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CAMBRIDGE INTERNATIONAL MATHEMATICS

0607/41

Paper 4 (Extended)

October/November 2023

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 . $A = \pi rl$

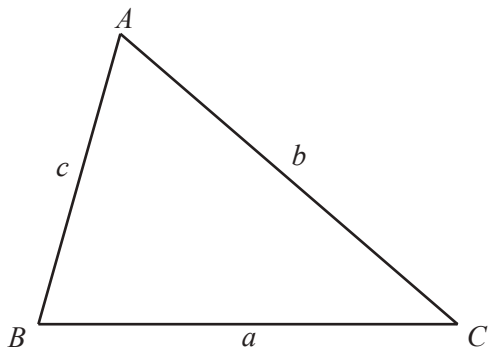
Curved surface area, A , of sphere of radius r . $A = 4\pi r^2$

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) Find \$2.40 as a percentage of \$1.60 .

..... % [1]

(b) Calculate 7.2% of 2.5 g.

..... g [2]

(c) Amir invests \$400 at a rate of 1.8% per year compound interest.

Calculate the value of this investment at the end of 6 years.

\$ [2]

(d) Each year the population of a small town increases by 4% of its value in the previous year.
The population is now 29 640.

(i) Calculate the population last year.

..... [2]

(ii) Calculate the number of complete years it will take for the population of 29 640 to be first greater than 40 000.

..... years [4]

2



$$f(x) = \frac{1}{\sin x^\circ} \text{ for } 0 \leq x \leq 360$$

(a) On the diagram, sketch the graph of $y = f(x)$. [3]

(b) Find the coordinates of the local minimum point.

(..... ,) [1]

(c) Write down the equations of the three asymptotes of the graph of $y = f(x)$.

.....,, [2]

(d) The equation $f(x) = k$ has no solutions.

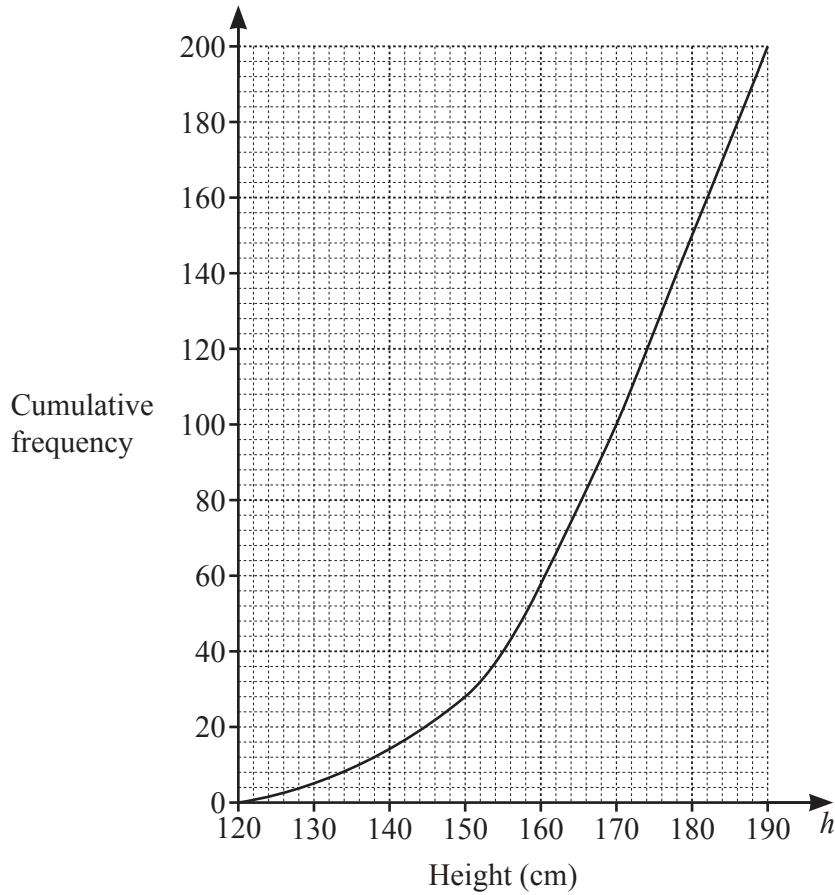
Write down the range of values of k .

..... [2]

(e) By sketching another graph on the diagram, solve the equation $\frac{1}{\sin x^\circ} = 5 \sin\left(\frac{x}{2}\right)^\circ$ for $0 \leq x \leq 360$.

..... [3]

- 3 Each of 200 students records their height, h cm.
The results are shown on the cumulative frequency curve.



(a) Use the cumulative frequency curve to find

(i) the median

..... cm [1]

(ii) the interquartile range

..... cm [2]

(iii) the number of students with a height greater than 150 cm.

..... [2]

(b) Use the cumulative frequency curve to complete the frequency table.

Height (h cm)	$120 < h \leq 150$	$150 < h \leq 170$	$170 < h \leq 180$	$180 < h \leq 190$
Frequency				

[2]

(c) Use the frequency table to calculate an estimate of the mean height.

..... cm [2]

4 (a) $\mathbf{p} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -5 \\ 1 \end{pmatrix}$

(i) Work out $\mathbf{p} + 2\mathbf{q}$.

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

(ii) A is the point $(2, 6)$ and B is the image of point A after a translation by the vector \mathbf{p} .

Find the coordinates of B .

$$(\dots\dots\dots, \dots\dots\dots) [1]$$

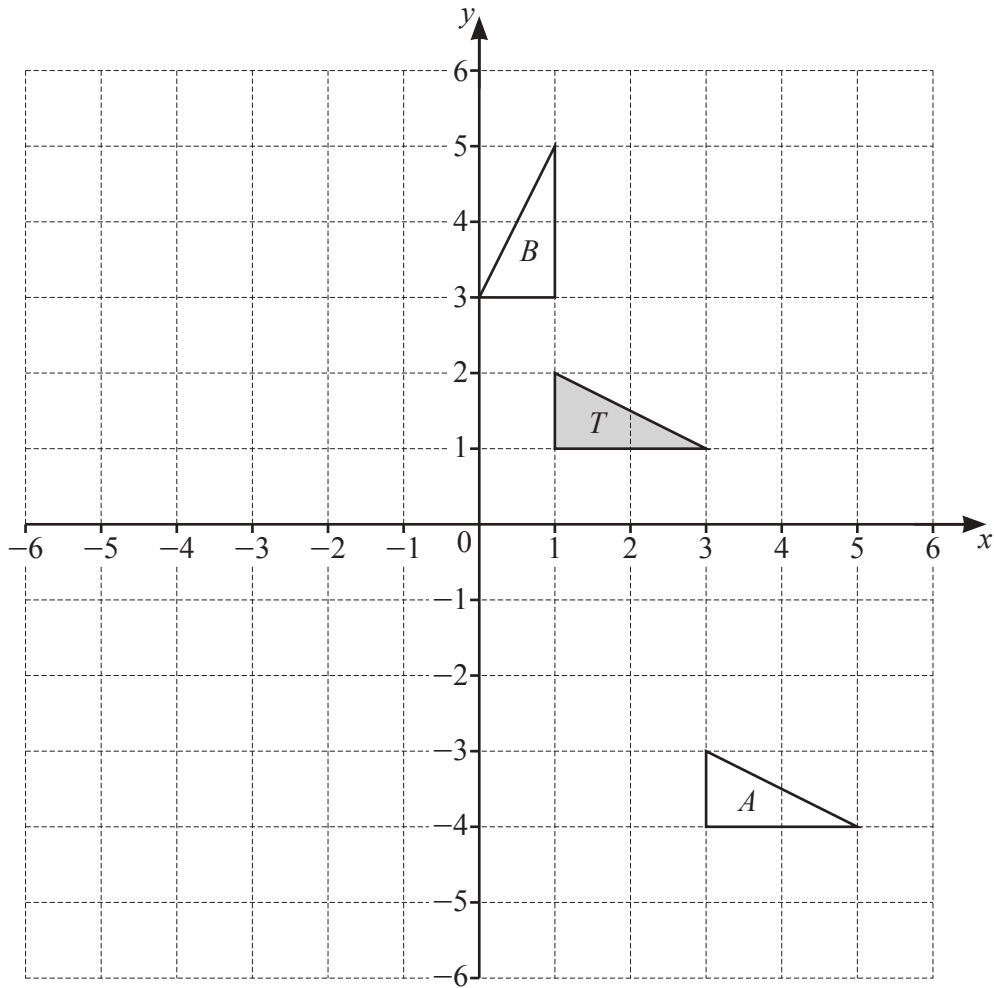
(iii) Find the magnitude of \mathbf{q} .

$$\dots\dots\dots [2]$$

(b) Find the vector that translates the point $(1, 5)$ to the point $(-1, 7)$.

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

(c)



(i) Describe fully the **single** transformation that maps triangle T onto triangle A .

.....
 [2]

(ii) Describe fully the **single** transformation that maps triangle T onto triangle B .

.....
 [3]

(iii) Reflect triangle T in the y -axis.

[1]

(iv) Stretch triangle T with factor 3 and invariant line $y = 3$.

[2]

5 $f(x) = 2x - 5$ $g(x) = x^2 + x + 3$ $h(x) = x^3$ $j(x) = 3^x$

(a) The domain of $f(x)$ is $0 \leq x \leq 10$.

Find the range of $f(x)$.

..... [2]

(b) Solve.

(i) $f(x) = -2$

$x =$ [2]

(ii) $g(x) = 3 - x$

$x =$ or $x =$ [3]

(c) Find $g(f(4))$.

..... [2]

(d) Find $h(2) - j(2)$.

..... [2]

(e) Find $h^{-1}(x)$.

$$h^{-1}(x) = \dots\dots\dots [1]$$

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

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

- 6 (a) Jade and Kim share \$160.
Jade receives \$8 more than Kim.

Find the ratio Jade's money : Kim's money.
Give your answer in its simplest form.

..... : [2]

- (b) Each year the height of a bush increases by $x\%$ of its height at the start of the year.
It takes 6 years for the bush to grow from 1.2 m to 1.664 m.

Find the value of x .

$x =$ [3]

- (c) Work out, giving each answer in standard form.

(i) $(4.5 \times 10^{85}) \times (3 \times 10^{36})$

..... [2]

(ii) $(2 \times 10^n) + (2 \times 10^{n-2})$

..... [2]

- 7 (a) Marcus runs for 1 hour at x km/h and then walks for 2 hours at $(x - 5)$ km/h. He travels a total distance of 14 km.

Find his running speed.

..... km/h [3]

- (b) Nina runs 5 km at y km/h and then walks 7 km at $(y - 7)$ km/h. She takes a total of 2 hours.

- (i) Show that $2y^2 - 26y + 35 = 0$.

[3]

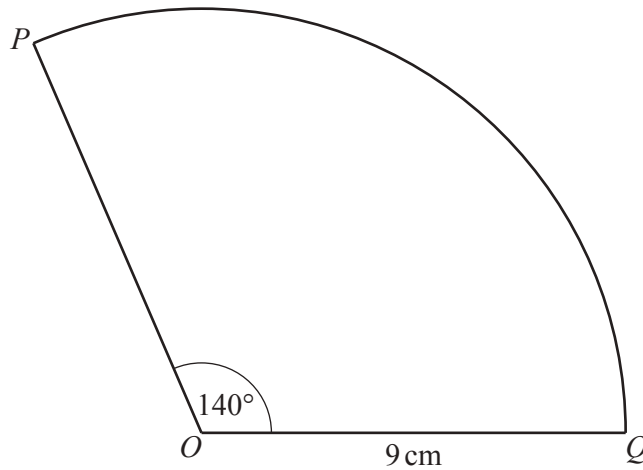
- (ii) Solve $2y^2 - 26y + 35 = 0$.

$y = \dots\dots\dots$ or $y = \dots\dots\dots$ [3]

- (iii) Find Nina's walking speed.

..... km/h [1]

8



NOT TO SCALE

The diagram shows the sector of a circle with radius 9 cm and sector angle 140° .

(a) Calculate the length of the arc PQ .

..... cm [2]

(b) Calculate the area of the sector.

..... cm^2 [2]

(c) The sector is the cross-section of a solid of length 20 cm .

Calculate the **total** surface area of the solid.

..... cm^2 [4]

- (d) Another solid is mathematically similar to the solid in **part (c)**.
The radius of the sector in this solid is 10 cm.

Calculate the total surface area of this solid.

..... cm² [2]

9 On any day the probability that Samira cycles to school is $\frac{5}{6}$.

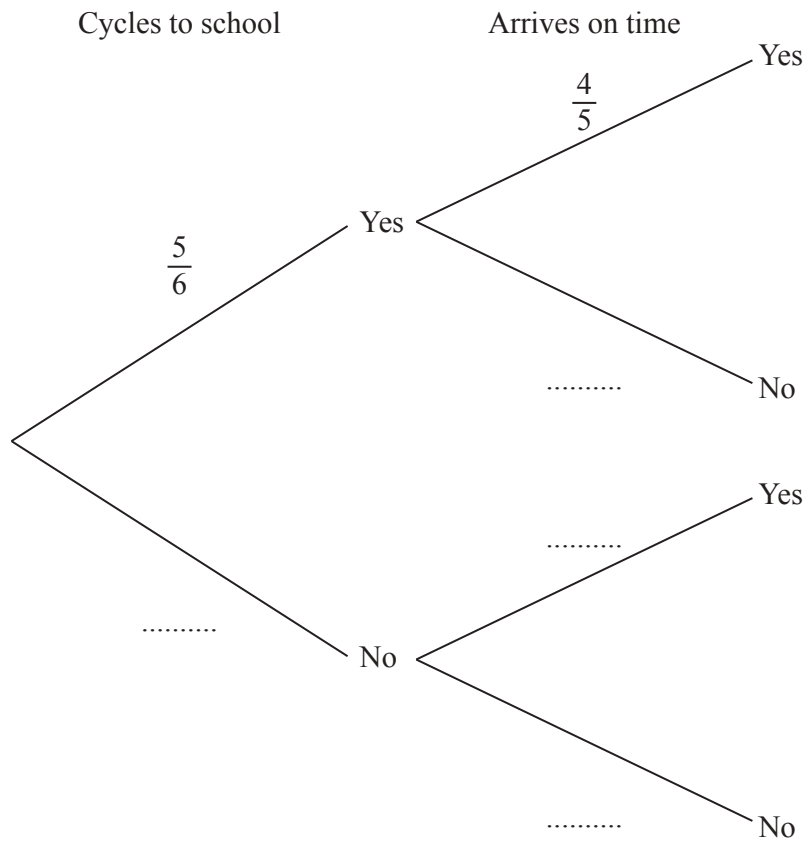
When Samira cycles to school the probability that she arrives on time is $\frac{4}{5}$.

When Samira does not cycle to school the probability that she arrives on time is $\frac{2}{5}$.

(a) Find the number of days Samira is expected to cycle to school in a school term of 54 days.

..... [1]

(b) Complete the tree diagram.



[2]

(c) Calculate the probability that on any day Samira arrives at school on time.

..... [3]

(d) In a school week of 5 days, find the probability that Samira cycles to school on exactly 1 day.

..... [3]

10 (a) Simplify.

(i) $\frac{k}{2p} \times \frac{t}{3}$

..... [1]

(ii) $\frac{u}{7} + \frac{2u}{21}$

..... [2]

(b) Simplify.

$$\frac{x^2 - x - 42}{2x^2 - 98}$$

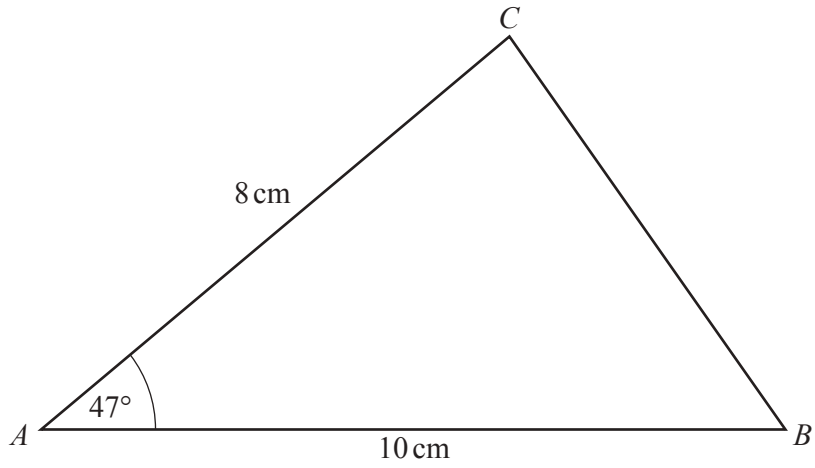
..... [4]

(c) Write as a single fraction in its simplest form.

$$\frac{g-1}{g+1} - \frac{2g}{5} + 4$$

..... [3]

11



NOT TO SCALE

(a) Calculate the area of triangle ABC .

..... cm^2 [2]

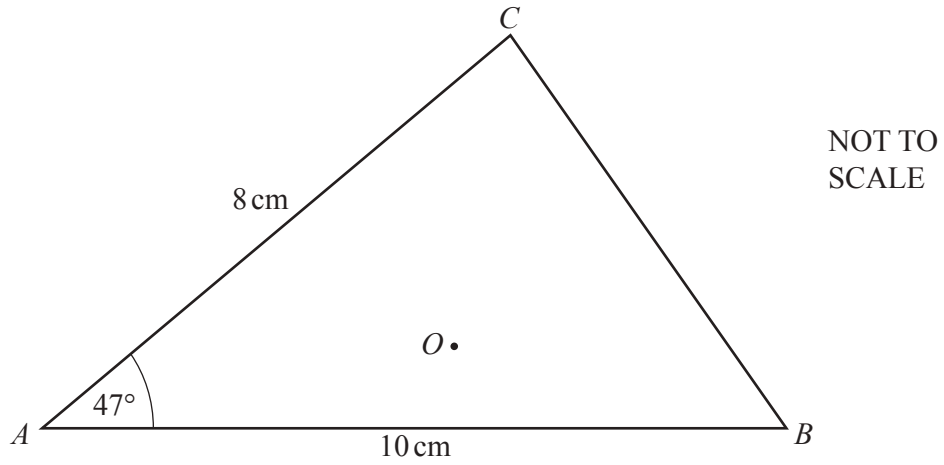
(b) Calculate the shortest distance from C to AB .

..... cm [3]

(c) Show that $BC = 7.41$ cm correct to 2 decimal places.

[3]

(d)



In triangle ABC , O is the centre of the circle that passes through A , B and C .

Calculate the radius of this circle.

..... cm [4]