



1 The price of a ticket for a football match is \$124.

(a) Calculate the amount received when 76 500 tickets are sold.

$$\begin{aligned} \star \text{ Amount received} &= \text{Unit price} \times \text{Qty. sold} \\ \text{"} &= \$124 \times 76\,500 \\ \text{Answer(a) \$} &\dots\dots\dots 9\,486\,000 \quad [1] \\ &= \$9\,486\,000 \end{aligned}$$

(b) Write your answer to **part (a)** in standard form.

$$\begin{aligned} &\overset{6}{9}.\overset{5}{4}\overset{4}{8}\overset{3}{6}\overset{2}{0}\overset{1}{0}\overset{0}{0} \\ &\underline{9.486 \times 10^6} \\ \text{Answer(b) \$} &\dots\dots\dots 9.486 \times 10^6 \quad [1] \end{aligned}$$

2 Gregor changes \$700 into euros (€) when the rate is €1 = \$1.4131.

Calculate the amount he receives.

$$\begin{aligned} \text{€1} &= \$1.4131 \quad \Rightarrow x = \frac{\$700}{\$1.4131} \times \text{€1} \\ x &= \$700 \\ \Rightarrow x &= \text{€} \underline{495.36} \quad \text{Answer €} \dots\dots\dots 495.36 \quad [2] \end{aligned}$$

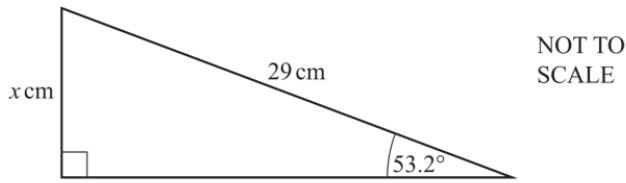
3 Factorise completely.

$$\begin{aligned} &15p^2 + 24pt \\ \Rightarrow &\underline{3p(5p + 8t)} \\ \text{Answer} &\dots\dots\dots 3p(5p + 8t) \quad [2] \end{aligned}$$

4 Write the following in order of size, **smallest** first.

$$\begin{array}{cccc} 0.47 & \frac{8}{17} & \sqrt{0.22} & \tan 25^\circ \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 0.47 & 0.4705\dots & 0.469\dots & 0.466\dots \\ 3 & 4 & 2 & 1 \\ \text{Answer} & \underline{\tan 25^\circ} < \underline{\sqrt{0.22}} < \underline{0.47} < \underline{\frac{8}{17}} & [2] \end{array}$$

5



Calculate the value of  $x$ .

$$\star \sin 53.2^\circ = \frac{x}{29 \text{ cm}} \quad \Rightarrow x = \underline{23.2 \text{ cm}} \text{ (3 sig. figs.)}$$

$$\Rightarrow x = (29 \sin 53.2^\circ) \text{ cm}$$

Answer  $x =$  ..... 23.2 ..... [2]

6 Leon scores the following marks in 5 tests.

8 4 8  $y$  9

His mean mark is 7.2.

Calculate the value of  $y$ .

$$\star \bar{x} = \frac{\sum f(x)}{\sum f} \quad \Rightarrow \underline{y = 7}$$

$$\Rightarrow 7.2 = \frac{8 + 4 + 8 + y + 9}{5}$$

$$\Rightarrow 36 = 29 + y$$

Answer  $y =$  ..... 7 ..... [2]

7 The sides of a rectangle are 6.3 cm and 4.8 cm, each correct to 1 decimal place.

Calculate the upper bound for the area of the rectangle.

$$\star l = (6.3 \pm \frac{0.1}{2}) \text{ cm} \quad \Rightarrow \text{UB}(A_{\text{rec}}) = \text{UB}(l) \times \text{UB}(w)$$

$$\Rightarrow \text{UB}(A_{\text{rec}}) = (6.35 \times 4.85) \text{ cm}^2$$

$$\star w = (4.8 \pm \frac{0.1}{2}) \text{ cm} \quad \Rightarrow \text{UB}(A_{\text{rec}}) = \underline{30.7975 \text{ cm}^2}$$

Answer ..... 30.7975 .....  $\text{cm}^2$  [2]

8 Find  $r$  when  $(5)^{\frac{r}{3}} = 125$ .

$$\star 5^{\frac{r}{3}} = 5^3$$

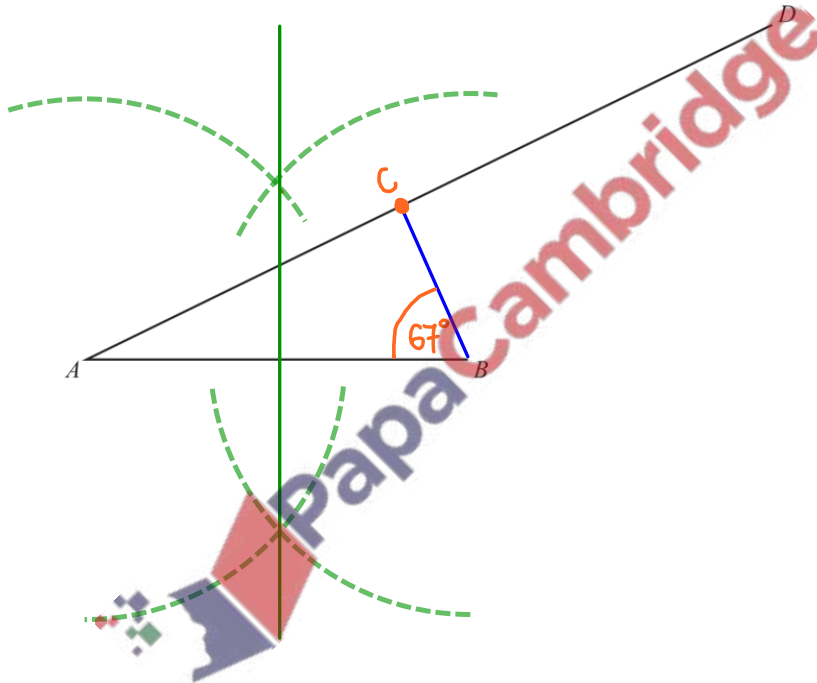
Since the bases are equal,

$$\Rightarrow \frac{r}{3} = 3$$

$$\Rightarrow \underline{r = 9}$$

Answer  $r =$  ..... 9 ..... [2]

9



(a) The point  $C$  lies on  $AD$  and angle  $ABC = 67^\circ$ .

Draw accurately the line  $BC$ .

[1]

(b) Using a straight edge and compasses only, construct the perpendicular bisector of  $AB$ . Show clearly all your construction arcs.

[2]

- 10 Shania invests \$750 at a rate of  $2\frac{1}{2}\%$  per year simple interest.

Calculate the **total** amount Shania has after 5 years.

$$\star \text{ Total amount} = \text{Principal} + \text{SI (5 years)}$$

$$\Rightarrow \text{Total amount} = \$750 + 5 \left( \frac{2.5}{100} \times \$750 \right)$$

$$\Rightarrow \text{Total amount} = \underline{\underline{\$843.75}}$$

Answer \$ 843.75 [3]

- 11 Solve the simultaneous equations.

$$3x + 5y = 24 \quad \text{--- (1)}$$

$$x + 7y = 56 \quad \text{--- (2)}$$

$$(2) \times 3 : 3x + 21y = 168 \quad \text{--- (3)}$$

$$(3) - (1) : (21 - 5)y = 168 - 24$$

$$\Rightarrow 16y = 144$$

$$\Rightarrow \underline{\underline{y = 9}}$$

• Finding  $x$ :

$$x + 7(9) = 56$$

$$\Rightarrow \underline{\underline{x = -7}}$$

Answer  $x = \underline{\underline{-7}}$   
 $y = \underline{\underline{9}}$  [3]

- 12 Without using your calculator, work out  $1\frac{5}{6} + \frac{9}{10}$ .

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

$$\star \left| \frac{5}{6} + \frac{9}{10} \right.$$

$$\Rightarrow \frac{11}{6} + \frac{9}{10}$$

$$\Rightarrow \frac{55 + 27}{30}$$

$$\Rightarrow \frac{82}{30} \stackrel{41}{15} = \underline{\underline{2\frac{11}{15}}}$$

Answer  $\underline{\underline{2\frac{11}{15}}}$  [3]

- 13  $y$  is **inversely** proportional to  $x^2$ .  
When  $x = 4$ ,  $y = 3$ .

$$\Rightarrow y = \frac{48}{x^2}$$

Find  $y$  when  $x = 5$ .

$$\star y \propto \frac{1}{x^2}$$

• Finding  $k$ :

$$\Rightarrow 3 = \frac{k}{4^2}$$

$$\Rightarrow y = \frac{48}{5^2}$$

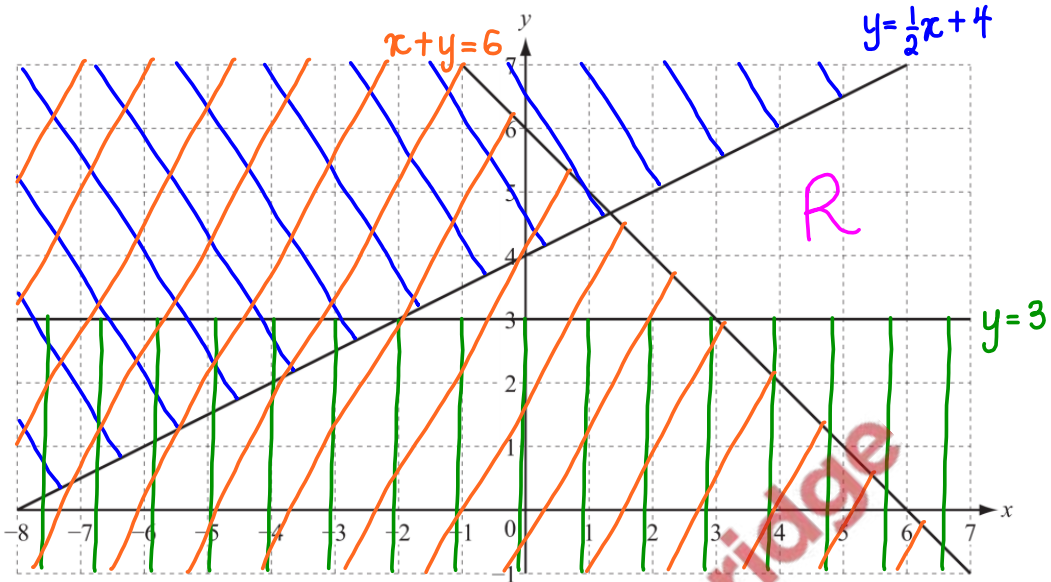
$$\Rightarrow y = \frac{k}{x^2}$$

$$\Rightarrow \underline{\underline{k = 48}}$$

$$\Rightarrow y = \underline{\underline{1.92}}$$

Answer  $y = \underline{\underline{1.92}}$  [3]

14

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The region  $R$  contains points which satisfy the inequalities

$$y \leq \frac{1}{2}x + 4, \quad y \geq 3 \quad \text{and} \quad x + y \geq 6.$$

On the grid, label with the letter  $R$  the region which satisfies these inequalities.

You must shade the **unwanted** regions.

[3]

15 The scale of a map is 1 : 500 000.

- (a) The actual distance between two towns is 172 km.  
Calculate the distance, in centimetres, between the towns on the map.

$$1 : 500\,000 \Rightarrow x = \frac{1}{500\,000} \times 172 \text{ km}$$

$$x : 172 \text{ km} \Rightarrow x = \frac{1}{500\,000} \times 172 \times 10^5 \text{ cm}$$

$$\Rightarrow x = \underline{34.4 \text{ cm}}$$

Answer(a) ..... 34.4 ..... cm [2]

- (b) The area of a lake on the map is  $12 \text{ cm}^2$ .

$$(1)^2 : (500\,000)^2 \Rightarrow x = \frac{(500\,000)^2}{(1)^2} \times 12 \text{ cm}^2$$

$$12 \text{ cm}^2 : x \Rightarrow x = \frac{(500\,000)^2}{(1)^2} \times 12 \times 10^{-10} \text{ km}^2$$

$$\Rightarrow x = \underline{300 \text{ km}^2}$$

Answer(b) ..... 300 .....  $\text{km}^2$  [2]

16

$$\mathbf{M} = \begin{pmatrix} 5 & 2 \\ -3 & 4 \end{pmatrix} \quad \mathbf{N} = \begin{pmatrix} -1 & -2 \\ 2 & 6 \end{pmatrix}$$

Calculate

(a)  $\mathbf{MN}$ ,

$$\star \mathbf{MN} = \begin{pmatrix} (5 \times -1) + (2 \times 2) & (5 \times -2) + (2 \times 6) \\ (-3 \times -1) + (4 \times 2) & (-3 \times -2) + (4 \times 6) \end{pmatrix}$$

$$\Rightarrow \mathbf{MN} = \begin{pmatrix} -1 & 2 \\ 11 & 30 \end{pmatrix}$$

$$\text{Answer(a) } \mathbf{MN} = \begin{pmatrix} -1 & 2 \\ 11 & 30 \end{pmatrix}$$

[2]

(b)  $\mathbf{M}^{-1}$ , the inverse of  $\mathbf{M}$ .

$$\star \mathbf{M}^{-1} = \frac{1}{(5 \times 4) - (-3 \times 2)} \begin{pmatrix} 4 & -2 \\ 3 & 5 \end{pmatrix}$$

$$\Rightarrow \mathbf{M}^{-1} = \frac{1}{26} \begin{pmatrix} 4 & -2 \\ 3 & 5 \end{pmatrix} \text{ OR } \begin{pmatrix} \frac{2}{13} & -\frac{1}{13} \\ \frac{3}{26} & \frac{5}{26} \end{pmatrix}$$

$$\text{Answer(b) } \mathbf{M}^{-1} = \frac{1}{26} \begin{pmatrix} 4 & -2 \\ 3 & 5 \end{pmatrix}$$

[2]

17 Make  $w$  the subject of the formula.

$$c = \frac{4 + w}{w + 3}$$

$$\Rightarrow c(w + 3) = 4 + w$$

$$\Rightarrow cw + 3c = 4 + w$$

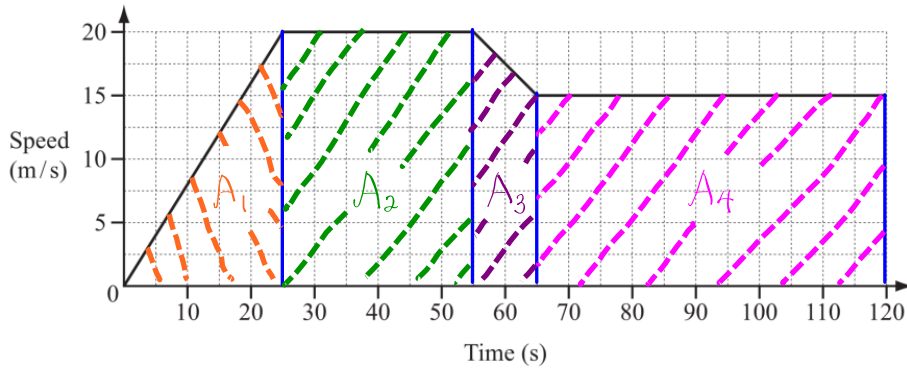
$$\Rightarrow cw - w = 4 - 3c$$

$$\Rightarrow w(c - 1) = 4 - 3c$$

$$\Rightarrow w = \frac{4 - 3c}{c - 1}$$

$$\text{Answer } w = \frac{4 - 3c}{c - 1} \quad [4]$$





The diagram shows the speed-time graph for the first 120 seconds of a car journey.

- (a) Calculate the acceleration of the car during the first 25 seconds.

$$\star a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t_2 - t_1}$$

$$\Rightarrow a = \frac{(20 - 0) \text{ m/s}}{(25 - 0) \text{ s}} = \underline{0.8 \text{ m/s}^2}$$

Answer(a) 0.8 m/s<sup>2</sup> [1]

- (b) Calculate the distance travelled by the car in the first 120 seconds.

$\star$  Total Distance (D) = Area under the graph

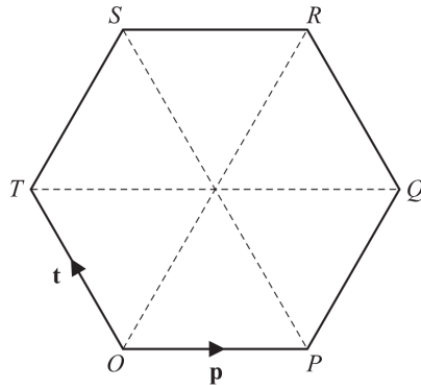
$$\Rightarrow D = A_1 + A_2 + A_3 + A_4$$

$$\Rightarrow D = \left(\frac{1}{2} \times b \times h\right) + (l \times b) + \left(\frac{1}{2}(a+b) \times h\right) + (l \times b)$$

$$\Rightarrow D = \left(\frac{1}{2} \times 25 \times 20\right) \text{ m} + (30 \times 20) \text{ m} + \left(\frac{1}{2}(15+20) \times 10\right) \text{ m} + (55 \times 15) \text{ m}$$

$$\Rightarrow D = \underline{1850 \text{ m}}$$

Answer(b) 1850 m [4]



$O$  is the origin and  $OPQRST$  is a regular hexagon.

$\vec{OP} = \mathbf{p}$  and  $\vec{OT} = \mathbf{t}$ .

Find, in terms of  $\mathbf{p}$  and  $\mathbf{t}$ , in their simplest forms,

(a)  $\vec{PT}$ ,

$$\star \vec{PT} = \vec{PO} + \vec{OT}$$

$$\Rightarrow \vec{PT} = \underline{\underline{-\mathbf{p} + \mathbf{t}}}$$

Answer(a)  $\vec{PT} = \dots\dots\dots -\mathbf{p} + \mathbf{t} \dots\dots\dots$  [1]

(b)  $\vec{PR}$ ,

$$\star \vec{PR} = \vec{PS} + \vec{SR}$$

$$\Rightarrow \vec{PR} = \underline{\underline{2\mathbf{t} + \mathbf{p}}}$$

Answer(b)  $\vec{PR} = \dots\dots\dots 2\mathbf{t} + \mathbf{p} \dots\dots\dots$  [2]

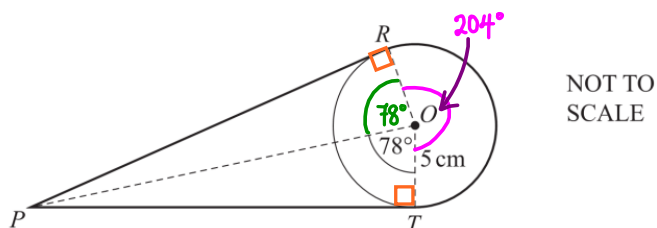
(c) the position vector of  $R$ .

$$\star \vec{OR} = \vec{OT} + \vec{TQ} + \vec{QR}$$

$$\Rightarrow \vec{OR} = \mathbf{t} + 2\mathbf{p} + \mathbf{t}$$

$$\Rightarrow \vec{OR} = \underline{\underline{2\mathbf{t} + 2\mathbf{p}}}$$

Answer(c)  $\dots\dots\dots 2\mathbf{t} + 2\mathbf{p} \dots\dots\dots$  [2]



$R$  and  $T$  are points on a circle, centre  $O$ , with radius 5 cm.  
 $PR$  and  $PT$  are tangents to the circle and angle  $POT = 78^\circ$ .

A thin rope goes from  $P$  to  $R$ , around the major arc  $RT$  and then from  $T$  to  $P$ .

Calculate the length of the rope.

$$\star L_{\text{rope}} = PR + \text{Major arc } RT + PT$$

$$\bullet PR = PT$$

$$\Rightarrow L_{\text{rope}} = 2PT + \text{Major arc } RT$$

$$\Rightarrow L_{\text{rope}} = 2(5 \tan 78^\circ) \text{ cm} + \left( \frac{204^\circ}{360^\circ} \times 2\pi(5 \text{ cm}) \right)$$

$$\Rightarrow L_{\text{rope}} = 10 \tan 78^\circ \text{ cm} + \frac{17\pi}{3} \text{ cm}$$

$$\Rightarrow L_{\text{rope}} = \underline{64.8 \text{ cm}} \text{ (3 sig. fig.)}$$

Answer ..... 64.8 ..... cm [6]

Question 21 is printed on the next page.

**21 In this question, give all your answers as fractions.**

A box contains 3 red pencils, 2 blue pencils and 4 green pencils.  
Raj chooses 2 pencils at random, without replacement.

Calculate the probability that

- (a) they are both red,

$$\star P = P_{\text{RED}} \text{ and } P_{\text{RED}}$$

$$\Rightarrow P = \frac{3}{9} \times \frac{2}{8}$$

$$\Rightarrow P = \frac{1}{12}$$

Answer(a) .....  $\frac{1}{12}$  ..... [2]

- (b) they are both the same colour,

$$\star P = (P_{\text{RED}} \text{ and } P_{\text{RED}}) \text{ or } (P_{\text{BLUE}} \text{ and } P_{\text{BLUE}}) \text{ or } (P_{\text{GREEN}} \text{ and } P_{\text{GREEN}})$$

$$\Rightarrow P = \left(\frac{3}{9} \times \frac{2}{8}\right) + \left(\frac{2}{9} \times \frac{1}{8}\right) + \left(\frac{4}{9} \times \frac{3}{8}\right)$$

$$\Rightarrow P = \frac{5}{18}$$

Answer(b) .....  $\frac{5}{18}$  ..... [3]

- (c) exactly one of the two pencils is green.

$$\star P = (P_{\text{GREEN}} \text{ and } P_{\text{BLUE}}) \text{ or } (P_{\text{BLUE}} \text{ and } P_{\text{GREEN}}) \text{ or } (P_{\text{GREEN}} \text{ and } P_{\text{RED}}) \text{ or } (P_{\text{RED}} \text{ and } P_{\text{GREEN}})$$

$$\Rightarrow P = \left(\frac{4}{9} \times \frac{2}{8}\right) + \left(\frac{2}{9} \times \frac{4}{8}\right) + \left(\frac{4}{9} \times \frac{3}{8}\right) + \left(\frac{3}{9} \times \frac{4}{8}\right)$$

$$\Rightarrow P = \frac{5}{9}$$

Answer(c) .....  $\frac{5}{9}$  ..... [3]

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