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 $LCM = \frac{\text{Product of the two numbers}}{GCD \text{ of the numbers}}$ $140 = \frac{20 \times x}{7}$ $x = \frac{140 \times 7}{20}$ $= 49$	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 = 2 | 27 30 45 3 | 27 15 45 3 | 9 5 15 3 | 3 5 5 5 | 1 5 5 | 1 1 1 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 y – x = xy - 5 x + y + 1 = xy y – x + 5 + = xy x + y + 1 = y – x + 5 2x = 4 x = 2 Y – 2 + 5 = 2y = y = 3	 B1 B1 B1	
		03	

2. $X > -1$
$X \geq 3$

3. $2x\ 2^3 \times 8^x \times 8^2 = 128$
$2x \div 2^3 \times 2^3 x \times 8^2 = 128$
Let 2^x be y
$^y/_8 \times y^3 \times 64 = 128$
$^{8y}/_8 = 128/8$
$y^4 = 16$ M1
$y^4 = 24$ M1
$\therefore y = 2$ A1
$-5 \times 6 \div 2 + (-5)$

4. $-12 - 3 = 4$
$4 \times 4 + 15$
Numerator $16 + 15 = 31$
Denominator $-5 \times 3 + -5 = 31$
$-15 + -5$
$-15 + -5$
$= -20$
$\frac{31}{-20}$
$= -1\ ^{11}/_{20}$

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. $\frac{-8 \div 2 + 12 \times 9 - 4 \times 6}{56 \div 7 \times 2}$
$= \frac{-4 + 108 - 24}{16}$

$\frac{80}{16} = 5$

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	$2.181818\ldots\times 100 = 218.1818\ldots$ $2.181818\ldots\times 1\ldots\ldots\quad 2.1818\ldots$ 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 $\frac{A_1}{3}$	For +ve index
8.	$\frac{\frac{6}{7}of\frac{14}{3}\div 80\times-\frac{20}{3}}{-2\times5+(14\div7)\times3}$ $\frac{4\div80\times-\frac{20}{3}}{-2\times5+2\times3}$ $\frac{\frac{1}{20}\times-\frac{20}{3}}{-10+6}$	M1 M1 M1	

	$\frac{-\frac{1}{3}}{-4}$ $\frac{1}{3}\times\frac{1}{4}=\frac{1}{12}$	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 Number of chickens = 48 Number of turkeys = 48 + 6 = 54 Total number of birds = 54 + 48 = 102	B1 B1	For 48 For 102
		02	

11. -4 of (-4 -3) + -3-2)
-12 + 3 + 5

-4 of (-7-3-2)
-4 M1 for -4

= 48
-4 M1 for 48

= -12 A1

3

12.	(a) (i) ratio $r=\frac{3}{100}\div\frac{3}{10}$ $r=\frac{3}{100}\times\frac{10}{3}=\frac{1}{10}$ $ii)S_n=\frac{\frac{3}{10}\left(1-\frac{1}{10}\right)^{n-1}}{1-\frac{1}{10}}$ $S_n=\frac{\frac{3}{10}\left(\frac{9}{10}\right)^{n-1}}{\frac{9}{10}}$ $S_n=\frac{3}{10}\times\frac{10}{9}\left(\frac{9}{10}\right)^{n-1}$ $S_n=\frac{1}{3}\left(\frac{9}{10}\right)^{n-1}$ $iii)T_8=\frac{3}{10}\left(\frac{1}{10}\right)^{8-1}$ $=\frac{3}{10}\left(\frac{1}{10}\right)^{7}$ $=\frac{3}{10}\times\frac{1}{10^7}=\frac{3}{100,000,000}$	M1 A1 M1 M1 A1 M1 A1 M1	

	(b) 1st bounce 30m 2nd ¾ x 30 = 22.5m 3rd ¾ x 22.5 = 16.85m 4th ¾ x 16.85 = 12.64m 5th ¾ x 12.64 = 9.48m 6th ¾ x 9.48 = 7.11m 7th ¾ x 7.11 = 5.3325m 8th ¾ x 5.3325 = 3.9993m 9th ¾ x 3.9993 = 2.9995m 10th ¾ x 2.9995 = 2.2496m ≅2.25 Or using formula $T_{10} = 30(\frac{3}{4})^{10-1} = 30(\frac{3}{4})^{9}$ = 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	$100r = 193.3\dot{3}\ldots\ldots$ $10r = 19.3\dot{3}\ldots\ldots$ $90r = 174$ $r = \frac{174}{90}$ $100r = 25.2\dot{5}\ldots\ldots$ $r = 0.2\dot{5}\ldots\ldots$ $99r = 25$ $r = \frac{25}{99}$ $\frac{174}{90} + \frac{25}{99}$ $= \frac{2164}{990}$ $= 2\frac{92}{445}$	B1 B1 B1	
		3	

18. $\frac{1}{2} \times \frac{7}{2} = \frac{3}{2} \times 1\frac{5}{6} \quad \frac{3}{4} \times \frac{5}{2} \times X$

$\frac{7}{4} + \frac{3}{2} \times \frac{11}{2} = \frac{15}{4}$

$\frac{7}{4} + \frac{11}{4} = \frac{18}{4}$

$\therefore \frac{18}{4} \div \frac{15}{4}$ B1

$\frac{18}{4} \times \frac{4}{15} = \frac{6}{5} = 1\frac{1}{5}$ A1

19. $^2/_5 \div \frac{1}{2}\ 0f\ ^4/_9 - 1^1/_{10}$

$= ^2/_5 \div \frac{1}{2}\ X\ ^4/_9 - ^{11}/_{10}$

$= ^2/_5 \times ^9/_2 - ^{11}/_{10}$

$= ^9/_5 - ^{11}/_{10} = ^{18\text{-}11}/_{10} = ^7/_{10}$

$^1/_8 - ^1/_6\ X\ ^3/_8 = ^1/_8 - ^1/_{16}$

$= ^{2\text{-}1}/_{16} = ^1/_{16}$

$\frac{^2/_5 \div \frac{1}{2}\ 0f\ ^4/_9 - 1^1/_{10}}{^1/_8 - ^1/_6\ of\ ^3/_8} = \frac{^7/_{10}}{^1/_{16}}$

$= ^7/_{10}\ X\ ^{16}/_1$

$= ^{56}/_5 \quad = 11^1/_5$

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

$^9/_7 - ^3/_8 = 72 - 21 = 51 \times ^2/_3 = ^{17}/_{28}$ *M1*

$^{57}/_{28} \times ^{28}/_{17} = 3\ ^6/_{17}$ *A1*

21. $\frac{2}{5} \times \frac{9}{2} - \frac{11}{10}$

$\frac{1}{8} - \frac{1}{16}$

$= \frac{7}{10} \times \frac{16}{1}$

$= \frac{56}{5} = 11\frac{1}{5}$

22. $\frac{3}{8}\left(\frac{38}{5} - \frac{55}{36} \times \frac{12}{5}\right)$

$\frac{3}{8} \times \frac{59}{15} = \frac{59}{40} = 1\frac{19}{40}$

23. Numerator

$\frac{\left(\frac{9}{5} X \frac{25}{18}\right) \div \frac{5}{2} X 24}{\frac{7}{3} - \left(\frac{1}{4} \times 12\right) \div \frac{5}{3}}$

$\frac{9}{5} \times \frac{25}{18} = \frac{5}{2} \div \frac{5}{3} \times 24$

$\frac{5}{2} \times \frac{3}{5} \times 24 = 36$

$7/3 - \frac{1}{4} \times 12 \div 5/3$

$7/3 - 3 \times 3/5$

$\therefore \frac{36}{\frac{8}{15}} = 67.50 = 67\frac{1}{2}$

$\frac{7}{3} - 3 \times \frac{3}{5}$

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	$\div$ 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	A_1	
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. $\frac{84 \times 132 \times 35}{287 \times 560}$
$41 \quad 4 \quad 16$
$= \frac{99}{41} \quad 1$

8. $\frac{12 \times 0.25 - 12.4 \div 0.4 \times 3}{\frac{1}{8} \text{ of } 2.56 + 8.68}$
$\frac{3 - 31 \times 3}{0.32 + 8.68}$
$\frac{-90}{9}$
$= -10$

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.	$19.901\text{x}10^2$ $19.901+1=1991.1$ $\underline{1991.1}$ 0.07245 $1991.1\times 0.1380\times 10^2$ $=165.77$	**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 x 8.575 – 2 x 0.07224
= 25.725 - 0.14448
= 25.58052
= 25.58

7. $\frac{153 \times 1.8}{0.68 \times 0.32}$

$\sqrt{\frac{158 \times 1.8 \times 10000}{0.68 \times 0.32 \times 10000}}$

$\sqrt{\frac{158 \times 18000}{68 \times 32}} = \sqrt{\frac{9 \times 9000}{4 \times 16}}$

$\sqrt{\frac{9 \times 9 \times 10^3}{4 \times 16}} = \frac{9 \times 1\,0^{3}/_{2}}{8}$

$1.125 \times 10^{3}/_{2}$

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 = $^{5}/_{2}$ (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. $6u^2y^2 + 13uy - 5 = (2uy + 5)(3xy - 1)$

$3u^2y^2 - 13uy + X = (uy - 4)(3xy - 1)$

$\frac{(2xy + 5)}{(uy - 4)} \quad \frac{(3xy - 1)}{(3xy - 1)}$

$= \frac{2xy + 5}{Uy - 4}$

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) $x = y = 8 \quad$ 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. $\frac{6x^2 + 35x - 6}{2x^2 - 72}$

$= \frac{6x(x - + 6) - 1(x + 6)}{2(x^2 - 36)}$

$= \frac{(6x - 1)(x + 6)}{2(x - 6)(x + 6)}$

$= \frac{6x - 1}{2(x - 6)}$

8. $\frac{2}{5}(3x - 2) - \frac{3}{4}(2x - 2)$

$= \frac{8(3x-2) - 9(2x-2)}{12}$

$= 24x - 16 - 18x + 18$

$= \frac{6x + 2}{12}$

$= \frac{2(3x + 1)}{12}$

$= \frac{3x + 1}{6}$

$\frac{124x - 2x}{2}$

x | 385 | x

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 : $(2y + x)(2y-x)$

$(2x+3y)(x-2y)$

$-\frac{2x + 3y}{2y + x}$ *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 $x = 3$, $y = 3x \times 3 + 1 = 10$ *Point (3, 10)*

12. *(a)* $\frac{y(y + 2)}{}$

$$\frac{y(y^2 - y - 60}{y(y+2)} = \frac{y + 2}{y(y^2 - y - 6)} \quad \frac{}{(y+2)(y-3)}$$

(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. $\frac{104.6}{2.4} = \frac{44 \times 2}{}$

$\frac{63.9}{2.4} = \frac{26 \times 2}{}$

$= 88 + 54 = 142$

14. $3(25x^2 - 9y^2)$

$3(5x + 3y)(5x - 3y)$

15. i) $d = 8.4 \qquad r = \frac{1}{2}$

6^{th} jump $= 8(\frac{1}{2})^{6-1}$

$\frac{8.4}{32}$

$= 0.2625 = 0.26cm$

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) $8(2^2)^y = 6 \times 2^y - 1$

let $t = 2^y$

$8t^2 = 6t - 1$

$8t^2 - 4t - 2t + 1 = 0$

$(4t - 1)(2t - 1) = 0$

$t = ¼$ or $½$

$\therefore t = 2^y = ¼ = 2^{-2}$

$\therefore y = -2$

0r $t = 2^y = ½ = 2^{-1}$

$\therefore y = -1$

$\therefore y = -2$ 0r -1

b) Numerator $= 2x^2 - 98$

$= 2(x^2 - 49)$

$= 2(x + 7)(x - 7)$

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. $\frac{(2x - y)(2x + y)}{(x - 3y)(2x - y)}$ √

$\frac{2x + y}{x - 3y}$ √

21. $P^2 - 2pq + q^2 = (p-q)^2$

$P^3 - pq^2 + p^2q - q^3$

$= p(p^2-q^2) + q(p^2 - q^2)$

$= (p + q)(p^2-q^2)$

$\frac{(p - q)^2}{(p + q)(P^2 - q^2)} = \frac{(p - q)^2}{(p+q)^2 (p-q)}$ ✓

$= \frac{p - q}{(p + q)^2}$

22. Let the numbers be a and b

$a + b = 15 \quad \times 3$

$5a - 3b = 19 \quad \times 1$

$3a + 3b = 45$

$5a - 3b = 19$

$8a = 64$

$a = 8$

$b = 7$

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 (10xt) + (5x2t)+1(21-3t)=72 20t+21-3t = 72 17t = 51 t = 3	 **B1** **M1** **A1**	
		03	
2.	(a) ¼ : ½ : $^1/_5$ = 5 : 10 : 4 ¼ = $^5/_{19}$ x 1000 = 263 ½ = $^{10}/_{19}$ x 1000 = 526 $^1/_5$ = $^4/_{119}$ x 1000 = 710 (b) Let volume of 45% concentration be x Therefore 25% wwill be (100 – x) $\frac{0.45x + 0.25(100 - x)}{100}$ = 30% 0.45x – 0.25x + 25 = 30 0.20x = 5.0 x = $^{50}/_2$ x = 25cm^3 vol of 45% = 25cm^3 vol of 25% = 75cm^3 ration 1 : 3 (c) (i) Cost of 1 kg mixture $^2/_5$ x 140 + $^3/_5$ x 160 152 Profit = 240 – 152 = sh 88 Gain $^{88}/_{152}$ x 100 = 57.9% (ii) 140 160 148	 **B1** **B1** **B1** **M1** **B1** **M1** **A1** **B1**	 Follow through for alternative

	12 : 8 3 : 2	**B1**	
		10	
3.	(a) $V = \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 3.5$ $= 539 m^3$ $= 539000000 cm^3$ $capacity = \frac{539000000}{1000}$ $= 539{,}000 litres$ (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.	l, 1.2 l, w, 0.9 w $\%\Delta = \frac{1.2 \times 0.9l - wl}{wl} \times 100$ $= (1.08 - 1)100$ $= 8\%$ *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*
$x = \left(\frac{6}{2} \times \frac{21}{21} \times 5\right) = 15$

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 = $\frac{2}{60}$ X 100 = 3.33%
B - ¼
Capacity filled in 1 hr = $^1/_3$ + ¼
= $^7/_{12}$
$^7/_{12}$ = 1 hr
1 = 1 x 1 x $^{12}/_7$
= 1 $^5/_7$ hrs.
ii) $^1/_3$ + ¼ - $^1/_6$ = $^5/_{12}$ ⇒ in one hr
$^5/_{12}$ = 1hr
1 = 1 x 1 x $^{12}/_5$
= 2 $^2/_5$ hrs

14. (a) $\frac{144000}{n-5} - \frac{144000}{R}$
= $\frac{720{,}000}{n(n-5)}$

(b) 720,000 = 2400
n(n-5)
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 = $\frac{2400}{7200}$ x 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 = $\frac{17}{120}$ x 5
= $\frac{17}{24}$
(b) In two hours taps x and y

$$\left(\frac{1}{\quad} + \frac{1}{\quad}\right) \times 2$$ *of the tank to be filled*

$\frac{40}{}$ $\frac{15}{}$

$= \frac{11}{60}$

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

$= \frac{13}{120} \times 40h$

$= 4\ ^1/_3$

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. $\frac{16}{X} \quad \frac{9}{7} \quad \frac{14}{12}$

$X = 16 \times \frac{9}{7} \times \frac{14}{12}$

$= 24$men

Extra men $= 24 - 6$

$= 8$men

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

$= \frac{180000}{12} = 15000$

% 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

$\frac{15}{100} \times 43200 =$ Shs. 6480

Rest of the profit

= 43200 – (8640 + 6480) = 28080

Ratio of contribution

40000 : 64000

5 : 8

Mue received

½ X 6480 = Shs.3240

$^{8}/_{13} \times 28080 =$ Shs. 17280

= Shs.20320

c) Konie received

Shs.3240 + 10800 = 14040

$\frac{14040}{1800} = 7.8$

= 7 cows

20. $(7x – 3y) : 2x + 3y$

$x= 2 \quad y= 1$

$14 – 9 : 4+ 9$

$5 : 13$

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) $= 4B + 24G = 94750 -$
$\underline{4B + 24G = 93600}$
$G = 1150$
∴ 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
$(\underline{0.3733x + 0.967x + 0.7x}) – x \times 100$

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 $2\frac{1}{2}x - 4$

$$\frac{2\frac{1}{2}x - 4}{x - 4} = \frac{3}{1}$$

$\frac{5}{2}x - 3x = -12$

$-\frac{1}{2}x = -12$

$x = 24$yrs

mother's age is $= (\frac{5}{2} \times 24)$

$= 60$yrs

24. $$\frac{16 \times 9 \times 14}{7 \times 12}$$

$= 24$

Extra men $= 24 - 16$

$B1 = 8$more 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

$M + n = 9...(i)$

$10m + n$, reversed $10n + m$

$10n + m - 10m + n = 27$

$1n - 9m$

27. $V1 = \pi r^2 h$

$R = 130r = 1.3r$

$H = \frac{80}{100}h = 0.8h$

$V_2 = \pi R^2 h = (1.3r)^2 \times 0.8h$

$= 1.352V_1$

$\%$ change $= \frac{V_2 - V_1}{V_1} \times 100$

$= \frac{(1.352 - 1)V_1}{V_1} \times 100$

0.352 x 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* $= {}^{25}/_{120}$
$= 30cm^3$
Alcohol in B $= {}^{20}/_{100} \times 180$
$= 36cm^3$
Results $= \frac{36 + 30}{120 + 180}$
$= \frac{66}{300} \times 100$
=22%

Remaining = 300-x

Volume of alcohol = (300 –x) x $^{22}/_{100}$ = 66-0.22x

Total volume of alcohol = 66-0.22x + x

= 66 + 0.78x

% alcohol = $\frac{66 + 0.78x \times 100}{300}$ = 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 = $\frac{2}{}$ X 100 = 3.33%

34. *a :b = 1:2*

b : c = 3:4

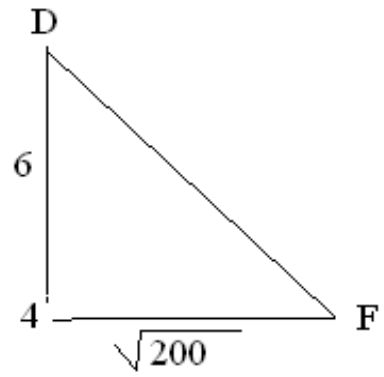
a:b = 3:6

b:c = 6:8

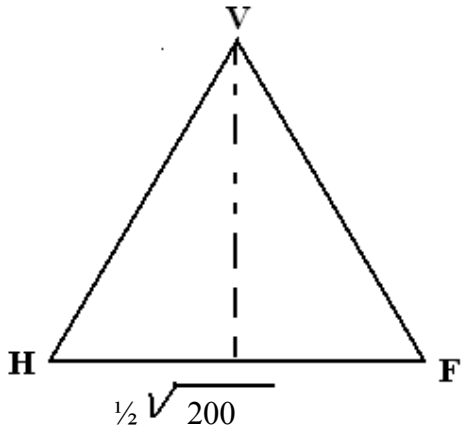
∴ a:b:c = 3:6:8

8. Length

1.	Mass = Density x volume But Density is constant. x y Vol (270000 x 2.8): x2.1 = $\frac{270000}{2.1}$ x 2.8 = 360m	M1 M1 M1 A1	
		4	

2. a.)	 $DF_1 = \sqrt{6^2 + (\sqrt{200})^2}$ = 15.362291	M1 A1	

b.)



$\sqrt{144 - ½\sqrt{200}^{2}}$

$= 9.6953597$ M1

$+ \frac{6}{15.6953597}$

$\text{Tan } \Theta = \frac{15.6953597}{7.0710678}$ A1

$= 2.219659$

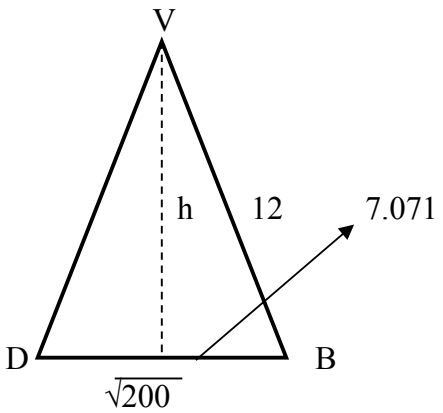
C. $\Theta = 65.747499^{o}$ B1

½ HF

½ x $\sqrt{200}$

= 7.0710678

d.



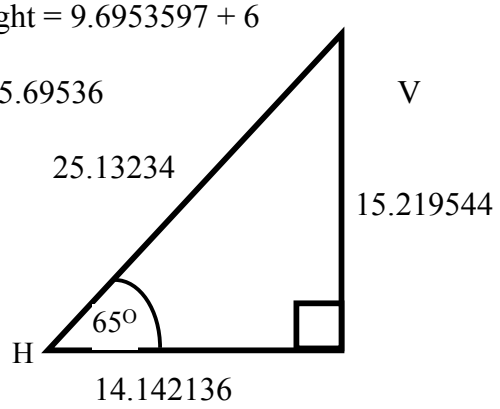
M1
B1

e.

$\sqrt{144 - 50} = 9.6953597$

Height = 9.6953597 + 6

= 15.69536



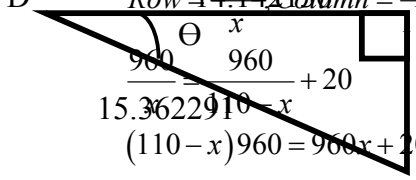
$\sqrt{14.142136^2 + 15.219544^2}$

= 25.13234 B1

$\angle$ BDF

f.

3



$Row = \frac{960}{x}$ $Column = \frac{960}{10-x}$

$\frac{960}{x} = \frac{960}{10-x} + 20$

15.362291

$(110-x)960 = 960x + 20x(110-x)$

$x^2 - 206x + 5380 = 0$

$\frac{\Theta}{6} = \frac{90}{15.362291}$ $x^2 - 30x - 176x + 5380 = 0$

$x(x-30) - 176(x-30) = 0$

$\Theta = \frac{90 \text{ X } 6}{15.362291}$ $(x-30)(x-176=0)$

$x = 176$

= 35.15° *or*

$x = 30$ M1

Dimensions 30 by 80 cm

No of tiles =

$\frac{960 \times 960}{30 \times 30}$

$= 384$

A1

10

Cost =

$\frac{364}{12} \times 1500 + 3000$

$= sh.483000$

		10	

4. $\frac{(3x + 2y)(5x - 3y)}{(5x - 3y)(x-y)}$

$= \frac{3x + 2y}{x - y}$

5. $3N + \frac{1}{2}(R-M)$

$= 3\begin{pmatrix} \frac{2}{3} & 1 \\ 2 & 4 \end{pmatrix} + \frac{1}{2}\begin{pmatrix} -1 & -2 \\ 0 & 0 \end{pmatrix} \quad \begin{pmatrix} 3 & 0 \\ -1 & 4 \end{pmatrix}$

$= \begin{pmatrix} 2 & 3 \\ 6 & 12 \end{pmatrix} + \frac{1}{2}\begin{pmatrix} -4 & 2 \\ 1 & 4 \end{pmatrix}$

$= \begin{pmatrix} 2 & 3 \\ 6 & 12 \end{pmatrix} + \begin{pmatrix} -2 & 1 \\ 0.5 & -2 \end{pmatrix} = \begin{pmatrix} 0 & 4 \\ 6.5 & 10 \end{pmatrix}$

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

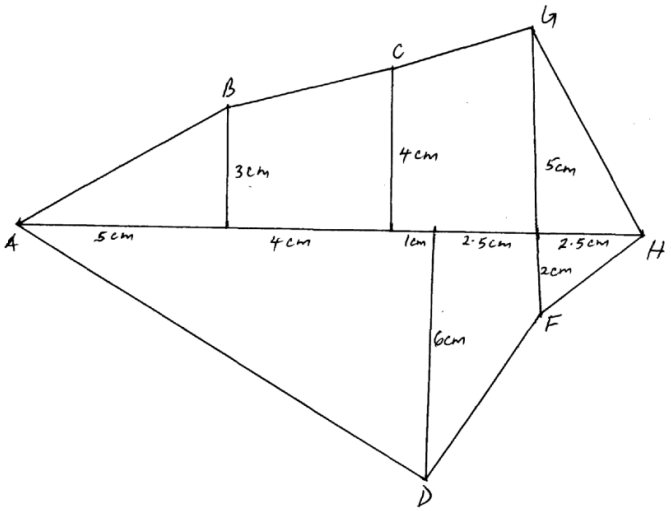
13.091 x 2 = 26.182cm^2 M1

∴ Area of shaded part

43.3025 – 26.182 M1

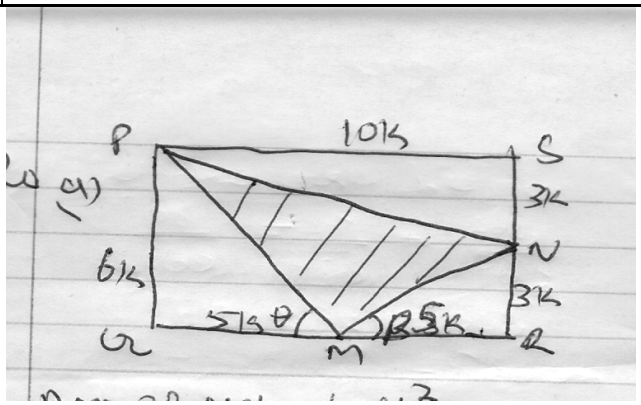
= 17.11225cm^2 A1

10

6.		**B1** **B1** **B1**	For AH for✓ offset ✓div for AH
	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** **M1** **M1** **M1** **A1** **B1**	Offsets ⊥to AH Complete diagram
		10	

7.	$S = \frac{5.7+4.2+6.3}{2} = 8.1$ $= \sqrt{8.1(8.1-5.7)(8.1-4.2)(8.1-6.3)}$ $= \sqrt{8.1\times 2.4\times 3.9\times 1.8} = 11.68$ $Shaded\ area = 18.05 - 11.68$ $= 6.368cm^2$	B1 M1 A1 B1	
		04	

8



Area of the rectangle= $60k^2$ M1

Area of unshaded part parts

$= \frac{1}{2}6k\times 5k + \frac{1}{2}\times 15k^2 + \frac{1}{2}\times 30k^2$ M1

$= 15k^2 + 7.5k^2 + 15k^2$

$= 37.5k^2$

Area of shaded part = $60k^2 - 37.5k^2$ M1

$= 22.5k^2$ A1

b)

$\frac{1}{2}\times 15k^2 = 30$ M1

$k^2 = \frac{30\times 2}{15}$

$k = 2$

Dimensions = 20m by 12 cm A1

$\tan\theta = \frac{12}{10}$

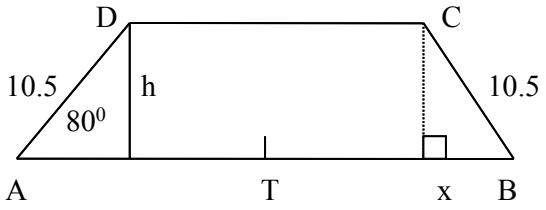
$\theta = 50.19^0$

$\tan\beta = \frac{6}{10}$ M1

$\beta = 30.96^0$ A1

M1

A1

		10	
9	a) = $\frac{160}{360}\times\frac{22}{7}\times10.5^2$ $=154cm^2$	M1 A1	
			
	$\sin 80 = \frac{h}{10.5}$ $h = 10.5\sin 80 = 10.34cm$	B1	
	$\cos 80 = \frac{x}{10.5}$ $x = 10.5\cos 80 = 1.823$ $lengthCD = 21-(1.823\times 2)$ $=17.354$	B1 M1 A1	
	Area of AXYBCD $=\frac{1}{2}\times10.34(17.354+21)\times2$ $=396.58cm^2$	M1 A1	
	b) Area of the shaded part = 396.58-154 = 88.58 cm^2	M1 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

$\frac{15 \times 700}{}$ *cartons*

$$\text{Cost} = \frac{15 \times 700}{20} \times 800$$

$$\text{Cost} = \text{Kshs. } 420{,}000$$

(ii) Other expenses = 2000 + 600 = 2600/=

Total expenses = Kshs. 420,000 + 2600

= Kshs. 422600

$$\text{Selling price} = \frac{112.5}{100} \times 422600$$

= Kshs. 475, 425

$$\text{Selling price per tile} = \frac{475{,}425}{525 \times 20}$$

= 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°

= 27.28

13. $S = ½ (170 + 190 + 210)$

$S = 285$

$\text{Area} = \sqrt{285 (285 - 170) (285 - 190) (285 - 210)}$

$= \sqrt{2865 \times 115 \times 95 \times 75}$

$= \frac{15281 m^2}{10{,}000}$

= 1.528ha

14. LCM of 30, 50 and 35 mins

30 = 2 x 3 x 5

35 = 5x 7

50 = 2 x 52

} L.C.M = 2 x 3 x 5 = 1050

Into hrs $\left(\frac{1050}{60}\right)$ hrs = 17.5hrs

Next wail together at 7:18

+ 17:30

24:48

= at 1. 48 a.m on Tuesday

15. Maize – $¼ \times \frac{2}{3} = \frac{1}{6}$

Remainder – $\frac{2}{3} - \frac{1}{6} = \frac{3}{6} = ½$

Beans – $\frac{4}{5} \times ½ = \frac{2}{5}$

carrrots – $\frac{1}{5} \times \frac{1}{2} = \frac{1}{10}$

Let total area of farm be x acres

$\frac{1}{10}x = 0.9$

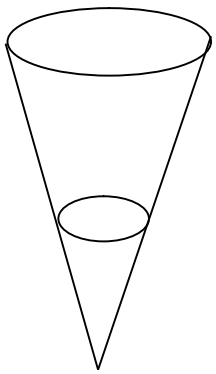
$x = 0.9 \times 10 = 9\text{acres}$

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 $\frac{1}{3}\ \Pi\times 1600\times 120 - ⅓\ \Pi\times 900\times 90$ $(64\,000\ \Pi - 27\,000)\div 1000$ 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

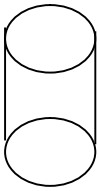
$h = \sqrt{90^2 - 12^2}$
$= 89.2$

$H = \sqrt{120^2 - 16^2}$
$= 118.9$ 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) 4.5 12



3.142 x 12^2 x h=
18426.364 M1

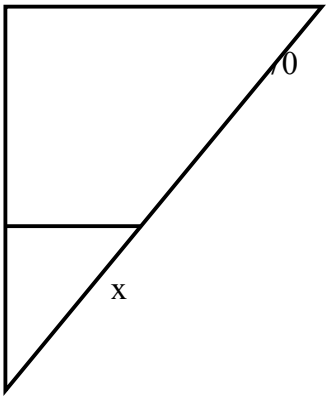
h = 40.73 A1

S.A = 2 x 3.142 x 12 (45 – 40.73) M1
= 321.99cm^2 A1

10

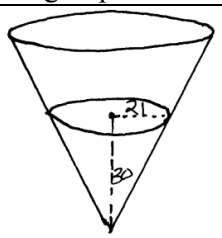
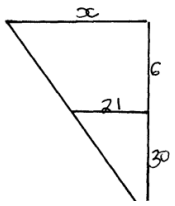
6.	(a) (300x5) + (140x8) = 1500 + 1120 = 2620fans (b) Cost of fuel Boeng 747 = 120x10.5x60x5x2x0.3 =226800 dollars Boeng 740 = 200x10.5x60x8x2x0.3 =604,800 dollars (c) Total collection Boeng 747 = 300x5x800 = 1,200,000 dollars Boeng 740	M1 A1 M1 A1 M1 A1 B1	

	= 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  $^{50}/_{15} = {}^{70+x}/_{x}$ 50x = 15(70 + x) 50x = 1050 + 15x 35x = 1050 = 30 cm Total height = $\sqrt{100^2 - 50^2}$ = $\sqrt{7500}$ = 86.60am $\frac{50}{15} = \frac{86.60}{Y}$ Y = $\frac{86.6 \times 15}{50}$ = 25.98 Height = 86.60 – 25.98 = 60.62	M1 A1 B1 M1 A1 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)		

	 M1 $volume = \frac{\pi}{3} r^2 h$ A1 $= \frac{3.142}{3} \times 21 \times 21 \times 30$ $= 13856.22 cm^3$ b)  M1 A1 $\frac{x}{21} = \frac{36}{30}$ M1 $x = 25.2cm$ A1 ii) New volume = $^1/_3$ x 3.142 x 25.2 x 25.2 x 36 $= 23943.55 cm^3$ B1 Volume change = 23943.55 – 13856.22 $= 10087.33 cm^3$ M1 iii) $2/3\pi r^3 = 10087.33$ $r^3 = 10087.3 \times {}^3/_2 \times {}^1/_\pi$ A1 $r^3 = 4815.72$ $r = \sqrt[3]{4815.72}$ B1 r = 16.89cm diameter = 16.89 x 2 = 33.78cm	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

$= \frac{7}{1} \times \frac{3.142 \times 9 \times 13.16}{9}$

$= 289.4$

Top area $= (3.142 \times 9^2) = 254.5cm$

$\therefore$ Total area $= 543.9m^2$

(ii) Volume of smaller cone $= \frac{3.142 \times 9^2 \times 9.6}{3}$

$= 814.41$

Volume of frustrum $= \frac{37 \times 814.41}{27}$

$= 1116.043m^3$

$= 1116043L$

Litres used per day $= (15 \times 15 \times 40) + (116 \times 65) = 16540L$

No. of days $= \frac{1116043}{16540} = 67.5days$

10. $L.S.F = \frac{3}{2} = \frac{28 + h}{h}$

$56 + 2h = 3h$

$h = 56cm$

Volume $= 1/3\ r^2H - 1/3r^2h$

$= {}^1/_3 \times {}^{22}/_7 \times 15 \times 15 \times 56 - {}^1/_3 \times {}^{22}/_7 \times 10 \times 10 \times 28$

$= 13200 - 29331/_3$

$= 10.2667litres$

(b) Slant height $= 152 + 562 = 3361$

$= 57.97cm$

Curved surface $- RL - rl$

11. $2.6 \times 4.8 \times 3.2 = 39.936m^3$

$1m^3 = 1000litres$

$39.936m^3 = 39.936 \times 1000$

$= 39936$ 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

$h = {}^1/_3 \times 45 = 15cm$

volume of removed cone $= {}^1/_3\ r^2h$

$= 1 \times \frac{22}{7} \times 7 \times 7 \times 15$

$= 770cm^3$

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 x 27= 20790cm³
Capacity of frustrum
= vol. of original cone – vol. of removed cone
= 20790 – 770= 20020cm³
20200
1000 = 20 l

(d) capacity of tank = 150 x 120 x 80
1000 = 1440l
No. of buckets = 1440
20 = 72buckets

13. *Mass of water = 1 x 3000 cm³ = 3000 g*
Mass of alcohol = 0.8 x 1200 = 9600g
Mass of mixture = 12,600g
Volume of mixture = 15,000 cm³

Density of mixture = 12600
15000
= 0.84g/cm³

14. *(a) Vol. of tank = 22 x 144 x 1.7 = 5.236*
Vol. of milk = 3/5 x 5.236 = 3.146m³
Vol. in liters = 3.1416 x 1000 = 3141.6litres

(b) (i) Vol. of packet (1/3 x 10 sin 60) x 13.6
= 26.97 x 13.6
= 3.66.75cm³
= 367cm³

(ii) No. packets = (3141.6 x 1000)
367

(iii) Amount = 8560.2 x 20
= 171204.3597
= Shs.171,204.40

15. *Volume of culvert*
= 22/7 (76² – 64²) x 300 x 10⁻⁶
= 22/7 x 1680 x 300
10000000000
= 1.584m³

11. Mass, weight and density

2.	$4 \times 3.142 \times r^2 = 18$ $\rightarrow R \simeq 1.197$ Vol. $= \frac{4}{3} \times 3.142 \times 1.197$	**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 = $\frac{300 \times 1,000,000}{20 \times 1000}$*

$= 15,000\ kg/m^3$

6. $D = \frac{M}{V}$

Mas = D x V

$= \frac{1g}{cm^3} \times 2500cm^3$

= 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 $= \frac{160}{4.5} km/h$ $= 35.56km/h$	M_1 M_1 A_1	✓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 $= \frac{300}{7½}$
$= 40km/h$

13. Linear

1	(0,3), (3,0) $\frac{3-0}{0-3} = -1$ $\frac{y-0}{x-3} = -1 \quad y = -x+3$ $y < -x+3$ $x \geq 1$ $y \geq 0$	 B_1 B_1 B_1	
2.	(a) $x \geq -4$ (b) $y = -x$ $y + x \leq 0$ (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.	$2x + 3 \geq 5x - 3$ $-3x \geq -6$ $x \leq 2$ $5x - 3 > -8$ $5x > -5$ $x > -1$ $-1 < x \leq 2$ 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 $\frac{A_1}{2}$	
7	$-3x + 2 < x + 6$ $x > 1$ $x + 6 \leq 17 - 2x$ $x \leq 3\frac{2}{3}$ 2, 3	B_1 B_1 B_1 3	
8.	$\frac{3a+2}{4} \leq \frac{2a+3}{5} \leq \frac{4a+15}{6}$ $\frac{3a+2}{4} \leq \frac{2a+3}{5}$ $5(3a + 2) \leq 4(2a + 3)$ $15a + 10 \leq 8a + 12$ $7a \leq 2$ $a \leq 0.2857$ $\frac{2a+3}{5} \leq \frac{4a+15}{6}$ $6(2a + 3) \leq 5(4a + 15)$ $-8a/-8 \leq 57/-8$ $a \leq -7.125$; $-7.125 \leq a \leq 0.28$ Integral values -7, -6, -5, -4, -3, -2, -1	 1 M1 B1 B1	
		03	

9. $\frac{1}{2}x - 2 \leq 3 - 2$; $3x - 2 < + \frac{1}{2}x$

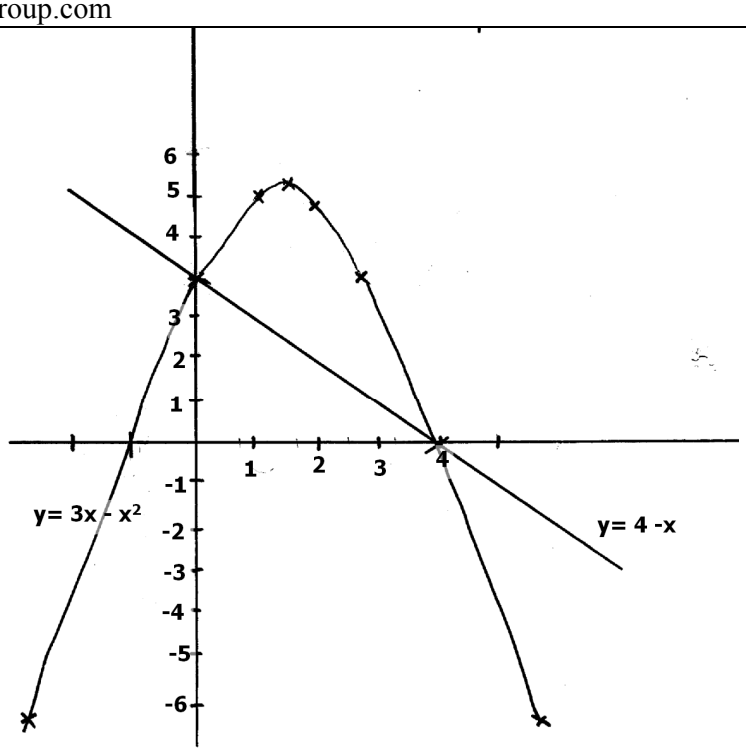
$O \leq {}^{7}/_{2}x$ $\quad {}^{5}/_{2}x < 4$

$O \leq x$ - B1 $\quad x < {}^{8}/_{5}$ B1

$x = 0, 1$ A1

3

10.	$y \leq 2, x > -3$ (3,-3) & (-3,1) $M = \frac{1+3}{-3-3} = \frac{4}{-6} = -\frac{2}{3}$ $y = -\frac{2}{3}x + c$ $-3 = -\frac{2}{3} \times 3 + c$ $-3 = -2+c$ $c = -1$ $y = {}^{1}/_{3}x - 2$, 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 $y \geq 5x - 18$	B1 B1 B1	Both B0 if any one is wrong For □ Ineq
		03	
11.	$-4x + 2y \leq 4$ $y \geq 0$ $x + y \leq 4$	**B1** **B1** **B1**	
		03	
12.	$3y + 2x \angle 6$ $4y - 3x \geq -12$ $y + 3x \geq -3$	**B1** **B1** **B1**	
		03	
13.	<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>	**B2** **S1** **P1** **C1** **L1**	For all values ✓



B1

B1

B1

B1

b) turning point 1.5, 6.25

c) i) Line y = 0 x = -1 or x = 4

x = -1 or x = 4

ii) $4 + 3x - x^2 = y$

$4x - x^2 = 0$

$4 - x = y$

x	0	4
y	4	0

x = 0 or x = 4

10

14 $\frac{2x}{3} + \frac{3x}{4} \leq 9.5 + 5.5$

$\frac{8x + 9x}{12} \leq 15$

$17x \geq 180$

$x \leq \frac{180}{17}$ M1

$-\frac{x}{3} - \frac{3x}{4} < 18 - 9.5$

	$\frac{-4x-9x}{12} < 8.5$ $-\frac{13x}{12} < \frac{17}{2}$ $-13x < 102$ $x > -\frac{102}{13}$ $-\frac{102}{13} < x \leq \frac{180}{17}$ $-7\frac{11}{13} < x \leq 10\frac{10}{17}$	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
$6b + 15p = 360$

$\underline{6b + 4p = 228}$
$11p = 132$
$P = 121$
$2b + 60 = 120$
$2b = 60$
$b = 30$
$\therefore$ 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. $2s + 3t = 1750$
$3s + 2t = 1500$
$4s + 6t = 3500$
$9s + 6t = 4500$

$2t = 1500 - 600$
$t = 450$

$5s = 1000$
$s = 200$
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
∴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)
$p^2 + 5p - 288 = 0$

$$p = \frac{-5 \pm \sqrt{25 - 4 \times 1 \times -228}}{2 \times 1}$$

P = 13 (to the nearest whole no.)
b= 4+ 13 = 17

24. *3x – 2 (x + 2) = 21*
X = 25
Large No = 25 + 2 = 27
∴ product = 25 x 27 = 695

25. *x -20 + 3x = 180°C*
4x = 200
x = 50°

Attempt to get x by using t+e = 180°
$e = \frac{(2n-4)90}{n}$
number of sides

26. *5x + 4y = 6160*
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
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 $x = 4\ y = 5$ $x = -1\ y = -5$	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) Area = (2x + 5)(x + 5) (a) 75 = 2x2 + 10x + 5x + 25 2x2 + 15x – 50 = 0 (b) 2x2 + 15x – 50 = 0 2x2 + 5x + 20x – 50 = 0 x(2x – 5) + 10(2x – 5) = 0 (x + 10)(2x – 5) = 0 x = -10 or 2 ½ length (2 x 5/2 + 5) = 10cm width (5/2 + 5) = 7.5cm (c) Area not covered = area of frame – area of photo = 75 – 25 = 50cm2 % area = 50/75 x 100 = 66.67%/66 2/3%	B1 M1 A1 M1 A1 B1 B1 M1 M1 A1	Dimension with unknowns Factorization Difference in area
		10	
3.	$24x\left(\frac{1}{4x}\right) = 24x\left(\frac{5}{6x}\right) - 7(24x)$ $6 = 20 - 168x$ $\frac{-14}{-168} = x$ $\frac{1}{12} = x$	M1 M1 A1	Multiplication by LC.
4	3(25x2 – 9y2) 3(5x – 3y) (5x + 3y)	M1 A1 2	For 3 out
5.	$\frac{x-3}{5} = 4 - \frac{x-2}{2}$ $10\left(\frac{x-3}{5}\right) = 10 \times 4 - 10\left(\frac{x-2}{2}\right)$ 2(x – 3) = 10(4) – 5(x – 2) 2x – 6 = 40 – 5x + 10 7x = 56 x = 8	 M1 M1 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

$a + b = 45$
$4a + 2b = 100$ } B1 for both equations

$a + b = 45$
$-2a + b = 50$ M1 method for solving any of the unknown

$-a = -5$
$a = 5$
$b = 40$

Goats were 5
Chicken were 40 } 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.	$13824 = 2^9 \times 3^3$ $0.000125 = \frac{1}{8000} = \frac{1}{2^6 \times 5^3}$ $\therefore = \left(\frac{2^9 \times 3^2}{2^6 \times 5^3}\right)^{-\frac{1}{3}}$ $= \left(\frac{2^6 \times 5^3}{2^9 \times 3^3}\right)^{\frac{1}{3}}$ $= \left(\frac{5}{2 \times 3}\right)$	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.	$\frac{3^5 \times 3^{2y}}{3^6 \times 3^{y-2y+1}} = 3^4$ $\frac{3^{5+2y}}{3^{7-y}} = 3^4$ $y = 2$	**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.	$27^{-m} \times \frac{1}{81} = 243$ $(3^3)^{-m} \times \frac{1}{3^4} = 3^5$ $3^{-3m-4} = 3^5$ $-3m - 4 = 5$ $-3m = 9$ $m = -3$	 M1 M1 $\frac{A1}{3}$	 Exp. in powers of 3 Equating powers of 3

18.	 $4p + 6q = 184$….x3 $3p + 8q = 222$….x4 $12p + 18q = 552$ $12p + 32q = 888$ $\frac{14q}{14} = \frac{336}{14}$ $q = 24$ $4p + 144 = 184$	 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 New area = (80 – 2x)(60 – 2x) = 2 $\Rightarrow 4x^2 - 280x + 4800 = 2/3 \times 4800$ $4x^2 - 280 + 1600 = 0$ X = 6.28m	M1 M1 M1 A1	✓old area ✓ exp ✓solving CAO
		04	

20	$4t + 3n = 4250$ $6t + 2n = 4000$ $3t + n = 2000$ $9t + 3 = 6000$ $4t + 3n = 4250$ _____ 5t =350 n=2000-1050 = 950 $3\times350+3\times950=3900$	B1 M1 A1 B1	2 equations solving For t and n

21. *Through A/C in Kenya*
1000000 X 76.84 = Shs.7684000
through A/C in UK
1000000 X 115.70 = Shs.7,562,091.15
1.53
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 = 2800265 = 279562.4264*
10.0166

Expenses = (115,700 + 97000 + 53689)
= 266389 Rand
Remainder = 279562.4264
266,389.000
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 =(975) = 500
1.95

25. *Amount in dollars = 75 x 40 = 3,000*
Amount in Ksh = 3000 x 81.40 = 244,200/=
Less commission 4,000

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 = 618821
12.11= 51100rands

27. *500000 J yen into Kshs.= (500000 x 66.5)*
100
= Kshs. 330,250
Amount spend in Kenya= Kshs. 16200
Remained with Kshs. (330250 – 16200)
= Kshs. 314,040
Kshs. 314040 into Euros:
= (314040)
78.15
= 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
(1 x 232241 / 9.51)
= shs.24420.715

29. *1UK £ = 125.30*
9000 UK £ = 125.30 x 9000

$= 1,127,700$

Commission $= 5/100 \times 1,127,700 = 56,385$

He got $1,071,315$

Expenditure $= \frac{3}{4}$ *of* $1,071,315 = 803,486.25$

Amt. left $= 267,828.75$

In US \$ $= \frac{267,828.75}{63.20}$

$= 4237.7966 \simeq 4237$ *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*

$= \frac{\sum 50,000 \times Shs.120.7131}{\sum}$ *= Kshs.6035655*

Amount received in sterling pound

$= \frac{1 \sum \times Kshs.6035655}{120.9294} = \sum 49910.568$

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	
	= Ksh. 350, 000	M_1 A_1	✓exp
	Sales 350, 000 + 100, 000 = 450, 000		
	(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) $InUsh.1050000+60\times Ush1016+\frac{55}{100}\times 1050000$ $=1050000+60960+577500$ $=Ush1688460$ In Ksh. $\frac{1688460}{24.83}$ $Ksh.68000.81$ (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 = $\frac{48000 \times 100}{145}$ = 3310.34 (b) $\frac{5454.54 - 3310.34}{3310.34} \times 100$ = 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 $(0.5 \times 200 \times 20) + (0.3 \times 600 \times 40)$ 2000×7200 $\frac{9200}{48000} \times 100$ % 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
$63\frac{1}{3}$ % 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 M1 $\frac{y}{100}$ x 45000 = 2250 M1 ∴x = 4.5% y = 5% A1		
		03	
18.	Sitienei – x Lagat – 1.1x Rotich – 1.155x M1 Diff = 1.155x – 1.1x = 0.55x = 110,000 X = 2,000,000 A1 Rotic paid 1.155 x 200,000 = 231000		
		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.)	$A = 1200000\ (1 - {}^{8}/_{100})^2$ $1200000\ (0.92)^2$ = 1,051,680	M1 M1	
	$1015680\ (1-{}^{12}/_{100})^4$ $1015680\ (0.88)^4$ = 609098.58	M1 A1	
b.)	${}^{125}/_{100}$ x 609098.58 = 761373.23	M1 A1	
	$761373.23 = 1200000(1- {}^{r}/_{100})^{72}$ $(1/ {}^{r}/_{100})^{72} = 0.6344776$	M1	Follow thro' if A1 is missing
	${}^{72}/_{72} \log (1- {}^{r}/_{100}) = {}^{-0.1975836}/_{72}$ $\text{Log}(1- {}^{r}/_{100}) = {}^{-}\ 0.0027442173$	M1	
	$1-{}^{r}/_{100} = 0.9937011$ ${}^{r}/_{100} = 0.0062988$ r = 0.62988 % p.m.	M1 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 $y = 0 \quad x = -3$

$x = 0 \quad y = 2$

$\therefore$ 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. $Y = 3x - 1$

$M = 3$

$M_1 m_2 = -1$

$M_2 = -\frac{1}{3}$

$\frac{y - 3}{x - 2} = -\frac{1}{3}$

$3y - 9 = -x + 2$

$\frac{3y}{3} = \frac{-x}{3} + \frac{11}{3}$

$Y = \frac{x}{3} + \frac{11}{3}$

29. Pt T is $\left(\frac{1 + 5}{2}, \frac{4 + 10}{2}\right) = (-2, 7)$

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

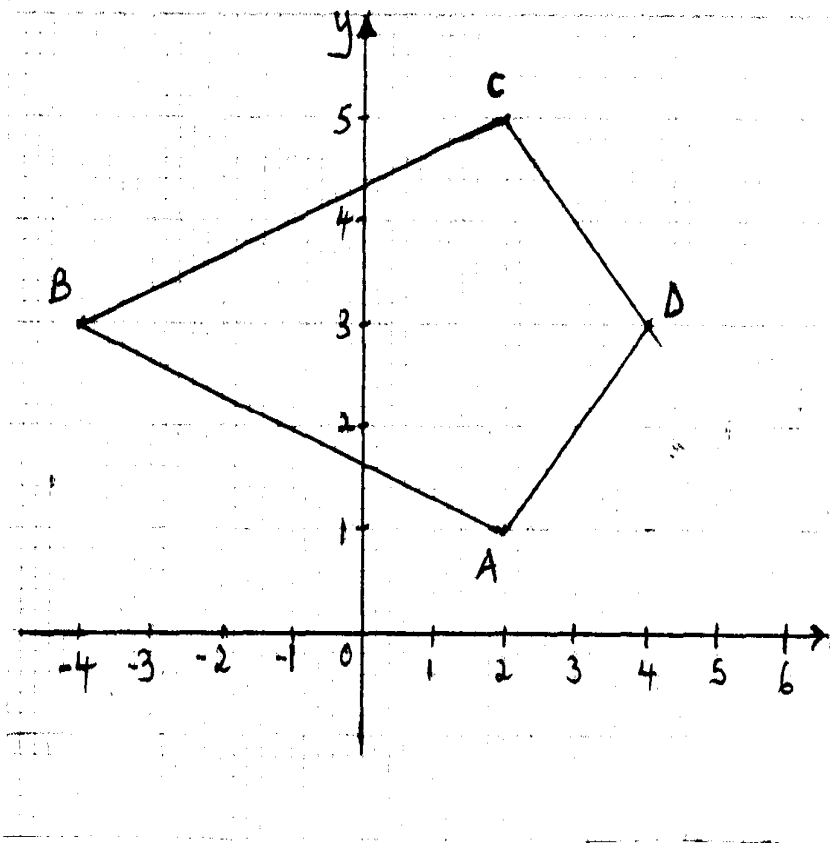
$\Rightarrow \frac{y - 7}{x - 2} = \frac{3}{7}$

$\Rightarrow 7y - 49 = 3x + 6$

$7y = 3x + 55$

Or $y = \frac{3x}{} + \frac{55}{}$ } **Equation of 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
y- 4 = 1
x – 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) $AN = ON - OA = \frac{1}{2} OM - OA$

$OM = OA + \frac{1}{2} AB = (2) + \frac{1}{2}(2)$

$= 3$

$AN = \frac{1}{2} \begin{pmatrix} 3 \\ 1 \end{pmatrix} - \begin{pmatrix} 2 \\ -1 \end{pmatrix} = \begin{pmatrix} \frac{1}{2} \\ -\frac{1}{3} \end{pmatrix}$

$= \frac{1}{2}$

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) $AC = OC - OA = \begin{pmatrix} 0 \\ 5 \end{pmatrix} - \begin{pmatrix} 2 \\ -1 \end{pmatrix} = 2 \begin{pmatrix} -1 \\ 3 \end{pmatrix}$

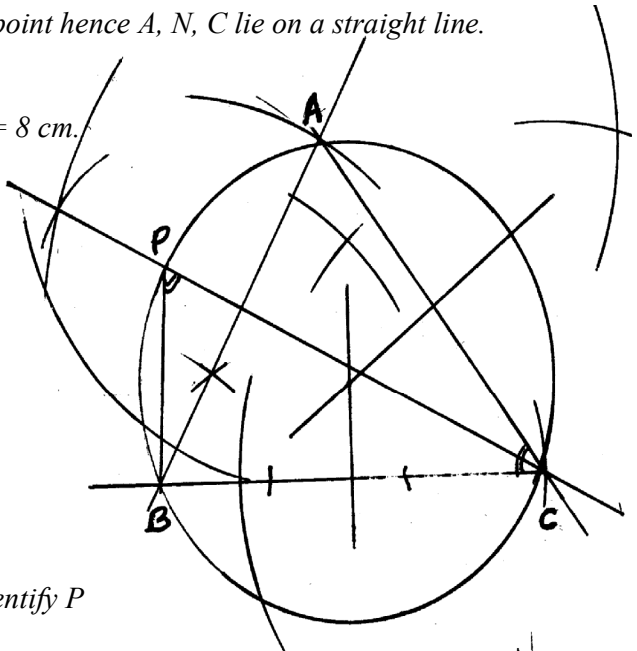
c) $AN = \frac{1}{2} \begin{pmatrix} -1 \\ 3 \end{pmatrix}$

$NC = \frac{3}{2} \begin{pmatrix} -\frac{1}{3} \\ \end{pmatrix}$

$4AN = AC$ *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 $\measuredangle 60^o$



(b) AC = 7.6 $\pm$ *0.1 and*

$\measuredangle ACB = 53 \pm 1^o$

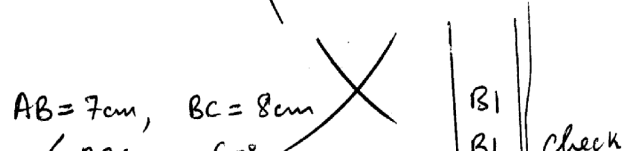
(c) 2 sides bisector 1

Circle drawn radius 4.4. $\pm$ *0.1*

(d) Bisect $\measuredangle ACB$

Bisection line to cut the circle to identify P

$\measuredangle PBC$ *measure* $\equiv$



(a) AB = 7 cm, BC = 8 cm

$\angle$ ABC = 60°

(b) AC = 7.6 $\pm$ 0.1 cm

$\angle$ ABC = 53° $\pm$ 0.1

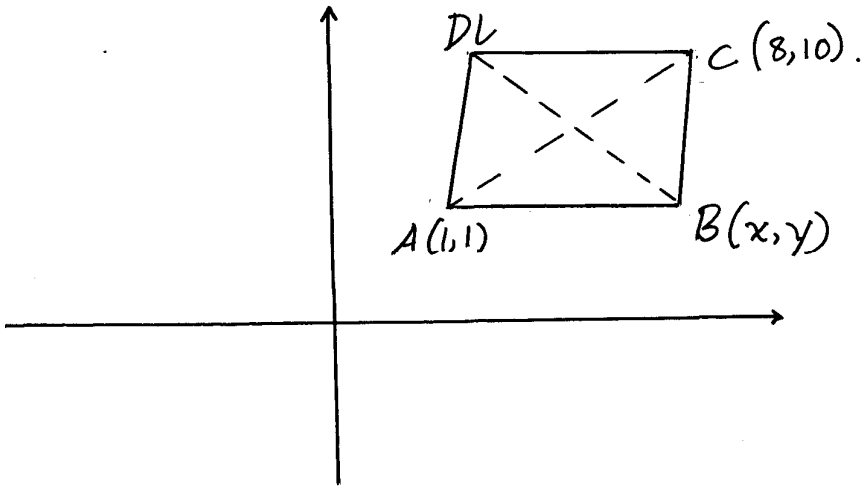
(c) Perpendicular bisectors of any two sides.
Circle drawn
Radius = 4.4. $\pm$ 0.1. cm

(d) $\angle$ ACB bisected
Bisection line drawn to cut circle at P

$\angle$BPC = $\angle$BAC = 67°

$\angle$ PBC = 88 ± 0.1°

34.



M $\left(\frac{1+8}{2}, \frac{1+10}{2}\right)$ = M (4.5, 5.5)

b) AB: 4x – 5y = -1 x 2
BC: 5x – 2y = 20 x 5
8x – 10y = -2
25x – 10y = 100
-17x = -102
$x = {}^{102}/_{17} = 6.0$
24 – 5y = -1
5y = -25
Y = 5
∴ B(6,5)

$\frac{x + 6.0}{2}$ = 4.5 *x = 3*

$\frac{y+5}{2} = 5.5 \qquad y = 6$

$\therefore \underline{D\ (3,6)}$

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) $k\left(\frac{3-7}{2}, \frac{4+2}{2}\right) = (-2,3)$ $p\left(\frac{3+1}{2}, \frac{4-2}{2}\right) = (2,1)$ (ii) $G_1 = \frac{3-2}{-2-2} = \frac{-1}{2}$ $G_2 = 2$ Mid $p + kp = \left(\frac{-2+2}{2}, \frac{3+1}{2}\right) = (0,2)$ $\therefore equation \quad y = 2x + c$ $when \quad x = 0, y = 2, then \quad c = 2$ $hence, \quad y = 2x + 2$	B_1 for both p and k ✓ B_1 for both G_1 and G_2 ✓ r identified $\frac{B_1}{3}$

2. *Let the exterior* $\angle$ *be x*

$6.5x + x = 180$

$7.5x = 180^0$

$x = 24$

No. of sides $= \frac{360}{24}$

$= 15\ sides.$

3. $\frac{(2n-4)\ 90}{(2(n+2)-4)90} = \frac{3}{4}$

$\frac{2n-4}{2n} = \frac{3}{4}$

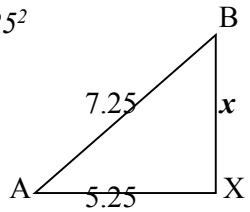
$8n - 16 = 6n$

$2n = 16$

$n = 8$
$(2(8) - 4)\ 90$
$= 12 \times 90 = 1080$

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. $x^2 = 7.25^2 - 5.25^2$
$x = \sqrt{7.25^2 - 5.25^2}$
$= 52.5625$
$\frac{27.5625}{\sqrt{25}}$ -
$= 5cm$



$BC = 15.25 + 5 = 22.25cm$
$Arc\ CD = {}^{90}/_{360} \times 3.142 \times 2 \times 22.25$
$= 34.65475$
$Perimeter = AB + BC + CD + DE + EA$
$= 15.25 + 7.25 + 22.25 + 34.95 + 5.25$
$= 84.95cm$

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 $\angle + e = 180^o$
$e = \frac{(2n-4)90}{n}$
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 $x = 5^{3y}$
$5^3 \times 5^{3y} + 5^{3y} = 630$
$125x + x = 630$
$x = 5$
$5^{3y} = 5^1$
$3y = 1$
$y = {}^1/_3$

12. $\frac{360}{n} + 108 = 180 - \frac{360}{n}$
$360 + 108n = 180n - 360$
$-72n = -720$
$n = 10$

13. Let exterior angle be x
$\frac{4x}{4} = \frac{180^o}{4}$
$x = 45^o$
$n = \frac{360}{}$
Exterior angle
$n = \frac{360}{45}$
$= 8$sides

14. a) Let $< BDC = ø$
$A^2 = 5^2 + 8^2 - 2 \times 5 \times 8 \cos ø$
$\cos ø = \frac{89 - 16}{80} = \frac{73}{80} = 0.9125$
$Ø = 24°9\frac{1}{1} = 24° 8$

b) Area of ABD
$= ½ \times 8 \times 10 \sin 24°9^1$
$= 40 \times 0.4091$
$= 16.36cm^3$ 16.37 16.38

15. (a) $\angle CDF = 100\text{-}60 = 40^o$ (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

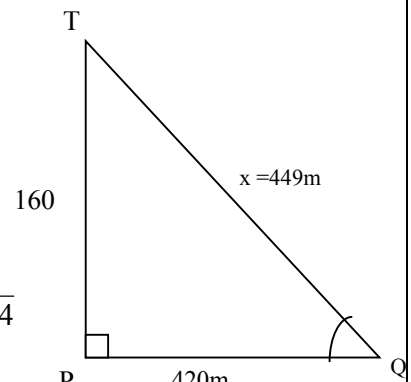
18. $<PQR = <SRT = x$ (Alt $<SPQ$ //RS)
$\therefore 5x + 3x + x = 180°$ < 's of Δ
$9x = 180°$
$X = 20°$
$\therefore 5 \times 20 + y = 180$
$y = 180 - 120 = 60$

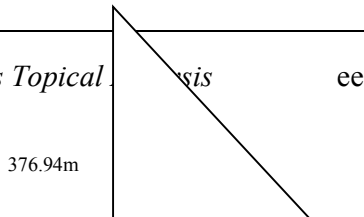
19. *Let the interior ∠ be x and exterior be y*
$\therefore x + y = 180$
$+$
$x - y = 132$
$2x = 312$
$x = 156$
$y = 180 - 156 = 24^o$

No. of sides (n) $= \frac{360^o}{24} = 15$
$= 15$ *sides*

17. Angles and Plane figures

1	$2a + b = 180$ $13a - b = 360$ $15a = 540$ $a = \frac{540}{15} = 36$ $72 + b = 180$ $b = 180 - 72 - 108^0$	M_1 M_1 M_1 A_1	✓formation of the equations ✓attempt to solve
2	$\angle XAD = 30^0$ $180 - (50 + 30)$ $= 180 - 80 = 100^0$	B1 B1	
3	$\frac{h}{100} = \tan 67^0$ $h = 160 \times \tan 67^0$ $= 376.94m$ $x^2 = \sqrt{160^2 + 420^2} = \sqrt{25600.1764}$ $= 449m$	M_1 M_1 A_1	

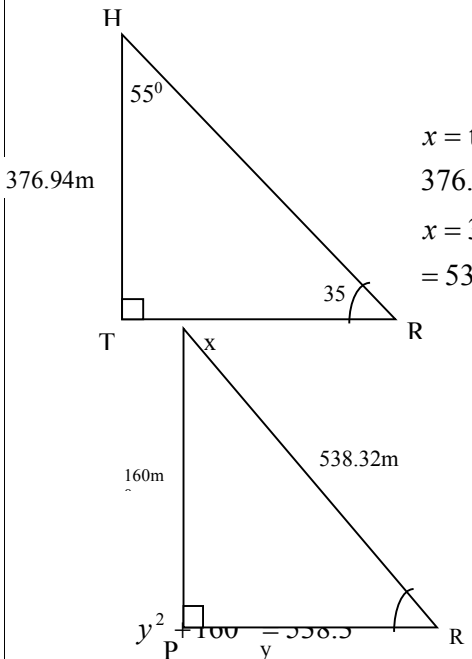




$$\text{Tan } \theta = \frac{376.94m}{449m} = 0.8395$$

$$\vartheta = 40^0$$

M1



M1

A1

$x = \tan 55^0$

376.94

$x = 376.94 \times \tan 55^0$

$= 538.32km$

M1

M1

$y^2 + 160^2 = 538.3$

$y^2 = \sqrt{538.32^2 - 160^2}$

$y = \sqrt{264{,}188.4224}$

M1

$= 513.99m$

$\approx 514m$

A1

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	M1 M1 $\frac{A_1}{3}$

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 = $\frac{360}{20}$
= 18 sides

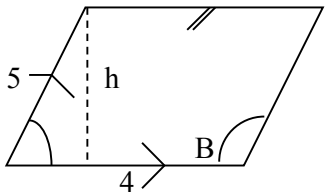
M1

A1

3

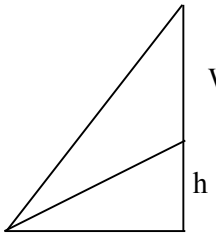
ALT
n = No. of sides
$\left(\frac{n-2}{n}\right) 180 = 8\left(\frac{360}{n}\right)$ M1M1
n = 18 sides A1

10.



Area = 5 x sin α = 12 M1
α = 36.87^0 A1
B = 143.13^0 A1
3

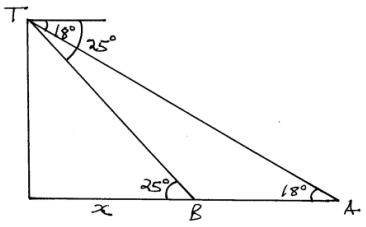
11. 5^0 27^0



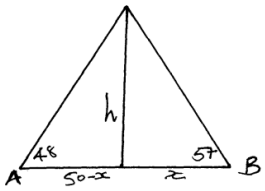
Tan 27^0 = $\frac{h}{20}$
h = 10.19m M1
Tan 32^0 = $x/20$
x = 12.50m M1
Window height = 2.31m A1

3

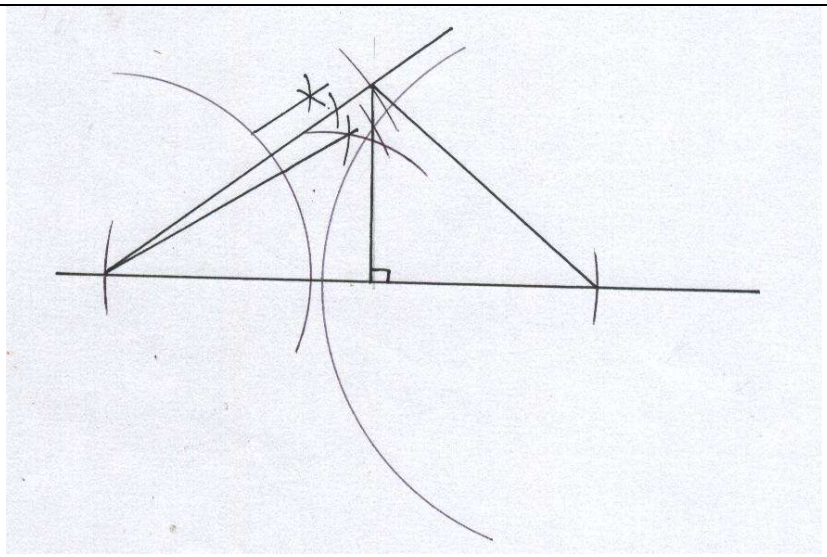
12.	$\frac{360^0}{n} = 18^0$ n = $\frac{360^0}{18^0}$ = 20 sides Area = (½ x 16 x $16/2$ tan 81^0) x 20 = (8 x8 x 6.3138) x 20 = 8081.66cm^2	B1 M1 A1	
		03	
13.	(a)	B2	

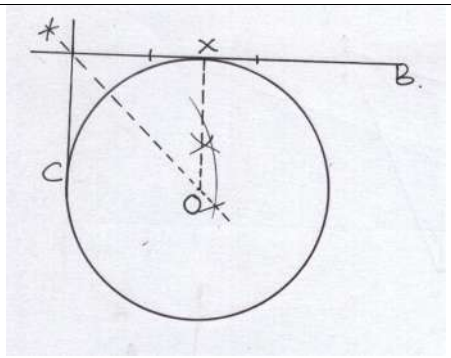
	 Sketch	M1	
	(b) i) $\frac{h}{x} = \tan 25^0 \Rightarrow h = x \tan 25$	M1	
	$\frac{h}{x+70} = \tan 18^0 \Rightarrow h = \tan 18(x + 70)$	M1	
	Equating the two equations $x \tan 25^0 = x \tan 18^0 + 70 \tan 18^0$	M1	
	$x(\tan 25 \tan 18^0) = 70 \tan 18^0$	A1	
	$x = \frac{70 \tan 18^0}{\tan 25^0 - \tan 18^0}$	B1	
	$x = \frac{22.744 = 160.8}{0.1414}$ $h = 160.8 \tan 25 = 75m$	M1	
	(c) Distance of A to the front of post $= x + 70$ $= 160.8 + 70$ $= 230.8m$	A1	
		10	

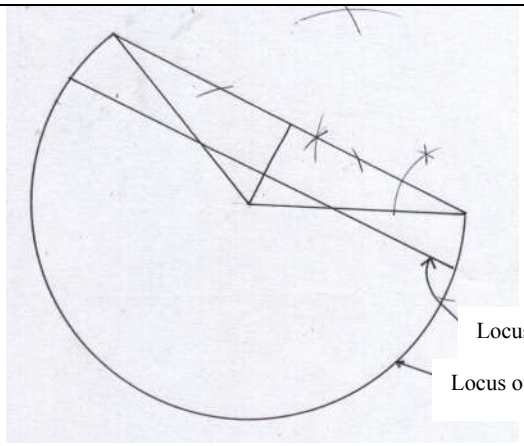
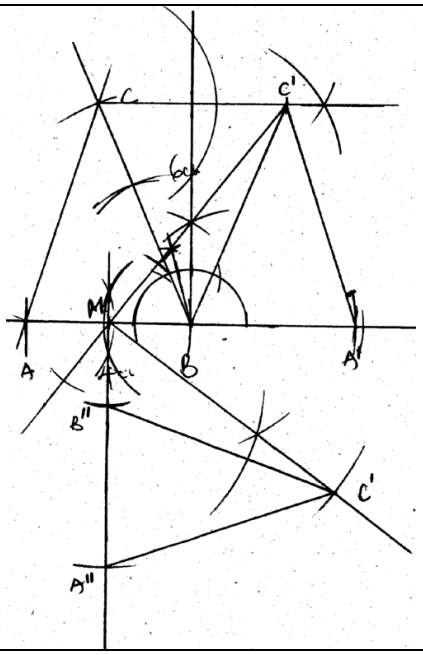
14.	$\{2(8) - 2\} \times 90$ 14×90 1260^0	M1 A1 2	

15.	 $\tan 57^0 = \frac{h}{x} \Rightarrow h = x \tan 57^0$ $\tan 48^0 = \frac{h}{50 - x} h = (50 - x) \tan 48^0$	M1	
	$x \tan 57^0 = (50 - x) \tan 48$ $1.53986x = 55.53 - 1.1106x$ $x = 20.95$	A1	
	$distance = 50 - 20.95 = 29.045m \text{ or } 20.95m$	M1	
	$h = x \tan 57 = 20.95 \tan 57$ $= 32.26m$	A1	
		04	

18. Geometrical constructions

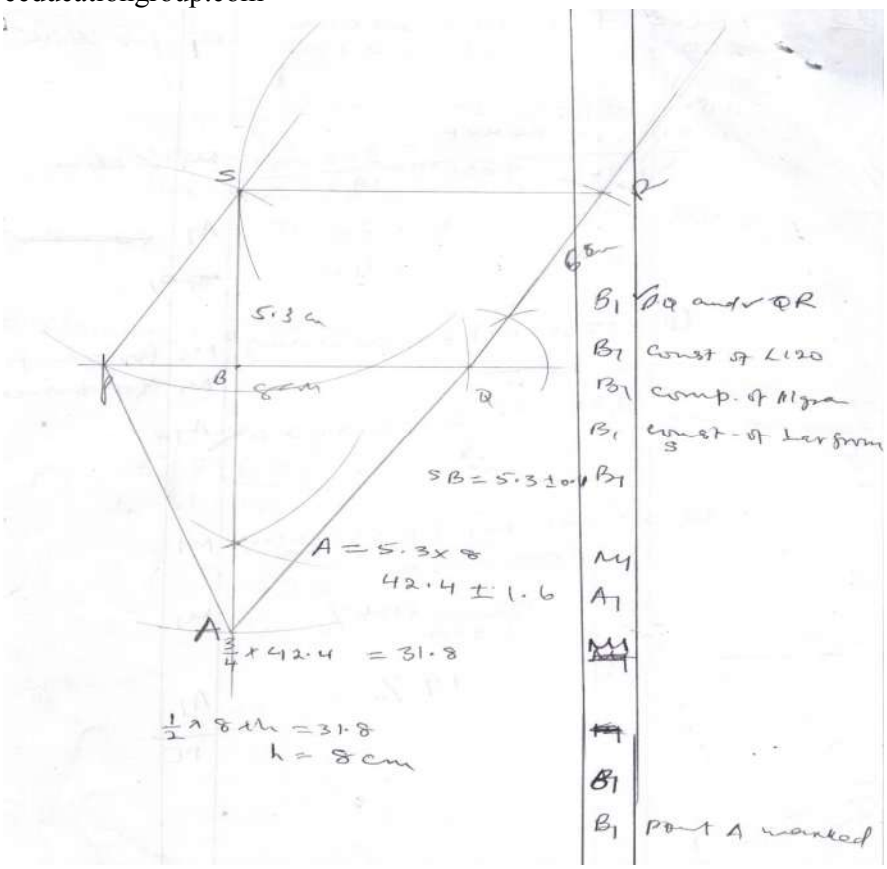
1	 $CD = 3.7cm \pm 0.1$ Area of $\Delta ABC = \frac{1}{2} \times 9 \times 3.7cm$ $= 16.65cm^2$ AE=	B_1 B_1 B_1 B_1 B_1 B_1 M_1 A_1 B_1 B_1	✓conct 30^0 ✓conct 15^0 ✓AB 9cm ✓AC 6cm ✓ΔABC ✓CD Loci of E For AE

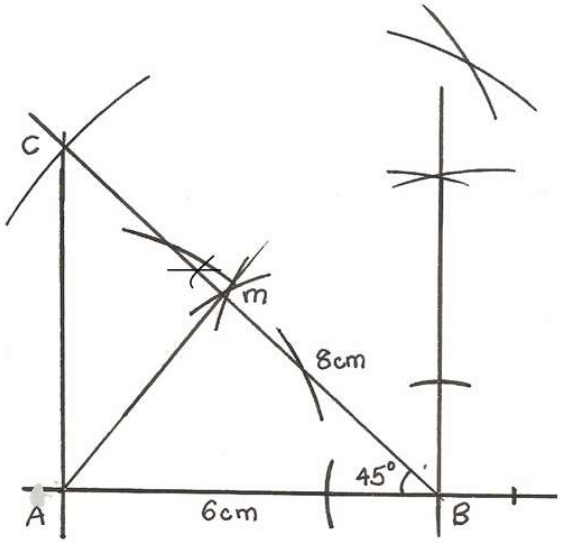
2		B_1 B_1 B_1	✓construction of 90^0at x ✓bisection of line XC and location of centre O ✓circle drawn

		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

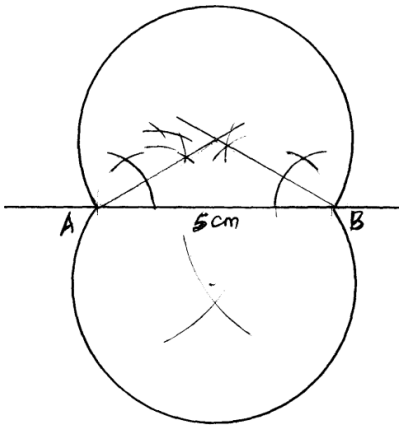
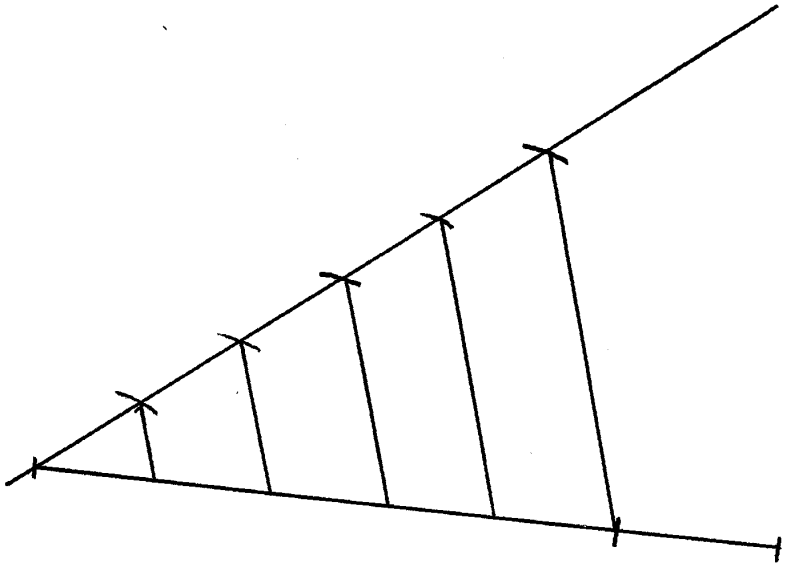
13.091 x 2 = 26.182cm^2 M1

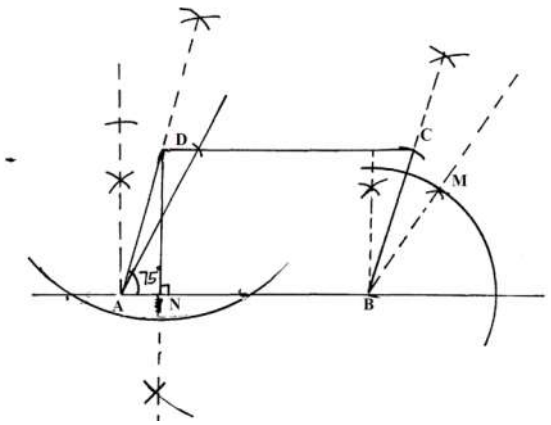
$\therefore$ Area of shaded part

43.3025 – 26.182 M1

= 17.11225cm^2 A1

10

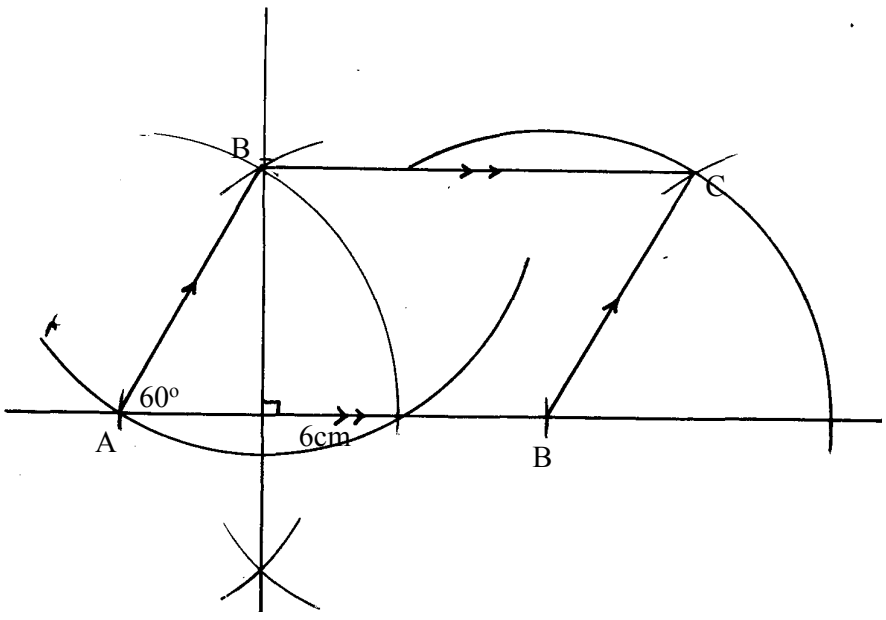
10.	 Constant angle locus	B1 B1 B1 B1	Const of 30^0 at A Const. of 30^0 at B For one arc constructed For lower arc constructed.
11.		**B1** **B1** **B1**	A line drawn slunt to touch the given line at one end. Subdivided to 5 equal Sections Parallel lines drawn from slunt line to touch the given line .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 & 60^0at 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. $A = 120000\ (\ 1 + {}^{8}/_{100} \times {}^{1}/_{4}\ )^3$

$120000\ (1.02)^3 \qquad = 127344.95$

14.

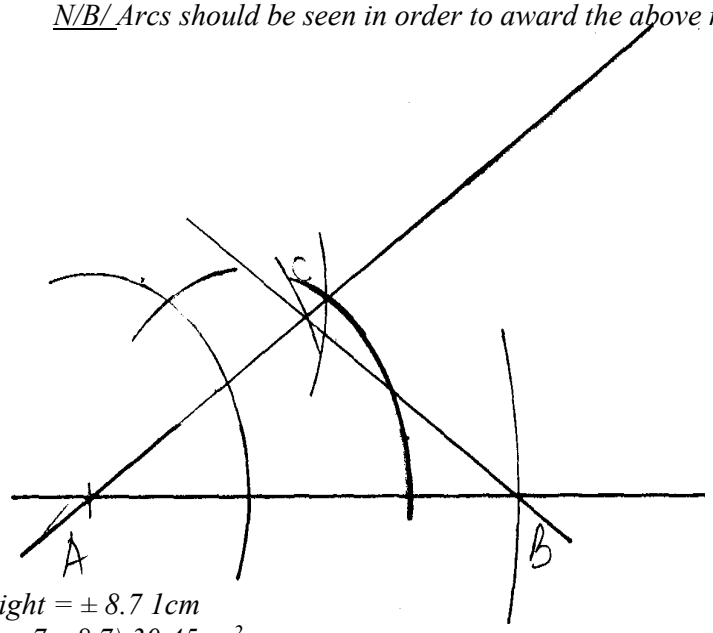


15. *BC = 3.5 cm ± 0.1* B_1

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) 30.45cm²

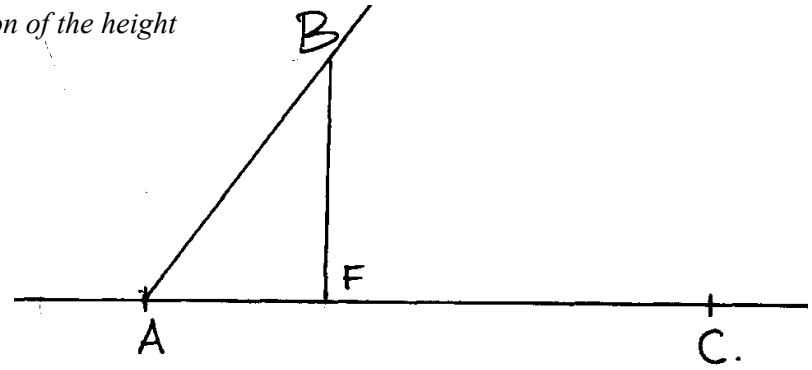
2 ±1cm

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*

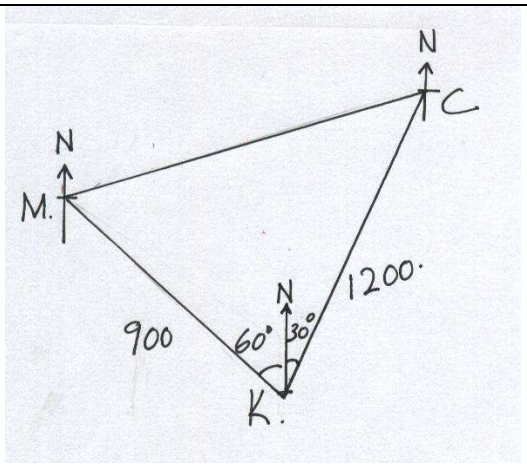
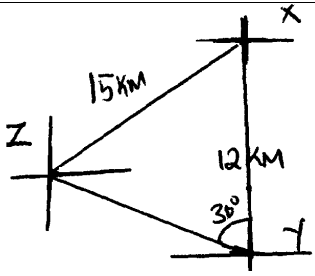
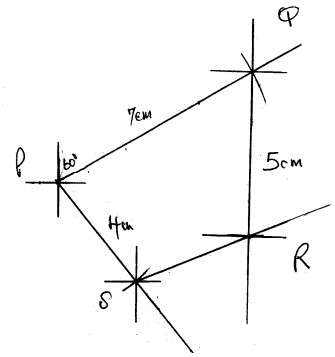
Cost = $\frac{100}{25}$ x 450 = shs.360

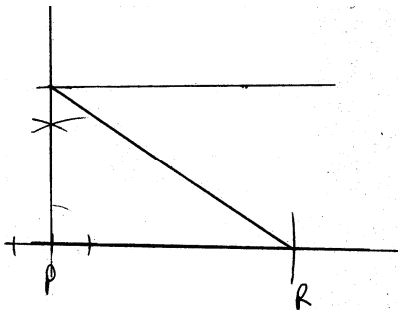
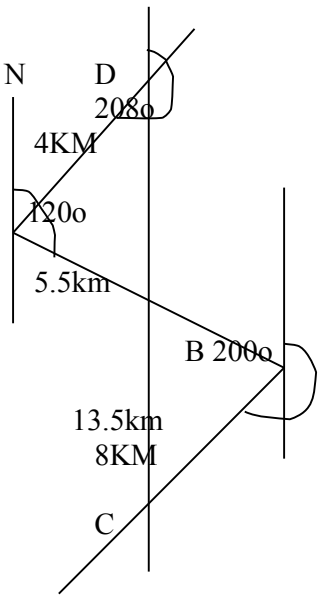
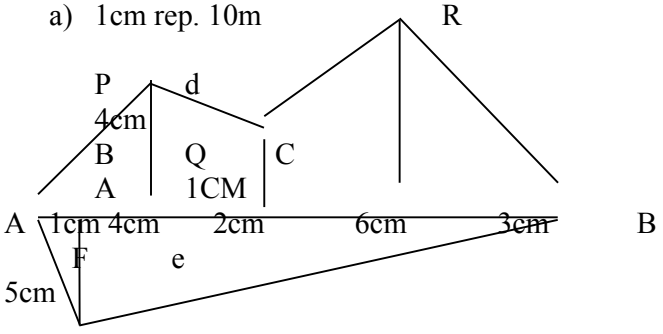
Profit = 500 – 360

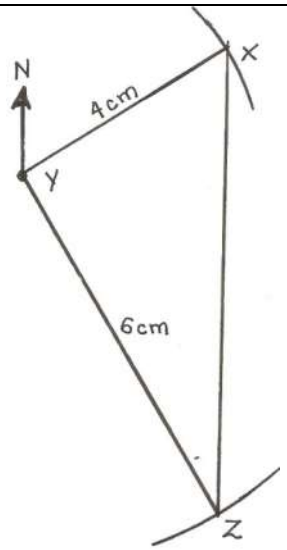
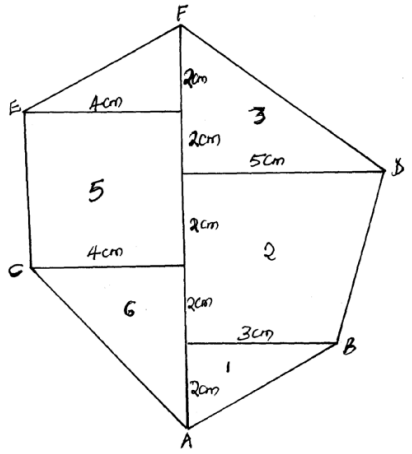
= shs. 140

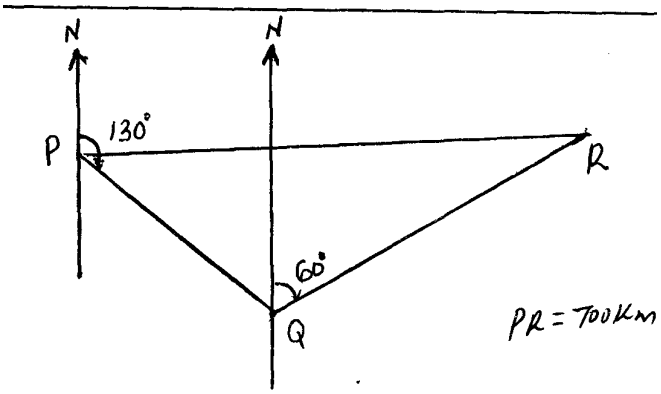
19. Scale drawing

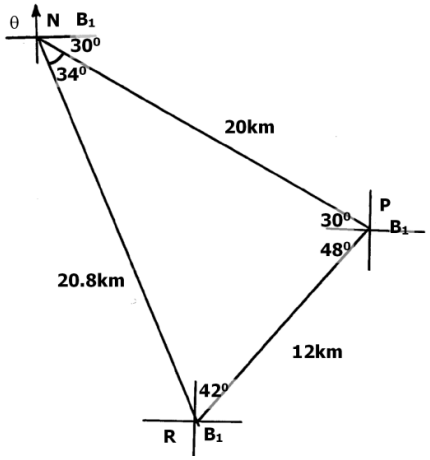
1	(i)	B_1	✓sketch not on scale

	 (ii) MC $= \sqrt{1200^2 + 900^2}$ $= \sqrt{1440000 + 810000}$ $= \sqrt{2250000}$ $= 1500m$	M_1 A_1 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.

	 Angle of depression = 330	B1 B1 B1	Award of 3 digits only Posts P drawn Position P and R shown and triangle completed Angle of depression given
		10	
4	1cm represent 1km  Bearing 030o 4km from starting point	1M 1M 1M A1	Bearing of starting point A Use of scale correctly and plotting of points Use of bearing correctly
5	a) 1cm rep. 10m  b) Area	B1 B1	Correct scales Correct drawing

	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 1000000 10000 = 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 42500 10,000 = 4.25 ha	M1 A1 2	

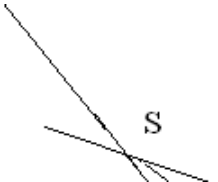
13.

Positions

Q B1
R B1
S B1

<

Const 300 B1

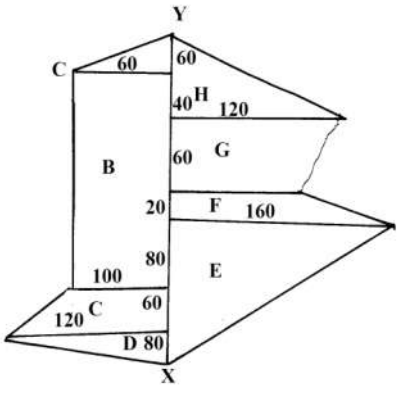


$\langle$330 B1

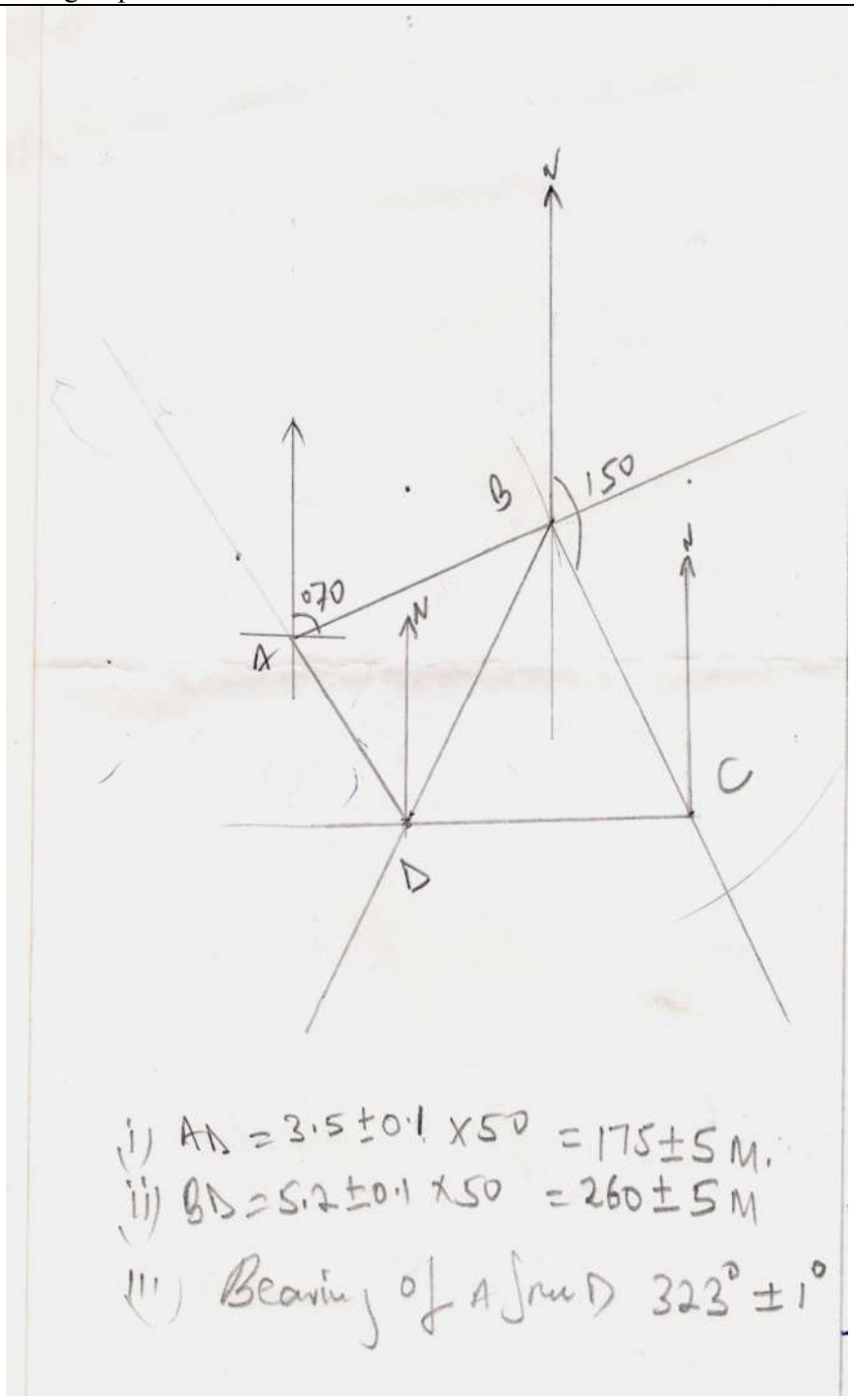
Scale B1

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		B1 B1 B1 B1 M1 A1 M1 A1 B1	Locating A Locating B Locating C Locating D North at D
		10	

17. a) $\frac{YZ}{\sin 28^o} = \frac{13.5}{\sin 100^o}$

Duration of travel = 8:55a.m – 7.35a.m

$= {}^4/_3$

Speed = $\frac{6.436}{{}^4/_3}$

= 4.827km/hr

(b) $\frac{13.5}{\sin 10^o} = 6.436 + ZQ$

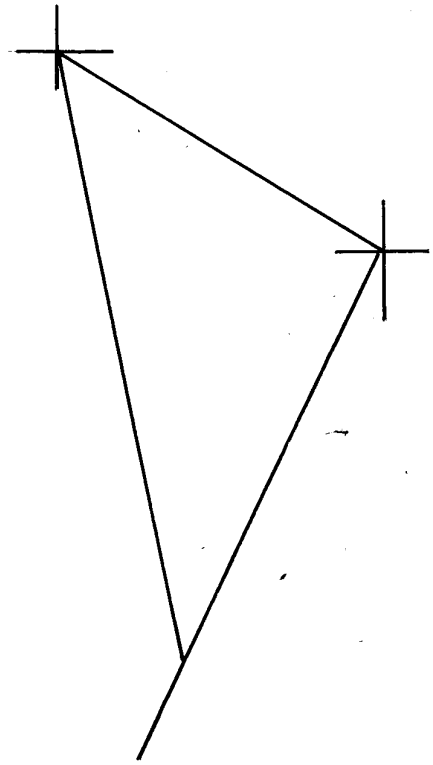
$\sin 118^o$

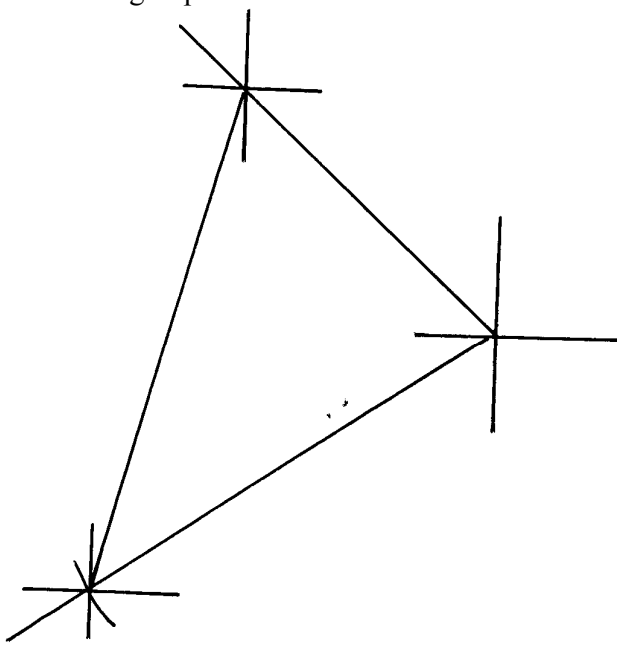
$6.436 + ZQ = 13.5 \times \sin 118^o = 68.659$

$ZQ = 68.659 - 6.436$

$= 62.223$

18. 1cm rep 100km

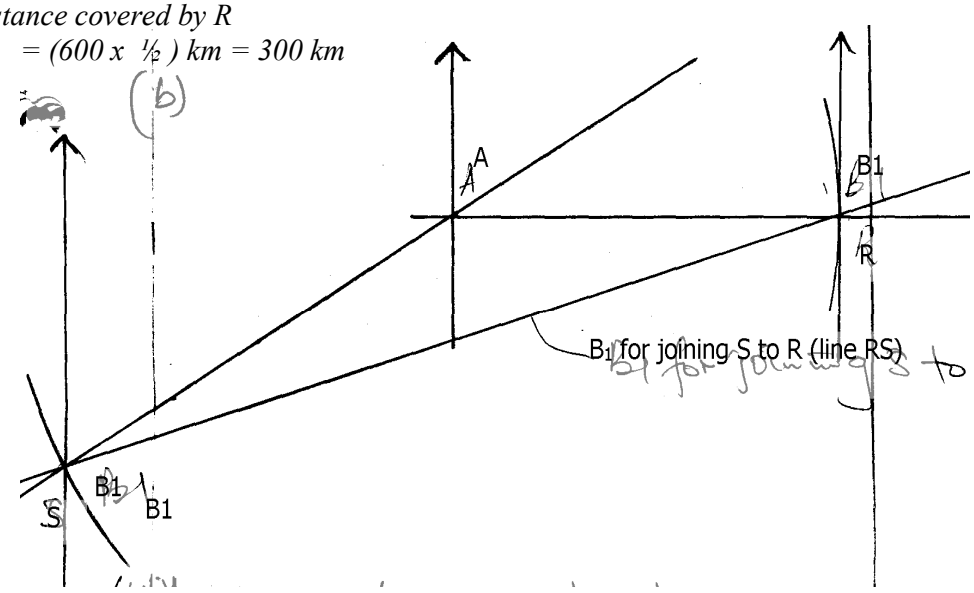




b) i) 049 ± 1
ii) 190 ± 1
c) 6.7± 0.1
670 ± 10

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

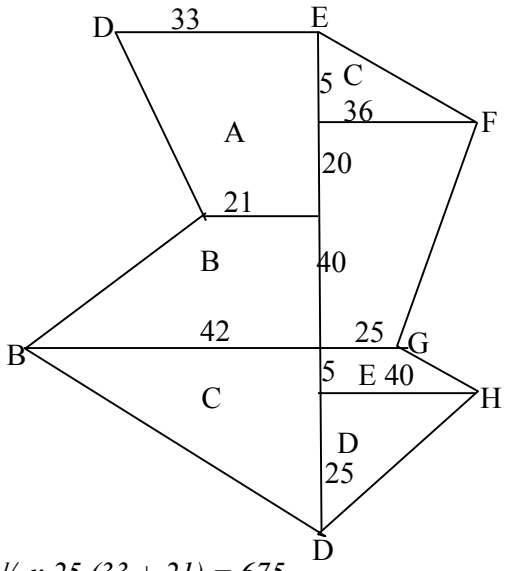
(ii) Speed = $\left(\frac{625 \times 60}{}\right)$ km/hr

$= \frac{45}{} = 833\ ^1/_3$ km /h

(c) (i) Bearing of S from R = 225°

(ii) The bearing of R from S = 72°

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°

(i) 62 ± 1km

(ii) 97 ± 1 km

a. 304°

030°

22. Graph

b) i) 80 km

ii) 11.06a.m

c) Average speed of the 2nd train

Time taken = $80 \div 1\ ^{11}/_{12} = \frac{80 \times 12}{23}$

$= 41.74$km/h

23. L.S.F = $\frac{4}{2000000} = \frac{1}{500000}$

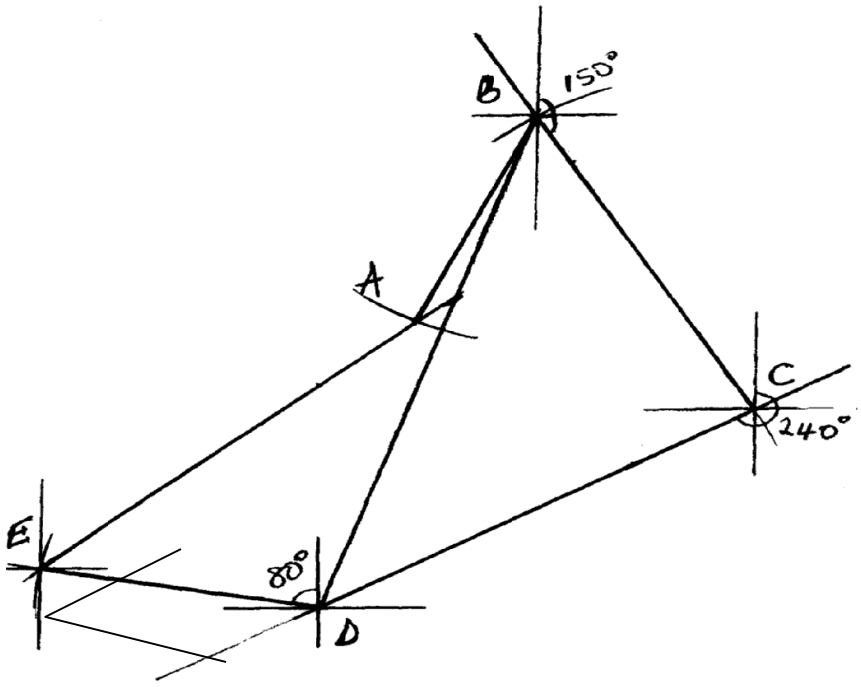
A.S.F = $\left(\frac{1}{}\right)^2 = \frac{1}{}$

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

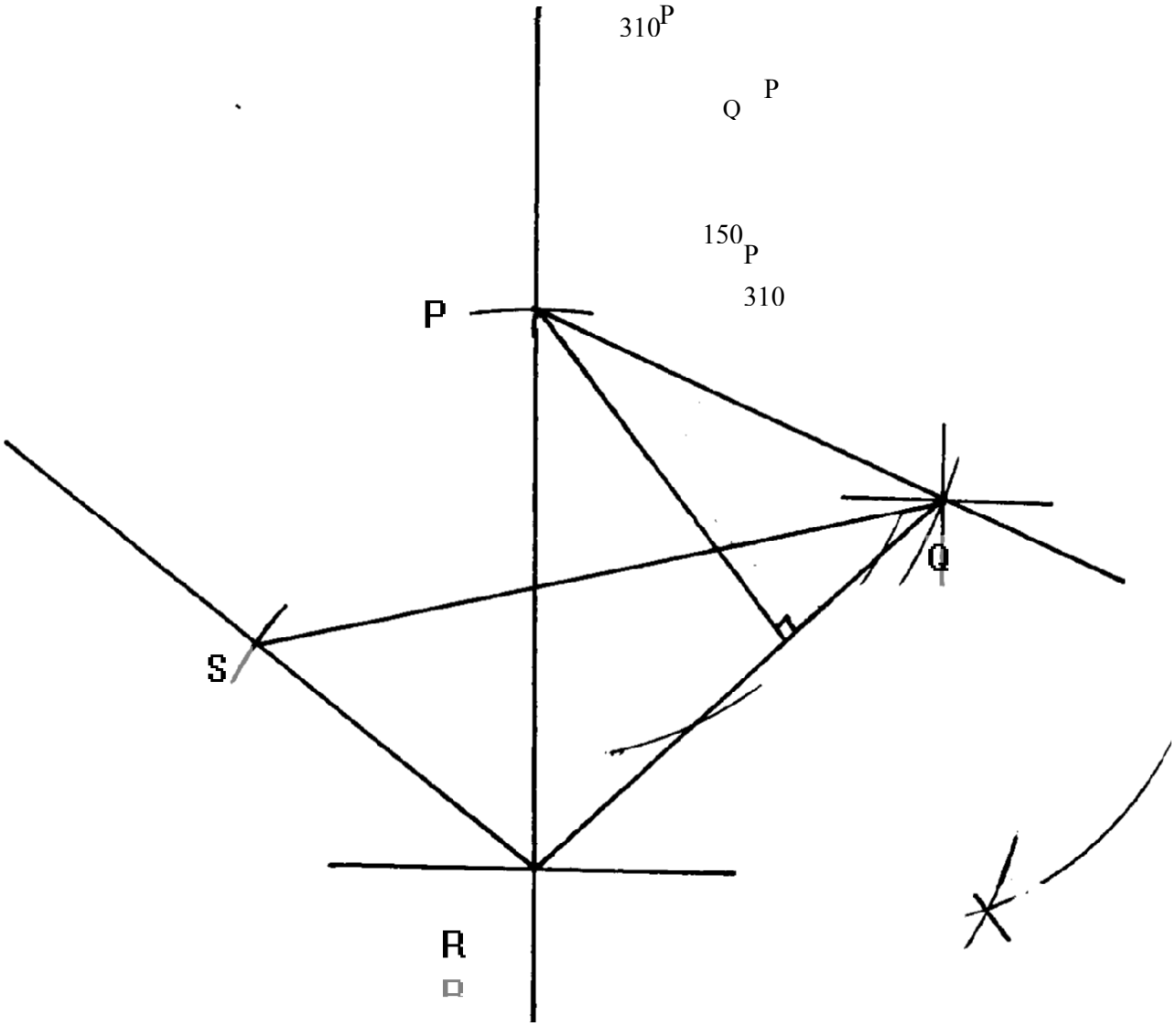
25. a)



b) i) 6.8 + 0.1cm
Distance Ae = 340 + 5 km

ii) 180 + 18 = 198 + 2

26. a)



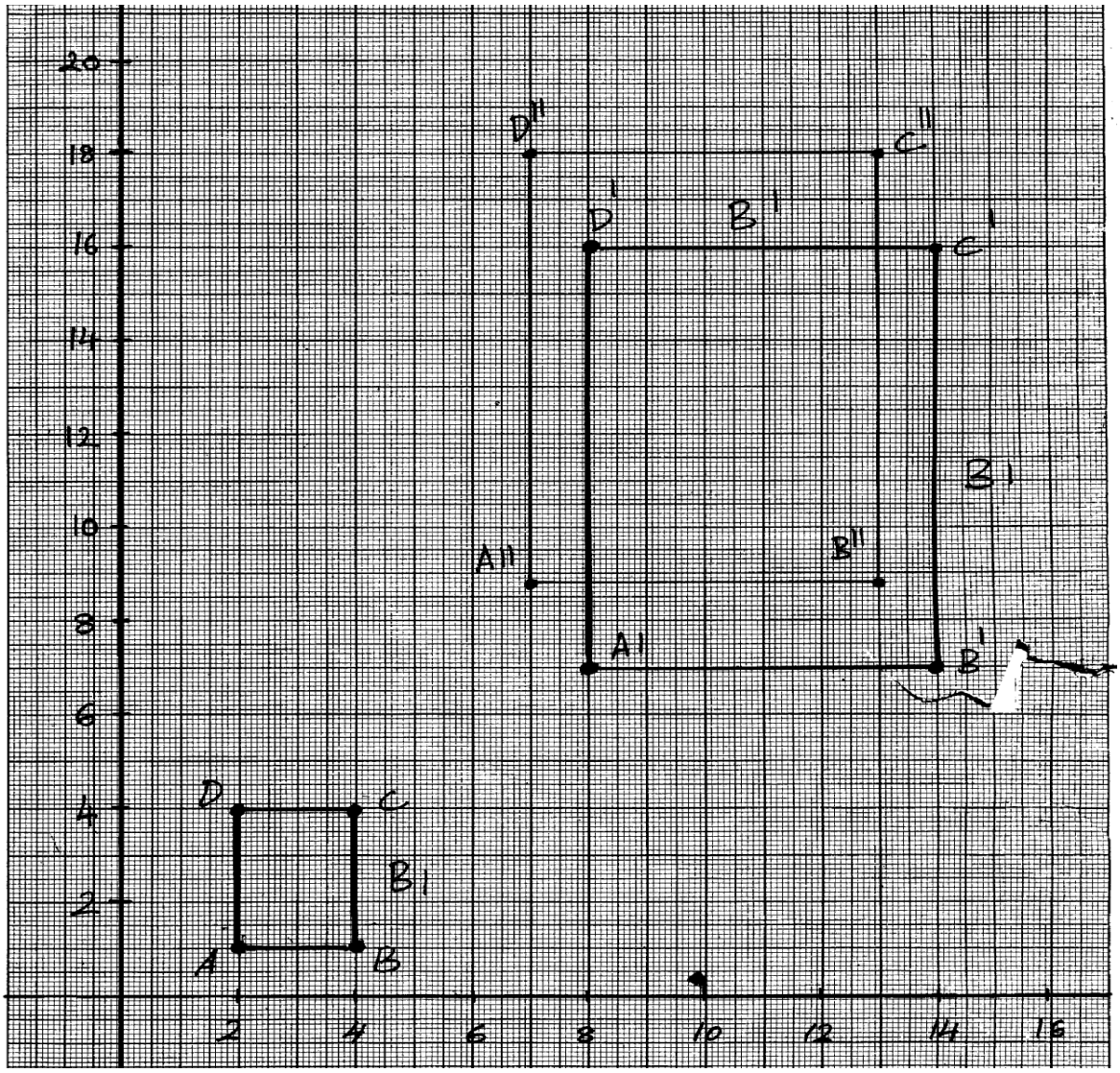
b) *(i) SP = 7.8 x 50 = 390 km ± 5 km*
(ii) S & Q = 255° ± 1°
(iii) 4 x 50 = 200 km + 5 km

27. *(a) Scale = 50km*
Drawing accurately<NCE = 25°
<NCT = 145°
<NTY = 90°
Lines drawn //

(b)By measurement:
(i) Distance SY = 6.9 x 50 = 345± 5km
Bearing Y For S = 360° – 114 = 246±1°
(ii) distance ST = 7.9 x 50 = 39.5 ±5km

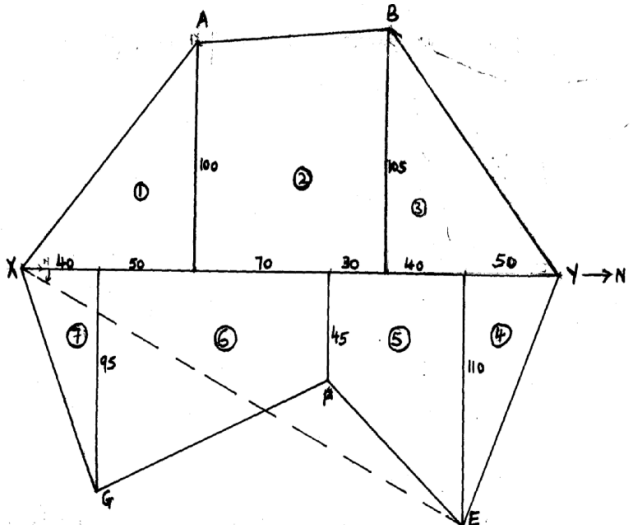
(iii) distance YT = 9.8 x 50 = 490 5km

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 = 26600 = 2.66ha
10,000

29.



(b) Total area = area (1) + (2) + (3) + (4) +(5) + (6) + (7)

Area (1)= ½ x 90 x 100 = 4500m²

(2) = $\frac{(100 + 105)}{2}$10 = 10250m²

(3) = ½ x 90 x 105 = 4725m²

(4) = ½ x 50 x 110 = 2750m²

(5) = ½ x (110 + 45)70 = 5425m²

(6) = $\frac{(45 + 95)}{2}$ 120 8400m²

(7) = ½ x 40 x 95 = 1900m²

Total area = 37,950m²

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 = ½ x 170 x 80 = 6800

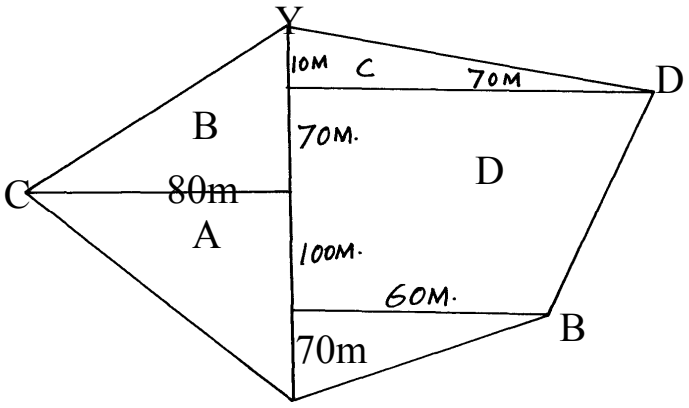
B = ½ x 80 x 80 = 3200

C = ½ x 10 x 70 = 350

D = ½ x 170 x 130 = 11050

E = ½ x 70 x 60 = 2100

Total = 23,500 m²



31. (a) L.s.f = 1

40,000

$\frac{1}{40,000} = \frac{3.25}{x}$

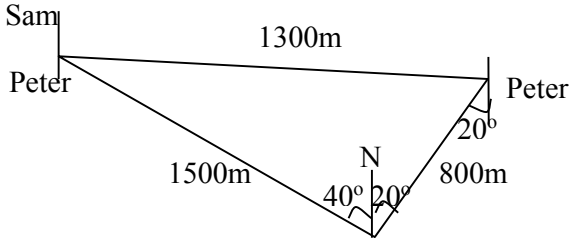
x = 130,000cm

(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 = 0.0225cm²

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) $\frac{1300}{\sin 60} = \frac{1500}{\sin c}$

$1300 \sin c = 1500 \sin 60$

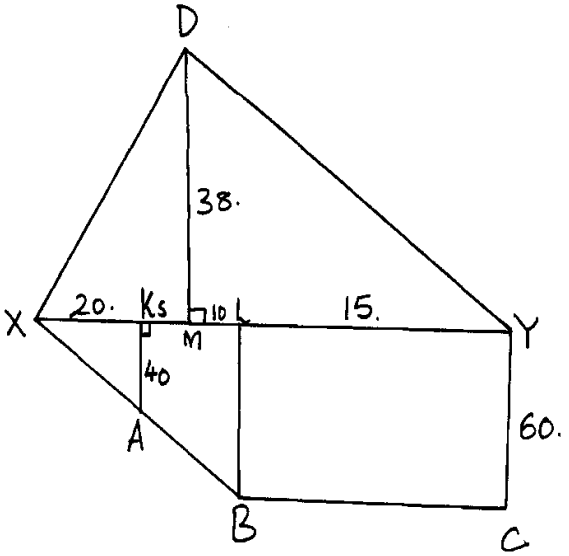
$\sin c = \frac{1500 \sin 60}{1300}$

$= 0.9993$

$\therefore c = 87.79^o$

$c = 87.80$

33.



. A of Δ XYD = ½ x 50 x 38 = 950m²

A of XBCY = ½ (50 + 15) 60

= ½ x 65 x 60

= 1950m²

Total A = (950 + 1950)m²

= 2900m²

34. B1 for 86°

$\frac{30}{\sin 86^o} = \frac{QS}{\sin 56^o}$

$QS = \frac{30 \sin 56^o}{\sin 86^o}$

= 24.93km

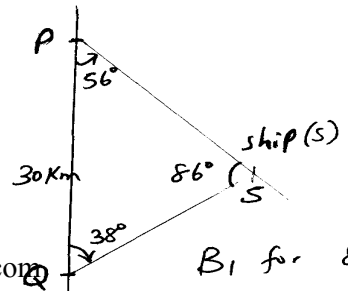
35. 1cm for 100000cm

1cm² = (100000cm)²

Area = 5.4 x 4.5 x 100000 cm²

= $\frac{5.4 \times 4.5 \times 100000 \times 100000}{100000 \times 100000} Km^2$

= 24.3km²



B1 fo

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

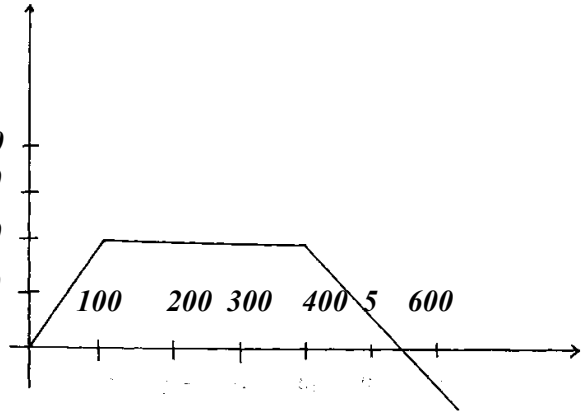
$= 3.5^o$ S

37. i) acc = $\frac{40 - 20}{100 - 50}$

$= {}^{20}/_{50}$ = 0.4m/s

ii) $\frac{20 - 40}{460 - 400} = \frac{-20}{60}$ = 0.3333 m/s²

iii) Area = ½ (520 + 300) x 40 x $^1/_{1000}$ = 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

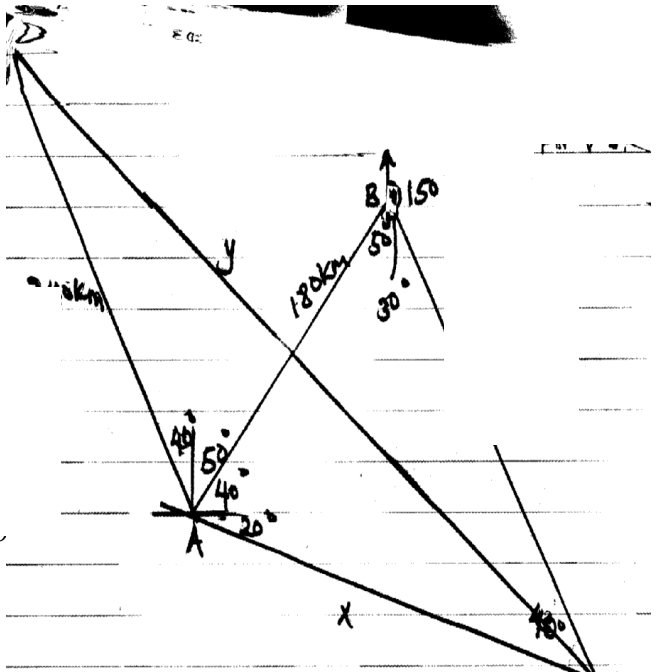
c) i) √ $50.9^2 - 49.9^2$ = 10.04cm

ii) Tan θ = $\frac{10.04}{200}$

= 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

$\frac{X}{\text{Sin } 80^o} \quad \frac{180}{\text{Sin } 40^o} \Rightarrow x = \frac{180 \sin 80^o}{\sin 40^o}$

$= 275.8$

Hence AC = 276 km

(b) Use the cosine rule in Δ AD when ∠DAC = 150°

$y^2 = 240^2 + 276^2 - 2 \times 240 \times 276 \cos 150^o$

$= 576000 + 76180 - 132\,480 (-\cos 30^o)$

$= 133776 + 114731 = 248507$

$y = \sqrt{248507}$

$= 498.5$

Hence CD = 499 km

(c) Using sine rule in ΔABC we have

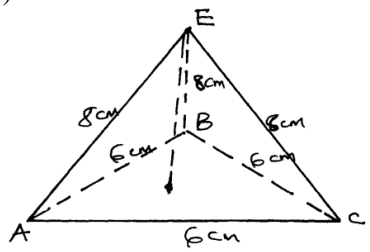
$\frac{BC}{\text{Sin } 60^o} = \frac{180}{\sin 40^o}$

$BC = \frac{180 \sin 60}{\text{Sin } 40}$

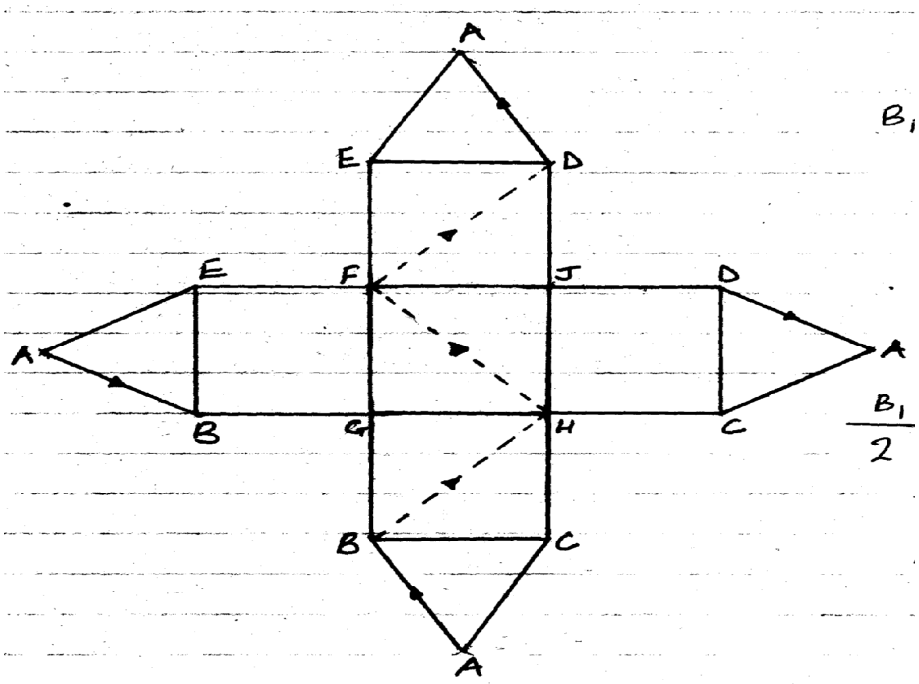
$= 242.5$

$= 243 km$

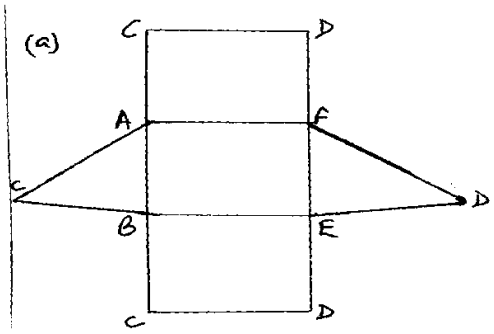
20. Common solids

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.

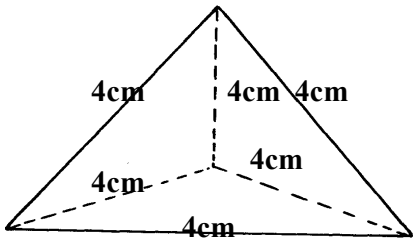


3. *(a)*

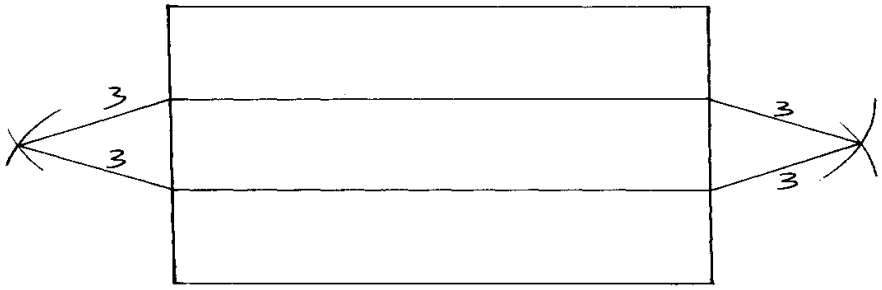


(b) Total surface area
= 2⌊ 9 x 3 x 4 x 2 + 10 (6 + 5 + 7)
= 29.39 + 180= 209.4cm²

4.



5.



21. Indices

1. $3^4 \times 3^{4x} + 3^{4x} = 246$

$3^{4x}(81 + 1) = 246$

$\frac{\cancel{82}}{\cancel{82}} \times 3^{4x} = \frac{\cancel{246}^{3}}{\cancel{82}}$

$3^{4x} = 3^1$ √

$4x = 1$

$x = \frac{1}{4}$

2. $5^{2y} \times 5^1 = 4^{(5y+1)} - 15$

$5^y \times 5^y \times 5^1 = 4 \times 5y \times 51 - 15$

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

$ABD = 90 - 48 = 42o$

$ADB = 180 - (69+42)$

$180-111=69^o$

$CDA = 90 + 69^o = 159^o$

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. $25^{\frac{3}{4}} = (25^{\frac{1}{2}})^{3/2} = 5$
$0.9^2 = (\frac{9}{10})^2 = \frac{92}{100}$
$2^2 = 2^2$
$\frac{(\sqrt{5})^3 \times 9^2 \times 2^2}{(\sqrt{5})^5 \times 10^2 \times 3^3}$
$\frac{3 \times 4}{(\sqrt{5})^2 \times 10^2}$
$\frac{3}{5 \times 25} = \frac{3}{125}$

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* $\quad \frac{0.9158}{2}$
2.399×10^{-3}	*3.3800*
	= 0.002399

7. $9^{x+1} + 3^{2x+1} = 36$
$3^{2x+2} + 3^{2x+1} = 36$
$3^{2x(9+3)} = 36$
$3^{2x} = 3^1$
$2x = 1$
$x = \frac{1}{2}$

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.

$\frac{1}{16^x} = \frac{1}{32}$

$\left(\frac{1}{2^{4x}}\right)^{x - \frac{1}{4}} = \frac{1}{2^5}$

$2^{-4x^2 + x} + x = 2^{-5}$

$-4x^2 + x + 5 = 0$

$4x^2 - x - 5 = 0$

$4x^2 - 5x + 4x - 5 = 0$

$x(4x - 5) + 1(4x - 5) = 0$

$x = -1$ 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. $^{1}/_{3}\ \{ 2 \times 1.5065 + 5 \times 1.2004 \}$

$^{1}/_{3}\ (3.013 + 6.002)\ (0.3333)$

$= 9.015 \times 0.3333$
$= 3.005$ (3 dp)

5. $\frac{12 \times 0.25 - 12.4 \div 0.4 \times 3}{\frac{1}{8}\ of\ 2.56 + 8.68}$

$\frac{3 - 31 \times 3}{0.32 + 8.68}$

$\frac{-90}{9}$

$= -10$

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. $3.5932 = 12.91$

$\Rightarrow \left(\frac{1}{1.291 \times 10} \right) + 2 \left(\frac{1}{5.26 \times 10^{-1}} \right)$

$= (0.7746 \times 10^{-1}) + 290.1901 \times 10)$
$= 0.07746$
$+ \underline{3.802}$
3.87946

$\sqrt{3.87946} = \sqrt{3.879}$

$= 1.9695$
$= 1.970$(4s.f)

9.

No	s.f	rec
0.6638	6.638×10^{-1}	$0.1500 \times 10 = 1.5000$
0.833	$8.33 \times 10\text{-}1$	$0.1200 \times 10 = 1.200$

$= {}^{1}/_{3}\ (2\ (105) + (1.2))$
$= {}^{1}/_{3}\ (3 + 6)$
$= {}^{1}/_{3} \times 9 = 3$

10. $3x1.485 + 13x6.410$
$= 4.455 + 83.33$
$= 87.785$

ALT

$^{30}/_{6.735} + {}^{130}/_{1.56}$ *= 30 x 0.1485 + 130x 0.641*

= 4.455 + 83.33

= 87.785

23. Common logarithms.

1.	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	**M1** **M1** **A1** **B1**	Subt b logs Multip by 3
		04	
2.	$\log_{10}25 - \log_{10}4 + \log_{10}1600$ $\log_{10}\left(\frac{25}{4}\times 1600\right)$ 4	**M1** **M1** **A1**	
		03	
3	No. / Std. form / Log $(0.00246)^2$ / $(2.46 \times 10^{-2})^2$ / 2.3909 142 / 1.42×10^2 / x 2 4.7818 +2.1523 2.9341 0.002 / 2.0×10^{-3} 1.14 / 1.14×10^o / 3.3010 +0.0569 3.3579 2.9341 -3.3579 1.5762 1.5762 3 3.3527 / 3.3527×10^o 0.5254	1M 1M 1M A1	Correct logs addition Correct logs addition Correct logs substractions Correct answer
		4	
4	$\frac{\log\left(\frac{1}{4}\times 64\right)}{\log\left(\frac{1}{32}\div\frac{1}{8}\right)}$ $\frac{\log 2^4}{\log 2^{-2}}$ $\frac{4\log 2}{-2\log 2}$ -2	M_1 M_1 M_1 A_1 4	

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		
			$\bar{1}.6417$	$\underline{\bar{1}.6417 +}$	M1
				$\bar{1}.3125$	
	0.005937	$5.937\text{x}10^{-3}$		$-\ \underline{\bar{3}.7736}$	M1
		$3.459\text{x}10^{-1}$	←	$\bar{1}.5389$	M1
	0.3459				A1
					04

7	Number	log			
	8.694	0.9392		M1	All logs
	0.1267	$\bar{1}.1028 \times \frac{1}{3} = \bar{1}.7009$			
				M1	+ - x of logs
	0.006974	$\bar{3}.8434$			
		$\bar{3}.5443 \times \frac{3}{4}$		M1	$\div \times of$ log s
		$\bar{1}.3861 \times 3 = \bar{2}.1583$			
		0.9392			
		$\bar{2}'1583$			
	6.039×10^2	2.7809		A1	
	602.9				
				4 marks	

8.

No.	*Log*	
2849	*3.4547*	
		+
-		
0.00574	*3. 7589*	
1.2136		
36.891.1	*1. 5669*	
-		
0.023	*2.3617*	
	3.2052	
-		

All logs read correctly

Correct Addn /subst. of logs.

$2.0084 \times \frac{1}{4}$

$3.178 \times \bar{1}0^{-1}$ ← 1.5021

→ 0.3178

9. $\log y = \log B + n \log x$

$n \log x = \log y - \log B$

$n = \frac{\log (y/B)}{\log x}$

10. $= 6 \log_2 4 + 10 \log_3 3$

$= 12 \log_2 2 + 10 \log_3 3$

$= 12 + 10$

11. $\log \frac{2x - 11}{2} = \frac{\log 3}{x}$

$(2x - 11) = 3/x$

$2x^2 - 11x - 6 = 0$

$(2x + 1)(x - 6) = 0$

$x = -\frac{1}{2}$ 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
$3\sqrt{0.3563}$	(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. $H^3 \sim \frac{3d(L-d)}{10L}$

$\sim 3dL - 10H^3L = 3d^2$

$\sim L(3d - 10H^3) = 3d^2$

$\sim L = \frac{3d^2}{3d - 10H^3}$

15.

No.	Log
6.195	0.7920
11.82	1.0726
	1.8646
83.52	1.9218
	$\bar{1}.9428 \times \frac{1}{4}$
	$4. + 3.9428$
	4
0.9676	$\bar{1}.9857$

16. $\log y^2(x-1) = \log 9 \quad y^2(x-1) = 9 \quad ....(1)$

$\log (xy) \log 6 \quad xy = 6 ....2$

from (2) $x = {}^6/_y$

substitute in (1) $y\frac{(6-1)}{y} = 9$

$6y - y^2 = 9$

$y^2 - 6y + 9 = 0$

$(y-3)^2 = 0$

$y = 3$

$\therefore x = 2$

17. $\frac{5}{4}\log_{10}25 + \log_{10} 25x2 - \log 10$

$4 \log 2 = \log_{10} 25x2 - 3\log 2$

$2 \log 10 + 2 \log 5$

$\log 10 \times 100$

18.

NO	LOG	
0.9895 →	$\bar{1}.9954$	
$(0.9895)^2$ →	1.9954×2	Use sine rule
	1.9908	
0.004974 →	$\bar{3}.6968$	
	$3.\bar{6}876 \div 4$	
	1.4219×3	
6.598	2.2657	
	0.8195 –	
	2.2657	
$3.579 X10^2$ ←	2.5538	
OR 357.9		

19. Log 3x + 8 – log 8 = log (x-4)

$\log \frac{3x+8}{8} = \log (x-4)$

$3x + 8 = x - 4$

$3x + 8 = 8x - 32$

$5x = 40$

20.

No.	Log
$36.72 \longrightarrow$	1.5649
$0.46^2 \longrightarrow$	2(T.6628)
	T.3256
185.4	0.8905
	2.2682
	$2.9223 \times \frac{1}{3} = \frac{\bar{3}}{3} + \frac{1.6223}{3}$
3.474×10^{-1}	$\bar{1}.5408$
Or 0.3474	

21.

No		Log
Sin 44.5		1.8457
Tan 14.9	1.4250	2.5686 -
Cos 82	1.1486 +	
	$\frac{1.2772}{2}$	
10×4.351	0.6386	

22. From square roots 12.25 = 3.5

$\frac{3.264 \times 1.215 \times 3.5\sqrt{x}}{1.088 \times 0.4725 \times 107}$

$\frac{3264 \times 1215 \times 35}{1088 \times 4725}$

$\sqrt{27} = 3$

23. $\log_8 (x + 5) - \log_8(x - 3) = \log_8 4$

$\log_8 \frac{(x+5)}{x-3} = \log_8 4$

$\frac{x+5}{x-3} = 4$

$4x - 12 = x + 5$

$3x = 17$

$x = 17 = 5\frac{2}{3}$

Or $\log_8 \frac{x+5}{x-3} = \frac{2}{3}$

$8^{\frac{2}{3}} = \frac{x+5}{x-3}$

$2^3(\frac{2}{3}) = \frac{x+5}{x-3}$

$2^2 = \frac{x+5}{x-3} \Rightarrow 4 = \frac{x+5}{x-3}$

$4x - 12 = x + 5 \Rightarrow 3x = 17$

$x = \frac{17}{3} = 5^2/_3$

24.

No 6.57^2 4.317×10^1 *43.17 + 6.57* *49.74* $(7.92)^2$ *30.08* 2.636×10^{-2}	*Log* *0.8176* *2x* *1.6352* *1.6967* *0.8987* *X2* *1.7974* *1.4783 + 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* $(7.92)^2$ *30.08* 2.636×10^{-2}	*Log* *0.8176* *2x* *1.6352* *1.6967* *0.8987* *X2* *1.7974* *1.4783 + 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. $Log_2 (3x - 4) = {}^1/_3 lo_2\ 8x^6 - log_2 4$
$Log_2 (3x - 4) = log_2 (2^3x^6) - log_2 4$
$Log_2 (3x - 4) = log_2 2x^2 - log_2 4$
$Log_2 (3x - 4) - log_2 \left(\frac{2x^2}{4}\right)$
$= 3x - 4 = \frac{2x^2}{4}$
$2x^2 - 12x + 16 = 0$
$x^2 - 6x + 8 = 0$
$x - 2x - 4x + 8 = 0$
$(x - 2)(x - 4) = 0$
$x = 2$ or $x = 4$

27.

No	Log
5.627	0.7503
$(0.234)^3$	T. 3692
	x 3
	2.8579
8.237	0.4779 $\frac{0.9158}{2}$
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	$2.8766 \times 2 = 3.7532$
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	3.9767 X 2 +
	5. 9534
	4.5851 -
Log 9.814	1.9964
	4. 5887 ÷ 5
$2.0785 \text{ X } 10^{-1}$ ←	1.3177
= 0.20785	

24. Equations of straight lines

1	$RV = 3.2 + \frac{1}{4}V$ $R = \frac{3.2}{V} + \frac{1}{4}$ $Gradient = 3.2$ $y - \text{int}ercept = \frac{1}{4}$	B1 B1 B1	
		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 = $\sqrt{10^2 + 8^2}$
= $\sqrt{164}$

Vertical height = $\sqrt{16^2 - (\frac{\sqrt{164}}{2})^2}$ = 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

$(\frac{1}{2} \times 8 \times \sqrt{240} \times 2) = 124.0\ cm^2$

$(\frac{1}{2} \times 10x \sqrt{231} \times 2) = 152.0cm^2$

Area of the rectangular base $= 8 \times 10 = 80cm^2$

Total surface area = $\underline{356cm^2}$

c) Volume

$= (\frac{1}{3} \times 80 \times 14.66) = 391.0cm^3$

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 $= -\frac{3}{2}$

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 $x = \frac{1}{3}$

$2x - 3x^2 = 11 - 2ax$

$\frac{2}{3} - 3(\frac{1}{3})^2 = 1 - 2ax\frac{1}{3}$

$\frac{2}{3} - \frac{1}{3} = 1 - \frac{2}{3}a$

$-\frac{3}{2} = -\frac{2}{3}a$

$\frac{9}{4} = a$

4. $M1 = \frac{5 - 1}{4 - -2} = \frac{4}{6} = \frac{2}{3}$

$M2 = -\frac{3}{2}$

i.e. $-\frac{3}{2} = \frac{y - 5}{x - 4}$

$2(y - 5) = -3(x - 4)$

$2y - 10 - -3x + 12$

$3x + 2y - 22$

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. $L.S.F = \frac{4}{2000000} = \frac{1}{500000}$

$A.S.F = \left(\frac{1}{5 \times 10^5}\right)^2 = \frac{1}{2.5 \times 10^{11}}$

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. $2y - 5x = 11$

$Y = \frac{5}{2}x + \frac{11}{2}$

$g = \frac{5}{2}$

$\frac{5}{2}m = -1$

$M = -\frac{2}{5}$

$\frac{Y-4}{X+4} = -\frac{2}{5}$

$5y + 2x = 14$

$P(x,o)$

$5 X o + 2x = 14$

$X = 7$

$Q(o, y)$

$5y + 2 X o = 14$

$Y = 2.8$

$P(7,0)$

$Q(0, 2.8)$

11. i) $K\left(\frac{3-7}{2}, \frac{4+2}{2}\right)$ $(-2, 3)$

$P\left(\frac{3+1}{2}, \frac{4-2}{2}\right) = (2,1)$

ii) $K_1 = \frac{3-1}{-2-2} = -\frac{1}{2}$

$= 2$

12. Gradient of $L1 = \frac{1}{5}$

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*

$5y = 3x - 10$

$y = \frac{3}{5}x - 2$

$\therefore$ *Gradient* $= \frac{-5}{3}$

$5 = \frac{y - 3}{x + 1}$

$3y - 9 = 5x - 5$

14. *Gradient* $= g = \frac{m - 1}{4 - 2} = \frac{m - 1}{2}$

$3y = 5 - 2x$

$y = {}^{5}/_{3} - {}^{2x}/_{3}$ $\quad g_1 = {}^{-2}/_{3}$

$g \times g1 = \frac{m - 1}{2} \cdot \frac{-2}{3} = -1$

$-2(m - 1) = -6$

$-2m + 2 = -6$

$-2m = -8$

$M = 4$

15. $L_1\ y = -\frac{2}{3}x - \frac{4}{3}$

$M_1 = -\frac{2}{3}$

$M_2 = \frac{3}{2}$

$L_2\ y = \frac{3}{2}x + c \quad x = 1, y = 1$

$1 = \frac{3}{2} + c$

$c = -\frac{1}{2}$

$L_2 \quad y = \frac{3}{2}x - \frac{1}{2}$

16. *BP* $=$ *shs.* $\frac{144}{6} \times 100$

SP = shs. $\frac{140}{} \times \frac{144}{} \times 100$

$\frac{100}{} \quad \frac{6}{}$

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° – 20° = 340°

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 = $\frac{8.1 \times 125}{}$

$= 37.5m^3$

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) $64 \equiv 800\,kg$ $\therefore 125 \equiv \frac{125\times800}{64}$ $\equiv 1562.5kg$	M_1 M_1 M_1 A_1 B_1 M_1 A_1 B_1 M_1 A_1	✓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 $= \frac{9}{4} = \frac{336}{x}$

$x = 149{}^1/_3 cm^2$

Area of QRTS $= 336 - 149{}^1/_3$

$= 186{}^2/_3 cm^2$

5. (a) $\frac{4}{3} = \frac{64}{x}$

$x = 48cm$

(b) $\frac{3}{4} = \frac{810}{y}$

$\frac{27}{64} = \frac{810}{y}$

$27y = 810 \times 64$

$y = 1920$*grams*

6. ΔABC is similar to ΔADE

$DE = \frac{7}{4}$

$DE = \frac{(7x8)cm}{4}$

$= 14cm$ $= -\frac{7}{23}$

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. $\frac{1}{2} h (a + b)$ = Area of trap.

$\frac{1}{2} \times 3 (DC + 4) = 15.6$

$DC + 4 = \frac{15.6 \times 2}{3}$

$DC = 6.4$

$\frac{DC}{BE} = \frac{DA}{EA}$

$\therefore \frac{3 + x}{x} = \frac{6.4}{4}$

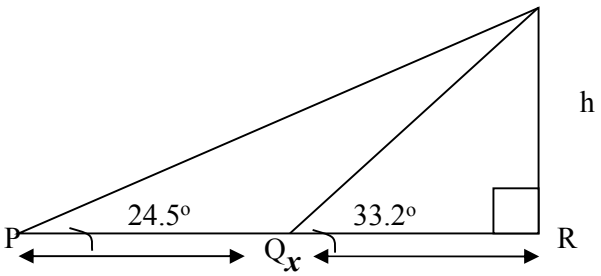
$12 + 4x = 6.4x \surd$

$2.4x = 12 \surd$

$x = 5cm$

28. The Pythagoras theorem

1.



From ΔPTR, $\tan 24.5° = \frac{h}{x}$ ____ x _____ $\frac{h}{\tan 24.5°}$

From ΔQTR, $\tan 33.2° = \frac{h}{x-5}$ ____ $x = \frac{h}{\tan 33.2°} + 5$

$\therefore \frac{h}{\tan 24.5°} = \frac{h}{\tan 33.2°} + 5$ ____ $\frac{h}{\tan 24.5°} - \frac{h}{\tan 33.2°} = 5$

$h \left[\frac{1}{0.4557} - \frac{1}{0.6544}\right] = 5$

$h = (2.194 - 1.528) = 5$

$h = \frac{5}{0.666} = 7.508$

$\therefore$ height = 7.5m

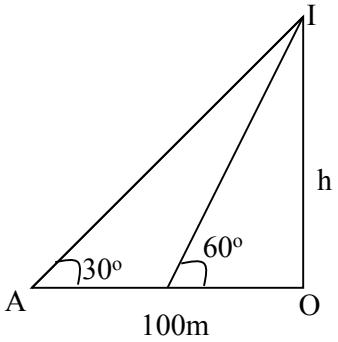
2. $L.S.F = \frac{2}{3}$

$V.S.F. = \left(\frac{2}{3}\right) = \frac{8}{27}$

$Ratio = 8 : 27$

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

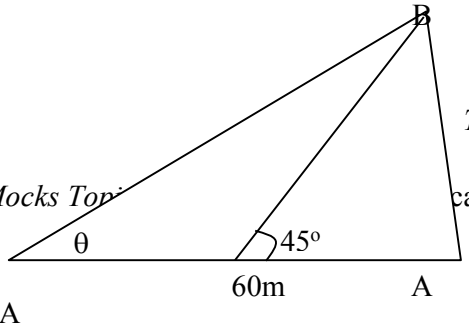
(b) (ii) Reflection in the line $y = x$

(c) combine transformation $= \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$

$Det \begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix} 0 - 2 \times 2 = -4$

$Inverse\ transformation = -¼ \begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix} = \begin{pmatrix} 0 & -½ \\ -½ & 0 \end{pmatrix}$

4.



$Tan\ 45 = \frac{AB}{60}$

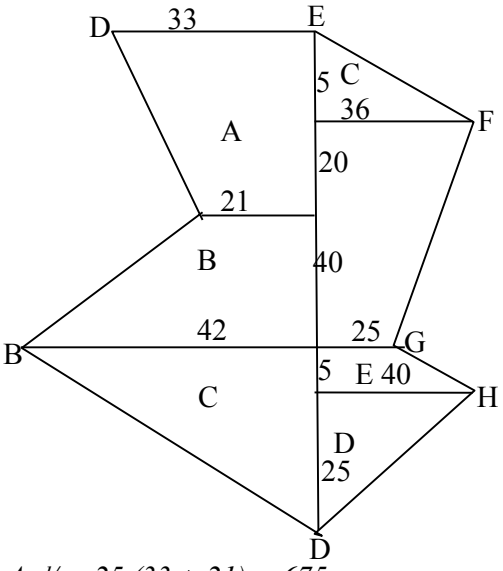
$AB = 45$

$\tan\theta = \frac{45}{240}$

$= 0.1875$

$\theta = 10.62^{o}$

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.

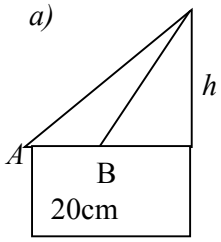
$2\cos 2x = 0.600$

$\cos 2x = 0.3000$

$2x = 72.5^{o}, 287.5$

$x = 36.25^{0}, 143.75$

7. a)



$\tan 32 = \frac{h}{20 + x}$

$h = (20 + x)\tan 32^{o} = 12.498 + 0.6249x$

$\tan 40^{o} = {}^{h}/_{x}$

$h = x \tan 40^{o} = 0.8391x$

$0.8391x = 12.498 + 0.6249x$

$0.8391x - 0.6249x = 12.498$

$0.2142x = 12.498$

$x = \frac{12.498}{} = 58.35m$

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. $\tan 32^oc = \frac{h}{20 + x}$

$h = (20 + x) \tan 32^o$

$\tan 40^o = \frac{h}{x}$

$h = \tan 40^o$

$\therefore x \tan 40^o = (20 + x) \tan 32^o$

$0.8391x = (20 + x)\ 0.6249$

$0.8391x = 12.498 + 0.6249x$

$0.8391x - 0.6249x = 12.498$

$x = 58.35m$

$20 + 58.35 = 78.35m$

(b) The height of the house

$\text{Tan } 40^o = \frac{h}{58.35} = h = 58.35 \tan 40^o$

$h = 58.35 \times 0.8391$

$h = 48.96 + 1.82$

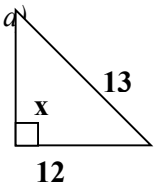
$h = 50.78$

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)*



$Hyp = \sqrt{5^2 + 12^2}$

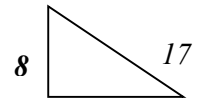
$= 13$

$\cos x = {}^{12}/_{13}$

(b) Sin2990-x)

$= ({}^{12}/_{13})^2 = {}^{144}/_{169}$

]14. $\tan \theta = {}^{8}/_{15}$ *C*



$AB^2 = 8^2 + 15^2$

$AB = \sqrt{289} = 17$

$\sin \theta = {}^{8}/_{17}$, $\cos \theta = {}^{15}/_{17}$

$\frac{\sin \theta - \cos \theta}{\cos \theta + \sin \theta} = \frac{{}^{8}/_{17} - {}^{15}/_{17}}{{}^{15}/_{17} + {}^{8}/_{17}} = {}^{-7}/_{17} \times {}^{17}/_{23}$

$= {}^{-7}/_{23}$

30. Area of a triangle

1. *a)* $BC^2 = 50^2 + 80^2 - 2 \times 50 \times 80 \cos 30$

$= 2500 + 6400 - 6928.20 = 1971.8$

$\therefore BC = \sqrt{1971.8}$

$= 44.40m$

$= 44m$

b) Area of the plot

$= {}^{1}/_{2} \times 50 \times 80 \times \sin 30 = 1000m^2$

$= \frac{1000}{10000}$ *ha*

$= 0.01ha$

c) *i) Length of wire required*

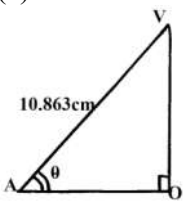
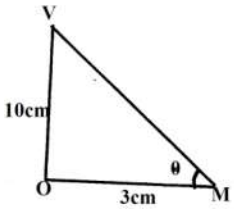
$= (50 + 80 + 44) \times 4 = 696m$

ii) Complete rolls to be bought = 2

iii) Cost (2 x 4000) = Shs.8000

31. Area of polygons

1.	(a) AC (b) AC = $\sqrt{6^2 + 6^2}$ $= \sqrt{72}$ $= 8.485$ $\bar{AO} = {}^{1}/_{2} \times 8.485 = 4.243$ VA = $\sqrt{4.243^2 + 10^2}$ $= \sqrt{118.003}$	**B1** **M1** **M1**	

	= 10.863. (c)  Cos θ = $\frac{4.243}{10.863}$ Cos θ = 0.39059 θ = 67.01^0 (d)  Tan θ = $^{10}/_{3}$ θ = 73.30^0 (e) Vol = $^{1}/_{3}$ x 6 x 6 x 10 = $120cm^3$	**A1** **M1** **A1** **M1** **A1** **M1** **A1**	
		10	

1. $\frac{180(n-2)}{180(n-1-2)} = \frac{4}{3}$

$540n - 1080 = 720n - 2160$

$720n - 540n - 2160 - 1080$

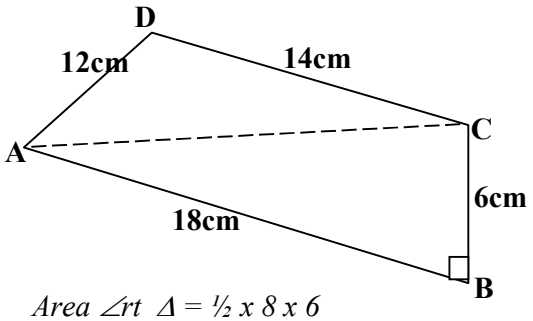
$180n = 1080$

$n = 6$

Area of hexagon = 6 (½ x 10 x sin 60)

= 6 x 43.30 = 259.81 cm²

2.



Area ∠rt Δ = ½ x 8 x 6

$S = \frac{12 + 14 + 10}{2}$

$A = \sqrt{18(18-12)(18-14)(18-10)}$

$= \sqrt{18 \times 6 \times 4 \times 8}$
$= \sqrt{3456}$
$= 58.79$
Total area $= 24 + 58.79 = 82.79$

32. Area of part of a circle

1. (a) $A = \frac{120}{360} \times \pi \times 10^2 - \frac{1}{2} \times 100 \times 10 \sin 12$
$= 104.72 - 43.30 = 61.42m^2$

(b) (ii) $\frac{120}{360} \times 2 \times 10 \times 20$
$= 418.9m^2$

(b) Total area $= 61.42 + 61.42 + 418.9$
$= 541.74m^2$
Cost $= 541.74 \times 310 = 167,939$

2. a) $\cos 54° = \frac{x}{10}$
$X = 5.878$
$\therefore$ size $= 2 \times 5.878 = 11.756$
Area of $\Delta = \frac{1}{2} \times 10^2 \sin 72° = 47.55$
Total area of $\Delta s = 47.55 \times 5 = 237.8cm2$

b) Area of circle $= \frac{22}{7} \times 10 \times 10 = 314.8$

Shaded region $= \frac{3}{5}(3.143 - 237.8)$
$= 45.9cm^2$

3. (a) $7.8^2 = 6.6^2 + 5.9^2 - 2 \times 6.6 \times 5.9 \cos R$
$\cos R = \frac{6.6^2 + 5.9^2 - 7.8^2}{2 \times 6.6 \times 5.9}$
$= \frac{78.37 - 60.84}{77.88}$
$= 0.2251$

$\angle R = 77^o$
$\frac{7.8}{\sin 77} = 2r$

$r = \frac{7.8}{2 \sin 77}$
$= 4 cm$

(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

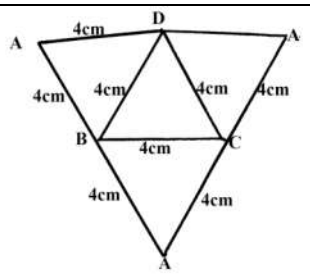
$= 3.142 \times 4^2 - \frac{1}{2} \times 6.6 \times 5.9 \sin 77$

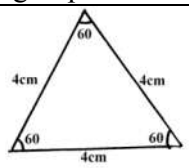
$= 50.27 - 18.97 = 31.30$

4. $(\frac{60}{360} \times \frac{22}{7} \times 24 \times 24) - (\frac{60}{360} \times \frac{22}{7} \times 12 \times 12)$

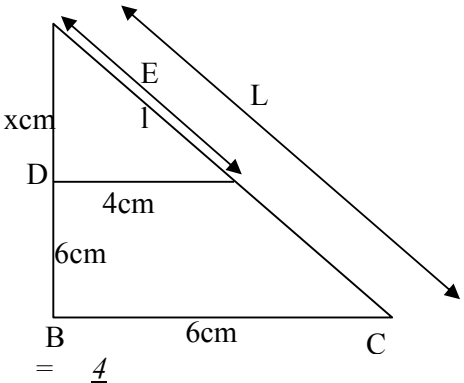
$301.71 - 75.43 = 226.26$

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)

$L = \sqrt{18^2 + 6^2}$

$\sqrt{360}$

$= 18.97$

$SA = \pi(RL - rL)$

$= 3.142\ (6 \times 18.97 - 4 \times 12.65)$

$= 3.142 \times 63.22 = 198.64\ cm^2$

(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*

$= 4.22 \times \pi$

$= (17.64\pi)cm^2$

Area of the curved surface

$= (8.4\pi \times 150$

$= \frac{1260\pi}{2}\ cm^2$

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

$= \frac{1}{2} \times 4\ UR^2$

$= 2 \times {}^{22}/_{7} \times 35 \times 35$

$= 7700cm^2$

b) Slant height for original cone

$$\frac{L}{L-60} = \frac{35}{14}$$

$L = 100cm$

c) Surface area of frustrum

$= URL - url$

$= {}^{22}/_{7} \times 35 \times 100 - {}^{22}/_{7} \times 14 \times 40$

$= 11000 - 1760 = 9240\ cm^2$

d) Area of base

${}^{22}/_{7} \times 14^2 = 616\ cm^2$

e) Total surface

$= 7700 + 9240 + 616 = 17556cm^2$

5. a) $TA = 2 \times 6.8 \times 3.5 + 2 \times 4.2 \times 3.5m^2$

$= 47.6 + 29.4\ m^2 \quad = 77m^2$

b) $77 - ({}^{75}/_{100} \times 2.5 \times 2 + {}^{400}/_{100} \times 1.25)m^2$

$77 - (3.75 + 5)\ m^2$

$77 - 68.25\ m^2 = 8.75m^2$

c)i) Cost of paint A

$= 68.25 \times 0.8 \times 80 = Kshs.43681$

ii) Cost of paint B

$$\frac{68.25 \times 35}{0.5}$$

$= Kshs.4777.5$

d) No of tins

$$= \frac{54.6 \times 1000}{400}$$

$$= \frac{136.5}{} \quad = 137\ tins$$

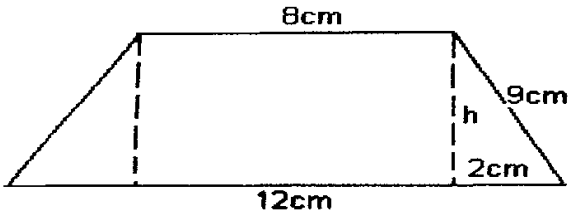
No. of tins

$$= \frac{136.5}{1.25}$$

$= 109.2 \quad = 110\ tins$

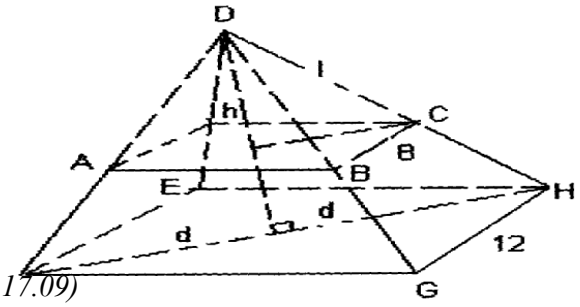
6. *Top surface area = 8x8 =64cm²*
Bottom surface area = 12x12=144cm²
Height of slanting faces
H = 9² – 2² = 8.775cm
Area of slanting face = ½ (12 + 8) x 8.775 x 4
= 351cm²
T.S.A = 64 + 144 + 351 = 559cm²

For both
Attempt to solve area for slant face

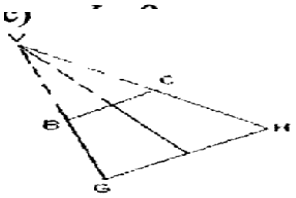


1/8 = 1+9/12
1 = 18
D= ½√(12² + 12²) = 8.485

H = √(27² – 8.485²) = 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)
= 865.7cm²



(c) Tan θ 25.63/6 = 4.272
θ = 76.82°



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 $\frac{22}{7}$ of π as

	$\frac{4}{3}\pi r^3 + \frac{4}{3}\pi r^3$ $= \frac{4}{3} \times \frac{22}{7}(2.3^3 + 3.86^3)$ $= \frac{88}{21} \times 69.679456$ $= 291.990$ Remaining material $\left(\frac{19}{20} \times 291.990\right)$ $= 277.297$ No of slabs = $\frac{277.297}{3.142 \times 0.8^2 \times 7}$ $= 19.699$ $= 19\ slabs$	M1 M1 A1	used
		04	

1. *a) Length of diagonal = √ $10^2 + 8^2$*
= √164

Vertical height = √16^2 – (√164/2)^2
= 14.66cm

b) Height of the slant surfaces
√$16^2 – 4^2$ = √240
√$16^2 – 5^2$ = √231
Area of slant surfaces
(½ x 8 x √240 x 2) = 124.0 cm^2
(½ x 10x √231 x 2) = 152.0cm^2
Area of the rectangular base= 8 x 10 = 80cm^2

Total surface area = 356cm^2

c) Volume
= (1/3 x 80 x 14.66) = 391.0cm^3

2. *Volume of the cylinder*
= (22/7 x 6 x 6 x 12)cm^3 = 1357.71cm^3
Volume of a sphere
= (4/3 x 22/7 x 3 x 3 x 3)cm^3 = 113.14cm^3
∴ No. of spheres formed
= 1357.71 / 113.14cm^3
= 12 spheres

3. *Let the smaller length be x cm*
∴ 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. $(\frac{60}{360} \times \frac{22}{7} \times 24 \times 24) - (\frac{60}{360} \times \frac{22}{7} \times 12 \times 12)$

$301.71 - 75.43 = 226.26$

5. (a)(i) $2\pi rh + 2r\pi^2 + \pi r^2$

$= 2 \times 22/7 \times 1.4 \times 1.4) + 2 \times 22/7 \times 1.42) + (22/7 \times 1.42)m^2$

$= (12.32 + 12.32 + 6.16)m^2 = 30.8m^2$

OR $r(2h + 2r + r)$

$= 22 \times 1.4\ (2 \times 1.4 + 3(1.4) = 30.8m^2$

(ii) shs. $(75 \times 30.8) =$ Shs.2,310

(iii) Total vol.

$= \frac{22}{7} \times 1.42 \times 1.4) + (\frac{1}{2} \times \frac{4}{3} \times \frac{22}{7} \times 1.42)m^3$

$= 8.624\ \ 4.106 = 12.7306m^3$

capacity $= (12.7306 \times 1000)$liters $= 12730.6$litres

(b) First 2days $= 185 \times 2 = 370$litres

Remaining amount $= (12730.6 - 370)$liters

$= 12360.6$litres

Days to use $= \frac{12,360.6}{200}$

$= 61.803$days

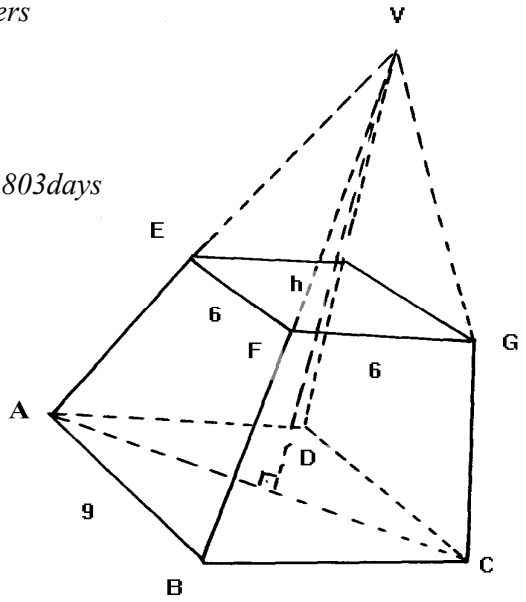
In all it takes $= (61.803 + 2)$days $= 63.803$days

6. a) $\frac{h + 3}{h} = \frac{9}{6}$ √

$6h + 18 = 9h$

$h = 6$ cm√

height $= \underline{6 + 3 = 9 \text{ cm}}$



b) Base $= 9 \times 9 = 81\ cm^2$

Top $= 6 \times 6 = 36\ cm^2$

Sides $= 3.67 \times 15 \times \frac{1}{2} \times 4$

$= 110.15\ cm^2$

Total $= \underline{227.15\ cm^2}$

c) Vol. of bigger $= \frac{1}{3} \times 81 \times 9$

$= 243$

Vol of smaller $= \frac{1}{3} \times 36 \times 6$

$= 72$

Vol. of frustrum $= \underline{171\ cm^2}$

d) $\sin\theta = \frac{9}{11.02}$

$\theta = \underline{54.8^o}$

7. *Volume of a hemisphere*

$\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 12 \times 12 \times 12$

$= \frac{176}{7} \times 144$

$= 3620.571429 = 3620.57$

Volume of a cone

$\frac{2}{3}\pi r^2 h$

$\frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times h = 36.20.57$

$\frac{6 \times 44h}{7} = 3620.57$

$264h = 3620.57 \times 7$

$h = \frac{3620.57 \times 7}{264}$

$= 95.9981 = 95.998$

8. $V = \left(\frac{22}{7} \times 2 \times 2 \times 1.5\right) + \left(\frac{22}{7} \times 3 \times 3 \times 1.5\right) + \left(\frac{22}{7} \times 4.4. \times 1.5\right)$

$= \frac{132}{7} + \frac{297}{7} + \frac{528}{7}$

V of hole $= \frac{22}{7} \times 1 \times 1 \times 4.5$

$= \frac{99}{7}$

$V = \frac{957}{7} - \frac{99}{7} = \frac{858}{7} = 122.57\ cm^3$

$Mass = 2.8 \times 122.57$

$= 343.196g$

$\simeq 343.2g$

9. *Volume of hemisphere* $= \frac{1}{2} \times \frac{4}{3} \times \frac{22}{7} \times 7 \times 7 \times 7$

$= 718.67\ cm^3$

Vol. of cylinder $= \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 5 = 770\ cm^3$

Vol of frustrum $= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times h_1 -$

$\frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times h_2$

Height of cone $\Rightarrow \frac{h_1}{h_2} = \frac{7}{3.5}$ *but* $h_1 = h_2 + 6$

$\frac{h_2 + 6}{h_2} = \frac{7}{3.5} \Rightarrow 7h_2 = 3.5h_2 + 21$

$3.5\ h_2 = 21$

$h_2 = 6\ cm$

$h_1 = 12\ cm$

$\therefore$ Vol. of frustrum $= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 12$ -

$\frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 6$

$= 616 - 77 = 539\ cm^3$

Total volume $= 718.67\ cm^3 + 770cm^3 + 539\ cm^3$

$= 2027.67\ cm^3$

a) S.A of top $= \pi r^2 \frac{22}{7} \times 3.5 \times 3.5 = 38.5\ cm^2$

S.A of curved part of frustrum $= \frac{22}{7} \times 7 \times 13.89$ -

$\frac{22}{7} \times 3.5 \times 6.945$

305.580

- 76.395

229.185 cm^2

S.A of curved part of cylinder $= 2\pi r \times h = 2 \times \frac{22}{7} \times 7 \times 5$

$= 2220\ cm^2$

S.A of hemisphere $= \frac{1}{2} \times 4\ \pi r^2 = \frac{22}{7} \times 7 \times 7 = 308\ cm^2$

Total S.A = $\underline{795.685\ cm^2}$

10. L/S.F $= \frac{2.2}{3.3} = \frac{2}{3}$

$\frac{4.8}{4.8 + h} = \frac{2}{3}$

$h = 24$

volume of smaller cone

$\frac{1}{3} \times \frac{22}{7} \times 2.2 \times 2.4$

$= 12.169$

Volume of large cone

$\frac{1}{3} \times \frac{22}{7} \times 3.3 \times 3.3\ (4.8 + 2.2)$

$\therefore$ V of frustum

$82.14 - 12.17 = 69.97\ cm^3$

11. (a) Volume $= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 \times \frac{3}{2} r = 31.5\pi$

$4r^3 + 3r^3 = 31.5 \times 6$

$r = \sqrt[3]{\frac{31.5 \times 6}{7}}$

$= 3cm$

(b) slant height of con $= \sqrt{4.5^2 + 3^2}$

$= 5.408cm$

Surface are $= 2\pi \times 3^2 + \pi \times 3 \times 5.408 = 107.5cm^2$

(c) Height = $\frac{31.5}{4^2\pi}$

= 1.969cm

(d) Density = $\frac{144}{231.5\pi}$

= 1.46g/cm³

12. Volume of cube side x cm = (xcm)³

∴ $x^3cm^3 = \frac{1280}{20}\ cm^3$

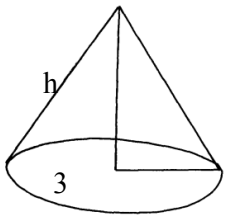
$x = \sqrt[3]{\frac{1280}{20}}$

$= \sqrt[3]{64}$

= 4 cm

13.

$^9/_3 = {}^{14+h}/_h$



9h = 42 + 3h

6h = 42

h = 7

volume of the frustrum = ($^1/_3$ x $^{22}/_7$ x 9 x 9 x 21)cm³

= ($^1/_3$ x $^{22}/_7$ x3 x 3x 7)cm³

= 1782 – 66 = 1716cm³

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. $(3x + 5)^2 + (\sqrt{611})^2 = (7x = 2)^2$

$(9x^2 + 30x + 25) + 611 = 49x^2 + 28x + 4$

$- 40x^2 + 2x + 632 = 0$

$20x^2 - x = \frac{316}{} = 0$

$x = \frac{1 \pm \sqrt{2581}}{40}$

$= \frac{160}{40}$ OR $x = 4$

Area = (½ $x\sqrt{611}$ x 17

= 210.1cm²

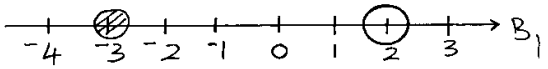
2. $7x - 4 \leq 9x + 2$ | $9x + 2 < 3x + 14$

$\underline{-6 \leq 2x}$ | $6x < 12$

$2 \quad 2$ | $x < 2$

$-3 \leq x$

$\therefore -3 \leq x < 2$



Integral values are -3, -2, -1, 0 and 1

36. Linear inequalities

1. $\underline{12 \times 0.25 - 12.4 \div 0.4 \times 3}$

$\frac{1}{8}$ *of* $2.56 + 8.68$

$\underline{3 - 31 \times 3}$

$0.32 + 8.68$

$\underline{-90}$

9

$= -10$

2. $x - 9 \leq -4 < 3x - 4$

$x - 9 \leq -4$

$x \leq 5$

$3x - 4 > -4$

$3x > 0$

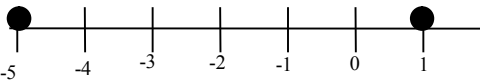
$x = 0$

$0 > x \leq 5$ √

$\{1, 2, 3, 4, 5\}$ √

3. $x > 3 - 2x$

$x \leq \frac{2x + 5}{3}$



$3 - 2x < x$

$-2x < x - 3$

$-3x < -3$

$x < 1$

$2x + 5 \geq 3x$

$-x \geq 5$

$x \leq -5$

$-5 \leq x < 1$

4. $3 - X \leq 1 - \frac{1}{2} X$

$3 - 1 \leq X - \frac{1}{2} X$

$2 \leq \frac{1}{2} X$

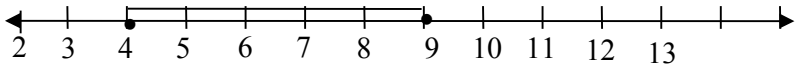
$X \geq 4$

$-x + 5 \leq 14 - 2x$

$2x - x \leq 14 - 5$

$x \leq 9$

$4 \leq X \leq 9$



5. $4x - 3 \leq 6x - 1$

$-2x \leq 2$

$x \geq -1$

$6x - 1 < 3x + 8$

$3x < 9$

$x < 3$

$-1 \leq x < 3$

6. $2(2-x) < 4x - 9$

$4 - 2n < 4x - 9$

$4 + 9 < 4x + 2n = 13\ 6x$

$= {}^{13}/_{6} < n$ $= 2^{1}/_{6} < n$

and $4x - 9 < x + 11$

$4n - n < 11 + 9$

$3n < 20$

$x < {}^{20}/_{3} = < {}^{2}/_{3}$

Integral values 3, 4, 5, 6

7. $L_3 : y \geq 1$

$L_1 : y + x \geq -1$

$L_2 : y - x$

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) (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 $y \geq -\frac{1}{4}x + 3$

$4y \geq -x + 12$

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 $y \leq -4x + 18$

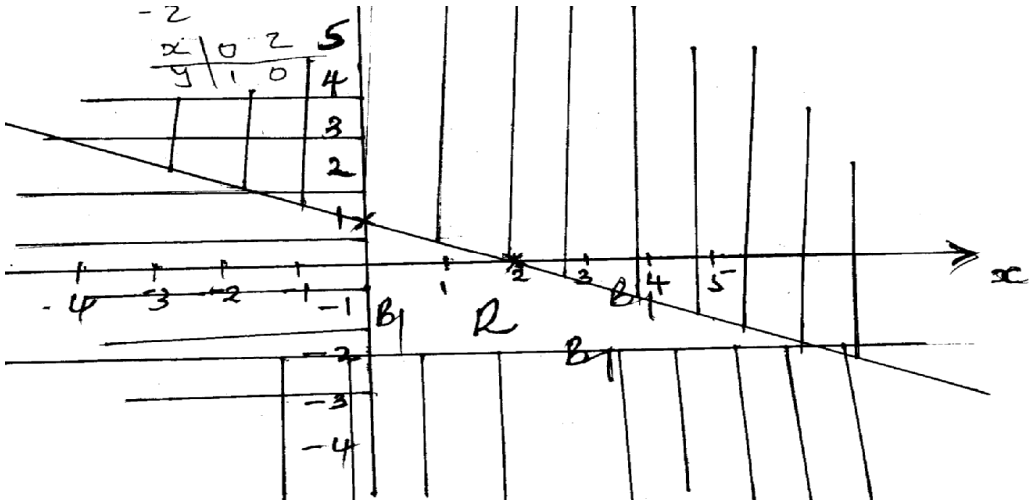
$y \leq {}^{4}/_{7}x + 2$

Or 7y 4x + 14

10. *Lines to be drawn x = 0, y = 2*

$2y + x = 2$

x	0	2
y	1	0



11. $3(1 + x) < 5x - 11$

$3 + 3x) < 5x - 11$

$-2x < -14$

$x > 7$

$5x - 11 < 45$

$5x < 56$

$x < 11.2$

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 = $90^0 - 30 - 30^0$ $= 30^0$ <QRO + ORP + SRP = 90^0 Diam. Subt 90^0 at circumference (b) ORP = 60^0 Base angle of isosceles triangle (c) OP to MPT <OPT = 90^0 Radius meets tangent at 90^0 <RTP = 90^0 - <OPR	 **B1** **B1** **B1 B1** **B1**	

	$= 90^0 - 30^0$ $= 60^0$ (d) <STP = 180^0 - <OPT 90^0 - <POT 60^0 Angle sum of triangle $= 30^0$ (e) <QPM = <QRP = 60^0 Angles in alternate segment	**B1** **B1** **B1** **B1** **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 $= 30^0$ <QRO + ORP + SRP = 90^0 Diam. Subt 90^0 at circumference (b) ORP = 60^0 Base angle of isosceles triangle (c) OP to MPT <OPT = 90^0 Radius meets tangent at 90^0 <RTP = 90^0 - <OPR $= 90^0 - 30^0$ $= 60^0$ (d) <STP = 180^0 - <OPT 90^0 - <POT 60^0 Angle sum of triangle $= 30^0$ (e) <QPM = <QRP = 60^0 Angles in alternate segment	 **B1** **B1** **B1 B1** **B1** **B1** **B1** **B1** **B1** **B1**	
		10	

1. *Area of $\Delta AXY = \frac{1}{2} \times 4^2 \times \sin 97.2^0$*
$= 7.94\ cm^2$
Area of sector AXY = $\frac{97.2}{360} \times \pi \times 4^2$

$= 13.57\ cm^2$
Area of shaded part = $13.57 - 7.94 = 5.63\ cm^2$
Area of $\Delta BXY = \frac{1}{2} \times 6^2 \sin 30$
$= 9\ cm^2$
Area of sector BXY = $\frac{30}{360} \times \pi \times 6^2$
$= 9.42\ cm^2$
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. $^2/_5 \div ½$ *0f* $^4/_9 - 1^1/_{10}$

$= ^2/_5 \div ½ \; X \; ^4/_9 - ^{11}/_{10}$

$= ^2/_5 \; x \; ^9/_2 - ^{11}/_{10}$

$= ^9/_5 - ^{11}/_{10} = ^{18-11}/_{10} = ^7/_{10}$

$^1/_8 - ^1/_6 \; X \; ^3/_8 = ^1/_8 - ^1/_{16}$

$= ^{2-1}/_{16} = ^1/_{16}$

$\frac{^2/_5 \div ½ \text{ 0f } ^4/_9 - 1^1/_{10}}{^1/_8 - ^1/_6 \text{ of } ^3/_8} = \frac{^7/_{10}}{^1/_{16}}$

$= ^7/_{10} \; X \; ^{16}/_1$

$= ^{56}/_5 = 11^1/_5$

4. *a)* $DAC = DCA = ½ (180 - 100)$ *(base sios* $= 40^o$

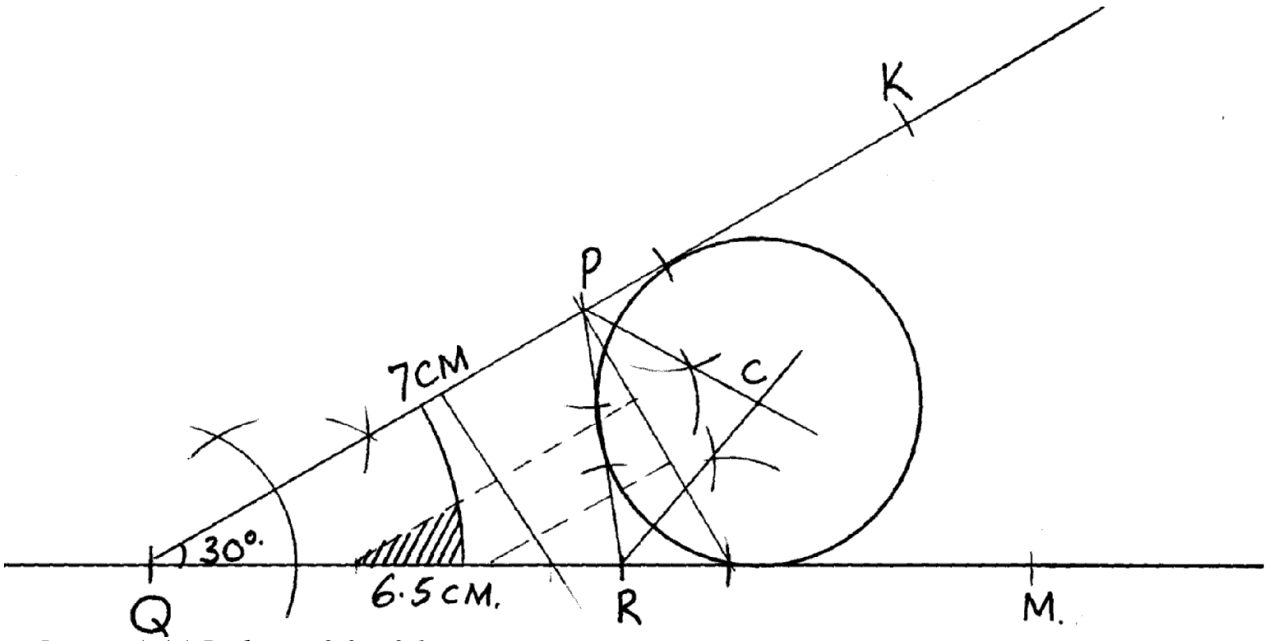
(b) $BAC =$ *DCA alt ,*$\angle$*s AB//AD)*

$= 40^o$

(b) $DAB = DAC + BAC = 40 + 40 = 80^o$

$BCD = 180^o - 80^o$

$= 100^o$



5. *c) (ii) Radius* $= 2.3 \pm 0.1cm$

Name of QPR : Escribed circle

6. *(i)* $\angle ACB = 10^o$ *(*$\angle$*s subtended by chord AB)*

(ii) $\angle AOD = 160^o$ *(*$\angle$ *at centre line at circumference)*

(iii) $\angle CAB = 40^o$ *(*$\angle$*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

$= \frac{1}{2} \times 9 \times 9 \sin 80^0$

$= 39.8847\ cm^2$

iii) $\frac{180}{360} \times \frac{22}{7} \times 9 \times 9$

$= 127.2857\ cm^2$

Segment: $63.6429 - 39.8847$

$= 23.7582 \times 2 = 47.5164\ cm^2$

$\therefore 127.2857 - 47.5164$

$= 79.7693 cm^2 = 79.77\ cm^2$

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 $= \left(\frac{80}{360} \times \pi \times 2.645^2\right) = 4.884cm^2$

Area of the shaded segment $= (4.884 - 3.445) = 1.439cm^2$

10. a) $\measuredangle BDC = 90^o - 33^o$, 3rd 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) $\lvert p+2q\rvert$ $=\begin{pmatrix}-2\\5\end{pmatrix}+\begin{pmatrix}-12\\10\end{pmatrix}$ $\begin{pmatrix}-14\\15\end{pmatrix}=\sqrt{(-14)^2+(15)^2}=\sqrt{196+225}=\sqrt{421}=20.52$ (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	$\underset{\sim}{P} = 2\begin{pmatrix}1\\-2\\1\end{pmatrix} - \frac{1}{3}\begin{pmatrix}6\\-3\\9\end{pmatrix} + \begin{pmatrix}-3\\2\\3\end{pmatrix}$ i) $= \begin{pmatrix}2\\-4\\2\end{pmatrix} - \begin{pmatrix}2\\-1\\3\end{pmatrix} + \begin{pmatrix}-3\\2\\3\end{pmatrix}$ $= \begin{pmatrix}-3\\-1\\2\end{pmatrix}$ ii) $\lvert P\rvert = \sqrt{9+1+4}$ $= \sqrt{14} = 3.742$	M1 A1 B1	
		3	
4.	$\underset{\sim}{PQ} = \begin{pmatrix}-2\\-1\end{pmatrix} - \begin{pmatrix}-6\\-3\end{pmatrix} = \begin{pmatrix}4\\2\end{pmatrix}$ $\underset{\sim}{QR} = \begin{pmatrix}6\\3\end{pmatrix} - \begin{pmatrix}-2\\-1\end{pmatrix} = \begin{pmatrix}8\\4\end{pmatrix}$ $2\ \underset{\sim}{PQ} = \underset{\sim}{QR}$ multiples of each other Q is common point hence PQ and R are collinear	B1 B1 B1	
		03	

1.

$$\sin 60 = \sqrt{3}/2 \qquad \sin 45 = 1/\sqrt{2}$$

$$\frac{1}{\frac{\sqrt{3}}{2} \cdot \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}}$$

$$= \frac{1}{\frac{\sqrt{3}}{2\sqrt{2}} - \frac{1}{\sqrt{2}}}$$

$$= \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{2}$$

$$= \frac{\sqrt{6} - 2\sqrt{2}}{4}$$

2. $\underset{\sim}{OP} = \underset{\sim}{OA} + \frac{1}{4}\underset{\sim}{AB}$

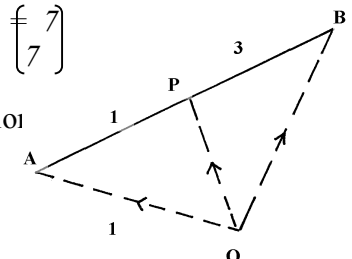
$= \underset{\sim}{OA} + \frac{1}{4}(\underset{\sim}{QB} - \underset{\sim}{OA})$

$= \underset{\sim}{QA} + \frac{1}{4}\underset{\sim}{QB} - \frac{1}{4}\underset{\sim}{QA}$

$= \frac{3}{4}\underset{\sim}{QA} + \frac{1}{4}\underset{\sim}{QB}$

$= \frac{3}{4}\underset{\sim}{QA} + \frac{1}{4}\underset{\sim}{QB}$

$= \frac{3}{4}\begin{pmatrix}12\\8\end{pmatrix} + \frac{1}{4}\begin{pmatrix}16\\4\end{pmatrix} = \begin{pmatrix}3\\6\end{pmatrix} + \begin{pmatrix}4\\1\end{pmatrix} = \begin{pmatrix}7\\7\end{pmatrix}$



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
$8m - 6n = 10$
$9m + 6n = 24$
$17m = 34$
$m = 2$
$4 \times 2 - 3n = 5$
$-3n = -3$
$n = 1$
$\therefore m = 2, n = 1$

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)

$(1 - t) = ¾\ h$ ....(ii) $t = \frac{5 - 5h}{2}$

$1 - (\frac{5 - 5h}{2}) = \frac{2}{3}h = 11h = 9$

$h = \frac{9}{11}$

$t = \frac{5 - 5}{2}\left[\frac{9}{11}\right] = \frac{5}{11}$

(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 ⇒1 – x = 2 ⇒ x = -1
6 – y = 4 ⇒ y = 2
∴ D = (-1, 2)

b) (i) $\overrightarrow{RQ}$ = Q – R = q – $^3/_2$q - ½ p
= -½ q - p = ½ p – q √

(ii) PR = $^3/_2$ q - ½ p – P √
= $^3/_2$ (q - p)
$^3/_2$ q = - ½ Also -$^3/_2$ p = ½ kp
⇒k = -3 ⇒ k = -3
Hence P, Q, R, Q Collinear.

(iii) $\overrightarrow{PQ}$ = q - p , QR = 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 ${}^{1}/_{12}(p-4q)$

$QT: TS = {}^{1}/6(p-4q): {}^{1}/12(p-4q) = {}^{1}/6:{}^{1}/12 = 2:1$

$\therefore QT = 2TS$ $OT//TS$ 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. $3a = 3(-3) = (-9)$

$2 \quad 6$

$½\ b = ½\ (4) = (2)$

$-6 \quad -3$

${}^{1}/_{10}c = {}^{1}/_{10}\ (5) = (0.5)$

$-10 \quad -1$

$P = (-9) - (2) + 0.5)$

$6 \quad -3 \quad -1$

$= (-10.5)$

8

$/P/ = \sqrt{(-10.5)^2 + 8^2}$

$= \sqrt{110.25} = 64$

$= \sqrt{174.25}$

$= 13.20037878$

$= 13.20$ (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

$= b + k(2a - b)$

$\underset{\sim}{=} \frac{2}{5} ka + b(1- k)$

OX = OA + AX

$= a + h\left(\frac{2}{3}b - a\right)$

$= a(1-h) + 2hb$

$= a(10h) 2hb$

(c) ${}^{2}/_{5}\, a = a(1-h)$ *also* $b(1-k) = 2hb$

$2k = 1-h \quad 1-k = 2h$

$k = \frac{5}{2} - \frac{5h}{2}$

$\therefore 1 - \frac{5}{2} + \frac{5h}{2} = \frac{2h}{3}$

$\frac{5h}{2} - \frac{2h}{3} = \frac{5}{2} - 1$

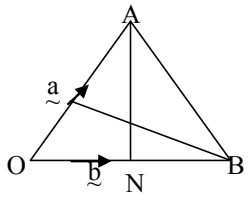
$1\ \frac{5h}{6} = \frac{3}{2}$

$h = \frac{3}{2} \times \frac{6}{11} = 9$

$k = \frac{5}{2} - \frac{5}{2} \quad \frac{9}{11}$

$= \frac{5}{2} - \frac{45}{22}$

$= \frac{5}{11}$



10. *(i)* $AN = AO + ON$

$= -a + \frac{4}{5} b$

(ii) $\underset{\sim}{BM} = \underset{\sim}{BO} + \underset{\sim}{OM}$

$\underset{\sim}{=} -b + {}^{2}/_{5}\, \underset{\sim}{a}$

(iii) $AB = \underset{\sim}{AO} + \underset{\sim}{OB}$

$= -\underset{\sim}{a} + \underset{\sim}{b}$

$\underset{\sim}{AX} = s\underset{\sim}{AN}$

$\underset{\sim}{BX} = t\underset{\sim}{BM}$

$\underset{\sim}{OX} = \underset{\sim}{OB} + \underset{\sim}{BX}$

$= b + tBM$

$= \underset{\sim}{b} + t\,\underset{\sim}{(-b} + {}^{2}/_{5}a)$

$= \underset{\sim}{b} - t\underset{\sim}{b} + {}^{2}/_{5}\,t\underset{\sim}{a}$

$= \underset{\sim}{b}\,(1-t) + {}^{2}/_{5}\,t\underset{\sim}{a}$

$OX = OA + AX$

$= \underset{\sim}{a} + s\underset{\sim}{AN}$

$= \underset{\sim}{a} + s(-\underset{\sim}{a} + {}^{4}/_{5}\,\underset{\sim}{b})$

$= \underset{\sim}{a} - Sa + {}^{4}/_{5}\;s\underset{\sim}{b}$

$\underset{\sim}{a}(1-s) + {}^{4}/_{5}\,s\underset{\sim}{b}$

$b(1-t) + {}^{2}/_{5}t\underset{\sim}{a} = a\,(1-s)\,{}^{4}/_{5}s\underset{\sim}{b}$

$b(1-t) = {}^{4}/_{5}\,s\underset{\sim}{b}$

$1-t = {}^{4}/_{5}s$----------(i)

$a\,(1-s) = {}^{2}/_{5}t\underset{\sim}{a}$

$1-s = {}^{2}/_{5}t\underset{\sim}{a}$

$s = 1 - {}^{2}/_{5}t$----------(ii)

$1-t = {}^{4}/_{5}(1 - {}^{2}/_{5}t)$

$1 - t = {}^{4}/_{5} - {}^{8}/_{25}t$

$-{}^{17}/_{25} = -\,1/_{5}$

$t = {}^{5}/_{17}$

$s = {}^{15}/_{17}$

$\underset{\sim}{\quad}\quad\underset{\sim}{\quad}\quad\underset{\sim}{\quad}\quad\underset{\sim}{\quad}$

11. $\dfrac{115800}{76.84} \times \dfrac{97.5}{100}$

$= 1469.35\ \surd$

$= 1469.35 - 270$

$= 1199.35\ \surd$

$= 1199$ dollars

12.
$$RM = \begin{pmatrix} -2 \\ 6 \\ 7 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \\ 0 \end{pmatrix} = \begin{pmatrix} -3 \\ 8 \\ -1 \end{pmatrix}$$

$|\underset{\sim}{RM}| = \sqrt{(-3)^2 + 82(-1)^2}$

$\underset{\sim}{74} = 8.602$ units

13. (a) (i) $\underset{\sim}{OB} = a + b$

(ii) $BC = \underset{\sim}{BA} + AO + \underset{\sim}{OC}$

$= \underset{\sim}{b} + -a + \underset{\sim}{2b}$

$= \underset{\sim}{b} - \underset{\sim}{a}$

(b) $CX = CQ + OA + AB + BX$

$\underset{\sim}{\quad}\quad\underset{\sim}{\quad}\quad\underset{\sim}{\quad}\quad\underset{\sim}{\quad}$

$= -2b + a + b + hBC$

$= a - b + h(b - a)$

$= a - b + hb - ha$

$= (1 - h)a + (h - 1)b$

(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) $BD = BA + AD$

$= -b + 3/5c$

$AE = AB + BE$

$= b + \frac{1}{2} BC = b + \frac{1}{2}(c - b)$

$= \frac{1}{2} b + \frac{1}{2} c$

ii) $BF = t(3/5c - b)$

$AF = n(\frac{1}{2} b + \frac{1}{2} c) = n/2 (b + c)$

$AF = AB + BF$

$= b + t(3/5c - b) = b + 3/5tc + tb$

$= (1 - t) b + 3/5tc$

$(1 - t)b + 3/5tc = n/2 b + n/2 c$

$1 - t = n/2$; $2 - 2t = n$ …… (i)

$3/5t = n/2$; $6t - 5n = 0$ …….. (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 = ¾ AE
F divides AE in the ratio 3 :1

16. *BA* = $\begin{pmatrix} -8 \\ -2 \end{pmatrix}$

½ BC = ½ $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$ = $\begin{pmatrix} 1\frac{1}{2} \\ -2 \end{pmatrix}$

OP = $\begin{pmatrix} -8 \\ -2 \end{pmatrix} + \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ ½ = $\begin{pmatrix} -9\frac{1}{2} \\ -4 \end{pmatrix}$

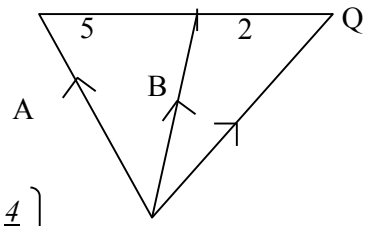
Co-ordinates of P (-9 ½ , -4)

17. $OB = \frac{5}{7}OQ + \frac{2}{5}OA$

$OQ = \frac{7}{5}OB - \frac{2}{5}OA$

$OQ = \frac{7}{5}\begin{pmatrix} 2 \\ -1 \end{pmatrix} - \frac{2}{5}\begin{pmatrix} -3 \\ 4 \end{pmatrix}$

$= \begin{pmatrix} 14/5 \\ -7/5 \end{pmatrix} - \begin{pmatrix} -6/5 \\ 8/5 \end{pmatrix} = \begin{pmatrix} 20/5 \\ -15/5 \end{pmatrix} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$



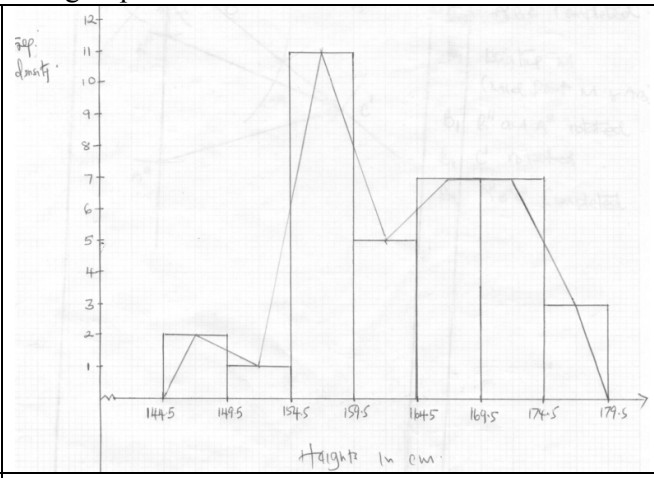
Q= (4, -3)

39. Representation of data

1. (a)

Class	Tally mark	Freq	Freq D
145-149	//	2	2
150-154	/	1	1
155-159	𝍸 𝍸 /	11	11
169-164	𝍸	5	5
165-169	𝍸 //	7	7
170-174	𝍸 //	7	7
175-179	///	3	3

B1	Classes
B1	Tally mark column
B1	Freq. column
B1	Freq density column (can be implied)
B1	Freq. density (y axis
B1	Height (x axis)
	Correct spacing as per scale
B1	Histogram drawn (bars)
B1	Joining mid point of the bars
B1	Joining mid point of first class to 144.5
B1	Joining mid point of last class to 179.5

			
		10	

1.

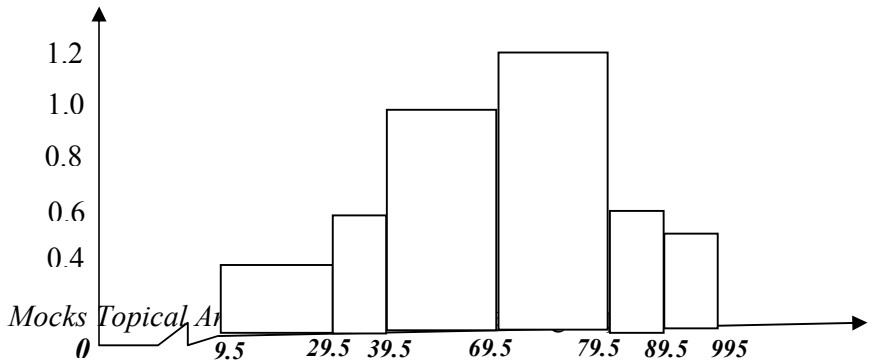
Length	*Frequency*
11.5 ≤ x≤ 13.5	*6*
13.5 ≤ x≤ 15.5	*9*
15.5 ≤ x≤ 17.5	*6*
17.5 ≤ x≤ 23.5	*3*

2. *Food: $^{40}/_{100}$ x 360 = 144 °*
Transport: $^{10}/_{100}$ x 360 = 36°
Education: $^{20}/_{100}$ x 360 = 72 °
Clothing: $^{20}/_{100}$ x 360 = 72 °
Rent: $^{10}/_{100}$ x 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	*20*
10-19	*50*
20-30	*40*
40-49	*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*	

$$x = \frac{\Sigma fx}{\Sigma f} = \frac{3380}{140} = 24.14$$

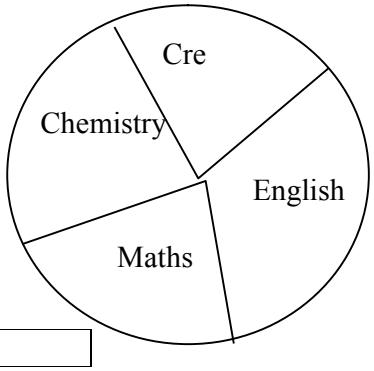
(ii) Median mark is at 70 + 71 = 70.5th position

$$\text{Median} = 119.5 + \frac{0.5}{40} \times 20$$

$$= 19.5 + 0.25$$

$$= 19.75$$

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 20.5^{th} value

The value also in the 145 – 153 class

b)

Class	x	f	fx
118- 126	122	3	366
127- 135	131	4	524
136 – 144	140 B1	10 B2	1400
145 – 153	149	12	1788
154 – 162	158	5	790
163 – 171	167	4	668
172 - 180	176	2	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 $20^{th} = 144.5 + ({}^{11}/_{12} \times 9) = 152.75$

$21^{st} = 144.5 + ({}^{12}/_{12} \times 9) = 153.5$

$Median = \frac{152.75 + 153.5}{2} = 153.125$

(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. $Log_{10} 5^2 - log_{10} 2^3 + log\ 2^5$

$Log_{10}\left(\frac{25 \times 32}{8}\right)$

$Log_{10} 100 = log_{10}{}^{2}10$

$= 2\ log_{10}10$

But $log_{10}10 = 1$

$\therefore = 2$

✓***Application of logarithmic laws.***

✓***Application***

C.A.O

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

$= \frac{1}{2}\left(59.5 + \frac{5}{12} \times 10 + 59.5 + \frac{6}{12} \times 10\right)$

$= \frac{1}{2}(59.5 + 4.16666 + 59.5 + 5)$

$= \frac{1}{2}(128.16666667) = 64.083$

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

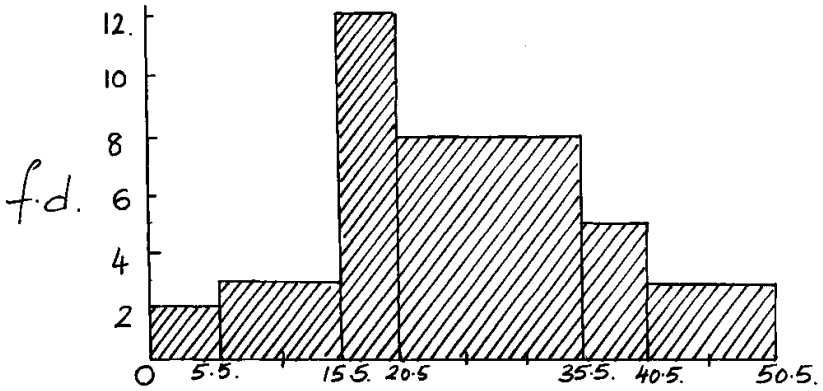
ii) class where medium lies
median class 50- 59

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
$$Median = L1t\ (\tfrac{n}{2} - \frac{cfa}{Fn})$$
$$= 8 + \frac{(25 - 11)}{19} \times 4$$
$$= 10.947$$

11.



41. Linear motion

1. *Distance covered by Kinyua in $1^2/_3$hrs*
= 5 x 90 = 150km
Distance traveled by Nyaboke during the rest = ($^1/_3$ x 120) = 40km
$$\frac{x}{90} = \frac{390 - x}{120} \Rightarrow 120x = 90(390 - x)$$
= 167.1km
$$Time = \frac{167.1}{90} = 1.86$$
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

$\frac{1}{2} X\ 12\ (50 + t + t) = \frac{1}{2} X\ 2700$

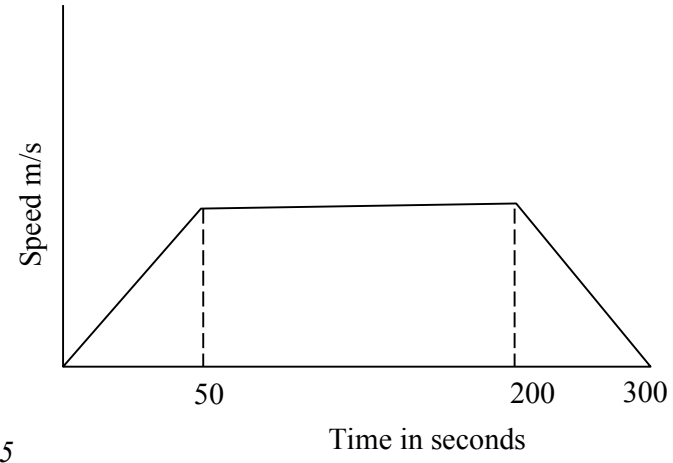
$6(50 + 2t) = \frac{1}{2} X\ 2700$

$50 + 2t = 225$

$$T = \frac{225 - 50}{2} = 87.5$$

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
$= {}^{90}/_{7.5}$
= 12km/hr

5. $D = \frac{5}{4} \times 80 + \frac{50}{1000}$
= 100.05km
Speed = 120 – 80 = 40km/h
$T = \frac{D}{S} = \frac{100.05}{40}$
= 2.50125hours

(b) $D = S \times T = 120 + \frac{100.05}{4000} + \frac{199}{800}$
$= \frac{120 \times 11000}{40000}$
= 330km

(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 x 2 ½
= 150km

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*

$S \Rightarrow Bus = 40\ km/h$
$Trailer = x km/h$
$Relative\ speed = (40 - x)\ km/h$
$T = 4.8\ sec. = \frac{4.8h}{3600}$

$S = \frac{D}{T}$

$(40 - x) = \frac{0.02}{\frac{48}{3600}}$

$\simeq \frac{0.02 \times 3600}{48}$

$= 15\ km/h$

$40 - x = 15$

$x = 25\ km/h$

9. $L.C.M = 2^4 \times 3^2 \times 5^3 = 1800$

$GC.D. = 2 \times 3 \times 5^2 = 150$

10. $Total\ distance = 60\ cm$
$Total\ time\ taken = 3\ 1/5\ hrs$
$Let\ speed\ in\ still\ water\ be\ x\ km/h$
$Speed\ upstream = (x - 5)\ km/h$
$Speed\ downstream = (x + 5)\ km/h$

$\frac{30}{x - 5} + \frac{30}{x + 5} = \frac{16}{5}$

$30x - 150 + 30x + 150 = \frac{16}{5}(x^2 - 25)$

$300x = 16x^2 - 400$

$x = -5/4 \text{ or } 20$

$\therefore Speed\ in\ still\ water\ is\ 20\ km/hr$

11. $When\ David\ left,\ Ojwang\ had\ covered\ 15 \times 3/2 = 22.5\ km.$

a) (i) $Remaining\ dist. = 40 - 22.5 = 17.5\ km$
$Relative\ speed = 15 + 25 = 40\ km/h$
$Time\ taken\ before\ meeting = \frac{17.5}{40} = 0.4375\ hrs$
$Ojwang\ covered\ 15 \times 0.437 = 5.5625\ km$
$Distance\ from\ Ojwang's\ house = 22.5 + 6.5625\ \surd$
$= \underline{29.0625\ km}$

(ii) $0.4375 = 26\ min\ 15\ sec$
$\therefore They\ met\ at\ 10.30 + 26.15$
$= 10.56.\ 15\ am.$

(iii) $40 - 29.0625\ \surd = \underline{10.9375\ km}\ \surd$

b) $Time\ take = \frac{10.9375}{12}\ \surd = 0.9115\ hrs$

= 54 min, 41 sec.
They arrived at 10.56. 15 + 54.41 + 10 min
= 12.00. 56 pm. √

12. (a) In 10minutes Kamau has travelled
10/60 x 24 = 6km
Distance left = 42 – 6 = 36km
Relating speed = 24 + 50.4k/hr
= 74.4km/hr
Time taken to meet = 42/74.4 = 0.565hrs
= 34minutes
Time for meeting is 6.10
34
6.44a.m
34/60 x 50.4 = 28.56km from R or 13.44 from S

(b) Kamau arrival time
42km/24km/hr = 1.75hrs
1hr .45 minutes

6.00a.m
1.45
7.45a.m

(c) Mrs Ronoh speed = 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 24 = 8.75
76.8
He was overtaken at 7.00
+ 18.75
7.18am
At distance of D = S x t
= 100.8 x 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
16 X 1000 X 54 m/60 X 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

$\frac{60 \times 60 \times 240}{128 \times 1000}\ s = \frac{27}{4}$ *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

$= \frac{5}{6} \times 60$

$= 50$*mins*

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 = $\frac{1}{2} \times 80 = 40$*km*

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 + $\frac{18}{60} \times 80$

= 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 x 80 + 50 x 80 = 240 + 66 $^{2}/_{3}$

60

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

1

x	-4	-3	-2	-1	0	1	2
$2x^3$	-128	-54	-16	-2	0	2	16
$5x^2$	80	45	20	5	0	5	20
-x	4	3	2	1	0	-1	-2
-6	-6	-6	-6	-6	-6	-6	-6
y	-50	-12	0	-2	-6	0	28

B_2

$2x^3 + 5x^2 + x - 6 = y$

$2x^3 + 5x^2 x - 4 = 0$

$-2x - 2 = y$

$y = -2x - 2$

X	0	2
Y	-2	-6

10

2

a)

$\frac{dy}{dx} = 4x - 6$ B1

b)

$4x - 6 = 0 \therefore x = 1.5$ M1 Equating to zero

$y = 2(1.5)^2 - 6(1.5) + 9$ M1

$= 4.5$ A1

$\therefore$ Turning point $(1.5, 4.5)$ B1

1	1.5	2
-1	0	+2
\	_	/

B1 ✓gradient

	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) $y = 5x - \underline{x^2} - 3$

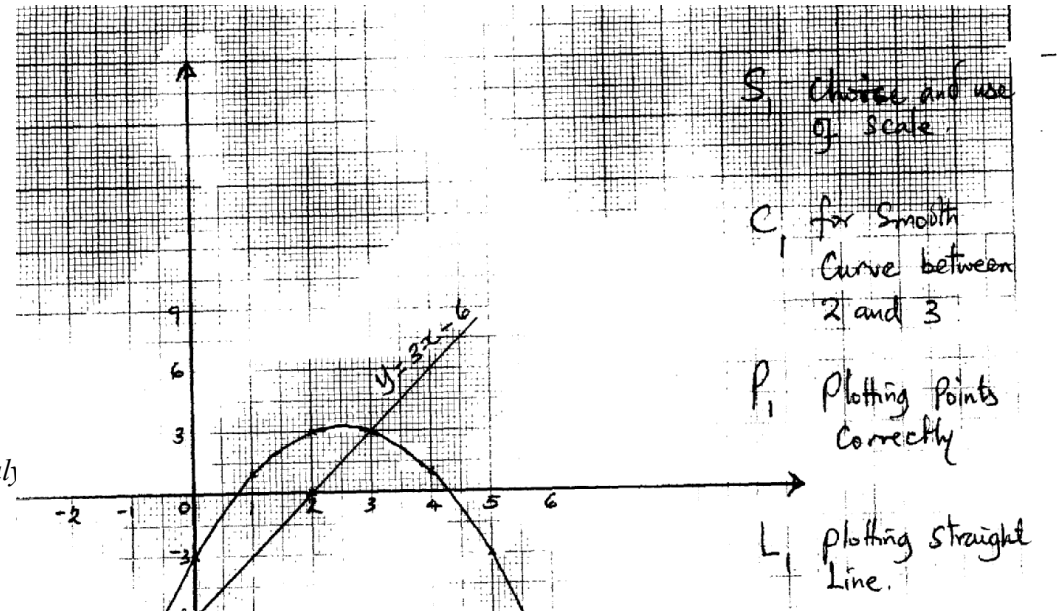
$\underline{0 = 2x - x^2 + 3}$

$y = 3x - 6$

x	*0*	*-1*	*2*
y	*-6*	*-9*	*0*

For all ✓values of y B1 for at least 5 ✓values.

x = -1 or 3 ± 0.1



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

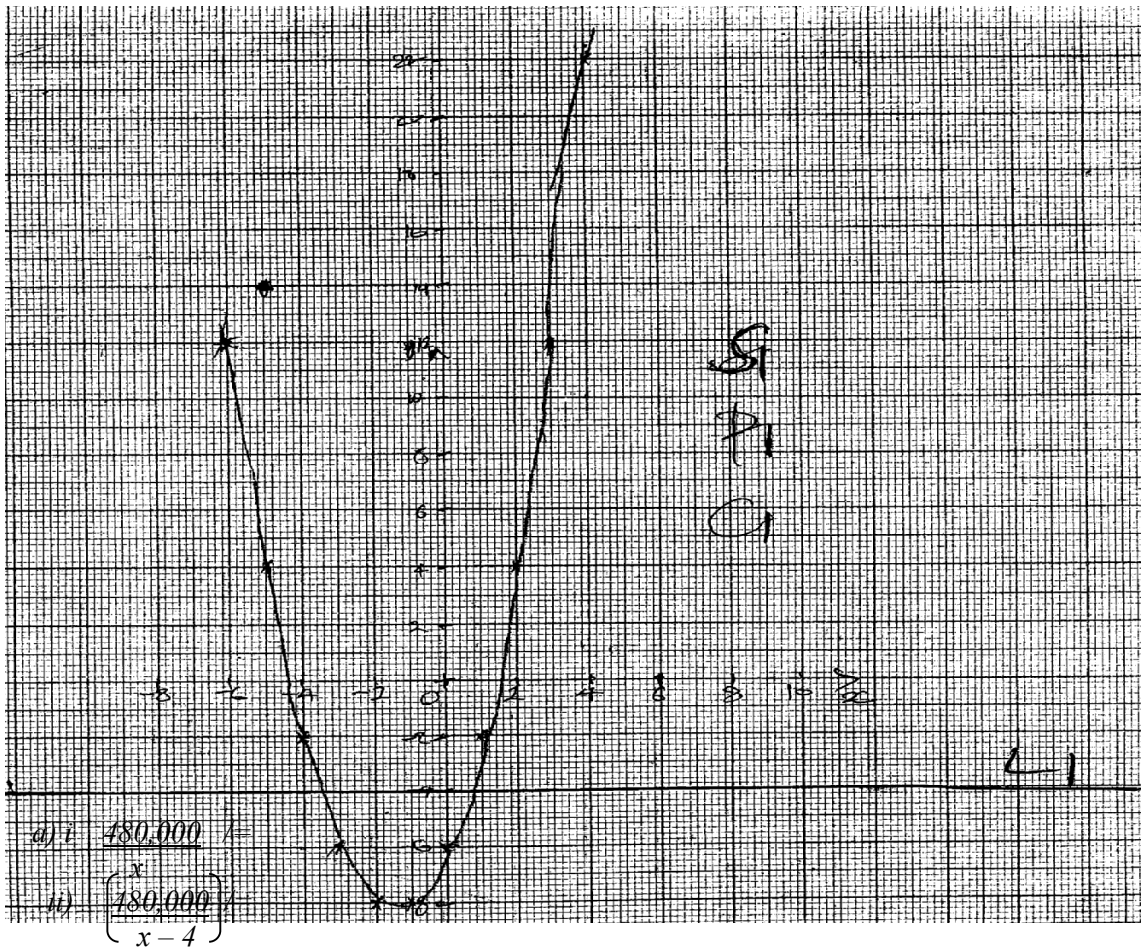
(c) $2x^2 + 3x + 1 = 0$

$2x + 4x - 3 = 0$

$-x + 2 = y$

$x = 0.6$ or $x = -2.6 \pm 0.1$

(d) $x = 0.30 - x = -1.8 \pm 0.1$



6. a) i $\frac{480,000}{x}$ h

ii) $\left(\frac{480,000}{x-4}\right)$ h

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

$48x = 48x - 192 + 2x^2 - 4x$

$48x - 48x + 4x - 2x^2 + 192 = 0$

$4x - 2x^2 + 192 = 0$

$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

$= \frac{-4 \pm \sqrt{1552}}{-4}$

$= \frac{-4 \pm 39.3954}{-4}$

$x = \frac{-4 + 39.3954}{-4}$ 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) $y = 2x^2 + x - 2$

$0 = 2x^2 + 2x - 3$

$y = -x + 1$

x	-3	-2	-1	0	1	2
y	5	3	2	1	0	-1

$y = 2x^2 + x - 2$

$0 = 2x^2 + x - 5$

$y = 3$

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*

$A = \frac{1}{2} h \left\{ (y_1 + y_7) + 2(y_2 \ldots\ldots\ldots\ldots\ldots y_6) \right\}$

$= \frac{1}{2} \times \frac{1}{2} \left\{ (0 + 9) + 2 (0.25 + 9 + 2.25 + 4 + 0.25 \right\}$ √

$= \frac{1}{4} \left\{ 9 + 4.25 \right\}$ √

$= \underline{13.25 \text{ sq. units}}$ √

b) $\int_{-2}^{0} (x^2 + 4x + 4)\, dx + \int_{0}^{1} (x^2 + 4x + u)\, dx$

$\left[\frac{x^3}{3} + 2x^2 + 4x \right]_{-2}^{0} + \left[\frac{x^3}{3} + 2x^2 + ux \right]_{0}^{1}$ √

$= (-\frac{8}{3} + 8 - 8) + (\frac{1}{3} + 2 + 4)$ √

$= 9$ √

Error $= \overline{13.25} - 9 = 4.125$

$\% = \frac{4.125}{9}$ √ $\times 100$

$= \underline{45.84\%}$

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*

$A = \frac{1}{2} h \left\{ (y_1 + y_7) + 2(y_2 \ldots\ldots\ldots\ldots\ldots y_6) \right\}$

$= \frac{1}{2} \times \frac{1}{2} \left\{ (0 + 9) + 2 (0.25 + 9 + 2.25 + 4 + 0.25 \right\}$ √

$= \frac{1}{4} \left\{ 9 + 4.25 \right\}$ √

$= \underline{13.25 \text{ sq. units}}$ √

b) $\int_{-2}^{0} (x^2 + 4x + 4)\, dx + \int_{0}^{1} (x^2 + 4x + u)\, dx$

$\left(\frac{x^3}{3} + 2x^2 + 4x\right)_{-2}^{} + \frac{x^3}{3} + 2x^2 + ux \quad \sqrt{}$

$= (-\frac{8}{3} + 8 - 8) + (\frac{1}{3} + 2 + 4) \sqrt{} \quad 0$

$= 9 \sqrt{}$

Error $= \sqrt{13.25} - 9 = 4.125$

$\% = \frac{4.125}{9} \sqrt{} \times 100$

$= \underline{45.84\%}$

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) -0.9×2.8

$x = -1$ 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 $x = -2.6 \pm 0.1$

$x = 0.6 \pm 0.1$

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

$0 = 2x^2 + x - 5$

$y = 3x + 2$

Roots read from the 2 pts of intersection of the line and curve.

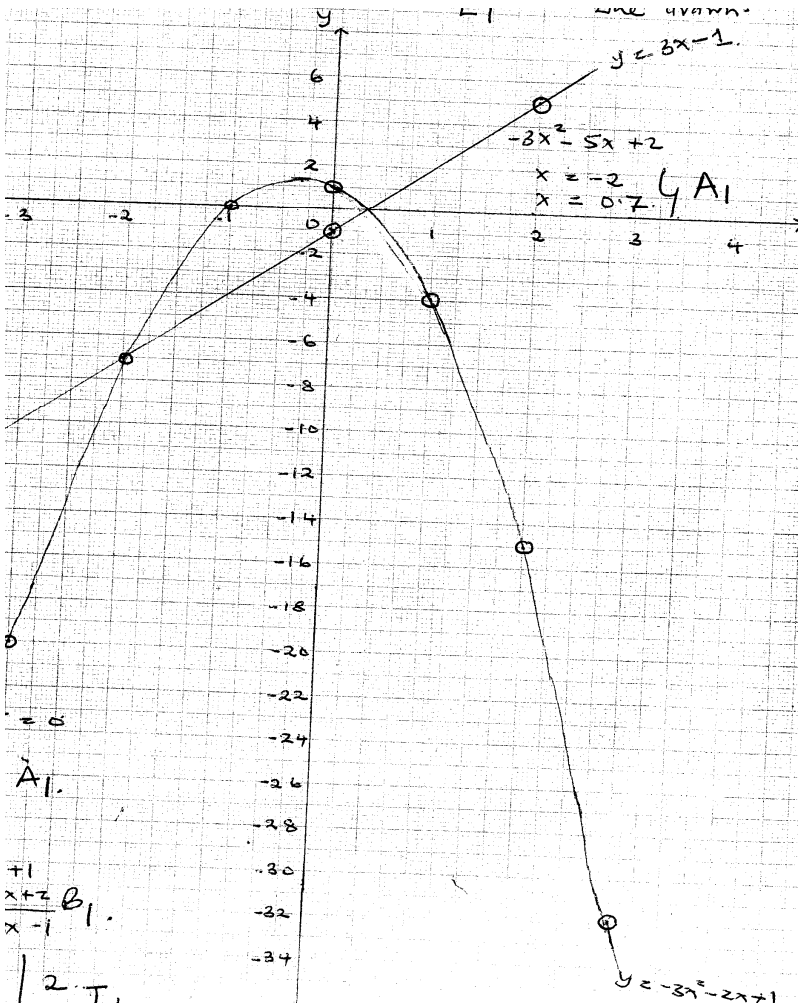
$X = -1.9 \pm 0.1$

$X = 1.4 \pm 0.1$

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* *



$1 - 2x - 3x^2 = 0$
$x = -1$
$\text{or } x = 0.7$ } 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) $a + b = 13$
$a - b = 3$
$2a = 16$

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 $= 2(12.05 + 8.05) = 40.2$cm
Actual perimeter $= 2(12.0 + 18.0) = 40.0$cm
Error $= 40.2$cm $- 40.0$cm $= 0.2$cm
%error $= \frac{0.2 \times 100}{40}$
$= 0.5\%$

2. $A = \frac{1}{2} \times 12 \times 8 = 48$
i) Absolute error
$= \left[\frac{1}{2} \times 12.5 \times 8.5 - \frac{1}{2} \times 11.5 \times 7.5\right]$
2
$= 5$
ii) % error $= 5/24 \times 100\%$
$= 10.4\%$

3. $A = L \times W$
$A = x(14 - x) = 14x - x^2$

$\frac{dA}{dx} = 14 - 2x = 0$

$14 = 2x,\ x = 7$

Maximum area $= 7(14 - 7)$

$= 7x\ 7 = 49cm^2$

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 $= 10..5 \times 15.05$

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***

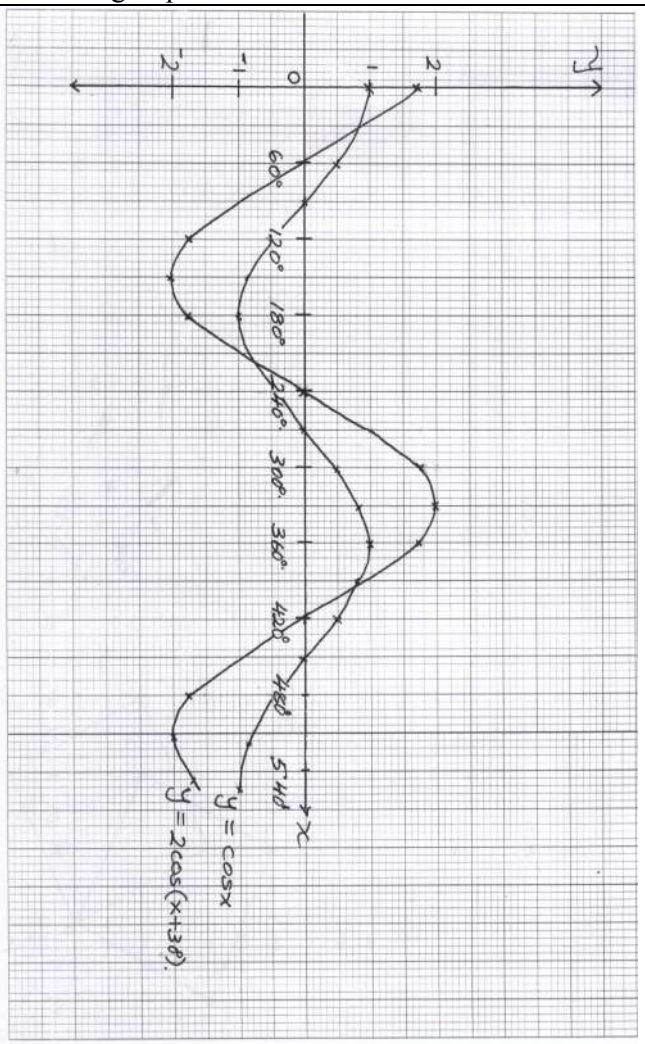
$= \frac{18}{2}$ ***Simplification***

$= 9$ ***CAO***

44. Trigometry 2

1	$Sin\frac{5}{2}x = -\frac{1}{2}$ $\frac{5}{2}x = 210^0, 330^0, 390^0$ $x = 84^0, 132^0, 156^0$	B_1 B_1	Allow for any 2 ✓angles
2	a) b) i) Period = 3600 ii) Phase angle = 300	B2 B1 B1	allow B1 for 7✓values ✓values to 2 d.p. apply ow-1 if given to other d.p

X^0	60^0	120^0	180^0	240^0	300^0	360^0	420^0	480^0	540^0
cosX	0.50	-0.50		-0.5		1.00	0.50	-0.5	-1.0
2cos(x+30)	0.00		-1.73		1.73	1.73	0.00	-1.73	-1.73



S_1

P_1 for all values ✓ly Plotted

C_1 smooth curve $y = \cos x$

C_1 smooth curve $y = 2\cos(x+30^0)$

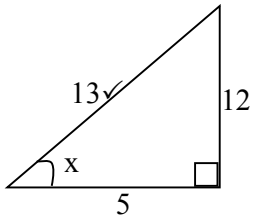
	c) $37.5^0 \le x \le 217.5^0$ $397.5^0 \le x \le 540^0$	B_1 B_1	Allow ± 0.5
		10	

1. $5\sin x + \cos x$

$= 5\left(\frac{12}{13}\right) - \frac{5}{13}$

$= \frac{60}{13} - \frac{5}{13} = \frac{55}{13}$

$= 4\frac{1}{13}$



2. $\frac{2\cos 3\theta}{2} = \frac{1}{2}$ 2

$\cos 3\theta = 0.5$

$3\theta = \cos^{-1}0.5$

$\frac{3}{3}\theta = \frac{60^o}{3}, \frac{300^o}{3}, \frac{420^o}{3}, \frac{66^o}{3}, \frac{78^o}{3}, \frac{102^o}{3}$

$\therefore \theta = 20^o, 100^o, 140^o, 220^o, 260^o, 340^o$

✓Identification of exact number of quadrants to satisfy the equation.
✓Values of at least 4 soln. of θ

3.. $\frac{\frac{1}{2} \times \frac{\sqrt{3}}{2}}{\frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}}$

$$\frac{\frac{\sqrt{3}}{4}}{\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}} \times \frac{\frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}}}{\frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}}}$$

$$\frac{\frac{3}{8} + \frac{\sqrt{3}}{4\sqrt{2}}}{\frac{3}{4} - \frac{1}{2}} = \frac{\frac{3}{8} + \frac{\sqrt{3}}{4\sqrt{2}}}{\frac{1}{4}}$$

$$= \frac{3}{2} + \frac{\sqrt{3}}{\sqrt{2}}$$

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) $\frac{9.3}{\sin 100} = \frac{5}{\sin \theta}$

$\sin \theta = \frac{5 \sin 100}{9.3} = 0.529466$

$\theta = 31.9694$

$\theta \simeq 32^0$

$32 - 20 = 12^0$

$Bearing = 360^0 - 12^0 = 348^0$

c) 020^0

5.

$\sin \overline{60} = \frac{\sqrt{3}}{2}$

$\sin \overline{45} = \frac{1}{\sqrt{2}}$

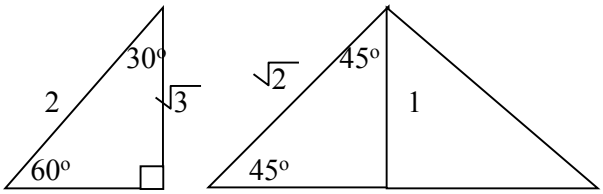
$$\frac{1}{\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}}$$

$$= \frac{1}{\frac{\sqrt{3}}{2\sqrt{2}} - \frac{1}{\sqrt{2}}}$$

$$= \frac{\sqrt{6}}{5} - \frac{\sqrt{2}}{2}$$

$$= \frac{\sqrt{6} - 2\sqrt{2}}{4}$$

6.



$1 + \frac{1}{1} \times \sqrt{3}$

$$\sqrt{2}\quad 2$$

$$1 + \sqrt{3} \times \frac{2\sqrt{2}}{2\sqrt{2}}$$

$$\frac{1}{1} + \frac{2\sqrt{6}}{4}$$

$$\frac{4 + 2\sqrt{6}}{4}$$

7. $$\frac{\sqrt{5}(2\sqrt{2} + \sqrt{5}) + \sqrt{2}(2\sqrt{2} - \sqrt{5})}{(2\sqrt{2})2 - (\sqrt{5})^2}$$

$$\frac{2\sqrt{10} + 5 + 4 - \sqrt{10}}{8 - 5}$$

$$\frac{9 + \sqrt{10}}{3}$$

$$3 + \tfrac{1}{3}\sqrt{10}$$

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) $\frac{9.3}{\sin 100} = \frac{5}{\sin \theta}$

$\sin \theta = \frac{5 \sin 100}{9.3} = 0.529466$

$\theta = 31.9694$

$\theta \simeq 32^0$

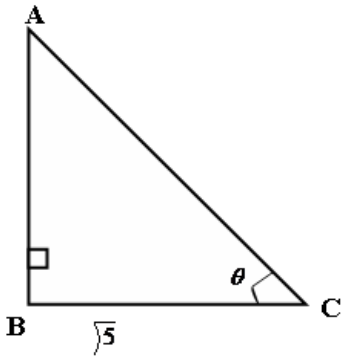
$32 - 20 = 12^0$

$Bearing = 360^0 - 12^0$

$= 348^0$

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.. $\frac{3}{\sqrt{7}-2} + \frac{1}{\sqrt{7}} = \frac{3}{\sqrt{7}-4} + \frac{7+2}{\sqrt{7}}$

$\frac{3}{\sqrt{7}-2} + \frac{1}{\sqrt{7}} = \frac{3\sqrt{7}+7-2)}{7-2\sqrt{7}}$

$3\sqrt{7} + (7-2)$

$7 - 2\sqrt{7}$

$= \frac{3\sqrt{7}+7-2\sqrt{7}+2\sqrt{7}}{7-2\sqrt{7}+2\sqrt{7}}$

$= 49 - 28$

$= \frac{(3\sqrt{7}+7-2)(7+2\sqrt{7}}{21}$

$= \frac{(4\sqrt{7}-2)7+2\sqrt{7}}{21}$

2.

$$\frac{2+\sqrt{5}}{2-\sqrt{5}} - \frac{3+\sqrt{5}}{2+\sqrt{5}} = a + b\sqrt{5}$$

$\frac{4+4\sqrt{5}+\sqrt{5}-(6-3\sqrt{5}+2\sqrt{5}-5)}{4-5}$

$\frac{8+5\sqrt{5}}{-1}$

$a = -8 \quad b = -5$

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.

$(\sqrt{2}-1)^2 = 2\sqrt{2}\ 2 + 1 \equiv \sqrt{3}\ 2\ \ 2$

$(\sqrt{2}-1)^3 = 2 - 1(3\sqrt{2}\ \ 2$

$= 5\sqrt{2} - 7$

$\frac{2-\sqrt{2}}{5\sqrt{2}-7} \times \frac{5\sqrt{2}+7}{5\ \ 2\sqrt{7}\ \ 1} = 2\sqrt{2}+7) - \ \ 2\sqrt{2}+2)$

$= 17\sqrt{2-6} \ \ = -6+1\sqrt{2}$

5. $(2-3)(3+2)$

$3(2)2 - 2)2$

$\underline{3x2 - 3 + 2 - 2}$

$9x2 - 4x3$

$\underline{6 - 3 + 2 - 6}$

$18 - 12 = 6$

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. $\text{Log}_{10}5 - \log_{10}10^2 + \log_{10}(2y+10) = \log_{10}(y-4)$

$\text{Log}_{10}\{5\frac{(2y+10)}{10^2}\} = \log_{10}(y-4)$

$10y + 50 = 100y - 400$

$90y = 450$

$y = 5$

8. $\frac{\sqrt{3} - \sqrt{2}\ \ \sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}\ \ (\sqrt{3} - \sqrt{2})}$

$= \frac{3 - \sqrt{6} - \sqrt{6} + 2}{3 - \sqrt{6} + \sqrt{6} - 2}$

$= \frac{5 - 2\sqrt{6}}{3 - 2}$

$= 5 - 2\sqrt{6}$

46. Further logarithms

1.

No	Log
1934^2	3.2865 X 2
$\sqrt{0.00324}$	= 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. $N.\ \log \frac{2^5 \times 2^7}{3^6} = \log \frac{2^{12}}{3^6}$

$$= \log \left(\frac{2^2}{3}\right)^6 = \left(\frac{4}{3}\right)^6$$

$$D;\ \log \frac{2^5 \times 2^1}{3^3} = \log \frac{2^6}{3^3} = \log \frac{2^2}{3} = 3\log \frac{4}{3}$$

$$N;\ \text{Log} \frac{4}{\left(\frac{D}{3}\right)^6}^3$$

$$\frac{Log\ \frac{4}{3}}{3\ log\ \frac{4}{3}} = 6 \log \frac{4}{3}$$

$$^6/_3 = 2$$

6. $Log\ (x+5) = log(4)$
$(x+2)$
$x + 5 = 4$
$x + 2$
$(x+5)(x+2) = 4$
$x^2 + 2x + 5X + 10 = 4$
$x^2 + 7x + 6 = 0$
$x^2 + 6x + x + 6 = 0$
$x(x+6) + 1(x+6) = 0$
$(x+1)(x+6) = 0$
$x = -1 \quad x = -6$

7. $a = 100$
$r = \frac{200}{100} = 2$
$\frac{a(r^n - 1)}{r - 1} > Sn$
$\frac{100(2^n - 1)}{2 - 1} > 3{,}100$
$2^n - 1 > 31$
$2^n > 32$
$2^n > 2^5$
$n > 5$
$n = 6$

8. a)

2	3	5	7
2	32	52	72
3	23	53	73
5	25	35	75
7	27	37	57

b) $P(E) = \frac{4}{16}$
$= ¼$

9. $x^2 + y^2 - 6x = 3 - 4y$
$x^2 - 6x + (^{-6}/_2)^2 + y^2 + 4y + (^4/_2)^2 = 3 + (^{-6}/_2)^2 + (^4/_2)^2$

$(x-3)^2 (y+2)^2 = 3 + 9 = 4$
$(x-3)^2 (y+2)^2 = 16$
$C\ (3, -2)$

$Gradient\ \frac{\Delta y}{\Delta x} = \frac{7 - -2}{6 - 3} = 3$

10. $A = P(1 + \frac{r}{100})^n$

$= 10000\ (1 + \frac{4}{100})^6$

$= 10000(1.04)^6$

$= 12653.19 \quad (12,653)$

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
		$= \frac{3}{33} + \frac{2.2149}{}$
0.5474	5.474×10^{-1} ←	1.7383

0.5474

12. $\log_{10} 5^2 - \log_{10} 2^3 + \log 2^5$

$\log_{10}\left(\frac{25 \times 32}{8}\right)^4$

$\log_{10} 100^2 = \log_{10} 10^2$

$= 2 \log_{10} 10^{10}$

But $\log_{10} 10^{10} = 1$

$\therefore = 2$

✓***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 = 95 x 4200000)*
100
= Shs.357,000
After 2nd year = (87 x 357000)
100
= sh310590
After 3rd year = (88 x 310590
100
= shs.273319.20
After 4th year = (91 x 273319.20)
100
=shs.248720.50
After 5th year = (248720.50 x 93)
100 *= shs.231310*

The next 6years
A = 231310 (1- 0.05)⁶ = 170034.10
Then 140000 = 170034.10 (1-0.04)ⁿ
(0.96)ⁿ = 140000 = 0.8234
170034.10
n = log 0.8234
log 0.96
= 0.0844 = 4.76yrs
0.01773
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

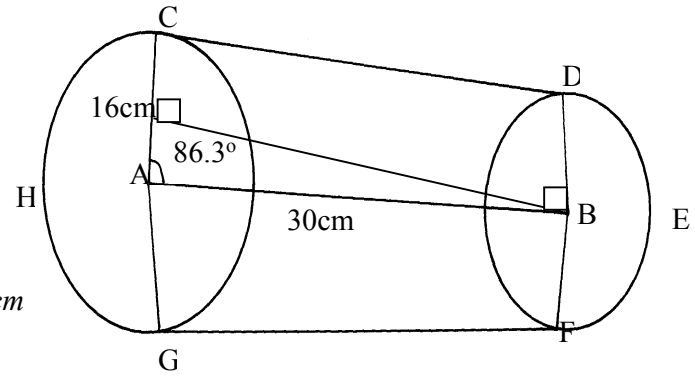
Monthly salary = $\frac{413142.86}{12}$ *+ 12,000*

= 34428.57 + 1200 = Sh 35628.57

3. *a) Sin 86.3° =* $^{XB}/_{AB}$

Sin 86.3°= $^{XB}/_{30}$

XB = 30sin86.3°



XB = CD = 29.93746855 cm

b) < ABX = 90° - 86.3°

= 3.7°

∴ < ABD = 3.7° + 90°

= 93.7°

c) < DBF obtuse = 360° - 187.4°

= 172.6°

Arc DEF = $^{ø}/_{360}$ *πD or* $^{ø}/_{360}$ *x2πr*

But cos 86.3° = $^{AX}/_{AB}$

Cos 86.3° = $^{AX}/_{30}$

AX = 1.935969248 cm

DB = 16 – 1.935969248 = 14.06403075 cm

∴ Arc DEF = $^{172.6°}/_{360°}$ *x* $^{22}/_{7}$ *x 14.06403075*

$= \frac{106807.8751}{2520}$

= 42.38407742 cm

Arc CGH

< reflex CAG = 360° - (2x 86.3°)

= 187.4°

∴ Arc CGH = $^{187.4°}/_{360°}$ x2 x $^{22}/_{7}$ x 16

= $\frac{131,929.6}{2520}$

= 52.35301587 cm

Total length of belt to go round the belt

= CD + DEF + GF + CHG

= 29.93746855 + 42.38407742 + 29.93746855 + 52.35301587

= 154.6120304 cm

4. ∠ABD = 31^0

∠ CBD = 37^0

5. $A = 15,000(1 + {}^{8}/_{100})^{7}$

= Ksh.25,707

6. Principle = 30,000 – 6,000

= 24,000/=

Amount = 18 x 2000

= 36,000/=

$A = P\left(1 + \frac{r}{100}\right)^{T}$

$6,000 = 24000\left(\frac{1}{100} + r\right)^{18}$

$\frac{36000}{24000} = \left(1 + \frac{r}{100}\right)$

$\frac{3}{2} = \left(\frac{1}{00} + r\right)$

$1 + \frac{r}{100} = \sqrt[18]{1.8}$

$1 + \frac{r}{100} = 1.023$

$\frac{r}{100} = 0.023$

⇒<u>2.3%</u>

7. Commission earned Kshs. (8368 – 6700) = Kshs. 1668/=

let sales in 3rd bracket be y

$({}^{10}/_{100}$ x 5000) + ($^{15}/_{100}$ x 3000) + ($^{20}/_{100}$ 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

. $A = P\left(1 + \frac{R}{100}\right)^{n}$

$I = A - P$

$\therefore A = (100 + \underline{R})^n$
$\quad 100$

$I = P (100 + \underline{R})^n - P$
$\quad 100$

$= P (100 + R/100)n – 1$

$\underline{450000} = P = \underline{450000} = 565397$

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:

1^{st} 4350 = $4350 \times {}^{2}/_{20} = 683.25$

2^{nd} 4555 = $4555 \times {}^{3}/_{20} – 683.25$

3^{rd} 4555 = $4555 \times {}^{4}/_{20} – 911$

4^{th} 4555 = $4555 \times {}^{5}/_{20}$ - 1138.75

Rem. 17465 = 17645 x 6/20 – 5239

Total tax – 8407.5

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

% increase in income ax = 4257.6 x 100
7607.5 = 55.97%

11. $A = P(HR/100)^n$

$500000 = P(1+ \underline{20})^5$
$\quad 100$

$500,000 = ({}^{120}/_{100})^5$

$\underline{500,000} = P$

$(1.2)^5$

$P =$ Shs.200,938.786 $\approx$ shs. 200,939

12. Principal = 26, 000 - 6,000 = 20,000

Total H.P instalments = 1045.3 x 24= 25087.20

$$25087.20 = 20{,}000\left(\frac{1}{100} + r\right)^2$$

$$1.254 = \left(1 + \frac{r}{\ }\right)^2$$

$$1.120 = \frac{1}{100} + \frac{r}{100}$$

$\frac{r}{100}$ = 0.12 or 12%

13. No. of periods =12
r = 4% per period
A = 1.0412 x 15000
= 24015.5

14. a) i) taxable income = 19200 + 12000 + 1300 + 2300 = 34800
b) Net tax
8400 x $^{2}/_{20}$ = 840
9600 x $^{3}/_{20}$ = 1440
12000 x $^{4}/_{20}$ = 2400
4800 x $5/_{20}$ = 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
Taxes
450 x 2 = shs.9000
3000 x 3 = shs.9000
3000 x 4 = shs.12000
3000 x 5 = shs.15000
3000 x 6 = shs.18000
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
14400
Shs.417,420
Monthly basic pay = shs. 34785

16. (a) Net tax 5512
Add relief 1162
Tax payable 6674

Tax on 9680 earned
9680 X $^{10}/_{100}$ = 968

Tax on 9120 earned
9120 x $^{15}/_{100}$ = Shs. 1368

Tax on next 9120 x $^{20}/_{100}$ = Shs.1824

Tax on next 9120 x $^{25}/_{100}$ = 2280

Total 968 + 1368 + 1824 + 2280 = 6440
6674 – 6440 = 234
Let x be charged at 30%
$^{30}/_{100}$ X x = 234

$$X = \frac{234 \times 100}{30} = \text{Shs.780}$$

Total chargeable Income
780 + (9120 x 3) + 9680 = 37820
Salary 37820 – 15220 = Shs.2260 per month.

b) Net salary (37820 – 1270 – 6674) = Shs.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 x $^{15}/_{100}$ x 2
= Sh 900 ……

$$A = 3000\left(1 + \frac{15}{100}\right)^2$$

= 3000 $(1.15)^2$
= 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

= Ksh.39,300

= K£ 1965 p.m.

(ii) Tax due 325 x 2 = sh 650
650 x 3 = sh 1950
325 x 5 = sh 1725
325 x 6 = sh 1950
340 x 7.50 = sh 2250
Total tax = sh. 8825 P.m……
without relief

(b) (i) Total deduction

= sh (7280 + 2400 + 1200 + $\frac{2}{100}$ of 24 800)……

= (7280 + 2400 + 1200 + 496) + 1220

= sh (11376 +_ 1220) = sh. 12,596 P.m ……

(ii) Net income = sh (24800 + 1200 – 12596) = sh. 24,204 P.m……

19. a) Total instalments = (24 x 1250)= Shs.30000

H.P = 7200 + 30000= 37200

b) 124% = 37200

100% =

C.P = $\frac{100}{124}$ x 37200

= 30000

c) $A = 30000 (1 + {}^{18}/_{100})^2$

$= 30000 (1.18)^2 = 41772$

Total interest = 41772 – 30000 = 11772

20. (a) (i) (10, 500 + 6,500) x $\frac{12}{20}$ = K£ 10,20 p.a

(ii) 1st 1980 x 2 = Kshs. 3960
2nd 1980 x 3 = Kshs 5940
3rd 2480 x 5 = Kshs. 12 400
4th 1480 x 7 = Kshs. 10360
5th 1980 x 9 = Kshs.17 820
Last 300 x 10 = Kshs 3 000
Kshs. 53 480

PAYE = $\frac{53480}{12} - \frac{300 \times 12}{12}$

= Shs. 4156.70

(b) Net monthly pay

17000 – 320 + $\frac{2}{100}$ x 17000

= 17000 – 660

= Kshs 16 340.00

48. Circles –chords and tangents

1.	$6^2 = x(5 + x)$ $x^2 + 5x – 36 = 0$ $(x – 4)(x + 9) = 0$ $x = 4$ or -4 BC = 4cm	**M1** **M1** **A1**	 Correct factorisation
		03	

1. *a) i) $\angle DCF = \frac{180 – 92}{2} = 44° = \angle CAD$*

ii) $\angle BAO = 50°$

Acute angle AOB = 80°

$\therefore$ obtuse angle = 360 – 80 = 280°

b) Area of the sector = $(\frac{80}{360} \times \frac{22}{7} \times 7 \times 7) = 34.22cm^2$

Area of the Δ = ½ x 7 x 7 x sin80= $24.13cm^2$

Area of the shaded segment = 34.22 – 24.13

$10.09cm^2$

2. *$\angle COB = 2 \times 50 = 100°$*

$\angle OCA = \angle OAC = \frac{180 – 100}{2} = 40$

$\therefore \angle BAC = 180 – (50 + 70)$

$= 60$

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 $< BED = 45° = <BGD$

$\therefore$ In Δ GED, $<GDE = 180 – (25 + 40 + 45) = 70°$

$\therefore <GFE = 180 – 70 = 110^o$ (Sup angles)

d) Angle CBD in ΔBGE, Angle GBE $= 180 – (110) = 70^o$

$\therefore$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

$\therefore$Angle BCD $= 180 – (70 + 45)$ Angles of a triangle $= 65^o$

11. (a) $\sin\theta = \frac{4.5}{8} = 0.5025$

$\theta = \sin^{-1} 0.5625$

$= 34.23^o$

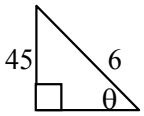
$\angle Apb = 68.46^o$

$\sin\alpha = \frac{4-5}{6} = 0.75$

$\alpha = \sin -10.75$

$= \angle 48.59^o$

$\angle Aqb = 97.18^o$



(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 $= ½ 64 \sin 68.46 + ½ x 36 \sin 92.18$

$= 29.77 + 17.86 = 47.63$

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

$\angle DAB = 69^o$

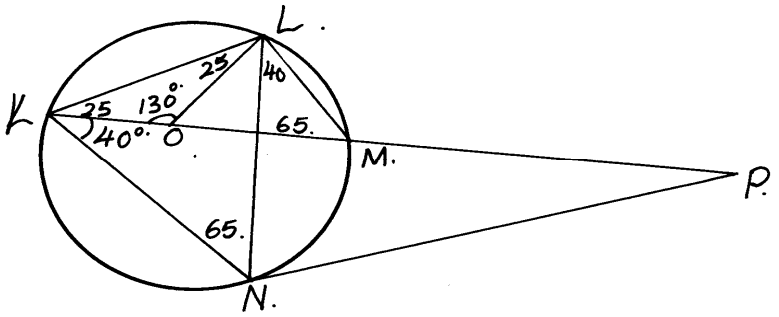
$\angle DAB = 69^o$

$\angle ADB = 69^o$

$\angle ABD = 42^o$

So two angles are equal hence it is asoccesters

13.



a) MLN = 40° angles subtended by same chord in the same segment are equal.

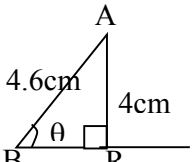
b) OLN = 90 – 65 = 25°
Angle sum of Δ is 180° or angle subtended by > diameter is 90°.

c) LNP = 65° 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° angle sum of a Δ is 180°

e) LMO = 65° angles subtended by same chord.

14. (a)



$Sin = {}^{4}/_{4.6} = 0.869565$
$= sin\text{-}10.89565 = 60.408^o$
$ABR = 2 \times 60.408^o = 120.8163^oC$
$\approx 120.82^o$ *(2d.p)*

(b) Area of sector ABCR

$= \frac{120.8163^o}{360^o} \times \pi \times 4.62)cm^2$

$= 22.30994cm^2$

Area of sector OAPC

$= \frac{60^o}{360^o} \times \pi \times 8^2)cm^2$

$= 33.51032cm^2$

$= 33.51cm^2$*(2d.p)*

Area of ΔABC $= (½ \times 4.6^2 \sin 120.8163)cm^2 = 9.08625cm^2$
Area of AOC $= (½ \times 82 \sin 60)\ cm^2 = 27.7128cm^2$
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 $\Delta TDC = 12^o$

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) $GFE = 180 – EDG$

$= 180 – 70 = 110°$

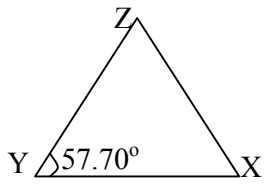
17. $XZ^2 = 13.4^2 + 5^2 – 2 \times 13.4 \times 5 \cos 57.7^o$

$= 170.56 + 25 – 134 \times 0.5344$

$= 204.56 – 71.6096$

$XZ^2 = 132.9504$

$XZ = 11.5304cm$



(ii) $2R = 11.5304$

$\text{Sin } 57.7^o$

$2R = \frac{11.5304}{0.8453}$

$2R = 13.60866$

$R = 6.08043cm$

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) $\angle PQR = 180^o – 75^o$

$= 105^o$. NPQR is cyclic quadrilateral.

(b) $\angle NRP = 90^o - 75^o$
$= 15^o$, Third angle of Δ NRP.

$\angle PRS = 180^o - 65^o$, Angles on a
$= 115^o$, straight line.

$\therefore \angle QSR = 180^o - (115^o - 35^o)$
$= 30^o$, 3rd angle of triangle PRS.

(c) Reflex $\angle POR = 2\ \angle PQR$
$= 2 \times 105^o = 210^o$

(d) $\angle MQR = \angle MNR = 40^o$
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)
$2a + 6d = 50$
$3a - 6d = 0$
$5a = 50$
$a = 10 \quad d = 5$

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) $A \propto B$. $\frac{1}{}$ ***√Substitution √Formulation***
√Values of constants.
√Substitution

$$A = \frac{K.B}{C^3}$$

$$12 = \frac{3K}{2^3}$$

$$K = \frac{12 \times 8}{3} = 32$$

$$\therefore A = \frac{32B}{C^3}$$

$$\frac{10 \times (1.5)^3}{32} = B$$

$$\therefore B = 1.055$$

c) $y = K + Mx^2$ where K and M are constants

$7 = K + 100M$

$5.5 = K + 400M$

$1.5 = 300M$

$100 \times 0.005 + K = 7$

$-0.5 + K = 7$

$K = 7.5$

$M = 0.005$

$y = 7.5 - 0.005 \times 18^2$

$y = 7.5 - 1.62$

$y = 5.88$

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) $< APB$

$\sin \frac{1}{2} \theta = \frac{4}{5} = 0.8$

$\frac{1}{2} \sin \theta = 53.13$

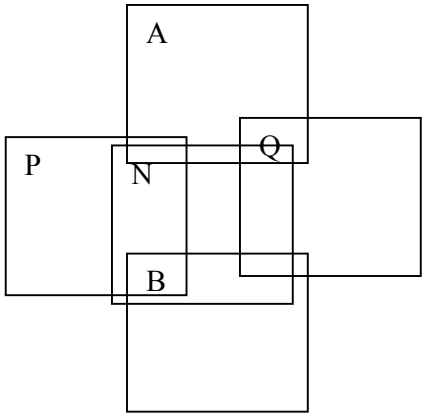
$< APB$

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

$= \frac{106.3}{360} \times \frac{22}{7} \times 5^2 - \frac{1}{2} \times 5 \times 5 \sin 106.3$

$= 23.19 - 11.998 = 11.192$

$\frac{83.6}{360} \times \frac{22}{7} \times 6 \times 6 - \frac{1}{2} \times 6 \times 6 \sin 83.6 = 8.38$

Total $11.192 + 8.38 = 19.52$

27. *Using cosine rule*

$7.8^2 = 6.6^2 + 5.9^2 - 2 \times 6.6 \times 5.9 \cos R$

$\cos C = \frac{6.6^2 + 5.9^2 - 7.8^2}{2 \times 6.6 \times 5.9}$

$= \frac{43.59 + 34.81 - 60.84}{77.88} = \frac{78.37 - 60.84}{77.88}$

$= \frac{17.53}{77.88} = 0.2251$

$\angle C = 77^o$

$\frac{7.8}{\sin 77} = 2r \Rightarrow r = \frac{7.8}{2 \times \sin 77}$

$= 4cm$

Area of circle $= 3.142 \times 4^2 = 50.27$

Area of PQR $= \frac{1}{2}(6.6)(5.9) \sin 77$

$= 18.97$

$\therefore$ Area of shaded region $= 50.27 - 18.97 = 31.30cm^2$

28. a) $\angle PAQ = 2\ PAB = 42^o \times 2 = 84^o$ ✓ **angle**

$\angle PBQ = 2 \angle ABQ = 30^0 \times 2 = 60^o$ ✓ **angle**

(b) (i) Area of sector $APQ = \frac{84}{360} \times \frac{22}{7} \times 6 \times 6 = 26.4\ cm^2$ ✓

Area of sector $PBQ \frac{60}{360} \times \frac{22}{7} \times 8 \times = 33.5\ cm^2$ ✓

(ii) Area of $\Delta APQ = \frac{1}{2} \times 6 \times 65{:}- 84^o = 18 \times 0.9945$ ✓ **diff. areas**

$= 17.9\ cm^2$ ✓ **diff. areas**

Area of Δ PBQ $= \frac{1}{2} \times 8 \times 85{:} = 60^o = 32 \times 0.8660$ **Exp. for total**

$= 27.7\ cm^2$ ✓ **answer.**

(iii) For each circle, shaded area = sector area – triangle Area.

= area of sector APQ – area of triangle APQ

$= 26.4 - 17.9 = 8.5\ cm^2$

2^{nd} circle, shaded area

= area of sector PBQ – area of ΔPBQ

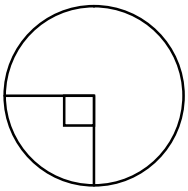
$= 33.5 - 27.7 = 5.8\ cm^2$

Total shaded area $= 8.5 + 5.8 = 14.3\ cm^2$

29. $\frac{90}{360} \times 3.142 \times 2 \times 6.5$

$\underline{10.2115\ cm}$

$= 10.21\ cm$



49. Matrices

1	$C = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ Let $\begin{pmatrix} 11 & 3 \\ 4 & 1 \end{pmatrix}\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 2 & 4 \\ 3 & 6 \end{pmatrix}$ $(11a + 3c = 2)\times 1 \qquad (11b + 3d = 4)\times 1$ $(4a + c = 3)\times 3 \qquad (4b + d = 6)\times 3$ $11a + 3c = 2 \qquad 11b + 3d = 4$ $12a + 3c = 9 \qquad 12b + 3d = 18$ $a = 7 \qquad b = 14$ $c = -25 \qquad d = -50$ $\therefore C = \begin{pmatrix} 7 & 14 \\ -25 & -50 \end{pmatrix}$	M_1 M_1 A_1 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.

$$\begin{pmatrix} 3 & 2 \\ 4 & -1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 12 \\ 5 \end{pmatrix}$$

Premultiplication by the inverse.

$$\begin{pmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{4}{11} & \frac{-3}{11} \end{pmatrix}\begin{pmatrix} 3 & 2 \\ 4 & -1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{4}{11} & \frac{-3}{11} \end{pmatrix}\begin{pmatrix} 12 \\ 5 \end{pmatrix}$$

Simplification.

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

C.A.O

$$\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

a = 2 √ and b = 3 √

2. $(x-3) - (2x) = 0$
$x-3-2x = 0$
$-2x + x - 3 = 0$
$-x - 3 = 0$
$x = 3$

3. $\begin{pmatrix} 1 & 5 \\ 3 & 7 \end{pmatrix} \quad \begin{pmatrix} 7 & 3 \\ -4 & -2 \end{pmatrix} \quad = \quad \begin{pmatrix} -13 & -7 \\ -4 & -2 \end{pmatrix}$

$Determinant = +65 - 49 = 16$

$C^{-1} = \frac{1}{16} \begin{pmatrix} -5 & 7 \\ 7 & -13 \end{pmatrix}$

4. $\begin{pmatrix} 3 & 2 \\ 2 & 2 \end{pmatrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 9 & -3 \\ 2 & 1 \end{pmatrix}$

$3a + 2c = 9$
$\underline{2a + 2c = 2}$
$a = 7$
$c = -6$
$3b + 2d = -3$
$\underline{2b + 2d = 1}$
$b = -4$
$d = 4.5$
$\underset{\sim}{A} = \begin{pmatrix} 7 & -4 \\ -6 & 4.5 \end{pmatrix}$

5. $20x (-3 - {}^{-}8)$
100 area of 1^{st} image.
$100 x (4 - {}^{-}3)$
700 area of 2^{nd} 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 $PQ = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$\begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$

$\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 & 3 \\ 1 & q \end{pmatrix} \begin{pmatrix} 5 \\ -3 \end{pmatrix}$

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$

$x = 1 \quad y = -2$

8. $\frac{1}{2}x - \frac{1}{4}y = 2$

$\frac{2}{5} + \frac{1}{6} = 6$

$2x \_ y = 8$

$12x + 5y = 180$

$10x - 5y = 40 \quad +$

$22x = 220$

$x = 10$

$\frac{1}{4}y = \frac{1}{2}(10)^{-2}$

$\frac{1}{4}y = 5\text{-}2 = 3$

$Y = 12$

9. $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

$= \begin{pmatrix} -1 & -2 & -6 \\ 1 & 4 & 9 \end{pmatrix}$

$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} X^1 & Y^1 & Z^1 \\ -1 & -2 & -6 \\ 1 & 4 & 9 \end{pmatrix}$

$= \begin{pmatrix} 1 & 4 & 9 \\ -1 & -2 & -6 \end{pmatrix}$

Final image $X^{11}\ Y^{11}Z^{11}$

$X^{11}(1, -1)\ Y^{11}(4, -2),\ Z^{11}(9, -6)$

10. $P \quad Q \quad R \qquad A \quad B \quad C$

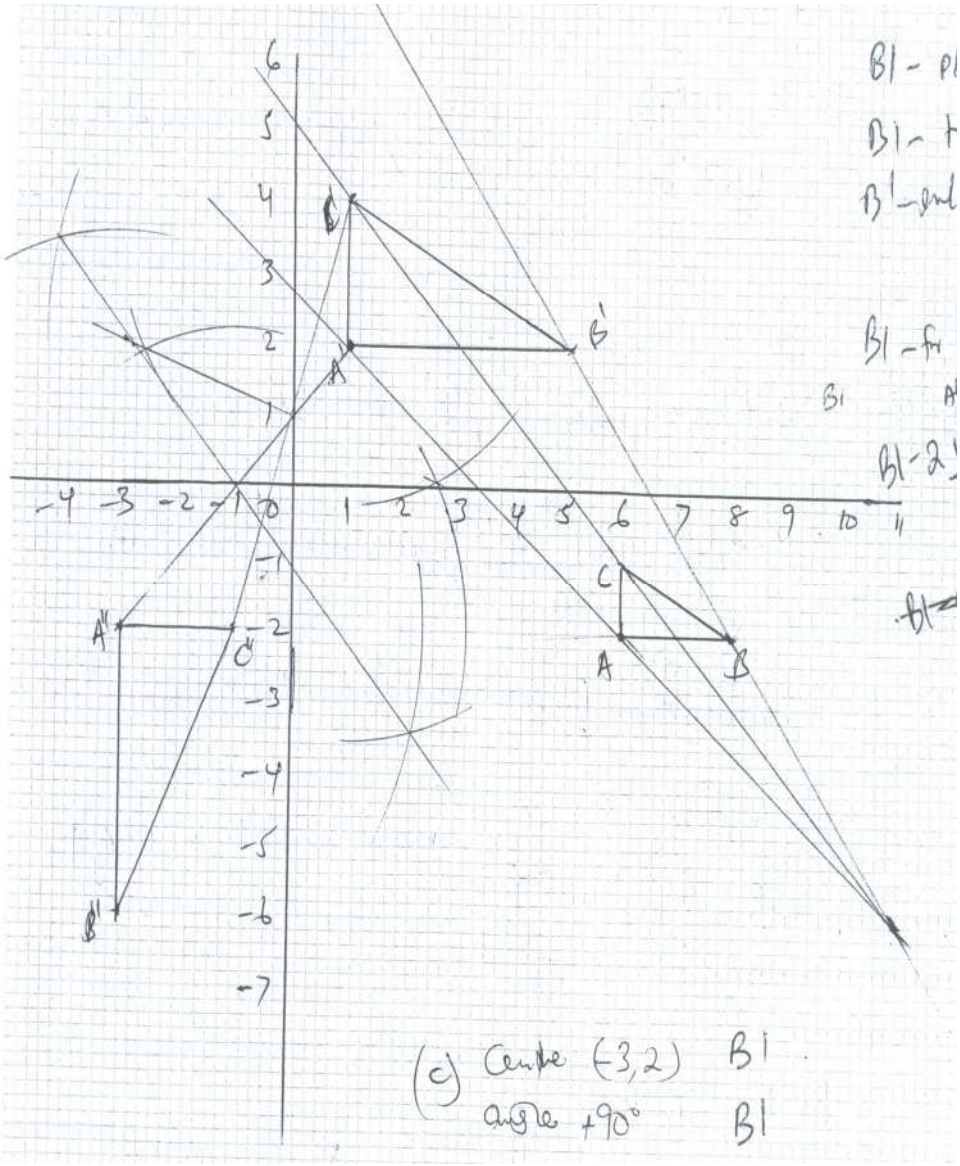
a|: $\begin{pmatrix} 2 & 2 \\ 0 & 4 \end{pmatrix} \begin{pmatrix} 5 & 6 & 4 \\ -1 & -1 & -\frac{1}{2} \end{pmatrix} = \begin{pmatrix} 6 & 8 & 6 \\ -2 & 2 & -1 \end{pmatrix}$

(c) Centre (-3,2)

Angle + 90°

$A \quad B \quad C$

a) $\begin{pmatrix} 2 & 4 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 5 & 6 & 4 \\ -1 & -1 & -\frac{1}{2} \end{pmatrix} = \begin{pmatrix} 6 & 8 & 6 \\ 2 & 2 & -1 \end{pmatrix}$



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
$\frac{54}{}$ cm^2 = A

3

Area of $\Delta ABC = 18\ cm^2$

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	$X = \frac{U^2V}{U^2 2W}$ $U^2X + 2WX = U^2V$ $U^2X - U^2V = -2WX$ $U^2(X - V) = -2WX$ $U^2 = \frac{-2WX}{X - V}$ $U = \pm\sqrt{\frac{-2WX}{X - V}}$	 M1 M1 A1	 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) $(80C + 4K = 9)2$ $(48C + 2K = 5)4$ $160C + 8K = 18$ $192C + 8K = 20$ $-32\ C = -2$ $C = \frac{1}{16} \therefore K = 1$ $P = 32 + \frac{32 \times 32}{16}$ $= 96$	 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. $P = kr^2$; $R = MT^2$

$18 = 9k$ $3 = 25m$

$K = 2$ $M = \frac{3}{25}$

$P = 2R^2$ $R = \frac{3}{25} T^2$

$\left(P = 2\right)^2 \frac{3}{25} T^2 = \frac{18}{625} T^4$

$P = \frac{18 \times 10000}{625} = 288$

2. $v^2 = \frac{r}{r + c}$

$v^2 \frac{(r + c)}{r + c} = \frac{r}{} (r + c)$

$v^2 r + vc = r$ ***Removing the sg. Root.***

$r - v^2 r = vc$

$r(1 - v^2) = vc$ ***Factorization.***

$r = \frac{vc}{}$ ***C.A.O***

$1 - v^2$

3. $X \alpha \frac{Y^3}{\sqrt{Z}} \Rightarrow x = KY^3$

$6 = \frac{K(3)^3}{\sqrt{25}}$

$6 = \frac{27K}{5}$

$K = \frac{10}{9}$

$\therefore X = \frac{10}{9} \frac{Y^3}{\sqrt{Z}}$

$X = \frac{10}{9} \frac{(7)^3}{9}$

$= \left(\frac{10 \times 34^3}{27}\right)$

$= 127.04$

(a) $Y^3 = \frac{9}{10} x Z$

$Y = 3\sqrt{\frac{9}{10} x 4 x 8}$

$Y = 3\sqrt{\frac{144}{5}} = 3.07$

(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

$\left(\frac{2.16KY^3}{\sqrt{Z}} - \frac{KY^3}{\sqrt{Z}}\right) x\ 100\ \%$ M_1

$\frac{KY^3}{\sqrt{Z}}$

$= 116\%$ A_1

4. $K(b-a) = ab$

$Kb - ka = ab$

$Kb - ab = ka$

$B(k-a) = ka$

$B = \frac{ka}{K-a}$

5. $x - 2.5 - \sqrt{3} \quad x - 2.5 + \sqrt{3} = 0$

$x^2 - 2.5x + x\sqrt{3} - 2.5x + 6.25 - 2.5\sqrt{3}$

$x\sqrt{3} + 2.5\sqrt{3} = 0$

$x^2 - 5x + 6.25 - 3 = 0$

$x^2 - 5x + 3.25 = 0$

$4x^2 - 20x + 13 = 0$

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. $ar^3 = 48$

$ar^6 = 384$

$\therefore \frac{ar^6}{ar^3} = \frac{384}{48}$

$r^3 = 8$

$r = 2$

$ar^3 = 48$

$8a = 48$

$a = 6$

$Sn = \frac{a(r^n - 1)}{r - 1}$

$\frac{6(2^6 - 1)}{2 - 1}$

$= 6(64 - 1)$

$= 6 \times 63$

$= 378$

8. $P = \frac{KQ^2}{R}$

$2 = \frac{16K}{6}$

$K = \frac{3}{4}$

$P = \frac{3}{4}\ \frac{Q^2}{R} = \frac{3}{4} \times \frac{64}{4} = 12$

9. $B \propto M^2 = {}^1/_N$

$B = Km^2 + {}^Q/_N$

$(96 = 4K + 2Q)^3$

$(46 = 3K + 0.5Q)^4$

$104 = 4Q$

$Q = 26$

$K = 11$

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

$3x = y - 1$
$4x = y - 9$
$-x = 9 \qquad x = -9$

$-27 = y - 1$
$y = -26$

11. $P = \sqrt[3]{\dfrac{x-1}{x+2}} \Rightarrow P^3 = \dfrac{x-1}{x+2}$

$P^3x - 2P^3 = x - 1$
$P^3x - x = -1 - 2p^3$
$x(P^3 - 1) = -1 - 2P^3$

$x = \left(\dfrac{-1 - 2P^3}{P^3 - 1}\right) - 1$
$x = \dfrac{1 + 2p^3}{1 - p^3}$

12. $a^4 = \dfrac{1 + d^2}{b^2} + \dfrac{b}{3}$
$3d^2 = 3a^4b^2 - b^2 - 3$

$d = \sqrt{\dfrac{3a^4b^2 - b^2 - 3}{3}}$

13. (a) $Z = \dfrac{KX^2}{y^2}$
$Z = \dfrac{100k}{16} = 15$
$K = \dfrac{12}{5}$
$Z = \dfrac{12x^2}{5^{y2}}$

(b) $Z = 21.90$

14. $R = kn + t\sqrt{n}$
$9k + 3t = 42$
$25k + 5t = 100$
$45k + 15t = 210$
$75k + 15t = 300$
$-30k \qquad = -90$
$k = 3$
$t = 5$

$R = 3(16) + S(4) = 68$

15. $a^2 = \dfrac{b^2 d^2}{b^2 + d}$
$a^2 b^2 + a^2 d = b^2 d^2$

$b^2d^2 - a^2 b^2 = a^2 d^2$

$b^2 (d^2 - a^2) = a^2d^2$

$b^2 = \frac{a^2 d^2}{d^2 - a^2}$

$b = \mp\sqrt{\frac{a^2 d^2}{d^2 - a^2}}$

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 $r = 4$

$V = {}^{120}/_{42} = 7.5 m/s$

19. $P = \sqrt[3]{\frac{XY}{z + X}}$

$P^3 = \frac{XY}{z + X}$

$Xy = P^3Z + P^3X$

$Xy - P^3X = P^3 z$

$X(y - P^3) = P^3 z$

$\therefore X = \frac{P^3 z}{Y - P^3}$

20. $X \propto y + {}^{1}/_{z}, 2, x = Ky + M$

$X = 6, y = 3, z = 2 - 6 = 3k + M$

$X = 8, y = 5, z = 1 - 8 = 5k + M$

$X4 \quad 24 = 12k + M$

$-16 = -7k, \; k = 1$

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)

$2a + 6d = 50$

$3a - 6d = 0$

$5a = 50$

$a = 10$

$d = 5$

22. (i) $R = m + nI$

$55 = M + 20n$……(i)

$58 = m + 28n$…....(ii)

$-3 = -8n$

$n = {}^{3}/_{8} = 0.375$

$55 = m + {}^{60}/_{8}$

$m = 55 - 7.5 \Rightarrow m = 47.5$

$R = 47.5 + 60 \times {}^{3}/_{8}$

$R = 70$ 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 x (1.02) = 42,448.32 km²

Encrouched area

= 42 448.32 – 40 000 = 2448.32 km²

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) $a = 3^{(2 \times 2.5 + 1)}$

$= 3^6$

$= 729$

$S_{10} = 729\frac{\left[1 + \left(\frac{1}{3}\right)^{10}\right]}{1 - \frac{2}{3}}$

For both the 5th and 7th term

= 1093.5 x 0.99998 = 1093.5

(d) 5^{th} *term* $= 729 \times (1/3)^4$

$= 9$

7^{th} *term* $= 729 \times (1/3)^6$

$= 1$

$a = 9 \quad d = 1 - 9 = -8$

$S_{20} = \left(\frac{20}{2}\right)[2 \times 9 + (20 - 1)](-8)$

= 10 (18 – 152) = -1340

3. $-12 \pm -10 + -8 + \ldots\ldots\ldots\ldots\ldots\ldots$

$a = -12 \quad d = z$

$S_n = \frac{n}{2}\{2a + (n-1)d$

$338 = \{\frac{n}{2} \quad 2(-12) + (n-1)2\}$

$676 = \{n \quad -24 + 2n\} - 2$

$\frac{2n^2}{2} - \frac{26n}{2} - \frac{676}{2} = \frac{0}{2}$

$n^2 - 13n - 338 = 0$

$(n-26)(n+13) = 0$

$n = 26$ or $n = -13$ reject

$\therefore n = 26$ terms

3. $-12 \pm -10 + -8 + \ldots\ldots\ldots\ldots\ldots\ldots$

$a = -12 \quad d = z$

$S_n = \frac{n}{2}\{2a + (n-1)d$

$338 = \{\frac{n}{2} \quad 2(-12) + (n-1)2\}$

$676 = \{n \quad -24 + 2n\} - 2$

$\frac{2n^2}{2} - \frac{26n}{2} - \frac{676}{2} = \frac{0}{2}$

$n^2 - 13n - 338 = 0$

$(n-26)(n+13) = 0$

$n = 26$ or $n = -13$ reject

$\therefore n = 26$ terms

4. $32 = 2 + (n-l)d \ldots\ldots(i)$

$357 = \{\frac{n}{2} \quad 2.2 + (n-l)d\} \ldots\ldots (ii)$

$N\,4 + (n-l)\,d = 714$

$2 + (n-l)d = 32$

$N(4 + nd - d) = 714$

$-d + nd = 30$

$4n + n^2d - d = 744$

$nd - d = 30$

$d(n-l) = 30$

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
∴ r(a + ½ b) = (1 + s) a + b
Comparing coefficients of a and b
r = 1 + S
and ½ r = 1 ⇒ r = 2
Substitute for r = 2 ⇒ 2 = 1 + s ⇒ s = 1

c) Now BX = BC + Cx
= a + a = 2a

∴ BC:BX = 1:2

6. *(a) -91 = 29 + (n-1) x -6*
-120 = -6n + 6
6n = 126
n = 21

(b) $S_{21} = {}^{21}/_{2}$ [(2 x 2a) + (20 x -6)]
= $\frac{21 \times -62}{2}$
= -651

7. *d = p-5.....(i)*
d = q – p ……(ii)
0 = 2p -q – 5
0 = 7 – 2q + p
- p + 2q = 7
2p – q = 5

$\begin{pmatrix} \mathbf{3} & \mathbf{-2} \\ \mathbf{2} & \mathbf{-1} \end{pmatrix}$

-2p + 4q = 14
2p – q = 5
3q = 19
q = ${}^{19}/2$
p=2q – 7 ${}^{38}/_{3} - 7$
$p={}^{17}/_{8}$
S = $\frac{n}{2}$ [2a + (n-1)d}
= ${}^{12}/_{2}$ (10+11 x ${}^{2}/_{3}$)
= 6 (10+${}^{22}/_{3}$) = 104
$S_n = a(r^n-1) = S(1.5-6)$
r-1 1.5 – 1
= 5 x (1.5 – 1) = 103.90
0.65 = 10.4

8. *a + a + d = 10……(i)*

$\frac{10}{2}\{2a + 9d\} = 210$……..(ii)

$2a + d = 10$

$2a + 9d = 42$

$8d = 32$

$d = 4$

$T1 = 3 + 6(4)$

$= 3 + 24$

$= 27$

9. $S_6 = \frac{15(1-0.56)}{1-0.5}$

$= 29.5314$metres

10. $Sn = \frac{n}{2}\{2a + (n-1)L\}$

$S51 = \frac{51}{2}(2x - 22) + (51 - 1)3$

$= 2703$

11. $100 + 200 + 400 + 800 + 1600 + 3200 + 6400 + 12800 + 25600 + 51200$

$\frac{200}{100} = \frac{400}{200} = \frac{800}{400}$

$= 51200 \quad 99600 \quad 108200 \quad 110,600$

$25600 \quad 6400 \quad 1600 \quad 700$

$76800 \quad 105,000 \quad 109,800 \quad 111,300$

$12800 \quad 3,200 \quad 800$

$99,600 \quad 108,200 \quad 110,600$

$= 111300$

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 $= \frac{720000}{}$

13. n^{th} *term is* ar^{n-1}

$a = 8, r = ½$

n^{th} *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. $3^{rd}\ a + 2d$

$9^{th}\ a + 8d$

$25^{th}\ a + 24d$

(i) $\frac{a + 2d}{} = \frac{a + 8d}{}$

$a + 8d\ a = 24d$

$(a + 2d)(a + 2d) = (a + 8d)(a + 8d)$

$a^2 + 26da + 48d^2 = a^2 + 16da + 64d^2$

$\frac{10da}{10d} = \frac{16d^2}{10d}$

$a = 1.6d$……(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 $d = 3.75$

$a = 1.6 \times 3.75$

first term $a = 6$

(ii) $S_n = {}^{n}/_{2}\,(2a + (n-1)d)$

$S_a = {}^{9}/_{2}\,((2x6) + (9-1)3.75)$

$= {}^{9}/_{2}\,(12 + 30)$

${}^{9}/_{2} \times 42 = 189$

15. $T_4 = a + 3d$

$T_7 = a + bd$

$(a + 6d) – (a + 3d) = 12$

$3d = 12$

$d = 4$

But $a = 9$

$S5 = \frac{5}{2}\ 2(9) + 4(4)$

$= \frac{5}{}\ 18 + 16$

$= \frac{2}{5} \times 34$

$= 85$

52. Vectors 2

1.	(a) BD = BA + AD $= -\underset{\sim}{b} + \frac{3}{5}\underset{\sim}{c}$ $AE = AB + BE$ $= \underset{\sim}{b} + \frac{1}{2}BC$ $= \underset{\sim}{b} + \frac{1}{2}\left(\underset{\sim}{c} - \underset{\sim}{b}\right)$ $= \frac{1}{2}\underset{\sim}{b} + \frac{1}{2}\underset{\sim}{c}$ (b) $BF = +\left(\frac{3}{5}\underset{\sim}{c} - \underset{\sim}{b}\right)$ $AF = n\left(\frac{1}{2}\underset{\sim}{b} + \frac{1}{2}\underset{\sim}{c}\right)$	**B1** **M1** **A1** **M1** **M1** **M1** **A1**	AF and BF interms of n and t Equating the expressions Extraction of the coefficient Substitution/its equivalent Any of the unknown

	$= \frac{n}{2}\left(\underset{\sim}{b}+\underset{\sim}{c}\right)$ $AF = AB + BF$ $= \underset{\sim}{b}+\frac{3}{5}t\,\underset{\sim}{c}-t\,\underset{\sim}{b}$ $= (1-t)\underset{\sim}{b}+\frac{3}{5}+\underset{\sim}{c}$ $(1-t)\underset{\sim}{b}+\frac{3}{5}t\,\underset{\sim}{c} = \frac{n}{2}\underset{\sim}{b}+\frac{n}{2}\underset{\sim}{c}$ $1-t = \frac{n}{2}$.....(i) $2-2t = n$ $\frac{3}{5}t = \frac{n}{2}$.....(ii) $6t-5n = 0$ *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) $\overrightarrow{AT} = \frac{7}{13}\overrightarrow{AN}$

$\frac{7}{13}\left(-\underset{\sim}{a} + \frac{2}{7}\underset{\sim}{b}\right)$

$\frac{2}{13}\underset{\sim}{b} - \frac{7}{13}\underset{\sim}{a}$

(iii) $AM = \frac{1}{4}AB$

$= \frac{1}{4}(\overrightarrow{AO} + \overrightarrow{OB})$

$= \frac{1}{4}(b - a)$

(b) $OT = OA + AT$

$= a + \left(\frac{2}{13}b - \frac{7}{13}a\right)$

$= \frac{2}{13}(3a + b)$

$\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$

$= a + \left(-\frac{1}{4}a + \frac{1}{4}b\right)$

$\frac{3}{4}a + \frac{1}{4}b$

$\frac{1}{4}(3a + b)$

$\frac{OT}{OM} = \frac{2}{13}\frac{(3a + b)}{\frac{1}{4}(3a + b)}$

$\overrightarrow{OT} = \frac{8}{13}\overrightarrow{OM}$

Or $\overrightarrow{OM} = \frac{13}{8}\overrightarrow{OT}$

Since $\overrightarrow{OT} = \frac{8}{13}\overrightarrow{OM}$

Then $OT : TM = \frac{8}{13} : \frac{5}{13}$

$= 8 : 5$

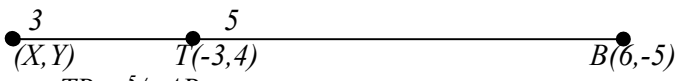
√✓Construction of ∠60° and ∠90°

Bisect ∠ btw 90° and 60° to obtain ∠75°

✓ Construction of the given sides

Construction of Δ XYZ

2.



$TB = \frac{5}{8}AB$

$\begin{pmatrix}6\\-5\end{pmatrix} - \begin{pmatrix}-3\\4\end{pmatrix} = \frac{5}{8}AB$

$\begin{pmatrix}9\\-9\end{pmatrix} = \frac{5}{8}\left\{\begin{pmatrix}6\\-5\end{pmatrix} - \begin{pmatrix}x\\y\end{pmatrix}\right\}$

$\begin{pmatrix}9\\-9\end{pmatrix} = \frac{5}{8}(6-x)$
$\frac{5}{8}(-5-y)$

$\frac{30}{8} - \frac{5}{8}X = 9$

$-\frac{25}{8} - \frac{5}{8}y = -9$

$30 - 5x = 72$ | $-5x = 42$

$-25 - 5y = -72$ | $-5y = -47$

$X = -8.4 \quad y = 9.4$

3. $\underset{\sim}{OX} = \frac{2}{3}(3\underset{\sim}{i} + 2\underset{\sim}{j} - 4\underset{\sim}{k}) + \frac{1}{3}(6\underset{\sim}{i} + 11\underset{\sim}{j} + 2\underset{\sim}{k})$

$= 2\underset{\sim}{i} + 4\underset{\sim}{j} - \frac{8}{3}\underset{\sim}{k} + 2\underset{\sim}{i} + \frac{11}{3}\underset{\sim}{j} + \frac{2}{3}$

$= 4\underset{\sim}{i} + 5\underset{\sim}{j} - 2\underset{\sim}{k}$

$10x1 = \sqrt{16 + 25 + 4}$

$= 6.71 units$

4. a) $2^5 - 5(2^4)(^1/_5) + 10(2^3)(^1/_5 x)^2 - 10(2^2)(^1/_5 x)^3 + 5(2)(^1/_5 x)^4 - (^1/_5 x)^5$

$32 - 16x + {}^{16}/_5 x^2 - {}^8/_{25}x^3 + {}^2/_{125}x^4 - {}^1/_{3125}x^5$

$-{}^1/_5 x = -0.04$

$x = 0.2$

b) $32 - 16(0.2) + {}^{16}/_5 (0.2)^2 - {}^8/_{25}(0.2)^3 + \ldots\ldots$

$= 32 - 3.2 + 0.128 - 0.00256$

$= 28.92544$

$= 29.925$

5. $AS = AO + OS$

$= -a + 2(3c)$

$= 2c - a \ldots\ldots\ldots$

$BC = BA + AC$

$= a - b + AC$

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) $BT : BC$

$BT = 2BC$

6. (a) (i) $\underset{\sim}{PQ} = \underset{\sim}{PO} + \underset{\sim}{OQ}$

$= \underset{\sim}{P} + \underset{\sim}{q}$ 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) $\underset{\sim}{QR} = \underset{\sim}{QP} + \underset{\sim}{PR}$

$= \underset{\sim}{P} + \frac{2}{3}\underset{\sim}{PQ}$

$= \underset{\sim}{P} + \frac{2}{3}(\underset{\sim}{q} - \underset{\sim}{p})$

$= \underset{\sim}{P} + \frac{2}{3}\underset{\sim}{q} - \frac{2}{3}\underset{\sim}{p}$

$= \frac{1}{3}\underset{\sim}{p} + \frac{2}{3}\underset{\sim}{q}$

(iii) $\underset{\sim}{SQ} = \underset{\sim}{SO} + \underset{\sim}{OQ}$

$= -\frac{3}{4}\underset{\sim}{OP} + \underset{\sim}{OQ}$

$= -\frac{3}{4}\underset{\sim}{p} + \underset{\sim}{q}$ or $\underset{\sim}{q} - \frac{3}{4}\underset{\sim}{p}$

(b) Express OT in two different ways:

Given $\underset{\sim}{OT} = n\underset{\sim}{OR}$

$= n\left(\frac{1}{3}\underset{\sim}{P} + \frac{2}{3}\underset{\sim}{q}\right)$

$= \frac{n}{3}\underset{\sim}{p} + \frac{2n}{3}\underset{\sim}{q}$

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 $\underset{\sim}{q}$

$\frac{n}{3} = \frac{3}{4} - \frac{3}{4}m$

$4n = 9 - 9m$

$4n + 9m = 9$ ……..eq (1)

$\frac{2n}{3} = m$

$m = \frac{2n}{3}$ ……..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)

$m = \frac{2}{3} \times \frac{9}{10} = \frac{3}{5}$

53. Binominial expansion

1	a) $\left(2-\frac{1}{x}\right)^8 = 2^8 - 8.2^7\left(\frac{1}{x}\right) + 28.2^6.\left(\frac{1}{x}\right)^2 - 56.2^5\left(\frac{1}{x}\right)^3 +$ $70.2^4\left(\frac{1}{x}\right)^4 + ...$ $256 - \frac{1024}{x} + \frac{1792}{x^2} - \frac{1792}{x^3} + \frac{1120}{x^4}$ b) $(1.75)^8 = 256 - \frac{1024}{4} + \frac{1792}{16} - \frac{1792}{64} + \frac{1120}{256}$ $= 256 - 256 + 112 - 28 + 4.375$ $= 88.375$	M_1 A_1 M_1 A_1	$2 - 1/x = 1.75$ $0.25 = 1/x \therefore x = 4$
		4	
2.	(2+x)5 25 + 5(2)4x) + 10(2)3x + 10(2)2x3 +… = 32 + 80x + 80x2 + 40x3 + …. (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 = 29.67	M1 A1 M1 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) $3x = 1 - 0.997$

$x = 0.001$

$= 1 - 15(0.001) + 90(0.001)^2 - 270(0.001)^3 + 405(0.001)^4$

$= 1 - 0.015 + 0.00009 - 0.00000027 + \ldots\ldots\ldots\ldots$

$= 1 + 0.00009 - 0.015 - 0.00000027$

$= 1.00009 - 0.01500027 = 0.98508973$

$= -0.9851$ (4 d.p)

2. *(i) $5 + \frac{x}{2}^6 = 15625 + \frac{3125}{3}X + \frac{9375}{4}X^2 + \frac{625}{2}X^3 + \ldots\ldots$*

(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.

$(\sqrt{3} + 2x)^6 = (\sqrt{3})^6 + \sqrt{6}(\sqrt{3})^5\ 2x + 15(\sqrt{3})^4 (2x)^2 + 20\sqrt{3})^3 (2x)^3$

$= 27 + 108x\sqrt{3} + 270x^2 + 480x^3\sqrt{3}$

$3 + 2x = 3 \quad 3$

$\sqrt{2x} + 2\sqrt{3}$

$x = \quad 3$

$27 + 108\sqrt{3}\ \sqrt{3} + 270\sqrt{3^2} + 480\sqrt{3}\ (\ 3)^3$

$= 27 + 324 + 810 + 4320 = 5481$

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

$P(\text{Sum odd}) = {}^{18}/_{36} \qquad = ½$

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; $2^5,\ 2^4({}^3/_x),\ 23({}^8/_x)^2,\ 2^2({}^3/_x)^3,\ 2^3\ ({}^3/_x)^4$

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) $9.5 = 2 + {}^3/_x$

${}^3/_x = 7.5$

$x = {}^3/_{7.5} = 0.4$

$(9.5)^5 = 32 + \underline{240} + \underline{720} + \underline{1086} + \underline{810}$

$0.4 \quad (0.4)^2 \quad (0.4)^3 \quad (0.4)^4$

$= 53647.625(3d.p)$

7. $X^5 - 5x^4\ (0.2) + 10x3\ (0.20 - 10x2\ (0.2)^3 + 5x\ (0.2)^4 - (0.2)^{\ 5}$

$X^5 - 5x^4\ ({}^2/10) + 10x^3\ {}^2/10^2 - 10x^2\ ({}^2/10)^3 + 5x\ ({}^2/10)^4 - ({}^2/10)^5 + x^5 - ({}^4/10)\ x^3 - ({}^8/100)x^2 + 5\ x\ 16 - 2^5/10^5$

$X^5 - x^4x^3 - {}_{8/}100x^2 + 80x - {}_2{}^5/10^5$

90, 392, 079

8. $Log\ (x + 24) = log(x(9\text{-}2x)$

$X + 24 = 81\text{-}18x$

$X = 3$

9. $1 + \underline{x} \quad = \quad 1 + \underline{x} \quad + \quad \underline{5x^2} \quad + \quad \underline{5x^3}$

$12 \qquad\qquad 2 \qquad 48 \qquad 432$

$\left(1 + \underline{x}\right)^6 = 1\ ¼$

12

$\underline{x} \quad = ¼$

12

$x \quad = 3$

6

$$\begin{pmatrix} 5 \\ 4 \end{pmatrix} = 1 + \frac{3}{2} + \frac{9}{48} + \frac{27}{432}$$

$= 2.7500$

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) $(1.05)8 = 1 + 4(0.1) + 7(0.1)2 + 7(0.1)3$

$= 1 + 0.4 + 0.07 + 0.0074\ldots$

$= 1.48$

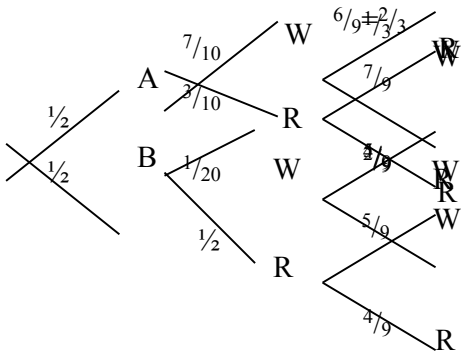
11. $81 + 27x + 9x^2 + 3x^3 + x^y$

$81 + 108x + 54x^3 + x4$

$81 + 108\ (0.02) + 54\ (0.02)^3$

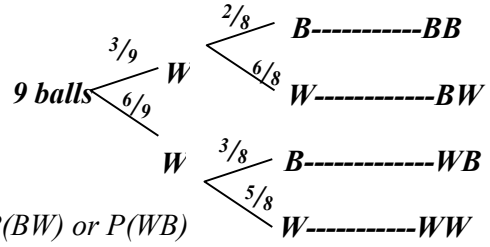
$= 83.182$

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 $P(RH)$ $\left(\frac{1}{8} \times \frac{4}{7}\right) + \left(\frac{7}{8} \times \frac{3}{7}\right) + \frac{3}{56}$ $\frac{4}{56} + \frac{21}{56} + \frac{3}{56}$ $= \frac{28}{56} or \frac{1}{2} or 0.5$	B_1 M_1 M_1 A_1	
		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 – 22 45	B2	

	= 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 – 23 = 22 45 45	U1 A1 M1 A1 M1 A1 B1 A1	
		10	

1. (a) (i) Total balls = 3 + 6 = 9



= P(BW) or P(WB)

$= \left(\frac{1}{\cancel{3}_{3}} \times \frac{2}{\cancel{6}_{3}}\right) + \left(\frac{6}{9} \times \frac{3}{8}\right)$

$= \frac{18}{72} + \frac{18}{72} = \frac{36}{72}$

$= ½$

(ii) = P(BW) or P(WB)

$= \left(\frac{3}{9} \times \frac{6}{9}\right) + \left(\frac{6}{9} \times \frac{3}{9}\right)$

$= \frac{18}{81} + \frac{18}{81}$

$= \frac{36}{81} = \frac{4}{9}$

(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)

$= (1\text{-}P(BBB) = 1\text{-}({}^{5}/_{12} \times {}^{4}/_{11} \times {}^{3}/_{10})$

$= {}^{21}/_{22}$

(iv) P (same colour) = P(BBB or WWW)

$= ({}^{7}/_{12} \times {}^{6}/_{11} \times {}^{5}/_{10}) + ({}^{5}/_{12} \times {}^{4}/_{11} \times 3/_{10})$

$= {}^{9}/_{44}$

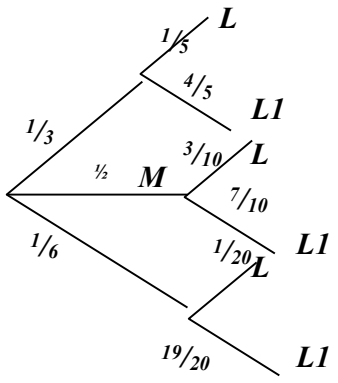
3. a)

2	3	5	7
2	32	52	72
3	23	53	73
5	25	35	75
7	27	37	57

b) P(E) $= \frac{4}{16}$

$= {}^{1}/_{4}$

4.



(a) P(late) $= ({}^{1}/_{3} \times {}^{1}/_{5}) + ({}^{1}/_{2} \times {}^{3}/_{10}) + ({}^{1}/_{6} \times {}^{1}/_{20})$

$= {}^{1}/_{15} + {}^{3}/_{20} + {}^{1}/_{120}$

$= {}^{9}/_{40}$

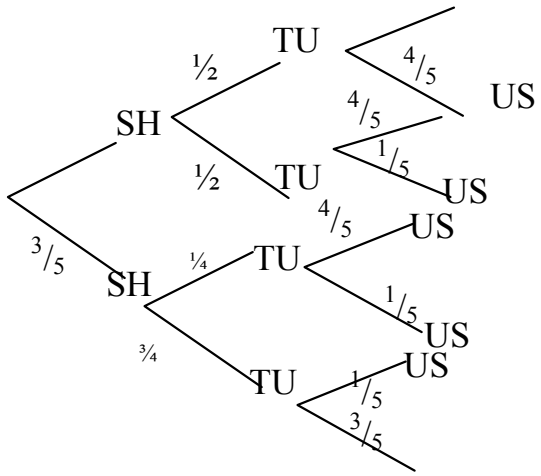
(b) $P = {}^{1}/_{3} \times {}^{1}/_{5}) + ({}^{1}/_{6} \times 1/_{20})$

$= {}^{1}/_{15} + 1/_{20}$

$= {}^{3}/_{40}$

(c) P= (not late) = (1- $^{9}/_{40}$)

5. a)

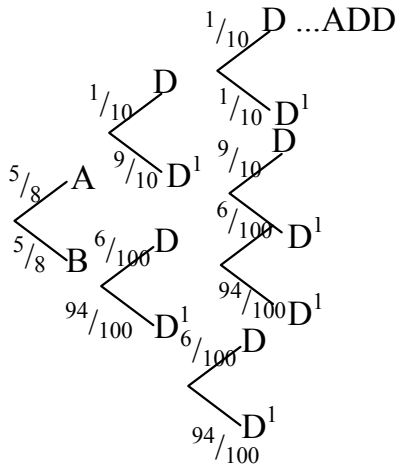


b) i) P(all faults)= P(SH and TU and US)

$= {}^{2}/_{5} \times {}^{1}/_{2} \times {}^{4}/_{5} = {}^{4}/_{25}$

ii) P(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

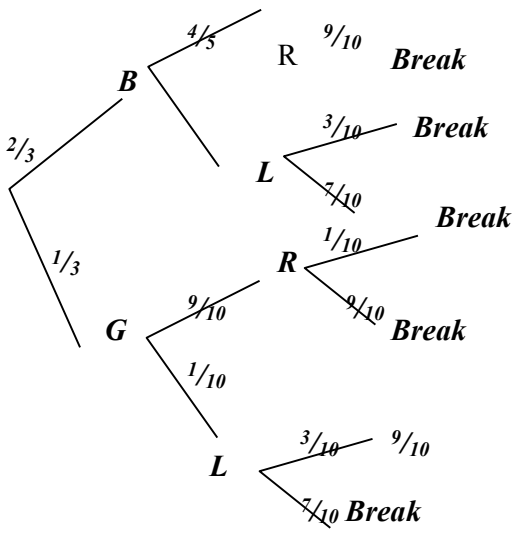
$= \frac{3}{8} \times \frac{1}{10} \times \frac{1}{10} + \frac{5}{8} \times \frac{6}{100} \times \frac{6}{100}$

$= \frac{3}{800} + \frac{180}{80000}$

$= \frac{24}{4000}$

$= \frac{3}{500}$

7. a)



b) i) P (BL or GL) = $^{2}/_{3} X ^{1}/_{10} + ^{1}/_{3} X ^{1}/_{10}$

$= ^{2}/_{15} + ^{1}/_{30} = ^{5}/_{30}$

ii) P(BL break or GR break)

$= ^{2}/_{3} X ^{1}/_{5} X ^{3}/_{10} + ^{1}/_{3} X ^{1}/_{10} X ^{3}/_{10}$

$= ^{2}/_{50} + ^{1}/_{100} = ^{4+1}/_{100} = ^{5}/_{100}$

iii) P(BR break or GR 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)

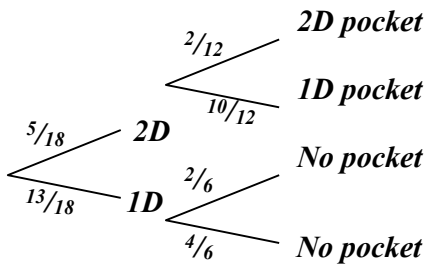
$= \frac{5}{18} \times \frac{10}{12}$

$= \frac{25}{108}$

(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) $= 1 - P(WW)$

$= 1 - \frac{2}{15}$

$\frac{13}{15}$

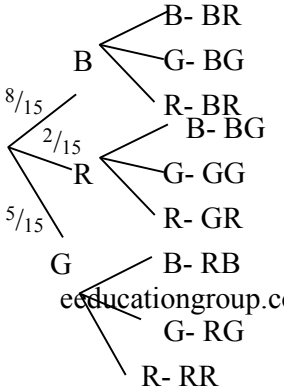
(iv) $P(WR) \text{ or } P(RW) = \frac{3}{5} \times \frac{4}{9} + \frac{2}{5} \times \frac{2}{3}$

$= \frac{8}{15}$

10. a) i) $^8/_{15}$

ii) $^2/_{15} + {}^5/_{15} = {}^7/_{15}$

b) i)



$Gh = {}^{2}/_{15} \times {}^{1}/_{14} = {}^{2}/_{210} = {}^{1}/_{105}$

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 $= {}^{5}/_{9} \times {}^{4}/_{2} \times {}^{3}/_{7} + {}^{4}/_{9} \times {}^{3}/_{8} \times {}^{2}/_{7}$

$= {}^{5}/_{42} + {}^{1}/_{7}$

$= {}^{11}/_{42}$

(ii) more red balls $= {}^{5}/_{89} \times {}^{1}/_{2} \times {}^{3}/_{7} + {}^{5}/_{9} \times {}^{1}/_{2} \times {}^{4}/_{7} + {}^{5}/_{9} \times {}^{1}/_{2} \times {}^{4}/7$

$= {}^{5}/_{42} + {}^{10}/_{63} = {}^{10}/_{63}$

$= {}^{5}/_{42} + {}^{20}/_{63} = \frac{15 + 40}{126} = \frac{55}{126}$

(iii) at least black ball was picked

$= 1 - {}^{5}/_{9} \times {}^{1}/_{2} \times {}^{3}/_{7}$

$= 1 - {}^{5}/_{21}$

$= {}^{16}/_{21}$

(iv) Atmost 1 red ball picked

$= {}^{5}/_{9} \times {}^{4}/_{2} \times {}^{3}/_{7} + {}^{4}/_{9} \times {}^{5}/_{8} \times {}^{3}/_{7} + {}^{4}/_{9} \times {}^{3}/_{8} \times {}^{2}/_{7}$

$= {}^{5}/_{42} + {}^{5}/_{92} + {}^{1}/_{21}$

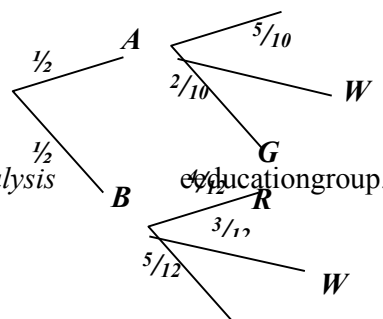
$= \frac{5 + 5 + 2}{42}$

$= {}^{12}/_{42}$

$= {}^{2}/_{7}$

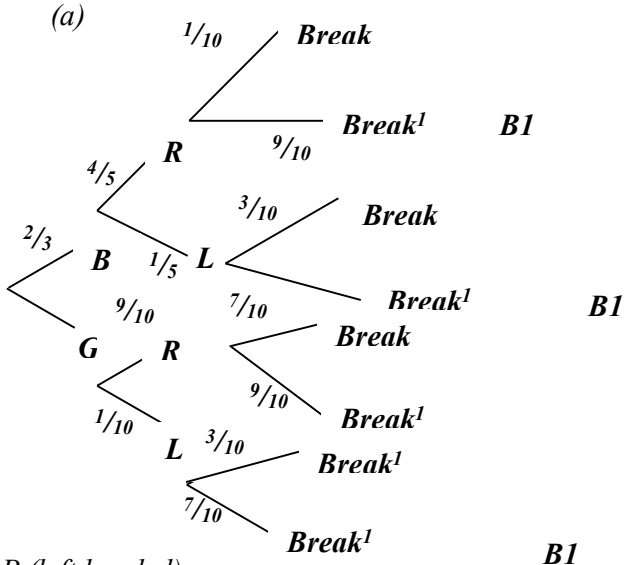
$${}^{3}/_{10}$$

12.



$P\ (Red) = (\frac{1}{2} \times \frac{3}{10}) + (\frac{1}{2} \times \frac{4}{12}) = 19\ \ 60$

13. (a)



bi) P (left handed)

$= \frac{2}{3} \times \frac{1}{5} + \frac{1}{3} \times \frac{1}{10}$

$= \frac{2}{15} + \frac{1}{3}$

$= \frac{5}{30} = \frac{1}{6}$

ii) P (Right handed and will break)

$= \frac{2}{3} \times \frac{4}{5} \times \frac{1}{10} + \frac{1}{3} \times \frac{1}{9} \times \frac{1}{10}$

$= \frac{8}{150} + \frac{9}{300}$

$= \frac{25}{300} = \frac{1}{18}$

c) P $(= \frac{2}{3} \times \frac{4}{5} \times \frac{1}{10} + \frac{2}{3} \times \frac{1}{5} \times \frac{3}{10} + \frac{1}{3} \times \frac{9}{10} \times \frac{1}{10} + \frac{1}{3} \times \frac{1}{10} \times \frac{3}{10}$

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)

$$\frac{5}{15} X \frac{4}{15} X \frac{6}{15} + \frac{6}{15} X \frac{5}{15} X \frac{4}{15} + \frac{4}{15} X \frac{6}{15} X \frac{5}{15}$$

$$= \frac{120}{3375} + \frac{120}{3375} + \frac{120}{3375}$$

$$= \frac{24}{}$$

(iv) P(BBB) + P(GGG) + P(BBG) + P (GGB)

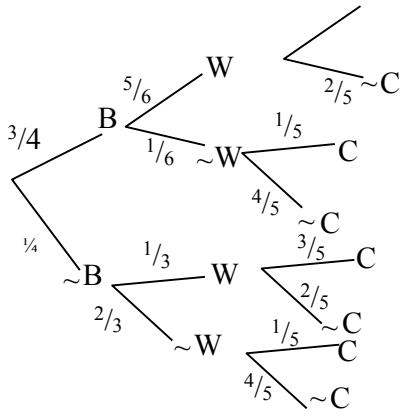
$$= \frac{4}{15} X \frac{4}{15} X \frac{4}{15} + \frac{6}{15} X \frac{6}{15} X \frac{6}{15} + \frac{4}{15} X \frac{4}{15} X \frac{6}{15} + \frac{6}{15} X \frac{6}{15} X \frac{4}{15}$$

$$= \frac{64}{3375} + \frac{216}{3375} + \frac{96}{3375} + \frac{144}{3375}$$

$$= \frac{520}{3375} + \frac{104}{3375}$$

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

(a) (i) P(Bnw) = ¾ x 5/6
= 5/8

√tree diagram.
√Addition of probability

ii) P(Waking up late)

$$\left(\frac{1}{\cancel{3}/4} \times \frac{1}{\cancel{6}/3}\right) + \left(\frac{1}{\cancel{1}/4} \times \frac{\cancel{2}/3}{2}\right)$$

$$= \frac{1}{8} + \frac{1}{6} = \frac{3+4}{24}$$

$$= \frac{7}{24}$$

√Addition of prob.
√Addition of prob.

b) (i) P (BW~C) or P(B~W~C)

$$\left(\frac{\cancel{3}/4}{2} \times \frac{1}{\cancel{6}} \times \frac{\cancel{4}}{5}\right) + \left(\frac{\cancel{3}/4}{2} \times \frac{5}{\cancel{6}/1} \times \frac{\cancel{2}}{\cancel{5}}\right)$$

$$\frac{1}{10} + \frac{1}{4} = \frac{4+10}{40}$$

$$= \frac{7}{20}$$

ii) P (~B ~C) = $\frac{1}{4} \times \frac{1}{3} \times \frac{3}{5} + \frac{1}{4} \times \frac{2}{3} \times \frac{1}{5}$

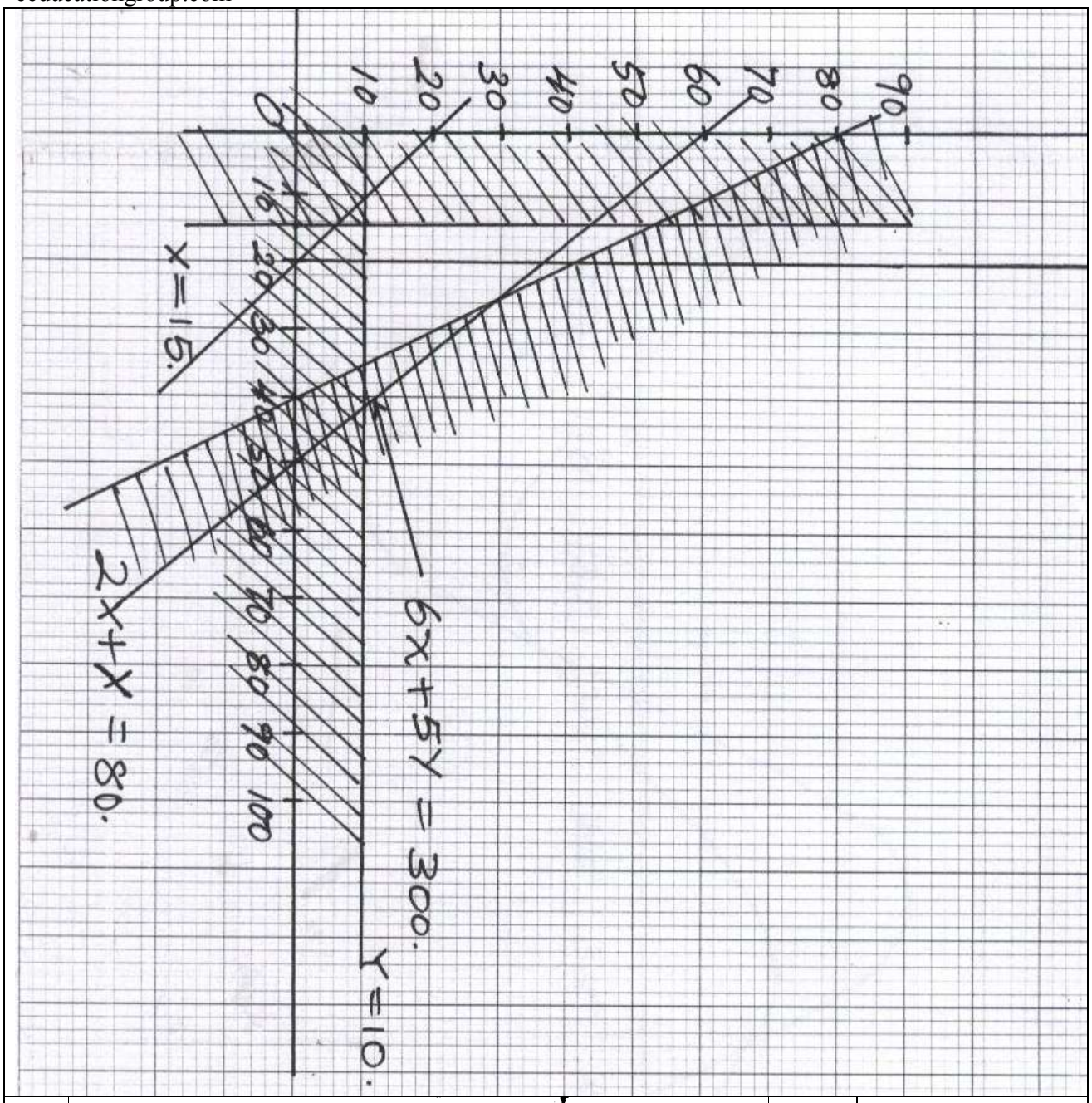
$$= \frac{1}{20} + \frac{1}{30} = \frac{3+2}{60} = \frac{5}{60}$$

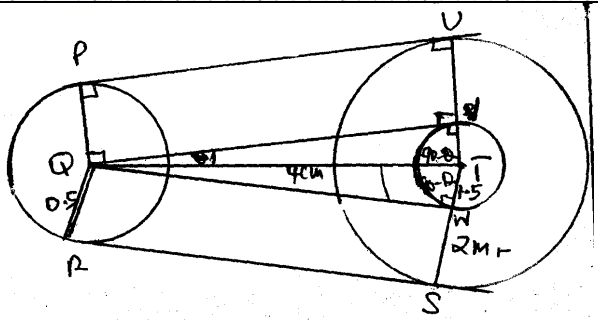
$$= \frac{1}{}$$

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	



3.	 PU = QV = QW = RS $= \sqrt{4^2 - 1.5^2}$ = 3.708cm	**M1** **M1**	

	$Sin\theta = \frac{1.5}{4} \Rightarrow Sin^{-1}0.375 = 22.02^0$ $\angle PQR\,(obtuse) = 360^0 - 2(90 + 22.02)$ $= 135.96^0$ $Arc\ PR = \frac{135.96}{360} \times 2 \times 3.14 \times 0.5 = 1.1866$ Arc US subtends angle 360 – 2(90 – 22.02) = 224.04 Arc US = $\frac{224.04}{360} \times 2 \times 3.142 \times 2 = 7.8215$ Total length = 3.708 x 2 + 1.1866 + 7.8215 = 16.4241 (b) ($^4/_3$ x 16.4241) 21.8988 22.90	**M1** **M1** **M1** **M1** **A1** **M1** **A1** **B1**	
		10	

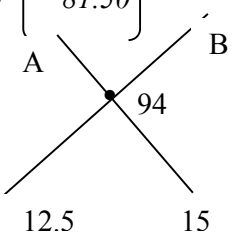
1. a) Deposit: Total ratio 2 + 3 + 5 = 10
Georgina: $^2/_{10}$ x 30000 = 6000
Gilbert: $^3/_{10}$ x 30000 = 9000
Akumu: $^5/_{10}$ x 30000 = 15000

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 ?
= $\frac{12 \times 20}{16}$ 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

130.50 *97.80*
112.80
15 *18*

A sales at $\frac{109}{100} \times 120$
$= \underline{130.50/=}$
B sales at $\frac{81.50}{100} \times 120$
$= \underline{\underline{97.80/=}}$

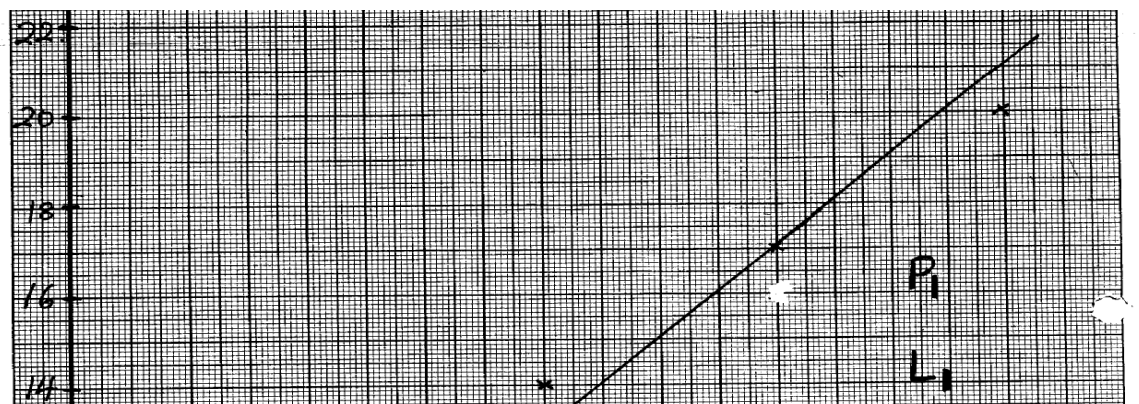
A & B mixed sells at
$\frac{94 \times 120}{100} =$
sh 112.80 per kg
Ratio A : B
(112.80 – 97.8) :
(130 – 112.8)
15: 18
5 : 6

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 $\frac{dy}{dx} = 6x2 + x – 4$
When x = 1,
$\frac{dy}{dx} = 6+1 -4 = 3$
Grad of normal $= -\frac{1}{3}$
$y + \frac{1}{2} = -\frac{1}{3}(X -1)$
$y = -\frac{1}{3} x – \frac{1}{6}$

6 *Gradient* $= \frac{11 – 8}{3 – 1.5}$
$= 2$
K = 2, M = 5 *B = 2A + 5*

M



7 *(70 – 25 x 60 = 2700*
2700 Cos 47
= 2700 x 0.68 = 1841.4nm

8 $\frac{6x\ 72 + 66 \times 4}{10} = 69.6$
100% = 69.6
∴ 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
= 112 x 156
100 = shs. 174.72

(b) *At 11.45 a.m*
Depth filled by P in 2hrs = 2.1m
3hrs = 3hr x 2.1m
2hr
= 3.15m
Depth filled by q in 7hrs = 2.1m
3hrs = 3hrs x 2.1m
7hrs

$= 0.9m$

Depth emptied by R in 6hrs $= 2.1m$

$\frac{2hrs}{6hrs} = 2hr \times 2.1$

$\therefore$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 $= r^2$

$= (\frac{22}{7} \times 35 \times 35)cm^2$

Flow per second $= (\frac{22}{7} \times 35 \times 35 \times 45)cm^2$

After 2¼ hrs $= (\frac{22}{7} \times 35 \times 35 \times 45 \times 3 \times 60 \times 69)$liters

$= 233887.5$litres

12 a) In 2000, Costs Shs

Material $= {}^{8}/_{25} \times 1250 = 400$

Labour $= {}^{14}/_{25} \times 1250 = 700$

Transport $= {}^{3}/_{25} \times 1250 = 150$

In 2003

Material $= 400 \times 2 = 800$

Labour $= {}^{130}/_{100} \times 700 = 910$

Transport $= {}^{120}/_{100} \times 150 = 180$

b) In 2004 Costs

Material = 800

Transport = 180

$\therefore$ labour $= 1981 - (800 + 180) =$ Shs.1001

$\therefore$ Increase in labour $= 1001 - 910 = 91$

% increase $= {}^{91}/_{910} \times 100$

$= 10\%$

13. Cost price $= 100 \times \frac{114}{120} =$ shs. 95

Let A: B = n :1

$\frac{95}{1} = \frac{80n + 100}{n + 1}$

$95n + 95 = 80n + 100$

$15\ n = 5$

$n = {}^{1}/_{3}$

$n:1 = 1:3$

$A:B = 1:3$

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/ $kg = 28.75\ X\ {}^{20}/_{100}$

$= 5.75$

b) i) Selling price

$= 28.75 \times {}^{112}/_{100} = 32.20$

$32.20 \times {}^{120}/_{100} = 38.64$

38.64

ii) New cost/ kg

$= 1.12 \times 28.75 = 32.20$

$\%\ Profit = \frac{40.25 - 32.20}{32.20}\ X\ 100$

$= 25\%$

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. $x^2 + 6x + (3)^2 + y^2 - 10y + (-5) = 2 + 9 + 25$

Completing of sq. for expression in x and y.

$(x + 3)^2 + (y - 5)^2 = 36$

$(x - -3)^2 + (y - +5)^2 = 6^2$

√Expression.

√Centre

$\therefore$ centre (-3, 5)

Radius 6 units

√Radius

3. $CBE = 40^0$ (alt.segiment theoren)

$\angle BCE = 120^0$ (Suppl. To $BCD = 60^0$ alt. seg.)

$\therefore (40 + 120 + E) = 180^0$ (Angle sum of Δ)

$\angle BEC = 20^0$

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.

$\frac{dy}{dx} = 3x^2 - 3 = 0$

$x^2 = 1$

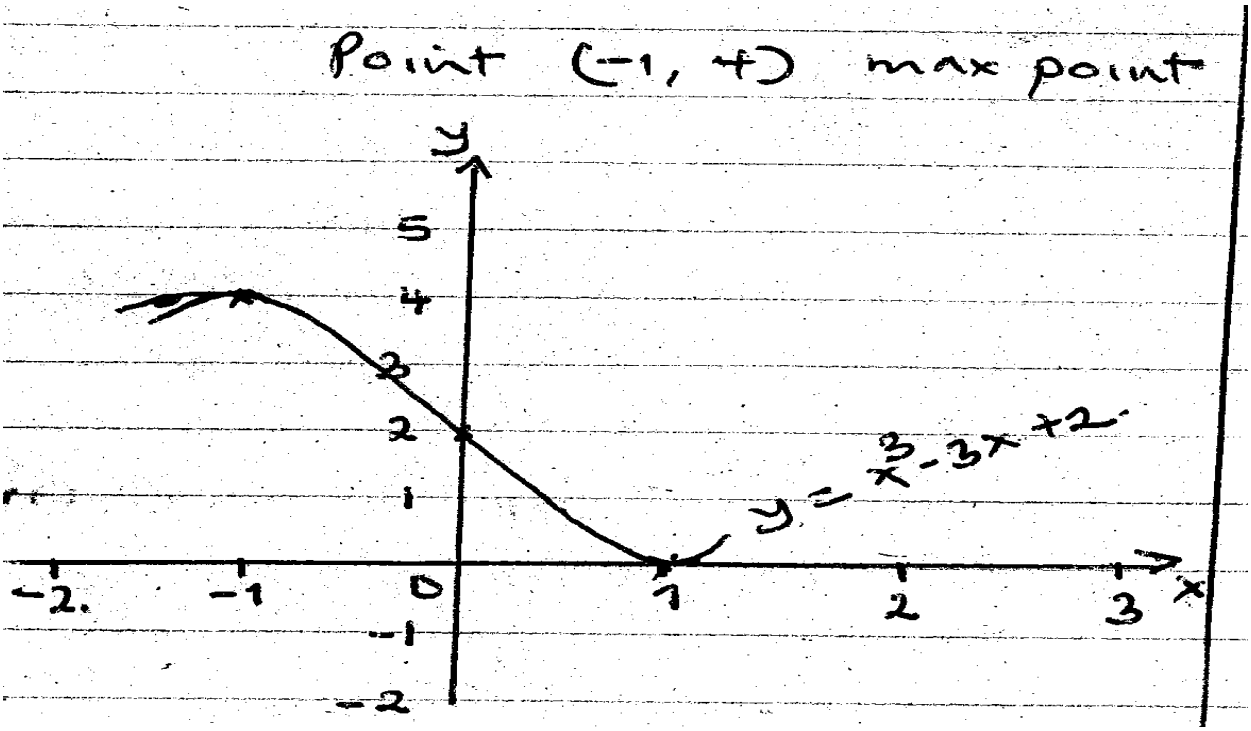
$x = \mp 1$

$x = 1$ $y = 0$

Point (1, 0) min point

$x = -1$, $y = 4$

Point (-1, 4) max point.



7. $4x_2 - 12x + 4y^2 + 12y = 7$
$x^2 - 3x + y^2 + 3y = {}^7/_4$
$x^2 - 3x + ({}^3/_2)^2 + y^2 + 3y + ({}^3/_2)^2 = {}^7/_4 + {}^9/_4 + {}^9/_4 = {}^{25}/_4$
$(x - {}^3/_2)^2 + (y + 3/2)2 = 25/4$
$\therefore$ Centre (1,5, -1.5) Radius 2.5units

8. $\log R = n\log p + \log K$

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

$\frac{I}{T} = \frac{b + V}{a}$

$\frac{I}{T} = \frac{1}{a}V + \frac{b}{a}$

$y = mx + C$

b) (i) $\frac{1}{a} = Grad \Rightarrow \frac{\Delta y}{\Delta x} = \frac{10 - 6}{7.3 - 5} = \frac{4}{2.3} = 0.575$

$a = 1.739$

$\frac{b}{a} = y - Intercept \Rightarrow 2.04$

$\frac{b}{1.739} = 2.04 \qquad b = 2.04 \times 1.739$

$= 3.547556$

$b \simeq 3.548$

(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. $3^5 = 3^{-4} \times 3^{-x}$

$3^5 = 3^{-4-x}$

$-4 - x = 5$

$-x = 9$

$x = -9$

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)

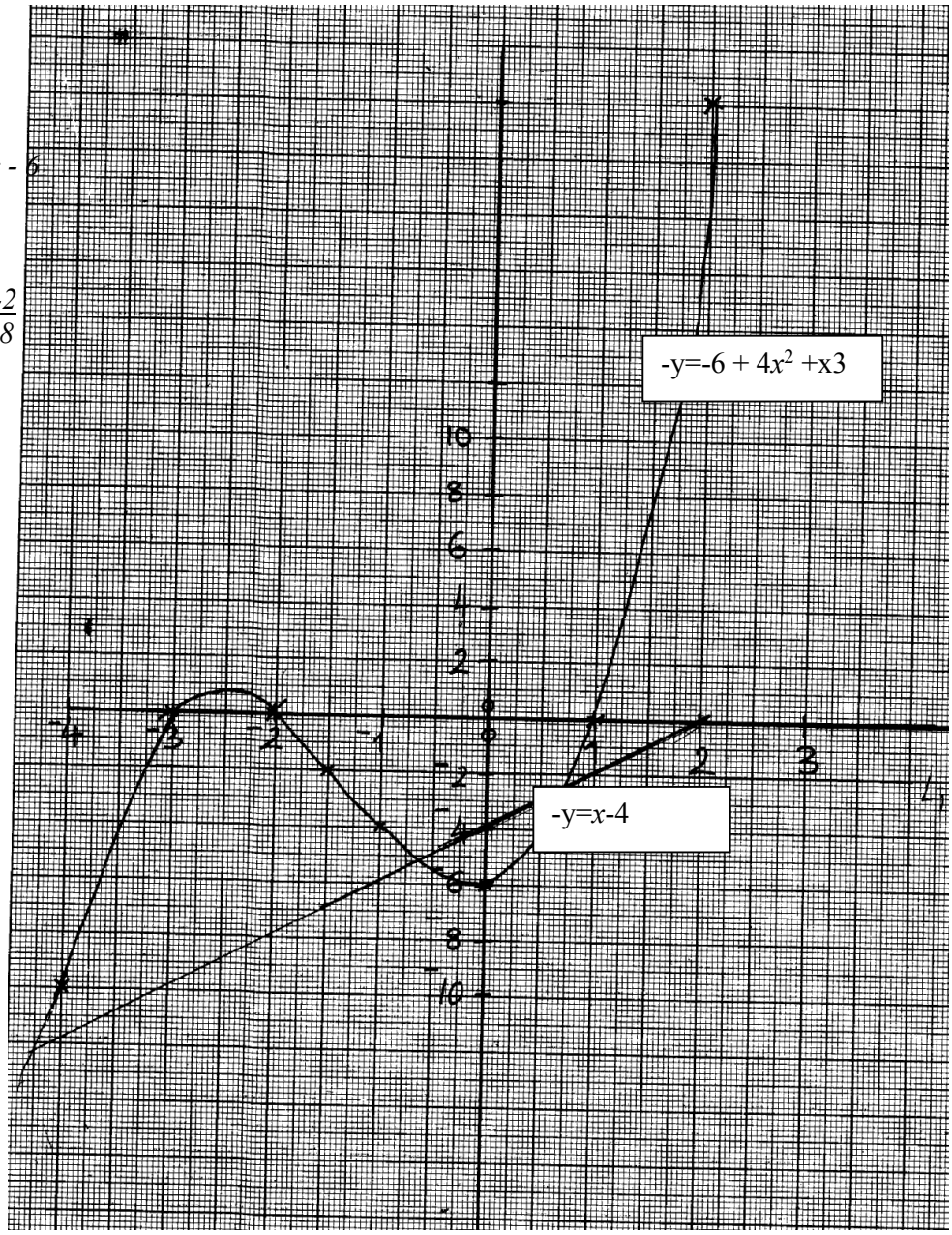
X	-4	-3	-2	-1	0	1	2

-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

$y = x^3 + 4x^2 + x - 6$
$0 = x^3 + 4x^2 + x - 4$
$y = -2$

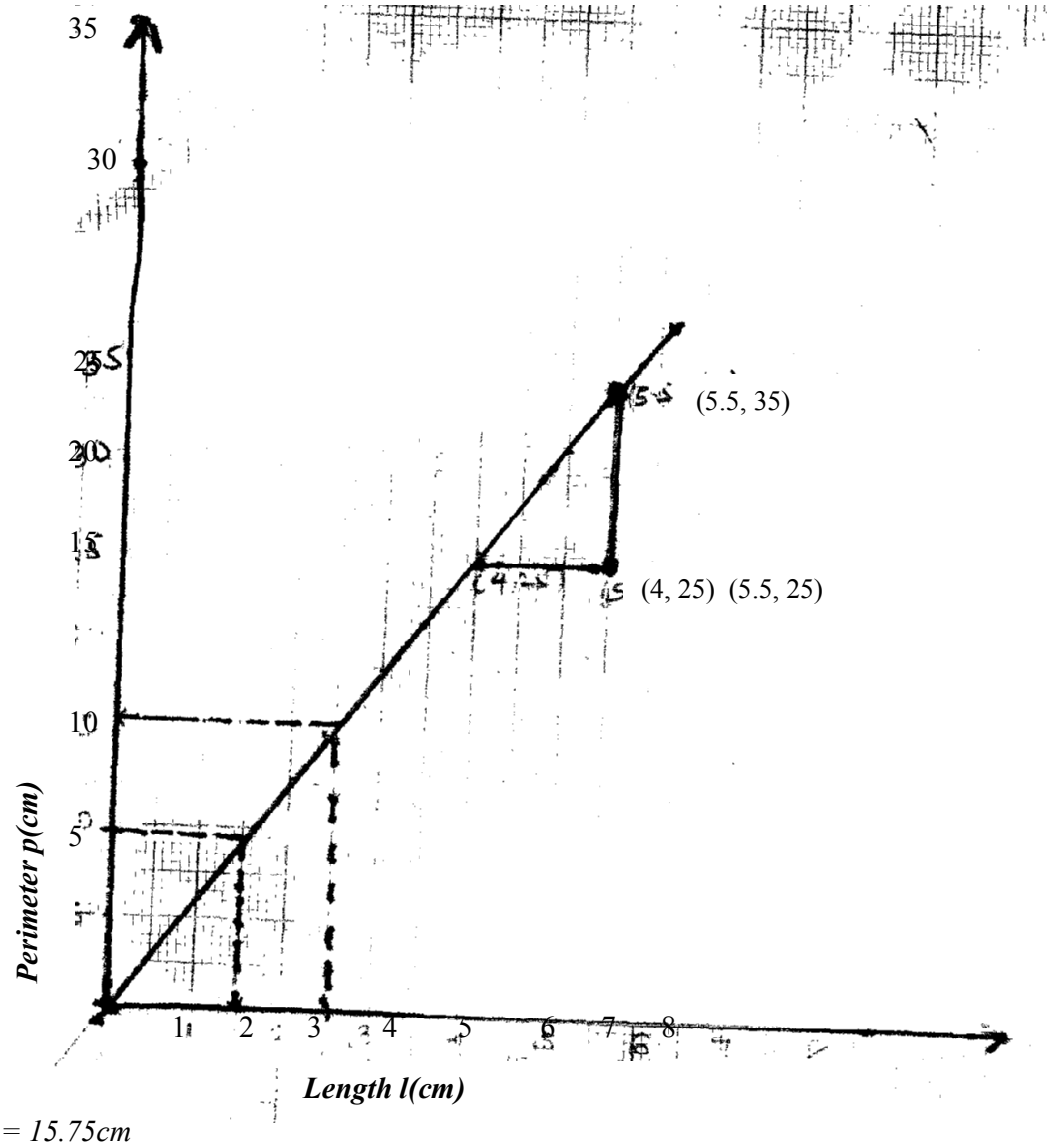
(iii) $y = x^3 + 4x^2 + x - 6$
$0 = x^3 + 4x^2 + 0 - 2$
$y = x - 4$

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)

$\frac{p-31.4}{l-5} = \frac{10}{1.5}$

$\frac{p-31.4}{l-5} = \frac{100}{1.5}$

$15p - 471 = 100k - 500$

$15p = 100l - 29$

$\frac{15}{15}$ $\frac{15}{15}$

$2k = \frac{100}{15}$

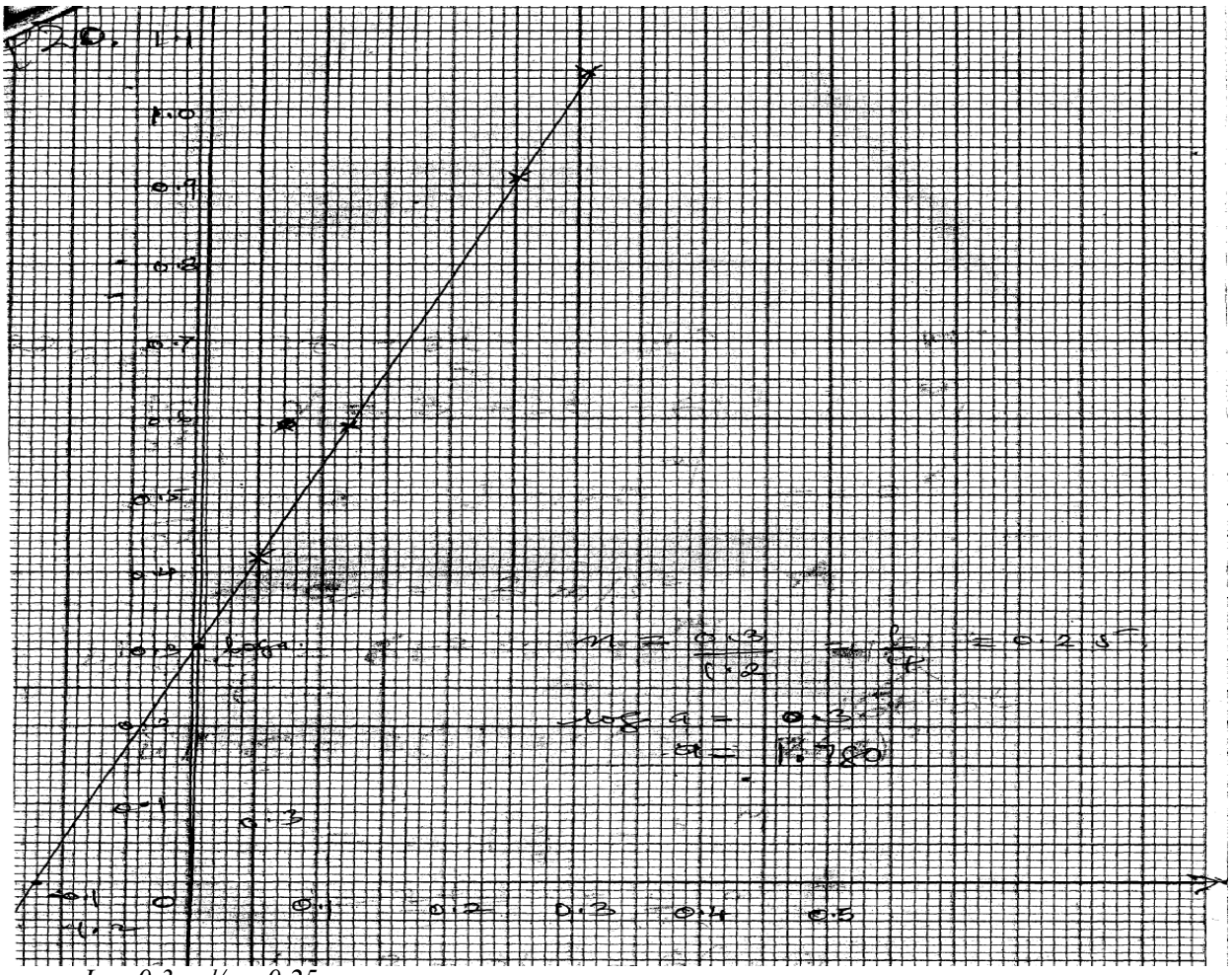
$k = \frac{100}{2 \times 15} = 3.33$

$c = 1.93$

$P + 0.6 = ar^h$

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*
Log (P + 0.6)	*-0.13*	*0.42*	*0.59*	*0.91*	*1.05*
Log R	*-0.05*	*0.05*	*0.12*	*0.25*	*0.30*



Log 0.3 = ¼ = 0.25
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)

$Gradient \frac{\Delta y}{\Delta x} = \frac{7 - -2}{6 - 3} = 3$

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. $\frac{Dy}{dx} = 12x^2 - 12$

$12x^2 - 12 = 0$

$12(x^2 - 1) = 0$

$x = 1$

$x = -1$

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. $2x^2 + 2y^2 - 6x + 10y + 9 = 0$

$x^2 + y^2 - 3x + 5y + 9/2 = 0$

$x^2 + y^2 - 3x + 5y = -9/2$

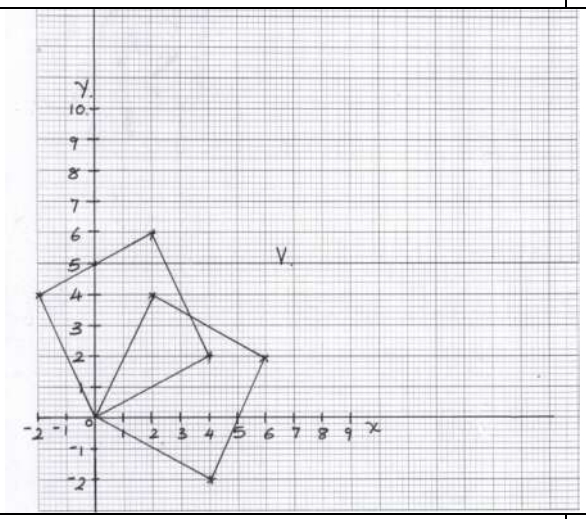
$x^2 - 3x + \frac{9}{4} + y^2 + 5y + \frac{25}{4} = 8.5 - 4.5$

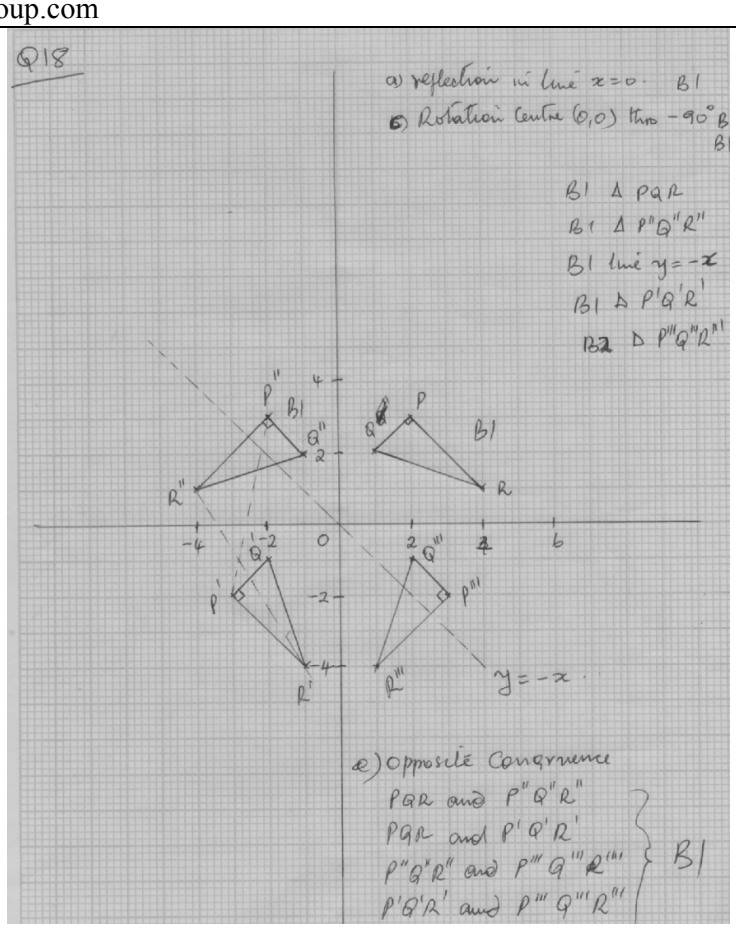
$(x - \frac{3}{2})^2 + (y + \frac{5}{2})^2 = 4$

Radius = 2 units

Centre = (1.5, -2.5)

57. Matrices and Transformations

1	a) (i) (ii) $\begin{pmatrix}2&-1\\1&2\end{pmatrix}\quad\begin{pmatrix}0&2&2&0\\0&0&2&2\end{pmatrix}$ $=\begin{pmatrix}0&4&2&-2\\0&2&6&4\end{pmatrix}$ $T \Rightarrow (0,0),(4,-2),(2,6),(-2,4)$ (iii) $\begin{pmatrix}2&1\\-1&2\end{pmatrix}\quad\begin{pmatrix}0&2&2&0\\0&0&2&2\end{pmatrix}=\begin{pmatrix}0&4&6&2\\0&-2&2&4\end{pmatrix}$ $U \Rightarrow (0,0),(4,-2),(6,2),(2,4)$ b) (i) $\begin{pmatrix}2&-1\\1&2\end{pmatrix}\begin{pmatrix}2&1\\-1&2\end{pmatrix}=\begin{pmatrix}5&0\\0&5\end{pmatrix}$ $\begin{pmatrix}5&0\\0&5\end{pmatrix}\begin{pmatrix}0&2&2&0\\0&0&2&2\end{pmatrix}=\begin{pmatrix}0&10&10&0\\0&0&10&10\end{pmatrix}$ $V \Leftarrow (0,0),(10,0),(10,10),(0,10)$ (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	Square S drawn ✓coordinates given Square T drawn ✓coordinates (implied) Square U drawn ✓coordinates (implied) Square V drawn
			
		10	

2.	 Total 10		
		10	

1. *a) B (4,-5), C (3,6 ½)*

Δ ABC drawn

Δ ABC drawn

a) ii) Shear maps

1

I (1, 1½)

Matrix = 1 0

1 ½

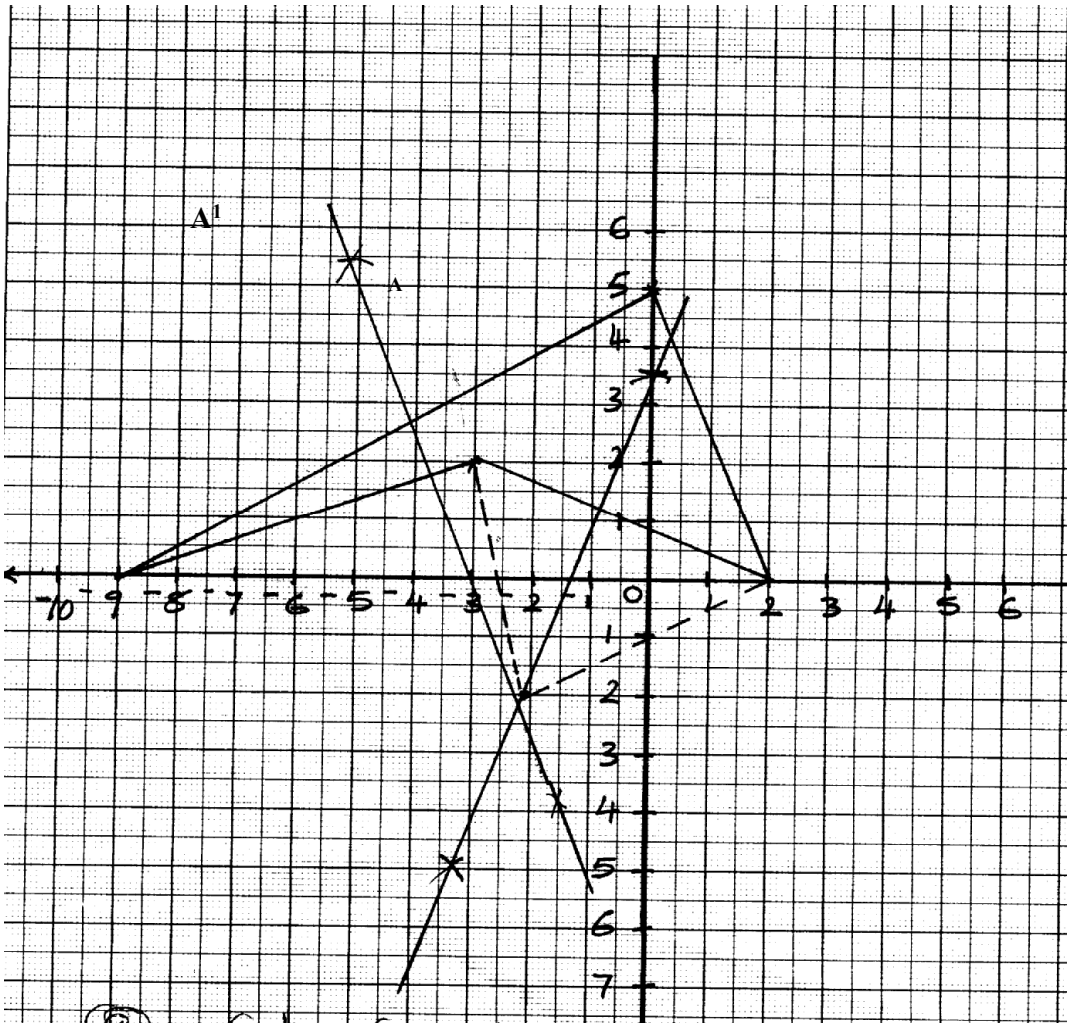
b) i) $\begin{pmatrix} 1 & 0 \\ -1 & 1 \\ 3/2 & -1 \end{pmatrix} \begin{matrix} 1 & 1 & 1 \\ A & B & C \end{matrix} \begin{pmatrix} -6 & -4 & 3 \\ -4 & -5 & 6\frac{1}{2} \end{pmatrix}$

$= \begin{matrix} A^{11} & B^{11} & C^{11} \end{matrix} \begin{pmatrix} 6 & 4 & -3 \\ -5 & -1 & -2 \end{pmatrix}$

Δ A^{11} B^{11} C^{11} D^{11} drawn

ii) Half turn about (0,0)

2.



(a) Centre (-2, -2) 90º
(b) A11 (-2 , -4) , B11 (0, 9)
(c) Half-turn about the centre (0, 2)

3.

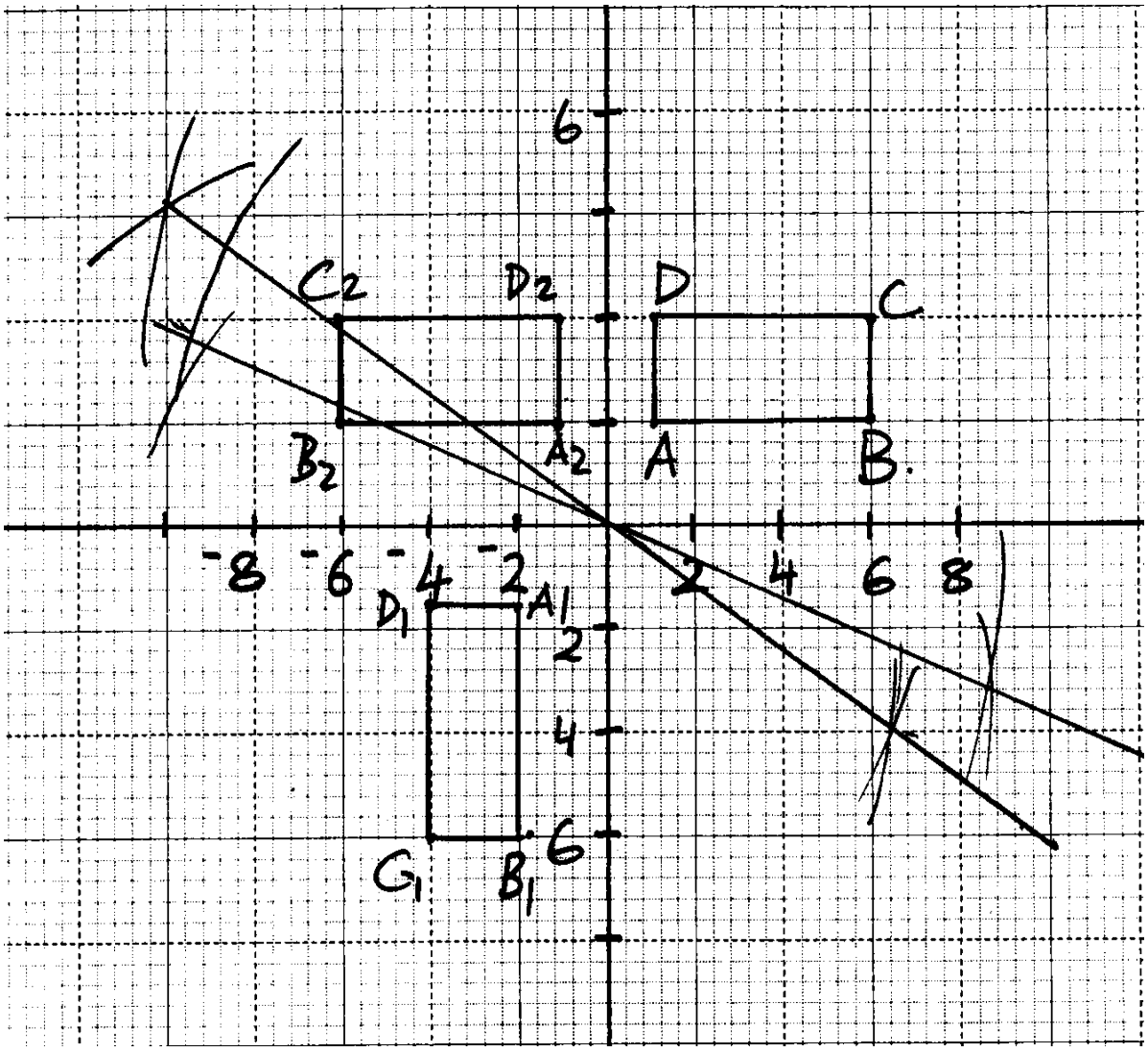
$$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} A & B & C & D \\ 1 & 6 & 6 & 1 \\ 2 & 2 & 4 & 4 \end{pmatrix} \quad \begin{pmatrix} A^1 & B^1 & C^1 & D^1 \\ -2 & -2 & -4 & -4 \\ -1 & -6 & -6 & -6 \end{pmatrix}$$

A_1 (-2, -1)
B_1 (-2, -6)
C_1 (4, -6
D_1 (-4, -1)

$$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} A_1 & B_1 & C_1 & D_1 \\ -2 & -2 & -4 & -4 \\ -1 & -6 & -6 & -6 \end{pmatrix} \quad \begin{pmatrix} A_2 & B_2 & C_2 & D_2 \\ -1 & -6 & -6 & -6 \\ 2 & 2 & 4 & 4 \end{pmatrix}$$

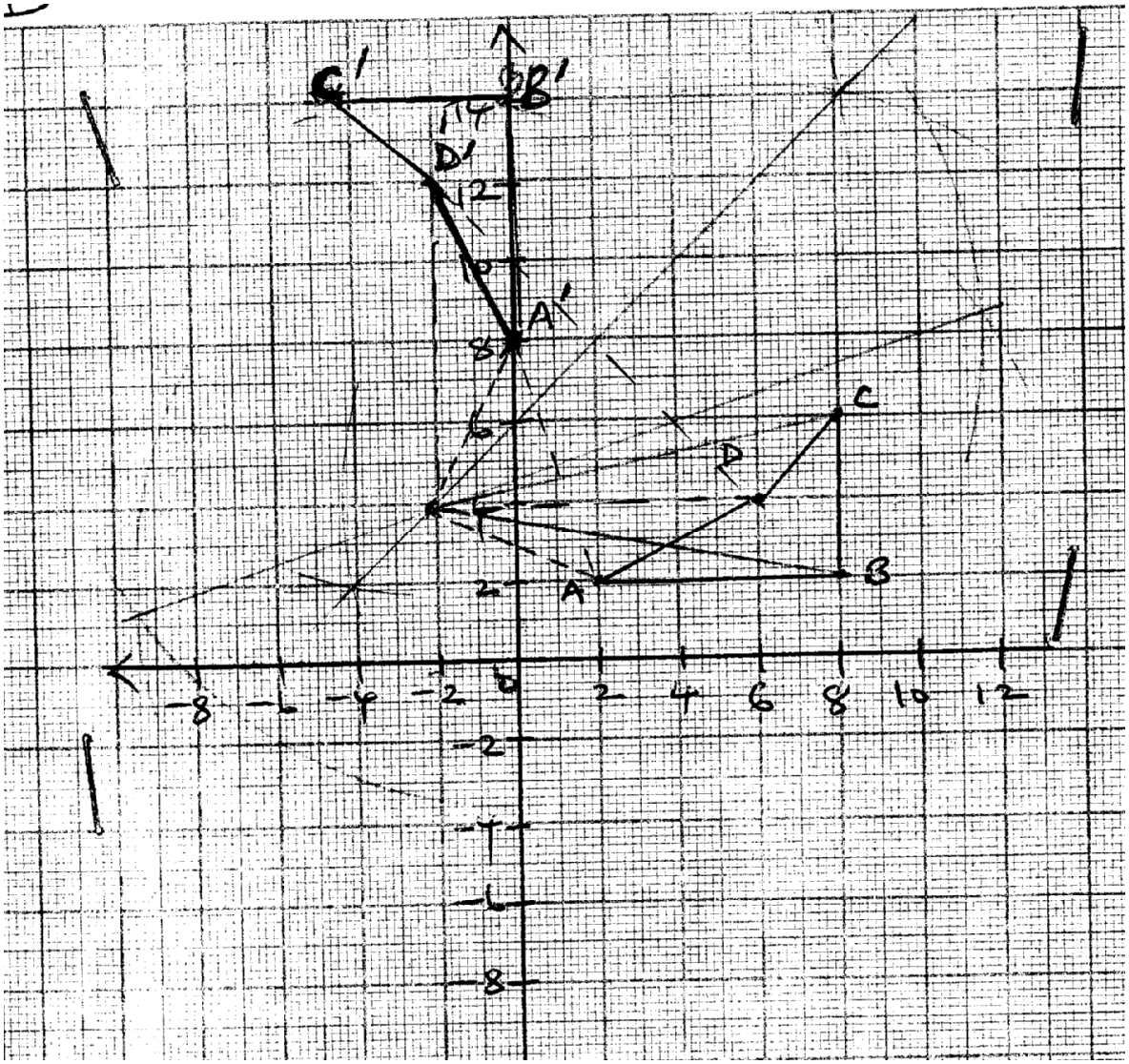
A_2 (-1, 2)
B_2 (-2, -6)
C_2 (-6, 4)
D_2 (-6, 4)

(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)*

$$\begin{pmatrix} 5 \\ -3 \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$$

$$\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$$

$$R^1 = \begin{pmatrix} -2 \\ \end{pmatrix} + \begin{pmatrix} -3 \\ \end{pmatrix}$$

$$\begin{pmatrix} \\ \end{pmatrix}$$

$\begin{matrix} -3 & -2 \end{matrix}$

$= \begin{matrix} -5 \\ -5 \end{matrix}$

$P^1R^1 = \begin{matrix} -5 & - & -2 \\ -5 & & -5 \end{matrix}$

$= \begin{matrix} -7 \\ 0 \end{matrix}$

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 = 216cm²

$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 3 & 15 \\ -9 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 5 \\ -3 & 1 \end{pmatrix}$

$5(31 - 9b = 1 \qquad 5(3c - 9d = -3$

$\underline{-15a + 3b = 5} \qquad \underline{15c + 3d = 1}$

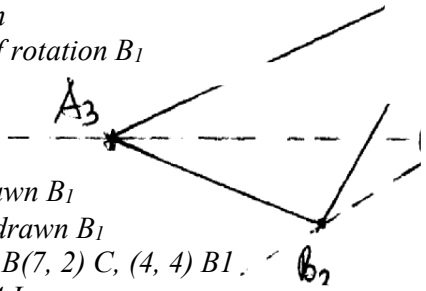
$-48b = 0 \qquad -48d = -16$

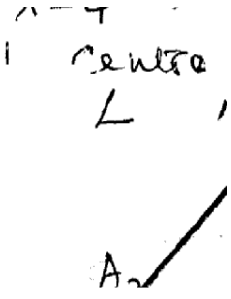
$b = 0 \qquad d = {}^1/_3$

$a = {}^1/_3 \qquad c = 0$

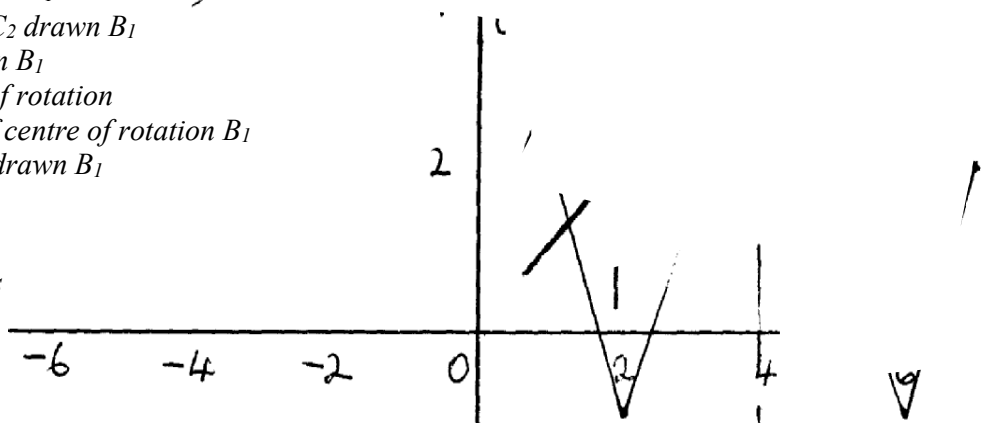
matrix $\begin{pmatrix} {}^1/_3 & 0 \\ 0 & {}^1/_3 \end{pmatrix}$

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) $\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} A^1 & B^1 & C^1 & D^1 \\ 3 & 3 & 1 & 4 \\ 4 & 2 & 4 & 5 \end{pmatrix}$

$= \begin{pmatrix} A^{11} & B^{11} & C^{11} & D^{11} \\ -5 & -1 & -7 & -6 \\ 4 & 2 & 4 & 5 \end{pmatrix}$

$A^{11}(-5, 4)$, $B^{11}(-1, 2)$, $C^{11}(-7, 4)$ and $D^{11}(-6, 5)$
(ii) A stretch with y-axis invariant and a sketch factor (3)
$2h = 6$
$h = 3$

$-5a + 4b = 4$
$-a + 2b = 2$

$-5a + 4b = 4$
$-a + 4b = 4$
$-4a = 0$
$a = 0$
$b = 1$

$-5c + 4d = -3$
$-c + 2d = 3$
$-5c + 4d = -3$
$-c + 4d = -6$
$-4c = 3$
$c = -\frac{3}{4}$
$d = \frac{15}{8}$

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

(c) $\begin{pmatrix} 0 & -2 \\ 2, & 0 \end{pmatrix}$ $\begin{pmatrix} 5, & 7 & -2 \\ -1, & -1, & 2 \end{pmatrix}$ $\begin{pmatrix} 5, & 7 & -2 \\ -1, & -1, & 2 \end{pmatrix}$

$\begin{pmatrix} 0 & -2 \\ 2, & 0 \end{pmatrix}$ $\begin{pmatrix} 1 & -1 \\ 0, & 1 \end{pmatrix}$ $\begin{pmatrix} 0, & -2 \\ 2, & -6 \end{pmatrix}$

(d)) Area of $\Delta X_2y_2Z_2$
$= 4 \times 15 = 60cm^2$

10. $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{matrix} 2 & 4 \\ 1 & 1 \end{matrix} \begin{matrix} 4 & 2 \\ 4 & 4 \end{matrix} = \begin{matrix} 7 & 14 \\ 8 & 7 \end{matrix} \begin{matrix} 14 & 8 \\ 16 & 16 \end{matrix}$

$2a + b = 8$

$\underline{4a + b = 14}$

$-2a = -6$

$6 + b = 8$

$b = 2$

$\therefore 6 + b = 8$

$b = 2$

$2c + d = 7$

$\underline{4c + d = 7}$

$-2c = 0$

$c = 0$

$d = 7$

$\therefore \begin{pmatrix} 3 & 2 \\ 0 & 7 \end{pmatrix}$

- it is an enlargement with scale factor 3 with centre (-1, -2)

(c) $\begin{pmatrix} 8 \\ 7 \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 7 \\ 9 \end{pmatrix}$

$a + 8 = 7 \qquad 7 + b = 9$

$a = -1 \quad b = 2$

$\therefore T = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

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) C^{111} = (-8, 4) B_1 All correct

B^{111} = (-6, 0) 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^1 (-3, 5) B^1(-2, 6) C^1(6, -16)

$\begin{pmatrix} 2 & -1 & -3 \\ 1 & 2 & 5 \end{pmatrix} = \begin{pmatrix} -2 & 6 \\ 6 & -6 \end{pmatrix}$

$\begin{matrix} A^{11} & B^{11} & C^{11} \end{matrix}$

$\begin{pmatrix} & & \\ & & \end{pmatrix}$

$$\begin{matrix} -11 & -10 & 18 \\ 7 & 10 & -6 \end{matrix}$$

$A^1(-11, 7)$ $B^1(-10, 10)$ 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. $T + (2) = (4)$

$-4 \quad 0$

$T = (4 \ -2) = (2)$

$0 + 4 \quad 4$

$\therefore (2) + (-1) = (1)$

$4 \quad 2 \quad 6$

$Q(1,6)$

16. $5x^2 + 6 = 110/10$

$5x^2 + 6 = 11$

$x^2 = 1$

$x = \pm 1$

58. Statistics II

1

X	0	1	2	3	4	5
f	20	8	6	4	1	1
fx	0	8	12	12	4	5
fx^2	0	8	24	36	16	25

$\sum f = 40 \quad \sum fx = 41 \quad \sum fx^2 = 109$

$$s.d = \sqrt{\frac{109}{40} - \left(\frac{41}{40}\right)^2}$$

M_1 fx

M_1 fx^2

M_1

	$= \sqrt{2.725 - 1.050625}$ $= \sqrt{1.674375}$ $= 1.294$	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*
		Σf = 140		*Σfd = - 480*		*Σfd = 9800*

Marks awarded for √ table as follows:-

Σf = 140 BI

Column for d B1

Column for fd B1

Σfd = - 480 B1

√Column for d^2 = 9800 B_1

Σfd = 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*
				$\sum fd$ 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*
	$\sum f=80$	$\sum f99x=3676$			$\sum fx^2$33,923

Mean $= \frac{\sum fx}{\sum f} = \frac{3676}{80}$

$= 45.95$

(b) $Q1 = 30.5 + \frac{3}{14} \times 10$

$= 62.64$

$S.I.R = ½ (62.64 - 32)$

$= 15.32$

(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

$Ef = 90 \quad Efd = 170 \quad Efd^2 = 11250$

$Mean = \frac{E + d}{Ef} + A$

$= \frac{-170}{90} + 22$

$= 22 – 1.888 = 20.11$

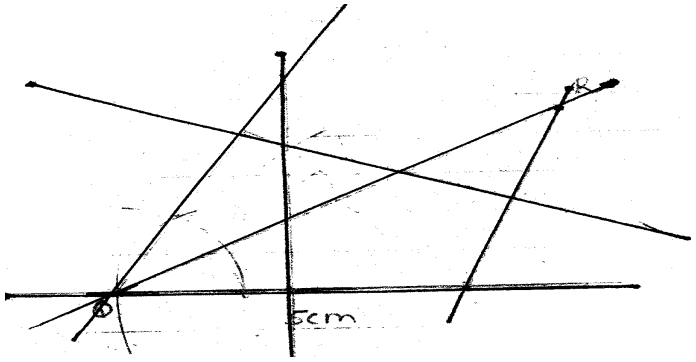
ii) $S.d = \sqrt{\frac{Efd}{Ef} - \left[\frac{Efd}{Ef}\right]^2}$

$= \sqrt{122 – (-1.888)^2}$

$= \sqrt{125 – 3.566} \quad = \sqrt{121.4}$

$= 11.02$

7.



$RQ = 7.5 \pm 0.1$

$< PRQ\ 40° \pm 1$

B1 circle through P, Q and R

d) $r = 4.1 \circ 0$

$A = \pi r^2$

$^{22}/_{7} \times 4.1 \times 4.1 = 52.83$

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

$$D = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$$

$$= 10\sqrt{\frac{34135.11}{40} - \left(\frac{-74}{40}\right)^2}$$

$10 \times 29.1531 = 29.1531$

b) 30th student = 10th from bottom

$$30.5 + \left(\frac{10 - 8}{7}\right)10$$

$= 30.5 + 2.9 = 33.4$ 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) $Q_1 = 39.5 + \frac{50 - 30}{72} \times 10$

$= 42.28$

$Q_3 = 49.5 + \frac{150-102}{53} \times 10$

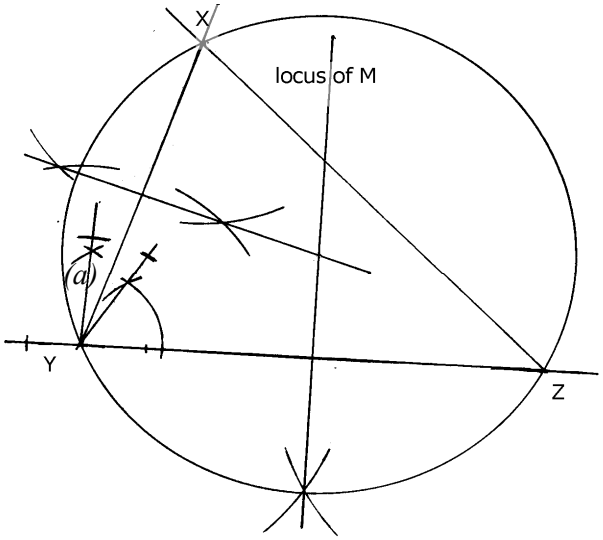
$= 58.56$

$Q_3 - Q1 = 58.56 - 42.28$

$= 16.28$

59. Loci

1.



√✓***Construction of ∠60^o and ∠90^o***

Bisect ∠ btw 90^o and 60^o to obtain ∠75^o

✓ 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

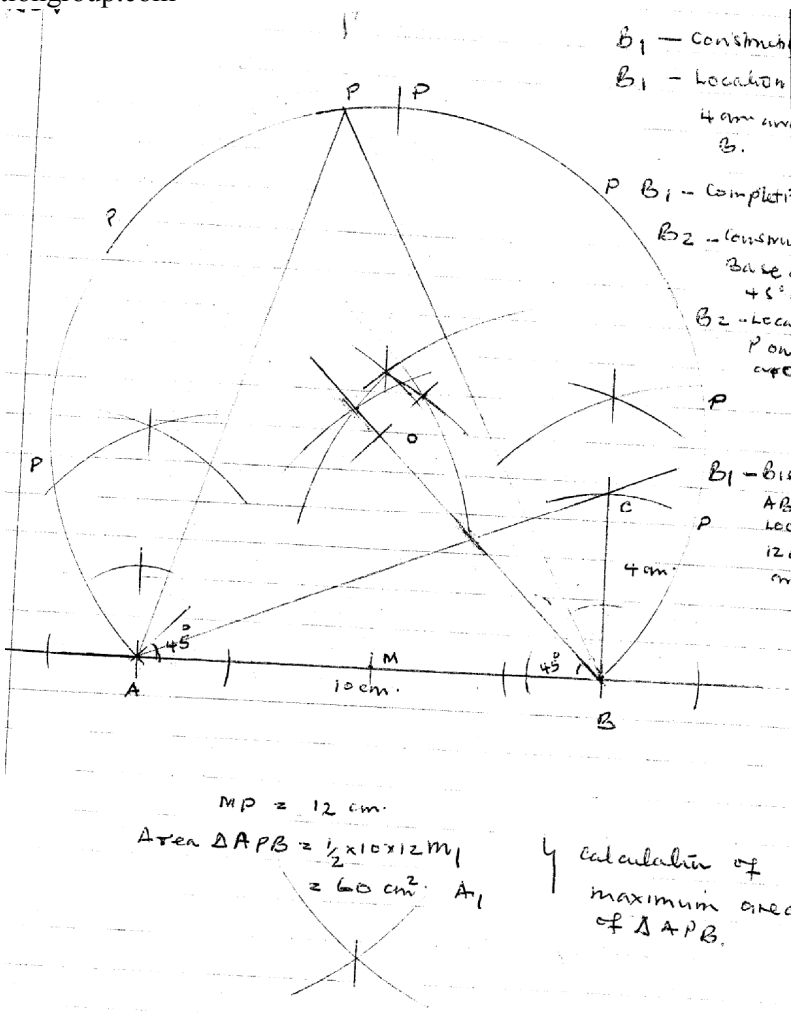
c) $h = 7 \pm 0.1$

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.

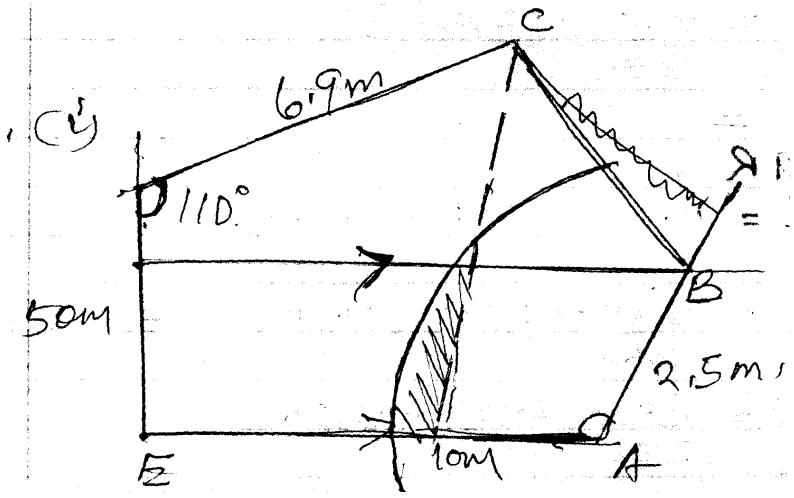


- Constructing of 90^0
- Location of C 4 cm away from B.

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

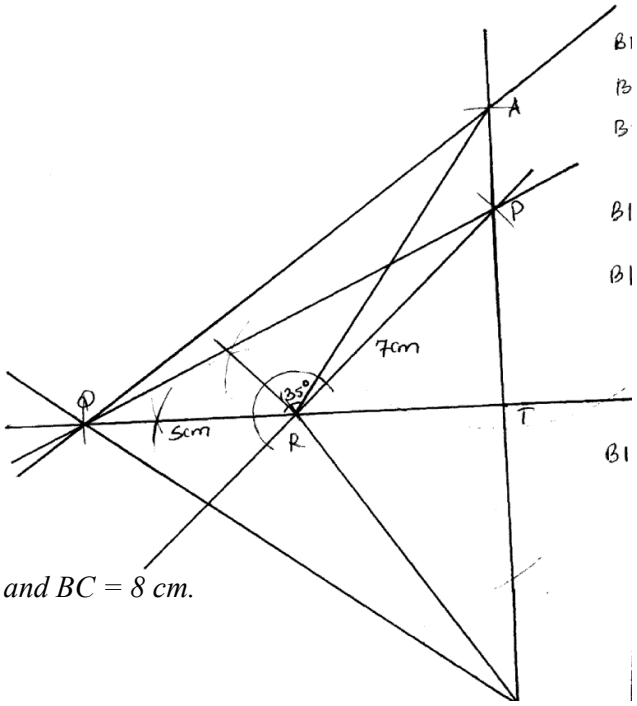
MP = 12 cm
Area Δ APB = ½ x 10 x 12 = 60 cm^2

5. i)



ii) Yes

6. *(a)*



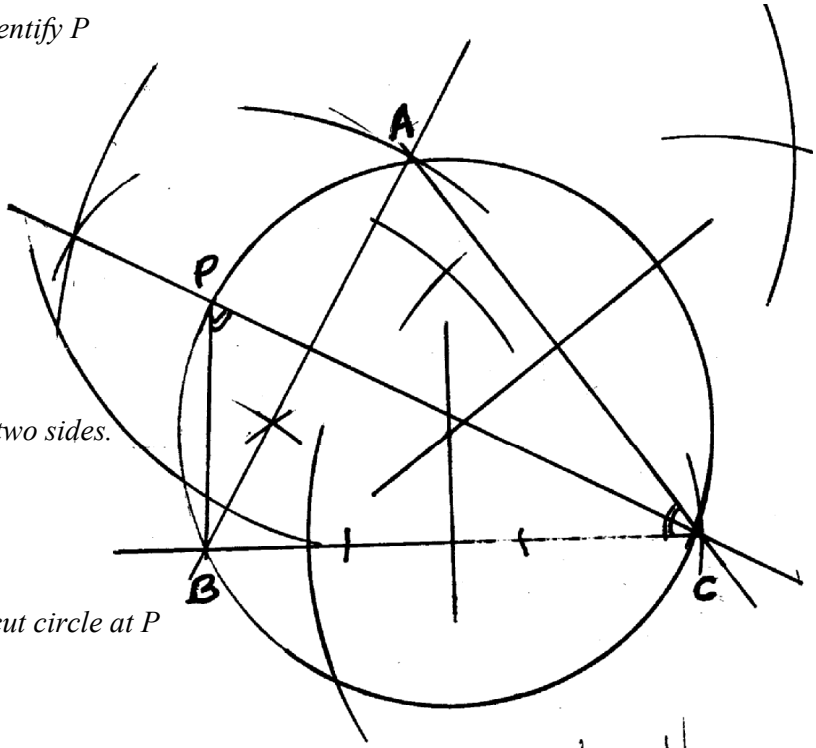
b) < PQR = 26° + 1°
d) 4.9 + 0.1cm
e) AT = u = 8.7cm
f) <AQR = 37 + 1

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

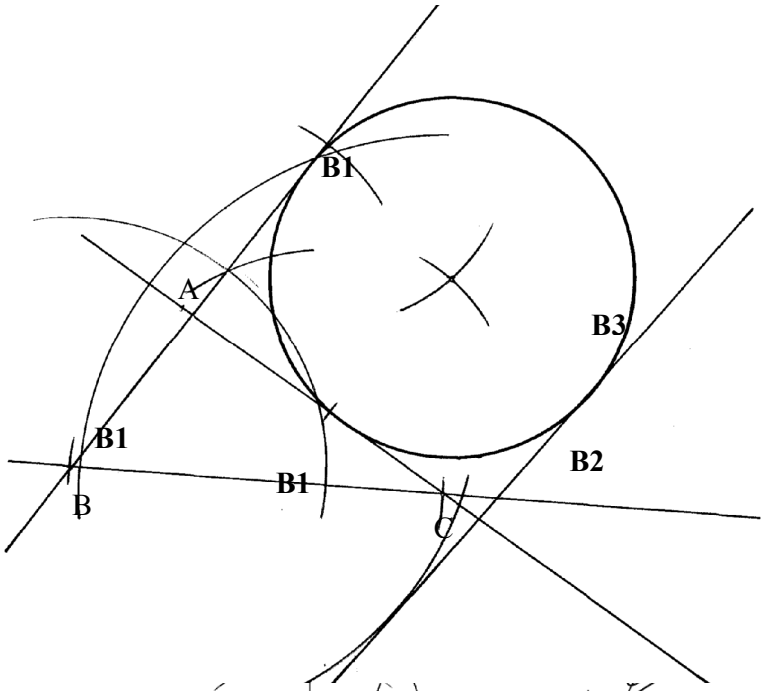
(c) Perpendicular bisectors of any two sides.
Circle drawn
Radius = 4.4.±0.1. cm

(d) ∡ ACB bisected
Bisection line drawn to cut circle at P
∡BPC = ∡BAC = 67°
∡ PBC = 88 ± 0.1°

AB = 7cm, BC = 8cm

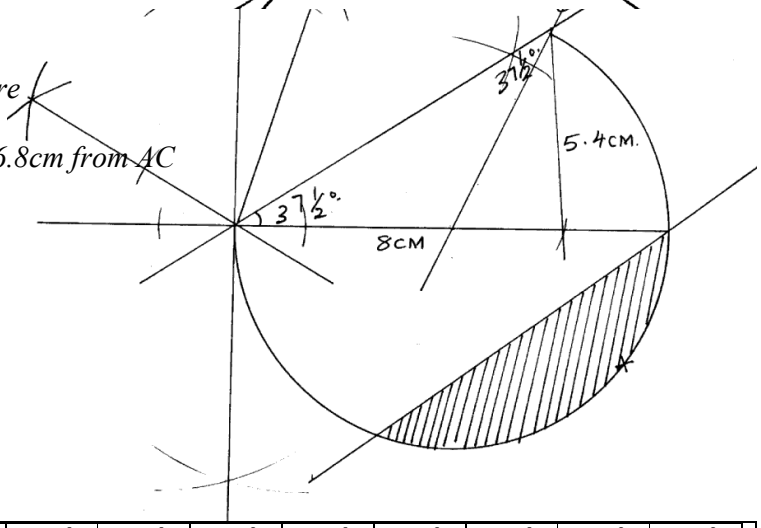
B1
B1 check

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

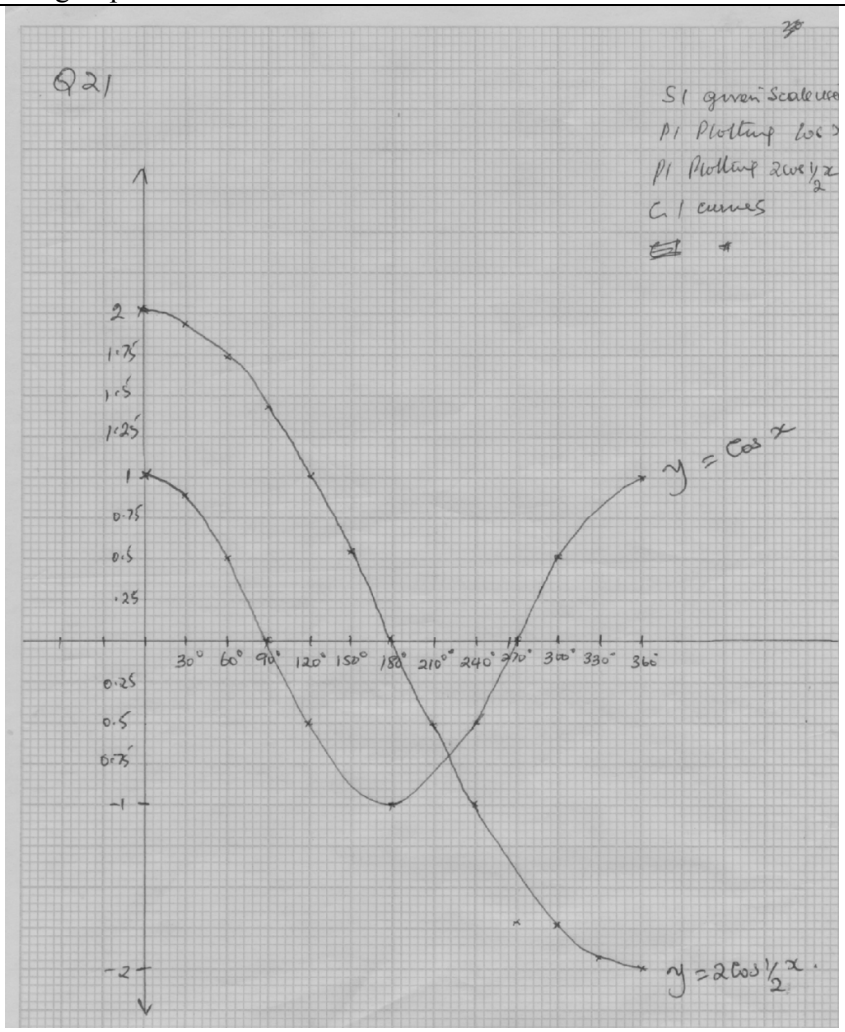
(b) *(i) B1For locating locus centre*
B1 for locus of X
(ii) B1 for constructing arcs 6.8cm from AC
B1 for locus Y
(c)B2 for shading the locus of P



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



B1	All values of cos x		
B1	All values of cos ½ x		
S1	Given scale used		
P1	Plotting cos x		
P1	Ploting 2 cos ½ x		
C1	Curve smooth continous		
B1			
B1			

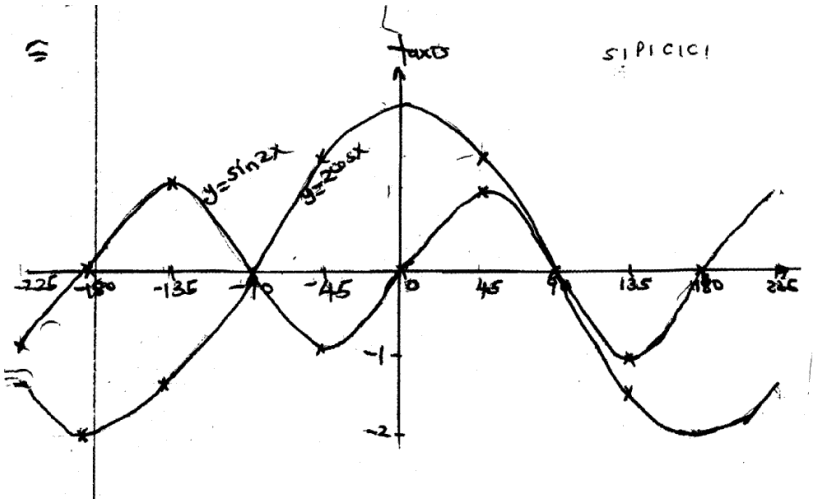
(a) amplititude = 2 B1
period = 720^0 B1

(b) 2cos ½ x = cos x
X = $222^0 \pm 6^0$

1. a)

X°	*-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) -90º or 90º
(d) (i) Highest point 1 unit
Lowest point - 1.4

2.

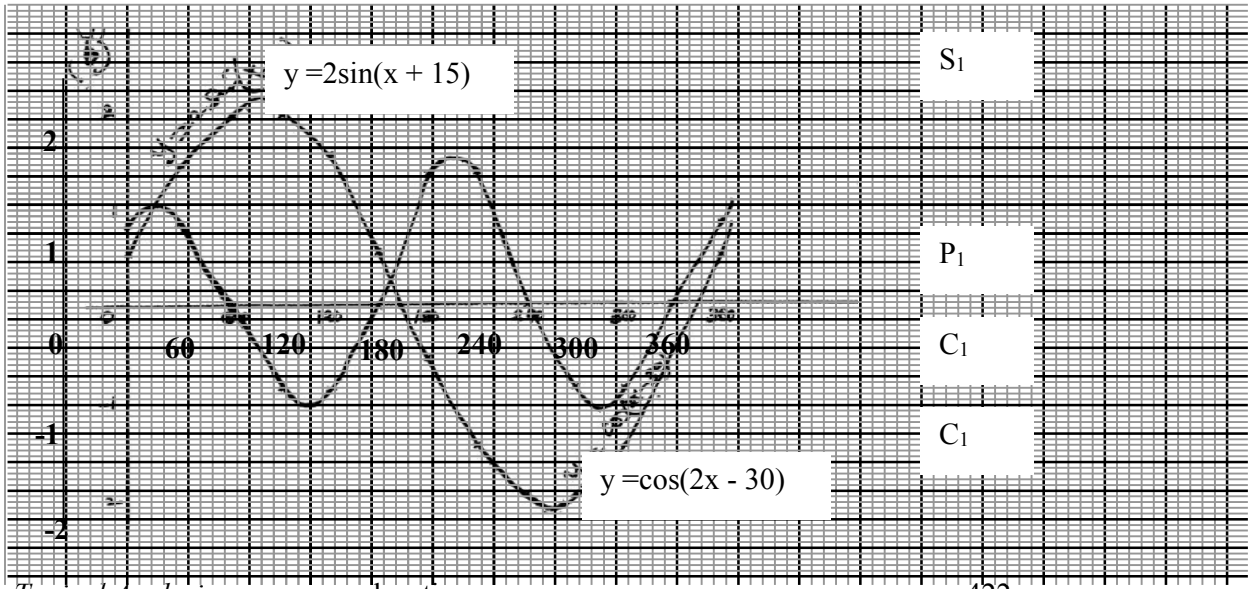
x	*0*	*30*	*60*	*90*	*120*	*150*	*180*	*210*
2sin(x+15º)	*0.52*	*1.41*	*1.93*	*1.93*	*1.41*	*0.52*	*-0.52*	*-1.41*
Cos(2x -30º)	*0.87*	*0.87*	*0*	*-0.87*	*0.87*	*0*	*0.87*	*0.87*

x	*240*	*270*	*300*	*330*	*360*
2sin(x+15º)	*-1.93*	*-1.93*	*-1.41*	*-0.52*	*0.52*
Cos (2x -30º)	*0*	*-0.87*	*-0.87*	*0*	*0.87*

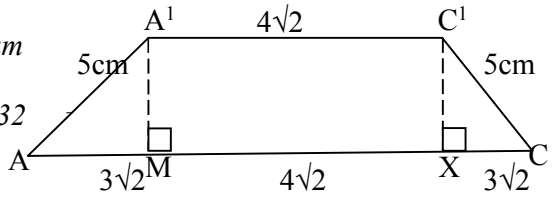
B_1 B_1 B_1

(i) Amplitudes:, y = 2 sin (x + 15)
= 2units
y = cos (2x – 30) B_1
=1unit B_1

12º, 159º



3. *Determine the*



i) Altitude of the frustrum

Solution

$A^1C^1 = \sqrt{4^2 + 4^2} = \sqrt{32}$

$AC = \sqrt{10^2 + 10^2}$

$= \sqrt{200}$

$= 10\sqrt{2}$

$AM + XM = 10\sqrt{2} - 4\sqrt{2}$

$= 6\sqrt{2}$

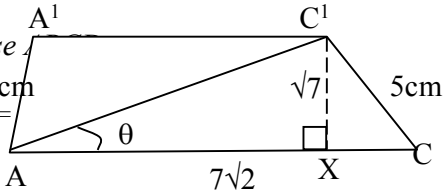
$AM = {}^{6\sqrt{2}}/_{2} = 3\sqrt{2}$

$Height = AM = \sqrt{5^2 - (3\sqrt{2})^2} = \sqrt{25 - 18}$

$= \sqrt{7} = 2.646$

$\therefore$ *the altitude of the frustrum = 2.646 cm*

ii) Angle between AC and the base



$AX = 3\sqrt{2} + 4\sqrt{2} = 7\sqrt{2}$

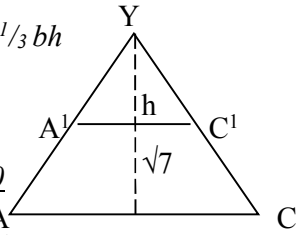
$Tan\ \theta = {}^{CX}/_{AX} = {}^{\sqrt{7}}/_{7\sqrt{2}} =$

$= 0.2673$

$\theta = tan^{-1}0.2673$

$= 14.96°$

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. $(A/B)^2 = \frac{p + 33q}{q - 3P}$

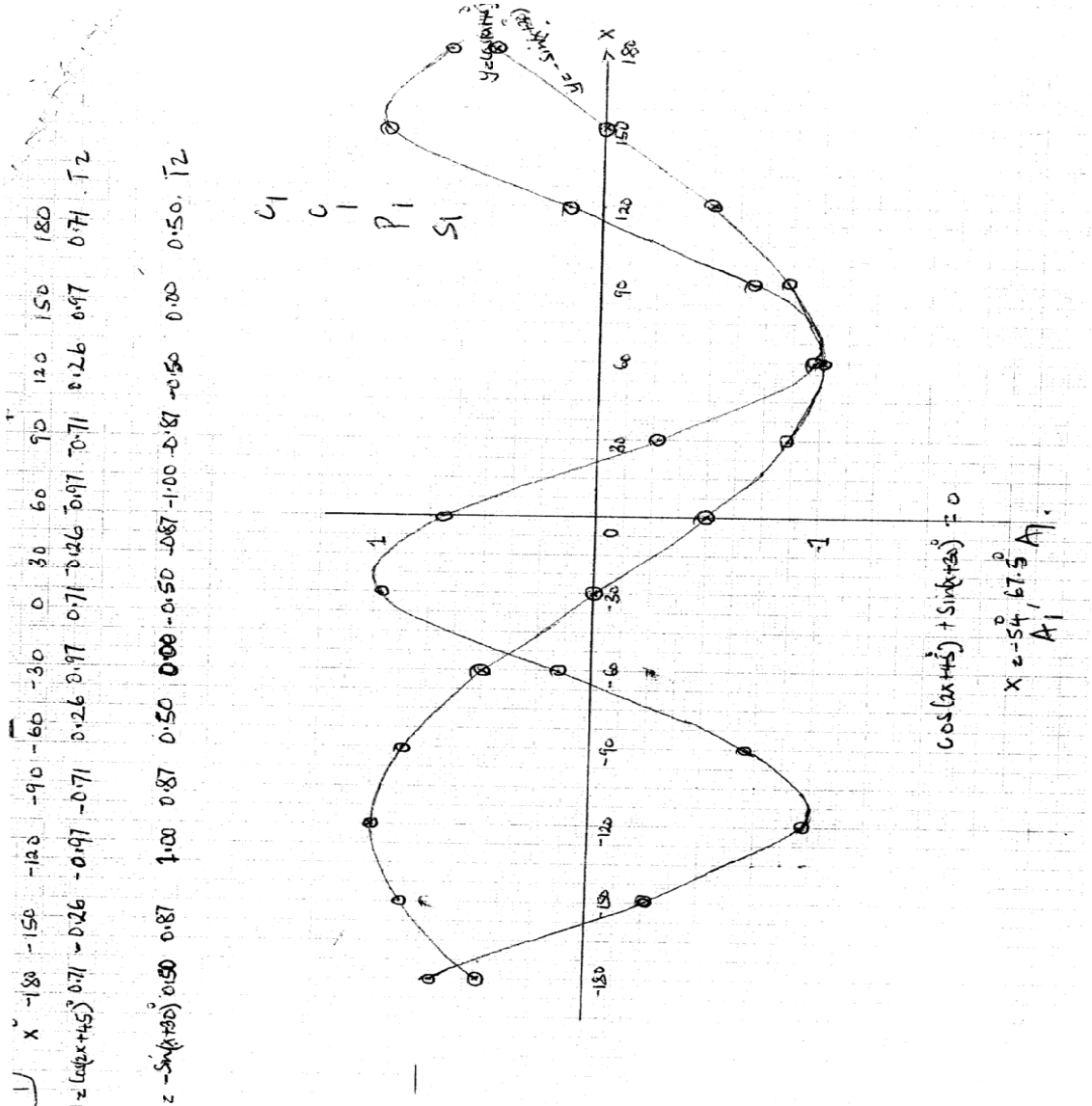
$A^2q - 3A^2P = BP + 3Bq$

$Aq^2 - 3Bq = BP + 3A^2P$

$2(A^2 - 3B) = BP + 3A^2P$

$Q = \frac{BP + 3A^2P}{A^2 - 3B}$

6.



7. 7. $\frac{\sqrt{3}}{2} \times \frac{1}{2}$

$\frac{1}{\sqrt{3}} \times \frac{1}{\sqrt{2}}$

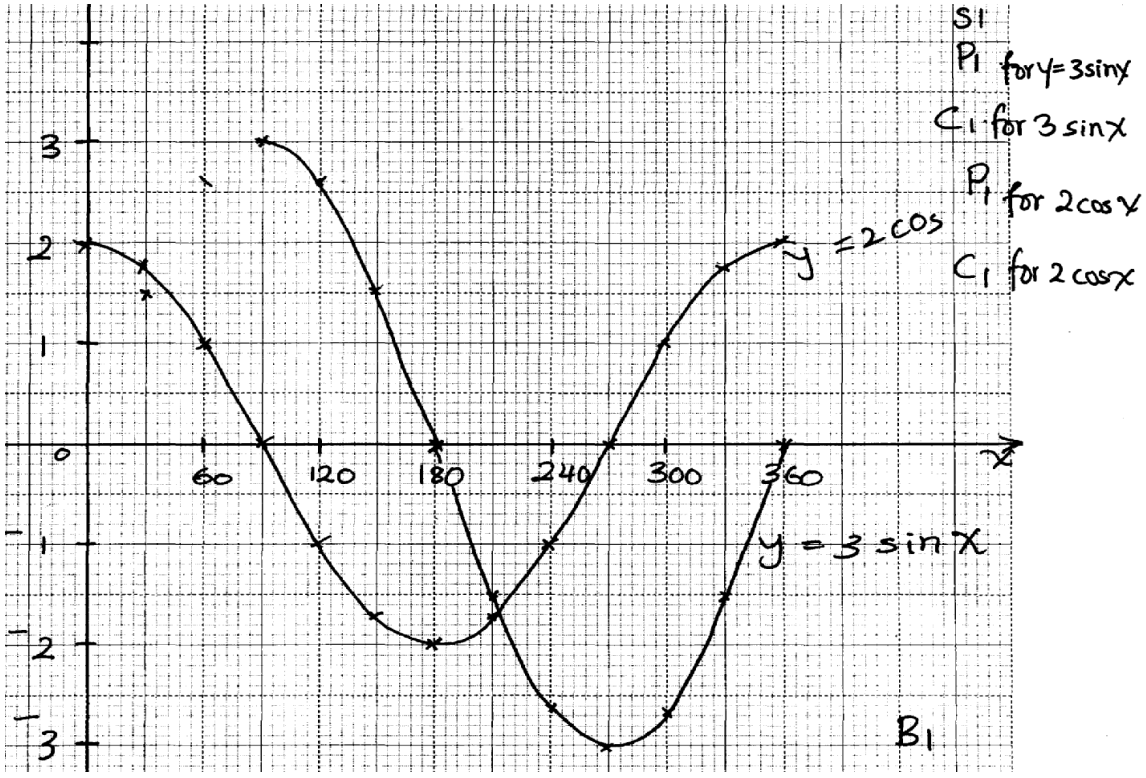
$\frac{\sqrt{3}}{4} \times \frac{\sqrt{6}}{1}$

$\sqrt{18}$

$\frac{4}{3}$ $\sqrt{2}$
$\frac{}{4}$

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°
x = 216°
(iii) 33° ≤x ≤213°

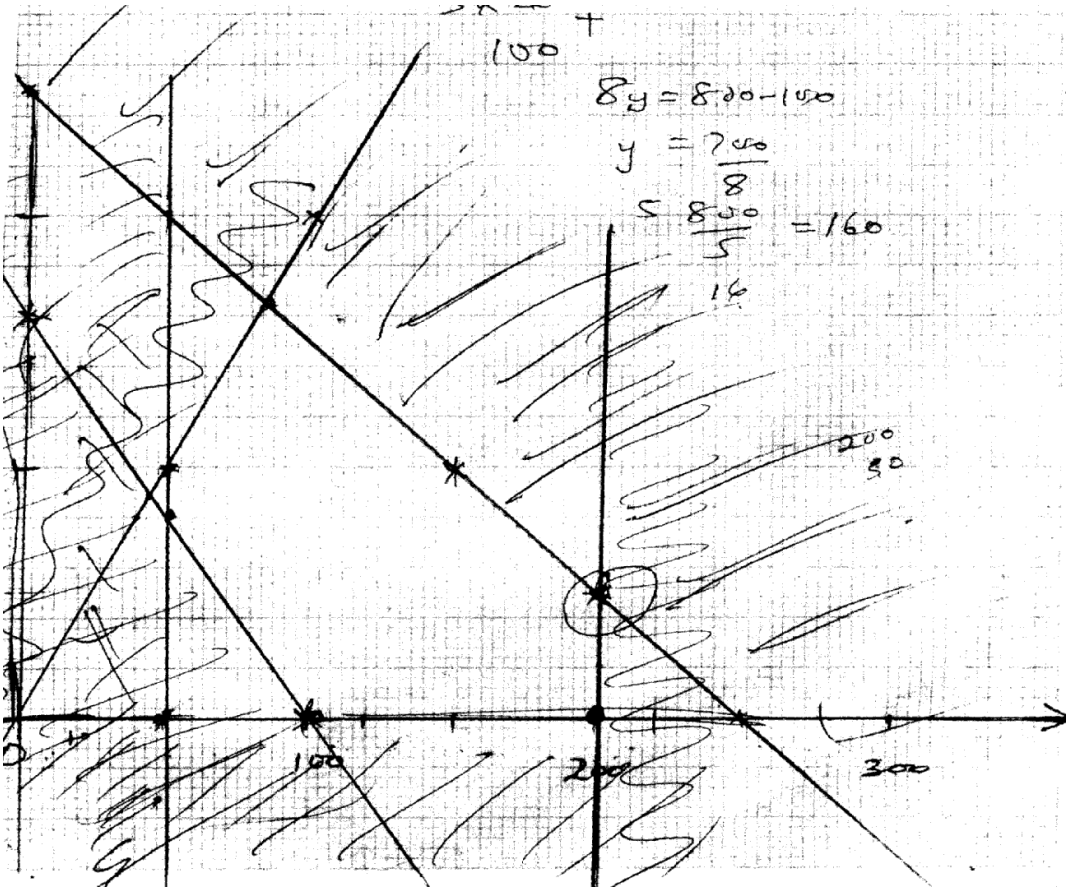
9.

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°*	*30°*	*60°*	*90°*	*120°*	*150°*	*180°*
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*



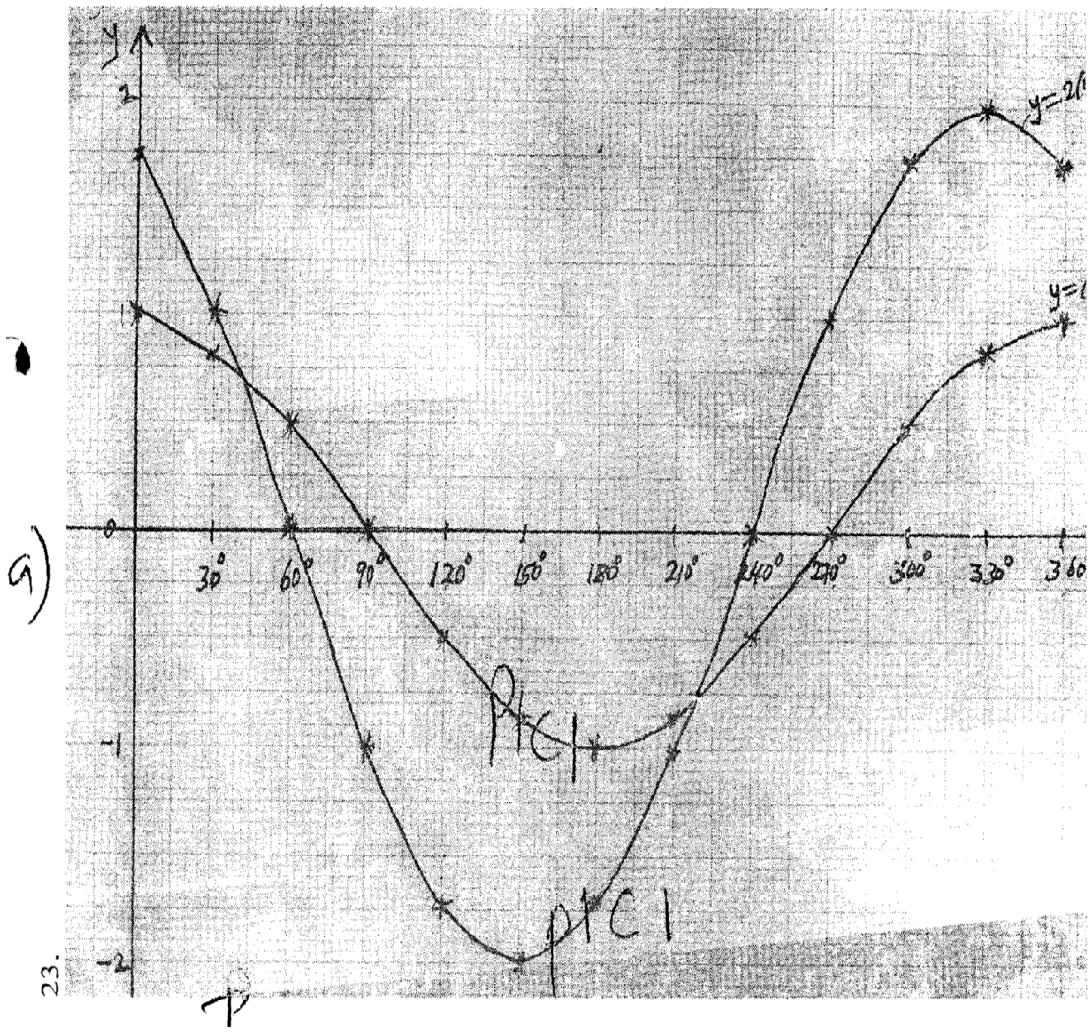
11. *Sin (x + 30) = 0.5*
x + 30 = 30°
x = 0
0, 180, 360

12. *(c)10sin x = $^{-1}/_{50}$ + 5*
Y = $^{-1}/_{50}$ + 5

X	*0*	*50*
y	*5*	*4*

X_1 = 28° ±1
X_2 = 70° ±1

12.



b) *i) amplitude = 1*
ii) Period = 360°
iii) 45°, 219°

13. $2\theta + 10 = 210^o, 330^o, 570^o, 690^o$
$2\theta = 200, 320, 560, 680$
$= 100^o, 160^o, 280^o, 340^o$
$= \frac{5\pi^c}{90}, \frac{8\pi^c}{9}, \frac{14\pi^c}{9}, \frac{17\pi^c}{9}$

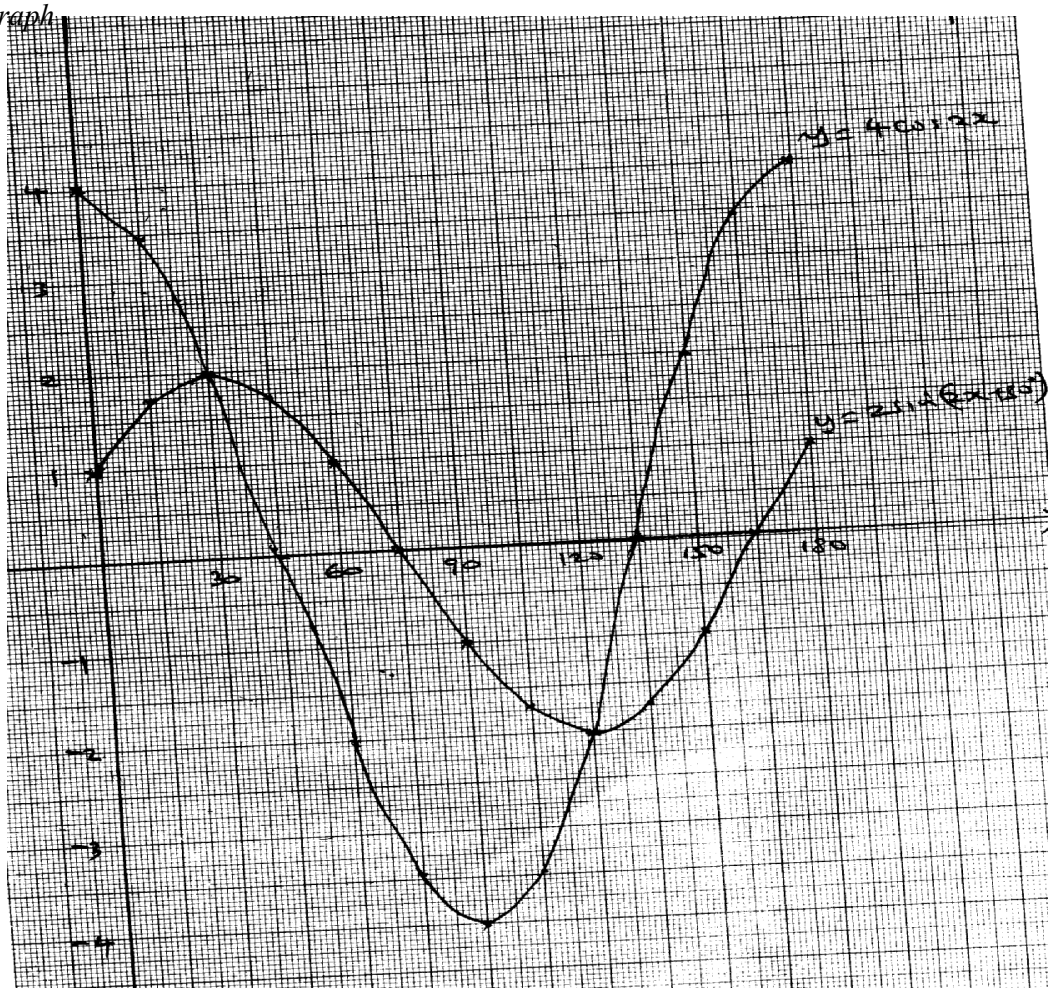
14. $4\sin 2x + 4\cos x - 5 = 0$

4(1-cos2X) + 4 cosx -5= 0
4cos2x – 4 cosx + 1=0
4cos2x – 2cosx – 2cos x +1 =0
(2cos x – 1)2 = 0
X = 60°, 300°

15.

x	*15°*	*60°*	*150°*	*165°*
4 Cos 2x	*3.46*			*3.46*
2Sin (2x + 30°)		*1.00*	*-1.00*	

(b) graph

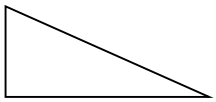


(c)(i) Amplitude = 4
(ii) period = 180°

(d) x = 30°, 120°

60. Three dimensional geometry

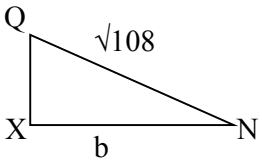
1. a)



$QN = \sqrt{12^2 - 6^2}$

$= 10.39$

b)

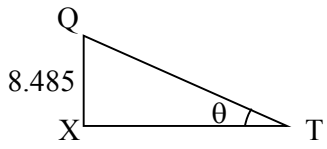


$QX = (\sqrt{108})^2 - 6^2$

$= \sqrt{72}$

$= 8.485$

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) $\frac{Sin}{a} \frac{36^0}{} = \frac{5}{}$

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) ½ ab sin θ

½ x 8.507^2 Sin 72 x 5

$= 172.06\ cm^2$

c) $\frac{Tan}{x} \frac{36^0}{} = \frac{5}{}$

$x = 6.882$

$Tan \theta = 16.09$

6.882

$\theta = 66.84^2$

d) $^1/_3 \times 172.06 \times 16.09 = 922.8cm^3$

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) $AC = \sqrt{4.2^2 + 7.5^2}$

$= \sqrt{17.64 + 56.25}$

$= \sqrt{73.89}$

$= 8.596$

$AO = 8.596 \div 2 = 4.298$

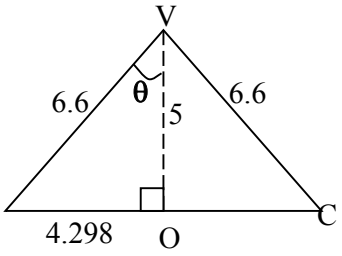
$AV = \sqrt{AO^2 + OV^2}$

$= \sqrt{4.298^2 + 5^2}$

$= 18.47 + 25$

$= \sqrt{43.47}$

$= 6.6cm$



(iii) $Tan\theta = \frac{4.298}{5}$

$= 0.8596$

$\theta = 40.68^o$

$\angle AVC = 40.68 \times 2$

$= 81.36$

Alternative

$\cos\theta = \frac{5}{6.6} = 0.7576$

$\theta = 40.749^oC$

$\angle AVO = 40.749^o$

$\angle AVC = 81.498^o$

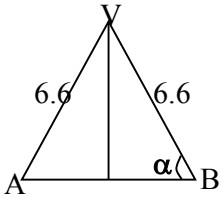
(iv) $Cos\alpha = \frac{2.1}{6.6}$

$= 0.3182$

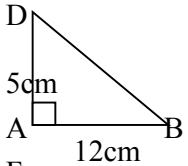
$\alpha = 71.45^o$ Acute angle

obtuse angle $= 180^o - 71.45^o$

$= 108.55^o$



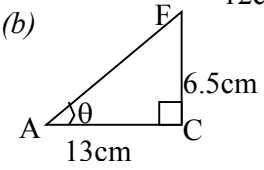
4. (a)



$BD^2 = 12^2 + 5^2 = 144 + 25 = 169$

$BD = \sqrt{169} = 13m$

(b)

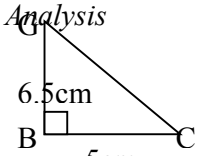


$AF^2 = 13^2 + 6.52 = 169 + 42.25$

$= 211.25$ $AF = \sqrt{211.25} = 14.53cm$ B1

$\tan\theta = \frac{6.5}{13} = 0.5$ M1

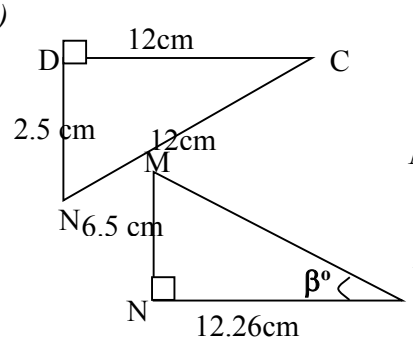
$\theta = 26.57^o$ A1



(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*

$AC = \sqrt{AB^2 + BC^2}$

$= \sqrt{10^2 + 10^2}$

$= \sqrt{200}$

$= 14.142$

$\therefore OA = \frac{1}{2} AC = \frac{14.14^2}{2} = 7.71$

A θ 7.71 C

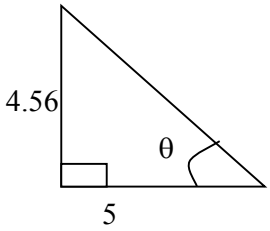
$OE = \sqrt{AE^2 - AO^2}$

$= \sqrt{64 - 59.44} = 4.56$

5

b)i) $\tan\theta = \frac{4.56}{5.00} = 0.912$

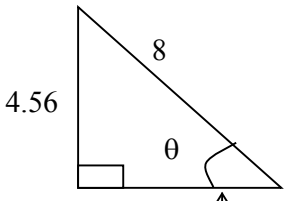
$\theta = 65.78°$

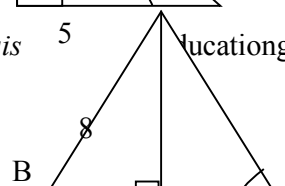


ii) $\tan\theta = \frac{4.56}{7.71} = 0.5914$

$\theta = 30.\ 6°$

c)



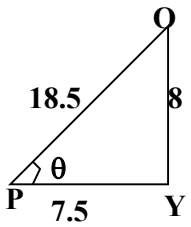


$< AEC = 30.6 \times 2$
$= 61.2°$

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 = ½ x11.6 x 5.5 – ½ x 4.4 x 2.1
$= 27.28\ m$
Total surface area = 4 x 27.28 + 2.1 x 2.1 = 113.5

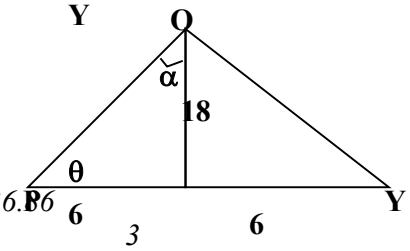
b) ½ litre paint $10m^2$
4 litres paints $80m^2$
$\therefore 113.5m^2$ requires 2 tins
2 x 650 = Kshs.1300/=

8. (a) $PR = 12^2 + 9^2 = 144 + 81 = 225 = 15cm$
$h = \sqrt{19.52 - 7.52}$
$= \sqrt{380.25 - 56.25}$
$= \sqrt{324} = 18$



(b) $\tan\theta = \frac{18}{7.5} = 2.4$
$\theta^2 \tan 2.4 = 67.38^o$

(c) $\tan\alpha = \frac{6}{18} = \frac{1}{3}$
$\alpha = \tan^{-1} 0.3333$
$= 18.43^o$
$\therefore \angle x\ OY = 2 \times 18.43 = 36.86$



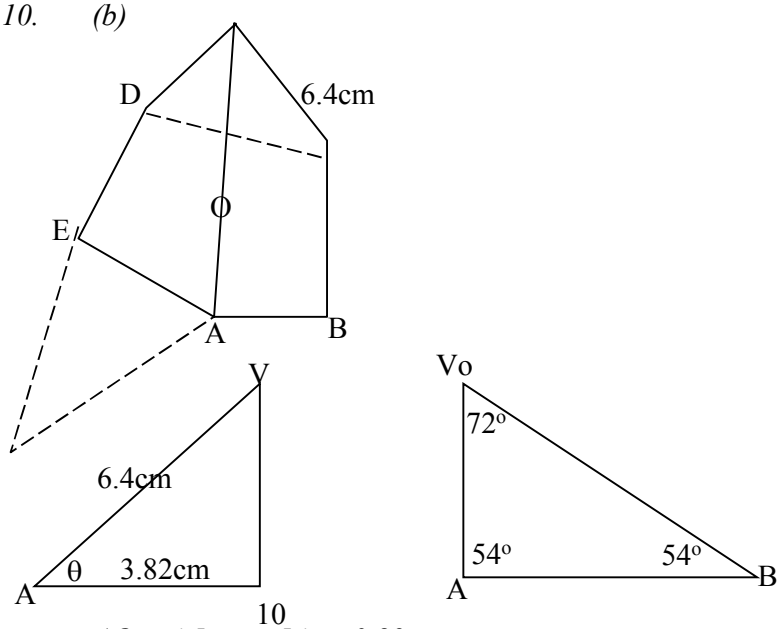
(d) Volume = $\frac{1}{3} \times 12 \times 9 \times 18$
$= 648cm^3$

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 = 12x12 = 144cm
$\therefore$ Volume = $\frac{1}{3} \times 144 \times 22.45$
$= 1077.6cm^3$

c) Slanting surface = √30(30-24) (30-24) (30-12)
= 139.44cm²
Total curved S.A = 139.44cm² x 4 + 144cm²
= 701.6cm²

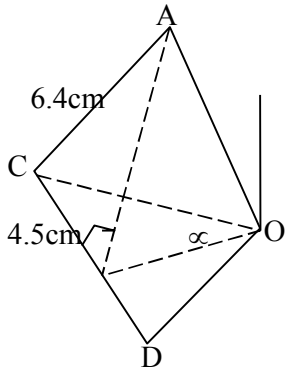
10. (b)



10

AO = 4.5 x sin 54° / Sin 72° = 3.82cm
= cos⁻¹ (3.82/6.4) = 53.35°

(c) Vo = √6.42 – 3.82
= 5.13
VX = √6.4² – 2.55²
= 5.99cm
∝= Sin⁻¹ (Vo/Vx) Sin-1(5.13/5.99)
∝= 58.91°



11. a) Longitude difference = 139 ° + 41 °
= 180 °

b) Distance along latitude = $^{\emptyset}/_{360}$ x 2 π r cos θ
= $^{180}/_{360}$ x 2 x $^{22}/_{7}$ x 6370 cos 60°
= 22 x 910 x 0.5
= 10,010 Km

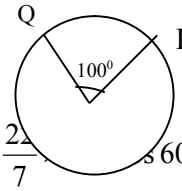
Or via north pole (great circle)
Latitude difference = 60°
Distance = $^{60}/_{360}$ x 2 x $^{22}/_{7}$ x 6370
= 6673.33 Km

c) Distance = $^{long\ diff}/_{360}$ x 2πR cos 60°
420 = $^{\emptyset}/_{360}$ x 2 x $^{22}/_{7}$ x 6370 cos 60°

$$\theta = \frac{420 \times 360 \times 7}{2 \times 22 \times 6370 \cos 60^\circ}$$

= 7.552°
Longitude of C = 41° - 7.55° = 33.45°N

61. Longitudes and latitudes

1	∠ difference  $40 + 60 = 100^0$ Area $= \frac{100}{360} \times \frac{22}{7}$ (illegible) $60)^2$ $= \frac{55}{63} \times 0.01$ $= 0.008730$ $(87.30cm^2)$	B_1 M_1 A_1	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 $\therefore$ 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 $\text{Cos P} = \frac{1370}{60 \times 44}$ Cos-1 o.51894 = 58.740 58.740	M1 M1 A1	Subst Cos P the subject
		03	
4.	a = 400 E b = 600 N c = 200 W (b) R (600N, 400E) P (300N, 200W) Q (300N, 400E) S (600N, 200W) PQR PQ = 600 x 60 cos 300 = 3600x = 3117.69 ✓ QR = 30 x 60 = 1800nm ✓ Total distance = 1800 + 3117.69 = 4917.69nm PSR PS = 30 x 60 = 1800nm SR = 60 x 60 cos 60 = 1800 = Total distance 1800 + 1800 = 3600 ✓ (c) PQR speed 400nm/hr Time = 4917.69 = 12.294 hrs 400 Along PSR Time = 3600 = 12 hrs 300 2nd pilot by 0.294hrs or 18 min	B1 B1 B1 M1 A1 M1 A1 B1 B1 B1	 ✓values of PQ and QR ✓value of PS and SR
		10	

1. *(70 – 25 x 60 = 2700*
2700 Cos 47= 2700 x 0.68 = 1841.4nm

2. *(a) $\frac{22}{7}$ x 6370 x 2 x $\frac{\alpha}{360}$ = 1600*
$\alpha = 14.4^o$
Position (4.4^oN, 60^oE)
(b) 72 x 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

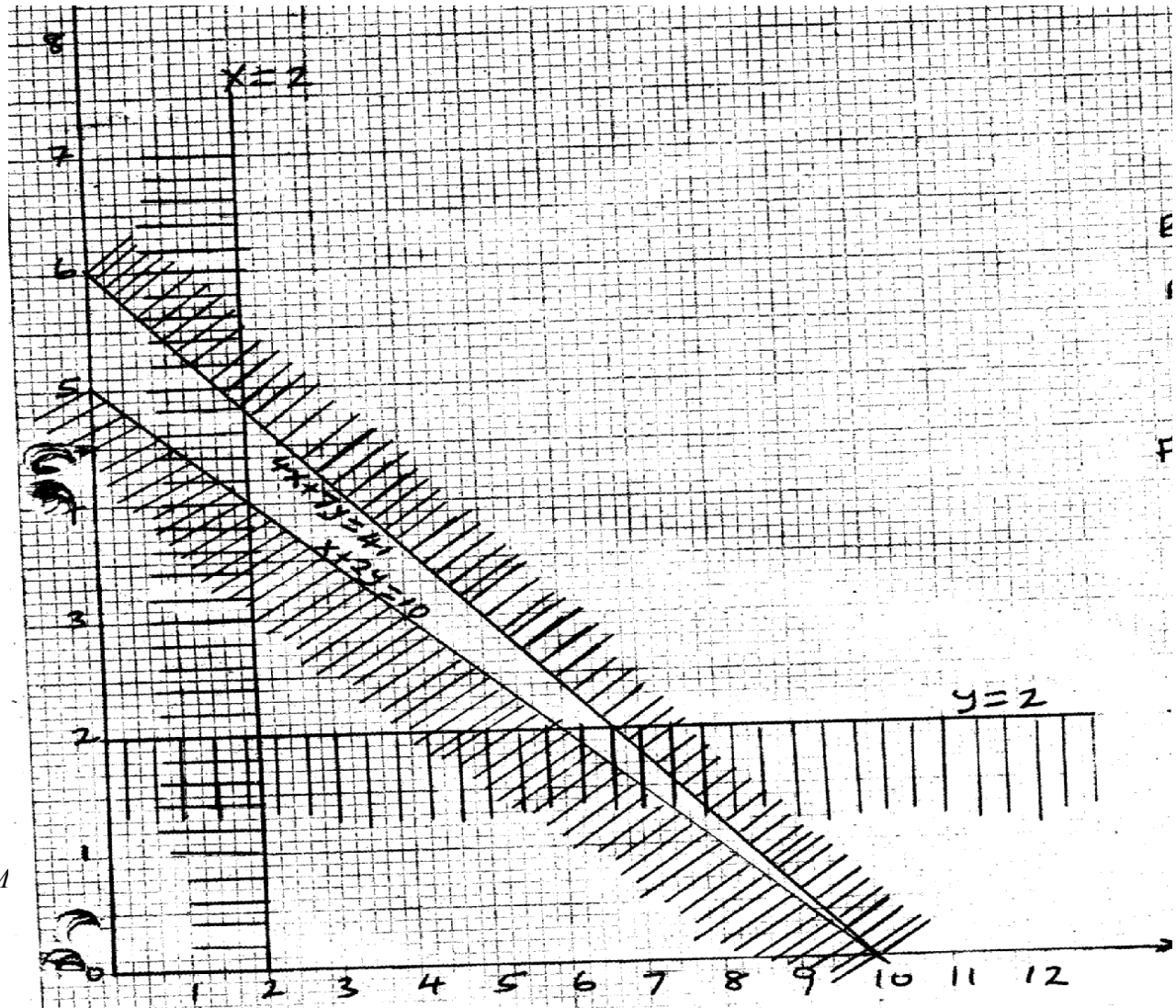
3. *a) 800 x + 1600 y ≥ 8000*
x + 2y ≥ 10

$4x + 7y \leq 41$

$x \geq 2$

$y \geq 2$

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) $\theta = 180°$
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
$\theta = \frac{4 \times 25}{9} \times 3.142$
= $\frac{314.2}{9}$ cm
= 34.9111 cm.

(ii) $\frac{\theta}{360}$ x 2 x 3.142 x 25cos 50^o = $\frac{314.2}{9}$
$\theta = \frac{314.2 \times 360}{50 \times 3.142 \times \cos 50}$
= 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 = $\frac{314.2}{}$ 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) $\frac{180}{360} \times 2 \times \frac{22}{7} \times 6370 \times \cos 360o$

$= 16196.52m$

(ii) $\frac{180}{360} \times 2 \times \frac{22}{7} \times 6370$

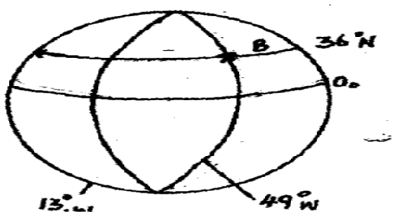
$= 12012km$

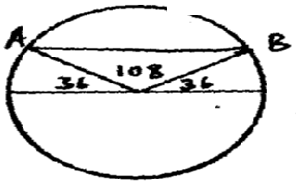
(c) $\frac{\theta}{360} \times 2 \times \frac{22}{7} \times 6370 \cos 36 = 840$

$= 9.3353^o$

$=$ *position C* $= 131\text{-}9.3^oW$

$C(36^o N, 121.7^oW)$





9. *a)* $PQ = \frac{120}{360}\pi \times 6370 \times 2$

$= \frac{240}{360}\pi \times \frac{22}{7} \times 6370 = 13,346.6$

b) $2PR \cos 60°$

$PR = \frac{100}{360} \times 2\pi \times 6370 \cos 60$

$= \frac{200}{360} \times \frac{22}{7} \times 6370 \cos 60 = 5561.1km$

c) $PN = \frac{30}{360} \times 2 \times \frac{22}{7} \times 6370$

$= 3336.67\ km$

10. *(a) (i)* $60 (z - 50) = 1200$

$Z = 20$

$Z = 70^oS$

(ii) $xy = \frac{48}{360} \times 2 \times 6370 \cos 50$

$= 3431.629km$

(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*

$= 80 \times 60 = 4800nm$

$B - C = 15 + 45 = 60\ 0$ long. Diff

$= (60 \times 60 \times \cos 45$

$= 3600 \times 0.7071 = 2545.56nm$

Total distance $= (4800 + 2525.56)nm$

$= 7345.56nm$

$\approx 7346nm$ (4.s.f)

b) $\frac{80}{360} \times 2 \times \frac{22}{7} \times 6370$ 910

$= \frac{88 \times 910}{9}$

$= 8897.78\ km$

$\approx 8898km$ (to nearest km)

c) $B - C = \frac{60}{360} \times 2 \times \frac{22}{7} \times 6370 \times \cos 45^0$

$= \frac{22 \times 910 \times 0.7071}{6 \quad 3}$

$= 471.8.7\ km$

$A - C$ in Km $= (8898 + 4718.70$

$= 13616.7\ KM$

Time taken $= \frac{13616.7}{840} = 16.21$ hours

$= 16$ hrs 13min

Arrival time $= 08.15$

$+ \underline{16.13}$

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) $3x + 2\frac{1}{2}y \leq 600$ (material)	**B1**	
	(ii) $x \leq 1000$	**B2**	all✓
	$y \geq 80$	**B1**	any two✓
	$x \geq 0$		
	(b) Lines drawn		
	$3x + 2\frac{1}{2}y = 600$	**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	**B1**	Use of search line or inspection
	maximum profit		
	100 garment og type A	**B1**	✓
	120 garments of type B	**B1**	

1. $30x + 20y \leq 4800$……..(i)
$30x + 40y \geq 3600$……..(ii)
$10x \leq 30y$……..(iii)
$x \geq 0 \quad y \geq 0$

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) consiaer (60,40)
$10(60) + 12(40) = 600 + 480$
$= 1080$
$10x + 12y = 1080$
$5x + 6y = 540$ – search line

X	20	40	60
y	73	57	40

Maximum profit at $(\alpha, 240)$
No queen cake , 240 marble cakes

(iii) $240 \times 12 = sh.\ 2880$

(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	
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

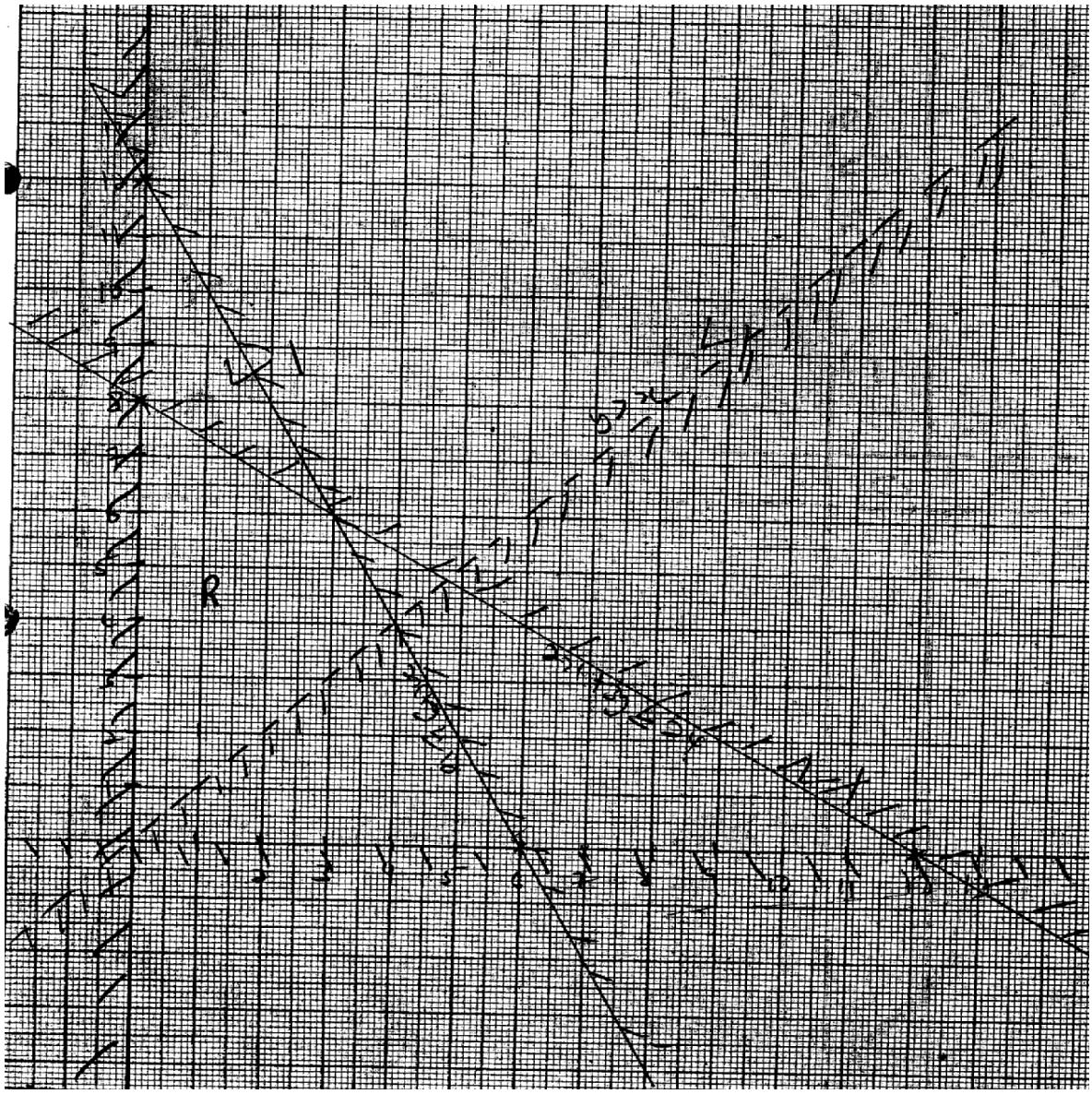
(i) $2x + 3y = 24$

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) $3x + 7y \leq 210$
$x + y\ 20$
$x < 2y$
$x > 15$

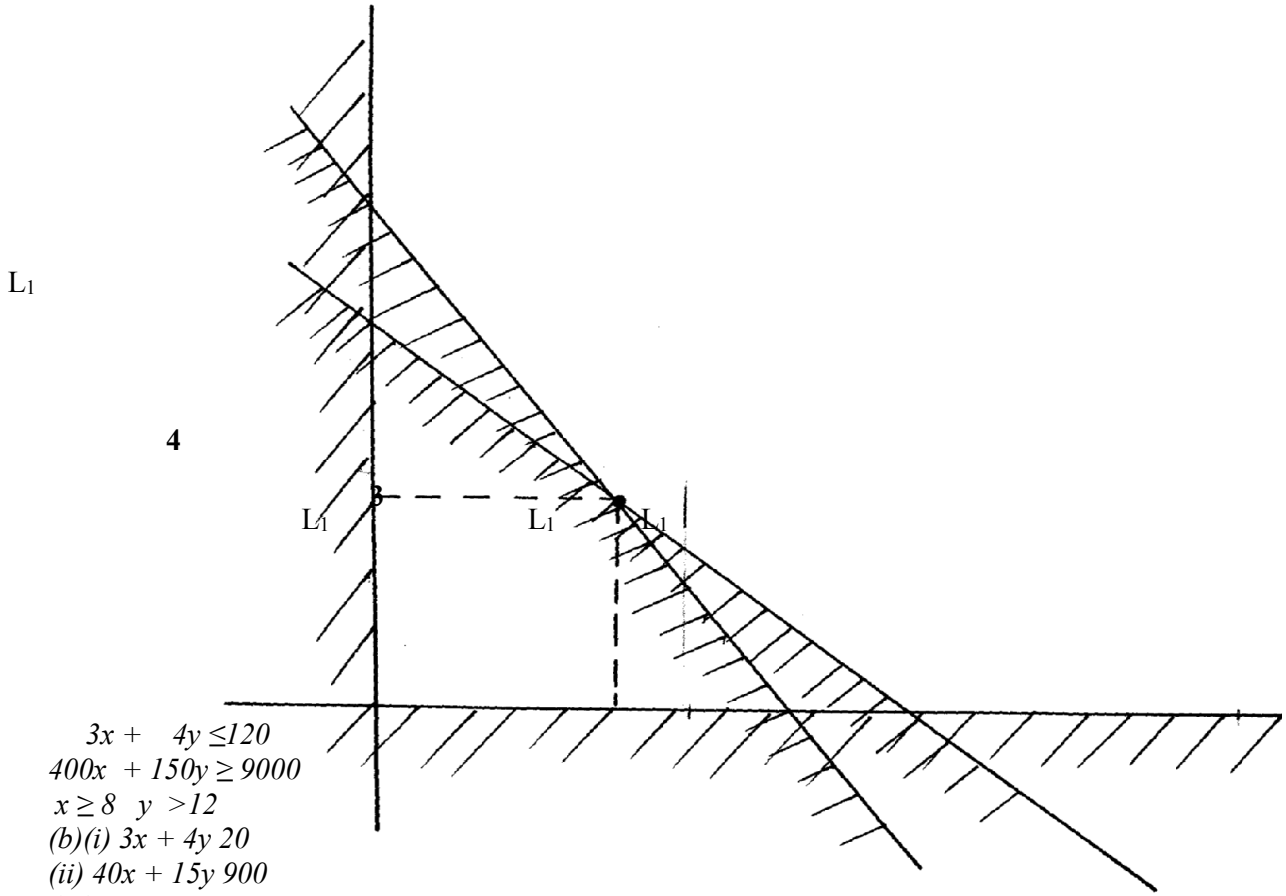
(b) refer

(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

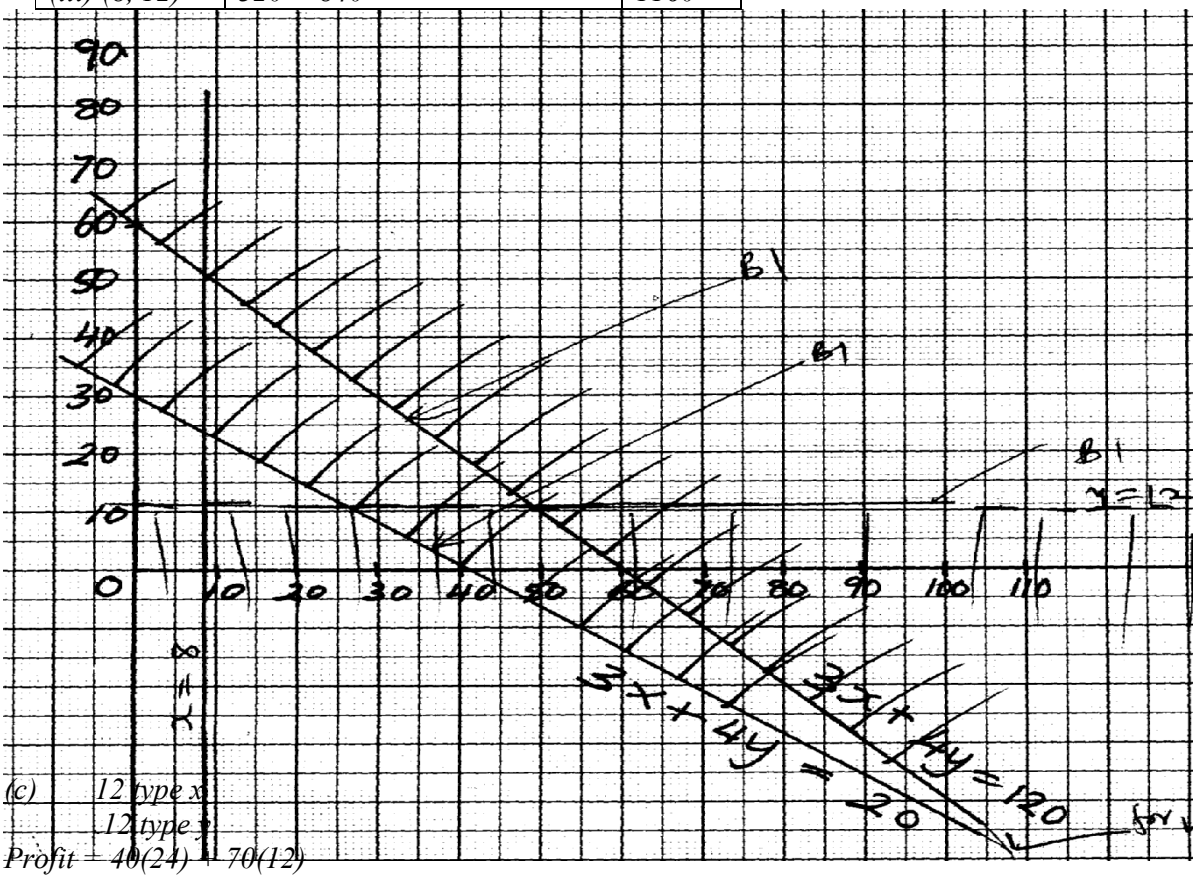
Total cost = 2500x + 20000y
(3,4)
3 type x
4 type y



5. *3x + 4y ≤120*
400x + 150y ≥ 9000
x ≥ 8 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

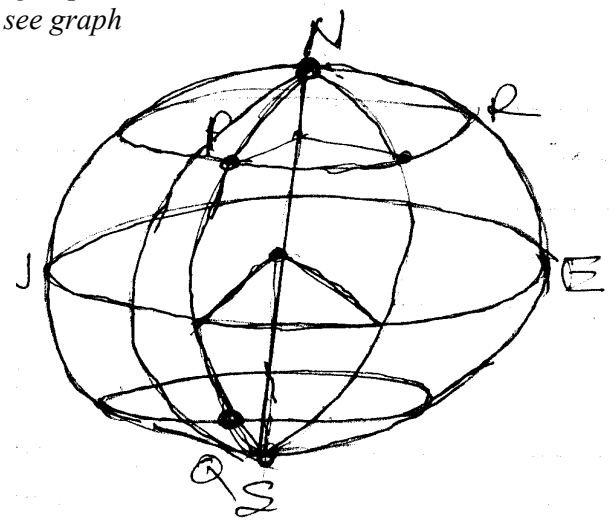
6. *100 x = 160y = 16000*
=100 x 200 + 160 x 50
20000 + 8000
28000/=

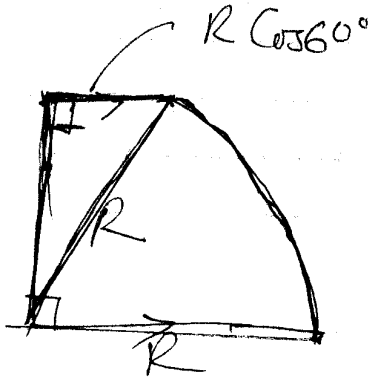
5 x 200 + 8 x 50
1000 + 4000
10 x 200 + 16 x 50=
10x + 16y = 1600
5x + 8y = 800
5 x 20 + 100
8y = 800 – 100
$y = \frac{700}{8}$
$^{800}/_{5} = 160$

a) y<2x, 50≤x≤200 x >100
y >0, x+y ≤250, 100x + 160y ≥ 16000

b) See graph

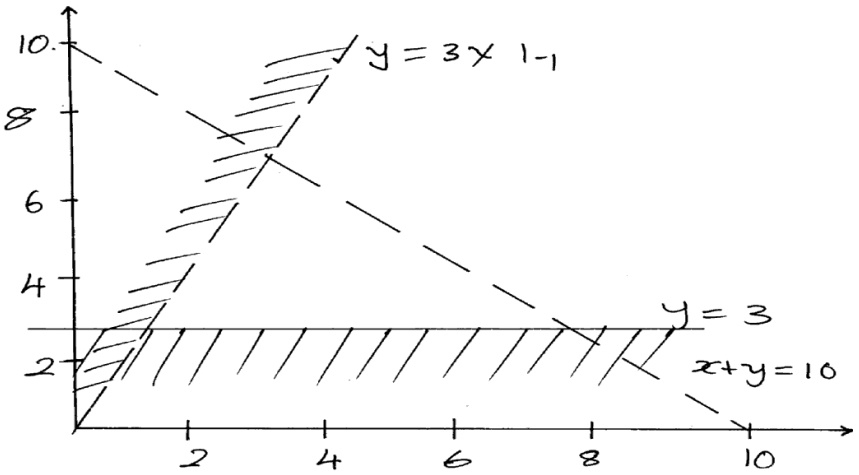
c) see graph





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
   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 $= (3t^2 - 3t - 6)dt$

$= t^3 - \frac{3}{2}t^2 - 6t \Big|_1^4$

$\left\{4^3 - \frac{3}{2}(4)^2 - 6(4)\right\} - \left\{1^3 - 3(1)^2 - 6(1)\right\}$

$16 - {}^{-13}/_{2} =$

63. Differentiation

1	$\int_1^2 (9t^2 - 6t + 2)dt$ $\left[3t^3 - 3t^2 + 2t + c\right]_1^2$	M_1 M_1 A_1	

	$(3\times2^3-3\times2^2+2\times2)-(3-3+2)$ $(24-12+4)-(2)$ $16-2=14m$		
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 :

$\frac{dv}{dt} = 0$

$\frac{dv}{dt} = 6t - 6$

$6t - 6 = 0$

$t = 1$

$Min\text{-}velocity = 3(1)^2 - 6(1) + 2$

$= -1m/s$

(c) $3t^2 - 6t + 2 = 0$

$t = \frac{6 \pm \sqrt{(-6) - 4\ (3)\ (2)}}{6}$

$= \frac{6 \pm 5.2}{6}$

$t = 1.58 \text{ or } 0.4sec$

(d) $acc = \frac{dv}{dt} = 6t - 6$

$a = 6(3) - 6 = 12m/s^2$

2. a)

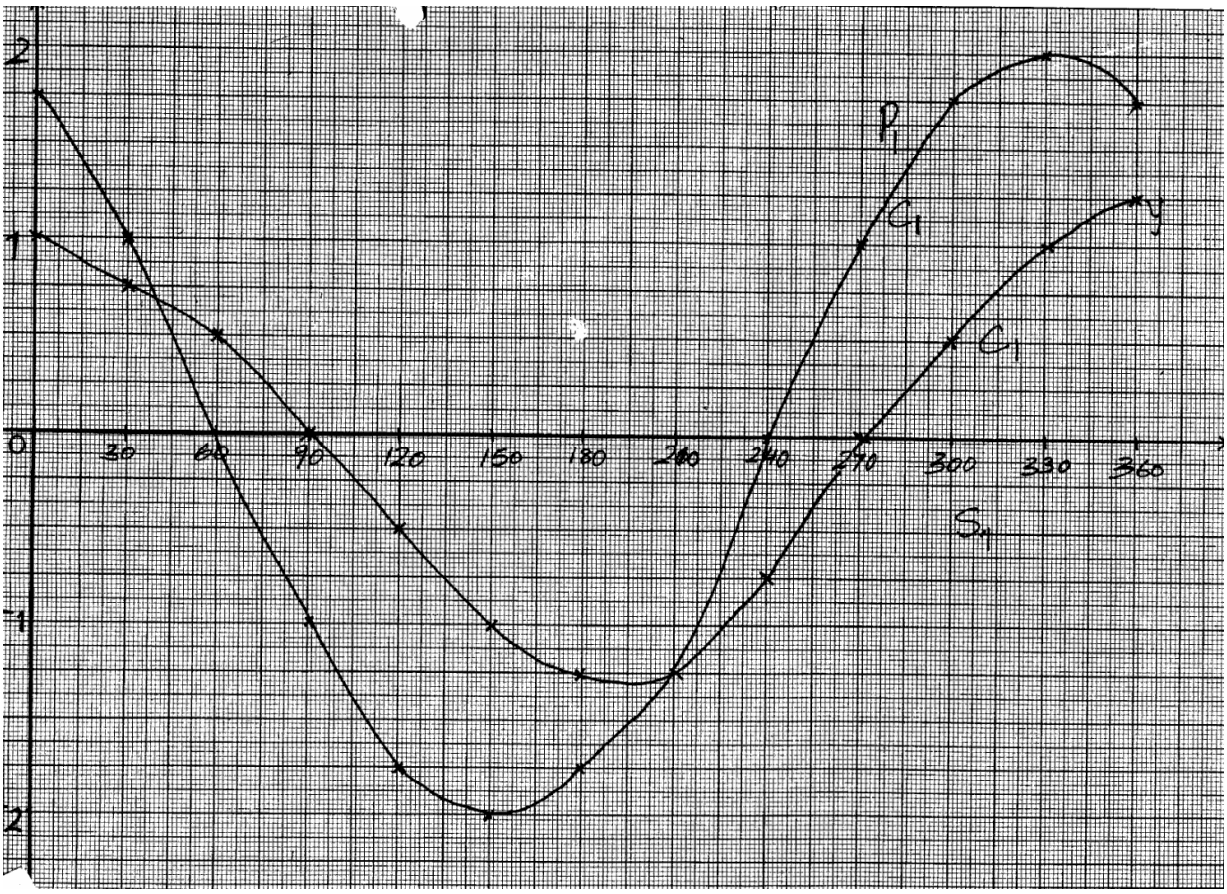
X	*2*	*5*	*8*	*10*

y	*5*	*26*	*65*	*101*

b) $A = h\,(2 + 10 + 26 + 50 + 82)$
$= 2 \times 170$
$= 34$ *square units*

c) $A = \int (x^2 + 1)\,dx$
$= (^{1000}/_{3} + 10) - 0$
$= 333.33 + 10$
$= 343.33$
$= 343.33$ *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) $AC = -4t + 1$

$-4t + 1 = 0$

$T = ¼$

$V = -2(¼)2 + ¼ + 28$

$V = 28.125$

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) $D = \frac{2t^3}{3} + \frac{t^2}{2} + 28t + 5$

$D = -2 \times 3^3/_3 + 3^2/_3 + 28 \times 3 + 5$

$= -18 + 4.5 + 84 + 5$

$= 70.5 + 5 = 75.5$

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) $S = \left[15t + 2t^2 - t^3 + C \right]_0^{2/3}$

$= 15\left({}^2/_3\right) + 2\left({}^2/_3\right)^2 - \left({}^2/_3\right)^3$

$= \frac{10}{1} + \frac{8}{9} = \frac{8}{27}$

$= \frac{286}{27} = 10.5925 \simeq 10.59$

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 $\int_{-2}^{2} x^2 = \left[\frac{x^3}{3}\right]_{-2}^{2}$

$= \frac{8 - {}^{-}8}{3}$

$= \frac{16}{3}$

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 $a = 0$

$6t - 5 = 0$

$t = {}^{5}/_{6}$

$v = \frac{ds}{dt} = 3t^2 - 5t^2 = 3 \times \frac{25}{36} - 5 \times \frac{5}{6} + 2$

$= -\frac{1}{12} m/s$

8. (a) $V = 6t + 4 = 3t^2 + 4t + c$

$5 = 3(0)^2 + 4(0) + c$

$5 = c$

$V = 3t^2 + 4t + 5$

(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) $S = t^3 + 2t^2 + 5t$ 4 1

$= \left[(4)^3 + 2(4)^2 + 5(4)\right] - \left[(1)^3 + 2(1)^3 + 5(1)\right]$

$= 108$ m

9. a) $S = 3t + \frac{3t^2}{2} - 2t^3$

$\frac{ds}{dt} = v = 3 + 3t - 6t^2$

$\frac{dv}{dt} = a = 3 - 12t \qquad t = 0$

$a = 3m/s^2$

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 $y = mx + c$

$= \frac{23 - y}{2 - x}$

$23 - y = 37(2-x)$

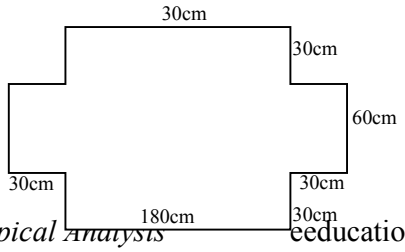
$23 - y = 74-x$

$23 = 37(2) + c$

$C = 23 - 74 = -51$

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 – 52 x + 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

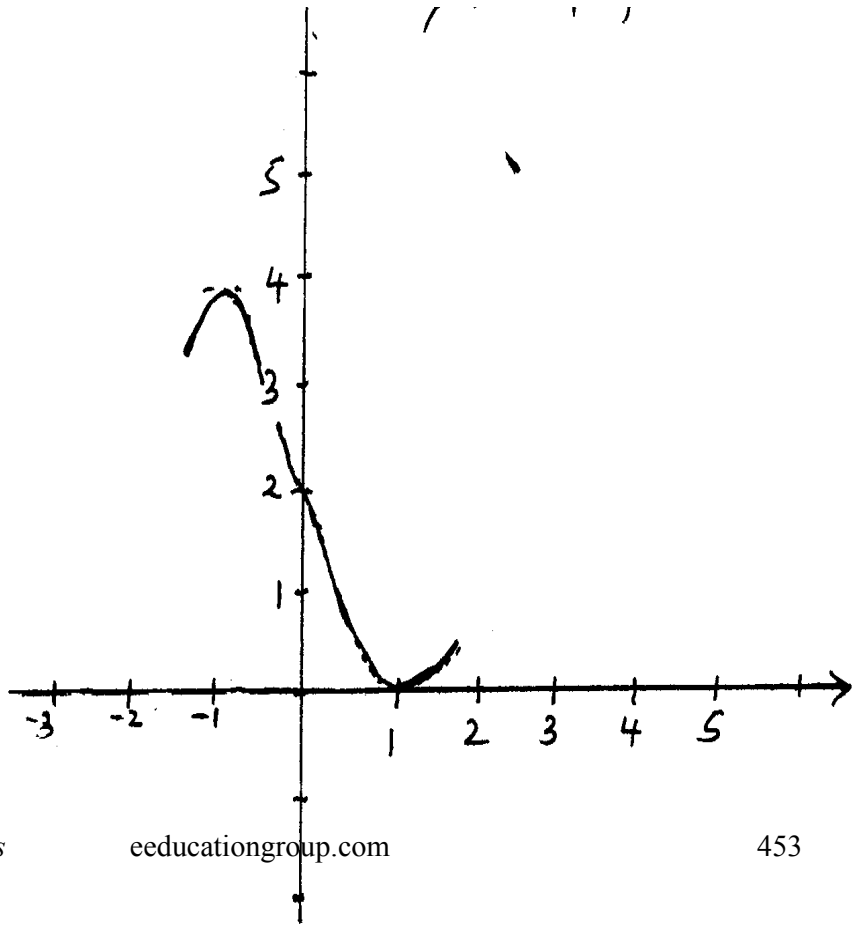
To sketch the curve we

(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= 4seconds

(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) $S = 28t + \underline{t}^2 - \underline{2}t^3 + C$

$2 \quad 3$

when $t = 0$, $s = 0$

$\therefore S = 28t + t2 - 2t$

PB at rest after 4s

$\therefore S = 28 \times 4 \times 42 - \underline{2} \times 4^3$

3

$= 112 + 8 - 42.667$

$= 120 - 42.6667 = 77.33m$

15. $S = t^3 - 3t^2 + 2t$

(a) $V = \underline{ds} = 3t^2 - 6t + 2$

dt

When $t = 2$

$V = 3(4) - 6(2) + 2$

$= 2m/s$

(b) At minimum velocity :

$\underline{dv} = 0$

dt

$\underline{dv} = 6t - 6$

dt

$6t - 6 = 0$

$t = 1$

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) $acc = \frac{dv}{dt} = 6t - 6$

$a = 6(3) - 6 = 12m/s^2$

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

$A = 0.8 (5 + 5) + 2 (7.56 + 8.84 + 8.84 + 7.56)$

$= 0.4 \quad 10 + 2(32.8)$

$= 0.4 \times 75.6$

$= 30.24$ sq. units

2. $y_o = 0$

$y_1 = 2.5$

$y_2 = 6$

$y_3 = 10.5$

$y_4 = 16$

$y_5 = 22.5$

$y_6 = 30$

$A = ½ \times 1(0+30) + 2(2.5 + 6 + 10.5 + 16 + 22.5)$

$= ½ \times 145 = 72.5$

(b) $½ x^2 - 2 = \frac{x^3}{6} - x$

$= \frac{8^3}{6} - 8 - \frac{2^3}{6} - 2$

$= 77.33 - -0.67$

$= 78$ square units

(c) $\%$ error $= \frac{72.5 - 78}{78} \times 100$

$= -7.05\%$

3 $y_o = 0$

$y_1 = 2.5$

$y_2 = 6$

$y_3 = 10.5$

$y_4 = 16$

$y_5 = 22.5$

$y_6 = 30$

$A = ½ \times 1(0+30) + 2(2.5 + 6 + 10.5 + 16 + 22.5)$

$= ½ \times 145$

$= 72.5$

(b) $½ x^2 - 2 = \frac{x^3}{6} - x$

$= \frac{8^3}{6} - 8 - \frac{2^3}{6} - 2$

$= 77.33 - -0.67$

$= 78$ square units

(c) % error $= \frac{72.5 - 78}{78} \times 100$

$= -7.05\%$

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 $x = -\frac{1}{2}$

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) $A = 0.5\ (18.56 + 14.06 + 10.06 + 6.56 + 3.56 + 1.06)$

$= 0.5 \times 53.86 = 26.93$

c) i) $\int x^1 + 2x - 3$

$[x^3 + x^2 - 3x]^{-3}$

3

$= [\frac{(-3)^3}{3} + (-3)^2 - 3(-3)]$

$= 9 + 18 = 27$ square units

ii) $\frac{27 - 26.93}{27} \times 100$

$= 0.25925\ \% = 0.2593\ \%$

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

$\therefore Area = \left\{ \frac{1}{2} n \quad (y_0 + y_n) + 2(y_1 + \ldots\ldots\ldots) \right\} y_n - 1$

$= \frac{1}{2}\ (1) \left\{ (18 + 233) + 2(41 + 74 + 55 + 170) \right\}$

$= \frac{1}{2} \left\{ 251 + 2(340) \right\}$

$= \frac{1}{2} (251 + 680)$

$= \frac{1}{2} (831)$

= *415.5 sq. units.*

65. Integration

1	a) $x^2 + 5 = 8 - 2x$ $x^2 + 2x - 3 = 0$ $(x-1)(x+3) = 0$ X = 1 or x = -3 $C(-3,14)$ $D(1,6)$ b) $\int_{-3}^{1}(x^2+5)dx$ $\left[\frac{1}{3}x^3 + 5x\right]_{-3}^{11}$ $\left(\frac{1}{3}+5\right) - (-9-15)$ $5\frac{1}{3} + 24$ $= 29\frac{1}{3} squnits$ c) $\frac{1}{2}(14+6)\times 4 = Area$ $\therefore A = 2 \times 20$ $= 40 squnits$ d) $40 - 29\frac{1}{3}$ $= 10\frac{2}{3} sq$ units	M_1 A_1 B_1 B_1 M_1 M_1 A_1 M_1 A_1 B_1	**Diagram**
		10	

1. $S_{10} = 100$

$\int_2^5 \frac{(x-1)(x-2)}{x-2} dx$

$= \int_2^5 x - 1 dx$

$= [x^2/2 - x]_2^5$

2.

$\int (x^2 + 1)\, dx = 2a$

$\left[\frac{x^3}{3} + \frac{x}{1}\right]_0^a = 2a$

$\frac{a^3}{} + \frac{a}{} - 0 = 2a$

$3 \quad 1$

$a^3 + 3a = 6a$

$a^3 = 3a$

$(a^3 - 3a) = 0$

$a(a^2 - 3) = 0$

$a = 0$

$\sqrt{3} = \pm 1.732$