Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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MATHEMATICS **0580/22**

Paper 2 (Extended) **February/March 2022**

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

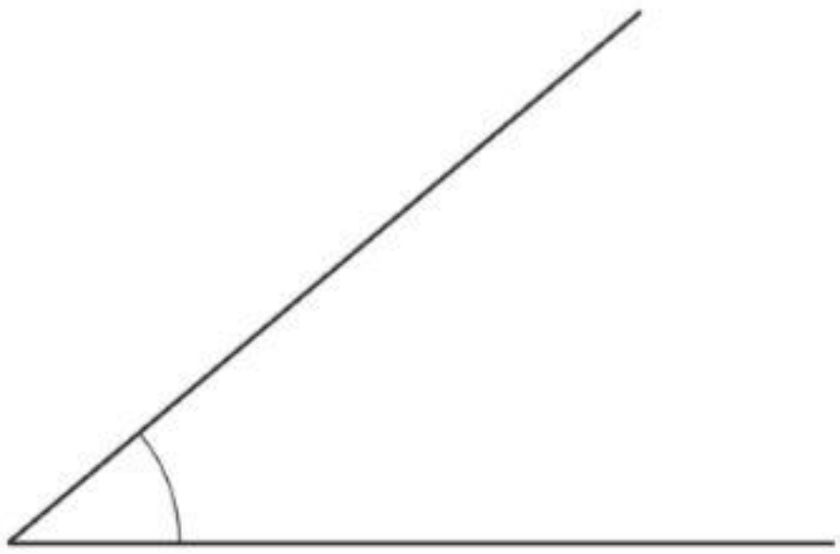
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction 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 π, 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. Any blank pages are indicated.

1



Measure the marked angle.

40° ..... [1]

2 Work out $\sqrt{5} \times 6^2$.
Give your answer correct to 2 decimal places.

80.50 ..... [2]

3 A journey starts at 21 15 one day and ends at 04 33 the next day.

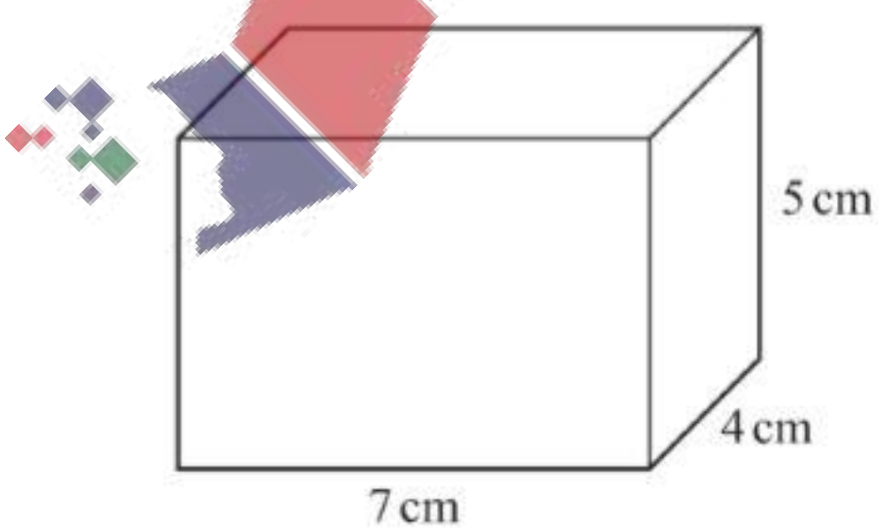
Calculate the time taken, in hours and minutes.

hrs.	mins.
~~23~~ 24	~~00~~ 60
− 21	15
2	45

hrs.	mins.
2 +1	45
+ 4	33
7	18

7 ..... h 18 ..... min [1]

4



NOT TO SCALE

Calculate the **total** surface area of this cuboid.

★ $A = 2lw + 2lh + 2wh$

$\Rightarrow A = 2(7\times4)cm^2 + 2(7\times5)cm^2 + 2(4\times5)cm^2$

$\Rightarrow A = 166cm^2$

166 ..... cm^2 [3]

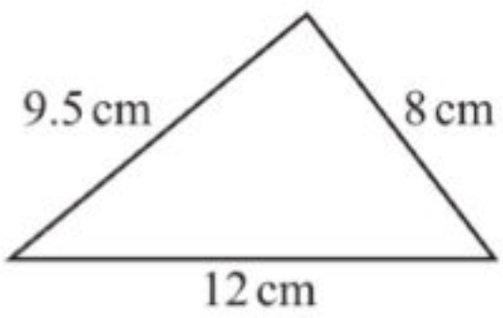
5 **(a)** Write down the gradient of the line $y = 5x + 7$.

5 [1]

(b) Find the coordinates of the point where the line $y = 5x + 7$ crosses the y-axis.

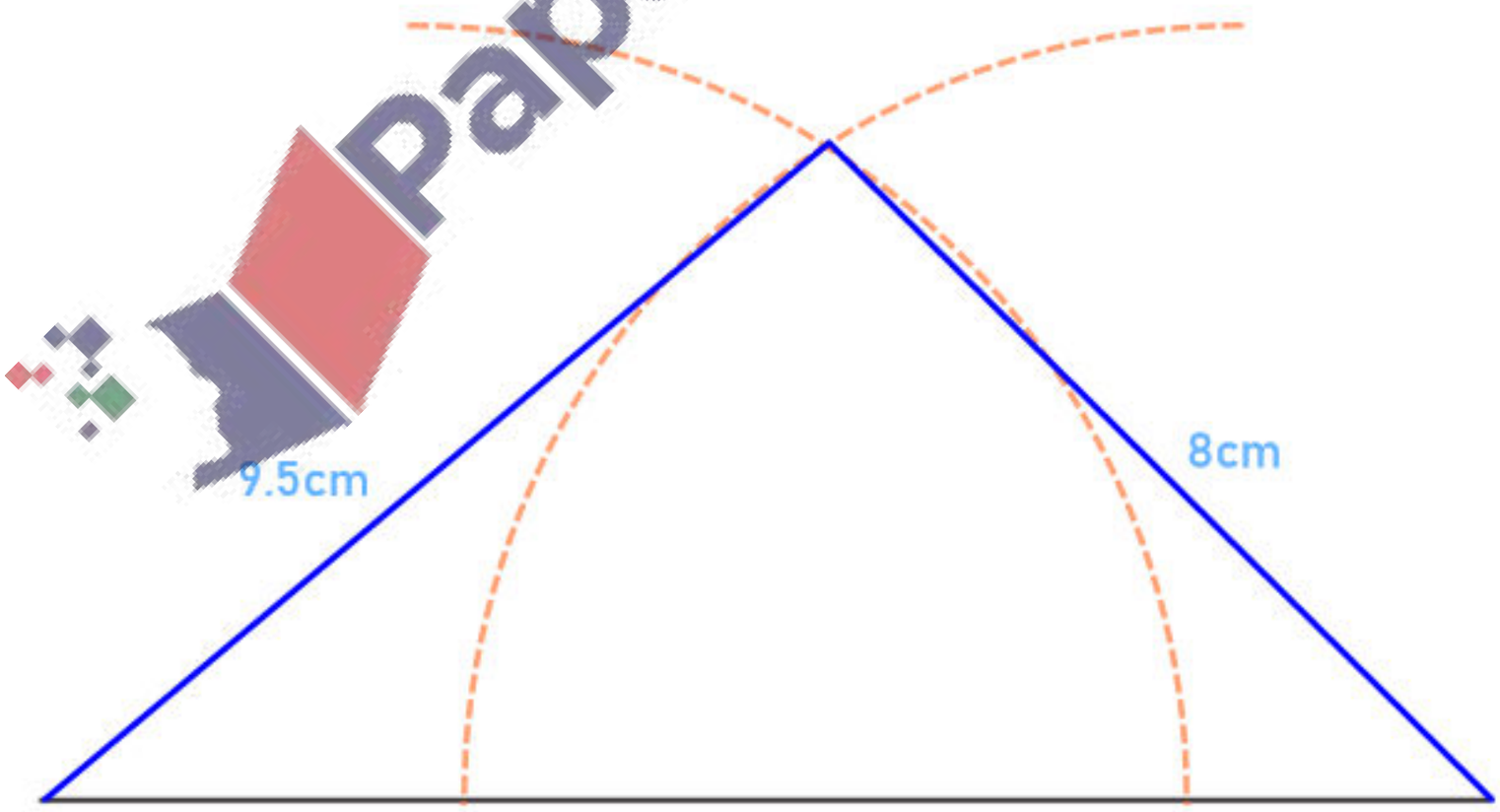
(0 , 7) [1]

6



NOT TO SCALE

Using a ruler and compasses only, construct this triangle.
Leave in your construction arcs.
The side of length 12 cm has been drawn for you.



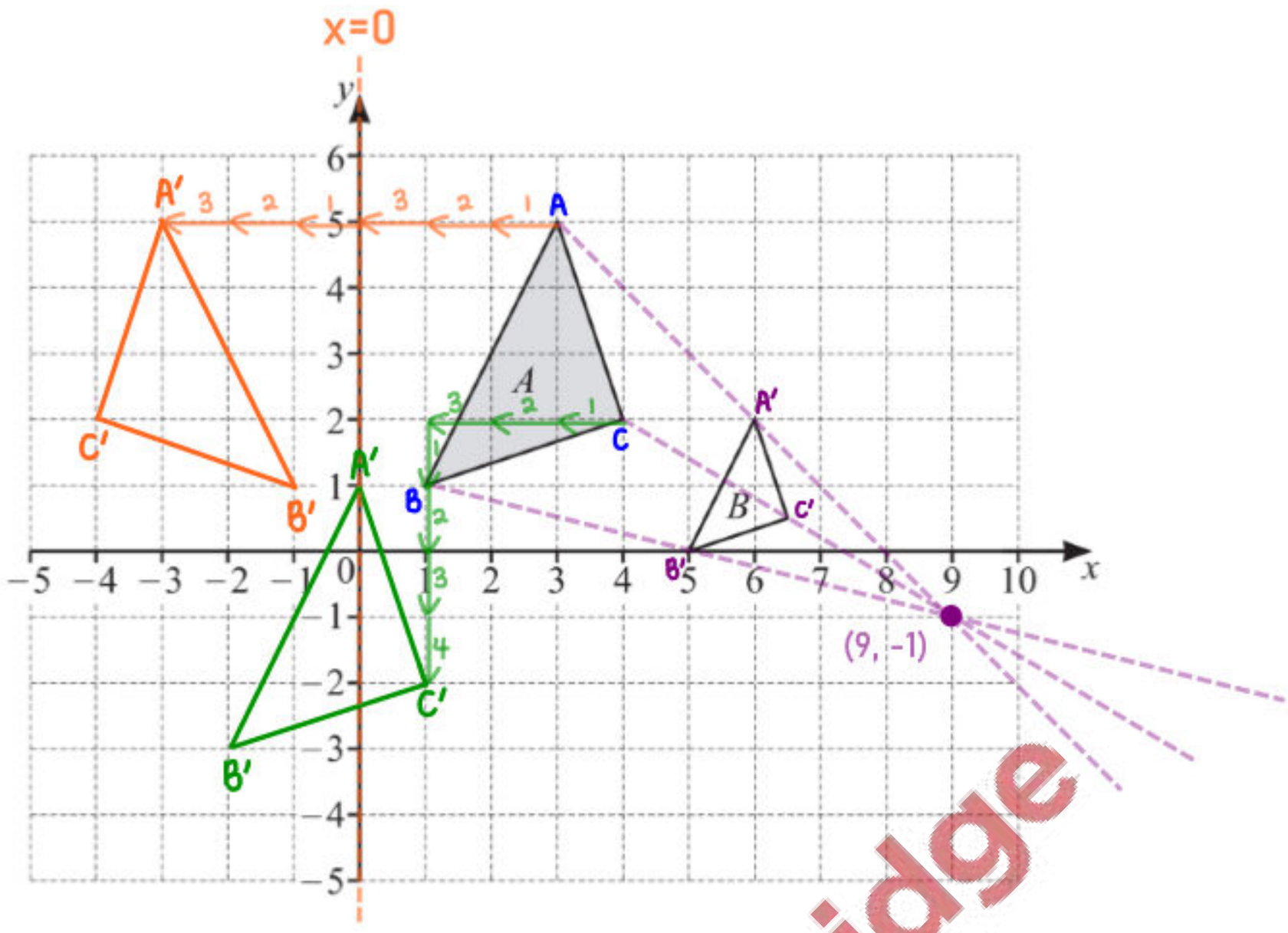
[2]

7

Write down the inequality, in terms of n, shown by the number line.

n > −1 [1]

8



(a) On the grid, draw the image of

(i) triangle A after a reflection in the y-axis, [1]

(ii) triangle A after a translation by the vector $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$. [2]

(b) Describe fully the **single** transformation that maps triangle A onto triangle B.

Enlargement by a scale factor of 1/2 about the centre (9, -1).

..... [3]

9 Factorise completely.

$12a^3 - 21a$

$3a(4a^2 - 7)$ [2]

10 **(a)** The nth term of a sequence is $n^2 + 7$.

Find the first three terms of this sequence.

* $(1)^2 + 7 = 8$
* $(2)^2 + 7 = 11$
* $(3)^2 + 7 = 16$

8 , 11 , 16 [2]

(b) These are the first four terms of a different sequence.

15 (−8) 7 (−8) −1 (−8) −9

Find the nth term of this sequence.

* $a_n = a_1 + (n-1)d$
$\Rightarrow a_n = 15 + (n-1) \times -8$
$\Rightarrow a_n = 15 - 8n + 8$
$\Rightarrow a_n = 23 - 8n$

23 − 8n [2]

11 As the temperature increases, people eat more ice cream.

What type of correlation does this statement describe?

positive [1]

12 **(a)** Sanjay invests \$700 in an account paying simple interest at a rate of 2.5% per year.

Calculate the value of his investment at the end of 6 years.

* $\text{Total} = P + I$
$\Rightarrow \text{Total} = P + \frac{P \times R \times T}{100}$
$\Rightarrow \text{Total} = \$700 + \frac{\$700 \times 2.5 \times 6}{100}$
$\Rightarrow \text{Total} = \$805$

\$ 805 [3]

(b) Meera invests \$700 in an account paying compound interest at a rate of r% per year.
At the end of 17 years the value of her investment is \$1030.35 .

Find the value of r.

* $A = a\left(1 + \frac{r}{100}\right)^t$
$\Rightarrow r = 100\left(\left(\frac{A}{a}\right)^{\frac{1}{t}} - 1\right)$
$\Rightarrow r = 100\left(\left(\frac{\$1030.35}{\$700}\right)^{\frac{1}{17}} - 1\right)$
$\Rightarrow r = 2.30$ (3 sig. figs.)

$r =$ 2.30 [3]

13 **(a)** Simplify $h^2 \times h^5$.

$\Rightarrow h^{2+5}$

$\Rightarrow h^7$

h^7 [1]

(b) Simplify $\left(\frac{7}{x}\right)^{-3}$.

$\Rightarrow \frac{7^{-3}}{x^{-3}}$

$\Rightarrow \frac{x^3}{7^3} = \frac{x^3}{343}$

$\frac{x^3}{343}$ [1]

(c) $a^8 \div a^p = a^2$

Find the value of p.

$\Rightarrow a^{8-p} = a^2$

Since the bases are equal,

$\Rightarrow 8 - p = 2$

$\Rightarrow p = 8 - 2$

$\Rightarrow p = 6$

$p =$ 6 [1]

14 Calculate the circumference of a circle with radius 4.7 cm.

$\star C = 2\pi r$

$\Rightarrow C = 2\pi(4.7\text{cm})$

$\Rightarrow C = 29.5\text{ cm}$ (3 sig. figs.)

29.5 cm [2]

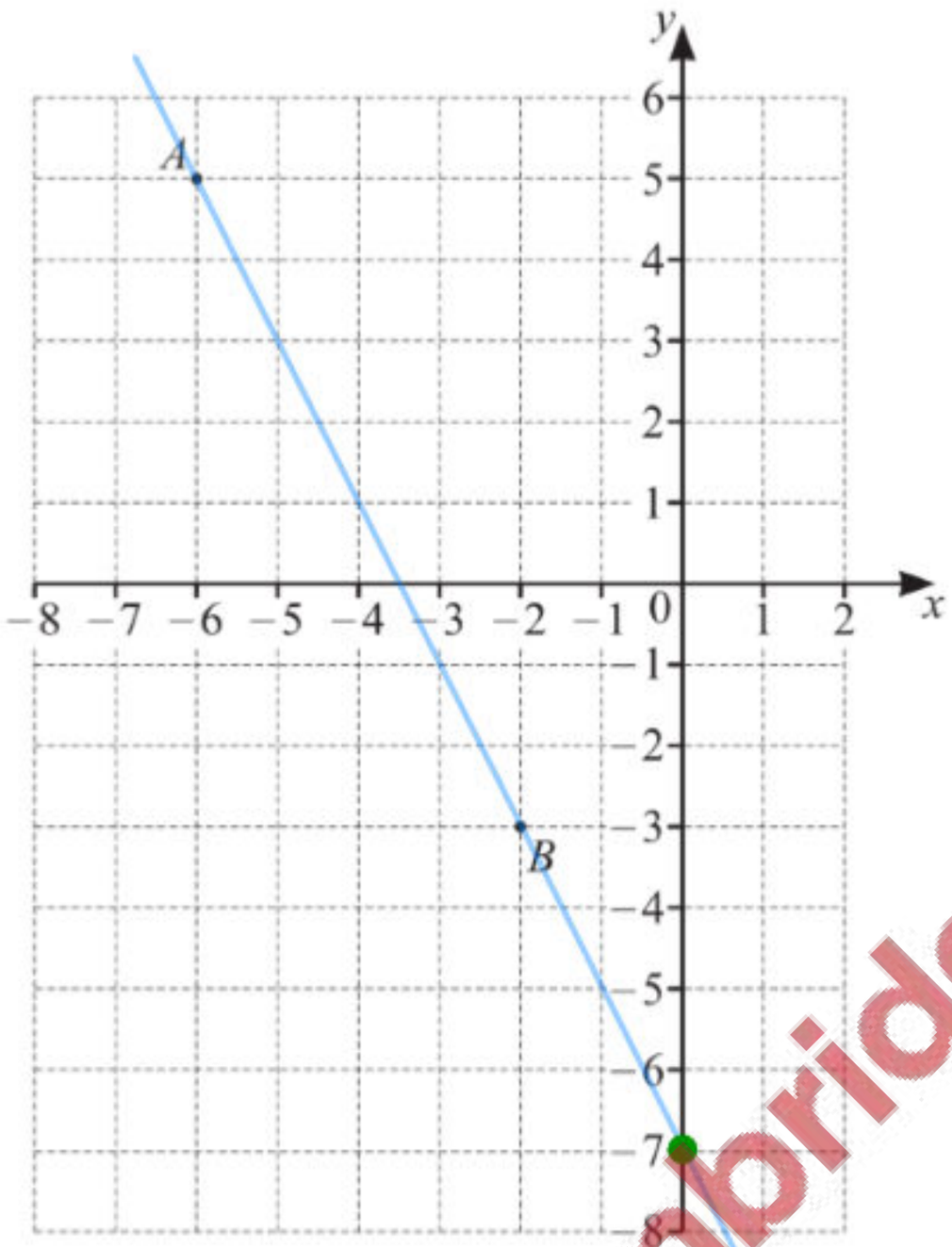
15 **Without using a calculator**, work out $2\frac{1}{3} \times \frac{11}{14}$.
You must show all your working and give your answer as a mixed number in its simplest form.

$\Rightarrow \frac{7}{3} \times \frac{11}{14_2}$

$\Rightarrow \frac{11}{6} = 1\frac{5}{6}$

$1\frac{5}{6}$ [3]

16



A is the point $(-6, 5)$ and B is the point $(-2, -3)$.

(a) Find the equation of the straight line, l, that passes through point A and point B.
Give your answer in the form $y = mx + c$.

* $y = mx + c$

• $m = \frac{5-(-3)}{-6-(-2)} = -2$ //

• $c = -7$ //

$y =$ $-2x-7$ [2]

(b) Find the equation of the line that is perpendicular to l and passes through the origin.

* $y = mx + c$

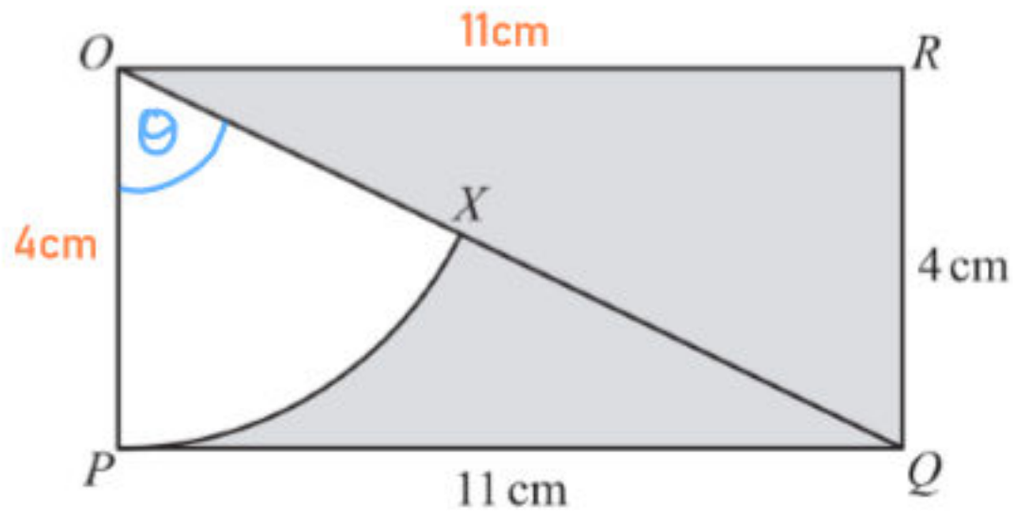
• $m \times -2 = -1$

$\Rightarrow m = \frac{1}{2}$ //

• $c = 0$ //

$y = \frac{1}{2}x$ [2]

17



NOT TO SCALE

The diagram shows a rectangle $OPQR$ with length 11 cm and width 4 cm.
OQ is a diagonal and OPX is a sector of a circle, centre O.

Calculate the percentage of the rectangle that is shaded.

★ $\tan\theta = \frac{11\text{cm}}{4\text{cm}}$

$\Rightarrow \theta = \tan^{-1}\left(\frac{11}{4}\right)$ //

★ % Shaded Rectangle = $\frac{\text{Shaded Area}}{\text{Area of rectangle}} \times 100\%$

• Area of rectangle = $(11 \times 4)\,\text{cm}^2$
$= 44\,\text{cm}^2$ //

• Shaded Area = $A_{REC} - A_{SECTOR}$
$= 44\,\text{cm}^2 - \left(\frac{\tan^{-1}(11/4)}{360^\circ} \times \pi(4\,\text{cm})^2\right)$
$= 34.22\ldots\,\text{cm}^2$ //

$\Rightarrow$ % Shaded rectangle = $\frac{34.22\,\text{cm}^2}{44\,\text{cm}^2} \times 100\%$

$\Rightarrow$ % Shaded rectangle = 77.8% (3 sig. figs.) //

77.8 ..... % [5]

18 Mrs Kohli buys a jacket, 2 shirts and a hat.
The jacket costs $\$x$.
The shirts each cost \$24 less than the jacket and the hat costs \$16 less than the jacket.
Mrs Kohli spends exactly \$100.

Write down an equation in terms of x.
Solve this equation to find the cost of the jacket.

★ $1(x) + 2(x-24) + 1(x-16) = 100$
$\Rightarrow x + 2x - 48 + x - 16 = 100$
$\Rightarrow 4x - 64 = 100$
$\Rightarrow 4x = 164$
$\Rightarrow x = 41$ //

$ 41 ..... [3]

19 y is inversely proportional to the square root of $(x+4)$.
When $x = 5$, $y = 2$.

Find y when $x = 77$.

$* \; y \propto \frac{1}{\sqrt{x+4}}$

$\Rightarrow y = \frac{k}{\sqrt{x+4}}$

Finding k:

$* \; 2 = \frac{k}{\sqrt{5+4}}$

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

$\Rightarrow k = 6$ //

$\Rightarrow y = \frac{6}{\sqrt{77+4}}$

$\Rightarrow y = \frac{2}{3}$ //

$y =$ ..... $\frac{2}{3}$ ..... [3]

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

$$3x + y = 11 \quad -(1)$$
$$x^2 - 2y = 18 \quad -(2)$$

(1) × 2 : $6x + 2y = 22 \quad -(3)$

(2) + (3) : $x^2 + 6x = 40$

$\Rightarrow x^2 + 6x - 40 = 0$

Solve for x:

$\Rightarrow x^2 - 4x + 10x - 40 = 0$

$\Rightarrow x(x-4) + 10(x-4) = 0$

$\Rightarrow (x+10)(x-4) = 0$

$x + 10 = 0$ $\qquad$ $x - 4 = 0$

$x = -10$ // $\qquad$ $x = 4$ //

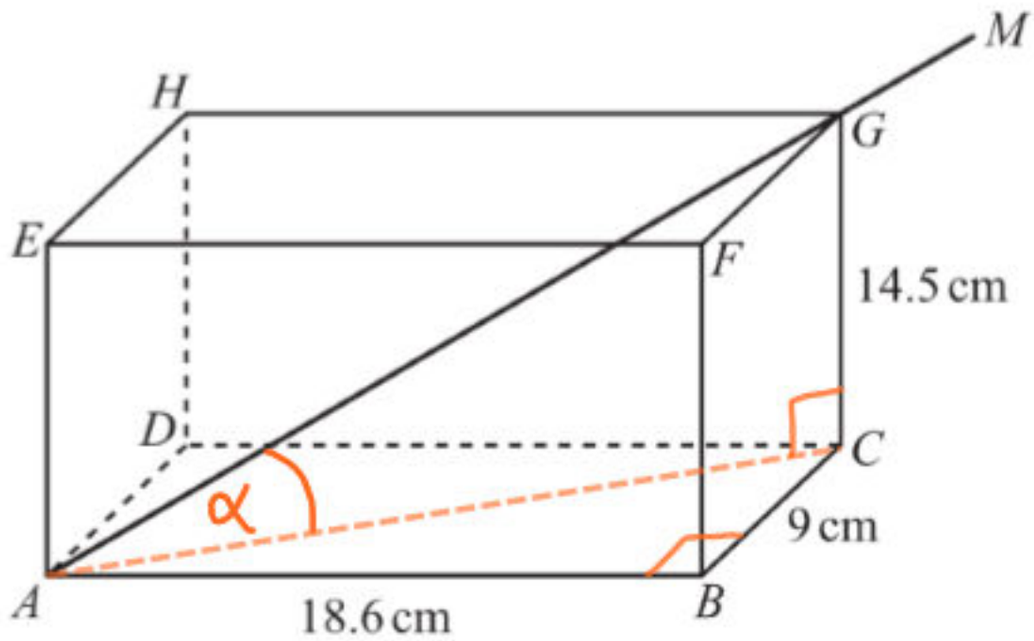
* When $x = -10$,
$\Rightarrow 3(-10) + y = 11$
$\Rightarrow -30 + y = 11$
$\Rightarrow y = 41$ //

* When $x = 4$,
$\Rightarrow 3(4) + y = 11$
$\Rightarrow 12 + y = 11$
$\Rightarrow y = -1$ //

$x =$ ..... -10 ..... $y =$ ..... 41 .....

$x =$ ..... 4 ..... $y =$ ..... -1 ..... [5]

21



NOT TO SCALE

The diagram shows an open rectangular box *ABCDEFGH*.
AB = 18.6 cm, *BC* = 9 cm and *CG* = 14.5 cm.
A straight stick *AGM* rests against *A* and *G* and extends outside the box to *M*.

(a) Calculate the angle between the stick and the base of the box.

* $\tan\alpha = \frac{14.5\text{cm}}{AC}$

$\Rightarrow \alpha = \tan^{-1}\left(\frac{14.5\text{cm}}{AC}\right)$

Finding AC:

• $AC^2 = AB^2 + BC^2$

$\Rightarrow AC = \left(\sqrt{18.6^2 + 9^2}\right)\text{cm}$ //

Hence,

$\Rightarrow \alpha = \tan^{-1}\left(\frac{14.5\text{cm}}{\sqrt{18.6^2 + 9^2}\text{cm}}\right)$

$\Rightarrow \alpha = 35.1°\ (1\text{ dp})$ //

35.1° ..... [4]

(b) *AM* = 30 cm.

Show that *GM* = 4.8 cm, correct to 1 decimal place.

* GM = AM − AG

Finding AG:

• $\sin 35.1° = \frac{14.5\text{cm}}{AG}$

$\Rightarrow AG = \left(\frac{14.5}{\sin 35.1°}\right)\text{cm}$ //

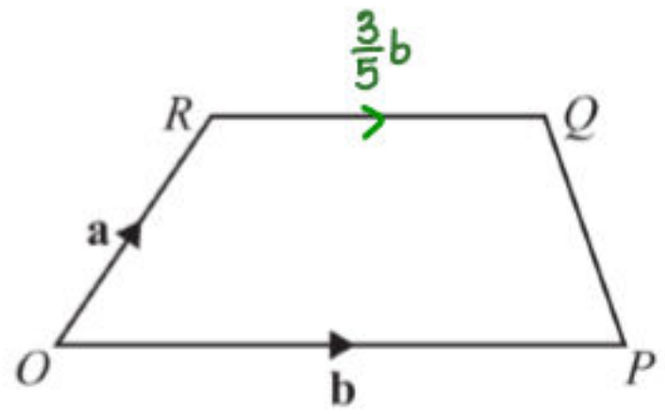
Hence,

$\Rightarrow GM = 30\text{cm} - \left(\frac{14.5}{\sin 35.1°}\right)\text{cm}$

$\Rightarrow GM = 4.78\ldots\text{cm} \approx 4.8\text{cm}\ (1\text{ dp})$ //

[3]

22



NOT TO SCALE

The diagram shows a trapezium $OPQR$.

O is the origin, $\overrightarrow{OR} = \mathbf{a}$ and $\overrightarrow{OP} = \mathbf{b}$.

$|\overrightarrow{RQ}| = \frac{3}{5}|\overrightarrow{OP}|$

(a) Find $\overrightarrow{PQ}$ in terms of **a** and **b** in its simplest form.

$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OR} + \overrightarrow{RQ}$

$\Rightarrow \overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OR} + \frac{3}{5}\overrightarrow{OP}$

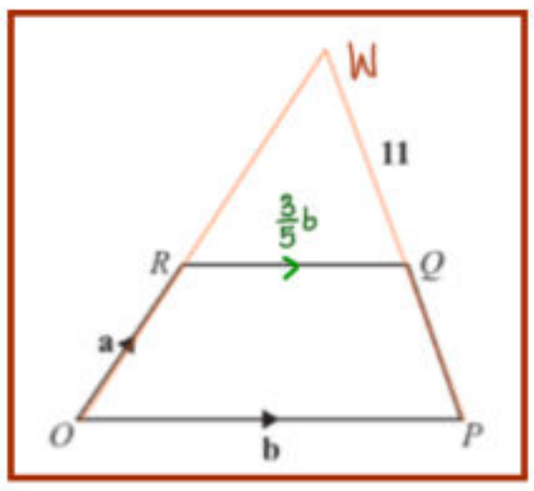
$\Rightarrow \overrightarrow{PQ} = -\mathbf{b} + \mathbf{a} + \frac{3}{5}\mathbf{b}$

$\Rightarrow \overrightarrow{PQ} = \mathbf{a} - \frac{2}{5}\mathbf{b}$

$\overrightarrow{PQ} =$ $\mathbf{a} - \frac{2}{5}\mathbf{b}$ [2]

(b) When PQ and OR are extended, they intersect at W.

Find the position vector of W.



$\overrightarrow{OW} = x\overrightarrow{OR} = x\mathbf{a}$

$\overrightarrow{OW} = \overrightarrow{OP} + \overrightarrow{PW}$

$\Rightarrow \overrightarrow{OW} = \overrightarrow{OP} + y\overrightarrow{PQ}$

$\Rightarrow \overrightarrow{OW} = \mathbf{b} + y\left(\mathbf{a} - \frac{2}{5}\mathbf{b}\right)$

$\Rightarrow \overrightarrow{OW} = \mathbf{b} + y\mathbf{a} - \frac{2}{5}y\mathbf{b}$

$\Rightarrow \overrightarrow{OW} = y\mathbf{a} + \left(1 - \frac{2}{5}y\right)\mathbf{b}$

$x = y$

$1 - \frac{2}{5}y = 0$

$\Rightarrow \frac{2}{5}y = 1$

$\Rightarrow y = 2.5$

$\therefore x = 2.5$

Hence,

$\overrightarrow{OW} = 2.5\mathbf{a}$

$2.5\mathbf{a}$ [2]

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