Cambridge Assessment International Education

# Cambridge O Level

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| CANDIDATE NAME | | | | | | | | | |
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*5034367099*

**MATHEMATICS (SYLLABUS D)** **4024/22**

Paper 2 **May/June 2023**

**2 hours 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 $\pi$, use either your calculator value or 3.142.

**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.

DC (CE/JG) 315946/3

**1** **(a)** A shop buys some fruit.
The table shows the bill for this fruit.

| Item | Quantity (kg) | Price per kg ($) | Cost price ($) |
|---|---|---|---|
| Bananas | 50 | 0.51 | 25.50 |
| Oranges | 72 | 1.35 | $p$ |
| Avocados | $r$ | 1.95 | $q$ |
| Pears | 45 | $s$ | 51.30 |
| | | Total cost price | 240.30 |

**(i)** Find the value of each of $p$, $q$, $r$ and $s$.

$p =$ .....

$q =$ .....

$r =$ .....

$s =$ ..... [4]

**(ii)** The shop sells all this fruit for a total of $325.

Calculate the percentage profit.

..... % [2]

**(b)** In 2022, the shop's total sales were $34 974.

**(i)** A pie chart is drawn to show the item types that make up these total sales.

**(a)** The sales for fruit were $9520.70 .

Calculate the angle representing fruit on the pie chart.

..... [2]

**(b)** The angle representing frozen food is 46°.

Calculate the sales for frozen food.

$ ..... [2]

**(ii)** The shop's total sales of $34 974 in 2022 were a 4.4% increase on the total sales in 2021.

Calculate the total sales in 2021.

$ ..... [2]

**2** **(a)** One chocolate bar costs $p$ cents and one packet of sweets costs 75 cents.
Tanish pays \$9.10 for 5 chocolate bars and 8 packets of sweets.

Form an equation and solve it to find the value of $p$.
Show your working.

$p =$ ..... [3]

**(b)** Factorise $6ac - 27c$.

..... [2]

**(c)** Write $\frac{3m^2n}{10} \times \frac{5n}{9m}$ as a single fraction in its simplest form.

..... [2]

**(d)** Rearrange the formula $y = \frac{3x^2}{5}$ to make $x$ the subject.

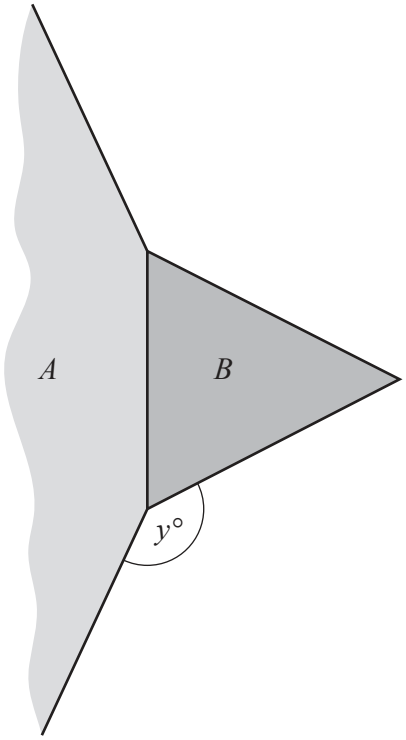
$x =$ ..... [2]

**(e)** A group of $k$ numbers has a mean of 56.8 .
The number 52 is added to the group.
The new mean is 56.5 .

Find the value of $k$.

$k =$ ..... [4]

**3 (a)**




NOT TO SCALE

The diagram shows the equilateral triangle $B$ and part of the regular polygon $A$ which have a common side.
The interior angle of polygon $A$ is 165°.

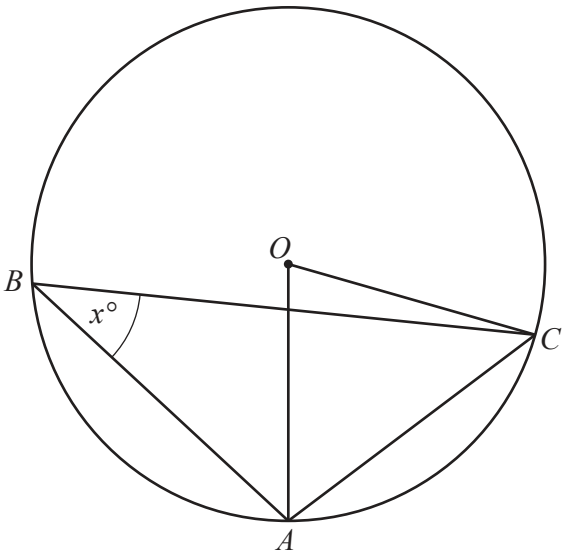
**(i)** Find the value of $y$.

$y =$ ..... [1]

**(ii)** Calculate the number of sides of polygon $A$.

..... [2]

**(b)**




NOT TO SCALE

$A$, $B$ and $C$ are points on the circumference of a circle, centre $O$.
Angle $ABC = x°$.

**(i)** Show that angle $OAC = (90 - x)°$.
Give reasons for your answer.

.....

.....

..... [3]

**(ii)** Angle $BAO = 54°$ and angle $OCB = 11°$.

Find the value of $x$.

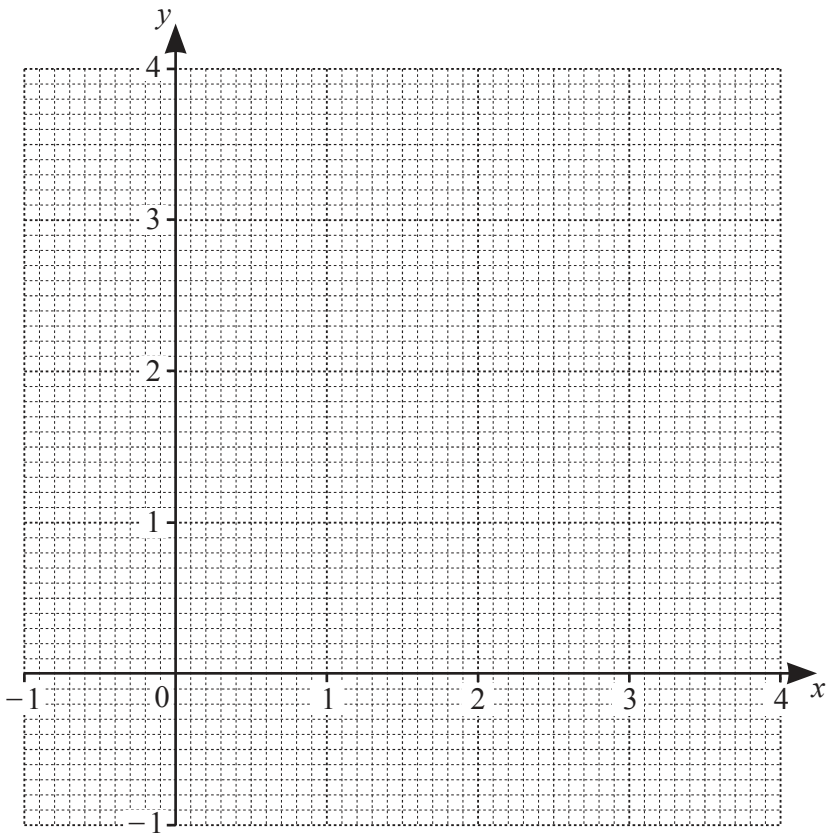
$x =$ ..... [2]

**4** **(a)** Complete the table of values for $y = \frac{2^x}{5}$.

| $x$ | $-1$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| $y$ | 0.1 | 0.2 | 0.4 | 0.8 | 1.6 | |

[1]

**(b)** Draw the graph of $y = \frac{2^x}{5}$ for $-1 \leqslant x \leqslant 4$.




[3]

**(c)** By drawing a suitable line on the grid, solve $2^x = 6$.

$x =$ ..... [2]

**(d) (i)** Complete the table of values for $4y = 2x + 1$.

| $x$ | $-1$ | 2 | 4 |
|---|---|---|---|
| $y$ | | | 2.25 |

[1]

**(ii)** On the grid on page 8, draw the graph of $4y = 2x + 1$ for $-1 \leqslant x \leqslant 4$. [1]

**(iii)** Find the $x$-coordinates of the points where the line $4y = 2x + 1$ crosses the graph of $y = \frac{2^x}{5}$.

$x =$ ..... and $x =$ ..... [1]

**(iv)** The $x$-coordinates in **part (d)(iii)** are the solutions of the equation $A \times 2^x + Bx + C = 0$, where $A$, $B$ and $C$ are all integers.

Use the equations $4y = 2x + 1$ and $y = \frac{2^x}{5}$ to find the exact value of each of $A$, $B$ and $C$.

$A =$ .....

$B =$ .....

$C =$ ..... [3]

**5** **(a)** The table shows the population and area of three countries in 2019.

| Country | Population | Area ($km^2$) |
|---|---|---|
| Sri Lanka | $2.18\times10^7$ | $6.56\times10^4$ |
| South Korea | $5.17\times10^7$ | $1.00\times10^5$ |
| Pakistan | $2.17\times10^8$ | $8.82\times10^5$ |

**(i)** Write down the value of the smallest population.

..... [1]

**(ii)** Find the difference in area between Sri Lanka and Pakistan.
Give your answer in standard form.

..... $km^2$ [1]

**(iii)** The population density of a country is the number of people per square kilometre.

Find the value of the largest population density from these countries.

..... people/$km^2$ [2]

**(b)** In standard form, $A = 8.6\times10^n$ and $B = 1.5\times10^{n-1}$.

Giving your answer in standard form, find in terms of $n$

**(i)** $A - B$

..... [1]

**(ii)** $A \times B$.

..... [2]

**6** Sophia takes part in the Trio Challenge.
She walks, then cycles and then swims.

| Trio Challenge |
| --- |
| Walk 6.3 km |
| Cycle 3000 m |
| Swim 1800 m |

**(a)** Write these distances walk : cycle : swim as a ratio in its simplest form.

..... : ..... : ..... [2]

**(b)** Sophia walks at an average speed of 1.4 m/s.
She completes the walk at 11 05.

Find the time she starts walking.

..... [3]

**(c)** Sophia cycles a distance of 3000 m correct to the nearest 10 metres.
She cycles this distance in a time of 450 seconds correct to the nearest 10 seconds.

Calculate the upper bound for her average cycling speed in metres per second.

..... m/s [3]

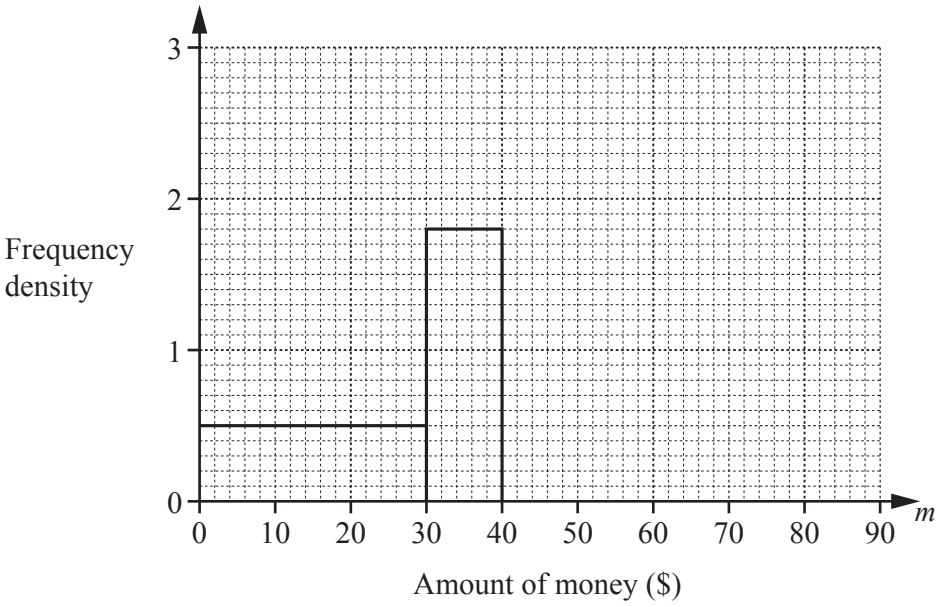


**[Turn over**

**7** **(a)** On Monday, the amount of money spent on a website by each customer was recorded. The table shows the results.

| Amount of money ($\$m$) | $0 < m \leqslant 30$ | $30 < m \leqslant 40$ | $40 < m \leqslant 50$ | $50 < m \leqslant 60$ | $60 < m \leqslant 90$ |
|---|---|---|---|---|---|
| Frequency | $p$ | 18 | 24 | 19 | 24 |

The histogram shows some of the results.




**(i)** Find the value of $p$.

$p =$ ..... [1]

**(ii)** Complete the histogram. [3]

**(iii)** One of these customers is selected at random to receive a discount voucher.

Calculate the probability that this customer spent more than \$50 on Monday.

..... [1]

**(b)** The table shows the amount of money spent on a website by each customer on Tuesday.

| Amount of money ($\$m$) | $0 < m \leqslant 30$ | $30 < m \leqslant 40$ | $40 < m \leqslant 50$ | $50 < m \leqslant 60$ | $60 < m \leqslant 90$ |
|---|---|---|---|---|---|
| Frequency | 22 | 16 | 24 | 19 | 14 |

**(i)** Calculate an estimate of the mean.

$ ..... [3]

**(ii)** An error was made and one of the sales on Tuesday was not included in the table.
That customer spent $41.
Tristan says:

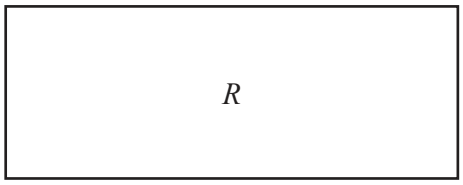
> If that value had been included in the table, then the **estimated** mean would have been higher.

Without calculation, explain why he is correct.

.....

..... [1]

**8 (a)**




NOT TO SCALE

The length of the rectangle $R$ is twice its width.
Rectangle $R$ has a perimeter of 20.4 cm.

**(i)** Find the length and width of the rectangle $R$.

length = ..... cm

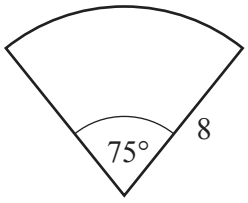
width = ..... cm [2]

**(ii)** Rectangle $S$ is mathematically similar to rectangle $R$.
Rectangle $S$ has a perimeter of 30.6 cm.

Calculate the length of rectangle $S$.

length = ..... cm [2]

**(b)**



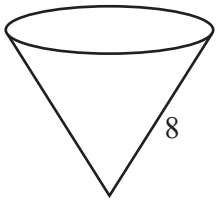

NOT TO SCALE

A piece of card is a sector of a circle with sector angle 75° and radius 8 cm.

**(i)** Find an expression, in terms of $\pi$, for the arc length of the sector.
Give your answer in its simplest form.

..... cm [2]

**(ii)** **[Volume of a cone $= \frac{1}{3}\pi r^2 h$]**

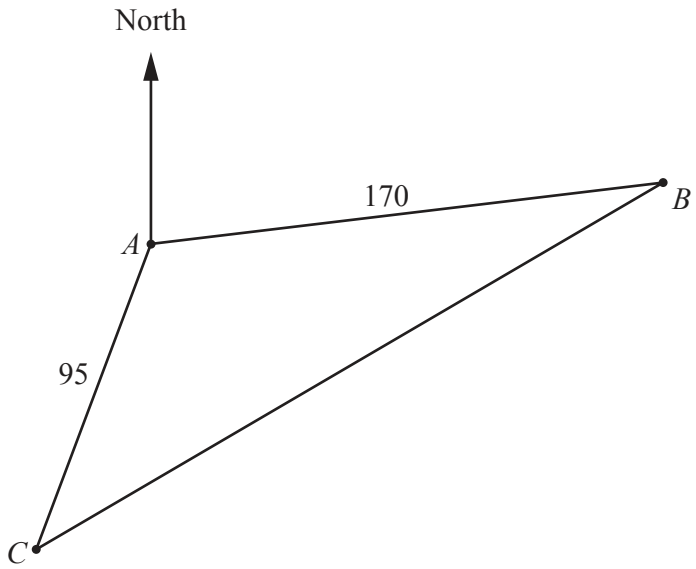



The piece of card forms the curved surface area of a cone.
The cone is filled to the top with water.

Calculate the volume of water in the cone.

..... $cm^3$ [5]

**9**




NOT TO SCALE

$A$, $B$ and $C$ are points on horizontal ground.
The bearing of $B$ from $A$ is 072°.
The bearing of $C$ from $A$ is 205°.
$AB = 170$ m and $AC = 95$ m.

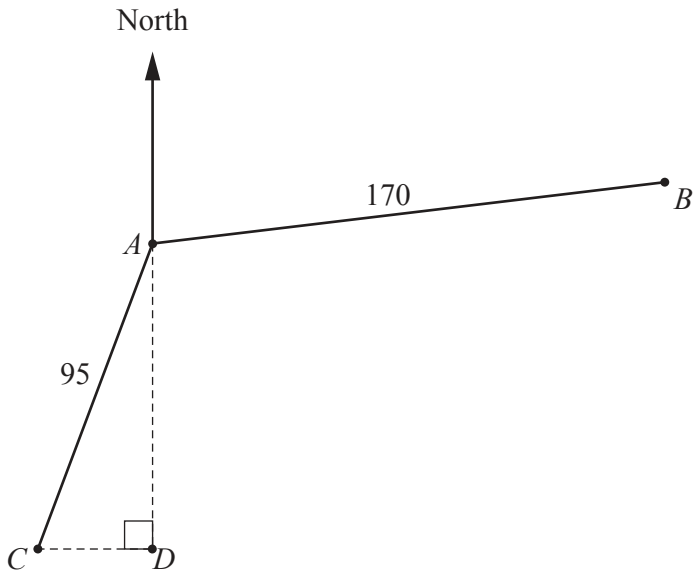
**(a)** Calculate $BC$.

..... m [4]

**(b)** Find the bearing of $A$ from $C$.

..... [2]

**(c)**




NOT TO SCALE

The point $D$ lies on the horizontal ground, due south of $A$ and due east of $C$.

**(i)** Show that $AD = 86.1$ m, correct to 1 decimal place.

[2]

**(ii)** A point $X$ is at the top of a vertical mast at $A$.
The angle of elevation of $X$ from $B$ is 7°.

Calculate the angle of elevation of $X$ from $D$.

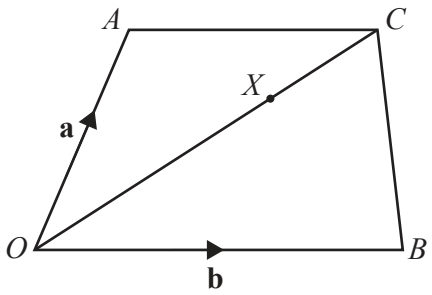
..... [4]

**10** **(a)** $F$ is the point $(6, 1)$ , $G$ is the point $(-2, 4)$ and $\overrightarrow{GH} = \begin{pmatrix} -1 \\ -8 \end{pmatrix}$.

Calculate $\left|\overrightarrow{FH}\right|$.

$\left|\overrightarrow{FH}\right| =$ ..... [3]

**(b)**




NOT TO SCALE

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{AC} = k\mathbf{b}$.
$X$ is the point on $OC$ such that $OX = mOC$.

**(i)** Write $\overrightarrow{OX}$ in terms of $m$, $k$, **a** and **b**.

$\overrightarrow{OX} =$ ..... [2]

**(ii)** $\overrightarrow{BX} = \frac{3}{5}\mathbf{a} - \frac{1}{2}\mathbf{b}$

Find the value of $k$.

$k =$ ..... [3]

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