Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTER NUMBER						CANDIDATE NUMBER				

7147967587

MATHEMATICS (US) **0444/41**

Paper 4 (Extended) **May/June 2017**

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 **16** printed pages.

CAMBRIDGE International Examinations

Formula List

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

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

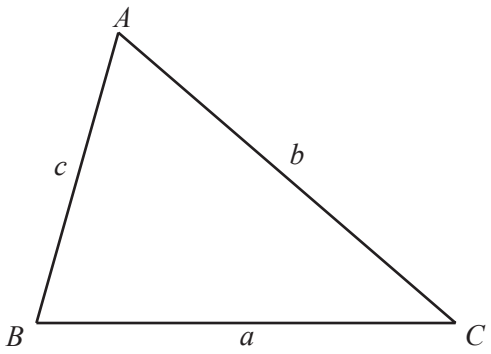
Lateral surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

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

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

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

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

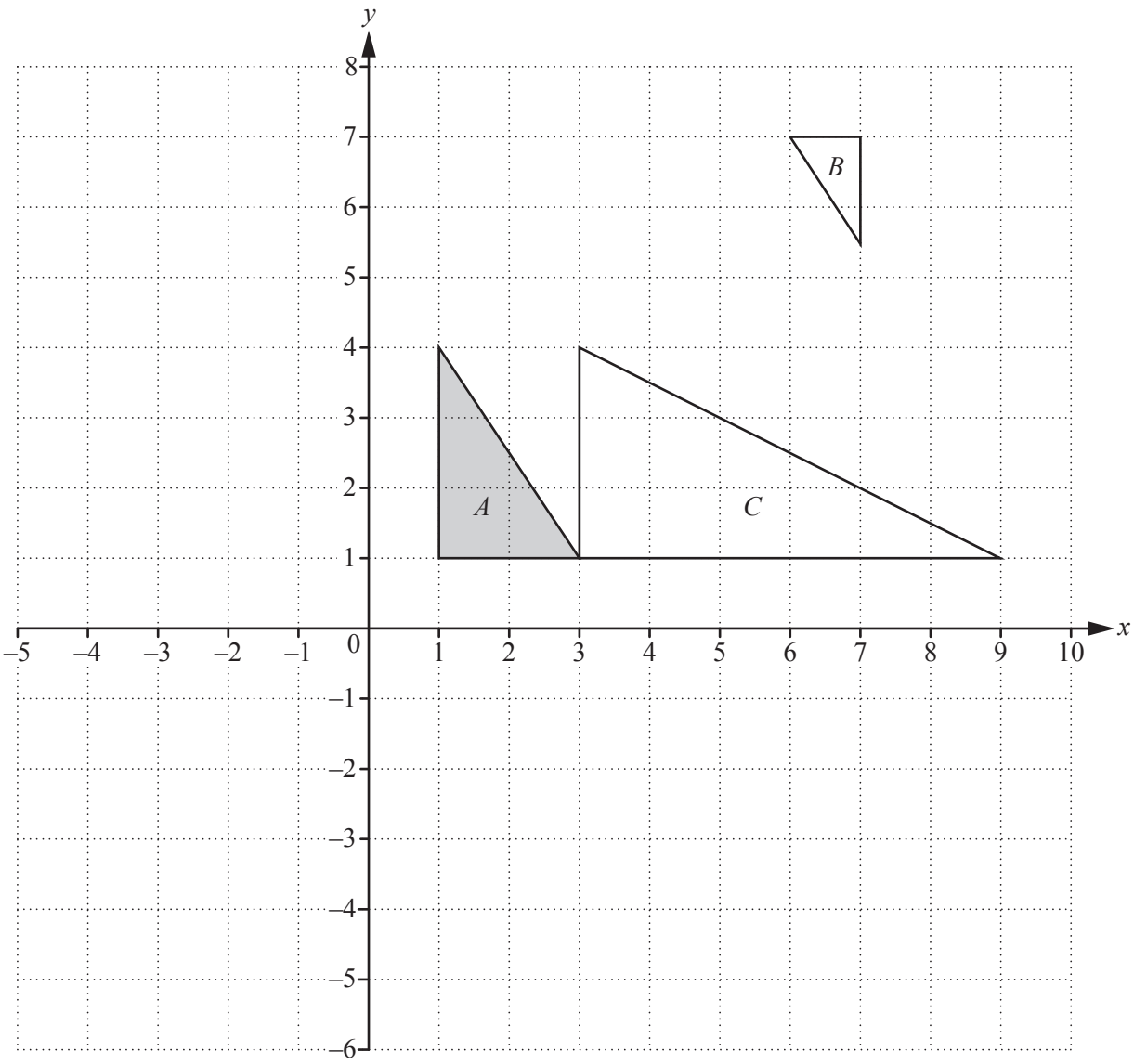


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1



(a) (i) Draw the image of triangle A after reflection in the line $y = 4$. [2]

(ii) Draw the image of triangle A after rotation of 90° counterclockwise about (0, 0). [2]

(iii) Draw the image of triangle A after translation by the vector $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$. [2]

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

.....

..... [3]

(ii) Describe fully the **single** transformation that maps triangle A onto triangle C.

.....

..... [3]

2 An energy company charged these prices in 2013.

Electricity price	Gas price
23.15 cents per day plus 13.5 cents for each unit used	24.5 cents per day plus 5.5 cents for each unit used

(a) (i) In 90 days, the Siddique family used 1885 units of **electricity**.

Calculate the total cost, in dollars, of the electricity they used.

$ ..... [2]

(ii) In 90 days, the **gas** used by the Khan family cost $198.16 .

Calculate the number of units of gas used.

..... units [3]

(b) In 2013, the price for each unit of electricity was 13.5 cents.
Over the next 3 years, this price increased exponentially at a rate of 8% per year.

Calculate the price for each unit of electricity after 3 years.

..... cents [2]

(c) Over these 3 years, the price for each unit of gas increased from 5.5 cents to 7.7 cents.

(i) Calculate the percentage increase from 5.5 cents to 7.7 cents.

..... % [3]

(ii) Over the 3 years, the 5.5 cents increased exponentially by the same percentage each year to 7.7 cents.

Calculate the percentage increase **each year**.

..... % [3]

(d) In 2015, the energy company divided its profits in the ratio

shareholders : bonuses : development $= 5 : 2 : 6$.

In 2015, its profits were \$390 million.

Calculate the amount the company gave to shareholders.

\$ ..... million [2]

(e) The share price of the company in June 2015 was \$258.25 .
This was an increase of 3.3% on the share price in May 2015.

Calculate the share price in May 2015.

\$ ..... [3]

3 The time taken for each of 90 cars to complete one lap of a race track is shown in the table.

Time (t seconds)	$70 < t \leqslant 71$	$71 < t \leqslant 72$	$72 < t \leqslant 73$	$73 < t \leqslant 74$	$74 < t \leqslant 75$
Frequency	17	24	21	18	10

(a) Write down the modal time interval.

..... $< t \leqslant$ ..... [1]

(b) Calculate an estimate of the mean time.

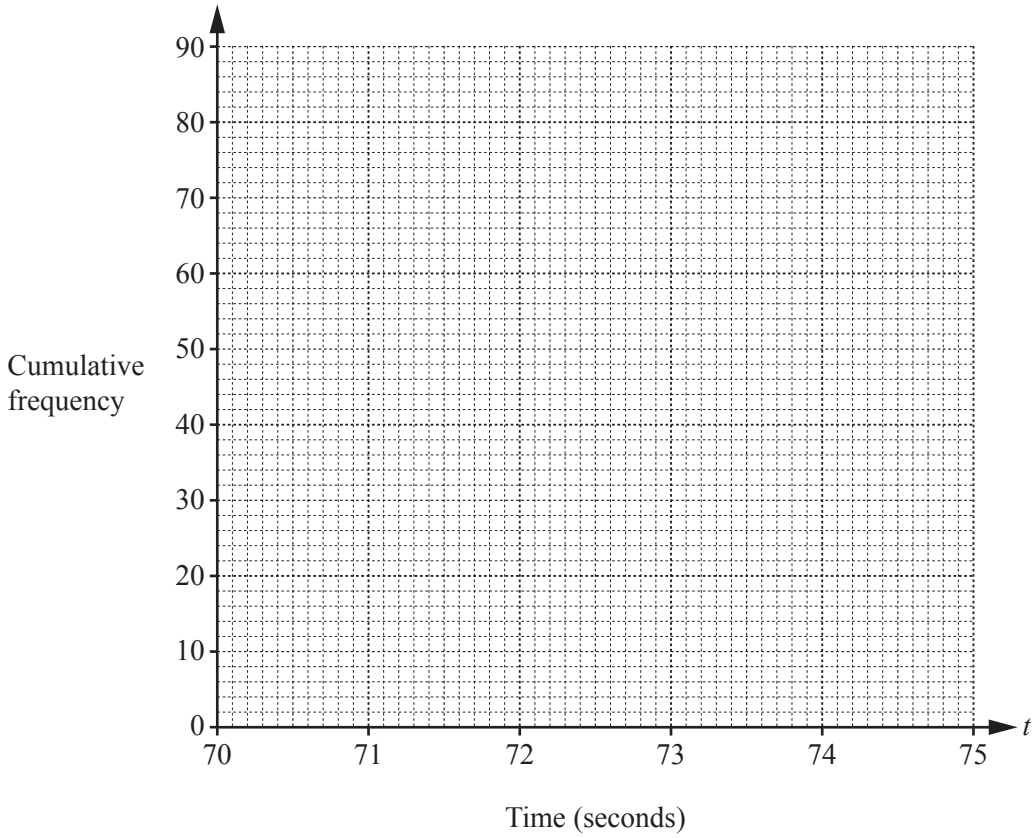
..... s [4]

(c) **(i)** Complete the cumulative frequency table.

Time (t seconds)	$t \leqslant 71$	$t \leqslant 72$	$t \leqslant 73$	$t \leqslant 74$	$t \leqslant 75$
Cumulative frequency	17				

[2]

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



[3]

(iii) Find the median time.

..... s [1]

(iv) Find the inter-quartile range.

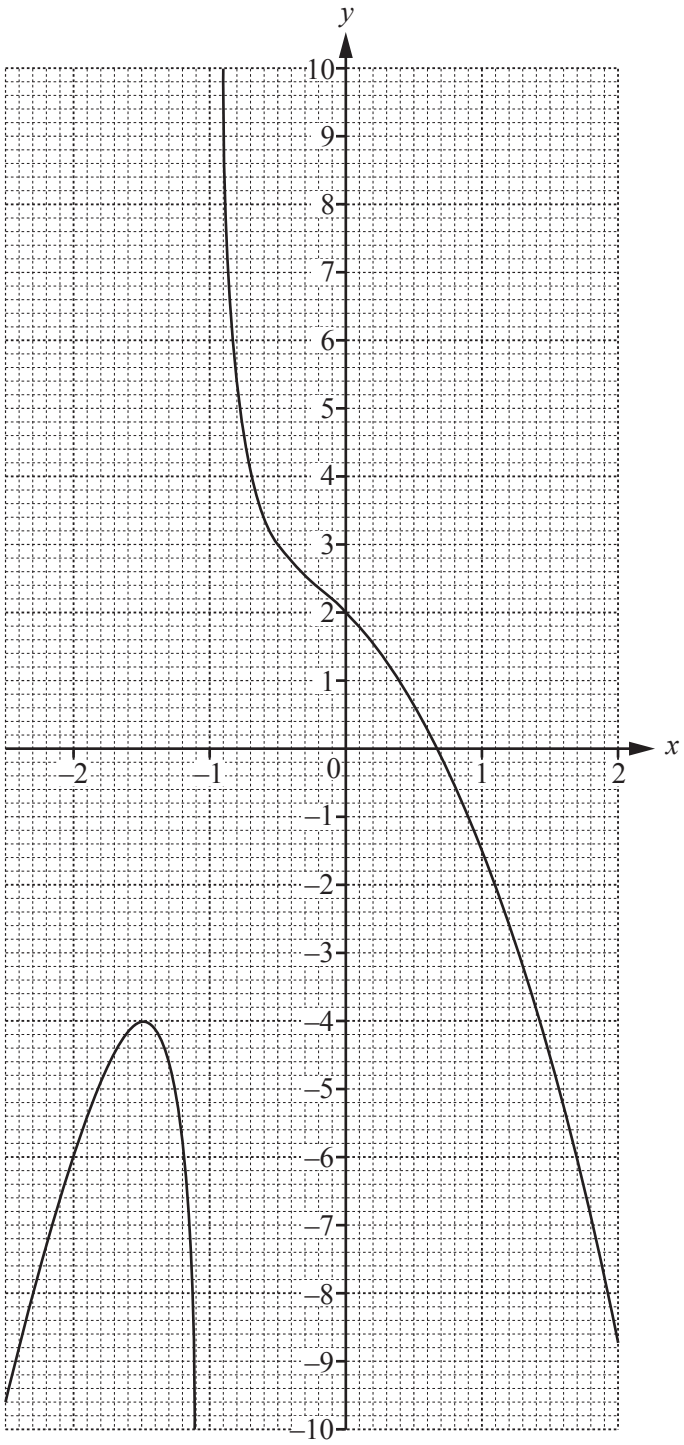
..... s [2]

(d) One lap of the race track measures 3720 m.
One car took 40 seconds to complete the first 2000 m and then traveled the remaining part of the lap at a speed of 190 km/h.

Calculate the average speed for the whole lap.
Give your answer in km/h.

..... km/h [4]

4 The diagram shows the graph of $y = f(x)$ for $-2.5 \leqslant x \leqslant 2$.



(a) Find f(1).

..... [1]

(b) Solve $f(x) = 3$.

$x =$ ..... [1]

(c) The equation $f(x) = k$ has only one solution for $-2.5 \leqslant x \leqslant 2$.

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

..... [2]

(d) By drawing a suitable straight line, solve the equation $f(x) = x - 5$.

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

(e) Draw a tangent to the graph of $y = f(x)$ at the point where $x = 1$.

Use your tangent to estimate the slope of $y = f(x)$ when $x = 1$.

..... [3]

5 $f(x) = 2x - 1$ $g(x) = x^2 + 1$ $h(x) = 3^x$

(a) Find h(2).

..... [1]

(b) $g(f(x)) = ax^2 + bx + c$

Find the values of a, b and c.

$a =$ .....

$b =$ .....

$c =$ ..... [3]

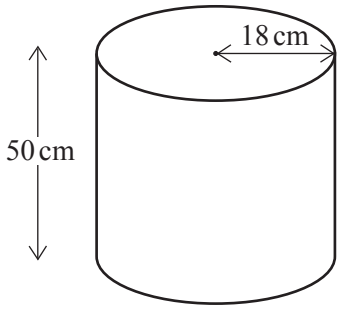
(c) Find $f^{-1}(x)$.

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

(d) Find x when $h^{-1}(x) = 0.5$.

$x =$ ..... [1]

6 **(a)** The diagram shows a cylindrical container used to serve coffee in a hotel.



NOT TO SCALE

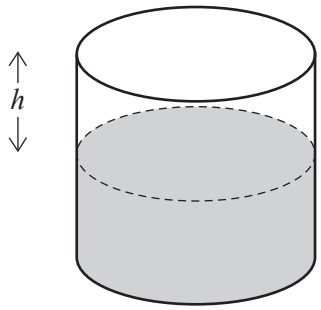
The container has a height of 50 cm and a radius of 18 cm.

(i) Calculate the volume of the cylinder and show that it rounds to 50 900 cm^3, correct to 3 significant figures.

[2]

(ii) 30 liters of coffee are poured into the container.

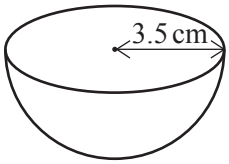
Work out the height, h, of the empty space in the container.



NOT TO SCALE

$h =$ ..... cm [3]

(iii) Cups in the shape of a hemisphere are filled with coffee from the container.
The radius of a cup is 3.5 cm.

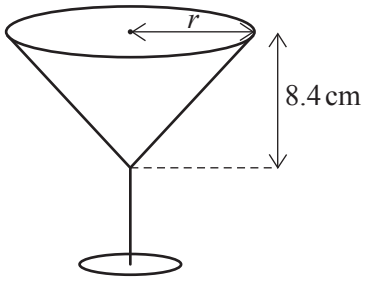


NOT TO SCALE

Work out the maximum number of these cups that can be completely filled from the 30 liters of coffee in the container.

..... [4]

(b) The hotel also uses glasses in the shape of a cone.



NOT TO SCALE

The capacity of each glass is 95 cm^3.

(i) Calculate the radius, r, and show that it rounds to 3.3 cm, correct to 1 decimal place.

[3]

(ii) Calculate the curved surface area of the cone.

..... cm^2 [4]

7 **(a)** Expand and simplify.

(i) $4(2x+5)-5(3x-7)$

..... [2]

(ii) $(x-7)^2$

..... [2]

(b) Solve.

(i) $\frac{2x}{3}+5=-7$

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

(ii) $4x+9=3(2x-7)$

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

(iii) $3x^2-1=74$

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

8 A line joins the points $A(-3, 8)$ and $B(2, -2)$.

(a) Find the co-ordinates of the midpoint of AB.

(..... , ...) [2]

(b) Find the equation of the line through A and B.
Give your answer in the form $y = mx + b$.

$y =$ ..... [3]

(c) Another line is parallel to AB and passes through the point (0, 7).

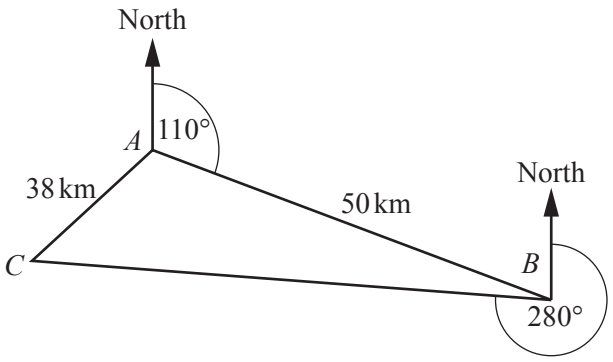
Write down the equation of this line.

..... [2]

(d) Find the equation of the line perpendicular to AB which passes through the point (1, 5).
Give your answer in the form $ax + by = d$ where a, b and d are integers.

..... [4]

9 (a)



NOT TO SCALE

A, B and C are three towns.
The bearing of B from A is 110°.
The bearing of C from B is 280°.
$AC = 38$ km and $AB = 50$ km.

(i) Find the bearing of A from B.

..... [2]

(ii) Calculate angle BAC.

Angle $BAC =$ ..... [5]

(iii) A road is built from A to join the straight road BC.

Calculate the shortest possible length of this new road.

..... km [3]

(b) Town A has a rectangular park.
The length of the park is x m.
The width of the park is 25 m shorter than the length.
The area of the park is 2200 m^2.

(i) Show that $x^2 - 25x - 2200 = 0$.

[1]

(ii) Solve $x^2 - 25x - 2200 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [4]

Question 10 is printed on the next page.

10 **(a)** The nth term of a sequence is $8n - 3$.

(i) Write down the first two terms of this sequence.

..... , ... [1]

(ii) Show that the number 203 is not in this sequence.

[2]

(b) Find the nth term of these sequences.

(i) 13, 19, 25, 31, …

..... [2]

(ii) 4, 8, 14, 22, …

..... [2]

(c) … , 20, 50, …

The second term of this sequence is 20 and the third term is 50.
The rule for finding the next term in this sequence is subtract y then multiply by 5.

Find the value of y and work out the first term of this sequence.

$y =$ .....

First term = ... [4]