1. Evaluate: (3 mks)

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

$$\left(\frac{\frac{3}{4}+\frac{12}{7}\div\frac{4}{7}\times\frac{7}{3}}{\left(\frac{10}{7}-\frac{5}{8}\right)\times\frac{2}{3}}\right)^{2}.$$

$$\left(\frac{\frac{3}{4}+\frac{12}{7}\times\frac{7}{4}\times\frac{7}{3}}{\left(\frac{80-35}{56}\right)\times\frac{2}{3}}\right)^{2}.$$

$$\left(\frac{\frac{3}{4}+7}{\frac{45}{56}\times\frac{2}{3}}\right)^{2}=\left(\frac{31}{4}\times\frac{28}{15}\right)^{2}=\left(\frac{217}{15}\right)^{2}$$

$$\frac{47089}{225}=209\frac{64}{225}$$

2. Mr. Kamau son and daughter needed clothes. The son clothes were costing Ksh 324 while the daughter clothes were costing Ksh 220. Mr Kamau wanted to give them equal amounts of money. Calculate the least amount of money he would spend on the two and how many clothes each will buy. (3 mks)

2	324	220
2	162	110
3	81	55
3	27	55
3	9	55
3	3	55
5	1	11
11	1	1

$2^2 \times 3^4 \times 5 \times 11$

$\frac{17820}{324}$

$= 55$ clothes

$\frac{17820}{220}$

$= 81$ clothes

3. Use reciprocal tables to find the value of $(0.325)^{-1}$ hence evaluate $\frac{\left(\sqrt[3]{0.000125}\right)}{0.325}$, give your answer to 4 s.f. (3 mks)

$$\frac{1}{3.25\times10^{-1}}=0.3077\times10^{1}$$

$$=3.077\times\sqrt[3]{125\times10^{-6}}$$

$$3.077\times5\times10^{-3}.$$

$$\frac{15.385}{1000}=0.015385$$

4. A type of paper is 40cm long, 32 cm wide and 0.8 mm thick. The paper costs sh 10 per m^2. Find the total cost of a pile of such paper of height 4.8m. **(4 mks)**

No of papers in the pile $= \frac{4.8}{0.8 \times 10^{-3}} = \frac{4.8 \times 1000}{0.8}$

$= 6000$

Area of one paper $= (0.4 \times 0.32) m^2$

Total area $= 0.4 \times 0.32 \times 6000$

$= 768$

Total Cost $= 768 \times 10 = Sh\ 7680$

5. A square based brass plate is 2mm high and has a mass of 1.05kg. The density of the brass is 8.4 g/cm^3. Calculate the length of the plate in centimeter. (3 mks)

Volume of brass $= \frac{1.05}{8.4 \times 1000} = 1.25 \times 10^{-4} m^3$

$= 125 cm^3$

$x \times x \times \frac{2}{10} = 125$

$x^2 = 625$

$x = 25$ cm

6. Solve for x in the equation: (3 mks)

$$\frac{x-3}{4} - \frac{x+3}{6} = \frac{x}{3}$$

Lcm = 12.

$3(x-3) - 2(x+3) = 4x.$

$3x - 9 - 2x - 6 = 4x.$

$x - 15 = 4x.$

$-3x = 15$

$x = -5.$

7. A salesman earns 3% commission for selling a chair and 4% commission for selling a table. A chair fetches K£ 75. One time, he sold ten more chairs than tables and earned seven thousand, two hundred Kenya shillings as commission. Find the number of tables and chairs sold. (4 mks)

Let the No of Chairs and tables sold be c and t respectively

Commission earned.

$\frac{3}{100}(600c) + \frac{4}{100}(1500t) = 7200$

$3c + 10t = 1200$
$c - t = 10$

$3c + 10t = 1200$
$3c - 3t = 30$

$13t = 1170$
$t = 90$

$c = 10 + t$
$c = 10 + 90$
$= 100$

8. Using the three quadratic identities only factorise and simplify: (3 mks)

$$\frac{(x-y)^2-(x+y)^2}{(x^2+y^2)^2-(x^2-y^2)^2}$$

$$\frac{x^2-2xy+y^2-(x^2+2xy+y^2)}{x^4+2x^2y^2+y^4-(x^4-2x^2y^2+y^4)}$$

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

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

$$= \frac{-1}{xy}.$$

9. Two numbers are in the ratio 3 : 5. When 4 is added to each the ratio becomes 2 : 3. What are the numbers? (3 mks)

Soln.

$\frac{x}{y} = \frac{3}{5} \Rightarrow 5x = 3y \Rightarrow x = \frac{3}{5}y.$

$\frac{x+4}{y+4} = \frac{2}{3}$

$3(x+4) = 2(y+4)$
$3x + 12 = 2y + 8$
$2y - 3x = 4$

~~by~~ but

$2y - 3\left(\frac{3}{5}y\right) = 4$

$\frac{2y}{1} - \frac{9}{5}y = 4$

$\frac{10y - 9y}{5} = 4$

$y = 20$

$x = \frac{3}{5} \times 20$

$x = 12$

10. Given that Sin $(x + 4^0) = \text{Cos}\,(3x)^0$. Find tan $(x + 40^0)$ to 4 s.f. (3 mks)

$x + 40 + 3x = 90$

$4x = 50$

$x = 12.5$

$\tan(x + 40) = \tan 52.5$

$= 1.303225373$

$= 1.303$ (4 s.f.)

11. In a regular polygon, the exterior angle is $^1/_3$ of its supplement. Find the number of sides of this polygon. (3 mks)

Interior + exterior = 180.

$x + \frac{1}{3}x = 180$

$\frac{4}{3}x = 180$

$x = \cancel{180}^{45} \times \frac{3}{4}$

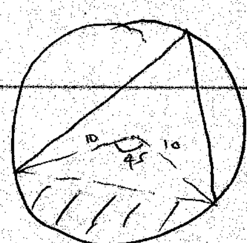
$= 135$

Exterior $= 45$

No. of sides $= \frac{360}{45}$

$= 8$

12. Find the area of a segment of a circle whose arc subtends an angle of 22 ½^0 on the circumference of a circle, radius 10cm. (3 mks)



$\frac{45}{360} \times \pi r^2 - \frac{1}{2} \times 10 \times 10 \sin 45.$

$= \frac{45}{360} \times \frac{22}{7} \times 100 - 50 \sin 45$

$= 39.26990817 - 35.35533906$

$= 3.91456911$

13. An airplane leaves point A (60^0S, 10^0W) and travels due East for a distance of 960 nautical miles to point B. determine the position of B and the time difference between points A and B. (3 mks)

Distance along a latitude $= \theta \times 60 \cos x$

$$960 = \theta \times 60 \cos 60^\circ$$

$$\theta = \frac{960}{60 \cos 60}$$

$$= 32.$$

longitude of B $= 32 - 10$

$$= 22^\circ$$

Position of B

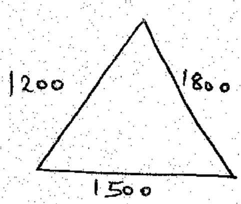
$(60^\circ S, 22^\circ E)$

Time diff.

$= 32 \times 4 = 128$ min

$= 2$ hrs 8 min

14. Mr. Onyango's piece of land is in a form of triangle whose dimensions are 1200M, 1800M and 1500M respectively. Find the area of this land in ha. (Give your answer to the nearest whole number). (3 mks)



$$S = \frac{1200 + 1800 + 1500}{2}$$

$$= 2250$$

$$A = \sqrt{2250(2250 - 1200)(2250 - 1800)(2250 - 1500)}$$

$$= \sqrt{7.9734 \times 10^{11}}$$

$$= \frac{892941.0675 \text{ m}^2}{10000}$$

$$= 89.29410675$$

$\simeq$ 89 ha

15. Two men each working for 8 hours a day can cultivate an acre of land in 4 days. How long would 6 men, each working 4 hours a day take to cultivate 4 acres? (3 mks)

Men	hrs	Acres	Days
2	8	1	4
6	4	4	?

$$\frac{\cancel{2}^{1}}{\cancel{6}_{3}} \times \frac{8}{4} \times \frac{4}{1} \times 4 = \frac{32}{3} = 10\tfrac{2}{3} \text{ days.}$$

16. Find the equation of a straight line which is perpendicular to the line $8x + 2y - 3 = 0$ given that they intersect at $y = 0$ leaving your answer in a double intercept form. (3 mks)

$2y = -8x + 3.$

When $y = 0$

$8x = 3$

$x = 3/8$

$y = -4x + 3/2$

$M_2 = 1/4$

$$\frac{y - 0}{x - 3/8} = 1/4$$

$y = 1/4\left(x - 3/8\right)$

$y = 1/4x - 3/32$

$\frac{1}{4}x - y = 3/32$

$\frac{8x}{3} - \frac{32y}{3} = 1$

$$\frac{x}{3/8} + \frac{y}{-3/32} = 1$$

SECTION B

17. (a) Use the mid-ordinate rule to estimate the area bounded by the curve $y = x + 3x^{-1}$, the x-axis, lines $x = 1$ and $x = 6$. (4 mks)

x	1.5	2.5	3.5	4.5	5.5
y	3.5	3.7	4.36	5.167	6.045

$A = 1(3.5 + 3.7 + 4.36 + 5.167 + 6.045)$

$= 1(22.772)$

$= 22.772$ units^2

(b) Find the exact area of the region in (a) above. (3 mks)

$\int_1^6 (x + 3x^{-1})\,dx.$

$= \left[\frac{x^2}{2}\right]_1^6 = \frac{6^2}{2} - \frac{1^2}{2} = 17.5$ units^2

(c) Calculate the percentage error in area when mid-ordinate rule is used. (3 mks)

$\% \text{ error} = \frac{|17.5 - 22.772|}{17.5} \times 100$

$= 30.1257\%$

18. A car whose initial value is Ksh 600,000 depreciates at a rate of 12% p.a. Determine:

(a) Its value after 5 years. (4 mks)

$$A = P\left(1 - \frac{r}{100}\right)^n$$

$$= 600000\left(1 - \frac{12}{100}\right)^5$$

$$= 600000\,(0.88)^5$$

$$= 600000\,(0.5277)$$

$$= \text{Ksh } \underline{\underline{316620}}$$

(b) Its value of depreciation after 5 years. (2 mks)

$$\text{Ksh } (600{,}000 - 316620)$$

$$= \text{ksh } \underline{\underline{283380}}$$

(c) The number of year it will take for the value of the car to be Ksh 300,000 (3 mks)

$$300000 = 600000\left(1 - \frac{12}{100}\right)^n$$

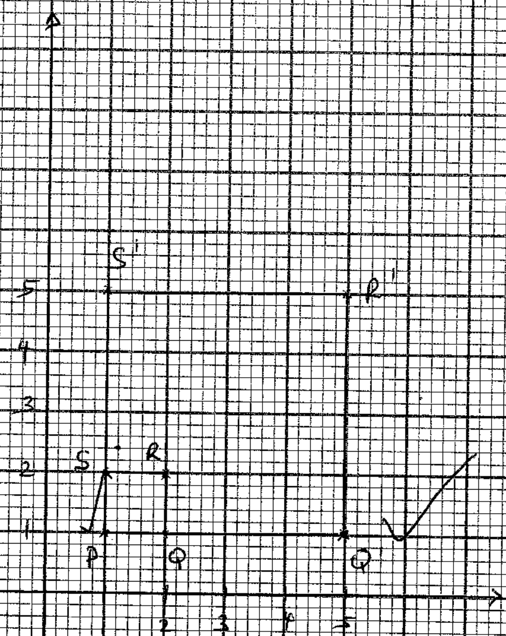
$$0.5 = 0.88^n$$

$$\log 0.5 = n \log 0.88$$

$$n = \frac{\log 0.5}{\log 0.88}$$

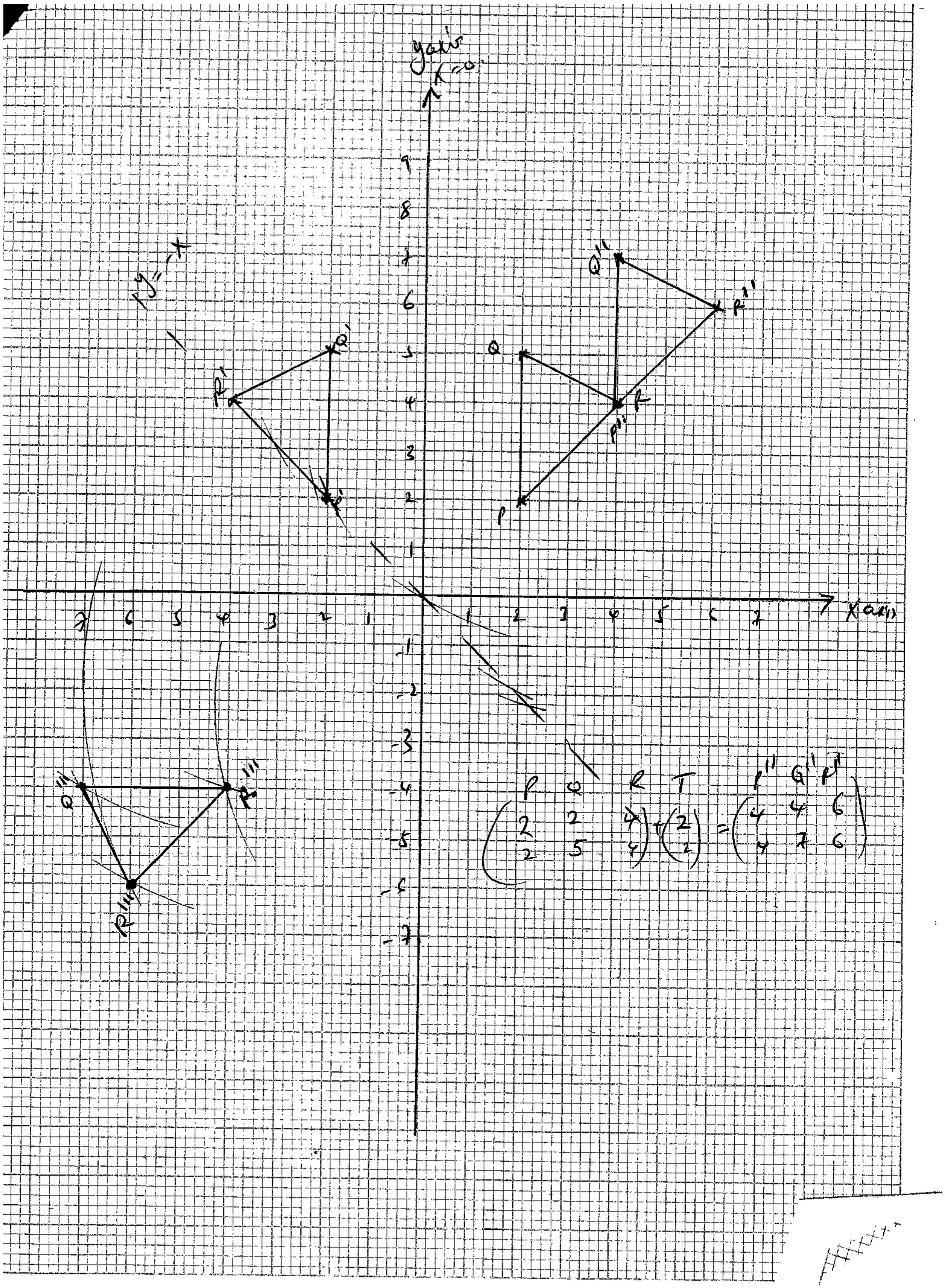
$$= \underline{\underline{5.422}} \text{ years.}$$

9 (b)



(i) Centre (1, 1)

(ii) Scale factor 4.


y axis
x=0
y = -x
x axis
P Q R T P'' Q'' R''
(2 2 4 / 2 5 4) + (2 / 2) = (4 4 6 / 4 7 6)

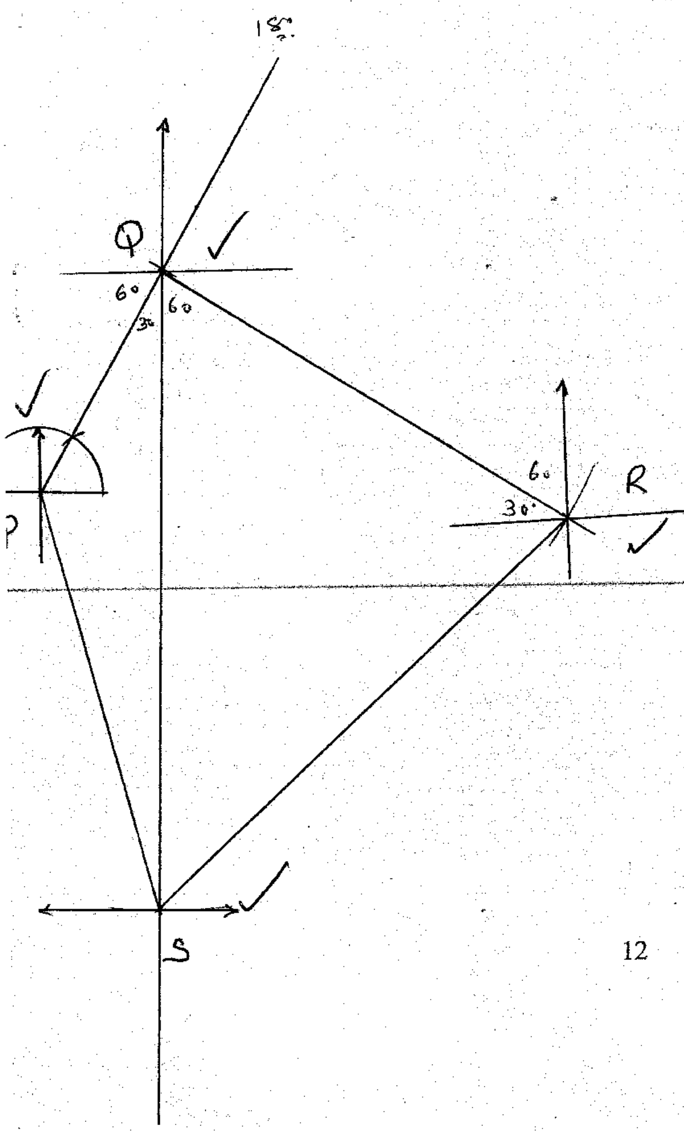
21. Three warships P, Q and R are at sea such that ship Q is 400 km on a bearing of N30^0 E from ship P. ship R is 750 km from ship Q and on a bearing of S60^{0}E from ship Q. an enemy warship S is sighted 1000 km due south of ship Q.

(a) Use scale drawing to locate the position of ships P, Q, R and S. (4 mks)

(b) Find the compass bearing of: (2 mks)
   (i) Ship P from ship S   N 15° W ✓
   (ii) Ship S from ship R   S 50° W ✓

(c) Use scale drawing to determine: (2 mks)
   (i) The distance of S from P   6.8cm x 100 = 680Km ✓ ± 10Km.
   (ii) The distance of R from S   8.8 cm x 100   880 km ± 10Km ✓

(d) Find the bearing of: (2 mks)
   (i) Q from R   300° or N 60° W ✓
   (ii) P from Q   210 or S 30° W. ✓   1cm rep 100 km



22. The table below shows the amount in shillings of pocket money given to students in a particular school.

fd	0.26	1.3	2.3	3.2	2.6	2.	1.5	1.2	0.4
x	210	224.5	234.5	244.5	254.5	264.5	274.5	284.5	294.5
Pocket money (Kshs)	201 – 219	220 – 229	230 – 239	240 – 249	250 – 259	260 – 269	270 – 279	280 – 289	290 – 299
	19	10	10	10	10	10	10	10	10
No. of students	5	13	23	32	26	20	15	12	4
fx	1050	2918.5	5393.5	7824	6617	5290	4117.5	3414	1178

$\Sigma fx = 37802.5$

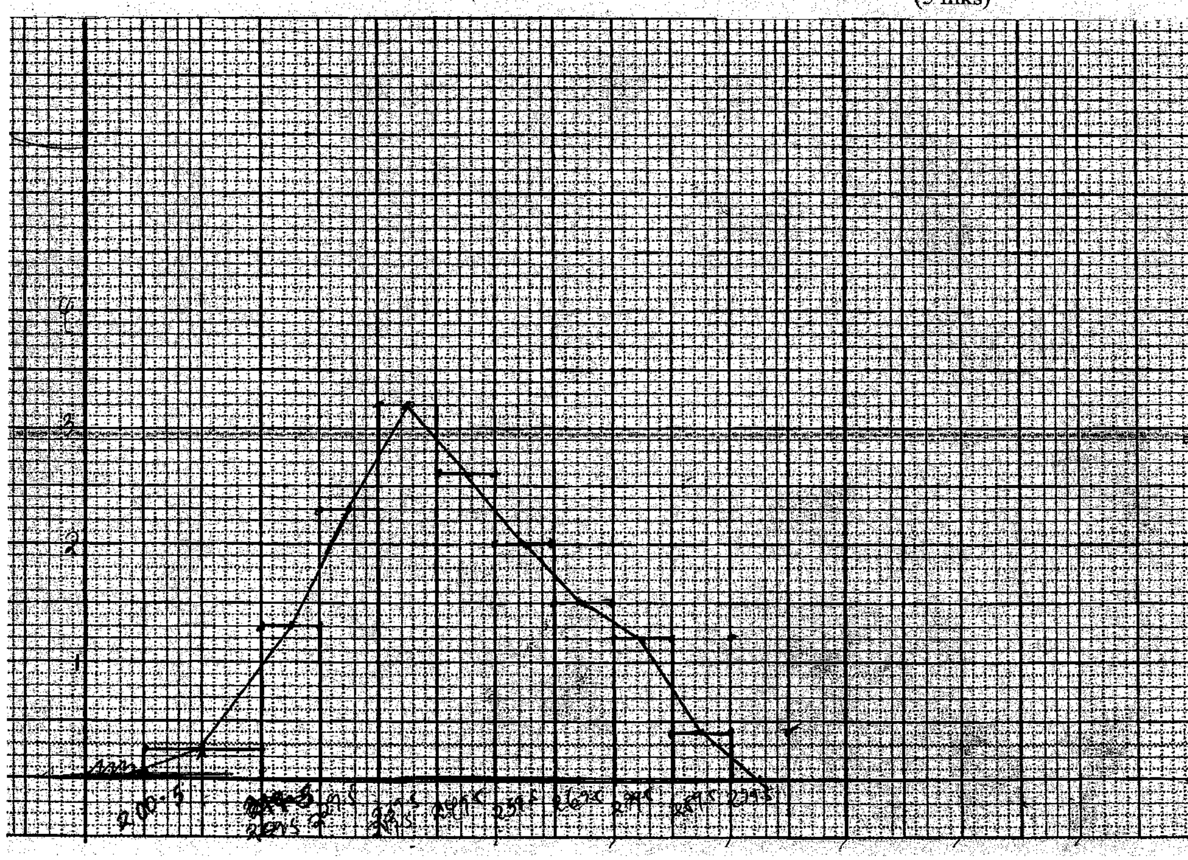
(a) State the modal class. (1 mk)

(b) Calculate the mean amount of pocket money given to these students to the nearest shilling. (4 mks)

$$\frac{\Sigma fx}{\Sigma f} = \frac{37802.5}{150} = 252.02$$

$$\simeq 252$$

(c) Use the same axes to draw a histogram and a frequency polygon on the grid provided. (5 mks)



23. Given that points X (0,-2), Y (4, 2) and Z (x,6);

(a) Write down the column vector $\overrightarrow{XY}$. (1 mk)

$\overrightarrow{XY} = Y - X \quad \begin{pmatrix}4\\2\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix} = \begin{pmatrix}4\\4\end{pmatrix}$

(b) (i) Find $|\overrightarrow{XY}|$ leaving your answer in index form. (3 mks)

$|\overrightarrow{XY}| = \sqrt{4^2+4^2}$

$\sqrt{32}$

$= 5.656854249$

(ii) Given that $|\overrightarrow{XZ}| = 11.3170$, find the coordinates of Z. (3 mks)

$\overrightarrow{XZ} = Z - X$

$\begin{pmatrix}x\\6\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix} = \begin{pmatrix}x\\8\end{pmatrix}$

$\sqrt{x^2+64} = 11.3170$

$x^2 + 64 = (11.3170)^2$

$x^2 = 128.074489 - 64$

$x^2 = 64.074489$

$x = 8.0046$

$Z(8,6)$

(c) Find the mid-point of the line YZ. (3 mks)

$Y(4,2) \quad Z(8,6)$

Mid point $= \left(\frac{4+8}{2}, \frac{2+6}{2}\right)$

Midpoint $= (6,4)$

24. A bus and a matatu left Voi for ~~from~~ Mombasa, 240 km away at 8.00 am. They travelled at 90 km/h and 120 km/h respectively. After 20 minutes the matatu had a puncture which took 30 minutes to mend. It then continued with the journey.

(a) How far from Voi did the catch up with the bus. (6 mks)

Bus travelled a distance of $\frac{20}{60} \times 90 = 30\,km$

After 30min

$\frac{30}{60} \times 90 = 45\,km$

Total distance by bus

$30 + 45 = 75\,Km$

Matatu $= 120 \times \frac{20}{60} = 40\,km$

Distance between the two

$75 - 40 = 35\,Km$

Relative speed $= 120 - 90$

$= 30\,km/h$

Time to catch up $\Rightarrow \frac{35}{30} = 7/6$

Distance from Voi $\Rightarrow$

$40 + (7/6 \times 120) = \underline{\underline{180\,km}}$

(b) At what time did the matatu catch up with the bus? (2 mks)

$20 + 30 + 1\,hr\ 10\,min = 2\,hrs.$

$8.00 + 2\,hrs = 10.00\,A.M.$

(c) At what time did the bud reach Mombasa? (2 mks)

~~Time taken by bus = 240/90 = 2hrs 40min~~

Arrival time $= 8.00 + 240\,min$

$= \underline{\underline{10.40\,A.M}}$

4. The sides of triangles were measured and recorded as 8.4 cm, 10.5 cm and 15.3. Calculate the percentage error in perimeter correct to 2 d.p. (3 mks)

Max Perimeter $= 8.45 + 10.55 + 15.35$
$= 34.35$ cm.
Min Perimeter $= 8.35 + 10.45 + 15.25$
$= 34.05$ cm.
Absolute error in Perimeter
$= \frac{34.35 - 34.05}{2} = 0.15$

% error $= \frac{0.15}{34.2} \times 100$
$= 0.438596491\%$
$= \underline{\underline{0.44}}$

5. Simplify: (3 mks)

$$\frac{\log 16 + \log 81}{\log 8 + \log 27}$$

Soln

$$\frac{\log 2^4 + \log 3^4}{\log 2^3 + \log 3^3} = \frac{4\cancel{(\log 2 + \log 3)}}{3\cancel{(\log 2 + \log 3)}} = \frac{4}{3}.$$

6. Simplify the expression: (4 mks)

$$\frac{(-36+9x^2)+(-6y+3xy)}{3x-6}$$

$$\frac{(9x^2-36)(3xy-6y)}{3x-6.}$$

$$\frac{(3x+6)(3x-6)+y(3x-6)}{3x-6}$$

$$\frac{(3x+6+y)\cancel{(3x-6)}}{\cancel{(3x-6)}} = \underline{\underline{3x+6+y}}$$

7. Given that $\frac{x(x^2-1)}{x+1}$, find $dy/_{dx}$ at the point (2,4). (3 mks)

$y = \frac{x(x-1)\cancel{(x+1)}}{\cancel{(x+1)}}$ @ (2,4)

$\Rightarrow 2 \times 2 - 1$

$y = x^2 - x$ $= \underline{3}$

$\frac{dy}{dx} = 2x - 1$

8. (a) Expand and simplify the expression $\left(10 + \frac{2}{x}\right)^5$ (2 mks)

10^5, $10^4 \cdot \frac{2}{x}$, $10^3 \cdot \frac{4}{x^2}$, $10^2 \cdot \frac{8}{x^3}$, $10 \cdot \frac{16}{x^4}$, $\frac{32}{x^5}$.

$100000 + \frac{100000}{x} + \frac{40000}{x^2} + \frac{8000}{x^3} + \frac{800}{x^4} + \frac{32}{x^5}$

(b) Use the expression in (a) above to find the value of 14^5. (1 mk)

$\left(10 + \frac{2}{x}\right)^5 = 14^5$

$10 + \frac{2}{x} = 14$

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

$100000 + \frac{100000}{0.5} + \frac{40,000}{0.5^2} + \frac{8000}{(0.5)^3} + \frac{800}{(0.5)^4} + \frac{32}{(0.5)^5}$

$100000 + 200000 + 160000 + 64000 + 12800 + 1024$

$= 537824.$

9. John buys and sells rive in packets. He mixes 30 pockets of rive A costing sh 400 per packet with 50 packets of another kind of rive B costing sh 350 per packet. If he sells the mixture at a gain of 20%, at what price does he sell a pocket? (3 mks)

Cost of type A = 30 x 400 = 12000

Cost of type B = 50 x 350 = 17500

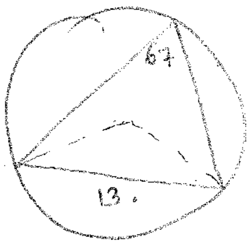
Total cost of the packets = 29500

Average cost of one packet $\frac{29500}{80}$

Selling price @ 20% gain

$\frac{120}{100} \times \frac{29500}{80}$ = Sh 442.50 per packet

10. A chord ~~of~~ AB of length 13cm subtends an angle of 670 at the circumference of a circle centre O. find the radius of the circle. (3 mks)



$$\frac{13}{\sin 67} = 2R.$$

$$\frac{12}{0.9205} = 2R$$

$$R = 7.06135$$

$$14.1227 = 2R$$

$$R = \frac{14.1227}{2}$$

11. Find the coordinates of the image of a point (5, -3) when its rotated through 180^0 about (3,1). (3 mks)

A rotation of $180°$ about (h, k) maps a point (a, b) on to the point $(2h - a, 2k - b)$

hence $(2\times3 - 5, 2\times1 - (-3))$

$(1, 5)$

$(1, 5)$

12. Two points P (-3,-4) and Q (2,5) are the points on a circle such that PQ is the diameter of the circle. Find the equation of the circle in the form $ax^2 + by^2 + cx + dy + e = 0$ where a, b, c and e are constants. (4 mks)

$$M\left(\frac{-3+2}{2}, \frac{-4+5}{2}\right) = \left(-\tfrac{1}{2}, \tfrac{1}{2}\right)$$

$$\underset{\sim}{PQ} = Q - P = \begin{pmatrix}5\\2\end{pmatrix} - \begin{pmatrix}-4\\-3\end{pmatrix} = \begin{pmatrix}9\\5\end{pmatrix} = \sqrt{9^2+5^2} = \sqrt{10}$$

$$\left(x+\tfrac{1}{2}\right)^2 + \left(y-\tfrac{1}{2}\right)^2 = \frac{106}{4}$$

$$x^2 + x + \frac{1}{4} + y^2 - y + \frac{1}{4} = \frac{106}{4}$$

$$4x^2 + 4y^2 + 4x - 4y + 2 = 106$$

$$4x^2 + 4y^2 + 4x - 4y - 104 = 0$$

$$2x^2 + 2y^2 + 2x - 2y - 52 = 0$$

$$x^2 + y^2 + x - y - 26 = 0.$$

13. Two metal spheres of radius 2.3 cm and 2.86 cm are melted. The molten material is used to cast equal cylindrical slabs of radius 8 mm and length 70mm. If $^{1}/_{20}$ of the meal is lost during casting. Calculate the number of complete slabs cast. (3 mks)

Volume of the two spheres $= \frac{4}{3} \times \frac{22}{7}(2.3^3 \times 3.86^3)$

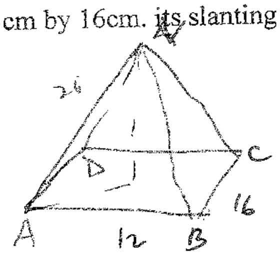
$= 291.99$

Remaining material $= \frac{19}{20} \times 291.99 = 277.297$

No. of slabs $= \dfrac{277.297}{\frac{22}{7} \times 0.8^2 \times 7} = 19.694392$

$= \underline{19}$

14. A right pyramid has a rectangular base of 12 cm by 16cm. its slanting lengths are 26 cm. Determine:

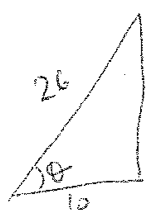


(a) The length of AC (1 mk)

$AC = \sqrt{12^2 + 16^2}$

$= 20cm.$

(b) The angle AV makes with the base ABCD. (2 mks)



$\cos\theta = \frac{10}{26}$

$\theta = \underline{\underline{67.38°}}$

15. Determine the inverse, T^{-1} of the matrix T $\begin{pmatrix} 4 & 6 \\ 6 & -2 \end{pmatrix}$ hence solve : (3 mks)

$2x + 3y = 30$
$3x - y = 10$

$T^{-1} = (-8 - 36) = -44.$

$-\frac{1}{44}\begin{pmatrix} -2 & -6 \\ -6 & 4 \end{pmatrix} = \begin{pmatrix} 2/44 & 6/44 \\ 6/44 & -4/44 \end{pmatrix} = \begin{pmatrix} 1/22 & 3/22 \\ 3/22 & -1/11 \end{pmatrix}$

$4x + 6y = 60$
$6x - 2y = 20$

$\begin{pmatrix} 4 & 6 \\ 6 & -2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 60 \\ 20 \end{pmatrix}$

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1/22 & 3/22 \\ 3/22 & -1/11 \end{pmatrix}\begin{pmatrix} 60 \\ 20 \end{pmatrix}$

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5\frac{5}{11} \\ 6\frac{4}{11} \end{pmatrix}$

$x = 5\frac{5}{11}$
$y = 6\frac{4}{11}$

16. Use squares, square roots and tables to evaluate: (3 mks)

$3.045^2 + (49.24)^{-1/2}$

$3.045^2 + \frac{1}{\sqrt{49.24}}$

$3.045^2 = 9.272$

$\frac{1}{\sqrt{49.24}} = \frac{1}{7.0171}$

$9.272 + \frac{1}{7.0711}$

$9.272 + 0.1425$

$= \underline{\underline{9.3595}}$

SECTION B

17. The table below shows the frequency distribution of diameter for 40 tins in millimeters.

Diameter (mm)	130 – 139	140 – 149	150 – 159	160 – 169	170 – 179	180 – 189
No of tins	1	3	7	13	10	6

Using a suitable working mean calculate:

(a) The actual mean for the grouped lengths. (4 mks)

X	f	X – A	d^2	fd	fd^2
134.5	1	-20	400	-20	400
144.5	3	-10	100	-30	300
154.5	7	0	0	0	0
164.5	13	10	100	130	1300
174.5	10	20	400	200	4000
184.5	6	30	900	180	5400

$$\bar{X} = A + \frac{\Sigma fd}{\Sigma f}$$

$$= 154.5 + \frac{460}{40}$$

$$= \underline{\underline{166}}$$

(b) The standard deviation of the distribution. (6 mks)

$$S.D = \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)^2}$$

$$= \sqrt{\frac{11400}{40} - 132.25}$$

$$= \sqrt{285 - 132.25}$$

$$= \sqrt{152.75}$$

$$= \underline{\underline{12.35}}$$

18. A $^3/_2$ Bao yearly plan is a school pocket money (SPM) saving scheme requiring 12 months payments of a fixed amount of money on the same data each month. All savings earn interest at a rate of p% per complete calendar month.

Lewis Kamau decides to invest K£ 30 per month in this scheme as advised by Gumbo and Oteinde 4Q and 4P class governors a.k.a class secretaries and witnesses by very determined mathematics. Martine Mutua Mukumbu (M^3) and makes no withdrawals during the year.

(a) Show that after 12 compelete calendar months, Lewis first payment has increased in value to K£ 30 r^{12}, where $r = 1 + \frac{P}{100}$ (4 mks)

After 1 month, the initial payement of K£30 ha a value of K£30 + K£30 × P/100

$= K£30\left(1 + \frac{P}{100}\right)$

K£30r

After 2 months = K£30r^2

After 12 months = K£30r^{12}

(b) Show that the total value, after 12 complete calendar months, of all 12 payments is K£ 30 $r = \frac{r(r^{12}-1)}{(r-1)}$ (3 mks)

Total value of all 12 payements

$= K£(30r^{12} + 30r^{11} + 30r^{10} + --- + 30r)$

Hence $S_n = \frac{a(r^n - 1)}{r-1}$

$\frac{30r(r^{12} - 1)}{r-1}$

(c) Hence calculate the total interest received during the 12 months when the monthly rate of interest is ½ per cent. (3 mks)

$r = 1 + P/100$

$P = 1/2$ So $r = 1 + \frac{0.5}{100}$

$S_{12} = \frac{30(1.005)(1.005^{12} - 1)}{(1.005 - 1)}$

$= K£371.92$

19. A mobile dealer sells phones of two types: Nokia and Motorola. The price of one nokia and one Motorola phone is Ksh 2000 and Ksh 1600 respectively. The dealers wishes to have al least fifty mobile phones. The number of Nokia phones should be atleast the same as those of Motorola phones. He has Ksh 120,000 to spend on phones. If he purchases x Nokia phones and y Motorola phones;

(a) Write down all the inequalities to represent the above information. (3 mks)

$2000x + 1600y \leq 120{,}000$

$20x + 16y \leq 1200$

$5x + 4y \leq 300$ ---- (i)

$x + y \geq 50$ ---- (ii)

$x \geq y$ ---- (iii)

$y > 0$

(b) Represent the inequalities in part (a) above on the grid pro\vided. (4 mks)

$5x + 4y \leq 300$

x	0	60
y	75	0

$x + y \leq 50$

x	0	50
y	50	0

(c) The profit on a nokia phone is Ksh 200 and that on a Motorola phone is Ksh 300. Find the number of phones of each type he should stock so as to maximize profit. (3mks)

$P = 200x + 300y$

$(24, 25)$

$P = 200(24) + 300(25) = 12300$

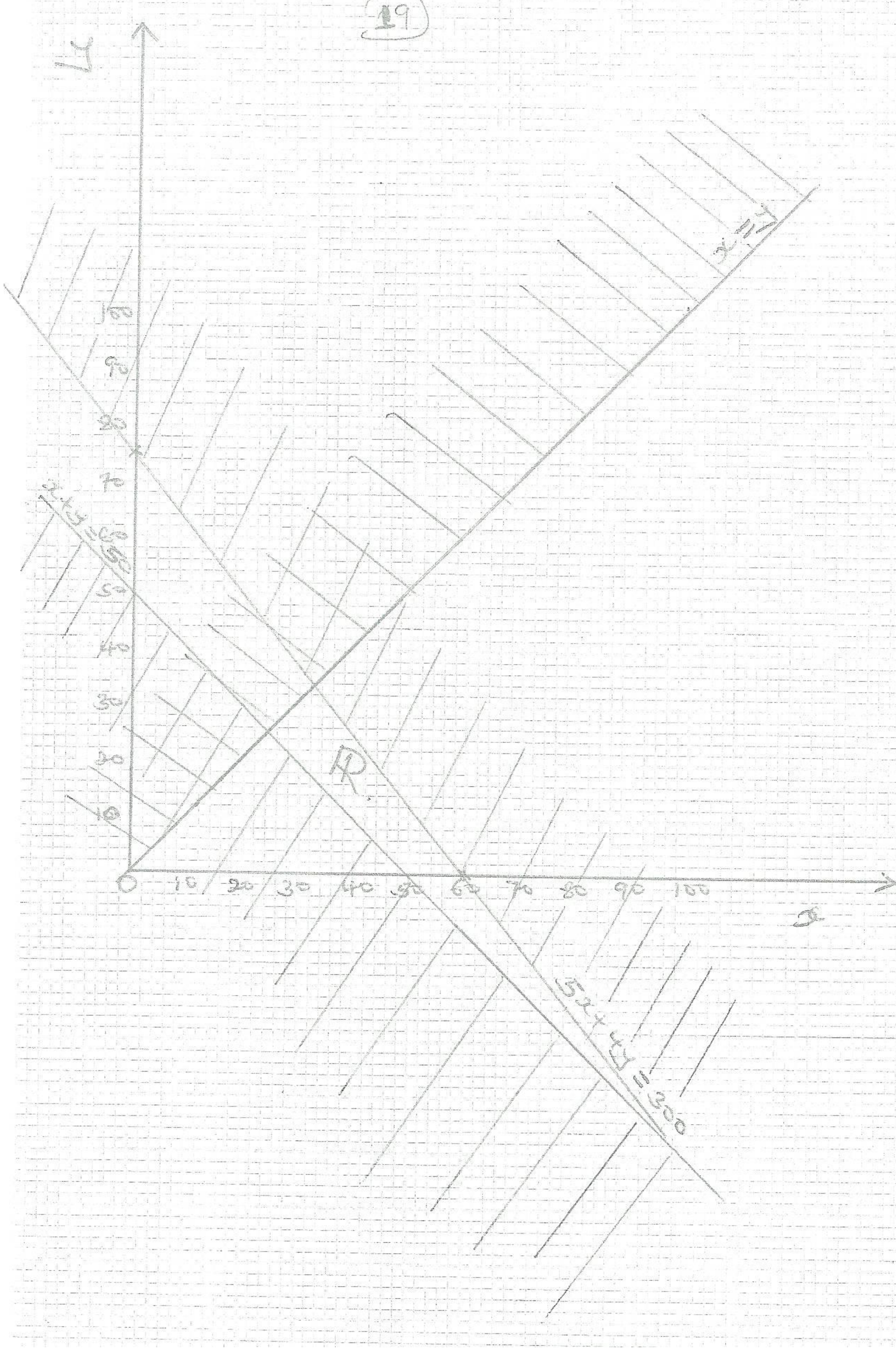
$P = 200x + 300y$

$(33, 34)$

$P = 200(33) + 300(34) = 16800$

Nokia = 33
Motorola = 34

05


y
x = y
100
90
80
70
60
50
40
30
20
10
O
10
20
30
40
50
60
70
80
90
100
x
R
5x + 4y = 300

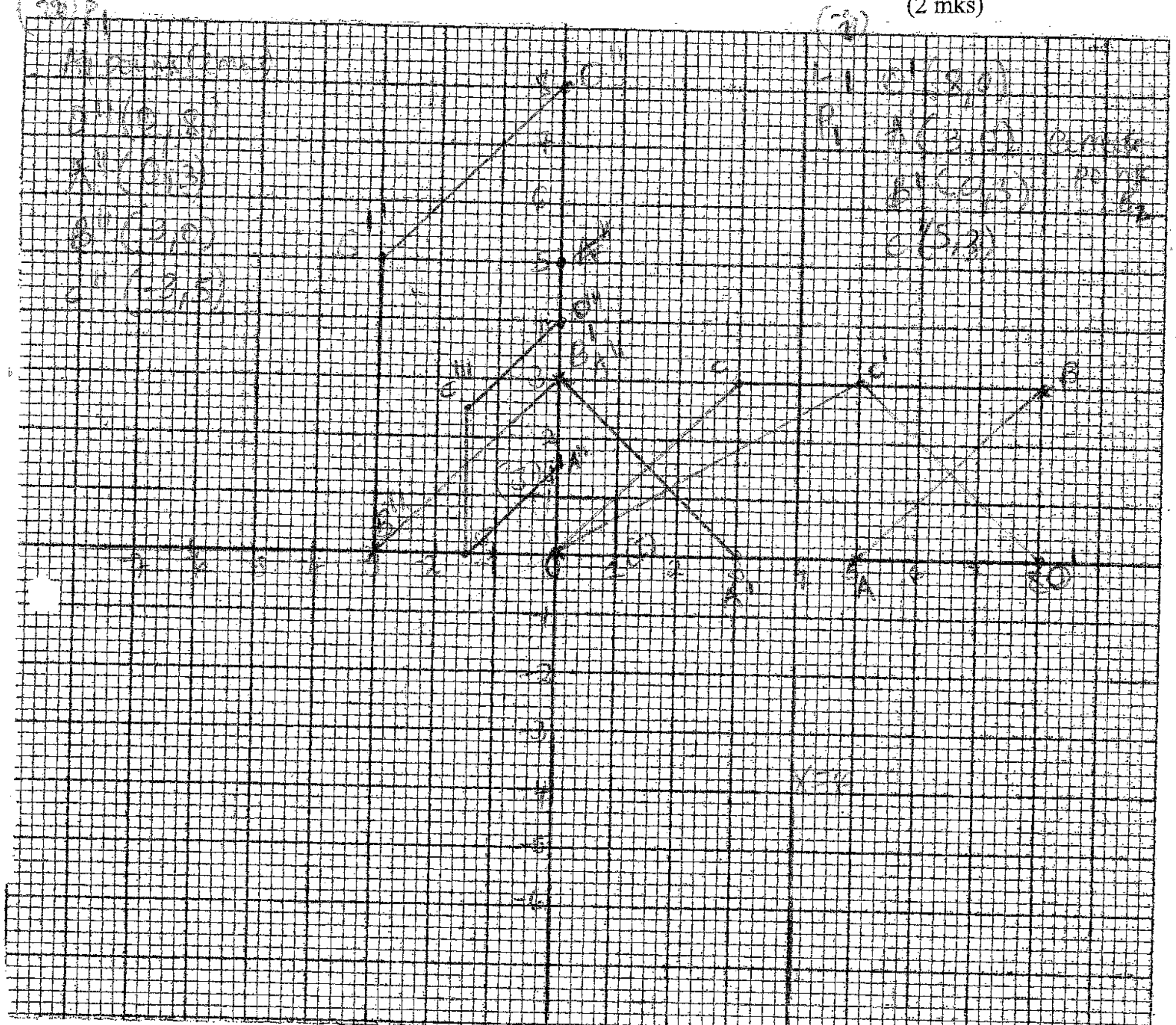
20. The vertices of parallelogram are O (0,0), A (5,0) B (8,3) and C (3,3). Plot on the same axes:

(i) Parallelogram O'A'B'C', the image of OABC under reflection in the line x = 4 (4 mks)

(ii) Parallelogram O''A''B''C'' the image of O'A'B'C' under a transformation described by the matix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ Describe the transformation. (4 mks) 1

Rotation ⇒ positive quarter turn about the origin.

(iii) Parallelogram O'''A'''B'''C''' under the enlargement, centre (0,0) and scale factor ½ (2 mks)



$$\begin{array}{cccc} I & J & I' & J' \end{array}$$
$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \rightarrow \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

11 (20) O'''(0,4) P1
A'''(0,1.5) B1 → All points correctly plotted
B'''(-1.5,0)
C'''(-1.5,2.5)

21. A particle moving with acceleration $a = (10 - t)\ m/s^2$. When $t = 1$ velocity $V = 2$ m/s and when $t = 0$ displacement $S = OM$.

(a) Express displacement and velocity in terms of t.

(b) Calculate the velocity when t = 35

(c) What is the displacement when t = 5

(d) Calculate maximum velocity.

$a = 10 - t$

(a) $V = 10t - \frac{1}{2}t^2 + c$

$t = 0, V = 0$

$c = 0$

$V = 10t - \frac{1}{2}t^2$ ✓ 1

$S = 5t^2 - \frac{1}{6}t^3 + c$

$S = 5t^2 - \frac{1}{6}t^3$ ✓ 1

(b) $V = 10t - \frac{1}{2}t^2$

$= 10(35) - \frac{1}{2}(35)^2$

$= 350 -$

(c) $S = 5t^2 - \frac{1}{6}t^3$

$S = 5(25) - \frac{1}{6}(125)$

$=$

(d) Max vel, $a = 0$

$V = 10(10) - \frac{1}{2}(100)$

$V = 100 - 50$

$= 50$ m/s.

21. A particle moving with acceleration $a = (10 - t)\ m/s^2$. When $t = 1$ velocity $V = 2$ m/s and when $t = 0$ displacement $S = OM$.

(a) Express displacement and velocity in terms of t.

(b) Calculate the velocity when t = 35

(c) What is the displacement when t = 5

(d) Calculate maximum velocity.

a) $a = \frac{dv}{dt}$

$\frac{dv}{dt} = 10 - t$

$v = 10t - \frac{t^2}{2} + c$

$2 = 10 - \frac{1}{2} + c$

$c = -7\frac{1}{2}$

$V = 10t - \frac{t^2}{2} - 7\frac{1}{2}$

$V = \frac{ds}{dt} = 10t - \frac{t^2}{2} - 7\frac{1}{2}$

$S = 5t^2 - \frac{t^3}{6} - 7.5t + c$

When $t = 0$ $S = 0$. then $C = 0$.

$S = 5t^2 - \frac{t^3}{6} - 7.5t$

b) $V = 10t - \frac{t^2}{2} - 7.5$ $t = 35$

$350 - 612 - 7.5 = -270\ m/s$.

c) $S = 5(5) - \frac{1}{6} \times 125 - 7.5 \times 5$
12

$125 - 20\frac{5}{6} - 37.5 = 66\frac{2}{3}\ m$.

(d) Max Vel is when $\frac{dv}{dt} = 0$

$a = 10 - t$

$t = 10$

$V = 10 \times 10 - \frac{100}{2} - 7.5 = 42.5\ m/s$.

22. (a) Three quantities x, y and t were such that the square root of y varies directly as x and inversely as t. find the percentage change in t if x decreases in ratio 4 : 5 and y increases by 44%. (5 mks)

$\sqrt{y} = \frac{kx}{t}$

$t = \frac{kx}{\sqrt{y}}$

$t = \frac{k\,0.8x}{\sqrt{1.44y}}$

$\cancel{\dfrac{\frac{0.8kx}{\sqrt{1.44y}} - \frac{kx}{\sqrt{y}}}{\frac{kx}{\sqrt{y}}}}$

$= \dfrac{\frac{kx}{\sqrt{y}} - \frac{0.8kx}{\sqrt{1.44y}}}{\frac{kx}{\sqrt{y}}} \times 100$

$= 33.33\%$

Increase

(b) If y varies as the square root of x and the sum of the vale of y when x = 4 and y = 100 is 2:

(i) Find y in terms of x (3 mks)

$y \propto \sqrt{x}.$

$y = kx.$

$100 = 2k$

$k = 50$

$y = 50\sqrt{x}.$

(ii) Find x correct to one d.p when y = 14 (2 mks)

$y = 50\sqrt{x}.$

$14 = 50\sqrt{x}.$

$\sqrt{x} = \frac{14}{50}$

$\sqrt{x} = 0.28$

$x = (0.28)^2$

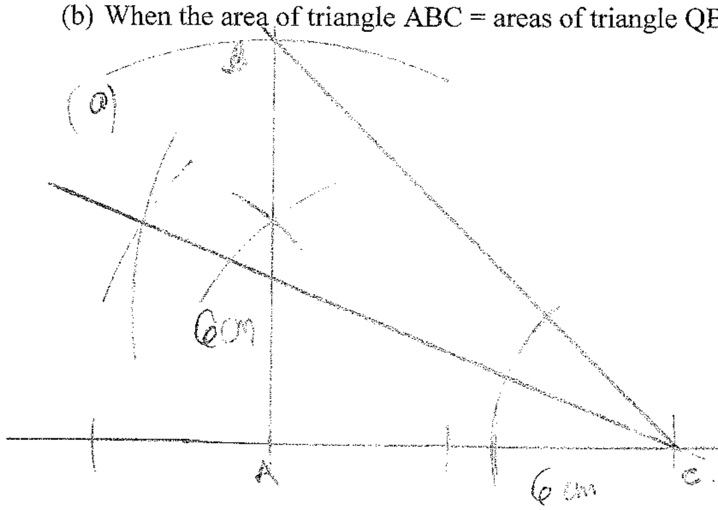
$= 0.0784$

$= 0.1$

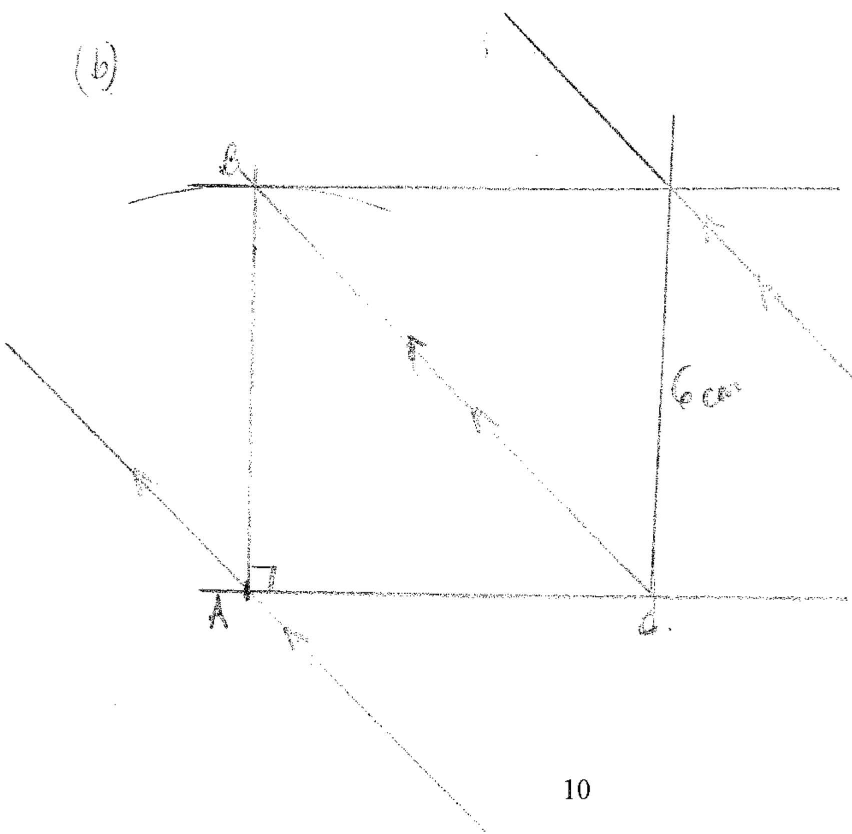
19. Use a ruler and pair of compasses only in this question. ABC is a fixed triangle in which AB = AC = 6 cm and angle BAC = 90^0. Show clearly on a two dimensional drawing the locus of Q in each case below.

(a) When Q is equidistant from both lines CA and CB. (5 mks)

(b) When the area of triangle ABC = areas of triangle QBC. (5 mks)



Angle bisector of <ACB (locus of Q).



locus of Q is any point on the lines parallel to CB.

24. Two fair dice are tossed once. The event A and B are defined as follows:
A: the score on the two dices are the same
B: at least one die shows a 4.

(a) Draw a probability space representing the tossing. (2 mks)

(b) Calculate:
(i) The probability of even A (1 mk)

(ii) The probability of even B (2 mks)

(iii) The probability of even A and B (2 mks)

(c) If the two dice are tossed three time
(i) Draw a tree diagram showing the event A happening for the three tosses. (1 mk)

(ii) Calculate the probability that A occurs:
(a) Exactly once (1 mk)

(b) At least once (2 mk)

(c) At most once (2 mks)

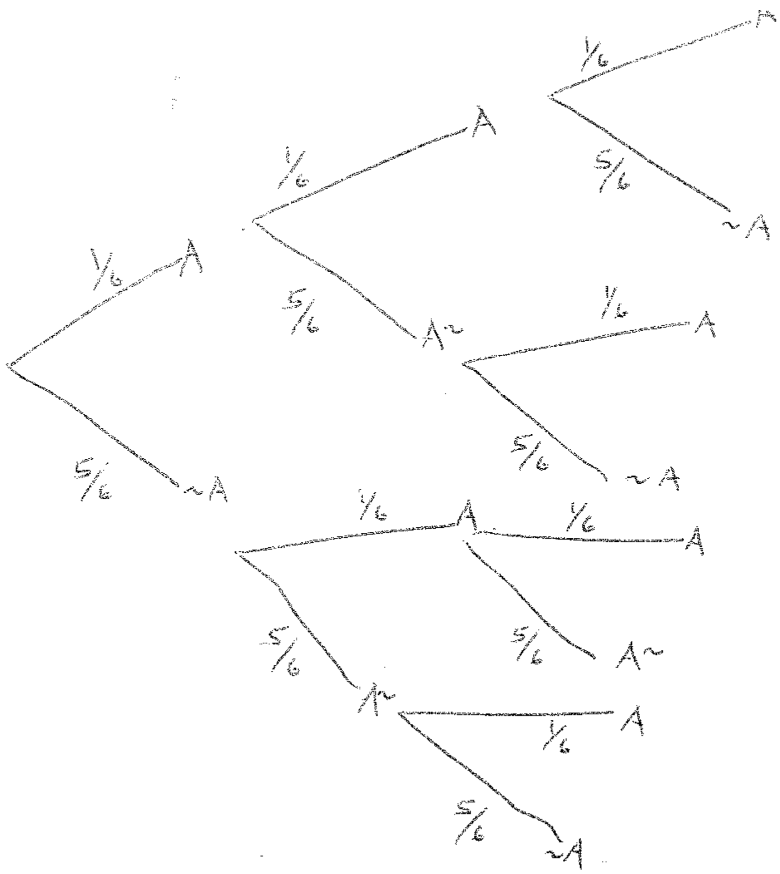
Die 2 / Die 1	1	2	3	4	5	6
1	(1, 1)	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 6	5, 7
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

b)(i) $P(A) = \frac{6}{36} = \frac{1}{6}$.

(ii) $P(B) = \frac{11}{36}$.

(iii) $P(A \text{ and } B) = P(4,4) = \frac{1}{36}$

P.T.O



(1)(a) $P(\text{A occurs exactly Once}) = 3\left(\frac{1}{6} \times \frac{5}{6} \times \frac{5}{6}\right) = \frac{25}{72}$

(b) $P(\text{A occurs at Most Once}) = \cancel{P} \; 1 - P(\text{A doesn't occur})$

$= 1 - \left(\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6}\right) = 1 - \frac{125}{216} = \frac{91}{216}.$

(c) $P(\text{A occurs at most Once} = P(\text{A occurs Once or Zero times})$

$= \frac{25}{72} + \frac{125}{216} = \frac{200}{216} = \underline{\underline{\frac{25}{27}}}$