Name.......MARKING GUIDE...............  ADM Number....F2 MS

School:......URANGA MATHS........  Candidate's Signature.........................

121/1
Mathematics Alt.A
FORM TWO.
JULY 3RD 2024.
2 ½ Hours.

# URANGA MATHEMATICS ASSOCIATION-2024.
### Kenya Certificate of Secondary Education
MATHEMATICS 121/1
FORM TWO
TIME: 2 ½ HOURS

## INSTRUCTIONS TO CANDIDATES:
- Write your name, school, admission number and sign in the spaces provided above.
- This paper contains TWO sections: Section I and Section II.
- Answer ALL the questions in Section I and FIVE questions from section II.
- All answers and working MUST be written on the question paper in the spaces provided below each question.
- Marks may be given for correct working even if the answer is wrong.
- Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.

## FOR EXAMINERS 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

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

(3 marks)

1.  Without using mathematical tables, evaluate;

$$\sqrt[3]{\frac{\overset{8}{64} \times 125}{8}} \quad \text{—M1}$$

$$= \sqrt[3]{1000} \quad \text{— M1}$$

$$= 10. \quad \text{— A1}$$

$\overline{03}$

$$\sqrt[3]{\frac{0.064 \times 0.125}{0.008 \times 0.001}}$$

2.  Use reciprocals and cube tables to evaluate to 4 significant figures. $\dfrac{1}{56.24} + (6.443)^3$ (3 marks)

$$\frac{1}{56.24}$$

$$= \frac{1}{5.624} \times \frac{1}{10}$$

$$= 0.1778 \times 10^{-1} \quad \text{—M1}$$

$$= 0.01778$$

$$6.443^3 = 267.1$$
$$\quad\quad\quad 4 + \quad \text{—M4}$$
$$\overline{267.5}$$

$$= 0.01778 + 267.5$$

$$= 267.5. \quad \frac{\text{A1}}{03}$$

3.  A bank in Kenya buys and sells foreign currencies as follows.

|  | buying (Ksh) | Selling (kshs.) |
|---|---|---|
| 1 Us dollar | 85.86 | 86.06 |
| 1 sterling pound | 142.41 | 142.73 |

A tourist from united States of America converted 43,521 US dollars into Kenya shillings.

i) Calculate the amount in Kenya shillings that she received   (2mark)

$$= 43,521 \times 85.86 \quad \text{—M1}$$

$$= Sh. \; 3,736,713.06. \; \text{—A1}$$

(ii) While in Kenya, the tourist spent sh. 2437821 and converted the balance to sterling pounds. How much in Sterling pound did the tourist receive to the nearest sterling pound?   (2 marks)

$$= \frac{Sh. \; 3,736,713.06 - Sh. \; 2,437,821 \quad \text{—M1}}{142.73}$$

$$= 9,100 \; \text{Sterling pounds} \; \text{A1}$$

$\overline{04}$

4. ·Use the elimination method to solve the simultaneous equations    (3 marks)

$$2x + 3y = 1$$
$$3x = 2y + 8$$

$(2x + 3y = 1)\,3$
$(3x - 2y = 8)\,2$

———————————
$6x + 9y = 3$     $-M1$
$6x - 4y = 16$  $-$
———————————
$13y = -13$

$y = -1$  $- A1$
$2x + 3(-1) = 1$
$2x = 4$
$x = 2.$  $- B1$
———————
$03$

5. Use logarithms to evaluate.    (4 marks)

$$\sqrt[4]{\dfrac{43.52 \times 0.08792}{785.3}}$$

| No | sf | Log |
|----|----|-----|
| 43.52 | $4.352 \times 10^1$ | $1.6387$ |
| 0.08792 | $8.792 \times 10^{-2}$ | $\bar{2}.9411$ $+$ |
|  |  | $0.5828$ |
| 785.3 | $7.853 \times 10^2$ | $2.8951$ $-$ |
|  |  | $\bar{3}.6877$ |
|  |  | $4$ |
| $2.642 \times 10^{-1}$ $\leftarrow$ |  | $= \bar{1}.42195$ |

$= 0.2642$

$M1 -$ All Logs
$M1 -$ Add subtracti
$M1 -$ Division by 4.
$A1 -$
————
$04$ .

6. Using a ruler and a pair of compasses only, construct triangle ABC such that AB = 4 cm, AC = 8 cm and ∠BAC = 30°. Measure BC.    (3 marks)
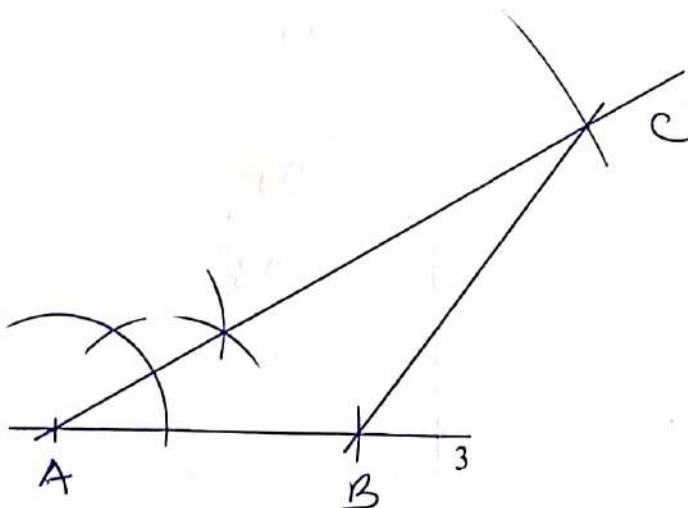


$B1 -$ 30° Constructed at A
$B1 -$ Complete diagr-

$BC = 5cm \pm 0.1$  $B1$
—————
$03.$

7. Find the equation of the $L_1$ in the form $y = mx + c$ which is perpendicular to the line $3y + 2x = 6$ and passes through the point $(-3, 4)$. (3 marks)

$$y = -\tfrac{2}{3}x + 2$$
$$m_2 = \tfrac{3}{2} \quad\text{------ B1}$$
$$\frac{y-4}{x+3} = \tfrac{3}{2} \quad\text{------ M1}$$
$$y = 1\tfrac{1}{2}x + 8\tfrac{1}{2} \quad\text{------ A1}$$
$$\overline{03}$$

8. A saleswoman is paid a commission of 2% on goods sold over Ksh 100 000. She is also paid a monthly salary of Ksh 12 000. In a certain month, she sold goods worth sh 180 000. Calculate the saleswoman earnings that month. (3 marks)

$$Com = \tfrac{2}{100} \wedge sh. 80,000 \quad\text{—M1}$$
$$= Sh. 1600$$
$$Earnings = sh. (12,000 + 1600) \quad\text{— M1}$$
$$= sh. 13,600. \quad\text{------ A1}$$
$$\overline{03}$$

9. Express $2.\overset{..}{8}\overset{.}{3}$ as a fraction leaving it in the form $\dfrac{p}{q}$ (3 marks)

$$\text{Let } x = 2.8383\cdots$$
$$100x = 283.83\cdots \quad\text{------ M1}$$
$$\underline{\quad x = \quad 2.83\cdots\quad}$$
$$99x = 281 \quad\text{------ M1}$$
$$x = \frac{281}{99}. \quad\text{------ A1}$$
$$\overline{03.}$$

4

10. Three alarms go off at intervals of 12 seconds, 18 seconds and one minute. At 6.30 p.m, the alarms went off simultaneously. Find the times when the three alarms go off simultaneously again in the next 10 minutes. (3 marks)

| 2 | 12 | 18 | 60 |
|---|----|----|----|
| 2 | 6  | 9  | 30 |
| 3 | 3  | 9  | 15 |
| 3 | 1  | 3  | 5  |
| 5 |    | 1  | 5  |
|   |    |    | 1  |

— M1

$LCM = 2^2 \times 3^2 \times 5 = 180\,sec$

$= \dfrac{10 \times 60}{180}$ — M1

$= 3\ times.$ — M1

03

11. The surface areas of two similar bottles are 12cm² and 108cm² respectively. If the bigger one has a volume of 810cm³. Find the volume of the smaller one. (3 marks)

$ASF = \dfrac{12}{108} = \dfrac{1}{9}$

$VSF = \left(\sqrt{\dfrac{1}{9}}\right)^3$ — M1

$= \dfrac{1}{27}$

$= \dfrac{810}{27}$ — M1

$= 30\,cm^3.$ — A1

03.

12. In the parallelogram ABCD below, AB = 12cm, BC = 10cm and Angle BAD = 120°. Calculate the area of the parallelogram. (3 marks)



Note: check alternatives.

$A = \left(\dfrac{1}{2} \times 12 \times 10 \; \sin 60\right) 2$ — M; M1

$= 103.92\,a^2$ — A1

03

5
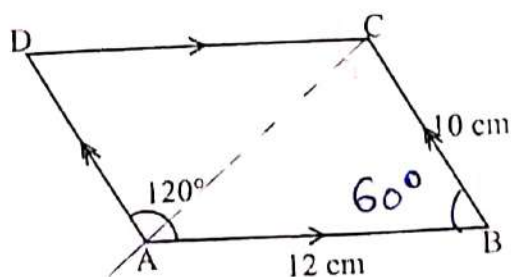
13. A piece of metal has a volume of 20cm$^3$ and a mass of 300g. Calculate the density of the metal in kg/m$^3$. (3 marks)

$D = \dfrac{300}{20}$ ———————— M1

$= 15 g/a^3$

$= 15 \times 1000$ ———— M1

$= 15,000 \ kg/m^3$ ——— A1

03

14. A triangular flower garden has its edges measuring 14 metres and 8 metres and 10 metres. Calculate the area of the garden in m$^2$. (3 marks)

$S = \dfrac{14 + 8 + 10}{2}$ ————— M1

$= 16$

$A = \sqrt{16(16-14)(16-8)(16-10)}$ ———— M1

$= 39.19 \ m^2$ ————— A1

03

15. Given that sin $(x - 30)^0$ = Cos $(4x)^0$. Find x given that it is an acute angle. (3 marks)

$(x - 30)^0 + 4x^0 = 90^0$ —— M1

$\dfrac{5x}{5} = \dfrac{120^0}{5}$ ———— M1

$x = 24^0$ ———— A1

03

16. The figure below is a prism whose cross-section is an equilateral triangle such that AB=BC=CA=3cm, BE=CD=AF=5cm
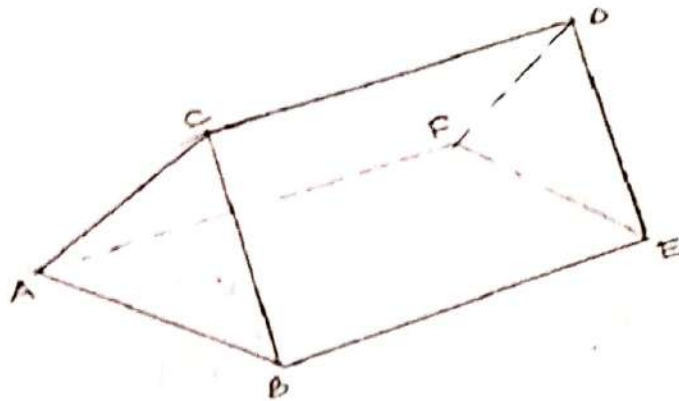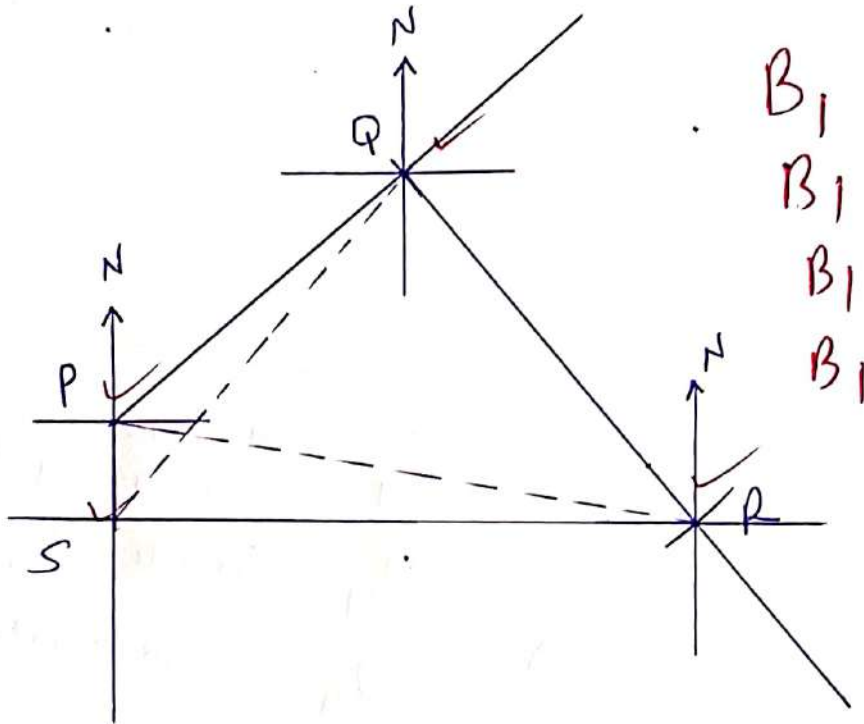


(3 marks)

Draw the net of the prism
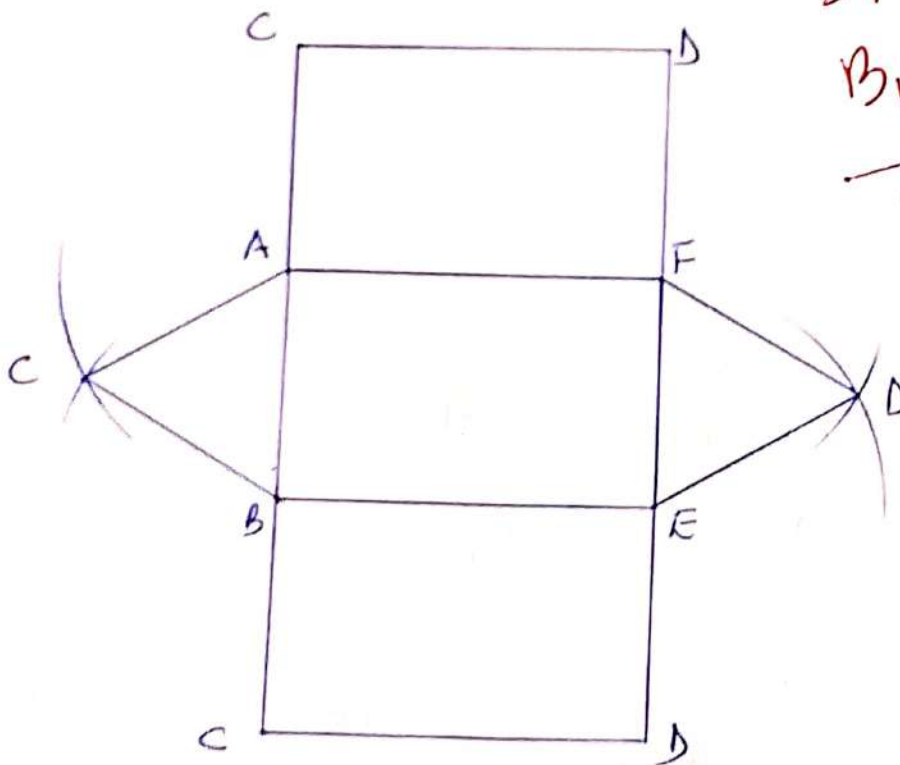


$B_1$ – All measurements accurately done

$B_1$ – Complete diagram

$B_1$ – Correct naming

$\overline{03}$

17. A plane leaves airport P for airport Q, 500 km away on a bearing of 050°. It then flies to airport R 600km away on a bearing of 140°. From R, it flies west to another airport S which is to the south of P.

(a) Use a scale of 1 cm represents 100 km, draw a diagram showing the relative positions of the four airports. (4 marks)



(b) Use the scale drawing to find the

i) Distance between airport P and airport R. (2 marks)

$7 \cdot 8 \times 100$ — M1

$= 780 \pm 10 \, Km.$ — A1

ii) Bearing of R from P. (1 mark)

$100° \pm 1°.$ — B1

iii) Distance and bearing of S from Q (3 marks)

$Distance = 5 \cdot 9 \times 100$ — M1

$= 590 \pm 10 \, Km.$ — A1

$Bearing = 220° \pm 1°$ — B1

$\overline{10}$

18. A butcher bought a number of bulls and a number of goats at Ksh.15,500 per bull and Ksh.2,400 per goat spending a total of Ksh 43,000. If he had bought half as many bulls and twice as many goats he would have saved Ksh.3,500. He slaughtered all the animals and sold the meat at a profit of 30% per bull and 40% per goat. Determine

a. The number of bulls and the number of goats the butcher bought. (5 marks)

Let bulls be $= x$ and goats $= y$.

$(15,500x + 2400y = 43,000)2$ ——— M1
$(7750x + 4800y = 39,500)1$

$31000x + 4800y = 86,000$ ——— M1
$7750x + 4800y = 39500$ ———
_____
$23250x = 46,500$

——— A1

$x = 2.$

$15,500(2) + 2400y = 43,000$ ——— M1

$y = 5.$ ——— A1

2 bulls and 5 goats.

b. The percentage profit he made on all the animals giving your answer to one decimal place. (5 marks)

Profit per bull
$= \frac{30}{100} \times sh.15,500$ ——— M1
$= sh. 4,650$

Profit per goat $= \frac{40}{100} \times sh. 2400$ ——— M1
$= sh. 960$

Total profit $= 2(4650) + 5(960)$ ——— M1
$= sh. 14,100$

$\%P = \frac{14,100}{43,000} \times 100\%$ ——— M1

$= 32.8\%$ ——— A1

9

_____
10

19. The table shows recordings from surveyors' field book.

|  | B |  |
|---|---|---|
|  | 280 |  |
| E 25 | 200 |  |
|  | 160 | B 80 |
| C 70 | 120 |  |
|  | 100 | D 50 |
|  | A |  |

a. Draw a sketch diagram from the data in the field book                    (2 marks)



B₁

B₁
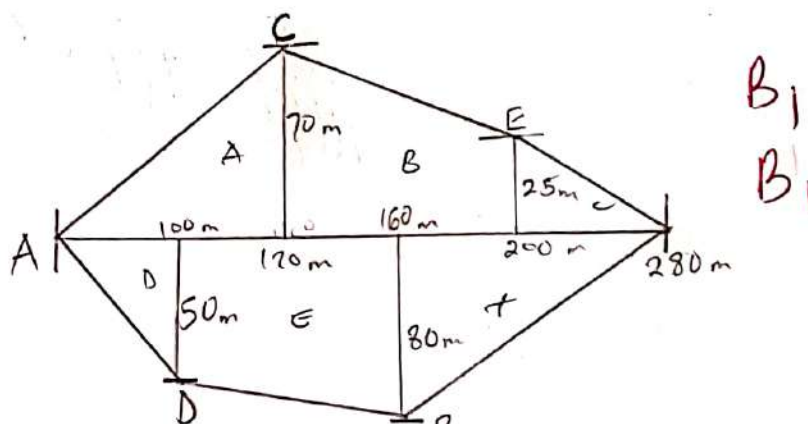
b. Given that the recordings are in metres, determine the area of the land in hectares.                    (8 marks)

$A = \frac{1}{2} \times 120 \times 70 = 4200 \, m^2$    MI

$B = \frac{1}{2}(70 + 75)\overset{40}{80} = 3800 \, m^2$    MI

$C = \frac{1}{2} \times \overset{40}{80} \times 25 = 1000 \, m^2$    MI

$D = \frac{1}{2} \times \overset{50}{100} \times 50 = 2500 \, m^2$    MI

$E = \frac{1}{2}(80 + 50)\overset{30}{60} = 3900 \, m^2$    MI

$\frac{1}{2} \times \overset{90}{120} \times 80 = 4800 \, m^2$    MI

Total Area $= 20,200 \, m^2$    A₁

$10,000 m^2 = 1 \, hectare$

$20,200 m^2 = \dfrac{20,200 \times 1}{10,000}$

$= 2.02 \, h$

$\Rightarrow 2.02 \, hectares$    B₁

10

10

20. a) The figure below represents a model of a hut whose base ABCD is a square of side 10cm, AE = 15cm and EV = 13cm.
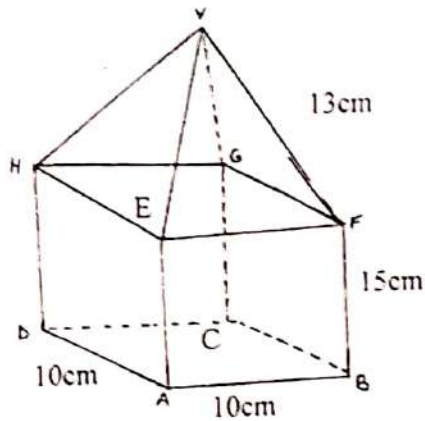


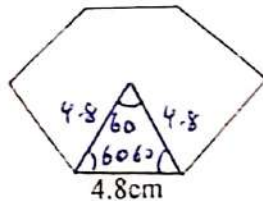Calculate the total surface area of the solid. (5 marks)

Floor = $10 \times 10 = 100 \, cm^2$

Sides = $2(10 \times 15) + 2(10 \times 15)$ $\}M_1$
$= 600 \, Cm^2$

Top = $\{\frac{1}{2} \times 10 \times 12\} \times 4$ —— $M_1 \, M_1$
$= 240 \, cm^2$

TSA $= 100 + 600 + 240$ —— $M_1$
$= 940 \, cm^2$ —— $A_1$

b) The cross section of a prism consists of a regular hexagon of sides 4.8cm as shown in the figure below.



4.8cm

i) Calculate the area of the cross-section. (3 marks)

$= (\frac{1}{2} \times 4.8^2 \, Sin \, 60°) \, 6$ —— $M_1 \, M_1$

$= 59.86 \, cm^2$ —— $A_1$

Note: Check alternatives.

ii) If the prism is 10.5cm long. Calculate its volume. (2 marks)

$= 59.86 \times 10.5$ —— $M_1$
$= 628.53 \, Cm^3$ . —— $A_1$

$\underline{\phantom{xxxxx}}$
$\phantom{xxx} 10$

21. In the figure below, O is the centre of the circle of radius 3cm and AB is a chord such that its shortest distance from O is 1cm.
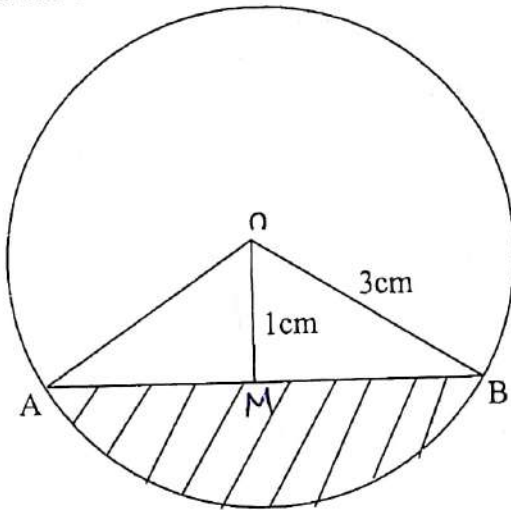


Calcuate:-

(2 marks)

(a) The length of the chord AB.

$$= \left(\sqrt{3^2-1^2}\right)2 \quad\text{——} \quad M_1$$

$$= 5.657a \quad\text{——} \quad A_1$$

(3 marks)

(b) The angle AOB



$$= \left(\cos^{-1} \tfrac{1}{3}\right)2 \quad\text{——} \quad M_1 \, M_1$$

$$= 141.06° \quad\text{——} \quad A_1$$

(2 marks)

(c) The area of the minor sector OAB.

$$= \frac{141.06}{360} \times 3.142 \times 3^2 \quad\text{——} \quad M_1$$

$$= 11.08 a^2 \quad\text{——} \quad A_1$$
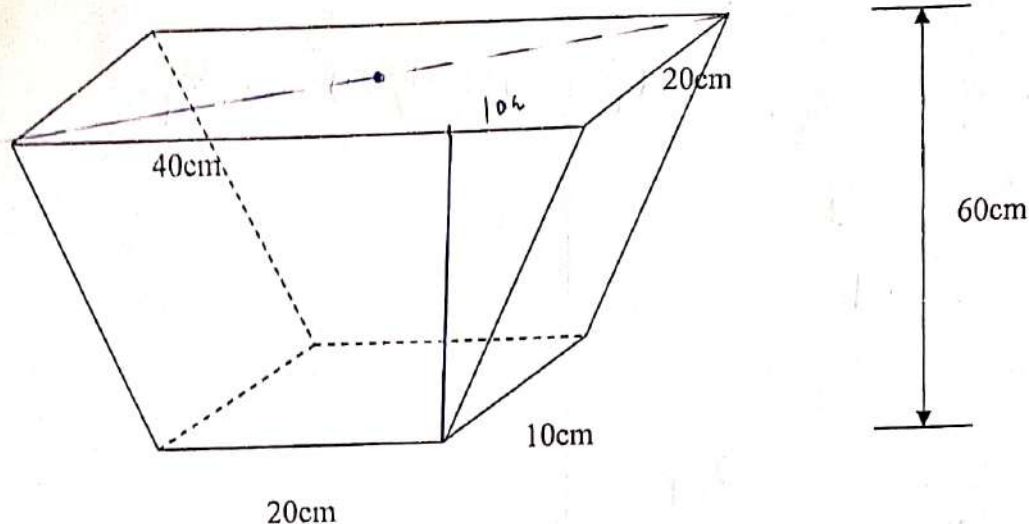
(3 marks)

(d) The area of the shaded segment.

$$\text{Area of Triangle} = \tfrac{1}{2} \wedge 3^2 \sin 141.06° \quad\text{——} \quad M_1$$

$$= 2.828 a^2$$

$$\text{Shaded Area} = 11.08 - 2.828 \quad\text{——} \quad M_1$$

$$= 8.252 a^2 \quad\text{——} \quad A_1$$

12

$$\frac{}{10}.$$

22. The figure shows a frustum of a right pyramid open container for storing water.



40cm
10cm
20cm
20cm
10cm
60cm

Calculate: (2 marks)

a) The height of the pyramid from which the frustum was cut from.

$$\frac{h+60}{h} = \frac{20}{10} \quad — M1$$

$$h = 60 \, cm$$

$$H = 60 + 60$$
$$= 120 \, cm. \quad — A1$$

(4 marks)

b) The capacity of the frustum in litres.

$$Volume = \left(\frac{1}{3} \times 40 \times 20 \times 120\right) — M1$$
$$- \left(\frac{1}{3} \times 20 \times 10 \times 60\right) — M1$$
$$= 28,000 \, cm^3$$

$$= \frac{28,000}{1000} \quad — M1$$
$$= 28 \, L \quad — A1$$

(4 marks)

c) The surface area of the frustum.

Bottom
$$(20 \times 10)$$
$$= 200 \, cm^2$$

40cm
20cm
H
61.03 h
$$122.07 \, cm.$$
$$H = \sqrt{20^2 + 122.07^2}$$
$$= 120.42$$
$$h = 60.21$$

20cm
H
10cm
60.03 h'
122.07
$$H = 121.66 \, cm.$$
$$h = 60.83 \, cm.$$

_M1
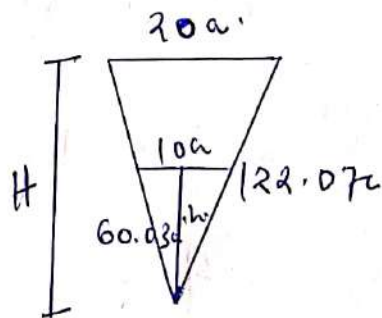
$$Sides = 2\left(\frac{1}{2} \times 40 \times 120.42 - \frac{1}{2} \times 20 \times 60.21\right) +$$
_M1
$$2\left(\frac{1}{2} \times 20 \times 121.66 - \frac{1}{2} \times 10 \times 60.83\right)$$
$$= 5,437.5 \, cm^2$$

$$TSA = (200 + 5,437.5) \, cm^2 \, M1$$
$$= 5,637.5 \, cm^2 \, A1$$

—T0.

13

23. The equation of a straight line is given as $y = -\frac{2}{3}x - \frac{2}{3}$. The line meets the x – axis at point T.

(a). Determine the coordinates of T.  (2 marks)

$$0 = -\frac{2}{3}x - \frac{2}{3} \quad \text{— M}_1 \qquad T(-1, 0) \quad \text{— A}_1$$

$$\frac{2}{3}x = -\frac{2}{3}$$

$$x = -1$$

(b). A second line L2 is perpendicular to line L1 at T. Find the equation of line L2 in the form $ax + by = c$ where a, b and c are constants.  (3 marks)

$$m_2 = \frac{3}{2} \quad \text{— B}_1$$

$$\frac{y - 0}{x + 1} = \frac{3}{2} \quad \text{— M}_1$$

$$3x + 3 = 2y$$

$$3x - 2y = -3 \quad \text{— A}_1$$

(c). A third line L3 passes through (–4,1) and is parallel to L1. Find;
The equation of line L3 in the form $y = mx + c$  (2 marks)

$$\frac{y - 1}{x + 4} = -\frac{2}{3} \quad \text{— M}_1$$

$$y - 1 = -\frac{2}{3}x - \frac{8}{3}$$

$$y = -\frac{2}{3}x - 1\frac{2}{3} \quad \text{— A}_1$$

(d). The coordinates of point S at which L3 intersects L2.  (3 marks)

$$\frac{3}{2}x + \frac{3}{2} = -\frac{2}{3}x - 1\frac{2}{3} \quad \text{— M}_1$$

$$2\frac{1}{6}x = -3\frac{1}{6}$$

$$x = -1\frac{6}{13}$$

$$\left(-1\frac{6}{13}, -\frac{9}{13}\right) \quad \text{— A}_1$$

$$y = -\frac{2}{3}\left(-1\frac{6}{13}\right) - 1\frac{2}{3} \quad \text{— M}_1$$

$$= -\frac{27}{39} = \frac{-9}{13}$$

14

24. The coordinates of △ ABC are A (-1, 1) B (-5, 2) and C (-3, 5). The image of ABC under a
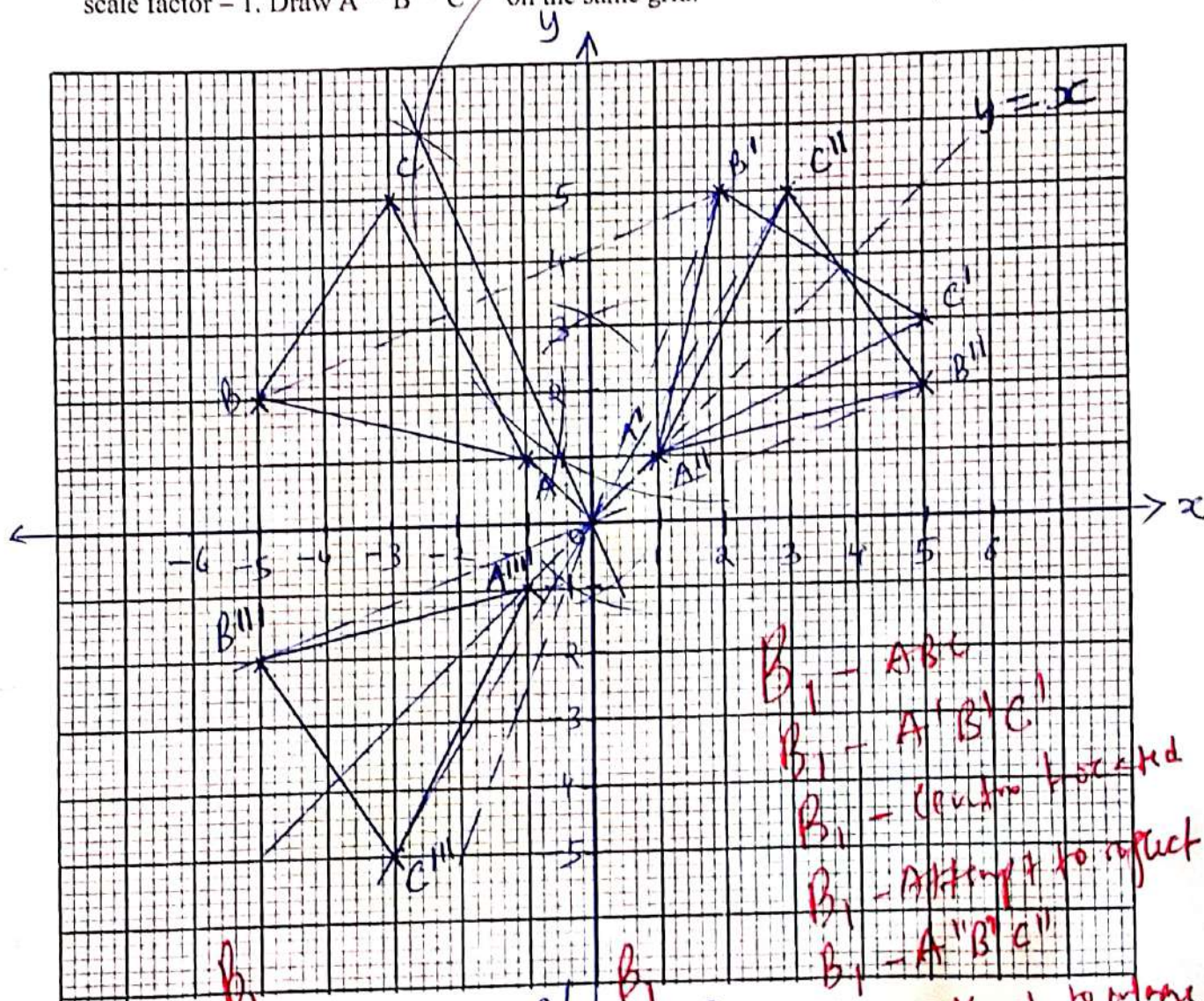rotation has coordinates A' (1, 1), B' (2, 5), C' (5, 3)
    a) Plot ABC and A'B'C' on same grid.  (2 marks)
    b) By construction find the centre and angle of rotation that maps ABC on to A'B'C'. (3 marks)
    c) A''B''C'' is the image of A'B'C' under a reflection on the line x-y =0. Plot A''B''C'' and
    write down its coordinates.  (3 marks)

$$A''(1,1), B''(5,2), C''(3,5) \quad B_1$$

    d) A''' B''' C ''' is the image A''B''C'' under an enlargement centre the origin and
    scale factor – 1. Draw A''' B''' C ''' on the same grid.  (2 marks)



Centre (0,0), Angle = −90° /+ 270°

$B_1$ – ABC
$B_1$ – A'B'C'
$B_1$ – Centre Located
$B_1$ – Attempt to reflect
$B_1$ – A''B''C''
$B_1$ – Attempt to enlarge
$B_1$ – A'''B'''C'''

10