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0444/21

May/June 2017

**1 hour 30 minutes**

Additional Materials: Geometrical instruments

## READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

If work is needed for any question it must be shown in the space provided.

The total of the points for this paper is 70.

This document consists of **14** printed pages and **2** blank pages.

## Formula List

For the equation

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Lateral surface area,  $A$ , of cylinder of radius  $r$ , height  $h$ .

$$A = 2\pi rh$$

Lateral surface area,  $A$ , of cone of radius  $r$ , sloping edge  $l$ .

$$A = \pi rl$$

Surface area,  $A$ , of sphere of radius  $r$ .

$$A = 4\pi r^2$$

Volume,  $V$ , of pyramid, base area  $A$ , height  $h$ .

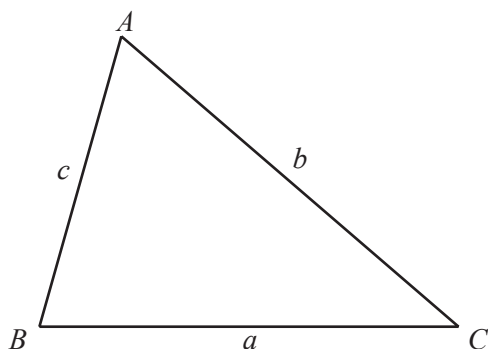
$$V = \frac{1}{3}Ah$$

Volume,  $V$ , of cone of radius  $r$ , height  $h$ .

$$V = \frac{1}{3}\pi r^2 h$$

Volume,  $V$ , of sphere of radius  $r$ .

$$V = \frac{4}{3}\pi r^3$$



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

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

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

- 1 Simplify.  
 $(x^2)^5$

..... [1]

- 2 The thickness of one sheet of paper is  $8 \times 10^{-3}$  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 ( $^{\circ}\text{C}$ )
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  $4^{\circ}\text{C}$ .

Write down the temperature in Helsinki at 2 pm.

.....  $^{\circ}\text{C}$  [1]

- 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	

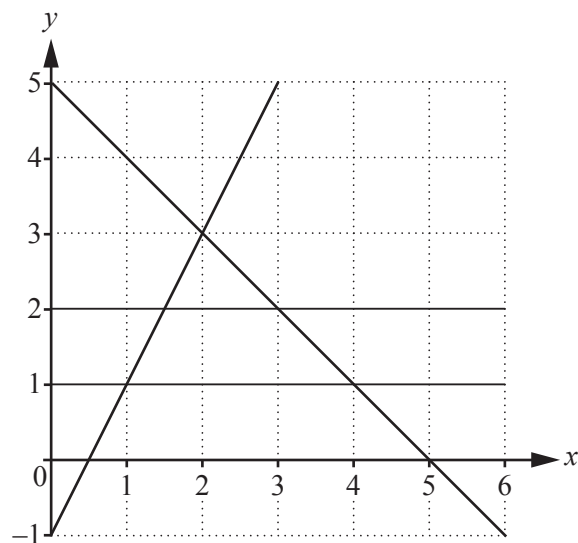
[3]

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

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

$h = \dots\dots\dots$  [3]

10



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

$$y \leq 2$$

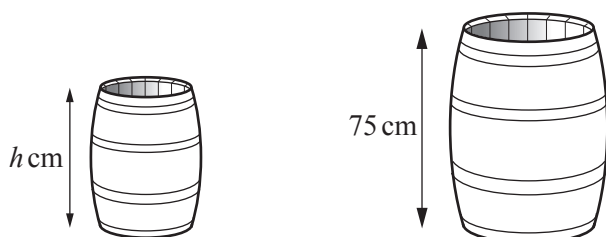
$$y \geq 1$$

$$y \leq 2x - 1$$

$$y \leq 5 - x$$

[3]

- 11 The two barrels in the diagram are mathematically similar.



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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  $h$ .

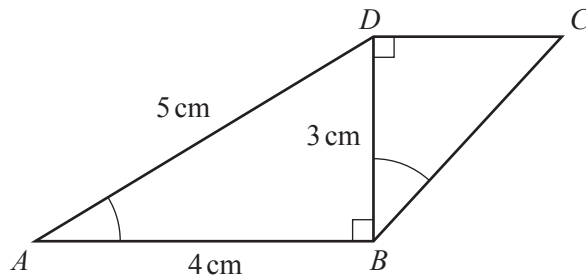
$h = \dots\dots\dots$  [3]

- 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  $k$ .

$x = \dots\dots\dots$  [3]

13



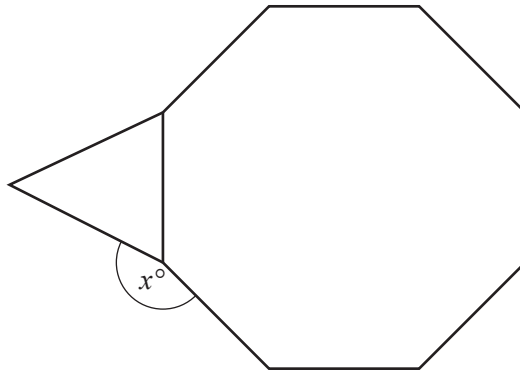
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Angle  $BAD = \text{angle } DBC$ .

Work out  $BC$ .

$BC = \dots\dots\dots$  cm [3]

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



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Work out the value of  $x$ .

$x = \dots\dots\dots$  [3]

- 15 Simplify.

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

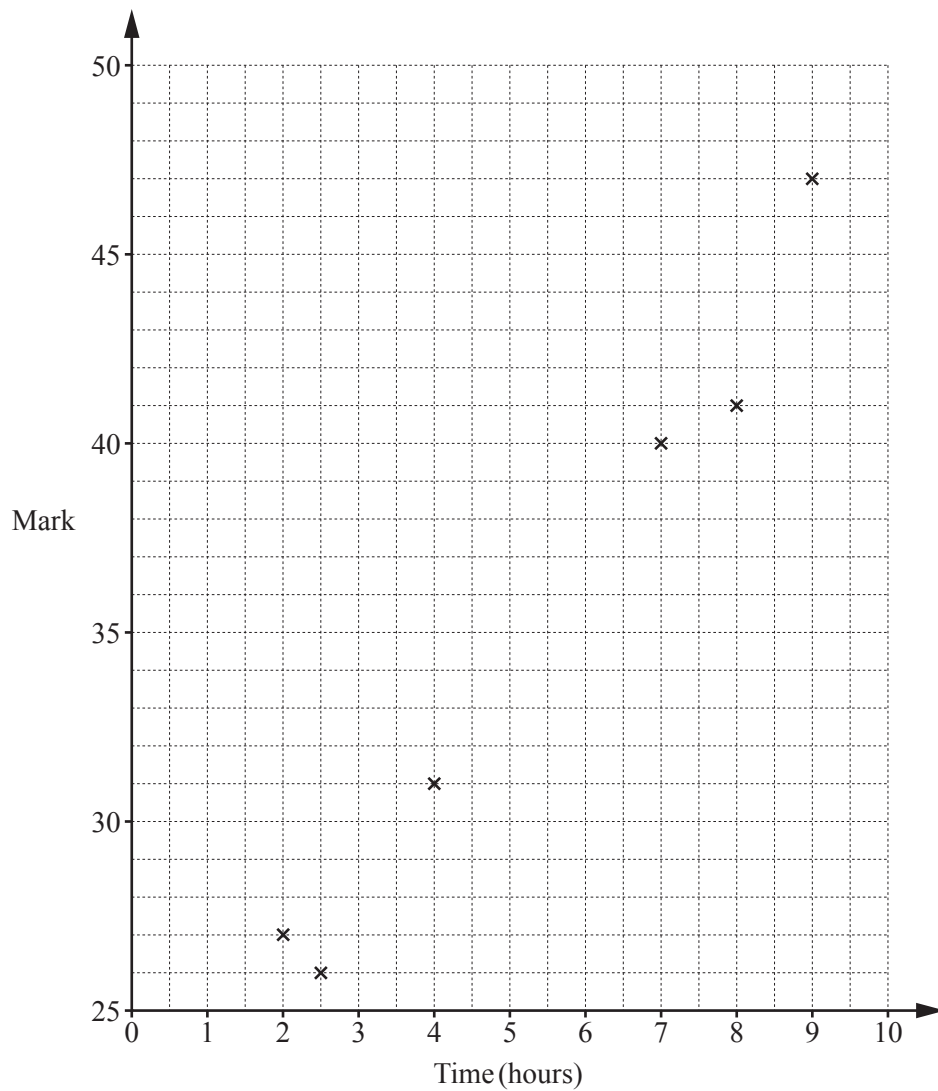
$\dots\dots\dots$  [2]

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

$\dots\dots\dots$  [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]

- 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]

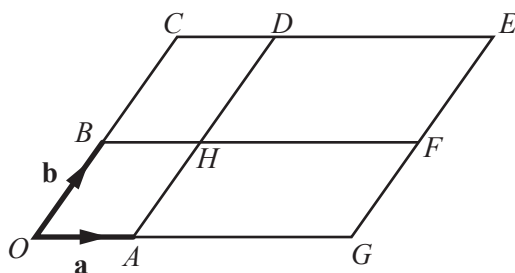
- (b) The graph of  $y = x^2 + x + 3$  is mapped onto the graph of  $y = x^2 + ux + v$  by the translation  $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ .

Find the value of  $u$  and the value of  $v$ .

$u =$  .....

$v =$  ..... [2]

- 18 The diagram shows a parallelogram  $OCEG$ .



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$O$  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  $\mathbf{a}$  and  $\mathbf{b}$ .

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

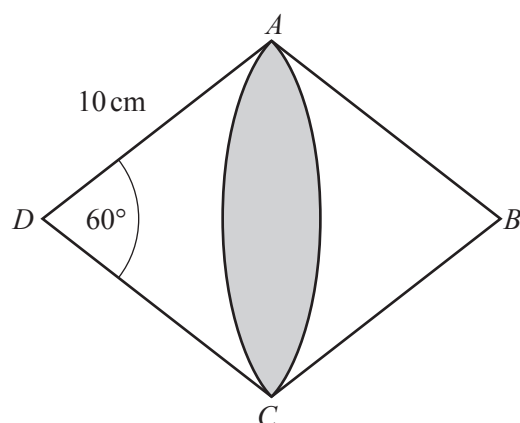
- (b) Complete this statement.

$\mathbf{a} + 2\mathbf{b}$  is the position vector of point ..... [1]

- (c) Write down two vectors that can be written as  $3\mathbf{a} - \mathbf{b}$ .

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

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



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Angle  $ADC = 60^\circ$ .

$DAC$  is a sector of a circle with center  $D$ .

$BAC$  is a sector of a circle with center  $B$ .

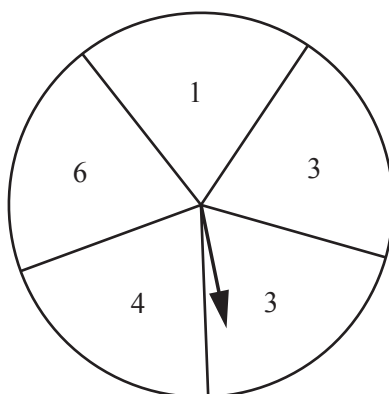
The area shaded is  $(p\pi + q\sqrt{3})\text{cm}^2$ .

Find the value of  $p$  and the value of  $q$ .

$p = \dots\dots\dots$

$q = \dots\dots\dots$  [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

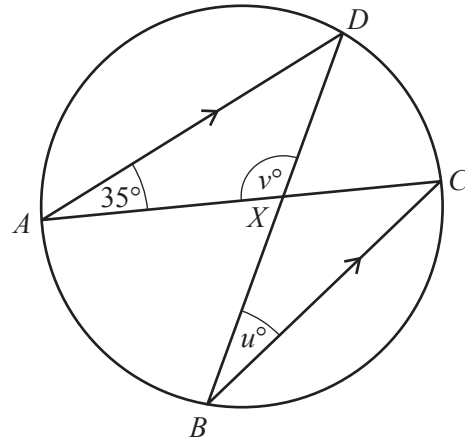
(i) a total less than 6,

..... [2]

(ii) a total of 3.

..... [1]

21 (a)

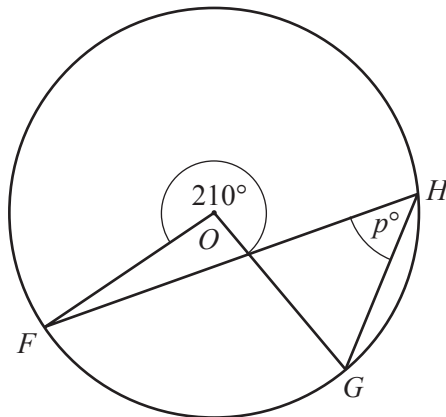
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$A$ ,  $B$ ,  $C$  and  $D$  are points on the circle.  
 $AD$  is parallel to  $BC$ .  
 The chords  $AC$  and  $BD$  intersect at  $X$ .

Find the value of  $u$  and the value of  $v$ .

 $u = \dots\dots\dots$ 
 $v = \dots\dots\dots [3]$ 

(b)

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

Find the value of  $p$ .

 $p = \dots\dots\dots [2]$

22 Write as a single fraction in its simplest form.

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

..... [3]

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

..... [3]



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