

TIME 2 1/2 HRS

SECTION A DO ALL THE QUESTIONS

1. Evaluate

$$\frac{(32 \div 4 \text{ of } (-4) \times 6 + 28)}{-40 \div 5 \times 2}$$

$$\frac{32 \div -16 \times 6 + 28}{-8 - 2}$$

$$\frac{-2 \times 6 + 28}{-16}$$

$$\left(\frac{-12 + 28}{-16} \right)$$

$$= \left(\frac{16}{-16} \right) \text{ B1}$$

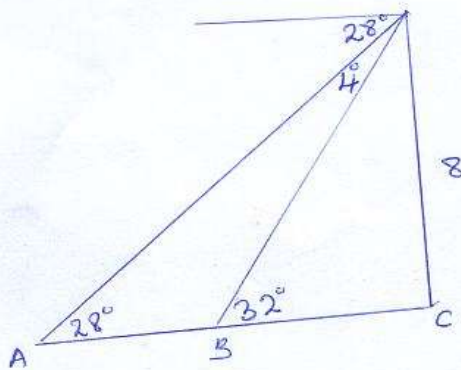
$$= -\frac{1}{2} \text{ A1}$$

(4mks)

(4)

2. The angle of depression of a hen on a horizontal surface on the ground to a crow perched on top of a building is 28 degrees. The building is 8m tall vertically. When the hen sees the crow, the hen moves directly towards base of the building to a point such that the angle of elevation of the cow from B is 32°.

Calculate the distance hen moved.



$$\tan \theta = \frac{8}{AC}$$

$$\tan 28 = \frac{8}{AC}$$

$$AC = \frac{8}{\tan 28} = 15.045$$

$$AB = 2.242 \text{ m}$$

Hen Moved 2.242 m A1

(3)

$$BC = \frac{8}{\tan 32} = 12.803$$

3. Use the method of completing the square to solve for x

(3 marks)

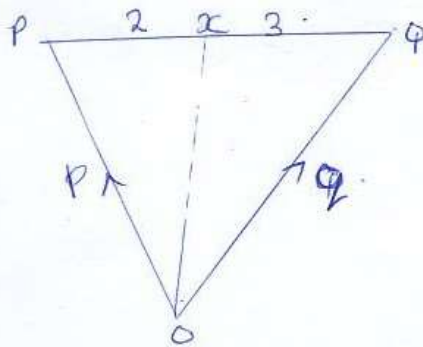
$$4x^2 + 12x - 9 = 0$$

4. The position vectors of points P and Q are

$$OP = \begin{pmatrix} 3 \\ 4 \\ -6 \end{pmatrix} \text{ and } OQ = \begin{pmatrix} -5 \\ -1 \\ 2 \end{pmatrix}$$

Find the position vector of point X, which divides line PQ internally in ratio, 2:3

(3mks)

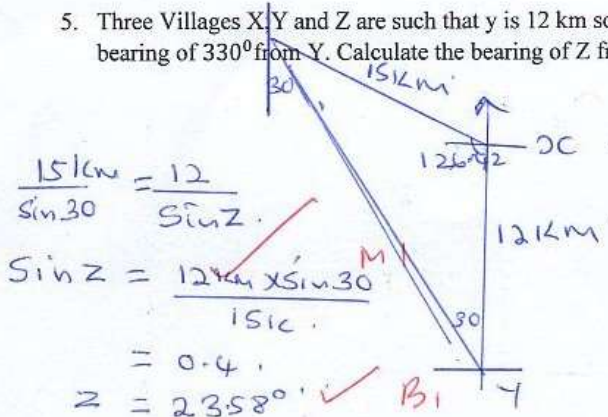


$$\begin{aligned} \vec{OX} &= \vec{OP} + \vec{PX} \\ \vec{PX} &= \frac{2}{5} \vec{PQ} \quad \checkmark \text{ M1} \\ \vec{PQ} &= \vec{OQ} - \vec{OP} \\ \vec{PX} &= \frac{2}{5} (\vec{OQ} - \vec{OP}) \quad \checkmark \text{ M1} \\ \vec{OX} &= \vec{OP} + \frac{2}{5} (\vec{OQ} - \vec{OP}) \\ &= \frac{3}{5} \vec{OP} + \frac{2}{5} \vec{OQ} \quad \checkmark \text{ A1} \end{aligned}$$

3

5. Three Villages X, Y and Z are such that Y is 12 km south of X and Z is 15 km from X. Village Z is on a bearing of 330° from Y. Calculate the bearing of Z from X.

(3mks)



$$\begin{aligned} \frac{15 \text{ km}}{\sin 30} &= \frac{12}{\sin Z} \\ \sin Z &= \frac{12 \times \sin 30}{15} \\ &= 0.4 \\ Z &= 23.58^\circ \quad \checkmark \text{ B1} \end{aligned}$$

$$\begin{aligned} 30 + 23.58 &= 53.58 \\ 180 - 53.58 &= 126.42 \quad \checkmark \text{ M1} \end{aligned}$$

$$\begin{aligned} \text{Bearing of Z from X is} \\ 180^\circ + 126.42 &= 306.42^\circ \quad \checkmark \text{ A1} \end{aligned}$$

4

6. A line AB is formed by coordinates A (1,2) and B (4,6). Another line 2 is the perpendicular bisector to line AB/. Find the equation of line 2.

(3mks)

$$\begin{aligned} \text{slope of AB} &= \frac{6-2}{4-1} \\ &= \frac{4}{3} \quad \checkmark \text{ M1} \end{aligned}$$

$$\begin{aligned} \text{line 2: } M_1 \times M_2 &= -1 \\ \frac{4}{3} M_2 &= -1 \\ M_2 &= -\frac{3}{4} \quad \checkmark \text{ M1} \end{aligned}$$

$$\begin{aligned} 4(y-4) &= -3(x+7.5) \\ 4y &= -3x + 23 \quad \checkmark \text{ A1} \end{aligned}$$

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$$\begin{aligned} \text{Mid AB: } & \left(\frac{1+4}{2}, \frac{2+6}{2} \right) \\ & (2.5, 4) \quad \checkmark \text{ B1} \\ \frac{y-4}{x-2.5} &= -\frac{3}{4} \end{aligned}$$

7. Ann bought four pens and three exercise books for a total of sh.17 while peter bought five pens and two similar pens and two exercise books for a total of sh.16.

Find the cost of a pen and an exercise book using matrix method.

(3mks)

$$\begin{aligned} 4x + 3y &= 17 \times 2 \\ 5x + 2y &= 16 \times 3 \end{aligned}$$

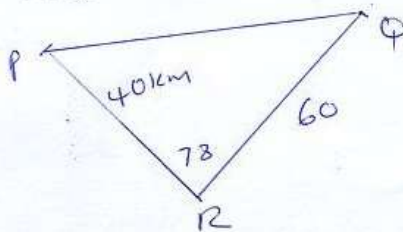
$$\begin{aligned} 8x + 6y &= 34 \\ 15x + 6y &= 48 \\ \hline 7x &= 14 \\ x &= 2 \end{aligned}$$

$$\begin{aligned} 8 + 3y &= 17 \\ 3y &= 9 \\ y &= 3 \end{aligned}$$

Pen cost 2 shillings
Ex. bk cost 3 shillings

8. Three villages are situated such that they form 3 sides of a triangle. The distance of villages P to R is 40km while R to Q is 60km. When represented on a paper angle PRQ is 78° . Find the distance of village P to Q.

(4mks)



cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

$$(PQ)^2 = 40^2 + 60^2 - 2 \cdot 40 \cdot 60 \cos 78^\circ$$

$$\begin{aligned} &= 1600 + 3600 - 4800 \cos 78^\circ \\ &= 5200 - 997.97 \\ &= 4202 \text{ km} \end{aligned}$$

$$PQ = \sqrt{4202} = 64.82$$

9. A water tank is cylindrical in shape is filled by a pipe p in 6 hours. This same tank is emptied when filled in 12 hours by a pipe Q. When someone starts with the tank empty, both pipes are opened at the same time and then pipe Q turned off after 4 hours. Find

The time taken to fill the tank.

(3mks)

$$\begin{aligned} P &= \frac{1}{6} \\ E &= \frac{1}{12} \end{aligned}$$

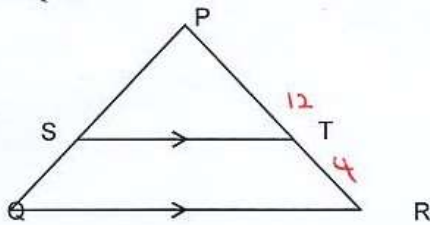
$$\begin{aligned} \frac{1}{6} - \frac{1}{12} &= \frac{1}{12} \times 4 \\ &= \frac{4}{12} \end{aligned}$$

$$\begin{aligned} \frac{7}{12} \div \frac{1}{6} \\ \frac{7}{12} \times \frac{6}{1} &= 3.5 \text{ h} \end{aligned}$$

Time taken
 $4 + 3.5 = 7\frac{1}{2}$

✓ A1

10. The figure below shows triangle PQR in which PR = 12cm. T is a point on PR such that TR = 4cm. Line ST is parallel to QR. If the area of triangle PQR is 336cm². Find the area of the quadrilateral STQR. (4 marks)



$$\begin{aligned}
 &16:12. \\
 &2:3 \text{ or } 4:3. \\
 &\text{A.S.P} = 16:9. \\
 &\text{Area of } \triangle PST \\
 &16 \Rightarrow 336 \\
 &9 \Rightarrow
 \end{aligned}$$

$$\frac{336 \times 9}{16} = 189 \quad \checkmark \quad B_1$$

$$\begin{aligned}
 \text{Area } STQR &= 336 - 189 \\
 &= 147 \text{ cm}^2 \quad \checkmark \quad A_1
 \end{aligned}$$

11. Kamau spent $\frac{3}{5}$ of his money on buying food, and $\frac{1}{2}$ of what was left on rent. After that, he finds that he has sh.1400 left in his pocket. Determine the amount money spent on buying food. (3mks)

$$\text{Food} = \frac{3}{5}$$

$$\begin{aligned}
 \text{Rent} &= \frac{2}{5} \times \frac{1}{2} \\
 &= \frac{1}{5}
 \end{aligned}$$

$$\frac{1}{5}x = 1400$$

$$\begin{aligned}
 \text{Food} &= 1400 \times 3 \\
 &= 4200 \text{ Shillings}
 \end{aligned}$$

12. Find the centre of enlargement if P(0,-1) is the image of P(2,3) under enlargement scale factor 3 (3mks)

let the centre be $C(x,y)$

$$3 \begin{bmatrix} 2 \\ 3 \end{bmatrix} - \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \end{bmatrix} - \begin{bmatrix} x \\ y \end{bmatrix} \quad \checkmark \text{ m1}$$

$$3 \begin{pmatrix} 2-x \\ 3-y \end{pmatrix} = \begin{pmatrix} -x \\ -1-y \end{pmatrix}$$

$$\begin{bmatrix} 6-3x \\ 9-3y \end{bmatrix} = \begin{bmatrix} -x \\ -1-y \end{bmatrix} \quad \checkmark \text{ m1}$$

$$6-3x = -x$$

$$6 = 2x$$

$$x = 3.$$

$$9-3y = -1-y$$

$$9+1 = 2y$$

$$10 = 2y$$

$$y = 5. \quad \checkmark \text{ A1}$$

$C(3,5)$

13. Use the reciprocal tables to evaluate to determine 3 decimal places,

(4mks)

$$\frac{2}{0.4821} - \frac{3}{24.71}$$

$$2 \left(\frac{1}{4.821 \times 10^{-1}} \right) - 3 \left(\frac{3}{2.471 \times 10^1} \right) \quad \checkmark \text{ m1}$$

$$2(0.2074 \times 10) - 3(0.4047 \times 10^{-1}) \quad \checkmark \text{ B1}$$

$$4.148 - 0.12141 \quad \checkmark \text{ B1}$$

$$4.02659 \quad \checkmark \text{ A1}$$

14. Three students shared a certain amount of money. The first got sh.120 more than the second thrice what the third student got. If the second got sh.300, how much did each of the other two get? (3mks)

let the second got sh. x then

1st got sh. $(x+120)$ $\checkmark \text{ m1}$

3rd got sh. $\frac{(x+120)}{3}$ $\checkmark \text{ B1}$

Then $x = \text{sh. } 300$

1st got $420 \times \frac{1}{3} = 140$ $\checkmark \text{ A1}$

i) CY
(2 marks)

ii) BT
(2 marks)

16. Use the method of completing the square to solve for x .

(3mks)

$$4x^2 + 12x - 9 = 0$$

$$\frac{15a^2b - 10ab^2}{3a^2 - 5ab + 2b^2}$$

Num: $5ab(3a - 2b)$ ✓ m_1

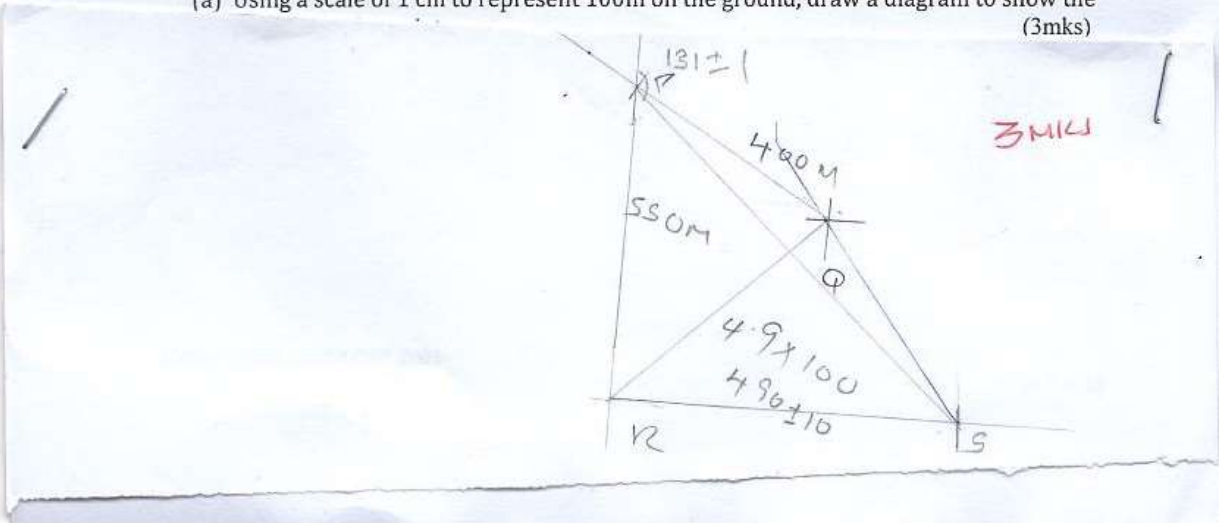
Den: $3a^2 - 3ab - 2ab + 2b^2$
 $(3a - 2b)(a - b)$

$$= \frac{5ab(3a - 2b)}{(3a - 2b)(a - b)} = \frac{5ab}{a - b}$$

✓ B_1
 ✓ A_1

17. Three points P, Q and S are pm the vertices of a triangular plain field. P is 400m from Q on a bearing of 300° and R of 550m directly south of P.

(a) Using a scale of 1 cm to represent 100m on the ground, draw a diagram to show the (3mks)



- (b) Use the scale drawing to determine;
(i) The distance and bearing of Q from R.

(3mks)

$$\begin{aligned} 360 - 45 &= 315^\circ \\ 045^\circ \pm 1 \\ 490 \pm 10 \text{ m} \end{aligned}$$

- (ii) The bearing and distance of point S from P given that point S is directly 600m East of R.

(3mks)

$$\begin{aligned} 8 \pm 1 \times 100 &= 800 \text{ m} \\ 131^\circ \pm 1 & \end{aligned}$$

- (iii) The bearing and distance of Q from S.

(3mks)

$$\begin{aligned} 4.15 \pm 1 \times 100 &= 415 \\ 323^\circ \pm 1 & \end{aligned}$$

18. A bus travelling at a speed of 80km/hr left Mombasa at 8.00am for Nairobi. Two hours later, a car travelling at a speed of 100km/hr left Nairobi for Mombasa.

Given that the distance between both cities is 500km, find the: -

- i) distance covered by bus at the time the car is starting.

(1mk)

$$80 \times 2 = 160 \text{ km} \quad \checkmark \quad 81$$

ii) Distance between the two vehicles at the time they are starting

(1mk)

$$500 - 160 = 340 \text{ km} \quad \checkmark \quad A1$$

iii) Relative speed of the two vehicles

(1mk)

$$100 + 80 = 180 \text{ km/hr} \quad \checkmark \quad A1$$

iv) Time taken for the two vehicles to meet

(2mks)

$$T_k = \frac{340}{180} \quad \checkmark \quad A1 \\ = 1.9 \quad \checkmark \quad A1$$

v) Time they met.

(1mk)

$$8 + 2 + 1.54 \text{ min} \\ 10.54 \text{ am} \quad \checkmark \quad A1$$

✓ After meeting, the speed of both vehicles dropped to 60km/hr due to traffic jam. At what time did each vehicle arrive at its destination?

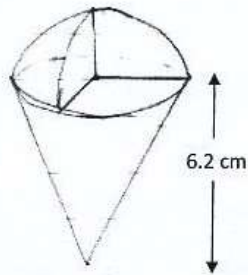
(3mks)

$$3.9 \times 80 = 312 \quad \checkmark \quad A1 \\ \frac{182}{60} = \quad \checkmark \quad A1$$

20. The kite shown on the fig below has vertices, A(-2,4)B(5,7)C(7,4)D(5,1). The kite ABCD is rotated about the origin through -90° to obtain its first image A'B'C'D'. The kite A'B'C'D' is then reflected along the line $x=0$ to obtain A''B''C''D''. Find
- (a) The equation of the Mirror line that reflects point A to itself, B on to D and C onto itself

(b) Draw a kite A'B'C'D and state its coordinates.

21. A given solid is made up of a cone and three quarters of hemisphere as shown in the diagram below. The radius and vertical height of the cone are 4cm and 6.2 cm respectively



a. Calculate the volume of the solid

(4mks)

Volume = $\frac{4}{3}\pi r^3$
 Sphere.

$$\frac{4}{3} \times 3.14 \times 4 \times 4 \times 4 \times \frac{3}{4} = 200.96$$

Cone: $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times 3.14 \times 4^2 \times 6.2 = 103.83$

Total 304.789 cm^3

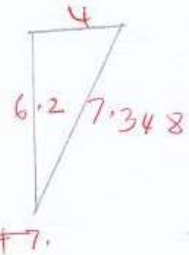
b. Calculate the surface area of the solid

(4mks)

$$\text{Sphere } 4\pi r^2 \times \frac{3}{4} = 4 \times 3.142 \times 4 \times 4 \times \frac{3}{4} = 150.816 \text{ cm}^2$$

$$\text{Cone } \pi r L = 3.142 \times 4 \times 7.348 = 92.345 \text{ cm}^2$$

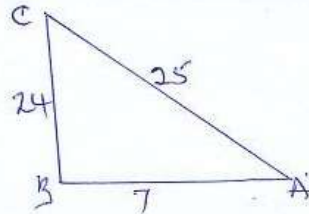
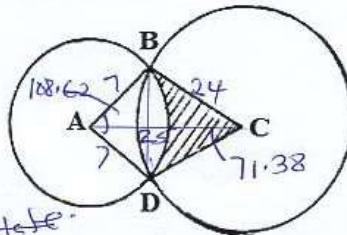
$$\text{Total} = 243.166 \text{ A}_1$$



c. The material used for making the solid costs shs 40 per cm^3 . What is the cost of making ten such solids

$$304.789 \times 40 = 12191.56 \text{ (2mks)}$$

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



Calculate

(a) Show that angle $ABC = 90^\circ$.
 Find $\angle A$ & $\angle C$
 $b^2 = a^2 + c^2 - 2ac \cos B$
 $25^2 = 24^2 + 7^2 - 2 \cdot 24 \cdot 7 \cos B$
 $625 = 576 + 49 - 336 \cos B$
 $625 = 625 - 336 \cos B$

$$\cos B = \frac{625 - 625}{-336} = 0$$

Implies $B = 90^\circ$ A₁

(b) Calculate (i) the size of obtuse angle BAD

$$\frac{1}{2} \times 7 \times 24 = \frac{84}{2} = 42$$

$$24^2 = 25^2 + 7^2 - 2 \times 25 \times 7 \cos A$$

$$576 = 674 - 168 \cos A$$

$$+98 = 168 \cos A$$

$$\cos A = 0.5833$$

$$A = 54.3^\circ$$

$$BAD = 108.62$$

(3mks)

(ii) the area of the shaded part

(4Mks)

$$\begin{aligned} \frac{7}{2} \times 7 \times 24 \times 2 &= 168 \text{ M}^2 \\ &= \frac{108.62}{360} \times 3.142 \times 2 \times 7 \text{ M}^2 \\ &= 13.27 \\ \text{Shadeded} &= 168 - 13.27 \text{ M}^2 \\ &= 154.73 \text{ M}^2 \end{aligned}$$

(a) Find the area of the farm in hectares

(3mks)

(b) Karis wishes to irrigate his farm using a sprinkler machine situated in the farm such that it is equidistant from points A, B and C.

(i) Calculate the distance of the sprinkler from point C.

(2 Marks)

(ii) The sprinkler rotates in a circular motion so that the maximum point reached by the water jets is the vertices A, B and C. Calculate the area outside his farm that will be irrigated.

(3 Marks)

23. Two lines $L_1=2y-3x=6$ and $L_2=3y+x-20=0$ intersect at point A.

a. Find the coordinates of A

(3marks)

$$\begin{aligned} (2y-3x=6) \times 3 \\ (3y+x=20) \times 2 \\ \hline 6y-9x=18 \\ 6y+x=40 \\ \hline -11x=-22 \\ x=2 \end{aligned}$$

$$\begin{aligned} 2y-3(2) &= 6 \\ 2y-6 &= 6 \\ 2y &= 12 \\ y &= 6 \end{aligned}$$

A (2, 6)

- i. A third line L_3 is perpendicular to L_2 at point A. Find the equation of L_3 in form of $y=mx+c$, where m and c are constants.

(3marks)

$$\begin{aligned} 3y &= -x+20 \\ y &= -\frac{1}{3}x + \frac{20}{3} \\ m &= 3 \\ \frac{y-6}{x-2} &= 3 \end{aligned}$$

$$\begin{aligned} y-6 &= 3x-6 \\ y &= 3x+0 \end{aligned}$$

- b. Another line L_4 is parallel to L_1 and passes through (-1,3). Find the x-intercept and the y-intercept of L_4 .

(4marks)

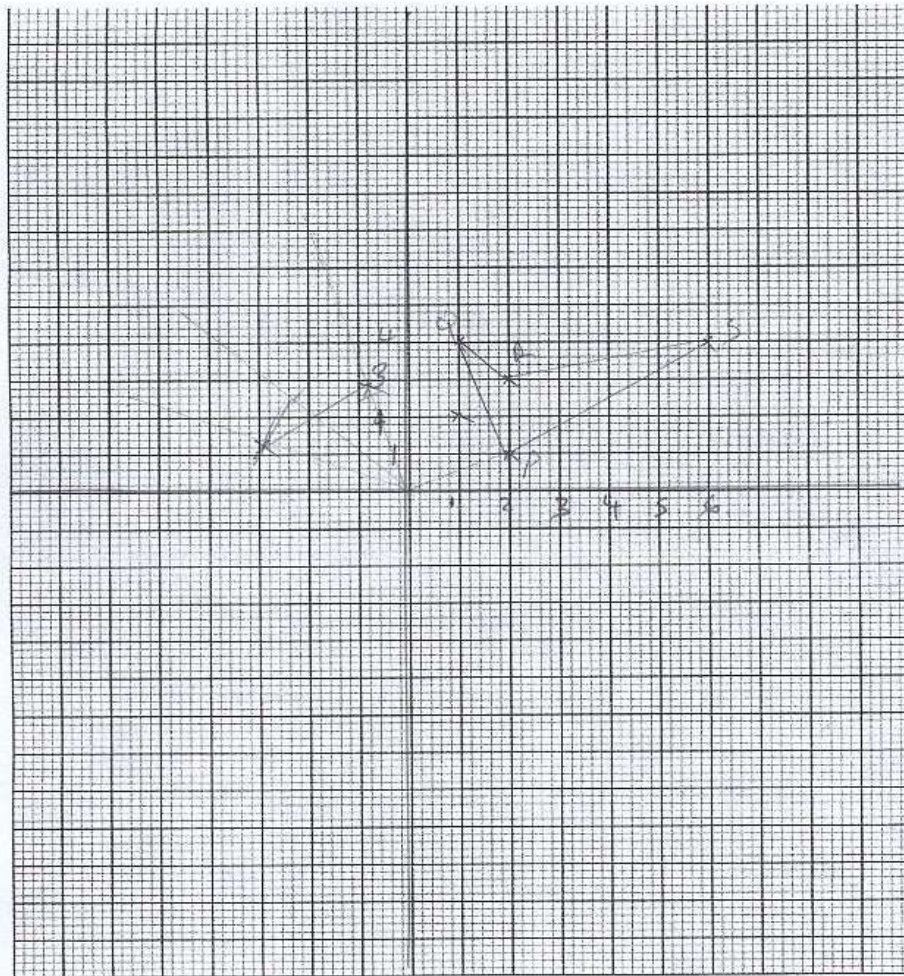
$$\begin{aligned} 2y &= 3x+6 \\ y &= \frac{3}{2}x+3 \\ \frac{y-3}{x+1} &= \frac{3}{2} \\ 2(y-3) &= 3(x+1) \\ 2y-6 &= 3x+3 \end{aligned}$$

$$\begin{aligned} 2y &= 3x+9 \\ y &= \frac{3}{2}x + \frac{9}{2} \\ x\text{-intercept } y &= 0 \\ \frac{2}{3} \times \frac{3}{2}x &= -\frac{9}{2} \times \frac{2}{3} \\ x &= -3 \\ y\text{-intercept } x &= 0 \\ y &= \frac{9}{2} \\ &= 4.5 \end{aligned}$$

24. (a) PQRS is a quadrilateral with vertices P(1,4), Q(2,1), R(2,3) and S(6,4). On the grid provided, plot the quadrilateral. **(2 mark)**

(b) Draw P'Q'R'S' the image of PQRS under a positive quarter turn about the origin and write down its co-ordinates. **(3 marks)**

(c) Draw P''Q''R''S'' the image of P'Q'R'S' under an enlargement scale factor -1 and center (0,0) and write down its co-ordinates. **(3 marks)**



Determine the single transformation that maps PQRS onto P''Q''R''S (2marks)

24. PQR is a triangle with coordinates; P(3, 3), R (2, 1) and Q(5, 1). P'Q'R' is the image of PQR under an enlargement such that the coordinates are P'(-3, 0), Q'(-7, 4) and R'(1, 4). Using a scale of 1:1 on both axes;

(a)(i) Plot PQR and P'Q'R' hence locate the Centre of enlargement by construction. (4 marks)

(c) P'''Q'''R''' is the image of PQR under a reflection whose mirror line is $y = -2$. Plot P'''Q'''R'''. (2 marks)

(ii) State the scale factor of the enlargement.

(2mark)

(b) P''Q''R'' is the image of PQR under a translation $T\left(\begin{smallmatrix} 1 \\ 3 \end{smallmatrix}\right)$.

Plot P''Q''R''. (3 marks)