Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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5965422393

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

Paper 2 **October/November 2014**

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 a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions.

Section B
Answer any **four** 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 **23** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** In 2013, Mary worked for Company A.
Her salary for the year was $18 750.

(i) $5625 of her salary was not taxed.

What percentage of her salary was not taxed?

Answer ..... % [2]

(ii) The remaining $13 125 of Mary's salary was taxed.
22% of this amount was deducted for tax.
Mary's take-home pay was the amount remaining from $18 750 after tax had been deducted.
She received this in 52 equal amounts as a weekly wage.

Calculate Mary's weekly wage.

Answer $ ..... [3]

(iii) In 2012 Mary had worked for Company B.
When she moved from Company B to Company A, her salary increased by 25% to $18 750.

Calculate her salary when she worked for Company B.

Answer $ ..... [2]

(b) The rate of exchange between pounds (£) and Indian rupees (R) is £1 = R87.21.
The rate of exchange between pounds (£) and Swiss francs (F) is £1 = F1.53.

(i) Mavis changed £750 into Indian rupees. How many rupees did she receive?

Answer .....rupees [1]

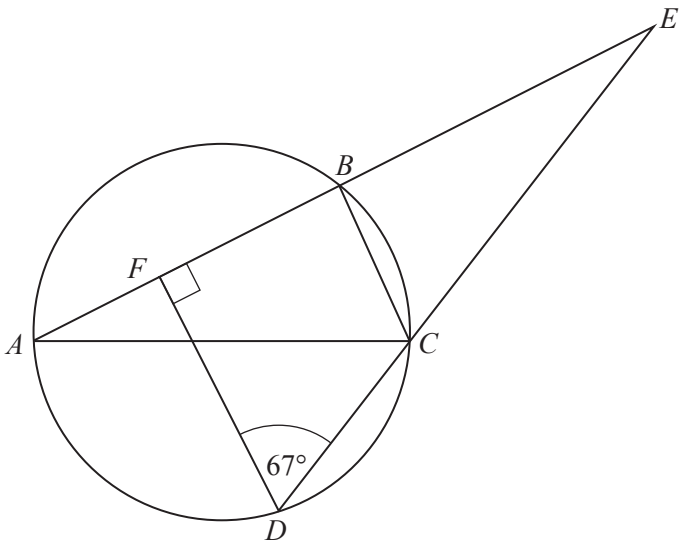
(ii) David changed F450 into pounds. How many pounds did he receive?

Answer £ ..... [1]

(iii) Brian changed R50 000 into Swiss francs. How many Swiss francs did he receive?

Answer .....francs [2]

2 (a)



A, B, C and D are points on the circumference of the circle and AC is a diameter.
$AFBE$ and DCE are straight lines.
DF is perpendicular to AE and $C\hat{D}F = 67°$.

(i) Find $A\hat{E}D$.

Answer $A\hat{E}D =$ ..... [1]

(ii) Find $C\hat{B}E$, giving a reason for your answer.

Answer $C\hat{B}E =$ ..... because .....

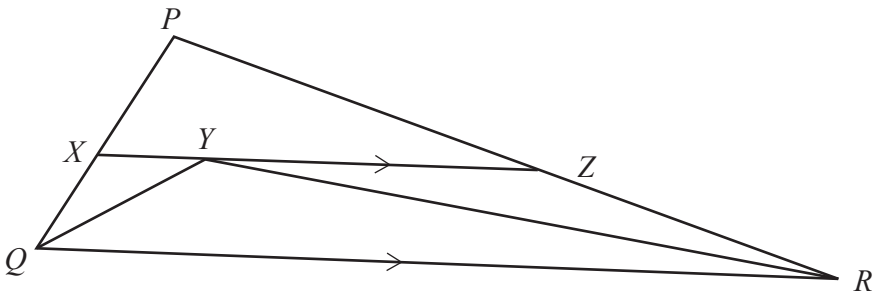
..... [1]

(iii) Explain why DF is parallel to CB.

Answer .....

..... [1]

(b)

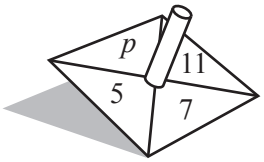


In the triangle PQR, the bisectors of $P\hat{Q}R$ and $P\hat{R}Q$ intersect at Y.
The straight line XYZ is parallel to QR.

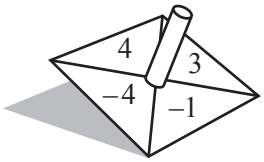
Prove that the perimeter of triangle $PXZ = PQ + PR$.

[3]

3



spinner X



spinner Y

In a game, when it is Mary's turn, she spins each of these fair spinners once.
Mary's score for the turn is worked out using the formula $xm + yn$, where x is the number on spinner X and y is the number on spinner Y.
The possibility space diagram shows Mary's possible scores.

		x (number on spinner X)			
		5	7	11	p
y (number on spinner Y)	−4	37	47	67	97
	−1	28	38	58	88
	3	16	26	46	76
	4	13	23	43	73

(a) Find the probability that Mary's score is less than 15.

Answer ..... [1]

(b) Calculate the probability that on two consecutive turns, Mary scores less than 40 on one and more than 75 on the other.

Answer ..... [3]

(c) The diagram shows 7 on spinner X and -1 on spinner Y.
Using the formula, the score for this turn is $7m - n = 38$.

(i) Using the table, find $7m + 3n$.

Answer ..... [1]

(ii) Hence find m and n.

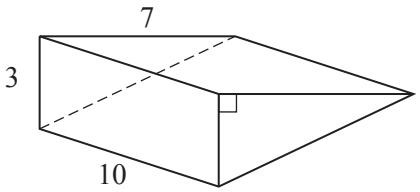
Answer $m =$ .....

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

(d) Find p.

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

4 (a)



The diagram shows a solid triangular prism. The dimensions are in metres.

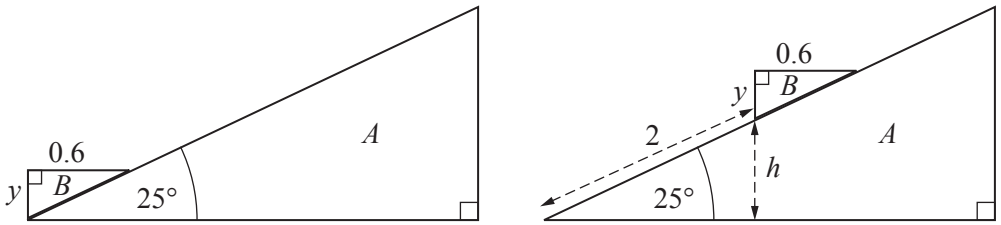
(i) Calculate the volume of the prism.

Answer .....m^3 [2]

(ii) Calculate the total surface area of the prism.

Answer .....m^2 [4]

(b)



The diagrams show the cross-sections of a ramp A and a triangular prism B.
The triangular prism B can move up and down the ramp A.
The ramp is inclined at 25° to the horizontal.

(i) When the prism has moved 2 m up the ramp, it has risen h metres vertically.

Calculate h.

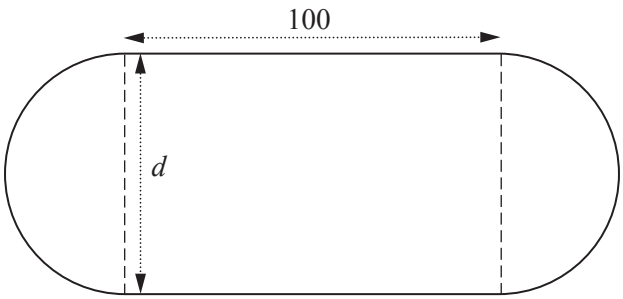
Answer $h =$ ..... [2]

(ii) As it moves, the uppermost face of the prism B remains horizontal.
The length of the horizontal edge of the face is 0.6 m.
The length of the vertical edge of the prism is y metres.

Calculate y.

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

5



The diagram shows the perimeter of a 400 m running track.
It consists of a rectangle measuring 100 m by d metres and two semicircles of diameter d metres.
The length of each semicircular arc is 100 m.

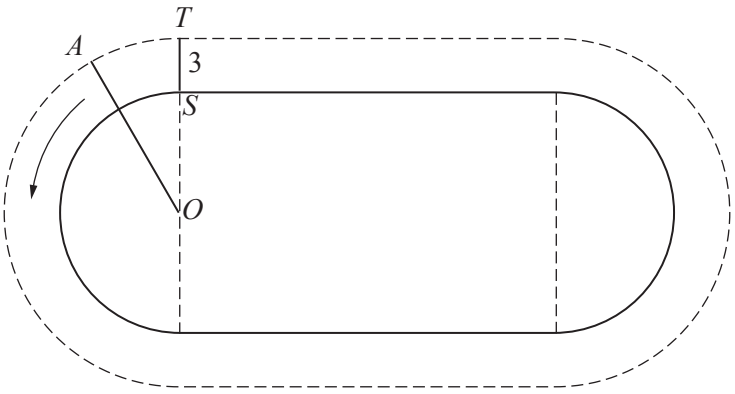
(a) Calculate d.

Answer $d =$ ..... [2]

(b) Calculate the total area of the region inside the running track.

Answer ..... m^2 [3]

(c)



S is the starting point and finishing point for the 400 m race for a runner in the inside lane.
A runner in an outer lane is always 3 m from the inner perimeter.
The runner in the outer lane starts at *A*, runs 400 m and finishes at *T*.
TS = 3 m.

(i) Calculate the length of the arc *TA*.

Answer ..... m [3]

(ii) *O* is the centre of a semi-circular part of the track.

Calculate $A\hat{O}T$.

Answer $A\hat{O}T$ = ... [2]

6 $ABCD$ is a field in the shape of a trapezium.
$A\hat{B}C = 56°$, $B\hat{A}D = 104°$ and the distance between the parallel sides of the field is 90 m.

(a) Using a scale of 1 cm to 20 m, draw a plan of the field.
AB has been drawn for you.

[4]

(b) Find the actual distance CD.

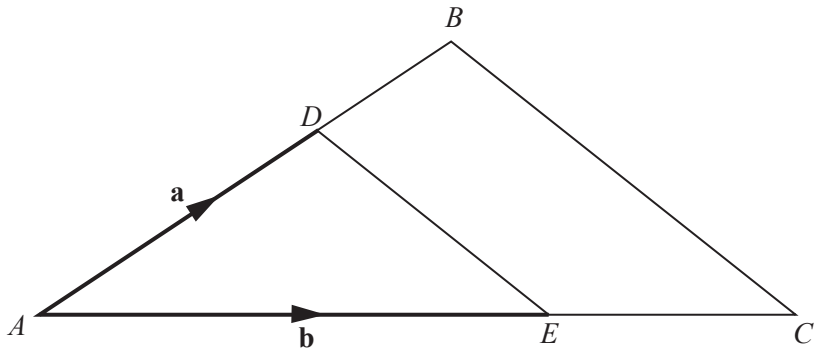
Answer $CD =$ ..... m [2]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 (a)



In the triangle ABC, D divides AB in the ratio 3 : 2, and E divides AC in the ratio 3 : 2.
$\overrightarrow{AD} = \mathbf{a}$ and $\overrightarrow{AE} = \mathbf{b}$.

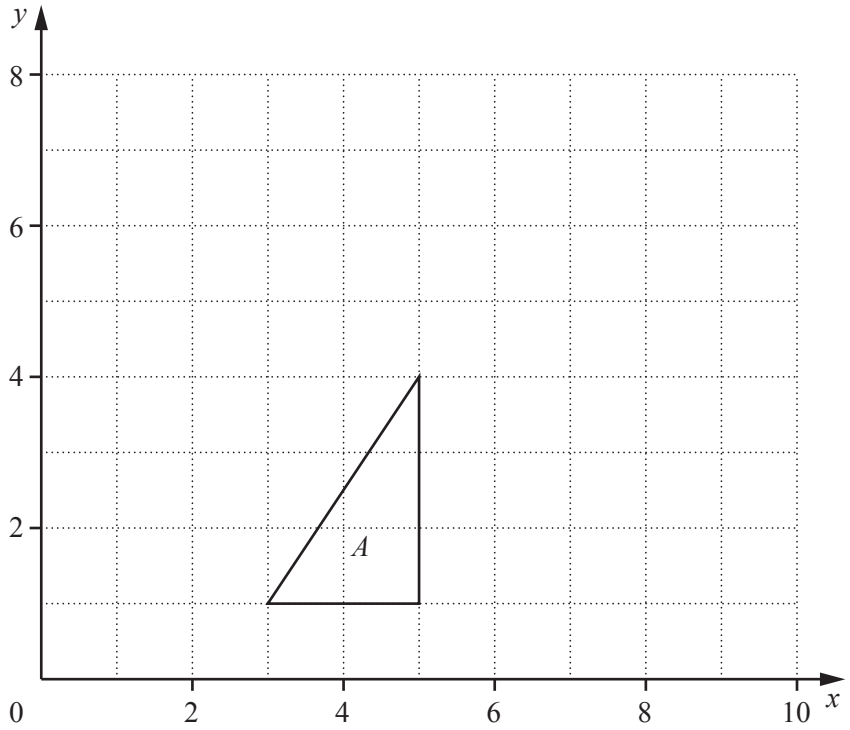
(i) Show, using vectors, that DE is parallel to BC.

[3]

(ii) Find the ratio Area of triangle ADE : Area of triangle ABC.

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

(b)



Triangle A has vertices (3, 1), (5, 1) and (5, 4).

The transformation S_1 is represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$.

S_1 maps triangle A onto triangle B.

(i) Draw and label triangle B. [2]

(ii) What type of transformation is S_1?

Answer ..... [1]

(iii) The transformation S_2 is represented by the matrix $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$.

Find the matrix that represents the combined transformation S_2S_1.

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(iv) The combined transformation S_2S_1 maps triangle A onto triangle C.

Find the matrix which represents the transformation that maps triangle C onto triangle A.

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

8 **(a)** $T = 2\pi\sqrt{\frac{h}{g}}$

(i) Find T when $h = 125$ and $g = 981$.

Answer $T =$ ..... [1]

(ii) Make h the subject of the formula.

Answer $h =$ ..... [3]

(b) Solve the equation $45 - (p + 3) = 2p$.

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

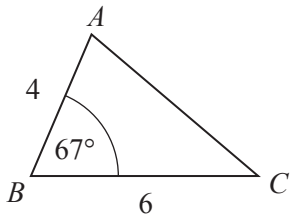
(c) Solve the equation $\frac{2x-3}{4}+\frac{5-x}{3}=0$.

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

(d) Solve the equation $3y^2 + 11y + 4 = 0$.
Give your answers correct to 2 decimal places.

Answer $y =$ ..... or ..... [3]

9 (a)

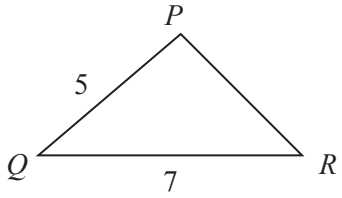


In triangle ABC, $AB = 4$ m, $BC = 6$ m and $A\hat{B}C = 67°$.

(i) Show that the area of triangle ABC is 11.05 m^2 correct to 2 decimal places.

[1]

(ii)

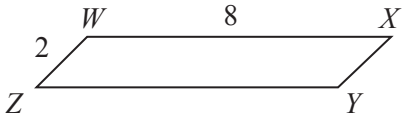


In triangle PQR, $PQ = 5$ m and $QR = 7$ m.
Area of triangle PQR = Area of triangle ABC.

Find the acute angle PQR.

Answer ..... [2]

(iii)



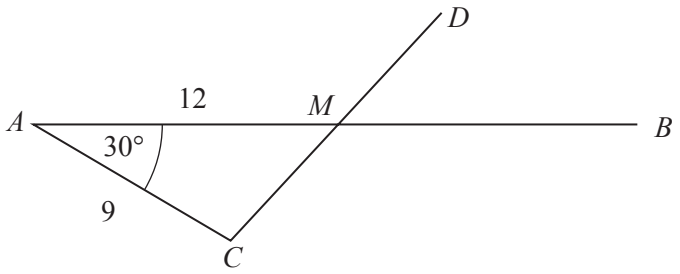
In the parallelogram $WXYZ$, $WX = 8$ m and $WZ = 2$ m.
Area of parallelogram $WXYZ$ = Area of triangle ABC.

Find the obtuse angle ZWX.

Answer ..... [3]

(b) AB, AC and CD are three rods. They can be fixed together in different positions.

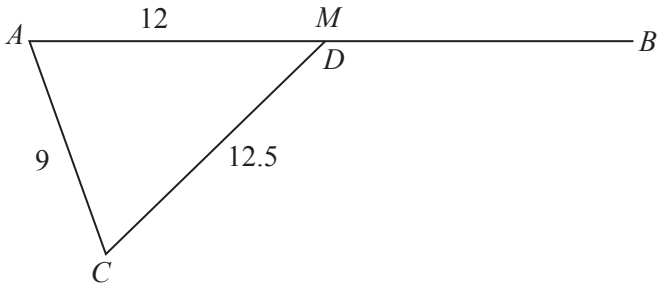
(i) $AC = 9$ cm and M is a fixed point on AB such that $AM = 12$ cm.



When $C\hat{A}M = 30°$, calculate CM.

Answer $CM =$ .....cm [3]

(ii)



In another position, the end D of the rod CD is fixed at the point M.
$CD = 12.5$ cm.

Calculate the increase in $C\hat{A}M$.

Answer ..... [3]

10 The table below is for $y = x^2 - 4x - 1$.

x	–2	–1	0	1	2	3	4	5	6
y		4	–1	–4	–5	–4	–1	4	

(a) Complete the table. [1]

(b) Using a scale of 2 cm to 1 unit, draw a horizontal x-axis for $-2 \leqslant x \leqslant 6$.
Using a scale of 2 cm to 5 units, draw a vertical y-axis for $-10 \leqslant y \leqslant 15$.
Plot the points from the table and join them with a smooth curve.

[3]

(c) By drawing a tangent, estimate the gradient of the curve at $x = 3$.

Answer ..... [2]

(d) **(i)** Find the least value of y.

Answer ..... [1]

(ii) $y \leqslant 4$ for $a \leqslant x \leqslant b$.

Find the least possible value of a and the greatest possible value of b.

Answer a .....

b ..... [2]

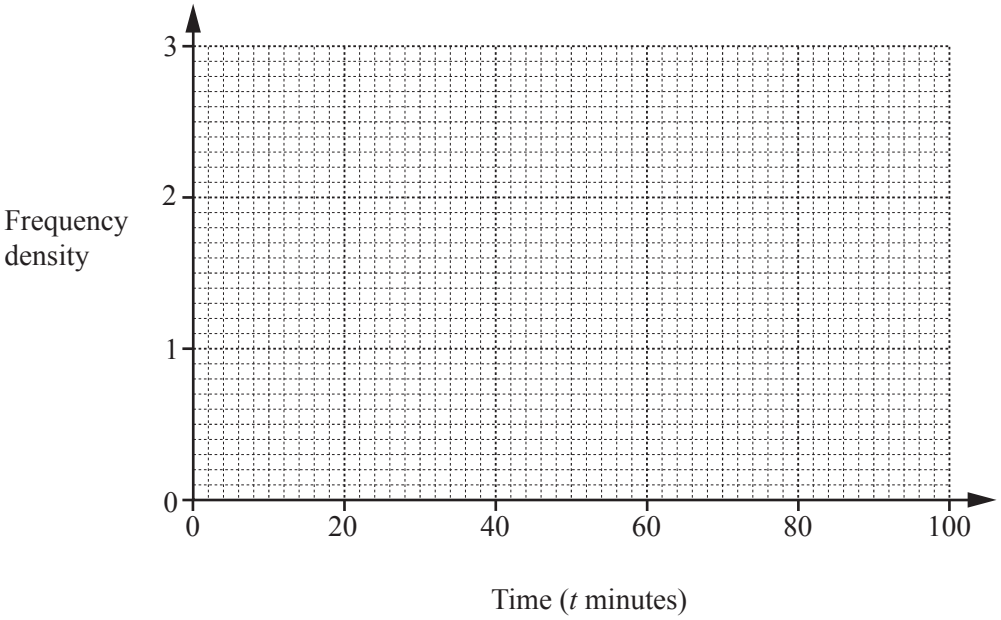
(e) **Use your graph** to solve the equation $x^2 - 4x + 2 = 0$.
Show your working to explain how you used your graph.

Answer ..... [3]

11 **(a)** 100 students were each asked how long they spent talking on their mobile phone during one day. The results are summarised in the table.

Time (t minutes)	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 40$	$40 < t \leqslant 60$	$60 < t \leqslant 80$	$80 < t \leqslant 100$
Frequency	10	30	12	16	20	12

On the axes below, draw a histogram to represent these results.

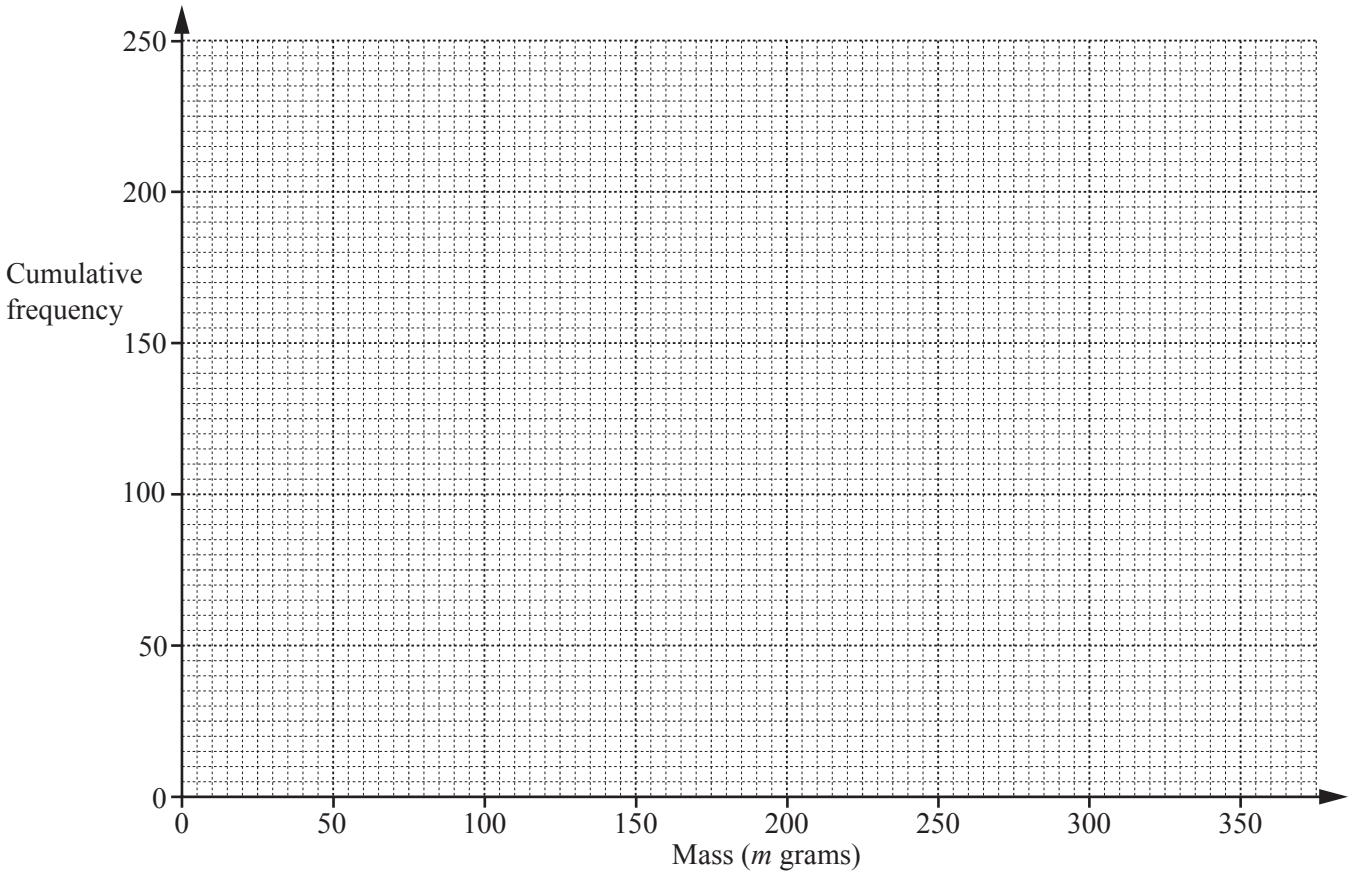


[3]

(b) The masses, in grams, of 240 potatoes were found.
The **cumulative** frequency table for these results is shown below.

Mass (m grams)	$m \leqslant 50$	$m \leqslant 100$	$m \leqslant 150$	$m \leqslant 200$	$m \leqslant 250$	$m \leqslant 300$	$m \leqslant 350$
Cumulative frequency	0	4	54	132	204	236	240

(i) Draw a smooth cumulative frequency curve to illustrate this information.



[2]

(ii) **(a)** Find the median.

Answer ..... [1]

(b) Find the inter-quartile range.

Answer ..... [2]

(iii) Complete the frequency table below.

Mass (m grams)	$50 < m \leqslant 100$	$100 < m \leqslant 150$	$150 < m \leqslant 200$	$200 < m \leqslant 250$	$250 < m \leqslant 300$	$300 < m \leqslant 350$
Frequency	4					

[1]

(iv) A potato with a mass greater than 250 grams is classed as extra large.

(a) How many of these potatoes are extra large?

Answer ..... [1]

(b) Which percentile of the distribution can be used to find this number?

Answer ..... [2]

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