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CAMBRIDGE INTERNATIONAL MATHEMATICS

0607/42

Paper 4 (Extended)

October/November 2021

2 hours 15 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 graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly and you will be given marks for correct methods, including sketches, even if your answer is incorrect.
- 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 your calculator value.

INFORMATION

- The total mark for this paper is 120.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

Formula List

For the equation $ax^2 + bx + c = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Curved surface area, A , of cylinder of radius r , height h . $A = 2\pi rh$

Curved surface area, A , of cone of radius r , sloping edge l . $A = \pi rl$

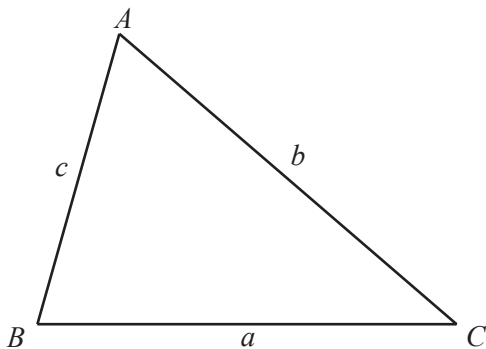
Curved surface area, A , of sphere of radius r . $A = 4\pi r^2$

Volume, V , of pyramid, base area A , height h . $V = \frac{1}{3}Ah$

Volume, V , of cylinder of radius r , height h . $V = \pi r^2 h$

Volume, V , of cone of radius r , height h . $V = \frac{1}{3}\pi r^2 h$

Volume, V , of sphere of radius r . $V = \frac{4}{3}\pi r^3$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area} = \frac{1}{2}bc \sin A$$

Answer **all** the questions.

1 (a) Stella and Tomas share \$200 in the ratio 11 : 14.

(i) Show that Stella receives \$88.

[1]

(ii) Stella invests her \$88 at a rate of 1.5% per year simple interest.

Calculate the amount of interest Stella has at the end of 6 years.

\$ [2]

(b) Urs buys some clothes in a sale.

(i) He buys a jacket for \$22.
The original price of the jacket was \$25.

Calculate the percentage reduction in the price of the jacket.

..... % [3]

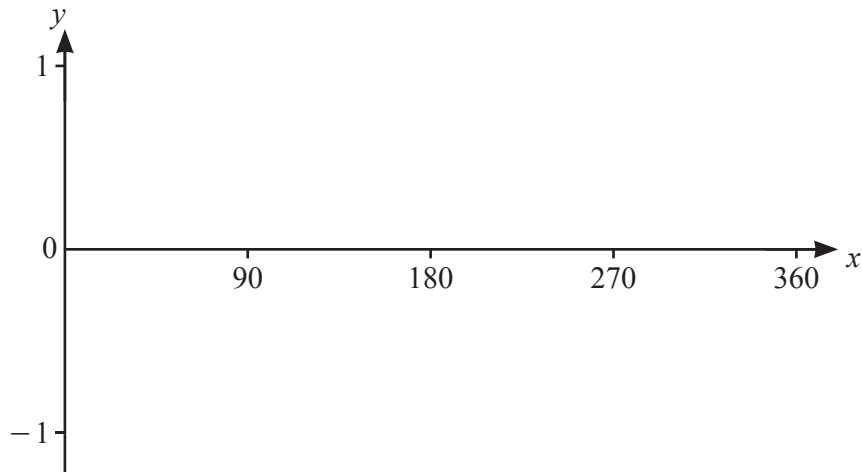
(ii) Urs buys a shirt for \$13.50 .
This is the price after a reduction of 10% of the original price.

Calculate the original price of the shirt.

\$ [2]

2 $f(x) = \sin x$ for $0^\circ \leq x \leq 360^\circ$

$g(x) = (\sin x)^2$ for $0^\circ \leq x \leq 360^\circ$



(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Write down the coordinates of the local minimum point on the graph of $y = f(x)$.

(..... ,) [1]

(c) Write down the period and amplitude of the graph of $y = f(x)$.

Period =

Amplitude = [2]

(d) On the same diagram, sketch the graph of $y = g(x)$. [2]

(e) Write down the range of

(i) $f(x)$,

..... [1]

(ii) $g(x)$.

..... [1]

(f) On the diagram, shade the regions where $\sin x \geq (\sin x)^2$. [1]

- 3 (a) The number of members in a social media group increases exponentially at a rate of 5% per month. At the start of the first month there are 882 members.

- (i) Calculate the number of members at the end of 10 months.
Give your answer correct to the nearest integer.

..... [3]

- (ii) Calculate the number of complete months from the start until the group has 2000 members.

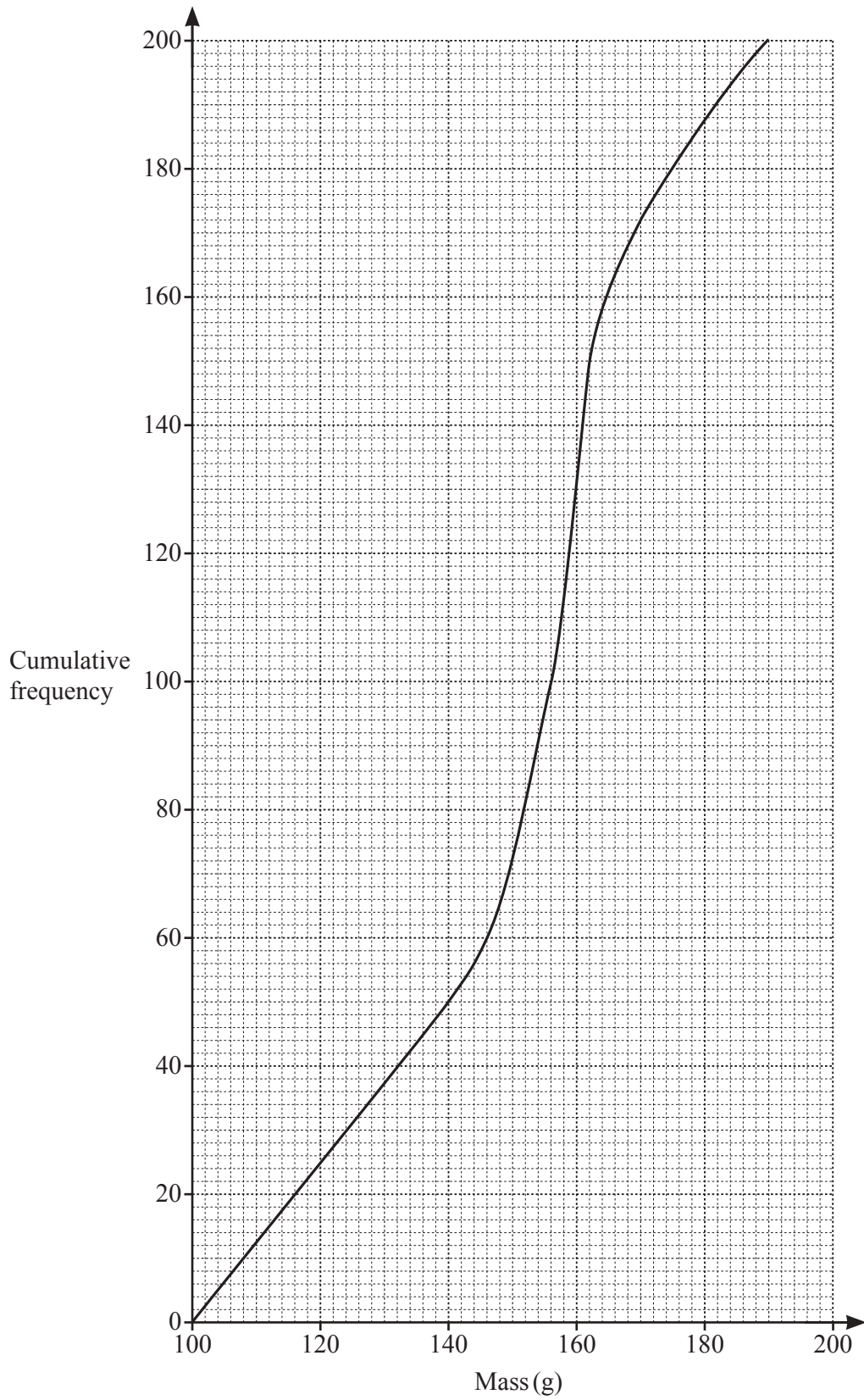
..... [4]

- (b) The mass of a radioactive substance decreases exponentially at a rate of $r\%$ per month. At the end of 10 months, its mass has decreased from 500 g to 242 g.

Find the value of r .

$r =$ [3]

- 4 The mass of each of 200 potatoes is measured.
The cumulative frequency curve shows the results.



(a) (i) Write down the mass of the heaviest potato.

..... g [1]

(ii) Find the median.

..... g [1]

(iii) Find the interquartile range.

..... g [2]

(iv) Find the number of potatoes with a mass greater than 170 g.

..... [2]

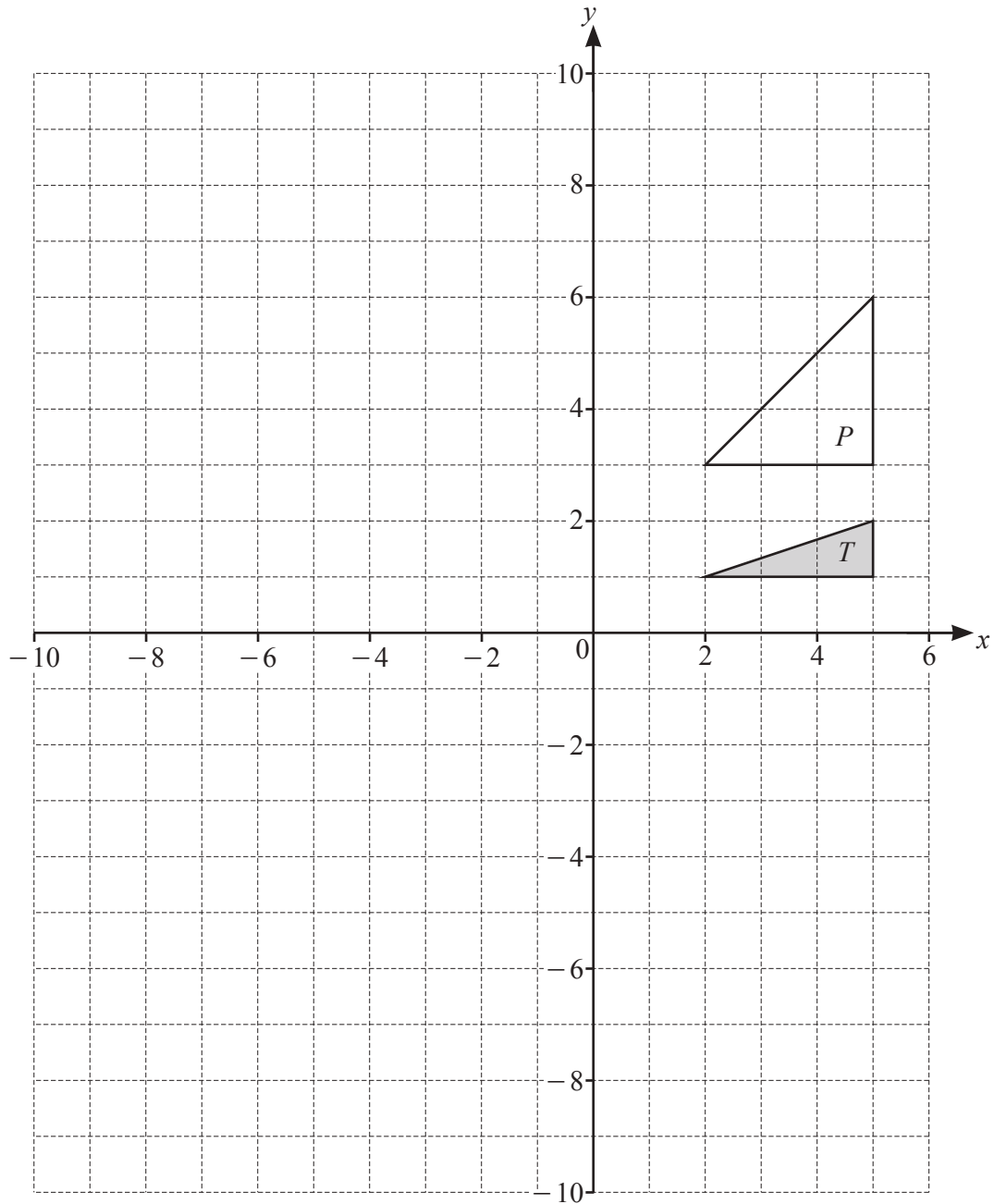
(b) This frequency table also shows information about the masses of the 200 potatoes.

Mass (m g)	$100 < m \leq 140$	$140 < m \leq 146$	$146 < m \leq 162$	$162 < m \leq 190$
Frequency	50	10	90	50

Calculate an estimate of the mean mass.

..... g [2]

5 (a)



- (i) Reflect shape *T* in the *y*-axis. [1]
- (ii) Translate shape *T* by the vector $\begin{pmatrix} -10 \\ 5 \end{pmatrix}$. [2]
- (iii) Rotate shape *T* through 90° clockwise about the point (2, 0). [2]
- (iv) Enlarge shape *T* with scale factor -2 and centre (0, 0). [2]
- (v) Describe fully the **single** transformation that maps shape *T* onto shape *P*.

..... [3]

.....

(b) $f(x) = x^2$

- (i) The graph of $y = f(x)$ is mapped onto the graph of $y = g(x)$ by a translation with vector $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$.

Find $g(x)$ in terms of x .

$$g(x) = \dots\dots\dots [1]$$

- (ii) The graph of $y = f(x)$ is mapped onto the graph of $y = h(x)$ by a stretch with factor 2 and the x -axis invariant.

Find $h(x)$ in terms of x .

$$h(x) = \dots\dots\dots [1]$$

6 (a) (i) Work out $\begin{pmatrix} 3 \\ 5 \end{pmatrix} - 2\begin{pmatrix} -1 \\ -2 \end{pmatrix}$.

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

(ii) A is the point $(3, 5)$ and C is the point $(4, 3)$.

Find the column vector that maps the point A onto the point C .

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

(iii) D is the point $(1, 3)$ and the vector from D to E is $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$.

Find the coordinates of E .

(..... ,) [1]

(iv) Find the magnitude of the vector $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$.

..... [2]

- (b) (i) P is the point $(-1, 6)$ and Q is the point $(3, 4)$.

Find the equation of the perpendicular bisector of the line PQ .

..... [5]

- (ii) Find the coordinates of the point where the perpendicular bisector in **part(b)(i)** crosses the x -axis.

(..... ,) [2]

- 7 (a) The cost of a newspaper is $\$p$.
The cost of a magazine is $\$m$.

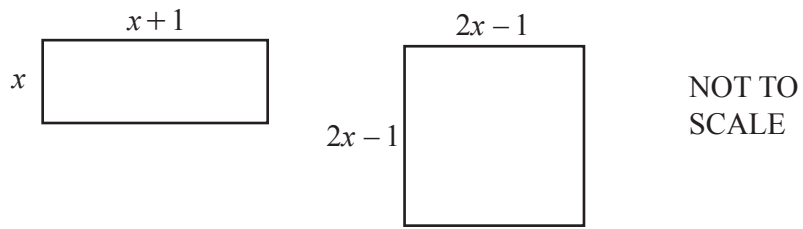
The total cost of 3 newspapers and 5 magazines is $\$13.30$.
The total cost of 1 newspaper and 7 magazines is $\$15.90$.

Find the value of p and the value of m .

$$p = \dots\dots\dots$$

$$m = \dots\dots\dots [5]$$

(b)



The area of the rectangle is equal to the area of the square.

Find the value of x .

$$x = \dots\dots\dots [7]$$

8 (a) $f(x) = 3x - 2$ $g(x) = 5x - 1$ $h(x) = \frac{1}{x+1}, x \neq -1$

(i) Find

(a) $f(3)$,

..... [1]

(b) $h(f(3))$.

..... [1]

(ii) Find $f(g(x))$ in its simplest form.

..... [2]

(iii) Solve $f(x) = g(x)$.

$x =$ [2]

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

$g^{-1}(x) =$ [2]

(v) Simplify $2h(x) + h(x+1)$.

Give your answer as a single fraction, in terms of x , in its simplest form.

..... [4]

(b) $j(x) = 5^x$

(i) Find the value of x when $j(x) = \frac{1}{5\sqrt{5}}$.

$x =$ [1]

(ii) Find $j^{-1}(x)$.

$j^{-1}(x) =$ [2]

9 (a) Complete the table for each sequence.

Sequence	1st term	2nd term	3rd term	4th term	5th term		n th term
A	7	5	3	1			
B	16	25	36	49			
C	$\frac{1}{2}$	1	2	4			

[9]

(b) $y \propto \frac{1}{\sqrt{x}}$ and $z \propto y^3$.

When $x = 36$, $y = 2$ and $z = 24$.

Find z in terms of x .

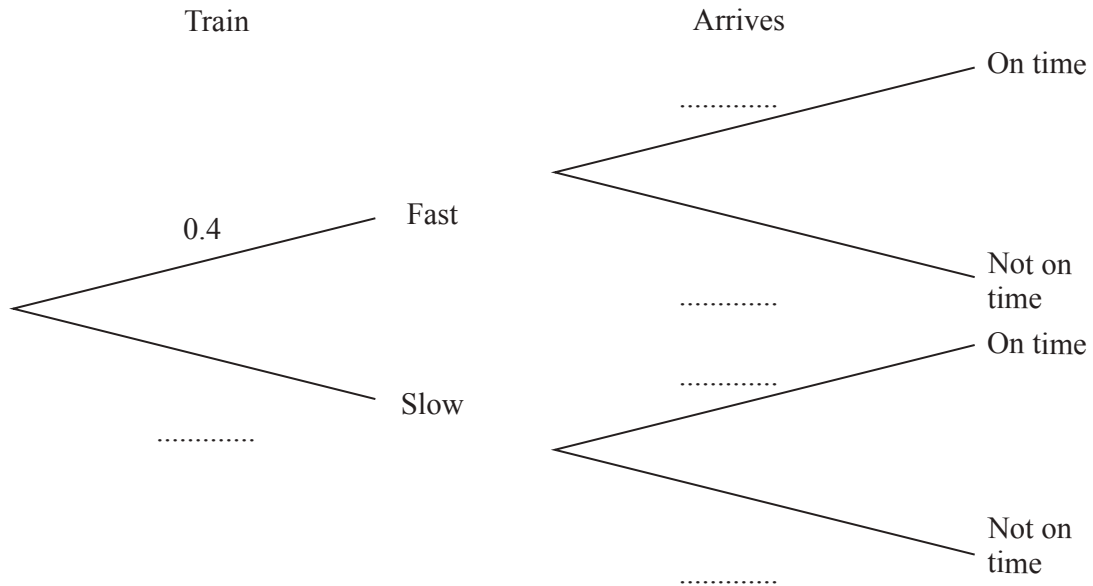
$z = \dots\dots\dots$ [4]

- 10 Fast trains and slow trains travel from City A to City B.
40% of the trains from City A to City B are fast trains.

The probability that a fast train arrives in City B on time is 0.9 .
The probability that a slow train arrives in City B on time is 0.95 .

Manuela goes to the station in City A and takes the next train to City B.

- (a) Complete the tree diagram.

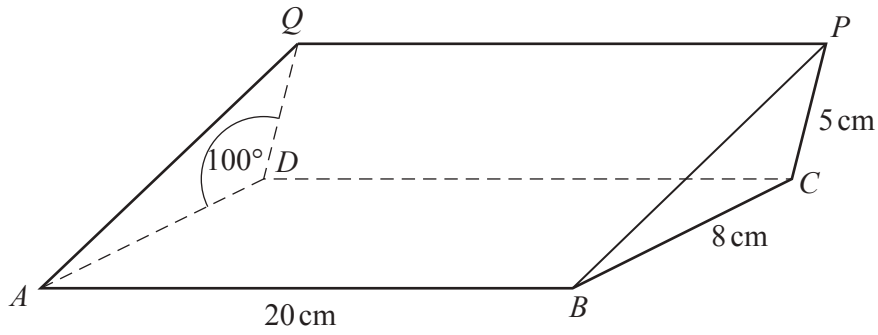


[3]

- (b) Find the probability that Manuela arrives in City B on time.

..... [3]

11



NOT TO SCALE

The diagram shows a solid triangular prism of length 20 cm.
 The cross-section of the prism is triangle BCP and three faces are rectangles.
 $BC = 8$ cm, $CP = 5$ cm and angle $ADQ =$ angle $BCP = 100^\circ$.

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

..... cm^2 [7]

- (b) (i) On the diagram of the prism, draw two straight lines and mark angle PAC . [1]
- (ii) Angle $APC = 73.45^\circ$.
Calculate angle PAC .

Angle $PAC = \dots\dots\dots$ [4]