

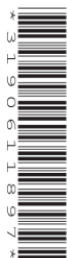
# Cambridge IGCSE™

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**MATHEMATICS****0580/22**

Paper 2 (Extended)

**February/March 2021****1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

**INSTRUCTIONS**

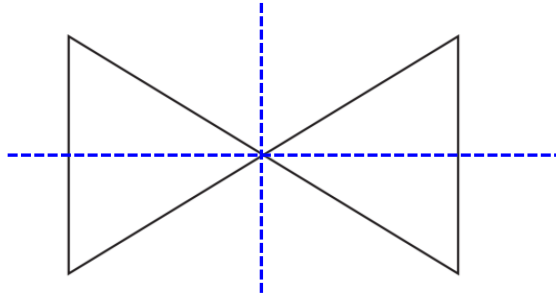
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical **answers** correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different **level** of accuracy is specified in the question.
- For  $\pi$ , use either your calculator value or 3.142.

**INFORMATION**

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

1



(a) Complete this statement.

The diagram has rotational symmetry of order ..... 2 ..... [1]

(b) On the diagram, draw all the lines of symmetry. [2]

2 Sahil and Anika share \$78 in the ratio <sup>S A</sup> 5 : 8.

Calculate the amount each receives.

$$\star S = \frac{5}{5+8} \times \$78 = \underline{\$30}$$

$$\star A = \frac{8}{5+8} \times \$78 = \underline{\$48}$$

Sahil \$ ..... 30 .....Anika \$ ..... 48 ..... [2]

3 The number of passengers on a bus is recorded each day for 14 days.

15	18	22	17	35	38	24
19	19	24	25	31	36	29

(a) Complete the stem-and-leaf diagram.

1	<u>5, 7, 8, 9, 9</u>
2	<u>2, 4, 4, 5, 9</u>
3	<u>1, 5, 6, 8</u>

Key: 1 | 5 represents 15 passengers

[2]

(b) Find the median.

..... 24 ..... [1]

- 4 By writing each number correct to 1 significant figure, find an estimate for the value of

$$\frac{2.8 \times 82.6}{27.8 - 13.9}$$

$$\Rightarrow \frac{3 \times 80}{30 - 10}$$

$$\Rightarrow \underline{\underline{12}}$$

.....12..... [2]

- 5 The number of bowls of hot soup sold decreases when the temperature rises.

What type of correlation does this statement describe?

.....negative..... [1]

- 6 Joseph spends  $\frac{5}{24}$  of one week's earnings to buy a jacket.  
The cost of the jacket is \$56.50 .

Calculate the amount Joseph earns in a week.

$$\star \frac{5}{24} \times y = \$56.50$$

$$\Rightarrow y = \frac{\$56.50 \times 24}{5} = \underline{\underline{\$271.20}} \text{ (2dp)}$$

\$ .....271.20..... [2]

- 7 Without using a calculator, work out  $2\frac{1}{4} \times 3\frac{2}{3}$ .

You must show all your working and give your answer as a mixed number in its simplest form.

$$\star 2\frac{1}{4} \times 3\frac{2}{3}$$

$$\Rightarrow \frac{9}{4} \times \frac{11}{3}$$

$$\Rightarrow \frac{33}{4} = \underline{\underline{8\frac{1}{4}}}$$

..... $8\frac{1}{4}$ ..... [3]

8 Write  $0.\dot{3}\dot{7}$  as a fraction.

$$\star \text{ Let } x = 0.373737\dots$$

$$10x = 3.737373\dots$$

$$100x = 37.373737\dots$$

$$\Rightarrow 100x - x = 37.373737\dots - 0.373737\dots$$

$$\Rightarrow 99x = 37$$

$$\Rightarrow x = \frac{37}{99}$$

$$\frac{37}{99}$$

..... [1]

9 Calculate  $4.8 \times 10^6 + 3.7 \times 10^7$ .

Give your answer in standard form.

$$\Rightarrow 0.48 \times 10^7 + 3.7 \times 10^7$$

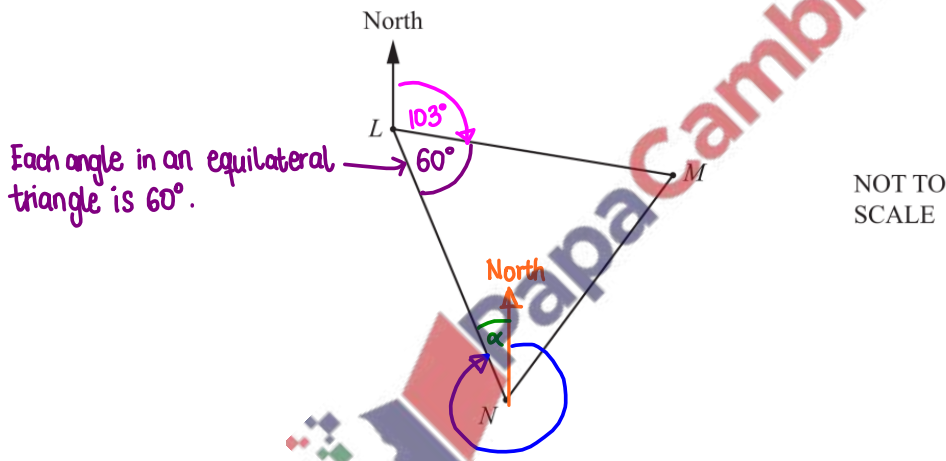
$$\Rightarrow (0.48 + 3.7) \times 10^7$$

$$\Rightarrow \underline{4.18 \times 10^7}$$

$$4.18 \times 10^7$$

..... [1]

10



On a map, the positions of the towns  $L$ ,  $M$  and  $N$  form an equilateral triangle. The bearing of  $M$  from  $L$  is  $103^\circ$ .

Work out the bearing of  $L$  from  $N$ .

$$\star \text{ Bearing} = 360^\circ - \alpha$$

$$\bullet \alpha + 103^\circ + 60^\circ = 180^\circ$$

$$\Rightarrow \alpha + 163^\circ = 180^\circ$$

$$\Rightarrow \alpha = \underline{17^\circ}$$

$$\therefore \text{Bearing} = 360^\circ - 17^\circ = \underline{343^\circ}$$

$$343^\circ$$

..... [2]

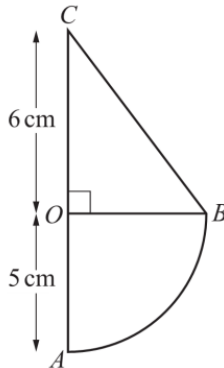
- 11 Find the highest common factor (HCF) of 36 and 84.

$$* 36 = 2 \times 2 \times 3 \times 3 \quad * 84 = 2 \times 2 \times 3 \times 7$$

$$\therefore \text{HCF} = 2 \times 2 \times 3 = \underline{12}$$

..... 12 ..... [2]

- 12



NOT TO  
SCALE

The diagram shows a shape made from a quarter-circle,  $OAB$ , and a right-angled triangle  $OBC$ . The radius of the circle is 5 cm and  $OC = 6$  cm.

Calculate the area of the shape.

$$* A_{\text{TOTAL}} = A_{\text{AOB}} + A_{\text{BOC}}$$

$$\Rightarrow A_{\text{TOTAL}} = \left( \frac{\pi r^2}{4} \right) + \left( \frac{1}{2} \times b \times h \right)$$

$$\Rightarrow A_{\text{TOTAL}} = \left( \frac{\pi(5)^2}{4} \right) \text{cm}^2 + \left( \frac{1}{2} \times 5 \times 6 \right) \text{cm}^2$$

$$\Rightarrow A_{\text{TOTAL}} = \underline{34.6} \text{cm}^2 \text{ (3 sig. figs.)}$$

..... 34.6 .....  $\text{cm}^2$  [3]

- 13 The population of one variety of butterfly is decreasing exponentially at a rate of 34% per year. At the end of 2014, the population was 125.9 million.

Calculate the population at the end of 2019.

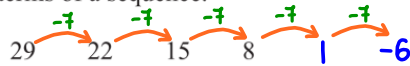
$$* A = a \left( 1 - \frac{r}{100} \right)^t$$

$$\Rightarrow A = 125.9 \text{m} \left( 1 - \frac{34}{100} \right)^5$$

$$\Rightarrow A = \underline{15.8} \text{m}$$

..... 15.8 ..... million [2]

- 14 (a) These are the first four terms of a sequence.



Write down the next two terms.

..... 1 ..... , ..... -6 ..... [2]

- (b) These are the first five terms of another sequence.

$$\star a_n = an^2 + bn + c$$

Find the  $n$ th term.

$$a + b + c = \boxed{4} \quad 7 \quad 12 \quad 19 \quad 28$$

$$3a + b = \boxed{+3} \quad +5 \quad +7 \quad +9$$

$$2a = \boxed{+2} \quad +2 \quad +2$$

$$\bullet 2a = 2$$

$$\Rightarrow \underline{a = 1}$$

$$\bullet (3 \times 1) + b = 3$$

$$\Rightarrow \underline{b = 0}$$

$$\bullet 1 + 0 + c = 4$$

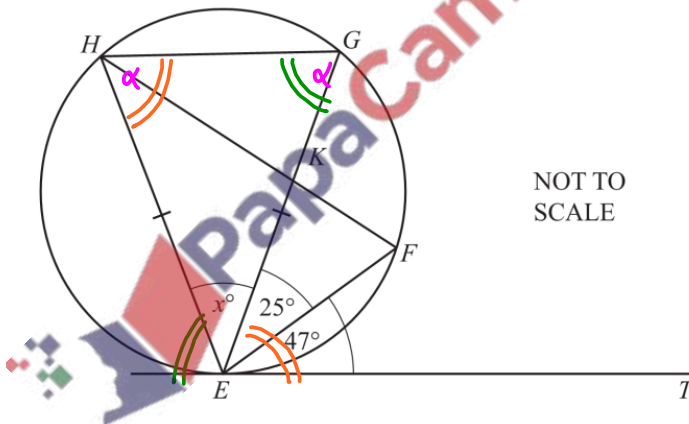
$$\Rightarrow \underline{c = 3}$$

Hence,

$$a_n = \underline{n^2 + 3}$$

$$\dots\dots\dots n^2 + 3 \dots\dots\dots [2]$$

15



NOT TO SCALE

Points  $E, F, G$  and  $H$  lie on the circle and  $EG = EH$ .  
 $HF$  and  $EG$  intersect at  $K$ .  
 $ET$  is a tangent to the circle at  $E$ .  
 Angle  $FET = 47^\circ$  and angle  $FEG = 25^\circ$ .

Find the value of  $x$ .

$$\star x + 2\alpha = 180^\circ$$

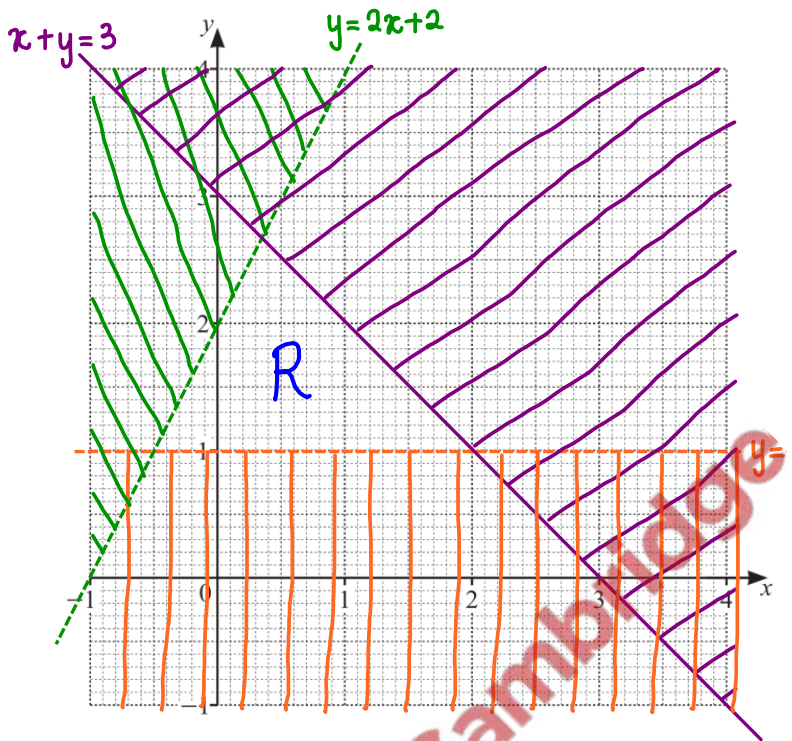
$$\Rightarrow x + 2(25^\circ + 47^\circ) = 180^\circ$$

$$\Rightarrow x + 144^\circ = 180^\circ$$

$$\Rightarrow \underline{x = 36^\circ}$$

$x = \dots\dots\dots 36 \dots\dots\dots [2]$

16



The region  $R$  satisfies these three inequalities.

$$y > 1 \quad y < 2x + 2 \quad x + y \leq 3$$

By drawing three suitable lines, and shading unwanted regions, find and label the region  $R$ . [5]

- 17 Some students were asked how many books they each had in their school bags. The table shows some of this information.

Number of books	5	6	7	8	9	10
Frequency	4	5	$x$	11	7	5

The mean number of books is 7.6 .

Calculate the value of  $x$ .

$$\star \bar{x} = \frac{\sum f(x)}{\sum f}$$

$$\Rightarrow 7.6 = \frac{(5 \times 4) + (6 \times 5) + 7x + (8 \times 11) + (9 \times 7) + (10 \times 5)}{4 + 5 + x + 11 + 7 + 5}$$

$$\Rightarrow 7.6 = \frac{251 + 7x}{32 + x}$$

$$\Rightarrow 7.6(32 + x) = 251 + 7x$$

$$\Rightarrow 0.6x = 7.8$$

$$\Rightarrow \underline{x = 13}$$

$$x = \dots\dots\dots 13 \dots\dots\dots [3]$$

18 Simplify  $(343x^9)^{\frac{2}{3}}$ .

$$\Rightarrow 343^{\frac{2}{3}} \cdot (x^9)^{\frac{2}{3}}$$

$$\Rightarrow 49x^{9 \times \frac{2}{3}}$$

$$\Rightarrow \underline{49x^6}$$

$$\dots\dots\dots 49x^6 \dots\dots\dots [2]$$

19 Solve the simultaneous equations.  
You must show all your working.

$$x - y = 7 \quad \text{---(1)}$$

$$x^2 + y = 149 \quad \text{---(2)}$$

$$(1) + (2): x + x^2 = 7 + 149$$

$$\Rightarrow x^2 + x - 156 = 0$$

$$\bullet x = \frac{-1 \pm \sqrt{(1)^2 - 4(1)(-156)}}{2(1)}$$

$$\Rightarrow x = \frac{-1 \pm 25}{2}$$

$$x_1 = \frac{-1 + 25}{2} = \underline{12}$$

$$x_2 = \frac{-1 - 25}{2} = \underline{-13}$$

• When  $x = 12$ ,

$$\Rightarrow 12 - y = 7$$

$$\Rightarrow \underline{y = 5}$$

• When  $x = -13$ ,

$$\Rightarrow -13 - y = 7$$

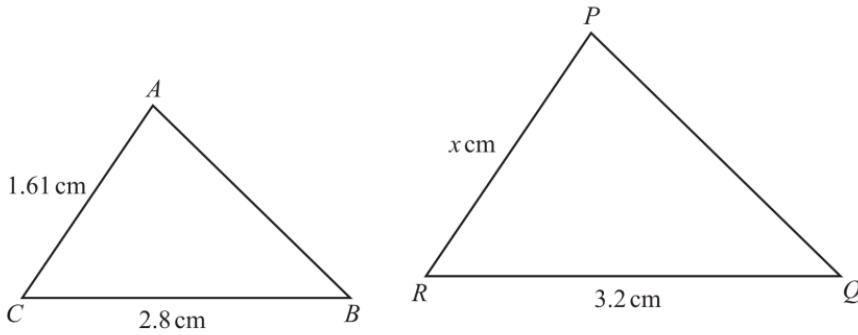
$$\Rightarrow \underline{y = -20}$$

$$x = \dots\dots 12 \dots\dots y = \dots\dots 5 \dots\dots$$

$$x = \dots\dots -13 \dots\dots y = \dots\dots -20 \dots\dots [5]$$



20 (a)



NOT TO SCALE

Triangle  $ABC$  is mathematically similar to triangle  $PQR$ .

Find the value of  $x$ .

$$\star \frac{x}{1.61 \text{ cm}} = \frac{3.2 \text{ cm}}{2.8 \text{ cm}}$$

$$\Rightarrow x = \left( \frac{3.2}{2.8} \times 1.61 \right) \text{ cm}$$

$$\Rightarrow x = \underline{1.84 \text{ cm}}$$

$$x = \dots\dots\dots 1.84 \dots\dots\dots [2]$$

(b)



NOT TO SCALE

The diagram shows two mathematically similar bowls.  
The larger bowl has capacity 7.8 litres and height 11.5 cm.  
The smaller bowl has capacity 4 litres.

Calculate the height of the smaller bowl.

Small  
 $h^3$

Large  
 $11.5^3$

$$\Rightarrow \frac{h^3}{4} = \frac{11.5^3}{7.8}$$

4

7.8

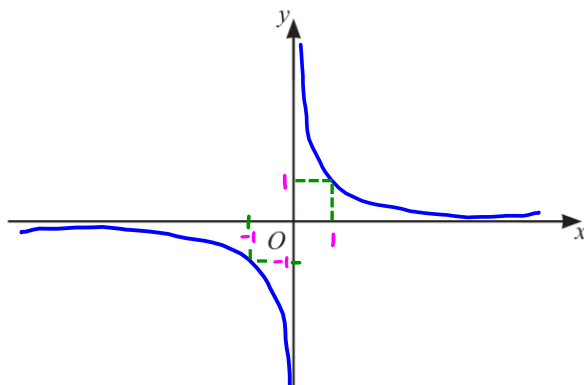
$$\Rightarrow h = \left( \frac{11.5^3}{7.8} \times 4 \right)^{\frac{1}{3}} \text{ cm}$$

$$\Rightarrow h = \underline{9.20 \text{ cm (3 sig. fig.)}}$$

$$\dots\dots\dots 9.20 \dots\dots\dots \text{ cm [3]}$$

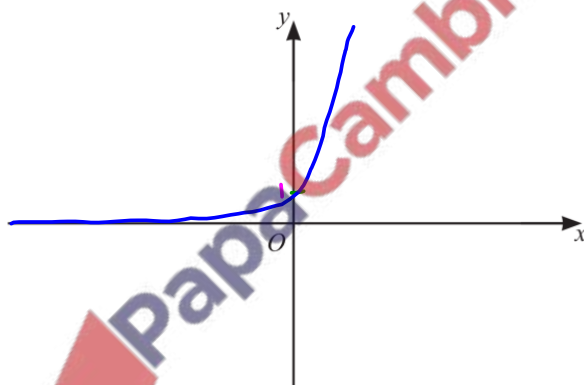
21 On the axes, sketch the graph of each of these functions.

(a)  $y = \frac{1}{x}$



[2]

(b)  $y = 4^x$



[2]

22 (a) A bag of rice has a mass of 25 kg, correct to the nearest kilogram.

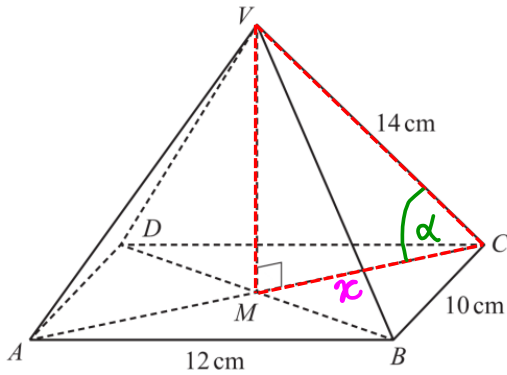
Calculate the lower bound of the total mass of 10 of these bags.

$$\begin{aligned} * M &= 25 \text{ kg} \pm \frac{1}{2} \text{ kg} & * LB(M_{10}) &= 10 \left( 25 - \frac{1}{2} \right) \text{ kg} & \dots\dots\dots 245 & \dots\dots\dots \text{ kg [1]} \\ & & \Rightarrow LB(M_{10}) &= \underline{245} \text{ kg} & & \end{aligned}$$

(b) Virat has 200 metres of wire, correct to the nearest metre.  
He cuts the wire into  $n$  pieces of length 3 metres, correct to the nearest 20 centimetres.

Calculate the largest possible value of  $n$ .

$$\begin{aligned} * L &= 200 \text{ m} \pm \frac{1}{2} \text{ m} & * UB(n) &= \frac{UB(L)}{LB(l)} & \Rightarrow UB(n) &= \underline{69} \text{ (nearest whole no.)} \\ * l &= 3 \text{ m} \pm \frac{0.2}{2} \text{ m} & \Rightarrow UB(n) &= \frac{(200 + 0.5) \text{ m}}{(3 - 0.1) \text{ m}} & n &= \dots\dots\dots 69 \dots\dots\dots [3] \end{aligned}$$



NOT TO  
SCALE

The diagram shows a pyramid  $VABCD$  with a rectangular base.  $V$  is vertically above  $M$ , the intersection of the diagonals  $AC$  and  $BD$ .  $AB = 12$  cm,  $BC = 10$  cm and  $VC = 14$  cm.

Calculate the angle that  $VC$  makes with the base  $ABCD$ .

$$\star \cos \alpha = \frac{x}{14 \text{ cm}}$$

$$\bullet x = \frac{1}{2} \times AC$$

$$\Rightarrow x = \left( \frac{1}{2} \times \sqrt{10^2 + 12^2} \right) \text{ cm}$$

$$\Rightarrow x = \frac{\sqrt{244}}{2} \text{ cm}$$

Hence,

$$\Rightarrow \alpha = \cos^{-1} \left( \frac{\frac{\sqrt{244}}{2}}{14} \right)$$

$$\Rightarrow \alpha = \underline{56.1^\circ} \text{ (1 dp)}$$

56.1°

[4]

Question 24 is printed on the next page.

24 A curve has equation  $y = x^3 - 2x^2 + 5$ .

Find the coordinates of its two stationary points.

★ At a stationary point,

$$\frac{dy}{dx} = 0$$

$$\Rightarrow 3x^2 - 4x = 0$$

$$\Rightarrow x(3x - 4) = 0$$

$$\xrightarrow{\text{orange}} \underline{x = 0}$$

$$\xrightarrow{\text{green}} 3x - 4 = 0$$

$$\Rightarrow \underline{\underline{x = \frac{4}{3}}}$$

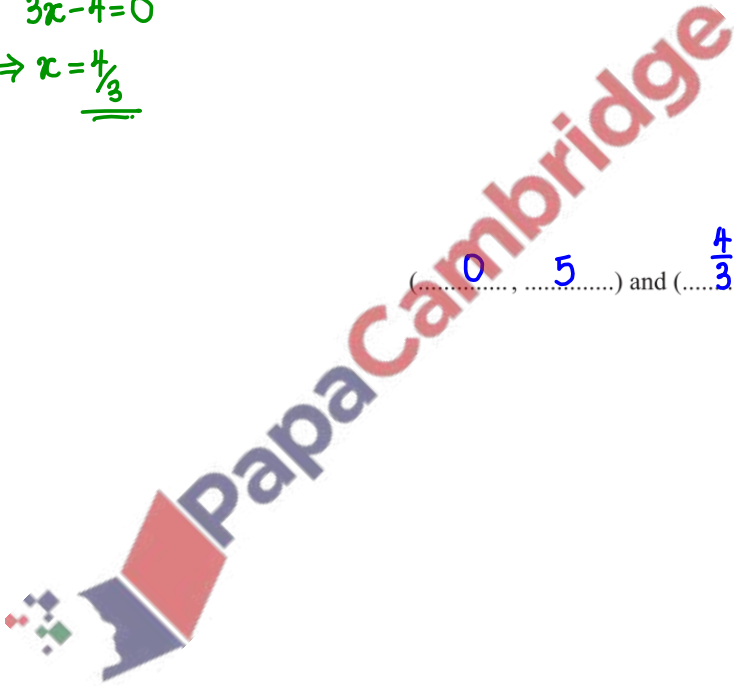
• When  $x = 0$ ,

$$\Rightarrow y = 0^3 - 2(0)^2 + 5 = \underline{\underline{5}}$$

• When  $x = \frac{4}{3}$ ,

$$\Rightarrow y = \left(\frac{4}{3}\right)^3 - 2\left(\frac{4}{3}\right)^2 + 5 = \underline{\underline{\frac{103}{27}}}$$

(.....0....., .....5.....) and (..... $\frac{4}{3}$ ....., ..... $\frac{103}{27}$ .....) [5]



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