CANDIDATE NAME: ……………………………………………………
INDEX NUMBER: ……………………………………………………
CENTRE CODE: ……………………………………………………
CENTRE NAME: ……………………………………………………
RANDOM NUMBER: ……………………………………………………

121/1

Candidate's signature: ……………………… Date: ………..………

KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

121/1

MATHEMATICS Alt. A

Paper 1

Nov. 2025 – 2½ hours

Candidate's signature: ………………………………………….. Date: ………………..………………..

Instructions to candidates

(a) Confirm that this question paper has your name, name of your school and the correct index number.
(b) Sign and write the date of examination in the spaces provided above.
(c) The paper consists of **two** sections. **Section I** and **Section II.**
(d) Answer **ALL** the questions in Section I and any **FIVE** questions in Section II.
(e) **Show all the steps in your calculations, giving your answer at each stage in the spaces provided below each question.**
(f) Marks may be given for correct working even if the answer is wrong.
(g) **Non-programmable** silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.
(h) ***This paper consists of 18 printed pages.***
(i) ***Candidates must check the question paper to ascertain that all pages are printed as indicated and that no questions are missing***
(j) **Candidates should answer the questions in English.**

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**

Grand Total	

SECTION I (50 marks)

*Answer **all** the questions in this section in the spaces provided.*

1. Without using mathematical tables or a calculator, evaluate:

$\sqrt{\frac{11}{12}-\frac{1}{3}\div 1\frac{1}{2}}$ (3 marks)

$$\sqrt{\frac{11}{12}-\frac{1}{3}\div\frac{3}{2}} = \sqrt{\frac{11}{12}-\frac{1}{3}\times\frac{2}{3}}$$
$$= \sqrt{\frac{11}{12}-\frac{2}{9}} \checkmark$$
$$= \sqrt{\frac{33-8}{36}}$$
$$= \sqrt{\frac{25}{36}} \checkmark$$

$$\sqrt{\frac{25}{36}} = \pm\sqrt{\frac{5^2}{6^2}}$$
$$= \pm\frac{5}{6} \checkmark$$

2. Baraka earns Ksh. 210 per hour working at a supermarket. The employer changed the amount earned per hour in the ratio 8:7.

Determine the amount that Baraka would earn in $10\frac{1}{2}$ hours at the new rate. (3 marks)

New rate : $\frac{8}{7}\times 210 = \text{Ksh. } 240 \checkmark$

Amount earned $= \frac{21}{2}\times 240 \checkmark$

$= \text{Ksh. } 2520 \checkmark$

Alternatively

Amount earned $\frac{8}{7}\times 210\times\frac{21}{2} \checkmark$

Ksh. 2520 ✓

3. Solve for x in the equation.

$4^{3x}\times 8 = \left(\frac{1}{32}\right)^{2x-3}$ (3 marks)

$$\left(2^2\right)^{3x}\times 2^3 = \left(\frac{1}{2^5}\right)^{2x-3}$$
$$2^{6x}\times 2^{3} = \left(2^{-5}\right)^{2x-3} \checkmark$$
$$2^{6x+3} = 2^{-10x+15}$$
$$6x+3 = -10x+15 \checkmark$$
$$16x = 12$$
$$x = \frac{12}{16} = \frac{3}{4} \textbf{ or } 0.75 \checkmark$$

Alternatively

$$64^{x}\times 8 = \left(32^{-1}\right)^{2x-3}$$
$$2^{6x}\times 2^{3} = 2^{-5(2x-3)} \checkmark$$
$$2^{6x+3} = 2^{-10x+15}$$
$$6x+3 = -10x+15 \checkmark$$
$$16x = 12$$
$$x = \frac{12}{16} = \frac{3}{4} \textbf{ or } 0.75 \checkmark$$

4. Solve $-1 \leq \frac{5-2x}{3} < 2x - 1$, giving the answer as a combined inequality. (3 marks)

$-1 \leq \frac{5-2x}{3}$

Multiplying by 3 on both sides

$-3 \leq 5 - 2x$

$2x \leq 8$

$x \leq 4$ ✓

$\frac{5-2x}{3} < 2x - 1$

Multiplying by 3 on both sides

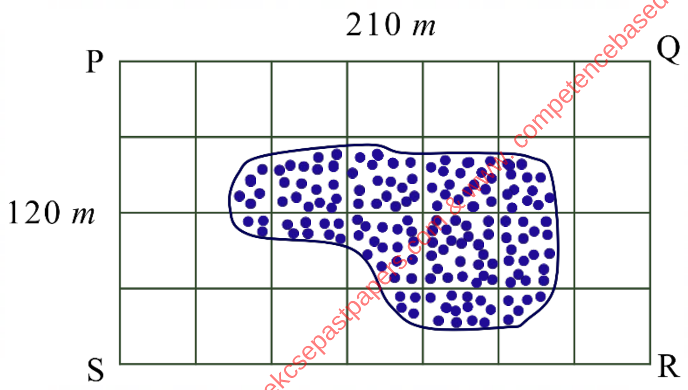
$5 - 2x < 6x - 3$

$8 < 8x$

$1 < x$ ✓

Combined inequality: $1 < x \leq 4$ ✓

5. The following figure represents a rectangular farm, PQRS, of length 210 m and width 120 m drawn on a grid of 1 cm squares. The dotted area inside the farm represents a flooded section.



Estimate in m^2, the area of the farm that is not flooded. (3 marks)

$\frac{210}{7} = \frac{120}{4} = 30$

Scale : 1 cm represents 30 m

Area of farm $= 210 \times 120 = 25{,}200\ m^2$ ✓

Area of flooded section $= \left(1 + \frac{12}{2}\right) \times (30 \times 30) = 6\ 300\ m^2$ ✓

Area of the farm that is not flooded $= 25{,}200 - 6\ 300$

$= 18\ 900\ m^2$ ✓

Alternatively :

Area of farm not flooded $= \left(15 + \frac{12}{2}\right) \times (30 \times 30) = 18\ 900\ m^2$ ✓

6. A relief organisation donated 240 kg of maize and 150 kg of beans to needy families. Each family received exactly the same quantity by mass of either maize or beans. No family received both. Determine the least possible number of needy families. (3 marks)

$240 = 2^4 \times 3^1 \times 5^1$

$150 = 2^1 \times 3^1 \times 5^2$

$\text{GCD} = 2^1 \times 3^1 \times 5^1 = 30\ kg$ ✓

$\text{Least number of needy families} = \frac{240 + 150}{30}$ ✓

$= 13 \text{ families}$ ✓

7. Simplify $\frac{x^2 - 4y^2}{x^2 + 4xy + 4y^2}$. (3 marks)

Numerator

$x^2 - (2y)^2$

$(x + 2y)(x - 2y)$ ✓

Denominator

$P = 4,\ S = 4,\ \text{factors}: 2, 2$

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

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

$(x + 2y)(x + 2y)$ ✓

Numerator / Denominator

$\frac{(x + 2y)^1 (x - 2y)}{(x + 2y)^1 (x + 2y)}$

$\frac{x - 2y}{x + 2y}$ ✓

8. The area of a sector of a circle is 550 cm². The sector is curved to form an open cone of radius 7 cm. Calculate the height of the cone. (4 marks)

Circumference of circular face of cone = length of arc, l

$\therefore\ l = 2 \times \frac{22}{7} \times 7 = 44 \text{ cm}$ ✓

Let the angle subtended by the arc at the centre of the circle be θ and the radius be r.

$\therefore\ \boxed{\pi r^2 \times \frac{\theta}{360°} = 550}$ .... (i) and $\boxed{2\pi r \times \frac{\theta}{360°} = 44}$ .... (ii) ✓

From (ii): $\frac{\theta \pi r}{180} = 44 \Rightarrow \pi \theta r = 7920$

Substituting in (i): $7920r = 198000$

$r = 25\ cm$ ✓ (slant height of cone)

Alternatively, $\pi r l = 550 \Rightarrow l = \frac{550}{22}$ ✓ $= 25\ cm$ ✓

$\perp$ height of cone $= \sqrt{25^2 - 7^2} = 24\ cm$ ✓

9. A clock which loses 18 seconds every hour was set to read the correct time at 8.00 am on Monday. Determine the time, in 12 – hour system, the clock will read on the following Saturday at 11.20 am. (3 marks)

Time difference from Monday 8.00 a.m. to Saturday 11.20 am.

$$(5 \times 24 \text{ hours}) + (1120\text{h} - 0800\text{h})$$

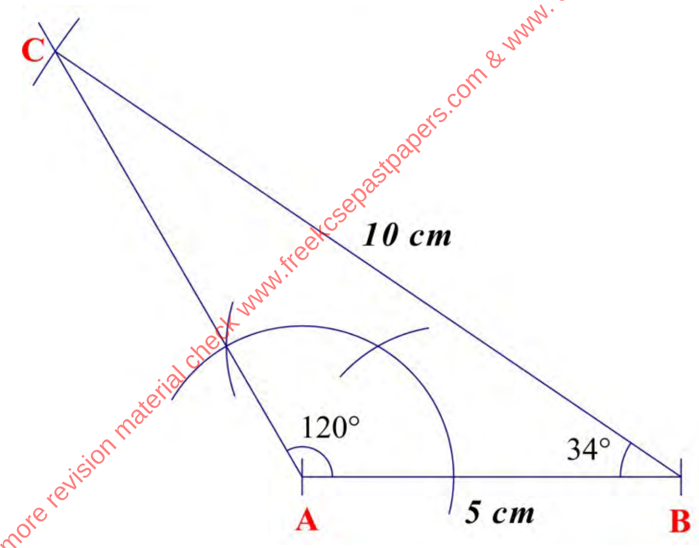
$$120 \text{ hours} + 3\text{h}\ \ 20\text{min}$$

$$123\text{h}\ \ 20\text{min} = 123\frac{1}{3} \text{ hrs} ✓$$

$$\text{Time lost in minutes} = \frac{370}{3} \times 18 \times \frac{1}{60} = 37 \text{ minutes} ✓$$

The clock will read: 11:20 a.m. – 37 min = 10.43 a.m. ✓

10. In the following figure, line AB = 5 cm is a side of triangle ABC in which $\angle BAC = 120°$ and line BC = 10 cm. Using a pair of compasses and a ruler, complete triangle ABC and hence measure the size of angle ABC. (3 marks)



11. A shopkeeper bought an item from a wholesaler. If the shopkeeper sells the item at Ksh. 2 740, he would make a profit of Ksh. 3x. If the shopkeeper sells the item at Ksh. 2 340, he would make a loss of Ksh. 2x. Determine the amount that the shopkeeper paid for the item.

(3 marks)

$$\left.\begin{aligned} BP &= SP - \text{profit} \\ BP &= SP + \text{loss} \end{aligned}\right\} \Rightarrow \boxed{SP - \text{profit}} = \boxed{SP + \text{loss}}$$

$$\therefore 2,740 - 3x = 2,340 + 2x ✓$$

$$5x = 400 \Rightarrow x = 80 ✓$$

He paid: $2,340 + (2 \times 80)$ or $2,740 - (3 \times 80)$

Ksh. 2,500 ✓

 Turn Over

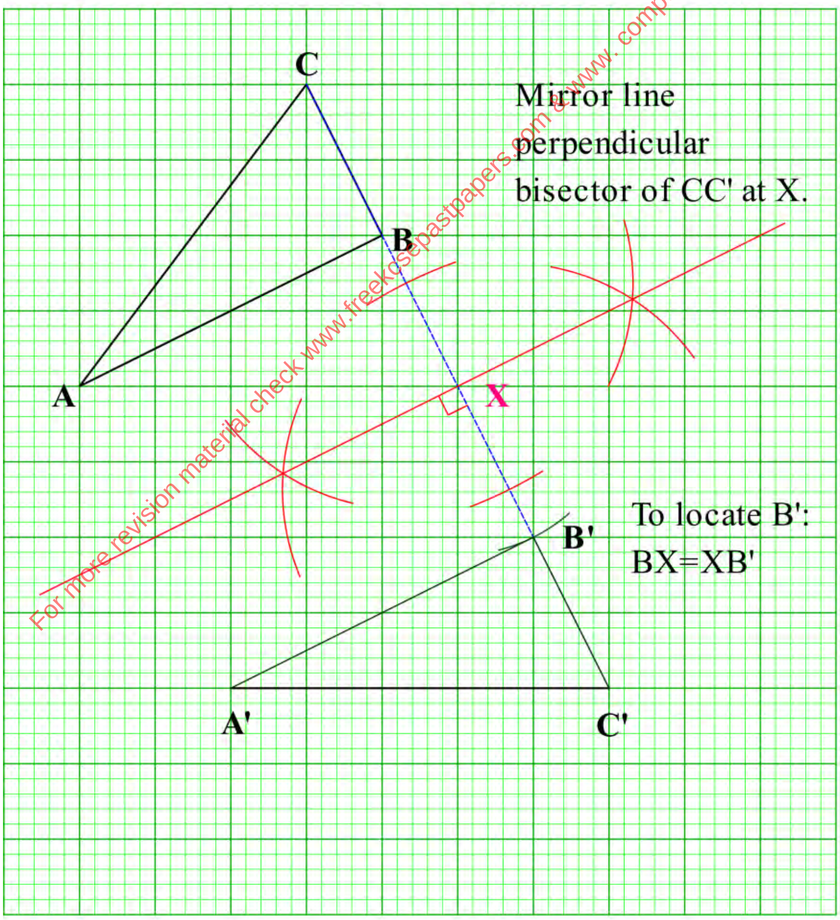
12. The following table shows the frequency distribution of marks scored by students in a Mathematics test. The frequencies for two classes are not shown. The table also shows the height of each rectangular bar of a histogram drawn to represent the information on the marks scored by students.

Marks	10 – 14	15 – 19	20 – 29
Frequency	7		
Height of bar	1.4	2	1.5

Calculate the missing frequencies. (3 marks)

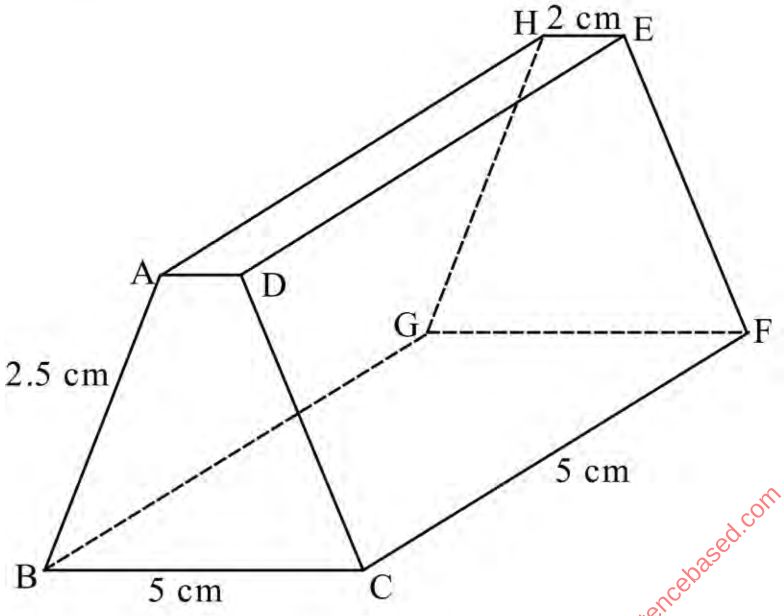
i	$14.5-9.5=\mathbf{5}$	$19.5-14.5=\mathbf{5}$	$29.5-19.5=\mathbf{10}$ ✓
Frequency, $f = fd \times i$	7	$2\times\mathbf{5}=10$ ✓	$1.5\times\mathbf{10}=15$ ✓
fd	1.4	2	1.5

13. On the following grid, line $A'C'$ is part of $\Delta A'B'C'$. Triangle $A'B'C'$ is the image of ΔABC after a reflection along a mirror line.

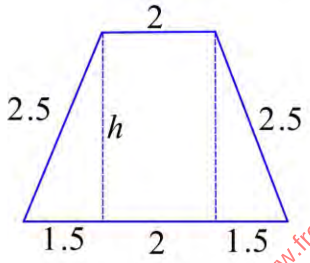


On the same grid, draw the mirror line and hence complete $\Delta A'B'C'$. (3 marks)

14. The figure below represents a prism ABCDEFGH. The cross section of the prism is a trapezium. BC = CF = 5 cm, AD = HE = 2 cm and AB = DC = 2.5 cm.



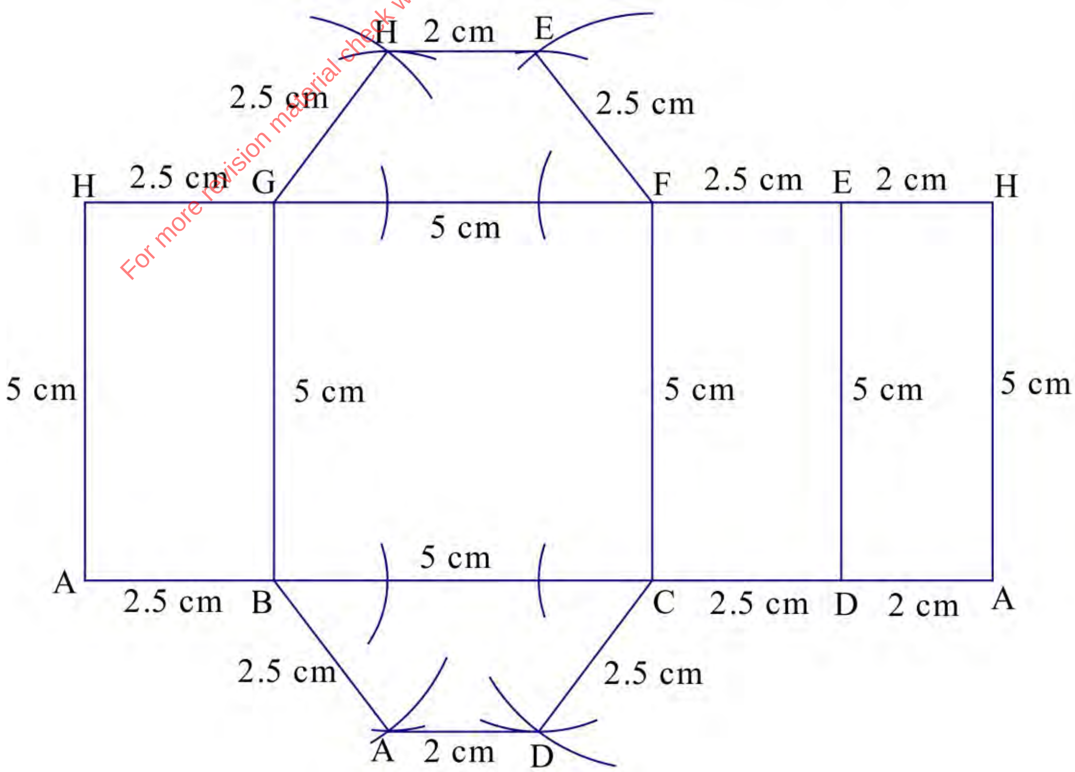
Draw a labelled net of the prism. (3 marks)



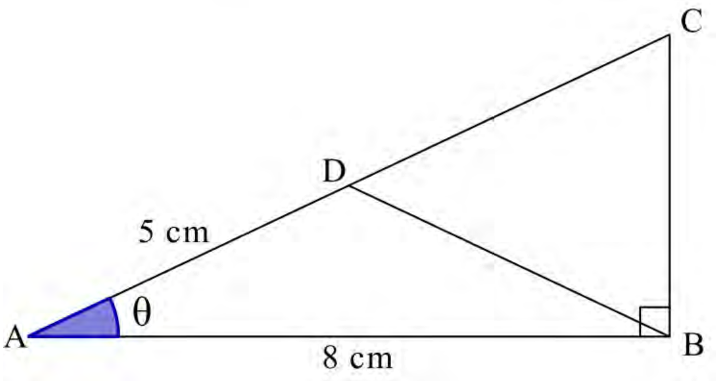
h = ⊥ height of trapezoidal face

$= \sqrt{2.5^2 - 1.5^2}$

$= 2$ cm



15. In the following figure, triangle ABC is right angled at B and AB = 8 cm. D is a point on AC such that AD = 5 cm and the area of triangle ABD = 10 cm^2.



Calculate the length of side BC. (4 marks)

$$\frac{1}{2}\times 5\times 8\times \sin\theta = 10 ✓$$

$$\sin\theta = \frac{10}{20} = 0.5$$

$$\theta = \sin^{-1}(0.5) = 30° ✓$$

$$\tan 30° = \frac{BC}{8} \Rightarrow BC = 8\tan 30°$$

$$= 8\times 0.5774$$

$$= 4.6192 \text{ cm} ✓$$

Alternatively

$$\frac{1}{2}\times 5\times 8\times \sin\theta = 10 ✓$$

$$\sin\theta = \frac{10}{20} = 0.5$$

$$\theta = \sin^{-1}(0.5) = 30° ✓$$

$$\tan 60° = \frac{8}{BC} \Rightarrow BC = \frac{8}{\tan 30°}$$

$$= \frac{8}{1.7321} = 4.6187 \text{ cm} ✓$$

16. The quadratic curve $y = 3x^2 - 4x$ passes through the point $P(1, -1)$. Determine the equation of a tangent to the curve at point P leaving the answer in the form $ax + by = c$, where a, b and c are scalars. (3 marks)

$$\frac{dy}{dx} = 6x - 4 ✓$$

Gradient of tangent $= \frac{dy}{dx}$ at $P(1, -1)$

$$= 6(1) - 4 = 2 ✓$$

$$(y - y_1) = m(x - x_1)$$

$$y - (-1) = 2(x - 1)$$

$$y + 1 = 2x - 2$$

$$y = 2x - 3$$

Hence: $2x - y = 3$ ✓

or

$$-2x + y = -3 ✓$$

SECTION II (50 marks)

*Answer only **five** questions in this section in the spaces provided.*

17. The road connecting town A and town B is 160 km long. A lorry, travelling at an average speed of 45 km/h, left town A for town B at 11.50 am. At the same time, a car travelling at an average speed of 75 km/h, left town B for town A. The two vehicles met at C, a town along the road.

(a) Determine:

(i) the time when the two vehicles met; (4 marks)

$$\text{Relative speed} = 75 + 45 = 120 \text{ km/h} ✓$$

$$\text{Relative time} = \frac{160}{120} = 1\frac{1}{3}\text{ h} = 1\text{h } 20\text{min} ✓$$

Meeting time: 1150h + 1h 20 min✓

1310 h (1.10 p.m)✓

(ii) the distance, in km, from town A to town C. (2 marks)

$$d = 45 \text{ km/h} \times \frac{4}{3}\text{h} ✓$$

$$= 60 \text{ km} ✓$$

OR

$$d = 160\text{km} - \left(75\text{km/h} \times \frac{4}{3}h\right) ✓$$

$$= 160 - 100$$

$$= 60 \text{ km} ✓$$

(b) The car stopped at town C for a period of 1 hour 40 minutes. The lorry continued with its journey at the same speed of 45 km/h. After the stop, the car left town C for town A and arrived at its destination at the same time as the lorry arrived at B. Determine the average speed of the car for the journey from town C to town A. (4 marks)

Total time the lorry requires from A to B $= \frac{160}{45} = 3\frac{5}{9}h$ ✓

Total time travelled by lorry up to when the car left C:

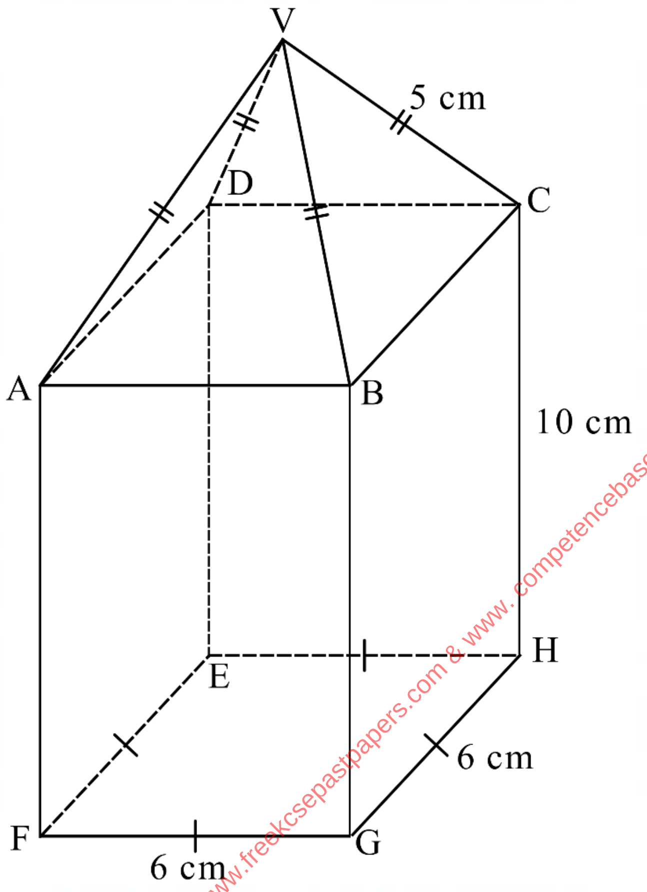
1h 20 min + 1h 40 min = 3 hours✓

Remaining time to get to B $= \left(3\frac{5}{9} - 3\right)h = \frac{5}{9}h$ ✓

This is the same amount of time the car uses to cover distance from C to A.

$$\text{Speed} = \frac{60km}{\frac{5}{9}h} = 60 \times \frac{9}{5} = 108 \text{ km/h} ✓$$

18. Figure VABCDEFGH shows a solid consisting of a right pyramid mounted on a rectangular block. The right pyramid and the rectangular block have an identical square base of length 6 cm. The height of the rectangular block is 10 cm while VA = VB = VC = VD = 5 cm.



(a) Calculate the volume of the solid. (4 marks)

$$\text{Volume of rectangular block} = 6 \times 6 \times 10 = 360\,\text{cm}^3 ✓$$

$$AC = \sqrt{6^2 + 6^2} = \sqrt{72} = 6\sqrt{2}\ \text{cm}$$

$$\text{Mipoint of } AC = \frac{6\sqrt{2}}{2} = 3\sqrt{2}\ \text{cm}$$

$$\text{Height of pyramid} = \sqrt{5^2 - \left(3\sqrt{2}\right)^2} = \sqrt{7} = 2.646\ \text{cm} ✓$$

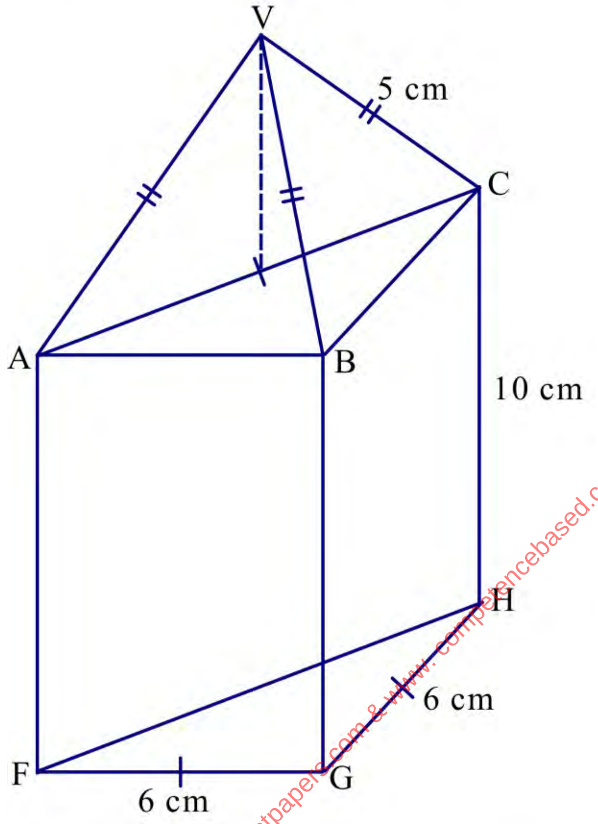
$$\text{Volume of pyramid} = \frac{1}{3} \times 6^2 \times 2.646 = 31.752\ \text{cm}^3 ✓$$

$$\text{Volume of solid} = 360 + 31.752$$

$$= 391.752\ \text{cm}^3 ✓$$

 Turn Over

(b) The solid is cut into two identical halves along the plane of symmetry VAFHCV. Calculate the surface area of one of the pieces. (6 marks)



Area of face ABGF $= 6\times10 = 60\text{ cm}^2$

Area of face BGHC $= 6\times10 = 60\text{ cm}^2$ ✓

Area of face ACHF $= 6\sqrt{2}\times10 = 84.853\text{ cm}^2$ ✓

Area of face AVC $= \frac{1}{2}\times\sqrt{72}\times2.646 = 11.226\text{ cm}^2$ ✓

Area of face FGH $= \frac{1}{2}\times6\times6 = 18\text{ cm}^2$ ✓

For triangular faces VAB and VBC:

$$s = \frac{5+5+6}{2} = 8$$

$$\text{Area} = 2\times\sqrt{8(8-6)(8-5)(8-5)} = 24\text{ cm}^2$$ ✓

Total surface area $= 60+60+84.853+11.226+18+24$

$= \mathbf{258.079\text{ cm}^2}$ ✓

19. Two lines L_1 and L_2 are parallel. Line L_3 is perpendicular to both lines L_1 and L_2.

(a)

(i) Line L_1 passes through points $A(-3,6)$ and $B(3,9)$. Find the gradient of line L_1. (2 marks)

$$m_{L_1} = \frac{9-6}{3-(-3)} ✓$$
$$= \frac{3}{6}$$
$$= \frac{1}{2} ✓$$

(ii) Line L_2 intersects the x-axis at point $C(-5,0)$. Determine the equation of L_2 in the form $y = mx + c$. (2 marks)

$$m_{L_1} = m_{L_2} = \frac{1}{2}$$
$$(y - y_1) = m(x - x_1)$$
$$y - 0 = \frac{1}{2}(x - {}^-5) ✓$$
$$y - 0 = \frac{1}{2}(x + 5)$$
$$y = \frac{1}{2}x + 2\frac{1}{2} ✓$$

(b) Line L_3 intersects lines L_1 and L_2 at points $A(-3,6)$ and P respectively.

(i) Determine the equation of L_3 in the form $y = mx + c$. (3 marks)

$$m_{L_3} = -\left(\frac{2}{1}\right) = -2 ✓$$
$$(y - y_1) = m(x - x_1)$$
$$y - 6 = -2(x - {}^-3) ✓$$
$$y - 6 = -2(x + 3)$$
$$y - 6 = -2x - 6$$
$$y = -2x ✓$$

(ii) Determine the coordinates of point P. (3 marks)

$$\frac{1}{2}x + \frac{5}{2} = -2x ✓$$
$$2.5x = -2.5$$
$$\left.\begin{array}{l} x = -1 \\ y = -2(-1) = 2 \end{array}\right\} ✓$$
$$P(-1, 2) ✓$$

20. A transporter was contracted to transport 133 tonnes of sand from site A to site B. The transporter used two lorries; a 7-tonne lorry and a 14-tonne lorry. The transporter incurred a cost of Ksh. 3 000 per trip for the 7-tonne lorry and Ksh. 4 000 per trip for the 14-tonne lorry. The total cost incurred by the transporter was Ksh. 47 000.

(a) Given that the 7-tonne lorry made x trips while the 14-tonne lorry made y trips, write down two equations to represent the information. (2 marks)

$$7x + 14y = 133 \qquad 3000x + 4000y = 4700$$
$$x + 2y = 19 \checkmark \qquad 3x + 4y = 47 \checkmark$$

Allow even of not simplified.

(b) Use matrix method to solve the equation in (a). (5 marks)

Matrix of coefficients, variables and constants: $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 19 \\ 47 \end{pmatrix}$

determinant of matrix of coefficients $= (1\times 4) - (2\times 3) = -2 \checkmark$

inverse of matrix of coefficients $= \frac{1}{-2}\begin{pmatrix} 4 & -2 \\ -3 & 1 \end{pmatrix} = \begin{pmatrix} -2 & 1 \\ 1.5 & -0.5 \end{pmatrix} \checkmark$

Premultiplication by this inverse on both sides:

$$\begin{pmatrix} -2 & 1 \\ 1.5 & -0.5 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -2 & 1 \\ 1.5 & -0.5 \end{pmatrix}\begin{pmatrix} 19 \\ 47 \end{pmatrix}$$

$$\begin{pmatrix} (-2\times 1) + (1\times 3) & (-2\times 2) + (1\times 4) \\ (1.5\times 1) + (-0.5\times 3) & (1.5\times 2) + (-0.5\times 4) \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} (-2\times 19) + (1\times 47) \\ (1.5\times 19) + (-0.5\times 47) \end{pmatrix} \checkmark$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 5 \end{pmatrix} \checkmark$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 5 \end{pmatrix}$$

$\Rightarrow x = 9$ trips, $y = 5$ trips $\checkmark$

(c) The transporter was paid Ksh. 500 per tonne of sand delivered to site B. Calculate the amount of profit made by the transporter. (3 marks)

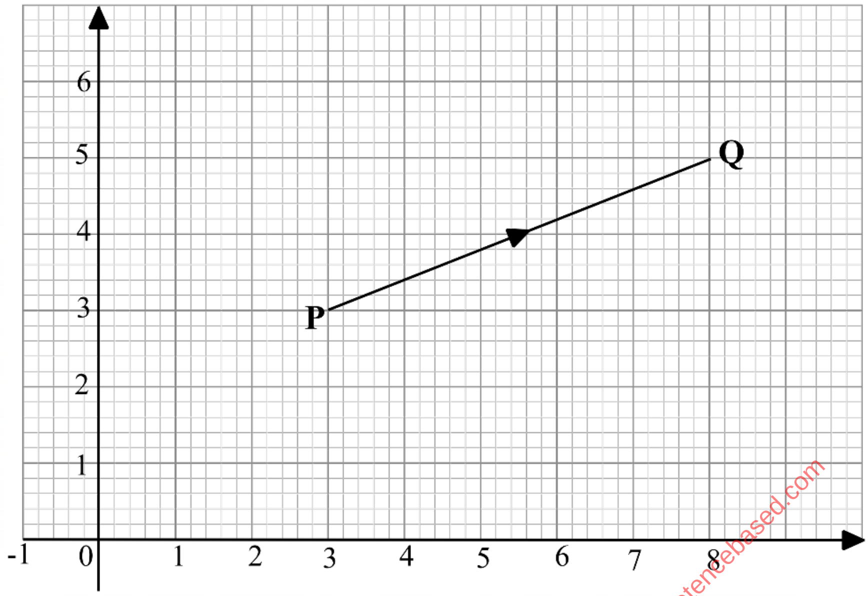
Total amount paid for the sand $= (133\times 500)$

$= \text{Ksh. } 66{,}500 \checkmark$

Profit $= \text{Ksh. } (66{,}500 - 47{,}000) \checkmark$

$= \text{Ksh. } 19{,}500 \checkmark$

21. In the grid provided, the coordinates of points P and Q are (3, 3) and (8, 5) respectively. Vector **PQ** is also shown.



(a) Express **PQ** as a column vector. (2 marks)

$$\mathbf{PQ} = \mathbf{OQ} - \mathbf{OP}$$
$$= \begin{pmatrix} 8 \\ 5 \end{pmatrix} - \begin{pmatrix} 3 \\ 3 \end{pmatrix} ✓$$
$$= \begin{pmatrix} 5 \\ 2 \end{pmatrix} ✓$$

(b) Two vectors $\mathbf{a} = \begin{pmatrix} 3 \\ - \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$ are such that $k\mathbf{a} + h\mathbf{b} = \mathbf{PQ}$ where k and h are scalars.

(i) Determine the values of k and h. (4 marks)

$$k\begin{pmatrix} 3 \\ -1 \end{pmatrix} + h\begin{pmatrix} -1 \\ 4 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 3k \\ -k \end{pmatrix} + \begin{pmatrix} -h \\ 4h \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} ✓$$

$$\begin{pmatrix} 3k - h \\ -k + 4h \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$$

$$\left.\begin{array}{l} 3k - h = 5 \ldots.(i) \Rightarrow h = 3k - 5 \\ 4h - k = 2 \ldots.(ii) \end{array}\right\} ✓$$

$$By\ substitution: 4(3k - 5) - k = 2 ✓$$

$$12k - 20 - k = 2$$

$$11k = 22$$

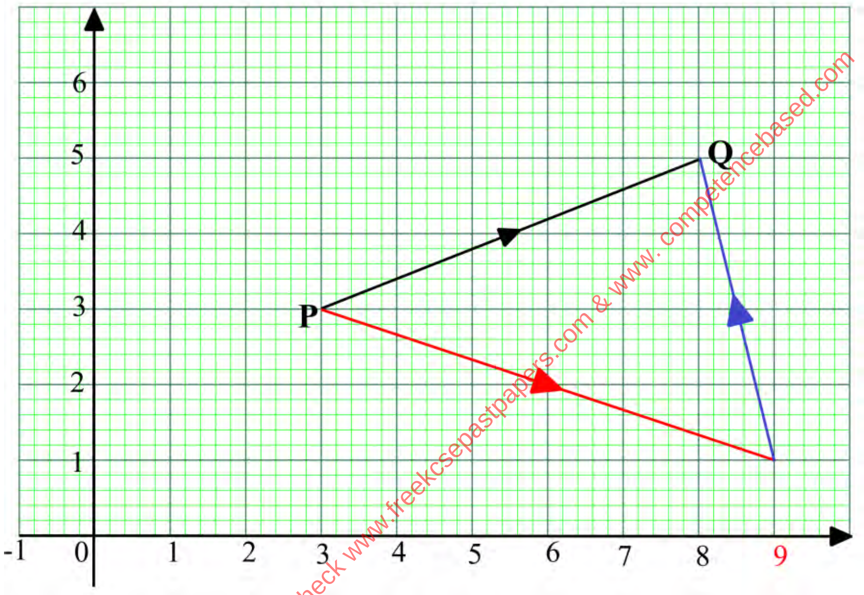
$$\left.\begin{array}{l} k = 2 \\ \therefore h = 3(2) - 5 = 1 \end{array}\right\} ✓$$

(ii) On the same grid, from point P, represent by accurate drawing, the sum of vectors $k\mathbf{a} + h\mathbf{b}$. (2 marks)

$$k\mathbf{a} = 2\begin{pmatrix} 3 \\ -1 \end{pmatrix} = \begin{pmatrix} 6 \\ -2 \end{pmatrix} \qquad h\mathbf{b} = 1\begin{pmatrix} -1 \\ 4 \end{pmatrix} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$$

$$\therefore \mathbf{PQ} = \begin{pmatrix} 6 \\ -2 \end{pmatrix} + \begin{pmatrix} -1 \\ 4 \end{pmatrix} ✓$$

Drawn on the graph below in red and blue.



(c) Determine the magnitude of vector $k\mathbf{a}$. (2 marks)#

$$|k\mathbf{a}| = \sqrt{6^2 + (-2)^2} ✓$$

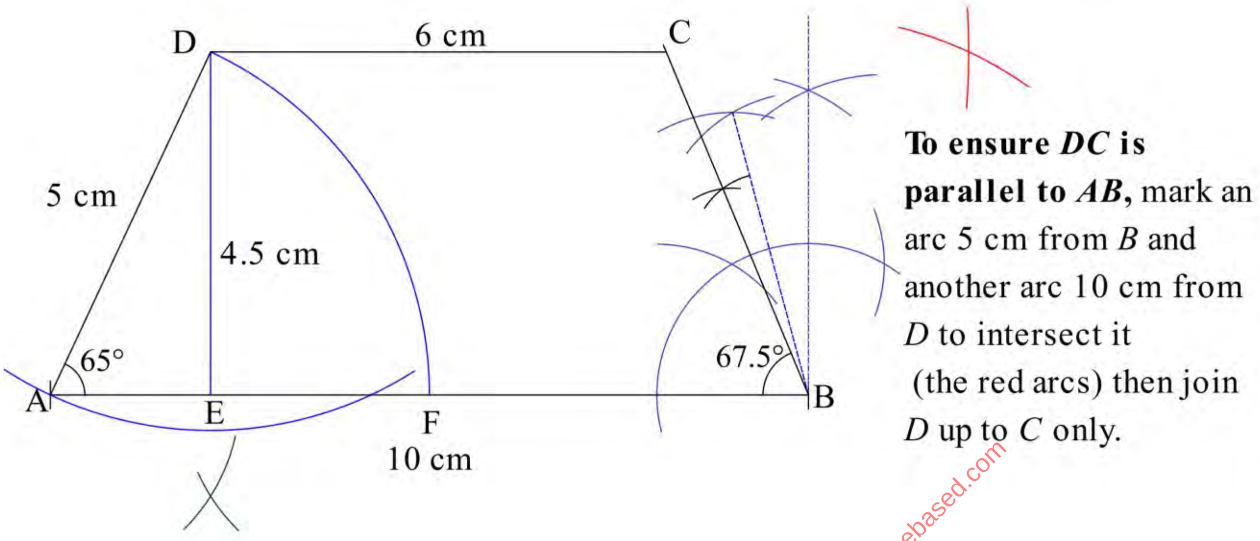
$$= \sqrt{36 + 4}$$

$$= \sqrt{40}$$

$$= 6.325 \text{ units} ✓$$

 Turn Over

22. In the following figure, lines AB = 10 cm and AD = 5 cm are part of a trapezium ABCD in which line AB is parallel to line DC. Angle DAB = 65°.



(a) On the same figure, using a ruler and a pair of compasses only:

(i) complete trapezium ABCD given that $\angle ABC = 67.5°$. Measure the length of line DC; (4 marks)

DC = 6 cm

(ii) drop a perpendicular line from D to meet AB at E. Measure the length of line DE; (2 marks)

DE = 4.5 cm

(iii) draw an arc of a circle, centre A and radius 5 cm. The clockwise directed arc should join D to a point F on line AB. (1 mark)

(b) Calculate the area of trapezium ABCD that lies outside the arc drawn in (a) (iii). (Take $\pi = 3.142$) (3 marks)

$$\text{Area of the trapezium} = \frac{1}{2}(10+6)\times 4.5$$

$$= 36 \text{ cm}^2 \checkmark$$

$$\text{Area of sector ADF} = 3.142 \times 5^2 \times \frac{65°}{360°}$$

$$= 14.1826 \text{ cm}^2 \checkmark$$

Area of trapezium ABCD that lies outside the arc:

$$36 - 14.1826 = 21.8174 \text{ cm}^2 \checkmark$$

23. The quantity of petrol in litres used by 40 boda boda riders on a particular day is as follows.

1.7	2.9	2.1	2.8	3.6	2.1	1.6	2.8
4.0	2.4	3.1	1.8	2.5	1.9	2.6	3.2
3.1	1.5	3.4	2.9	2.9	3.4	2.1	2.6
3.4	4.1	3.9	4.3	3.7	2.8	2.3	2.7
3.3	2.7	2.4	3.5	2.0	1.5	1.8	2.3

The cost of 1 litre of petrol is Ksh. 160.

(a) Starting with 1.5 litres and using a class size of 0.5, draw a frequency distribution table for the data. ✓B2 (2 marks)

Litres	Tally	Frequency, *f*	Class mark, *x*	*fx*	*cf*
1.5 – 1.9	~~////~~ //	7	1.7	11.9	7
2.0 – 2.4	~~////~~ ///	8	2.2	17.6	15
2.5 – 2.9	~~////~~ ~~////~~ /	11	2.7	29.7	26
3.0 – 3.4	~~////~~ //	7	3.2	22.4	33
3.5 – 3.9	////	4	3.7	14.8	37
4.0 – 4.4	///	3	4.2	12.6	40
		$\sum f = 40$	✓	$\sum fx = 109$ ✓	

(b) Use the frequency distribution table in (a) to estimate:

(i) the mean amount of money spent on petrol by the boda boda riders on that day. (4 marks)

$$\bar{x} = \frac{\sum fx}{\sum f} = \frac{109}{40} = 2.725 \text{ litres}$$ ✓

Mean amount $= 2.725 \times 160 = \text{Ksh. } 436$ ✓

(ii) the median amount of money spent on fuel by the median boda boda rider. (4 marks)

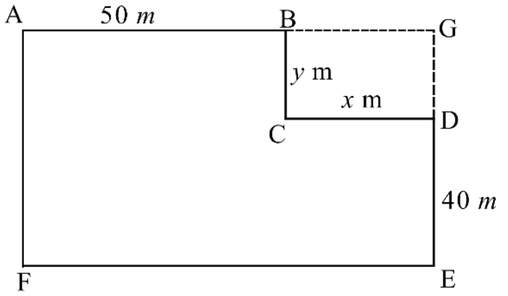
Median position $= \frac{40}{2} = 20^{th}$ Median class: 2.5 – 2.9

$$\text{Median} = 2.45 + \left(\frac{20-15}{11} \times 0.5\right) = 2.6773 \text{ litres}$$ ✓ ✓

Median amount $= 2.6773 \times 160$ ✓

$\simeq$ Ksh. 428.37 ✓

24. Figure ABCDEF represents a plot of land. Length AB = 50 m, BC = y m, CD = x m and DE = 40 m. The figure also shows an adjacent plot of land BCDG. All angles in the figure are right angles.



The owner of plot ABCDEF later purchased plot BCDG. Given that the perimeter of plot BCDG is 60 m:

(a)

(i) Write an expression for y in terms of x. (1 mark)

$$2x + 2y = 60 ✓$$

$$2y = 60 - 2x \Rightarrow y = 30 - x ✓$$

(ii) Write down a simplified expression in x for the area of the entire plot of land AGEF. (3 marks)

$$A = (x+50)(y+40) \text{ but } y = 30 - x$$

$$\textit{hence}: A = (x+50)(30 - x + 40) ✓$$

$$= (x+50)(70-x)$$

$$= x(70-x) + 50(70-x) ✓$$

$$= 70x - x^2 + 3500 - 50x$$

$$A = 3500 + 20x - x^2 ✓$$

(b)

(i) Determine the dimensions of plot BGDC that would maximize the size of the entire plot of land AGEF. (3 marks)

$$\frac{dA}{dx} = 20 - 2x ✓$$

Area is maximum when $\frac{dA}{dx} = 0.$

$$\therefore 20 - 2x = 0 \Rightarrow x = 10\ m$$

$$y = 30 - 10 = 20\ m ✓$$

Dimensions of BGDC: 20 m by 10 m ✓

(ii) Determine, in m^2, the maximum possible area of plot AGEF. (2 marks)

$$A_{max} = 3500 + 20(10) - 10^2 ✓$$

$$= 3600\ m^2 ✓$$

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