Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

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 π, 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.

[Turn over

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.

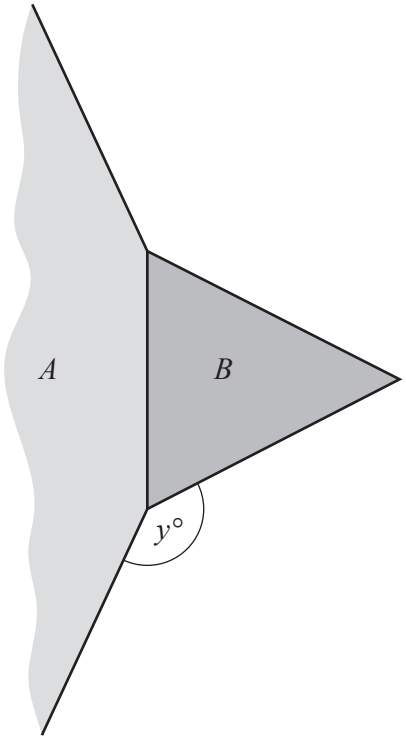
$x =$ ..... [2]

(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°.

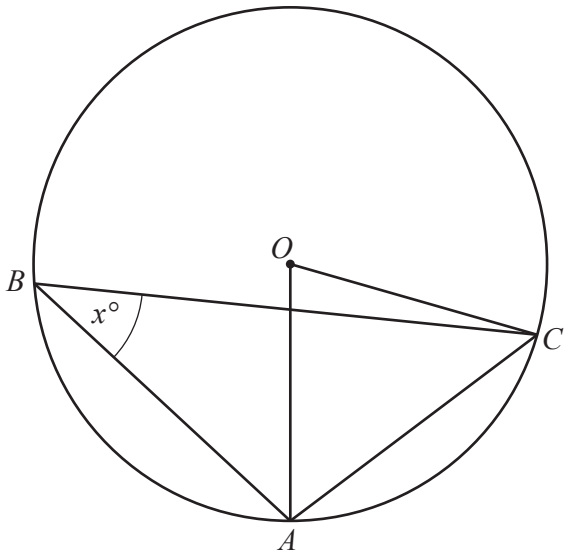
(i) Find the value of y.

$y =$ ..... [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.

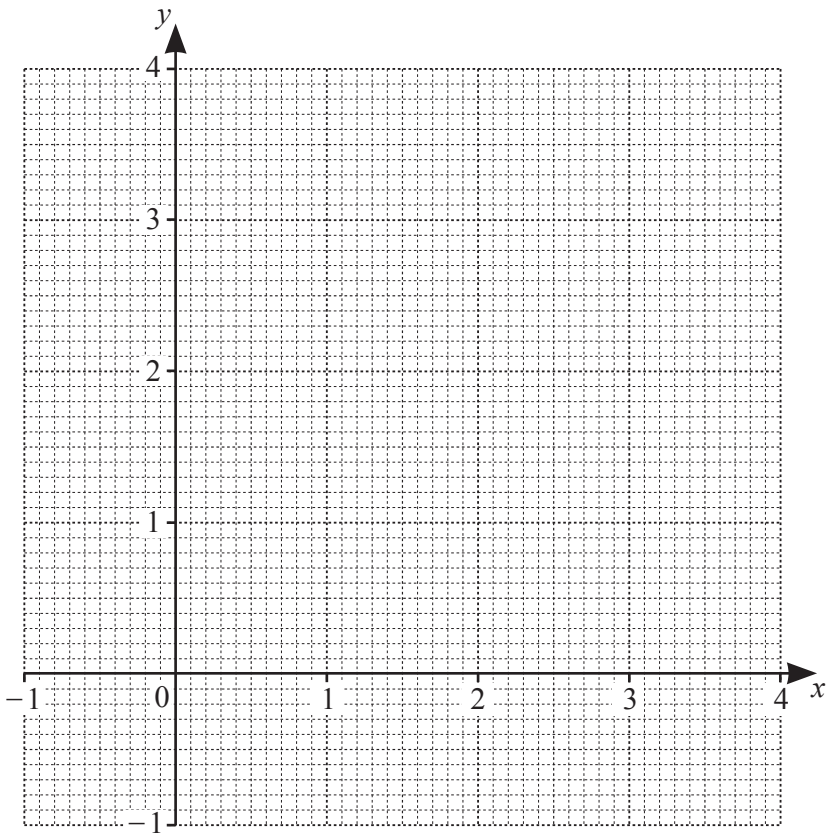
$x =$ ..... [2]

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]

[Turn over

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

Country	Population	Area (km^2)
Sri Lanka	2.18×10^7	6.56×10^4
South Korea	5.17×10^7	1.00×10^5
Pakistan	2.17×10^8	8.82×10^5

(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.

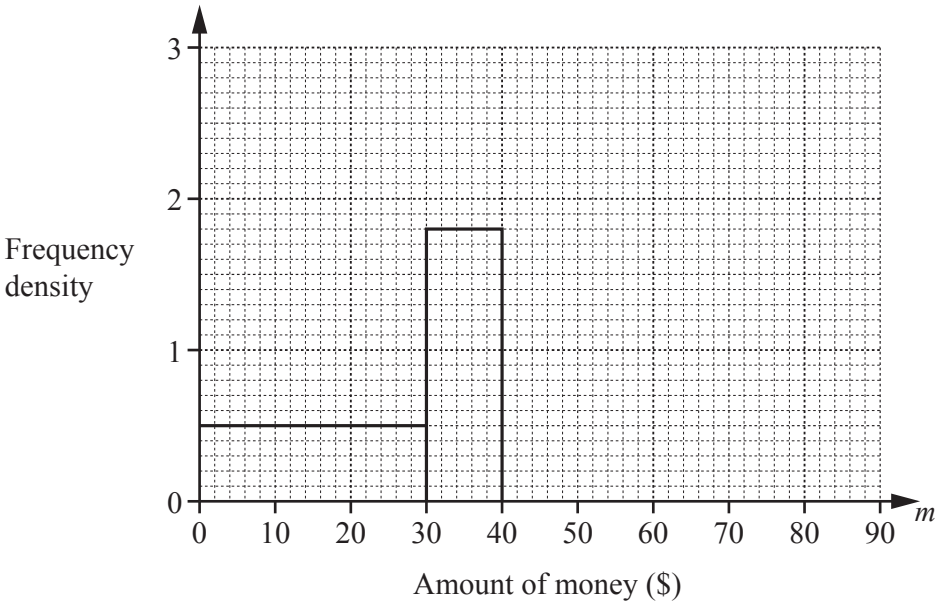
Calculate the upper bound for her average cycling speed in metres per second.

..... m/s [3]

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:

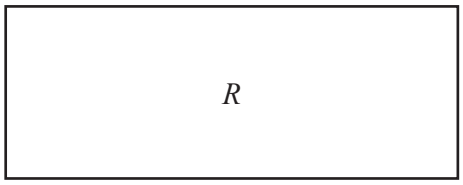
> If that value had been included in the table, then the **estimated** mean would have been higher.

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

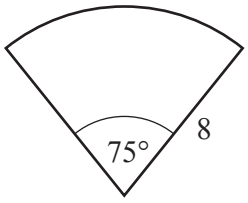
width = ... cm [2]

(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)



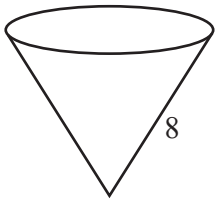
NOT TO SCALE

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 π, for the arc length of the sector.
Give your answer in its simplest form.

..... cm [2]

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

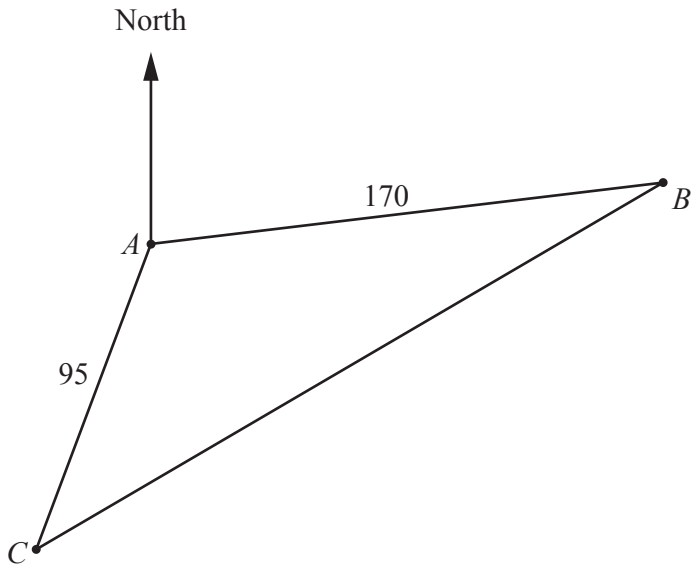


The piece of card forms the curved surface area of a cone.
The cone is filled to the top with water.

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.

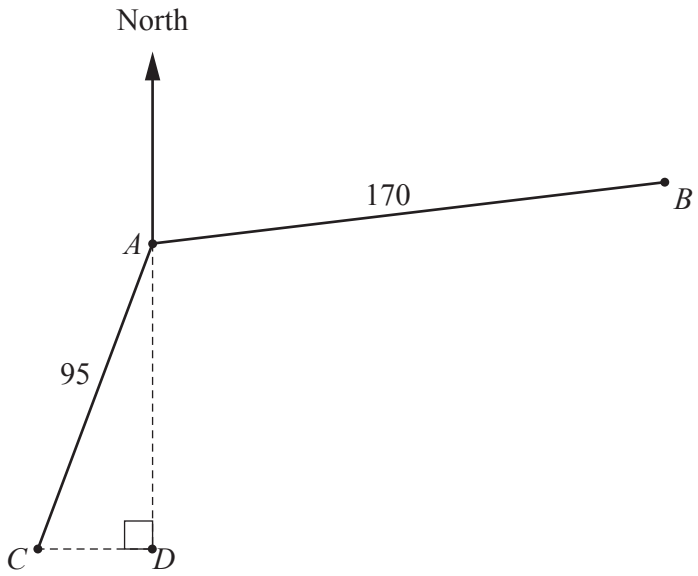
(a) Calculate BC.

..... 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.

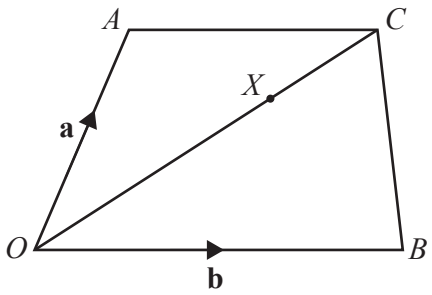
..... [4]

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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