Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

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

Paper 2 **October/November 2020**

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. Blank pages are indicated.

[Turn over

1 **(a)** Here is some information about a holiday.

7-night holiday $340 per person 8% discount if you book before 31 March

On 15 February, Naseem books this holiday for 2 people.

Calculate the total cost of his holiday.

$ ..... [2]

(b) Naseem hires a car for his holiday.
The total cost is $241.50 .
This cost includes 15% tax.

Calculate the cost of hiring the car excluding tax.

$ ..... [2]

(c) Naseem drives a total of 800 km on holiday.
He uses a total of 29.6 litres of fuel.

Calculate the average rate of fuel used in litres per 100 km.

..... litres per 100 km [2]

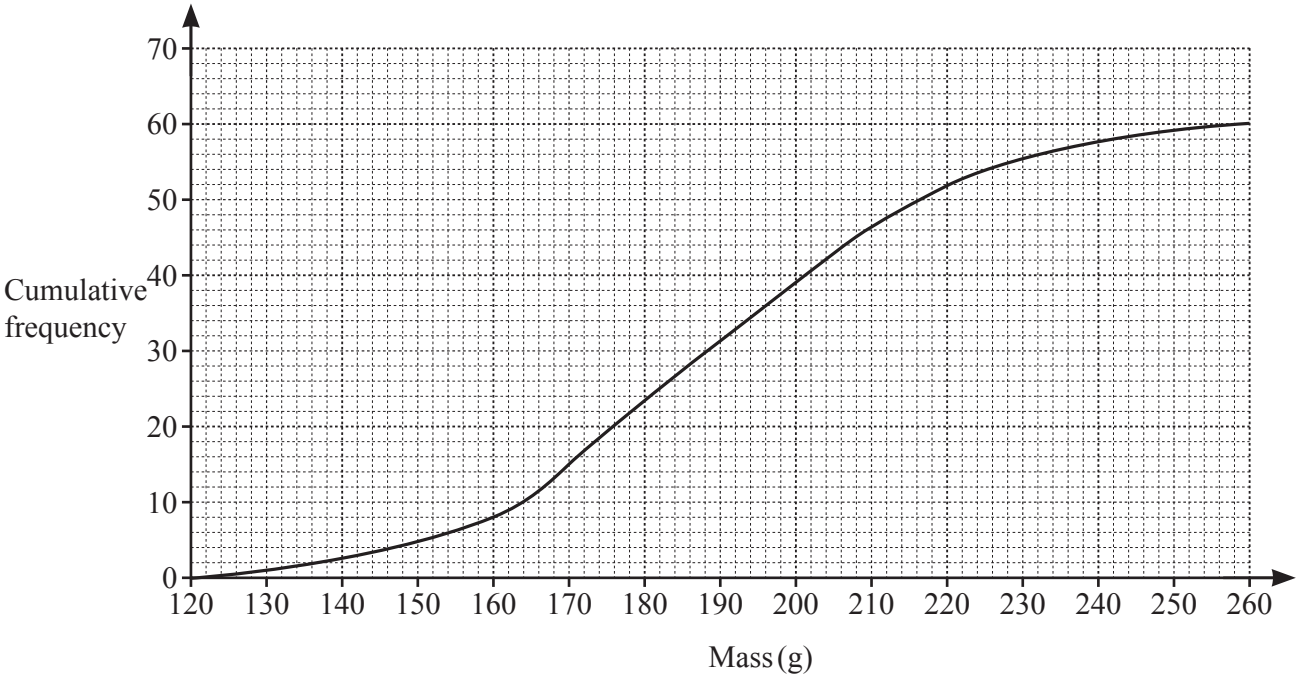
(d) Naseem changes $450 to euros (€) for his holiday.
The exchange rate between dollars and euros is $1 = €0.82 .
On holiday, he spends €297.

Naseem changes the remaining money back to dollars when he returns home.
The exchange rate is now $1 = €0.80 .

Work out how many dollars he receives.

$ ..... [3]

2 **(a)** The cumulative frequency diagram shows the masses, in grams, of 60 potatoes of variety A.



(i) Use the diagram to estimate

(a) the median,

..... g [1]

(b) the interquartile range.

..... g [2]

(ii) Potatoes with a mass greater than 220 g are sold as baking potatoes.

Find the percentage of the potatoes that are sold as baking potatoes.

.....% [3]

(iii) The masses of 60 potatoes of variety B are also measured.
For variety B, the median is 175 g and the interquartile range is 30 g.

Kali wants to buy potatoes that are more consistent in mass.

Should she choose variety A or variety B?
Explain how you decide.

Variety ..... because ..... [1]

(b) The table shows the masses, m grams, of 120 potatoes of variety C.

Mass (m g)	$80 \leqslant m < 100$	$100 \leqslant m < 120$	$120 \leqslant m < 130$	$130 \leqslant m < 140$	$140 \leqslant m < 200$
Frequency	10	15	42	36	17

Calculate an estimate of the mean mass.

..... g [3]

(c) A bag of potatoes has a mass of 2.5 kg, correct to the nearest 100 g.
Bags of potatoes are packed into a box.
The mass of the box is 600 g, correct to the nearest 10 g.

Calculate the upper bound of the total mass, in kilograms, of a box containing 10 of these bags of potatoes.

..... kg [3]

[Turn over

3 **(a)** In triangle PQR, $PR = 7.5\,\text{cm}$ and $QR = 6\,\text{cm}$.

(i) **Using a ruler and compasses only**, construct triangle PQR.
Line PQ has been drawn for you.

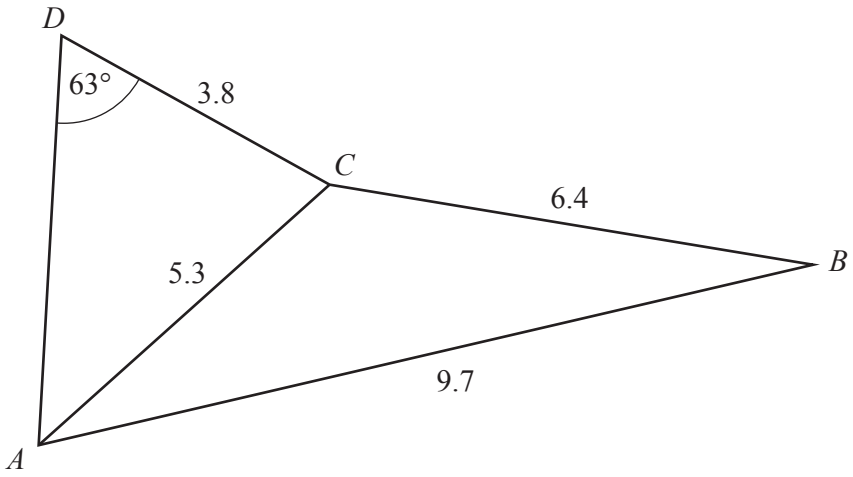
P Q

[2]

(ii) By taking suitable measurements from your triangle, calculate the area of triangle PQR.

..... cm^2 [2]

(b)



NOT TO SCALE

The diagram shows two triangles.
$AB = 9.7\,\text{cm}$, $BC = 6.4\,\text{cm}$, $CD = 3.8\,\text{cm}$ and $AC = 5.3\,\text{cm}$.
$A\hat{D}C = 63°$.

(i) Calculate $D\hat{A}C$.

$D\hat{A}C =$ ..... [3]

(ii) Calculate $A\hat{B}C$.

$A\hat{B}C =$ ..... [3]

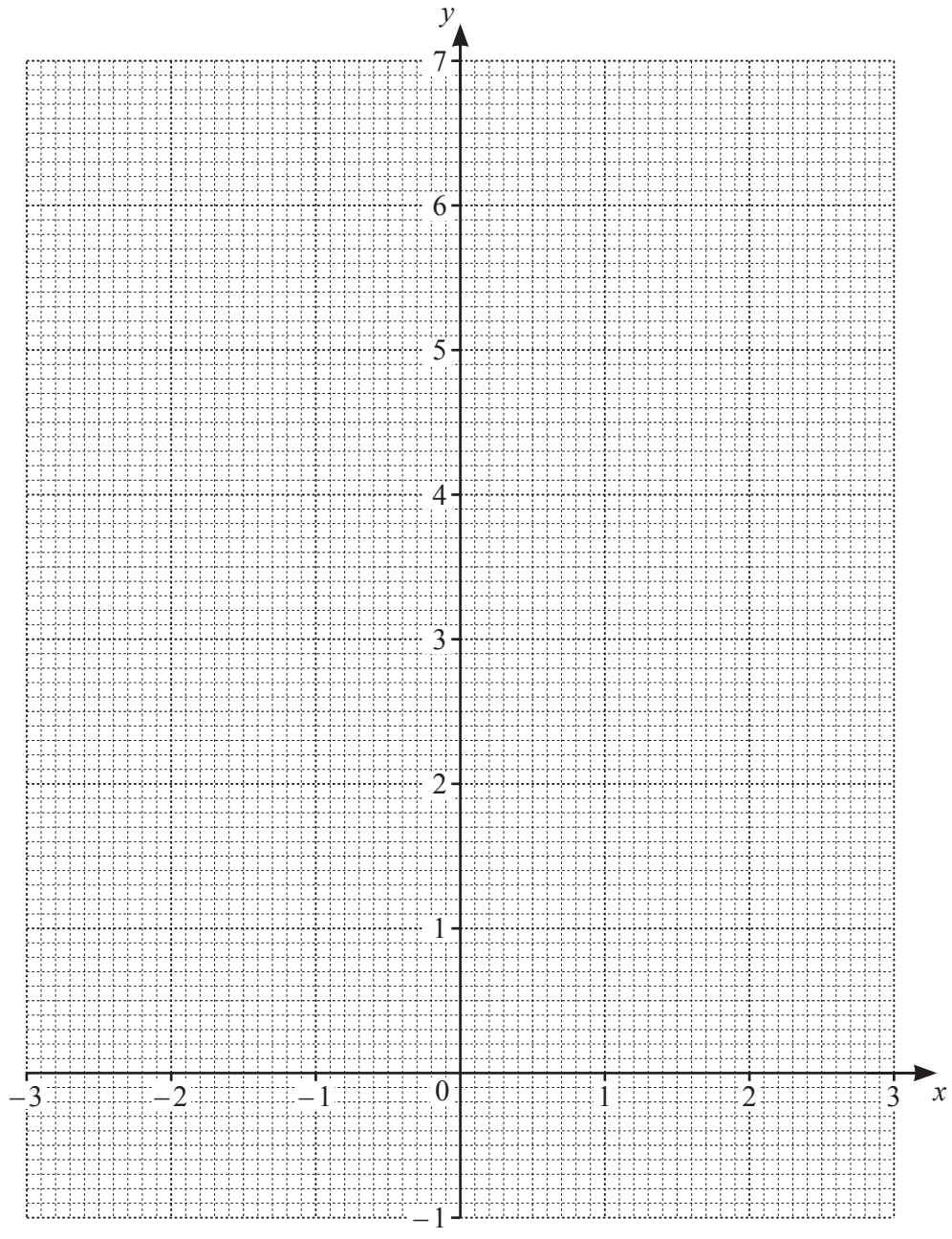
[Turn over

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

x	-3	-2	-1	0	1	2	3
y		0.2	0.4	0.8	1.6	3.2	6.4

[1]

(b) On the grid, draw the graph of $y = \frac{4}{5} \times 2^x$ for $-3 \leqslant x \leqslant 3$.



[3]

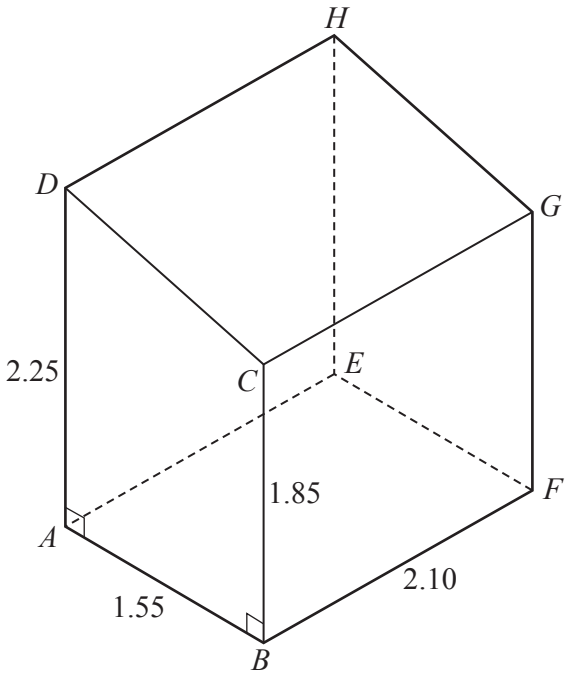
(c) By drawing a tangent, estimate the gradient of $y = \frac{4}{5} \times 2^x$ when $x = 2$.

..... [2]

(d) Use your graph to estimate the solution of the equation $4 \times 2^x = 5$.

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

5



The diagram shows a garden shed positioned on horizontal ground.
It is in the shape of a prism with trapezium $ABCD$ as its cross-section.
The base of the shed, $ABFE$, is a rectangle.
$AB = 1.55\,\text{m}$, $AD = 2.25\,\text{m}$, $BC = 1.85\,\text{m}$ and $BF = 2.10\,\text{m}$.

(a) Calculate the volume of the shed.

..... m^3 [3]

(b) The roof of the shed, *CGHD*, is painted.
1 litre of paint covers 2 square metres.

Calculate the amount of paint used.

..... litres [4]

(c) Calculate the angle of elevation of *D* from *F*.

..... [4]

6 **(a)** Solve the inequality $6x - 7 > 5 - 2x$.

..... [2]

(b) Chen buys 4 notebooks and 3 pens for \$17.50 .
Liu buys 2 notebooks and 5 pens for \$14.

Form a pair of simultaneous equations and solve them to find the cost of a notebook and the cost of a pen.
Show your working.

Notebook \$ .....

Pen \$ ..... [4]

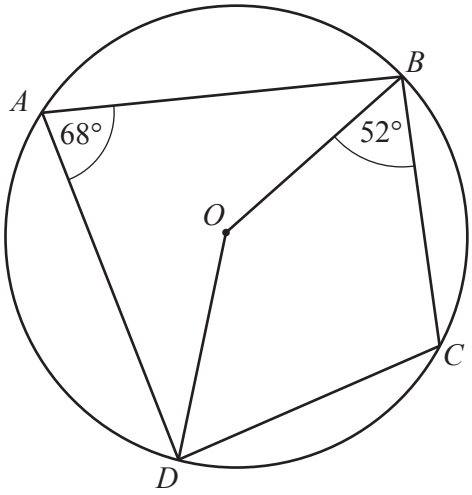
(c) (i) Show that $\frac{x}{x+2} - \frac{3}{x-5} = 4$ can be rearranged to $3x^2 - 4x - 34 = 0$.

[3]

(ii) Solve the equation $3x^2 - 4x - 34 = 0$.
Show your working and give your answers correct to 2 decimal places.

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

7 (a)



NOT TO SCALE

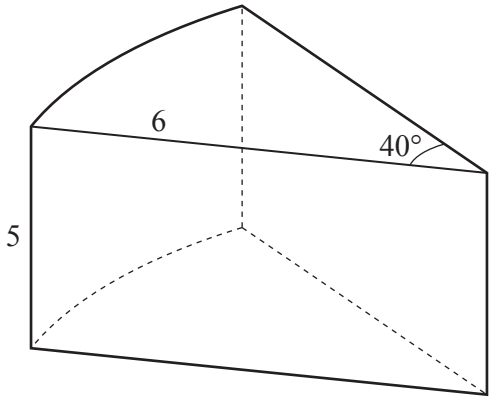
A, B, C and D are points on the circle, centre O.
$B\hat{A}D = 68°$ and $C\hat{B}O = 52°$.

Find $C\hat{D}O$.

$C\hat{D}O =$ ..... [3]

(b)

Solid *A*



The cross-section of solid *A* is the sector of a circle of radius 6 cm and angle 40°.
The height of solid *A* is 5 cm.

(i) Calculate the total surface area of solid *A*.

..... cm^2 [4]

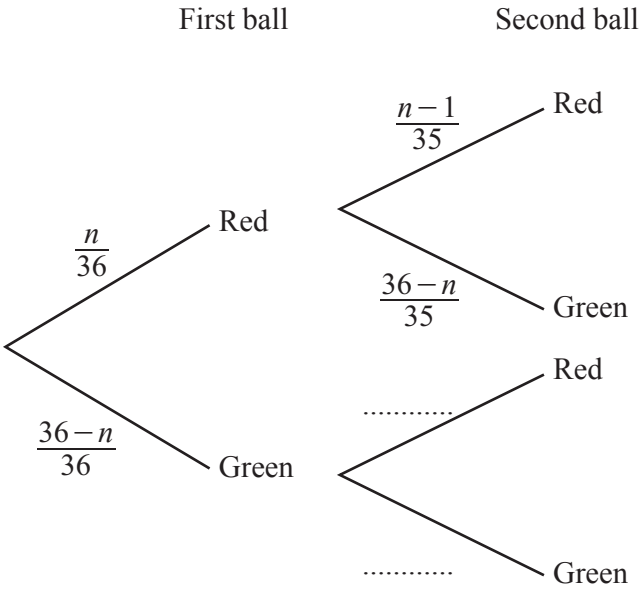
(ii) Solid *B* is mathematically similar to solid *A*.
The ratio volume of solid *A* : volume of solid *B* = 27 : 1.

Calculate the surface area of solid *B*.

..... cm^2 [2]

8 A bag contains 36 balls.
There are n red balls in the bag.
The rest of the balls are green.
Esther takes two balls from the bag, at random, without replacement.

(a) Complete the tree diagram.



[2]

(b) Write an expression, in terms of n, for the probability that Esther's first ball is red and her second ball is green.

..... [1]

(c) The probability that Esther's first ball is red and her second ball is green is $\frac{1}{7}$.

Show that $n^2 - 36n + 180 = 0$.

[2]

(d) Solve the equation $n^2 - 36n + 180 = 0$.
Show your working.

$n =$ ..... or $n =$ ..... [2]

(e) There are more green balls than red balls in the bag.

Find the probability that Esther takes two green balls.
Give your answer as a fraction in its lowest terms.

..... [3]

9 **(a)** H is the point (5, 2) and J is the point $(-3, 6)$.

(i) Find $\overrightarrow{HJ}$.

$\overrightarrow{HJ} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) Calculate the magnitude of $\overrightarrow{HJ}$.

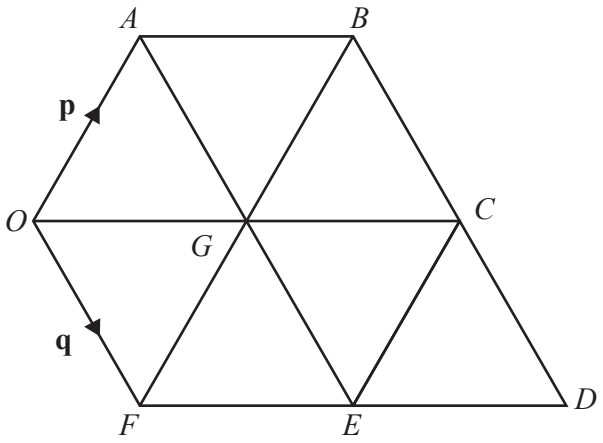
..... [2]

(iii) M is the midpoint of HJ.

Find the position vector of M.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(b)



The diagram shows a shape made from seven identical equilateral triangles.
$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OF} = \mathbf{q}$.

(i) Express, as simply as possible, in terms of **p** and/or **q**

(a) $\overrightarrow{FB}$,

$\overrightarrow{FB} =$ ..... [1]

(b) $\overrightarrow{FE}$.

$\overrightarrow{FE} =$ ..... [1]

(ii) X is a point on FB and $FX : XB = 3 : 1$.

Express $\overrightarrow{OX}$, as simply as possible, in terms of **p** and/or **q**.

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

(iii) Y is a point on BD.
Quadrilateral $OXYF$ is a trapezium.

Express $\overrightarrow{XY}$, as simply as possible, in terms of **p** and/or **q**.

$\overrightarrow{XY} =$ ..... [3]

Question 10 is printed on the next page.

[Turn over

10 $\mathrm{f}(x) = \dfrac{3-2x}{5}$ $\mathrm{g}(x) = \dfrac{x-7}{4}$

(a) Find $\mathrm{f}(-4)$.

..... [1]

(b) Find $\mathrm{f}^{-1}(x)$.

$\mathrm{f}^{-1}(x) =$ ..... [3]

(c) $\mathrm{g}(p) = \mathrm{f}(p+1)$

Find the value of p.

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