Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER

CANDIDATE NUMBER

2420298868

MATHEMATICS (US) **0444/21**

Paper 2 (Extended) **May/June 2017**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

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.
CALCULATORS MUST NOT BE USED IN THIS PAPER.
All answers should be given in their simplest form.
If work is needed for any question it must be shown in the space provided.

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 70.

This document consists of **14** printed pages and **2** blank 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. $\quad A = 2\pi rh$

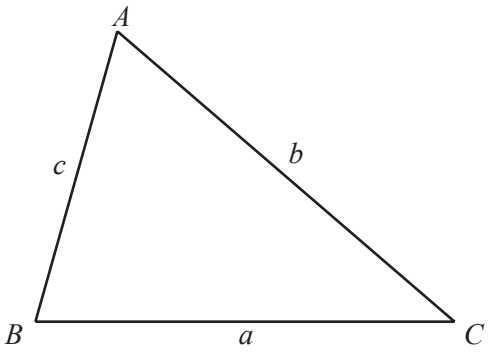
Lateral surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

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 Simplify.

$(x^2)^5$

..... [1]

2 The thickness of one sheet of paper is 8×10^{-3} cm.

Work out the thickness of 500 sheets of paper.

..... cm [1]

3 Write 23.4571 correct to

(a) 4 significant digits,

..... [1]

(b) the nearest 10.

..... [1]

4 The table shows the temperatures in five places at 10 am one day in January.

Place	Temperature (°C)
Helsinki	−7
Chicago	−10
London	3
Moscow	−4
Bangkok	26

(a) Which place was the coldest?

..... [1]

(b) At 2 pm the temperature in Helsinki had increased by 4 °C.

Write down the temperature in Helsinki at 2 pm.

..... °C [1]

[Turn over

5 Factor completely.

$$12n^2 - 4mn$$

..... [2]

6 **(a)** $2^r = \frac{1}{16}$

Find the value of r.

$r =$ ..... [1]

(b) $3^t = \sqrt[5]{3}$

Find the value of t.

$t =$ ..... [1]

7 Work out $1\frac{2}{3} + \frac{5}{7}$.

Give your answer as a mixed number in its simplest form.

..... [3]

8 Simon has two boxes of cards.
In one box, each card has one shape drawn on it that is either a triangle or a square.
In the other box, each card is colored either red or blue.

Simon picks a card from each box at random.
The probability of picking a triangle card is t.
The probability of picking a red card is r.

Complete the table for the cards that Simon picks, writing each probability in terms of r and t.

Event	Probability
Triangle and red	
Square and red	$(1 - t)r$
Triangle and blue	
Square and blue	

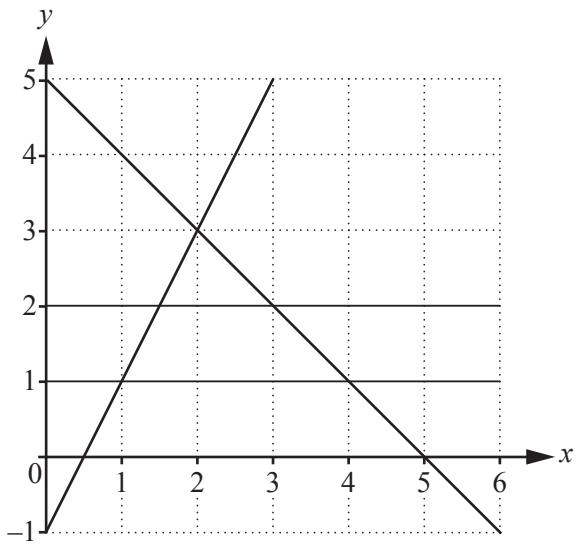
[3]

9 h varies directly as the square root of p.
$h = 6$ when $p = 4$.

Find h when $p = \frac{1}{4}$.

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

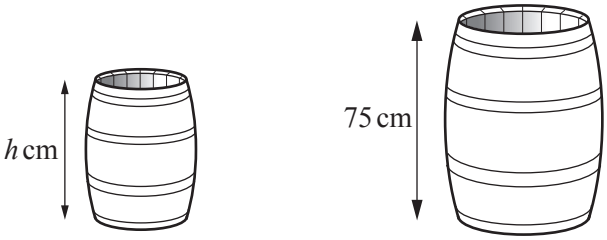
10



By shading the **unwanted** regions of the grid, find and label the region R that satisfies the following four inequalities.

$y \leqslant 2$ $y \geqslant 1$ $y \leqslant 2x - 1$ $y \leqslant 5 - x$ [3]

11 The two barrels in the diagram are mathematically similar.



NOT TO SCALE

The smaller barrel has a height of h cm and a capacity of 64 liters.
The larger barrel has a height of 75 cm and a capacity of 125 liters.

Work out the value of h.

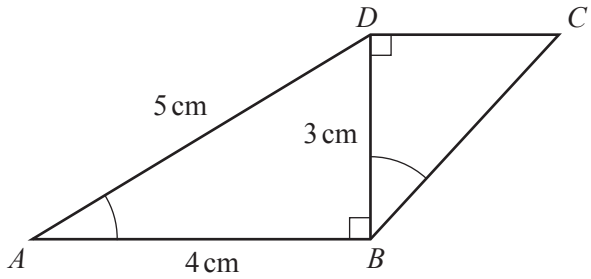
$h =$ ..... [3]

12 A line has slope 5.
M and N are two points on this line.
M is the point $(x, 8)$ and N is the point $(k, 23)$.

Find an expression for x in terms of k.

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

13



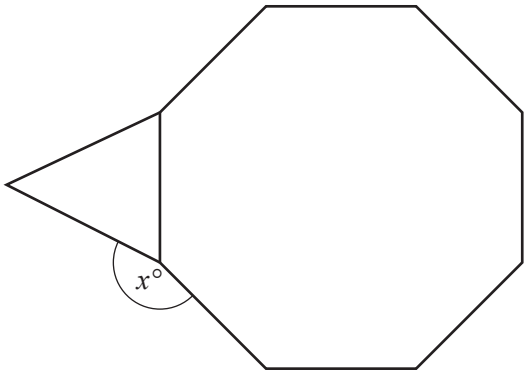
NOT TO SCALE

Angle BAD = angle DBC.

Work out BC.

$BC =$ ..... cm [3]

14 The diagram shows a regular octagon joined to an equilateral triangle.



NOT TO SCALE

Work out the value of x.

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

15 Simplify.

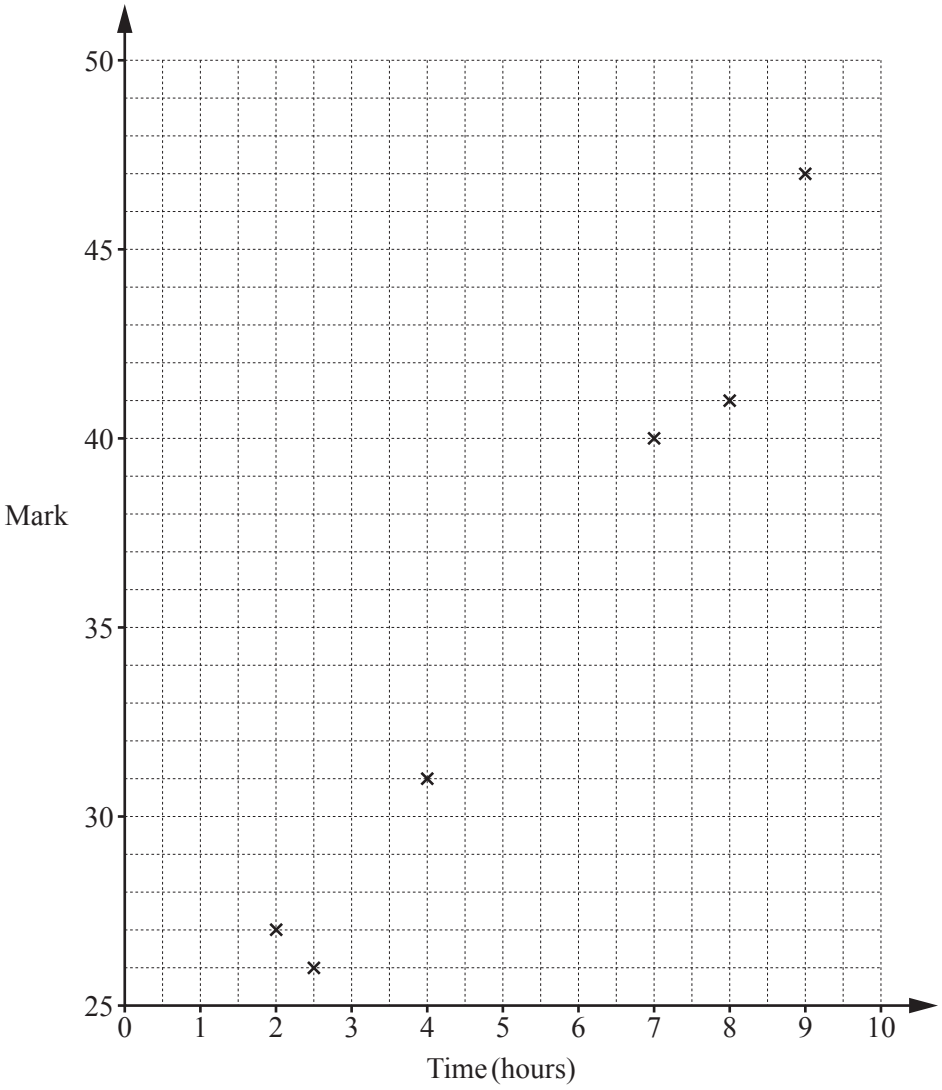
(a) $\sqrt{20} + \sqrt{125}$

..... [2]

(b) $(\sqrt{2} + 2\sqrt{3})^2$

..... [2]

16 Six students revise for a test.
The scatter diagram shows the time, in hours, each student spent revising and their mark in the test.



(a) The data for two more students is shown in the table.

Time (hours)	4.5	6.5
Mark	33	35

Plot these two points on the scatter diagram. [1]

(b) What type of correlation is shown on the scatter diagram?

..... [1]

(c) Draw a line of best fit on the scatter diagram. [1]

(d) Another student spent 5.5 hours revising.

Estimate a mark for this student.

..... [1]

[Turn over

17 **(a)** Write down the amplitude and period of the function $f(x) = \frac{1}{2}\cos\left(\frac{x}{3}\right)$.

Amplitude = ...

Period = ... [2]

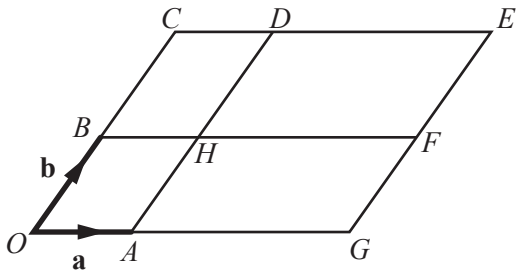
(b) The graph of $y = x^2 + x + 3$ is mapped onto the graph of $y = x^2 + ux + v$ by the translation $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$.

Find the value of u and the value of v.

u = ...

v = ... [2]

18 The diagram shows a parallelogram $OCEG$.



NOT TO SCALE

O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
BHF and AHD are straight lines parallel to the sides of the parallelogram.
$\overrightarrow{OG} = 3\overrightarrow{OA}$ and $\overrightarrow{OC} = 2\overrightarrow{OB}$.

(a) Write the vector $\overrightarrow{HE}$ in terms of **a** and **b**.

$\overrightarrow{HE}$ = ... [1]

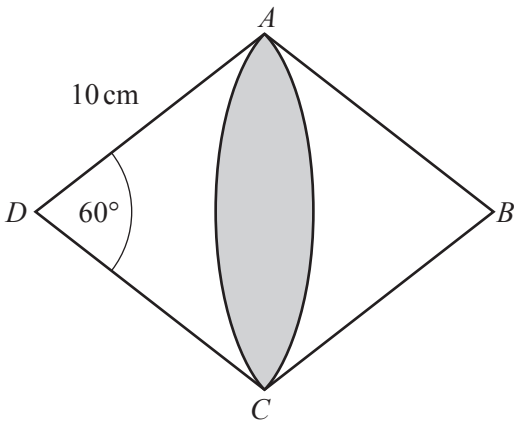
(b) Complete this statement.

a + 2**b** is the position vector of point ..... [1]

(c) Write down two vectors that can be written as 3**a** − **b**.

..... and ..... [2]

19 $ABCD$ is a rhombus with side length 10 cm.



NOT TO SCALE

Angle $ADC = 60°$.
DAC is a sector of a circle with center D.
BAC is a sector of a circle with center B.

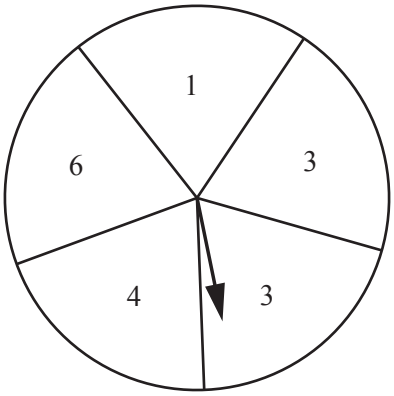
The area shaded is $(p\pi + q\sqrt{3})\text{cm}^2$.

Find the value of p and the value of q.

$p =$ .....

$q =$ ..... [4]

20 The diagram shows a fair spinner.



Anna spins it twice and adds the scores.

(a) Complete the table for the total scores.

		Score on first spin				
		1	3	3	4	6
Score on second spin	1	2	4	4	5	7
	3	4	6	6	7	9
	3	4	6	6	7	9
	4					
	6					

[1]

(b) Write down the most likely total score.

..... [1]

(c) Find the probability that Anna scores

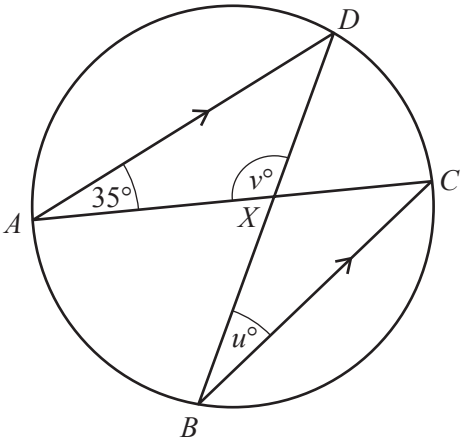
(i) a total less than 6,

..... [2]

(ii) a total of 3.

..... [1]

21 (a)



NOT TO SCALE

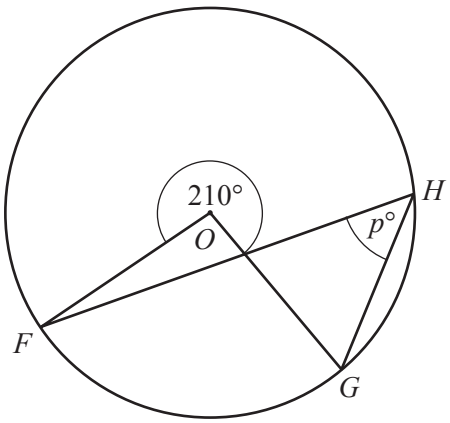
A, B, C and D are points on the circle.
AD is parallel to BC.
The chords AC and BD intersect at X.

Find the value of u and the value of v.

$u =$ .....

$v =$ ..... [3]

(b)



NOT TO SCALE

F, G and H are points on the circle, center O.

Find the value of p.

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

22 Write as a single fraction in its simplest form.

(a) $\dfrac{x^2-3x}{x^2-9}$

..... [3]

(b) $\dfrac{3}{x-4}+\dfrac{2}{2x+5}$

..... [3]

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