Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

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

Paper 2 **May/June 2021**

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.

[Turn over

1 In 2019 Nicole's annual income was \$22 000.

(a) She spent \$7200 on accommodation in 2019.

Calculate the percentage of her income she spent on accommodation.

..... % [2]

(b) Her annual income of \$22 000 increased by 4% in 2020.

Calculate her annual income in 2020.

\$ ..... [2]

(c) Nicole invests \$2000 in an account.
The account pays compound interest at a rate of K% per year.
At the end of the first year, the money in the account is \$2036.

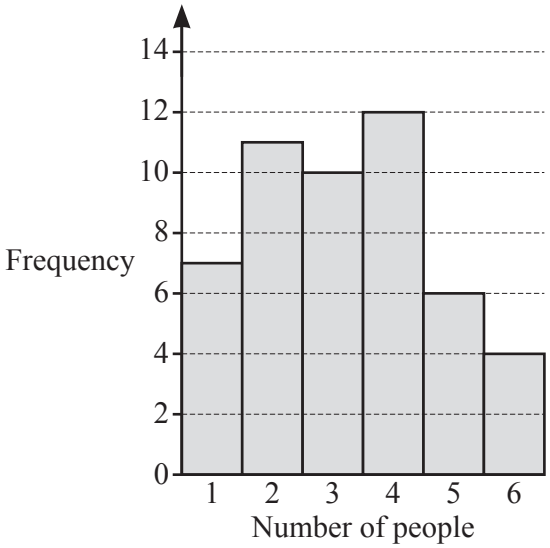
(i) Show that $K = 1.8$.

[2]

(ii) Find the number of complete years before Nicole has at least \$2150 in the account.
Show your working.

..... years [3]

2 A survey recorded the number of people living in each of 50 houses.
The bar chart shows the results.



(a) Find the mode.

..... [1]

(b) Find the median.

..... [1]

(c) Calculate the mean.

..... [3]

(d) One of these houses is chosen at random.

Find the probability that exactly 3 people live there.

..... [1]

(e) Two houses are chosen at random from these 50 houses.

Find the probability that only one of the two houses has exactly 5 people living there.

..... [3]

3 **(a)** $p = \dfrac{3q+5}{r^2}$

Calculate p when $q = 15$ and $r = -4$.

$p =$ ..... [2]

(b) Expand and simplify $3(2x+1)+4(x-5)$.

..... [2]

(c) Solve $\dfrac{3-k}{4} = 1$.

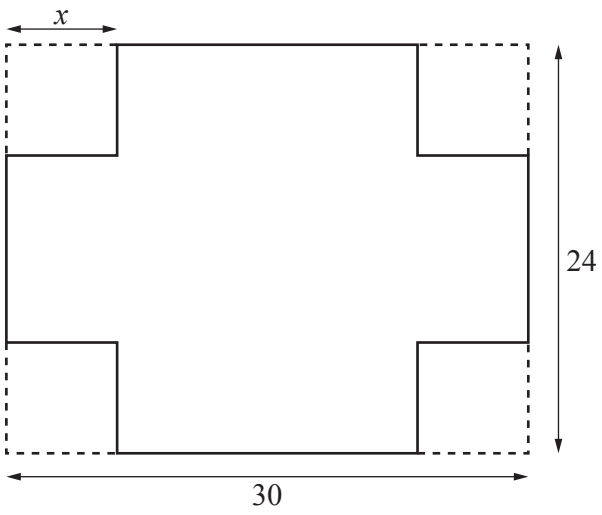
$k =$ ..... [2]

(d) $\dfrac{x^6}{x^m} = x^{-3}$

Find m.

$m =$ ..... [1]

(e)



NOT TO SCALE

A rectangular piece of card measures 30 cm by 24 cm.
The net of an open box is made by removing a square from each corner of this piece of card.
Each square that is removed has side x cm.
The area of the net is 576 cm^2.

(i) Form an equation in x and solve it to find the value of x.

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

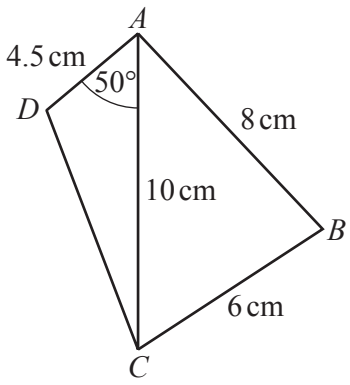
(ii) The net is made into an open box.
1000 cm^3 of sand is placed inside the box.

Find the fraction of the box that is filled with sand.
Give your answer in its simplest form.

..... [3]

[Turn over

4 **(a)** The diagram shows a sketch of quadrilateral $ABCD$.



NOT TO SCALE

(i) Construct an accurate drawing of $ABCD$.
AC has been drawn for you.

[3]

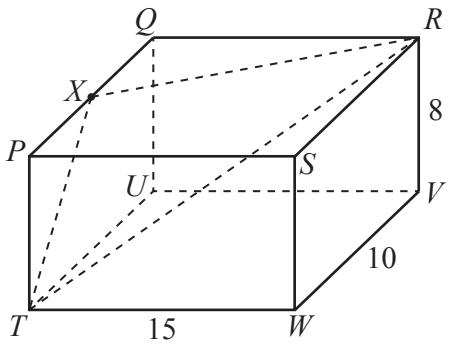
(ii) Measure $A\hat{D}C$.

..... [1]

(iii) By taking a suitable measurement from your diagram, find the perimeter of quadrilateral $ABCD$.

..... cm [1]

(b)



The diagram shows a cuboid.
$TW = 15$ cm, $WV = 10$ cm and $RV = 8$ cm.

(i) Show that $TR = 19.7$ cm, correct to 1 decimal place.

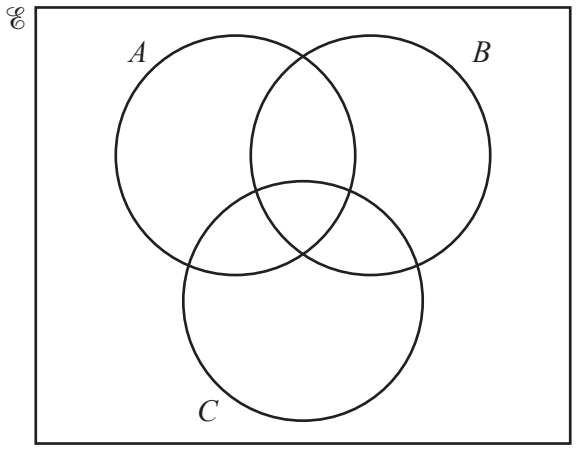
[3]

(ii) X is the midpoint of PQ.

Calculate $T\hat{R}X$.

$T\hat{R}X =$ ..... [5]

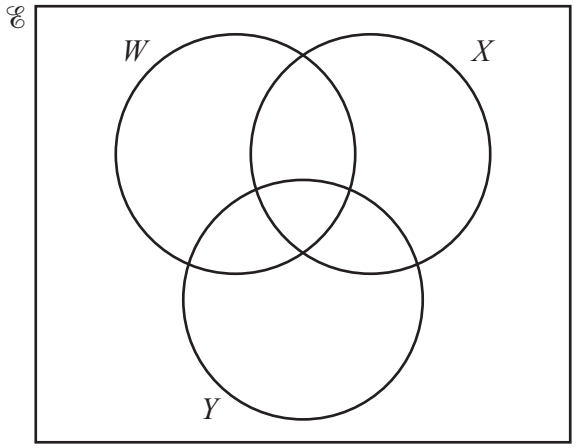
5 **(a)** Shade the subset $A' \cap B \cap C$.



[1]

(b) $\mathscr{E} = \{ \mathsf{A}, \mathsf{C}, \mathsf{E}, \mathsf{G}, \mathsf{H}, \mathsf{J}, \mathsf{N}, \mathsf{R}, \mathsf{T}, \mathsf{Z} \}$
$W = \{ x : x \text{ has rotational symmetry of order 2} \}$
$X = \{ x : x \text{ has line symmetry} \}$
$Y = \{ \mathsf{R}, \mathsf{A}, \mathsf{N}, \mathsf{G}, \mathsf{E} \}$

(i) Complete the Venn diagram.



[3]

(ii) List the elements of $X \cap (W \cup Y)'$.

..... [1]

(iii) Find $\mathrm{n}(W \cup X \cup Y)'$.

..... [1]

(iv) Using set notation, complete this statement.

..... $= \varnothing$ [1]

6 $f(x) = 2x + 3$ $\quad$ $g(x) = \dfrac{12 - 3x}{5}$

(a) Find g(–1).

..... [1]

(b) Solve $f(x) = 2$.

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

(c) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [3]

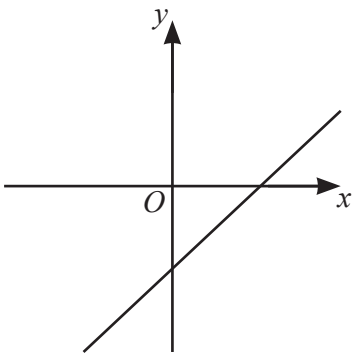
(d) Find the value of x when f(x) is 4 more than g(x).

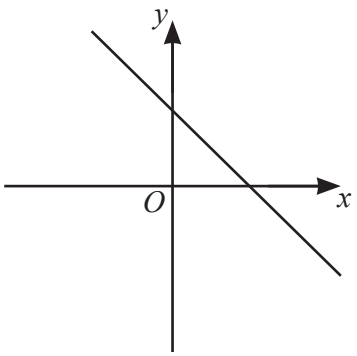
$x =$ ..... [4]

7 **(a)** $y = 2x + 1$ $y = 2x - 1$ $y = -2x + 1$ $y = -2x - 1$

The diagrams below show sketches of two of these lines.

Write the correct equation below each diagram.

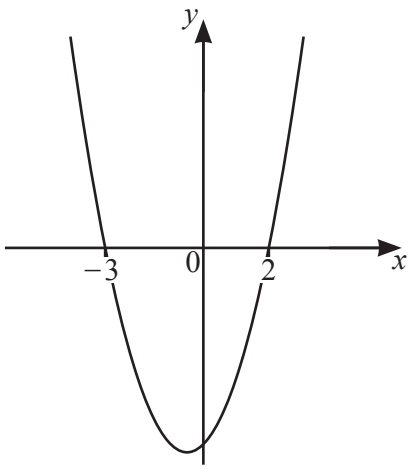




....

[2]

(b)

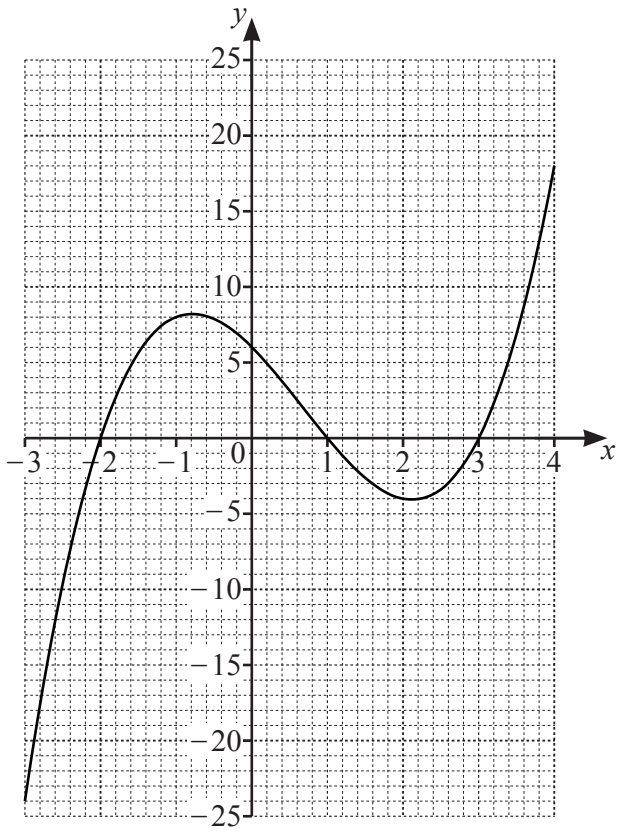


This diagram shows a sketch of the graph of $y = x^2 + ax + b$.

Find the value of a and the value of b.

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

(c)



The grid shows the graph of $y = x^3 - 2x^2 - 5x + 6$.

(i) $x^3 - 2x^2 - 5x + 6 = k$ has exactly 2 solutions.

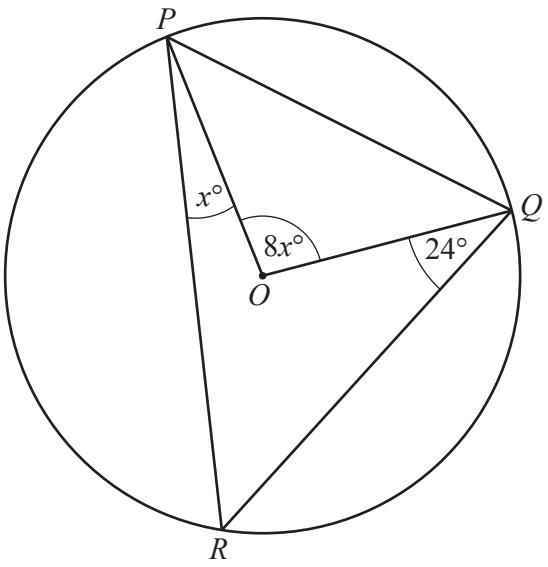
Use the graph to find the possible values of k.

..... [2]

(ii) By drawing a suitable line on the grid, find the solutions of $x^3 - 2x^2 - 7x + 5 = 0$.

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

8 (a)



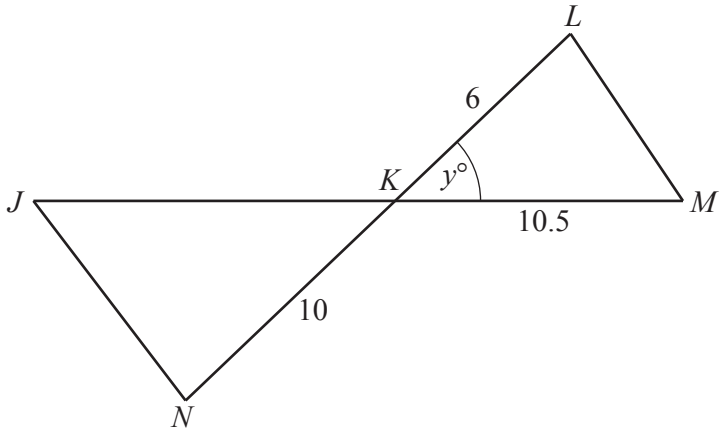
NOT TO SCALE

P, Q and R are points on the circumference of a circle, centre O.
Angle $POQ = 8x^o$, angle $RPO = x^o$ and angle $OQR = 24^o$.

Calculate angle PQO.

Angle $PQO =$ ..... [4]

(b)



NOT TO SCALE

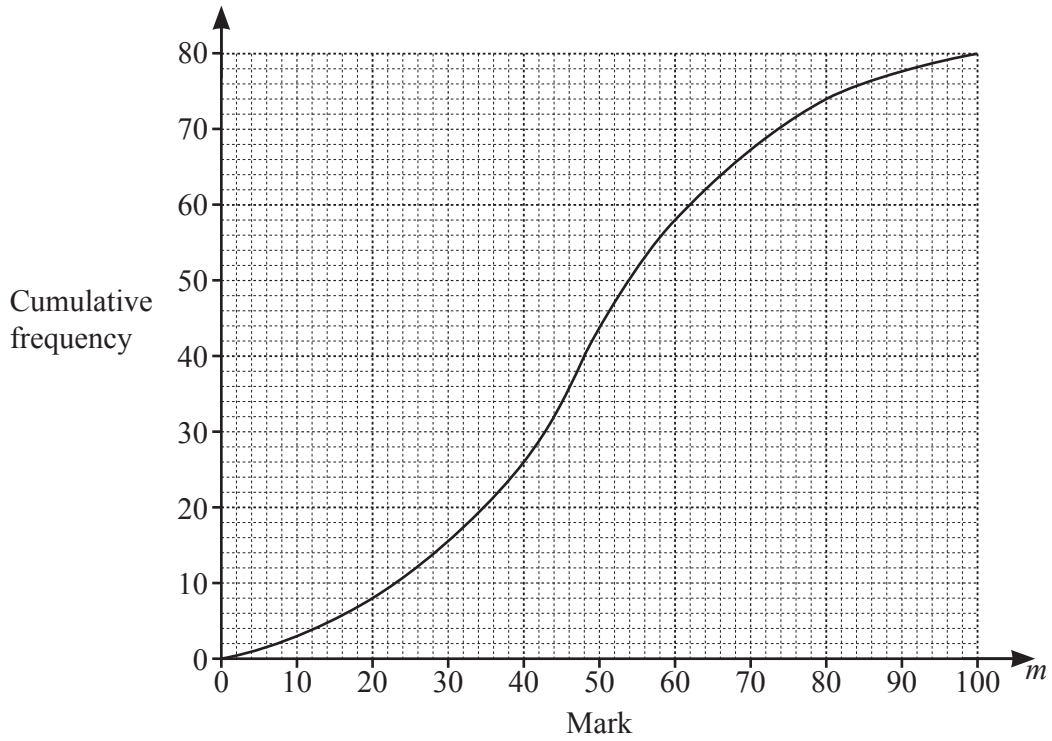
Triangle *KLM* is similar to triangle *KNJ*.
JKM and *NKL* are straight lines.

$K\hat{L}M = K\hat{N}J$ and $L\hat{K}M = y°$.
$KL = 6$ cm, $KM = 10.5$ cm and $KN = 10$ cm.
The area of triangle *JKN* is 75 cm^2.

Calculate y.

$y =$ ..... [5]

9 **(a)** The cumulative frequency diagram shows the marks obtained by 80 students in a Maths test.



(i) Use the diagram to find an estimate of the median.

..... [1]

(ii) 60% of the students passed the test.

Use the diagram to find the number of marks needed to pass the test.

..... [2]

(iii) Using the information on the diagram, complete the frequency table.

Mark (m)	$0 \leqslant m < 20$	$20 \leqslant m < 40$	$40 \leqslant m < 60$	$60 \leqslant m < 80$	$80 \leqslant m < 100$
Frequency	8				

[2]

(b) The times taken by the 80 students to complete a Science test are shown in the frequency table.

Time (m minutes)	$40 < m \leqslant 50$	$50 < m \leqslant 60$	$60 < m \leqslant 70$	$70 < m \leqslant 80$	$80 < m \leqslant 90$
Frequency	8	13	p	20	q

An estimate for the mean time taken to complete the test is 67.625 minutes.
This is calculated using the mid-interval value as an estimate of the time in each interval.

Calculate the value of p and the value of q.

$p =$ ..... $q =$ ..... [5]

[Turn over

10 **(a)** $\overrightarrow{AB} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

(i) Calculate $\left|\overrightarrow{AB}\right|$.

$\left|\overrightarrow{AB}\right| =$ ..... [2]

(ii) $\overrightarrow{AC} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$ and C is the point $(10, -1)$.

(a) Find the coordinates of the point A.

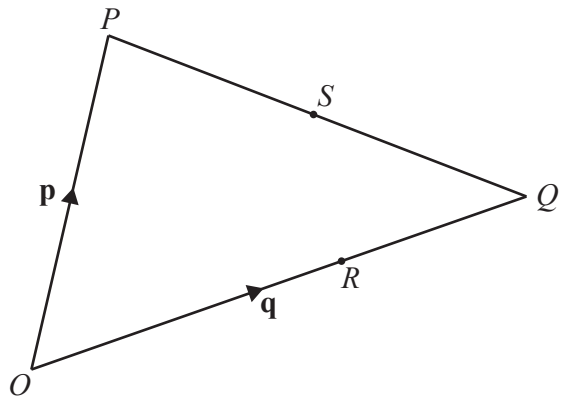
(..... , ...) [1]

(b) B is the midpoint of AD.

Find the coordinates of the point D.

(..... , ...) [2]

(b)



NOT TO SCALE

The diagram shows triangle OPQ.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
R is the point on OQ such that $OR = 2RQ$.
S is the midpoint of PQ.

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

(i) $\overrightarrow{PQ}$,

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

(ii) $\overrightarrow{OS}$,

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

(iii) $\overrightarrow{SR}$.

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

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