Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1965518351

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **October/November 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.

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1 **(a)** The population of a town is 36 400.
23% of the population are aged 18 and under.

Work out the number of people in the town aged over 18.

..... [2]

(b) In a village, the ratio of the ages of the population is under 18 : 18 to 60 : over 60 = 4 : 11 : 5 .
There are 890 people aged over 60.

Work out the total number of people in the village aged 60 and under.

..... [2]

(c) In 2015, the population of a city was 702 800.

(i) In 2020, the population was 678 202.

Calculate the percentage decrease in the population from 2015 to 2020.

.....% [2]

(ii) The population of the city increased by 12% between 1980 and 2015.

Calculate the population of the city in 1980.

..... [2]

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(d) The table shows the population and area of some countries.

Country	Population	Area in km^2
Bangladesh	1.63×10^8	148 000
Bahrain	1.54×10^6	760
Maldives	3.92×10^5	298
Lebanon	5.30×10^6	10 400

(i) Work out how many more people live in Bahrain than in Maldives.
Give your answer in standard form.

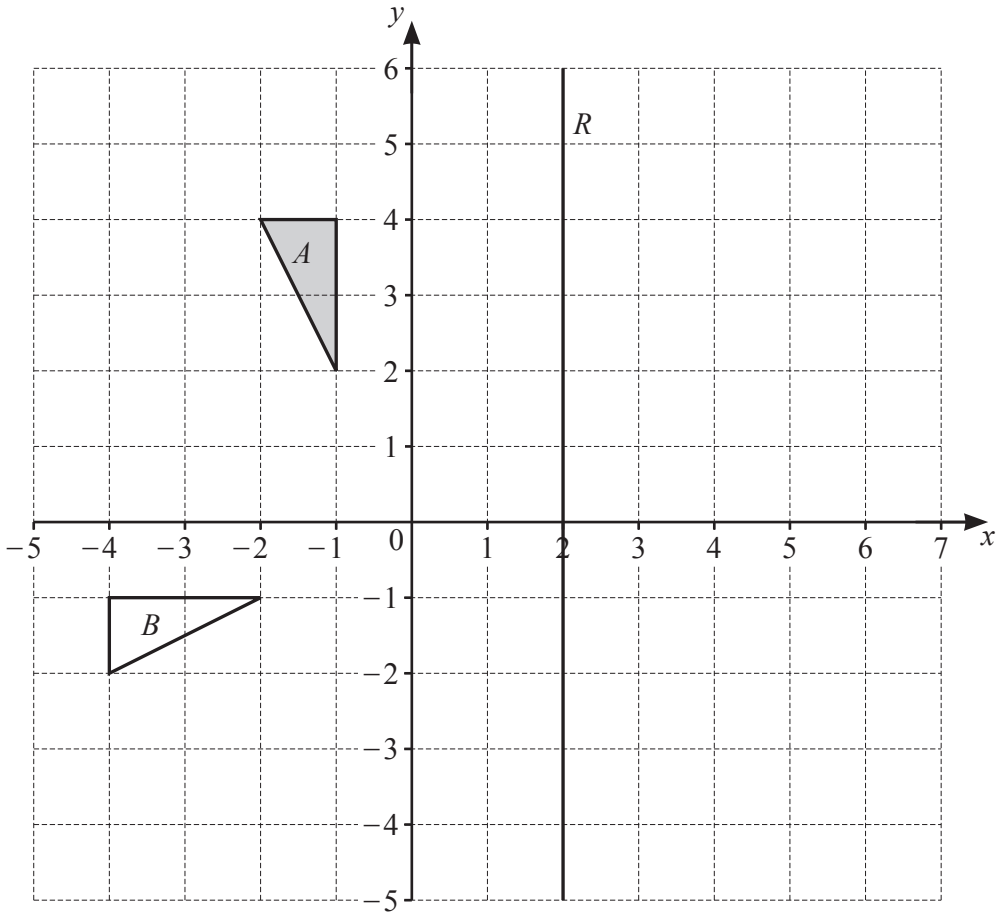
..... [1]

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

Which of these countries has the highest population density?
Show how you decide.

..... [3]

2



Triangle A, triangle B and line R are drawn on the grid.

(a) (i) Write down the equation of line R.

..... [1]

(ii) Draw the image of triangle A after a reflection in line R. [1]

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

.....

..... [3]

3 **(a)** The equation of line L is $4y = x - 5$.

(i) Find the gradient of line L.

..... [1]

(ii) Find the coordinates of the point where line L crosses the y-axis.

(..... , ...) [1]

(b) A is the point (4, 5) and B is the point (−2, 8).

(i) Find the length of line AB.

..... [2]

(ii) Find the equation of line AB.
Give your answer in the form $y = mx + c$.

$y =$ ..... [3]

4 **(a)** These are the first five terms of a sequence.

5 12 19 26 33

(i) Find the next term of the sequence.

..... [1]

(ii) Find an expression for the nth term of the sequence.

..... [2]

(iii) T_k and T_{k+1} are consecutive terms of the sequence.
The sum of these two terms is 703.

Find the value of k.

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

(b) An expression for the nth term of a different sequence is $n^2 + an + b$.
The 1st term of the sequence is 3.
The 3rd term of the sequence is 19.

Find the 6th term of the sequence.

..... [5]

5 **(a)** This is part of a bus timetable.

Town square	0630	0650	0710	0735	0745
Railway station	0648	0708	0728	0753	0803
Business park	0716	0736	0756	0821	0831
Airport	0735	0755	0815	0840	0850

(i) Work out how long the bus takes to get from the town square to the business park.

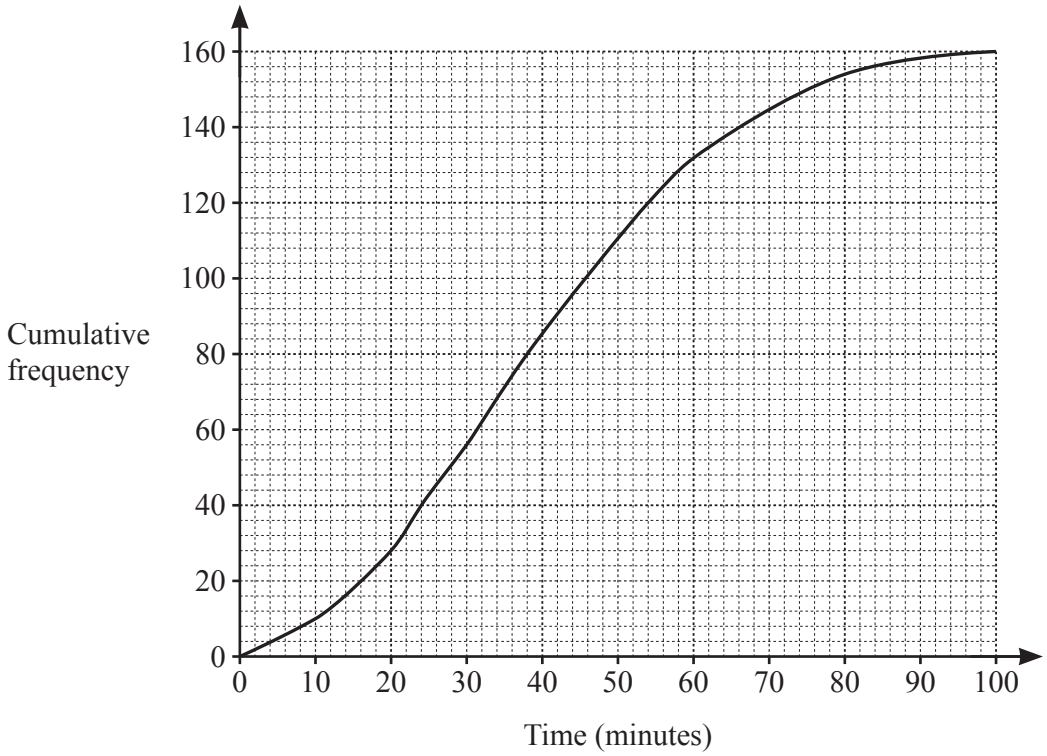
..... minutes [1]

(ii) Tom arrives at the railway station at 0712.
He gets on the next bus to the airport.

Find the time he arrives at the airport.

..... [1]

(b) 160 workers at the business park are asked the time taken, in minutes, for their journey to work.
The results are shown in the cumulative frequency diagram.



Use the diagram to estimate

(i) the number of workers whose journey took less than 30 minutes

..... [1]

(ii) the interquartile range

..... minutes [2]

(iii) the percentage of workers whose journey took longer than 1 hour.

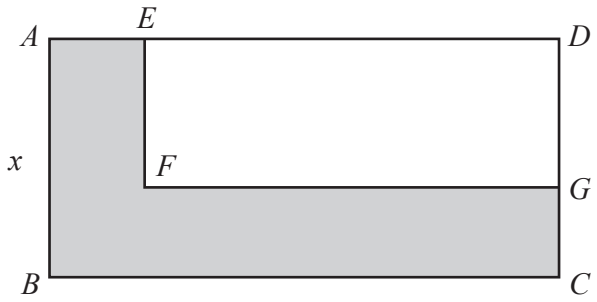
..... % [3]

(c) Chen's journey to work is a distance of 37 km, correct to the nearest kilometre.
His journey on Monday takes 43 minutes, correct to the nearest minute.

Calculate the lower bound of the average speed for this journey.
Give your answer in kilometres per hour.

..... km/h [3]

6



NOT TO SCALE

$ABCD$ is a rectangle with area $30\,\text{cm}^2$.
$AB = x$ cm.

Rectangle $DEFG$ is removed from the corner of rectangle $ABCD$.
$AE = CG = 2\,\text{cm}$.

(a) Write down an expression for BC in terms of x.

..... [1]

(b) Show that the shaded area, $y\,\text{cm}^2$, is given by

$$y = 2x + \frac{60}{x} - 4.$$

[3]

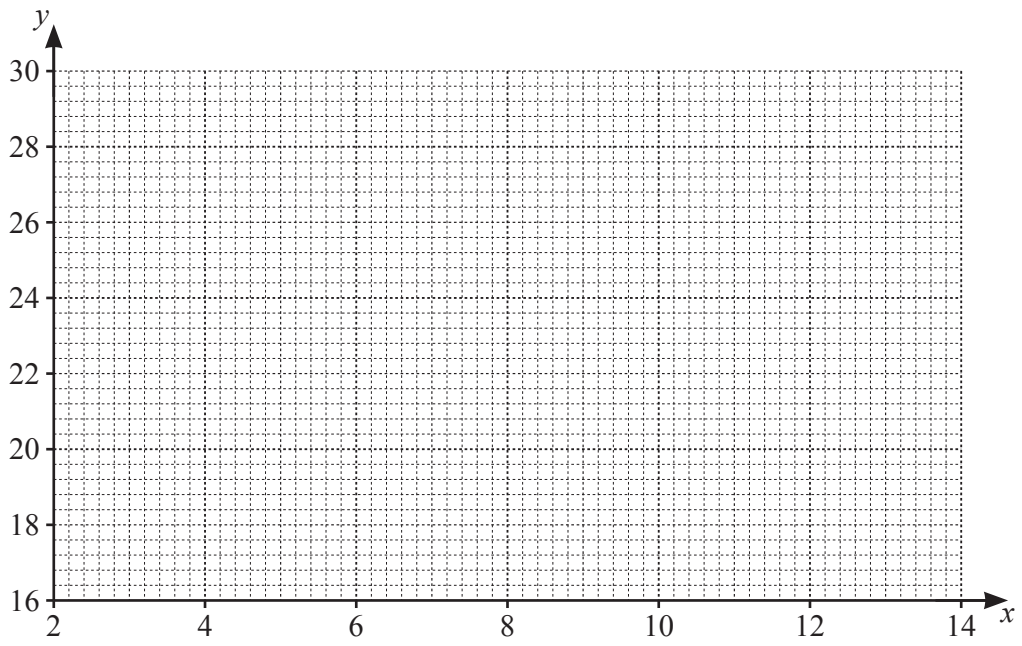
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(c) Complete the table for $y = 2x + \frac{60}{x} - 4$.
Write your answer correct to 1 decimal place.

x	2	3	4	6	8	10	12	14
y	30	22	19	18	19.5	22	25	

[1]

(d) Draw the graph of $y = 2x + \frac{60}{x} - 4$ for $2 \leqslant x \leqslant 14$.



[3]

(e) The shaded area is $24\,\text{cm}^2$.
The length of AB is less than the length of BC.

Use your graph to find the dimensions of rectangle $ABCD$.

..... cm by ..... cm [2]

7 **(a)** Simplify.

$7a - 4b - 2a + b$

..... [2]

(b) Expand and simplify.

$3(2x - 3) + 5(x + 2)$

..... [2]

(c) Solve.

$6x^2 - 2x - 9 = 0$

Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [3]

(d) Write as a single fraction in its simplest form.

(i) $\frac{x}{4} \div \frac{2}{y}$

..... [1]

(ii) $\frac{3}{x-5} - \frac{7}{2x+1}$

..... [3]

8 **(a)** A group of 40 children are each asked how many books they read last month.
The table shows the results.

Number of books	0	1	2	3	4	5
Frequency	7	11	9	5	6	2

(i) Write down the mode.

..... [1]

(ii) Find the median.

..... [1]

(iii) Calculate the mean.

..... [2]

(iv) One of the 40 children is chosen at random.

Find the probability that this child read 4 or more books.
Give your answer as a fraction in its simplest form.

..... [2]

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(b) There are 10 books on a shelf.
7 of the books are fiction and 3 are non-fiction.

(i) Sanjay takes a book from the shelf at random, looks at it and replaces it.
He then takes another book from the shelf at random, looks at it and replaces it.

Find the probability that one book is fiction and the other book is non-fiction.

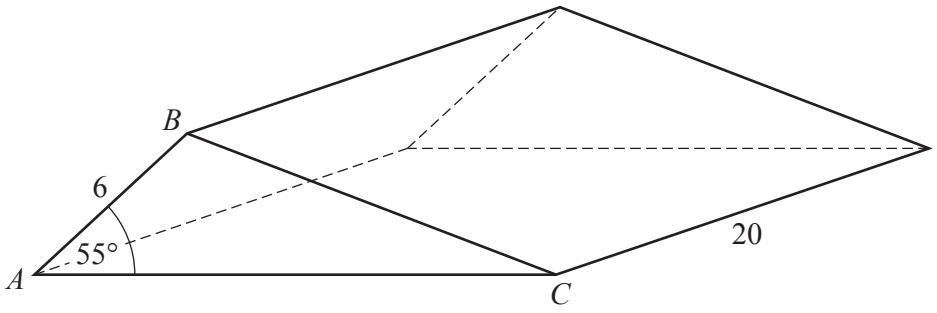
..... [2]

(ii) Mona takes 3 books from the 10 books on the shelf at random without replacement.

Find the probability that only one of the books she takes is fiction.

..... [3]

9 (a)



The diagram shows a triangular prism.
$AB = 6\,\text{cm}$, angle $BAC = 55°$ and the length of the prism is 20 cm.
The area of triangle ABC is $34.4\,\text{cm}^2$.

(i) Calculate the volume of the prism.
Give the units of your answer.

.... [2]

(ii) Show that $AC = 14.0\,\text{cm}$, correct to 3 significant figures.

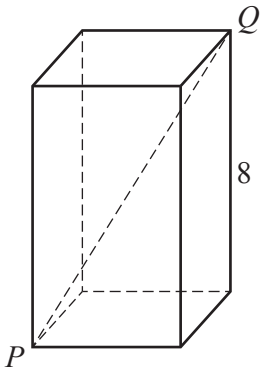
[3]

(iii) Calculate the surface area of the prism.

..... cm^2 [5]

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(b)

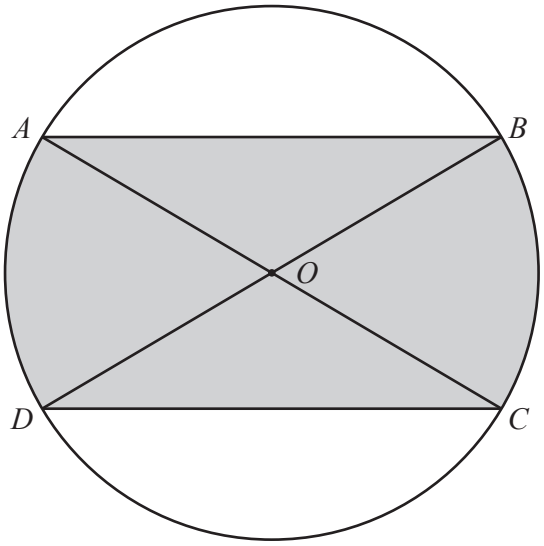


The diagram shows a cuboid with a square base.
The height of the cuboid is 8 cm.
The volume of the cuboid is 98 cm^3.

Calculate PQ.

..... cm [4]

10



NOT TO SCALE

The diagram shows a circle, centre O, with diameters AC and BD.

(a) Show that triangle OAB is congruent to triangle ODC.
Give a reason for each statement you make.

.....

.....

.....

..... [3]

(b) The diameter of the circle is 10 cm and $AB = 9$ cm.

Calculate the difference between the circumference of the circle and the perimeter of the shaded shape.

..... cm [5]

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