



Cambridge O Level

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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.

- 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 .

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots$$

$$r = \dots\dots\dots$$

$$s = \dots\dots\dots [4]$$

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

Calculate the percentage profit.

$$\dots\dots\dots \% [2]$$

(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.

$$p = \dots\dots\dots [3]$$

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

$$\dots\dots\dots [2]$$

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

$$\dots\dots\dots [2]$$

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

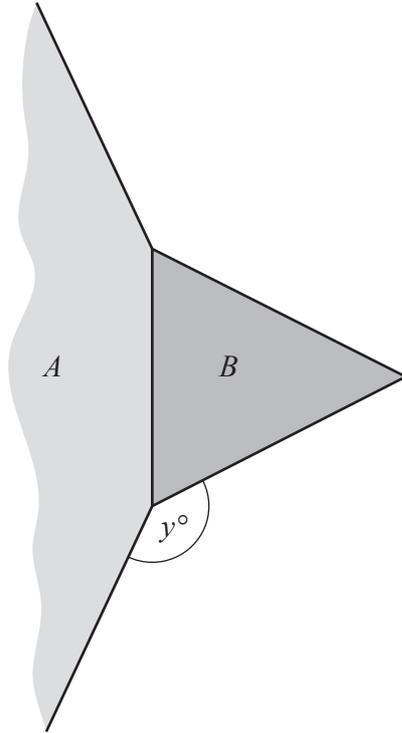
$$x = \dots\dots\dots [2]$$

- (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 .

$k = \dots\dots\dots$ [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° .

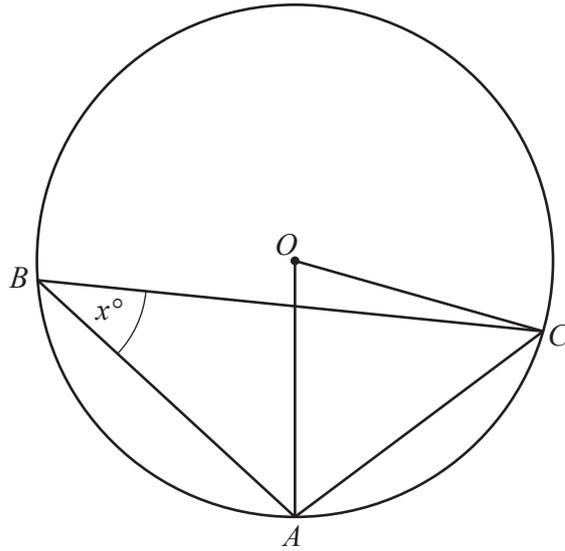
(i) Find the value of y .

$y = \dots\dots\dots$ [1]

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

$\dots\dots\dots$ [2]

(b)

NOT TO
SCALE

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

- (i) Show that angle $OAC = (90 - x)^\circ$.
Give reasons for your answer.

.....

 [3]

- (ii) Angle $BAO = 54^\circ$ and angle $OCB = 11^\circ$.

Find the value of x .

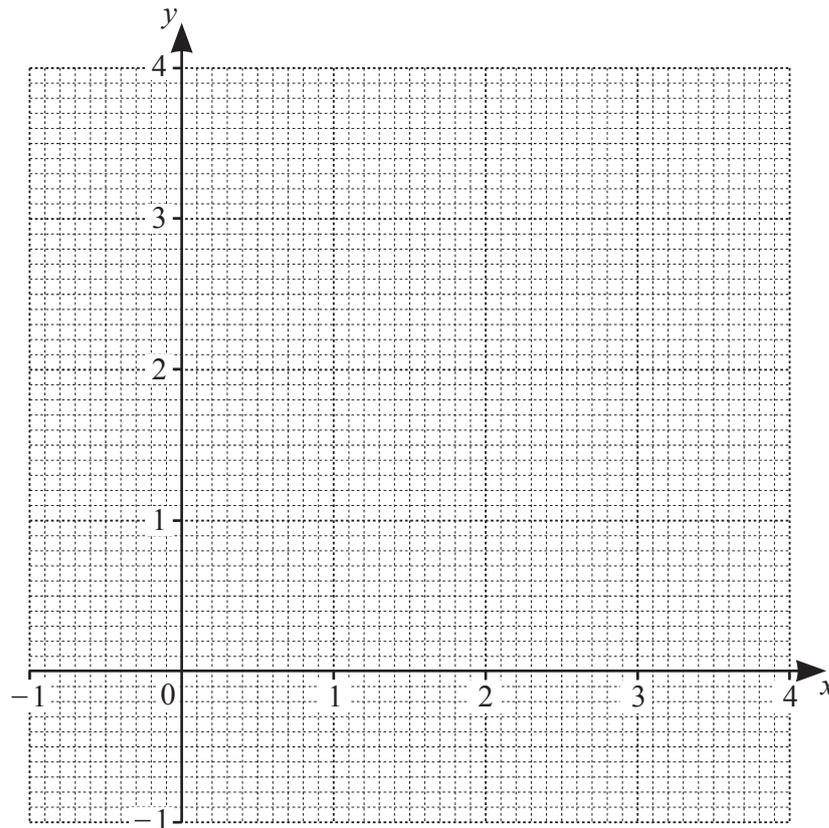
$x =$ [2]

- 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 $-1 \leq x \leq 4$.



[3]

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

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

$x = \dots\dots\dots$ and $x = \dots\dots\dots$ [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 .

$A = \dots\dots\dots$

$B = \dots\dots\dots$

$C = \dots\dots\dots$ [3]

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.

..... km² [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/km² [2]

(b) In standard form, $A = 8.6 \times 10^n$ and $B = 1.5 \times 10^{n-1}$.

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.

<u>Trio Challenge</u>
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.

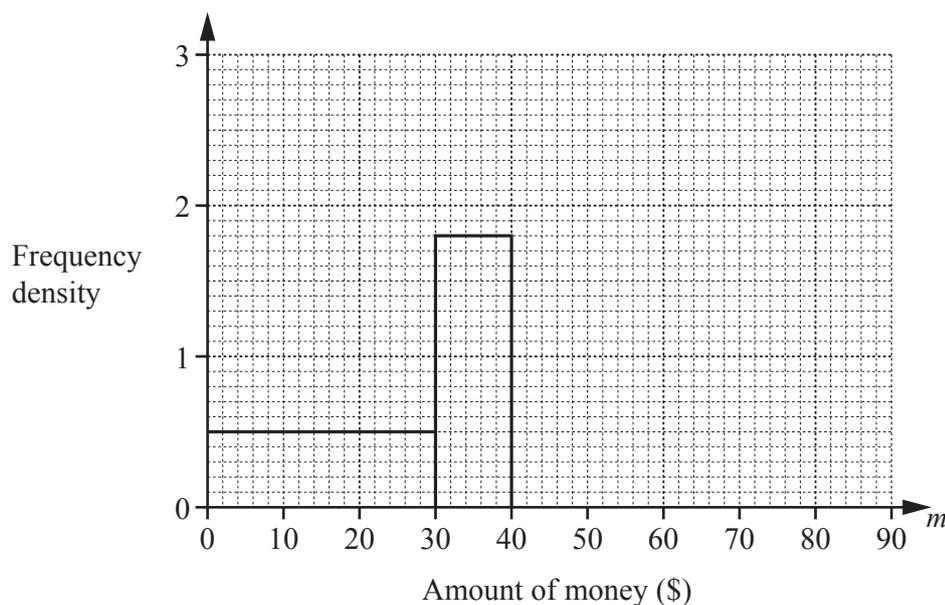
Calculate the upper bound for her average cycling speed in metres per second.

..... 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)	$0 < m \leq 30$	$30 < m \leq 40$	$40 < m \leq 50$	$50 < m \leq 60$	$60 < m \leq 90$
Frequency	p	18	24	19	24

The histogram shows some of the results.



- (i) Find the value of p .

$p = \dots\dots\dots$ [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.

$\dots\dots\dots$ [1]

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

Amount of money (\$ m)	$0 < m \leq 30$	$30 < m \leq 40$	$40 < m \leq 50$	$50 < m \leq 60$	$60 < m \leq 90$
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:

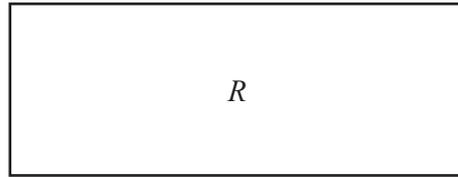
If that value had been included in the table, then the **estimated** mean would have been higher.

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

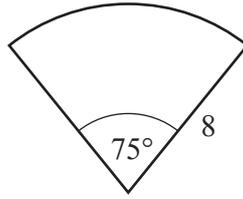
width = cm [2]

(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)

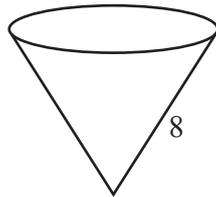
NOT TO
SCALE

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]

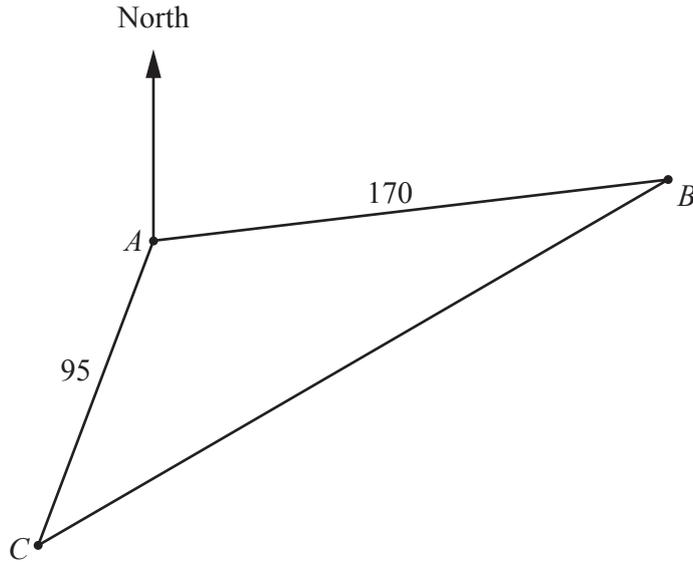
- (ii) [Volume of a cone = $\frac{1}{3}\pi r^2 h$]



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.

..... cm³ [5]



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.

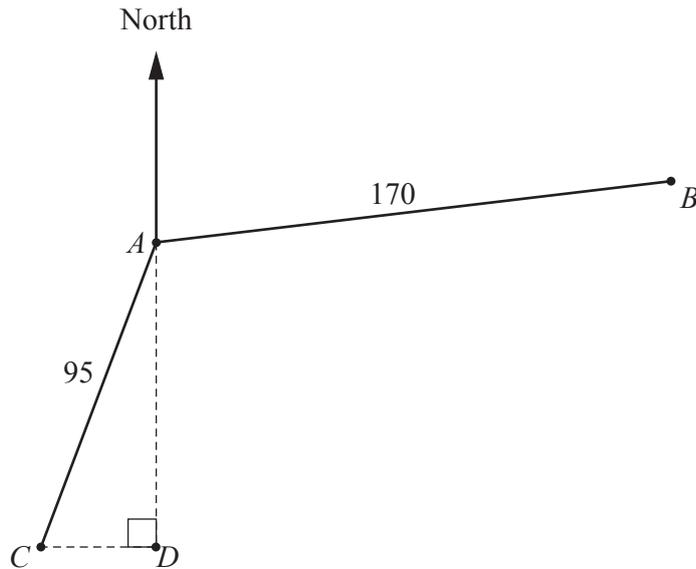
(a) Calculate BC .

..... 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° .

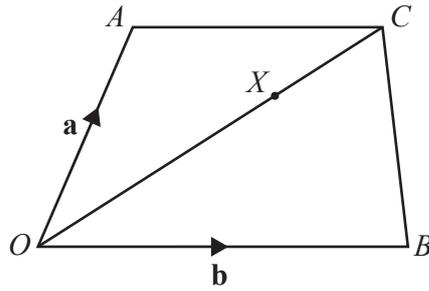
Calculate the angle of elevation of X from D .

..... [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 $|\overrightarrow{FH}|$.

$$|\overrightarrow{FH}| = \dots\dots\dots [3]$$

(b)

NOT TO
SCALE

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

(i) Write \vec{OX} in terms of m , k , \mathbf{a} and \mathbf{b} .

$$\vec{OX} = \dots\dots\dots [2]$$

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

Find the value of k .

$$k = \dots\dots\dots [3]$$

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