

Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
24 – 25	
26	
TOTAL	



General Certificate of Secondary Education  
Higher Tier  
June 2014

# Methods in Mathematics (Linked Pair Pilot)

93652H

H

## Unit 2 Geometry and Algebra

Friday 20 June 2014 9.00 am to 10.30 am

For this paper you must have:

- a calculator
- mathematical instruments.



### Time allowed

- 1 hour 30 minutes

### Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.14 unless another value is given in the question.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- The quality of your written communication is specifically assessed in Questions 2, 5 and 18. These questions are indicated with an asterisk (\*).
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.
- You are expected to use a calculator where appropriate.

### Advice

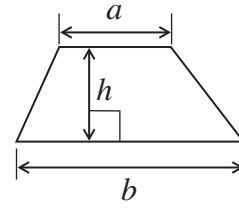
- In all calculations, show clearly how you work out your answer.



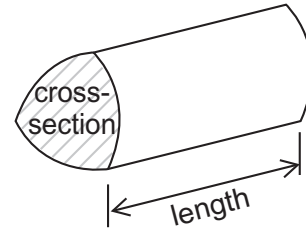
J U N 1 4 9 3 6 5 2 H 0 1

### Formulae Sheet: Higher Tier

**Area of trapezium** =  $\frac{1}{2}(a+b)h$

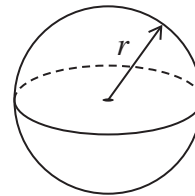


**Volume of prism** = area of cross-section  $\times$  length



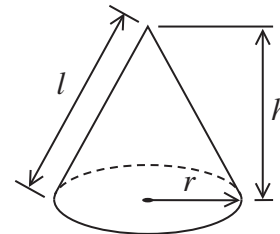
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

**Surface area of sphere** =  $4\pi r^2$



**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

**Curved surface area of cone** =  $\pi r l$

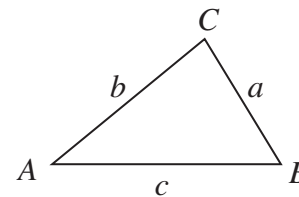


**In any triangle ABC**

**Area of triangle** =  $\frac{1}{2}ab \sin C$

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

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



### The Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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



Answer **all** questions in the spaces provided.

**1** There are 40 counters in a bag.  
23 of them are red.

What percentage of the counters is **not** red?

**[3 marks]**

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Answer ..... %

**\*2**  $a$  is an odd number.  
 $b$  is an even number.

Tick the correct statement.

$a^2 + b^2$  is always even

$a^2 + b^2$  is always odd

$a^2 + b^2$  could be even or odd

Give a reason for your answer.

**[2 marks]**

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5

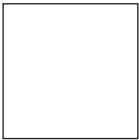
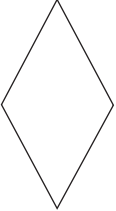
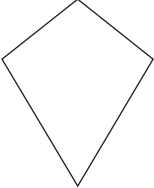
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3

Tick (✓) or cross (×) the properties of the quadrilaterals shown.  
The square has been done as an example.

[4 marks]

	Property				
	Diagonals cross at right angles	One pair of equal opposite angles	All sides equal	Exactly one line of symmetry	Rotational symmetry of order 2
<b>Square</b> 	✓	×	✓	×	×
<b>Rhombus</b> 					
<b>Kite</b> 					



4 Use your calculator to work out  $\frac{3.21 + 4.89}{5.62 - 1.89}$  as a decimal.

4 (a) Write down your full calculator display.

[1 mark]

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Answer .....

4 (b) Write your answer to 1 decimal place.

[1 mark]

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Answer .....

Turn over for the next question

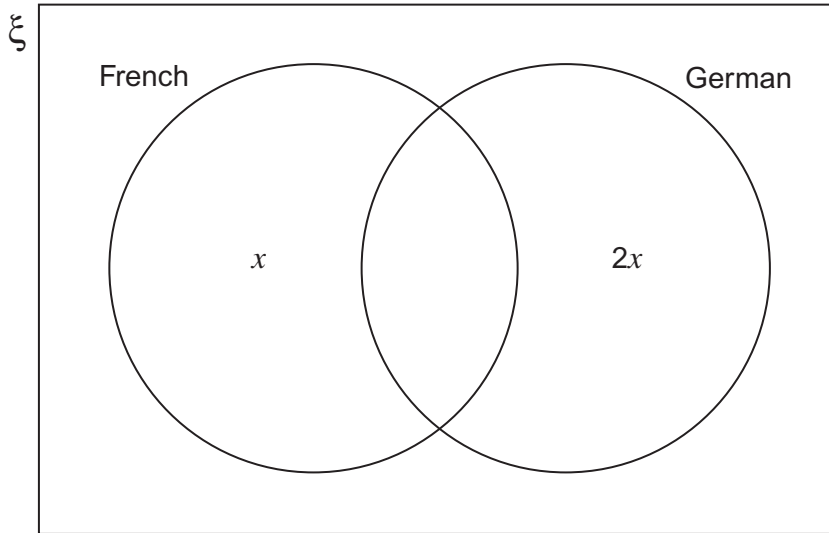


5 In a group of 30 students

$x$  students take French **only**

$2x$  students take German **only**

This information is shown in the Venn diagram.



5 (a) 3 students take **both** French and German.  
6 students do **not** take either French **or** German.

Add this information to the Venn diagram.

[1 mark]

\*5 (b) Set up and solve an equation to work out the value of  $x$ .

[3 marks]

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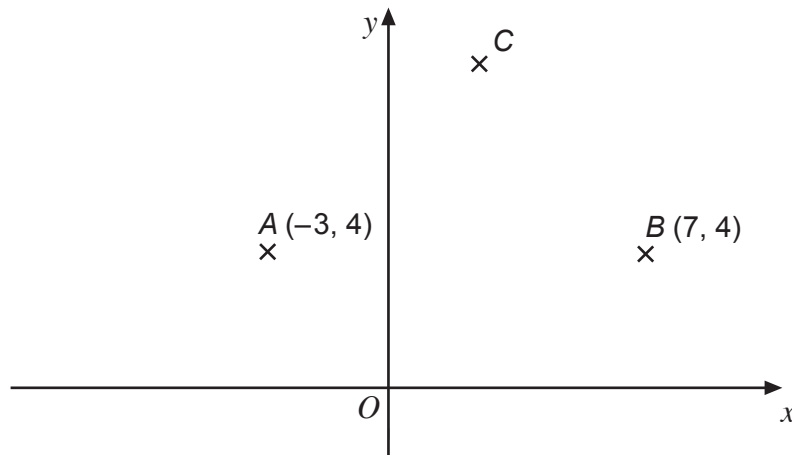
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$x =$  .....



6 Points A, B and C are plotted.



They form an **isosceles** triangle such that  $AC = BC$   
 A is  $(-3, 4)$  and B is  $(7, 4)$ .  
 The area of triangle ABC is 20 square units.

Work out the coordinates of C.  
 You **must** show your working, some of which may be on the diagram.

[4 marks]

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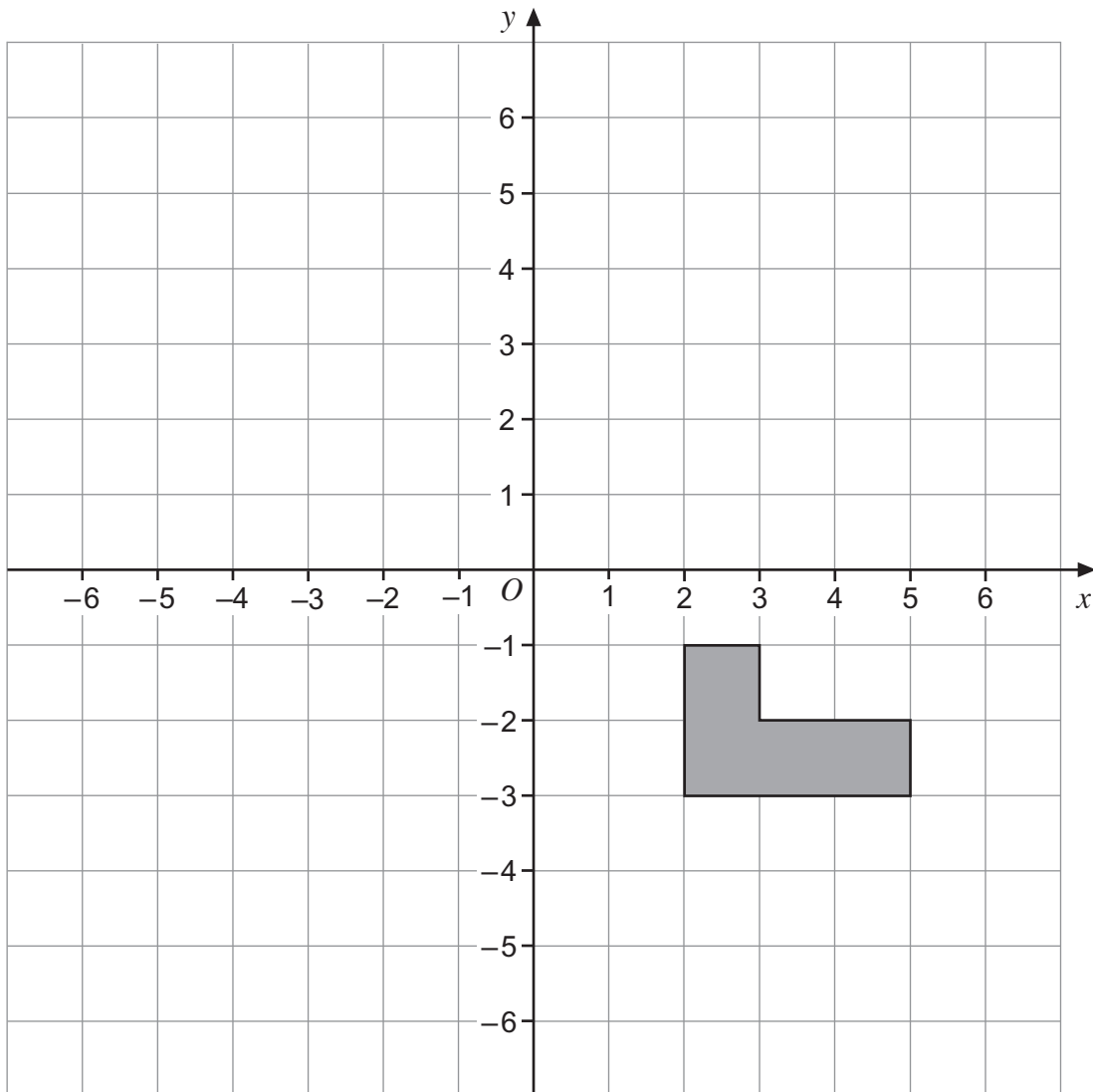
Answer ( ..... , ..... )

Turn over for the next question



7 (a) Reflect the shape in the line  $x = 2$

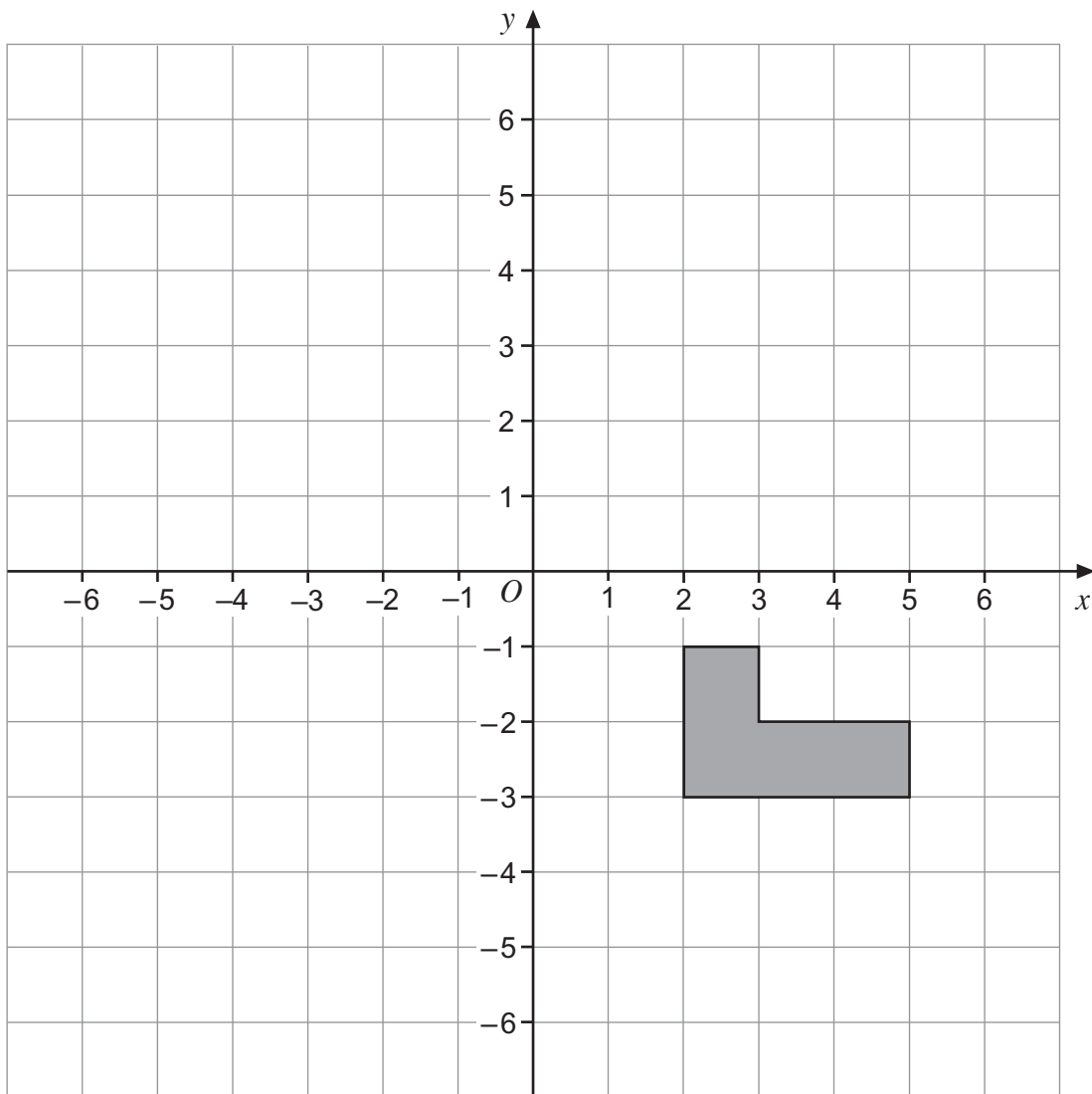
[2 marks]



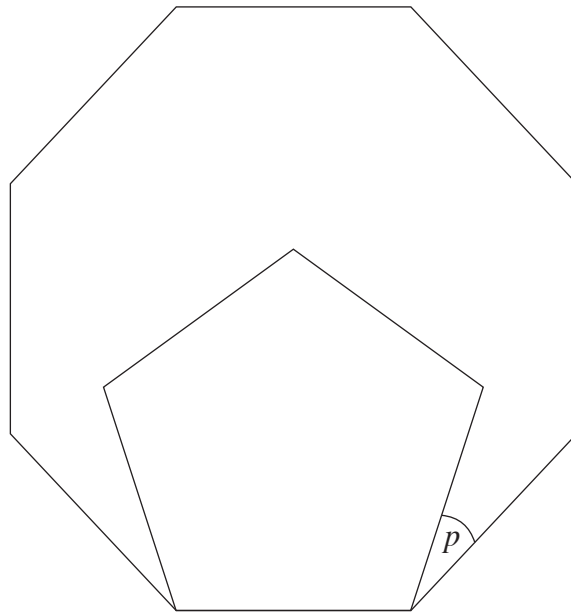


7 (b) Translate the shape by the vector  $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$ .

[2 marks]



8 A regular pentagon is drawn inside a regular octagon as shown.



Not drawn  
accurately

Calculate the size of angle  $p$ .  
You **must** show your working.

[3 marks]

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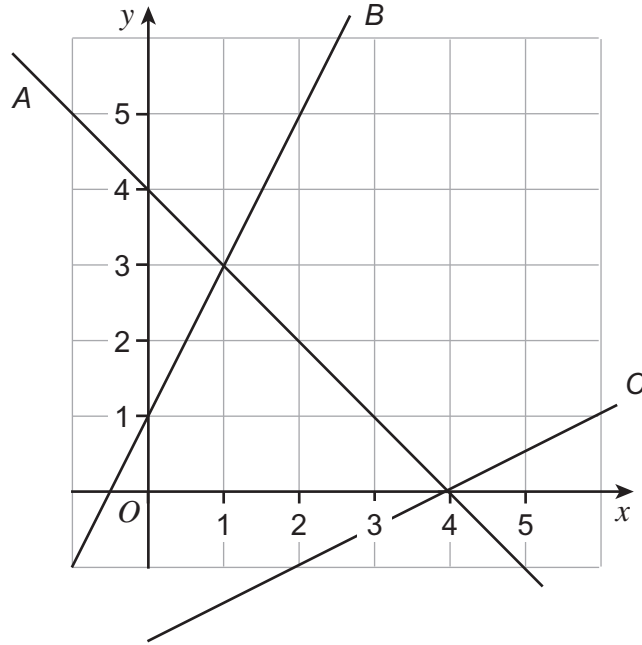
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Answer ..... degrees



9 The graph shows three lines, A, B and C.



9 (a) Complete these sentences with A, B or C to make them true.

[2 marks]

$y = \frac{1}{2}x - 2$  is the equation of line .....

$x + y = 4$  is the equation of line .....

$y = 2x + 1$  is the equation of line .....

9 (b) Which of the lines does the point  $(-4, -4)$  lie on?  
Circle your answer.

[1 mark]

$y = \frac{1}{2}x - 2$

$x + y = 4$

$y = 2x + 1$

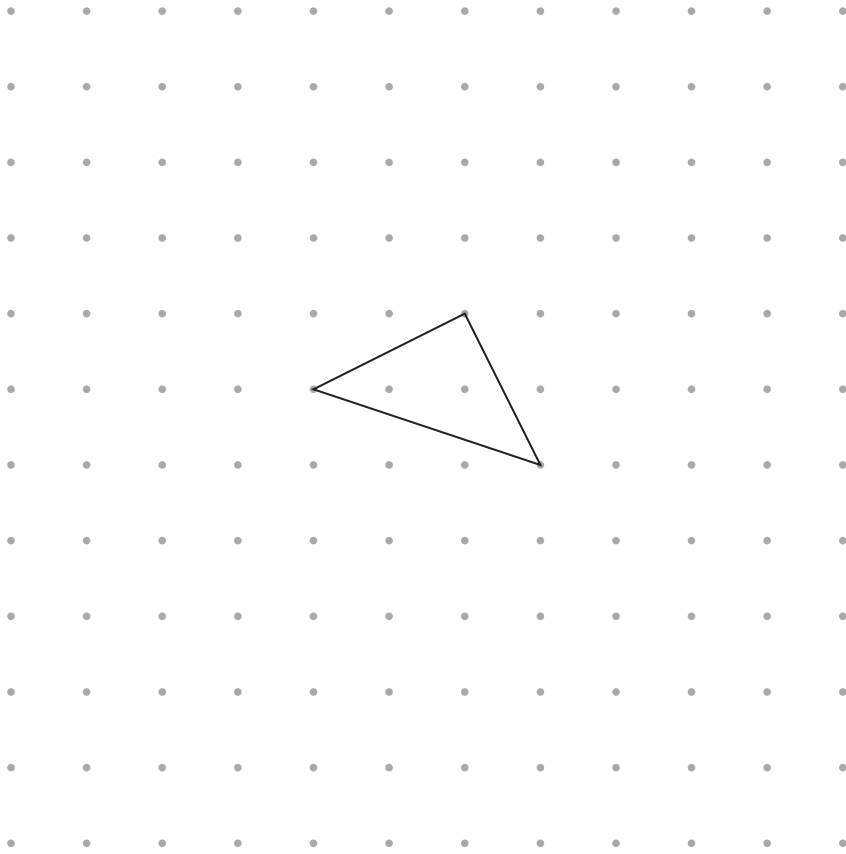


**10** A triangle is shown on the grid.

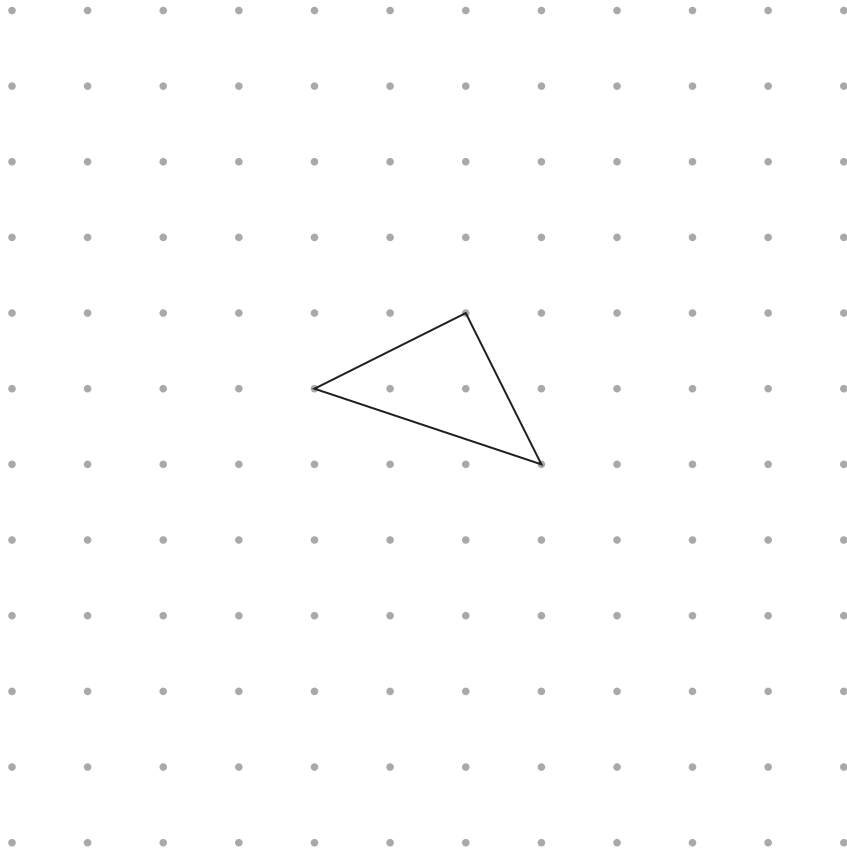
Draw enough triangles to show that it will tessellate.

**[2 marks]**

Use this grid for practice.



Use this grid for your answer.



Turn over for the next question

2

Turn over ►



**11 (a)** As a product of prime factors  $40 = 2^3 \times 5$

Write 50 as a product of prime factors.

**[2 marks]**

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.....

Answer .....

**11 (b)** Work out the Least Common Multiple of 40 and 50

**[2 marks]**

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Answer .....

**12** Work out the  $n$ th term of the sequence.

7      13      19      25      31      .....

**[2 marks]**

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Answer .....



13 Solve the following equations.  
Do **not** use trial and improvement.

13 (a)

$$\frac{x}{5} + 2 = x$$

[3 marks]

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$x =$  .....

13 (b)

$$\frac{2y - 3}{4} + \frac{y - 4}{3} = 1$$

[4 marks]

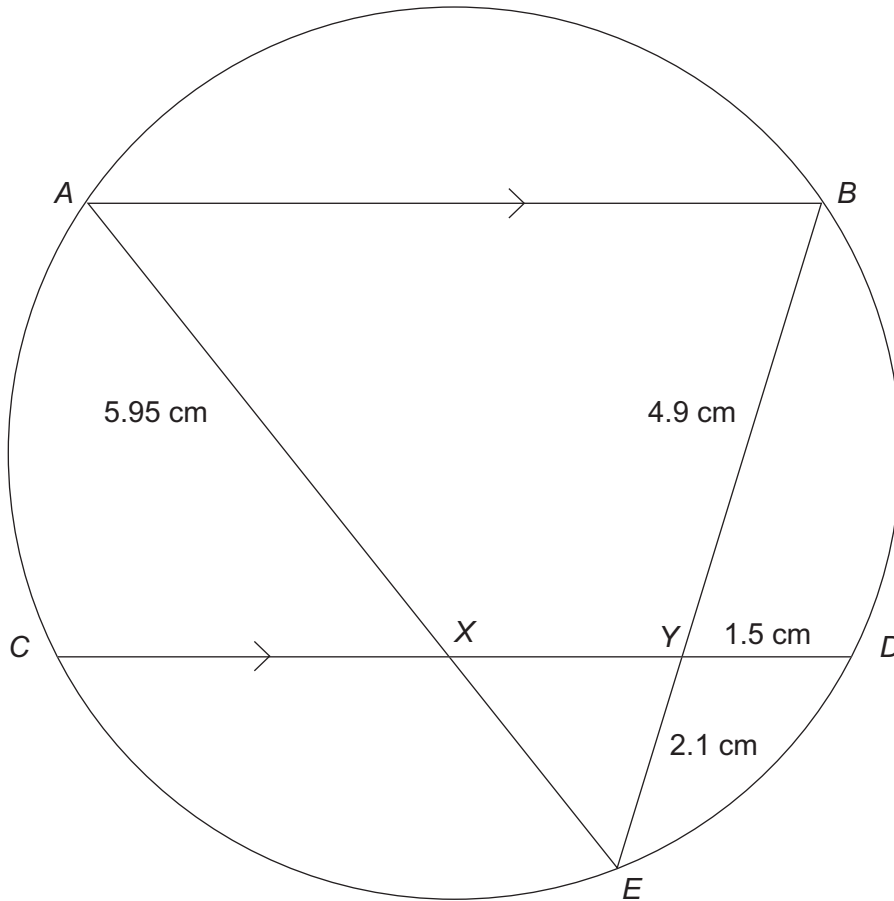
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$y =$  .....



14  $AB$  and  $CD$  are parallel chords of a circle.  
 $AE$  and  $BE$  intersect the chord  $CD$  at  $X$  and  $Y$  respectively.

$AX = 5.95$  cm  
 $BY = 4.9$  cm  
 $YE = 2.1$  cm  
 $YD = 1.5$  cm



Not drawn  
accurately

14 (a) Use the intercept theorem to show that  $XE = 2.55$  cm

[2 marks]

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14 (b) Use the intersecting chords theorem to show that  $CY = 6.86$  cm

[2 marks]

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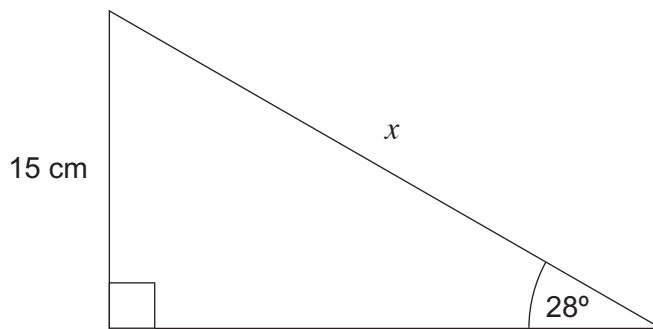
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15 Work out the length  $x$ .

[3 marks]



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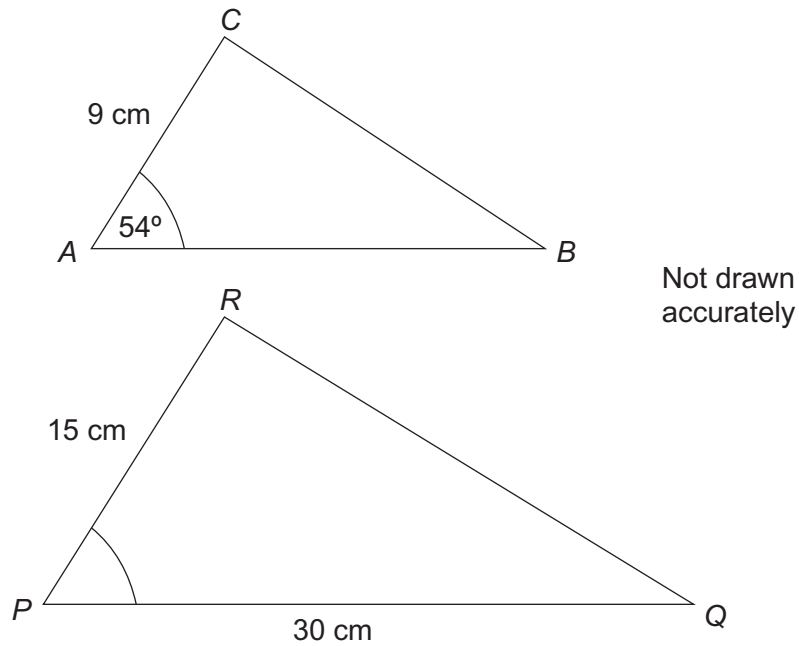
Answer ..... cm

7

Turn over ►



16 Triangle  $PQR$  is an enlargement of triangle  $ABC$ .



16 (a) Work out the scale factor of the enlargement.

[1 mark]

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Answer .....

16 (b) Write down the size of angle  $P$ .

[1 mark]

Answer ..... degrees

16 (c) Work out the length  $AB$ .

[1 mark]

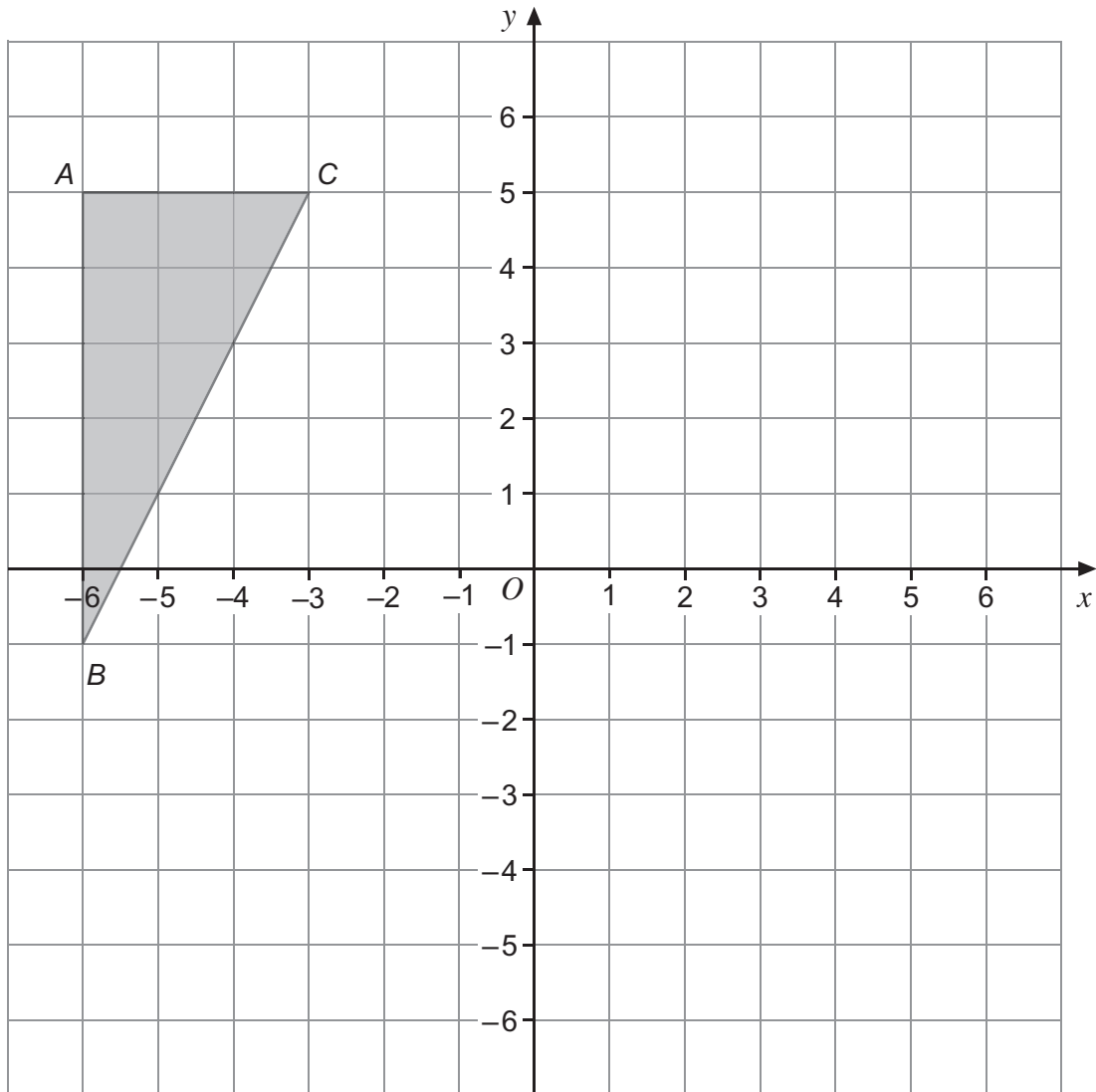
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Answer ..... cm



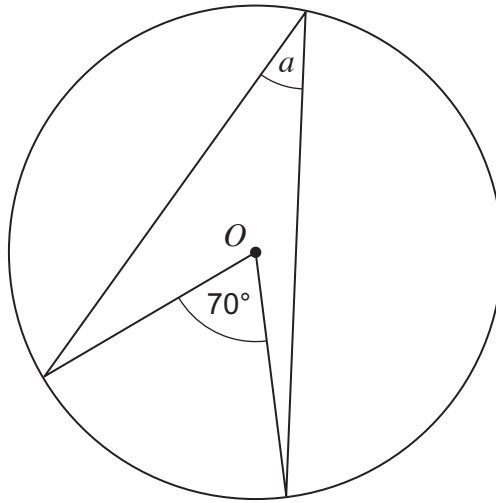
17

Enlarge triangle  $ABC$  by scale factor  $-\frac{2}{3}$ , centre  $(0, 2)$ .**[2 marks]****Turn over for the next question****Turn over ►**

**18 (a)**  $O$  is the centre of the circle.

Write down the size of angle  $a$ .

[1 mark]

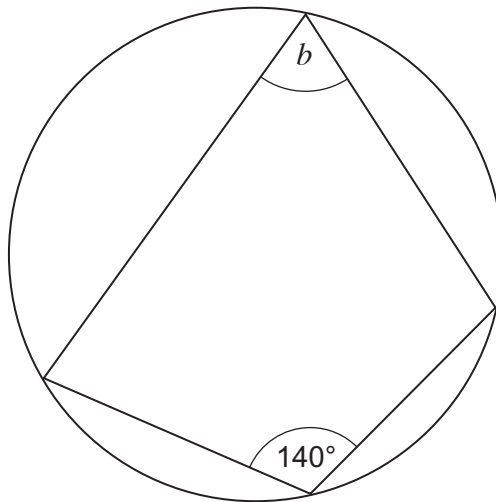


Not drawn  
accurately

Answer ..... degrees

**\*18 (b)** Write down the size of angle  $b$ .  
Give a reason for your answer.

[2 marks]



Not drawn  
accurately

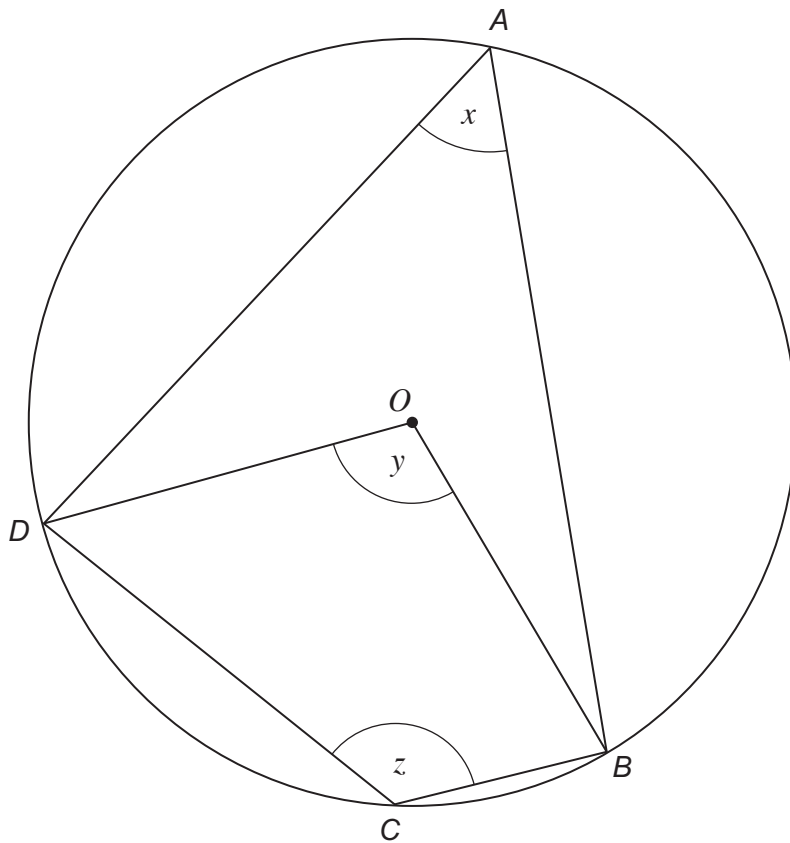
Answer ..... degrees

Reason .....

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18 (c) A, B, C and D are points on a circle, centre O.



Not drawn  
accurately

$x + y + z = 290^\circ$

Work out the values of  $x$ ,  $y$  and  $z$ .

[3 marks]

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$x =$  ..... degrees

$y =$  ..... degrees

$z =$  ..... degrees

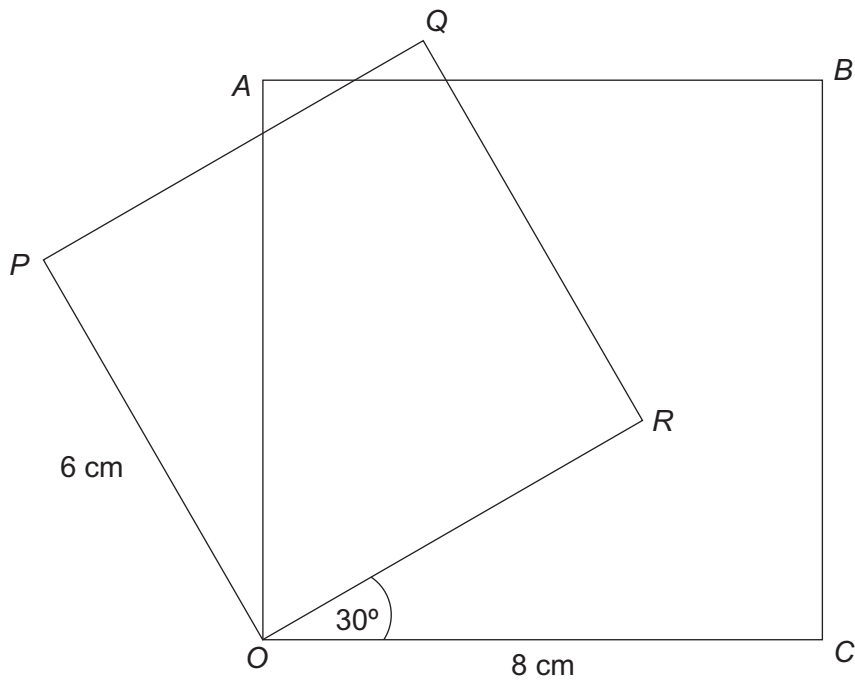
6
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Turn over ►



19

$OABC$  is a square of side 8 cm  
 $OPQR$  is a square of side 6 cm  
 Angle  $ROC$  is  $30^\circ$



Not drawn  
accurately

Prove that triangle  $ORC$  and triangle  $OPA$  are congruent.

[4 marks]

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20

Use the quadratic formula to solve  
Give your answers to 2 decimal places.

$$2x^2 - 5x - 4 = 0$$

[3 marks]

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Answer .....

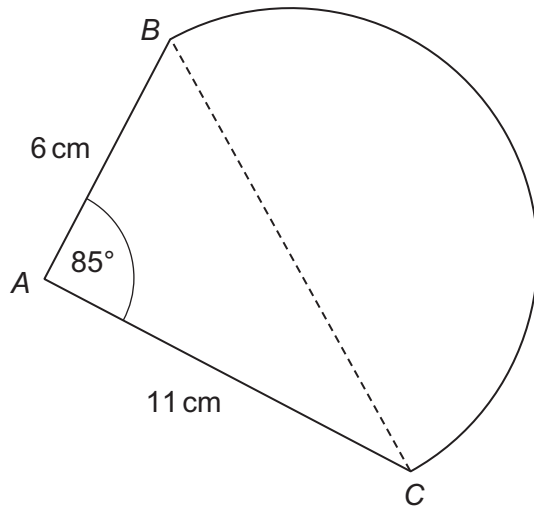
Turn over for the next question

7

Turn over ►



21 This shape is made from a semicircle and a triangle.



Not drawn  
accurately

Calculate the perimeter of the shape.

[5 marks]

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Answer ..... cm

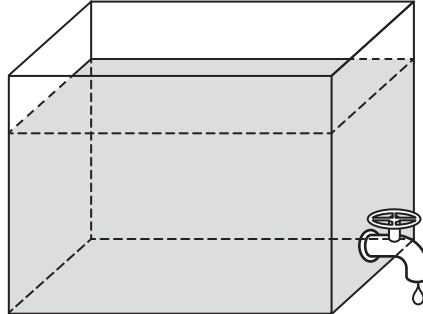




22

A water tank contains  $V\text{m}^3$  of water.  
The tank begins to leak.

At the end of each day the tank has lost  $\frac{1}{9}$  of the volume of water at the start of the day.



Show that after 6 days the volume of water is **just below**  $\frac{V}{2}\text{m}^3$

[3 marks]

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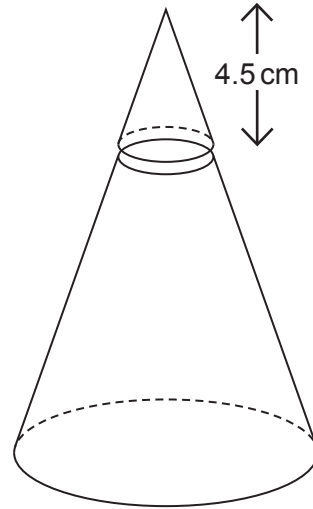
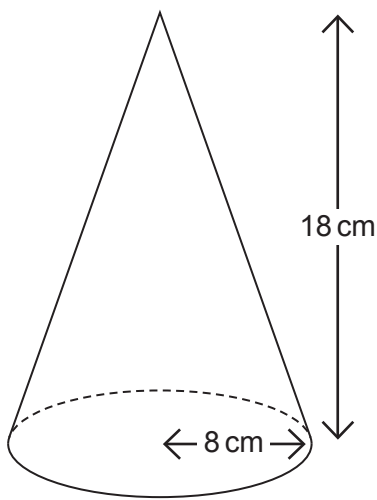
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23

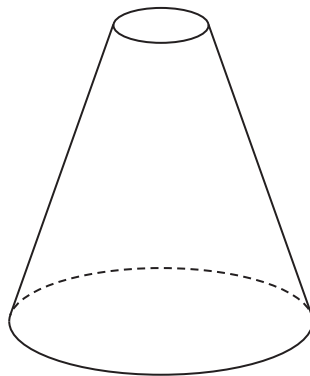
A cone has a vertical height of 18 cm and a base radius of 8 cm

A cut is made parallel to the base so that a cone of height 4.5 cm is removed.



Calculate the volume of the remaining frustum.

[3 marks]



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Answer ..... cm<sup>3</sup>

**END OF QUESTIONS**

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