Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTER NUMBER		CANDIDATE NUMBER

MATHEMATICS (US) **0444/41**

Paper 4 (Extended) **May/June 2015**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If work is needed for any question it must be shown in the space provided.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 130.

Write your calculator model in the box below.

This document consists of **20** printed pages.

International Examinations

Formula List

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

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

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

Surface area, A, of sphere of radius r. $\qquad A = 4\pi r^2$

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

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

Volume, V, of sphere of radius r. $\qquad V = \dfrac{4}{3}\pi r^3$
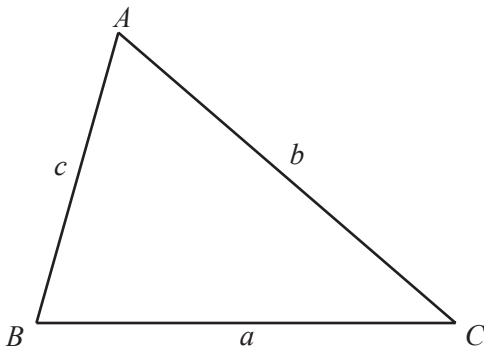
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1   12 000 vehicles drive through a road toll on one day.
    The ratio   cars : trucks : motorcycles = 13 : 8 : 3.

   (a) **(i)** Show that 6500 cars drive through the road toll on that day.

   Answer(a)(i)

[1]

   (ii) Calculate the number of trucks that drive through the road toll on that day.

   Answer(a)(ii) .... [1]

   (b) The toll charges in 2014 are shown in the table.

Vehicle	Charge
Cars	$2
Trucks	$5
Motorcycles	$1

   Show that the total amount paid in tolls on that day is $34 500.

   Answer(b)

[2]

   (c) This total amount is a decrease of 8% on the total amount paid on the same day in 2013.
   Calculate the total amount paid on that day in 2013.

   Answer(c) $... [3]

   (d) 2750 of the 6500 car drivers pay their toll using a credit card.
   Write down, in its simplest terms, the fraction of car drivers who pay using a credit card.
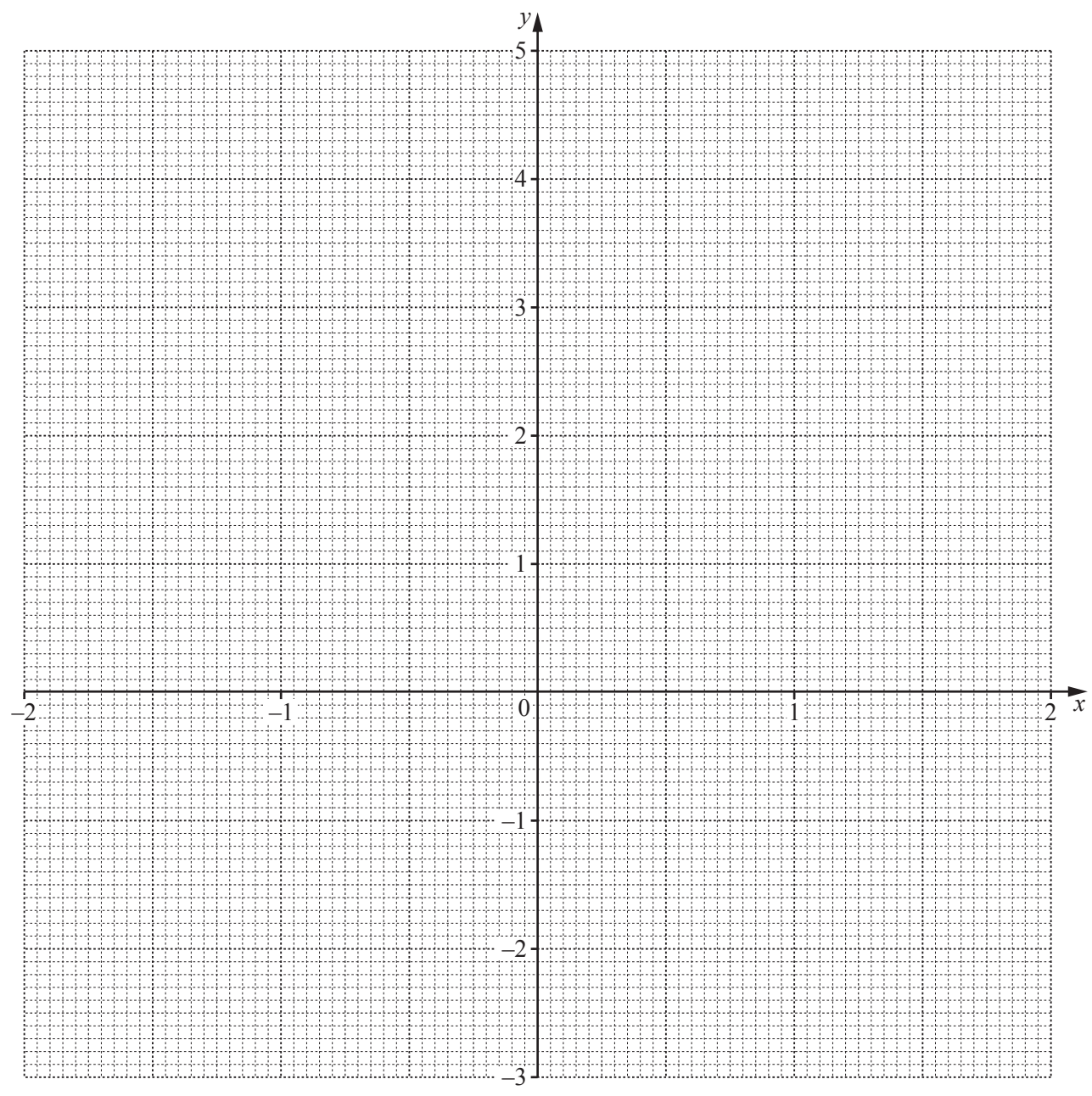
   Answer(d) .... [2]

[Turn over

2 The table shows some values for the function $y = x^2 - \dfrac{1}{2x}$, $x \neq 0$.

x	-2	-1.5	-1	-0.5	-0.25	-0.2		0.2	0.25	0.5	1	1.5
y	4.25	2.58			2.06	2.54		-2.46	-1.94			1.92	3.75

(a) Complete the table of values. [4]

(b) On the grid, draw the graph of $y = x^2 - \dfrac{1}{2x}$ for $-2 \leqslant x \leqslant -0.2$ and $0.2 \leqslant x \leqslant 2$.

[5]

(c) By drawing a suitable line, use your graph to solve the equation $x^2 - \dfrac{1}{2x} = 2$.

Answer(c) x = ... or *x* = ... or *x* = ... [3]
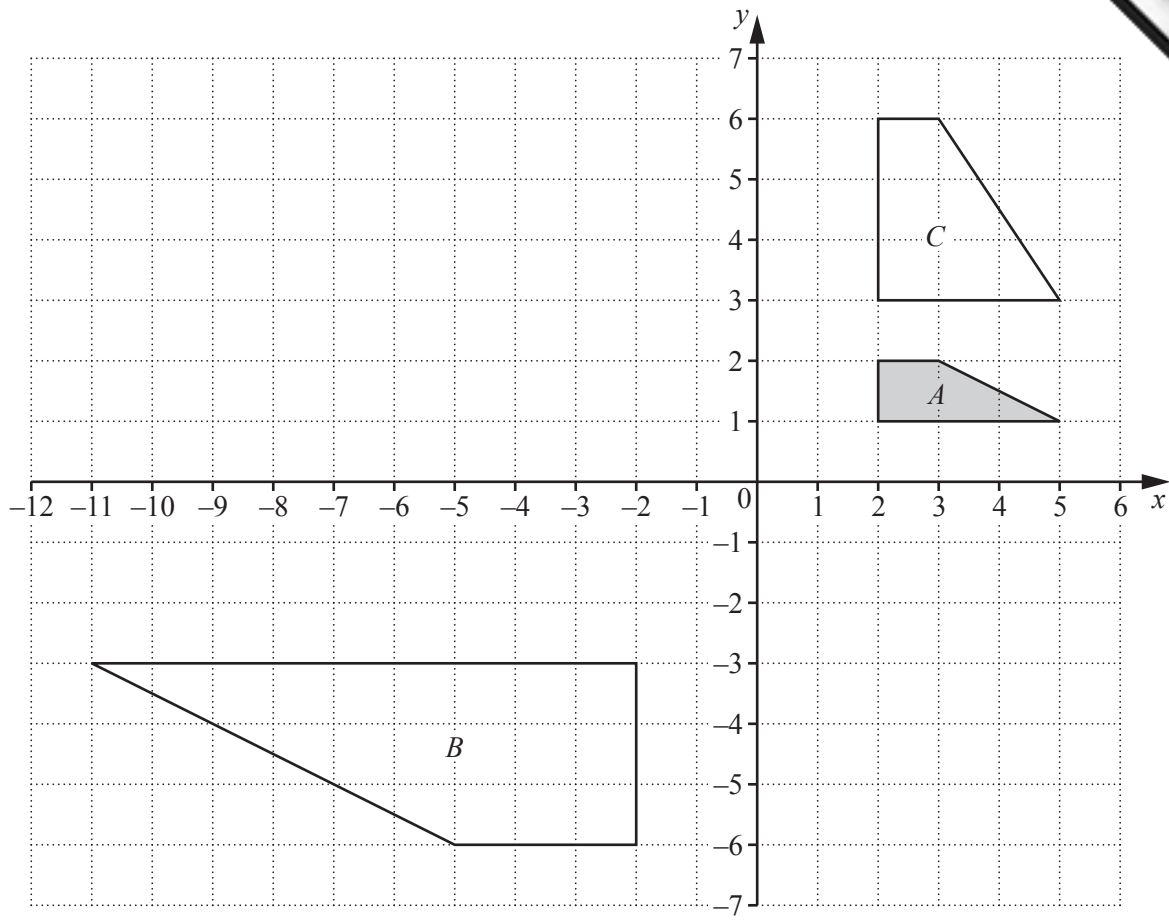
(d) The equation $x^2 - \dfrac{1}{2x} = k$ has only one solution, where x is a real number.

Write down the range of values of k for which this is possible.

Answer(d) .... [2]

(e) By drawing a suitable tangent, find an estimate of the slope of the curve at the point where $x = -1$.

Answer(e) .... [3]

3

(a) Draw the image of

  (i) shape A after a translation by $\begin{pmatrix} -1 \\ -4 \end{pmatrix}$, [2]

  (ii) shape A after a reflection in the line $x = -2$, [2]

  (iii) shape A after a rotation through 180° about the point (–2, 0). [2]

(b) Describe fully the **single** transformation that maps

  (i) shape A onto shape B,

  Answer(b)(i) ....

  .... [3]

  (ii) shape A onto shape C.

  Answer(b)(ii) ....

  .... [3]

4 Here are two lists of letters.

List 1	A	A	E	I	I	O	U	U

List 2	A	E	E	I	I	I	I	O	U

(a) A letter is chosen at random from List 1.

Write down the probability that it is

(i) A or O,

Answer(a)(i) .... [1]

(ii) not E.

Answer(a)(ii) .... [1]

(b) A letter is chosen at random from List 1 and a letter is chosen at random from List 2.

(i) Complete the tree diagram.

List 1   List 2

$\frac{2}{8}$ Letter I

$\frac{4}{9}$ Letter I

.... Not letter I

.... Letter I

.... Not letter I

.... Not letter I

....
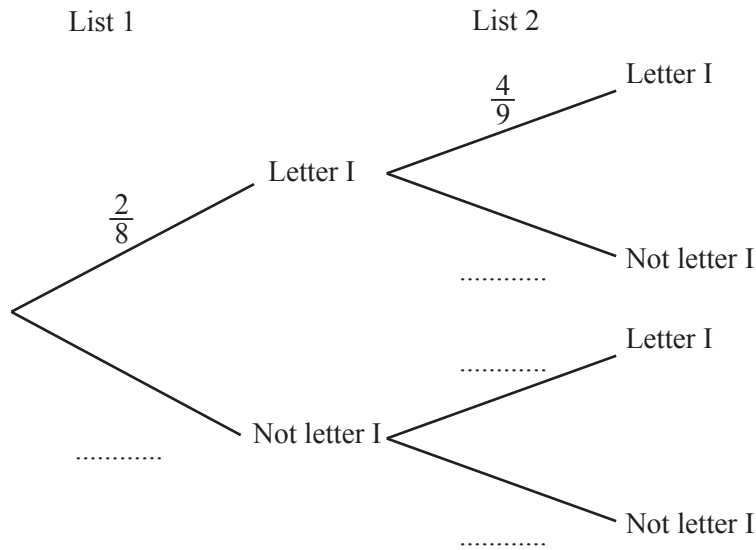
[2]

(ii) Find the probability that exactly one of the letters is the letter I.

Answer(b)(ii) .... [3]

(c) A letter is chosen at random from List 1 and a letter is chosen at random from List 2.

Find the probability that neither letter is the letter U.

Answer(c) .... [2]

[Turn over

5 **(a)** Andrei stands on level horizontal ground, 294 m from the foot of a vertical tower which

    (i) Calculate the angle of elevation of the top of the tower.

Answer(a)(i) .... [2]

    (ii) Andrei walks a distance *x* meters directly towards the tower.
The angle of elevation of the top of the tower is now 24.8°.

       Calculate the value of *x*.

Answer(a)(ii) *x* = ... [4]

(b) (i) Find the values of x when

$$\sin x = 0.2 \text{ and } 0° \leqslant x \leqslant 360°.$$

Answer(b)(i) .... , ... [2]

(ii) $\tan y = \dfrac{1}{\sqrt{3}}$.

Find the exact value of $\tan(90 - y)$.

Answer(b)(ii) .... [1]

(iii)
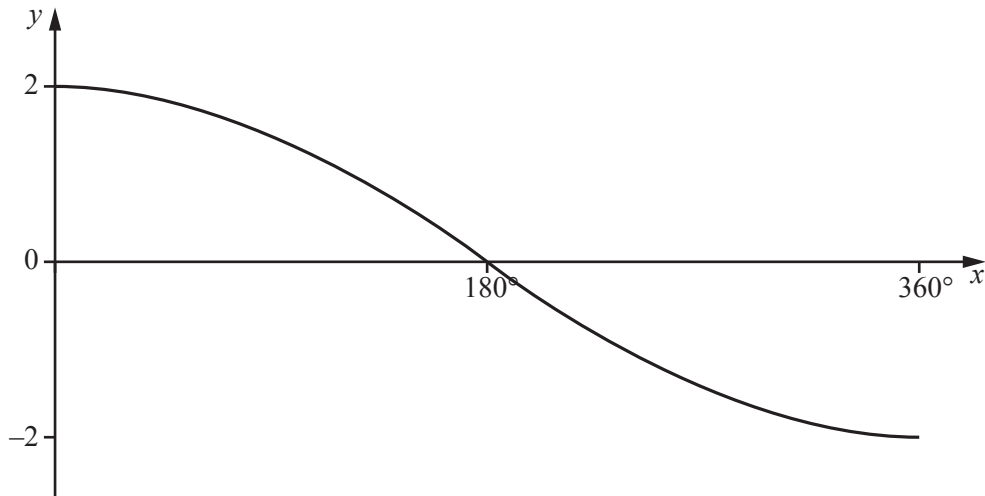
The diagram shows the graph of the function $p\cos(qx)$ for $0° \leqslant x \leqslant 360°$.

Find the value of p and the value of q.

Answer(b)(iii) $p =$ ....

$q =$ .... [2]

(iv) $f(x) = \tan x$

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

Find $g(x)$.

Answer(b)(iv) $g(x) =$ .... [1]

[Turn over

6 The table shows the time, t minutes, that 400 people take to complete a test.

Time taken (t mins)	$0 < t \leqslant 10$	$10 < t \leqslant 24$	$24 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$	$60 < t \leqslant 70$
Frequency	10	90	135	85	70	10

(a) (i) Write down the modal class.

Answer(a)(i) .... min [1]

(ii) Calculate an estimate of the mean time taken to complete the test.

Answer(a)(ii) .... min [4]

(b) (i) Complete the table of cumulative frequencies.

Time taken (t mins)	$t \leqslant 10$	$t \leqslant 24$	$t \leqslant 30$	$t \leqslant 40$	$t \leqslant 60$	$t \leqslant 70$
Cumulative frequency	10	100				400

[2]

(ii) On the grid opposite, draw a cumulative frequency diagram to show this information.

Cumulative
frequency

0   10   20   30   40   50   60   70   *t*

Time taken (minutes)
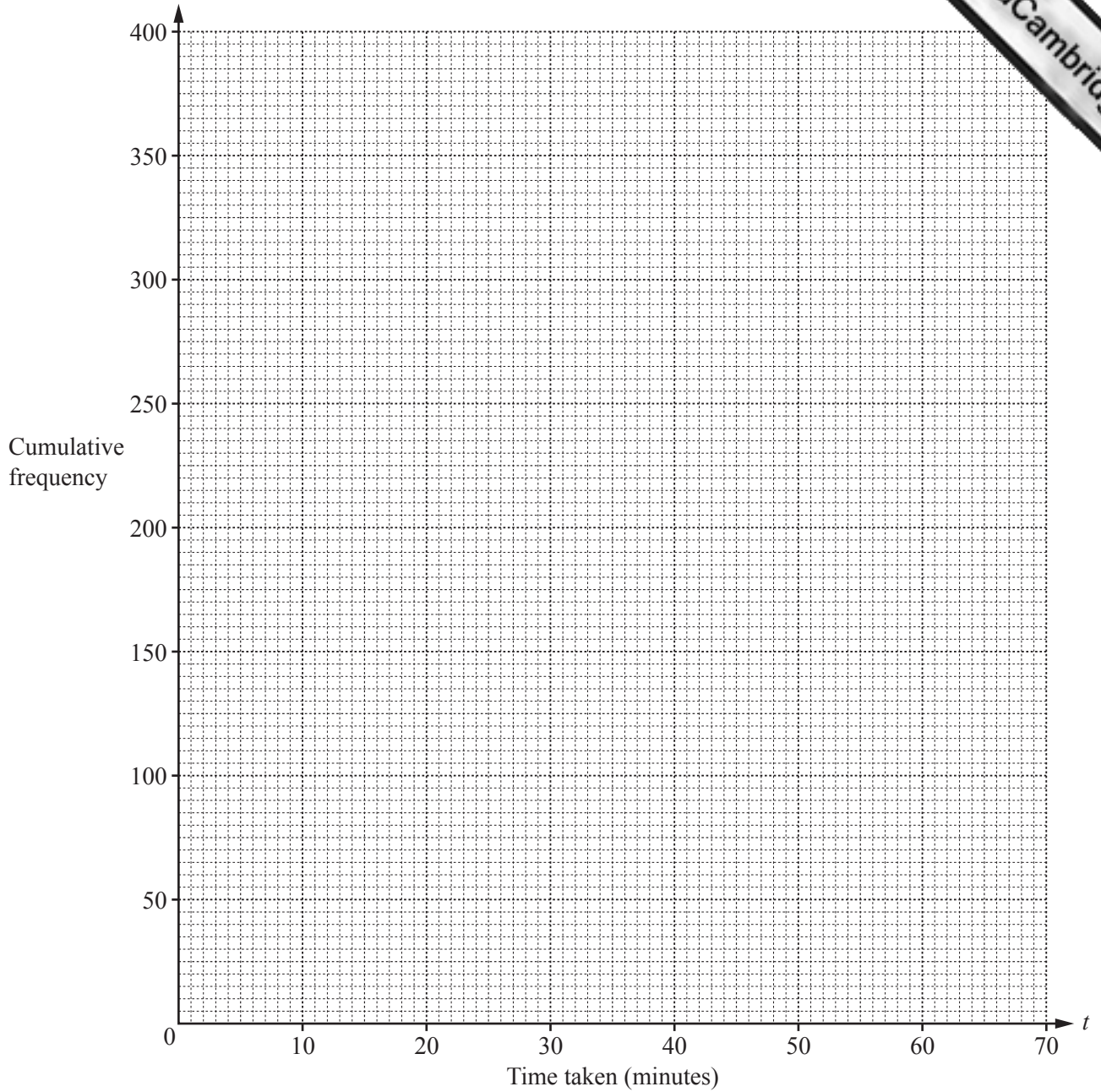
[3]

(c) Use your graph to estimate

    (i) the median time,

Answer(c)(i) .... min [1]

  (ii) the inter-quartile range,

Answer(c)(ii) .... min [2]

(iii) the 15th percentile,

Answer(c)(iii) .... min [2]

 (iv) the number of people who took more than 50 minutes.

Answer(c)(iv) .... [2]

7 **(a)**
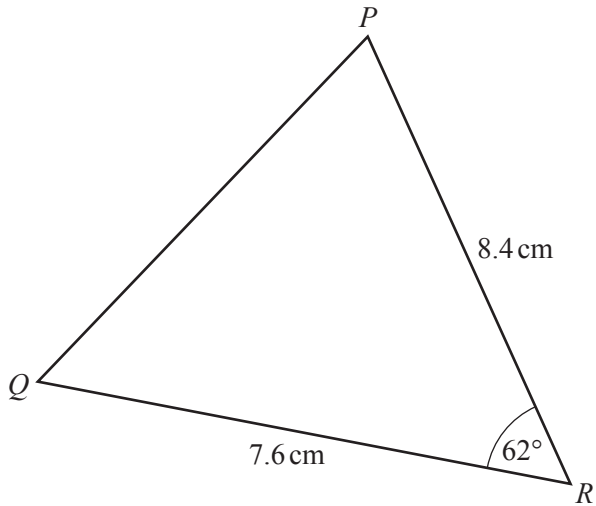
NOT TO
SCALE

In the triangle *PQR*, *QR* = 7.6 cm and *PR* = 8.4 cm.
Angle *QRP* = 62°.

Calculate

(i) *PQ*,

Answer(a)(i) *PQ* = ... cm [4]

(ii) the area of triangle *PQR*.

Answer(a)(ii) .... cm² [2]

(b)

North

H

North

NOT TO
SCALE

63 km

G

J
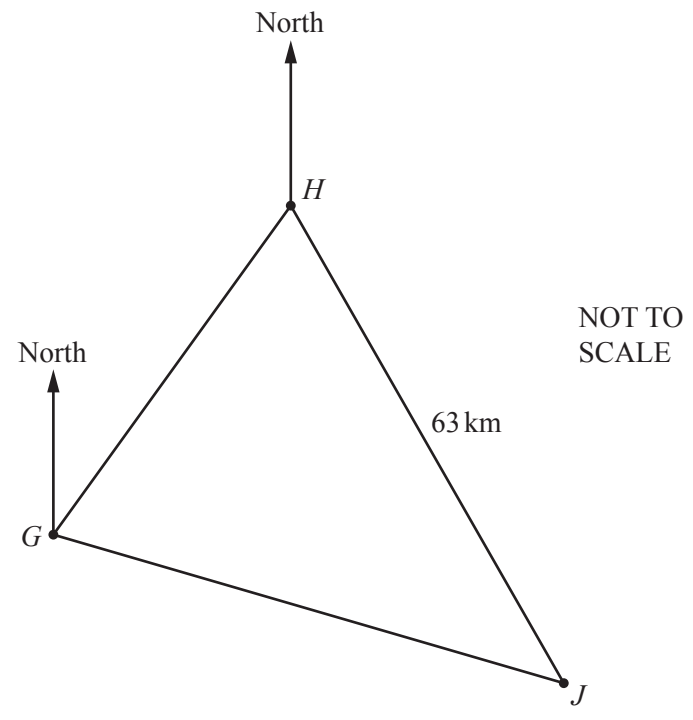
The diagram shows the positions of three small islands *G*, *H* and *J*.
The bearing of *H* from *G* is 045°.
The bearing of *J* from *G* is 126°.
The bearing of *J* from *H* is 164°.
The distance *HJ* is 63 km.

Calculate the distance *GJ*.

Answer(b) GJ = ... km [5]

8 **(a)** Jamil, Kiera and Luther collect badges.
Jamil has x badges.
Kiera has 12 badges more than Jamil.
Luther has 3 times as many badges as Kiera.
Altogether they have 123 badges.

Form an equation and solve it to find the value of x.

Answer(a) x = ... [3]

(b) Find the integer values of t which satisfy the inequalities.

$$4t + 7 < 39 \leqslant 7t + 2$$

Answer(b) .... [3]

(c) Solve the following equations.

(i) $\dfrac{21 - x}{x + 3} = 4$

Answer(c)(i) *x =* .... [3]

(ii) $3x^2 + 7x - 5 = 0$

Show all your working and give your answers correct to 2 decimal places.

Answer(c)(ii) $x =$ .... or $x =$ .... [4]

[Turn over

9   (a)
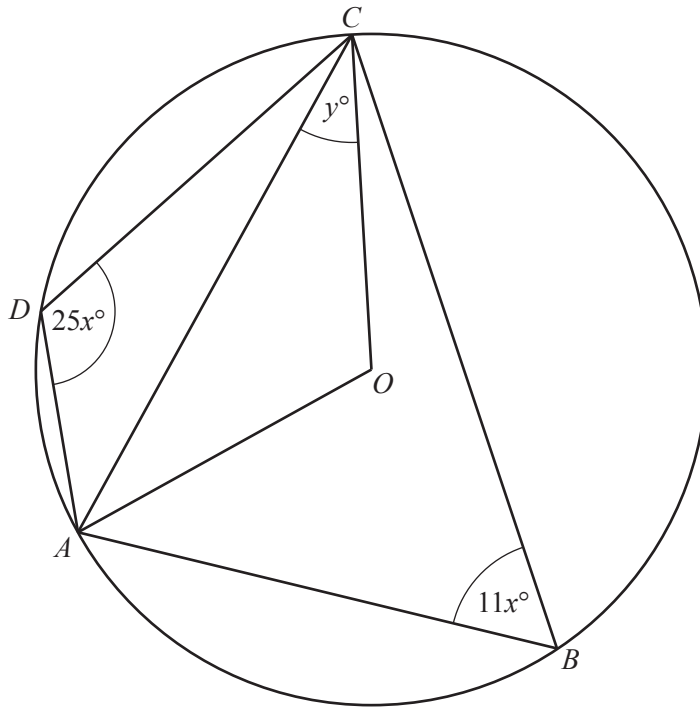
A, B, C and D lie on a circle, center O.
Angle $ABC = 11x°$ and angle $ADC = 25x°$.
Angle $ACO = y°$.

Find the value of

(i) x,

Answer(a)(i) $x =$ .... [2]

(ii) y.

Answer(a)(ii) $y =$ .... [2]

(b) The diagram shows a shaded shape formed by three semi-circular arcs.
The radius of each semi-circle is shown in the diagram.

NOT TO
SCALE

6 cm

4 cm

2 cm
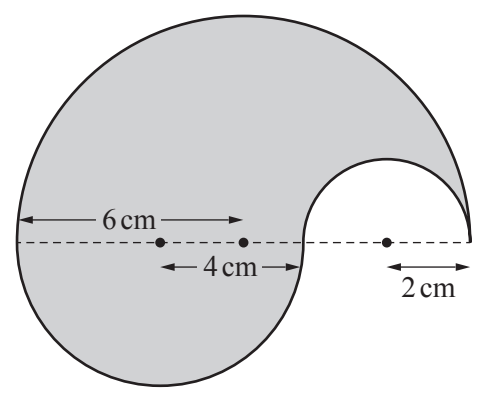
(i) Calculate the perimeter of the shaded shape.

Answer(b)(i) .... cm [2]

(ii) The shaded shape is made from metal 1.6 mm thick.

Calculate the volume of metal used to make this shape.
Give your answer in cubic millimeters.

Answer(b)(ii) .... mm³ [5]

10
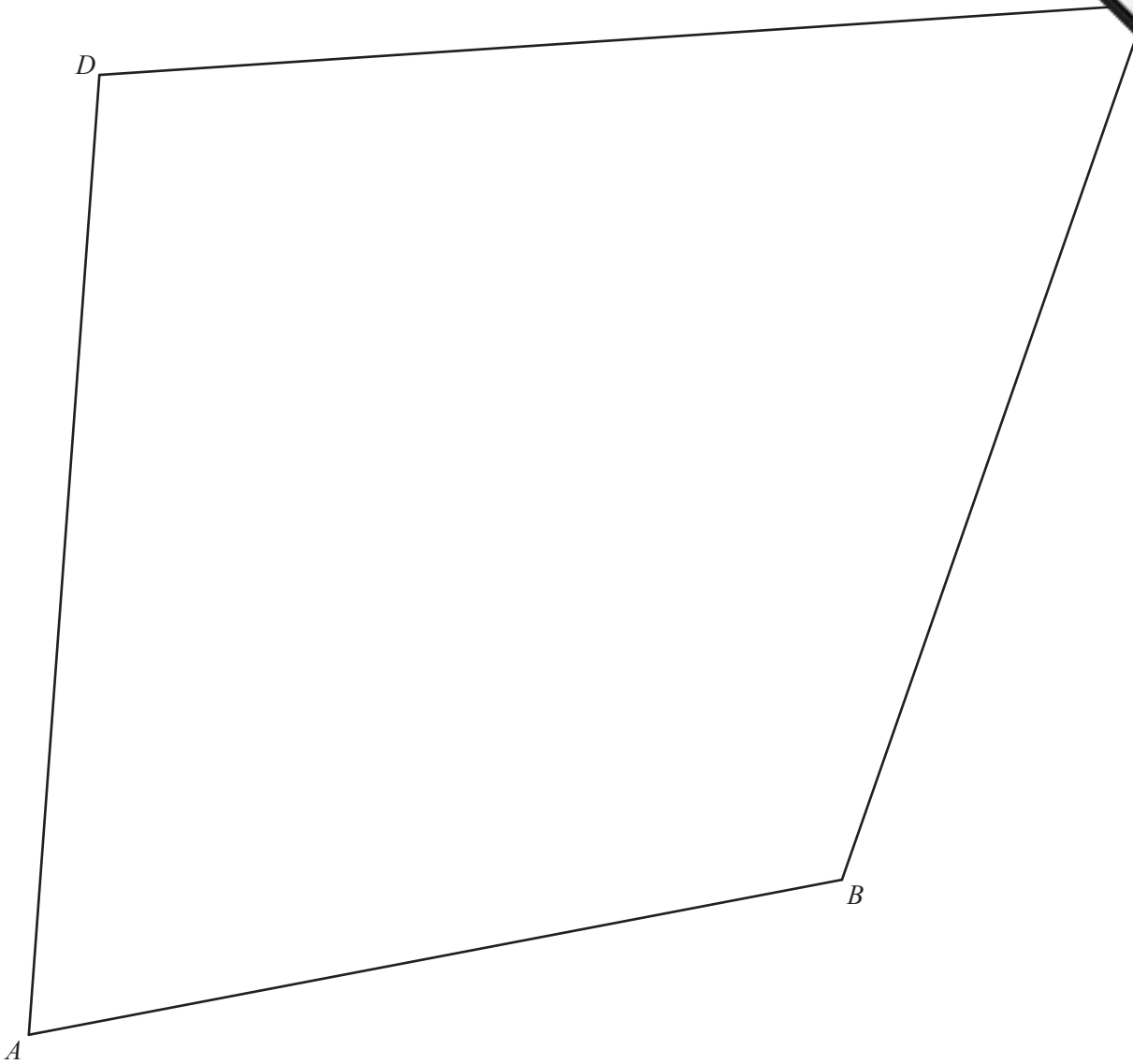
(a) Measure

(i) the length of *BC*,

Answer(a)(i) *BC* = ... cm [1]

(ii) angle *ABC*.

Answer(a)(ii) Angle *ABC* = ... [1]

(b) Using a compass and straight edge only, construct

   (i) the perpendicular bisector of *AB*,

   (ii) the bisector of angle *BAD*. [2]

(c) The perpendicular bisector of *AB* and the bisector of angle *BAD* meet at *X*.

  Draw the circle, center *X*, so that *AD* is a tangent to this circle. [1]

(d) Using a compass and straight edge only, mark the point *Y* on *BC* so that angle *ADY* is equal to angle *DCB*. [2]

Question 11 is printed on the next page.

[Turn over

11 (a) Solve for x.

$$A - x = \frac{xr}{t}$$

Answer(a) x = ... [4]

(b) Find the value of a and the value of b when $x^2 - 16x + a = (x + b)^2$.

Answer(b) a = ...

b = ... [3]

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

$$\frac{6}{x - 4} - \frac{5}{3x - 2}$$

Answer(c) .... [3]