

CANDIDATE  
NAME

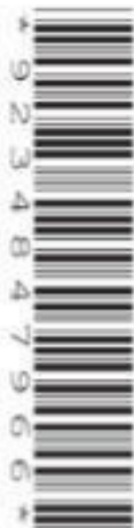
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CENTRE  
NUMBER

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**MATHEMATICS**

**0580/22**

Paper 2 (Extended)

**February/March 2019**

**1 hour 30 minutes**

Candidates answer on the Question Paper.

Additional Materials:      Electronic calculator  
   Tracing paper (optional)

Geometrical instruments

**READ THESE INSTRUCTIONS FIRST**

Write your centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

If working is needed for any question it must be shown below that question.

Electronic calculators should be used.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 70.

This document consists of 11 printed pages and 1 blank page.

- 1 The temperature at 07 00 is  $-3^{\circ}\text{C}$ .  
This temperature is  $11^{\circ}\text{C}$  higher than the temperature at 01 00.

Find the temperature at 01 00.

$$* -3^{\circ}\text{C} = 11^{\circ}\text{C} + T$$

$$\Rightarrow T = -14^{\circ}\text{C} //$$

.....  $-14$  .....  $^{\circ}\text{C}$  [1]

- 2 Jodi swims 22 lengths of a swimming pool to raise money for charity.  
She receives \$15 for each length she swims.

Calculate how much money Jodi raises for charity.

$$* T_{\text{MONEY}} = 22 \times \$15 = \$330 //$$

\$.....  $330$  ..... [1]

- 3 Write the recurring decimal  $0.\dot{2}\dot{3}$  as a fraction.

$$* \text{let } x = 0.\dot{2}\dot{3} \quad \Rightarrow 100x - x = 23.\dot{2}\dot{3} - 0.\dot{2}\dot{3}$$

$$10x = 2.\dot{3}\dot{2}\dot{3} \quad \Rightarrow 99x = 23$$

$$100x = 23.\dot{2}\dot{3} \quad \Rightarrow x = \frac{23}{99} //$$

.....  $\frac{23}{99}$  ..... [1]

- 4 (a) Write  $0.046875$  correct to 2 significant figures.

.....  $0.047$  ..... [1]

- (b) Write 2760000 in standard form.

$$\begin{array}{cccccccc} 6 & 5 & 4 & 3 & 2 & 1 & & \\ \circ & \circ & \circ & \circ & \circ & \circ & & \\ 2 & 7 & 6 & 0 & 0 & 0 & 0 & \\ \circ & \circ & \circ & \circ & \circ & \circ & \circ & \\ 2 & 7 & 6 & \times 10^6 & & & & \\ // & & & & & & & \end{array}$$

.....  $2.76 \times 10^6$  ..... [1]

- 5 A tourist changes \$500 to euros (€) when the exchange rate is  $\text{€}1 = \$1.0697$ .

Calculate how many euros he receives.

$$\text{€}1 = \$1.0697 \quad \Rightarrow x = \frac{\cancel{\$500}}{\cancel{\$1.0697}} \times \text{€}1$$

$$x = \$500$$

$$\Rightarrow x = \text{€}467.42 (2 \text{ dp}) //$$

€.....  $467.42$  ..... [2]



- 6 The probability that a sweet made in a factory is the wrong shape is 0.0028 .  
One day, the factory makes 25 000 sweets.

Calculate the number of sweets that are expected to be the wrong shape.

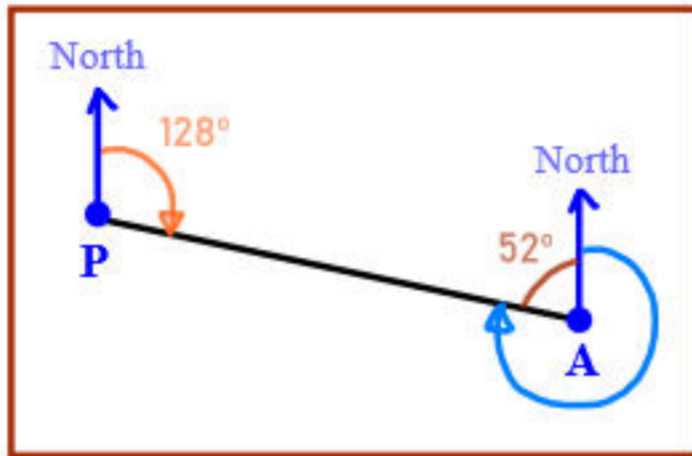
$$* N = 0.0028 \times 25\,000$$

$$\Rightarrow N = 70 //$$

..... 70 ..... [2]

- 7 The bearing of Alexandria from Paris is  $128^\circ$ .

Calculate the bearing of Paris from Alexandria.



$$* \text{Bearing} = 360^\circ - 52^\circ \\ = 308^\circ //$$

..... 308° ..... [2]

- 8  $O$  is the origin,  $\vec{OA} = 2x + 3y$  and  $\vec{BA} = x - 4y$ .

Find the position vector of  $B$ , in terms of  $x$  and  $y$ , in its simplest form.

$$* \vec{OB} = \vec{OA} + \vec{AB}$$

$$\Rightarrow \vec{OB} = \vec{OA} - \vec{BA}$$

$$\Rightarrow \vec{OB} = 2x + 3y - (x - 4y)$$

$$\Rightarrow \vec{OB} = 2x + 3y - x + 4y$$

$$\Rightarrow \vec{OB} = x + 7y //$$

.....  $x + 7y$  ..... [2]

- 9  $y$  is directly proportional to  $(x-4)$ .  
When  $x = 16$ ,  $y = 3$ .

Find  $y$  in terms of  $x$ .

$$* y \propto (x-4)$$

$$\Rightarrow y = k(x-4)$$

Finding  $k$

$$\Rightarrow 3 = k(16-4)$$

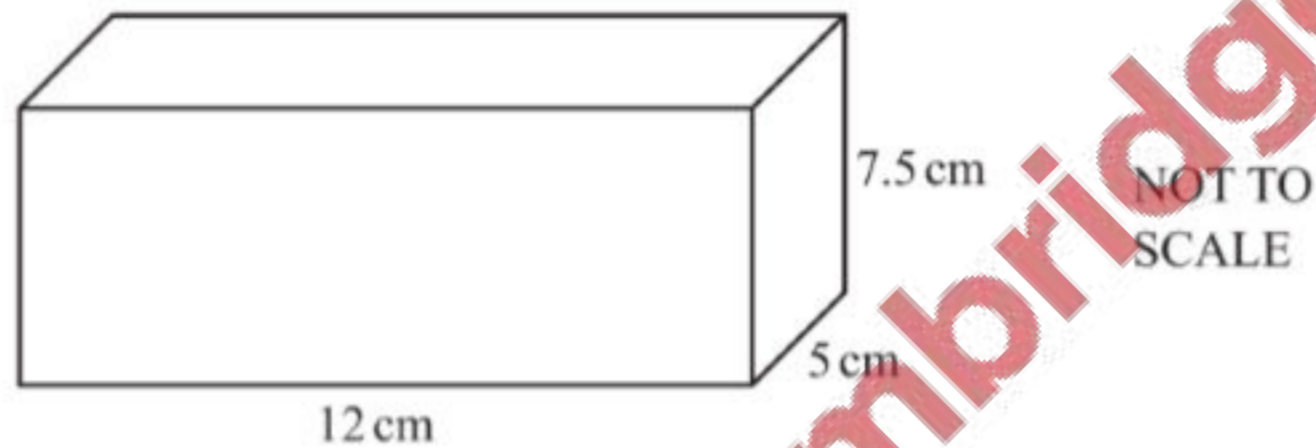
$$\Rightarrow 3 = 12k$$

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

$$\therefore y = \frac{1}{4}(x-4)$$

$$y = \frac{1}{4}(x-4) \quad [2]$$

10



Calculate the total surface area of the cuboid.

$$* A = 2lw + 2lh + 2wh$$

$$\Rightarrow A = (2 \times 12 \times 5) \text{ cm}^2 + (2 \times 12 \times 7.5) \text{ cm}^2 + (2 \times 5 \times 7.5) \text{ cm}^2$$

$$\Rightarrow A = 375 \text{ cm}^2$$

$$\dots\dots\dots 375 \dots\dots\dots \text{cm}^2 \quad [3]$$

- 11 The number of passengers on a train increases from 63 to 77.

Calculate the percentage increase.

$$* \text{Percentage increase} = \frac{77-63}{63} \times 100\%$$

$$= 22.2\% \text{ (3 sig. figs.)}$$

$$\dots\dots\dots 22.2 \dots\dots\dots \% \quad [3]$$



- 12 A cone with height 14.8 cm has volume  $275 \text{ cm}^3$ .

Calculate the radius of the cone.

[The volume,  $V$ , of a cone with radius  $r$  and height  $h$  is  $V = \frac{1}{3}\pi r^2 h$ .]

$$\Rightarrow r = \sqrt{\frac{3V}{h\pi}}$$

$$\Rightarrow r = \left( \sqrt{\frac{3(275)}{14.8\pi}} \right) \text{ cm}$$

$$\Rightarrow r = 4.21 \text{ cm (3 sig. figs.)}$$

$$\dots\dots\dots 4.21 \dots\dots\dots \text{ cm [3]}$$

- 13 Factorise.

(a)  $7k^2 - 15k$

$$\dots\dots\dots k(7k-15) \dots\dots\dots [1]$$

(b)  $12(m+p) + 8(m+p)^2$

$$\Rightarrow 4(m+p)[3+2(m+p)]$$

$$\Rightarrow 4(m+p)(3+2m+2p)$$

$$\dots\dots\dots 4(m+p)(3+2m+2p) \dots\dots\dots [2]$$

- 14 Eric invests an amount in a bank that pays compound interest at a rate of 2.16% per year. At the end of 5 years, the value of his investment is \$6999.31 .

Calculate the amount Eric invests.

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

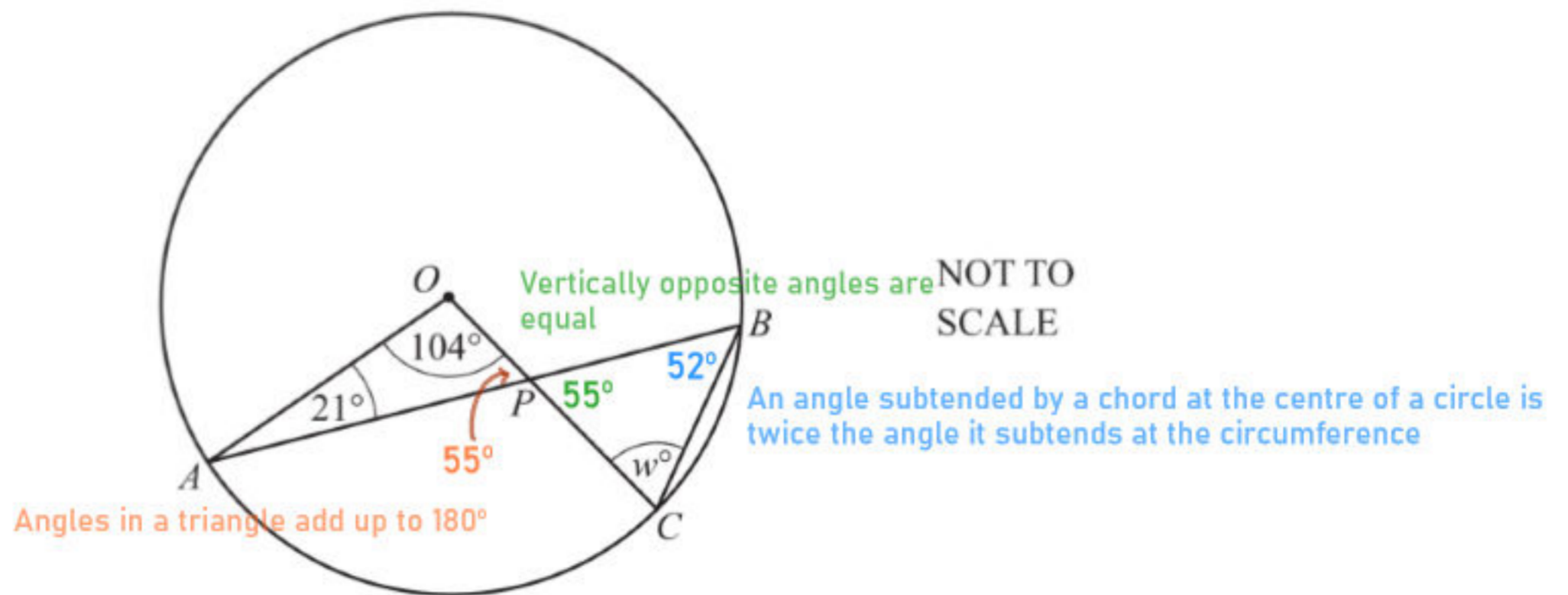
$$\Rightarrow a = \frac{A}{\left(1 + \frac{r}{100}\right)^t}$$

$$\Rightarrow a = \frac{\$6999.31}{\left(1 + \frac{2.16}{100}\right)^5}$$

$$\Rightarrow a = \$6290.00 \text{ (2 dp)}$$

$$\text{\$} \dots\dots\dots 6290.00 \dots\dots\dots [3]$$

15



$A$ ,  $B$  and  $C$  are points on the circle, centre  $O$ .  
 $AB$  and  $OC$  intersect at  $P$ .

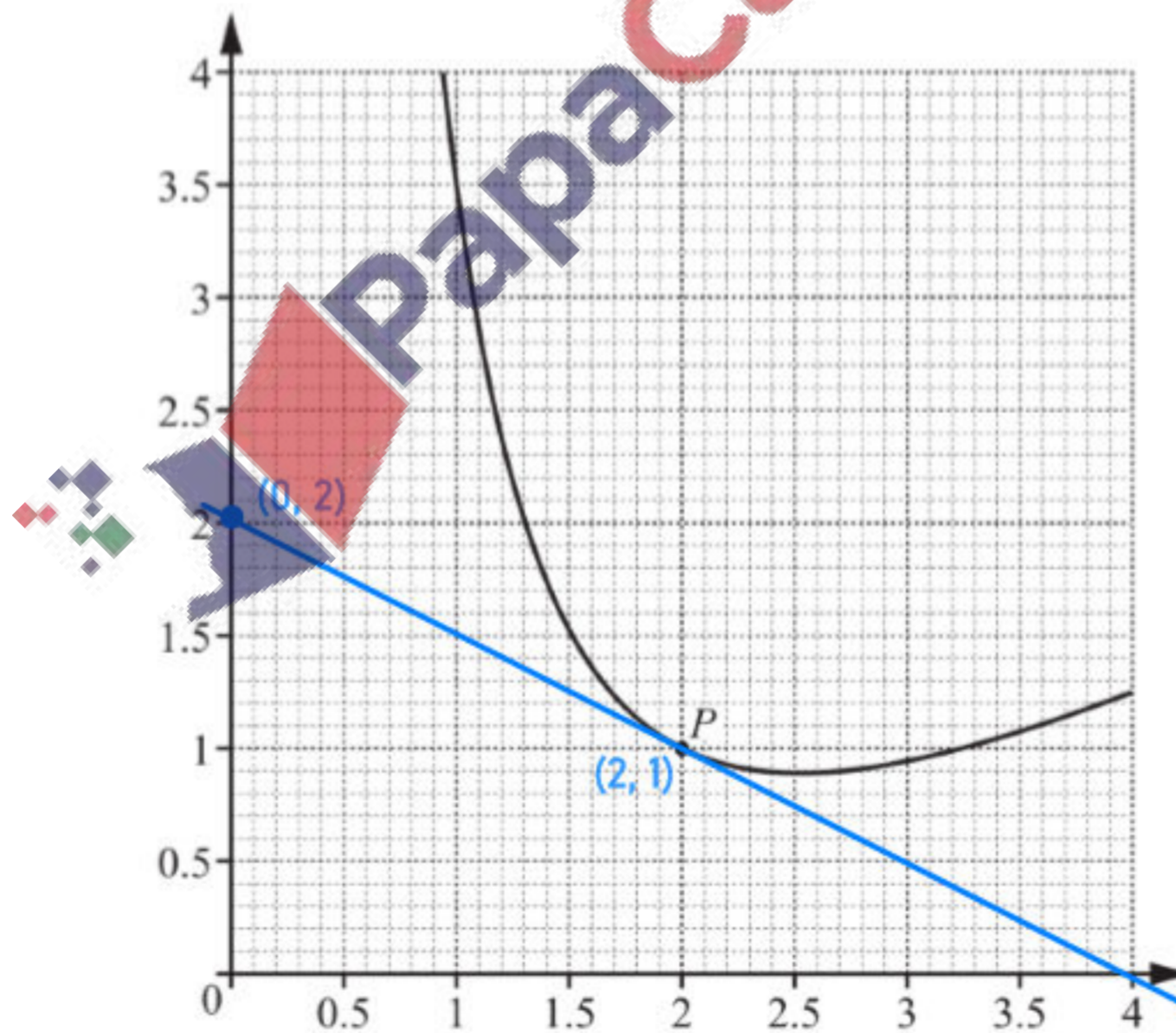
Find the value of  $w$ .

$$\star w + 55^\circ + 52^\circ = 180^\circ$$

$$\Rightarrow w = 73^\circ,$$

$$w = \dots\dots\dots 73^\circ \dots\dots\dots [3]$$

16



By drawing a suitable tangent, estimate the gradient of the curve at the point  $P$ .

$$\star m = \frac{2-1}{0-2} = -0.5,$$

$$\dots\dots\dots -0.5 \dots\dots\dots [3]$$



- 17 (a) Find the value of  $n$  when  $5^n = \frac{1}{125}$ .

$$\Rightarrow 5^n = \frac{1}{5^3}$$

$$\Rightarrow 5^n = 5^{-3}$$

Since the bases are equal,

$$\Rightarrow n = -3$$

$$n = \dots\dots\dots -3 \dots\dots\dots [1]$$

- (b) Simplify  $\left(\frac{64}{m^3}\right)^{-\frac{1}{3}}$ .

$$\Rightarrow \frac{(4^3)^{-\frac{1}{3}}}{(m^3)^{-\frac{1}{3}}}$$

$$\Rightarrow \frac{4^{-1}}{m^{-1}}$$

$$\Rightarrow \frac{m}{4}$$

$$\dots\dots\dots \frac{m}{4} \dots\dots\dots [2]$$

- 18 A pipe is full of water.  
The cross-section of the pipe is a circle, radius 2.6 cm.  
Water flows through the pipe into a tank at a speed of 12 centimetres per second.

Calculate the number of litres that flow into the tank in one hour.

$$* V = \sqrt{\text{RATE}} \times t$$

$$\Rightarrow V = (A_c \times L_{\text{RATE}}) \times t$$

$$\Rightarrow V = (\pi (2.6)^2 \times 12) \frac{\text{cm}^3}{\text{s}} \times 1 \times 3600 \text{ s}$$

$$\Rightarrow V = 292\,032\pi \text{ cm}^3$$

$$\Rightarrow V = \frac{292\,032\pi}{1000}$$

$$\Rightarrow V = 917 \text{ (3 sig. figs.)}$$

$$\dots\dots\dots 917 \dots\dots\dots \text{ litres [3]}$$

- 19 Simplify.

$$\frac{ab - b^2}{a^2 - b^2}$$

$$\Rightarrow \frac{b(a-b)}{(a+b)(a-b)}$$

$$\Rightarrow \frac{b}{a+b}$$

$$\dots\dots\dots \frac{b}{a+b} \dots\dots\dots [3]$$

20 (a) Work out  $\begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix} \begin{pmatrix} 1 & 6 \\ -5 & 4 \end{pmatrix}$ .

$$\Rightarrow \begin{pmatrix} (2 \times 1) + (-1 \times -5) & (2 \times 6) + (-1 \times 4) \\ (4 \times 1) + (3 \times -5) & (4 \times 6) + (3 \times 4) \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} 7 & 8 \\ -11 & 36 \end{pmatrix} //$$

$$\begin{pmatrix} 7 & 8 \\ -11 & 36 \end{pmatrix} [2]$$

(b) Find the value of  $x$  when the determinant of  $\begin{pmatrix} 3 & -1 \\ -7 & x \end{pmatrix}$  is 5.

$$* 3x - (-1 \times -7) = 5$$

$$\Rightarrow 3x - 7 = 5$$

$$\Rightarrow 3x = 12$$

$$\Rightarrow x = 4 //$$

4

$x = \dots\dots\dots 4 \dots\dots\dots [2]$

21 Without using a calculator, work out  $3\frac{1}{8} \div \frac{5}{12}$ .  
You must show all your working and give your answer as a mixed number in its simplest form.

$$\Rightarrow \frac{25}{8} \div \frac{5}{12}$$

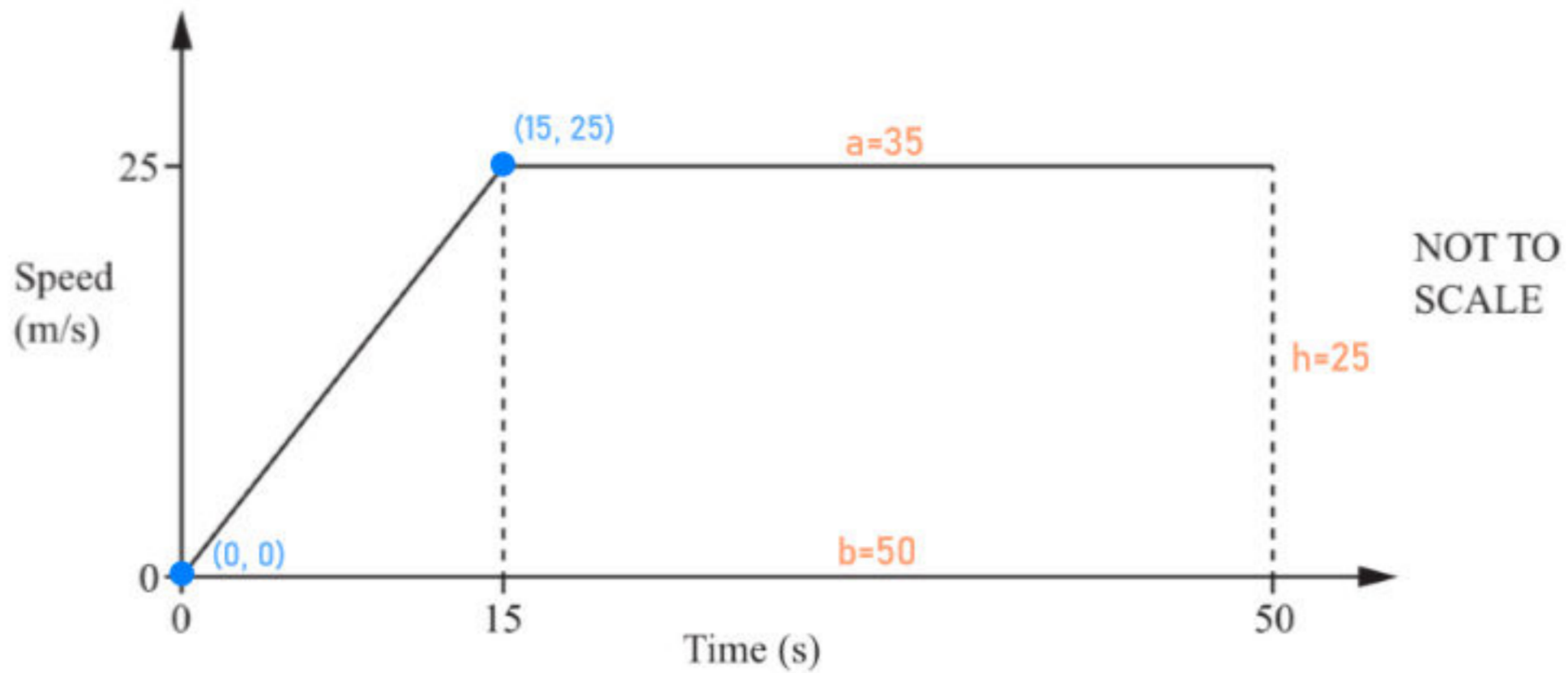
$$\Rightarrow \frac{25}{8} \times \frac{12}{5}$$

$$\Rightarrow \frac{15}{2} = 7\frac{1}{2} //$$

7 1/2

$\dots\dots\dots 7\frac{1}{2} \dots\dots\dots [4]$





The speed–time graph shows the first 50 seconds of a journey.

Calculate

- (a) the acceleration during the first 15 seconds,

$$\star a = \frac{(25 - 0) \text{ m/s}}{(15 - 0) \text{ s}}$$

$$\Rightarrow a = 1.67 \text{ m/s}^2 \text{ (3 sig. figs.)}$$

$$\dots\dots\dots 1.67 \dots\dots\dots \text{m/s}^2 \text{ [1]}$$

- (b) the distance travelled in the 50 seconds.

The distance traveled is the area under the speed-time graph

$$\star D = \frac{1}{2}(a+b) \times h$$

$$\Rightarrow D = \left[ \frac{1}{2}(35 + 50) \times 25 \right] \text{ m}$$

$$\Rightarrow D = 1062.5 \text{ m}$$

$$\dots\dots\dots 1062.5 \dots\dots\dots \text{m [3]}$$

23  $A$  is the point  $(2, 3)$  and  $B$  is the point  $(7, -5)$ .

(a) Find the co-ordinates of the midpoint of  $AB$ .

$$\star M_{AB} \left( \frac{2+7}{2}, \frac{3+(-5)}{2} \right)$$

$$\Rightarrow M_{AB} (4.5, -1)$$

(..... 4.5 ..... -1 .....) [2]

(b) Find the equation of the line through  $A$  that is perpendicular to  $AB$ .  
Give your answer in the form  $y = mx + c$ .

$$\star y = mx + c$$

Finding  $m$

$$\star m_{AB} = \frac{3 - (-5)}{2 - 7} = -\frac{8}{5}$$

$$\bullet mx - \frac{8}{5} = -1$$

$$\Rightarrow m = \frac{5}{8}$$

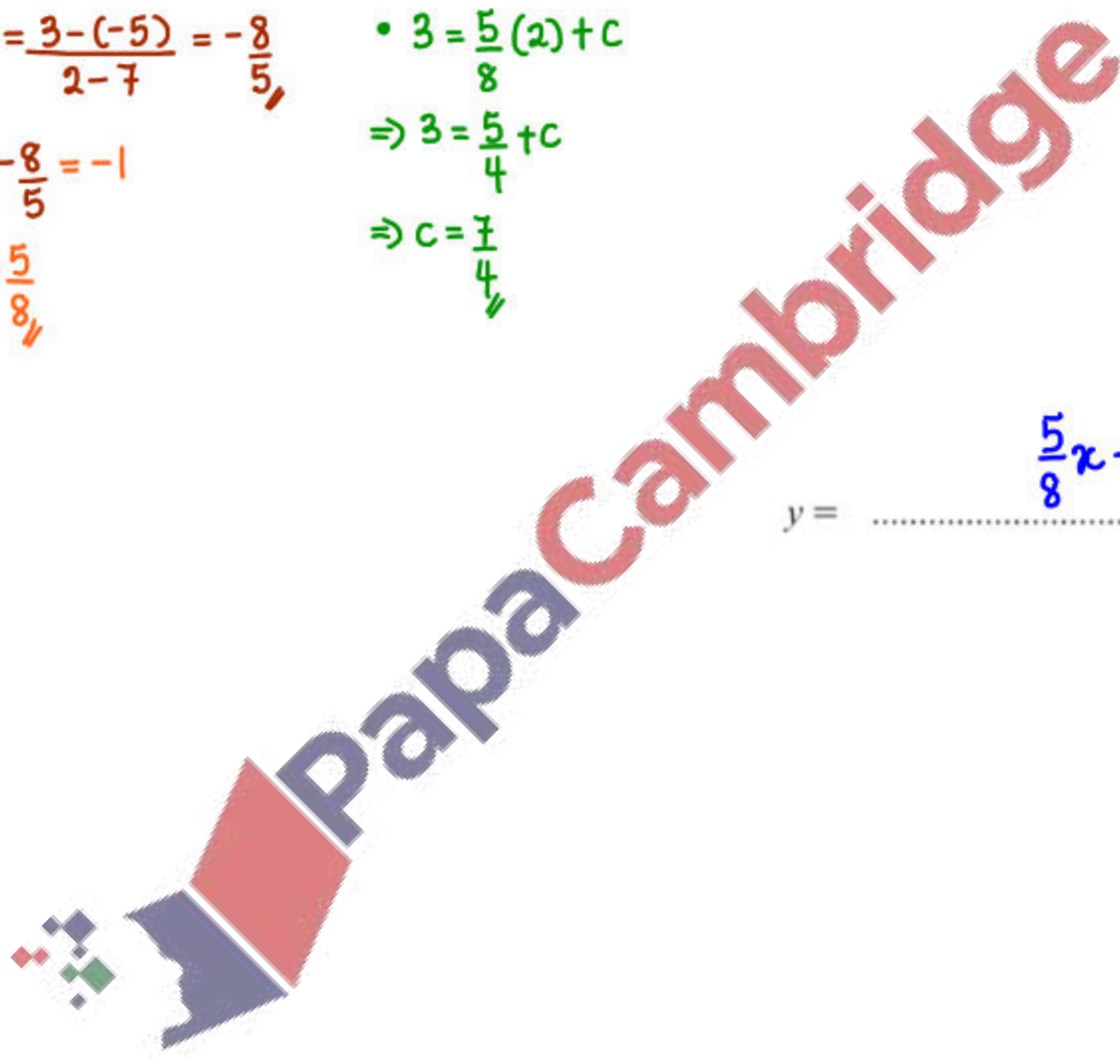
Finding  $c$

$$\bullet 3 = \frac{5}{8}(2) + c$$

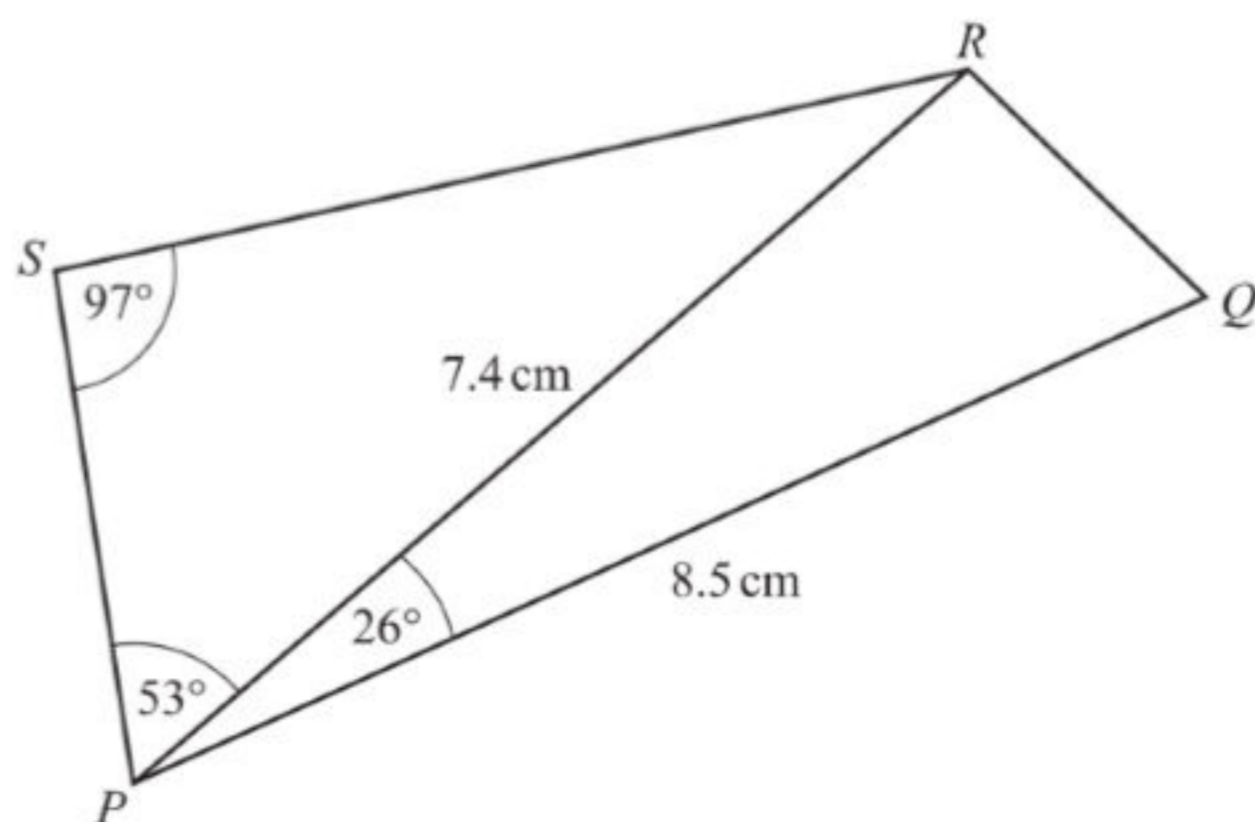
$$\Rightarrow 3 = \frac{5}{4} + c$$

$$\Rightarrow c = \frac{7}{4}$$

$y = \dots\dots\dots \frac{5}{8}x + \frac{7}{4} \dots\dots\dots$  [4]







NOT TO  
SCALE

Calculate

(a)  $SR$ ,

$$\star \frac{SR}{\sin 53^\circ} = \frac{7.4 \text{ cm}}{\sin 97^\circ}$$

$$\Rightarrow SR = \frac{7.4 \text{ cm}}{\sin 97^\circ} \times \sin 53^\circ$$

$$\Rightarrow SR = 5.95 \text{ cm (3 sig. figs.)}$$

$$SR = \dots\dots\dots 5.95 \dots\dots\dots \text{ cm [3]}$$

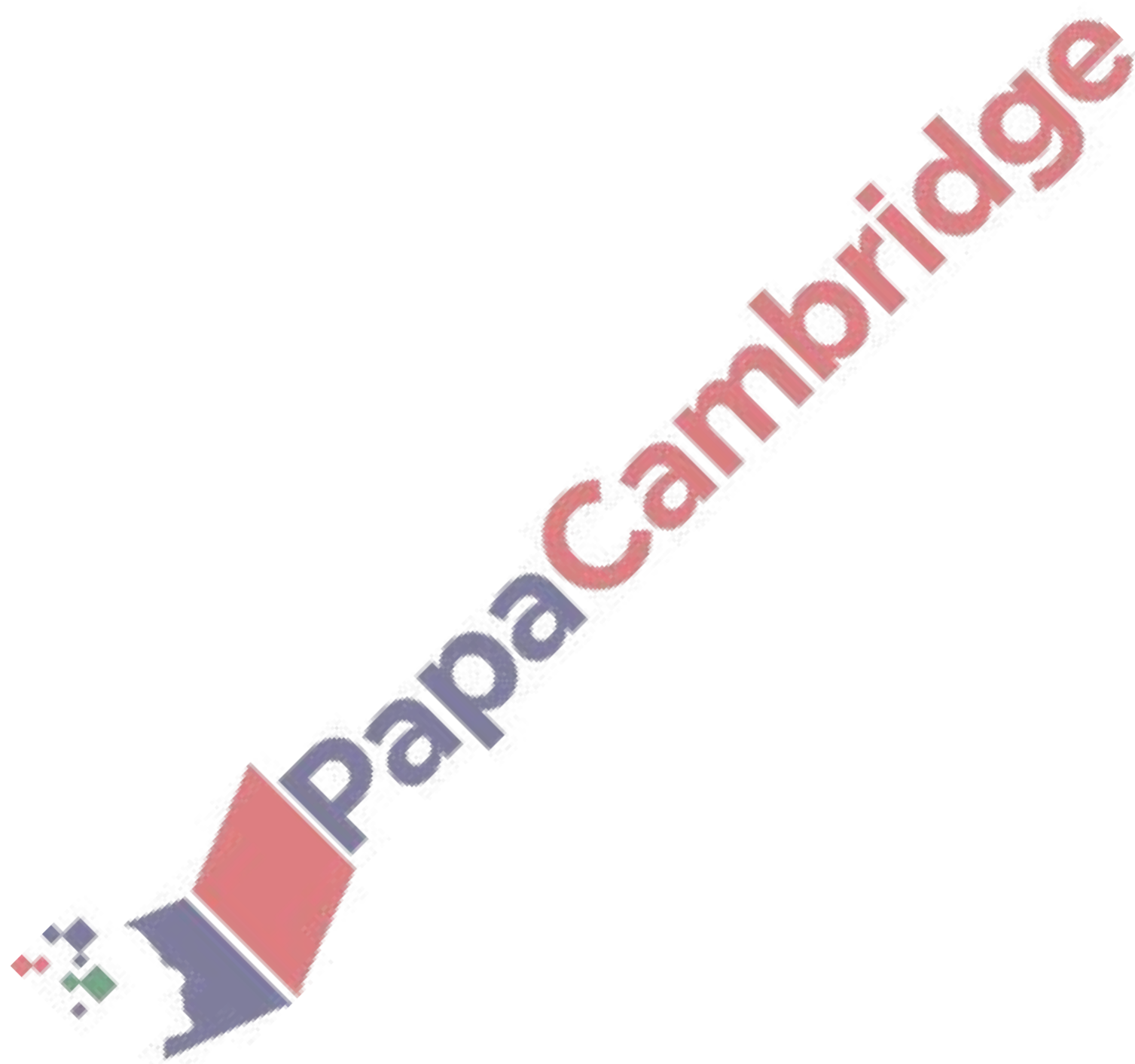
(b)  $RQ$ .

$$\star RQ^2 = PR^2 + PQ^2 - 2(PR)(PQ) \cos \hat{QPR}$$

$$\Rightarrow RQ = (\sqrt{7.4^2 + 8.5^2 - 2(7.4)(8.5) \cos 26^\circ}) \text{ cm}$$

$$\Rightarrow RQ = 3.73 \text{ cm (3 sig. figs.)}$$

$$RQ = \dots\dots\dots 3.73 \dots\dots\dots \text{ cm [4]}$$



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