. $3a = 3\begin{pmatrix}-3\\2\end{pmatrix} = \begin{pmatrix}-9\\6\end{pmatrix}$

$\frac{1}{2} b = \frac{1}{2}\begin{pmatrix}4\\-6\end{pmatrix} = \begin{pmatrix}2\\-3\end{pmatrix}$

$^{1}/_{10}c = ^{1}/_{10}\begin{pmatrix}5\\-10\end{pmatrix} = \begin{pmatrix}0.5\\-1\end{pmatrix}$

$P = \begin{pmatrix}-9\\6\end{pmatrix} - \begin{pmatrix}2\\-3\end{pmatrix} + \begin{pmatrix}0.5\\-1\end{pmatrix}$

$= \begin{pmatrix}-10.5\\8\end{pmatrix}$

/P/ = $\sqrt{(-10.5)^2 + 8^2}$

= √110.25 = 64

= √174.25

= 13.20037878

= 13.20 (2 d.p)

9. (i) $BM = BO + OM$

$= {}^{2}/_{5}a - b$

(ii) $AN = AO + ON$

$= \frac{2}{3} b - a$

(b) $OX = OB + BX$

$= b + k(2a - b)$

$\sim \underset{\sim}{=} \frac{2}{5} ka + b(1- k)$

$OX = OA + AX$

$= a + h(\frac{2}{3}b - a)$

$= a(1-h) + 2hb$

$= a(10h) 2hb$

(c) ${}^{2}/_{5} a = a(1-h)$ also $b(1-k) = 2hb$

$2k = 1-h \quad 1-k = 2h$

$k = \frac{5}{2} - \frac{5h}{2}$

$\therefore 1 - \frac{5}{2} + \frac{5h}{2} = \frac{2h}{3}$

$\frac{5h}{2} - \frac{2h}{3} = \frac{5}{2} - 1$

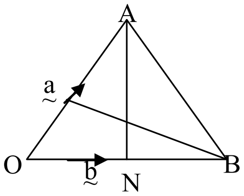
$1 \frac{5h}{6} = \frac{3}{2}$

$h = \frac{3}{2} x \frac{6}{11} = 9$

$k = \frac{5}{2} - \frac{5}{2} \quad \frac{9}{11}$

$= \frac{5}{2} - \frac{45}{22}$

$= \frac{5}{11}$



10. (i) $AN = AO + ON$

$= -a + \frac{4}{5} b$

(ii) $\underset{\sim}{BM} \underset{\sim}{=} BO + OM$

$\underset{\sim}{=} -b + \underset{\sim}{{}^{2}/_{5}} a$

(iii) $AB = A\underset{\sim}{O} + O\underset{\sim}{B}$

$\underset{\sim}{=} -\underset{\sim}{a} + b$

$\sim AX = \underset{\sim}{s}AN$

$\sim BX = \underset{\sim}{t}BM$

$O\underset{\sim}{X} = O\underset{\sim}{B} + B\underset{\sim}{X}$

$= b + tBM$

$= \underset{\sim}{b} + t\,(\underset{\sim}{-b} + {}^{2}/_{5}\underset{\sim}{a})$

$$\left.\begin{array}{l} = \underset{\sim}{b} - \underset{\sim}{t}b + {}^{2}/_{5}\,\underset{\sim}{ta} \\ = \underset{\sim}{b}\,(1-t) + {}^{2}/_{5}\,\underset{\sim}{ta} \end{array}\right\}$$

$OX \underset{\sim}{=} OA \underset{\sim}{+} AX$

$= \underset{\sim}{a} + s\underset{\sim}{A}N$

$= \underset{\sim}{a} + s(\underset{\sim}{-a} + {}^{4}/_{5}\,\underset{\sim}{b})$

$$\left.\begin{array}{l} = \underset{\sim}{a} - Sa + {}^{4}/_{5}\ s\underset{\sim}{b} \\ \underset{\sim}{a}(1-s) + {}^{4}/_{5}\,s\underset{\sim}{b} \end{array}\right\}$$

$b(1-t) + \underset{\sim}{2}/_{5}t\underset{\sim}{a} = a\ (1-s)\ \underset{\sim}{4}/_{5}sb$

$b(1-t) = {}^{4}\!/_{5}\ sb$

$1-t = {}^{4}/_{5}s$-------------(i)

$a\ (1-s) = {}^{2}/_{5}ta$

$1-s = {}^{2}/_{5}t\underset{\sim}{a}$

$s = 1-{}^{2}/_{5}t$-------------(ii)

$1-t = {}^{4}/_{5}(1-{}_{2}/_{5}t)$

$1 - t = {}^{4}/_{5} - 8/_{25}t$

$-{}^{17}/_{25} = -\ 1/_{5}$

$t = {}^{5}/_{17}$

$s = {}^{15}/_{17}$

11. $\dfrac{115800}{76.84} \times \dfrac{97.5}{100}$

$= 1469.35$ √

$= 1469.35 - 270$

$= 1199.35$ √

$= 1199$ dollars

12.
$$RM = \begin{pmatrix} -2 \\ 6 \\ 7 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \\ 0 \end{pmatrix} = \begin{pmatrix} -3 \\ 8 \\ -1 \end{pmatrix}$$

$|\underset{\sim}{RM}| = \sqrt{(-3)^2 + 82(-1)^2}$

$\sqrt{74} = 8.602$ units

13. (a) (i) $\underset{\sim}{OB} \underset{\sim}{=} a \underset{\sim}{+} b$

(ii) $BC = \underset{\sim}{B}A + AO + \underset{\sim}{O}C$

$= \underset{\sim}{-b} + -a + \underset{\sim}{2}b$

$= \underset{\sim}{b} - \underset{\sim}{a}$

(b) $\underset{\sim}{CX} = \underset{\sim}{CO} + \underset{\sim}{OA} + \underset{\sim}{AB} + \underset{\sim}{BX}$

$= -2b + a + b + hBC$

$= a – b + h(b - a)$

$= a – b + hb - ha$

$= (1 - h)a + (h – 1) b$

(c) $CX = CO + OA + AX$

$= 2b + a + KAT$

but $AT = AO + OT$

$= -a + 3b$

$CX = 2b + a + K(3b – a)$

$= a – Ka + 3Kb + 2b$

$= (1- K) a + 3 (K + 2) b$

(d) $I – h = 1 – k$ ....(i)

$h – 1 = 3k + 2$.......(ii)

from (i) $h = k$

sub in (ii) $h-1 = 3h + 2$

$h = {}^{-3}/_{2}$

$K = {}^{-3}/_{2}$

14. $a + b = (2 – 3)i + (1 + 4)j + (-2-1)k$

$= -i + 5j – 3k$

$|a + b| \sqrt{(-1)^2 + (5)^2 + (-3)^2}$

$= \sqrt{35}$

$= 5.916$

15. i) $BD = BA + AD$

$= -b + {}^{3}/_{5}c$

$AE = AB + BE$

$= b + ½ BC = b + ½ (c – b)$

$= ½ b + ½ c$

ii) $BF = t ({}^{3}/_{5}c – b)$

$AF = n (½ b + ½ c) = {}^{n}/_{2} (b+ c)$

$AF = AB + BF$

$= b + t({}^{3}/_{5}c – b) = b + {}^{3}/_{5}tc + tb$

$= (1 – t) b + {}^{3}/5tc$

$(1 – t)b + {}^{3}/_{5}tc = {}^{n}/_{2}b + {}^{n}/_{2}c$

$1 – t = {}^{n}/_{2}$; $2 – 2t = n$ ………… (i)

${}^{3}/_{5}t = {}^{n}/_{2}$; $6t – 5n = 0$ ………... (ii)

Sub from équation (ii)

$6t – 5(2 – 2t) = 0$

$6t – 10 + 10t = 0$

$16t = 10$

$t = {}^{10}/_{16} = {}^{5}/_{8}$

$n= ¾$

iii) $BF = {}^5/_8 BD$

F divides BD in the ratio 5 :3

$AF = \frac{3}{4} AE$

F divides AE in the ratio 3 :1

16. $BA = \begin{pmatrix}-8\\-2\end{pmatrix}$

$\frac{1}{2} BC = \frac{1}{2}\begin{pmatrix}-3\\-4\end{pmatrix} = \begin{pmatrix}1\frac{1}{2}\\-2\end{pmatrix}$

$OP = \begin{pmatrix}-8\\-2\end{pmatrix} + \begin{pmatrix}-1\frac{1}{2}\\-2\end{pmatrix} = \begin{pmatrix}-9\frac{1}{2}\\-4\end{pmatrix}$

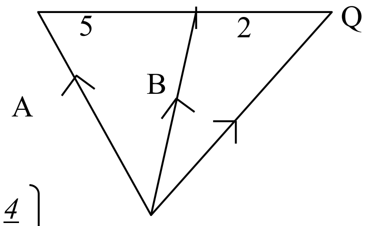
Co-ordinates of P (-9 ½ , -4)

17. $OB = \frac{5}{7}OQ + \frac{2}{5}OA$

$OQ = \frac{7}{5}OB - \frac{2}{5}OA$

$OQ = \frac{7}{5}\begin{pmatrix}2\\-1\end{pmatrix} - \frac{2}{5}\begin{pmatrix}-3\\4\end{pmatrix}$

$= \begin{pmatrix}{}^{14}/_5\\{}^{-7}/_5\end{pmatrix} - \begin{pmatrix}{}^{-6}/_5\\{}^{8}/_5\end{pmatrix} = \begin{pmatrix}{}^{20}/_5\\{}^{-15}/_5\end{pmatrix} = \begin{pmatrix}4\\-3\end{pmatrix}$



Q= (4, -3)

39. Representation of data

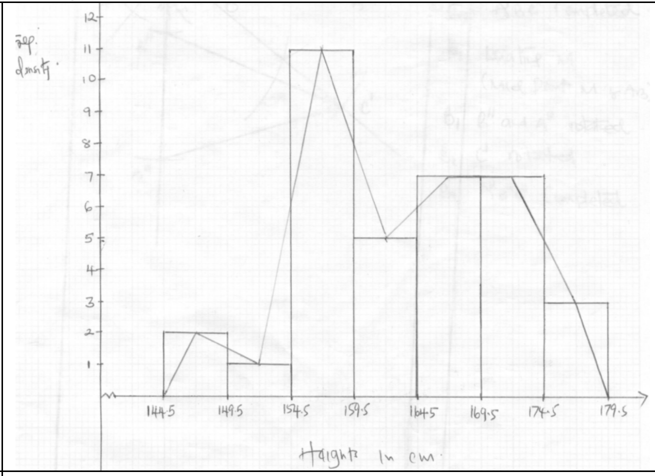
<table>
<tr>
<td>1.</td>
<td>(a)
<table>
<tr><td>Class</td><td>Tally mark</td><td>Freq</td><td>Freq D</td></tr>
<tr><td>145-149</td><td>//</td><td>2</td><td>2</td></tr>
<tr><td>150-154</td><td>/</td><td>1</td><td>1</td></tr>
<tr><td>155-159</td><td>𝍸 𝍸 /</td><td>11</td><td>11</td></tr>
<tr><td>169-164</td><td>𝍸</td><td>5</td><td>5</td></tr>
<tr><td>165-169</td><td>𝍸 //</td><td>7</td><td>7</td></tr>
<tr><td>170-174</td><td>𝍸 //</td><td>7</td><td>7</td></tr>
<tr><td>175-179</td><td>///</td><td>3</td><td>3</td></tr>
</table>
</td>
<td>B1
B1
B1
B1

B1
B1

B1
B1

B1

B1</td>
<td>Classes
Tally mark column
Freq. column
Freq density column (can be implied)
Freq. density (y axis
Height (x axis)
Correct spacing as per scale
Histogram drawn (bars)
Joining mid point of the bars
Joining mid point of first class to 144.5
Joining mid point of last class to 179.5</td>
</tr>
</table>

			
		10	

1.

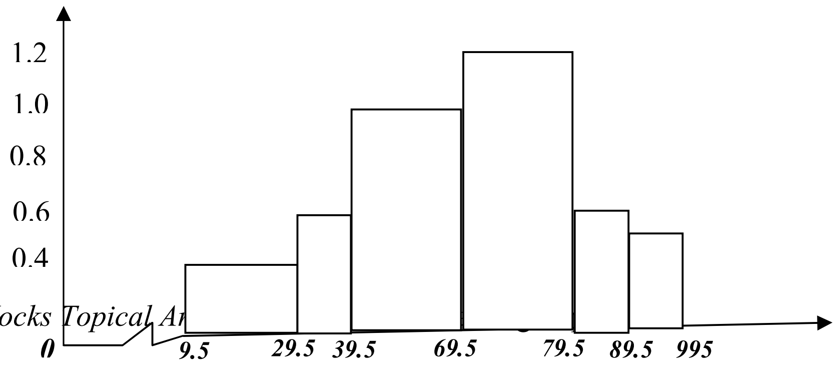
Length	*Frequency*
11.5 ≤x≤ 13.5	*6*
13.5 ≤x≤ 15.5	*9*
15.5 ≤x≤ 17.5	*6*
17.5 ≤x≤ 23.5	*3*

2. *Food:* $^{40}/_{100} \times 360 = 144°$
Transport: $^{10}/_{100} \times 360 = 36°$
Education: $^{20}/_{100} \times 360 = 72°$
Clothing: $^{20}/_{100} \times 360 = 72°$
Rent: $^{10}/_{100} \times 360 = 36°$

3.

Class	*Tally*	*Frequency*	*Upper Limit*
10 – 29	*~~////~~ ///*	*8*	*29.5 B_2 for*
30 – 39	*~~////~~ /*	*6*	*39.5 all tally*
40 – 69	*~~////~~ ~~////~~ ~~////~~ ~~////~~ ~~////~~ ///*	*28*	*69.5 B_2 all*
70 – 74	*~~////~~ /*	*6*	*74.5 - frequency*
75 - 89	*~~////~~ ///*	*8*	*89.5 - B_1*
90 – 99	*~~////~~*	*4*	*99.5 B_1*

Modal class 40 – 69 B1



S_1- scale
B_3- Au Histogram
B_2- any 4
B_1- any 3

0.2

4. *See the graph paper.*
For correct class boundaries
For correct class intervals.
All frequency densities

Correct scale
All the bars drawn.

Top mid pts. Of bars indicated.
For the mid pts. Joint to make a polygon.
For correctly identifying the modal mark point.
For reading correctly the modal mark ≡ 53.5 ± 0.1

5. (a)

Marks	*Frequency*
5-9 *10-19* *20-30* *40-49*	*20* *50* *40* *30*

(b) Modal class is 10-19

(c)(i)

Class	*x*	*f*	*fx*	*Cf*
5-9	*7*	*20*	*140*	*20*
10-19	*14.5*	*50*	*725*	*70*
20-39	*29.5*	*40*	*1180*	*110*
40-49	*44.5*	*30*	*1335*	*140*
		ΣF = 140	*ΣFx =3380*	

$$x = \frac{\Sigma fx}{\Sigma f} = \frac{3380}{140} = 24.14$$

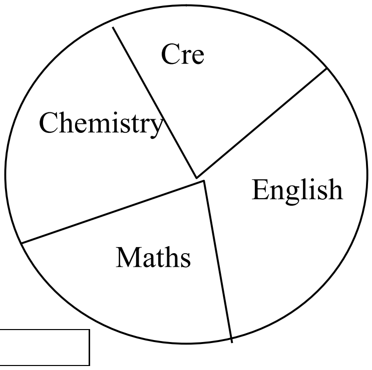
(ii) Median mark is at 70 + 71 = 70.5th position

$$\text{Median} = 119.5 + \left(\frac{0.5}{40}\right) \times 20$$

$$= 19.5 + 0.25$$

$$= 19.75$$

6. *Total No. of sessions*
= 8 + 7 + 4 + 3 = 22
Angle for:
English = $^{8}/_{22}$ *x 360 = 130.9°*
Maths = $^{7}/_{22}$ *x 360 = 114.5°*
Chemistry = $^{4/}{}_{22}$ *x 360 = 65.5°*
CRE = $^{3}/_{22}$ *x 360 = 49.01°*



7. *180 – 189*
Class limits

class	*limits*	*f*	*cf*

149.5	159.5	2	2
159.5	169.5	9	11
169.5	179.5	12	23
179.5	189.5	16	39
189.5	199.5	7	46
199.5	209.5	4	50

Median = $^{50}/_{2} = 25$

$179.5 + \frac{25 - 23}{16} \times 10$

$= 179.5 + \frac{20}{16} = 180.75$

$179.5 + \frac{26 - 23}{16} \times 10$

$179.5 + \frac{30}{16} = 181.38$

$\frac{180.75 + 181.38}{2}$

$= 181.06$

8. a) i) 145 – 153

ii) Median class

$(^{40+1}/_{2})^{th}$ *value* ∴ *median class* = 145 – 153

This is the 20.5th *value*

The value also in the 145 – 153 *class*

b)

Class	x	f	fx
118- 126 127- 135 136 – 144 145 – 153 154 – 162 163 – 171 172 - 180	122 131 140 B1 149 158 167 176	3 4 10 B2 12 5 4 2	366 524 1400 1788 790 668 352
		Ef = 40	Efx = 5888

B2 for all values of fx correct and B1 for 4 values of fx and above orrect

Mean = $\frac{Efx}{Ef} = \frac{5888}{40} = 147.2mm$

Median 20th = $144.5 + (^{11}/_{12} \times 9) = 152.75$

21st = $144.5 + (^{12}/_{12} \times 9) = 153.5$

Median = $\frac{152.75 + 153.5}{2} = 153.125$

(Alternatively one could work out the 20.5 value directly using median formula)

40. Measures of central tendency

1. $4 + 6 + 10 + 14 + x + 24 + 14 + 6 = 100$

$78 + x = 100$

(i) $x = 22$

(ii) *Modal class* = 55 -59

Marks	x	f	fx	cf

30-34	*32*	*4*	*128*	*4*
35-39	*37*	*6*	*222*	*10*
40-44	*42*	*10*	*420*	*20*
45-49	*47*	*14*	*659*	*34*
50-54	*52*	*22*	*1144*	*56*
55-59	*57*	*24*	*1368*	*80*
60-64	*62*	*14*	*868*	*94*
65-69	*67*	*6*	*462*	*100*
B_1		$\Sigma f = 100$ B_1	$\Sigma fx = 5210$	B_1

$\Sigma fx = 5210$

(i) $Mean = \frac{5210}{100}$

$= 52.10$

(ii) $Median = 49.5 + \left(\frac{50-34}{22}\right) x\ 5$

$= 53.14$

2. $Log_{10}\, 5^2 - log_{10}\, 2^3 + log\ 2^5$

$Log_{10}\left(\frac{25 \times \overset{4}{\cancel{32}}}{\underset{1}{\cancel{8}}}\right)$ **✓Application of logarithmic laws.**

✓Application

C.A.O

$Log_{10}\ 100 = \overset{2}{log}_{10}{}^{10}$

$= 2\ log\ _{10}{}^{10}$

But $log_{10}{}^{10} = 1$

$\therefore = 2$

3. Modal class 150-154

Height	*Frequency*	*c.f*
140- 144	*3*	*3*
145 – 149	*15*	*18*
150 – 154	*19*	*37*
155 – 159	*11*	*48*
160 -164	*2*	*50*

Height Frequency c.f

$= 149.5 + \frac{(25-18)}{19} x\ 5$

$= 149.5 + \frac{7}{19} x\ 5$

$= 149.5 + 1.842$

$= 15.34$

4.

H	*20-24*	*25-29*	*30-34*	*35-39*	*40-44*	*45-49*
F	*3*	*19*	*25*	*20*	*18*	*15*
CF	*3*	*22*	*47*	*67*	*85*	*100*

$Md = 34.5 + \frac{(50 - 47)}{20} x\ 4$

$= 34.5 + {}^{12}/_{20} = 35.1$

5. a) $2x^2 + 6x – 2x = 0$

$32 – 24 – 2x = 0$

$-2x = -8$

$x = 4$

b) $2x^2 + 6x – 8 = 0$

$x^2 + 3x – 4= 0$

$x^2 + 4x – x - 4 = 0$

$x(x – 4) – (x + 4) = 0$

$(x – 1) (x + 4) = 0$

$\therefore$ the other root is 1

6. $\sum xf = 61 \times 10 + 65.5 \times 20 + 71 \times 40 + 77 \times 15$

$= 610 + 1310 + 2840 + 1155$

$= 5915$

$\frac{\sum xf}{\sum f} = \frac{5915}{85}$

X Mean = 69.59

7.

Marks	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of candidates	2	3	10	12	8	3	2
C.F	2	5	15	27	35	38	40

a) Number who sat = 40

b) The modal class = 60 – 69

c)

Marks	x	f	X – 64.5= d	fd
30-39	34.5	2	-30	-60
40-49	44.5	3	-20	-60
50-59	54.5	10	-10	-100
60-69	64.5	12	0	0
70-79	74.5	8	10	80
80-89	84.5	3	20	60
90-99	94.5	2	30	60
		£f = 40		£ fd = -20

Mean $= 64.5 + \frac{-20}{40}$

$= 64.0$

d) The median mark

$= ½ (20^{th}$ and 21^{st}) marks

$= ½ (59.5 + \frac{5}{12} \times 10 + 59.5 + \frac{6}{12} \times 10)$

$= ½ (59.5 + 4.16666 + 59.5 + 5)$

$= ½ (128.16666667)$ $= 64.083$

8. 1, 1, 2, 2, 3, 4, 4, 6

a) Mode = 4

b) Median = 3

c) Mean $= \frac{1 \times 2 + 2 \times 2 + 3 \times 1 + 4 \times 3 + 6 \times 1}{9}$

$= 3$

9. a) i) Modal class = 60 – 69

ii) class where medium lies
median class 50- 59

Class	Centre X	Fd	D= x – A
0 - 9	4.5	-50	-50
10 – 19	14.5	-80	-40
20 – 29	24.5	-120	-30
30 – 39	34.5	-140	-20
40 – 49	44.5	-100	-10
50 – 59	54.5	0	0
60 – 69	64.5	200	10
70 – 79	74.5	120	20
80 – 89	84.5	90	30
90 – 99	94.5	40	40
		εfd -40	

Mean = $54.5 - \frac{40}{70}$

$= 53.93$

10. Cumulative frequency

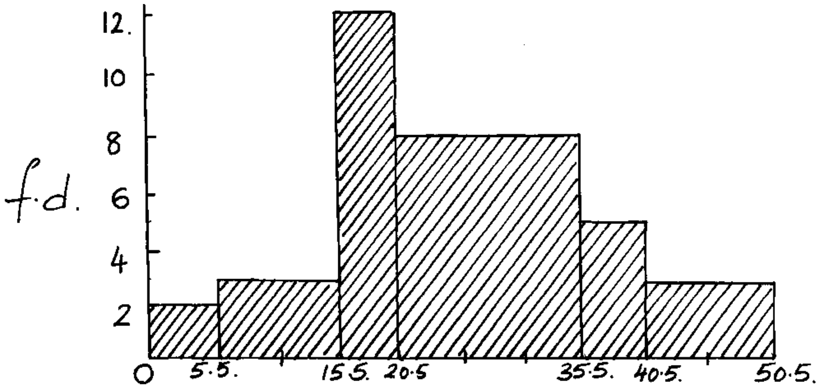
3,11, 30, 44, 50

Median = $L1t \frac{(^n/_2 - cfa)}{Fn}$

$= 8 + \frac{(25 - 11)}{19} X 4$

$= 10.947$

11.



41. Linear motion

1. Distance covered by Kinyua in $1^2/_3$hrs

$= 5 x 90 = 150$km

Distance traveled by Nyaboke during the rest = $(^1/_3$ x $120) = 40$km

$\frac{x}{90} = \frac{390 - x}{120} \Rightarrow 120x = 90(390 - x)$

$= 167.1$km

Time = $\frac{167.1}{90} = 1.86$

8.33 + 1.86 = 10.19; they met at = 10.11a.m

580 – (150 + 167 .1) = 262.9km from M

Before the rally driver started, Nyaboke had traveled for 1 ½ hrs

$(^3/_2 \times 120) = 180km$

$$\frac{x}{120} = \frac{x + 180}{80}$$

$180x – 120x = 21600$

$x = 360km$

Distance from K $= 580 – (180 + 360)$

$x = 40km$

Time $= \frac{540}{180} = 3hrs$

$(9.30 + 3hrs) = 12.30p.m$

2. *Distance covered by the car after 15 min* $=(\frac{1}{4} \times 80)km = 20km$

Distance covered together $= 130km$

Relative speed $= (80 + 40) = 120km/h$

Time taken to meet

$= (\frac{130}{120})$ hrs

$= 1hr\ 5\ min$

Time they met = 10:15 a.m + 1:05

11:20 a.m

3. . a) $\frac{1}{2} X 50h + \frac{1}{2} X 100 h + 150h = 2700$

$225h = 2700$

$H = \frac{2700}{225} = 12m/s$

Maximum speed $= \frac{12 \times 60 \times 60}{1000}$

$= 43.2km/h$

b) *Acceleration* $= {}^{12}/_{50}$ m/s

$= {}^{6}/_{25}$ m/s

c) $\frac{1}{2} X 50 \times 6$

150 m

d) *Time for half of journey*

$\frac{1}{2} X 12 (50 + t + t) = \frac{1}{2} X 2700$

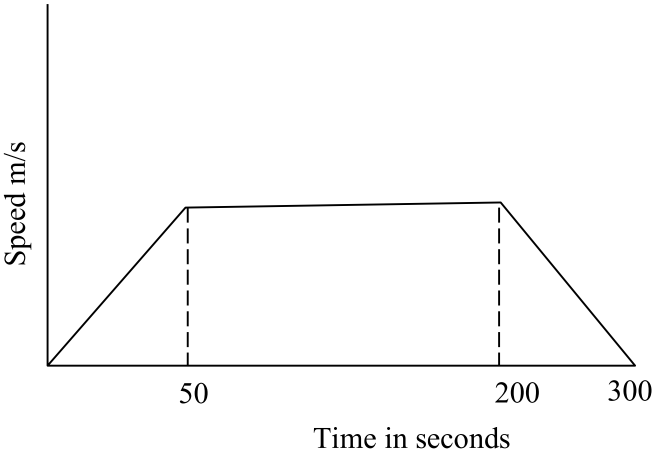
$6(50 + 2t) = \frac{1}{2} X 2700$

$50 + 2t = 225$

$T = \frac{225 – 50}{2} = 87.5$

Total time

$= 50 + 87.5 = 137.5$ sec



4. *Time taken at 10km*

$= {}^{45}/_{10} = 4.5$ hrs

Time taken at 15km/hr

${}^{45}/_{15} = 3hrs$

Total time taken $= (4.5 + 3) = 7.5$

$(4.5 + 3) = 7.5$ hrs

Average speed

$= {}^{90}/_{7.5}$

$= 12$km/hr

5. $D = \frac{5}{4} \times 80 + \frac{50}{1000}$

$= 100.05$km

Speed $= 120 - 80 = 40$km/h

$T = \frac{D}{S} = \frac{100.05}{40}$

$= 2.50125$hours

(b) $D = S \times T = 120 + \frac{100.05}{4000} + \frac{199}{800}$

$= \frac{120 \times 11000}{40000}$

$= 330$km

(c) Total time $= \frac{330}{80}$

$= 4{}^{1}/_{8}$hrs

Time lapse $= 4\frac{1}{8} - \frac{5}{4} + \frac{100.05}{40000} + \frac{199}{800}$

$= 4\frac{1}{8} - 4$ $= {}^{1}/_{8}$hrs

6. a) Distance traveled by bus before the matatu started off the journey is

Distance = speed x time

$= 60 \times 2\frac{1}{2}$

$= 150$km

Relative speed = 100- 60 = 40km/hr

The matatu would cover the bus head start of 150km in 150/40 hrs = 3.75hrs = 3hrs 45 min

∴ The matatu will overtake the bus after 3hrs 45 minutes

This will be 1:15 + 3:45 = 5.00pm

b) Time taken by the matatu to complete the remaining 350km = 350/100 = 3 ½ hrs

= 3hours 30 minutes

Time taken by the bus to complete the remaining 350

$= {}^{350}/_{60} = 5{}^{5}/_{6}$ hrs = 5 hours 50 minutes

Matatu waits for 5hr 50min – 3hr 30 min = 2 hrs 20 min

7. Total distance = 100 + 140 + 150 = 490

Total speed = 88 + 164 = 252 km/hr

252 km/hr into m/h $= \frac{252 \times 1000}{3600} = 70$m/h

Time taken $= {}^{490}/_{70} = 7$ sec

8. Distance = (5 + 15)m = 20m = 0.02km

S ⇒ Bus = 40 km/h

Trailer = xkm/h

Relative speed = (40 – x) km/h

$T = 4.8 \text{ sec.} \quad = \frac{4.8h}{3600}$

$S = \frac{D}{T}$

$(40 - x) = \frac{0.02}{\frac{48}{3600}}$

$\simeq \frac{0.02 \times 3600}{48}$

$= 15 \text{ km/h}$

$40 - x = 15$

$x = 25 \text{ km/h}$

9. $L.C.M = 2^4 \times 3^2 \times 5^3 = 1800$

$GC.D. = 2 \times 3 \times 5^2 = 150$

10. *Total distance = 60 cm*

Total time taken = $3\,{}^1/_5$ *hrs*

Let speed in still water be x km/h

Speed upstream = (x – 5) km/h

Speed downstream = (x + 5) km/h

$$\frac{30}{x - 5} + \frac{30}{x + 5} = \frac{16}{5}$$

$$30x - 150 + 30x + 150 = \frac{16}{5}(x^2 - 25)$$

$300x = 16x^2 - 400$

$x = -{}^5/_4$ or 20

∴ *Speed in still water is 20 km/hr*

11. *When David left, Ojwang had covered* $15 \times {}^3/_2 = 22.5$ *km.*

a) (i) Remaining dist. = 40 – 22.5 = 17.5 km

Relative speed = 15 + 25 = 40 km/h

Time taken before meeting = $\frac{17.5}{40} = 0.4375$ *hrs*

Ojwang covered 15 x 0.437 = 5.5625 km

Distance from Ojwang's house $= 22.5 + 6.5625^{\surd}$

$= \underline{29.0625 \text{ km}}$

(ii) 0.4375 = 26 min 15 sec

∴ *They met at 10.30 + 26.15*

= 10.56. 15 am.

(iii) $40 - 29.0625^{\surd} = \underline{10.9375 \text{ km}}^{\surd}$

b) Time take = $\frac{10.9375^{\surd}}{12} = 0.9115$ *hrs*

= 54 min, 41 sec.

They arrived at 10.56. 15 + 54.41 + 10 min

= <u>12.00. 56 pm</u>. √

12. (a) *In 10minutes Kamau has travelled*

$\frac{10}{60} \times 24 = 6km$

Distance left = 42 – 6 = 36km

Relating speed = 24 + 50.4k/hr

= 74.4km/hr

Time taken to meet = $\frac{42}{74.4}$ *= 0.565hrs*

= 34minutes

Time for meeting is 6.10

<u>34</u>

6.44a.m

$\frac{34}{60} \times 50.4 = 28.56$*km from R or 13.44 from S*

(b) Kamau arrival time

$\frac{42km}{24km/hr}$ *= 1.75hrs*

1hr .45 minutes

6.00a.m

<u>1.45</u>

7.45a.m

(c) Mrs Ronoh speed = $\frac{D}{T}$

= 50.4km/hr

Twice = 50.4 x 2 = 100.8

7.00a.m, Mr. Kamau covered = 1x24= 24km

Retain speed = 100.8- 24 = 76.8km/hr

So $\frac{24}{76.8}$ *= 8.75*

He was overtaken at 7.00

<u>+ 18.75</u>

7.18am

At distance of D = S x t

$= \frac{100.8 \times 189.75}{60}$

31.5km from S or 10.5km from R

13. i) *A gains on B at the rate of (72 – 56) Km/hr or 16km/h*

∴ in 1 hr A gains on B 16km

In 545 A gains on B

$\frac{16 \times 1000 \times 54\ m}{60 \times 60} = 240$

The sum of the lengths of the two trains is 240m but the length of the first train is 100m

The length of the second train is 140m

ii) Relative speed = (72 + 56) km/h = 128km/hr

Distance between A and B decrease at the rate of 128km/hr

The distance decreases by 240m

$\frac{60 X 60 X 240}{128 X 1000}$ s $= \frac{27}{4}$ seconds

$= 6 \frac{3}{4}$ s

14. (a) Time $= \frac{D}{S}$

$= \frac{5}{x}$ hrs

(ii) Time $= \frac{7}{x + 24}$ hrs

(b) $\frac{5}{x} - \frac{36}{60} = \frac{7}{x + 24}$

$\frac{7}{x + 24} = \frac{25 - 3x}{5x}$

$35x = 25x - 3x^2 + 600 - 72x$

$3x^2 + 82x - 600 = 0$

$(3x + 100) (x-6) = 0$

$x = \frac{-100}{3}$ or 6

His speed = 6km/hr

(c) Time = S x T

$= \frac{5}{6} x 60$

= 50mins

15. a) Relative speed = 80 - 60

= 20 km/h

Time $= \frac{40}{20}$ hrs

= 2 hrs

(b) 1.50 p.m. = 13.50 hrs.

Time = 13.50 + 2 = 15.50 hrs

16. (a) Nairobi 400km Kisumu

Speed = 120km/h

Distance = 400km

Time taken $= \frac{400}{120} = 10 =$ 3hrs 20min

8.30 + 3hrs 20min = 11:50a.m

(b) at 8.30a.m distance covered by bus = ½ x 80 = 40km

Dist. Left = 360km speed = 200km/h

Time taken $= \frac{360}{200} =$ 1hr 48mins

They met at 8:30+ 1hr 48mins

= 10:18a.m

(c) 8 – 10.18a.m is 2hrs 18mins distance $= 2 x 80 + \frac{18}{60} x 80$

= 160 + 24km = 184 from Nairobi

(d) car arrived in Nairobi after 3hrs 20mins

Bus traveled a time of 3hrs 20mins + 30mins

3hrs 50mins

Dist. $= 3 \times 80 + \frac{50 \times 80}{60} = 240 + 66\,^2/_3$

Distance from Kisumu $= 93\,^1/_3$ *km*

17. *Total distance = 25m*

Relative speed= 54km/hr

To m/s $= \left(\frac{54 \times 1000}{60 \times 60}\right) = 15$*/ms*

Time they met $= \left(\frac{25}{15}\right)$

$= 1^2/_3$ *sec*

42. Quadratic expressions and equation 2

<table>
<tr><td>1</td><td>
<table>
<tr><td>x</td><td>-4</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>2x³</td><td>-128</td><td>-54</td><td>-16</td><td>-2</td><td>0</td><td>2</td><td>16</td></tr>
<tr><td>5x²</td><td>80</td><td>45</td><td>20</td><td>5</td><td>0</td><td>5</td><td>20</td></tr>
<tr><td>-x</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>-1</td><td>-2</td></tr>
<tr><td>-6</td><td>-6</td><td>-6</td><td>-6</td><td>-6</td><td>-6</td><td>-6</td><td>-6</td></tr>
<tr><td>y</td><td>-50</td><td>-12</td><td>0</td><td>-2</td><td>-6</td><td>0</td><td>28</td></tr>
</table>
$2x^3+5x^2+x-6=y$
$2x^3+5x^2x-4=0$
$-2x-2=y$
$y=-2x-2$
<table>
<tr><td>X</td><td>0</td><td>2</td></tr>
<tr><td>Y</td><td>-2</td><td>-6</td></tr>
</table>
</td><td>B₂</td><td></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td></td><td></td><td>10</td><td></td></tr>
<tr><td>2</td><td>
a)
$\frac{dy}{dx}=4x-6$
b)
$4x-6=0 \therefore x=1.5$
$y=2(1.5)^2-6(1.5)+9$
$=4.5$
$\therefore$ Turning point $(1.5,4.5)$
<table>
<tr><td>1</td><td>1.5</td><td>2</td></tr>
<tr><td>-1</td><td>0</td><td>+2</td></tr>
<tr><td>\</td><td>_</td><td>/</td></tr>
</table>
</td><td>B1
M1
M1
A1
B1
B1
B1</td><td>Equating to zero
✓gradient</td></tr>
</table>

	Minimum point d) (i) Gradient = 2 $\frac{y-5}{x-2}=2$ $\therefore y=2x+1$ (ii) $M_1 \times M_2 = -1$ $\therefore M_2 = -\frac{1}{2}$ $\frac{y-5}{x-2} = -\frac{1}{2}$ $\therefore y = -\frac{1}{2}x+6$	B1 B1 B1	✓gradient of normal
		10	
3.	A = ½ x{(6+14) + 2(6 + 4 16)} = ½ (20 + 32) = 26 units	M1 M1 A1	Use of absolute values of y
		03	

1.
(a)

x	*-2*	*-1*	*0*	*1*	*2*	*3*	*4*	*5*	*6*
y	*-17*	*-9*	*-3*	*1*	*3*	*3*	*1*	*-3*	*-9*

(b) $y = 5x - x^2 - 3$

$\underline{0 = 5x - x^2 - 3}$

$y = 0$

$x = \underline{0.75 \text{ or } 4.3 \pm 0.1}$

(c) $y = 5x - \underline{x}^2 - 3$

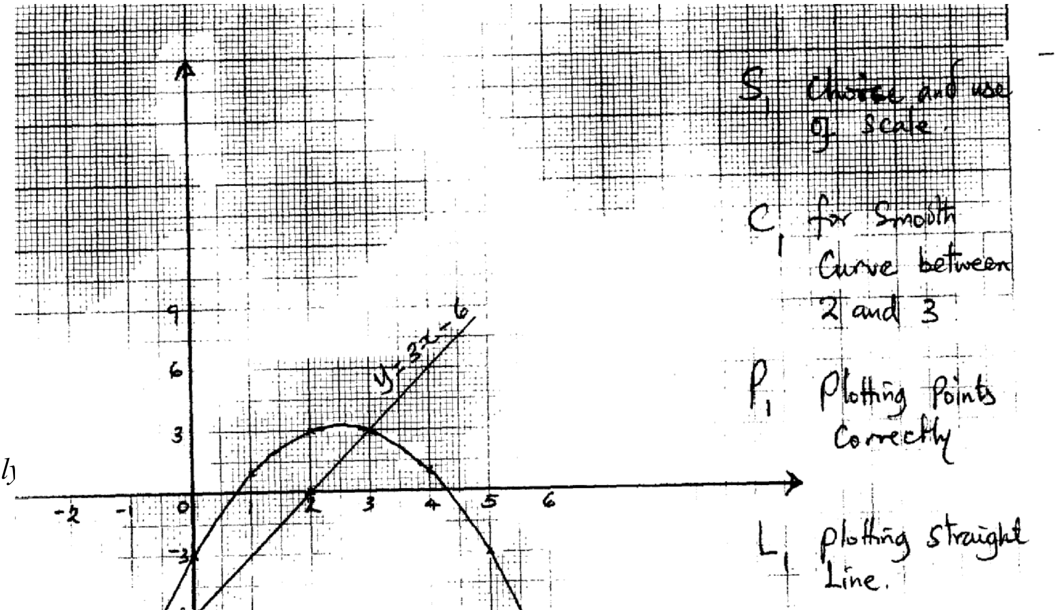
$\underline{0 = 2x - x^2 + 3}$

$y = 3x - 6$

For all √values of y B1
for at least 5 √values.

x	*0*	*-1*	*2*
y	*-6*	*-9*	*0*

x = -1 or 3 ± 0.1



S1 Choice and use of scale.

C1 for Smooth Curve between 2 and 3

P1 Plotting Points Correctly

L1 plotting straight Line.

2. $x - 2.5 - \sqrt{3} \quad x - 2.5 + \sqrt{3} \_ = 0$

$x^2 - 2.5x + x\sqrt{3} - 2.5x + 6.25 - 2.5\sqrt{3}$

$x\sqrt{3} + 2.5\sqrt{3} = 0$

$x^2 - 5x + 6.25 - 3 = 0$

$x^2 - 5x + 3.25 = 0$

$4x^2 - 20x + 13 = 0$

3. $17.35 \times 13.85 = 240.3$

$17.35 \times 13.75 = 237.2$

$\therefore 17.3 \times 13.8 = 238.7$

Max err $240.3 - 238.7 = 1.5$

Min err $238.7 - 237.2 = 1.6$

Max err $= \frac{1.6 + 1.5}{2} = \frac{3.1}{2} = 1.55$

Product 238.7 ± 1.55

Last product 240

Max err = 1.55

Relative err = $\frac{1.55}{28.1\%}$

error = $\frac{1.55}{28.1} \times 100 = 0.6\%$

Relative err = $\frac{1.55}{238.7}$

4.

x	-6	-5	-4	-3	-2	-1	0	1	2	3	4
y		04	-2		-8	-8		-2	4	12	

(c) (i) $x^2 + 3x - 6 = 0$

$x = -4.5$ or 1.5 ± 0.2

(ii) $y = x^2 + 3x - 6$

$x^2 + 3x -2$

$y = -4$

$x = 5$ or 4 ± 0.2

5.

x	-4	-3	-2	-1	0	1	2	3
y	21	10	3	0	1	6	15	28

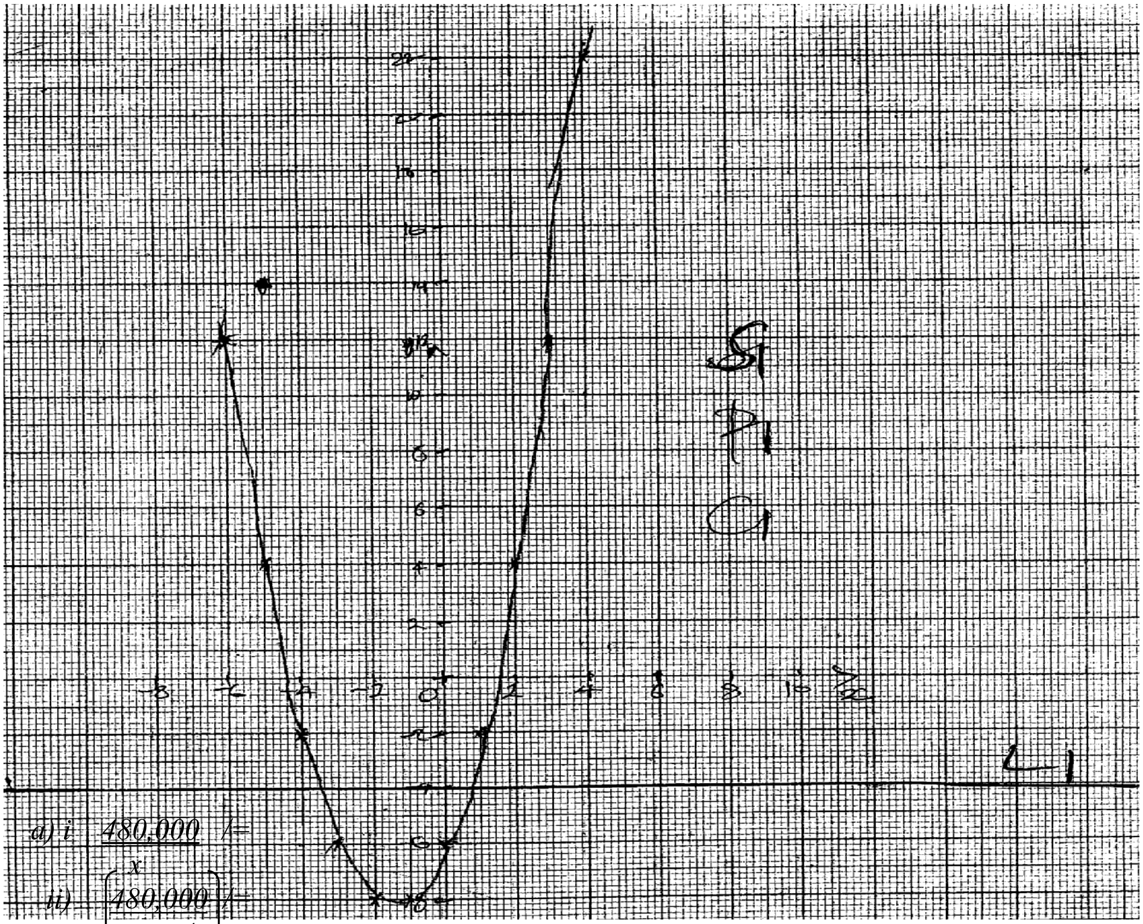
(c) $2x^2 + 3x + 1 = 0$

$\underline{2x + 4x - 3 = 0}$

$-x + 2 = y$

$x = 0.6$ or $x = -2.6 \pm 0.1$

(d) $x = 0.30 -x = -1.8 \pm 0.1$



6. a) i $\frac{480,000}{x}$ /=

ii) $\left(\frac{480,000}{x-4}\right)$ /=

b) $\frac{480,000}{x-4} = \frac{480,000}{x} + 20,000$

Multiply all hr' by L.C.M.

$480{,}000x = 480{,}000(x - 4) + 20{,}000(x^2 - 4x)$

Dividing by 10,000

$48x = 48x - 192 + 2x^2 - 4x$

$48x - 48x + 4x - 2x^2 + 192 = 0$

$4x - 2x^2 + 192 = 0$

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

$$= \frac{-4 \pm \sqrt{1552}}{-4}$$

$$= \frac{-4 \pm \quad 39.3954}{-4}$$

$x = \frac{-4 + 39.3954}{-4}$ or $x = \frac{-4 - 39.3954}{-4}$

But x cannot be –ve hence

$x = \frac{-43.3954}{-4} = 10.8489$

$= 11$

c) Original : new cont.

$\frac{480{,}000}{11} : \frac{480{,}000}{7}$

d) Size of land bought $= 6$ hectares

$\frac{6}{7} = 0.857143$

$\simeq 0.8571$ hectares

7.

19.

x	-3	-2	-1	0	1	2
y	13	4	-1	-2	1	8

(iii) $y = 2x^2 + x - 2$

$\underline{0 = 2x^2 + 2x - 3}$

$y =- \quad x + 1$

x	-3	-2	-1	0	1	2
y	5	3	2	1	0	-1

$y = 2x^2 + x - 2$

$\underline{0 = 2x^2 + x - 5}$

$y = \quad 3$

8. (a) Dist. traveled in 3hrs s. drawing

Plane A – 400 x 3 = 1200km – cm

Plane B – 500 x 3 – 7.5cm

Plane C – 300 x 3 = 900km – 4.5cm

(b) Dist. BA = 12.8 0.1 x 200 = 2560km 20km

$T = \frac{D}{S} = \frac{2560}{500}$ hrs

= 5.12hrs of 5hrs, 7.2mns

≈ 5hrs, 7min (nearest min)

(c) Bearing of B from C = 360° – 20° = 340°

Dist. BC = (10.9 ± 0.1 x 200)km

= 2180km ± 20km

9. a)

x	-2	-1.5	-1	-0.5	0	0.5	1
x^2	4	2.25	1	0.25	0	0.25	1
4x	-8	-6	4	-2	0	2	4

4	4	4	4	4	4	4	4
y	0	0.25	9	2.25	4	6.25	9

$A = \frac{1}{2} h \left\{ (y_1 + y_7) + 2(y_2 \dots\dots\dots\dots\dots\dots\dots y_6) \right\}$

$= \frac{1}{2} \times \frac{1}{2} \left\{ (0 + 9) + 2(0.25 + 9 + 2.25 + 4 + 0.25 \right\}$ √

$= \frac{1}{4} \left\{ 9 + 4.25 \right\}$ √

$= \underline{13.25 \text{ sq. units}}$ √

b) $\int_{-2}^{0} (x^2 + 4x + 4)\, dx + \int_{0}^{1} (x^2 + 4x + u)\, dx$

$\left[\frac{x^3}{3} + 2x^2 + 4x \right]_{-2}^{0} + \left[\frac{x^3}{3} + 2x^2 + ux \right]_{0}^{1}$ √

$= (-{}^{8}/_{3} + 8 - 8) + ({}^{1}/_{3} + 2 + 4)$ √

$= \underline{\underline{9}}$ √

Error = 13.25 – 9 = 4.125

$\% = \frac{4.125}{9}$ √ x 100

$= \underline{45.84\%}$

10. a)

x	-2	-1.5	-1	-0.5	0	0.5	1
x^2	4	2.25	1	0.25	0	0.25	1
4x	-8	-6	4	-2	0	2	4

4	4	4	4	4	4	4	4
y	0	0.25	9	2.25	4	6.25	9

$A = \frac{1}{2} h \left\{ (y_1 + y_7) + 2(y_2 \dots\dots\dots\dots\dots\dots\dots y_6) \right\}$

$= \frac{1}{2} \times \frac{1}{2} \left\{ (0 + 9) + 2(0.25 + 9 + 2.25 + 4 + 0.25 \right\}$ √

$= \frac{1}{4} \left\{ 9 + 4.25 \right\}$ √

$= \underline{13.25 \text{ sq. units}}$ √

b) $\int_{-2}^{0} (x^2 + 4x + 4)\, dx + \int_{0}^{1} (x^2 + 4x + u)\, dx$

0 1

$$\left[\frac{x^3}{3} + 2x^2 + 4x\right]_{-2} + \frac{x^3}{3} + 2x^2 + ux \quad \surd \quad 0$$

$= (-{}^{8}/_{3} + 8 - 8) + ({}^{1}/_{3} + 2 + 4)$ √

$= \underline{\underline{9}}$ √

Error = 13.25 – 9 = 4.125

$\% = \frac{4.125}{9}$ √ x 100

$= \underline{45.84\%}$

11. $y = 2x^2 - 4x - 5$ $y = 2x + 3$

X	-3	-2	0	1	2	3	4	5			x	-4	-2	0	2
$2x^2$	18	2	0	2	8	18	32	50			y	-5	-1	3	7
4x	-12	-8	-4	0	4	8	12	16	20						
5	5	5	5	5	5	5	5	5	5						
y	25	11	1	-5	-7	1	11	25	11	B_2					

(a) x =1

(b) -0.9 x 2.8

x = -1 and x =4

12.

X	-1.5	-1	0	1.5	2	2.5	3.5
Y	-4	0	5	5	3	0	-9

(0.75, 6.125)

Y= -2

Range of values -1.3, < x < 2.75

Integral values; -1, 0, 1, 2

13. a)

x	-4	-3	-2	-1	0	1	2
$2x^2$	32	18	8	2	0	2	8
4x – 3	-19	-15	-11	-7	-3	1	5
y	13	3	-3	-5	-3	3	13

(b)Roots for x = -2.6 ± 0.1

x = 0.6 ± 0.1

$y = 2x^2 + 4x - 3$

\-

$\underline{0 = 2x^2 + x - 5}$

$y = 3x + 2$

Roots read from the 2 pts of intersection of the line and curve.

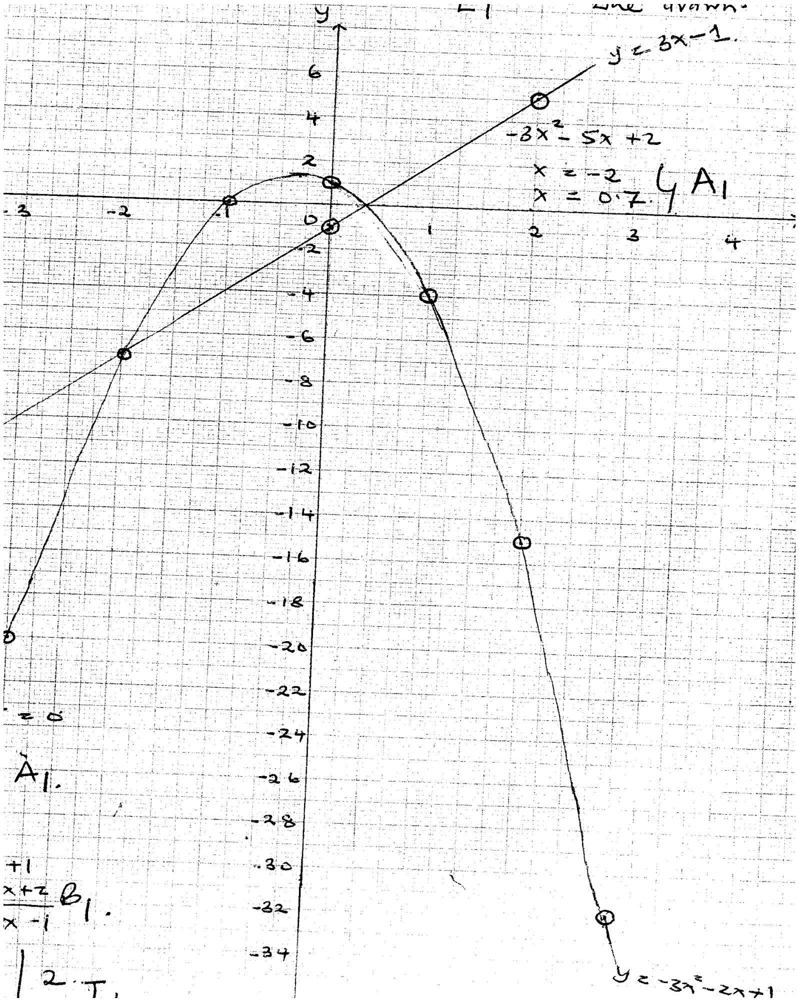
X = - 1.9 ± 0.1

X = 1.4 ± 0.1

14.

x	-3	-2	-1	0	1	2	3
$-3x^2$	-27	-12 *	-3	0	-3*	-12	-27*
-2x	6 *	4	2 *	0	-2 *	-4 *	-6

1	*1*	*1*	*1*	*1*	*1*	*1*	*1*
y	*-20*	*-7* *	*0* *	*1*	*-4* *	*-15*	*-32* *



$1 – 2x – 3x^2 = 0$

$x = -1$

or $x = 0.7$ } A_1

$y = -3x^2 – 2x + 1$

$\underline{0 = -3x^2 – 5x + 2}$

$y = o + 3x – 1$ } B_1

x	*0*	*2*
y	*-1*	*5*

} T_1

15. $x^2 + ax – b = 0$

$(x-1)(x+5) = x^2 + ax – b$

$x^2 + 4x – 5 = x^2 + ax – b$

$a = 4, b = 5$

16. Let $a = 1.5 + \sqrt{2}$

$b = 1.5 - \sqrt{2}$

$\therefore (x - a)(x - b) = 0$

$x^2 - xb - ax + ab = 0$

$x^2 - x(1.5 - \sqrt{2}) - x(1.5 + \sqrt{2}) + ab = 0$

$x^2 - 1.5x + x\sqrt{2}) - x\ 1.5x - \sqrt{2}) = 0$

$x^2 - 3x + ab$

$x^2 - 3x + (1.5 + \sqrt{2})(1.5 - \sqrt{2}) = 0$

$x^2 - 3x + 2.25 - 2 = 0$

$x^2 - 3x + \frac{1}{4} = 0$

$4x^2 - 12x + 1 = 0$

17. a) i) $a^2 + b^2 = 89 \qquad a + b = 13$

$a^2 + 2ab + b^2 = (a + b)^2 = 13^2 = 169$

ii) $2ab = 169 - 89$

$= 80$

iii) $a^2 - 2ab + b^2 = a^2 + b^2 - 2ab$

$= 89 - 80 = 9$

iv) $(a - b)2 = 9$

$a - b = \pm 3$

b) $a + b = 13$

$\underline{a - b = 3}$

$2a = 16$

43. Approximation and errors

1	Error in length $= 0.015 \times 15 = 0.225$ Error in breadth $= 0.015 \times 12 = 0.18$ Error in perimeter $= 2(0.225 + 0.18)$ $= 0.81$	M_1 M_1 A_1	Finding error in both length and breadth
		3	

1. Maximum perimeter = 2(12.05 + 8.05) = 40.2cm

Actual perimeter = 2(12.0 + 18.0)= 40.0cm

Error = 40.2cm – 40.0cm = 0.2cm

$\%error = \frac{(0.2 \times 100)}{40}$

$= 0.5\%$

2. $A = \frac{1}{2} \times 12 \times 8 = 48$

i) Absolute error

$= \frac{[\frac{1}{2} \times 12.5 \times 8.5 - \frac{1}{2} \times 11.5 \times 7.5]}{2}$

$= 5$

ii) % error = 5/24 X 100%

= 10.4%

3. $A = L \times W$

$A = x(14 - x) = 14x - x^2$

$\frac{dA}{dx} = 14 - 2x = 0$

$14 = 2x, x = 7$

Maximum area $= 7(14 - 7)$

$= 7 \times 7 = 49cm^2$

4. **5.2** — **U.limit** **5.25m**

U.limit **5.15m**

3.08 — **U.limit** **3.085m**

U.limit **3.075m**

Shortest possible length of 2nd piece

$= 5.15 - 3.085 = 2.065m$

5. *Absolute error* 10 ± 0.05 *and* 15 ± 0.05

Max area = 10..5 x 15.05

Min area $= 9.95 \times 14.95 = 148.7525$

$a.e = \frac{150.2525 - 15 + 150 - 148.7525}{2}$

$= 1.25$

$\%\ error = {}^{1.25}/_{150} \times 100$

$= 0.8333\%$

6. $17.35 \times 13.85 = 240.3$

$17.35 \times 13.75 = 237.2$

$\therefore 17.3 \times 13.8 = 238.7$

Max err $240.3 - 238.7 = 1.5$

Min err $238.7 - 237.2 = 1.6$

Max err $= \frac{1.6 + 1.5}{2} = \frac{3.1}{2} = 1.55$

Product 238.7 ± 1.55

Last product 240

Max err = 1.55

Relative err = $\frac{1.55}{28.1\%}$

error = $\frac{1.55}{28.1} \times 100 = 0.6\%$

Relative err = $\frac{1.55}{238.7}$

7. *14 Kg to the nearest* ${}^{10}/_{1000}$ *Kg*

A.E = 0.01

$\%\ E = \frac{0.01}{14} \times 100$

$= 0.07$

8.

X	0°	3°	60	90	120°	150°	180°	21	24	270°	300°	330°	360°

			°	°				0°	0°				
Cos x	*1*	*0.87*	*0.5*	*0*	*-0.5*	*0.87*	*-1.0*	*-0.87*	*0.5*	*0*	*0.5*	*0.87*	*1*
2 cos (x + 30)	*1.73*	*1*	*0*	*-1.0*	*-1.73*	*-2.0*	*-1.73*	*-1.0*	*0*	*1*	*1.73*	*2.00*	*1.73*

b) i) Amplitude of y = cos x is 1 unit
And Y = 2cos (x +30) 2 units

ii) period of y = 2 cos (x + 30°)
330°

c) Cos x = 2 cos (x + 30°)
x = 40° ± 1
x = 219° ± 1

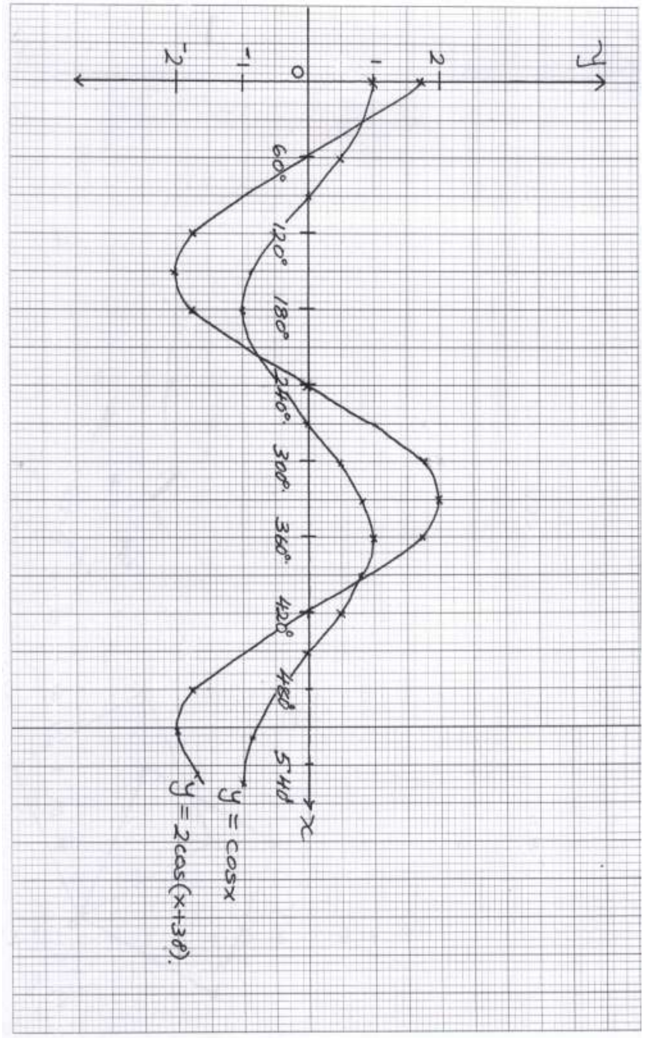
9. $\frac{y+x}{y-x} = \frac{12+6}{8-6}$ — ***Correct substitution***

$= \frac{18}{2}$ — ***Simplification***

$= 9$ — ***CAO***

44. Trigometry 2

<table>
<tr><td>1</td><td>$Sin\frac{5}{2}x = -\frac{1}{2}$
$\frac{5}{2}x = 210^0, 330^0, 390^0$
$x = 84^0, 132^0, 156^0$</td><td>B_1
B_1</td><td>Allow for any 2 ✓angles</td></tr>
<tr><td>2</td><td>a)
<table>
<tr><td>X⁰</td><td>60^0</td><td>120^0</td><td>180^0</td><td>240^0</td><td>300^0</td><td>360^0</td><td>420^0</td><td>480^0</td><td>540^0</td></tr>
<tr><td>cosX</td><td>0.50</td><td>-0.50</td><td></td><td>-0.5</td><td></td><td>1.00</td><td>0.50</td><td>-0.5</td><td>-1.0</td></tr>
<tr><td>2cos(x+30)</td><td>0.00</td><td></td><td>-1.73</td><td></td><td>1.73</td><td>1.73</td><td>0.00</td><td>-1.73</td><td>-1.73</td></tr>
</table>
b)
i) Period = 3600
ii) Phase angle = 300</td><td>B2
B1
B1</td><td>allow B1 for 7✓values ✓values to 2 d.p. apply ow-1 if given to other d.p</td></tr>
</table>

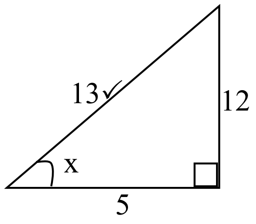
		S$_1$ P$_1$ for all values ✓ly Plotted C$_1$ smooth curve y = cos x C$_1$ smooth curve y = 2cos (x+30^0)	
	c) $37.5^0 \le x \le 217.5^0$ $397.5^0 \le x \le 540^0$	B$_1$ B$_1$	Allow ± 0.5
		10	

1. $5\sin x + \cos x$

$= 5\left(\frac{12}{13}\right) - \frac{5}{13}$

$= \frac{60}{13} - \frac{5}{13} = \frac{55}{13}$

$= \frac{12}{13}\,\mathbf{1}$



2. $\frac{\cancel{2}\cos 3\theta}{\cancel{2}} = \frac{1}{2}$

$\text{Cos } 3^1\theta = 0.5$

$3\,\theta = \text{Cos}^{-1}0.5$

$\frac{3}{3}\theta = \frac{60^o}{3}, \frac{300^o}{3}, \frac{420^o}{3}, \frac{66^o}{3}, \frac{78^o}{3}, \frac{102^o}{3}$

$\therefore \theta = 20^o, 100^o, 140^o, 220^o, 260^o, 340^o$

√Identification of exact number of quadrants to satisfy the equation.

√Values of at least 4 soln. of θ

3.. $\dfrac{\frac{1}{2} \times \frac{\sqrt{3}}{2}}{\frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}}$

$\dfrac{\frac{\sqrt{3}}{4}}{\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}} \times \dfrac{\frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}}}{\frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}}}$

$\dfrac{\frac{3}{8} + \frac{\sqrt{3}}{4\sqrt{2}}}{\frac{3}{4} - \frac{1}{2}} = \dfrac{\frac{3}{8} + \frac{\sqrt{3}}{4\sqrt{2}}}{\frac{1}{4}}$

$= \frac{3}{2} + \frac{\sqrt{3}}{\sqrt{2}}$

4. a) $b^2 = a^2 + c^2 - 2ac \cos B$

$b^2 = 7^2 + 5^2 - 2.5..\ 7 \cos 100$

$= 74 - 70(-0.173648)$

$= 74 + 12.15537$

$b^2 = 86.15537$

$b = 9.28199$

AC = 9.3 km

b) $\dfrac{9.3}{\sin 100} = \dfrac{5}{\sin \theta}$

$\sin \theta = \dfrac{5 \sin 100}{9.3} = 0.529466$

$\theta = 31.9694$

$\theta \simeq 32^0$

$32 - 20 = 12^0$

Bearing $= 360^0 - 12^0 = 348^0$

c) 020^0

5.

$\sin \overline{60} = \sqrt{3}/2$

$\sin \overline{45} = 1/\sqrt{2}$

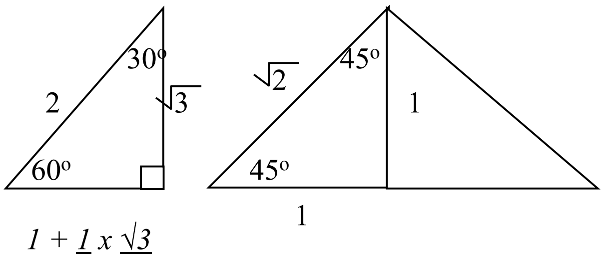
$\dfrac{1}{\frac{\sqrt{3}}{2\ \sqrt{2}}\ \frac{1}{\sqrt{2}} - \underline{1}}$

$= \dfrac{1}{\frac{\sqrt{3}}{2\sqrt{2}} \quad \frac{-1}{\sqrt{2}}}$

$= \dfrac{\sqrt{6}}{5} - \dfrac{\sqrt{2}}{2}$

$= \dfrac{\sqrt{6} \quad - 2\sqrt{2}}{4}$

6.



$1 + \underline{1} \times \underline{\sqrt{3}}$

$\sqrt{2} \quad 2$

$$\frac{1+\sqrt{3}}{2\sqrt{2}} \times \frac{2\sqrt{2}}{2\sqrt{2}}$$

$$\frac{1}{1} + \frac{2\sqrt{6}}{4}$$

$$\frac{4+2\sqrt{6}}{4}$$

7. $$\frac{\sqrt{5}(2\sqrt{2}+\sqrt{5})+\sqrt{2}(2\sqrt{2}-\sqrt{5})}{(2\sqrt{2})2-(\sqrt{5})^2}$$

$$\frac{2\sqrt{10}+5+4-\sqrt{10}}{8-5}$$

$$\frac{9+\sqrt{10}}{3}$$

$3 + {}^{1}/_{3}\sqrt{10}$

8. a) $b^2 = a^2 + c^2 - 2ac \cos B$

$b^2 = 7^2 + 5^2 - 2.5..\ 7 \cos 100$

$= 74 - 70(-0.173648)$

$= 74 + 12.15537$

$b^2 = 86.15537$

$b = 9.28199$

$AC = 9.3$ km

b) $$\frac{9.3}{\sin 100} = \frac{5}{\sin \theta}$$

$$\sin \theta = \frac{5 \sin 100}{9.3} = 0.529466$$

$\theta = 31.9694$

$\theta \simeq 32^0$

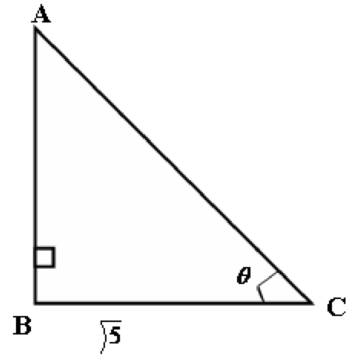
$32 - 20 = 12^0$

Bearing $= 360^0 - 12^0$

$= 348^0$

c) 020^0

45. Surds

1.	 $BC = \sqrt{r5^2 + 1^2}$ $\sqrt{6}$ Sin (90 - θ) $\frac{\sqrt{5}}{\sqrt{6}}$	**B1** **B1** **B1**	
		02	

1.. $\frac{3}{\sqrt{7}-2} + \frac{1}{\sqrt{7}} = \frac{3\quad 7+2}{\sqrt{7}-4} + \frac{\sqrt{\ }\ 7}{\sqrt{7}}$

$\frac{3}{\sqrt{7}-2} + \frac{1 = 3\sqrt{7} + 7 - 2)}{\sqrt{7}\quad 7 - 2\quad 7}$

$3\sqrt{7} + (7-2)$

$7 - 2\sqrt{7}$

$= \frac{3\sqrt{7} + 7 - 2\quad 7 + 2\sqrt{7}}{7 - 2\sqrt{7}\quad 7 + 2\sqrt{7}}$

$= 49 - 28$

$= \frac{(3\ 7 + 7-2)\ (7 + 2\sqrt{7}}{21}$

$= \frac{(4\sqrt{7} - 2)\ 7 + 2\ 7}{21}$

2.

$$\boldsymbol{\frac{2+\sqrt{5}}{2-\sqrt{5}} - \frac{3+\sqrt{5}}{2+\sqrt{5}} = a + b\sqrt{5}}$$

$\frac{4 + 4\ 5 + \sqrt{5} - (6 - 3\sqrt{5} + 2\sqrt{\ }\ 5-5)}{4-5}$

$\frac{8 + 5\sqrt{5}}{-1}$

$a = -8 \quad b = -5$

3. $\frac{\sqrt{14}\ (\sqrt{7} + \sqrt{2}) - \sqrt{14}(\sqrt{7} - \sqrt{12})}{7 - 12}$

$\frac{\sqrt{14}.\sqrt{7} + \sqrt{14}.\ \sqrt{12}\ - \sqrt{14}\ .\sqrt{7}\ + \sqrt{14}.\sqrt{12}}{-5}$

4.

$(\sqrt{2-1})^2 = 2 - \sqrt{2}\ \ 2 + 1 = \sqrt{3\ 2}\ \ \ 2$

$(\sqrt{2} - 1)^3 = 2 - 1(\sqrt{3-2}\ \ \ 2$

$= 5\sqrt{2} - 7$

$\frac{2 - \sqrt{2}}{5\sqrt{2}-7}\ x\ \frac{5\sqrt{2}+7}{5\ \ 2\sqrt{+7\ \ \ 1}} = 2\sqrt{2} + 7) -\ \ \ 2\sqrt{2} + 2)$

$= 17\sqrt{2-6}\ \ = -6 + 17\sqrt{2}$

5. (2 – 3) (3 + 2)

3(2)2 – 2)2

$\frac{3x2 - 3 + 2 - 2}{9x2 - 4x3}$

$\frac{6 - 3 + 2 - 6}{18 - 12 = 6}$

6. i) Or = $16^2 - 5^2$

$= \sqrt{256 - 25}$

$= 15.198$ cm

ii) $\tan\theta = \frac{5.066}{4} = 1.2665$

$\therefore \theta\ 51.71^0$

7. $\log_{10}5 - \log_{10}10^2 + \log_{10}(2y + 10) = \log_{10}(y - 4)$

$\log_{10}\{\frac{5\ (2y + 10)}{10^2}\} = \log_{10}(y-4)$

$10y + 50 = 100\,y - 400$

$90\,y = 450$

$y = 5$

8. $\frac{\sqrt{3} - \ \sqrt{2}\ \ \ \sqrt{3}\ \ -\ \sqrt{2}}{\sqrt{3}\ + \ \sqrt{2}\ \left(\sqrt{3}\ -\ \sqrt{2}\right)}$

$\frac{= 3 - \sqrt{6} - \sqrt{6} + 2}{3 - \sqrt{6} + \sqrt{6} - 2}$

$= \frac{5 - 2\sqrt{6}}{3 - 2}$

$= 5 - 2\sqrt{6}$

46. Further logarithms

1.

No	Log
1934^2	3.2865 X 2
√0.00324	= 6.5729
	-3.5105 : 2
	= 2.7553
	= 5.328
2.8727	0.4583
	= 4.8699
Anti log 4.8699 = 7.4114 X 10	
= 74114	

2. *a) monthly taxable pay;*

15% of monthly salary = $^{15}/_{100}$ *x 20000*

= kshs.3000

Monthly pay = Kshs.(20000 + 3000 – 700)

= Kshs. 22300

In Kenya pounds = $^{22300}/_{20}$

= KE 1115

b) Total tax payable (Gross tax)

1 – 342_________ 342x2 = Kshs.684

343 – 684 _______ 342 x3=Kshs.1026

685 – 1026 ______ 342 x4= Kshs.1368

1027 – 1368 _____ 89x5 = Kshs.445

Total tax = Kshs.3523

c) Net tax

= Gross tax – relief

= Kshs.(3523 – 600) = Kshs.2923

d) Net pay;

= Kshs.20000 – (2923 + 2100 + 200 + 2/100 x 20000)

= Kshs. (20000 – 5623) = Kshs.14377

3. *6 month depreciation rate = 8%*

Number of periods = 8

$400,000 (1 – 0.08)^8 = 205288$

4. *Mid ordinate*

Area = 1.2 (6.2 + 4.3 + 2.6)

= 15.72

5. $N.\ \log \frac{2^5 \times 2^7}{3^6} = \log \frac{2^{12}}{3^6}$

$$= \log \left(\frac{2^2}{3}\right)^6 = \left(\frac{4}{3}\right)^6$$

$$\left(D;\ \log \frac{2^5\ \times 2^1}{3^3}\right) = \left(\log \frac{2^6}{3^3}\right) = \log\left(\frac{2^2}{3}\right)^3 = 3\log \frac{4}{\ }$$

$$\frac{N}{\left(D\right)^6 \left(\ \right)^3} ;\ \text{Log}\ \frac{4}{3}$$

$\text{Log } \frac{4}{3}$

$= \frac{6 \log \cancel{\left(\frac{4}{3}\right)}}{3 \log \cancel{\left(\frac{4}{3}\right)}}$

$^6/_3 = 2$

6. $\text{Log } \frac{(x+5)}{(x+2)} = \log(4)$

$\frac{x + 5}{x + 2} = 4$

$(x+5)(x+2) = 4$

$x^2 + 2x + 5X + 10 = 4$

$x^2 + 7x + 6 = 0$

$x^2 + 6x + x + 6 = 0$

$x(x+6) + 1(x+6) = 0$

$(x+1)(x+6) = 0$

$x = -1 \quad x = -6$

7. $a = 100$

$r = \frac{200}{100} = 2$

$\frac{a(r^n - 1)}{r - 1} \succ Sn$

$\frac{100(2^n - 1)}{2 - 1} \succ 3,100$

$2^n - 1 > 31$

$2^n > 32$

$2^n > 2^5$

$n > 5$

$n = 6$

8. a)

2	3	5	7
2	32	52	72
3	23	53	73
5	25	35	75
7	27	37	57

b) $P(E) = \frac{4}{16}$

$= \frac{1}{4}$

9. $x^2 + y^2 - 6x = 3 - 4y$

$x^2 - 6x + (^{-6}/_2)^2 + y^2 + 4y + (^4/_2)^2 = 3 + (^{-6}/_2)^2 + (^4/_2)^2$

$(x - 3)^2 (y + 2)^2 = 3 + 9 = 4$

$(x - 3)^2 (y + 2)^2 = 16$

$C(3, -2)$

$\text{Gradient } \frac{\Delta y}{\Delta x} = \frac{7 - -2}{6 - 3} = 3$

10. $A = P\left(1 + \frac{r}{100}\right)^n$

$= 10000 \left(1 + \frac{4}{100}\right)^6$

$= 10000(1.04)^6$

$= 12653.19$ (12,653)

11.

No.	Std. Form	Log
13.6	1.36×10^1	1.1335
		+
Cos 40^0	—	1.8842
		1.0177
63.5	6.35×10^1	— 1.8028
		1.2149 ÷ 3
		$= \underline{3} + \underline{2.2149}$ 33
0.5474	5.474×10^{-1}	← 1.7383

0.5474

12. $Log_{10}\, 5^2 - log_{10}\, 2^3 + log\, 2^5$

$Log_{10}\left(\frac{25 \times \overset{4}{\cancel{32}}}{\underset{1}{\cancel{8}}}\right)$

$Log_{10}\, 100 = log_{10}{}^{10^2}$

$= 2\, log_{10}{}^{10}$

But $log_{10}{}^{10} = 1$

$\therefore = 2$

√Application of logarithmic laws.

√Application

C.A.O

13. $Log\, \frac{3x + 8}{2^3} = log\,(x - 4)$

$\frac{3x + 8}{8} = x - 4$

$3x + 8 = 8(x - 4)$

$3x + 8 = 8x - 32$

$-5x = -40$

$x = 8$

Division of logs.

Dropping logs and simplification.

C.A.O

47. Commercial Arithmetic 2

1	a) $1.15 \times 54{,}450 + 6000$ $68{,}617.5 \times 12$ *sh.*823,410	M_1 M_1 A_1	
	b)	M_1	✓1st and 2nd slabs
		M_1	✓3rd and 4th slabs

	$1^{st}\ 116160 \times \frac{10}{100} = sh.11,616$ $next\ 109440 \times \frac{15}{100} = sh.16,416$ $next\ 109440 \times \frac{20}{100} = sh.21,888$ $next\ 109440 \times \frac{25}{100} = sh.27,360$ $\text{Re } maining\ 378,930 \times \frac{30}{100} = sh.113,95$ Total annually $= 190,959$ Monthly $= \frac{190,959}{2} = sh.15,913.25$ Less relief 1100.00 Net tax payable $= sh.14,813.25$ c) $\frac{20}{100} \times 54,450 = sh.10,890$ Total deductions $10,890 + 14,813.25$ $= 25,703.25$ Monthly income $= 60,450 - 25,703.25$ $= sh.34,746.75$	M_1 M_1 A_1 B_1 B_1	✓last slab Subtraction of relief Total deductions

1. *After 1st year =* $\frac{95}{100} \times 4200000)$

= Shs.357,000

After 2nd year = $(\frac{87}{100} \times 357000)$

= sh310590

After 3rd year = $(\frac{88}{100} \times 310590$

= shs.273319.20

After 4th year = $(\frac{91}{100} \times 273319.20)$

=shs.248720.50

After 5th year = $(\frac{248720.50}{100} \times 93)$ *= shs.231310*

The next 6years

$A = 231310 (1 - 0.05)^6 = 170034.10$

Then $140000 = 170034.10 (1-0.04)^n$

$(0.96)^n = \frac{140000}{170034.10} = 0.8234$

$n = \frac{\log 0.8234}{\log 0.96}$

$= \frac{0.0844}{0.01773} = 4.76yrs$

Total no. of years = 5 + 6 + 4.76yrs *= 15.76years*

2. *Gross tax = 4830 + 1120 + 600 = sh 6550 per month*

Annual gross tax = 6550 X 12= 78,600

$\frac{10}{100}$ *X 120,000 = sh.12,000*

$\frac{15}{100}$ *X 120,000 = sh.18,000*

$\frac{25}{100}$ *X 120,000 = sh. 30,000*

Re. tax = 78600 – (12000 + 18000+30000)

=78600 – 60,000 = 18,6000

$\frac{35}{100}$ *X x =18,600*

0.35x = 18,600

x = sh 53142.86

Taxable income p.a = 36,000+53142.86

=sh.412142.86

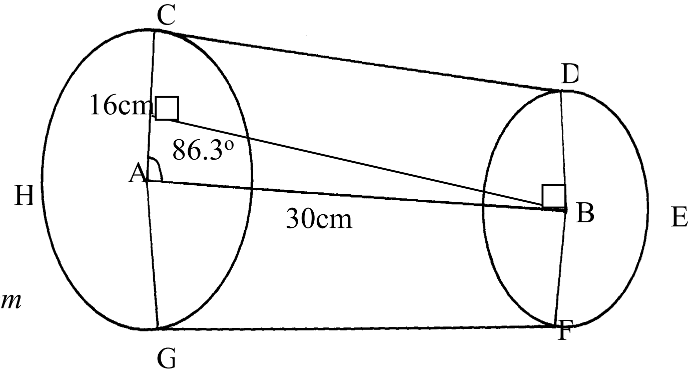
Monthly salary = $\frac{413142.86}{12}$ *+ 12,000*

= 34428.57 + 1200 = Sh 35628.57

3. a) $\sin 86.3° = {}^{XB}/_{AB}$

$\sin 86.3° = {}^{XB}/_{30}$

$XB = 30\sin 86.3°$



$XB = CD = 29.93746855$ *cm*

b) $< ABX = 90° - 86.3°$

$= 3.7°$

$\therefore < ABD = 3.7° + 90°$

$= 93.7°$

c) $< DBF$ *obtuse* $= 360° - 187.4°$

$= 172.6°$

Arc DEF = ${}^{\theta}/_{360}\ \pi D$ *or* ${}^{\theta}/_{360} x 2\pi r$

But $\cos 86.3° = {}^{AX}/_{AB}$

$\cos 86.3° = {}^{AX}/_{30}$

$AX = 1.935969248$ *cm*

$DB = 16 – 1.935969248 = 14.06403075$ *cm*

$\therefore$ *Arc DEF =* ${}^{172.6°}/_{360°}\ x\ {}^{22}/_{7}\ x\ 14.06403075$

$= \frac{106807.8751}{2520}$

$= 42.38407742$ *cm*

Arc CGH

$< \text{reflex } CAG = 360° - (2x\ 86.3°)$

$= 187.4°$

$\therefore \text{Arc } CGH = {}^{187.4°}/_{360°}\ x2\ x\ {}^{22}/_{7}\ x\ 16$

$= \frac{131,929.6}{2520}$

$= 52.35301587 \text{ cm}$

Total length of belt to go round the belt

$= CD + DEF + GF + CHG$

$= 29.93746855 + 42.38407742 + 29.93746855 + 52.35301587$

$= 154.6120304 \text{ cm}$

4. $\angle ABD = 31^0$

$\angle CBD = 37^0$

5. $A = 15,000(1 + {}^{8}/_{100})^7$

$= Ksh.25,707$

6. *Principle* $= 30,000 – 6,000$

$= 24,000/=$

Amount $= 18 \text{ x } 2000$

$= 36,000/=$

$$A = P\left(\frac{T1}{100} + r\right)$$

$$6,000 = 24000\left(\frac{1}{100} + r\right)^{18}$$

$$\frac{36000}{24000} = \left(1 + \frac{r}{100}\right)$$

$$\frac{3}{2} = \left(\frac{1}{00} + r\right)$$

$$1 + \frac{r}{100} = \sqrt[18]{1.8}$$

$$1 + \frac{r}{100} = 1.023$$

$$\frac{r}{100} = 0.023$$

$\Rightarrow \underline{2.3\%}$

7. *Commission earned Kshs.* $(8368 – 6700) = $ *Kshs.* $1668/=$

let sales in 3rd bracket be y

${}^{10}/_{100} \text{ x } 5000) + ({}^{15}/_{100} \text{ x } 3000) + ({}^{20}/_{100} \text{ x } y) = 1668$

$500 + 450 + 0.2y = 1668$

$0.2y = 1668 – 950 = 718$

$y = {}^{718}/_{0.2} = 35\%$

Total sales $= (8000 + 3590)$

$= shs.11590$

8. *Find the principal which in 12 years at 5% p.a compound interest amounts to sh.450,00*

. $A = P\left(1 + \frac{R}{100}\right)^n$

$I = A – P$

$$\therefore A = \left(100 + \frac{R}{100}\right)^n$$

$$I = P\left(100 + \frac{R}{100}\right)^n - P$$

$= P (100 + R/100)n - 1$

$\underline{450000} = P = \underline{450000} = 565397$

9. a) Taxable income = (25000 + 12000 + 3000) = 40000

b) Income tax

$10164 \times {}^{2}/_{20} =$ Shs.1016.40

$10164 \times {}^{3}/_{20} =$ Shs.1524.60

$10164 \times {}^{4}/_{20} =$ Shs.2032.80

Remaining :

$9508 \times {}^{5}/_{20} =$ Shs.2377

Total tax payable p.m = 6950.8 – 1162 = Shs.5788.80

c) Annual tax payable = 5788.80 x 12 = Shs.69465.60

10. (a) taxable income = Kshs. 25000 + Kshs.10480

= Kshs. 35480

b) tax charged:

1st 4350 = $4350 \times {}^{2}/_{20} = 683.25$

2nd 4555 = $4555 \times {}^{3}/_{20} - 683.25$

3rd 4555 = $4555 \times {}^{4}/_{20} - 911$

4th 4555 = $4555 \times {}^{5}/_{20} - 1138.75$

Rem. 17465 = 17645 x 6/20 – 5239

Total tax – 8407.5

$\underline{800.00}$

7607.50

(c) 40/100 x 35480 – 14.192 = 49672

New income = 35480 + 14192 = 49672

Remainder = 49672 – 18015 = 31657

Tax charged = 31657 x 6/20 = 12665.1

Total tax = 12665.1

$$\% \text{ increase in income ax} = \frac{4257.6 \times 100}{7607.5} = 55.97\%$$

11. $A = P(HR/100)^n$

$$500000 = P\left(1 + \frac{20}{100}\right)^5$$

$500{,}000 = ({}^{120}/_{100})^5$

$$\frac{500{,}000}{(1.2)^5} = P$$

P = Shs.200,938.786 ≈ shs. 200,939

12. Principal = 26, 000 - 6,000 = 20,000

Total H.P instalments = 1045.3 x 24 = 25087.20

$$25087.20 = 20{,}000\left(\frac{1}{100} + r\right)^2$$

$$1.254 = \left(1 + \underline{r}\right)^2$$

100

$1.120 = \frac{1}{100} + r$

$\frac{r}{100} = 0.12$ or 12%

13. No. of periods =12

$\left.\begin{array}{l} r = 4\% \text{ per period} \\ A = 1.0412 \times 15000 \end{array}\right\}$

= 24015.5

14. a) i) taxable income = 19200 + 12000 + 1300 + 2300 = 34800

b) Net tax

$8400 \times {}^{2}/_{20} = 840$

$9600 \times {}^{3}/_{20} = 1440$

$12000 \times {}^{4}/_{20} = 2400$

$4800 \times 5/_{20} = \underline{1200}$

5800

Net tax = 5800 – 1240

= 4560

c) Net salary = 34800 – (4560 + 5530)

= 24710

15. (a) 9000 + 350 + 800 + 1200 = 11350

(b) 9000 + 3000 = 12000

(c) Total taxes = 12000 x 12

= shs.144000p.a

<u>Taxes</u>

450 x 2 = shs.9000

3000 x 3 = shs.9000

3000 x 4 = shs.12000

3000 x 5 = shs.15000

3000 x 6 = <u>shs.18000</u>

Shs.63,000

144000 – 63000= shs.81000

7y = 81000y = 11571

Taxable income= 4500 + 3000 x 4 + 11571 = K 28071p.a

Gross salary = shs. 561420p.a

(d) Total allowances = 12000 x 12

= 144,000

Basic salary = 561420

- <u>14400</u>

Shs.417,420

Monthly basic pay = shs. 34785

16. (a) Net tax 5512

Add relief 1162

Tax payable 6674

Tax on 9680 earned

$9680 \times {}^{10/}_{100} = 968$

Tax on 9120 earned

$9120 \times {}^{15}/_{100}$ = Shs. 1368

Tax on next $9120 \times {}^{20}/_{100}$ = Shs.1824

Tax on next $9120 \times {}^{25}/_{100} = 2280$

Total $968 + 1368 + 1824 + 2280 = 6440$

$6674 - 6440 = 234$

Let x be charged at 30%

${}^{30}/_{100} X x = 234$

$$X = \frac{234 X 100}{30} = \text{Shs.}780$$

Total chargeable Income

$780 + (9120 \times 3) + 9680 = 37820$

Salary $37820 - 15220 =$ Shs.2260 per month.

b) Net salary $(37820 - 1270 - 6674)$ = Shs.$\underline{29876}$

17. a) 1st year after dep. Of 20%

$$800\,000 \times \frac{80}{100}$$

= Khs. 640,000……………………………………………………

2nd year after dep. of 5%

$$= 640000 \times \frac{95}{100}$$

= 608,000 ....

The next 3 yrs

$$A = P\left(1 - \frac{R}{100}\right)^n = 608,000\left(1 - \frac{10}{100}\right)^3$$

$= 698\,000\,(0.9)^3$

= Sh. 443,232 ……………………………………………………

800,000 – 443,232 = Sh. 356,768 ………………………………………………………..

(b) S.I $= 3000 \times {}^{15}/_{100} \times 2$

= Sh 900 ……………………………………………………

$$A = 3000\left(1 + \frac{15}{100}\right)^2$$

$= 3000\,\left(1.15\right)^2$

= sh. 3967.50 …………………………………………………..

C.I = sh 967.50

967.50 – 900 = sh 67.50 ………………………………………..

18. (i) Taxable Income

$$\left(\frac{115}{100} \times 24\,800\right) + 12000 - 1220$$

$= 28520 + 12000 - 1220$

$= \text{Ksh.}39,300$

$= \underline{\text{K£ } 1965 \text{ p.m.}}$

(ii) Tax due

$$\left.\begin{array}{ll} 325 \times 2 & = \text{sh } 650 \\ 650 \times 3 & = \text{sh } 1950 \\ 325 \times 5 & = \text{sh } 1725 \\ 325 \times 6 & = \text{sh } 1950 \\ 340 \times 7.50 & = \text{sh } 2250 \end{array}\right\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

Total tax $= \underline{\text{sh. } 8825 \text{ P.m}}$………………………
without relief

(b) (i) Total deduction

$= \text{sh } (7280 + 2400 + 1200 + \frac{2}{100} \text{ of } 24\,800)$………………..

$= (7280 + 2400 + 1200 + 496) + 1220$

$= \text{sh } (11376 +\_\ 1220) \qquad = \underline{\text{sh. } 12,596 \text{ P.m}}$ …………………………………………

(ii) Net income $= \text{sh } (24800 + 1200 - 12596) \qquad = \text{sh. } 24,204 \text{ P.m}$……………………………

19. a) Total instalments $= (24 \times 1250) = \text{Shs.}30000$

$\text{H.P} = 7200 + 30000 = 37200$

b) $124\% = 37200$

$100\% =$

$\text{C.P} = \frac{100}{124} \times 37200$

$= 30000$

c) $A = 30000\,(1 + {}^{18}/_{100})^2$

$= 30000\,(1.18)^2 = 41772$

Total interest $= 41772 - 30000 \qquad = 11772$

20. (a) (i) $(10,\ 500 + 6,500) \times \frac{12}{20} = \text{K£ } 10,20 \text{ p.a}$

(ii) 1^{st} $1980 \times 2 = \text{Kshs. } 3960$

2^{nd} $1980 \times 3 = \text{Kshs } 5940$

3^{rd} $2480 \times 5 = \text{Kshs. } 12\,400$

4^{th} $1480 \times 7 = \text{Kshs. } 10360$

5^{th} $1980 \times 9 = \text{Kshs.}17\,820$

Last $300 \times 10 = \text{Kshs } \underline{3\,000}$

$\text{Kshs. } 53\,480$

$\text{PAYE} = \frac{\underline{53480} - \underline{300 \times 12}}{12}$

$= \text{Shs. } 4156.70$

(b) Net monthly pay

$17000 - 320 + \frac{2}{100} \times 17000$

$= 17000 - 660$

$= \text{Kshs } 16\,340.00$

48. Circles –chords and tangents

1.	$6^2 = x(5 + x)$	**M1**	
	$x^2 + 5x - 36 = 0$		
	$(x - 4)(x + 9) = 0$	**M1**	Correct factorisation
	x = 4 or -4		
	BC = 4cm	**A1**	
		03	

1. a) i) <DCF = $\frac{180 - 92}{2}$ = 44° = < CAD

ii) < BAO = 50°

Acute angle AOB = 80°

$\therefore$ obtuse angle = 360 – 80 = 280°

b) Area of the sector = ($^{80}/_{360}$ x $^{22}/_{7}$ x 7 x 7)= 34.22cm^2

Area of the Δ = ½ x 7 x 7 x sin80= 24.13cm^2

Area of the shaded segment = 34.22 –

$\underline{24.13}$

10.09cm^2

2. < COB = 2 x 50 = 100 °

< OCA =< OAC = $\frac{180 - 100}{2}$ = 40

$\therefore$ < BAC = 180 – (50 + 70)

= 60

3. PB. PA $(PT)^2$

$\frac{PB}{PT} = \frac{PT}{PA}$

$\frac{4}{12} = \frac{12}{4 + 2r}$

$\frac{4(4 + 2r)}{4} = \frac{12^2}{4}$

4 + 2r = 36

2r = 32

r = 16 cm

4. (a) $\angle BOE = 2\angle BCE = 2 \times 20^0 = 40^0$

(b)$\angle BOE = 40^0$

$\angle BEC = ½ (360^0 - 60^0) = 150^0$

Angels subtended at the centre is twice at the Circumference.

c) $\angle CEF = 90^0 - 80^0 = 10^0$

d) $\angle BCO = \angle CBO = 60^0$

Base angles isosceles triangle.

$\angle OXC = 180^0 - (60^0 + 20^0)$

$= 100^0$

e) $\angle BCE = 20^0$

$\angle CXE = 180^0 - 100^0 = 80^0$

$\angle CEX = 80^0$

$\angle OEF = 180^0 - (80^0 + 50^0 + 10^0)$

$= 40^0$

5. (a) $PQ = \sqrt{8^2 - 2^2}$

$= 60$

$= 7.746cm$

(b) $\angle PAS = 2\cos^{-1}$

$= 151^o$

$\therefore$Reflex $\angle PAS = 209^o$ OR $360^o - 151^o = 209^o$

(c) Length PYS $= \frac{209}{360} \times 2 \times 6 = 21.89cm$

Length QXR $= \frac{151}{360} \times 2 \times 4 = 10.54cm$

(d) Length of belt $= 7.74 \times 2 + 21.89 + 10.54$

$= 47.92cm$

6. a) i) In 1 hr; Tap A fills $^1/_3$

B - ¼

Capacity filled in 1 hr $= {}^1/_3 + ¼$

$= {}^7/_{12}$

${}^7/_{12} = 1$ hr

$1 = 1 \times 1 \times {}^{12}/_7$

$= 1\ {}^5/_7$ hrs.

ii) ${}^1/_3 + ¼ - {}^1/_6 = {}^5/_{12}$ $\Rightarrow$ in one hr

${}^5/_{12} = 1$hr

$1 = 1 \times 1 \times {}^{12}/_5$

$= 2\ {}^2/_5$ hrs

7. $\angle ABD = 31^0$

$\angle CBD = 37^0$

8. $x (x+9) = 4x9$

$x^2 + 9x - 36 = 0$

$(x^2 - 3x) + (12x -36=0)$

$x(x-3) + 12(x-3) =0$

$(x+12) (x-3) = 0$

$x -3 = 0$

$x = 3$ only

9. PO. OQ = BO .OA

$8 \times 6 = 4.5 \times y$

$y = \frac{8 \times 6}{4.5}$

$= 10.67$

10. < DGB = < ABG = 40° (alt.seg <,s)

a) < DGE = < DBE = 25° (<s in same segment)

b) <EFG

< GEB = 40°, = <BDG and < BED = 45° = <BGD

∴ In Δ GED, <GDE = 180 – (25 + 40 + 45) = 70°

∴<GFE = 180 – 70 = 110^o (Sup angles)

d) Angle CBD in ΔBGE, Angle GBE = 180 – (110) = 70^o

∴Angle CBD = 180 – (40 + 70 + 25) = 45^o

Or Angle CBD = Angle BGD = 45^o (Angles in Alt segment)

e) Angle BCD in Δ BCD, Angle BDC = 70 ^{o} Angles in a straight line

∴Angle BCD = 180 – (70 + 45) Angles of a triangle = 65^o

11. (a) $Sin\theta = \frac{4.5}{8} = 0.5025$

$\theta = Sin^{-1}\ 0.5625$

$= 34.23^o$

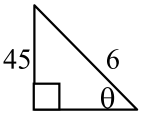
$\angle Apb = 68.46^o$

$Sin\alpha = \frac{4-5}{6} = 0.75$

$\alpha = Sin-10.75$

$= \angle 48.59^o$

$\angle Aqb = 97.18^o$



(b) Area Of Segment PAB = $\frac{68.46}{360} X \frac{22}{7} X\ 8\ X\ 8 – ½\ X\ 8\ Sin\ 68.46$

$= 38.25 – 29.77$

$= 8.48cm^2$

Area Of Segment AQB = $\frac{97.18}{360} X \frac{22}{7} X\ 36 – ½\ 36\ Sin\ 97.18$

$= 30.65 – 17.86 = 12.68cm^2$

Area of quadrilateral APBQ = ½ 64 sin 68.46 + ½ x 36sin 92.18

$= 29.77 + 17.86 = 47.63$

Shaded area = 47.63 – (8.48 + 12.68) = $26.47cm^2$

12. *CBD = 90 - 42 = 48^o*

Angle of triangle add to 180^o

DOB = 180^o – 42 = 138^o

Opposite angles of cyclic quadrilateral add to 180^o

DAB = $\frac{138^o}{2} = 69^o$

Angle at circumference is half the nagle substended at centre by same chord

CDA

ABD= 90 – 48 = 42o

ADB = 180 –(69+42)

180-111=69^o

CDA = 90 + 69^o = 159^o

Show ΔADB is asoccesters

$\angle DAB = 69^o$

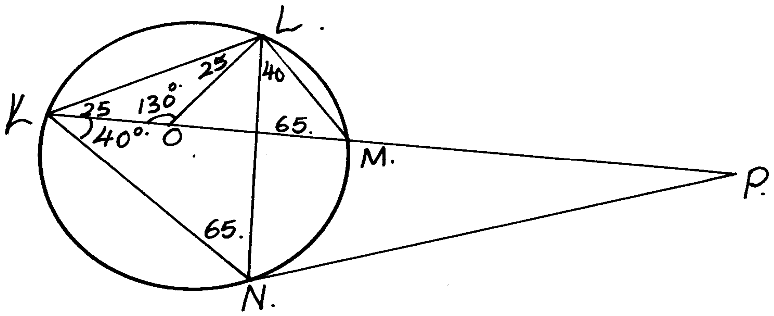
$\angle DAB = 69^o$

$\angle ADB = 69^o$

∠ABD = 42^o

So two angles are equal hence it is asoccesters

13.



a) MLN = 40^o angles subtended by same chord in the same segment are equal.

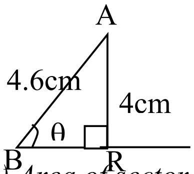
b) OLN = 90 – 65 = 25^o
Angle sum of Δ is 180^o or angle subtended by > diameter is 90^o.

c) LNP = 65^o exterior Δ is equal to opposite interior angle or angle btwn a chord and a tangent is equal to angle subtended by the same chord in the alternate segment.

d) MPN = 180 – 170 = 10^o angle sum of a Δ is 180^o

e) LMO = 65^o angles subtended by same chord.

14. (a)



Sin = $^4/_{4.6}$ = 0.869565
= sin-10.89565 = 60.408^o
ABR = 2 x 60.408^o = 120.8163^{o}C
≈120.82^o (2d.p)

(b) Area of sector ABCR
= $\frac{120.8163^o}{360^o}$ x πx 4.62)cm^2
= 22.30994cm^2
Area of sector OAPC
= $\frac{60^o}{360^o}$ x πx 8^2)cm^2
= 33.51032cm^2
= 33.51cm^2(2d.p)

Area of ΔABC = (½ x 4.6^{2}sin 120.8163)cm^2 = 9.08625cm^2
Area of AOC = (½ x 82 sin 60) cm^2 = 27.7128cm^2
Sum of area of Δs = 36.799cm^2 36.80cm^2
∴Area of shaded part = area of sectors – area of Δs
= (22.31 + 33.51 – 36.80)cm^2 = 19.02cm^2(2dp)

15. *(a) ∠TDC = ABT (exterior opp. angle of a cyclic quadrilateral)*
= 100^o
(b) BAT = ATB (base s of isosceles ATB)
= 180 – 100 = 40^o
(c) ∠TCD = ∠X TD (angles in alternate segments)
= 60^o
Or ∠BTC + 40^o = 100^o(exterior angle of a Δ)

$\angle BTC = 100^o - 40^o = 60^o$

(d) $DTC = 180^o - (58^o + 100^o)$ (angles in ΔTDC $= 12^o$

16. a) $GBD = 90°$

$ABG = 180 - (90 + 36)$

$= 180 - 126 = 54°$

$GEB = ABG = 54°$

b) $BED = CBD = 36°$

c) $DGE = FEG = 20°$

$OEB = 90 - (36 + 20)$

$= 90 - 56 = 34°$

$OBE = OEB = 34°$

d) $BGE = 36 + 20 = 56°$

e) $GFE = 180 - EDG$

$= 180 - 70 = 110°$

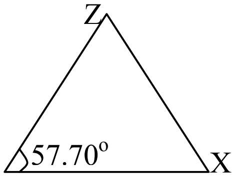
17. $XZ^2 = 13.4^2 + 5^2 - 2 \times 13.4 \times 5 \cos 57.7^o$

$= 170.56 + 25 - 134 \times 0.5344$

$= 204.56 - 71.6096$

$XZ^2 = 132.9504$

$XZ = 11.5304cm$



(ii) $2R = \frac{11.5304}{\text{Sin } 57.7^o}$

$2R = \frac{11.5304}{0.8453}$

$2R = 13.60866$

$R = 6.08043cm$

18. $52 = 62 + 62 - 2 \times 6 \times 6 \cos A$

$72 \cos A = 72 - 25 = 46$

$\text{Cos } A = {}^{46}/_{72} = 0.6389$

$A = \text{Cos-1 } 0.6389 = 50.29^o$

Area of the minor sector APQ

$= \frac{50.29}{360} \times 3.142 \times 6^2$

$= 15.801cm^2$

Area of the triangle APQ $= ½ \times 6 \times 6 \sin 50.29 = 13.847cm^2$

Area of the minor segment $= (15.801 - 13.847)cm^2 = 1.954cm^2$

Area of triangle PBQ

$\sqrt{6.5 (6.5 - 4) (6.5 - 4) (6.5 - 5)}$

$\sqrt{6.5 \times 2.5 \times 2.5 \times 1.5} = 7.806cm^2$

Area of shaded region $= (7.806 - 1.954)cm^2 = 5.852cm^2$

19. a) $\measuredangle PQR = 180^o - 75^o$

= 105^o. NPQR is cyclic quadrilateral.

(b) $\measuredangle NRP = 90^o - 75^o$
$= 15^o$, Third angle of Δ NRP.

$\measuredangle PRS = 180^o - 65^o$, Angles on a
$= 115^o$, straight line.

$\therefore \measuredangle QSR = 180^o - (115^o - 35^o)$
$= 30^o$, 3rd angle of triangle PRS.

(c) Reflex $\measuredangle POR = 2\ \measuredangle PQR$
$= 2 \times 105^o\ = 210^o$

(d) $\measuredangle MQR = \measuredangle MNR = 40^o$
Subtended by same chord MR

20.
(a) $\angle TDC = 100^o$ (Cyclic quadrilateral)
(b) $\angle TCB = 40^o$ (Cyclic quadrilateral)
(c) $\angle\ TCD = 58^o$ (Cyclic quadrilateral)
(d) $\angle BTC = 60^o$ (Sum angle of a Δ add upto 180^o)
(e) $\angle DTC = 22^o$ (angle sum of a straight line add upto 180^o)

21. $4 \times 10 = 5(5 + x)$
$40 = 25 + 5x$
$3 = x$

22. $T_{11} = a + 10d$
$T_2 = a + d$
$a + 10d = 4a + 4d$ ....(i)
$3a - 6d = 0$
$S7 = {}^7/_2\{2a + 6d\} = 175$ ...(ii)
$2a + 6d = 50$
$+$
$\underline{3a - 6d\ =\ 0}$
$5a \qquad = 50$
$a = 10 \qquad d\ = 5$

23. $CBE = 40^0$ (alt.segiment theoren)
$\angle BCE = 120^0$ (Suppl. To $BCD = 60^0$alt. seg.)
$\therefore (40 + 120 + E) = 180^0$ (Angle sum of Δ)
$\angle BEC = 20^0$

24. Taxable income p.a = 36,000+53142.86
=sh.412142.86
Monthly salary = $\frac{413142.86}{12} + 12,000$
= 34428.57 + 1200 = Sh 35628.57

25. a) (i) $\angle PTQ\ = 180^o\ - 56^o\ = 124^o$
$124 + 38 = 162^o$
$180^o - 162^o = 18^o$
$90^o + 18^o = 108^o$
$180^o - 108^o = 72^o$
$180^o - (72^o + 56^o) = 52^o$
$\angle PRS\ = 52^o$ ***√Value of the constant.***

(ii) $\angle RSQ = \angle RPQ = 18^o$

b) $A\ \alpha\ B.\ \underline{1}$ ***√Substitution √Formulation***

√Values of constants.
√Substitution

C^3

$$A = \frac{K.B}{C^3}$$

$$12 = \frac{3K}{2^3}$$

$$K = \frac{\cancel{12}^{4} \text{ x } 8}{\cancel{3}_{1}} = 32$$

$$\therefore A = \frac{32B}{C^3}$$

$$\frac{10 \text{ x } (1.5)^3}{32} = B$$

$\therefore B = 1.055$

c) $y = K + Mx^2$ where K and M are constants

$$\begin{array}{rl|l} 7 & = K + 100\,M & 100 \text{ x } 0.005 + K = 7 \\ \underline{5.5} & \underline{= K + 400M}^{-} & -0.5 + K = 7 \\ 1.5 & = 300M & K = 7.5 \end{array}$$

$M = 0.005$

$y = 7.5 – 0.005 \text{ x } 18^2$

$y = 7.5 – 1.62$

$y = 5.88$

26. a) $PN^2 = 5^2 - 4^2$

$PN = 3cm$

$QN^2 = 6^2 – 4^2$

$QN = 4.47cm$

$\therefore PQ = 3 + 4.47 = 7.47$

b)i) $< APB$

$\sin \frac{1}{2}\ \theta\ ^4/_5 = 0.8$

$\frac{1}{2} \sin \theta = 53.13$

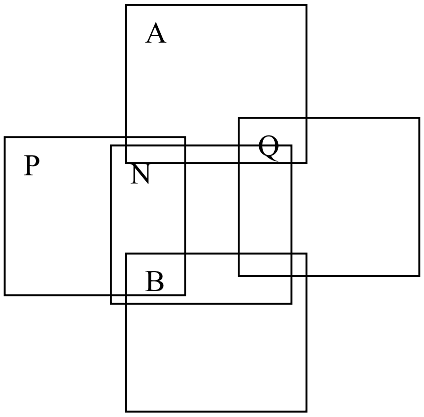
$< APB$

ii) $\sin \frac{1}{2} \propto = 4/6 = 0.6667$

$\frac{1}{2} \propto = 41.81$

$\propto 83.62$

$\therefore < AQB = 83.62°$



c) Area of the shaded region – Area of the segments

$$= \frac{106.3}{360} \text{ x } \frac{22}{7} \text{ x } 5^2 – \frac{1}{2} \text{ x } 5 \text{ x } 5 \sin 106.3$$

$= 23.19 – 11.998 = 11.192$

$$\frac{83.6}{360} \text{ x } \frac{22}{7} \text{ x } 6 \text{x } 6 – \frac{1}{2} \text{ x } 6 \text{ x } 6 \sin 83.6 = 8.38$$

Total $11.192 + 8.38 = 19.52$

27. *Using cosine rule*

$7.8^2 = 6.6^2 + 5.9^2 - 2 \text{ x } 6.6 \text{ x } 5.9 \cos R$

$\text{Cos } C = \dfrac{6.6^2 + 5.9^2 - 7.8^2}{2 \text{ x } 6.6 \text{ x } 5.9}$

$= \dfrac{43.59 + 34.81 - 60.84}{77.88} \qquad = \dfrac{78.37 - 60.84}{77.88}$

$= \dfrac{17.53}{77.88} = 0.2251$

$\angle C = 77^o$

$\dfrac{7.8}{\text{Sin } 77} = 2r \Rightarrow r = \dfrac{7.8}{2 \text{ x } \sin 77}$

$= 4cm$

Area of circle $= 3.142 \text{ x } 4^2 \qquad = 50.27$

A△ea of $PQR = \frac{1}{2} (6.6)(5.9) \sin 77$

$= 18.97$

$\therefore$ *Area of shaded region* $= 50.27 - 18.97 \quad = 31.30cm^2$

√ angle
√ angle
√
√
√
√
√ diff. areas
√ diff. areas
Exp. for total
√ answer.

28. a) $\angle PAQ = 2\ PAB = 42^o \text{ x } 2 = 84^o$

$\angle PBQ = 2 \angle ABQ = 30^0 \text{ x } 2 = 60^o$

(b) (i) *Area of sector APQ* $= \dfrac{84}{360} \text{ x } \dfrac{22}{7} \text{ x } 6 \text{ x } 6 = 26.4 \text{ cm}^2$

Area of sector PBQ $\dfrac{60}{360} \text{ x } \dfrac{22}{7} \text{ x } 8 \text{ x } = 33.5 \text{ cm}^2$

(ii) *Area of* $\Delta APQ = \frac{1}{2} \text{ x } 6 \text{ x } 65{:}\text{-}\ 84^o = 18 \text{ x } 0.9945$

$= 17.9 \text{ cm}^2$

Area of $\Delta\ PBQ = \frac{1}{2} \text{ x } 8 \text{ x } 85{:} = 60^o = 32 \text{ x } 0.8660$

$= 27.7 \text{ cm}^2$

(iii) *For each circle, shaded area = sector area – triangle Area.*

= area of sector APQ – area of triangle APQ

$= 26.4 - 17.9 \quad = 8.5 \text{ cm}^2$

2^{nd} *circle, shaded area*

= area of sector PBQ – area of ΔPBQ

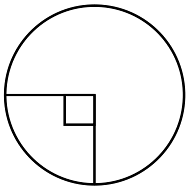
$= 33.5 - 27.7 \quad = 5.8 \text{ cm}^2$

Total shaded area $= 8.5 + 5.8 \qquad = 14.3 \text{ cm}^2$

29. $\dfrac{90}{360} \text{ x } 3.142 \text{ x } 2 \text{ x } 6.5$

$\underline{10.2115 \text{ cm}}$

$= 10.21 \text{ cm}$



49. Matrices

1	$C = \begin{pmatrix} a\,b \\ c\,d \end{pmatrix}$ Let $\begin{pmatrix} 11\,3 \\ 4\,1 \end{pmatrix}\begin{pmatrix} a\,b \\ c\,d \end{pmatrix} = \begin{pmatrix} 2\,4 \\ 3\,6 \end{pmatrix}$ $(11a+3c=2)\times 1 \qquad (11b+3d=4)\times 1$ $(4a+c=3)\times 3 \qquad (4b+d=6)\times 3$ $11a+3c=2 \qquad 11b+3d=4$ $12a+3c=9 \qquad 12b+3d=18$ $a=7 \qquad b=14$ $c=-25 \qquad d=-50$ $\therefore C = \begin{pmatrix} 7 & 14 \\ -25 & -50 \end{pmatrix}$	M₁ M₁ A₁ 3	Alternative $C = B^{-1}A$ ✓equations B^{-} ${}^{1}\begin{pmatrix} -1 & 3 \\ 4 & -11 \end{pmatrix}$ allow any two ✓solving of equations $\begin{pmatrix} -1 & 3 \\ 4 & -11 \end{pmatrix}\begin{pmatrix} 2\,4 \\ 3\,6 \end{pmatrix}$ or equivalent
2.	$\begin{pmatrix} 2 & 3 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 13 \\ 0 \end{pmatrix}$ $Det\ 4 -^{-} 9 = 13$ $\frac{1}{13}\begin{pmatrix} 2 & -3 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} 2 & 3 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{13}\begin{pmatrix} 2 & -3 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} 13 \\ 0 \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $x = 2,\ y = 3$	M1 M1 A1	
		03	

1.

$$\begin{pmatrix} 3 & 2 \\ 4 & -1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 12 \\ 5 \end{pmatrix}$$

$$\begin{pmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{4}{11} & \frac{-3}{11} \end{pmatrix}\begin{pmatrix} 3 & 2 \\ 4 & -1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{4}{11} & \frac{-3}{11} \end{pmatrix}\begin{pmatrix} 12 \\ 5 \end{pmatrix}$$

Premultiplication by the inverse.

Simplification.

C.A.O

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

a = 2 √ and b = 3 √

2. $(x-3) - (2x) = 0$

$x-3-2x = 0$

$-2x + x - 3 = 0$

$-x - 3 = 0$

$x = 3$

3. $$\begin{pmatrix}1 & 5\\ 3 & 7\end{pmatrix}\begin{pmatrix}7 & 3\\ -4 & -2\end{pmatrix} = \begin{pmatrix}-13 & -7\\ -4 & -2\end{pmatrix}$$

Determinant $= +65 - 49 = 16$

$$C^{-1} = 1 \begin{pmatrix}-5 & 7\\ 7 & -13\end{pmatrix}$$

4. $$\begin{pmatrix}3 & 2\\ 2 & 2\end{pmatrix}\begin{pmatrix}a & b\\ c & d\end{pmatrix} = \begin{matrix}9 & -3\\ 2 & 1\end{matrix}$$

$3a + 2c = 9$

$\underline{2a + 2c = 2}$

$a = 7$

$c = -6$

$3b + 2d = -3$

$\underline{2b + 2d = 1}$

$b = -4$

$d = 4.5$

$$\underset{\sim}{A} = \begin{pmatrix}7 & -4\\ -6 & 4.5\end{pmatrix}$$

5. $20x\ (-3 - {}^{-}8)$

100 area of 1st image.

$100\ x\ (4 - {}^{-}3)$

700 area of 2nd image

6. Det. $9 + 2 = 11$

$$A^{1} = \frac{1}{11}\begin{pmatrix}3 & -2\\ 1 & 3\end{pmatrix}$$

$$\begin{pmatrix}3 & 2\\ 3 & -1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}10\\ 4\end{pmatrix}$$

$$\begin{pmatrix}x\\ y\end{pmatrix} = \frac{1}{11}\begin{pmatrix}3 & -2\\ 1 & 3\end{pmatrix}\begin{pmatrix}10\\ 4\end{pmatrix}$$

$$\begin{pmatrix}x\\ y\end{pmatrix} = \frac{1}{11}\begin{pmatrix}22\\ 22\end{pmatrix}$$

$$\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}2\\ 2\end{pmatrix}$$

P (2, 2)

7 $PQ = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$$\begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$

$$\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 & 3 \\ 1 & q \end{pmatrix} \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

$x =1 \;\; y= -2$

8. $\frac{1}{2} x - \frac{1}{4} y = 2$

$\frac{2}{5} + \frac{1}{6} = 6$

$2x \_ y = 8$

$12x + 5y = 180$

$\underline{10x - 5y = 40 \qquad +}$

$22x \qquad = 220$

$x = 10$

$\frac{1}{4} y = \frac{1}{2} (10)^{-2}$

$\frac{1}{4} y = 5-2 = 3$

$Y = 12$

9. $$\begin{pmatrix} \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{-1} \end{pmatrix}$$

$$= \begin{pmatrix} \mathbf{-1} & \mathbf{-2} & \mathbf{-6} \\ \mathbf{1} & \mathbf{4} & \mathbf{9} \end{pmatrix}$$

$$\begin{pmatrix} \mathbf{0} & \mathbf{1} \\ \mathbf{1} & \mathbf{0} \end{pmatrix} \begin{pmatrix} X^1 & Y^1 & Z^1 \\ \mathbf{-1} & \mathbf{-2} & \mathbf{-6} \\ \mathbf{1} & \mathbf{4} & \mathbf{9} \end{pmatrix}$$

$$= \begin{pmatrix} \mathbf{1} & \mathbf{4} & \mathbf{9} \\ \mathbf{-1} & \mathbf{-2} & \mathbf{-6} \end{pmatrix}$$

Final image $X^{11}\ Y^{11} Z^{11}$

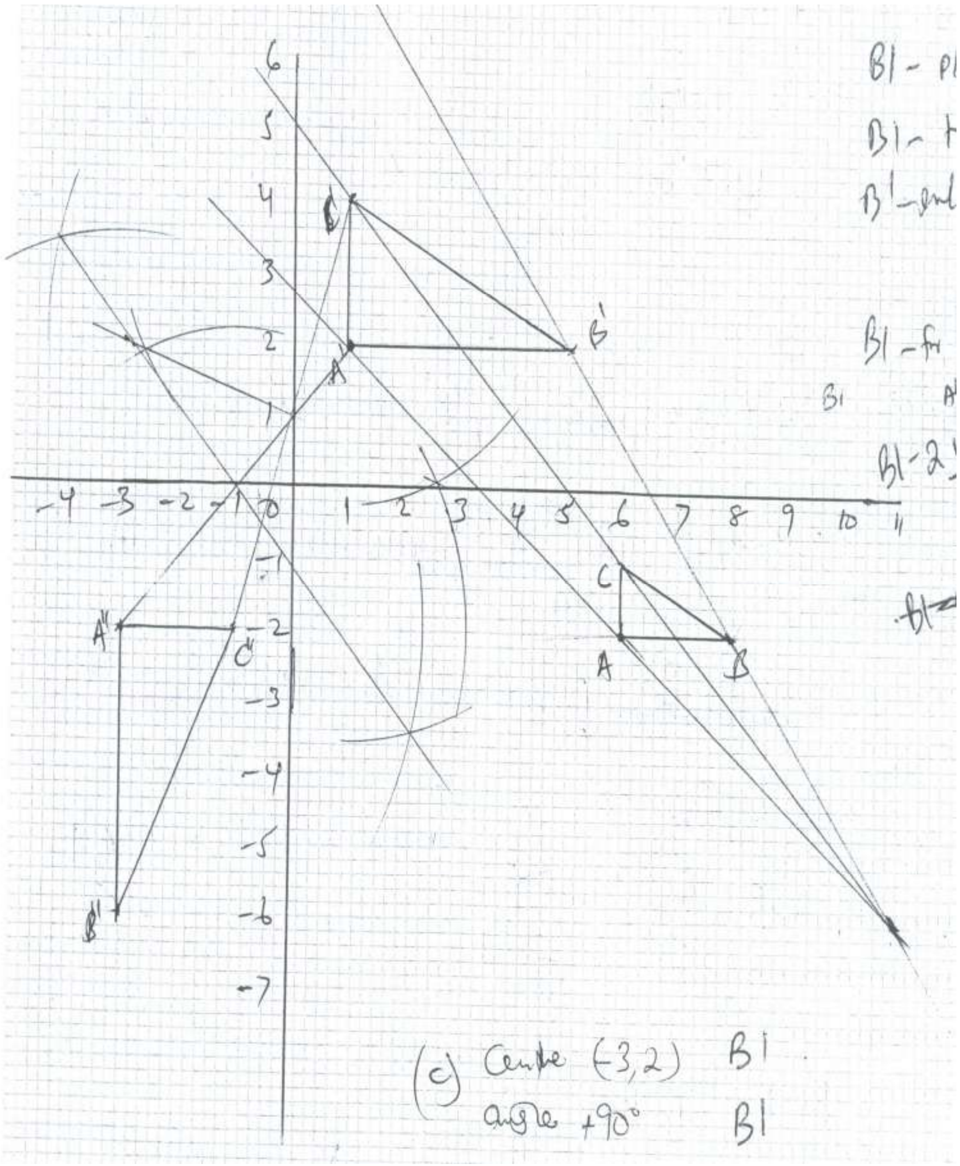
$X^{11}(1, -1)\ Y^{11}(4, -2),\ Z^{11}(9, -6)$

10. a|: $$\begin{pmatrix} 2 & 2 \\ 0 & 4 \end{pmatrix} \begin{array}{c} \begin{array}{ccc} P & Q & R \end{array} \\ \begin{pmatrix} 5 & 6 & 4 \\ -1 & -1 & -\frac{1}{2} \end{pmatrix} \end{array} = \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{pmatrix} 6 & 8 & 6 \\ -2 & 2 & -1 \end{pmatrix} \end{array}$$

(c) Centre (-3,2)

Angle + 90°

a) $$\begin{pmatrix} 2 & 4 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 5 & 6 & 4 \\ -1 & -1 & -\frac{1}{2} \end{pmatrix} = \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{pmatrix} 6 & 8 & 6 \\ 2 & 2 & -1 \end{pmatrix} \end{array}$$



11. Det 2 - -3 = 5

Area of $A^IB^IC^I$ = 5 x 15

= 75 cm^2

12. A.S.F = $\frac{110}{10}$ = 11

5X (X) - -6 = 11

$5X^2 + 6 = 11$

$5x^2 = 5$

$X^2 = 1$

$X = \pm 1$

13. Area of the image = Area of the object x Det.

Det. (Δ) = 15 – 18 = -3

54 cm^2 = A x -3

$\underline{54}$ cm^2 = A

3

Area of Δ *ABC = 18 cm²*

14. Det. $9 + 2 = 11$

$$A^1 = \frac{1}{11}\begin{pmatrix} 3 & -2 \\ 1 & 3 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 2 \\ 3 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 10 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11}\begin{pmatrix} 3 & -2 \\ 1 & 3 \end{pmatrix}\begin{pmatrix} 10 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11}\begin{pmatrix} 22 \\ 22 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$$

P (2, 2)

50. *Formulae and variation*

1	$X = \frac{U^2V}{U^2 2W}$ $U^2X + 2WX = U^2V$ $U^2X - U^2V = -2WX$ $U^2(X - V) = -2WX$ $U^2 = \frac{-2WX}{X - V}$ $U = \pm\sqrt{\frac{-2WX}{X - V}}$	M_1 M_1 A_1	Collecting terms of U^2 C.A.O $U = \pm\sqrt{\frac{2WX}{v - X}}$
		3	
2.	$P = Kt + Ct^2$ $45 = 20K + 400C........(i)$ $60 = 24K + 576C........(ii)$ $(80C + 4K = 9)2$ $(48C + 2K = 5)4$ $160C + 8K = 18$ $192C + 8K = 20$ $-32C = -2$ $C = \frac{1}{16} \therefore K = 1$ $P = 32 + \frac{32 \times 32}{16}$ $= 96$	M1 M1 A1 B1	Allow for one ✓equation ✓Attempt to solve For both values
		4	

3.	$V = \frac{K}{W^2} + C$ $W = 2, V = 14$ $14 = \frac{K}{2^2} + C \Rightarrow 56 = K + 4c..........(i)$ $9 = \frac{K}{3^2} + C \Rightarrow \frac{81 = K + 9c}{-25 = -5C}$ ....(ii) $(i)-(ii)$ $5 = c$ 56 = k + 20 36 = k $V = \frac{36}{W^2} + 5$ $V = \frac{36}{6^2} + 5 = 5$	B1 M1 A1 B1	
		04	
4.	$T^2 = \frac{1}{4}\left(\frac{2}{x+y}\right)$ $4T^2(x+y) = 2$ $x + y = \left(\frac{2}{4T^2}\right)$ $y = \frac{1}{2T^2} - x$	M1 M1 A1	Removal of root sign Simplification Y expressed in simplified form
		03	

1. $P = kr^2$; $R = MT^2$

$18 = 9k \quad 3 = 25m$

$K = 2 \qquad M = \frac{3}{25}$

$P = 2R^2 \qquad R = \frac{3}{25} T^2$

$\left(P = 2\right)^{2} \frac{3}{25} T^2 = \frac{18}{625} T^4$

$P = \frac{18 \times 10000}{625} = 288$

2. $v^2 = \frac{r}{r + c}$

$v^2 \frac{(r + c)}{\cancel{r + c}} = \cancel{r} \quad (r + c)$

$v^2 r + vc = r$

Removing the sg. Root.

$r - v^2 r = vc$

$r(1 - v^2) = vc$

Factorization.

$r = \underline{\quad vc \quad}$

C.A.O

$1 - v^2$

3. $X \alpha \frac{Y^3}{\sqrt{Z}} \Rightarrow x = KY^3$

$6 = \frac{K(3)^3}{\sqrt{25}}$

$6 = \frac{27K}{5}$

$K = \frac{10}{9}$

$\therefore X = \frac{10}{9} \frac{Y^3}{\sqrt{Z}}$

$X = \frac{10}{9} \frac{(7)^3}{9}$

$= \left(\frac{10 x 34^3}{27}\right)$

$= 127.04$

(a) $Y^3 = \frac{9}{10} x Z$

$Y = \sqrt[3]{\frac{9}{10} x 4 x 8}$

$Y = \sqrt[3]{\frac{144}{5}} = 3.07$

(b) $X_1 = \frac{KY^3}{\sqrt{\ Z}}$

$X_2 = \frac{K(1.2y)^3}{\sqrt{0.64Z}}$ M_1

$\frac{1.728KY^3}{\sqrt{0.8}\ Z} - \frac{KY^3}{\sqrt{Z}}$ M_1

$\frac{\left(\frac{2.16KY^3}{\sqrt{Z}} - \frac{KY^3}{\sqrt{Z}}\right) x\ 100\ \%}{\frac{KY^3}{\sqrt{Z}}}$ M_1

$= 116\%$ A_1

4. $K (b-a) = ab$

$Kb - ka = ab$

$Kb - ab = ka$

$B(k-a) = ka$

$B = \frac{ka}{K - a}$

5. $x - 2.5 - \sqrt{3} \qquad x - 2.5 + \sqrt{3} \quad = 0$

$x^2 - 2.5x + x\sqrt{3} - 2.5x + 6.25 - 2.5\sqrt{3}$

$x\sqrt{3} + 2.5\sqrt{3} = 0$

$x^2 - 5x + 6.25 - 3 = 0$

$x^2 - 5x + 3.25 = 0$

$4x^2 - 20x + 13 = 0$

6. $Z = \frac{Kx^2}{\sqrt{y}}$

$Z = \frac{(1.2x)^2K}{\sqrt{0.64y}}$

$= \frac{1.44Kx^2}{0.85y}$

$= 1.8\,\frac{Kx^2}{\sqrt{y}}$

% increase = 80%

7. $ar^3 = 48$

$ar^6 = 384$

$\therefore \frac{ar^6}{ar^3} = \frac{384}{48}$

$r^3 = 8$

$r = 2$

$ar^3 = 48$

$8a = 48$

$a = 6$

$Sn = \frac{a(r^n - 1)}{r - 1}$

$\frac{6(2^6 - 1)}{2 - 1}$

$= 6(64 - 1)$

$= 6 \text{ x } 63$

$= 378$

8. $P = \frac{KQ^2}{R}$

$2 = \frac{16K}{6}$

$K = \frac{3}{4}$

$P = \frac{3}{4}\,\frac{Q^2}{R} = \frac{3}{4} \text{ x } \frac{64}{4} = 12$

9. $B \;\&\; M^2 = {}^{1}/_{N}$

$B = Km^2 + {}^{Q}/_{N}$

$(96 = 4K + 2Q)^3$

$(46 = 3K + 0.5Q)^4$

$104 = 4Q$

$Q = 26$

$K = 11$

Expression $B = 11m^2 + {}^{26}/_{N}$

10. $3x = y - 1$ ……… i

$\frac{2x + 2}{y - 5} = \frac{1}{2}$

$4x + 4 = y - 5$

$4x + 9 = y$ …………… ii

$3x = y - 1$

$\underline{4x = y - 9}$

$-x = 9 \qquad x = -9$

$-27 = y - 1$

$y = -26$

11. $P = \sqrt[3]{\frac{x-1}{x+2}} \Rightarrow P^3 = \frac{x-1}{x+2}$

$P^3x - 2P^3 = x - 1$

$P^3x - x = -1 - 2p^3$

$x(P^3 - 1) = -1 - 2P^3$

$x = \left(\frac{-1-2P^3}{P^3-1}\right) -1$

$x = \frac{1+2p^3}{1-p^3}$

12. $a^4 = \frac{1+d^2}{b^2} + \frac{b}{3}$

$3d^2 = 3a^4b^2 - b^2 - 3$

$d = \sqrt{\frac{3a^4b^2 - b^2 - 3}{3}}$

13. (a) $Z = \frac{KX^2}{y^2}$

$Z = \frac{100k}{16} = 15$

$K = \frac{12}{5}$

$Z = \frac{12x^2}{5^{y2}}$

(b) $Z = 21.90$

14. $R = kn + t\sqrt{n}$

$9k + 3t = 42$

$25k + 5t = 100$

$45k + 15t = 210$

$\underline{75k + 15t = 300}$

$-30k = -90$

$k = 3$

$t = 5$

$R = 3(16) + S(4) = 68$

15. $a^2 = \frac{b^2 d^2}{b^2 + d}$

$a^2 b^2 + a^2 d = b^2d^2$

$b^2d^2 - a^2 b^2 = a^2 d^2$

$b^2 (d^2 – a^2) = a^2d^2$

$b^2 = \frac{a^2 d^2}{d^2 - a^2}$

$b = \mp\sqrt{\frac{a^2 d^2}{d^2 – a^2}}$

16. $P = KQ + m\sqrt{Q}$
$22 = K (4) + m(2)$……………(1)
$42 = K(g) + n(3)$……………(2)
$22= 4K + 2m$
$42 = 9K + 3m$
$3(22) = 3(4K) + 3(2m)$
$2(42) = 2(9K) + 2(3)$
$66 = 12k + 6m$
$84 = 18K + 6m$
$18= 6k = k=3$
$22 = 4(3) + 2m$
$22-12 = 2m$
$20 = 2m$
$M = 10$
$= 3(25) + 10(5)$
$= 75 + 50$
$= 125$

17. $b = \sqrt{k – ac}$
$b^2 = k – ac$
$b^2 – k = -ac$
$\frac{b^2 – k}{-9} = c$
$C = \frac{b^2 – k}{-9}$ or $c = \frac{k – b^2}{9}$
$C = \frac{1 – 2^2}{4}$
$= {}^{-3}/_{4}$ $= -0.75$

18. $V = 30, r = 2$
$K = Ur^2$
$= 30 \times 22 = 120$
When $r = 4$
$V = {}^{120}/_{42} = 7.5m/s$

19. $P = \sqrt[3]{\frac{X Y}{z + X}}$
$P^3 = \frac{XY}{z + X}$
$Xy = P^3Z + P^3X$
$Xy – P^3X = P^3 z$
$X(y-P^3)= P^3 z$
$\therefore X = \frac{P^3z}{Y –P^3}$

20. $X\alpha y + {}^{1}/_{z,2}, x = Ky + M$

$X = 6, y = 3, z = 2 – 6 = 3k + M$

$X = 8 , y = 5, z = 1 - 8 = 5k +M$

$X4\ \ 24 = 12k +M$

$-16 = -7k , k =1$

When $y =10$,

$z = \frac{16}{7}(10) - \frac{24}{7(64)} = \frac{160}{7} - \frac{24}{448} = \frac{10216}{448} = 22.8$

21. $T_{11} = a + 10d$

$T_2 = a + d$

$a + 10d = 4a + 4d$ ....(i)

$3a – 6d = 0$

$S7 = {}^7/_2\{2a + 6d\} = 175$ ...(ii)

$2a + 6d = 50$

$+$

$\underline{3a – 6d = 0}$

$5a = 50$

$a = 10$

$d = 5$

22. (i) $R = m + nI$

$55 = M + 20n$……(i)

$\underline{58 = m + 28n…….(ii)}$

$-3 = -8n$

$n = {}^3/_8 = 0.375$

$55 = m + {}^{60}/_8$

$m =55 -7.5 \Rightarrow m = 47.5$

$R = 47. 5 + 60 X\, {}^3/_8$

$R = 70$ ohms

23. $\left(1 – \frac{1}{(2x)}\right)^5 = \left(1 – 2x\right)^5$

$= 1^5 (-2x)^o + 5.1^4 (-2x)^1 + 10.1^3 (-2x)^2 + 101^2 (-2x)^3$

$= 1 – 10x + 40x^2 – 80x^3$

$(1 – 2x)^5 = (0.98)^5 = (1 – 0.02)^5$

$\therefore 2x = 0.02$

$x = 0.01$

Thus $(0.98)^5 = 1 – 10(0.01) + 40 (0.01)^2 – 80(0.01)^3$

$= 1 – 0.1 + 0.004 – 0.00008 = 0.9039$

51. Sequence and series

1	$S_n = \frac{n}{2}\{a+l\}$ $\frac{6}{2}(15+l)=360^0$	M_1 M_1 A_1	Alternative ${}^6\!/_2\{2\times 15+(6-1)d\}=360^0$ $\therefore d=18$ $15+5\times 18$

	$15 + l = 120^0$ $l = 105^0$		
		3	
2.	a = 2 nth = 32 Sn = 357 Sn = n/2 (2 + 32) 714 = 34n 21 = n	M1 M1 A1	Substitution Simplification
		03	

1. $P\left(1 + \frac{R}{100}\right)^{3}$

$= 40,000\left(1 + \frac{2}{{}_3 100}\right)$

$= 40, 000 \text{ x } (1.02) \quad = 42,448.32 \text{ km}^2$

Encrouched area

$= 42\ 448.32 - 40\ 000 \ = 2448.32 \text{ km}^2$

2. (a) $\frac{9^x}{3^{2x+1}} = \frac{81}{9^x}$

$9^{2x} = 3^4(3^{2x+1})$

$3^{4x} = 3^{4+2x+1}$

$3^{4x} = 3^{2x+5}$

$4x = 2x + 5$

$2x = 5$

$x = 2.5$

(b) Common ratio $= \frac{81}{92.5}$

$= \frac{1}{3}$

(c) $a = 3^{(2 \text{ x } 2.5 + 1)}$

$= 3^6$

$= 729$

$S_{10} = \frac{729\left[1 - \left(\frac{1}{3}\right)^{10}\right]}{1 - \frac{2}{3}}$

$= 1093.5 \text{ x } 0.99998 \quad = 1093.5$

(d) 5th term $= 729 \text{ x } \left({}^1/_3\right)^4$

$= 9$

7th term $= 729 \text{ x } \left({}^1/_3\right)^6$

$= 1$

$a = 9 \quad d = 1 - 9 = -8$

$S_{20} = \left(\frac{20}{2} \quad 2 \text{ x } 9 + (20-1)\right)(-8)$

$= 10\ (18 - 152) = -1340$

For both the 5th and 7th term

3. $-12 \pm -10 + -8 + \ldots\ldots$

$a = -12 \qquad d = z$

$$S_n = \frac{n}{2}\{2a + (n-1)d\}$$

$$338 = \frac{n}{2}\{2(-12) + (n-1)2\}$$

$$676 = \{n \;\; -24 + 2n\} - 2$$

$$\frac{2n^2}{2} - \frac{26n}{2} - \frac{676}{2} = \frac{0}{2}$$

$n^2 - 13n - 338 = 0$

$(n-26)(n+13) = 0$

$n = 26$ or $n = -13$ reject

$\therefore n = 26$ terms

3. $-12 \pm -10 + -8 + \ldots\ldots$

$a = -12 \qquad d = z$

$$S_n = \frac{n}{2}\{2a + (n-1)d\}$$

$$338 = \frac{n}{2}\{2(-12) + (n-1)2\}$$

$$676 = \{n \;\; -24 + 2n\} - 2$$

$$\frac{2n^2}{2} - \frac{26n}{2} - \frac{676}{2} = \frac{0}{2}$$

$n^2 - 13n - 338 = 0$

$(n-26)(n+13) = 0$

$n = 26$ or $n = -13$ reject

$\therefore n = 26$ terms

4. $32 = 2 + (n-l)d$…….(i)

$357 = \left\{\frac{n}{2}\; 2.2 + (n-l)d\right\}$…… (ii)

$N\,4 + (n-l)\,d = 714$

$2 + (n-l)d = 32$

$N(4 + nd - d) = 714$

$\underline{-d + nd \qquad = 30}$

$4n + n^2d - d = 744$

$nd - d = 30$

$d(n-l) = 30$

5. a) $OC = OB + BC = a + b$

b) $OM = OA + AM = a + ½ b$
Given $OX = rOM$
$= r(a + ½ b)$
From ΔOBX
$Ox = OB + BX$
$= OB + BC + CX$
$= b + a + sa$
$= (1+s)\ a + b$
$\therefore\ r(a + ½ b) = (1 + s)\ a + b$
Comparing coefficients of a and b
$r = 1 + S$
and $½ r = 1 \Rightarrow r = 2$
Substitute for $r = 2 \Rightarrow 2 = 1 + s \Rightarrow s = 1$

c) Now $BX = BC + Cx$
$= a + a = 2a$

$\therefore BC:BX = 1:2$

6. (a) $-91 = 29 + (n-1) \times -6$
$-120 = -6n + 6$
$6n = 126$
$n = 21$

(b) $S_{21} = {}^{21}/_{2}\ [(2 \times 2a) + (20 \times -6)]$
$= \frac{21 \times -62}{2}$
$= -651$

7. $d = p-5$.....(i)
$d = q – p$ ………(ii)

$$\begin{pmatrix}\mathbf{3} & \mathbf{-2}\\ \mathbf{2} & \mathbf{-1}\end{pmatrix}$$

$0 = 2p - q – 5$
$0 = 7 – 2q + p$
$-p + 2q = 7$
$2p – q = 5$

$-2p + 4q = 14$
$2p – q = 5$
$3q = 19$
$q = {}^{19}/2$
$p=2q – 7 \qquad {}^{38}/_{3} – 7$
$p={}^{17}/_{8}$
$S = \frac{n}{2}\ [2a + (n-1)d\}$
$= {}^{12}/_{2}\ (10+11 \times {}^{2}/_{3})$
$= 6\ (10+{}^{22}/_{3}) = 104$
$S_n = a(r^n-1) = S(1.5-6)$
$r-1 \quad 1.5 – 1$
$= 5 \times (1.5 – 1) = 103.90$
$0.65 = 10.4$

8. $a + a + d = 10$………………(i)

$\frac{10}{2}\left\{2a + 9d\right\} = 210$……………..(ii)

$2a + d = 10$

$\underline{2a + 9d = 42}$

$8d = 32$

$d = 4$

$T1 = 3 + 6(4)$

$= 3 + 24$

$= 27$

9. $S_6 = \frac{15\,(1-0.56)}{1-0.5}$

$= 29.5314$metres

10. $Sn = \frac{n}{2}\left\{2a + (n-1)d\right\}$

$S51 = \frac{51}{2}(2x - 22) + (51 - 1)3$

$= 2703$

11. 100 + 200 + 400 + 800 + 1600 + 3200 + 6400 + 12800 + 25600 + 51200

$\frac{200}{100} = \frac{400}{200} = \frac{800}{400}$

= 51200	99600	108200	110,600
25600	6400	1600	700
76800	105,000	109,800	111,300
12800	3,200	800	
99,600	108,200	110,600	

= 111300

12.. a) Let n be the initial members

Each to contribute $\frac{720000}{n}$

New membership $n + 20$

Contributions: $\frac{720000}{n + 20}$

$\frac{720000}{n} - \frac{720000}{n + 20} = 3000$

$720000(n + 20) - 720000n = 3000n(n + 20)$

$4800 = n(n + 20)$

$n^2 + 20 - 4800 = 0$

$n^2 + 80n - 60n - 4800 = 0$

$n(n + 80) - 60(n + 80) = 0$

$(n - 60)(n + 80) = 0$

$n = 60$

Original members = 60

b) Contributions required before recruitment

$= \frac{720000}{60} = 120000$

After requirement = $\underline{720000}$

13. nth term is ar^{n-1}

$a = 8,\ r = ½$

nth term $= {}^{1}/_{512}$

$8(½)^{n-1} = {}^{1}/_{512}$

$8(½)^{n-1} = 2^{-9}$

$(½)^{n-1} = 2^{-9} \div 2^{3}$

$(½)^{n-1} = 2-^{12} = (½)^{12}$

$n^{-1} = 12$

$n = 13$

14. 3rd $a + 2d$

9th $a + 8d$

25th $a + 24d$

(i) $\underline{a + 2d} = \underline{a + 8d}$

$a + 8d\ a = 24d$

$(a + 2d)(a + 2d) = (a + 8d)(a + 8d)$

$a^2 + 26da + 48d^2 = a^2 + 16da + 64d^2$

$\frac{10da}{10d} = \frac{16d^2}{10d}$

$a = 1.6d$………….(i)

$(a + 6b) + 2(a + 5d) = 78$

$3a + 16d = 78$…………………(ii)

But $a = 1.6d$

$\therefore (3x1.6d) + 16d = 78$

$4.8d + 16d = 78$

$4.8d + 16d = 78$

$\frac{20.8}{20.8} = \frac{78}{20.8}$

Common distance $d = 3.75$

$a = 1.6 \text{ x } 3.75$

first term $a = 6$

(ii) $S_n = {}^{n}/_{2}\,(2a + (n-1)d)$

$S_a = {}^{9}/_{2}\,((2x6) + (9-1)3.75)$

$= {}^{9}/_{2}\,(12 + 30)$

${}^{9}/_{2} \text{ x } 42 = 189$

15. $T_4 = a + 3d$

$T_7 = a + bd$

$(a + 6d) – (a + 3d) = 12$

$3d = 12$

$d = 4$

But $a = 9$

$S5 = \frac{5}{2}\ 2(9) + 4(4)$

$= \underline{5}\ 18 + 16$

$$= \frac{2}{\underline{5}} \times 34$$
$$2$$
$$= 85$$

52. Vectors 2

1.	(a) BD = BA + AD $= -\underset{\sim}{b} + \frac{3}{5}\underset{\sim}{c}$	**B1**	
	$AE = AB + BE$ $= \underset{\sim}{b} + \frac{1}{2}BC$ $= \underset{\sim}{b} + \frac{1}{2}\left(\underset{\sim}{c} - \underset{\sim}{b}\right)$	**M1**	
	$= \frac{1}{2}\underset{\sim}{b} + \frac{1}{2}\underset{\sim}{c}$	**A1**	
	(b) $BF = +\left(\frac{3}{5}\underset{\sim}{c} - \underset{\sim}{b}\right)$ $AF = n\left(\frac{1}{2}\underset{\sim}{b} + \frac{1}{2}\underset{\sim}{c}\right)$		
		M1	AF and BF interms of n and t
		M1	Equating the expressions
		M1	Extraction of the coefficient
		M1	Substitution/its equivalent
		A1	Any of the unknown

	$=\frac{n}{2}\left(\underset{\sim}{b}+\underset{\sim}{c}\right)$ $AF = AB + BF$ $=\underset{\sim}{b}+\frac{3}{5}t\underset{\sim}{c}-t\underset{\sim}{b}$ $=(1-t)\underset{\sim}{b}+\frac{3}{5}+\underset{\sim}{c}$ $(1-t)\underset{\sim}{b}+\frac{3}{5}t\underset{\sim}{c}=\frac{n}{2}\underset{\sim}{b}+\frac{n}{2}\underset{\sim}{c}$ $\left.\begin{array}{l}1-t=\frac{n}{2}...............(i)\\ 2-2t=n\\ \frac{3}{5}t=\frac{n}{2}...................(ii)\end{array}\right\}$ $6t-5n=0$ $subt\ \ (i)\,in\,(ii)$ $6t-5(2-2t)=0$ $6t=10$ $t=\frac{10}{16}=\frac{5}{8}$ $n=2-2\left(\frac{5}{8}\right)$ $n=\frac{3}{4}$ (c) BD:BF 8 : 5	**B1** **B1**	The other unknown
		10	

1. *a) (i)* $AN = OA + ON$

$= -\underset{\sim}{a} + \frac{2}{7}\underset{\sim}{b}$

$= \frac{2}{7}\underset{\sim}{b} - \underset{\sim}{a}$

(ii) $\overrightarrow{AT} = \frac{7}{13}\overrightarrow{AN}$

$\frac{7}{13}\left(-\underset{\sim}{a} + \frac{2}{7}\underset{\sim}{b}\right)$

$\frac{2}{13}\underset{\sim}{b} \quad - \frac{7}{13}\underset{\sim}{a}$

(iii) $AM = \frac{1}{4}AB$

$= \frac{1}{4}(\overrightarrow{AO} + \overrightarrow{OB})$

$= \frac{1}{4}\left(b - \underset{\sim}{a}\right)$

(b) $OT = OA + AT$

$= \underset{\sim}{a} \left(\frac{2}{13}\underset{\sim}{b} - \frac{7}{13}\underset{\sim}{a}\right)$

$= \frac{2}{13}\left(3\underset{\sim}{a} + \underset{\sim}{b}\right)$

$\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$

$= \underset{\sim}{a} + \left(-\frac{1}{4}a + \frac{1}{4}\underset{\sim}{b}\right)$

$\frac{3}{4}\underset{\sim}{a} + \frac{1}{4}\underset{\sim}{b}$

$\frac{1}{4}\left(3\underset{\sim}{a} + \underset{\sim}{b}\right)$

$$\frac{OT}{OM} = \frac{\frac{2}{13}\left(\cancel{3a + b}\right)}{\frac{1}{4}\left(\cancel{3a + b}\right)}$$

$\overrightarrow{OT} = \frac{8}{13} OM$

Or $\overrightarrow{OM} = \frac{13}{8}\overrightarrow{OT}$

Since $\overrightarrow{OT} = \frac{8}{13}\overrightarrow{OM}$

Then $OT : TM = \frac{8}{13} : \frac{5}{13}$

$= 8 : 5$

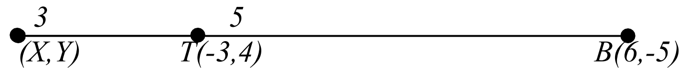
√√Construction of ∠60° and ∠90°

Bisect ∠ btw 90° and 60° to obtain ∠75°

√ Construction of the given sides

Construction of Δ XYZ

2.



$TB = \frac{5}{8} AB$

$\begin{pmatrix} 6 \\ -5 \end{pmatrix} - \begin{pmatrix} -3 \\ 4 \end{pmatrix} = \frac{5}{8} \underset{\sim}{AB}$

$\begin{pmatrix} 9 \\ -9 \end{pmatrix} = \frac{5}{8}\left\{\begin{pmatrix} 6 \\ -5 \end{pmatrix} - \begin{pmatrix} x \\ y \end{pmatrix}\right\}$

$\begin{pmatrix} 9 \\ -9 \end{pmatrix} = \begin{matrix} \frac{5}{8}(6-x) \\ \frac{5}{8}(-5-y) \end{matrix}$

$\frac{30}{8} - \frac{5}{8}X = 9$

$-\frac{25}{8} - \frac{5}{8}y = -9$

$30 - 5x = 72$	$-5x = 42$
$-25 - 5y = -72$	$-5y = -47$
$X = -8.4 \quad y = 9.4$	

3. $\underset{\sim}{OX} = \underset{\sim}{\frac{2}{3}}(3\underset{\sim}{i} + 2j - 4k) + \frac{1}{3}\underset{\sim}{(}6\underset{\sim}{i} + 11j + 2k)$

$\underset{\sim}{} = 2\underset{\sim}{i} + 4j - \frac{8}{3}\underset{\sim}{k} + 2\underset{\sim}{i} + \frac{11}{3}j + \frac{2}{3}$

$\underset{\sim}{} = 4\underset{\sim}{i} + \underset{\sim}{5}j - 2k$

$\underset{\sim}{} \quad 10\tilde{x}1 = \sqrt{16 + 25 + 4}$

$= 6.71\text{units}$

4. a) $2^5 - 5(2^4)(^1/_5) + 10(2^3)(^1/_5\,x)^2 - 10(2^2)(^1/_5\,x)^3 + 5(2)(^1/_5x)^4 - (^1/_5x)^5$

$32 - 16x + {}^{16}/_5x^2 - {}^8/_{25}x^3 + {}^2/_{125}x^4 - {}^1/_{3125}x^5$

$-{}^1/_5x = -0.04$

$x = 0.2$

b) $32 - 16(0.2) + {}^{16}/_5(0.2)^{2\,-}{}^8/_{25}(0.2)^3 + \ldots\ldots\ldots$

$= 32 - 3.2 + 0.128 - 0.00256$

$= 28.92544$

$= 29.925$

5. $AS = AO + OS$

$= -a + 2(3c)$

$= 2c - a\ldots\ldots\ldots\ldots$

$BC = BA + AC$

$= a - b + AC$

$\text{But } AC = AO + OC = -a + 3c$

$= 3c - a\ldots\ldots\ldots.$

$AB + \frac{2}{3}OC = \frac{2}{3}3c = 2c$

$BA = 2c\ldots\ldots.$

$BC = -12c + 3c - a = c - a.$

b) (i) $AT = \eta AS = \eta(2c - a)$

$= 2\eta c - \eta a$

$AT = AB + BT = 2c + K(c - a)$

$= 2c + Kc - Ka$

$= (2 + k)c - Ka$

(ii) $2 + K = 2\eta$ (i) $K = \eta$ (ii)

$2 + \eta = 2\eta$

$2 = 2\eta - \eta$

$2 = \eta, K = 2$

(c) $BT : BC$

$BT = 2\,BC$

6. $\underset{\sim}{(a)}$ (i) $\underset{\sim}{PQ} = \underset{\sim}{P}O + OQ$

$= \underset{\sim}{P} + \underset{\sim}{q} \text{ or } \underset{\sim}{q} - \underset{\sim}{p}$

For √ PQ or P and q

For √ exp. Of OR

For √ OR in p & q

For √ SQ in P & Q

(ii) $\underset{\sim}{OR} = \underset{\sim}{OP} + \underset{\sim}{PR}$

$$= \underset{\sim}{P} + \frac{2}{3}\ \underset{\sim}{PQ}$$

$$= \underset{\sim}{P} + \frac{2}{3}\ (\underset{\sim}{q} - \underset{\sim}{p})$$

$$= \underset{\sim}{P} + \frac{2}{3}\ \underset{\sim}{q} - \frac{2}{3}\underset{\sim}{p}$$

$$= \frac{1}{3}\ \underset{\sim}{p} + \frac{2}{3}\underset{\sim}{q}$$

(iii) $\underset{\sim}{SQ} = \underset{\sim}{SO} + \underset{\sim}{OQ}$

$$= -\frac{3}{4}\ \underset{\sim}{OP} + \underset{\sim}{OQ}$$

$$= -\frac{3}{4}\underset{\sim}{p} + \underset{\sim}{q} \text{ or } \underset{\sim}{q} - \frac{3}{4}\ \underset{\sim}{p}$$

(b) Express OT in two different ways:

Given $\underset{\sim}{OT} = n\ \underset{\sim}{OR}$

$$= n\left(\frac{1P}{3} + \frac{2}{3}\ \underset{\sim}{q}\right)$$

$$= \frac{n}{3}\underset{\sim}{p} + \frac{2n}{3}\underset{\sim}{q}$$

From ΔOST,

$$OT = \underset{\sim}{OS} + \underset{\sim}{ST}$$

$$= \frac{3}{4}\underset{\sim}{OP} + M\ \underset{\sim}{SQ}$$

$$= \frac{3}{4}\underset{\sim}{P} + M\left(-\frac{3}{4}\ \underset{\sim}{P} + \underset{\sim}{q}\right)$$

$$= \left(\frac{3}{4} - \frac{3m}{4}\right)\underset{\sim}{p} + m\underset{\sim}{q}$$

$$\therefore \frac{n}{3}\ \underset{\sim}{p} + \frac{2n}{3}\ \underset{\sim}{q} = \left(\frac{3}{4} - \frac{3m}{4}\right)\underset{\sim}{p} + m\underset{\sim}{q}$$

Compare the coefficients of $\underset{\sim}{p}$ and $\underset{\sim}{q}$

$$\frac{n}{3} = \frac{3}{4} - \frac{3}{4}\ m$$

$$4n = 9 - 9m$$

$$4n + 9m = 9 \text{ ....eq (1)}$$

$$\frac{2n}{3} = m$$

$$m = \frac{2n}{3} \text{ ....eq. (2)}$$

Substitutes form in equation (1)

$$4n + 9\left(\frac{2n}{3}\right) = 9$$

$$4n + 6n = 9$$

$$10n = 9$$

$$n = \frac{9}{10}$$

Substitute for n in equation (2)

$$m = \frac{2}{3}\ x\ \frac{9}{10} = \frac{3}{5}$$

53. Binominial expansion

1	a)		
	$\left(2-\frac{1}{x}\right)^8 = 2^8 - 8.2^7\left(\frac{1}{x}\right) + 28.2^6.\left(\frac{1}{x}\right)^2 - 56.2^5\left(\frac{1}{x}\right)^3 +$	M$_1$	
	$70.2^4\left(\frac{1}{x}\right)^4 + ...$	A$_1$	$2 - 1/x = 1.75$ $0.25 = 1/x \therefore x = 4$
	$256 - \frac{1024}{x} + \frac{1792}{x^2} - \frac{1792}{x^3} + \frac{1120}{x^4}$	M$_1$	
	b)	A$_1$	
	$(1.75)^8 = 256 - \frac{1024}{4} + \frac{1792}{16} - \frac{1792}{64} + \frac{1120}{256}$ $= 256 - 256 + 112 - 28 + 4.375$ $= 88.375$		
		4	
2.	(2+x)5		
	25 + 5(2)4x) + 10(2)3x + 10(2)2x3 +…	M1	
	= 32 + 80x + 80x2 + 40x3 + ….	A1	
	(1.970)5 = (2 – 0.03)5 x = -0.03		
	(1.97)5 = 32 + 80(-0.03) + 80(-0.03)2 + 40(-0.03)3 = 32 – 2.4 + 0.072 – 0.00108 = 29.67092	M1	
	= 29.67	A1	
		04	

1. *a)* $1^5 + 5(-3x)^1 + 10(-3x)^2 + 10(-3x)^3 + 5(-3x)^4 + (3x)^5$

$1 - 15x + 90x^2 - 270x^3 + 405x^4 - 243x^5$

$1 - 15x + 90x^2 - 270x^3 + 405x^4 - 243x^5$

b) $3x = 1 - 0.997$

$x = 0.001$

$= 1 - 15(0.001) + 90(0.001)^2 - 270(0.001)^3 + 405(0.001)^4$

$= 1 - 0.015 + 0.00009 - 0.00000027 + ……………..$

$= 1 + 0.00009 - 0.015 - 0.00000027$

$= 1.00009 - 0.01500027 = 0.98508973$

$= -0.9851$ *(4 d.p)*

2. *(i)* $5 + \frac{x}{2}\,^6 = 15625 + \frac{3125}{3}X + \frac{9375}{4}X^2 + \frac{625}{2}X^3 + ……$

(ii) $X = 1$

$\left(\frac{11}{2}\right)^6 = 15625 + \frac{3125}{3} + \frac{9375}{4} + \frac{625}{2}$

$= 15625 + 1041.667 + 2343.75 + 312.5$

3.

$(\sqrt{3} + 2x)^6 = (\sqrt{3})^6 + \sqrt{6}(\sqrt{3})^5 \; 2x + 15(3)^4(2x)^2 + 20\sqrt{3})^3(2x)^3$

$= 27 + 108x\sqrt{3} + 270x^2 + 480x^3\sqrt{3}$

$3 + 2x = 3 \quad 3$

$\sqrt{2x} + 2\sqrt{3}$

$x = \quad 3$

$27 + 108\sqrt{3}\ \sqrt{3} + 270\sqrt{3}^2 + 480\sqrt{3}\ (\ 3)^3$

$= 27 + 324 + 810 + 4320 = 5481$

4.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

P(Sum odd) = $^{18}/_{36}$ $= \frac{1}{2}$

5. $\angle PQR = 180 - (35o + 75)$

$= 70^o$

$PR^2 = 12^2 + 8.4^2 - 2(12)(8.4) \cos 70^o$

$PR = 145.61 \quad = 12.07$

6. (a) Terms; $2^5, 2^4(^3/_x), 23(^s/_x)^2, 2^2(^3/_x)^3, 2^3(^3/_x)^4$

Co eff 1, 5, 10, 10, 5

$(2 + {}^3/_x)^5 = 25 + 5(2)^4(^3/_x) + (2)^3(^3/_x)^2 + 10(22)\ {}^3/_x)^2 + 5(2)(^3/_x)$

$= 32 + 2140x\text{-}1 + 720x\text{-}2 + 1080x^3 + 820x\ \text{-}4$

(b) $9.5 = 2 + {}^3/_x$

${}^3/_x = 7.5$

$x = {}^3/_{7.5} = 0.4$

$$(9.5)^5 = 32 + \frac{240}{0.4} + \frac{720}{(0.4)^2} + \frac{1086}{(0.4)^3} + \frac{810}{(0.4)^4}$$

$= 53647.625$(3d.p)

7. $X^5 - 5x^4(0.2) + 10x3\ (0.20 - 10x2\ (0.2)^3 + 5x\ (0.2)^4 - (0.2)^5$

$X^5 - 5x^4(^2/10) + 10x^3\ {}^2/10^2 - 10x^2(^2/10)^3 + 5x(^2/10)^4 - (^2/10)^5 + x^5 - (^4/10)x^3 - (^8/100)x^2 + 5 \text{ x } 16 - 2^5/10^5$

$X^5 - x^4x^3 - {}_{8/}100x^2 + 80x - {}_2{}^5/10^5$

90, 392, 079

8. $\text{Log}(x + 24) = \log(x(9-2x)$

$X + 24 = 81 - 18x$

$X = 3$

9. $$1 + \frac{x}{12} = 1 + \frac{x}{2} + \frac{5x^2}{48} + \frac{5x^3}{432}$$

$$\left(1 + \frac{x}{12}\right)^6 = 1\tfrac{1}{4}$$

$$\frac{x}{12} = \tfrac{1}{4}$$

$x = 3$

6

$$\left(\frac{5}{4}\right) = 1 + \frac{3}{2} + \frac{9}{48} + \frac{27}{432}$$

$= 2.7500$

10. (a) $(1 + \frac{1}{2})^8 = 1 + 8(\frac{1}{2}) + 28(\frac{1}{2}x)^2 + 56(\frac{1}{2}x)^3 + 70(\frac{1}{2}x)^4 + 567(\frac{1}{2}x)^5 + 2(\frac{1}{2}x)^6 + 8(\frac{1}{2}x)^7 + (\frac{1}{2}x)^8$

$= 1 + 4x + 7x^2 + 7x^3 + 4.375x^4 + 1.75x^5 + 0.4375x^6 + 0.0625x^7 + {}^1/_{256}x^8$

(b) $(1.05)8 = 1 + 4(0.1) + 7(0.1)2 + 7(0.1)3$

$=1 + 0.4 + 0.07 + 0.0074\ldots$

$= 1.48$

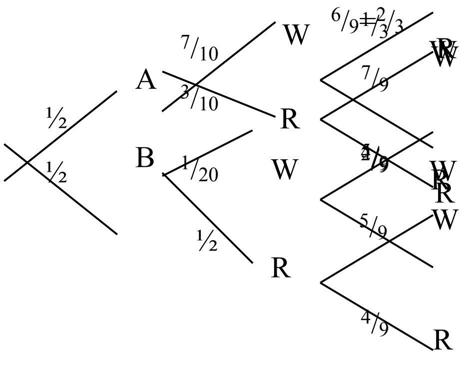
11. $81 + 27x + 9x^2 + 3x^3 + x^y$

$81 + 108x + 54x^3 + x4$

$81 + 108\ (0.02) + 54\ (0.02)^3$

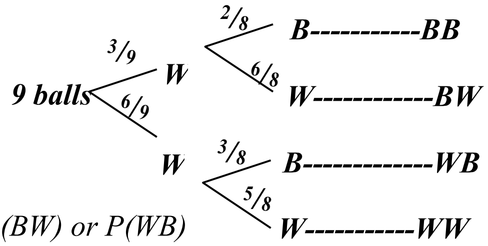
$= 83.182$

54. Probability

1	a) $P(R) = \frac{1}{8}$ and $P(H) = \frac{3}{7}$ $\therefore \frac{1}{8} \times \frac{3}{7} = \frac{3}{56}$ b) $P(RH')$ or $P(R'H)$ or $P(RH)$ $\left(\frac{1}{8} \times \frac{4}{7}\right) + \left(\frac{7}{8} \times \frac{3}{7}\right) + \frac{3}{56}$ $\frac{4}{56} + \frac{21}{56} + \frac{3}{56}$ $= \frac{28}{56}\ or\ \frac{1}{2}\ or\ 0.5$	B1 M1 M1 A1	
		4	
2.	 (b) (i) (½ x 7/10 x 2/3) + (½ x 3/10 x 2/9) + (½ + 4/9 x ½) + ½ x ½ x4/9) = 22/45 (ii) $1 - \frac{22}{45}$	B2	

	$= \frac{23}{45}$ (iii) (½ x 7/10 x 1/3) + (½ x 3/10 x 7/10) + (½ x ½ x 5/9) + (½ x ½ x ½) 7/60 + 7/60 + 5/36 + 5/36 = 23/45 (iv) $1 - \frac{23}{45} = \frac{22}{45}$	U1 A1 M1 A1 M1 A1 B1 A1	
		10	

1. (a) (i) Total balls = 3 + 6 = 9



= P(BW) or P(WB)

$$=\left(\frac{\overset{1}{\cancel{3}}}{\underset{3}{\cancel{9}}} \text{ x } \frac{\overset{2}{\cancel{6}}}{8}\right) + \left(\frac{6}{9} \text{ x } \frac{3}{8}\right)$$

$$= \frac{18}{72} + \frac{18}{72} = \frac{36}{72}$$

$$= ½$$

(ii) = P(BW) or P(WB)

$$=\left(\frac{3}{9} \text{ x } \frac{6}{9}\right) + \left(\frac{6}{9} \text{ x } \frac{3}{9}\right)$$

$$= \frac{18}{81} + \frac{18}{81}$$

$$= \frac{36}{81} = \frac{4}{9}$$

(b) (i) $P(WW) = \frac{6}{9} \times \frac{5}{8}$

$= \frac{30}{72} = \frac{5}{12}$

(ii) $P(WW) = \frac{6}{9} \times \frac{6}{9}$

$= \frac{4}{9}$

2. $P(W) = {}^{7}/_{12}$ $P(B) = {}^{5}/_{12}$

(2 white and one brown)

=(WWB or WBW or BWW

$= ({}^{7}/_{12} \times {}^{6}/_{11} \times {}^{5}/_{10}) + ({}^{7}/_{12} \times {}^{5}/_{11} \times {}^{6}/_{10}) + ({}^{7}/_{12} \times {}^{7}/_{11} \times {}^{6}/_{10})$

$= {}^{22}/_{44}$

(ii) P(BBW or BWB or WBB)

$= (5/_{12} \times {}^{4}/_{11} \times {}^{7}/_{10}) + ({}^{5}/_{12} \times {}^{7}/_{11} \times {}^{4}/_{10}) + ({}^{7}/_{12} \times {}^{5}/_{11} \times 4/_{10})$

$= {}^{7}/_{22}$

(iii) P (at least one white cup)

$= (1-P(BBB) = 1-({}^{5}/_{12} \times {}^{4}/_{11} \times {}^{3}/_{10})$

$= {}^{21}/_{22}$

(iv) P (same colour) = P(BBB or WWW)

$= ({}^{7}/_{12} \times {}^{6}/_{11} \times {}^{5}/_{10}) + ({}^{5}/_{12} \times {}^{4}/_{11} \times 3/_{10})$

$= {}^{9}/_{44}$

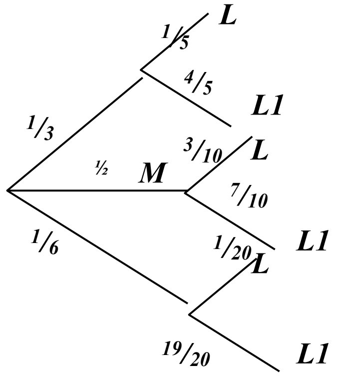
3. a)

2	3	5	7
2	32	52	72
3	23	53	73
5	25	35	75
7	27	37	57

b) $P(E) = \frac{4}{16}$

$= ¼$

4.



(a) $P(\text{late}) = ({}^{1}/_{3} \times {}^{1}/_{5}) + (½ \times {}^{3}/_{10}) + ({}^{1}/_{6} \times {}^{1}/_{20})$

$= {}^{1}/_{15} + {}^{3}/_{20} + {}^{1}/_{120}$

$= {}^{9}/_{40}$

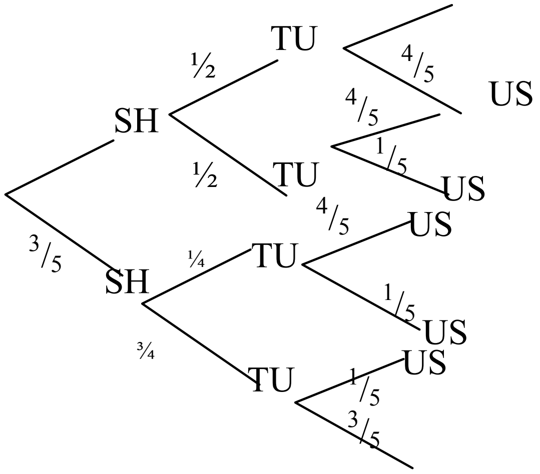
(b) $P = {}^{1}/_{3} \times {}^{1}/_{5}) + ({}^{1}/_{6} \times 1/_{20})$

$= {}^{1}/_{15} + 1/_{20}$

$= {}^{3}/_{40}$

(c) $P = (\text{not late}) = (1 - {}^{9}/_{40})$

5. *a)*

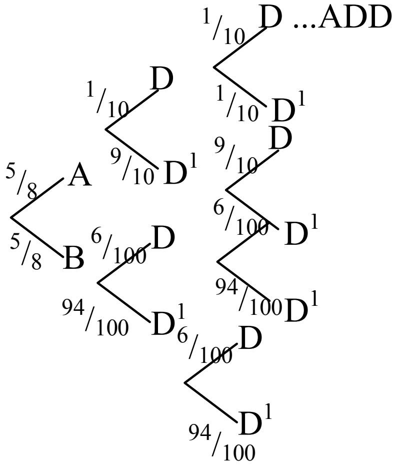


b) *i) P(all faults)= P(SH and TU and US)*

$= {}^{2}/_{5} \times {}^{1}/_{2} \times {}^{4}/_{5} = {}^{4}/_{25}$

ii) $P(\text{exactly two}) = {}^{2}/_{5} \times {}^{1}/_{2} \times {}^{1}/_{5} + {}^{2}/_{5} \times {}^{1}/_{2} \times {}^{1}/_{5} + {}^{3}/_{5} \times {}^{3}/_{4} \times {}^{1}/_{5}$

6.



Both defective

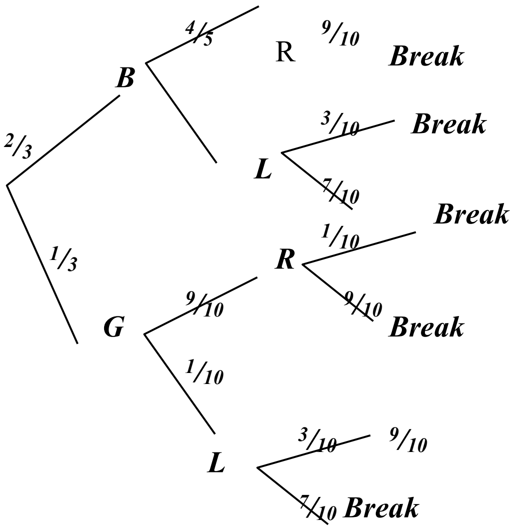
$= \frac{3}{8} \times \frac{1}{10} \times \frac{1}{10} + \frac{5}{8} \times \frac{6}{100} \times \frac{6}{100}$

$= \frac{3}{800} + \frac{180}{80000}$

$= \frac{24}{4000}$

$= \frac{3}{500}$

7. a)



b) i) $P\ (BL \text{ or } GL) = {}^{2}/_{3} X\ {}^{1}/_{10} + {}^{1}/_{3} X\ {}^{1}/_{10}$

$= {}^{2}/_{15} + {}^{1}/_{30} = {}^{5}/_{30}$

ii) $P(\ BL \text{ break or } GR \text{ break})$

$= {}^{2}/_{3} X\ {}^{1}/_{5} X\ {}^{3}/_{1}0 + {}^{1}/_{3} X\ {}^{1}/_{10} X\ {}^{3}/_{10}$

$= {}^{2}/_{50} + {}^{1}/_{100} = {}^{4+1}/_{100} = {}^{5}/_{100}$

iii) $P(\ BR \text{ break or } GR \text{ break})$

$= {}^{2}/_{3} X\ {}^{4}/_{5} X\ {}^{1}/_{10} + {}^{1}/_{3} X\ {}^{9}/_{10} X\ {}^{1}/_{10}$

$= {}^{8}/_{150} + {}^{9}/_{300} = {}^{16+9}/_{300} = {}^{25}/_{300}$

iv) $1 - ({}^{5}/_{100} + {}^{25}/_{300}) = 1 - {}^{15+25}/_{300}$

$= {}^{260}/_{300}$

8.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

P(a two days outing) $= {}^{10}/_{36} = {}^{5}/_{18}$

(b)	1	2	3	4	5	6
H	H1	H2	H3	H4	H5	H6
T	T1	T2	T3	T4	T5	T6

P(2days and one day pocket money)

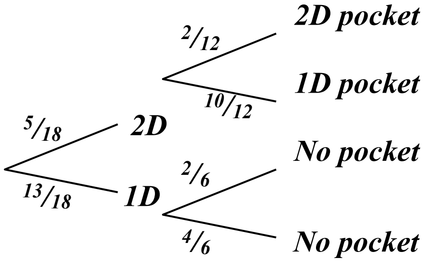
$= \frac{5}{18} x \frac{10}{12}$

$= \frac{25}{108}$

(c) (i) $^{5}/_{18} \times {}^{2}/_{12}$

$= {}^{5}/_{108}$

(ii)



P(get pocket money)

$= {}^{5}/_{18} \times {}^{2}/_{12} + {}^{5}/_{18} \times {}^{10}/_{12} + 1^{3}/_{18} \times {}^{2}/_{6}$

9. (a) (i) $P(WW) = \frac{4}{10} \times \frac{3}{9}$

$= \frac{2}{15}$

(ii) $P(WW) \text{ or } (RR) = \frac{4}{10} \times \frac{3}{9} + \frac{6}{10} \times \frac{5}{9}$

$= \frac{2}{15} + \frac{1}{3} = \frac{7}{15}$

(iii) P (at least Red) $= 1 - P(WW)$

$= 1 - \frac{2}{15}$

$\frac{13}{15}$

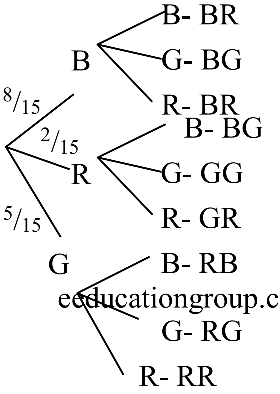
(iv) $P(WR) \text{ or } P(RW) = \frac{3}{5} \times \frac{4}{9} + \frac{2}{5} \times \frac{2}{3}$

$= \frac{8}{15}$

10. a) i) $^{8}/_{15}$

ii) $^{2}/_{15} + {}^{5}/_{15} = {}^{7}/_{15}$

b) i)



$Gh = {}^{2}/_{15}\ x\ {}^{1}/_{14} = {}^{2/}{}_{21}0 = {}^{1}/_{105}$

ii) RG or RB

$${}^{3}/_{21} + {}^{7}/_{45} = \frac{45 + 147}{945}$$

$$= \frac{192}{945}$$

(c)(i)

	H	T
1	1H	1T
2	2H	2T
3	3H	3T
4	4H	4T
5	5H	5T
6	6H	6T

11. (a)

(b) (i) same colour $= {}^{5}/_{9}\ x\ {}^{4}/_{2}\ x\ {}^{3}/_{7} + {}^{4}/_{9}\ x\ {}^{3}/_{8} x\ {}^{2}/_{7}$

$= {}^{5}/_{42} + {}^{1}/_{7}$

$= {}^{11}/_{42}$

(ii) more red balls $= {}^{5}/_{89}\ x\ ½\ x\ {}^{3}/_{7} + {}^{5}/_{9}\ x\ ½\ x\ {}^{4}/_{7} + {}^{5}/_{9}\ x\ ½\ x\ {}^{4/}7$

$= {}^{5}/_{42} + {}^{10}/_{63} = {}^{10}/_{63}$

$$= {}^{5}/_{42} + {}^{20}/_{63} = \frac{15 + 40}{126} = \frac{55}{126}$$

(iii) at least black ball was picked

$= 1 - {}^{5}/_{9}\ x\ ½\ x\ {}^{3}/_{7}$

$= 1 – {}^{5}/_{21}$

$= {}^{16}/_{21}$

(iv) Atmost 1 red ball picked

$= {}^{5}/_{9}\ x\ {}^{4}/_{2}\ x\ {}^{3}/_{7} + {}^{4}/_{9}\ x\ {}^{5}/_{8}\ x\ {}^{3}/_{7} + {}^{4}/_{9}\ x\ {}^{3}/_{8}\ x\ {}^{2}/_{7}$

$= {}^{5}/_{42} + 5/_{92} + {}^{1}/_{21}$

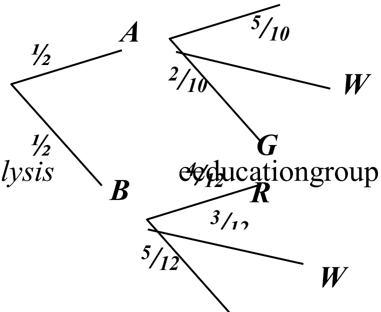
$$= \frac{5 + 5 + 2}{42}$$

$= {}^{12}/_{42}$

$= {}^{2}/_{7}$

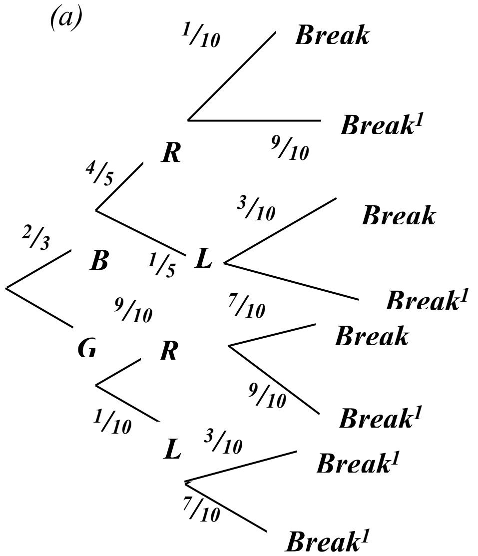
$^{3}/_{10}$

12.



P (Red) = (½ x $^{3}/_{10}$) + (½ x $^{4}/_{12}$)= 19 60

13. (a)



B1

B1

B1

bi) P (left handed)

= $^{2}/_{3}$ x $^{1}/_{5}$ + $^{1}/_{3}$ x $^{1}/_{10}$

= $^{2}/_{15}$ + $^{1}/_{3}$

= $^{5}/_{30}$ = $^{1}/_{6}$

ii) P (Right handed and will break)

= $^{2}/_{3}$ x $^{4}/_{5}$ x $^{1}/_{10}$ + $^{1}/_{3}$ x $^{1}/_{9}$ x $^{1}/_{10}$

= $^{8}/_{150}$ + $^{9}/_{300}$

= $^{25}/_{300}$ = $^{1}/_{18}$

c) P (= $^{2}/_{3}$ x $^{4}/_{5}$ x $^{1}/_{10}$ + $^{2}/_{3}$ x $^{1}/_{5}$ x $^{3}/_{10}$ + $^{1}/_{3}$ x $^{9}/_{10}$ x $^{1}/_{10}$ + $^{1}/_{3}$ x $^{1}/_{10}$ x $^{3}/_{10}$

14. (i) P (RRR) = $\frac{5}{15} X \frac{5}{15} X \frac{5}{15}$

$= \frac{125}{3375}$

$= \frac{1}{27}$

(ii) $\frac{125}{3375} + \frac{64}{3375} + \frac{216}{3375}$

$= \frac{405}{3375}$

$= \frac{3}{25}$

(iii) P (RBG) + P (GRB) + P(BGR)

$$\frac{5}{15} X \frac{4}{15} X \frac{6}{15} + \frac{6}{15} X \frac{5}{15} X \frac{4}{15} + \frac{4}{15} X \frac{6}{15} X \frac{5}{15}$$

$$= \frac{120}{3375} + \frac{120}{3375} + \frac{120}{3375}$$

$$= \underline{24}$$

(iv) P(BBB) + P(GGG) + P(BBG) + P (GGB)

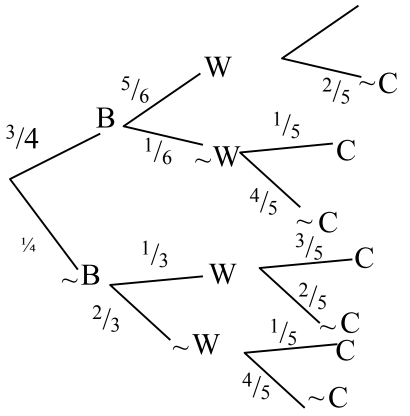
$$= \frac{4}{15} X \frac{4}{15} X \frac{4}{15} + \frac{6}{15} X \frac{6}{15} X \frac{6}{15} + \frac{4}{15} X \frac{4}{15} X \frac{6}{15} + \frac{6}{15} X \frac{6}{15} X \frac{4}{15}$$

$$= \frac{64}{3375} + \frac{216}{3375} + \frac{96}{3375} + \frac{144}{3375}$$

$$= \frac{520}{3375} + \frac{104}{3375}$$

B- To bed on time
B- To bed late
W- Waking upon time
W- waking up late
C- Getting to class on time
C- Getting to class late

15.



B- To bed on time
~B- To bed late
W- Waking upon time
~W- waking up late
C- Getting to class on time
~C- Getting to class late

√tree diagram.

√Addition of probability

√Addition of prob.

√Addition of prob.

(a) (i) P(Bnw) = $\frac{3}{4} x \frac{5}{6}$

$= \frac{5}{8}$

ii) P(Waking up late)

$$\left(\frac{\overset{1}{\cancel{3}}}{4} x \frac{1}{\underset{3}{\cancel{6}}}\right) + \left(\frac{1}{\underset{2}{\cancel{4}}} x \frac{\cancel{2}}{3}\right)$$

$$= \frac{1}{8} + \frac{1}{6} = \frac{3+4}{24}$$

$$= \frac{7}{24}$$

b) (i) P (BW~C) or P(B~W~C)

$$1\left(\frac{\cancel{3}}{\underset{2}{\cancel{4}}} x \frac{1}{\cancel{6}} x \frac{\cancel{4}}{5}\right) + \left(\frac{\cancel{3}}{\underset{2}{4}} x \frac{5}{\underset{1}{\cancel{6}}} x \frac{\cancel{2}}{\cancel{5}}\right)$$

$$\frac{1}{10} + \frac{1}{4} = \frac{4+10}{40}$$

$$= \frac{7}{20}$$

ii) P (~B ~C) = $\frac{1}{4} x \frac{1}{3} x \frac{3}{5} + \frac{1}{4} x \frac{2}{3} x \frac{1}{5}$

$$= \frac{1}{20} + \frac{1}{30} = \frac{3+2}{60} = \frac{5}{60}$$

$$= \underline{1}$$

12

55.Compound proportions, mixtures and rates of work

1	Cost of mixture per kg $=\frac{(5\times 30)+(3\times 60)}{8}$ = sh 41.25 Selling price $\Rightarrow \frac{130}{100}\times 41.25$ = Ksh.53.625	M_1 M_1 A_1	Allow 53.60
		3	
2	a) x-Hexagonal and y-Rectangular tables $x \geq 15$ $y \geq 10$ $6x+3y \leq 240(2x+y \leq 80)$ $120x+100y \leq 6000 \quad (6x+5y \leq 300)$ b) $x \geq 15$ region ✓shaded $y \geq 10$ region ✓shaded $2x+y \leq 80$ region ✓shaded $6x+5y \leq 300$ region ✓shaded c) (i) Search line ✓drawn (26, 28) (ii) $(26\times 80+28\times 60)$ Ksh. 3,760	B1 B1 B1 B1 B1 B1 B1 B1 B1 B1	
		10	

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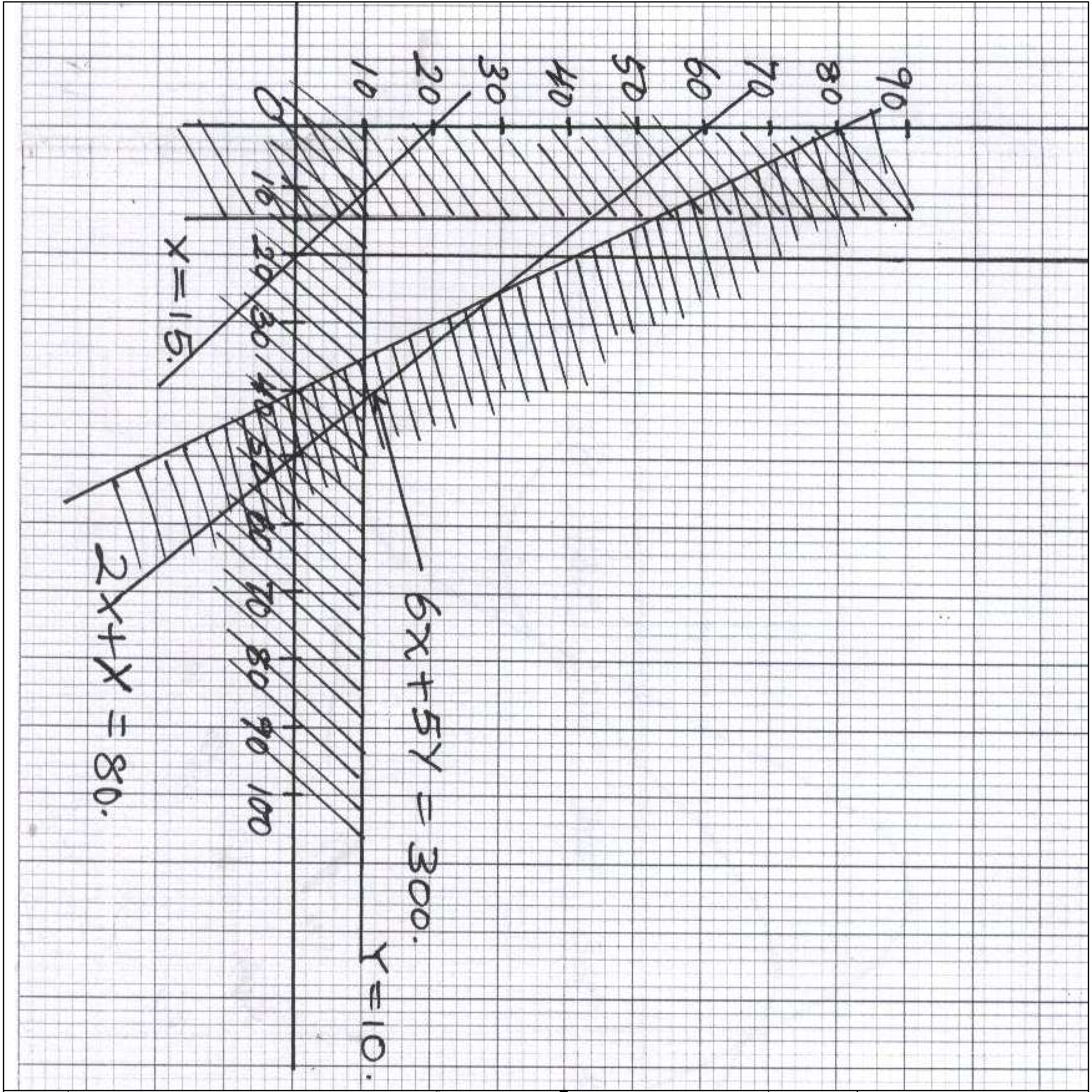
<tr><td colspan="4">
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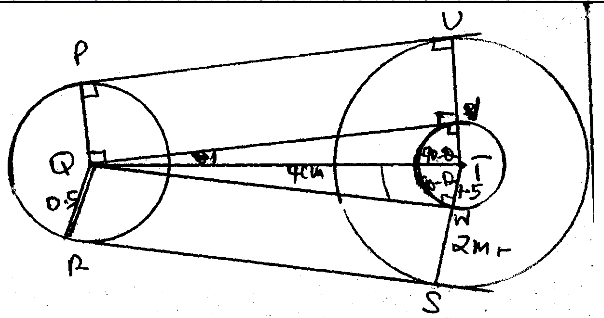
<tr><td>3.</td><td>

PU = QV = QW = RS
$= \sqrt{4^2 - 1.5^2}$
= 3.708cm</td><td>M1
M1</td><td></td></tr>
</table>

	$Sin\theta = \frac{1.5}{4} \Rightarrow Sin^{-1}0.375 = 22.02^0$	**M1**	
	$\angle PQR\,(obtuse) = 360^0 - 2(90 + 22.02)$	**M1**	
	$= 135.96^0$		
	$Arc\ PR = \frac{135.96}{360} \times 2 \times 3.14 \times 0.5 = 1.1866$	**M1**	
	Arc US subtends angle 360 – 2(90 – 22.02)	**M1**	
	= 224.04	**A1**	
	Arc US = $\frac{224.04}{360} \times 2 \times 3.142 \times 2 = 7.8215$	**M1**	
	Total length = 3.708 x 2 + 1.1866 + 7.8215	**A1**	
	= 16.4241		
	(b) ($^4/_3$ x 16.4241)	**B1**	
	21.8988		
	22.90		
		10	

1. a) Deposit: Total ratio 2 + 3 + 5 = 10

Georgina: $^2/_{10}$ x 30000 = 6000

Gilbert: $^3/_{10}$ x 30000 = 9000

Akumu: $^5/_{10}$ x 30000 = 15000

b) Balance to be paid

= 510000 – 30000 = 480000

Each pays = $\frac{480000}{3}$ = 160000

c) Profit = $^{20}/_{100}$ x 510000 = 102000

Georgina received: $^1/_6$x 102000= 17000

Gilbert received: $^2/_6$x 102000 = 34000

Akumu received: $^3/_6$ x 102000 = 51000

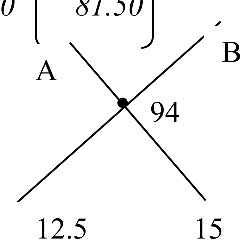
2.

Men	*Days*
12	*20*
16	*?*

= ($\frac{12}{16}$ x 20) days = 15 days

3 t cost

+09.00 81.50



Cost of mixture

Sh 112.8 x $\frac{100}{120}$ = 94 per kg

Ratio A : B

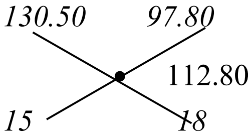
(81.50 – 94) : (109 – 94)

12.5 : 15

2.5 : 3

5 : 6

Alt. At selling Price



A sales at $\frac{109}{100} \times 120$

= $\underline{130.50/=}$

B sales at $\frac{81.50}{100} \times 120$

$\underline{\underline{= 97.80/=}}$

A & B mixed sells at

$\frac{94 \times 120}{100} =$

sh 112.80 per kg

Ratio A : B

(112.80 – 97.8) :

(130 – 112.8)

15: 18

5 : 6

4 *Let Onacha take x days.*

Mogutu takes x + 5 days.

$\frac{1}{x} + \frac{1}{x+5} = \frac{1}{6}$

$x^2 (x + 5) + 6x = x(x - 5)$

$x^2 - x - 30 = 0$

$(x - 10)(x + 3)$

$x = 10, 3$ *Onacha takes 10 days.*

5 $^{dy}/_{dx} = 6x2 + x - 4$

When x = 1,

$^{dy}/_{dx} = 6+1-4 = 3$

Grad of normal = $^{-1}/_{3}$

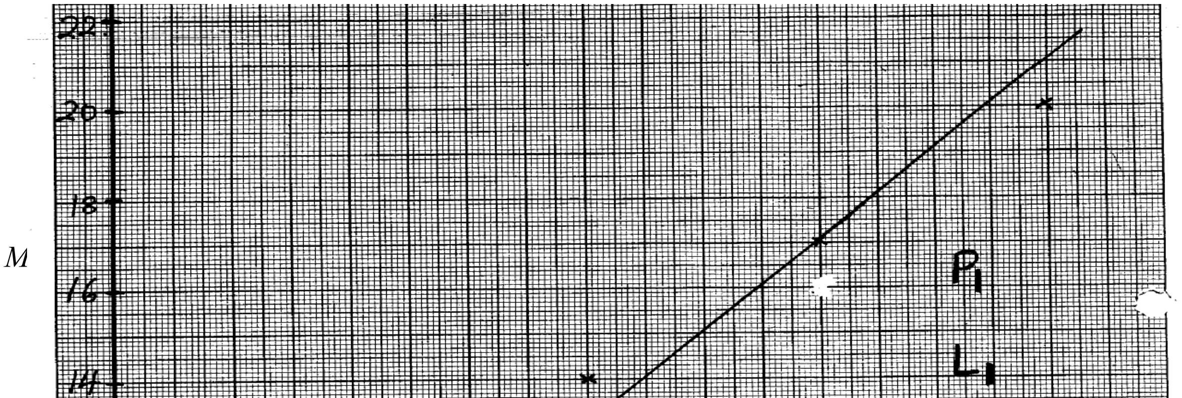
$y + \frac{1}{2} = -1/_3 (X - 1)$

$y = {}^{-1}/3\, x - {}^{1}/_{6}$

6 *Gradient =* $\frac{11 - 8}{3 - 1.5}$

$= 2$

K = 2, M = 5 *B = 2A + 5*



7 $(70 – 25 \text{ x } 60 = 2700$

$2700 \text{ Cos } 47$

$= 2700 \text{ x } 0.68 \quad = 1841.4\text{nm}$

8 $$\frac{6\text{x } 72 + 66 \text{ x } 4}{10} = 69.6$$

$100\% = 69.6$

$\therefore 105 = 73.10$

9 (a) (i)

A	B	Mixture
150	160	156
1	n	1+n
150	160n	(n+1)156

$150 + 160n = 156(n+1)$

$N = {}^6/_4 = {}^3/_2$

$$= \frac{112}{100} \text{ x } 156 = \text{shs. } 174.72$$

(b) At 11.45 a.m

Depth filled by P in 2hrs = 2.1m

$$3\text{hrs} = \frac{3\text{hr}}{2\text{hr}} \text{ x } 2.1\text{m}$$

$= 3.15\text{m}$

Depth filled by q in 7hrs = 2.1m

$$3\text{hrs} = \frac{3\text{hrs}}{7\text{hrs}} \text{ x } 2.1\text{m}$$

= 0.9m

Depth emptied by R in 6hrs = 2.1m

2hrs = 2hr x 2.1
6hrs

∴Depth at 11.45a.m = (3.15 + 0.9) – 0.7 = 3.35m

10 *Let the amount to be mixed be x kg of the lower, priced grade and y kg for higher price grade*

X kg of the lower priced grade cost Sh. 420x
Y kg of the higher priced grade cost Sh.470y
Total cost of (x+y0 kg of mixture

$= Shs.\frac{420x + 470y}{x + y}$

equating $\frac{420x + 470y}{x + y} = 455$

$420x + 470y = 455x + 455y$

$470y – 455y = 455x – 420y$

$15y = 35x$

$X: y = 3:7$

11. *Cross sectional area* $= r^2$

$= (\frac{22}{7} x\ 35\ x\ 35)cm^2$

Flow per second $= (\frac{22}{7} x\ 35\ x\ 35\ x\ 45)cm^2$

After 2¼ hrs $= (\frac{22}{7} x\ 35\ x\ 35\ x\ 45\ x\ 3\ x\ 60\ x\ 69)liters$

= 233887.5litres

12 *a) In 2000, Costs Shs*

Material = $\frac{8}{25}$ x 1250	=	400
Labour = $\frac{14}{25}$ x 1250	=	700
Transport = $\frac{3}{25}$ x 1250	=	150

In 2003

Material = 400 x 2	=	800
Labour = $\frac{130}{100}$ x 700	=	910
Transport = $\frac{120}{100}$ x 150	=	180

b) In 2004 Costs

Material = 800
Transport = 180

∴ labour = 1981 – (800 + 180)= Shs.1001

∴ Increase in labour = 1001 – 910 = 91

% increase $= \frac{91}{910} x\ 100$

= 10%

13. *Cost price* $= \frac{100 x 114}{120} = shs.\ 95$

Let A: B = n :1

$\frac{95}{1} = \frac{80n + 100}{n + 1}$

$95n + 95 = 80n + 100$

$15n = 5$

$n = {}^{1}/_{3}$

$n:1 = 1:3$

$A:B = 1:3$

14. Let the ratio be $x: y$

$76x + 84y = 81(x + y)$

$84y - 81y = 81x - 76x$

$3y = 5x$

$3 = x$

$5\ y$

$x : y = 3 : 5$

15. a) Cost of 8kg = $5 \times 25 + 2 \times 30 + 1 \times 45 = 230$

Cost of 1 kg= ${}^{230}/_{8} = 28.75$

Profit/ kg= $28.75 \times {}^{20}/_{100}$

$= 5.75$

b) i) Selling price

$= 28.75 \times {}^{112}/_{100} = 32.20$

$32.20 \times {}^{120}/_{100} = 38.64$

38.64

ii) New cost/ kg

$= 1.12 \times 28.75 = 32.20$

% Profit = $\frac{40.25 - 32.20}{32.20} \times 100$

$= 25\%$

16. $= \frac{3 (5.60) + 11y}{14} = 6.70$

$= 16.8 + 11y = 93.8$

$11y = 77$

$y = 7$

1Kg costs Shs. 7.00

56. Graphical methods

1. $x^2 + 4x + y^2 = 5$

$x^2 + 4x + (\frac{1}{2} \times 4)^2 + y^2 = 5 + (\frac{1}{2} \times 4)^2$

$(x + 2)^2 + (y + 0)^2 = 5 + 4$

$(x + 2)^2 + (y + 0)^2 = 9$

Centre (-2,0)

Radius $\sqrt{9}$

$r = 3$ units

2. $x^2 + 6x + (3)^2 + y^2 - 10y + (^-5) = 2 + 9 + 25$

$(x + 3)^2 + (y - 5)^2 = 36$

$(x - ^-3)^2 + (y - +5)^2 = 6^2$

$\therefore$ centre (-3, 5)

Radius 6 units

Completing of sq. for expression in x and y.

√Expression.

√Centre

√Radius

3. CBE = 40^0 (alt.segiment theoren)

$\angle BCE = 120^0$ (Suppl. To BCD = 60^0alt. seg.)

$\therefore (40 + 120 + E) = 180^0$ (Angle sum of Δ)

$\angle BEC = 20^0$

4. $X^2 + Y^2 - 10Y + 25 = 25 - 16$

$(X - 0)^2 + (Y - 5)^2 = 9$

$(X - 0)^2 + (Y - 5)^2 = 3^2$

Centre (0, 5)

Radius = 3

5.

x	-5	-4	-3	-2	-1	0	1
x^3	-125	-64	-27	-8	-1	0	1
$6x^2$	150	96	54	24	6	0	6
$8x$	-40	-32	-24	-16	-8	0	8
y	-15	0	3	0	-3	0	15

$x^3 + 6x^2 + 8x > 1$

Between

(i) $x = -3.85\ 0.1$ and $x\ -2.15\ 0.1$

(ii) $x > 0.5 \pm 0.1$

6. $y = x^3 - 3x + 2$

$x = 0, y = 2$

(0, 2) $\Rightarrow$ y – intercept.

$\frac{dy}{dx} = 3x^2 - 3 = 0$

$x^2 = 1$

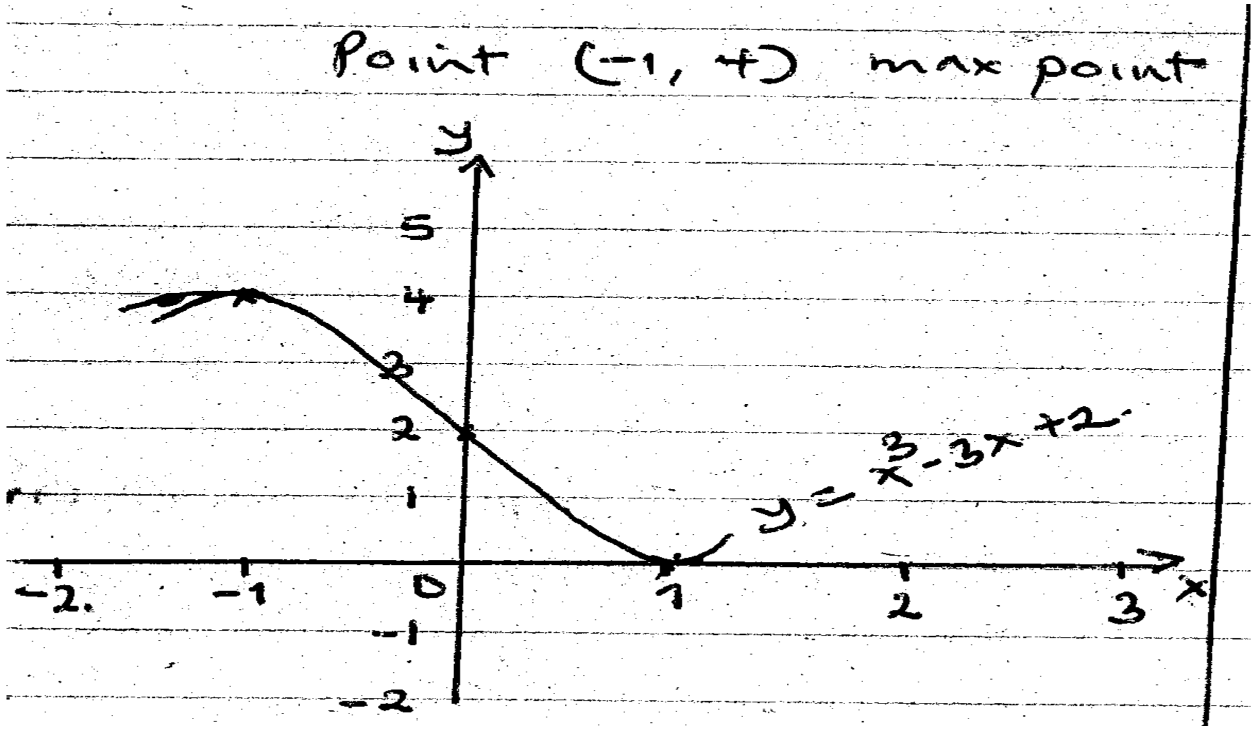
$x = \mp 1$

$x = 1 \quad y = 0$

Point (1, 0) min point

$x = -1, \quad y = 4$

Point (-1, 4) max point.



7. $4x_2 - 12x + 4y^2 + 12y = 7$

$x^2 - 3x + y^2 + 3y = {}^7/_4$

$x^2 - 3x + ({}^3/_2)^2 + y^2 + 3y + ({}^3/_2)^2 = {}^7/_4 + {}^9/_4 + {}^9/_4 = {}^{25}/_4$

$(x - {}^3/_2)^2 + (y + 3/2)2 = 25/4$

∴Centre (1,5, -1.5) Radius 2.5units

8. Log R =nlog p + log K

Log P	0.48	0.54	0.60	0.65	0.70
Log R	1.56	1.69	1.81	1.91	2.00

$\text{Gradient} = \frac{2 - 0.6}{0.7}$

$= \frac{1.4}{0.7} = 2$

Log R intercepts = 0.6 = logk

K= 4

The law connecting R and P is $R=4P^2$

$900 = 4P^2$

$P^2 = \frac{900}{4}$

$225 = P^2$

9. $(x +2)^2 (y-3)^2 = 3^2$

$X^2 + 4x + 4 + y^2 - 6y + 9 = 3^2$

$X^2 + y^2 + 4x - 6y + 4 = 0$

10.

V	0	2	4	6	8	10
$\frac{1}{T}$	2.04	3.33	4.17	5	6.25	7.30

T = a

$b + V$

$\frac{I}{T} = \frac{b + V}{a}$

$\frac{I}{T} = \frac{1}{a}V + \frac{b}{a}$

$y = mx + C$

b) (i) $\frac{1}{a} = \text{Grad} \Rightarrow \frac{\Delta y}{\Delta x} = \frac{7.3 - 5}{10 - 6} = \frac{2.3}{4} = 0.575$

$a = 1.739$

$\frac{b}{a} = y - \text{Intercept} \Rightarrow 2.04$

$\frac{b}{1.739} = 2.04$ $\quad b = 2.04 \times 1.739$

$= 3.547556$

$b \simeq 3.548$

(ii) $T = 0.38$

$\frac{I}{T} = 2.63$ shown on graph

$V = 1$

-1

(iii) $\frac{I}{T} = 4.45$

$T = (4.45)$

$= 0.2247$

$\simeq 0.22$

11. $y = 2x^3 + x^2 + 3x - 1$

$\frac{dy}{dx} = 6x^2 + 2x + 3$

gradeindent at (1, -5)

$= 6 + 2 + 3 = 11$

$\frac{y-(-5)}{x - 1} = 11$

$y + 5 = 11x - 11$

$y = 11x - 16$

12. $3^5 = 3^{-4}$ x 3^{-x}

$3^5 = 3^{-4-x}$

$-4 - x = 5$

$-x = 9$

$x = -9$

13. $x^2 + 2x + 1 + y^2 - 4y + 4 = 4 + 1 + 1$

$(x+1)^2 + (y-2)^2 = 9$

Centre (-1, 2)

Radius 3units

14. c)

X	-4	-3	-2	-1	0	1	2

-6	-6	-6	-6	-6	-6	-6	-6
X	-4	-3	-2	-1	0	1	2
$4x^2$	64	36	16	4	0	4	16
X^3	-64	-27	-8	-1	0	1	8
$Y=-6+x+4x^2+x^2$	-10	0	0	-4	-6	0	20

$y = x^3 + 4x^2 + x - 6$

$\underline{0 = x^3 + 4x^2 + x - 4}$

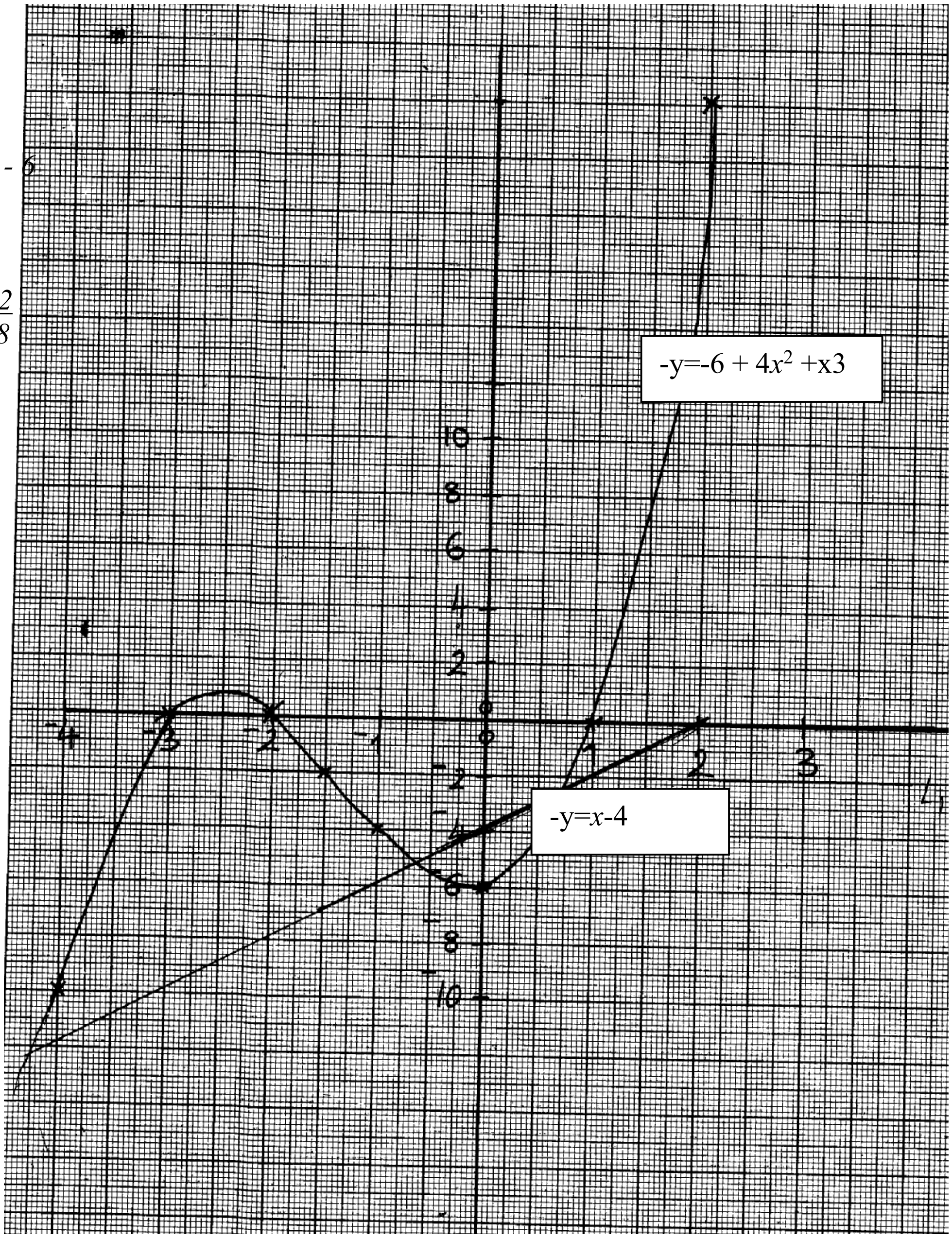
$y = -2$

(iii) $y = x^3 + 4x^2 + x - 6$

$\underline{0 = x^3 + 4x^2 + 0 - 2}$

$y = x - 4$

x	1	0	-2
y	-3	-4	-8



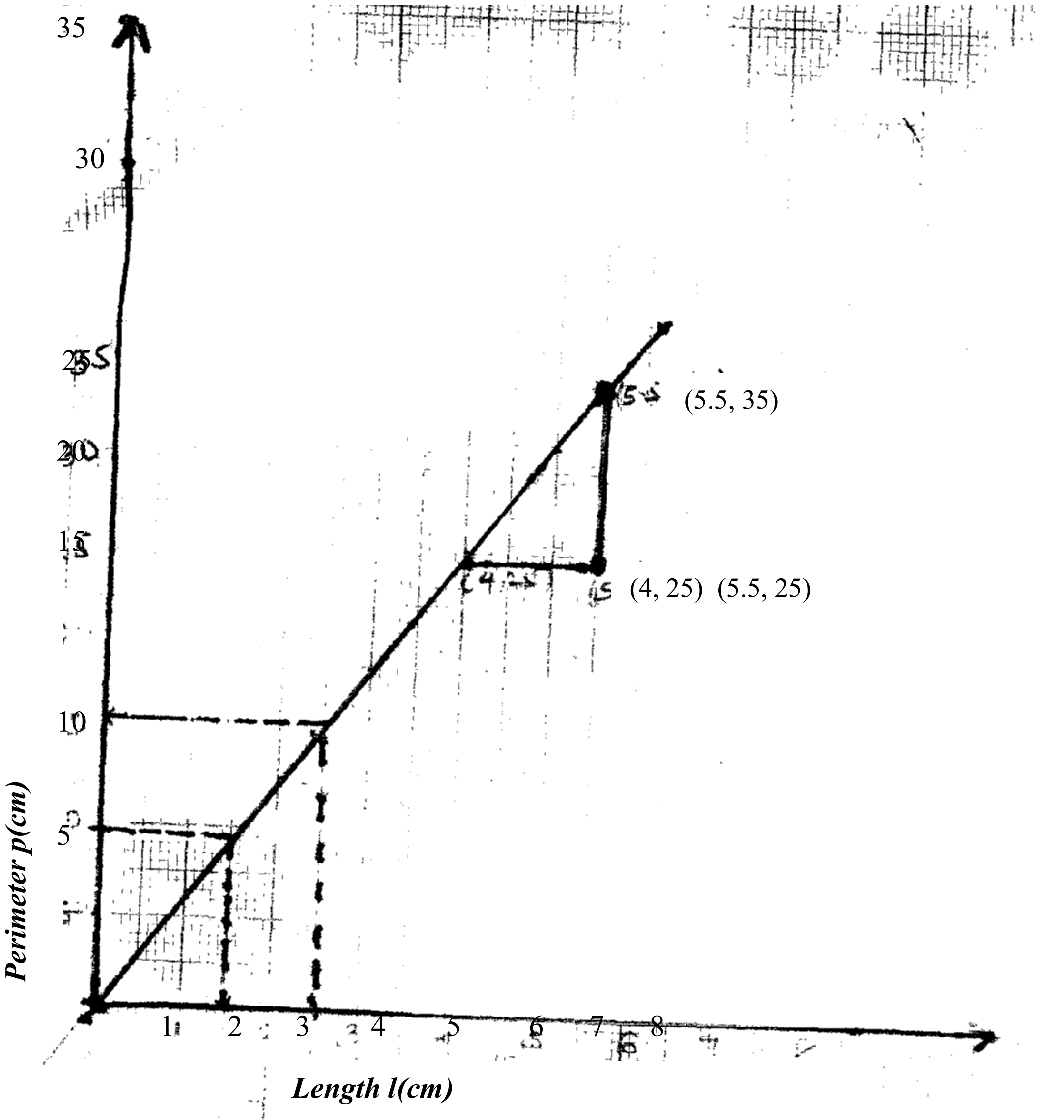
c (i) solution 0.8

-1.5

And -3.2

(c) 1, -2, -3

15.



(i) $P = 15.75cm$

(ii) $l=1.5cm$

(iii) $m = \frac{35- 25}{5.5 – 4.0} = \frac{10}{1.5} =$

(c) choose P(5,31.4)

$\frac{p - 31.4}{l -5} = \frac{10}{1.5}$

$\frac{p-31.4}{l-5} = \frac{100}{1.5}$

$15p – 471 = 100k – 500$

$15p = 100l – 29$

15 15

$2k = \frac{100}{15}$

$k= \frac{100}{2 x 15} = 3.33$

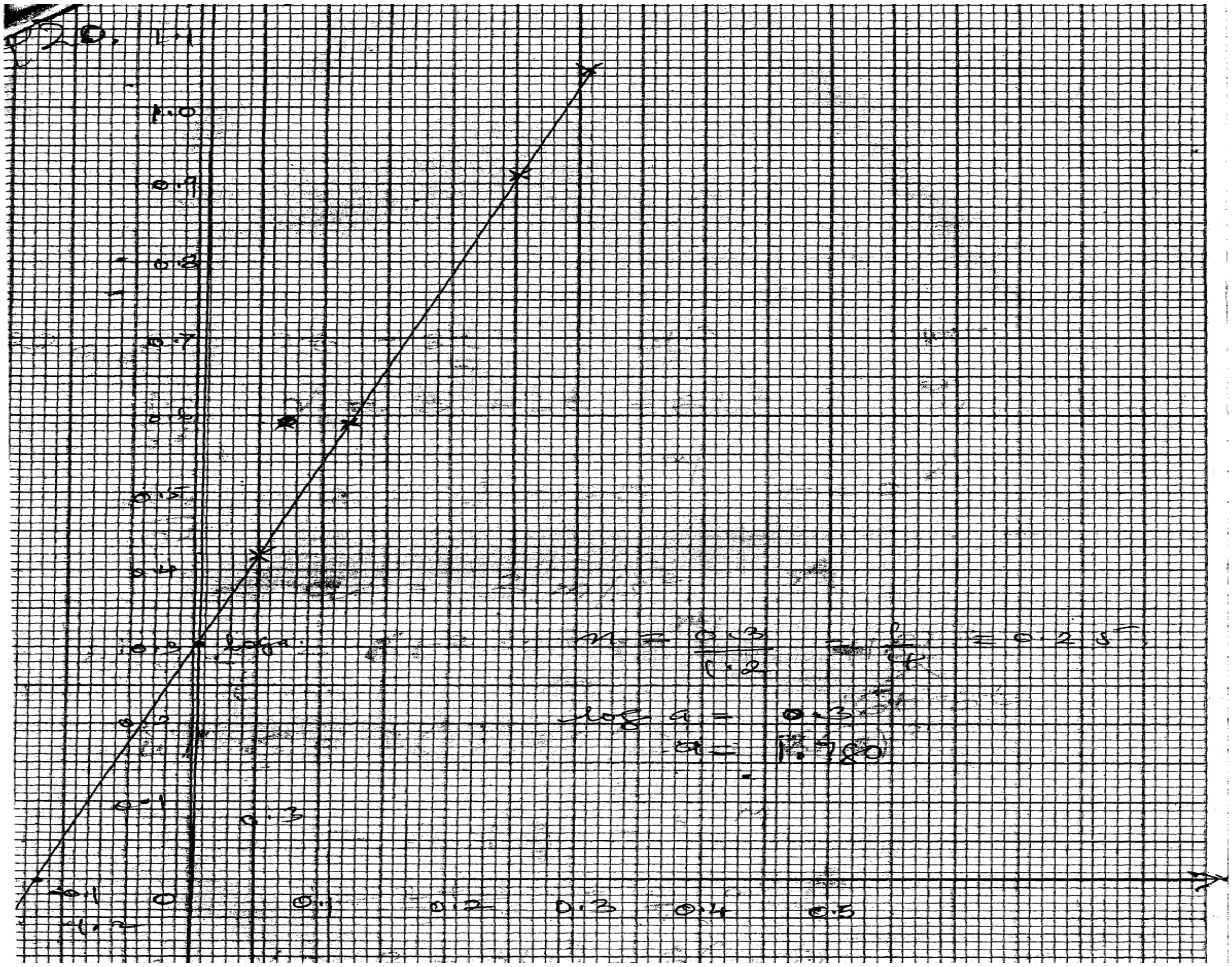
$c =1.93$

$P + 0.6 = ar^h$

$\text{Log}(P + 0.6) = \log a + n \log R$

$= n \log R + \log 9$

$P + 0.6$	1.33	2.65	3.85	8.04	11.22
$\text{Log}(P + 0.6)$	-0.13	0.42	0.59	0.91	1.05
$\text{Log } R$	-0.05	0.05	0.12	0.25	0.30



$\text{Log } 0.3 = ¼ = 0.25$

$\text{Log } a = 0.3$

17. $x^2 + y^2 - 6x = 3 - 4y$

$x^2 - 6x + ({}^{-6}/_{2})^2 + y^2 + 4y + ({}^{4}/_{2})^2 = 3 + ({}^{-6}/_{2})^2 + ({}^{4}/_{2})^2$

$(x - 3)^2 (y + 2)^2 = 3 + 9 = 4$

$(x - 3)^2 (y + 2)^2 = 16$

$C (3, -2)$

$\text{Gradient } \frac{\Delta y}{\Delta x} = \frac{7 - -2}{6 - 3} = 3$

18.

x	-3	-2	-1	0	1	2	3	4
$-x^3$	27	8	1	0	-1	-8	-27	-64
$2x^2$	18	8	2	0	2	8	18	32
$-4x$	12	8	4	0	-4	-8	-12	-16
2	2	2	2	2	2	2	2	2
y	59	26	9	2	-1	-6	-19	-46

b) Check on the graph paper.

c) $x = 0.5 \pm 0.1$

d) $-x^3 + 2x^2 - 5x + 3 = 0$

Line to allow: $y = x - 1$

x	0	1
y	-1	0

$x = 0.65$

19. $^{Dy}/_{dx} = 12x^2 - 12$

$12x^2 - 12 = 0$

$12(x^2 - 1) = 0$

$x = 1$

$x = -1$

At $x = 1$ At $x = -1$

0	1	2	-2	-1	0
GRD = 12	0	36	36	0	-12
-	0	+	+	0	-

(1,7) (-1, 9)

Minimum maximum

20. (a) table

(b) plotting

scale

smooth curve

(c) (i) $-0.5 < x < 1$ and $x>1$

(iii) $x = 2.5 \pm 0.1$

21. $2x^2 + 2y^2 - 6x + 10y + 9 = 0$

$x^2 + y^2 - 3x + 5y + 9/2 = 0$

$x^2 + y^2 - 3x + 5y = -9/2$

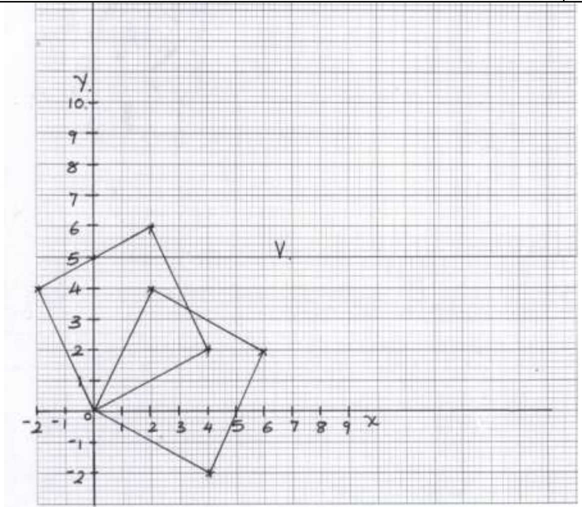
$x^2 - 3x + \frac{9}{4} + y^2 + 5y + \frac{25}{4} = 8.5 - 4.5$

$(x - \frac{3}{2})^2 + (y + \frac{5}{2})^2 = 4$

Radius = 2 units

Centre = (1.5, -2.5)

57. Matrices and Transformations

1	a) (i) (ii) $\begin{pmatrix}2-1\\1\ \ 2\end{pmatrix}\quad\begin{pmatrix}0220\\0022\end{pmatrix}$ $=\begin{pmatrix}042-2\\0264\end{pmatrix}$ $T\Rightarrow(0,0),(4,-2),(2,6),(-2,4)$ (iii) $\begin{pmatrix}2\ \ 1\\-1\,2\end{pmatrix}\quad\begin{pmatrix}0220\\0022\end{pmatrix}=\begin{pmatrix}0462\\0-226\end{pmatrix}$ $U\Rightarrow(0,0),(4,-2),(6,2),(2,4)$ b) (i) $\begin{pmatrix}2-1\\1\ \ 2\end{pmatrix}\begin{pmatrix}2\ \ 1\\-1\,2\end{pmatrix}=\begin{pmatrix}5\,0\\0\,5\end{pmatrix}$ $\begin{pmatrix}5\,0\\0\,5\end{pmatrix}\begin{pmatrix}0220\\2022\end{pmatrix}=\begin{pmatrix}010100\\001010\end{pmatrix}$ $V\Leftarrow(0,0),(10,0),(10,10),(0,10)$ (ii) Enlargement center (0,0) s.f = 5	B_1 M_1 A_1 B_1 B_1 B_1 B_1 B_1 B_1 B_1	Square S drawn ✓coordinates given Square T drawn ✓coordinates (implied) Square U drawn ✓coordinates (implied) Square V drawn
			
		10	

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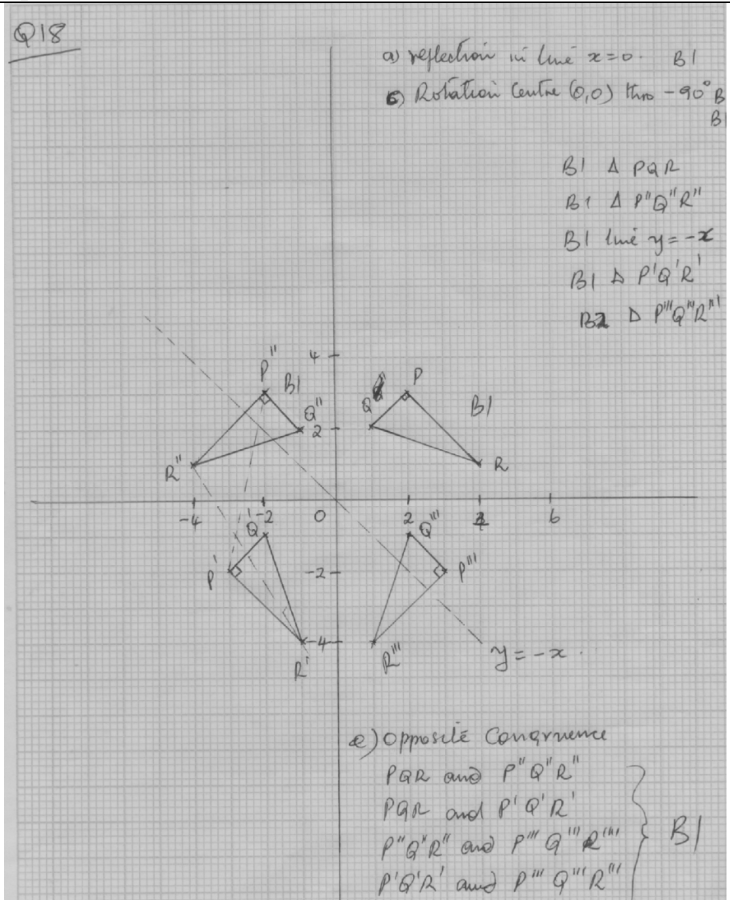
<tr><td>2.</td><td>

a) reflection in line x = 0. B1
b) Rotation Centre (0,0) thro -90° B
B1
B1 Δ PQR
B1 Δ P''Q''R''
B1 line y = -x
B1 Δ P'Q'R'
B2 Δ P'''Q'''R'''
e) Opposite Congruence
PQR and P''Q''R''
PQR and P'Q'R'
P''Q''R'' and P'''Q'''R'''
P'Q'R' and P'''Q'''R'''
B1
Total 10</td><td></td><td></td></tr>
<tr><td></td><td></td><td>10</td><td></td></tr>
</table>

1. *a) B (4,-5), C (3,6 ½)*

Δ ABC drawn

Δ ABC drawn

a) ii) Shear maps

1

I (1, 1½)

Matrix = $\begin{matrix}1 & 0\\ 1 & ½\end{matrix}$

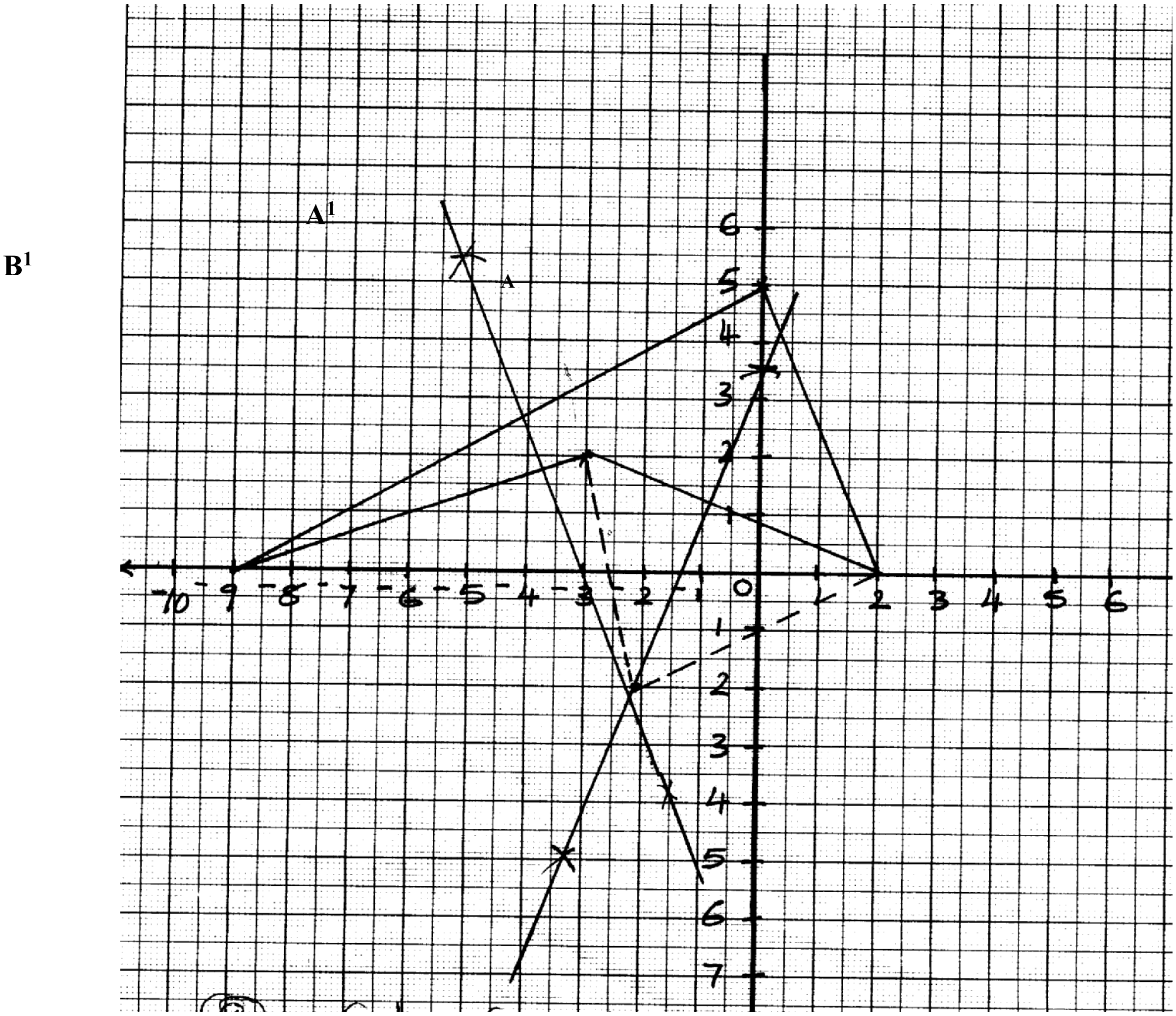
b) i) 1 1

$$\begin{pmatrix}-1 & 0\\ ^3/_2 & -1\end{pmatrix}\begin{array}{ccc}A^1 & B & C\\ \hline -6 & -4 & 3\\ -4 & -5 & 6\tfrac{1}{2}\end{array}$$

$$= \begin{array}{ccc}A^{11} & B^{11} & C^{11}\\ 6 & 4 & -3\\ -5 & -1 & -2\end{array}$$

Δ A^{11} B^{11} C^{11} D^{11} *drawn* *ii) Half turn about (0,0)*

2.



(a) Centre (-2, -2) 90°

(b) A11 (-2 , -4) , B11 (0, 9)

(c) Half-turn about the centre (0, 2)

3.

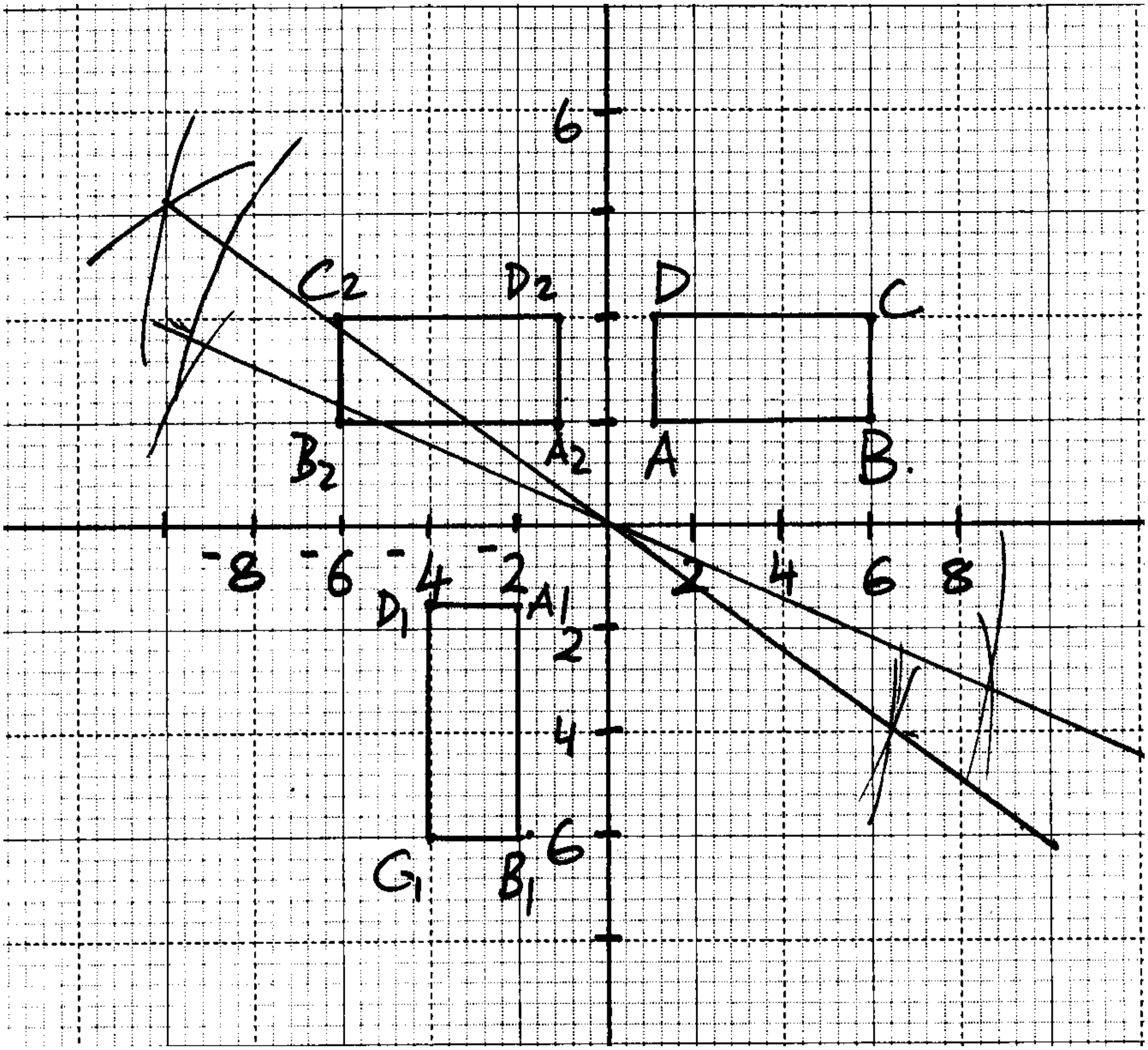
$$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} A & B & C & D \\ 1 & 6 & 6 & 1 \\ 2 & 2 & 4 & 4 \end{pmatrix} \begin{pmatrix} A^1 & B^1 & C^1 & D^1 \\ -2 & -2 & -4 & -4 \\ -1 & -6 & -6 & -6 \end{pmatrix}$$

A_1 (-2, -1)
B_1 (-2, -6)
C_1 (4, -6
D_1 (-4, -1)

$$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} A_1 & B_1 & C_1 & D_1 \\ -2 & -2 & -4 & -4 \\ -1 & -6 & -6 & -6 \end{pmatrix} \quad \begin{pmatrix} A_2 & B_2 & C_2 & D_2 \\ -1 & -6 & -6 & -6 \\ 2 & 2 & 4 & 4 \end{pmatrix}$$

A_2 (-1, 2)
B_2 (-2, -6)
C_2 (-6, 4)
D_2 (-6, 4)

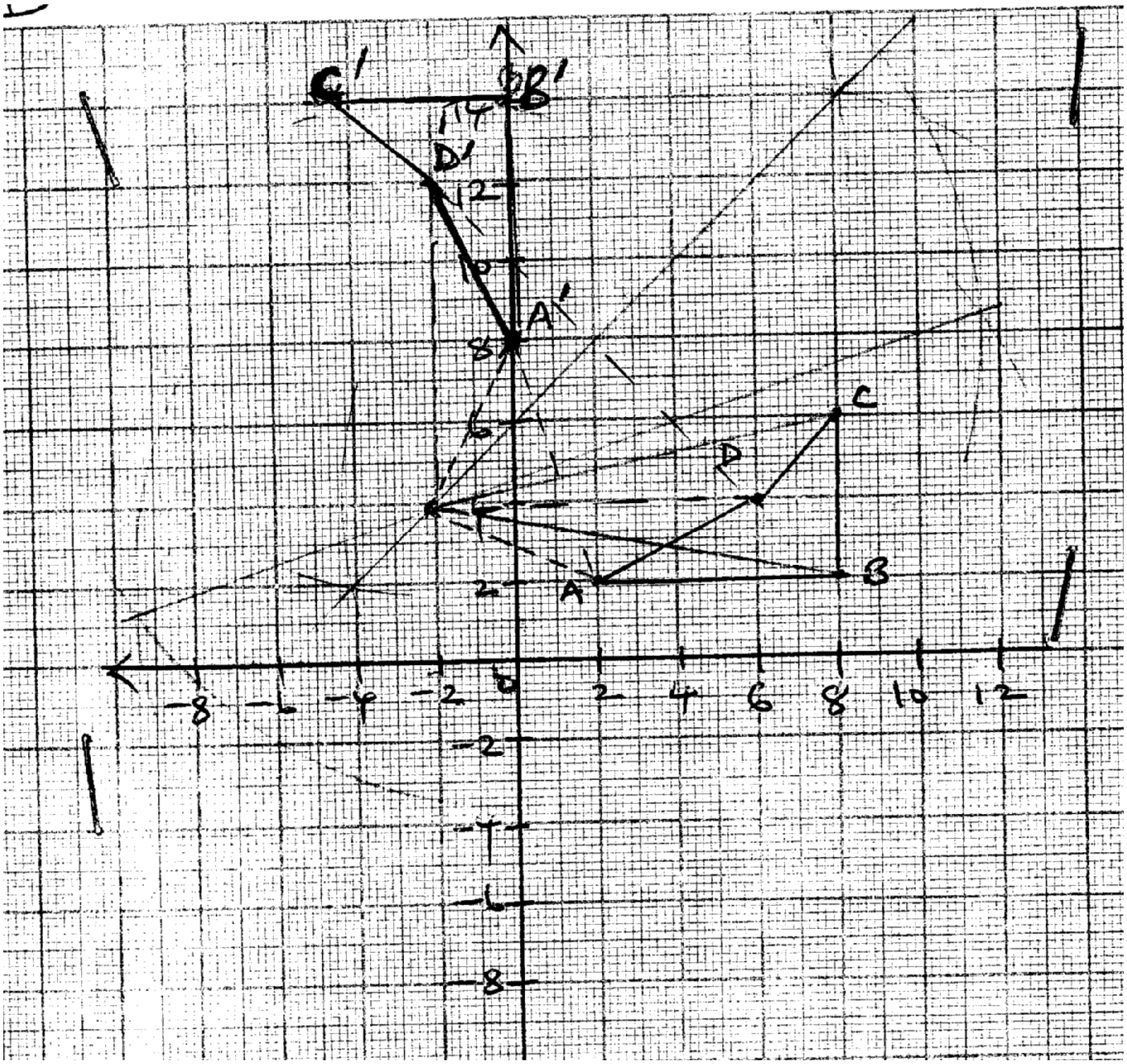
(b)



(c) (i) U - - positive three-quarter turn about the origin
(ii)UT – Reflection I the line x = 0

(d) IdetI = I2.5 x -2 – 1x 0 I= 5
∴Area = 5x(5x2) = 20sq. units

. (a)



b) Centre (-2, 4)
Angle + 90°

5. P(5,-3) P^1 (2, -5)

$$\begin{pmatrix}5\\-3\end{pmatrix} + \begin{pmatrix}a\\b\end{pmatrix} = \begin{pmatrix}2\\-5\end{pmatrix}$$

$$\begin{pmatrix}a\\b\end{pmatrix} = \begin{pmatrix}-3\\-2\end{pmatrix}$$

$R^1 = \begin{pmatrix}-2\\ \\ \end{pmatrix} + \begin{pmatrix}-3\\ \\ \end{pmatrix}$

$-3 \qquad -2$

$= \begin{pmatrix}-5\\-5\end{pmatrix}$

$P^1R^1 = \begin{pmatrix}-5\\-5\end{pmatrix} - \begin{pmatrix}-2\\-5\end{pmatrix}$

$= \begin{pmatrix}-7\\0\end{pmatrix}$

Mag. = 7units

6. $A^1 = (0+1, -1-2) = (1, -3)$

$B^1 = (4 + 1) , 3-2) = (4, 1)$

$C^1 = (2 +1, 2-2) = (3-0)$

Matrix $\begin{pmatrix}3 & 0\\0 & 3\end{pmatrix}$

$$\begin{pmatrix}3 & 0\\0 & 3\end{pmatrix}\begin{pmatrix}1 & 5 & 3\\-3 & 1 & 0\end{pmatrix} = \begin{pmatrix}3 & 15 & 9\\-9 & 3 & 0\end{pmatrix}$$

A^{11} (3, -9) B^{11}(15, 3) C^{11}(9,0)

Determinant (0-9) =-9

Area = 9x24 = 216cm^2

$$\begin{pmatrix}a & b\\c & d\end{pmatrix}\begin{pmatrix}3 & 15\\-9 & 3\end{pmatrix} = \begin{pmatrix}1 & 5\\-3 & 1\end{pmatrix}$$

5(31 -9b =1 5(3c-9d=-3

-15a+3b =5 15c +3d=1

-48b =0 -48d = -16

b = 0 d = $^1/_3$

a = $^1/_3$ c=0

matrix $\begin{pmatrix}^1/_3 & 0\\0 & ^1/_3\end{pmatrix}$

7. Scale used S_1

ΔABC drawn B_1

$\Delta A_1B_1C_1$ drawn B_1

A, (6, -1), B(7, 2) C, (4, 4) B1

Line x = 4 L_1

$\Delta A_2\ B_2\ C_2$ drawn B_1

Two seen B_1

Centre of rotation

Angle of centre of rotation B_1

$A_3B_3C_3$ drawn B_1

Scale used S_1

ΔABC drawn B_1

$\Delta A_1B_1C_1$ drawn B_1

A, (6, -1), B(7, 2) C, (4, 4) B1

Line x = 4 L_1

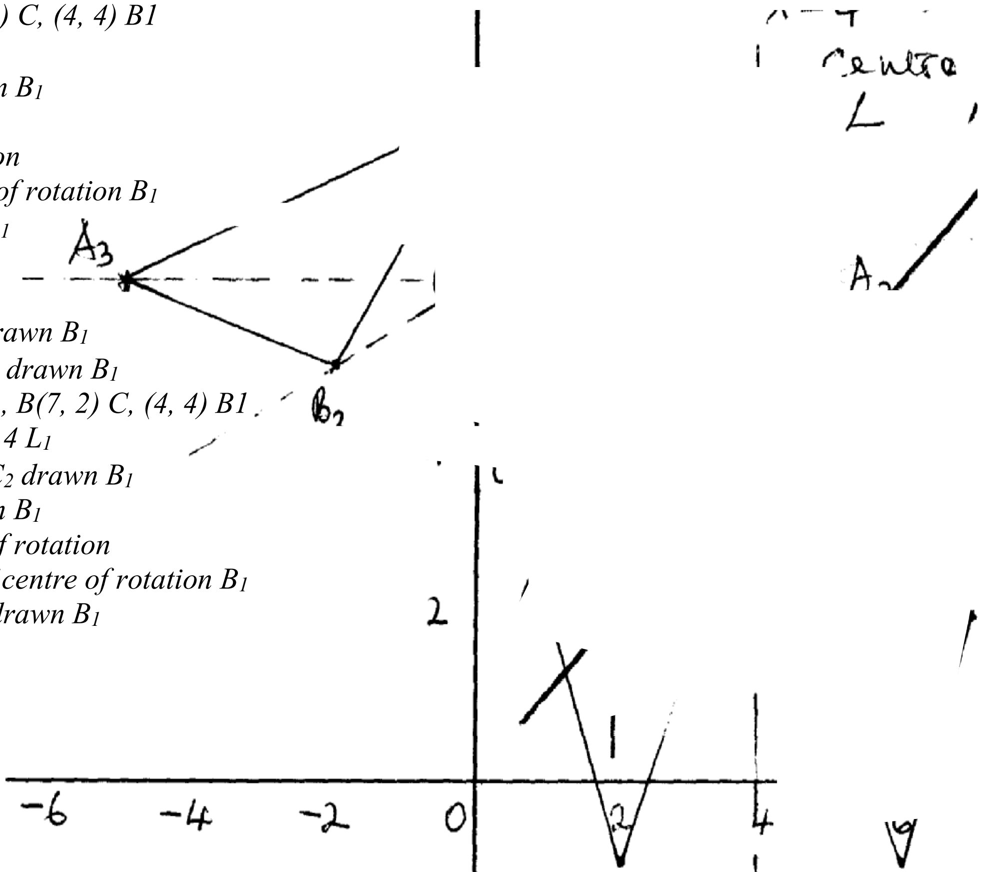
$\Delta A_2\ B_2\ C_2$ drawn B_1

Two seen B_1

Centre of rotation

Angle of centre of rotation B_1

$A_3B_3C_3$ drawn B_1



8. (a) $P(6, -2)$
$X^1 = 6 - 3(-2) = 12$
$Y^1 = 2(6) = 12$
$(X^1, Y^1) = (12, 12)$

(b) (i) $A^1(3,\ 4)$
(ii) $B^1(3,\ 2)$
$C^1(1,\ 4)$
$D^1(4, 3)$

(c) (i)
$$\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix} \left(\begin{array}{cccc} A^1 & B^1 & C^1 & D^1 \\ 3 & 3 & 1 & 4 \\ 4 & 2 & 4 & 5 \end{array}\right)$$
$$= \left(\begin{array}{cccc} A^{11} & B^{11} & C^{11} & D^{11} \\ -5 & -1 & -7 & -6 \\ 4 & 2 & 4 & 5 \end{array}\right)$$

$A^{11}(-5,\ 4)$, $B^{11}(-1,\ 2)$, $C^{11}(-7,\ 4)$ and $D^{11}(-6,\ 5)$

(ii) A stretch with y-axis invariant and a sketch factor (3)
$2h = 6$
$h = 3$

$$\left.\begin{array}{r} -5a + 4b = 4 \\ \underline{-a + 2b = 2} \end{array}\right\} \qquad \begin{array}{r} -5c + 4d = -3 \\ \underline{-c + 2d = 3} \end{array}$$
$$\left.\begin{array}{r} -5a + 4b = 4 \\ \underline{-a + 4b = 4} \end{array}\right\} \qquad \begin{array}{r} -5c + 4d = -3 \\ \underline{-c + 4d = -6} \end{array}$$
$$-4a = 0 \qquad -4c = 3$$
$$a = 0 \qquad c = -\tfrac{3}{4}$$
$$b = 1 \qquad d = {}^{15}/_{8}$$

9. (a) $X1(5, -1)\ y_1(7, -1)\ Z_1(-2, 2)$
$xyz\ \&\ x_1y_1z_1$ well drawn

(b) 1-3 xyz x1y1z1
$X_2(2, 10)\ y_2(2, 14)$
$X_2y_2Z_2$ well drawn
$$\begin{pmatrix} 0 & -2 \\ 2, & 0 \end{pmatrix} \begin{pmatrix} 5, & 7 & -2 \\ -1, & -1, & 2 \end{pmatrix} \qquad \begin{pmatrix} 5, & 7 & -2 \\ -1, & -1, & 2 \end{pmatrix}$$

(c)
$$\begin{pmatrix} 0 & -2 \\ 2, & 0 \end{pmatrix} \begin{pmatrix} 1 & -1 \\ 0, & 1 \end{pmatrix} \qquad \begin{pmatrix} 0, & -2 \\ 2, & -6 \end{pmatrix}$$

(d)) Area of $\Delta X_2y_2Z_2$
$= 4x15 = 60cm^2$

10. $\begin{pmatrix}a & b\\ c & d\end{pmatrix} \begin{matrix}2 & 4 & 4 & 2\\ 1 & 1 & 4 & 4\end{matrix} = \begin{matrix}7 & 14 & 14 & 8\\ 8 & 7 & 16 & 16\end{matrix}$

$2a + b = 8$
$\underline{4a + b = 14}$
$-2a = -6$
$6 + b -= 8$
$b = 2$
$\therefore 6 + b = 8$
$b=2$

$2c + d = 7$
$\underline{4c + d = 7}$
$-2c = 0$
$c = 0$
$d = 7$
$\therefore \begin{pmatrix}3 & 2\\ 0 & 7\end{pmatrix}$

- it is an enlargement with scale factor 3 with centre (-1, -2)

(c) $\begin{pmatrix}8\\ 7\end{pmatrix} + \begin{pmatrix}a\\ b\end{pmatrix} = \begin{pmatrix}7\\ 9\end{pmatrix}$
$a + 8 = 7$ $\quad 7 + b = 9$
$a =-1$ $\quad b = 2$
$\therefore T = \begin{pmatrix}-1\\ 2\end{pmatrix}$

11. a) ABCD drawn B_1
Name – Parallelogram B_1

b) $A^1B^1C^1D^1$ drawn B_1
Attempt to joining any two points and bisecting. B_1
Description – Rotation + 90^0. B_1 or quarter turn about (0,0)

c) $A^{11}B^{11}C^{11}D^{11}$ drawn. B_1
Description – Enlargement centre (0, 0) Scale factor –Z. B_1

d) $A^{111}B^{111}C^{111}D^{111}$ – drawn. B_1
~~Attempt to reflect. B_1~~
Coordinates
A^{111} = 9-2, 4) $\quad C^{111}$ = (-8, 4) B_1 All correct
B^{111} = (-6, 0) $\quad D^{111}$ (-4, 8)

12. $\begin{pmatrix}-1 & 1\\ 2 & -3\end{pmatrix} \begin{pmatrix}4 & 0 & -2\\ 1 & -2 & 4\end{pmatrix}$

$\begin{pmatrix}-3 & -2 & 6\\ 5 & 6 & -16\end{pmatrix}$
$A^{|}$ (-3, 5) $\quad B^{|}$(-2, 6) $\quad C^{|}$(6, -16)

$\begin{pmatrix}2 & -1 & -3\\ 1 & 2 & 5\end{pmatrix} = \begin{pmatrix}-2 & 6\\ 6 & -6\end{pmatrix}$

$A^{||}$ $\quad B^{||}$ $\quad C^{||}$

$$\begin{matrix} -11 & -10 & 18 \\ 7 & 10 & -6 \end{matrix}$$

$A^1(-11, 7)$ $B^1(-10, 10)$ $C''(18, -6)$

$$MN = \begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} -1 & 1 \\ 2 & -3 \end{pmatrix}$$

$$= \begin{pmatrix} -4 & 5 \\ 3 & -5 \end{pmatrix}$$

$$p\text{-}1 = \frac{1}{-12} \begin{pmatrix} 5 & -7 \\ -4 & 8 \end{pmatrix}$$

$$\begin{pmatrix} -^5/_{12} & ^7/_{12} \\ ^1/_3 & -^2/_3 \end{pmatrix}$$

13. $Det = 2 - 6$

$= -4$

$A.S.F = 4$

$\frac{25.6}{x} = 4$

$x = 6.4cm^2$

Area of $\Delta ABC = 6.4cm^2$

14. $T + \begin{pmatrix} 2 \\ -4 \end{pmatrix} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$

$T = \begin{pmatrix} 4 - 2 \\ 0 + 4 \end{pmatrix} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$

$\therefore \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} -1 \\ 2 \end{pmatrix} = \begin{pmatrix} 1 \\ 6 \end{pmatrix}$

$Q\ (1,6)$

16. $5x^2 + 6 = {}^{110}/_{10}$

$5x^2 + 6 = 11$

$x^2 = 1$

$x = \pm 1$

58. Statistics II

<table>
<tr>
<td>1</td>
<td>
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>f</td><td>20</td><td>8</td><td>6</td><td>4</td><td>1</td><td>1</td></tr>
<tr><td>fx</td><td>0</td><td>8</td><td>12</td><td>12</td><td>4</td><td>5</td></tr>
<tr><td>fx²</td><td>0</td><td>8</td><td>24</td><td>36</td><td>16</td><td>25</td></tr>
</table>
$\sum f = 40$ $\sum fx = 41$ $\sum fx^2 = 109$
$s.d = \sqrt{\frac{109}{40} - \left(\frac{41}{40}\right)^2}$
</td>
<td>M_1
M_1
M_1</td>
<td>fx
fx^2</td>
</tr>
</table>

	$= \sqrt{2.725 - 1.050625}$ $= \sqrt{1.674375}$ $= 1.294$	A_1	Allow 1.293976429
		4	

1.

Mass kg	*Mid term x*	*F*	*d = x A*	*fd*	d^2	fd^2
50 - 54	*52*	*19*	*-15*	*-285*	*225*	*4275*
55 - 59	*57*	*23*	*-10*	*-230*	*100*	*2300*
60 - 64	*62*	*40*	*-5*	*-200*	*25*	*1000*
65 - 69	*67*	*28*	*0*	*0*	*0*	*0*
70 - 74	*72*	*17*	*5*	*85*	*25*	*425*
75 - 79	*77*	*9*	*10*	*90*	*100*	*900*
80 - 84	*82*	*4*	*15*	*60*	*225*	*900*
		$\Sigma f = 140$		$\Sigma fd = -480$		$\Sigma fd = 9800$

Marks awarded for √ table as follows:-

$\Sigma f = 140$ *BI*

Column for d *B1*

Column for fd *B1*

$\Sigma fd = -480$ *B1*

√Column for $d^2 = 9800$ B_1

$\Sigma fd = 9800B_1$

—

$x = A + \frac{\Sigma fd}{\Sigma f}$

$= 67.0 + -\frac{480}{140}$

= 67.0 – 3.43 = 63.57 ………… M1

= 63.6 kg …………… A1

Standard deviation $= \frac{\Sigma fd^2}{\Sigma f} - \frac{\Sigma fd}{\Sigma f}$

$= \sqrt{\frac{9800}{140} - (3.43)^2}$

$= \sqrt{58.24} = 7.631$

= 7.6

2. $= {}^{8}/_{150} + {}^{6}/_{150} + {}^{9}/_{300} + {}^{3}/_{300}$

$= {}^{40}/_{300} = {}^{2}/_{15}$

a) Construction of AB B1

Construction of BC B1

Construction of AC B1

b) Construction of bisect of AC B1

Construction of bisect BC B1

Radius 3.6 cm B1

c) Construction of bisect < CAB B1 OC B1

Construction of AD B1 AD = 12.8cm B1

3. *a)*

Class	f	x	d = A – x	fd	d^2	fd^2
41 – 50	20	45.5	15	300	225	4500
51 – 55	60	53	7.5	450	56.25	3375
56 – 65	60	60.5	0	0	0	0
66 – 70	50	68	-7.5	-375	56.25	2812.50
71 – 85	15	73	-12.5	187.5	156.25	2343.75
				∑fd 562.5		$\sum fd^2$ 13031.25

b) $S = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$

$$S = \sqrt{\frac{13031.25}{205} - \left(\frac{562.5}{205}\right)^2}$$

$$= \sqrt{63.567 - 7.529}$$

$$= \sqrt{56.038}$$

$$= 7.486$$

4. $15 (ax)^4 (^{-2}/_{x^2}) = 4860$

$60a^4 = 4860$

$a^4 = 81$

$a = 3$

5.

Marks(x)	Freq.(f)	fx	d=x-x	d^2	Fd^2
5.5	1	5.5	-40.45	1636	1636
15.5	6	99	-30.45	927.2	5563
25.5	10	255	-20.45	418.2	4182
35.5	20	710	-10.45	109.2	2184
45.5	15	682.5	-0.45	0.2025	3038
55.5	5	277.5	9.55	91.20	456
65.6	14	917	19.55	382.2	535
75.5	5	377.5	29.55	873.2	4366
85.5	3	256.5	39.55	1564	4692
95.5	1	95.5	49.55	2455	2455
	∑f=80	∑f99x=3676			$\sum fx^2$33,923

Mean = $\frac{\sum fx}{\sum f} = \frac{3676}{80}$

$= 45.95$

(b) $Q1 = 30.5 + \frac{3}{14} x\ 10$

$= 62.64$

$S.I.R = \frac{1}{2} (62.64 - 32)$

$= 15.32$

(c) Standard deciation

$= \sqrt{\frac{\sum fd^2}{\sum f}} = \frac{33923}{80}$

$= 20.59$

6. a) $x = 90 – (2 + 13 + 51 + 27 + 14 + 1)$

$= 90 – 84 = 6$

b) 15 – 19

c) i)

Class	x	f	D= x-A	fd	D^2	Fd^2
5-9	7	2	-15	-30	225	450
10-14	12	13	-10	-130	100	1300
15-19	17	31	-5	-155	25	775
20-24	22	23	0	0	0	0
25-29	27	14	5	70	350	4900
30-34	32	6	10	60	600	3600
35-39	37	1	15	15	225	225

$Ef = 90 \quad Efd = 170 \quad Efd^2 = 11250$

$Mean = \frac{E + d}{Ef} + A$

$= \frac{-170}{90} + 22$

$= 22 – 1.888 = 20.11$

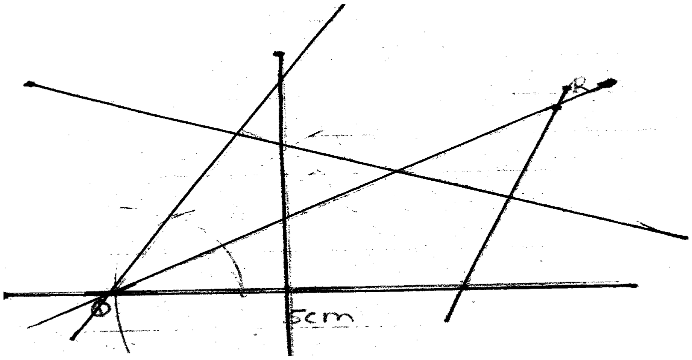
ii) $S.d = \sqrt{\frac{Efd}{Ef}} - \left[\frac{Efd}{Ef}\right]^2$

$= \sqrt{122 – (-1.888)^2}$

$= \sqrt{125 – 3.566} \quad = \sqrt{121.4}$

$= 11.02$

7.



RQ = 7.5± 0.1

< PRQ 40° ± 1

B1 circle through P, Q and R

d) $r = 4.1$ ° 0

$A = \pi r^2$

$^{22}/_{7}$ x 4.1 x 4.1 = 52.83

8.

Class limits	f	cf
-0.5 – 19.5	7	7
19.5- 39.5	21	28
39.5 – 59.5	38	66
59.5 – 79.5	27	93
79.5 -= 99.5	7	100

i) from the curve – median = 52. M1 A1

(ii) Inter quartile range = 66-38 = 28.

(iii) 7th 7/10 = 62.46marks

(iv) 60th percentile – 56.34

9. $25^2 + 24^2 + 22^2 + 23^2 + x^2 + 262 + 21^2 + 23^2 + 22^2 + 27^2 = 5154$

5.625 +576 + 2(484) + 2(529) + 676 + 441 + 729 + x2 = 5154

$X^2 = 81$

$X = 9$

-

(ii) $X = \frac{222}{10} = 22.2$

-$\Sigma(X - x)^2 = 2.8^2 + 1.8^2 + 0.22 + 0.8^2$

$13.2^2 + 3.8^2 + 1.22 + 0.8^2 + 0.2^2 + 4.8^2$

- $(x\text{-}x)^2 = 7.84 + 3.24\ 2(0.04) + 2(0.64)$

+174.24 + 14.44 + 1.44 + 23.04

$= \frac{225.6}{10}$

s.d 22.56

= 4.75

(b) (i) New mean = 22.2 + 3

= 25.2

(ii) s.d = 4.75

10. a) i) $x = A + \frac{\sum fd}{\sum f}$

$= 45.6 \frac{+ (-74)}{40}$

= 43.75

Class	Mis-pt x	d = (x – A)	Frequency f	fd	Fd^2
1 – 10	5.5	-40.1	1	-40.1	1608.01
11 – 20	15.5	-30.1	3	-90.3	8154.05
21 – 30	25.5	-20.1	4	-80.4	6464.16

31 – 40	35.5	-10.1	7	-70.7	4998.49
41 – 50	45.5	-0.1	12	-1.2	1.44
51 – 60	55.5	9.9	9	89.1	7938.81
61 – 70	65.5	19.9	2	39.8	1584.04
71 – 80	75.5	29.9	1	29.9	894.01
81 – 90	85.5	39.9	0	0	0
91 – 100	95.5	49.9	1	49.9	2410.01

i) Standard Deviation

$$D = \sqrt{e \frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$$

$$= \cancel{10}\sqrt{\frac{34135.11}{40} - \left(\frac{-74}{40}\right)^2}$$

$$\cancel{10} \text{ x } 29.1531 \qquad = 29.1531$$

b) 30th student = 10th from bottom

$$30.5 + \left(\frac{10-8}{7}\right)10$$

$$= 30.5 + 2.9 \qquad = \quad 33.4 \text{ marks.}$$

11. *a) Mean* $45.5 + \frac{530}{60}$

$$= 54.33$$

(b) Median $= 50.5 + \left(\frac{30.5-23}{14}\right) 10$

$$= 55.86$$

(c) Standard deviation $= \sqrt{\left(\frac{2300}{60}\right)^2 - \frac{530}{60}}$

$$= 17.52$$

(d) Modal class 51 – 60

12.

x	f	d	d2	fd	fd2
24.5	4	-30	900	-120	3600
34.5	26	-20	400	-520	10400
44.5	72	-10	100	-720	7200
54.5	53	0	0	0	0
64.5	25	10	100	250	2500
74.5	9	20	400	180	3600
84.5	11	30	900	330	9900
	200			-600	37200

(a) (i) Mean $= A + \frac{\Sigma fd}{\Sigma f}$

$$= 54.5 - \frac{600}{200}$$

$= 51.5$

(ii) Standard deviation

$= \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \frac{\Sigma fd^2}{\Sigma f}}$

$= \sqrt{\frac{37200}{200} - (-3)^2}$

$= \sqrt{186 - 9}$

$= 13.30$

(b) $Q_1 = 39.5 + \frac{50 - 30}{72} \times 10$

$= 42.28$

$Q_3 = 49.5 + \frac{150 - 102}{53} \times 10$

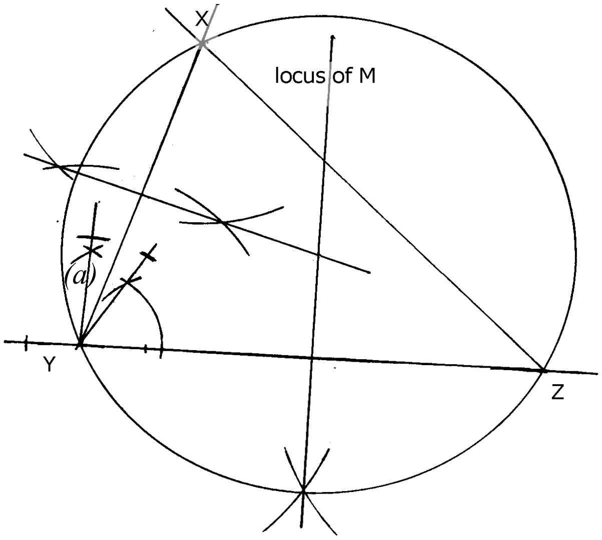
$= 58.56$

$Q_3 - Q1 = 58.56 - 42.28$

$= 16.28$

59. Loci

1.



√√Construction of ∠60° and ∠90°

Bisect ∠ btw 90° and 60° to obtain ∠75°

√ Construction of the given sides

Construction of Δ XYZ

(b) $\angle XYZ = 42^o \pm 1^o$

$XZ = 8.8 \pm 0.1$ *cm*

c) Bisecting any two sides

Drawing the circle

(d)Perpendicular bisector of YZ

Identification of locus of M

2. $AC = 8$ *cm* ± 0.1

$\angle ACB = 46^0 \pm 1^0$

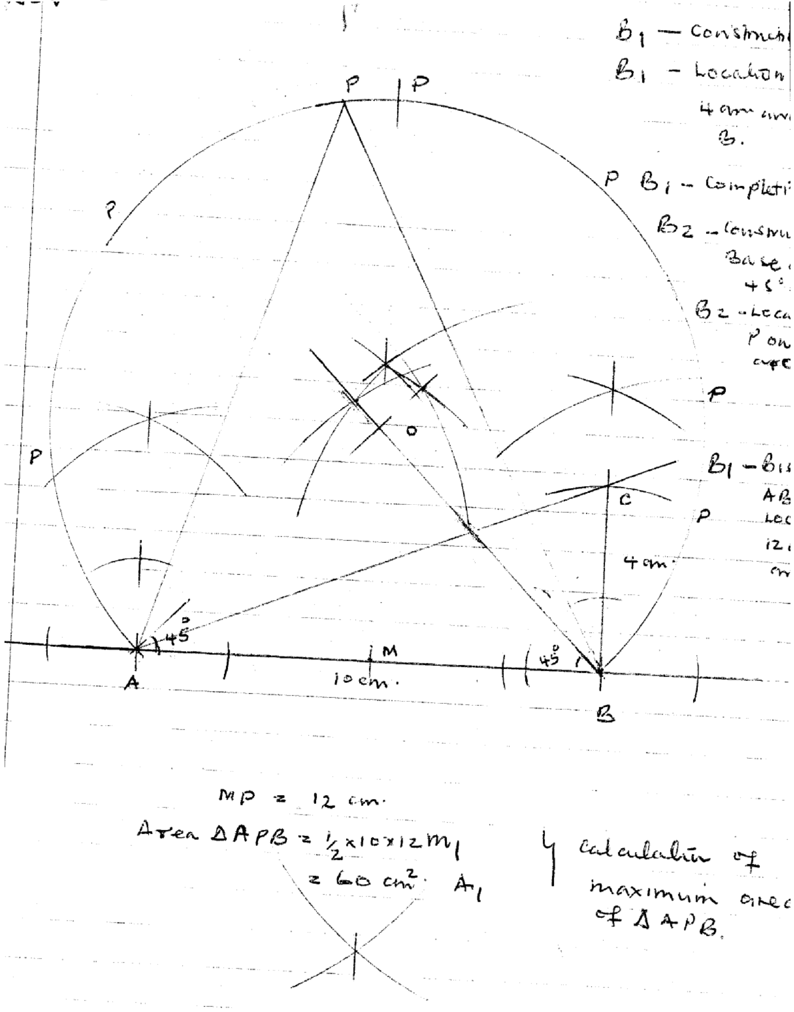
3. *a) $AC = 12.9 \pm 0.1cm$*

b) i) Line and well shaded B2

c) $h = 7 \pm 0.1$

d) ΔABC _____ Area = ½ x 8 x 7cm
= 28cm
i.e. ¾ x 28 = Area for ARB
= 21cm
i.e. ½ x 8 x h = 21
h = 5.25

4.

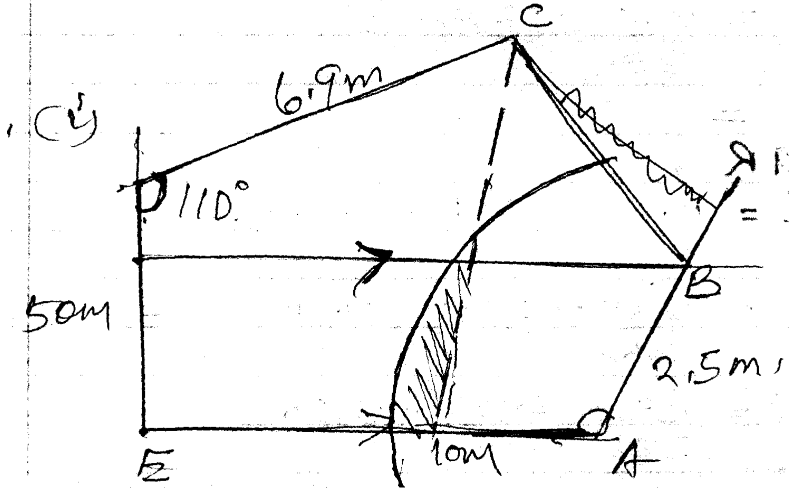


- Constructing of 90^0
- Location of C 4 cm away from B.

Completing Δ ABC
Construction of Base angles 45^0.
Location of P on major arc APB
Bisecting AB to locate P 12 cm away
Calculation of maximum area of Δ AP
B. B1
B1

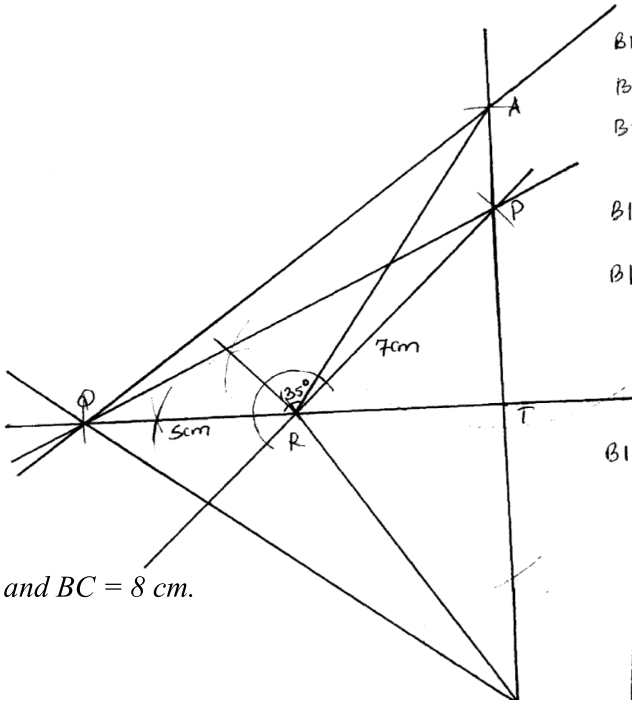
MP = 12 cm
Area Δ APB = ½ x 10 x 12 = 60 cm²

5. *i)*



ii) Yes

6. (a)



b) < PQR = 26° + 1°
d) 4.9 + 0.1cm
e) AT = u = 8.7cm
f) <AQR = 37 + 1

7. a) Δ ABC line AB = 7 cm and BC = 8 cm.

Construction of ∡60°

(b) AC = 7.6 ± 0.1 and

∡ACB = 53 ± 1°

(c) 2 sides bisector 1
Circle drawn radius 4.4. ± 0.1

(d) Bisect ∡ ACB
Bisection line to cut the circle to identify P

∡ PBC measure ≡

(a) AB = 7 cm, BC = 8 cm

∡ ABC = 60°

(b) AC = 7.6 ± 0.1 cm

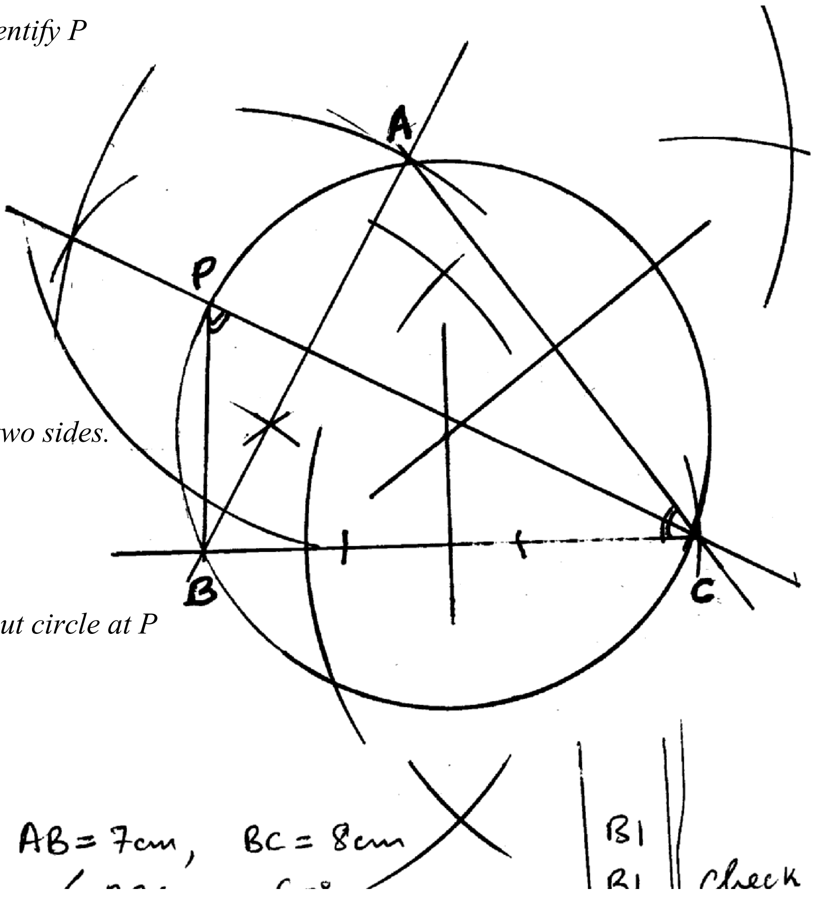
∡ ABC = 53°±0.1

(c) Perpendicular bisectors of any two sides.
Circle drawn
Radius = 4.4.±0.1. cm

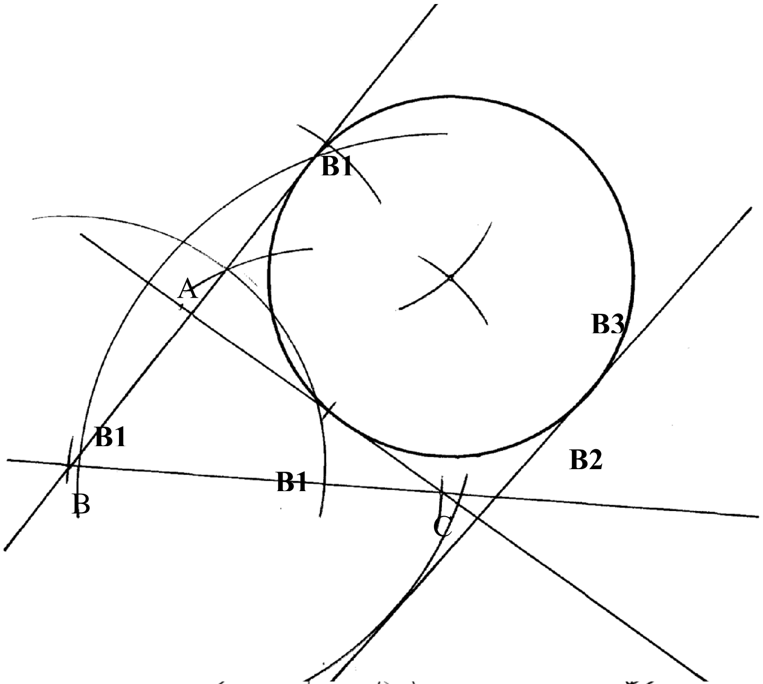
(d) ∡ ACB bisected
Bisection line drawn to cut circle at P

∡BPC = ∡BAC = 67°

∡ PBC = 88 ± 0.1°

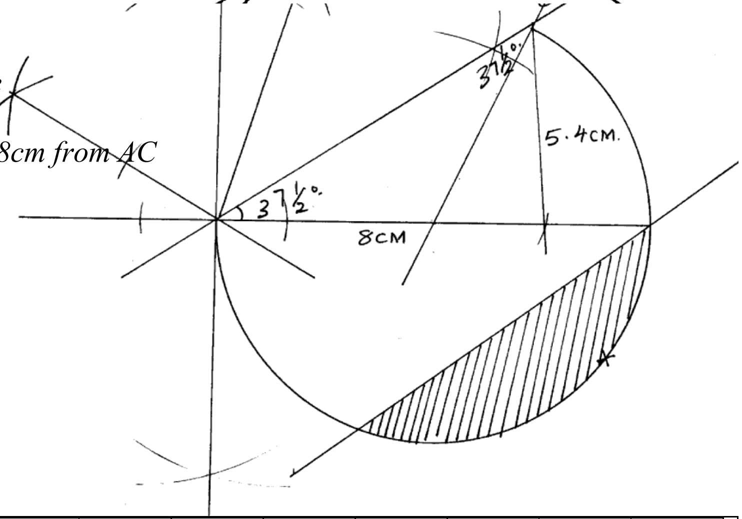


8. *B1 – Line AC*
B1Line AB
B1 AD
B3 – Drawing correct circle
B2- Tangent correctly drawn



9. *a)* *B1 for constructing 15*
B1 for constructing 75
B1 for completing tria
B1 for AC = 8.8 ± 0.1

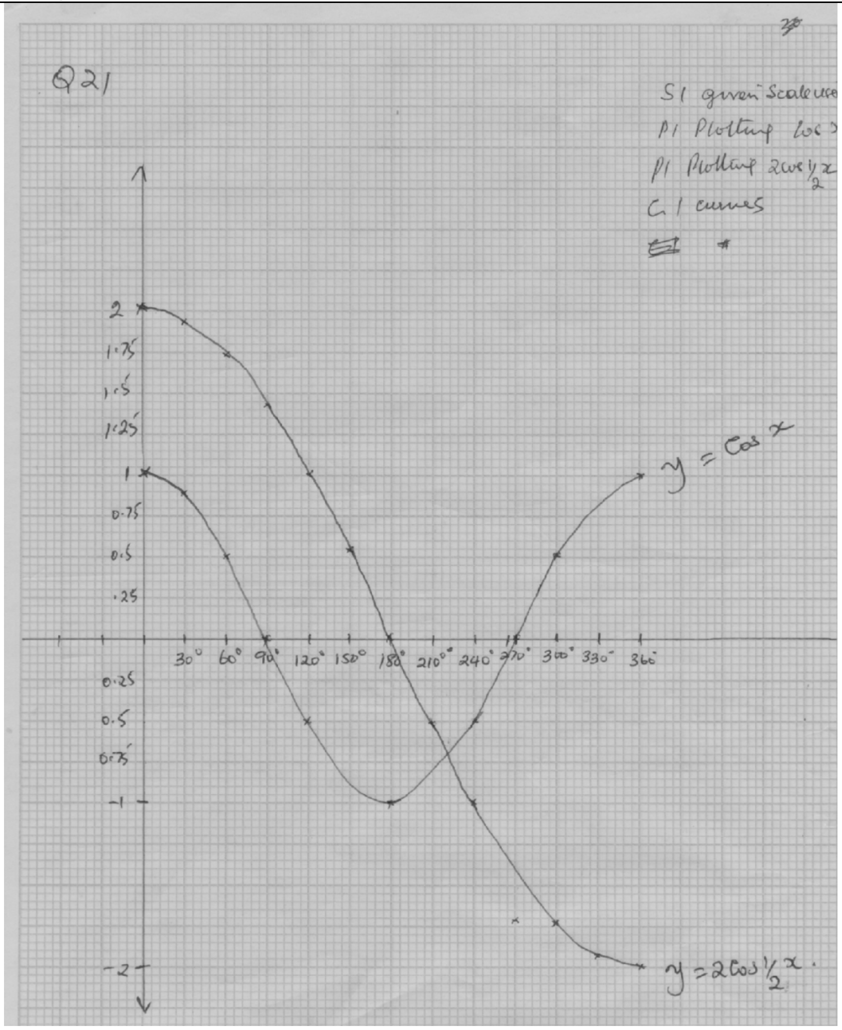
(b) *(i) B1For locating locus centre*
B1 for locus of X
(ii) B1 for constructing arcs 6.8cm from AC
B1 for locus Y
(c)B2 for shading the locus of P



60. Trigometric ratios 3

1.

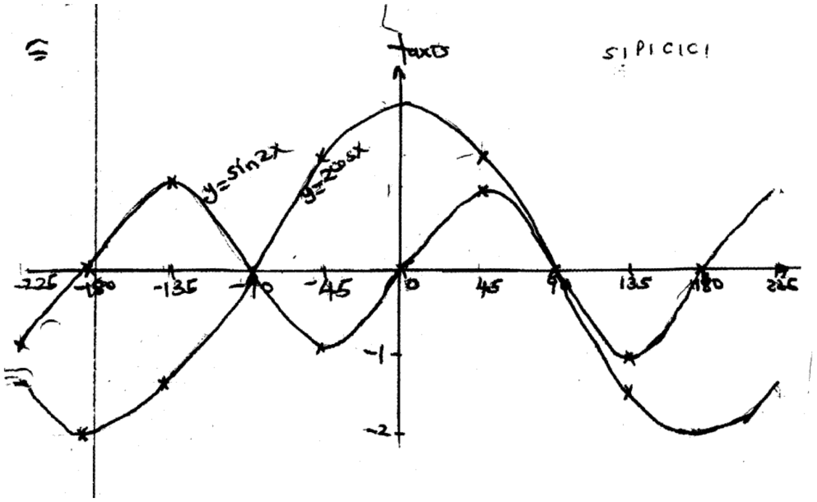
X^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0
Cos x	1.00	0.87	0.50	0	-0.5	-0.87	-1	-0.87	-0.5	0.5	0.7	1
2cos ½ x	2.00	1.93	1.73	1.41	1	0.52	0.00	-0.52	-1	-1.73	-1.93	-2.00

	 (a) amplititude = 2 B1 period = 720^0 B1 (b) 2cos ½ x = cos x X = 222^0 $\underline{+}$6^0	**B1** **B1** **S1** **P1** **P1** **C1** **B1** **B1**	All values of cos x All values of cos ½ x Given scale used Plotting cos x Ploting 2 cos ½ x Curve smooth continous

1. *a)*

X^o	*-225*	*-180*	*-135*	*-90*	*-45*	*0*	*45*	*90*	*135*	*180*	*225*
y = sin 2x		*0*		*0*	*1.0*		*1.0*	*0*		*0*	
y = 2cos x		*-2.0*		*0*	*1.4*		*1.4*	*0*		*-2.0*	

b)



(c) -90° or 90°

(d) (i) Highest point 1 unit

Lowest point - 1.4

2.

x	0	30	60	90	120	150	180	210	240	270	300	330	360
$2\sin(x+15^o)$	0.52	1.41	1.93	1.93	1.41	0.52	-0.52	-1.41	-1.93	-1.93	-1.41	-0.52	0.52
$\cos(2x-30^o)$	0.87	0.87	0	-0.87	0.87	0	0.87	0.87	0	-0.87	-0.87	0	0.87

B_1 B_1

B_1

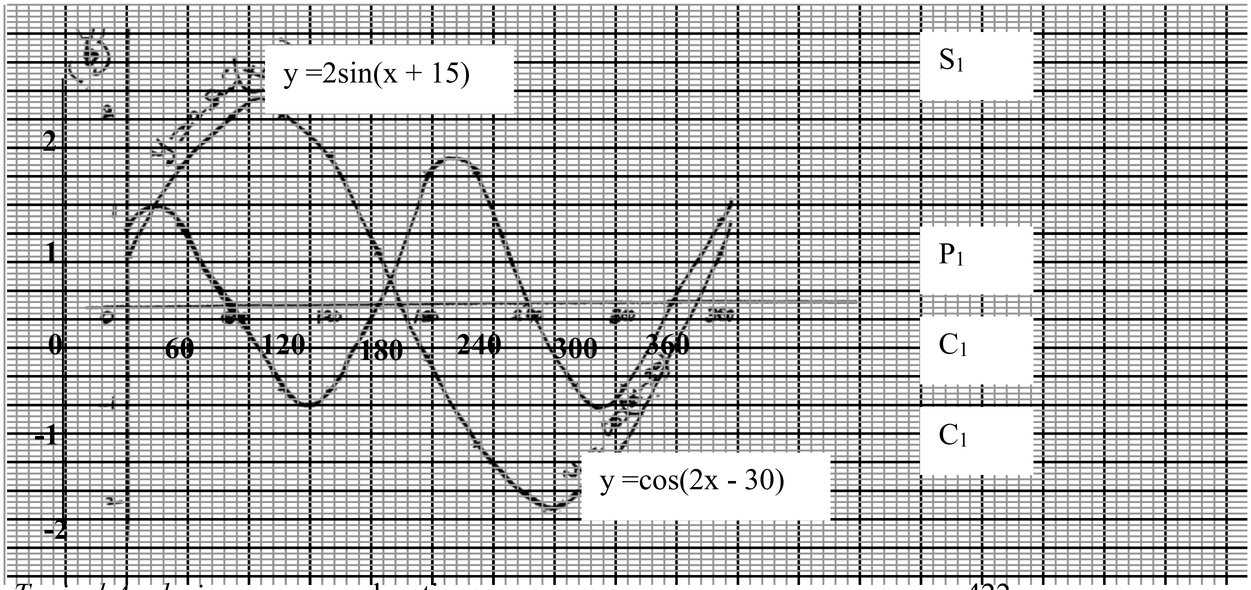
(i) Amplitudes:, $y = 2\sin(x + 15)$

$= 2$units

$y = \cos(2x - 30)$ B_1

$=1$unit B_1

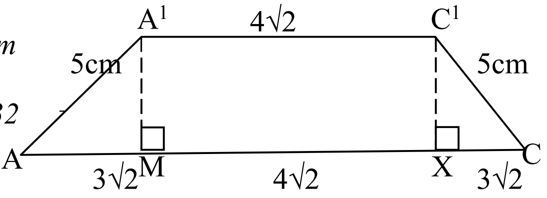
12^o, 159^o



3. *Determine the*

i) Altitude of the frustrum

Solution



$A^1C^1 = \sqrt{4^2 + 4^2} = \sqrt{32}$

$AC = \sqrt{10^2 + 10^2}$

$= \sqrt{200}$

$= 10\sqrt{2}$

$AM + XM = 10\sqrt{2} - 4\sqrt{2}$

$= 6\sqrt{2}$

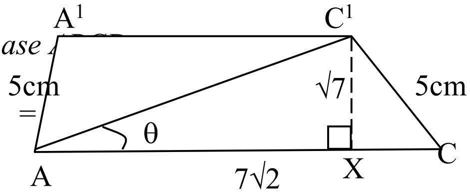
$AM = {}^{6\sqrt{2}}/_{2} = 3\sqrt{2}$

$Height = AM = \sqrt{5^2 - (3\sqrt{2})^2} = \sqrt{25 - 18}$

$= \sqrt{7} = 2.646$

$\therefore$ *the altitude of the frustrum = 2.646 cm*

ii) Angle between AC and the base



$AX = 3\sqrt{2} + 4\sqrt{2} = 7\sqrt{2}$

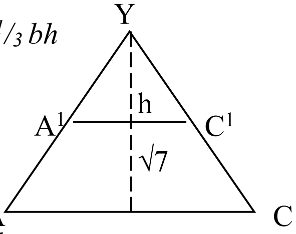
$Tan\ ø = {}^{CX}/_{AX} = {}^{\sqrt{7}}/_{7\sqrt{2}} =$

$= 0.2673$

$\theta = tan^{-1}0.2673$

$= 14.96°$

iii) Volume of pyramid $= {}^{1}/_{3}\,bh$



$AC = 10\sqrt{2}$

$A1C1 = 4\sqrt{2}$

$L.S.F = 10:4$

$$\therefore \frac{h + 2.646}{h} = \frac{10}{4}$$

$4(h + 2.646) = 10h$

$4h + 10.584 = 10h$

$6h = 10.584$

$h = 1.764$

$H = h + 2.646$

$= 1.764 + 2.646 = 4.410$

$Vf = ({}^{1}/_{3} \times 10 \times 10 \times 4.41) - ({}^{1}/_{3} \times 4 \times 4 \times 1.76)$

$= {}^{441.0}/_{3} - {}^{28.224}/_{3}$

$= {}^{413.776}/_{3}$

$= 137.592cm^3$

4. ✓*(a)* *table completed*

(b)

(c) (i) 3 *P1 – plotting* ✓

S1- scale ✓

C1 – smooth curve ✓

(ii) 180^o

(iii) Line y = 1 drawn

$x = 4.5^o$ *or* $72.8^{o\,-}$ 107.2^o - 175.4^o

5. $(^A/_B)^2 = \frac{p + 33q}{q - 3P}$

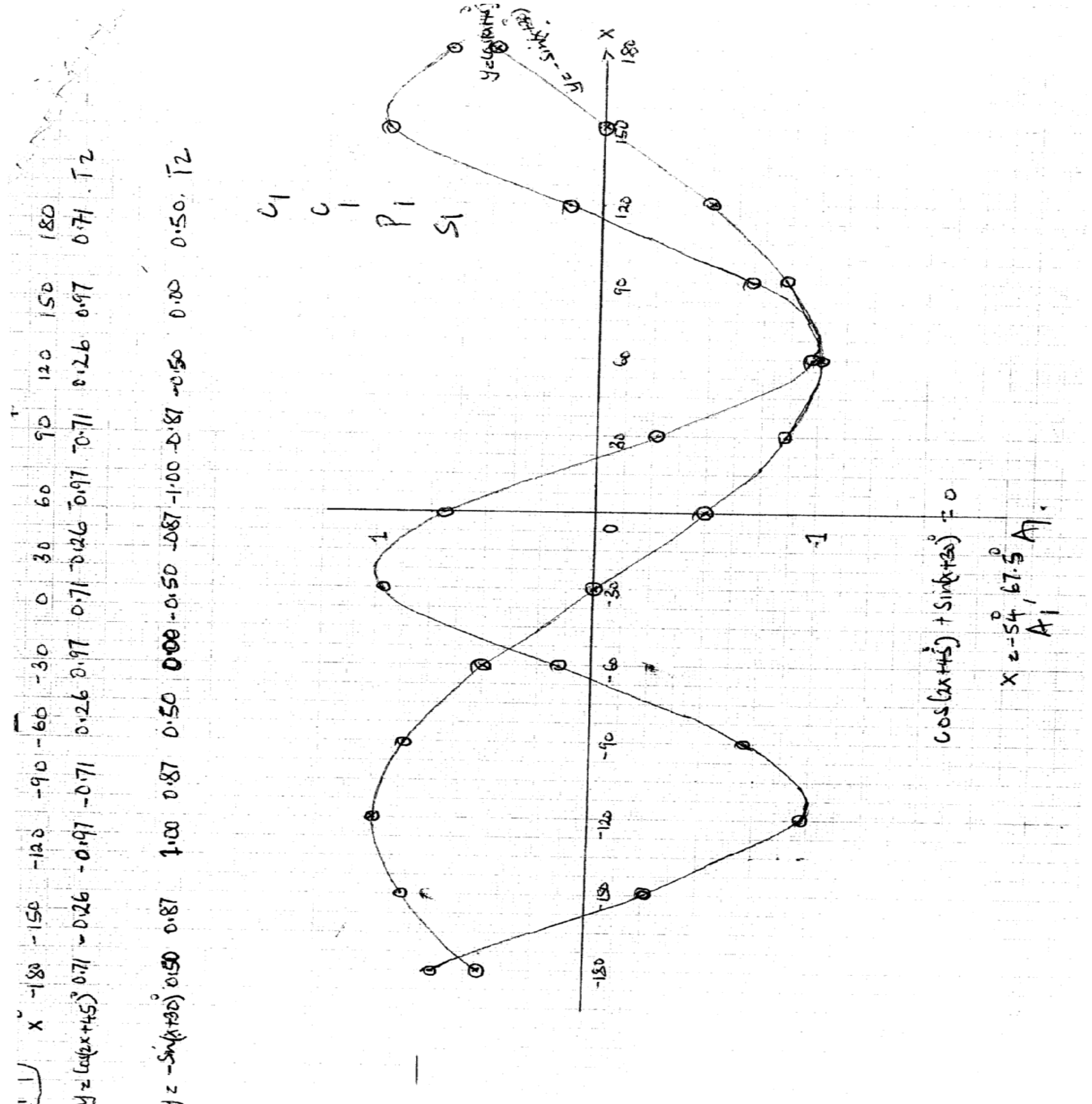
$A^2q - 3A^2P = BP + 3Bq$

$Aq^2 - 3Bq = BP + 3A^2P$

$2(A^2 - 3B) = BP + 3A^2P$

$Q = \frac{BP + 3A^2P}{A^2 - 3B}$

6.



x°	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
y = Cos(2x+45)°	0.71	-0.26	-0.97	-0.71	0.26	0.97	0.71	-0.26	-0.97	-0.71	0.26	0.97	0.71
y = -Sin(x+30)°	0.50	0.87	1.00	0.87	0.50	0.00	-0.50	-0.87	-1.00	-0.87	-0.50	0.00	0.50

T2

T2

C1

C1

P1

S1

cos(2x+45°) + sin(x+30°) = 0

x = -54°, 67.5° A1 A1.

7. 7. $\frac{\sqrt{3}}{2} \times \frac{1}{2}$

$\frac{1}{\sqrt{3}} \times \frac{1}{\sqrt{2}}$

$\frac{\sqrt{3}}{4} \times \frac{\sqrt{6}}{1}$

$\underline{\sqrt{18}}$

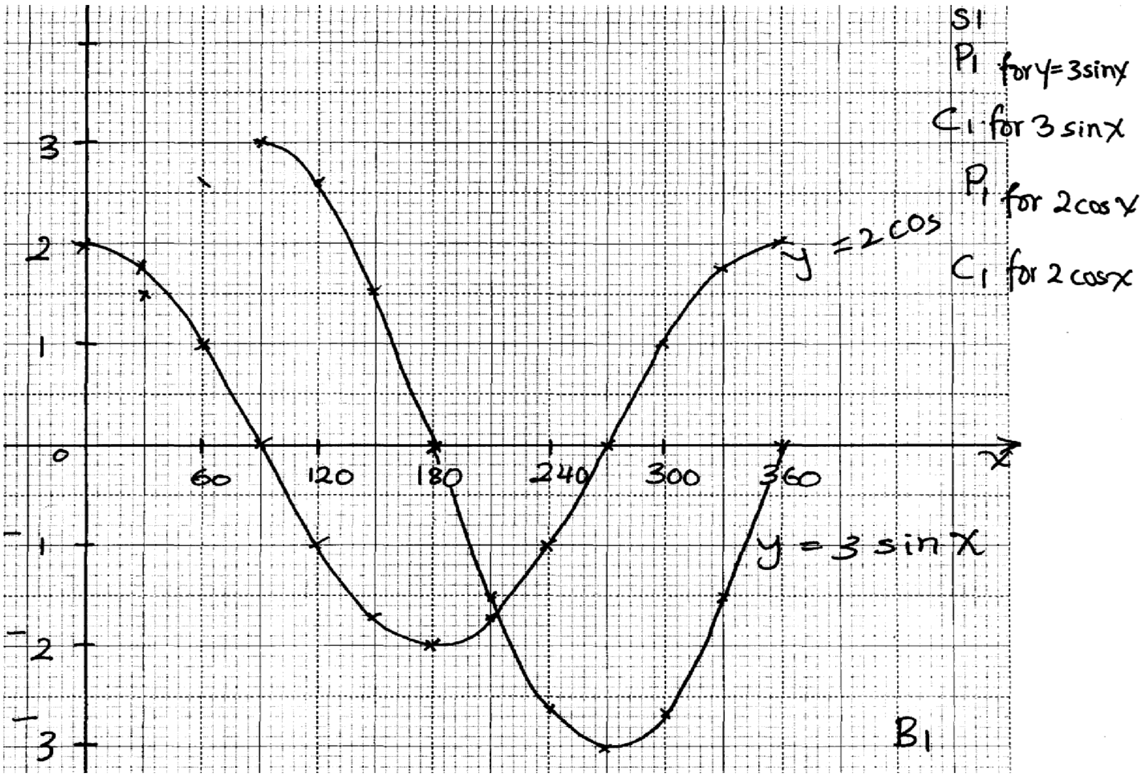
4

$\underline{3}$ √2

4

8. a)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
3sinx		1.5			2.6	1.5					-2.6		0
2cos x	2			0	-1.0			-1.7		0			



(c) (i) Amplitude =3

(ii) $x = 36^o$

$x = 216^o$

(iii) $33^o \leq x \leq 213^o$

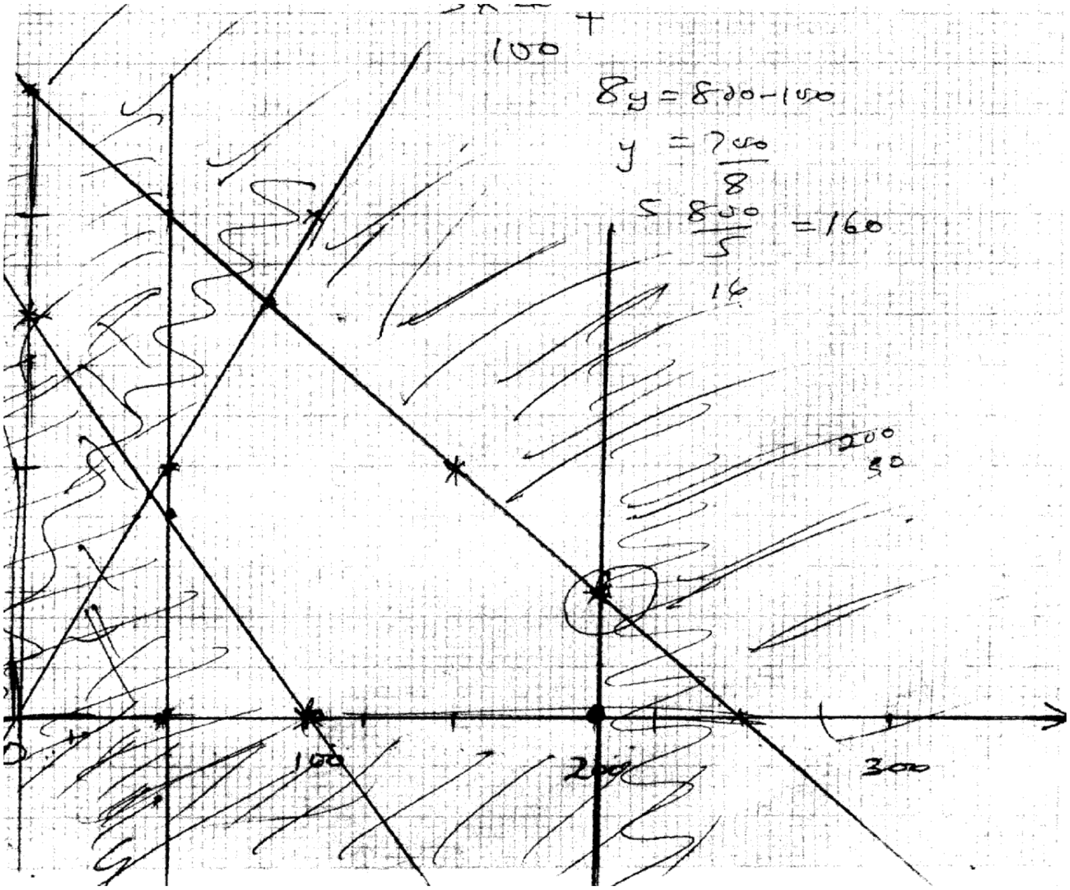
9.

x	0	90	180	270	360	450	540	630	720	810
sin ½x	0	0.71	1	0.71	0	-0.71	-1	-0.71	0	0.71
3Sin (½x + 60)	2.6	2.9	1.5	-0.78	-2.6	2.9	-1.5	0.78	2.6	2.9

10.

x	0^o	30^o	60^o	90^o	120^o	150^o	180^o
2 sin x	0	1	1.73	2	1.73	1.00	0

1-Cos X	1	0.13	0.50	1	0.06	1.87	2



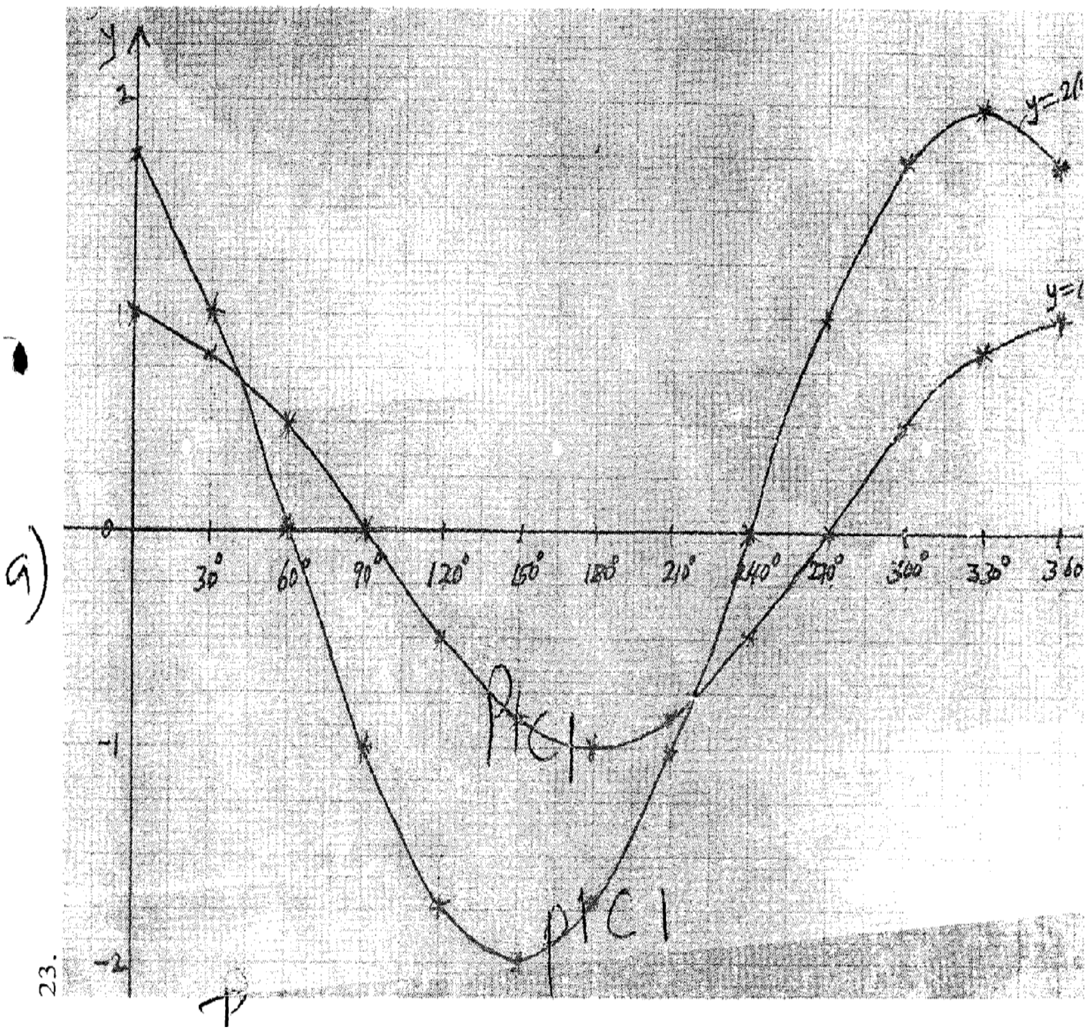
11. $\sin(x + 30) = 0.5$
$x + 30 = 30^o$
$x = 0$
0, 180, 360

12. (c)$10\sin x = {}^{-1}/_{50} + 5$
$Y = {}^{-1}/_{50} + 5$

X	0	50
y	5	4

$X_1 = 28^o \pm 1$
$X_2 = 70^o \pm 1$

12.



b) i) amplitude = 1

ii) Period = 360°

iii) 45°, 219°

13. $2\theta + 10 = 210^o, 330^o, 570^o, 690^o$

$2\theta = 200, 320, 560, 680$

$= 100^o, 160^o, 280^o, 340^o$

$= \frac{5\pi^c}{90}, \frac{8\pi^c}{9}, \frac{14\pi^c}{9}, \frac{17\pi^c}{9}$

14. $4\sin 2x + 4\cos x - 5 = 0$

$4(1-\cos 2X) + 4\cos x - 5 = 0$

$4\cos 2x - 4\cos x + 1 = 0$

$4\cos 2x - 2\cos x - 2\cos x + 1 = 0$

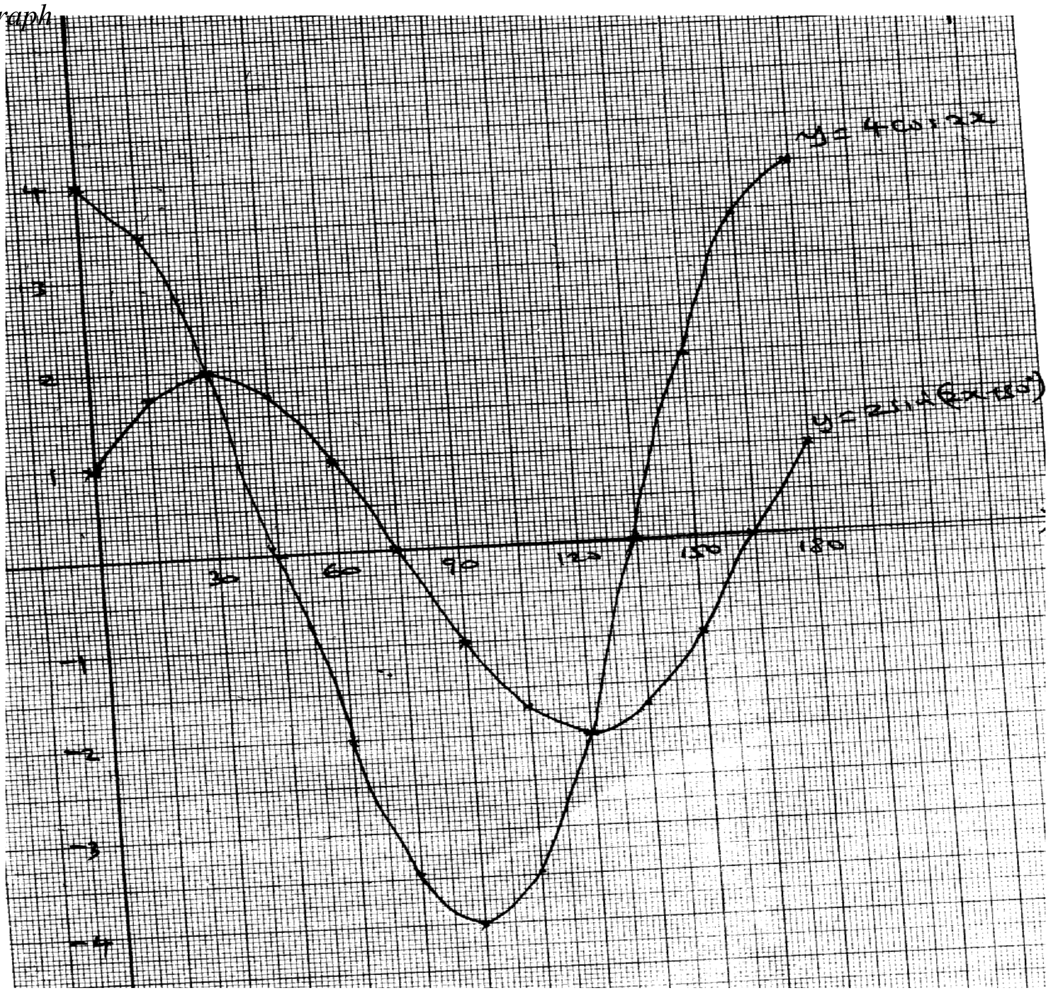
$(2\cos x - 1)2 = 0$

$X = 60°, 300°$

15.

x	15^o	60^o	150^o	165^o
$4\ Cos\ 2x$	3.46			3.46
$2Sin\ (2x + 30^o)$		1.00	-1.00	

(b) graph



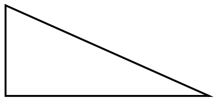
(c)(i) Amplitude = 4

(ii) period = 180^o

(d) $x = 30^o, 120^o$

60. Three dimensional geometry

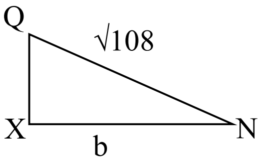
1. a)



$QN = \sqrt{12^2 - 6^2}$

$= 10.39$

b)

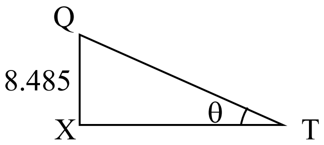


$QX = (\sqrt{108})^2 - 6^2$

$= \sqrt{72}$

$= 8.485$

c)



$\tan\theta = \frac{8.485}{6}$

$\theta = 54.73^0$

d) $\tan\theta = \frac{6}{10}$

$\theta = 30.96$

$\frac{6}{10}$ obtuse $= 180^0 - 30.96$

$= 149.04^0$

2. a) $\text{Sin } 36^0 = \frac{5}{a}$

Where a is the side

$a = \frac{5}{\sin 36} = 8.507$

$h^2 = 18.2 - 8.507$

$= 258.87$

$H = 16.09$ cm

b) $\frac{1}{2} ab \sin\theta$

$\frac{1}{2} \times 8.507^2 \text{ Sin } 72 \times 5$

$= 172.06 \text{ cm}^2$

c) $\text{Tan } 36^0 = \frac{5}{x}$

$x = 6.882$

$\text{Tan } \theta = 16.09$

6.882

$\theta = 66.84^2$

d) $\frac{1}{3} \times 172.06 \times 16.09 = 922.8cm^3$

e) $S = 23.2$

$\sqrt{23.2 (23.2 - 18.2) (23.2 - 10)}$

$= 87.50cm^3$

3. (i) $\frac{1}{3} \times 4.2 \times 7.5h = 52.5$

$h = \frac{52.5 \times 3}{4.2 \times 7.5} = 5.0cm$

(ii) $AC = \sqrt{4.2^2 + 7.5^2}$

$= \sqrt{17.64 + 56.25}$

$= \sqrt{73.89}$

$= 8.596$

$AO = 8.596 \div 2 = 4.298$

$AV = \sqrt{AO^2 + OV^2}$

$= \sqrt{4.298^2 + 5^2}$

$= 18.47 + 25$

$= \sqrt{43.47}$

$= 6.6cm$

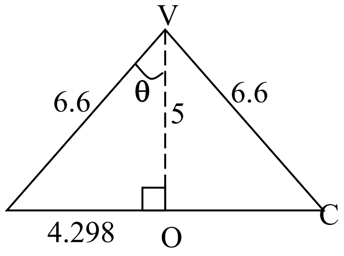
(iii) $\tan\theta = \frac{4.298}{5}$

$= 0.8596$

$\theta = 40.68^o$

$\angle AVC = 40.68 \times 2$

$= 81.36$



Alternative

$\cos\theta = \frac{5}{6.6} = 0.7576$

$\theta = 40.749^oC$

$\angle AVO = 40.749^o$

$\angle AVC = 81.498^o$

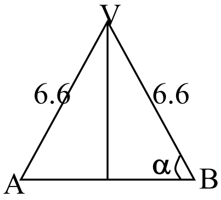
(iv) $\cos\alpha = \frac{2.1}{6.6}$

$= 0.3182$

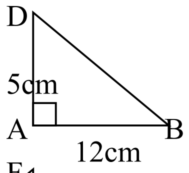
$\alpha = 71.45^o$ Acute angle

obtuse angle $= 180^o - 71.45^o$

$= 108.55^o$



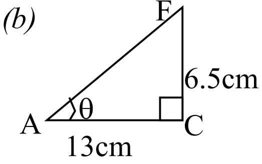
4. (a)



$BD^2 = 122 + 52 = 144 + 25 = 169$

$BD = \sqrt{169} = 13m$

(b)

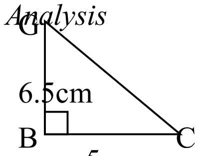


$AF^2 = 13^2 + 6.52 = 169 + 42.25$

$=211.25$ $AF = \sqrt{211.25} = 14.53cm$ B1

$\tan\theta = \frac{6.5}{13} = 0.5$ M1

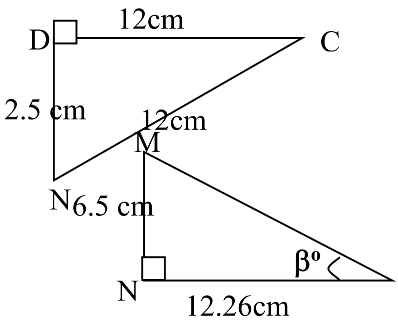
$\theta = 26.57^o$ A1



(c) $\tan\alpha^o = \frac{6.5}{5} = 1.3$ M1

$\alpha^o = 52.43$ A1

(d)



$NC^2 = 2.5^2 + 12^2 = 150.25$

$NC = \sqrt{150,25} = 12.26$ B1

$MC^2 = 6.52 + 150.25$

$= 42.75 + 150.25$

$= 192.5$

$MC = \sqrt{192.5} = 13.87$ Ba

$\tan\beta^o \frac{6.5}{12.26} = 0.5302$

$\beta^o = 27.93^o$ B1

5.

i) $Or = 16^2 - 5^2$

$= \sqrt{256 – 25}$

$= 15.198$ cm

ii) $\tan\theta = \frac{5.066}{4} = 1.2665$

$\therefore \theta\, 51.71^0$

6. a) Height

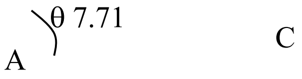
$AC = \sqrt{AB^2 + BC^2}$

$= \sqrt{10^2 + 10^2}$

$= \sqrt{200}$

$= 14.142$

$\therefore OA = ½\, AC = \frac{14.14\,^2}{2} = 7.71$



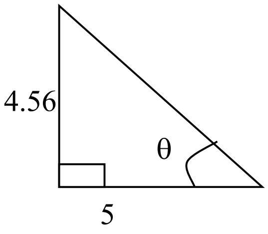
$OE = \sqrt{AE^2 - AO^2}$

5

$= \sqrt{64 - 59.44} = 4.56$

b)i) $\tan\theta = \frac{4.56}{5.00} = 0.912$

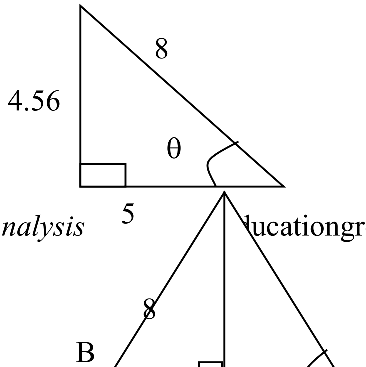
$\theta = 65.78°$



ii) $\tan\theta = \frac{4.56}{7.71} = 0.5914$

$\theta = 30.\ 6°$

c)



< AEC = 30.6 x 2
= 61.2°

7. *Let length of cut off pyramid be meters*

Then $\frac{7 + h}{H} = \frac{5.5}{2.1}$

$14.7 + 2.1h = 5.5$

$3.4h = 14.7$

$h = 4.3$

Slant height of big pyramid

$= \sqrt{11.3^2 + 2.75^2} = 11.6$

Slant height of the pyramid cut off

$= \sqrt{4.3^2 + 1.05^2} = 4.4m$

Area of EFCD $= \frac{1}{2} \times 11.6 \times 5.5 - \frac{1}{2} \times 4.4 \times 2.1$

$= 27.28$ *m*

Total surface area $= 4 \times 27.28 + 2.1 \times 2.1 = 113.5$

b) ½ *litre paint* $10m^2$

4 litres paints $80m^2$

$\therefore 113.5m^2$ *requires 2 tins*

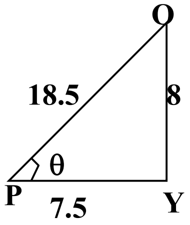
$2 \times 650 =$ *Kshs.1300/=*

8. *(a)* $PR = 12^2 + 9^2 = 144 + 81 = 225 = 15cm$

$h = \overline{19.52 - 7.52}$

$= \sqrt{380.25 - 56.25}$

$= \sqrt{324} = 18$



(b) $\tan\theta = \frac{18}{7.5} = 2.4$

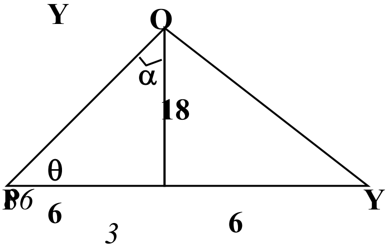
$\theta^2 \tan 2.4 = 67.38^o$

(c) $\tan \alpha = \frac{6}{18} = \frac{1}{3}$

$\alpha = \tan^{-1} 0.3333$

$= 18.43^o$

$\therefore \angle x OY = 2 \times 18.43 = 36.86$



(d) Volume $= \frac{1}{3} \times 12 \times 9 \times 18$

$= 648cm^3$

9. *a)* $AC^2 = 12^2 + 12^2 = 288$

$\therefore AC = \sqrt{288} = 16.97$

$VO^2 = h^2 = 24^2 - (\frac{16.97}{2})^2 = 504$

$h = \sqrt{504} = 22.45cm$

b) *Base area* $= 12 \times 12 = 144cm$

$\therefore$ *Volume* $= \frac{1}{3} \times 144 \times 22.45$

$= 1077.6cm^3$

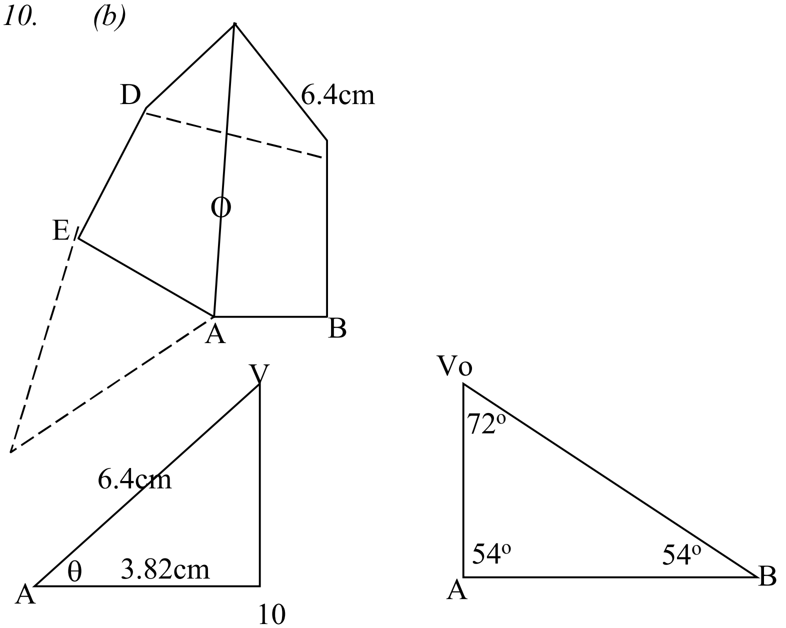
c) Slanting surface = $\sqrt{30(30-24)\ (30-24)\ (30-12)}$

$= 139.44cm^2$

Total curved S.A = $139.44cm^2 \times 4 + 144cm^2$

$= 701.6cm^2$

10. (b)



$AO = \frac{4.5 \times \sin 54^o}{\sin 72^o} = 3.82cm$

$= \cos^{-1} \frac{(3.82)}{6.4} = 53.35^o$

(c) $Vo = \sqrt{6.42 - 3.82}$

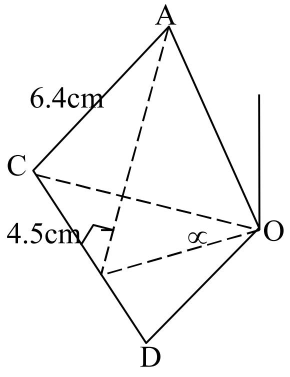
$= 5.13$

$VX = \sqrt{6.4^2 - 2.55^2}$

$= 5.99cm$

$\propto = \sin^{-1} ({}^{Vo}/_{Vx})\ \sin\text{-}1({}^{5.13}/_{5.99})$

$\propto = 58.91^o$



11. *a) Longitude difference = 139 ° + 41 °*

= 180 °

b) Distance along latitude = $^{\emptyset}/_{360} \times 2\pi r \cos\theta$

$= {}^{180}/_{360} \times 2 \times {}^{22}/_{7} \times 6370 \cos 60°$

$= 22 \times 910 \times 0.5$

$= 10{,}010$ *Km*

Or via north pole (great circle)

Latitude difference = 60°

Distance = $^{60}/_{360} \times 2 \times {}^{22}/_{7} \times 6370$

$= 6673.33$ *Km*

c) Distance = $^{\text{long diff}}/_{360} \times 2\pi R \cos 60°$

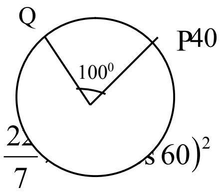
$420 = {}^{\emptyset}/_{360} \times 2 \times {}^{22}/_{7} \times 6370 \cos 60°$

$$\theta = \frac{420 \times 360 \times 7}{2 \times 22 \times 6370 \cos 60°}$$

$= 7.552°$

Longitude of C = 41° - 7.55° = 33.45°N

61. Longitudes and latitudes

1	∠ difference  $40 + 60 = 100^0$ Area $= \frac{100}{360} \times \frac{22}{7}$ $s60)^2$ $= \frac{55}{63} \times 0.01$ $= 0.008730$ $\left(87.30cm^2\right)$	B1 M1 A1	Angle difference
		3	
2	a) i) 480-1015’ = 46045’ B(46045’N,370E) ii) Diff in longitude $\Rightarrow 37 + 23 = 60^0$ $D = \frac{60}{360} \times 2 \times \frac{22}{7} \times 6370 \cos 46.75^0 = 4{,}572.45km$ b) i) $\frac{60 \times 4}{60} = 4hrs$ difference ∴ Time at C = $7.00 - 4hrs$ = 9.00p.m ii) Time taken $= \frac{4572.45}{840} = 5.44hrs$ Arrival at c $= 9.00 + 5hrs 26 \min s$ = 2.26a.m	M1 A1 M1 M1 A1 M1 A1 M1 M1 A1	Subtraction ✓position Addition Allow 4,572km Or (1426hrs)
		10	
3.	Angle difference btw longitudes (41+3) = 440 Dist = 60 x angle difference x cos latitude		

	1370 = 60 x 44 cos P	M1	Subst
	Cos P = $\frac{1370}{60 \times 44}$	M1	Cos P the subject
	Cos-1 o.51894 = 58.740		
	58.740	A1	
		03	
4.	a = 400 E	B1	
	b = 600 N	B1	
	c = 200 W	B1	
	(b)		
	R (600N, 400E)		
	P (300N, 200W)		
	Q (300N, 400E)		
	S (600N, 200W)		
	PQR PQ = 600 x 60 cos 300		
	= 3600x		
	= 3117.69 ✓	M1	✓values of PQ and QR
	QR = 30 x 60 = 1800nm ✓		
	Total distance = 1800 + 3117.69	A1	
	= 4917.69nm		
	PSR PS = 30 x 60 = 1800nm	M1	
	SR = 60 x 60 cos 60 = 1800 =	A1	✓value of PS and SR
	Total distance 1800 + 1800 = 3600 ✓		
	(c) PQR speed 400nm/hr	B1	
	Time = 4917.69 = 12.294 hrs 400		
	Along PSR	B1	
	Time = 3600 = 12 hrs 300	B1	
	2nd pilot by 0.294hrs or 18 min		
		10	

1. *(70 – 25 x 60 = 2700*
   2700 Cos 47= 2700 x 0.68 = 1841.4nm

2. *(a)* $\frac{22}{7} \times 6370 \times 2 \times \frac{\alpha}{360} = 1600$
   $\alpha = 14.4^o$
   Position $(4.4^oN, 60^oE)$
   (b) $72 \times 60 \cos 4.4^o$
   = 4307nm
   (c) $T = \frac{D}{S} = \frac{4307 \times 1.853}{800}$
   = 9.976 hrs
   (d) Difference in longitude $= 72^o$
   15^o *– 1hr*
   $\therefore 72^o = \frac{72}{15}$ *= 4.8hrs = 4hrs 48mins behind*
   1300hrs
   - 448
   8.12a.m

3. *a)* $800x + 1600y \geq 8000$
   $x + 2y \geq 10$

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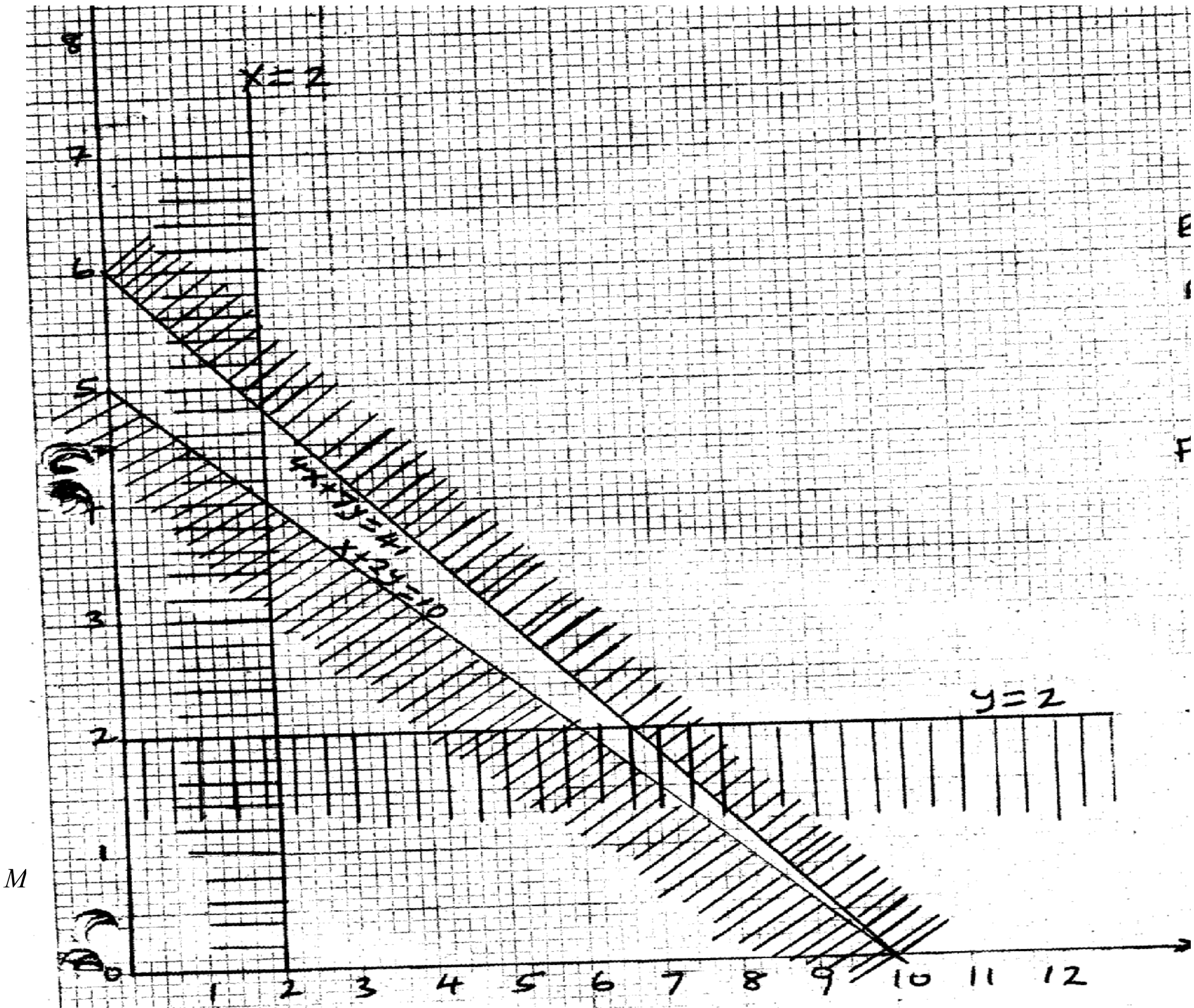
$4x + 7y \leq 41$

$x \geq 2$

$y \geq 2$

b)



M

c) For type A = 3 and B = 4

No. of operators = (3x4) + (4x7)

4. a) $^{180}/_{300}$ x 2 x 22/7 x 6370 cos 48 = 13,396Km

b) Km = $\frac{(180 - 96)}{360}$ x 2 x$^{22}/_{7}$ x 6370

= $^{84}/_{360}$ x 2 x $^{22}/_{7}$ x 6370 = 9342.7 km

Time = $\frac{9342}{280}$ = 33.36 km/hr

c) θ = 180°

time = $\frac{(4 \times 180)}{60}$ = 12 hrs

(14:15 – 12:00) = 2:15a.m

d) $\frac{600}{60}$ Nm

60°

Q = (12N, 30W)

5. Long Difference = 24-12

= 12^o

12 x 60 Cos34^o = 596.9nm

S = $\frac{\text{“5.96”nm}}{1.5}$

= 397.9knots

6. (i) AB = $\frac{80}{360}$ x 2 x 3.142 x 25

—|

∩ = $\frac{4 \times 25}{9}$ x 3.142

= $\frac{314.2}{9}$ cm

= 34.9111 cm.

(ii) $\frac{\theta}{360}$ x 2 x 3.142 x 25cos 50^o = $\frac{314.2}{9}$

θ = $\frac{\frac{314.2}{9} \times 360}{50 \times 3.142 \times \cos 50}$

= 93.35^o

Longitude of BC(93.35^o – 90^o)E

= 03.35^0E.

(iii) $\frac{\theta}{360}$ x 3.142 x 50 = $\frac{314.2}{9}$

θ = $\underline{314.2}$ x 360

$$\frac{9}{3.142 \times 50}$$

$= 80^o$

Latitude of B $(80^o - 50)$ S

$= 30^oS$

Position of B $\Rightarrow (30^oS, 03.35^oE$

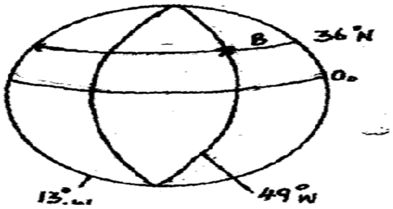
7. $2133.6 = \frac{x}{360} \times 2 \times \frac{22}{7} \times 6380 \cos 70^o$

$\propto = \frac{21.33 \times 6 \times 360 \times 7}{44 \times 6380 \times \cos 70^o}$

$\propto + 15^o = 56^o$

$= 56 - 15 = 41^oN$

$\therefore$Location of B is $B(70^oS, 41^oN$



8. (a) Longitudinal diff = 180^o

(b) (i) $^{180}/_{360} \times 2 \times {}^{22}/_{7} \times 6370 \times \cos 360o$

$= 16196.52m$

(ii) $^{180}/_{360} \times 2 \times {}^{22}/_{7} \times 6370$

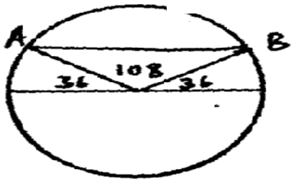
$= 12012km$

(c) $^{\theta}/_{360} \times 2 \times {}^{22}/_{7} \times 6370 \cos 36 = 840$

$= 9.3353^o$

$=$ position $C = 131 - 9.3^oW$

$C(36^o N,\ 121.7^oW)$



9. a) $PQ = {}^{120}/_{360} \pi \times 6370 \times 2$

$= {}^{240}/_{360} \pi \times {}^{22}/_{7} \times 6370 = 13,346.6$

b) $2PR \cos 60°$

$PR = {}^{100}/_{360} \times 2\pi \times 6370 \cos 60$

$= {}^{200}/_{360} \times {}^{22}/_{7} \times 6370 \cos 60 = 5561.1km$

c) $PN = {}^{30}/_{360} \times 2 \times {}^{22}/_{7} \times 6370$

$= 3336.67$ km

10. (a) (i) $60 (z - 50) = 1200$

$Z = 20$

$Z = 70^oS$

(ii) $xy = \frac{48 \times 2 \times 6370 \cos 50}{360} = 3431.629km$

(b) (i) $XZ = \frac{3431.627}{1.853} + 1200 = 3051.9km$

Time $= \frac{3051.9}{400} = 7.6hrs$

(b) (ii) tie $= 7.36 + 4.28 = 12.04$

11. a)$A - B = 45 + 35 = 800$ Lat. Diff

= 80 X 60 = 4800nm

B – C = 15 + 45 = 60 0 long. Diff

= (60 X 60 X cos 45

= 3600 X 0.7071 = 2545.56nm

Total distance = (4800 + 2525.56)nm

= 7345.56nm

≈7346nm (4.s.f)

b) $\frac{\cancel{80}}{\cancel{360}}$ X 2 X $\frac{22}{\cancel{7}}$ X $\cancel{6370}$ 910

2 p 9

= $\frac{88 \text{ x } 910}{9}$

= 8897.78 km

≈ 8898km (to nearest km)

c) B- C = $\frac{\cancel{60}}{\cancel{360}}$ X 2 X $\frac{22}{\cancel{7}}$ X $\cancel{6370}$ X cos 45^0

= $\frac{22 \text{ X } 910 \text{ X } 0.7071}{\cancel{6}\ 3}$

= 471.8.7 km 3

A – C in Km = (8898 + 4718.70

=13616.7 KM

Time taken = $\frac{13616.7}{840}$ = 16.21 hours

= 16 hrs 13min

Arrival time = 08.15
+ 16.13
24.28

= 12.28 am followinmorning

62. Linear programming

1.	(a) let the No. of garments of type A be x and those of type B be y		
	(i) 3x + 2 ½ y ≤600 (material)	**B1**	
	(ii) x ≤1000	**B2**	all✓
	y ≥ 80	**B1**	any two✓
	x ≥ 0		
	(b) Lines drawn 3x + 2 ½ y = 600	**B1**	✓lines and shading✓
	x = 100 x = 80	**B1**	✓lines and shading
	x = 0 (c) The object function is	**B1**	for✓region indicated
	P = 80x + 60y where P = total profit Either drawn a search line by choosing an appropriate value of P	**B1**	✓objective function
	e.g 12000 = 80x + 60y or inspect for maximum profit using points further from origin maximum profit	**B1**	Use of search line or inspection
	100 garment og type A 120 garments of type B	**B1** **B1**	✓

1. $30x + 20y \leq 4800$……..(i)

$30x + 40y \geq 3600$……..(ii)

$10x \langle 30y$…………(iii)

$x \rangle 0 \quad y \rangle 0$

objective function $10x + 12y = K$

$3x + 2y = 480$

X	40	60	80
y	180	150	120

$3x + 4y = 360$

X	20	40	60
Y	75	60	45

$x = 3y$

X	30	45	60
Y	10	15	20

(ii) consider (60,40)

$10(60) + 12(40) = 600 + 480$

$= 1080$

$10x + 12y = 108\ 0$

$5x + 6y = 540$ – search line

X	20	40	60
y	73	57	40

Maximum profit at (α, 240)

No queen cake , 240 marble cakes

(iii) 240 X 12 = sh. 2880

(iv) $10x + 12y \geq 600 \Rightarrow 10x + 12y = 600$

$5x + 6y = 300$

X	α	12	60
y	50	40	0

2. Machine A — Machine B

	Machine A		Machine B	
	Shirts	Jerseys	Shirts	Jerseys
No.	x	y	x	y
Hrs.	@2hrs	@3hrs	@2hrs	@1hr

(i) $2x + 3y \leq 24$

(ii) $2x + y \leq 12$

(iii) $y > x$

(iv) $x > 0$

$y > 0$

Max pt(3,6)

Max profit = 22 x 3 + 200 x 6

= 600 + 1200

= Shs. 1800

(i) $2x + 3y = 24$

x	**0**	**12**
y	**8**	**0**

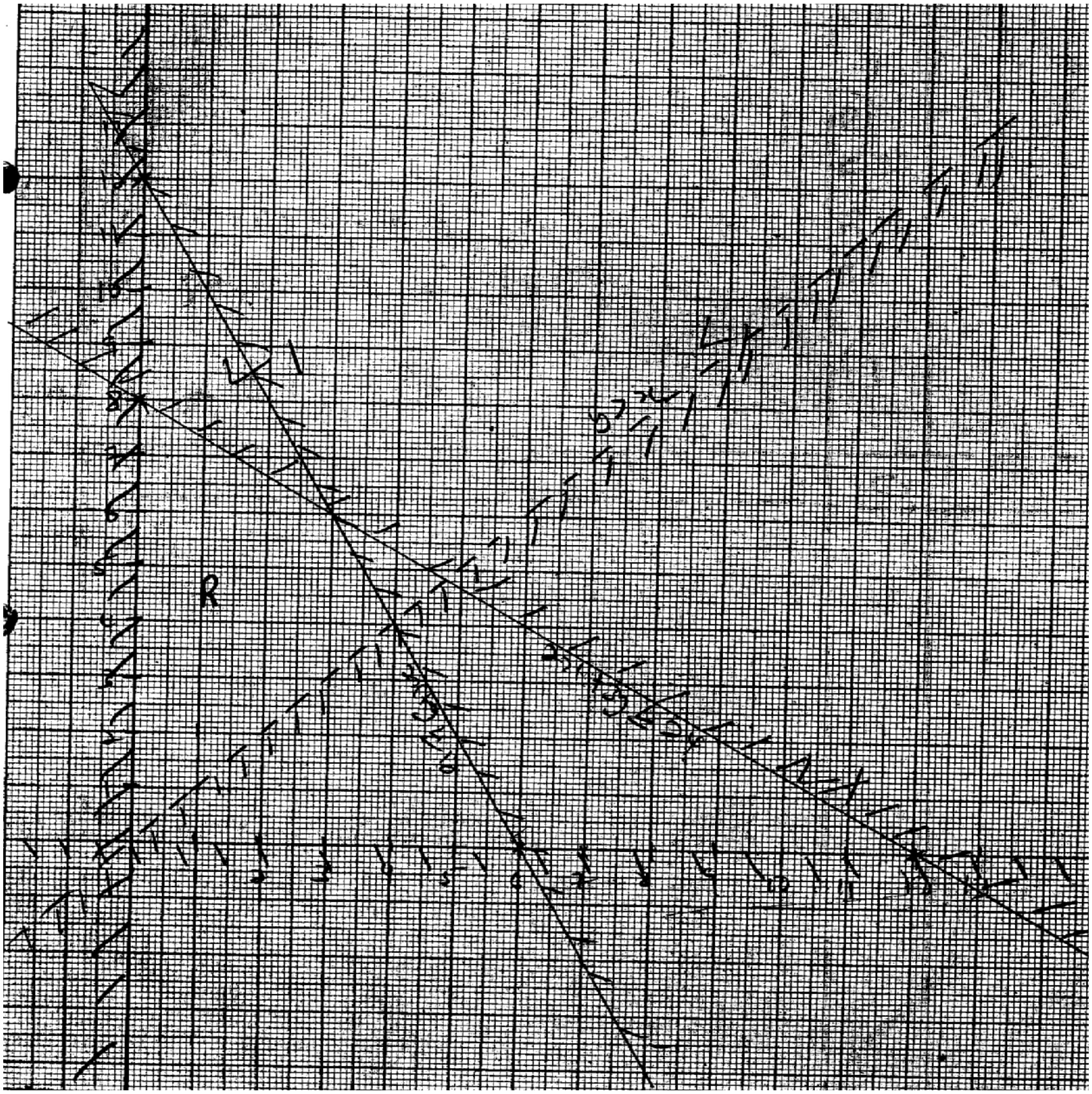
(ii) $2x + y = 12$

x	**0**	**6**
y	**12**	**0**

(iii) $y = x$

(iv) $y = 0$

$x = 0$



3. (a) $3x + 7y \leq 210$

$x + y 20$

$x < 2y$

$x > 15$

(b) refer

(c) $120x + 140y = 120 \times 130 + 140 \times 10$

Profit = shs.5960

$x = 31$

$y = 16$

4. Passengers

$64x + 48y \geq 384$ i.e. $8x + 6y \geq 48$

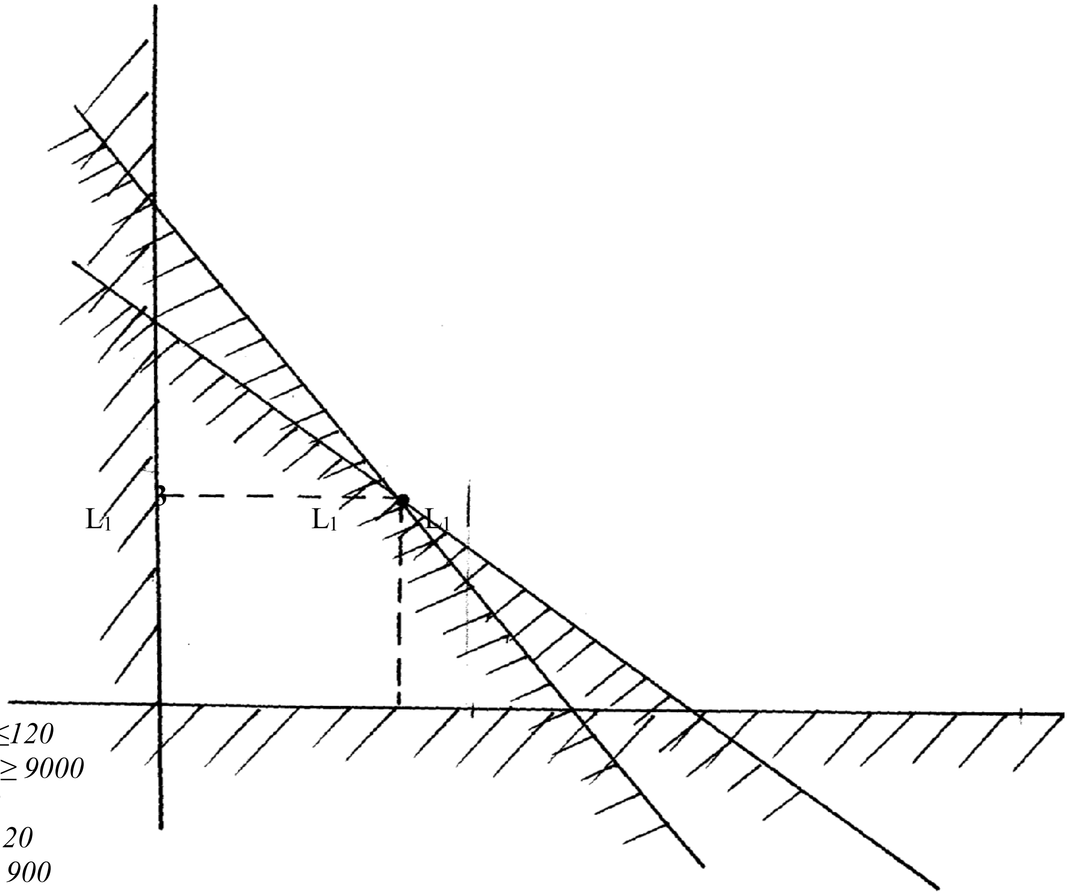
$x > 0$

$y > 0$

$x + y \geq 7$

Cost equation

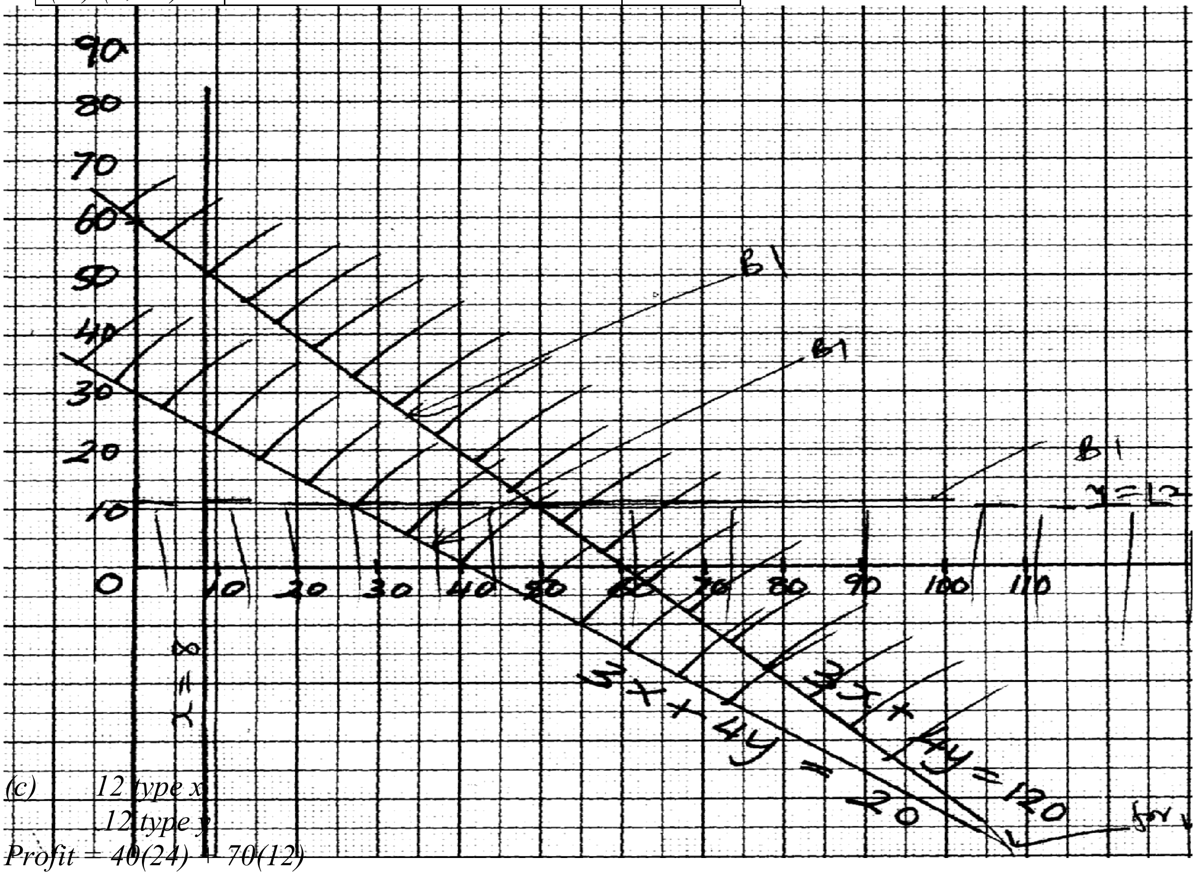
Total cost = 2500x + 20000y
(3,4)
3 type x
4 type y



5. $3x + 4y \leq 120$
$400x + 150y \geq 9000$
$x \geq 8 \quad y > 12$
(b)(i) $3x + 4y$ 20
(ii) $40x + 15y$ 900
(iii) x 8
(iv) y 12

(table showing calculation of profit)

Points	Objective function 40x + 70y	Profit
(i) (8,24)	320 + 1680	2000
(ii) (24, 12)	960 + 840	1800
(iii) (8, 12)	320 + 840	1160



(c) 12 type x

12 type y

Profit = 40(24) + 70(12)

= 1800

6. $100x = 160y = 16000$

$=100 \times 200 + 160 \times 50$

$20000 + 8000$

28000/=

$5 \times 200 + 8 \times 50$

$1000 + 4000$

$10 \times 200 + 16 \times 50=$

$10x + 16y = 1600$

$5x + 8y = 800$

$5 \times 20 + 100$

$8y = 800 - 100$

$y = \frac{700}{8}$

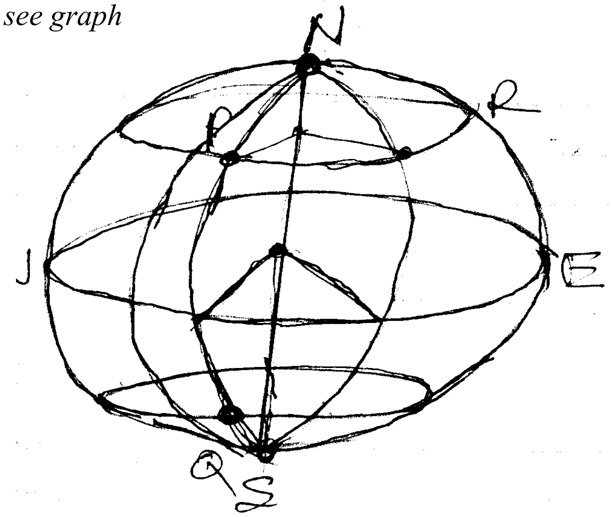
$^{800}/_5 = 160$

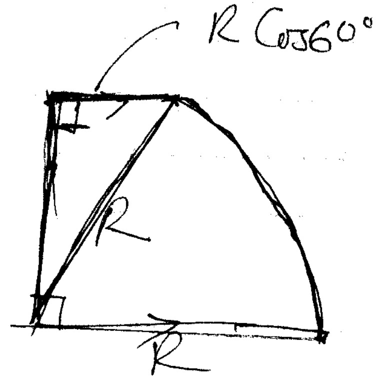
a) $y<2x$, $50 \leq x \leq 200$ $x >100$

$y >0$, $x+y \leq 250$, $100x + 160y \geq 16000$

b) See graph

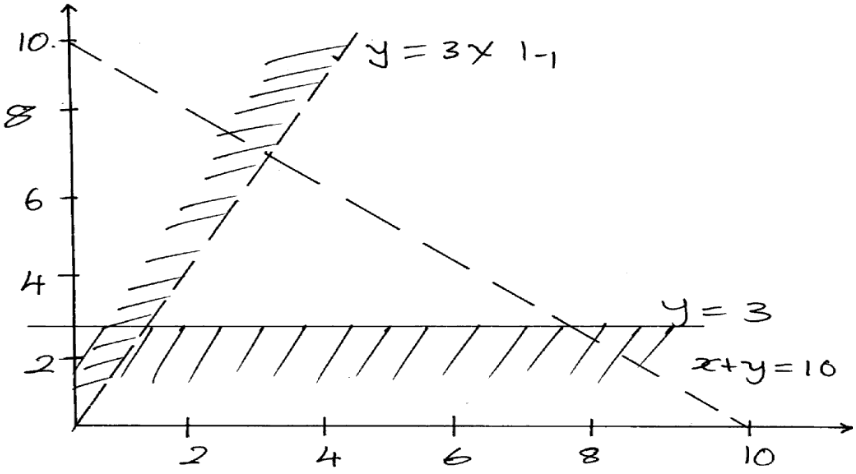
c) see graph





profit?

7. $x + y < 10$
$y < 3x$
$y > 3$



(c) *Obejctive function 3x = 2y = I or use of serach line*
5 packets of cups and 4packets of stucks

x	y	Profit
2	4	14
2	5	16
3	4	17
3	5	19
3	6	21
4	4	20
4	5	22
5	4	23

8. *Panga – P, Jembe J*
(a) $50P + 30J = 4260$
$50P + 15J = 1290$
$50P + 30J = 4260$
$\underline{10P + 30J = 1290}$

$40P = 1680$

$P = \frac{168}{4} = 42$

$50(42) + 30J = 4260$

$2100 + 30J = 4260$

$30J = 2160$

$J = \frac{(2160)}{30}$

$J = 72$

Wholesaler

$\frac{110}{100} \times 42 = \text{shs.}46.50 = \text{pangas}$

$\frac{85}{100} \times 72 = \text{shs } 60 = \text{jembes}$

For B

$50 \times 46.50 + 30 \times 61.2$

$2310 + 1836 = 4146$

Saving = 4260
4116
144

(b) Discount $5000 - 3500 = 1500$

$\%\ \text{discount} = \frac{1500}{5000} \times 100$

$= 30\%$

9. a) $X \geq 0, y = \geq 0$

$10x + 20y \geq 120$

$4x + y \geq 20$

b) On the graph.

c) i) (4,4)

$4 \times 100 + 4 \times 300$

$400 + 1200 = 1600$

10. Distance Covered $= (3t^2 - 3t - 6)dt$

$= t^3 - {}^3/_2\, t^2 - 6t\, 4 \;{}^4_1$

$$\left\{4^3 - \frac{3}{2}(4)^2 - 6(4)\right\} - \left\{1^3 - 3(1)^2 - 6(1)\right\}$$

$16 - {}^{-13}/_2 =$

63. Differentiation

1	$\int_1^2 (9t^2 - 6t + 2)dt$ $\left[3t^3 - 3t^2 + 2t + c\right]_1^2$	M1 M1 A1	

	$(3\times 2^3 - 3\times 2^2 + 2\times 2) - (3 - 3 + 2)$ $(24 - 12 + 4) - (2)$ $16 - 2 = 14m$		
2.	(a) V = ds/dt = 8 – 2t (i) At t = 1 V = 8 – 2 = 6m/s (ii) At t = 3 v = 8-6 = 2m/s (b) At maximum ds.dt = 0 8 – 2t = 0 t = 4 secs therefore maximum displacement s = 8t – t2 S = 8 x 4 - 42 = 16m (c) Acceleration = dv/dt = 2m/s-2 (d) At starting point, displacement is zero = 8t – t2 = 0 t(8 – t) = 0 t = 0 or t = 8 body back after 8sec	B1 B1 B1 M1 A1 M1 A1 B1 M1 A1	
		10	

1. $S = t^3 - 3t^2 + 2t$

(a) $V = \frac{ds}{dt} = 3t^2 - 6t + 2$

When t = 2

$V = 3(4) - 6(2) + 2$

$= 2m/s$

(b) At minimum velocity :

$\frac{dv}{dt} = 0$

$\frac{dv}{dt} = 6t - 6$

$6t - 6 = 0$

$t = 1$

Min-velocity $= 3(1)^2 - 6(1) + 2$

$= -1m/s$

(c) $3t^2 - 6t + 2 = 0$

$t = \frac{6 \pm \sqrt{(-6) - 4 (3) (2)}}{6}$

$= \frac{6 \pm 5.2}{6}$

t = 1.58 or 0.4sec

(d) acc $= \frac{dv}{dt} = 6t - 6$

$a = 6(3) - 6 = 12m/s^2$

2. a)

X	*2*	*5*	*8*	*10*

y	5	26	65	101

b) $A = h\,(2 + 10 + 26 + 50 + 82)$

$= 2 \times 170$

$= 34$ *square units*

c) $A = (x^2 + 1)\,dx$

$= (^{1000}/_{3} + 10) - 0$

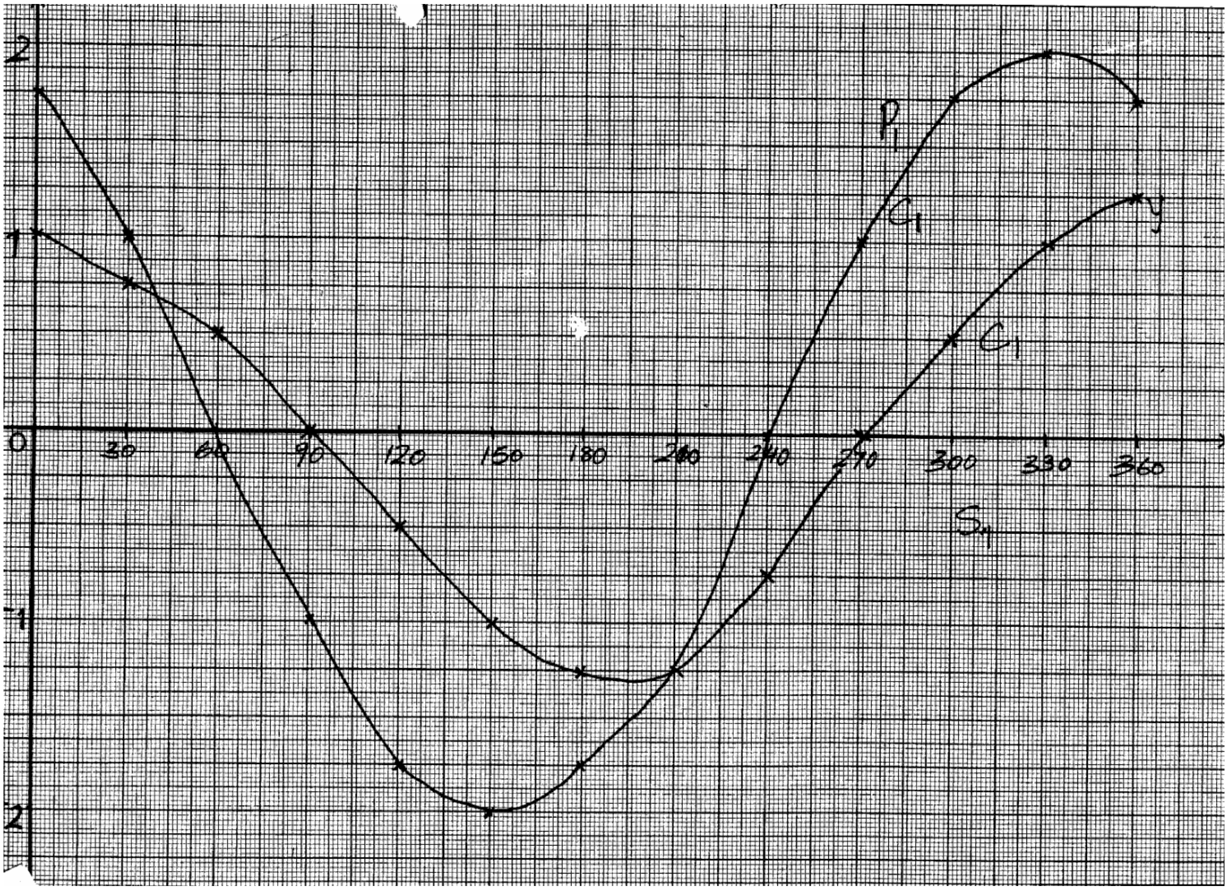
$= 333.33 + 10$

$= 343.33$

$= 343.33$ *square units*

d) *Percentage error* $= {}^{3.33}/_{343.33} \times 100\ \%$

$= 0.97\%$



3. $y = \frac{2x^2}{2} + x + c$

$a + x = -4\ ,\ y = 6$

$6 = (-4)^2 - 4 + c$

$c = -6$

$y = x^2 + x - 6$

4. a) $-2t^2 + t + 28 = 0$

$P = -56$

$S = 8, -7$

$-2t^2 + 8t - 7t + 28 = 0$

$-2t\,(t - 4) - 7(t - 4) = 0$

$t = 3.5$

$t = 4$

b) $AC = -4t + 1$

$-4t + 1 = 0$

$T = \frac{1}{4}$

$V = -2(\frac{1}{4})2 + \frac{1}{4} + 28$

$V = 28.125$

c) $Acc = -4t + 1$

At rest $t = 3.5$, $t = 4$

$Acc = -4 \times 4 + 1$

$= -15m/s^2$

At $t = 3.5$

$A = -13m/s^2$

d)(i) $D = \frac{2t^3}{3} + \frac{t^2}{2} + 28t + 5$

Distance $= -2 \times 3^3/_3 + 3^2/_3 + 28 \times 3 + 5 = 75.5m$

ii) $D = \frac{2t^3}{3} + \frac{t^2}{2} + 28t + 5$

$D = -2 \times 3^3/_3 + 3^2/_3 + 28 \times 3 + 5$

$= -18 + 4.5 + 84 + 5$

$= 70.5 + 5 \quad = 75.5$

5. a i) $V = 15 + 4t - 3t^2$

$\frac{dv}{dt} = Acc = 4 - 6t$

ii) $V = 15 + 4t - 3t^2$

$V = \frac{dv}{dt} = 15 + 4t - 3t^2$

$\therefore S = \int (15 + 4t - 3t^2)\, dt$

$S = 15t + \frac{4t^2}{2} - \frac{3t^2}{3} + C$

$S = 15t + 2t^2 - t^3 + C$

b) i) $Acc = 0$ hence $\frac{dv}{dt} = 0$

$4 - 6t = 0$

$-6 = -4$

$t = {}^2/_3$ sec.

ii) $S = \left[15t + 2t^2 - t^3 + C \right]_0^{2/3}$

$= 15\left(^2/_3\right) + 2\left(^2/_3\right)^2 - \left(^2/_3\right)^3$

$= \frac{10}{1} + \frac{8}{9} = \frac{8}{27}$

$= \frac{286}{27} \quad = 10.5925 \quad \simeq 10.59$

c) Acc. $4 - 6t$

$-4 = -6t$

$t = {}^{2}/_{3}$ Acc.= 0

$\therefore$ Time is 0 and ${}^{2}/_{3}$

Bth. 0 and ${}^{2}/_{3}$ sec.

6. (a) $x^2 = -x2 + 8$

$2x^2 = 8$

$x = 2 \quad a = -2, \quad b = 2$

(b) Area of $\int_{-}^{2} x^2 = \left[\frac{x^3}{3}\right]_{-2}^{2}$

$= \frac{8 - {}^{-}8}{3}$

$= \frac{16}{3}$

Area $=(x^2 + 8)dx$

$= \left(\frac{-x^3}{3}\right) + 8x$

$=\left(\frac{-80}{3} + 16\right)\left(- \frac{{}^{-}8}{3} - 16\right)$

$\frac{80}{3} = 26\,\frac{2}{3}$

(c) Area $= \frac{80}{3} + \frac{16}{3} = \frac{96}{3}$

$= 32$

7. $a = \frac{d^2s}{dt^2} = \frac{d^2}{dt^2}(t^3 - \frac{5}{2}t^2 + 2t + 5)$

$= \frac{d}{dt} = 3t^2 - 5t + 2$

$= 6t - 5$

If $a = 0$

$6t - 5 = 0$

$t = {}^{5}/_{6}$

$v = \frac{ds}{dt} = 3t^2 - 5t^2 = 3 \text{ x } \frac{25}{36} - 5 \text{ x } \frac{5}{6} + 2$

$= -\frac{1}{12}$m/s

8. (a) $V = \quad 6t + 4 = 3t^2 + 4t + c$

$5 = 3(0)^2 + 4(0) + c$

$5 = c$

$V = 3t^2 + 4t + 5$

(b) $V = 3(4)^2 + 4\,(4) + 5$

$= 69$ m/s

(c) (i) $\int 3t^2 + 4t + 5$

$= t^3 + 2t^2 + 5t + c$

When $t = 0$ $S = 0$

$S = t^3 + 2t^2 + 5t$

(ii) $S = \left. t^3 + 2t^2 + 5t \right]_1^4$

$= \left((4)^3 + 2(4)^2 + 5(4)\right) - \left((1)^3 + 2(1)^3 + 5(1)\right)$

$= 108\ m$

9. a) $S = 3t + \frac{3t^2}{2} - 2t^3$

$\frac{ds}{dt} = v = 3 + 3t - 6t^2$

$\frac{dv}{dt} = a = 3 - 12t$ $t = 0$

$a = 3m/s^2$

b)i) $O = -6t^2 = 3t + 3$

$t = 1$

-8^{t2}

$+6t - 3t$

ii) $S = 3(1) + \frac{3(1)^2}{2} - 6(1)^3$

$= 3 + {}^3/_2 - 2$

$= {}^2/_2 + {}^3/_2 = {}^5/_2$

c) $V = 3 + 3(1) - 6(1)$

$= 3 + 3 - 6$

$= 0m/s$

10. $dy/dx = 12x2 - 4x - 3$ at $(2,23)$

$= 12(4) - 4(2) - 3$

$= 48 - 8 - 3$

$= 40 - 3$

$= 37$

$M = y - y$ or $y = mx + c$

$= \frac{23 - y}{2 - x}$

$23 - y = 37(2-x)$

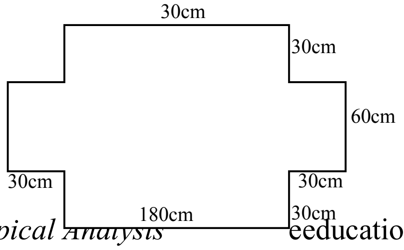
$23 - y = 74-x$

$23 = 37(2) + c$

$C = 23 - 74 = -51$

Hence equation is $y = 37x - 5$

11.



(i) (180 x 30 x 2) = 10800
(60 x 30 x 2) = 3600
(180 x 60 x 1 = 10800
Total area = $25200cm^2$

(ii) Volume of the cuboid
= (180 x 60 x 30) cm^3= $324,000cm^3$
Mass = (2.5 x 180 x 60x 30)
$= \frac{810000g}{1000}$
= 810kg
Volume of water = ($324,000cm^3$)
Mass of water $= \frac{(324,000 \times 1)}{1000}$
= 324kg
Mass of cuboid = 324 + 810
Full of water = 1,134kg

12. Let length of square cut off be x
Length of box = 8 – 2x
Width of box = 5 – 2x
Height of box = x

V = (8 -2x) (5-2x)x
$= 4x^3 – 26x^2 + 40x$
$\frac{dv}{dx} = 12x^2 – 52x + 40$
$12x^2 – 52x + 40 = 0$
$3x^2 – 13x + 10 = 0$
$3x^2 – 10x – 3x + 10 = 0$
X(3x -10) – 1 (3x-10) = 0
(x -1) (3x -10) = 0
x = 1 $x = {}^{10}/_{3}$

${}^{d2}/_{dx2} = 24x – 52$
x = 1
${}^{d2}/_{dx2} = 24x – 52 = -28$
maximum
x = 1cm gives maximum vol
(8-2) (5-2) X 1 = 6 x 3
$= 18cm^3$

13. a) $\frac{dy}{dx} = 3x^2 – 2$
Gradient of the tangent is 1 so, gradient of the normal is -1
$\frac{y – {}^{-}2}{x - 1} = \frac{-1}{1}$
$\frac{y + 2}{x – 1} = \frac{-1}{1}$
y = -x -1

(b) $dy = 3x^2 - 3 = 0$

$3x^2 -1) = 0$

$(x-1) =0$

$x =1, y = 0$ & $x = -1, y = 4$

Coordinates of turning points

$(1,0)$ and $(-1, 4)$

For $(1,0)$ $x< 1$, $\frac{dy}{dx}$ is –ve

$x > 1$, $\frac{dy}{dx}$ is +ve

$(1,0)$ is a minimum point for $(-1, 4)$ $x < -1$, $\frac{dy}{dx}$ is +ve

$(1, 0)$ is a minimum point for $(-1, 4)$ $x < -1$, $\frac{dy}{dx}$ is +ve

$x > -1$, $\frac{dy}{dx}$ is –ve

$\Rightarrow (-1, 4)$ is a maximum point

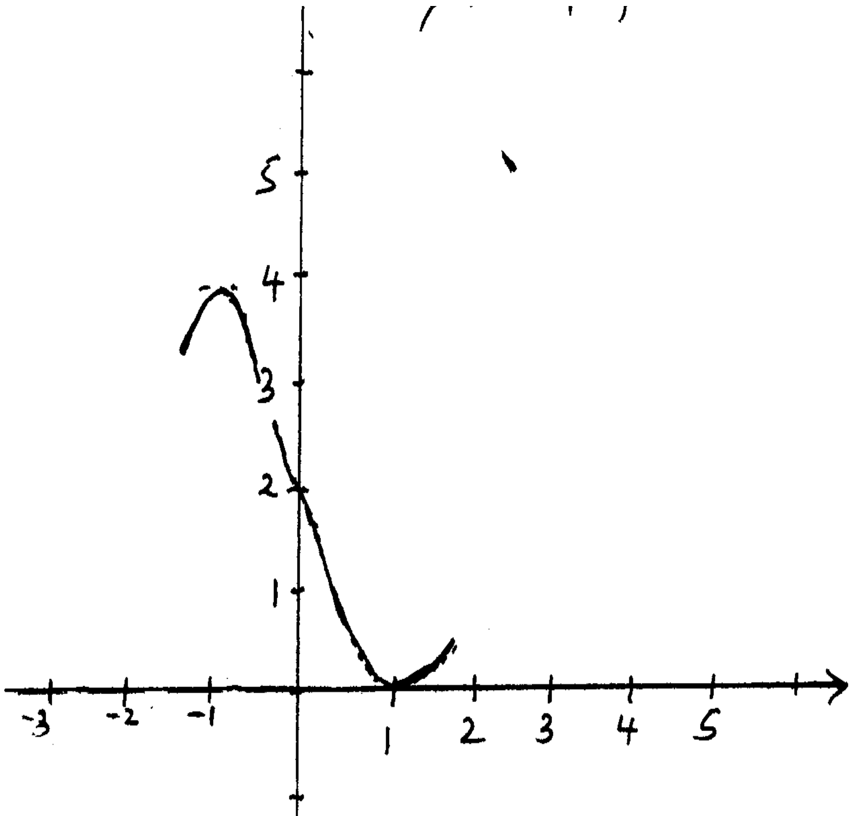
To sketch the curve we

(i) *Its turning points and their nature*

(ii) *The points the graph cuts the x and y axis i.e the x and y-intercepts*

(b) $\Rightarrow$*Indicating that the curve turns at* $(-1, 4)$ $(1, 0)$ *and cuts the y-axis at* $(0, 2)$ B_1

$\Rightarrow C_1$ *for correct sketch*



14. a) $-2t^2 + t + 28 = 0$

$t^2 – t – 28 = 0$

$2t^2 – 8t) + (7t – 28) = 0$

$+ (t-4) +7(t-4) = 0$

$t + 7) (t-4) = 0$

$t = -3.5$ or 4

p.B at rest at $t= 4$seconds

(b) $a = 1-4t$

$1 – 4t = 0$

$0.25s = t$

$V = 28 + 25 – 2 (0.25)^2$

$= 28.25 – 0.125$

$V = 28.125m/s$

(c) (i) $S = 28t + \frac{t^2}{2} – \frac{2t^3}{3} + C$

when $t = 0, s = 0$

$\therefore S = 28t + t2 – 2t$

PB at rest after 4s

$\therefore S = 28 \times 4 \times 42 – \frac{2}{3} \times 4^3$

$= 112 + 8 – 42.667$

$= 120 – 42.6667= 77.33m$

15. $S = t^3 – 3t^2 + 2t$

(a) $V = \frac{ds}{dt} = 3t^2 – 6t + 2$

When $t = 2$

$V = 3(4) – 6(2) + 2$

$= 2m/s$

(b) At minimum velocity :

$\frac{dv}{dt} = 0$

$\frac{dv}{dt} = 6t – 6$

$6t – 6 = 0$

$t = 1$

Min-velocity $= 3(1)^2 – 6(1) + 2$

$= -1m/s$

(c) $3t^2 – 6t + 2 = 0$

$t = \frac{6\pm \sqrt{(-6) – 4 (3) (2)}}{6}$

$= \frac{6 \pm 5.2}{6}$

$t = 1.58$ or $0.4 sec$

(d) $acc = \frac{dv}{dt} = 6t - 6$

$a = 6(3) - 6 = 12 m/s^2$

61. Approximation of area

1 $h = \frac{3 - -1}{5} = \frac{4}{5} = 0.8$

x	-1	-0.2	0.6	1.4	2.2	3
y	5	7.56	8.84	8.84	7.56	5

$A = 0.8 (5 + 5) + 2 (7.56 + 8.84 + 8.84 + 7.56)$

$= 0.4 \{10 + 2(32.8)\}$

$= 0.4 \times 75.6$

$= 30.24$ sq. units

2. $y_o = 0$

$y_1 = 2.5$

$y_2 = 6$

$y_3 = 10.5$

$y_4 = 16$

$y_5 = 22.5$

$y_6 = 30$

$A = \frac{1}{2} \times 1(0+30) + 2(2.5 + 6 + 10.5 + 16 + 22.5)$

$= \frac{1}{2} \times 145 = 72.5$

(b) $\frac{1}{2}x^2 - 2 = \frac{x^3}{6} - x$

$= \frac{8^3}{6} - 8 - \frac{2^3}{6} - 2$

$= 77.33 - -0.67$

$= 78$ square units

(c) $\% \text{ error} = \frac{72.5 - 78}{78} \times 100$

$= -7.05\%$

3 $y_o = 0$

$y_1 = 2.5$

$y_2 = 6$

$y_3 = 10.5$

$y_4 = 16$

$y_5 = 22.5$

$y_6 = 30$

$A = \frac{1}{2} \times 1(0+30) + 2(2.5 + 6 + 10.5 + 16 + 22.5)$

$= \frac{1}{2} \times 145$

$= 72.5$

(b) $\frac{1}{2}x^2 - 2 = \underline{x^3} - x$

$$= \frac{8^3}{6} - 8 - \overset{6}{\frac{2^3}{6}} - 2$$

$= 77.33 - -0.67$

$= 78$ square units

(c) % error $= \frac{72.5 - 78}{78} x\ 100$

$= -7.05\%$

4 a) $-2x^2 + 3x + 4 = 2x + 3$

$-2x^2 + x + 1 = 0$

$- 2x^2 + 2x - x + 1 = 0$

$(x-1)\ (-2x-) = 0$

$x = 1$ or $x = -½$

when $x = 1$ $y = 2x\ 1 + 3 = 5$

$Q\ (1 , 5)$

(b) $-2x^2 + 3x + 4)dx - (2x+3)dx$

5. a)

X	-5.5	-5	-4.25	-3.75
y	16.25	12	6.56	3.56

b) $A = 0.5\ (18.56 + 14.06 + 10.06 + 6.56 + 3.56 + 1.06)$

$= 0.5\ X\ 53.86 = 26.93$

c) i) $\int x^1 + 2x - 3$

$\left[\frac{x^3}{3} + x^2 - 3x\right]^{-3}$

$= \left[\frac{(-3)}{3}^3 + (-3)^2 - 3(-3)\right]$

$= 9 + 18 = 27$ square units

ii) $\frac{27 - 26.93}{27}\ X\ 100$

$= 0.25925\ \% = 0.2593\ \%$

6

x	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7
y	18	28.25	41	56.25	74	94.25	117	142.25	170	200.25	233

$\therefore \text{Area} = ½\ n \left\{(y_0 + y_n) + 2(y_1 + \ldots\ldots\ldots\ldots \right\} y_n - 1$

$= ½\ (1) \left\{(18 + 233) + 2(41 + 74 + 55 + 170)\right\}$

$= ½ \left\{251 + 2(340)\right\}$

$= ½\ (251 + 680)$

$= ½\ (831)$

= 415.5 sq. units.

65. Integration

1	a)		
	$x^2+5=8-2x$	M_1	**Diagram**
	$x^2+2x-3=0$	A_1	
	$(x-1)(x+3)=0$		
	X = 1 or x = -3	B_1	
	$C(-3,14)$	B_1	
	$D(1,6)$		
	b)		
	$\int_3^1 (x^2+5)dx$	M_1 M_1	
	$\left[\frac{1}{3}x^3+5x\right]_{-3}^{11}$		
	$\left(\frac{1}{3}+5\right)-(-9-15)$	A_1	
	$5\frac{1}{3}+24$	M_1	
	$=29\frac{1}{3} squnits$	A_1	
	c)		
	$\frac{1}{2}(14+6)\times 4 = Area$	B_1	
	$\therefore A = 2\times 20$		
	$=40 squnits$		
	d)		
	$40-29\ {}^{1}\!/_{3}$		
	$=10\ {}^{2}\!/_{3}\ sq$ units		
		10	

1. $S_{10} = 100$

$\int_2^5 \underline{(x-1)\ (x-2)}\ dx$

$x - 2$

$= \int_2^5 x - 1dx$

$= [\ {}^{x2}/_2 - x\ ]_2^5$

2.

$\int (x^2 + 1)\ dx = 2a$

$$\left[\frac{x^3}{3} + \frac{x}{1} = 2a\right]_o^a$$

$\underline{a^3} + \underline{a} - 0 = 2a$

$3 \quad 1$

$a^3 + 3a = 6a$

$a^3 = 3a$

$(a^3 - 3a) = 0$

$a(a^2 - 3) = 0$

$a = 0$

or $3 = \pm 1.732$