



**URANGA MATHEMATICS ASSOCIATION**  
Kenya Certificate of Secondary Education  
**TERM ONE JOINT EVALUATION, 2026**

**121/2 MATHEMATICS PP2 Alt A**  
**MARCH, 2026**                      **TIME: 2½ Hrs**  
**FORM FOUR**

Name: Marking Scheme ..... Admission No: .....

School: ..... Signature: ..... Wednesday, 11<sup>th</sup> Mar, 2026.

**INSTRUCTIONS TO CANDIDATES:**

1. Write your name, school, admission number and sign in the spaces provided above.
2. This paper contains **TWO** sections: Section I and Section II.
3. Answer **ALL** the questions in Section I and **FIVE** questions from section II.
4. All answers and working **MUST** be written on the question paper in the spaces provided below each question.
5. Marks may be given for correct working even if the answer is wrong.
6. Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
7. This paper consists of 16 printed pages. Check to confirm that all pages are printed.

**For Examiner's Use Only**

**SECTION I**

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

**SECTION II**

17	18	19	20	21	22	23	24	Total

**TOTAL**

**SECTION I (50 MARKS)**  
**Answer ALL questions in this section**

1. The masses in kg of eight boys are 56, 62, 58, 65, 50, 49, 57, 59. Find the quartile deviation of the data. (3 marks)

49, 50, 56, 57, 58, 59, 62, 65

$$\frac{50+56}{2} \quad \frac{59+62}{2} \checkmark$$

$Q_1 = 53$        $Q_3 = 60.5$

$$Qd = \frac{60.5 - 53}{2} \checkmark = 3.75 \checkmark$$

2. Solve for  $\theta$  in the equation  $6 \sin^2 \theta - \cos \theta = 5$  For  $0^\circ \leq \theta \leq 360^\circ$  (3 marks)

$$6(1 - \cos^2 \theta) - \cos \theta = 5$$

$$6 - 6\cos^2 \theta - \cos \theta = 5 \checkmark$$

$$6\cos^2 \theta + \cos \theta - 1 = 0$$

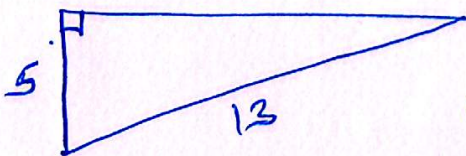
$$3\cos \theta (2\cos \theta + 1) - (2\cos \theta + 1) = 0$$

$$3\cos \theta - 1 = 0 \quad \vee \quad 2\cos \theta + 1 = 0 \checkmark$$

$$\cos \theta = \frac{1}{3} \quad \cos \theta = -\frac{1}{2}$$

$$\theta = 70.5^\circ, 289.5^\circ \quad \theta = 120^\circ, 240^\circ$$

3. Two circles of radii 3cm and 8cm have their centres 13cm apart. Calculate the length of their direct common tangent. (3 marks)



base = 8 - 3

$$h^2 = 13^2 - 5^2 \checkmark$$

$$h = \sqrt{144} \checkmark$$

$$h = 12 \text{ cm} \checkmark$$

M
M
A
03
M
M
A
03
M
M
A
03

4. Ken deposited Kshs 30,000 in a financial institution that paid simple interest at the rate of 12% per annum. Wekesa deposited the same amount of money as Ken in another financial institution that paid compound interest. After 5 years, they had equal amounts of money in the financial institutions. Determine the compound interest rate, to 1 decimal place for Wekesa's deposit. (3 marks)

$$30000 \times \frac{12}{100} \times 5 = 18000$$

$$A = 18000 + 30,000 \\ = 48,000$$

$$48000 = 30,000 \left(1 + \frac{r}{100}\right)^5$$

$$1.6 = \left(1 + \frac{r}{100}\right)^5$$

$$0.09856 = \frac{r}{100}$$

$$r = 9.9\%$$

5. Make P the subject of the formula in  $X = \left(\frac{1}{MP^3} - A^2\right)B$  (3 marks)

$$X = \frac{B}{MP^3} - A^2B$$

$$XMP^3 = B - A^2BMP^3$$

$$XMP^3 + A^2BMP^3 = B$$

$$P^3(XM + A^2BM) = B$$

$$P^3 = \frac{B}{XM + A^2BM}$$

$$P = \sqrt[3]{\frac{B}{XM + A^2BM}}$$

6. The position vector of points A and B are  $2i - j + 4k$  and  $4i + 3j$  respectively. If point R is the mid-point of AB, find the magnitude of AR. (4 marks)

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

$$= \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$$

$$AR = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ -1 \\ 4 \end{pmatrix}$$

$$|AR| = \sqrt{1^2 + 2^2 + (-2)^2}$$

$$= 3 \text{ units}$$

7. Determine the amplitude, period and phase angle of the wave represented by the equation

$$y = \frac{3}{2} \sin\left(\frac{2}{5}x + 40^\circ\right)$$

(3 marks)

Amplitude = 1.5 units ✓

Period  $\Rightarrow \frac{360}{\frac{2}{5}} = 900^\circ$  ✓

Phase angle =  $40^\circ$  ✓

B1

B1

B1

03

8. Without using a calculator, simplify  $\frac{\sqrt{252} + \sqrt{72}}{\sqrt{32} + \sqrt{28}}$ , leaving the answer in the form  $a\sqrt{b} + c$  where a, b and c are integers.

(3 marks)

$$\frac{6\sqrt{7} + 6\sqrt{2} (4\sqrt{2} - 2\sqrt{7})}{4\sqrt{2} + 2\sqrt{7} (4\sqrt{2} - 2\sqrt{7})} \quad \left| \quad 3\sqrt{14} - 9 \right. \checkmark$$

$$\frac{24\sqrt{14} - 12\sqrt{14} + 48 - 84}{(2 \times 6) - 28}$$

$$\frac{12\sqrt{14} - 36}{4} \quad \checkmark$$

M1

M1

A1

03

9. A triangle whose area is  $6.5\text{cm}^2$  is mapped onto a triangle whose area is  $13\text{cm}^2$  by the matrix.

$$\begin{pmatrix} x+4 & 6 \\ 5 & x \end{pmatrix}. \text{ Find the values of } x.$$

(3 marks)

$$X(X+4) - 30 = \frac{13}{0.5} \quad \checkmark$$

$$X^2 + 4X - 30 = 2$$

$$X^2 + 4X - 32 = 0$$

$$X^2 - 4X + 8X - 32 = 0$$

$$X(X-4) + 8(X-4) = 0 \quad \checkmark$$

$$(X-4)(X+8) = 0$$

$$X-4 = 0$$

$$X = 4$$

or

$$X+8 = 0$$

$$X = -8$$

$$X = 4 \text{ or } -8 \quad \checkmark$$

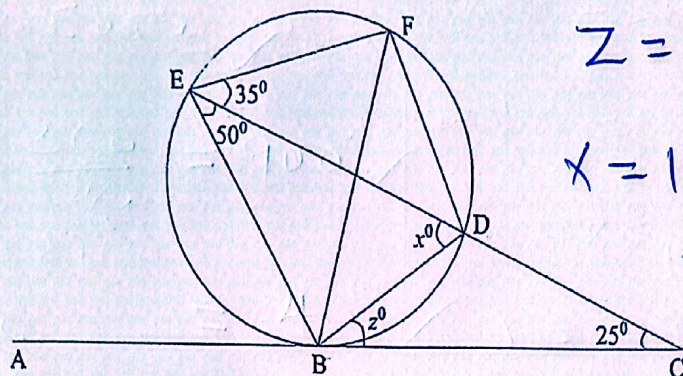
M1

M1

A1

03

10. In the figure below, ABC is a tangent at B and CDE is a straight line.  $\angle BED = 50^\circ$ ,  $\angle DEF = 35^\circ$  and  $\angle ECB = 25^\circ$ . Calculate the value of x and z. (2 marks)



$$z = 50^\circ$$

$$x = 180 - 105 = 75^\circ$$

B1  
B1  
B1  
02

11. Two variables P and L are such that P varies partly as L and partly as the square root of L. Determine the relationship between P and L given that when  $L = 16$ ,  $P = 500$  and when  $L = 25$ ,  $P = 800$ . (3 marks)

$$P = kL + b\sqrt{L}$$

$$500 = 16k + 4b$$

$$800 = 25k + 5b$$


---


$$2500 = 80k + 20b$$

$$3200 = 100k + 20b$$

$$700 = 20k$$

$$k = 35$$

$$500 = (16 \times 35) + 4b$$

$$b = -15$$

$$P = 35L - 15\sqrt{L}$$

M  
M  
A  
03

12. Two grades of tea costing shs.100 and shs.150 per kg respectively are mixed in the ratio 3: 5 by weight. The mixture is then sold at shs.160 per kg. Find the percentage profit on the cost price. (3 marks)

$$\frac{300 + 750}{8} = 131.25$$

$$21.9\%$$

$$\text{Profit} = 160 - 131.25 = 28.75$$

$$\frac{28.75}{131.25} \times 100$$

M1  
M1  
A1  
03

13. The points (2, 2) and (-4, -4) are the end points of the diameter of a circle. Find the equation of the circle giving your answer in the form  $ax^2 + by^2 + cx + dy = e$  where a, b, c and e are integers (4 marks)

$$\text{Centre} = \left( \frac{2+(-4)}{2}, \frac{2+(-4)}{2} \right) \checkmark$$

$$= (-1, -1)$$

$$r = \sqrt{3^2 + 3^2}$$

$$= \sqrt{18}$$

$$(x+1)^2 + (y+1)^2 = \sqrt{18}^2 \checkmark$$

$$x^2 + 2x + 1 + y^2 + 2y + 1 = 18 \checkmark$$

$$x^2 + y^2 + 2x + 2y = 16 \checkmark$$

M1

M1

A1

B1

04

14. Without using logarithm tables or calculator, solve for x (3 marks)

$$\log 5 - 2 + \log(2x + 10) = \log(x - 4)$$

$$\log 5 - 2 \log 10 + \log(2x + 10) = \log(x - 4)$$

$$\log \left( \frac{2x+10}{x-4} \right) = \log \left( \frac{100}{5} \right) \checkmark$$

$$2x+10 = 20x-80$$

$$18x = 90$$

$$\frac{2x+10}{x-4} = 20 \checkmark$$

$$x = \frac{90}{18} = 5 \checkmark$$

$$x = 5 \checkmark$$

M1

M1

A1

03

15. By using completing square method, solve for x in: (3 marks)

$$3x^2 + 4x - 4 = 0$$

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

$$x^2 + \left(\frac{4}{6}\right)^2 = \frac{4}{3} + \left(\frac{4}{6}\right)^2 \checkmark$$

$$\left(x + \frac{2}{3}\right)^2 = \frac{16}{9}$$

$$x = -\frac{2}{3} \pm \frac{4}{3} \checkmark$$

$$x = \frac{2}{3} \text{ or } -2 \checkmark$$

M1

M1

A1

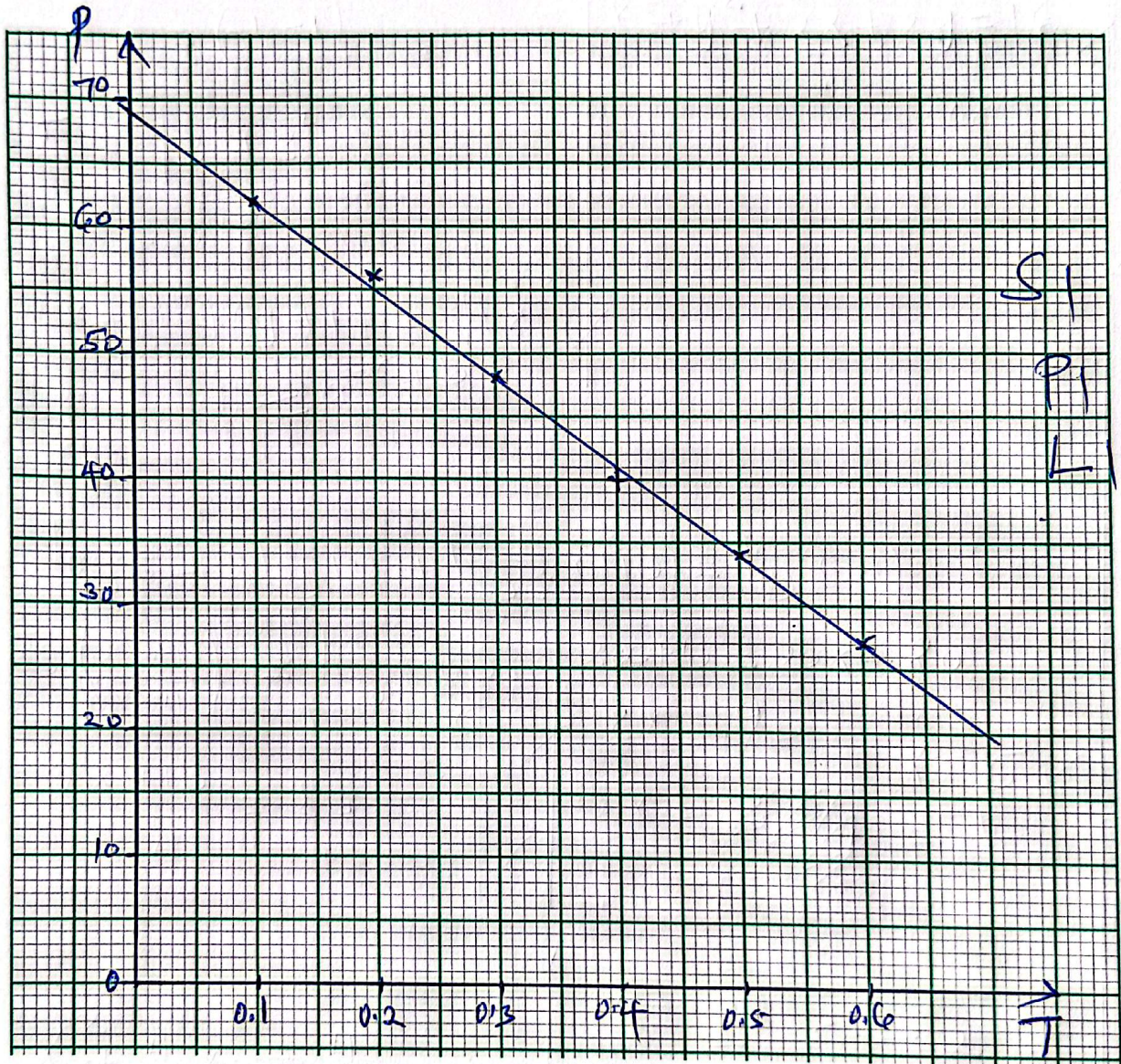
03

16. The table below represents a relationship between two variable P and T connected by the equation  $P = aT + b$  where a and b are constants

T	0.1	0.2	0.3	0.4	0.5	0.6
P	62	56	48	40	34	27

(a) On a grid, draw the line of best fit for the data

(3 marks)



(b) Use your graph to find the value of P when  $T = 0$

(1 mark)

$$P = 69$$

B1

04

**SECTION II (50 MARKS)**

**Answer ONLY five questions from this section.**

17. The table below shows masses of 100 form 4 students;

Mass	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
No. Of students	4	6	10	14	22	24	14	6

(a) Taking 52 as the working mean. Find the actual mean mass

(4 marks)

Marks	f	x	d=x-A	d <sup>2</sup>	fd	fd <sup>2</sup>
30-34	4	32	-20	400	-80	1600
35-39	6	37	-15	225	-90	1350
40-44	10	42	-10	100	-100	1000
45-49	14	47	-5	25	-70	350
50-54	22	52	0	0	0	0
55-59	24	57	5	25	120	600
60-64	14	62	10	100	140	1400
65-69	6	67	15	225	90	1350
	100				10	7650

$$\begin{aligned} \bar{X} &= \frac{\sum fd}{\sum f} + A \\ &= \frac{10}{100} + 52 \\ &= 52.1 \end{aligned}$$

B1    B1    B1    B1

(b) Determine the variance

(5 marks).

$$\begin{aligned} V &= \frac{\sum fd^2}{\sum f} - \left( \frac{\sum fd}{\sum f} \right)^2 \\ &= \frac{7650}{100} - \left( \frac{10}{100} \right)^2 \\ &= 76.5 - 0.01 \\ &= 76.49 \end{aligned}$$

(c) Find the standard deviation

(1 mark)

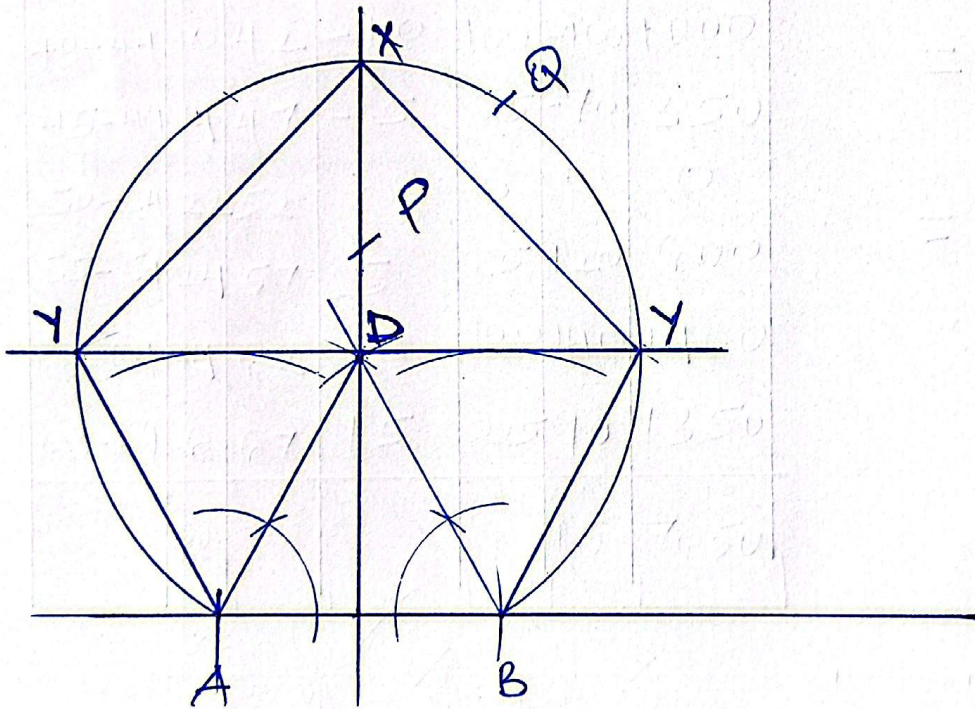
$$S = \sqrt{76.49} = 8.746$$

B1  
 M1  
 M1  
 A1  
 A1  
 B1  
 10



18. Use a ruler and a pair of compass only for all construction in this question.

- (a) Draw a line  $AB = 4\text{cm}$ . On the upper side of  $AB$ , Construct the locus of  $P$  such that it is equidistant from  $A$  and  $B$ . Locate a point  $D$  on the locus of  $P$  such that  $\angle ABD = 60^\circ$  (3 marks)
- (b) Construct the locus of  $Q$  such that  $\angle AQB = 30^\circ$  (2 marks)
- (c) Mark a point; (1 mark)
- (i)  $X$  where the locus of  $P$  and  $Q$  intersect.
- (ii)  $Y$  on the locus of  $Q$  such that the area of triangle  $ABD$  is equal to the area of triangle  $AYB$ . (2 marks)
- (d) The points  $A, B, X$  and  $Y$  are the vertices of a Pentagon with the locus of  $P$  as a line of symmetry. Complete the pentagon. (2 marks)



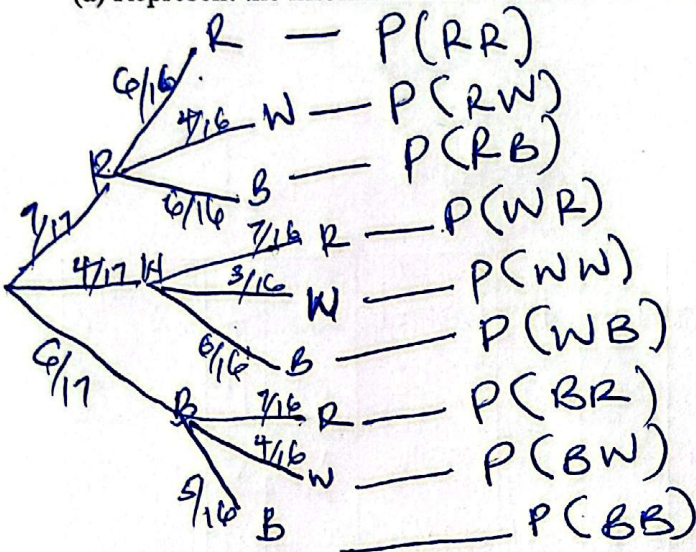
- $B_1$  locus  $P$
- $B_1$   $60^\circ$  at  $B$
- $B_1$   $D$  located
- $B_1$   $60^\circ$  at  $A$
- $B_1$  locus  $Q$
- $B_1$   $X$  Marked.
- $B_2$   $Y$  located on both sides
- $B_2$  Complete Pentagon.

20

19. A bag contains 7 red, 4 white, and 6 blue balls. Two balls are drawn at random from the bag one at a time without replacement.

(a) Represent the information above on a tree diagram

(2 marks)



(b) Use the tree diagram to find the probability that;

(i) The second ball drawn is red

(2 marks)

$$\left(\frac{7}{17} \times \frac{6}{16}\right) + \left(\frac{4}{17} \times \frac{7}{16}\right) + \left(\frac{6}{17} \times \frac{7}{16}\right)$$

$$= \frac{7}{17}$$

(ii) The two balls are of the same colour

(2 marks)

$$\left(\frac{7}{17} \times \frac{6}{16}\right) + \left(\frac{4}{17} \times \frac{3}{16}\right) + \left(\frac{6}{17} \times \frac{5}{16}\right)$$

$$= \frac{21}{68}$$

(iii) No white ball is drawn

(2 marks)

$$\left(\frac{7}{17} \times \frac{6}{16}\right) + \left(\frac{7}{17} \times \frac{6}{16}\right) + \left(\frac{6}{17} \times \frac{7}{16}\right) + \left(\frac{6}{17} \times \frac{5}{16}\right)$$

$$= \frac{39}{68}$$

(iv) At least one ball is blue

(2 marks)

$$1 - \left(\frac{7}{17} \times \frac{6}{16}\right) + \left(\frac{7}{17} \times \frac{4}{16}\right) + \left(\frac{4}{17} \times \frac{7}{16}\right) + \left(\frac{4}{17} \times \frac{3}{16}\right)$$

$$= \frac{81}{136}$$

B<sub>2</sub>

M<sub>1</sub>

A<sub>1</sub>

M<sub>1</sub>

A<sub>1</sub>

M<sub>1</sub>

A<sub>1</sub>

M<sub>1</sub>

A<sub>1</sub>

10

20. a) The first term of an Arithmetic Progression (AP) is 2. The sum of the first 8 terms of the AP is 156

i) Find the common difference of the AP.

(2 marks)

$$\frac{8}{2} \{4 + 7d\} = 156 \checkmark$$

$$16 + 28d = 156$$

$$d = 5 \checkmark$$

ii) Given that the sum of the first n terms of the AP is 416, find n.

(3 marks)

$$\frac{n}{2} \{2a + (n-1)d\}$$

$$\frac{n}{2} (4 + 5n - 5) = 416 \checkmark$$

$$4n + 5n^2 - 5n = 832$$

$$5n^2 - n - 832 = 0$$

$$\left(n - \frac{1}{10}\right)^2 = \frac{832}{5} + \left(\frac{1}{10}\right)^2 \checkmark$$

$$n = \frac{1}{10} \pm 12.9$$

$$n = 13 \text{ or } -12.8$$

$$n = 13 \checkmark$$

b) The 3<sup>rd</sup>, 5<sup>th</sup> and 8<sup>th</sup> terms of another AP form the first three terms of a Geometric Progression (GP) If the common difference of the AP is 3, find:

i) The first term of the GP;

(3 marks)

$$\frac{a+4d}{a+2d} = \frac{a+7d}{a+4d}$$

$$a^2 + 16d^2 + 8da = a^2 + 7ad + 2ad + 14d^2 \checkmark$$

$$2d^2 = ad \checkmark$$

$$a = 6$$

$$\text{1<sup>st</sup> term of GP} = 6 + 6 = 12 \checkmark$$

ii) The sum of the first 9 terms of the GP, to 4 significant figures.

(2 marks)

$$S_9 = \frac{12(1.5^9 - 1)}{1.5 - 1} = 898.6 \checkmark$$

M1

A1

M1

M1

A1

M1

M1

A1

M1

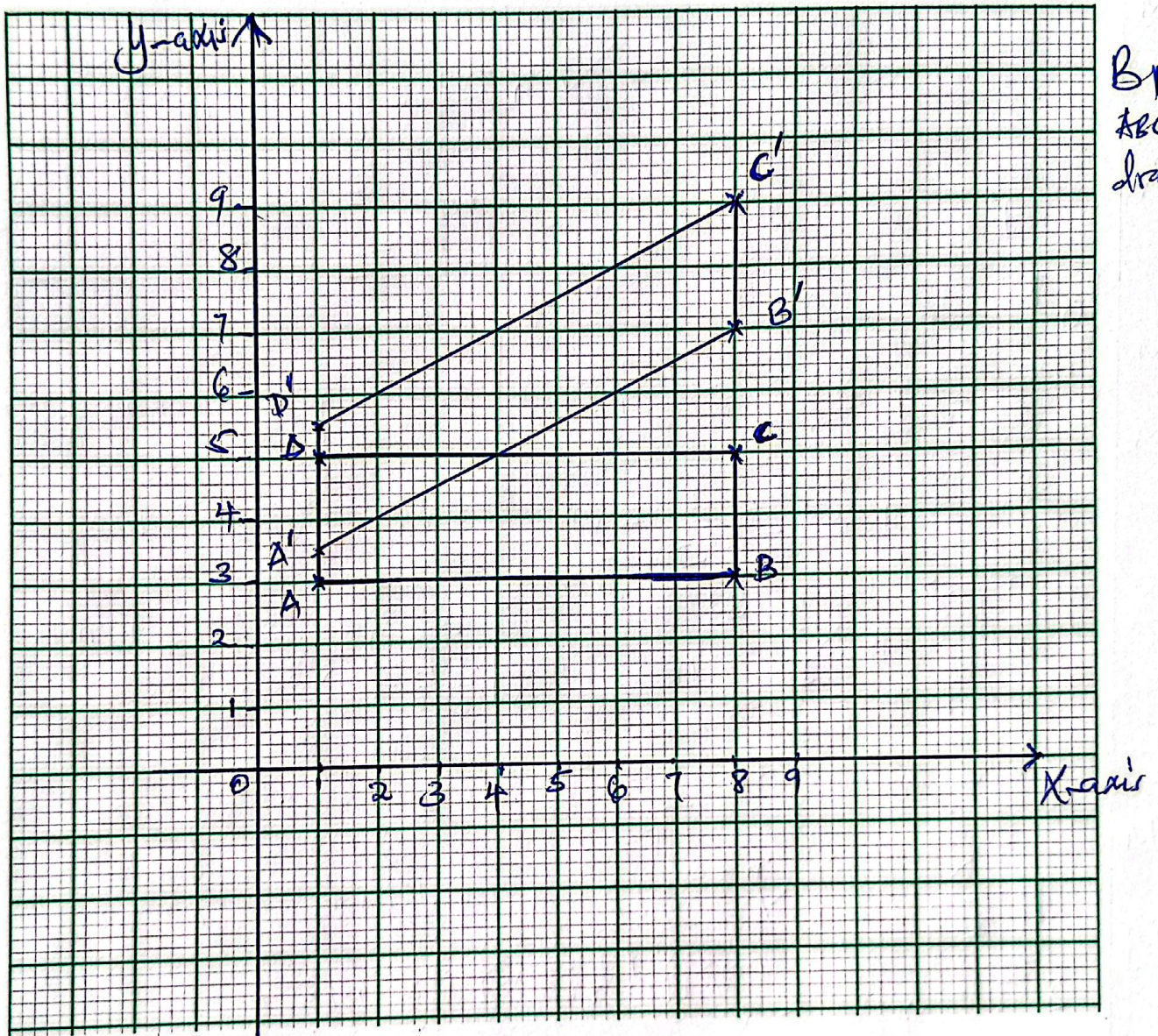
A1

10

21. Rectangle ABCD in which A(1,3), B(8,3), C(8,5) and D(1,5) undergoes a shear with  $x = 4$  as the invariant line.

a) Plot the rectangle ABCD

(1 mark)



B<sub>1</sub> for ABCD drawn

b) If the point C is mapped on the point C'(8,9) under this transformation, determine the coordinates of A', B' and D'.

(3 marks)

$$\begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix} \begin{pmatrix} 8 \\ 5 \end{pmatrix} = \begin{pmatrix} 8 \\ 9 \end{pmatrix}$$

$$8k = 9 - 5$$

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

$$\begin{pmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{pmatrix} \begin{pmatrix} 1 & 8 & 1 \\ 3 & 3 & 5 \end{pmatrix}$$

A' (1, 3 1/2)      B<sub>1</sub>

B' (8, 7)      B<sub>1</sub>

D' (1, 5 1/2)      B<sub>1</sub>

(1 mark)

c) Plot the figure A', B', C', D'

d) Find the matrix representing this transformation

(2 marks)

$$\begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix} \quad k = \frac{9-5}{8}$$

$$k = \frac{1}{2} \quad B_1$$

$$\begin{pmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{pmatrix} \quad B_1$$

e) Using the determinant of the matrix in (d) above, find the area of the figure  $A', B', C', D'$  (3 marks)

$$\text{Area of } ABCD = 7 \times 2$$

$$= 14 \text{ sq units} \quad B_1$$

$$\begin{pmatrix} 1 & 0 \\ 0.5 & 1 \end{pmatrix}$$

$$\det = 1 \quad B_1$$

$$1 = \frac{A}{14}$$

$$A = 14 \text{ sq units} \quad B_1$$

$$\underline{\underline{14}}$$

✓

22. The following table shows the rate at which income tax was charged during the year 2024.

Monthly taxable income in Ksh.	Tax rate %
0-9860	10
9861-19720	15
19721-29580	20
29581-39440	25
39441-49300	30
49301-59160	35
Over 59160	40

Mr. Kennedy earns a basic salary of Ksh 68,000, a monthly house allowance of Kshs. 16000 and commuter allowance of Ksh 8000. He contributes 7.5% of his basic salary to pension scheme and 5% of his basic salary towards SHA. These two contributions are exempted from taxation.

Calculate:

(a) His monthly Taxable income.

$$T.I = (68000 + 16000 + 8000) - \left( \frac{7.5}{100} \times 68000 + \frac{5}{100} \times 68000 \right)$$

$$92000 - 8500 = \text{Ksh. } 83,500$$

(b) Calculate his net monthly tax if he is entitled to a person relief of sh. 2400 per month.

(6 marks)

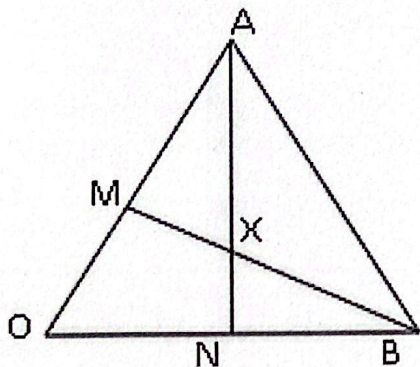
$9860 \times 0.1 = 986$ M	Gross Tax = 23047 M Relief = 2400 M <hr/> Net tax = Ksh. 20,647 M
$9860 \times 0.15 = 1479$	
$9860 \times 0.2 = 1972$ M	
$9860 \times 0.25 = 2465$	
$9860 \times 0.3 = 2958$ M	
$9860 \times 0.35 = 3451$	
$24340 \times 0.4 = 9736$ M	

(c) In addition, the following deductions were made from his salary: Bank Service charge ksh.200, Bank loan repayment ksh.5,000, Cooperative shares of ksh.6000. Calculate his net salary per month. (2marks)

$$\text{Net Salary} = 83500 - (20647 + 200 + 5000 + 6000)$$

$$= \text{Ksh. } 51,653$$

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



(a) Given that vectors  $OA = a$  and  $OB = b$ , express the following vectors in terms of  $a$  and  $b$

(i) AN

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

(1 mark)

B<sub>1</sub>

(ii) BM

$$= -b + \frac{2}{5}a \Rightarrow \frac{2}{5}a - b$$

(1 mark)

B<sub>1</sub>

(iii) AB

$$= -a + b \Rightarrow b - a$$

(1 mark)

B<sub>1</sub>

(b) If  $AX = sAN$  and  $BX = tBM$ , where  $s$  and  $t$  are constants. Find the values of  $s$  and  $t$

$$AX_1 = \frac{4}{5}bs - as$$

$$AX_2 = b - a + \frac{2}{5}at - tb$$

$$\frac{4}{5}bs - as = b - a + \frac{2}{5}at - tb$$

$$\frac{4}{5}bs = b - tb$$

$$\frac{4}{5}s = 1 - t \quad \text{--- (1)}$$

$$-as = -a + \frac{2}{5}at \quad \text{(6 marks)}$$

$$s = 1 - \frac{2}{5}t \quad \text{--- (2)}$$

$$1 - \frac{2}{5}t = \frac{5}{4} - \frac{5}{4}t$$

$$= \frac{17}{20}t = \frac{1}{4}$$

$$t = \frac{5}{17}$$

$$s = \frac{15}{17}$$

(1 mark)

(c) Find the ratio in which X divides AN

$$AX = \frac{15}{17}AN \Rightarrow AX:AN = 15:17$$

B<sub>1</sub>

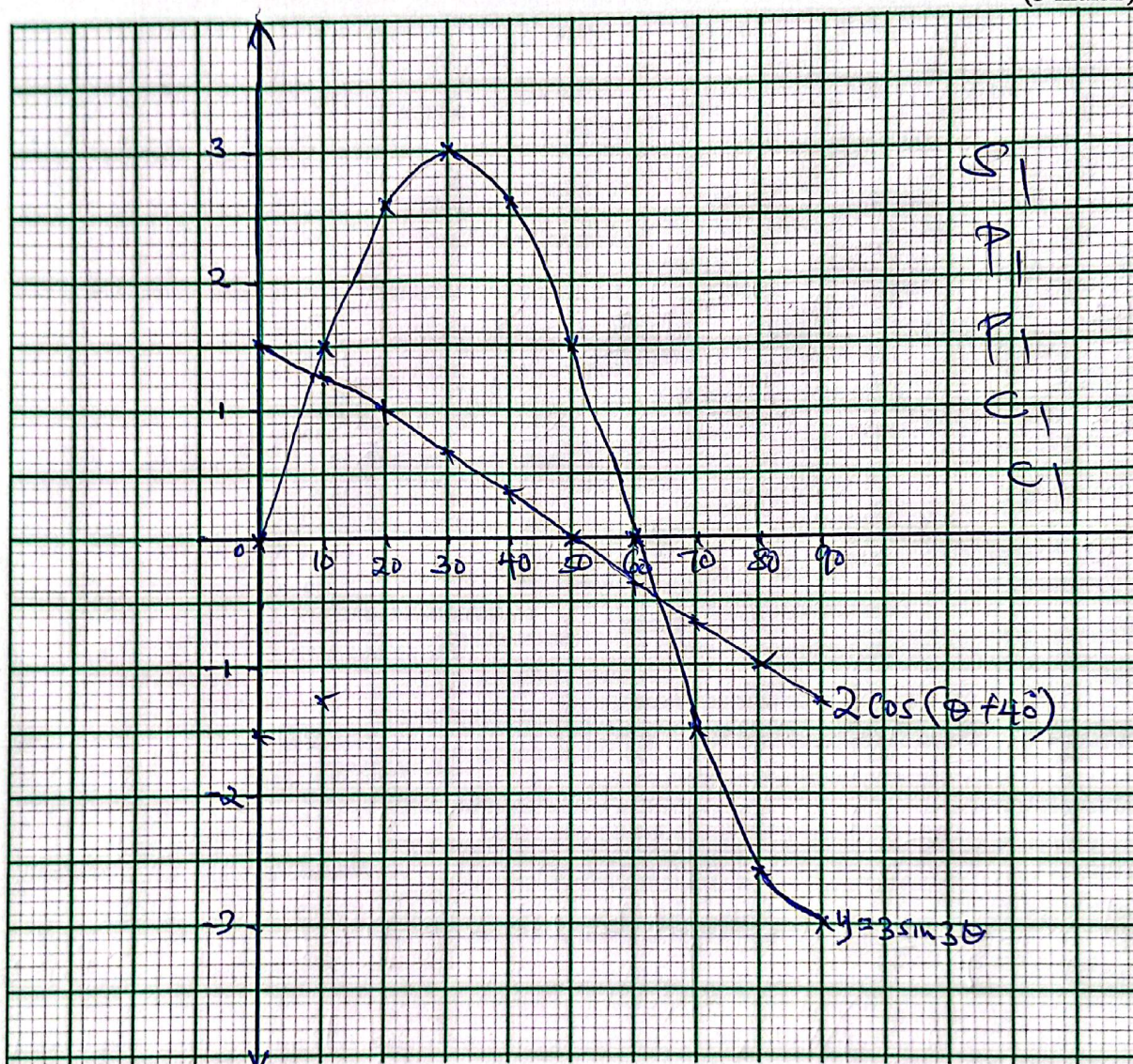
10

24. Complete the table below for the functions  $y = 3 \sin 3\theta$  and  $y = 2 \cos(\theta + 40^\circ)$  (2 marks)

$\theta^\circ$	$0^\circ$	$10^\circ$	$20^\circ$	$30^\circ$	$40^\circ$	$50^\circ$	$60^\circ$	$70^\circ$	$80^\circ$	$90^\circ$
$3 \sin 3\theta$	0	1.50	2.60	3.00	2.60	1.5	0.00	-1.5	-2.60	-3.0
$2 \cos(\theta + 40^\circ)$	1.53	1.29	1.00	0.68	0.35	0.00	-0.35	-0.69	-1.00	-1.29

B2

(a) On the grid provided, draw the graphs of  $y = 3 \sin 3\theta$  and  $y = 2 \cos(\theta + 40^\circ)$  on the same axis. Take 1 cm to represent  $10^\circ$  on the x-axis and 4 cm to represent 2 unit on the y-axis. (5 marks)



(b) From the graph find the roots of the equation.

(i)  $\frac{3}{4} \sin 3\theta = \frac{1}{2} \cos(\theta + 40^\circ)$

(2 marks)

B1

$\theta = 8^\circ$  and  $64^\circ$

B1

(ii)  $2 \cos(\theta + 40^\circ) = 0$  in the range  $0 \leq \theta \leq 90^\circ$

(1 mark)

B1

$\theta = 50^\circ$

✓  
✓