Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3966107324

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

Paper 2 **October/November 2019**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

This document consists of **19** printed pages and **1** blank page.

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[Turn over

1 Neema travels on a business trip.

(a) The total cost of her flight is \$406 including tax.
The cost of the flight excluding tax is \$350.

Calculate the tax as a percentage of \$350.

..... % [2]

(b) Neema takes a suitcase with mass 15.5 kg, correct to the nearest 0.5 kg.
She also takes 6 packets each with mass 1.2 kg, correct to the nearest 0.1 kg.
She has a luggage limit of exactly 23 kg for the flight.

Can Neema be certain that the mass of her luggage is below the limit?
Show how you decide.

.....

..... [2]

(c) Neema changes \$245 to euros (€) for the trip.
The exchange rate is \$1 = €0.73.

On the trip she spends €124.
When she returns, she changes the remaining euros back to dollars at a rate of \$1 = €0.76 .

Calculate the amount of money she receives.
Give your answer correct to the nearest dollar.

\$ ..... [3]

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(d) On her next trip, Neema hires a car.
She drives a total of 657 km in the car.
The car uses fuel at a rate of 4.3 litres per 100 km driven.
Neema pays $1.29 per litre of fuel.

Calculate the amount she spends on fuel during the trip.

$ ..... [3]

(e) Neema stays in a hotel for 7 nights.
This is her hotel bill.

Item	Cost
7 nights at $..... per night	$805
4 dinners at $..... each	$.....
Total before tax	$.....
Total including tax at 6.5%	$996.84

Complete the missing values in the hotel bill. [4]

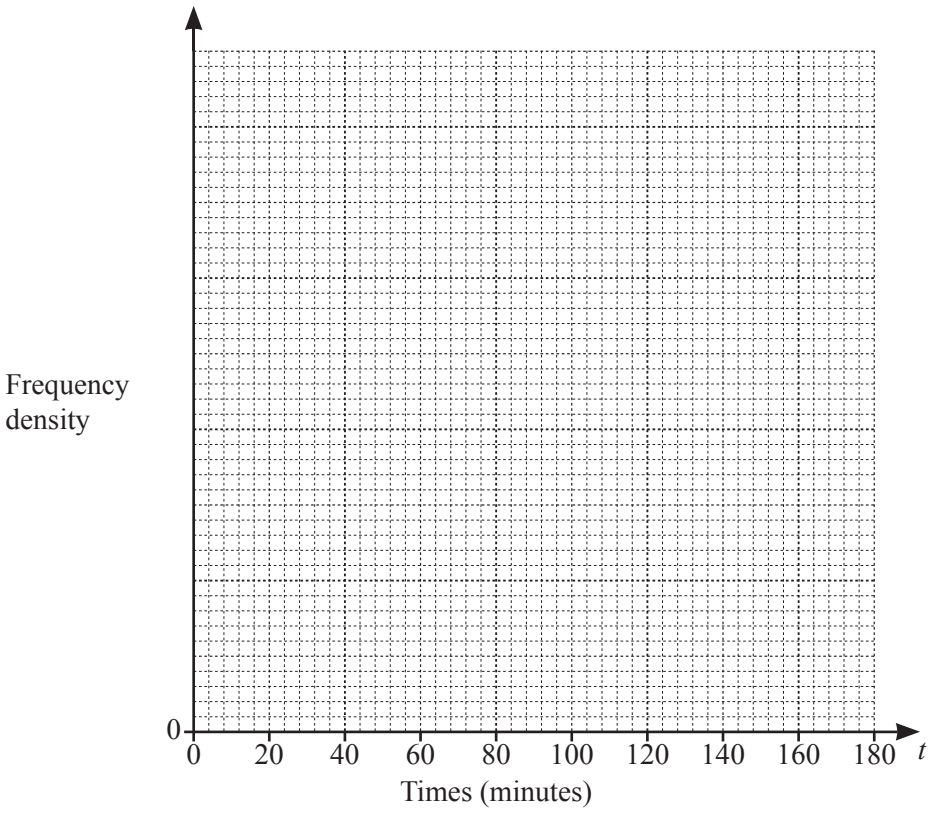
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[Turn over

2 **(a)** One afternoon, there were 200 visitors to a library.
The table summarises the time, in minutes, each visitor spent in the library.

Time (t minutes)	$0 < t \leqslant 20$	$20 < t \leqslant 40$	$40 < t \leqslant 60$	$60 < t \leqslant 90$	$90 < t \leqslant 180$
Frequency	26	76	56	24	18

(i) On the grid, draw a histogram to represent this data.



[3]

(ii) Work out the percentage of these visitors who spent more than 40 minutes in the library.

..... % [2]

(b) Mario recorded the number of books borrowed by each of the 200 visitors to the library. His results are shown in the table.

Number of books	0	1	2	3	4	5	6
Frequency	17	47	42	28	32	21	13

(i) Find the median.

..... [1]

(ii) Calculate the mean.

..... [2]

(iii) One of the visitors is selected at random.

Find the probability that this visitor borrowed more than 4 books.

..... [1]

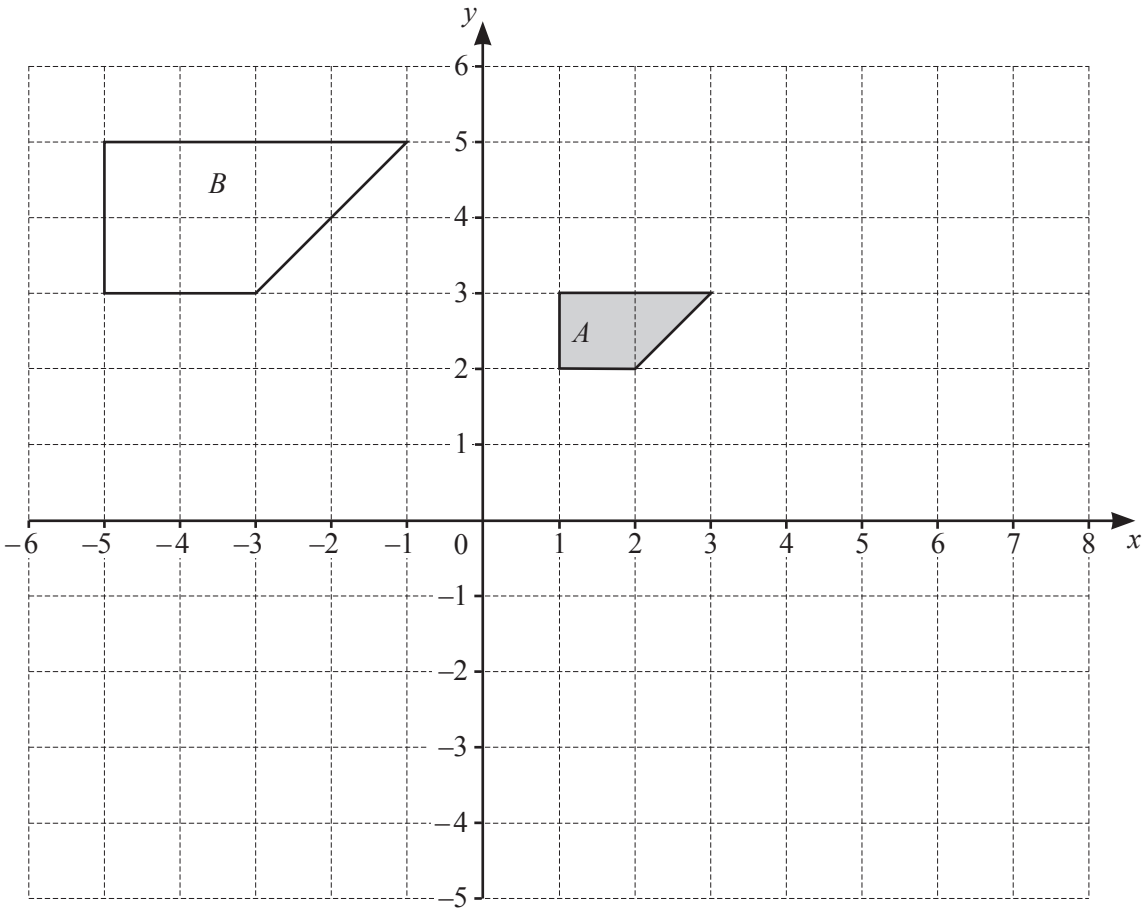
(iv) Two of the visitors are selected at random.

Find the probability that only one of them borrowed 6 books.
Give your answer as a decimal correct to 4 significant figures.

..... [3]

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3



Shape A and shape B are drawn on the grid.

(a) Describe fully the enlargement that maps shape A onto shape B.

.....

..... [2]

(b) Shape A is mapped onto shape C by a rotation of 90° clockwise, centre (1, 0).

Draw and label shape C on the grid. [2]

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(c) Transformation P is represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$.

P maps shape *A* onto shape *D*.

(i) Draw and label shape *D* on the grid. [2]

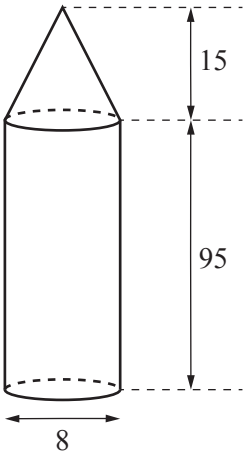
(ii) Describe fully the **single** transformation P.

.....

..... [2]

4 **[Volume of cone $= \frac{1}{3}\pi r^2 h$]**

[Curved surface area of a cone $= \pi rl$]



The diagram shows a gate post.
It is made in the shape of a cylinder with a cone on top.
The cylinder and the cone each have diameter 8 cm.
The height of the cylinder is 95 cm and the height of the cone is 15 cm.

(a) Calculate the volume of the gate post.

..... cm^3 [3]

(b) Show that the total curved surface area of the gate post is 2580 cm^2, correct to 3 significant figures.

[5]

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(c) A geometrically similar gate post has a **total** height of 150 cm.

Calculate the total curved surface area of this gate post.

..... cm^2 [2]

5 **(a)** **(i)** $x^2 + 7x - 13 = (x + a)^2 + b$

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [2]

(ii) Hence solve the equation $x^2 + 7x - 13 = 0$.
Show your working and give your answers correct to 3 significant figures.

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

(b) Simplify $\dfrac{4x^2 - 9}{2x^2 - 11x + 12}$.

..... [3]

(c) Solve $\frac{2x}{x+4} + \frac{6}{x-1} = 2$.

$x =$ ..... [4]

6 These are the first four patterns in a sequence made using counters.

Pattern 1 Pattern 2 Pattern 3 Pattern 4



(a) Complete the table for the patterns in this sequence.

Pattern number	1	2	3	4	5
Number of counters	3	8	15		

[1]

(b) Find an expression, in terms of n, for the number of counters in Pattern n.

..... [2]

(c) Ken has a bag containing 1358 counters.
He makes the largest possible pattern in the sequence, Pattern p, using these counters.

(i) Find the value of p.

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

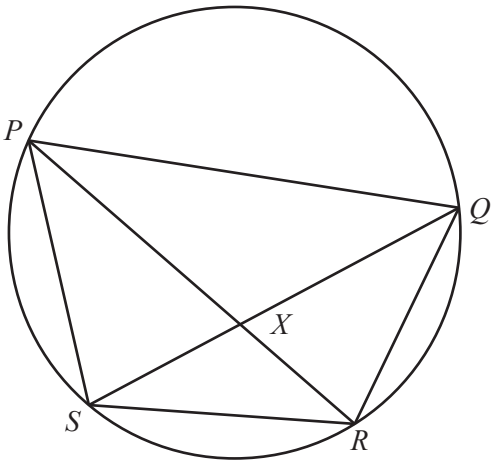
(ii) He uses all of the remaining counters to make another pattern in the sequence, Pattern q.

Find the value of q.

$q =$ ..... [2]

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7



NOT TO SCALE

P, *Q*, *R* and *S* are points on a circle.
PXR and *QXS* are straight lines.

(a) Show that triangle *PQX* is similar to triangle *SRX*.
Give a reason for each statement you make.

.....

.....

.....

..... [3]

(b) $PX = 8.1$ cm, $QX = 6.3$ cm and $SX = 4.5$ cm.

(i) Calculate *RX*.

..... cm [2]

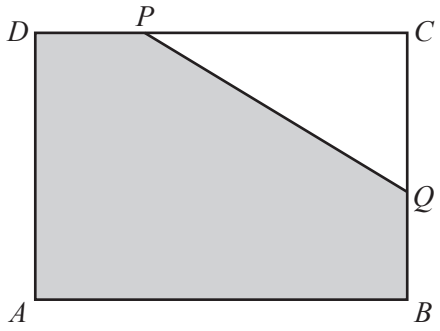
(ii) Find the ratio area of triangle *PQX* : area of triangle *PSX*.
Give your answer in its simplest form.

..... : ..... [2]

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[Turn over

8



NOT TO SCALE

Rectangle $ABCD$ has area $80\,\text{cm}^2$.
Triangle PCQ is removed from one corner of the rectangle.
$BQ = DP = 4\,\text{cm}$.
$AB = x\,\text{cm}$.

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

..... [1]

(b) Explain why $CQ = \left(\frac{80}{x} - 4\right)\text{cm}$.

.....

.....

.....

..... [1]

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

$$y = 32 + 2x + \frac{160}{x}.$$

[3]

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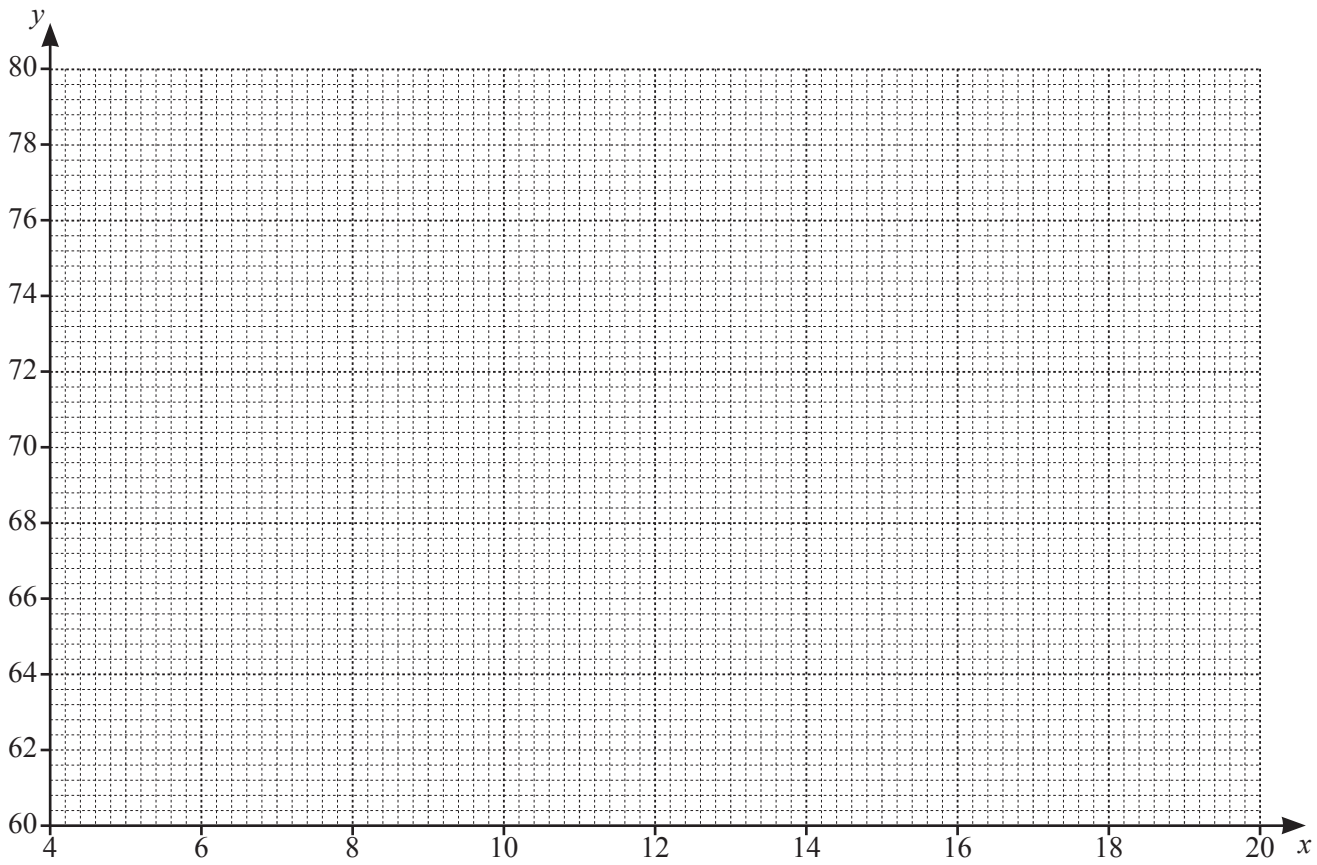
(d) Complete the table for $y = 32 + 2x + \frac{160}{x}$.

Values are given to 1 decimal place where appropriate.

x	4	6	8	10	12	14	16	18	20
y	80	70.7	68	68	69.3	71.4		76.9	80

[1]

(e) On the grid, draw the graph of $y = 32 + 2x + \frac{160}{x}$ for $4 \leqslant x \leqslant 20$.

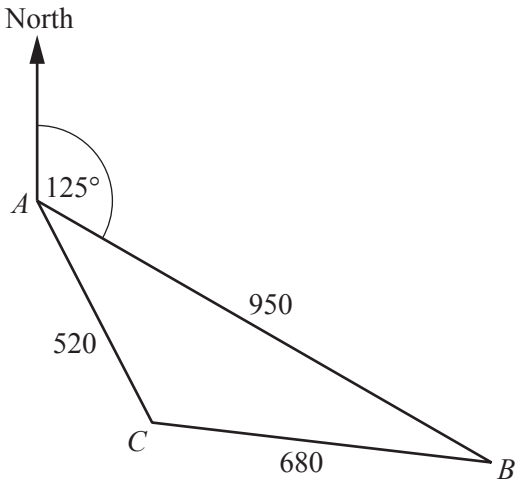


[3]

(f) Use your graph to find the minimum possible shaded area.

..... cm^2 [1]

9



NOT TO SCALE

The diagram shows the positions of three farms A, B and C on horizontal ground.
Farm B is on a bearing of 125° from farm A.
$AB = 950$ m, $BC = 680$ m and $AC = 520$ m.

(a) Show that $B\hat{A}C = 44.0°$, correct to 1 decimal place.

[3]

(b) Calculate the bearing of A from C.

..... [1]

(c) Farm A and farm B are joined by a straight track AB.
Amira walks along the track from A at a constant speed of 4.6 km/h.

Calculate the time it takes for Amira to walk from A to the point that is closest to farm C.
Give your answer in minutes and seconds, correct to the nearest second.

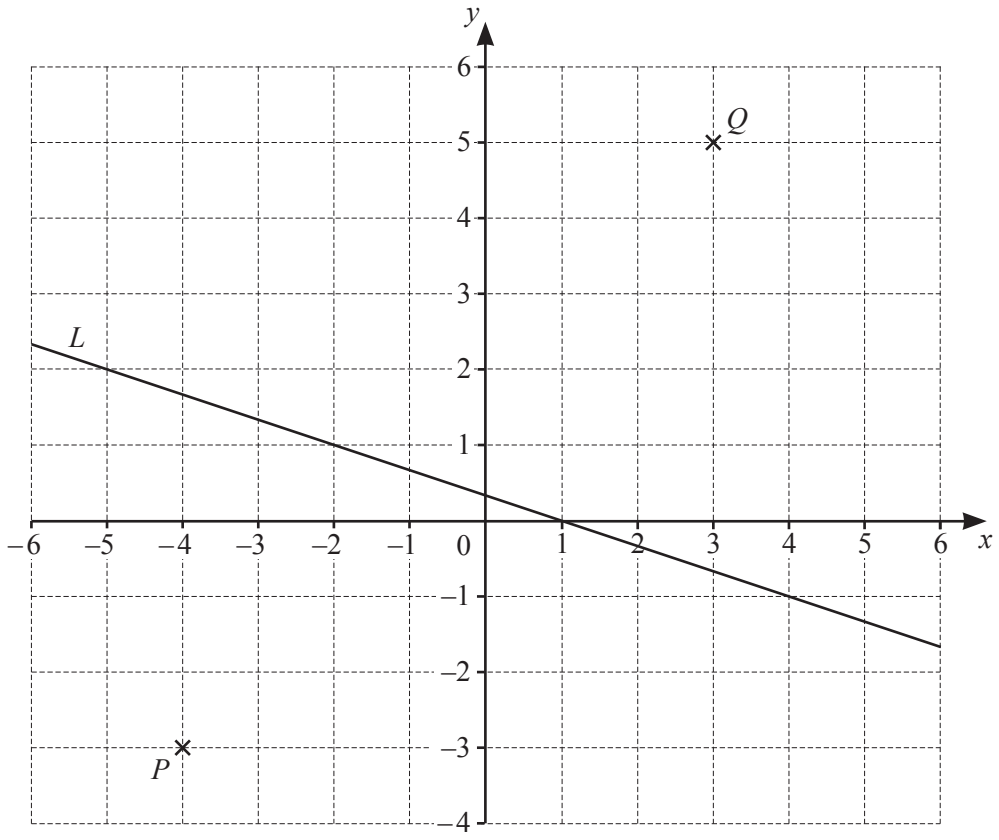
..... minutes ..... seconds [4]

(d) A helicopter hovers vertically above farm B.
The angle of elevation of the helicopter from farm A is 10.7°.

Calculate the angle of elevation of the helicopter from farm C.

..... [4]

10



Points P and Q and the line L are shown on the grid.

(a) Calculate the length of PQ.

..... cm [2]

(b) Show that the equation of line L is $3y + x = 1$.

[3]

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(c) Line M is perpendicular to line L and passes through point P.

Find the equation of line M.
Give your answer in the form $y = mx + c$.

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

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