Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS   **0580/22**

Paper 2 (Extended)   **February/March 2020**

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 [ ].

1
                3.56   5 $\sqrt{196}$ 8 $\sqrt{7}$ 12

From the list, write down a number that is

(a) a multiple of 3,

.... 12 .... [1]

(b) a cube number,

.... 8 .... [1]

(c) a prime number,

.... 5 .... [1]

(d) an irrational number.

.... $\sqrt{7}$ .... [1]

2   The number of people swimming in a pool is recorded each day for 12 days.

                24   28   13   38   15   26

                45   21   48   36   18   38

(a) Complete the stem-and-leaf diagram.

1	3, 5, 8
2	1, 4, 6, 8
3	6, 8, 8
4	5, 8

Key: 1|3 represents 13 swimmers

[2]

(b) Find the median number of swimmers.

* Median position = $\frac{1}{2}(12+1)$ th = 6.5 th

* Median = $\frac{26+28}{2}$ = 27

.... 27 .... [1]

3 Point *A* has coordinates (6, 4) and point *B* has coordinates (2, 7).

Write $\overrightarrow{AB}$ as a column vector.

★ $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$

$\Rightarrow \overrightarrow{AB} = \begin{pmatrix} 2 \\ 7 \end{pmatrix} - \begin{pmatrix} 6 \\ 4 \end{pmatrix}$

$\Rightarrow \overrightarrow{AB} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$

$\overrightarrow{AB} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ [1]

4 Find the interior angle of a regular polygon with 24 sides.

★ Interior angle $= \dfrac{180°(n-2)}{n}$

$\Rightarrow$ Interior angle $= \dfrac{180°(24-2)}{24} = 165°$

.... 165° .... [2]

5 **Without using a calculator,** work out $\dfrac{15}{28} \div \dfrac{4}{7}$.

You must show all your working and give your answer as a fraction in its simplest form.

$\Rightarrow \dfrac{15}{28} \times \dfrac{7}{4}$

$\Rightarrow \dfrac{15}{16}$

.... $\dfrac{15}{16}$ .... [3]

6   The table shows the marks scored by 40 students in a test.

Mark	5	6	7	8	9	10
Frequency	8	5	11	7	5	4

Calculate the mean mark.

★ Mean = $\dfrac{(5\times 8)+(6\times 5)+(7\times 11)+(8\times 7)+(9\times 5)+(10\times 4)}{40}$

⇒ Mean = 7·2

.... 7.2 .... [3]

7

$★\ h^2 = 8.5^2 + 10.8^2$

$⇒ h = \left(\sqrt{8.5^2 + 10.8^2}\right)\,cm$

$⇒ h = 13.7437...\,cm$

NOT TO SCALE

8.5 cm

h
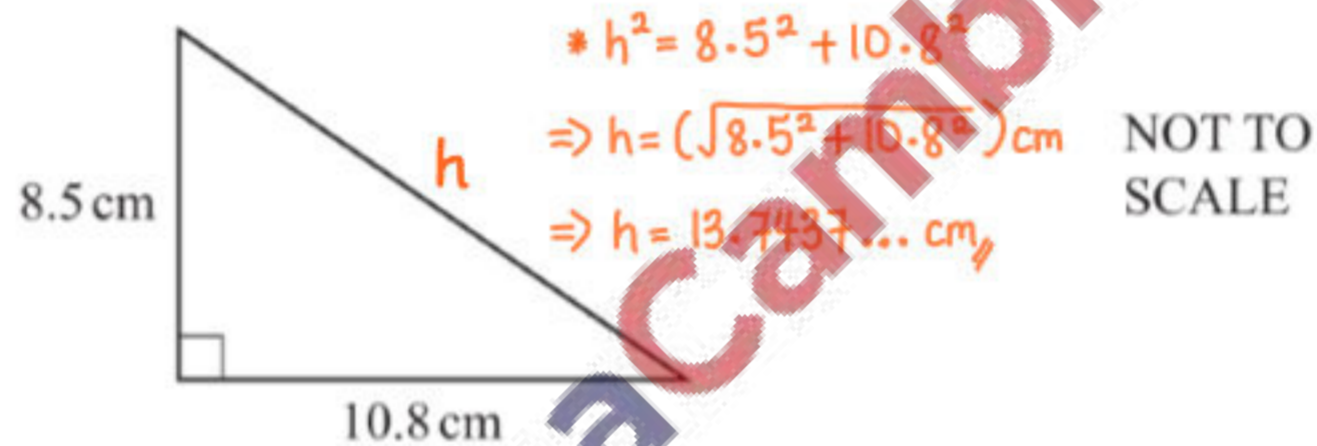
10.8 cm

The diagram shows a right-angled triangle.

(a) Calculate the area.

$★\ A = \dfrac{1}{2}\times b\times h$

$⇒ A = \dfrac{1}{2}\times 10.8\,cm \times 8.5\,cm = 45.9\,cm^2$

.... 45.9 .... cm² [2]

(b) Calculate the perimeter.

$★\ P = 8.5\,cm + 10.8\,cm + 13.7437\,cm$

$⇒ P = 33.0\,cm$ (3 sig. figs.)

.... 33.0 .... cm [3]

8 Calculate the value of $(2.3 \times 10^{-3}) + (6.8 \times 10^{-4})$.
Give your answer in standard form.

$$\Rightarrow 2.3 \times 10^{-3} + 0.68 \times 10^{-3}$$

$$\Rightarrow (2.3 + 0.68) \times 10^{-3}$$

$$\Rightarrow 2.98 \times 10^{-3}$$

............2.98×10^{-3}............ [1]

9 (a) Factorise completely.
$$3x^2 - 12xy$$

............$3x(x-4y)$............ [2]

(b) Expand and simplify.
$$(m-3)(m+2)$$

$$\Rightarrow m^2 + 2m - 3m - 6$$

$$\Rightarrow m^2 - m - 6$$

............$m^2 - m - 6$............ [2]
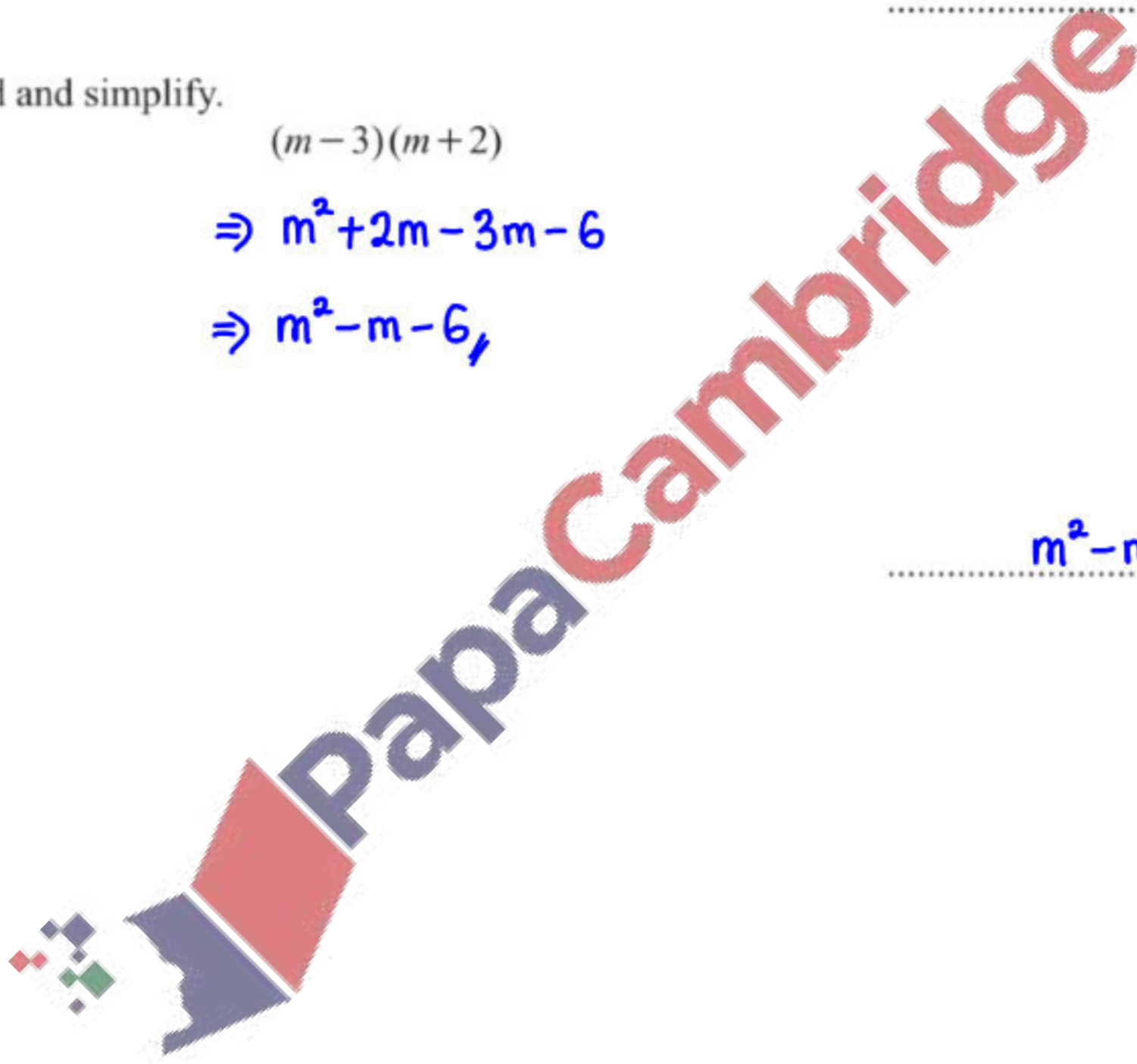
10 Sketch the graph of each function.

(a) $y = x - 3$

　　　* $x = 0$, $y = -3$
　　　* $x = 3$, $y = 0$

[1]

(b) $y = \dfrac{1}{x}$

[2]

　　　　　　　　　0580/22/F/M/20

7

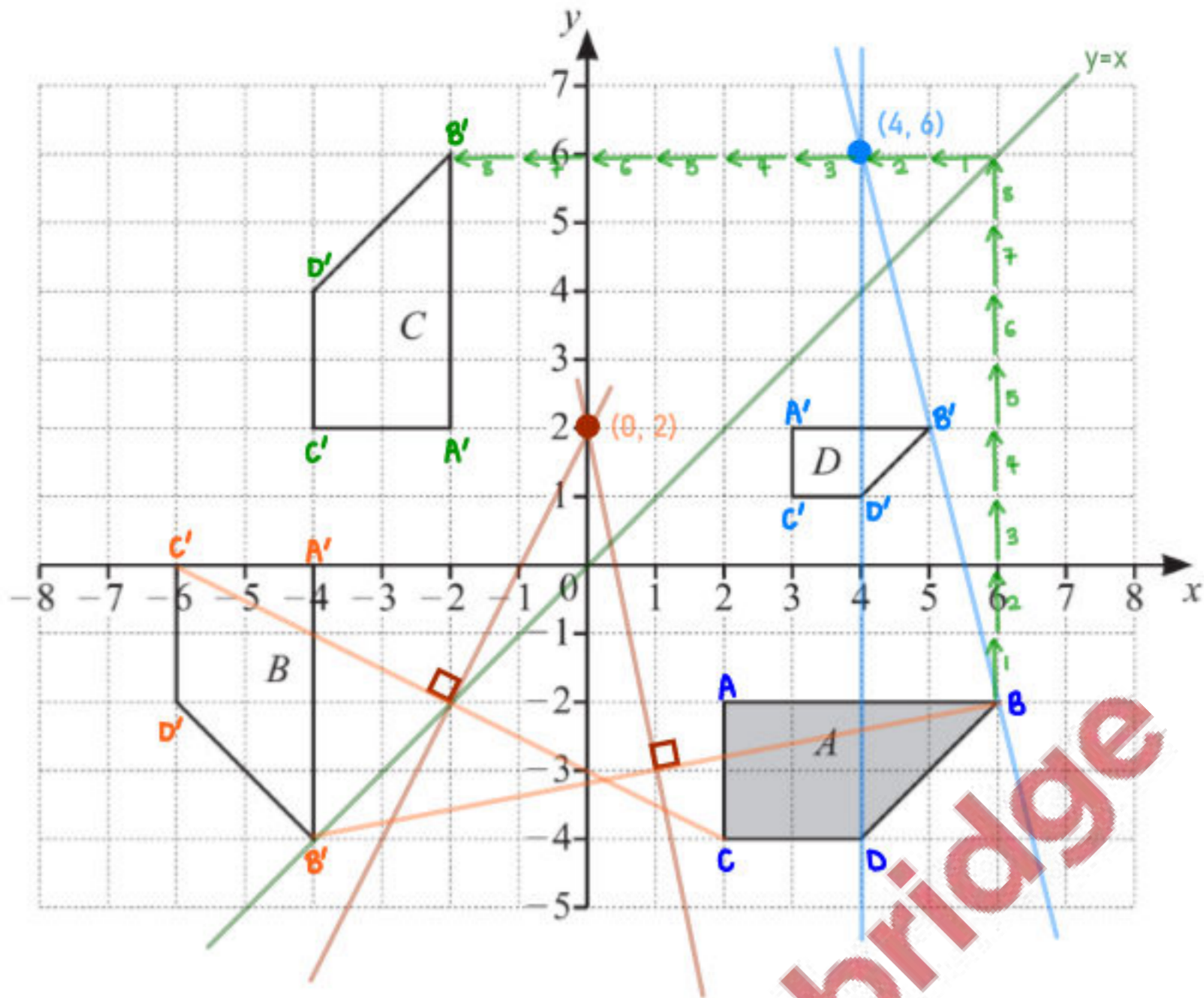**11**
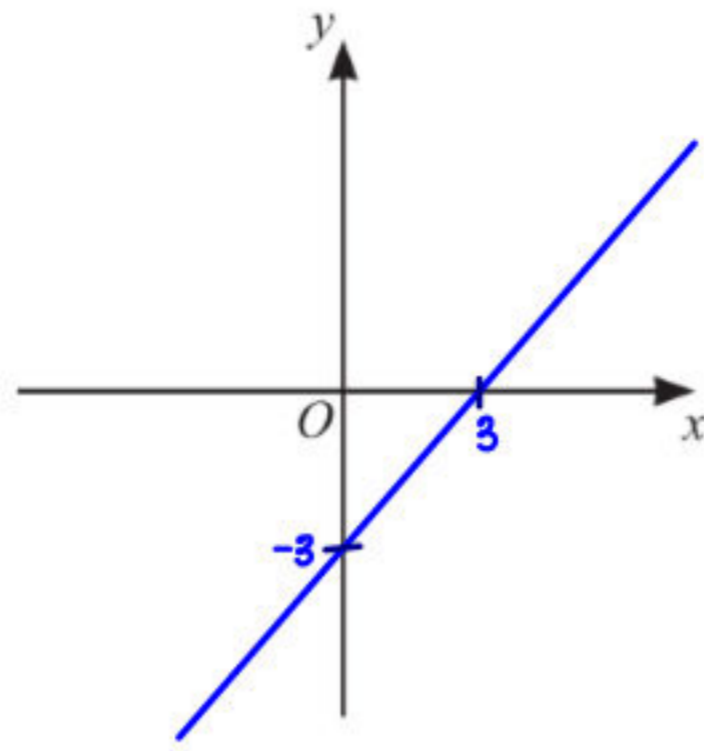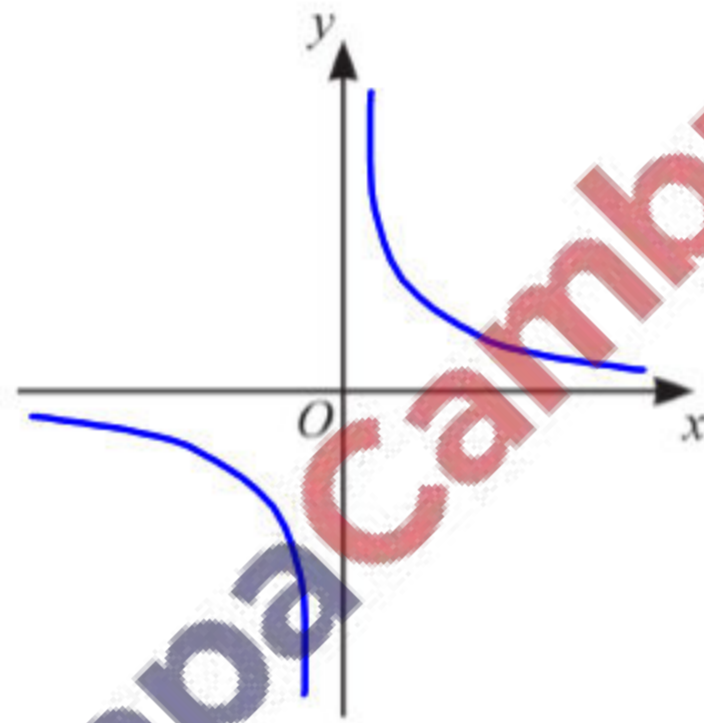
Describe fully the **single** transformation that maps

(a) shape *A* onto shape *B*,

Rotation 90° clockwise about the centre (0, 2)

.... [3]

(b) shape *A* onto shape *C*,

Reflection in the line y=x

.... [2]

(c) shape *A* onto shape *D*.

Enlargement by a scale factor of 1/2 about the centre (4, 6)

.... [3]

12 The population of a town decreases exponentially at a rate of 1.7% per year.
The population now is 250 000.

Calculate the population at the end of 5 years.
Give your answer correct to the nearest hundred.

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

$$\Rightarrow A = 250\,000\left(1 - \frac{1.7}{100}\right)^{5}$$

$$\Rightarrow A = 229\,460.32\ldots \approx 229\,500\ (\text{nearest hundred})$$
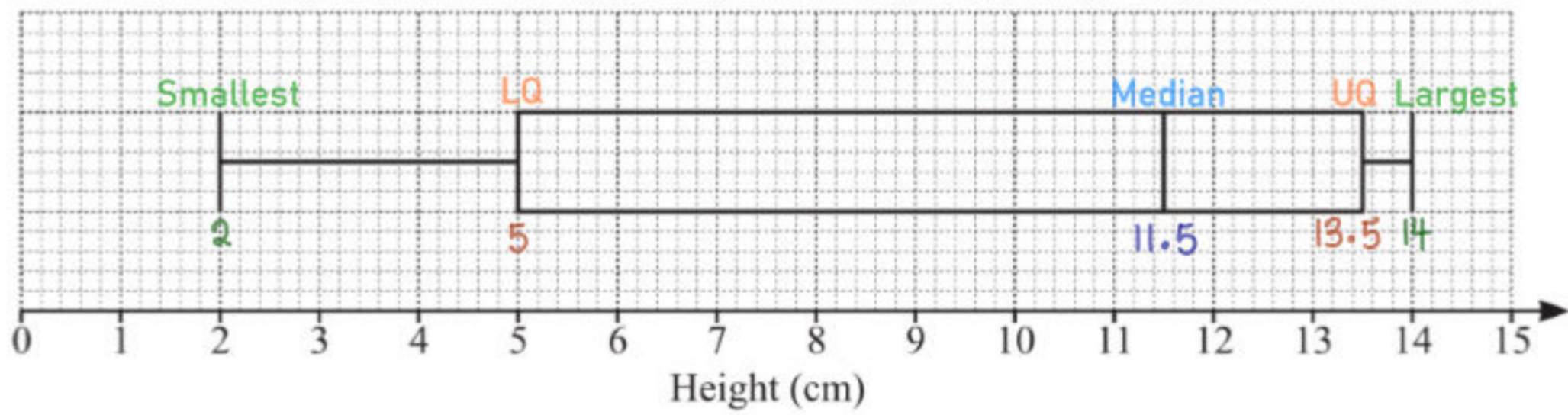
.... 229 500 .... [3]

13 Write the recurring decimal $0.2\dot{6}$ as a fraction.
You must show all your working.

$\star$ Let $x = 0.2\dot{6}$ $\Rightarrow 100x - 10x = 26.\dot{6} - 2.\dot{6}$

$10x = 2.\dot{6}$ $\Rightarrow 90x = 24$

$100x = 26.\dot{6}$ $\Rightarrow x = \dfrac{24}{90}^{4}_{15} = \dfrac{4}{15}$

.... $\dfrac{4}{15}$ .... [2]

14 The box-and-whisker plot gives information about the heights, in centimetres, of some plants.

(a) Write down the median.

...............**11.5**............... cm [1]

(b) Find

    (i) the range,

      ★ Range = 14 − 2 = 12∥

...............**12**............... cm [1]

    (ii) the interquartile range.

      ★ IQ = UQ − LQ

      ⇒ IQ = 13.5 − 5

      ⇒ IQ = 8.5∥

...............**8.5**............... cm [1]

15
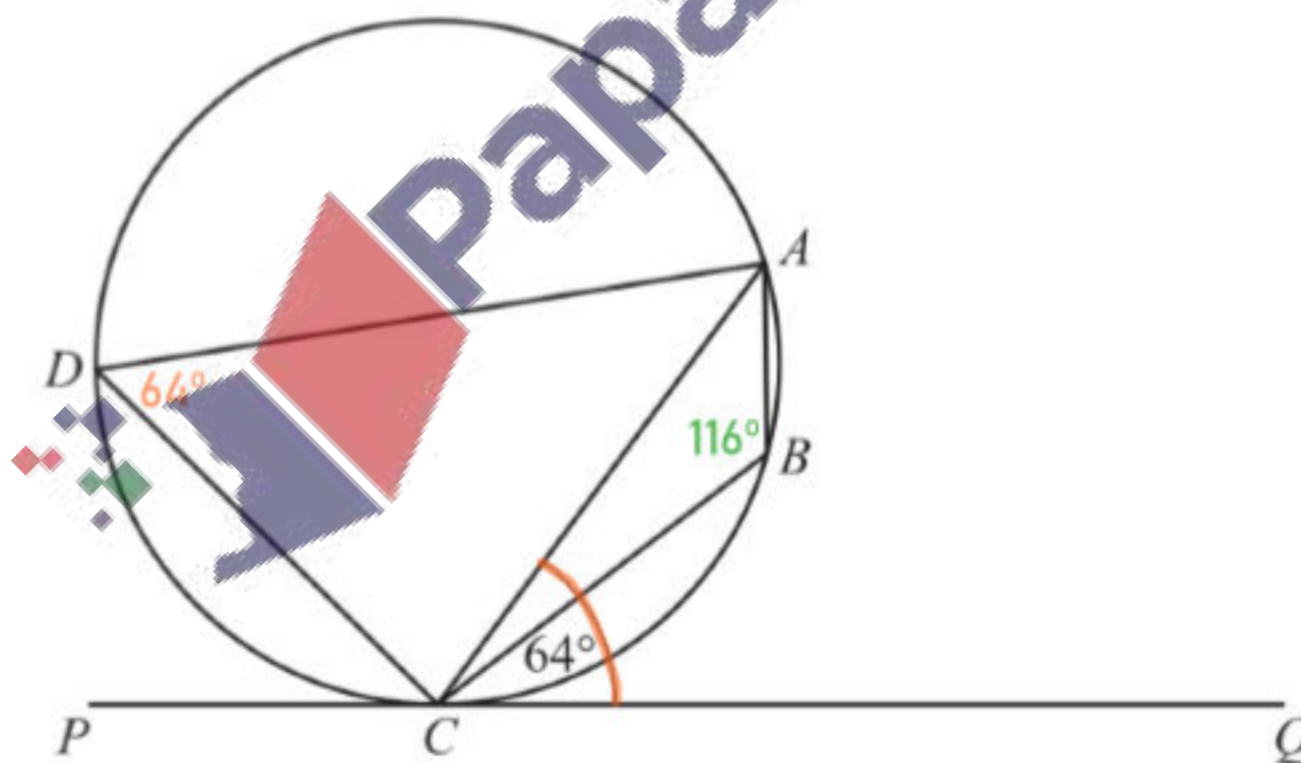
NOT TO SCALE

A, B, C and D lie on the circle.
PCQ is a tangent to the circle at C.
Angle ACQ = 64°.

Work out angle ABC, giving reasons for your answer.

Angle ABC = ...**116°**.......... because **based on the Alternate segment theorem,**

∠ADC = ∠ACQ = 64°. Opposite angles in a cyclic quadrilateral add up to 180°,

so ∠ABC + 64° = 180°.

.... [3]

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

$$x = 7 - 3y \quad -(1)$$
$$x^2 - y^2 = 39 \quad -(2)$$

Put x in (2)

$\Rightarrow (7-3y)^2 - y^2 = 39$

$\Rightarrow 49 - 42y + 9y^2 - y^2 = 39$

$\Rightarrow 8y^2 - 42y + 10 = 0$

$\Rightarrow 4y^2 - 21y + 5 = 0$

Solve for y using factorisation

$\Rightarrow 4y^2 - y - 20y + 5 = 0$

$\Rightarrow y(4y-1) - 5(4y-1) = 0$

$\Rightarrow (4y-1)(y-5) = 0$

$4y-1 = 0$ $y-5 = 0$

$y = 0.25$ $y = 5$

* When $y = 0.25$,
$\Rightarrow x = 7 - 3(0.25) = 6.25$

* When $y = 5$,
$\Rightarrow x = 7 - 3(5) = -8$

x = ...6.25......... y = ...0.25.........

x = ...−8......... y = ...5......... [6]

17 *A* is the point (3, 5) and *B* is the point (1, 7).

Find the equation of the line perpendicular to *AB* that passes through the point *A*.
Give your answer in the form $y = mx + c$.

★ $y = mx + c$

Finding m

• $m_{AB} = \dfrac{-7-5}{1-3} = 6$

★ $m \times 6 = -1$

$\Rightarrow m = -\dfrac{1}{6}$

Finding c

★ $5 = -\dfrac{1}{6}(3) + c$

$\Rightarrow 5 = -\dfrac{1}{2} + c$

$\Rightarrow c = 5.5$

y = ...$-\dfrac{1}{6}x + 5.5$......... [4]

18 A car travels at a constant speed.
    It travels a distance of 146.2 m, correct to 1 decimal place.
    This takes 7 seconds, correct to the nearest second.

    Calculate the upper bound for the speed of the car.

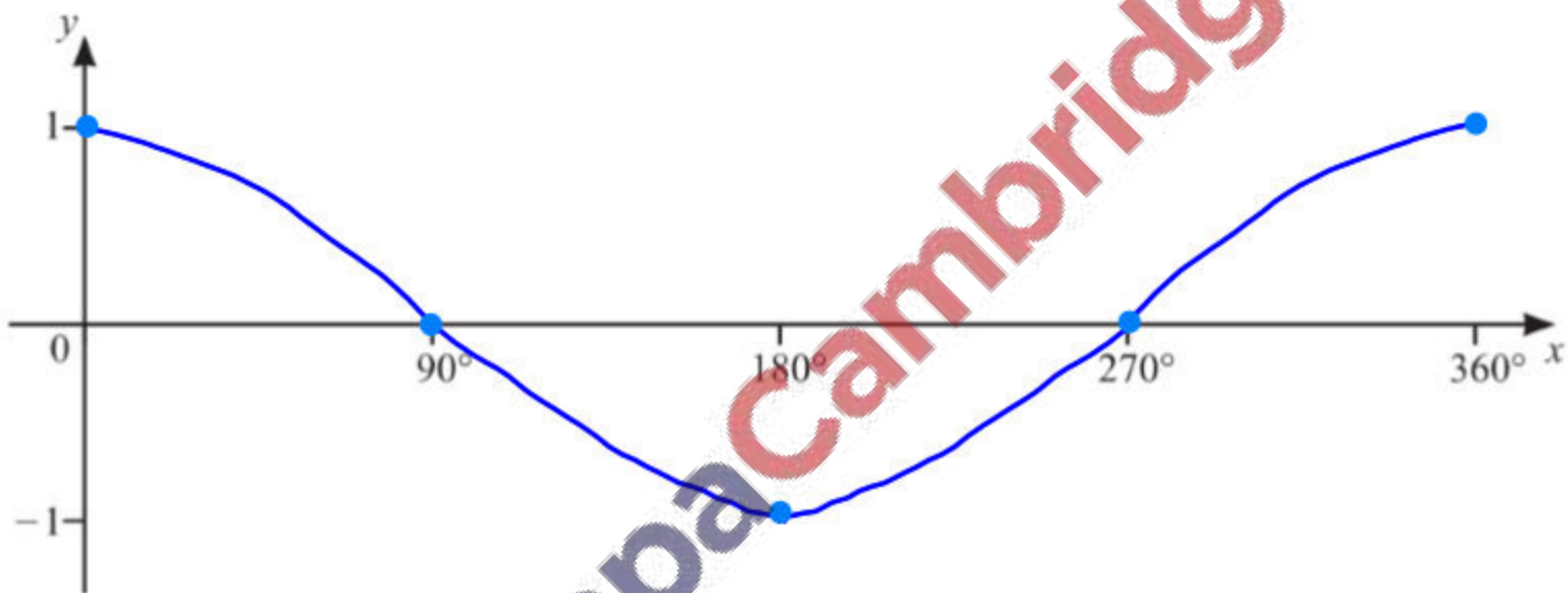   * $d = 146.2\,m \pm \dfrac{0.1}{2}$ ⋆ $v = \dfrac{d}{t}$

    * $t = 7s \pm \dfrac{1s}{2}$ $\Rightarrow UB(v) = \dfrac{UB(d)}{LB(t)}$

    $\Rightarrow UB(v) = \dfrac{\left(146.2 + \frac{0.1}{2}\right)m}{\left(7 - \frac{1}{2}\right)s}$

    $\Rightarrow UB(v) = 22.5\,m/s$

    ....**22.5**............... m/s [3]

19

    (a) On the diagram, sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$.   [2]

    (b) Solve the equation $4\cos x + 2 = 3$ for $0° \leqslant x \leqslant 360°$.

    $\Rightarrow 4\cos x = 1$ * $x_1 = 75.5°$

    $\Rightarrow \cos x = \dfrac{1}{4}$ * $x_2 = 360° - 75.5° = 284.5°$

    • $\alpha = \cos^{-1}\left(\frac{1}{4}\right)$

    $\Rightarrow \alpha = 75.5° (1\,dp)$

    $x = $ ....**75.5°**......... and $x = $ ....**284.5°**......... [3]

Questions 20 and 21 are printed on the next page.

20
$$x^2 - 12x + a = (x + b)^2$$

Find the value of a and the value of b.

$\Rightarrow x^2 - 12x + a = x^2 + 2bx + b^2$

• $2b = -12$ • $a = b^2$

$\Rightarrow b = -6$ $\Rightarrow a = (-6)^2$

$\Rightarrow a = 36$

$a = $ .... 36 ....

$b = $ .... -6 .... [2]

21 $\overrightarrow{XY} = 3\mathbf{a} + 2\mathbf{b}$ and $\overrightarrow{ZY} = 6\mathbf{a} + 4\mathbf{b}$. = 2(3a+2b)

Write down two statements about the relationship between the points X, Y and Z.

1 ...... The points are collinear ......

2 ...... X is the midpoint of ZY ...... [2]