

Total marks — 40  
Attempt ALL questions

1. Evaluate  $3\frac{2}{3} - 1\frac{1}{4}$ .

$$\begin{aligned} & 2\frac{2}{3} - \frac{1}{4} \\ &= 2\frac{8}{12} - \frac{3}{12} \\ &= \underline{2\frac{5}{12}} \end{aligned}$$

2

2. Given that  $f(x) = (x+3)^2$ , evaluate  $f(7)$ .

$$\begin{aligned} f(7) &= (7+3)^2 \\ &= 10^2 \\ &= 100 \end{aligned}$$

2

[Turn over



3. Expand and simplify  $(x+1)(x^2-4x+5)$ .

$$\begin{array}{r}
 x^2 \quad -4x \quad +5 \\
 x \begin{array}{|c|c|c|} \hline x^2 & -4x^2 & +5x \\ \hline \end{array} \\
 +1 \begin{array}{|c|c|c|} \hline +x^2 & -4x & +5 \\ \hline \end{array}
 \end{array}$$

$$\underline{x^3 - 3x^2 + x + 5}$$

4. Given  $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix}$  and  $\mathbf{b} = \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix}$ , find the resultant vector  $3\mathbf{a} + \mathbf{b}$ .

Express your answer in component form.

$$\begin{aligned}
 3\mathbf{a} + \mathbf{b} &= \begin{pmatrix} 9 \\ 12 \\ -3 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix} \\
 &= \begin{pmatrix} 14 \\ 15 \\ -1 \end{pmatrix}
 \end{aligned}$$



5. The prices, in pounds (£), of the cameras on display in a shop are listed below.

155     $\overset{Q_1}{\textcircled{160}}$     190     $\overset{Q_2}{\uparrow}$     210     $\overset{Q_3}{\textcircled{230}}$     240

(a) Calculate the median and the interquartile range of these prices.

3

$$\text{Median} = 200$$

$$\begin{aligned} \text{IQR} &= 230 - 160 \\ &= 70 \end{aligned}$$

On a website, a sample of camera prices have a median of £195 and an interquartile range of £73.

(b) Make two valid comments comparing the prices of the cameras in the shop and on the website.

2

On average, website is cheaper ( $\pounds 195 < \pounds 200$ )  
 website prices are less consistent ( $\pounds 73 > \pounds 70$ )

[Turn over



6. Simplify  $\sqrt{75} - \sqrt{3}$ .

$$\begin{aligned} & \sqrt{25} \sqrt{3} - \sqrt{3} \\ & = 5\sqrt{3} - \sqrt{3} \\ & = \underline{4\sqrt{3}} \end{aligned}$$

7. Solve, algebraically, the system of equations

$$\begin{aligned} 2p - 7r &= 11 & \textcircled{1} \\ 3p + 2r &= 4 & \textcircled{2} \end{aligned}$$

3

$$\begin{array}{r} \textcircled{1} \times 2 \quad 4p - 14r = 22 \quad \textcircled{3} \\ \textcircled{2} \times 7 \quad 21p + 14r = 28 \quad \textcircled{4} \\ \hline \end{array}$$

ADD  $25p = 50$

$p = 2$

sub 2 for p in  $\textcircled{2}$

$$6 + 2r = 4$$

$$2r = -2$$

$$\underline{\underline{r = -1}}$$

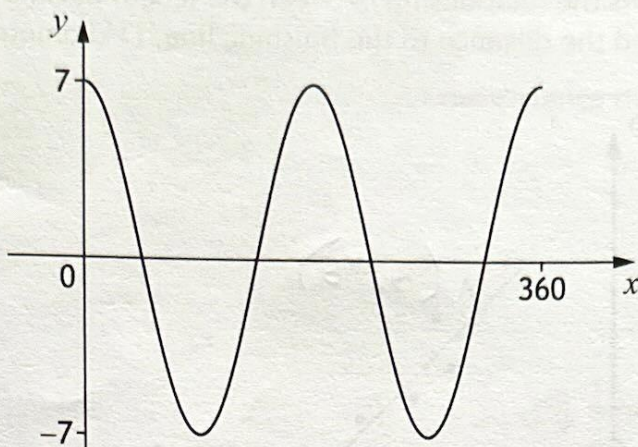
$p = 2, r = -1$

check in  $\textcircled{1}$

$$\begin{aligned} & 2p - 7r \\ & = 2(2) - 7(-1) \\ & = 4 + 7 \\ & = 11 \quad \checkmark \end{aligned}$$



8. The graph of  $y = a \cos bx^\circ$ ,  $0 \leq x \leq 360$ , is shown.



(a) State the value of  $a$ .

$a = 7$

1

(b) State the value of  $b$ .

$b = 2$

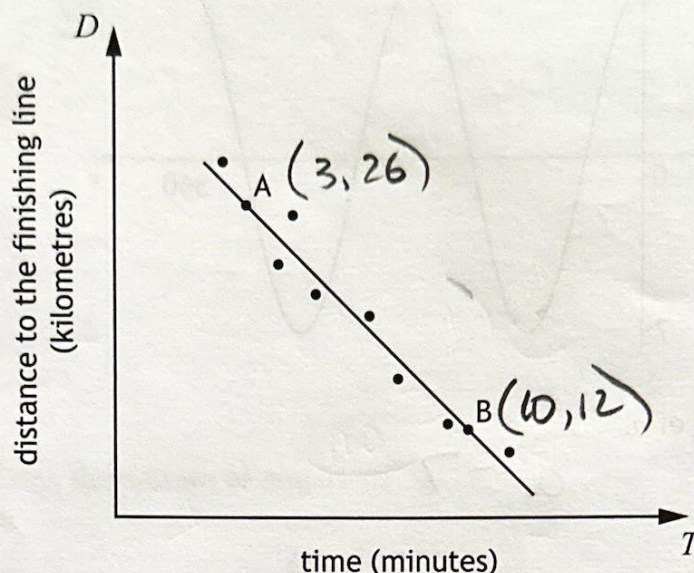
1

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9. In a car rally, competitors start at different times.

The scattergraph shows the relationship between the length of time they have been driving,  $T$  minutes, and the distance to the finishing line,  $D$  kilometres.



A line of best fit has been drawn.

Point A represents a competitor who has been driving for 3 minutes and is 26 kilometres from the finishing line.

Point B represents a competitor who has been driving for 10 minutes and is 12 kilometres from the finishing line.

(a) Find the equation of the line of best fit in terms of  $D$  and  $T$ .

Give the equation in its simplest form.

3

$$m = \frac{26 - 12}{3 - 10}$$

$$= \frac{14}{-7}$$

$$= -2$$

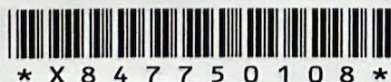
$$y - b = m(x - a)$$

$$y - 12 = -2(x - 10)$$

$$y - 12 = -2x + 20$$

$$y = -2x + 32$$

$$\therefore \underline{D = -2T + 32}$$



9. (continued)

Another competitor has been driving for 7 minutes.

- (b) Use your equation from part (a) to estimate the distance the competitor is from the finishing line.

1

$$\begin{aligned}
 D &= -2(7) + 32 \\
 &= -14 + 32 \\
 &= 18
 \end{aligned}$$

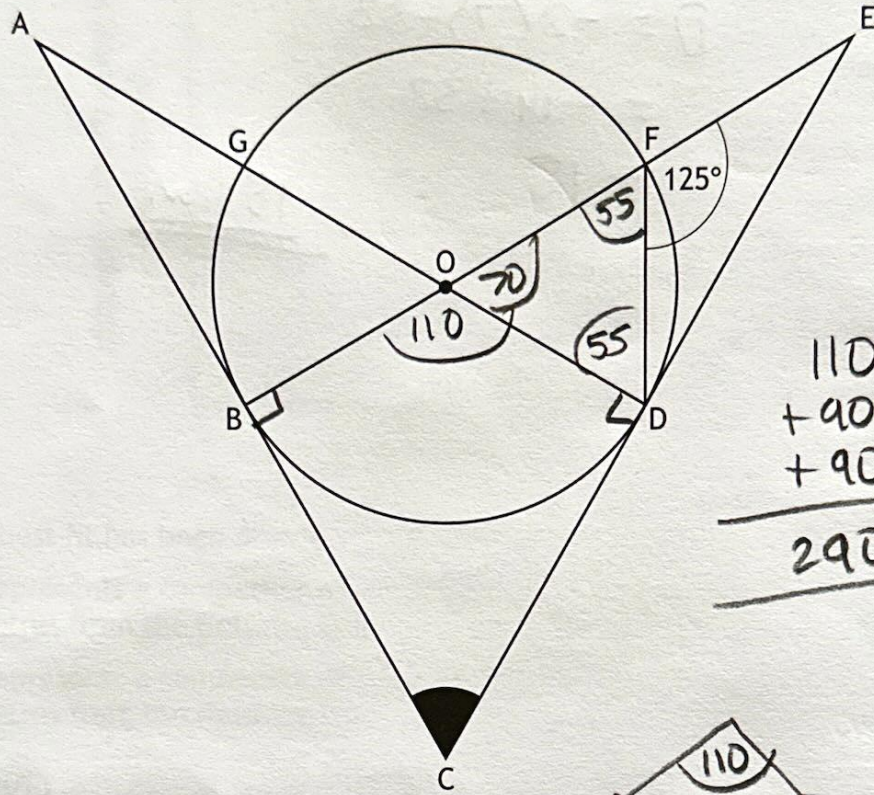
18 km

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\* X 8 4 7 7 5 0 1 0 9 \*

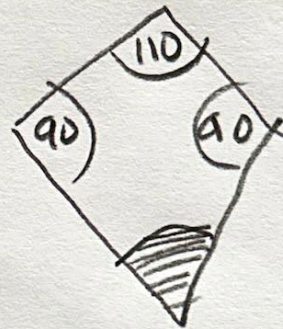
10. The diagram below shows a circle centre O.
- AC is a tangent to the circle at the point B.
  - CE is a tangent to the circle at the point D.
  - DG and BF are diameters of the circle.
  - Angle DFE is  $125^\circ$ .



$$\begin{array}{r}
 110 \\
 + 90 \\
 + 90 \\
 \hline
 290
 \end{array}
 \qquad
 \begin{array}{r}
 360 \\
 - 290 \\
 \hline
 70
 \end{array}$$

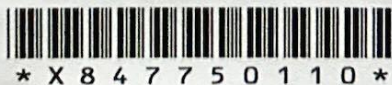
Calculate the size of shaded angle BCD.

70°



(kite angles add to  $360^\circ$ )

3





11. A straight line has equation  $x + 4y - 24 = 0$ .  
Find the gradient of this line.

$$4y = -x + 24$$

$$y = -\frac{1}{4}x + 6$$

$$\underline{\underline{m = -\frac{1}{4}}}$$

[Turn over



\* X 8 4 7 7 5 0 1 1 1 \*

12. (a) Express  $x^2 - 6x + 8$  in the form  $(x - a)^2 + b$ .

$$\begin{aligned} & (x - 3)^2 + 8 - 9 \\ & = (x - 3)^2 - 1 \end{aligned}$$

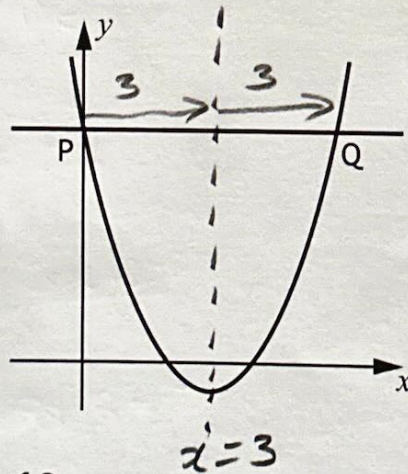
(b) Hence, or otherwise, state the coordinates of the turning point of the graph of  $y = x^2 - 6x + 8$ .

$$(3, -1)$$

The diagram shows the graph of  $y = x^2 - 6x + 8$ .

A line PQ has been drawn parallel to the x-axis, where:

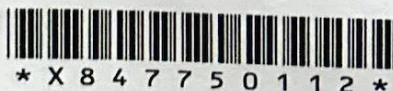
- P lies on the y-axis
- P and Q lie on the graph of  $y = x^2 - 6x + 8$ .



(c) Find the coordinates of Q.

$$\begin{aligned} & y = x^2 - 6x + 8 \\ & \text{y-axis } x = 0 \\ & \therefore y = 8 \\ & P = (0, 8) \end{aligned}$$

$$\begin{aligned} & \text{TP @ } (3, -1) \\ & \therefore \text{axis of symmetry } x = 3 \\ & \therefore P \rightarrow Q = 6 \text{ units} \\ & \therefore Q = (6, 8) \end{aligned}$$



13. Expand and simplify fully  $x\left(x^{\frac{1}{2}} + x^{-1}\right)$ .

2

$$\begin{aligned}
 & x(x^{\frac{1}{2}} + x^{-1}) \\
 &= x^{\frac{3}{2}} + x^0 \\
 &= \underline{x^{\frac{3}{2}} + 1}
 \end{aligned}$$

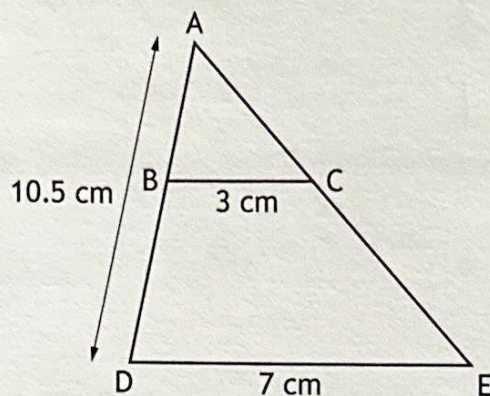
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\* X 8 4 7 7 5 0 1 1 3 \*

14. In the diagram, triangles ABC and ADE are mathematically similar.

- BC = 3 centimetres
- DE = 7 centimetres
- AD = 10.5 centimetres



Calculate the length of BD.

3

$$\frac{AB}{AD} = \frac{BC}{DE}$$

$$\therefore \frac{AB}{10.5} = \frac{3}{7}$$

$$AB = \frac{3 \times 10.5}{7}$$

$$AB = 31.5 \div 7$$

$$AB = 4.5 \text{ cm}$$

$$BD = 10.5 - 4.5$$

$$= \underline{\underline{6 \text{ cm}}}$$

[END OF QUESTION PAPER]

