



Cambridge O Level

CANDIDATE
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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.

- 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]

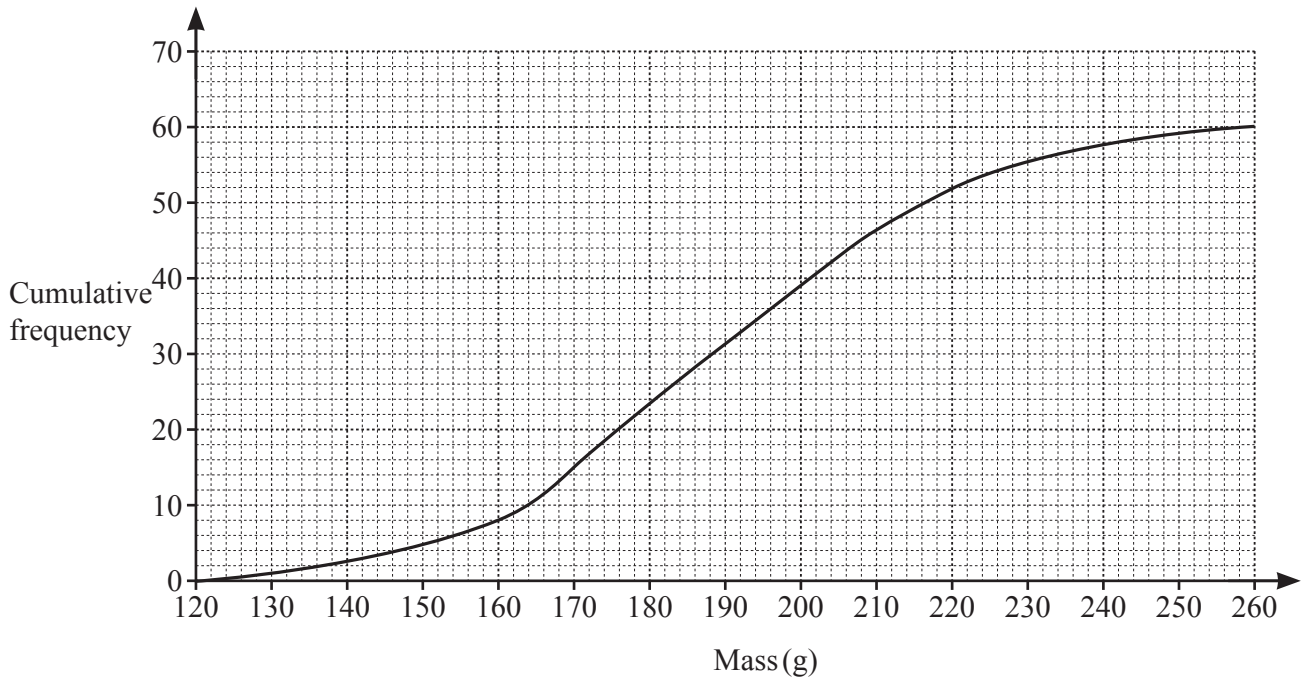
- (d) Naseem changes \$450 to euros (€) for his holiday.
The exchange rate between dollars and euros is $\$1 = \text{€}0.82$.
On holiday, he spends €297.

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

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)	$80 \leq m < 100$	$100 \leq m < 120$	$120 \leq m < 130$	$130 \leq m < 140$	$140 \leq m < 200$
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]

3 (a) In triangle PQR , $PR = 7.5$ cm and $QR = 6$ cm.

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

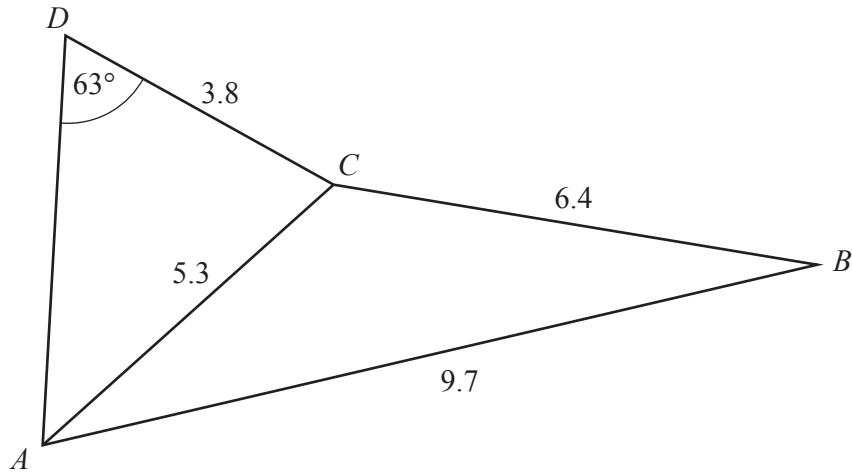


[2]

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

..... cm^2 [2]

(b)

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SCALE

The diagram shows two triangles.

$AB = 9.7$ cm, $BC = 6.4$ cm, $CD = 3.8$ cm and $AC = 5.3$ cm.

$\hat{ADC} = 63^\circ$.

(i) Calculate \hat{DAC} .

$\hat{DAC} = \dots\dots\dots$ [3]

(ii) Calculate \hat{ABC} .

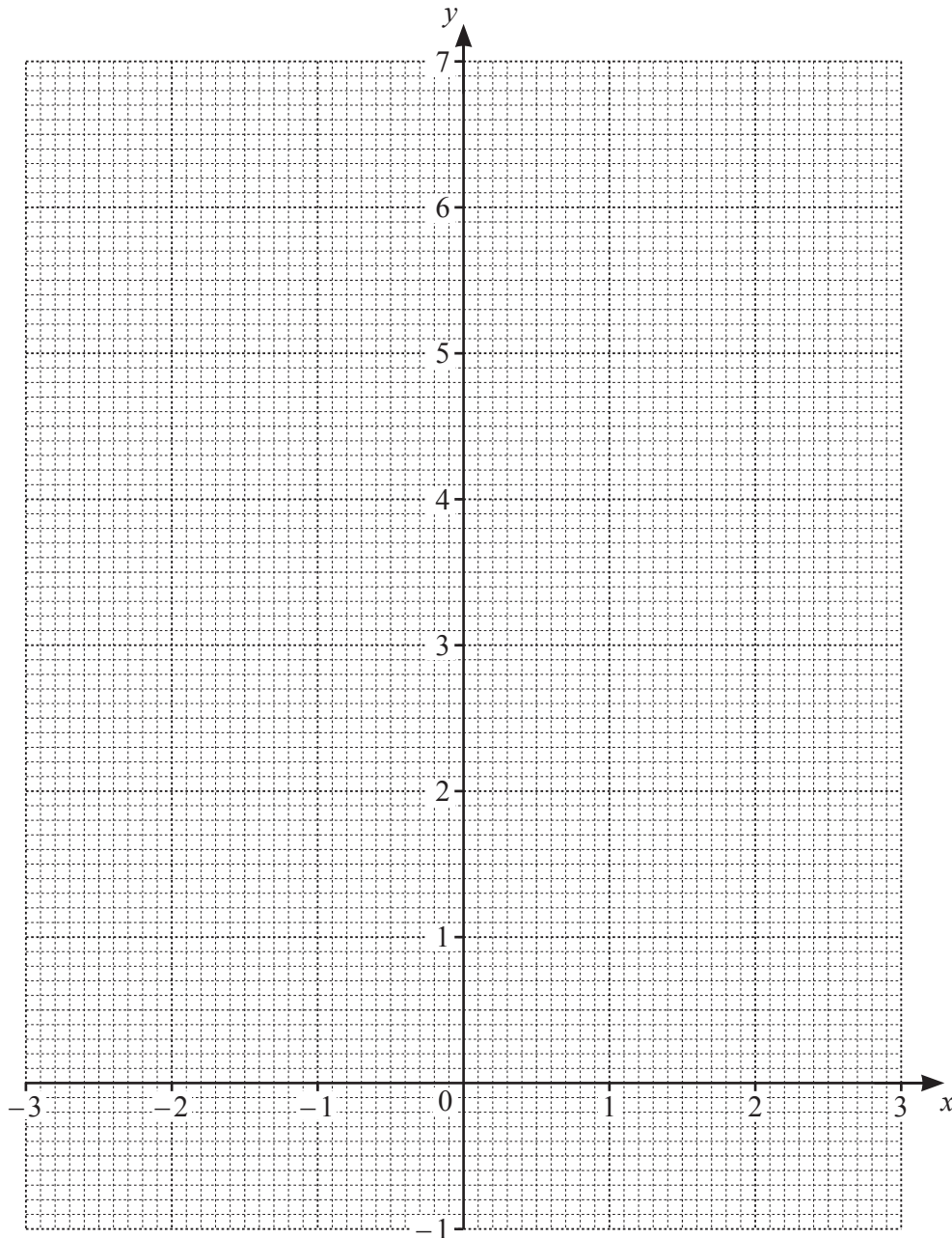
$\hat{ABC} = \dots\dots\dots$ [3]

- 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 $-3 \leq x \leq 3$.



[3]

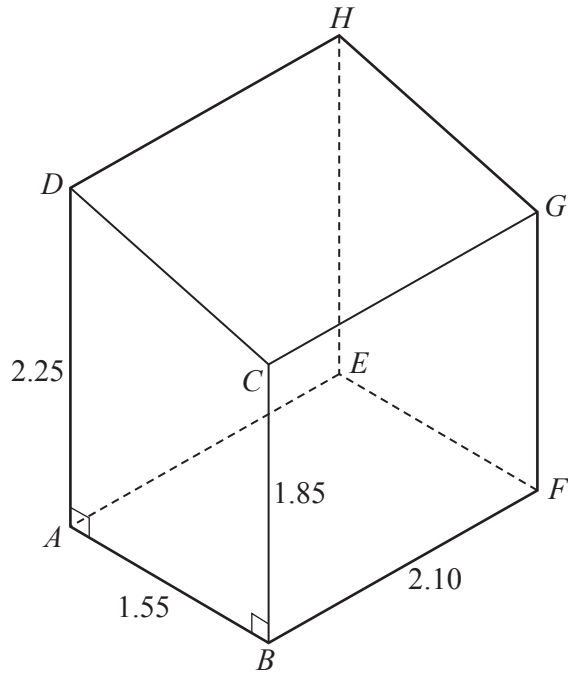
(c) By drawing a tangent, estimate the gradient of $y = \frac{4}{5} \times 2^x$ when $x = 2$.

..... [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. $AB = 1.55$ m, $AD = 2.25$ m, $BC = 1.85$ m and $BF = 2.10$ m.

(a) Calculate the volume of the shed.

..... m³ [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]

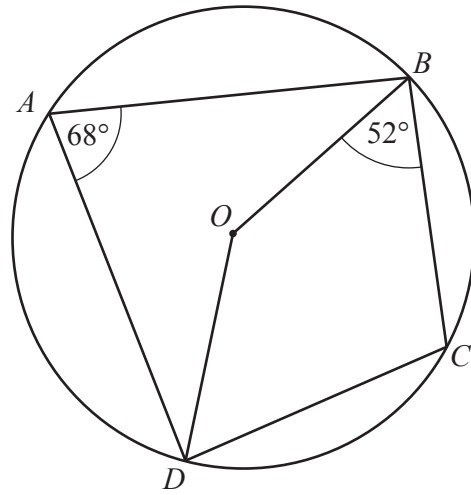
(c) (i) Show that $\frac{x}{x+2} - \frac{3}{x-5} = 4$ can be rearranged to $3x^2 - 4x - 34 = 0$.

[3]

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

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

7 (a)

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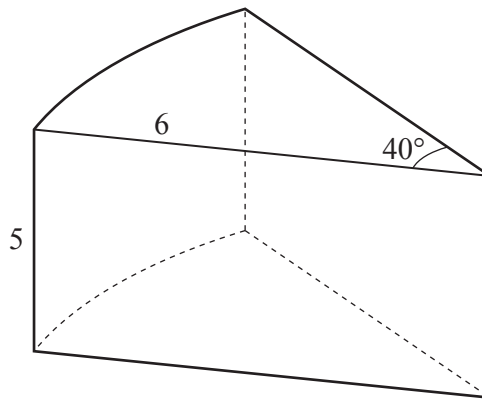
A, B, C and D are points on the circle, centre O .
 $\widehat{BAD} = 68^\circ$ and $\widehat{CBO} = 52^\circ$.

Find \widehat{CDO} .

$\widehat{CDO} = \dots\dots\dots [3]$

(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]

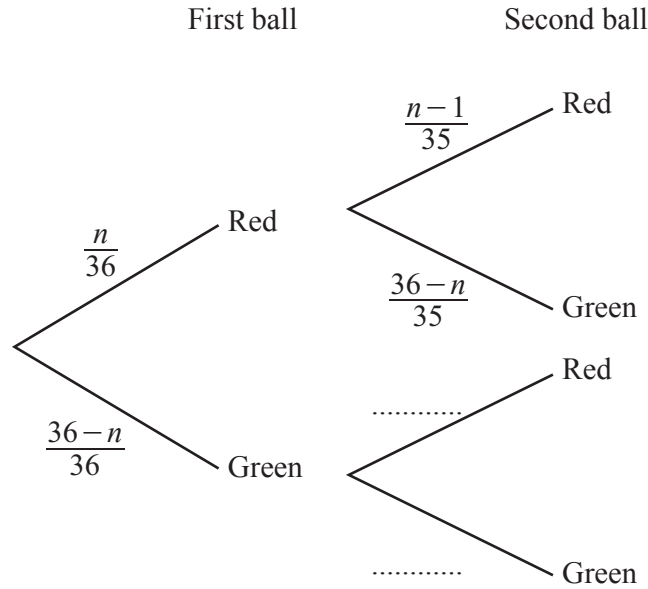
(ii) Solid *B* is mathematically similar to solid *A*.
The ratio volume of solid *A* : volume of solid *B* = 27 : 1.

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.

$n = \dots\dots\dots$ or $n = \dots\dots\dots$ [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.

$\dots\dots\dots$ [3]

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

(i) Find \vec{HJ} .

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

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

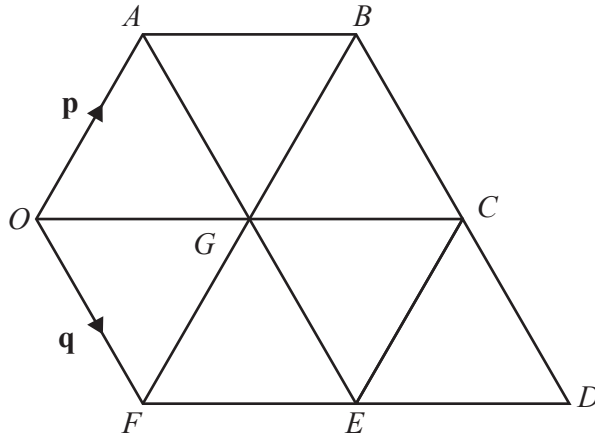
..... [2]

(iii) M is the midpoint of HJ .

Find the position vector of M .

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

(b)



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

(i) Express, as simply as possible, in terms of \mathbf{p} and/or \mathbf{q}

(a) \vec{FB} ,

$$\vec{FB} = \dots\dots\dots [1]$$

(b) \vec{FE} .

$$\vec{FE} = \dots\dots\dots [1]$$

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

Express \vec{OX} , as simply as possible, in terms of \mathbf{p} and/or \mathbf{q} .

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

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

Express \vec{XY} , as simply as possible, in terms of \mathbf{p} and/or \mathbf{q} .

$$\vec{XY} = \dots\dots\dots [3]$$

Question 10 is printed on the next page.

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

(a) Find $f(-4)$.

..... [1]

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

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

(c) $g(p) = f(p+1)$

Find the value of p .

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

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