Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0561161099

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **May/June 2022**

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)** In 2021, the cost of posting a letter was 84 cents.

(i) A company posts 1950 letters.

Find the cost, in dollars, to post these letters.

$ ..... [1]

(ii) In 2022, the cost of posting a letter is 96 cents.

Calculate the percentage increase in the cost of posting a letter.

.....% [2]

(b)

Cost of posting a letter is 96 cents
15% discount when monthly postage is more than $1000

Company *A* posts 1200 letters in one month.
Company *B* posts fewer letters than Company *A* in the same month.
Company *A* and Company *B* each pay the same amount to post their letters that month.

Find the number of letters Company *B* posts in that month.

..... [3]

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(c) In 2022, the cost of posting a parcel with a mass of 1 kg or less is $4.60 .
The cost increases by $1.10 for each additional 0.5 kg.

Find the cost of posting a parcel with a mass of 3.5 kg.

$ ..... [2]

(d) The cost of posting parcels increases by 7.2%.
After the increase, the cost of posting a parcel is $13.40 .

Calculate the original cost of posting this parcel.

$ ..... [2]

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[Turn over

2 **(a)** $A = 3p + q$

Find q when $A = 23$ and $p = 5$.

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

(b) Expand and simplify $2(2x + 5) + 3(x - 6)$.

..... [2]

(c) Solve $5y + 3 = 1$.

$y =$ ..... [2]

(d) Factorise $12r^2 - 8rs$.

..... [2]

(e) Rearrange $a = 3b$ to make b the subject.

..... [1]

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3 A 5-sided spinner is numbered 1, 2, 3, 4 and 5.
The table shows the results from spinning the spinner 200 times.

Number	Frequency
1	51
2	19
3	28
4	35
5	67

(a) A pie chart is drawn to show this information.

Calculate the angle of the sector representing the number 4.

..... [2]

(b) Use the results to estimate the probability that the spinner lands on 3.

..... [1]

(c) Use the results to estimate the probability that the spinner lands on a number that is a factor of 30.

..... [2]

(d) The spinner is spun 3000 times.

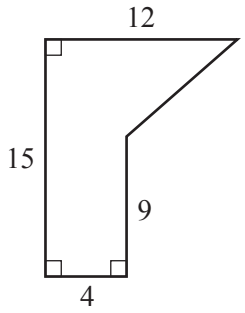
Estimate the number of times it lands on an even number.

..... [2]

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[Turn over

4 (a)



NOT TO SCALE

The diagram shows a pentagon.
All the lengths are in centimetres.

(i) Calculate the area of the pentagon.

..... cm^2 [2]

(ii) Find the perimeter of the pentagon.

..... cm [3]

(b) [Volume of a sphere = $\frac{4}{3}\pi r^3$]

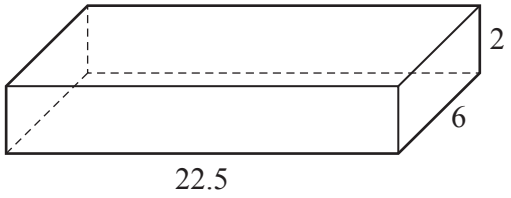
A sphere has a volume of 2572 cm^3.

Find the radius of the sphere.

..... cm [3]

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(c)



A cuboid has dimensions 2 cm by 6 cm by 22.5 cm.

(i) Calculate the surface area of the cuboid.

..... cm^2 [3]

(ii) A cube of edge x cm has the same surface area as the cuboid.

Form an equation in x and solve it to find the length of the edge of the cube.
Show your working.

..... cm [3]

5 **(a)** A group of students each complete a puzzle.
The table shows the time, t seconds, each student took to complete the puzzle.

Time (t seconds)	$80 < t \leqslant 120$	$120 < t \leqslant 140$	$140 < t \leqslant 150$	$150 < t \leqslant 240$
Frequency	13	26	27	24

(i) Find the number of students who took 2 minutes 20 seconds or less to complete the puzzle.

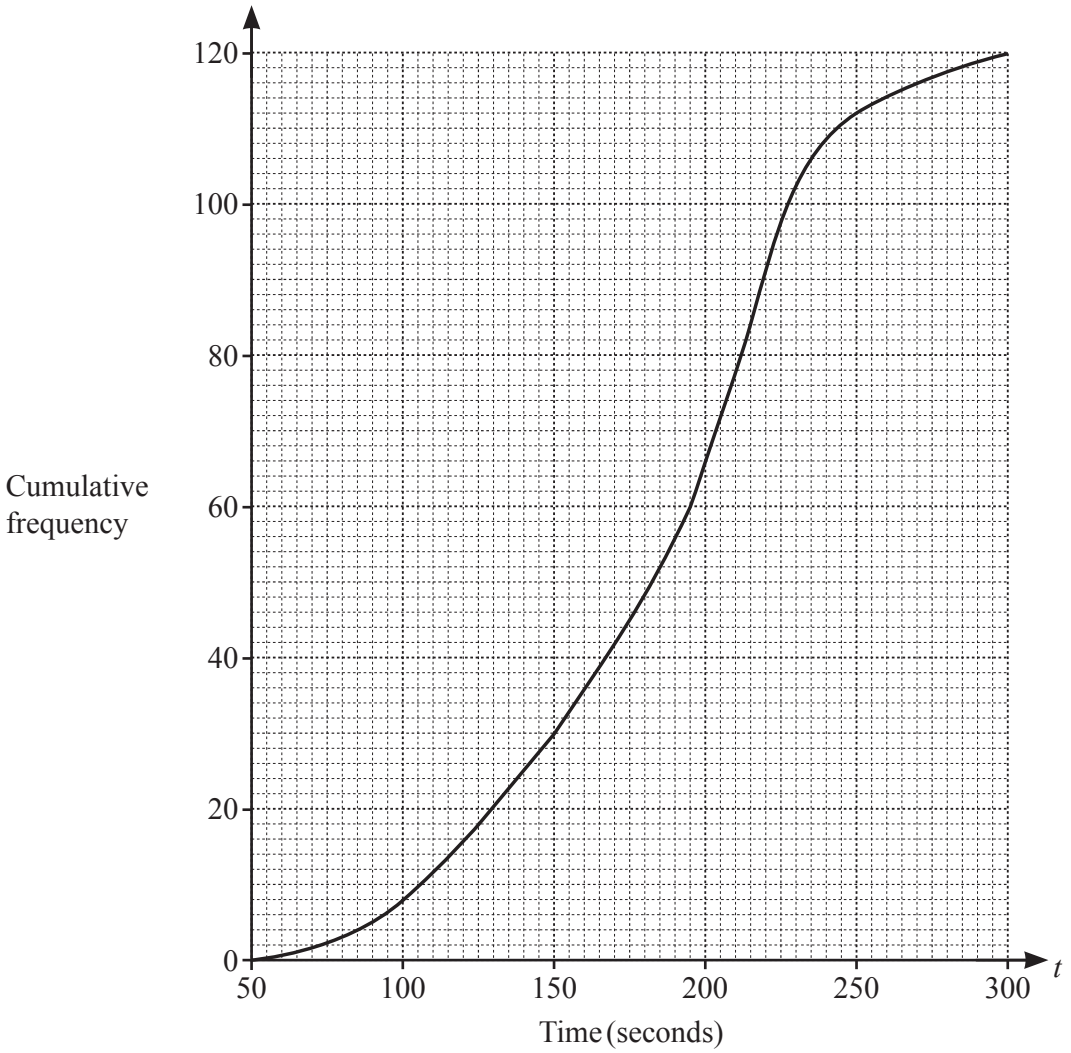
..... [1]

(ii) Calculate an estimate of the mean time taken, in seconds, to complete the puzzle.

..... s [3]

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(b) A group of adults also completed this puzzle.
A cumulative frequency diagram for their times is shown.



(i) Use the cumulative frequency diagram to complete the frequency table.

Time (t seconds)	$50 < t \leqslant 100$	$100 < t \leqslant 150$	$150 < t \leqslant 200$	$200 < t \leqslant 250$	$250 < t \leqslant 300$
Frequency	8				

[2]

(ii) Use the cumulative frequency diagram to find an estimate of the median.

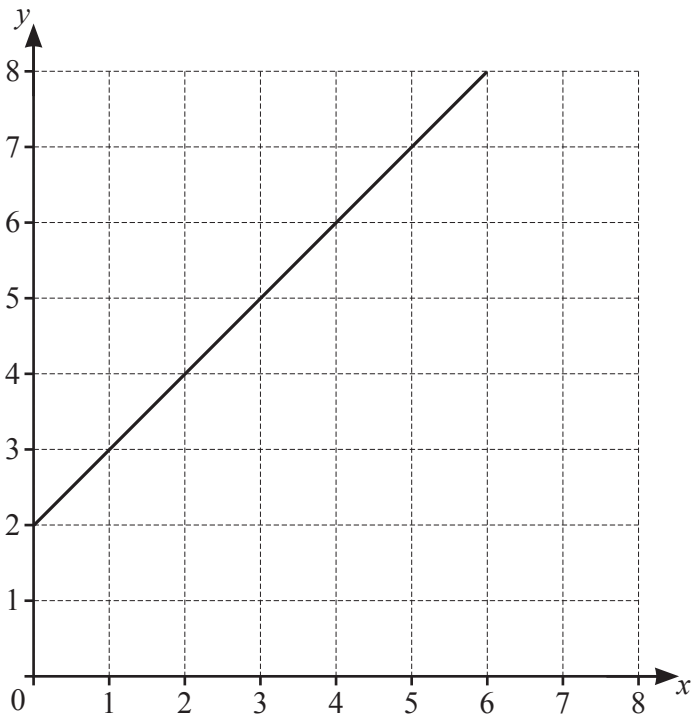
..... s [1]

(iii) 55% of the adults took between 125 seconds and k seconds to complete the puzzle.

Use the cumulative frequency diagram to find the value of k.

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

6



The line $y = x + 2$ is drawn on the grid.

(a) On the grid, draw the line $x + 2y = 7$. [2]

(b) Use your graph to find the solution of these simultaneous equations.

$y = x + 2$
$x + 2y = 7$

$x =$ .....

$y =$ ..... [1]

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(c) The region R is defined by these three inequalities.

$$y \leqslant x + 2 \qquad x + 2y \geqslant 7 \qquad x \leqslant 5$$

(i) Shade and label region R. [2]

(ii) The point Z is in region R.
The x-coordinate and the y-coordinate of point Z are both integers.
Point Z does **not** lie on the boundary of region R.

(a) Find the number of possible positions of point Z.

..... [1]

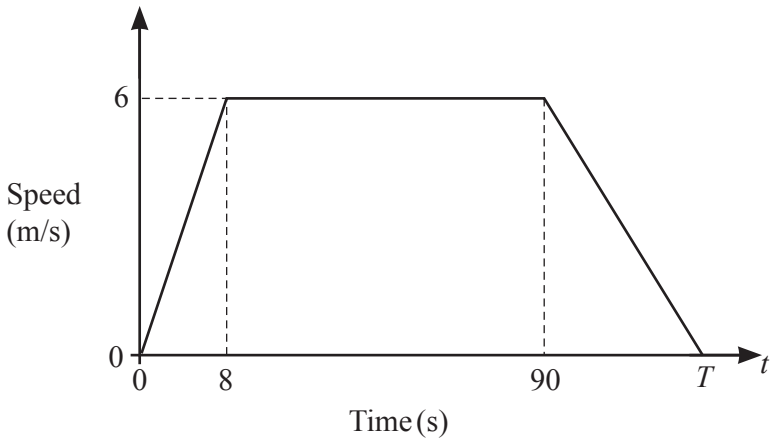
(b) The y-coordinate of point Z is one more than its x-coordinate.

Write down all the possible coordinates for point Z.

..... [2]

7 (a)

NOT TO SCALE



The diagram shows the speed–time graph for a cyclist's journey.

(i) Calculate the acceleration of the cyclist during the first 8 seconds.

..... m/s^2 [1]

(ii) Describe the motion of the cyclist between $t = 8$ and $t = 90$.

..... [1]

(iii) The total distance travelled by the cyclist during the journey is 558 m.

Find the value of T.

$T =$ ..... [3]

(iv) Convert 6 m/s into km/h.

..... km/h [2]

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(b) A car travels 352 km, correct to the nearest kilometre.
The time taken to travel this distance is 4.2 hours, correct to the nearest 0.1 hour.

Calculate the upper bound for the average speed of the car.

..... km/h [3]

8 **(a)** The matrix **A** satisfies the following equation.

$$\begin{pmatrix} 2 & 3 \\ 5 & 2 \end{pmatrix} - 3\mathbf{A} = \begin{pmatrix} 5 & 3 \\ -4 & -1 \end{pmatrix}$$

Find **A**.

$\mathbf{A} =$ $\left(\quad\quad\right)$ [2]

(b) $\mathbf{B} = \begin{pmatrix} 2 & -2 \\ 4 & p \end{pmatrix}$

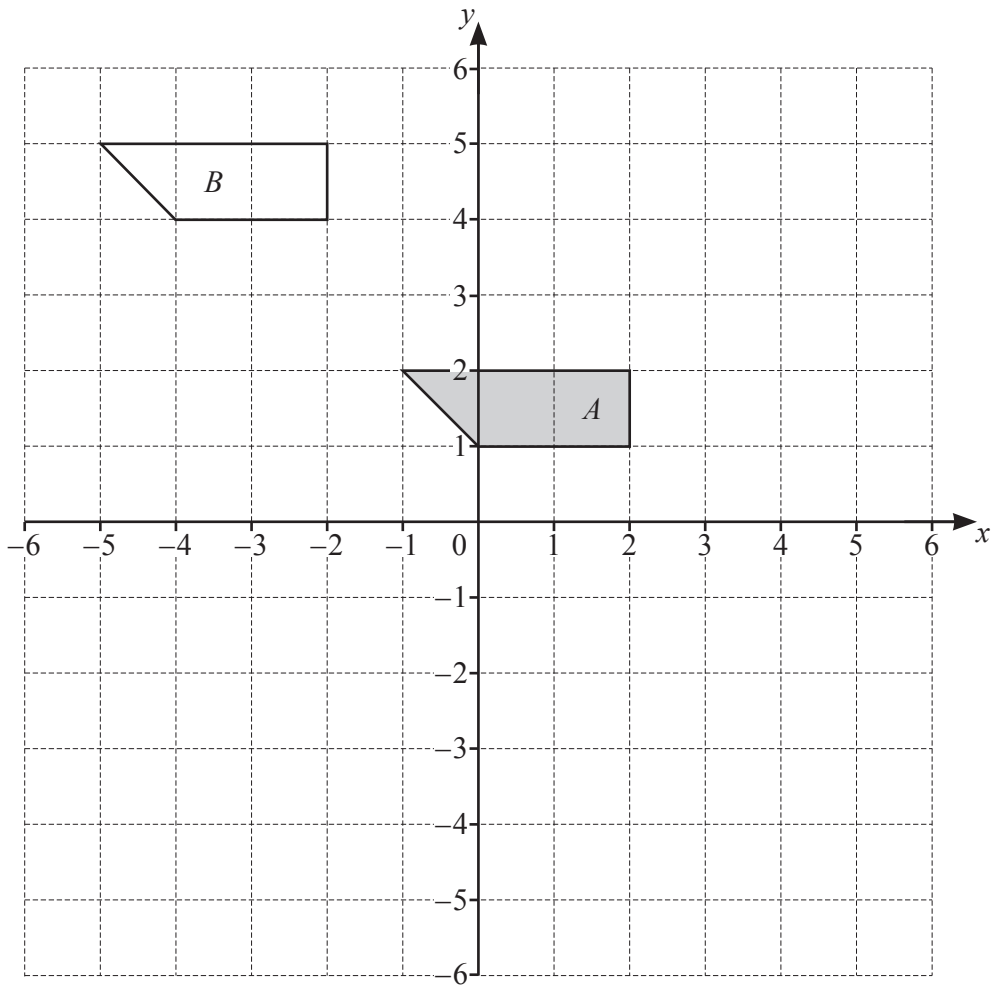
The determinant of **B** is 2.

Find the value of p and hence write down $\mathbf{B}^{-1}$.

$\mathbf{B}^{-1} =$ $\left(\quad\quad\right)$ [3]

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(c)



The diagram shows shape A and shape B.

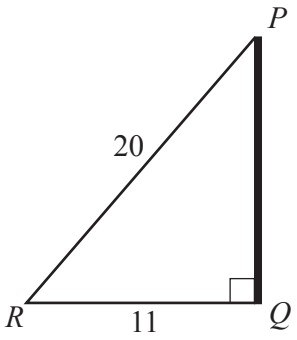
(i) Describe fully the **single** transformation that maps shape A onto shape B.

..... [2]

(ii) The transformation represented by the matrix $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$ maps shape A onto shape C.

Draw and label shape C. [2]

9



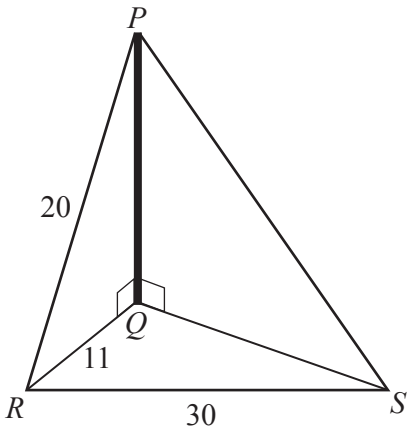
NOT TO SCALE

PQ is a vertical pole.
A rope is attached from the top of the pole, P, to a point on the ground, R.
$PR = 20\,\text{m}$, $RQ = 11\,\text{m}$ and $R\hat{Q}P = 90°$.

(a) Show that $PQ = 16.70\,\text{m}$, correct to 2 decimal places.

[2]

(b)



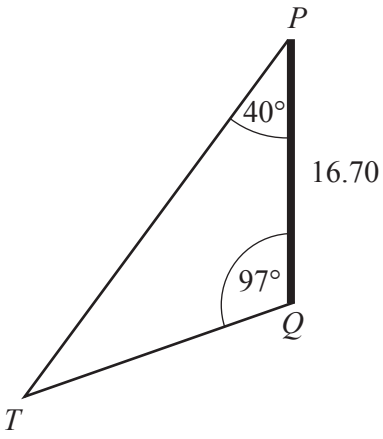
A second rope is attached from P to a point S.
$P\hat{Q}S = 90°$ and $RS = 30\,\text{m}$.
The angle of elevation of P from S is 36°.

Calculate $R\hat{Q}S$.

$R\hat{Q}S =$ ..... [5]

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(c)



NOT TO SCALE

A third rope is attached from P to a point T.
$T\hat{P}Q = 40°$ and $P\hat{Q}T = 97°$.

Calculate PT.

$PT =$ ..... m [4]

10 D is the point (4, 6) and E is the point (e, e).

(a) The length of DE is $\sqrt{20}$.

Form an equation in e and solve it to find the possible coordinates of E.
Show your working.

(..... , ...) or (..... , ...) [5]

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(b) F is the point $(-f, 5f)$.

The gradient of the perpendicular bisector of DF is $\frac{3}{2}$.

(i) Find the value of f.

$f =$ ..... [4]

(ii) The equation of the perpendicular bisector of DF is $2y = 3x + k$.

Find the value of k.

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

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