SUKELLEMO PRE-MOCK EXAMINATION.

121/1
MATHEMATICS ALT. A
PAPER 1
APRIL 2023
TIME: 2 ½ HOURS

NAME....MARKING SCHEME.... ADM NO. ....

DATE: ....SIGN: ....

Instructions toCandidates
1. Write your name, Admission number and class in the spaces provided.
2. Sign and write date of the examination in the spaces provided.
3. The paper contains TWO sections: Section I and II
4. Answer ALL questions in section I and **STRICTLY ANY FIVE** questions from section II.
5. All working and answers must be written on the question paper in the spaces provided below each question.
6. Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
7. Marks may be awarded for correct working even if the answer is wrong.
8. Non-programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.

For Examiner's use only
Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL

GRAND TOTAL

Section II

17	18	19	20	21	22	23	24	25	TOTAL

This paper consists of 15 printed pages. Candidates should check to ensure that all pages are printed as indicated and no questions are missing.

1. Evaluate $\dfrac{-12 \div (-3) \times 4 - (-20)}{-6 \times 6 \div 3 + (-6)}$ (2 Marks)

$\underline{NUM}$

$-12 \div 3 \times 4 + 20$

$\quad \div 12 + 20$

$-12 + 8$

$\underline{NUM}$

$-12 \div (-3) \times 4 - (-20)$

$= -12 \div -3 \times 4 + 20$

$= 4 \times 4 + 20$

$= 36$

$\underline{DEN}$

$-6 \times 6 \div 3 + (-6)$

$-6 \times 2 - 6$

-18

$\dfrac{36}{-18}$ M_1

$= -2$ A_1

2. Mr. Owino spends $\frac{1}{4}$ of his salary on school fees. He spends $\frac{2}{3}$ of the remainder on food and a fifth of what is left on transport. He saves the balance. In certain month he saved Sh. 3400. What was his salary? (3 Marks)

$Food = \frac{1}{2}$

$Transport = \frac{1}{20}$ $\Big\}$ M_1

$Remeinder$

Fraction of saving

$1 - \left(\frac{1}{2} + \frac{1}{20} + \frac{1}{4}\right) = 1 - \frac{16}{20} = \frac{4}{20}$ M_1

$= 3400 \times \frac{20}{4}$ $= 17\,000$ A_1

3. Simplify: (3 Marks)

$$\dfrac{2y^2 - 3xy - 2x^2}{4y^2 - x^2}$$

$\frac{5}{-3}$

$\frac{p}{-4}$

$\underline{NUM}$

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

$2y^2 - 4xy + xy - 2x^2$

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

$(2y + x)(y - 2x)$ M_1

$\underline{DEN}$

$4y^2 - x^2$

$2^2 y^2 - x^2$

$(2y + x)(2y - x)$ M_1

$\dfrac{(2y + x)(y - 2x)}{(2y + x)(2y - x)}$

$\dfrac{(y - 2x)}{(2y - x)}$ A_1

2

4. Find x if $3^{2x+3} + 1 = 28$ (2 Marks)

$3^{2x+3} + 1 = 28$

$3^{2x+3} = 27$
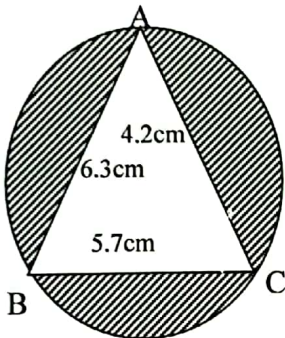
$3^{2x} \times 3^3 = 3^3$

$27 \times 3^{2x} = 27$ M_1

$3^{2x} = 1^0$

$2x = 0$

$x = 0$ A_1

5. The circle below whose area is 18.05cm² circumscribes triangle ABC where AB = 6.3cm, BC = 5.7cm and AC = 4.2cm. Find the area of the shaded part. (4 Marks)

$S = \dfrac{5.7 + 4.2 + 6.3}{2} = 8.1$ B_1

$= \sqrt{8.1(8.1-5.7)(8.1-4.2)(8.1-6.3)}$ M_1

$= \sqrt{8.1 \times 2.4 \times 3.9 \times 1.8} = 11.68$ A_1

Shaded area $= 18.05 - 11.68$

$= 6.368 \text{ cm}^2$ B_1

6. A salesman gets a commission of 2.4% on sales up to Sh. 100,000. He gets additional commission of 1.5% on sales above this. Calculate the commission he gets for sales worth Sh. 280,000. (3 Marks)

$\dfrac{2.4}{100} \times 100000 = 2400$ M_1
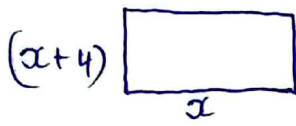
$\dfrac{3.9}{100} \times 180\,000 = 7020$ $+$ M_1

9420 A_1

7. A rectangle whose area is 96m² is such that its length is 4metres longer than its width.
   Find
   (a) It dimensions (2 Marks)

   $x(x+4)=96$ M1   length = 12
   $x^2+4x-96=0$ A1
   $(x-8)(x+12)=0$ width = 8
   $x=8$

   (b) Its perimeter (1 Mark)

   $2(8+12)$

   $= 40$ B1

8. The sum of interior angles of a triangle is given by $[10x-2y]^0$ while that of a hexagon is given by $[30x+24y]^0$ .Calculate the values of x and y   (3 Marks)

   $10x-2y=180$ $y=90-5x$ $x=16$
   $30x+24y=720$ $y=90-80$
                          $5x+4(90-5x)=120$
   $5x+y=90$ $5x+360-20x=120$ $y=10$ A1
   $5x+4y=120$ B1 $-15x=240$ M1

9. In triangle ABC below, AC = BC, AB is parallel to DE, AB = 15cm, DE = 7.5cm and BE = 6cm.
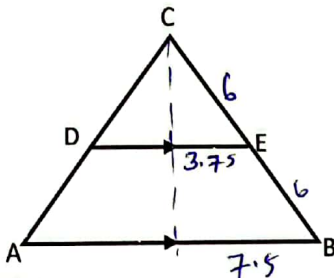
   Calculate
   (a) Length CE (2 Marks)

   $\dfrac{CE}{BC}=\dfrac{DE}{AB}$ $x=6$ A1

   $\dfrac{x}{x+6}=\dfrac{7.5}{15}$ M1

   (b) Area of quadrilateral ABED. (2 Marks)

Height of DEC $\sqrt{6^2-3.75^2}=4.684$

4

Height of ABC $\sqrt{12^2-7.5^2}=9.368$

Area of ABED $=\left(\frac{1}{2}\times15\times9.368\right)-\left(\frac{1}{2}\times7.5\times4.684\right)$ M1

$= 52.698$ A1

10. A measuring cylinder of base radius 5cm contains water whose level reads 6cm high. A spherical object is immersed in the water and the new level reads 10cm. Calculate the radius of the spherical object

(3 Marks)

$$\frac{22}{7} \times 5^2 (10-6) = 314 \cdot 29 \quad M_1$$

$$\frac{4}{3} \times \frac{22}{7} r^3 = 314 \cdot 29 \quad M_1$$

$$r = 4 \cdot 217 \, cm \qquad A_1$$

11. Using a ruler and pair of compasses only, construct triangle ABC in which AB = 6cm, BC = 8cm and angle ABC = 45°. Drop a perpendicular from A to BC to meet line BC at M. Measure AM and AC.

(4 Marks)
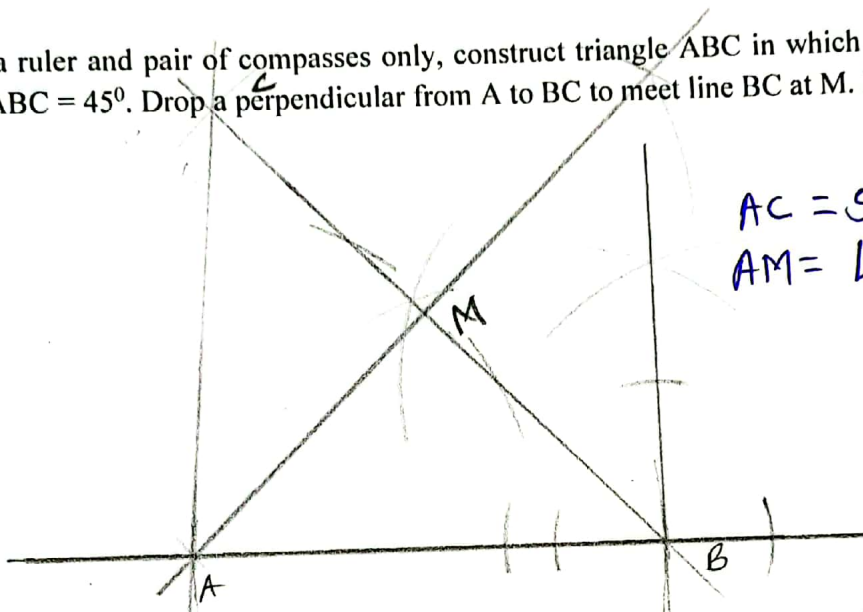
$$AC = 5 \cdot 4 \pm 1 \, cm \left.\right\}$$
$$AM = 4 \cdot 2 \pm 1 \, cm \left.\right\} B_1$$

— Construction of 45°
— ΔABC B_1
— $\perp$ Dropped from A to BC

12. In a book store, books packed in cartons are arranged in rows such that there are 50 cartons in the first row, 48 cartons in the next row, 46 in the next and so on.

(2 Marks)

(a) How many cartons will there be in the 8th row?

$$50, 48, 46 - - - \qquad a = 50 \quad S_n = \frac{20}{2} (2 \times 50 + (20-1)(x-2)$$
$$d = -2$$
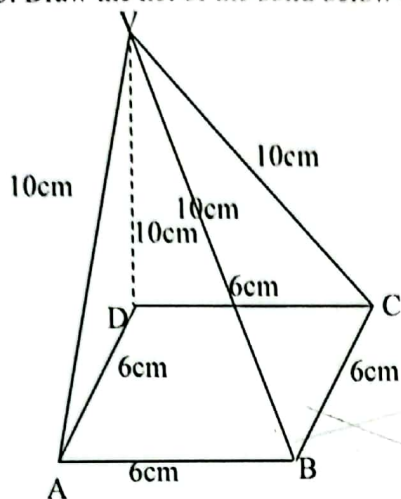$$T_8 = a + 7d \qquad M_1 \qquad = 620$$
$$= 50 + 7(-2)$$
$$= 36 \qquad A_1$$

(b) If there are 20 rows in total, find the total number of cartons in the book store.

(2 Marks)

$$S_n = \frac{20}{2} (2 \times 50 + (20-1) \quad M_1$$

$$= 620 \qquad A_1$$

13. Draw the net of the solid below and calculate the total surface area of its faces. (3 Marks)

B_1 – correct scale

S.A of the base $= 6 \times 6 = 36 \, cm^2$

Area of side flaps $= \left(\frac{1}{2} \times 6 \times 8\right) = 96 \, cm$ M_1

Total S.A $= 36 + 96 = 132 \, cm^2$ A_1

14. Solve the following inequalities and state the integral values. (3 Marks)

$$2x - 2 \le 3x + 1 < x + 11$$

$2x - 2 \le 3x + 1$ $3x + 1 \le x + 11$ $-3 \le x \le 5$

$2x - 3x \le 1 + 2$ $3x - x \le 11 - 1$

$-x \le 3$ $2x \le 10$ $-3, -2, -1, 0, 1, 2, 3, 4, 5$

$x \ge -3$ $x \le 5$ A_1

M_1 M_1

15. Solve for x in $2^{2x} - 18 \times 2^x = 40$ (3 Marks)

let $2^x = y$

$y^2 - 18y - 40 = 0$

6

16. A translation maps triangle ABC onto A¹B¹C¹ where A[1,-1], B[2,2], C[3,1] and C¹[-1,3]. Find,
    i.   Translation vector   (1 Mark)

$$\underset{C}{O} + \underset{T}{T} = I$$

$$\begin{bmatrix} 3 \\ 1 \end{bmatrix} + \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 3 \end{bmatrix} \qquad T = \begin{bmatrix} -4 \\ 2 \end{bmatrix}$$

B₁

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$$

         ii.   The coordinate of A¹ and B¹   [2 Marks]

$$\underset{A}{\begin{bmatrix} 1 \\ -1 \end{bmatrix}} + \underset{T}{\begin{bmatrix} -4 \\ 2 \end{bmatrix}} = \underset{A^{1}}{\begin{bmatrix} -3 \\ 1 \end{bmatrix}} \qquad B)$$

$$\underset{B}{\begin{bmatrix} 2 \\ 2 \end{bmatrix}} + \begin{bmatrix} -4 \\ 2 \end{bmatrix} = \underset{B^{1}}{\begin{bmatrix} -2 \\ 4 \end{bmatrix}} \qquad B)$$

7

17. The distance between towns A and B is 360km. A minibus left town A at 8.15 a.m. and traveled towards town B at an average speed of 90km/hr. A matatu left town B two and a third hours later on the same day and travelled towards A at average speed of 110km/hr.

(a) (i) At what time did the two vehicles meet? (4 Marks)

$$D = \frac{7}{3} \times 90 = 210 \text{ Km} \quad ---- M_1$$

$$\text{Remaining distance} = 360 - 210 = 150 \text{Km} \quad -- \, M_1$$

$$A \Rightarrow 90 + 110 = 200 \text{Km}$$

$$\text{Time for meeting} = \frac{150}{200} = 0.75 \text{hrs} \approx 45 \text{mins} \quad -- M_1$$

$$\text{Meeting time} = 10:35$$
$$\underline{+ \quad 45}$$
$$11.20 \text{ a.m.} \qquad ---- A_1$$
$$\frac{}{04}$$

(ii) How far from A did the two vehicles meet? (2 Marks)

$$\text{Distance from } A = 210 + (0.75 \times 90) \quad -- M_1$$
$$= 210 + 67.5$$
$$= 277.5 \text{ Km}. \quad --- A_1$$
$$\frac{}{02}$$

(b) A motorist started from his home at 10.30 a.m. on the same day as the matatu and travelled at an average speed of 100km/h. He arrive at B at the same time as the minibus. Calculate the distance from A to his house. (4 Marks)

$$\text{Time minibus arrived at } B = \frac{360}{90} = 4 \text{hrs.} \quad --- M_1$$

$$= 8:15 + 4 \text{hrs} = 12:15 \text{p.m.}$$

$$\text{Time taken by motorist to arrive at } B$$
$$= 12:15 \text{pm} - 10:30 \text{am} = 1 \text{h } 45 \text{mins.} \quad --- M_1$$
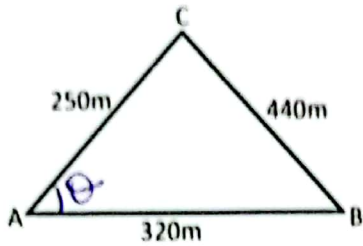
$$= \frac{145}{60} \times 100 = 175 \text{km} \quad --- M_1$$

$$\therefore \text{Home to } B = 175 \text{km}$$

$$\text{Home to } A = 360 - 175$$
$$= 185 \text{Km}. \qquad --- A_1$$
$$\frac{}{04}$$

8

18. Karis owns a farm that is triangular in shape as shown below

(a) Calculate the size of angle BAC   (2 Marks)

$$\cos\theta = \frac{250^2 + 320^2 - 440^2}{2 \times 250 \times 320} \quad ---- M_1$$

$$\theta = 100.33° \quad --- A_1 \qquad \overline{02}$$

(b) Find the area of the farm in hectares   (3 Marks)

$$Area = \frac{1}{2} \times 250 \times 320 \sin 100.33° \quad -- M_1$$

$$= \frac{39351.65}{10000} \quad ---- M_1$$

$$= 3.9852 \, Ha. \quad --- A_1 \qquad \overline{03}$$

(c) 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)

$$\frac{440}{\sin 100.33} = 2R \quad --M_1 \qquad Area = \frac{22}{7} \times 223.6^2 - 39351.65$$

$$R = 223.6m \quad --A_1 \qquad = 117781.7m^2 \quad -- A_1$$

$$\overline{02}$$

(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)

$$Area = \frac{22}{7} \times 223.6^2 = 157,133.3m^2 \quad --- M_1$$

$$= 157,133.3 - 39351.65 \quad -- M_1$$

$$= 117,781.7m^2 \quad --- A_1$$

19. A ship leaves port M and sails on a bearing of 050^0 heading towards island L. Two Navy destroyers sail from a naval base N to intercept the ship. Destroyer A sails such that it covers the shortest distance possible. Destroyer B sails on a bearing of 20^0 to L. The bearing of N from M is 100^0 and distance NM = 300KM. Using a scale of 1cm to represent 50km, determine:-
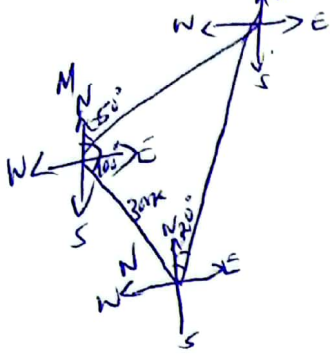
Scale 1cm rep. 300Km
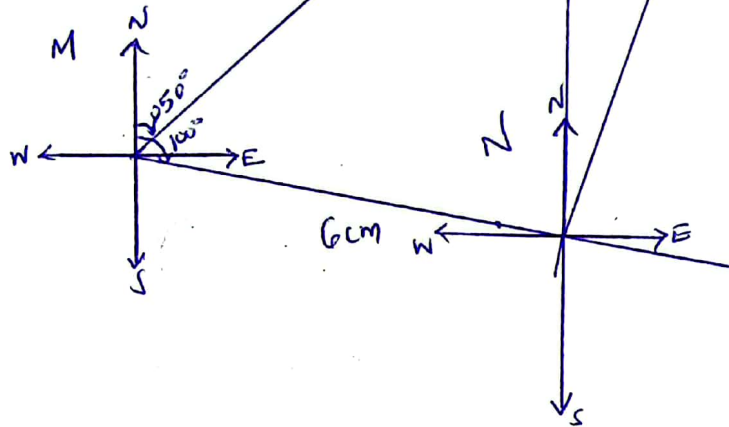
B1

B1

B1

03

(i) The positions of M, N and L. (3 Marks)

(ii) The distance travelled by destroyer A (3 Marks)

$$6.2cm \times 50$$
$$= 310 KM \pm 5$$

(iii) The distance travelled by destroyer B. (2 Marks)

$$9.5 cm \times 50$$
$$= 475 KM \pm 5$$

(iv) The bearing of N from L. (2 Marks)

$$235^0$$

10

20. A number of people agreed to contribute equally to buy books worth KSh. 1200 for a school library. Five people pulled out and so the others agreed to contribute an extra Shs. 10 each. Their contributions enabled them to buy books worth Shs. 200 more than they originally expected.

(a) If the original numbers of people was x, write an expression of how much each was originally to contribute. (1 Mark)

$$Sh. \frac{1200}{x}$$

B1

01

(b) Write down two expressions of how much each contributed after the five people pulled out. (2 Marks)

$$\frac{120}{x} + 10 = \frac{1400}{x-5}$$ --- B
--- A

02

(c) Calculate the number of people who made the contribution. (5 Marks)

$$\frac{1400}{x-5} - \frac{1200}{x} = 0 \quad --- \div M_1$$

$$\frac{1400x - 1200(x-5)}{x(x-5)} = 10$$

$$200x + 6000 = 10x^2 - 50x$$

$$20x + 600 = x^2 - 5x \quad --- M_1$$

$$x^2 + 15x - 40x - 600 = 0 \quad -- M_1$$

$$x(x+15) - 40(x+15) = 0$$

$$(x-40)(x+15) = 0$$

$$x = 40 \text{ people} --- B$$

$$40 - 5 = 35 \text{ pple} --- A$$

05

(d) Calculate how much each contributed. (2 Marks)

$$\frac{1400}{35} = Ksh. 40 \quad --- A$$ --- M,

02

11

10

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

   a) Find the coordinates of A.   **[3marks]**

$L_1 \div 2y - 3x - 6 = 0$

$\dfrac{2y}{2} = \dfrac{3x}{2} + \dfrac{6}{2}$

$y = \dfrac{3}{2}x + 3$

$L_2 \div 3y + x - 20 = 0$

$\dfrac{3y}{3} = \dfrac{-x}{3} + \dfrac{20}{3}$

$y = \dfrac{-1}{3}x + \dfrac{20}{3}$

at A $L_1 = L_2$

$\dfrac{3}{2}x + 3 = -\dfrac{1}{3}x + \dfrac{20}{3}$

$\dfrac{3}{2}x + \dfrac{1}{3}x = \dfrac{20}{3} - 3$

$\dfrac{6 \cdot \#}{\#6}x = \dfrac{\#}{3} \times \dfrac{6^2}{\pi}$

$M_1 \quad x = 2 \quad -- M_1$

$y = \dfrac{3}{2} \times 2 + 3$

$y = 6$

$A(2, 6)_{A_1}$

b) A third line L^3 is perpendicular to L_2 at point A. Find the equation of L3 in the form y = mx + c where m and c are constants.   **[3marks]**

$L_2 \div y = -\dfrac{1}{3}x + \dfrac{20}{3}$

$m_2 = -\dfrac{1}{3}$

$L_3 \dfrac{h \perp 2}{m_3 = 3} , (2, 6) \quad (x, y) \quad M_1$

$\dfrac{y - 6}{x - 2} \times \dfrac{3}{1} --- M_1$

$y - 6 = 3x - 6$

$y = 3x \quad - - -A_1$

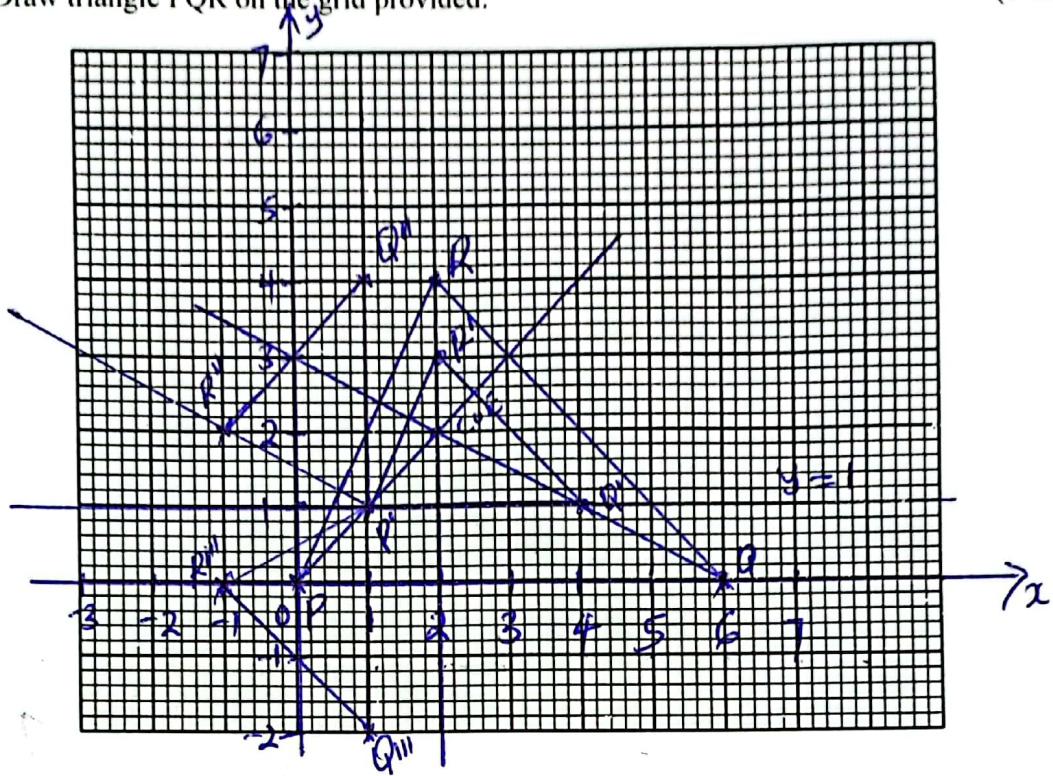c) Another line L4 is parallel to L1 and passes through [-1,3]. Find the x and y-intercept of L4.   **[4marks]**

$L_4 \gtrless L_1$

$M_1 = \dfrac{3}{2}$

$M_4 = \dfrac{3}{2}$

$(-1, 3) \quad (x, y)$

$\dfrac{y - 3}{x + 1} \times \dfrac{3}{2}$

$2y - 6 = 3x + 3$

$\dfrac{2y}{2} = \dfrac{3x}{2} + \dfrac{9}{2} \quad -M_1$

$L_4 \div y = \dfrac{3}{2}x + \dfrac{9}{2}$

y-intercept $= \dfrac{9}{2} \quad - - M_1$

at x-intercept $y = 0$

$0 = \dfrac{3}{2}x + \dfrac{9}{2}$

$\dfrac{3x}{3} \cdot \dfrac{3}{2}x = -\dfrac{9}{2} \times \dfrac{3^1}{3_1} \quad -- M_1$

$x = -3$

x-intercept $= -3 \quad - - - A_1$

10

22. The vertices of triangle PQR are P (0,0), Q (6, 0) and R (2, 4)

(a) Draw triangle PQR on the grid provided. (1 mark)

(b) Triangle $P'Q'R'$ is the image of a triangle PQR under an enlargement scale factor $-\frac{1}{2}$ and centre (2, 2). On the same grid draw triangle $P'Q'R'$ and write down its coordinates.

$P'(1,1), Q'(4,1)$ and $R'(2,3)$ (3 marks)

(c) On the same grid draw triangle $P''Q''R''$ the image of triangle $P'Q'R'$ under a positive quarter turn about point (1, 1). (3 marks)

$P''(1,1), Q''(1,4)$ and $R''(-1,2)$

(d) Draw a triangle $P'''Q'''R'''$ the image of triangle $P''Q''R''$ under reflection in the line $y=1$.

$P'''(1,1), Q'''(1,-2)$ $R'''(-1,0)$ (2 marks)

(e) State the type of congruence between triangle $P'''Q'''R'''$ and triangle $P'Q'R'$. (1 mark)

13

23. The table shows marks obtained by 100 candidates at Goseta Secondary School in Biology examination.

Marks	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85-94
Frequency	6	14	24	14	x	10	6	4

(a) Determine the value of x   (1 Mark)

$$6 + 14 + 24 + 14 + x + 10 + 6 + 4 = 100$$

$$x = 100 - 78$$ M_1

$$x = 22.$$

(b) State the modal class   (1 Mark)

$$35 - 44$$ A_1

(c) Calculate the median mark   (4 Marks)

$$Median = 44.5 + \left(\frac{\frac{100}{2} - 44}{14}\right) 10$$ M_1

$$= 44.5 + \frac{6}{14} \times 10$$ M_1

$$= 48.79$$ A_1

(d) Calculate the mean mark   (4 Marks)

Marks	f	x	xf	Cf
15-24	6	19.5	117	6
25-34	14	29.5	413	20
35-44	24	39.5	948	44
45-54	14	49.5	693	58
55-64	22	59.5	1309	80
65-74	10	69.5	695	90
75-84	6	79.5	477	96
85-94	4	89.5	358	100
	$\Sigma f = 100$		$\Sigma x = 5010$	

B_1

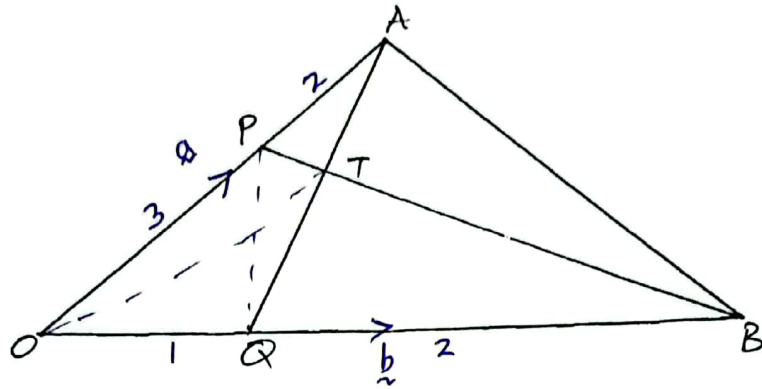$$Mean = \frac{\Sigma xf}{\Sigma f}$$

$$= \frac{5010}{100}$$ M_1

$$= 50.10$$ A_1

14

10

24. In the triangle below P and Q are points on OA and OB respectively such that OP:PA=3:2 and OQ:QB =1:2 AQ and PQ intersect at T. Given that OA= a and OB= b

(2mks)

(a) Express AQ and PQ in terms of a and b

$$\overrightarrow{AQ} = AO + OQ$$
$$= -a + \tfrac{1}{3} b$$
$$B1$$

$$\overrightarrow{PQ} = PO + OQ$$
$$= -\tfrac{3}{2} a + \tfrac{1}{3} b \quad B1$$

(b) Taking BT=kBP and AT=hAQ where h and k are real numbers. (2mks)
(i) Find two expressions for OT in terms of a and b

$$OT = OB + BT$$
$$= b + kBP$$
$$= b + k(BO+OP)$$
$$= b + -k b + \tfrac{3}{5} ka \quad B1$$
$$= b - k b + \tfrac{3}{5} a$$

$$OT = OA + AT$$
$$= a + h(AQ)$$
$$= a + h(-a + \tfrac{1}{3} b)$$
$$= a - ha + \tfrac{1}{3} hb \quad B1$$

(ii) Use the expressions in b(i) above to find the values of h and k. (5mks)

$$b(1-k) + \tfrac{3}{5} ka = a(1-h) + \tfrac{1}{3} hb \quad B1$$

$$1 - k = \tfrac{1}{3} h \quad ---(i) \quad B1$$

$$\tfrac{3}{5} k = 1 - h \quad ---(ii) \quad B1$$

$$3 - 3k = h$$
$$3 - 3k = h$$
$$k = \tfrac{2}{3}$$

$$\tfrac{3}{5} k - 1 = -h$$
$$-\tfrac{2}{5} = -h$$
$$h = \tfrac{2}{5}$$
$$3k = 5 - 5h$$

$$3k = 5 - 5(3 - 3k)$$
$$B1$$
$$3k = 5 - 15 + 15k$$
$$-12k = -10$$
$$k = \tfrac{10}{12} = \tfrac{5}{6} \quad A1$$
$$3 - 3(\tfrac{5}{6}) = h$$
$$3 - \tfrac{5}{2} = h$$
$$h = \tfrac{1}{2} \quad (1mk) \; A1$$

(c) In what ratio does T divide AQ.?

$$AT : TQ = 1 : 1$$

15