

# Cambridge IGCSE™

CANDIDATE NAME



CENTRE NUMBER

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## MATHEMATICS

0580/21

Paper 2 Non-calculator (Extended)

May/June 2025

2 hours



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.
- Calculators must **not** be used in this paper.
- You may use tracing paper.
- You must show all necessary working clearly.

### INFORMATION

- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.



Calculators must **not** be used in this paper.

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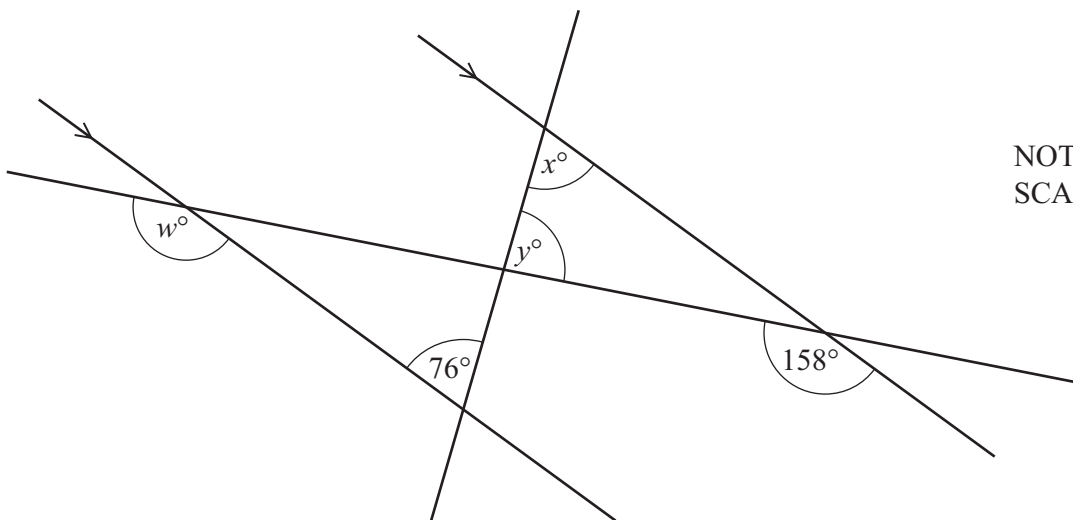
1 Simplify.



$7c - 5d + c + 3d$

$8c - 2d$  [2]

2



The diagram shows two parallel lines intersecting two straight lines.

Find the values of  $w$ ,  $x$  and  $y$ .

$w = 158^\circ$

$x = 76^\circ$

$y = 82^\circ$

[4]



- 3 Sally invests \$1500 at 3% per year simple interest.

**R**

Work out the total value of her investment at the end of 6 years.

$$\text{Interest after 6 years: } 1500 \times 3\% \times 6 = 270$$

$$\text{Total value after 6 years: } 1500 + 270 = 1770$$

\$ ..... 1770 ..... [3]

- 4 Work out.

**R**

$$\frac{5}{6} - \frac{2}{3} \times \frac{3}{8}$$

$$\frac{5}{6} - \frac{2}{8} = \frac{20}{24} - \frac{6}{24} = \frac{14}{24} = \frac{7}{12}$$

.....  $\frac{7}{12}$  ..... [3]

- 5 The interior angle of a regular polygon is  $150^\circ$ .

**R**

Find the number of sides of this polygon.

$$\frac{(n-2)180^\circ}{n} = 150^\circ$$

$$180^\circ n - 360^\circ = 150^\circ n$$

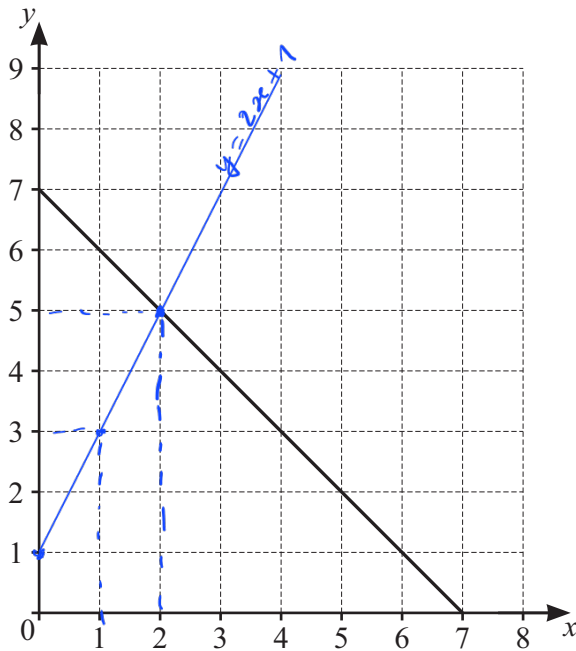
$$30^\circ n = 360^\circ$$

$$n = 12$$

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



6



The line  $x + y = 7$  is drawn on the grid.

(a) On the grid, draw the line  $y = 2x + 1$ .

[2]

(b) Use your graph to solve these simultaneous equations.

$$\begin{aligned} x + y &= 7 \\ y &= 2x + 1 \end{aligned}$$

$x = \dots\dots\dots 2 \dots\dots\dots$

$y = \dots\dots\dots 5 \dots\dots\dots$

[1]

7 Write the recurring decimal  $0.2\bar{6}$  as a fraction.

Give your answer in its simplest form.



$$\begin{aligned} x &= 0.2666\dots \\ 10x &= 2.666\dots \\ 100x &= 26.666\dots \\ 90x &= 26 - 2 = 24 \\ x &= \frac{24}{90} = \frac{4}{15} \end{aligned}$$

$\dots\dots\dots \frac{4}{15} \dots\dots\dots$  [3]



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8



$$\mathbf{m} = \begin{pmatrix} 11 \\ 5 \end{pmatrix} \quad \mathbf{n} = \begin{pmatrix} 8 \\ -3 \end{pmatrix}$$

(a) Find  $2\mathbf{m} - \mathbf{n}$ .

$$2 \begin{pmatrix} 11 \\ 5 \end{pmatrix} - \begin{pmatrix} 8 \\ -3 \end{pmatrix} = \begin{pmatrix} 22 \\ 10 \end{pmatrix} - \begin{pmatrix} 8 \\ -3 \end{pmatrix} = \begin{pmatrix} 14 \\ 13 \end{pmatrix}$$

$$\begin{pmatrix} 14 \\ 13 \end{pmatrix}$$

[2]

(b) The vector  $\begin{pmatrix} 5 \\ \sqrt{y} \end{pmatrix}$  has a magnitude of 7.Find the value of  $y$ .

$$\begin{aligned} \sqrt{5^2 + (\sqrt{y})^2} &= 7 \\ 25 + y &= 49 \\ y &= 24 \end{aligned}$$

$$y = \dots 24 \dots [2]$$

9 The table shows some information about the marks scored by a group of students in a test.



Test mark	4	5	8
Frequency	2	4	$n$

The mean mark is 6.

Work out the value of  $n$ .

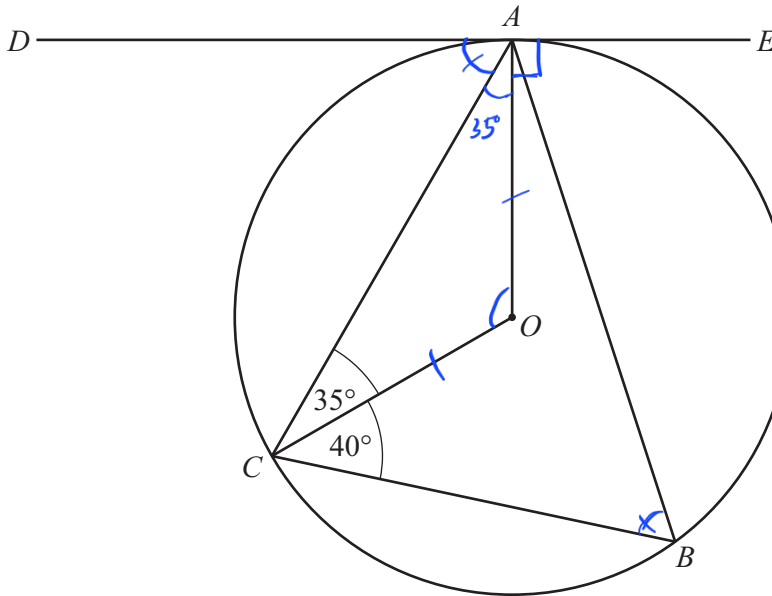
$$\begin{aligned} \frac{4 \times 2 + 5 \times 4 + 8n}{2 + 4 + n} &= 6 \\ 28 + 8n &= 36 + 6n \\ 2n &= 8 \\ n &= 4 \end{aligned}$$

$$n = \dots 4 \dots [3]$$





10



NOT TO SCALE

$A, B$  and  $C$  are three points on a circle, centre  $O$ .  
 $DE$  is a tangent to the circle at  $A$ .  
 Angle  $ACO = 35^\circ$  and angle  $BCO = 40^\circ$ .

Find

(a) angle  $AOC$

$$\widehat{AOC} = 180^\circ - 35^\circ \times 2 = 110^\circ$$

Angle  $AOC = \dots\dots\dots 110^\circ \dots\dots\dots [1]$

(b) angle  $ABC$

$$\widehat{ABC} = \frac{1}{2} \widehat{AOC} = \frac{1}{2} \times 110^\circ = 55^\circ$$

Angle  $ABC = \dots\dots\dots 55^\circ \dots\dots\dots [1]$

(c) angle  $DAC$

$$\widehat{DAC} = \widehat{ABC} = 55^\circ$$

Angle  $DAC = \dots\dots\dots 55^\circ \dots\dots\dots [1]$

(d) angle  $OAB$ .

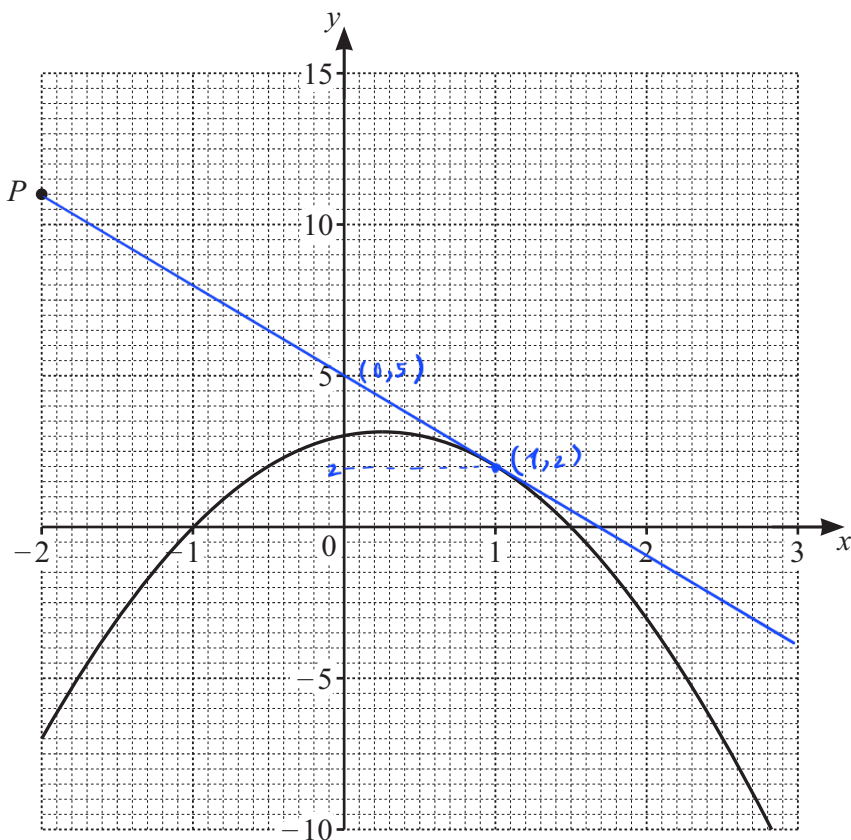
$$\begin{aligned} \widehat{EAB} &= \widehat{ACB} = 35^\circ + 40^\circ = 75^\circ \\ \widehat{OAB} &= \widehat{OAE} - \widehat{ACB} = 90^\circ - 75^\circ = 15^\circ \end{aligned}$$

Angle  $OAB = \dots\dots\dots 15^\circ \dots\dots\dots [1]$



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11 The diagram shows the graph of  $y = f(x)$  and the point  $P(-2, 11)$ .



The tangent from  $P$  touches the graph of  $y = f(x)$  at the point  $(a, b)$ .  
The values of  $a$  and  $b$  are integers.

(a) By drawing this tangent, find the value of  $a$  and the value of  $b$ .

$a = \dots\dots\dots 1 \dots\dots\dots, b = \dots\dots\dots 2 \dots\dots\dots$  [2]

(b) Find the equation of the tangent.  
Give your answer in the form  $y = mx + c$ .

$$m = \frac{2 - 5}{1 - 0} = -3$$

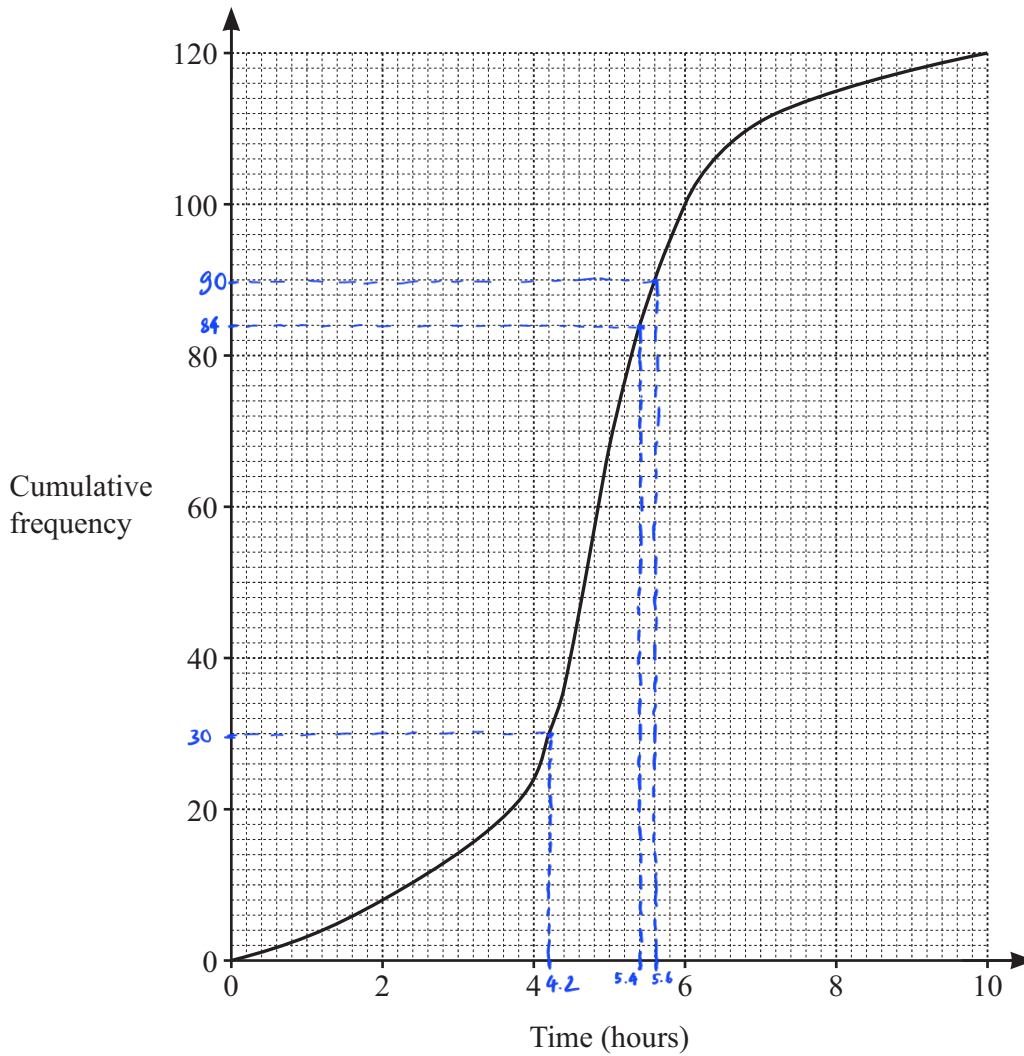
$$y = -3x + 5$$

$y = \dots\dots\dots -3x + 5 \dots\dots\dots$  [3]





- 12 The time spent on the internet by each of 120 adults is recorded for one day.  
 The cumulative frequency diagram shows this information.



- (a) Use the cumulative frequency diagram to find an estimate of the interquartile range.

$$Q_3 = 5.6, Q_1 = 4.2$$

$$5.6 - 4.2 = 1.4$$

..... 1.4 ..... h [2]

- (b) 70% of the adults spent less than  $k$  hours on the internet.

Use the cumulative frequency diagram to find an estimate of the value of  $k$ .

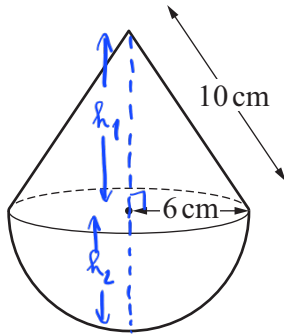
$k =$  ..... 5.4 ..... [2]



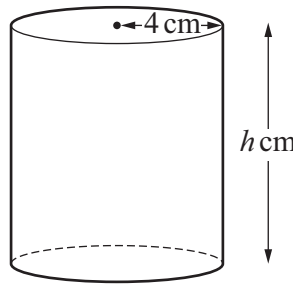
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13



Solid A



Solid B

NOT TO SCALE

The diagram shows solid A and solid B.  
 Solid A is made from a hemisphere and a cone each with radius 6 cm.  
 The cone has sloping edge 10 cm.  
 Solid B is a cylinder with radius 4 cm and height  $h$  cm.

The **total** surface area of solid A is equal to the **total** surface area of solid B.

(a) Work out the value of  $h$ .

$$\begin{aligned} \pi \times 6 \times 10 + \frac{4\pi 6^2}{2} &= 2\pi 4^2 + 2\pi \times 4h \\ 60\pi + 72\pi &= 32\pi + 8\pi h \\ 132 &= 32 + 8h \\ 8h &= 100 \\ h &= 100 : 8 = 12.5 \end{aligned}$$

$h = \dots\dots\dots 12.5 \dots\dots\dots$  [5]

(b) Work out the height of solid A.

$$\begin{aligned} &h_1 + h_2 \\ &= \sqrt{10^2 - 6^2} + 6 \\ &= \sqrt{64} + 6 \\ &= 14 \end{aligned}$$

$\dots\dots\dots 14 \dots\dots\dots$  cm [3]





14

f(x) = 3x - 4

g(x) = 4x + 1

R

(a) Find f(-2).

3(-2) - 4 = -10

..... -10 ..... [1]

(b) Find f<sup>-1</sup>(x).

y = 3x - 4

y + 4 = 3x

$\frac{y+4}{3} = x$

f<sup>-1</sup>(x) = .....  $\frac{x+4}{3}$  ..... [2]

(c) fg(x) = ax + b

Find the value of a, and the value of b.

3(4x + 1) - 4  
= 12x + 3 - 4  
= 12x - 1

a = ..... 12 ..... b = ..... -1 ..... [2]

(d) Simplify.

$\frac{2}{f(x)} - \frac{5}{g(x)}$

Give your answer as a single fraction in terms of x.

$\frac{2}{3x-4} - \frac{5}{4x+1}$   
 $\frac{2(4x+1) - 5(3x-4)}{(3x-4)(4x+1)}$   
 $\frac{8x+2 - 15x+20}{(3x-4)(4x+1)}$

.....  $\frac{-7x+22}{(3x-4)(4x+1)}$  ..... [3]



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15 (a) Expand and simplify.

$\mathcal{R}$

$$(2 - \sqrt{5})(1 - 3\sqrt{5})$$

$$2 - \sqrt{5} - 6\sqrt{5} + 15$$

$$17 - 7\sqrt{5}$$

$$\dots\dots\dots 17 - 7\sqrt{5} \dots\dots\dots [2]$$

(b) Rationalise the denominator.  
Give your answer in its simplest form.

$$\frac{6}{\sqrt{10}} = \frac{6\sqrt{10}}{\sqrt{10} \times \sqrt{10}} = \frac{6\sqrt{10}}{10} = \frac{3\sqrt{10}}{5}$$

$$\dots\dots\dots \frac{3\sqrt{10}}{5} \dots\dots\dots [2]$$

16 Expand and simplify.

$\mathcal{R}$

$$(x+4)(x-3)(3x+2)$$

$$(x^2 + 4x - 3x - 12)(3x+2)$$

$$(x^2 + x - 12)(3x+2)$$

$$3x^3 + 3x^2 - 36x + 2x^2 + 2x - 24$$

$$3x^3 + 5x^2 - 34x - 24$$

$$\dots\dots\dots 3x^3 + 5x^2 - 34x - 24 \dots\dots\dots [3]$$





- 17 (a) A bag contains 6 red marbles, 3 green marbles and 1 blue marble.  
 Two marbles are picked at random from the bag **with replacement**.

R

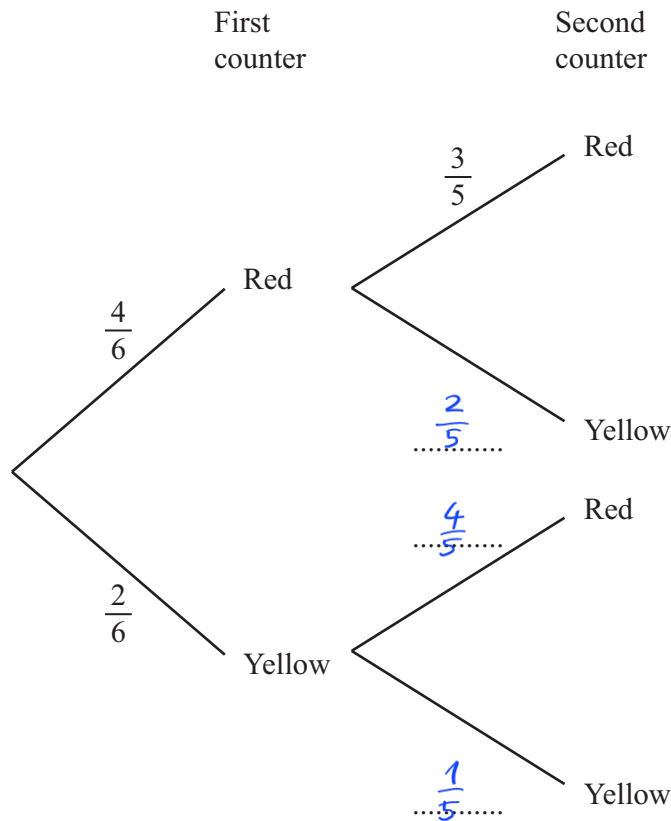
Find the probability that both marbles are green.

$$\frac{3}{10} \times \frac{3}{10} = \frac{9}{100}$$

.....  $\frac{9}{100}$  ..... [2]

- (b) Another bag contains 4 red counters and 2 yellow counters.  
 Two counters are picked at random from this bag **without replacement**.

(i) Complete the tree diagram.



[2]

(ii) Find the probability that one of the two counters is yellow.

$$P(R \cap Y) + P(Y \cap R)$$

$$= \frac{4}{6} \times \frac{2}{5} + \frac{2}{6} \times \frac{4}{5} = \frac{16}{30}$$

.....  $\frac{16}{30}$  ..... [3]



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- 18 One day, Anya runs 12 km at a speed of  $x$  km/h.  
 (R) The next day she walks 10 km at a speed of  $(x-4)$  km/h.

(a) Write down an expression, in terms of  $x$ , for the time she spends running.

$$\dots\dots\dots \frac{12}{x} \dots\dots\dots \text{ h [1]}$$

(b) Write down an expression, in terms of  $x$ , for the time she spends walking.

$$\dots\dots\dots \frac{10}{x-4} \dots\dots\dots \text{ h [1]}$$

(c) The time Anya spends walking is 1 hour more than the time she spends running.

Write an equation in terms of  $x$  and show that it simplifies to  $x^2 - 2x - 48 = 0$ .

$$\begin{aligned} \frac{10}{x-4} - \frac{12}{x} &= 1 \\ \frac{10x - 12(x-4)}{(x-4)x} &= 1 \\ 10x - 12x + 48 &= x^2 - 4x \\ x^2 - 2x - 48 &= 0 \end{aligned}$$

[4]

(d) Use factorisation to solve the equation  $x^2 - 2x - 48 = 0$ .

$$\begin{aligned} (x+6)(x-8) &= 0 \\ x+6 &= 0 \quad \text{or} \quad x-8 = 0 \\ x &= -6 \quad \text{or} \quad x = 8 \end{aligned}$$

$$x = \dots\dots\dots -6 \dots\dots\dots \text{ or } x = \dots\dots\dots 8 \dots\dots\dots \text{ [3]}$$

(e) Find the time Anya spends running.

$$\frac{12}{8} = 1.5$$

$$\dots\dots\dots 1.5 \dots\dots\dots \text{ h [1]}$$





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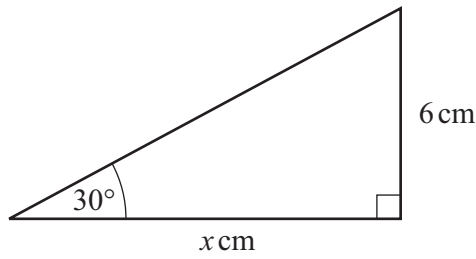
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19 Find the value of  $27^{-\frac{2}{3}}$ .

$$\textcircled{R} \quad \frac{1}{27^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{27})^2} = \frac{1}{3^2} = \frac{1}{9}$$

20

$\textcircled{R}$



$$\dots\dots\dots \frac{1}{9} \dots\dots\dots [2]$$

NOT TO SCALE

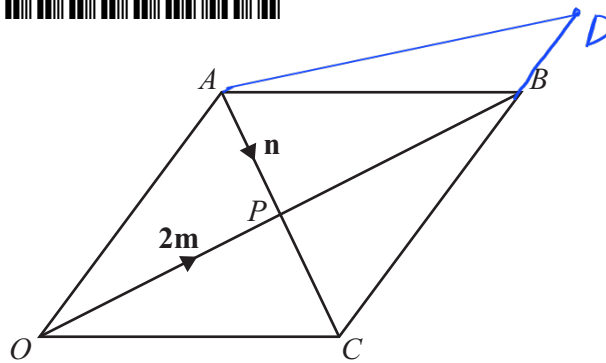
Find the exact value of  $x$ .

$$\tan 30^\circ = \frac{6}{x}$$

$$x = 6 \tan 30^\circ = 6\sqrt{3}$$

$$x = \dots\dots\dots 6\sqrt{3} \dots\dots\dots [4]$$





NOT TO  
SCALE

$OABC$  is a rhombus and  $O$  is the origin.  
The diagonals of the rhombus intersect at  $P$ .  
 $\overrightarrow{OP} = 2\mathbf{m}$  and  $\overrightarrow{AP} = \mathbf{n}$ .

(a) Find, in terms of  $\mathbf{m}$  and  $\mathbf{n}$ , in its simplest form

(i)  $\overrightarrow{OA}$   

$$\overrightarrow{OA} = \overrightarrow{OP} + \overrightarrow{PA} = 2\mathbf{m} - \mathbf{n}$$

$$\overrightarrow{OA} = \dots\dots\dots 2\mathbf{m} - \mathbf{n} \dots\dots\dots [1]$$

(ii)  $\overrightarrow{OC}$   

$$\overrightarrow{OC} = \overrightarrow{OP} + \overrightarrow{PC} = 2\mathbf{m} + \mathbf{n}$$

$$\overrightarrow{OC} = \dots\dots\dots 2\mathbf{m} + \mathbf{n} \dots\dots\dots [1]$$

(b)  $D$  is the point such that  $\overrightarrow{AD} = 10\mathbf{m} - 3\mathbf{n}$ .

Show that  $OADC$  is a trapezium.

$$\begin{aligned} \overrightarrow{CD} &= \overrightarrow{CA} + \overrightarrow{AD} \\ &= -2\mathbf{n} + 10\mathbf{m} - 3\mathbf{n} \\ &= 10\mathbf{m} - 5\mathbf{n} \\ \Rightarrow \overrightarrow{CD} &= 5\overrightarrow{OA} \\ \Rightarrow CD &\parallel OA \\ \Rightarrow OADC &\text{ is a trapezium} \end{aligned}$$

[3]



22 A curve has equation  $y = x^n + qx^2 + 9x$ .

$$\frac{dy}{dx} = 3x^2 - 12x + 9$$

(a) Find the value of  $n$ , and the value of  $q$ .

$$\begin{aligned} \frac{dy}{dx} &= nx^{n-1} + 2qx + 9 \\ &= 3x^2 - 12x + 9 \end{aligned}$$

$$n = \dots 3 \dots \quad q = \dots -6 \dots \quad [2]$$

(b) Work out the coordinates of the turning points of the curve.

$$\begin{aligned} \frac{dy}{dx} &= 3x^2 - 12x + 9 = 0 \\ &3(x-1)(x-3) = 0 \\ x-1 &= 0 \quad \text{or} \quad x-3 = 0 \\ x &= 1 \quad \text{or} \quad x = 3 \\ y &= 4 \quad \text{or} \quad y = 0 \end{aligned}$$

$$(\dots 1 \dots, \dots 4 \dots) \text{ and } (\dots 3 \dots, \dots 0 \dots) \quad [4]$$

23 Simplify.

$$\frac{2x^2 + 10x}{x^2 - 25}$$

$$\frac{2x(x+5)}{(x-5)(x+5)} = \frac{2x}{x-5}$$

$$\frac{2x}{x-5} \quad [3]$$

