

MARONG, SCHEME

NAME: _____ INDEX NO: _____ CLASS: _____
 CANDIDATE'S SIGNATURE: _____ DATE: _____

121/1
 MATHEMATICS ALTA
 PAPER 1
 Sep/Oct.
 TIME: 2½ hours

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MOMALICHE 8 CYCLE 3

INSTRUCTIONS TO CANDIDATES

- Write your name, admission and class in the spaces provided at the top of this page.
- Sign and Write the date of examination in the spaces provided above.
- This paper consists of TWO Sections: Section I and Section II.
- Answer ALL the questions in Section I and only five questions from Section II.
- Show all the steps in your calculations, giving your answer at each stage 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.
- This paper consists of 14 printed pages.
- Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
- 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 TOTAL

17	18	19	20	21	22	23	24	TOTAL

GRAND

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SECTION I (50 marks)

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

1. Use tables of reciprocal only to evaluate $\frac{1}{0.325}$, hence evaluate ;

$$\frac{\sqrt[3]{0.000125}}{0.325}$$

(4 mark)

$$\frac{1}{0.325} = \frac{1}{3.25} \times \frac{1}{10^{-1}} = 0.3077 \times 10 = 3.077 \text{ A}_1$$

$$\sqrt[3]{125 \times 10^{-6}} = 5 \times 10^{-2} = 0.05$$

$$0.05 \times 3.077 = 0.15385 \text{ A}_1$$

2. Solve the equation $3x^2 + 4x = 2$ giving the roots correct to two decimal places. (3 marks)

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

$$x = \frac{-4 \pm \sqrt{4^2 - (4 \times 3 \times -2)}}{2 \times 3} \text{ M}_1$$

$$x = \frac{-4 \pm \sqrt{40}}{6}$$

$$\text{Either } x = \frac{-4 + 6.325}{6} = 0.39 \text{ A}_1$$

$$\text{or } x = \frac{-4 - 6.325}{6} = -1.72$$

The straight line through the points D (6, 3) and E (3, -2) meets the y-axis at the point F. Determine the coordinates of F.

(3 marks)

$$m = \frac{-2 - 3}{3 - 6} = \frac{-5}{-3} = \frac{5}{3} \text{ M}_1$$

$$(6, 3) (x, y)$$

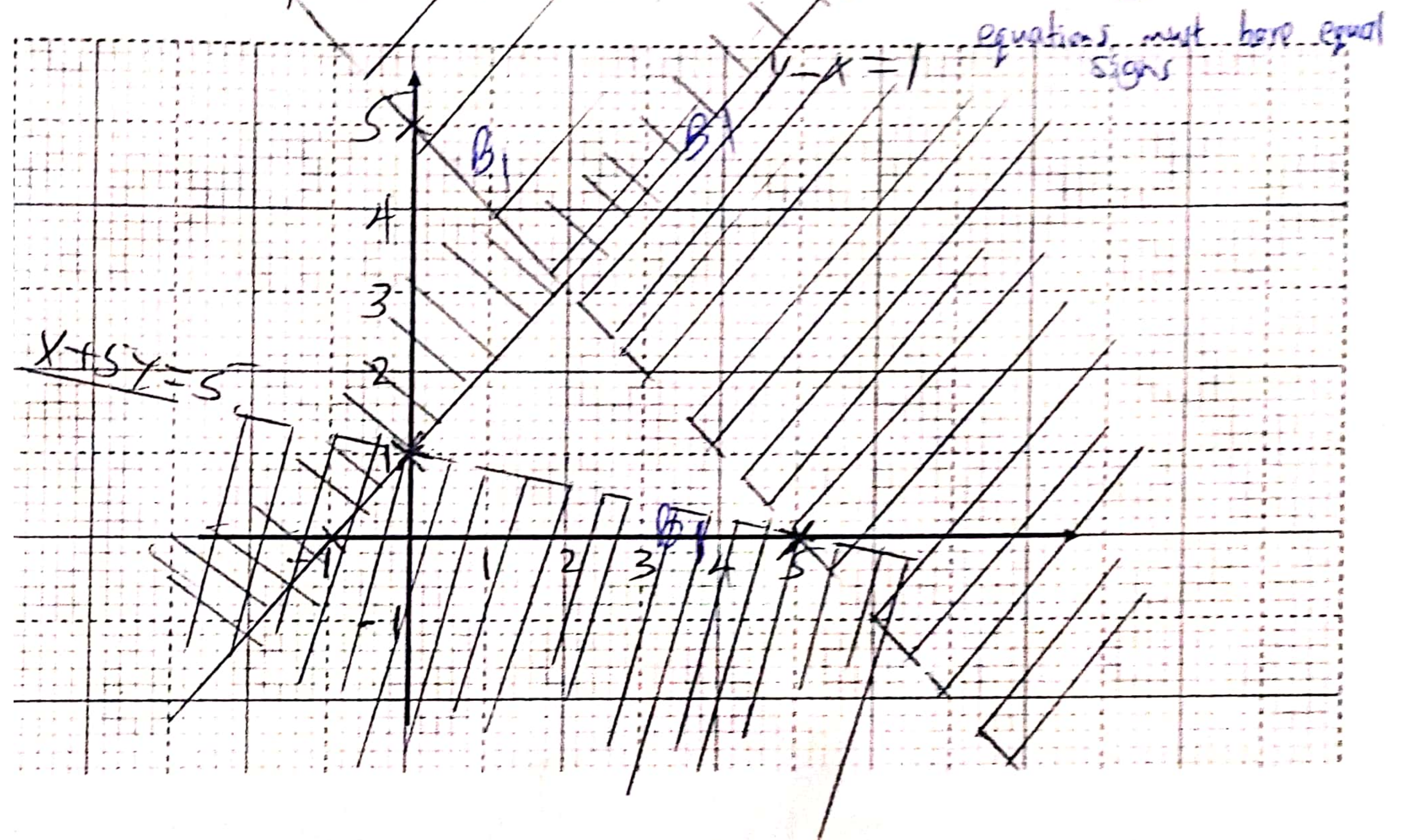
$$\frac{y - 3}{x - 6} = \frac{5}{3}$$

$$y = \frac{5}{3}x - 7 \text{ M}_1$$

$$y \text{ axis } x = 0$$

$$\therefore y = -7 \quad (0, -7) \text{ A}_1$$

Using the grid provided below, draw and shade the unwanted regions to show the region satisfied by R given the following inequalities; $y + x < 5$, $y - x \leq 1$ and $x + 3y > 5$ (3 marks)



Given that $a = -2$, $b = -1$ and $c = 3$, evaluate $\frac{2(a+c)^2 - (a-b)(b-c) - 2c}{3(a+b) - 2(b-c)}$

(3 marks)

$$\frac{2[-2+3]^2 - [-2-(-1)][-1-3] - 2(3)}{3[-2+(-1)] - 2[-1-3]}$$

$$\frac{2(1)^2 - (-1)(-4) - 6}{3(-3) - 2(-4)}$$

$$\frac{-8}{-1} = 8 \quad \underline{\underline{A.}}$$

6. Simplify:

$$\frac{x-2}{x+2} - \frac{2x-4}{x^2-4}$$

$$x+2 \quad x^2-4$$

$$\frac{x-2}{x+2} - \frac{2x-4}{x^2-4} = \frac{(x-2)(x-2) - 1(2x-4)}{x^2-4} \quad M_1$$

$$\frac{x^2 - 4x + 4 - 2x + 4}{x^2 - 4}$$

$$= \frac{x^2 - 6x + 8}{x^2 - 4}$$

$$= \frac{x^2 - 4x - 2x + 8}{(x-2)(x+2)} \quad M_1$$

$$= \frac{x(x-4) - 2(x-4)}{(x-2)(x+2)}$$

$$= \frac{(x-4)(x-2)}{(x-2)(x+2)}$$

$$= \frac{x-4}{x+2} \quad A_1$$

7. Two boys and a girl shared some money. The elder boy got $\frac{4}{9}$ of it, the younger boy got $\frac{2}{5}$ remainder and the girl got the rest. Find the percentage share of the younger boy to the girl's remainder.

Let the amount of money shared be x . (3 marks)

$$\text{Elder boy} = \frac{4}{9}x$$

$$\text{Younger boy} = \frac{2}{5} \times \frac{5}{9}x = \frac{2}{9}x \quad M_1$$

$$\text{Girl} = x - \left(\frac{4}{9}x + \frac{2}{9}x\right) = \frac{1}{3}x \quad M_1$$

$$\frac{\frac{2}{9}x}{\frac{1}{3}x} \times 100 = 66\frac{2}{3}\% \quad A_1$$

8. Annette has some money in two denominations only. Fifty shilling notes and twenty shilling coins. She has three times as many fifty shilling notes as twenty shilling coins. If altogether she has 3400 shillings, find the number of fifty shilling notes and 20 shilling coins. (3 marks)

Let the 20 coin be x .

50 note will be $3x$.

$$20x + 3x(50) = 3400 \quad M_1$$

$$170x = 3400$$

$$x = \frac{3400}{170} = 20 \quad M_1$$

$$\text{20 coins} = 20$$

9. The figure below shows a circle centre O and AOB is a sector of the circle and angle $AOB = 72^\circ$ as shown. Given that the area of a sector AOB is $5\pi\text{cm}^2$, find the radius of the circle and hence calculate the area of the shaded part. (4 marks)
(3 marks)

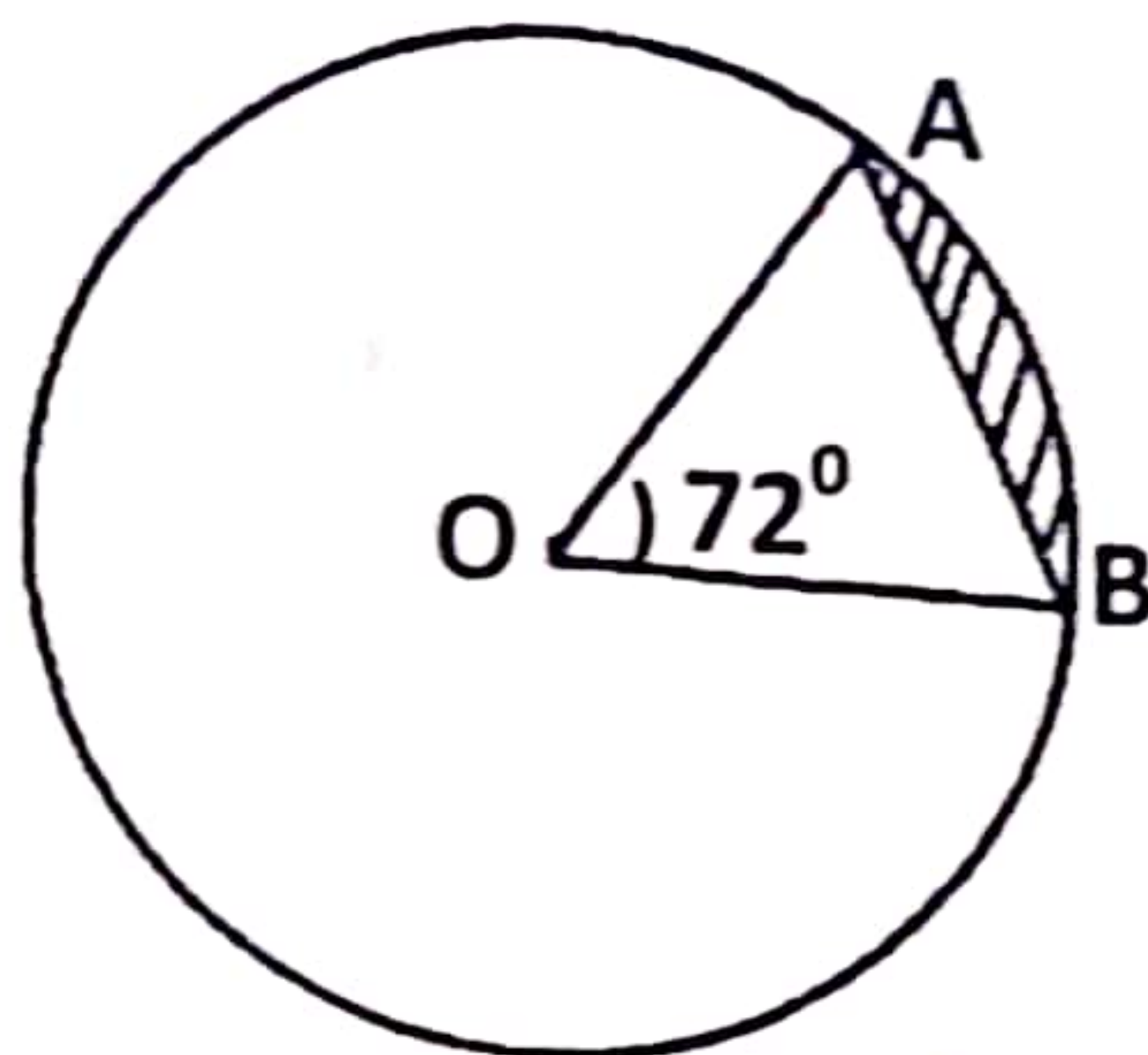
$$A = \frac{\theta}{360} \pi r^2$$

$$5\pi = \frac{72}{360} \pi r^2 \quad M1$$

$$r^2 = \frac{5\pi \times 360}{72\pi}$$

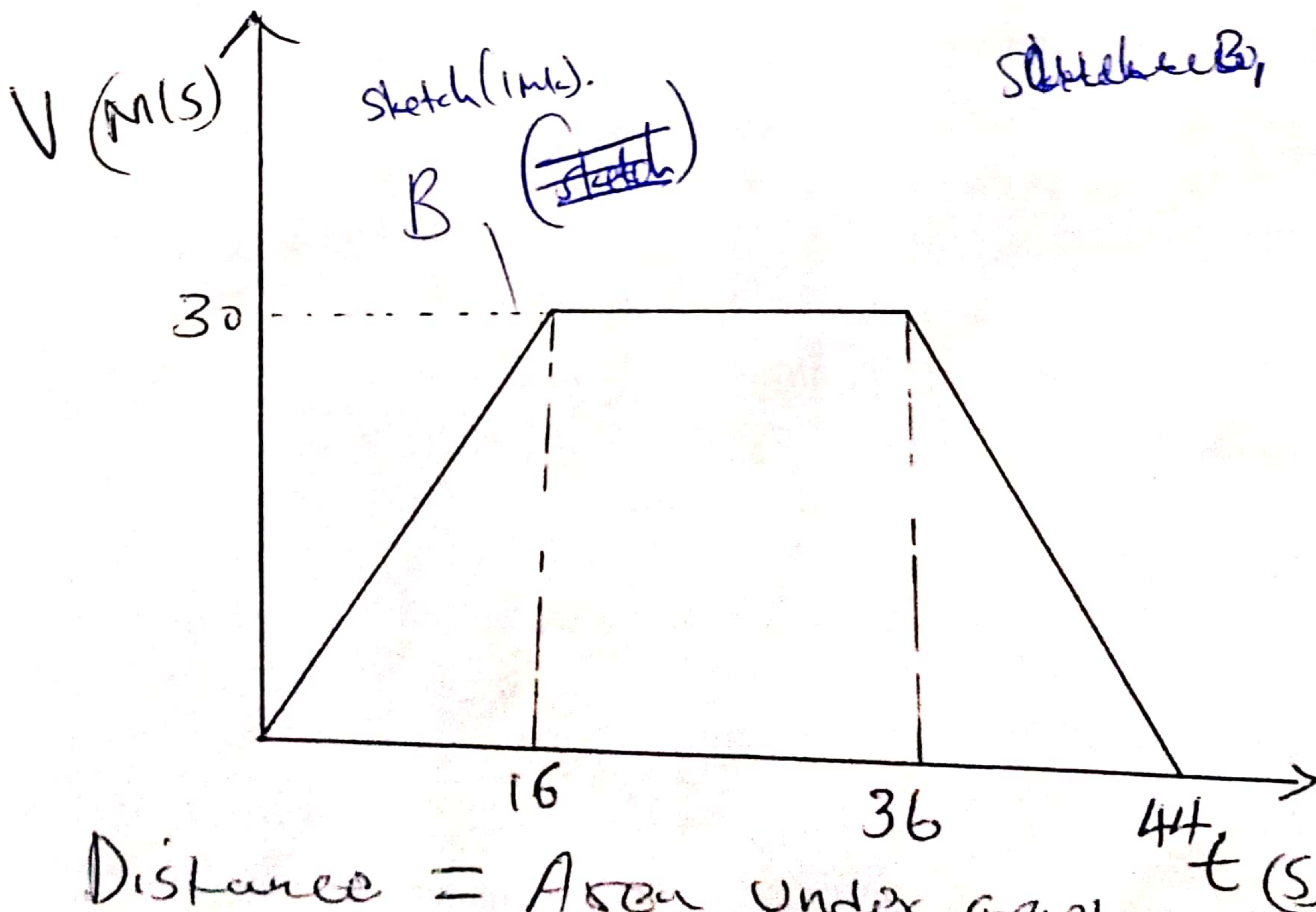
$$r^2 = 25$$

$$r = \underline{5\text{cm}} \quad A1$$



$$\begin{aligned} \text{Area of Shaded Region} &= \frac{\theta}{360} \pi r^2 - \frac{1}{2} ab \sin \theta \\ &= 5\pi - \frac{1}{2} \times 5^2 \sin 72^\circ \\ &= 15.71 - 11.89 \quad M1 \\ &= \underline{3.82\text{cm}^2} \quad A1 \end{aligned}$$

10. A particle accelerates uniformly from rest and attains a maximum velocity of 30m/s after 16 seconds. It travels at this constant velocity for the next 20 seconds before decelerating to rest after another 8 seconds. Calculate the total distance covered by the car. (4 marks)
(3 marks)



$$\begin{aligned} \text{Distance} &= \text{Area under graph.} \\ A &= \frac{1}{2} \times 30(20 + 44) \text{ m} \\ &= 15 \times 64 = \underline{960\text{m}} \quad A1 \end{aligned}$$

11. Find the value of x in the equation $5^{\frac{x}{4}} = \frac{1}{25}$

$$5^{\frac{x}{4}} = 5^{-2} \quad M_1$$

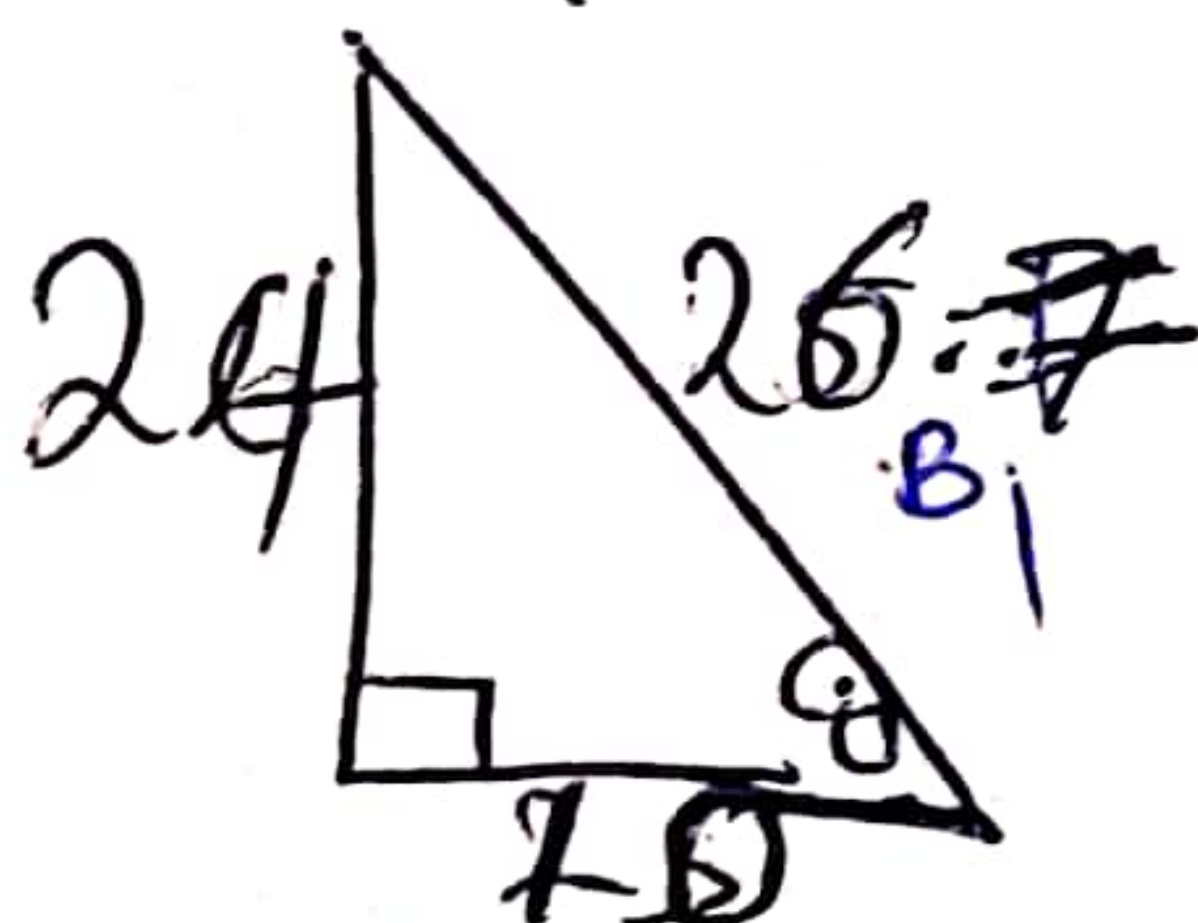
$$\frac{x}{4} = -2$$

$$\underline{\underline{x = -8}} \quad A_1$$

2mk
(3 marks)

12. Given that $\tan x = 2.4$, evaluate without use of tables and calculators, $\sin x - \cos x$ in the form $\frac{a}{b}$ where a and b are integers. (3mks)

$$\frac{24}{100} = \frac{6}{25}$$



$$\sin x = \frac{24}{26}$$

$$\cos x = \frac{10}{26}$$

$$6^2 + 10^2 = \sqrt{661} = 25.7$$

$$\frac{6}{26} = \frac{10}{26}$$

$$\frac{24}{26} - \frac{10}{26} = \frac{14}{26} = \frac{7}{13} \quad A$$

(3mks)
(4 marks)

13. The difference between the interior and exterior angles at each vertex of a regular polygon is 162° . Find the number of sides of the polygon. (3 marks)

Let the exterior $\angle$ be x .
" interior $\angle$ be y

$$y + x = 180$$

$$y - x = 162$$

$$2x = 18 \quad M_1$$

$$x = 9$$

$$\text{No. of sides} = 3$$

$$= 4$$

$$x + 162 = 180$$

$$x + 162 = 180$$

$$x = 18$$

$$x = 9$$

$$\frac{360}{9} = 40 \text{ sides}$$

or any method

14. The surface area of two similar bottles is 12cm^2 and 108cm^2 respectively. If the larger one has a volume of 810cm^3 . Find the volume of the smaller one. (3mks)

$$A.S.F = \frac{12}{108} = \frac{1}{9}$$

$$L.S.F = \frac{1}{3} \quad M_1$$

$$V.S.F = \frac{1}{27}$$

$$\frac{1}{27} = \frac{x}{810} \quad M_1$$

$$x = \frac{810}{27}$$

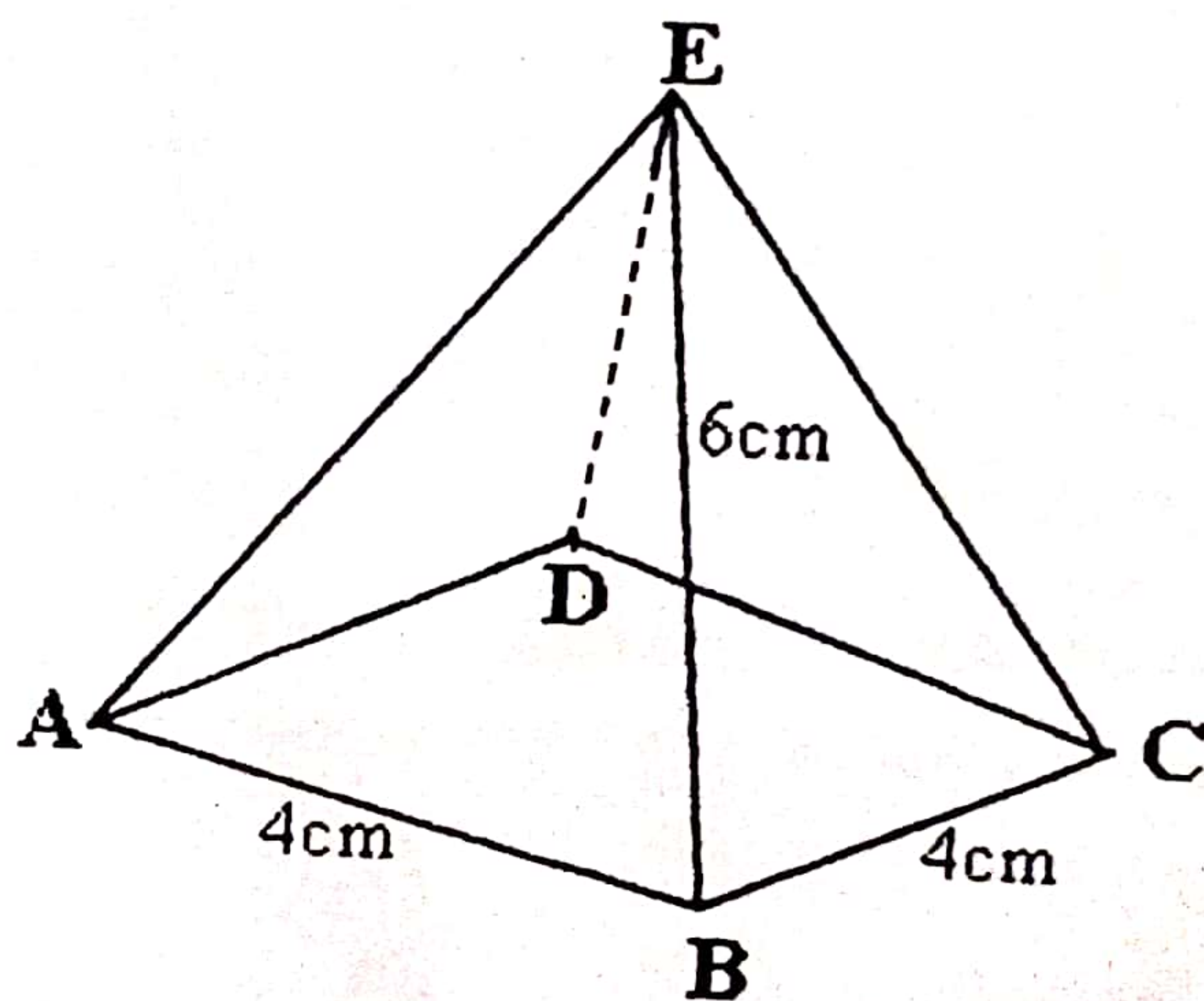
$$x = 30\text{cm}^3 \quad A_1$$

15. A cylindrical iron pipe is 2.1m long and 12cm in external diameter, the metal is 1cm thick and its density is 7.8 g/cm^3 . Taking π as $3\frac{1}{2}$ find its mass.

$$\begin{aligned}
 V &= \pi R^2 h - \pi r^2 h \\
 &= \pi h (R^2 - r^2) \\
 &= 3.142 \times 210 (6^2 - 5^2) \text{ cm}^3 \\
 &= 3.142 \times 210 \times 9 \text{ cm}^3 \\
 &= 5938.38 \text{ cm}^3
 \end{aligned}$$

$$\begin{aligned}
 M &= V \times d \\
 &= 5938.38 \times 7.8 \text{ g} \\
 &= 46319.364 \text{ g} \\
 &= \underline{\underline{46.32 \text{ kg}}}
 \end{aligned}$$

6. Draw the net of the solid below given that it is a right pyramid and that $AB = 4 \text{ cm} = BC = BE = 6 \text{ cm}$

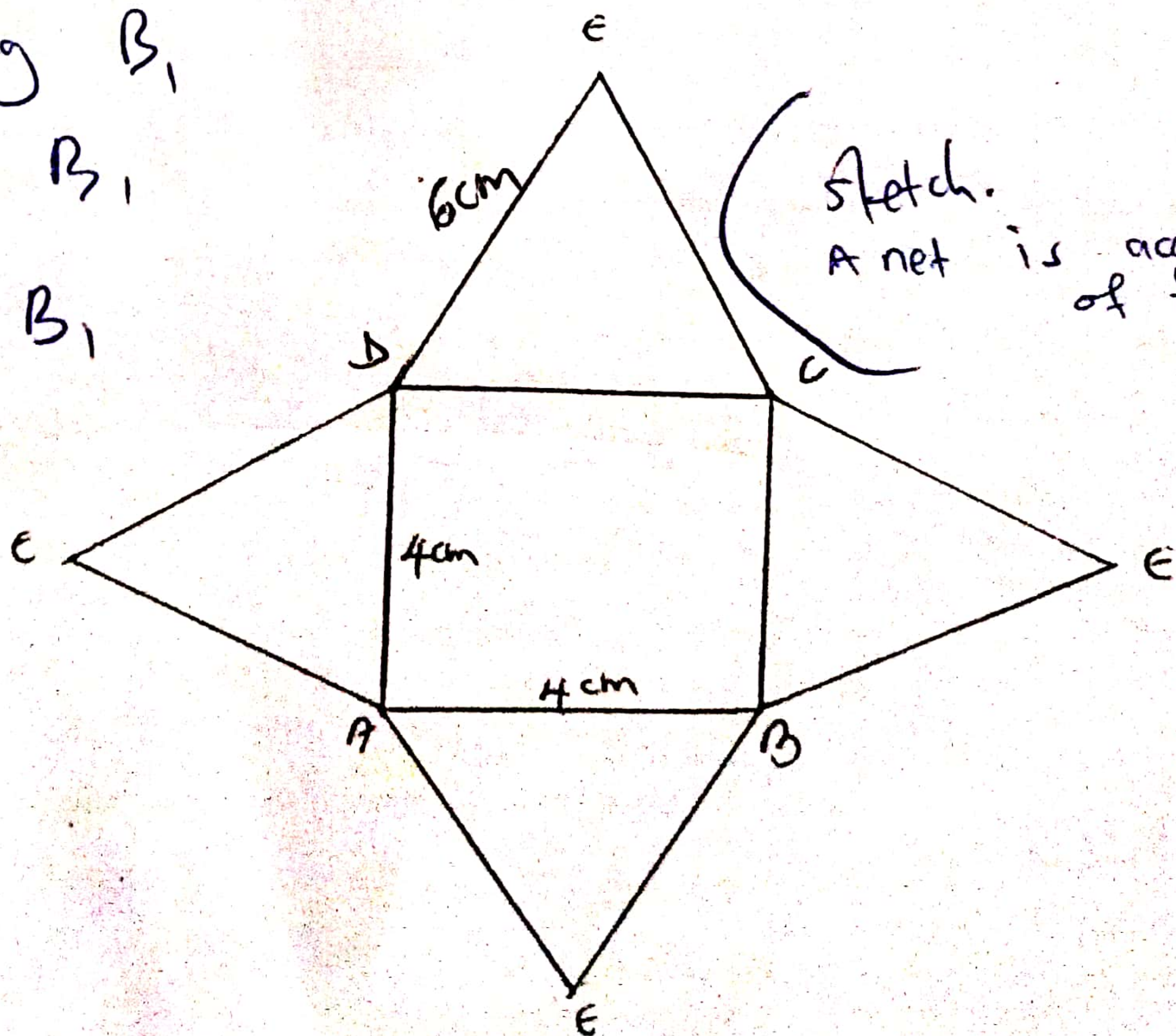


Marking points

Scale drawing B₁

labelling B₁

Correct net B₁



SECTION II (50marks)

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

17. Ruhu, Toru, and Lwamawa contributed a total of Kshs. 8041950.00 for their joint campaigns ahead of 2022 general elections. The ratios of their contributions were Ruhu to Toru 5:4 and Lwamawa to Toru 2:3.

a) How much did each contribute?

(4 Marks)

Ruhu	Toru	Lwa
5	4	2
15	12	8

$$\text{Lwa} \rightarrow \frac{8}{35} \times 8041950 = \text{Sh } 1,838,110$$

$$\text{Ruhu} \rightarrow \frac{15}{35} \times 8041950 = \text{Sh } 3,446,550$$

$$\text{Toru} \rightarrow \frac{12}{35} \times 8041950 = \text{Sh } 2,757,240$$

- b) Ruhu further contributed Kshs. 875,000.00 towards the campaigns kitty. in response, Toru and Lwamawa increased their contributions in the ratios 10:9 and 11:6 respectively. How much did Toru and Lwamawa further contribute altogether?

(3 marks)

$$\text{Toru } \frac{10}{9} \times 2,757,240 = \text{Sh } 3,063,600$$

$$\text{Lwa } \frac{11}{6} \times 1,838,110 = \text{Sh } 3,369,960$$

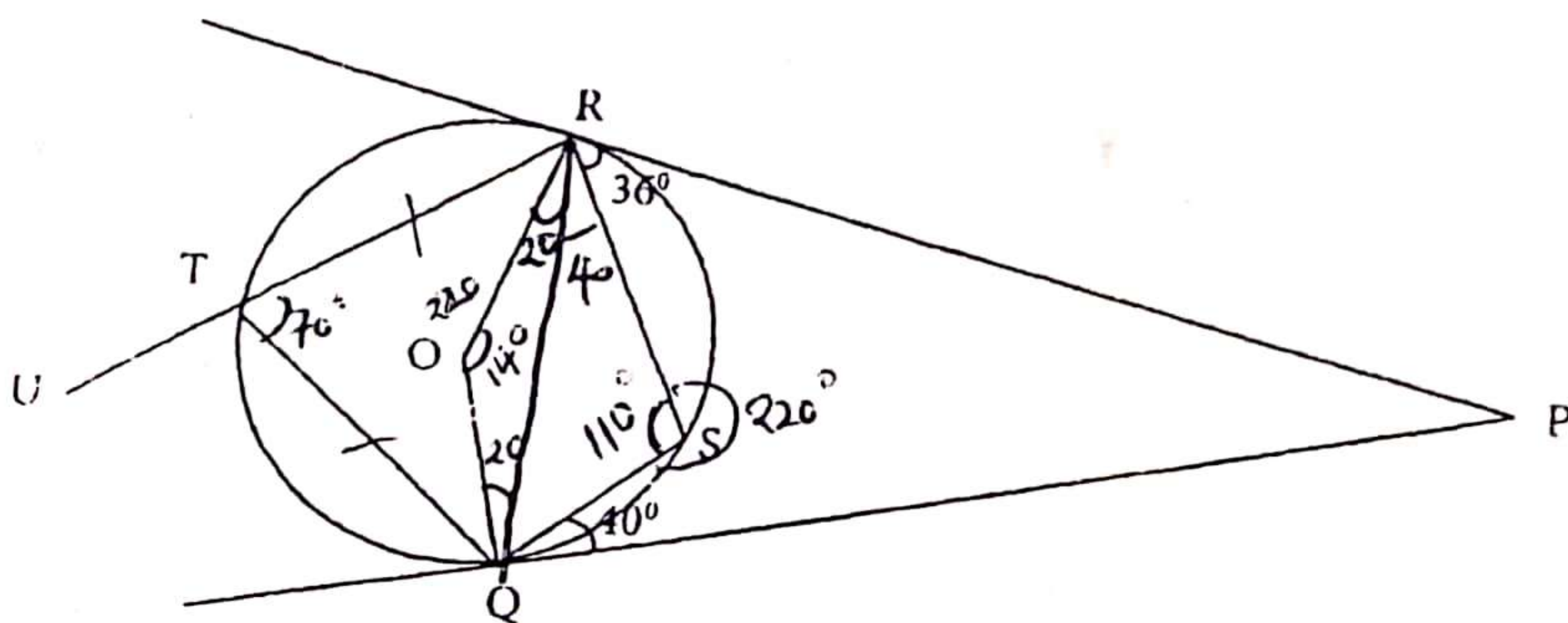
$$3,063,600 + 3,369,960 = \text{Sh } \underline{\underline{6,433,560}}$$

- c) The three agreed that if they win elections they would share the 15 cabinet positions amongst them in the ratio of their contributions. How many cabinets positions did Lwamawa get?

(3 Marks)

$$4,321,550 + 6,433,560 = 10,755,110$$

$$\frac{3,369,960}{10,755,110} \times 15 = 4.7 \approx \underline{\underline{5 \text{ positions}}}$$



220

$$\begin{array}{r} 220 \\ 70 \\ \hline 290 \end{array} \quad \begin{array}{r} 3160 \\ 290 \\ \hline 70 \end{array}$$

$$\begin{array}{r} 360 \\ 14 = \\ \hline 220 \end{array}$$

(2marks)

40° - angles in alternate segments are equal

(2 marks)

70° Sum of alternate angles

(2 marks

~~70~~^o, angles in a quadrilateral add up to 360°

(2 marks)

140° , isosceles triangle

(2 marks)

35° - ~~quadrilateral~~ a Bz & $\angle$ s of isosceles Δ

19. Complete the table below for the function $y = x^3 + 6x^2 + 8x$ for $-5 \leq x \leq 1$

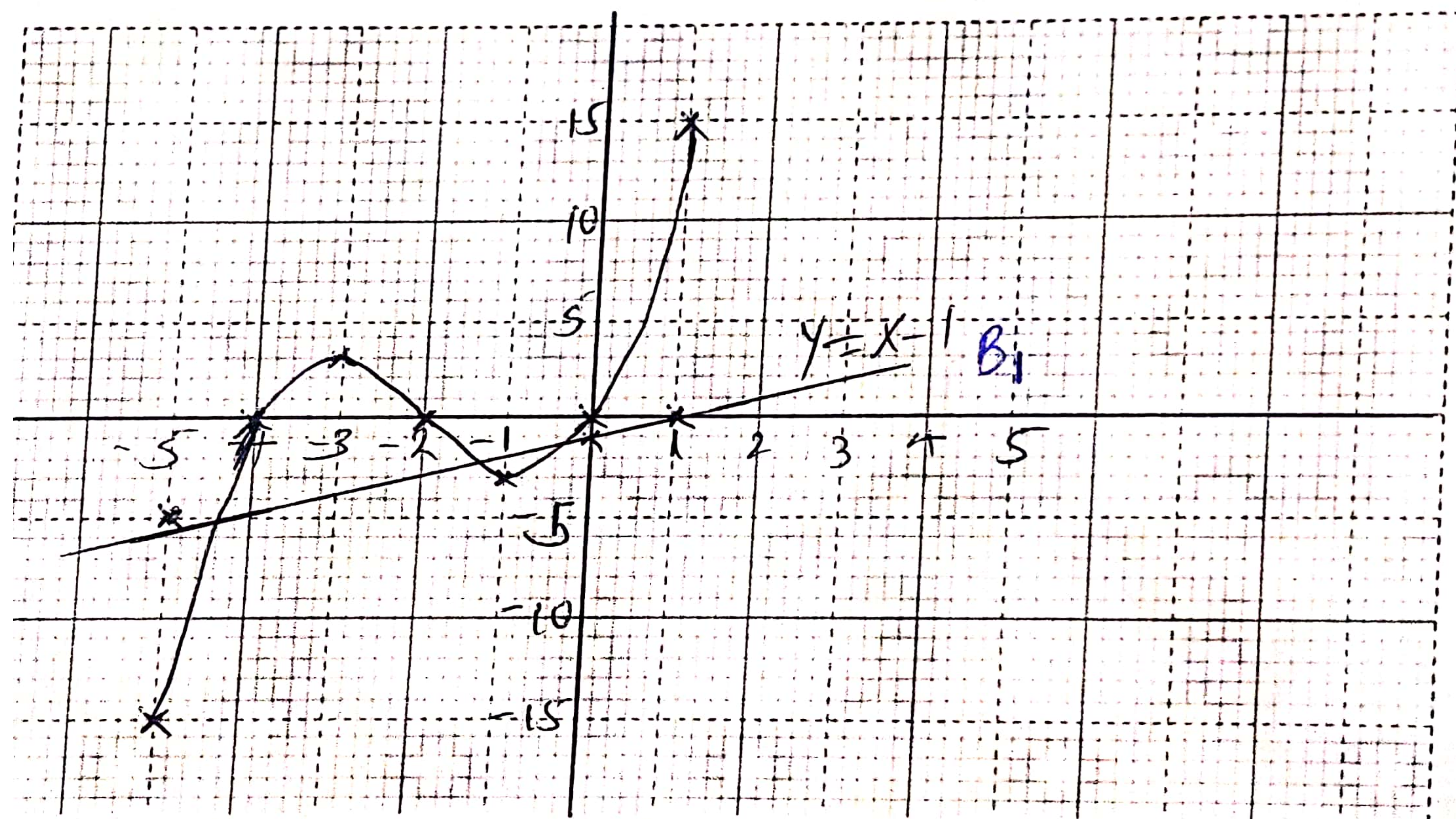
2 mks
(3 marks)

x	-5	-4	-3	-2	-1	0	1
x^3	-125	-64	-27	-8	-1	0	1
$6x^2$	150	96	54	24	6	0	6
$8x$	-40	-32	-24	-16	-8	0	8
y	-15	0	3	0	-3	0	15

(a) Draw the graph of the function $y = x^3 + 6x^2 + 8x$ for $-5 \leq x \leq 1$

(3 marks)

(Use a scale of 1cm to represent 1 unit on the x axis. 1 cm to represent 5 units on the y-axis)



i) $x^3 + 6x^2 + 8x = 0$ (1 mks)

ii) Hence use your graph to estimate the roots of the equation

$x^3 + 5x^2 + 4x = -x^2 - 3x - 1$

(4 marks)

$x^3 + 6x^2 + 7x + 1 = 0$

$= x^3 + 6x^2 + 8x$

$= x^3 + 6x^2 + 7x + 1$ B1

$= x - 1$

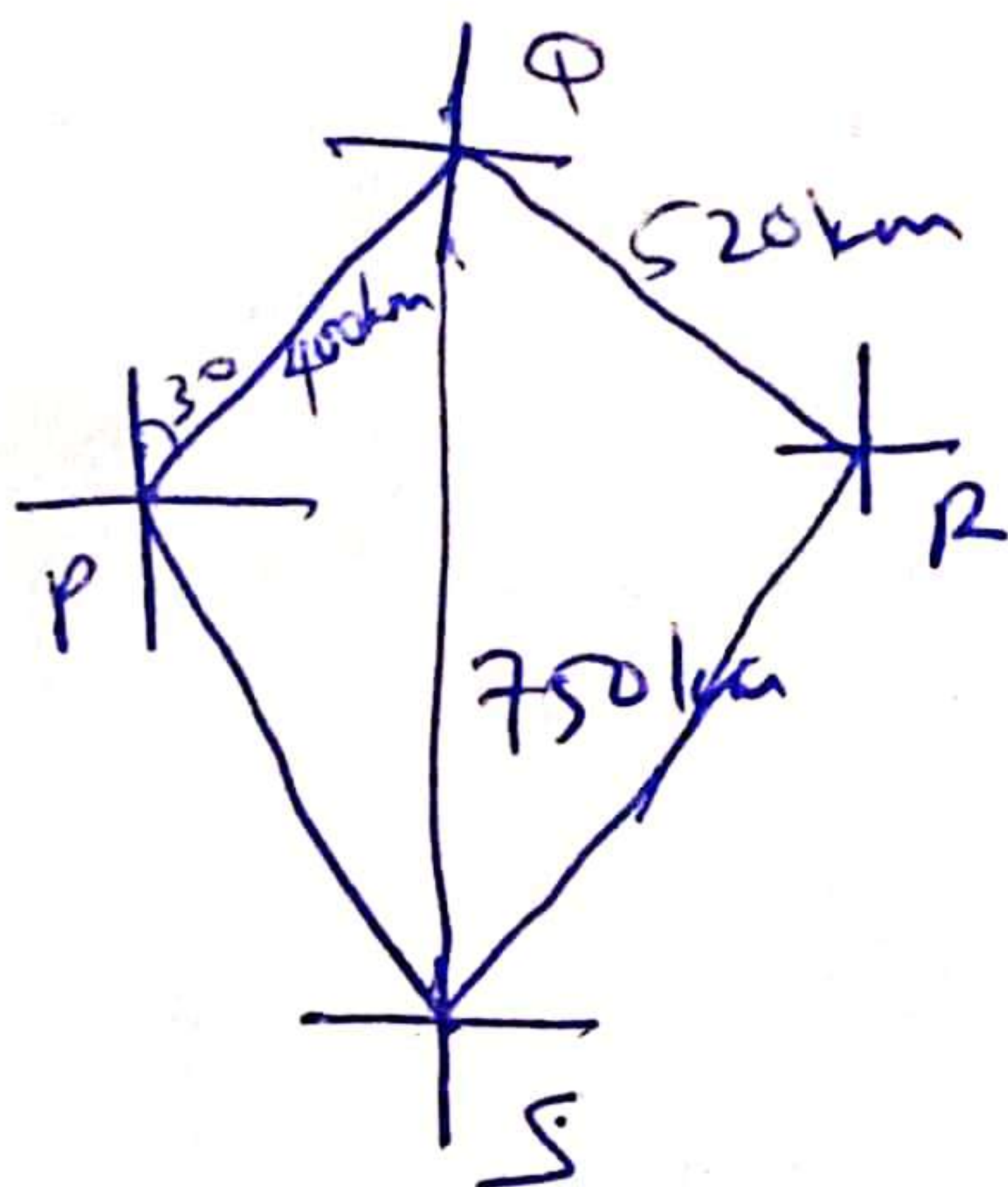
A
 $x_1 = -4.2 \pm 0.1$

$x_2 = -1.3 \pm 0.1$

$x_3 = -0.3 \pm 0.1$

20. Three islands P, Q, R and S are on an ocean such that island Q is 400 km on a bearing of 0° from island P. Island R is 520 km and on a bearing of 120° from island Q. A port S is sighted 75 km south of island Q.

(a) Taking a scale of 1 cm to represent 100 km, give a scale drawing showing the relative positions of P, Q, R and S. (4 marks)



(± 0.1 cm)

Use the scale drawing to

(b) Find the bearing of:

(i) Island R from island P

(1 mark)

(ii) Port S from island R

(1 mark)

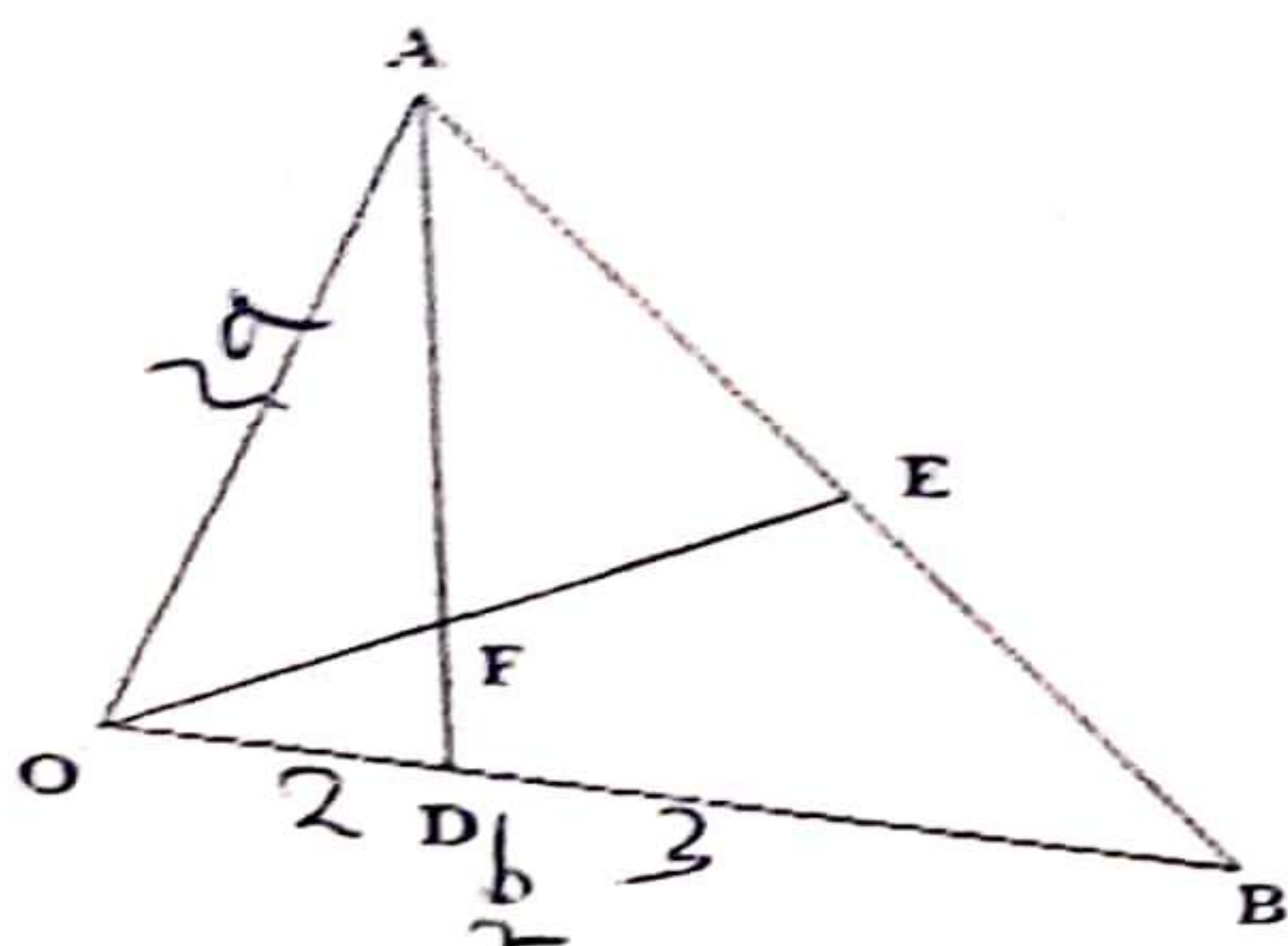
(c) Find the distance between island P and R

(2 marks)

(d) Find distance between S and R

(2 marks)

1. In the figure below, E is the midpoint of AB, OD : DB = 2 : 3 and F is the point of intersection of OE and AD



Given that $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$,

- (a) Express in terms of $\mathbf{a}$ and $\mathbf{b}$

- (i) $\vec{AD}$

$$\frac{2}{5}\mathbf{b} - \mathbf{a}$$

(1 mark)

- (ii) $\vec{OE}$

$$\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$$

(2 marks)

- (b) Given further that $\vec{AF} = s\vec{AD}$ and $\vec{OF} = t\vec{OE}$, find the values of s and t

(5 marks)

$$\vec{OF} = \mathbf{a} + s\left(\frac{2}{5}\mathbf{b} - \mathbf{a}\right)$$

$$\vec{OF} = (1-s)\mathbf{a} + \frac{2s}{5}\mathbf{b} \quad \dots (i)$$

$$\vec{OF} = t\left(\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}\right) \quad \dots (ii)$$

$$= \frac{1}{2}t\mathbf{a} + \frac{1}{2}t\mathbf{b} \quad \dots (ii)$$

$$(1-s)\mathbf{a} + \frac{2s}{5}\mathbf{b} = \frac{1}{2}t\mathbf{a} + \frac{1}{2}t\mathbf{b}$$

$$1-s = \frac{1}{2}t$$

$$2-2s = t$$

$$t + 2s = 2 \quad \dots (iii)$$

$$\frac{2s}{5}\mathbf{b} = \frac{1}{2}t\mathbf{b}$$

$$s = \frac{5}{2}t \quad \dots (iv)$$

$$t + 2\left(\frac{5}{2}t\right) = 2$$

$$6t = 2$$

$$t = \frac{1}{3}$$

$$s = \frac{5}{4}t$$

$$t + 2\left(\frac{5}{4}t\right) = 2$$

$$t + \frac{5}{2}t = 2$$

$$\frac{7}{2}t = 2$$

$$s = \frac{5}{6} \times \frac{4}{7} = \frac{5}{7}$$

- (c) Show that E, F and O are collinear

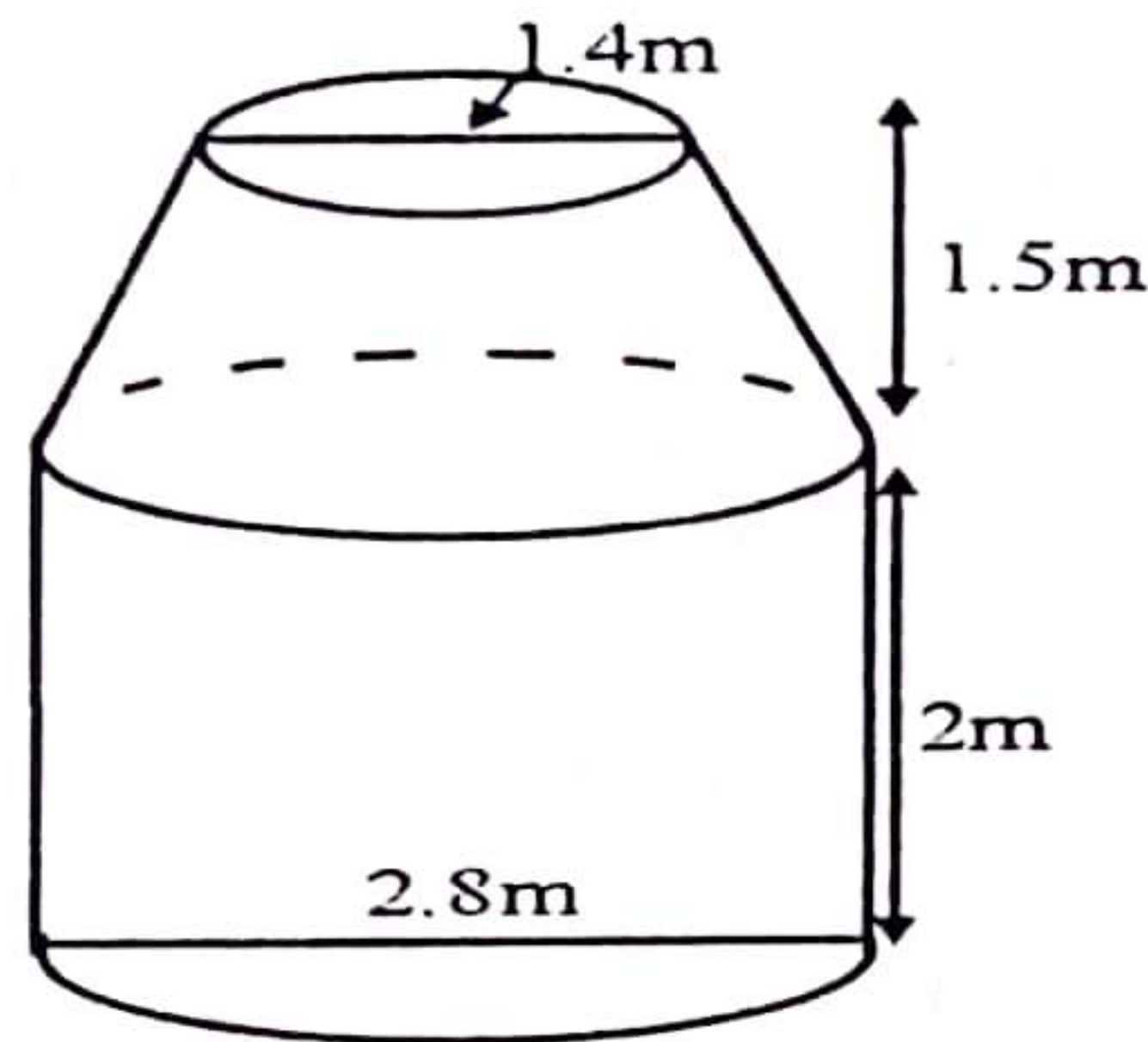
$$\vec{OF} = \vec{OE}$$

(2 marks)

$$s = \frac{5}{4} \left(\frac{4}{7}\right)$$

$$s = \frac{5}{7}$$

22. A plastic water tank has a shape as shown below, with a frustum of a cone on top, a cylindrical body and a hemispherical bottom.



$$L.S.F = \frac{2.8}{1.4} = 2$$

$$\frac{H}{h} = 2$$

$$\frac{h+1.5}{h} = 2$$

$$(a) \text{ Calculate } h = 1.5 \text{ m}$$

- (i) The volume of the tank in m^3 .

$$A = \frac{1}{3} \pi (1.4^2 \times 3 + 0.7^2 \times 1.5) + \frac{22}{7} \times 1.4 \times 1.4 \times 2 + \frac{2}{3} \times 1.4^3 \times \frac{22}{7}$$

$$= 5.39 + 12.32 + 5.749$$

$$= 23.46 \text{ cm}^3$$

- (b) A filler pipe takes 9 hours to fill a third of the tank. If the tank is already $\frac{1}{4}$ full, at what time will the filler pipe fill the tank if the pipe is opened at 9.00a.m.

$$\frac{1}{\frac{1}{3}} = 9 \text{ hrs}$$

$$1 \text{ hr} = \frac{1}{9} \text{ tank is filled}$$

$$\frac{3}{4} = \frac{3}{4} \times 9 = 6\frac{3}{4} \text{ hrs}$$

$$9.00 + 6.45 = 3.45 \text{ pm}$$

- (c) A particle falls in the tank. If its chances of being in any part of the tank are equally likely, find the probability of it being in the hemispherical part

$$\frac{5.749}{23.46} = 0.245$$

(5mks)
(4mks)

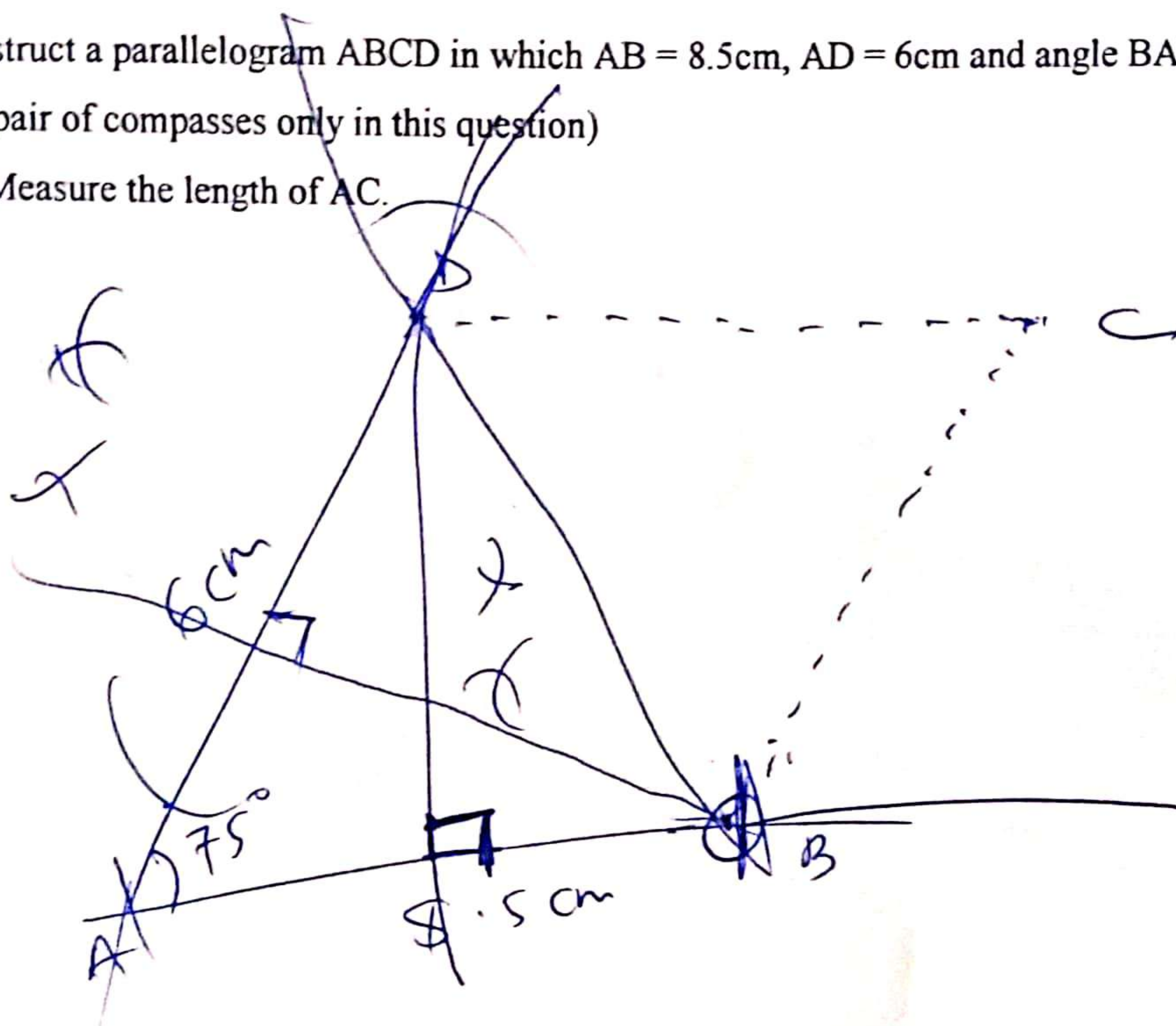
(4mks)
(3mks)

(2mks)

23. Construct a parallelogram ABCD in which $AB = 8.5\text{cm}$, $AD = 6\text{cm}$ and angle $BAD = 75^\circ$. (Use a ruler and pair of compasses only in this question)

a) Measure the length of AC.

(4mks)



b) On the same diagram, construct a perpendicular from B to line AD at M . Measure BM . Hence calculate the area of the parallelogram ABCD.

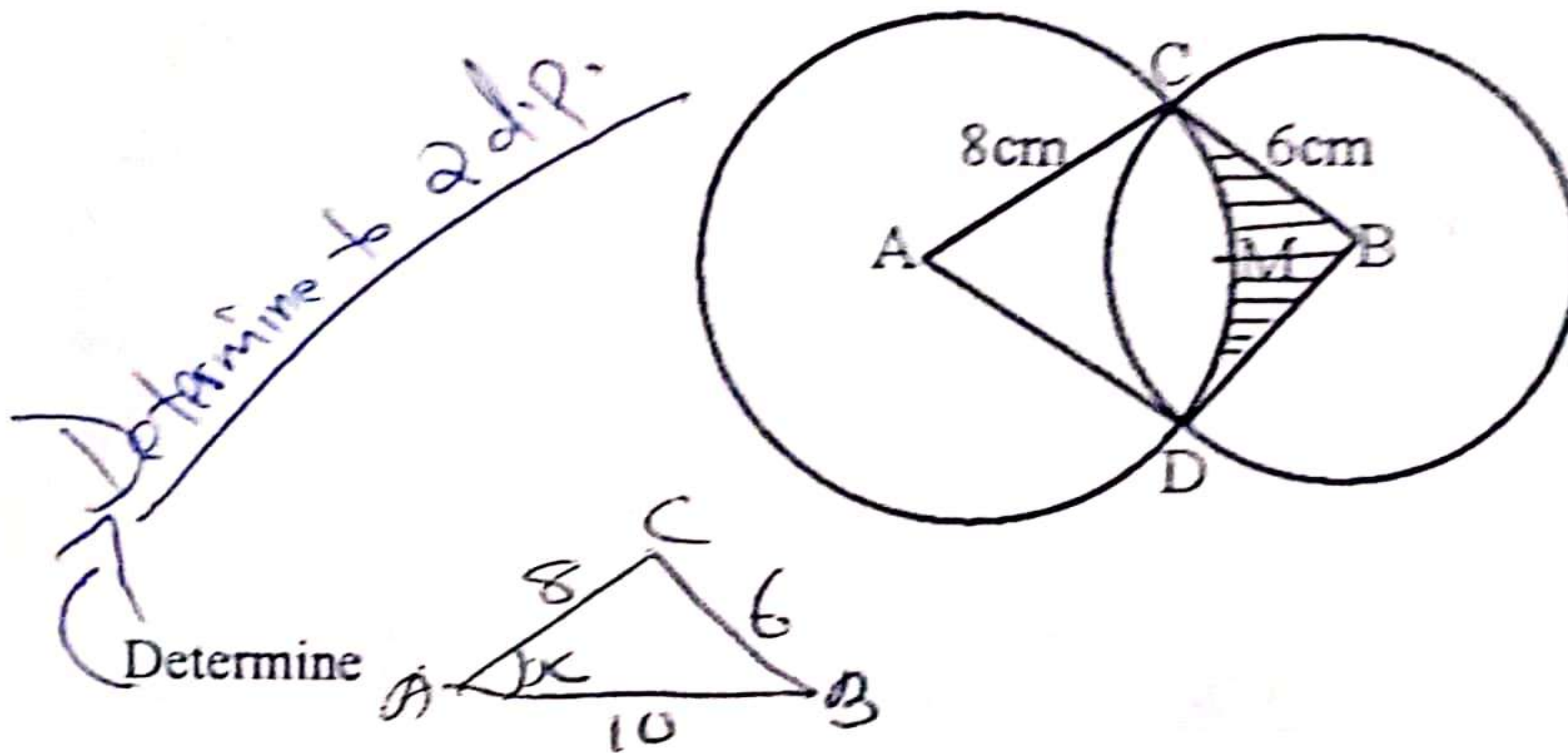
(4mks)

c) Ex-scribe a circle to triangle BDA

tangent to BD

(2marks)

24. The figure below shows two circles intersecting at C and D. The centres are A and B with radii 8cm and 6cm respectively. AB = 10cm.



- (i) Size of angle DAC (2mks)

$$6^2 = 8^2 + 10^2 - 2 \times 8 \times 10 \cos x \quad \angle DAC = 36.87 \times 2$$

$$x = \cos^{-1} \frac{12}{160} = 36.87^\circ \quad = \underline{\underline{73.74^\circ}} \quad (2mks)$$

- (ii) Size of angle DBC

$$8^2 = 6^2 + 10^2 - 2 \times 6 \times 10 \cos y$$

$$y = \cos^{-1} \frac{72}{120} = 53.13$$

- (iii) Area of sector ACMD (2mks)

$$\angle DBC = 53.13 \times 2 = \underline{\underline{106.25^\circ}}$$

$$= \frac{73.74}{360} \times \frac{22}{7} \times 8 \times 8$$

$$= \underline{\underline{41.83 \text{ cm}^2}}$$

- (iv) Area of the shaded region (4mks)

$$A = A \cap B = \frac{1}{2} \times 8 \times 8 \sin 73.74 + \frac{1}{2} \times 6 \times 6 \sin 106.6$$

$$= 30.72 + 17.28 = 48 \text{ cm}^2$$

$$= 48 - 41.83$$

$$= \underline{\underline{6.17 \text{ cm}^2}}$$