

CANDIDATE  
NAME

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CENTRE  
NUMBER

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**CAMBRIDGE INTERNATIONAL MATHEMATICS**

**0607/43**

Paper 4 (Extended)

**May/June 2016**

**2 hours 15 minutes**

Candidates answer on the Question Paper.

Additional Materials:      Geometrical Instruments  
   Graphics Calculator

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

Do not use staples, paper clips, glue or correction fluid.

You may use an HB pencil for any diagrams or graphs.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.

Unless instructed otherwise, give your answers exactly or correct to three significant figures as appropriate.

Answers in degrees should be given to one decimal place.

For  $\pi$ , use your calculator value.

You must show all the relevant working to gain full marks and you will be given marks for correct methods, including sketches, even if your answer is incorrect.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 120.

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

## 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) Write the number 13205.17268

(i) correct to 1 decimal place,

..... [1]

(ii) correct to 3 significant figures,

..... [1]

(iii) correct to the nearest 10,

..... [1]

(iv) correct to the nearest 0.001.

..... [1]

(b) Write the number 120 correct to the nearest 10.

..... [1]

2 (a) Factorise.

$$3x^2 - 10x - 8$$

..... [2]

(b) Solve the inequality.

$$3x^2 - 10x - 8 < 0$$

..... [2]

(c) Solve the equation.

$$3 \sin^2 x - 10 \sin x - 8 = 0 \quad \text{for } 0^\circ < x < 360^\circ$$

..... [3]

- 3  $y$  is directly proportional to  $(x+1)^3$ .  
 $y = 32$  when  $x = 3$ .

(a) Find the value of  $y$  when  $x = 4$ .

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

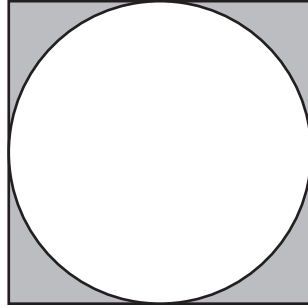
(b) Find the value of  $x$  when  $y = 13.5$ .

$$x = \dots\dots\dots [2]$$

(c) Find  $x$  in terms of  $y$ .

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

4



A circle of radius  $r$  cm is inside a square, so that the circle touches the sides of the square.

(a) (i) Find an expression for the area of the shaded region in terms of  $\pi$  and  $r$ .

..... [2]

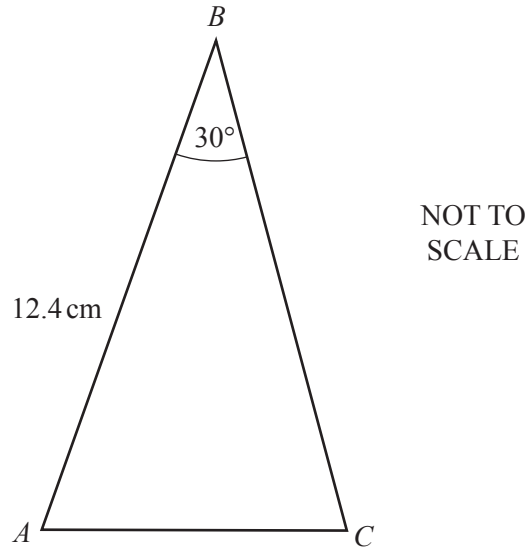
(ii) Calculate the area of the shaded region when  $r = 6$ .

.....  $\text{cm}^2$  [1]

(b) Find an expression for the perimeter of the shaded region in terms of  $\pi$  and  $r$ .

..... [3]

5



The area of triangle  $ABC$  is  $34.1 \text{ cm}^2$ .  
 $AB = 12.4 \text{ cm}$  and angle  $ABC = 30^\circ$ .

(a) Show that  $BC = 11 \text{ cm}$ .

(b) Find  $AC$ .

[1]

$AC = \dots\dots\dots \text{ cm}$  [3]

(c) Find angle  $CAB$ .

Angle  $CAB = \dots\dots\dots$  [3]

(d) Find the length of the perpendicular line from  $A$  to the line  $BC$ .

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

6 The heights of 400 students are given in the table.

Height ( $h$ cm)	Frequency
$145 < h \leq 155$	26
$155 < h \leq 160$	66
$160 < h \leq 165$	82
$165 < h \leq 170$	118
$170 < h \leq 175$	82
$175 < h \leq 190$	26

(a) Calculate an estimate of the mean height of a student.

..... cm [2]

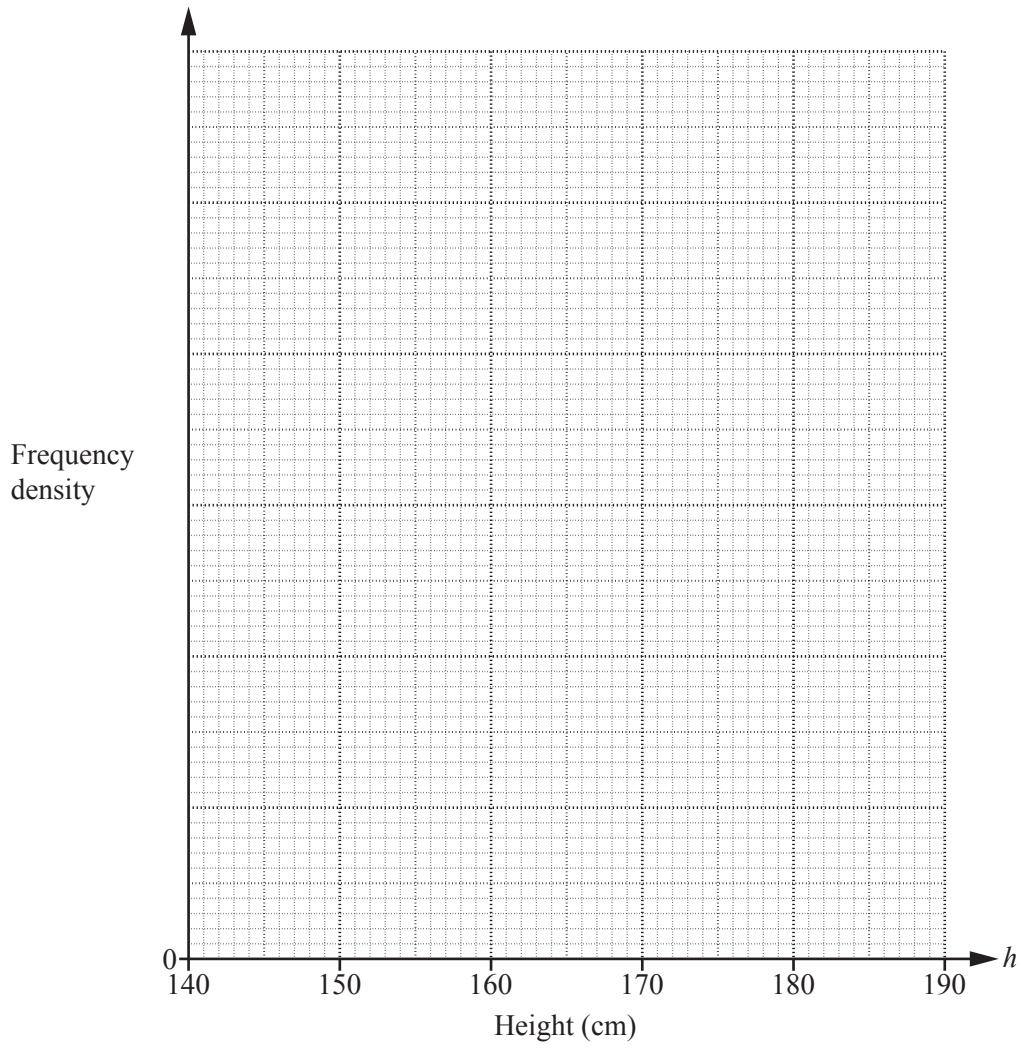
(b) (i) Complete the frequency density column in this table.

Height ( $h$ cm)	Frequency	Frequency density
$145 < h \leq 155$	26	
$155 < h \leq 160$	66	
$160 < h \leq 165$	82	
$165 < h \leq 170$	118	
$170 < h \leq 175$	82	
$175 < h \leq 190$	26	

[2]



- (ii) On the grid below, draw an accurate histogram to show this information. Complete the scale on the frequency density axis.



[4]

7 Sasha bought a house on 1st January 2013.  
By 1st January 2014 the value of the house had increased by 10%.  
By 1st January 2015 the value of the house had increased by a further 5% of its value on 1st January 2014.  
The value of the house on 1st January 2015 was \$103 950.

(a) Find how much Sasha paid for the house in 2013.

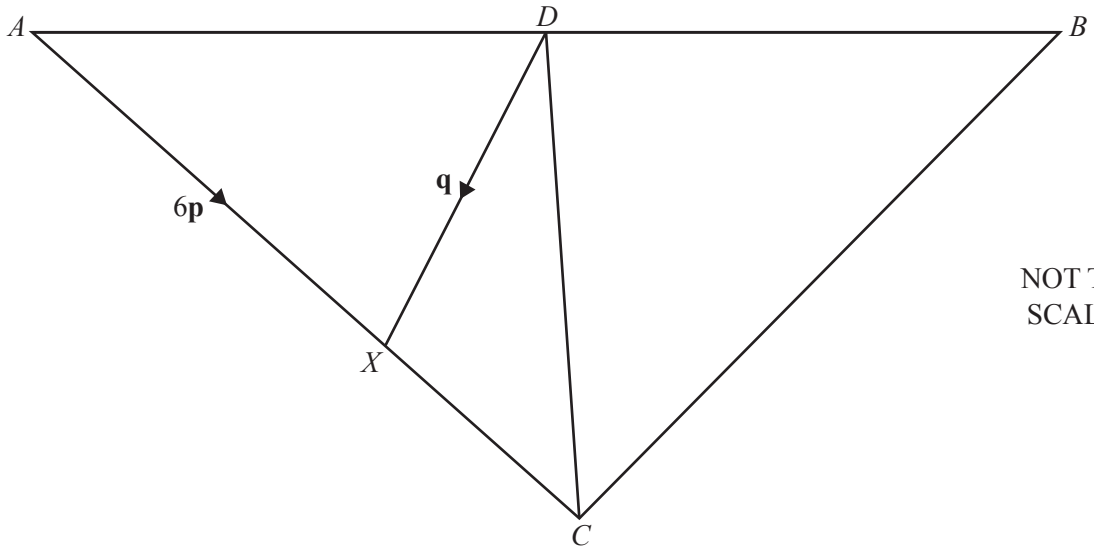
\$ ..... [4]

(b) By 1st January each year, from 2015, the value of the house increases by 5% of its value on 1st January the previous year.  
The value of the house on 1st January 2015 was \$103 950.

Find the year in which the value of the house will first be greater than \$200 000.

..... [3]

8



$ABC$  is a triangle.

$AX = \frac{2}{3}AC$  and  $AD = \frac{1}{2}AB$ .

$\vec{AX} = 6\mathbf{p}$  and  $\vec{DX} = \mathbf{q}$ .

Find an expression, in terms of  $\mathbf{p}$  and  $\mathbf{q}$ , for

(a)  $\vec{AD}$ ,

..... [2]

(b)  $\vec{DC}$ ,

..... [2]

(c)  $\vec{CB}$ .

..... [3]

9 The transformation **AB** means transformation **B** followed by transformation **A**.

- (a) The transformation **P** is a rotation through  $90^\circ$  clockwise about the origin.  
 The transformation **Q** is a rotation through  $180^\circ$  about the origin.  
 The transformation **R** is a rotation through  $270^\circ$  clockwise about the origin.  
 The transformation **S** is a reflection in the  $y$ -axis.  
 The transformation **T** is a reflection in the  $x$ -axis.

Write down the letter of the **single** transformation, **P**, **Q**, **R**, **S** or **T**, that is equivalent to each of the transformations **QR**, **PQR**, **ST**, **SQ**, **PTP** and **TPP**.

**QR** = .....

**PQR** = .....

**ST** = .....

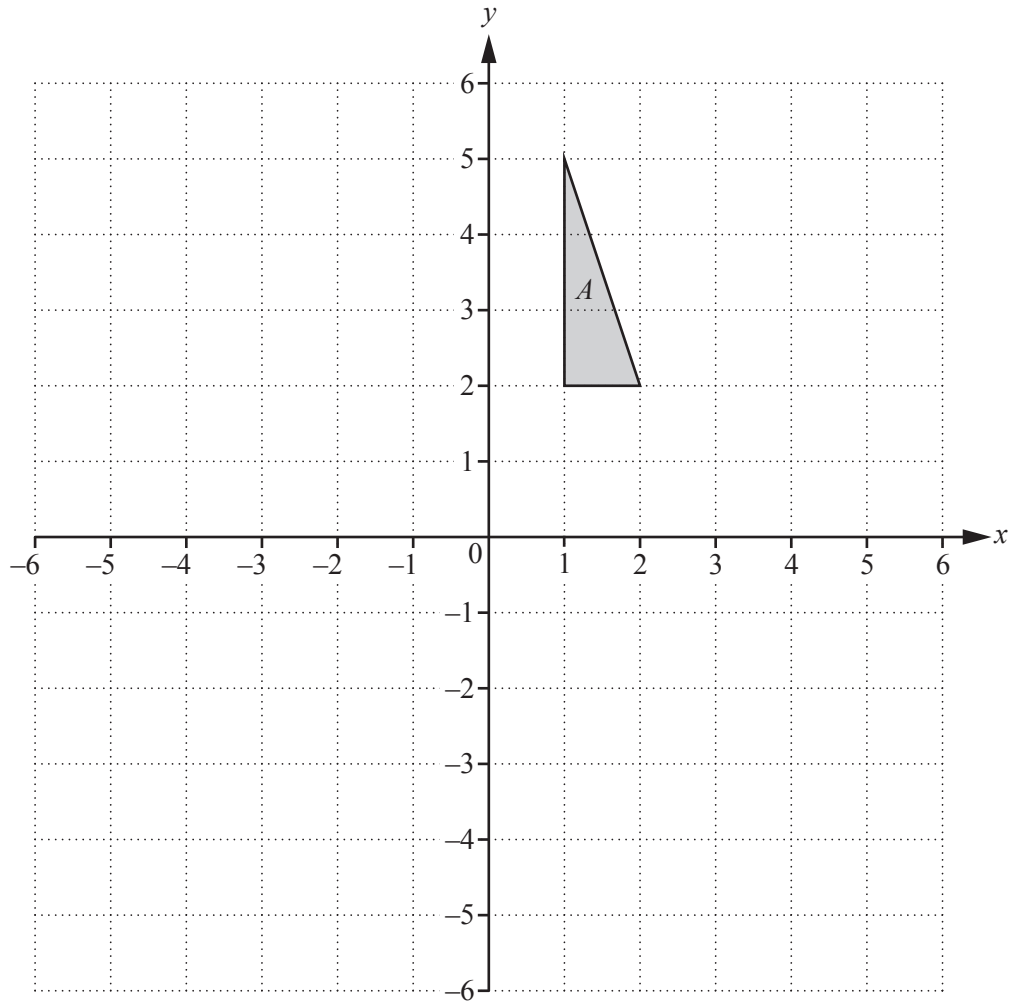
**SQ** = .....

**PTP** = .....

**TPP** = .....

[6]

(b)



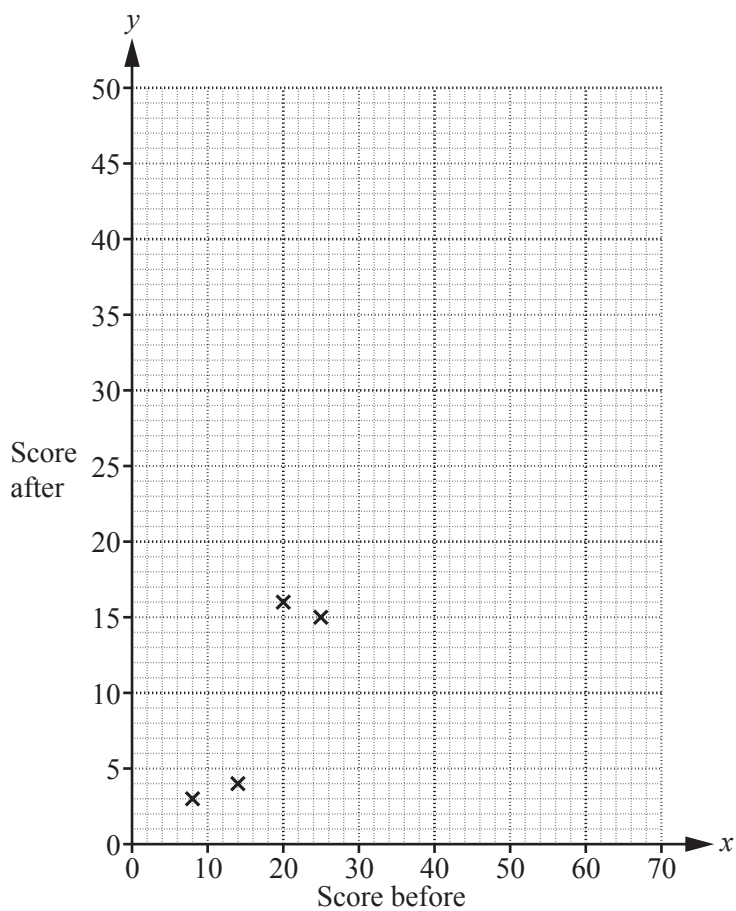
- (i) Draw the image of triangle *A* after a reflection in the line  $y = x$ .  
Label this image *B*. [2]
- (ii) Draw the image of **triangle B** after a reflection in the  $x$ -axis.  
Label this image *C*. [1]
- (iii) Describe fully the **single** transformation that maps **triangle C** onto **triangle A**.  
..... [3]  
.....

- 10 A company is testing a new drug.  
 Ten patients were examined and given a score before and after taking the drug.  
 A decrease in score represents an improvement.

The results are shown in the table.

Patient	A	B	C	D	E	F	G	H	I	J
Score before ( $x$ )	8	14	20	25	32	34	41	42	50	61
Score after ( $y$ )	3	4	16	15	20	27	34	28	40	49

- (a) (i) Complete the scatter diagram.  
 The first four points have been plotted for you.



[3]

- (ii) What type of correlation is shown by the scatter diagram?

..... [1]

(b) Find

(i) the mean score before taking the drug,

..... [1]

(ii) the mean score after taking the drug.

..... [1]

(c) (i) Find the equation of the regression line for  $y$  in terms of  $x$ .

$y =$  ..... [2]

(ii) Estimate the score after taking the drug when the score before taking the drug was 30.

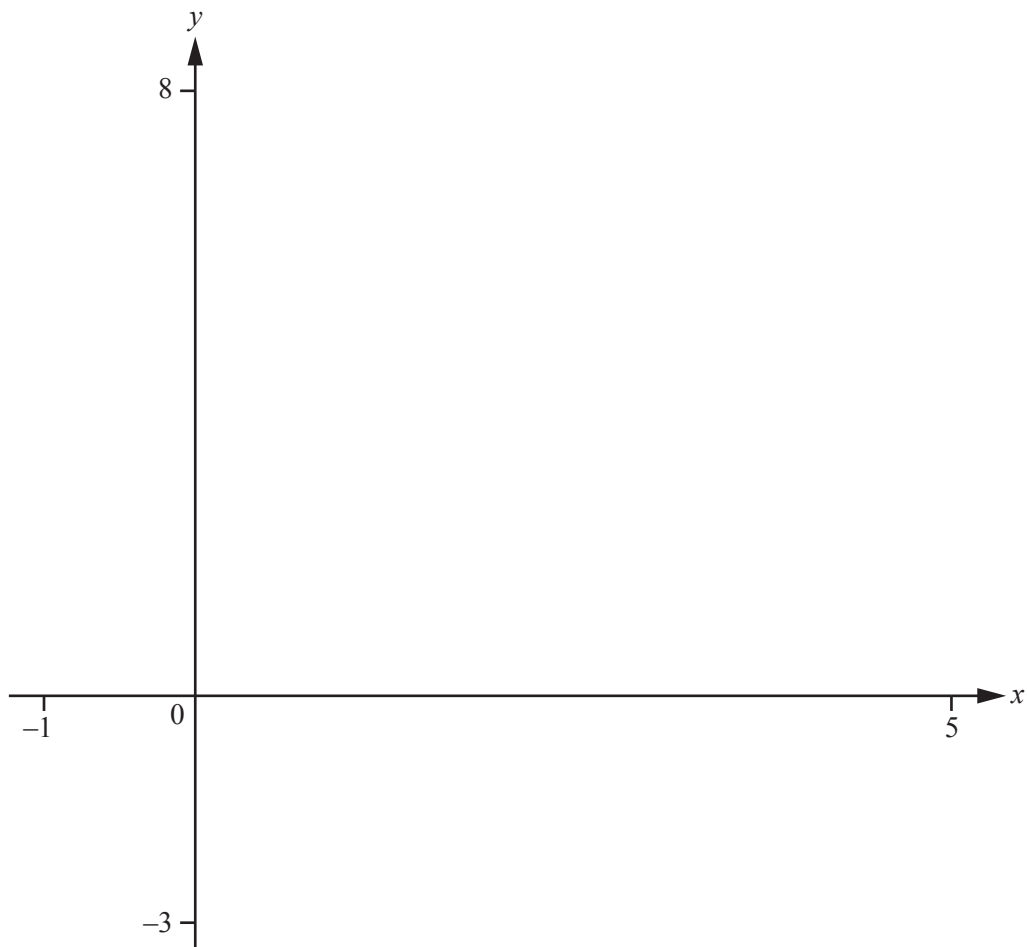
..... [1]

(iii) A patient has a score before taking the drug of 80.

Explain why using the line of regression is unlikely to be reliable in predicting the score of the patient after taking the drug.

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

11



$$f(x) = 3 + \frac{1}{(x^2 - 4x + 3)}$$

(a) On the diagram, sketch the graph of  $y = f(x)$  between  $x = -1$  and  $x = 5$ . [4]

(b) Write down the equations of the three asymptotes.

....., ....., ..... [3]

(c) Write down the co-ordinates of the local maximum point.

( ..... , ..... ) [1]

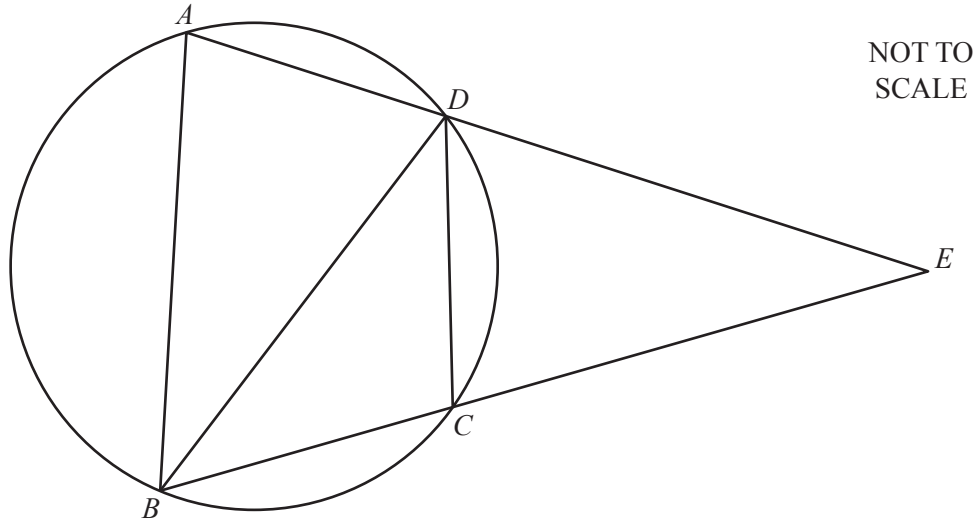
(d) The line  $y = x$  intersects the curve  $y = 3 + \frac{1}{(x^2 - 4x + 3)}$  three times.

Find the values of the  $x$  co-ordinates of these three points of intersection.

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



12



$A, B, C$  and  $D$  lie on a circle.  
 $ADE$  and  $BCE$  are straight lines that intersect at  $E$ .  
 $BD = DE$ , angle  $BAD = 4x$ , angle  $BCD = 6x$  and angle  $BDC = 3x$ .

Find

(a)  $x$ ,

$x = \dots\dots\dots$  [2]

(b) angle  $CBD$ ,

Angle  $CBD = \dots\dots\dots$  [2]

(c) angle  $CDE$ .

Angle  $CDE = \dots\dots\dots$  [3]

13

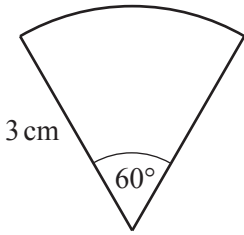


Diagram 1

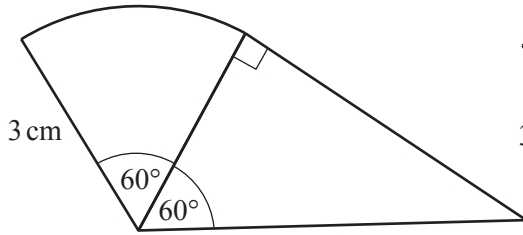


Diagram 2

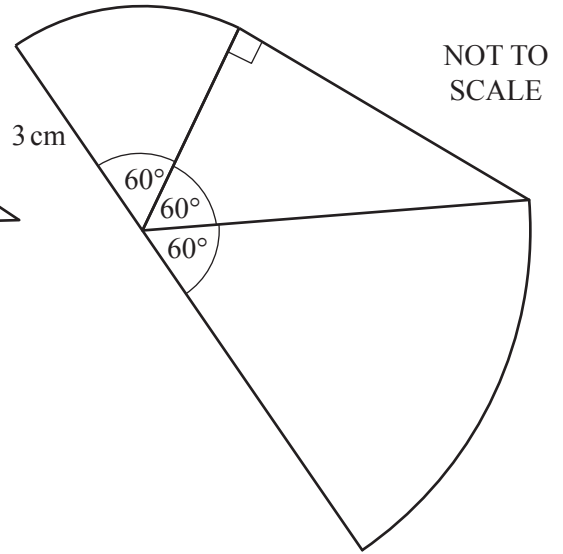


Diagram 3

Diagram 1 is a sector of a circle, radius 3 cm and sector angle  $60^\circ$ .

Diagram 2 has a right-angled triangle, with an angle of  $60^\circ$ , drawn on a radius of this sector.

Diagram 3 has a sector of a circle, with a sector angle  $60^\circ$ , drawn on the hypotenuse of the right-angled triangle.

(a) Calculate the area of

(i) Diagram 1,

.....  $\text{cm}^2$  [2]

(ii) Diagram 2,

.....  $\text{cm}^2$  [3]

(iii) Diagram 3.

..... cm<sup>2</sup> [3]

- (b) Diagram 1, Diagram 2 and Diagram 3 are the first three diagrams in a pattern.  
 There are 6 diagrams in the pattern.  
 Diagram 4 has a right-angled triangle added to Diagram 3 in the same way as Diagram 2.  
 Diagram 5 has a sector added to Diagram 4 in the same way as Diagram 3.  
 Diagram 6 has a right-angled triangle added to Diagram 5 in the same way as Diagram 2.

Find the area of Diagram 6.

..... cm<sup>2</sup> [4]

**Question 14 is printed on the next page.**

14 In this question, give all your answers as single fractions in terms of  $x$  and  $y$ .

A bag contains  $x$  red balls and  $y$  blue balls.

- (a) Rosario chooses a ball at random from the bag, notes its colour and replaces it in the bag. He then chooses a ball from the bag a second time, notes its colour and replaces it in the bag.

Find the probability, in terms of  $x$  and  $y$ , that the two balls chosen are

- (i) both red,

..... [2]

- (ii) one red and one blue.

..... [3]

- (b) Magda chooses a ball at random from the bag and does not replace it. She then chooses a ball from the bag a second time.

Find the probability, in terms of  $x$  and  $y$ , that the two balls chosen are

- (i) both red,

..... [3]

- (ii) one red and one blue.

..... [3]

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