

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Higher Tier  
November 2014

# Methods in Mathematics (Linked Pair)

93652H

H

Unit 2      Geometry and Algebra

Wednesday 12 November 2014    9.00 am to 10.30 am

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• a calculator</li> <li>• mathematical instruments.</li> </ul>	
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### 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 7, 14 and 16. These questions are indicated with an asterisk (\*).
- You may ask for more answer paper, tracing paper and graph 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.

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	
<b>TOTAL</b>	



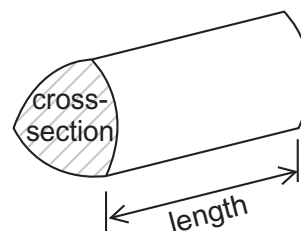
N 0 V 1 4 9 3 6 5 2 H 0 1

### 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** =  $\pi r l$

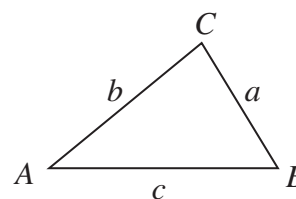


**In any triangle ABC**

**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

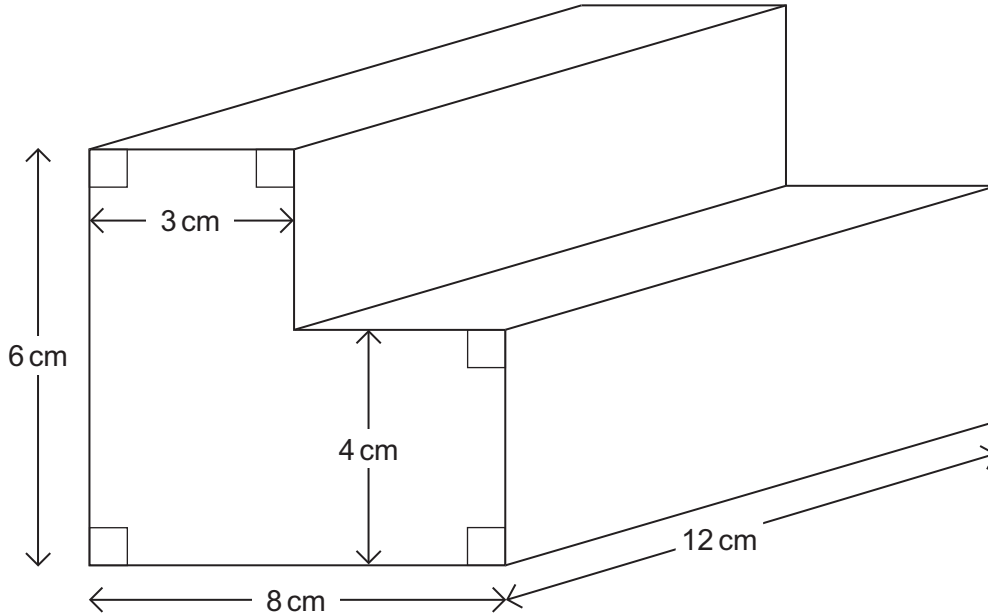
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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



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

1 The diagram shows a prism.



Work out the volume of the prism.  
You **must** show your working.

[4 marks]

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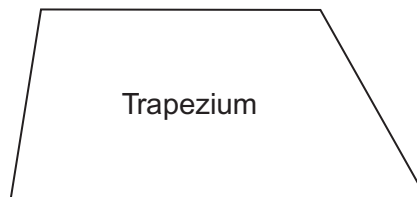
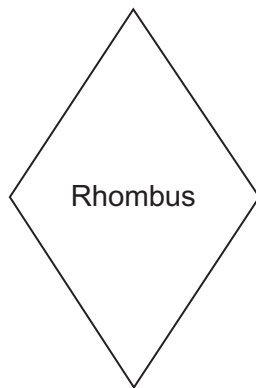
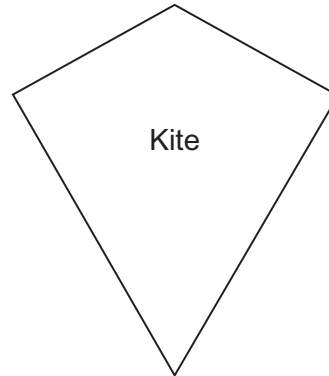
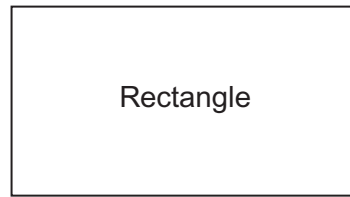
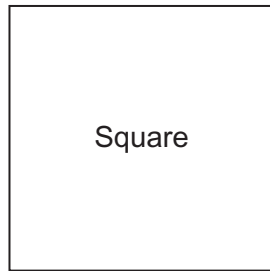
Answer ..... cm<sup>3</sup>

4
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Turn over ►



2 Here are six quadrilaterals.



2 (a) Write down the names of the **two** quadrilaterals that have  
rotational symmetry of order 2  
**and**  
diagonals of different lengths.

[2 marks]

Answer ..... and .....



**2 (b)** Three of the quadrilaterals are

kite

rectangle

parallelogram

The kite could be the odd one out.  
Give a reason why.

[1 mark]

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**2 (c)** Tick the **one** property that these three quadrilaterals have in common.

rectangle

square

rhombus

[1 mark]

All four sides the same length

All four angles  $90^\circ$

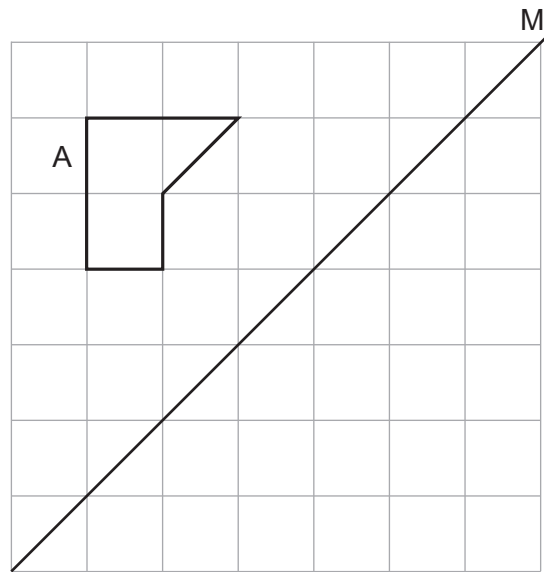
Diagonals bisect each other

No lines of symmetry



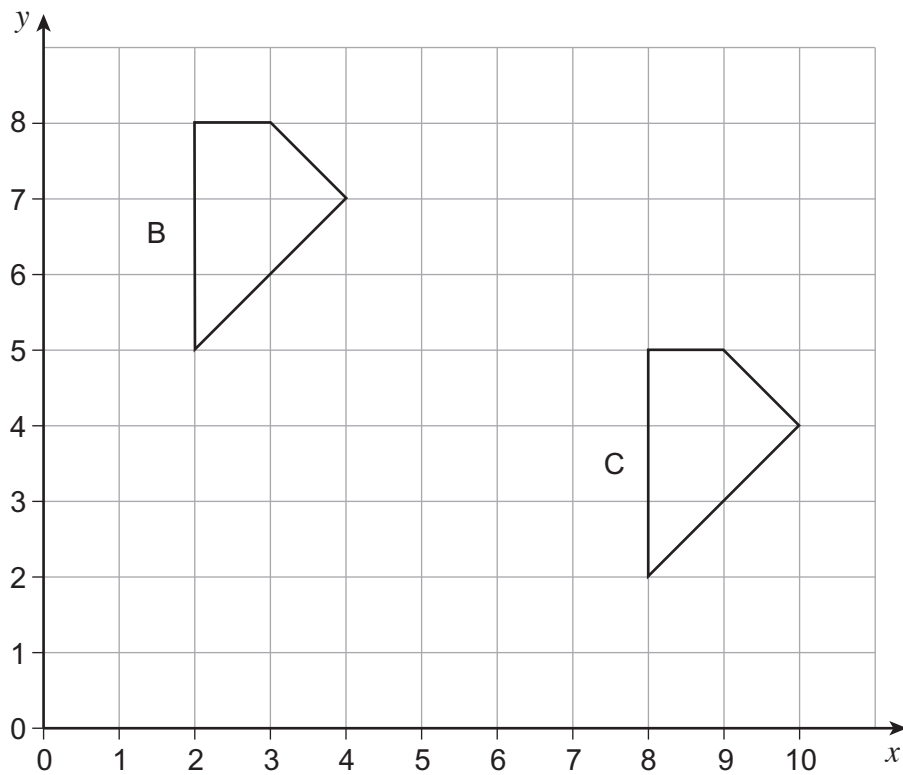
3 (a) Reflect shape A in the mirror line, M.

[2 marks]



3 (b) Write down the vector that maps shape B to shape C.

[2 marks]



Answer  $\begin{pmatrix} \dots \\ \dots \end{pmatrix}$



4 A six-digit number is made up of 3 two-digit numbers.  
All six digits are **different**.

The first two digits are the cube root of 493 039

The middle two digits are a prime number between 10 and 20

The last two digits are a square number.

Work out **one** of the possible six-digit numbers.

**[3 marks]**

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Answer .....

**Turn over for the next question**



5 Written as a product of prime factors  $2014 = 2 \times 19 \times 53$

Work out **all** the factors of 2014

**[3 marks]**

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Answer .....

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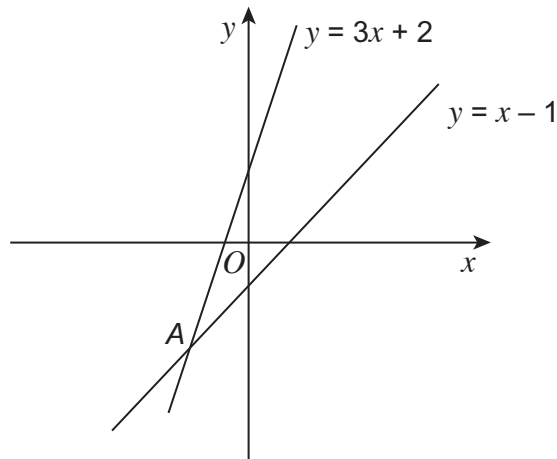
6 (a) Solve  $3x + 2 = x - 1$

[3 marks]

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$x =$  .....

6 (b) Here are sketches of the graphs  $y = 3x + 2$  and  $y = x - 1$



Not drawn accurately

The graphs  $y = 3x + 2$  and  $y = x - 1$  intersect at the point A.

Work out the coordinates of A.

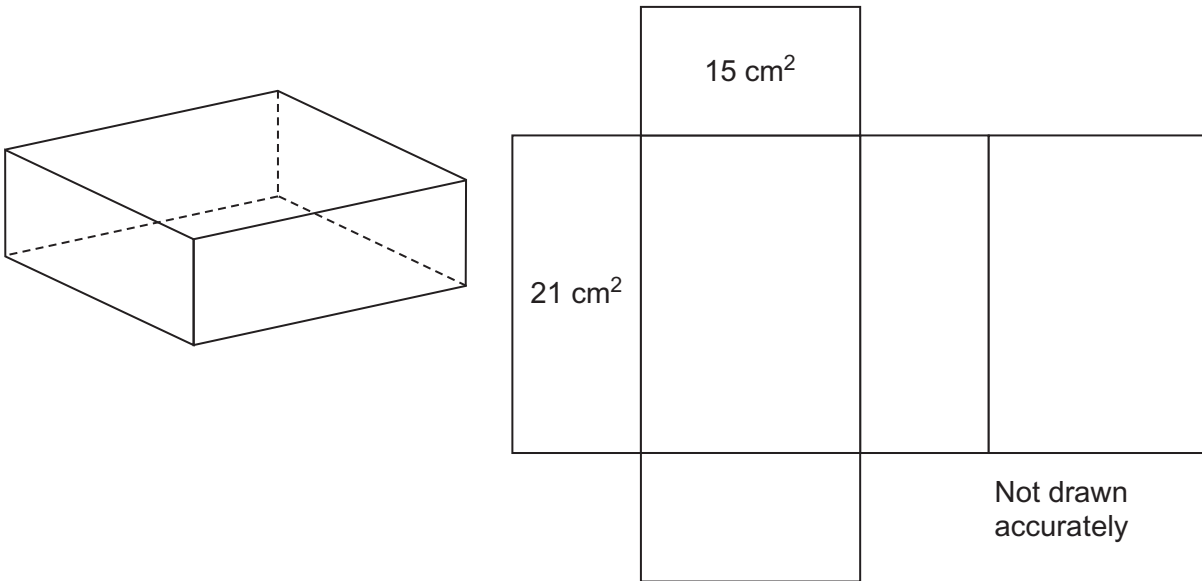
[1 mark]

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



\*7 A cuboid has a net as shown.  
The areas of two of the faces are shown on the net.  
The lengths of the sides of the cuboid are whole numbers of centimetres greater than 1



Work out the **total** surface area of the cuboid.  
You **must** show your working.

[4 marks]

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Answer ..... cm<sup>2</sup>



- 8 (a)** Use your calculator to work out  $\cos(\sin^{-1} 0.76)$   
Write down the first 6 digits of your calculator display.

[1 mark]

Answer .....

- 8 (b)** Write your answer to (a) to 3 significant figures.

[1 mark]

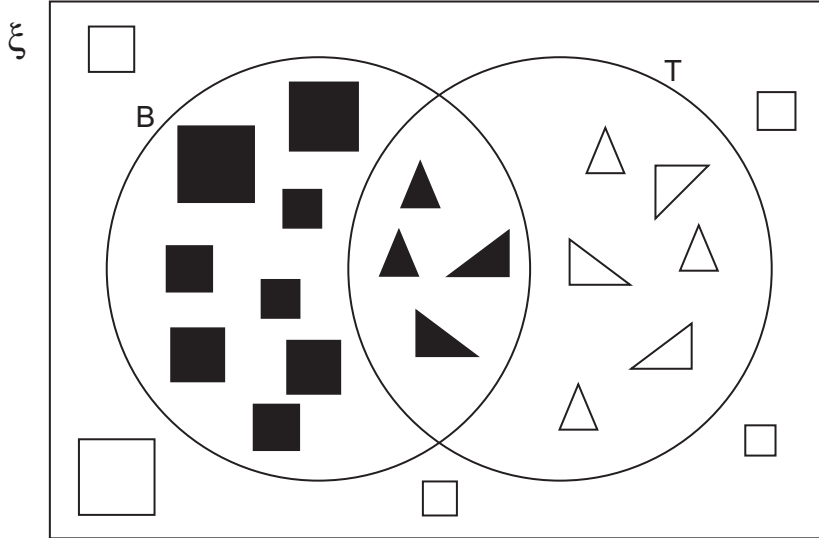
Answer .....

**Turn over for the next question**



9 In the Venn diagram,

- $\xi$  = square and triangular shapes
- B = black shapes
- T = triangular shapes



9 (a) How many shapes are black or triangular or both?

[1 mark]

Answer .....

9 (b) More **black** shapes are added to the Venn diagram.

The ratio black squares : black triangles does not change.

What is the smallest number of shapes that could have been added?  
You **must** show your working.

[2 marks]

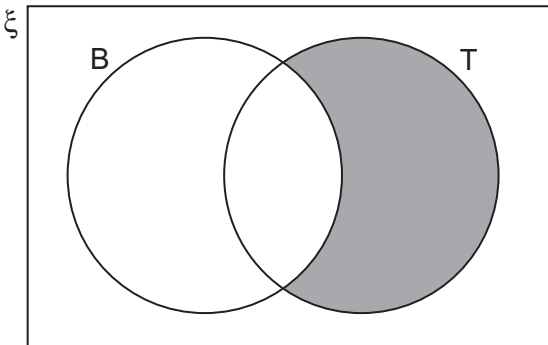
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Answer .....

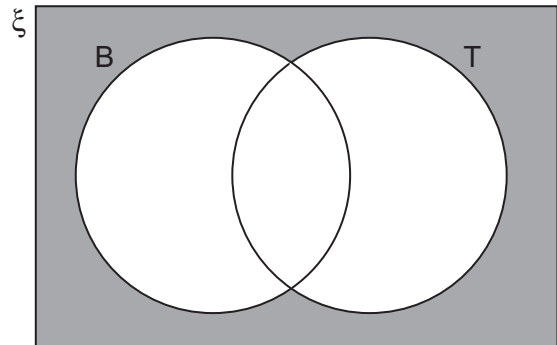


- 9 (c) Which one of the following **shaded** areas represents 'Shapes that are **not** black triangles'?
- Circle the number under the correct diagram.

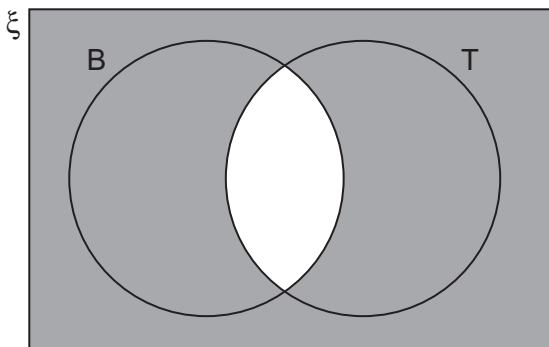
[1 mark]



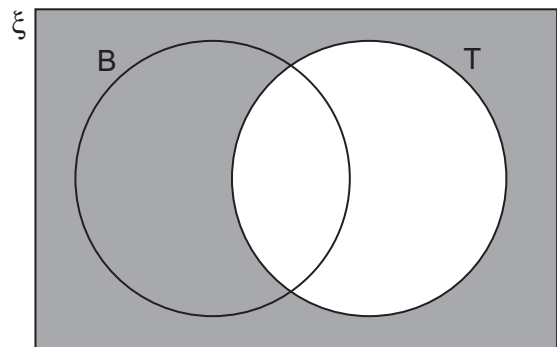
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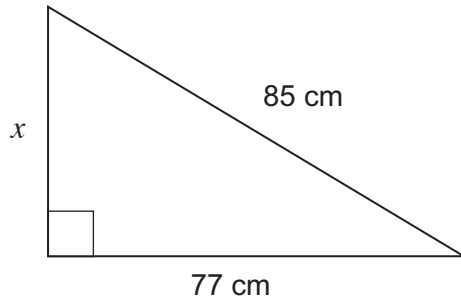
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Turn over ►



10 (a) Work out the length of  $x$ .

[3 marks]



Not drawn  
accurately

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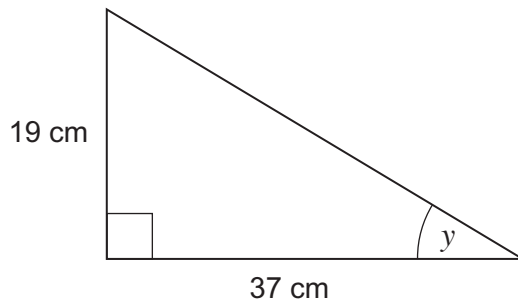
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Answer ..... cm

10 (b) Work out the size of angle  $y$ .

[3 marks]



Not drawn  
accurately

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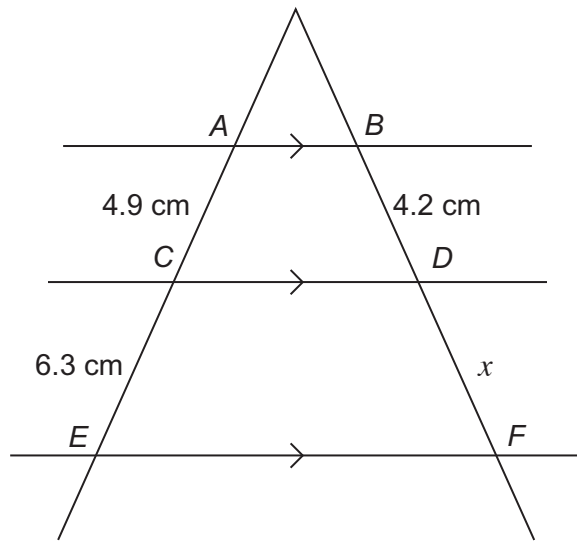
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Answer ..... degrees



- 11  $AB$ ,  $CD$  and  $EF$  are parallel.  
 $AC = 4.9$  cm,  $CE = 6.3$  cm,  $BD = 4.2$  cm



Not drawn  
accurately

Work out the length  $DF$ , marked  $x$  on the diagram.

[3 marks]

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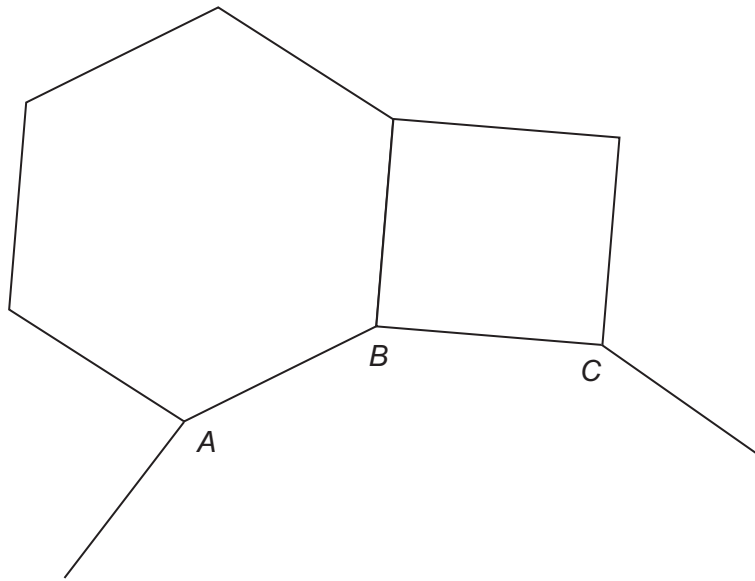
Answer ..... cm

Turn over for the next question



12

The diagram shows a regular hexagon and a square.  
The sides  $AB$  and  $BC$  are two sides of a regular polygon with  $n$  sides.



Not drawn  
accurately

Work out  $n$ .  
You **must** show your working, which may be on the diagram.

[4 marks]

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Answer .....





13 (a) Solve  $x^2 - x - 12 = 0$

[3 marks]

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Answer .....

13 (b) Factorise fully  $6x^2y - 8xy^2$

[2 marks]

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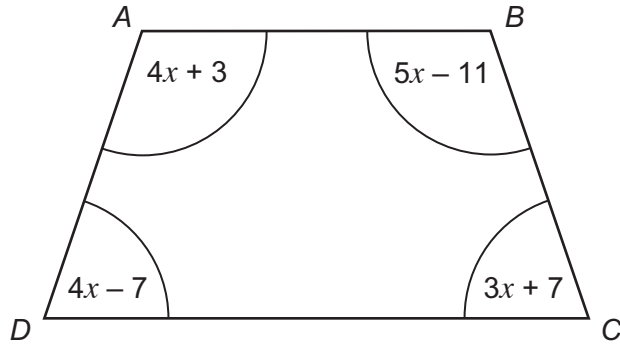
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Answer .....

Turn over for the next question



**\*14** The diagram shows a quadrilateral  $ABCD$ .  
Expressions for the angles, in degrees, are shown.



Not drawn  
accurately

Prove that  $ABCD$  is a trapezium.

**[5 marks]**

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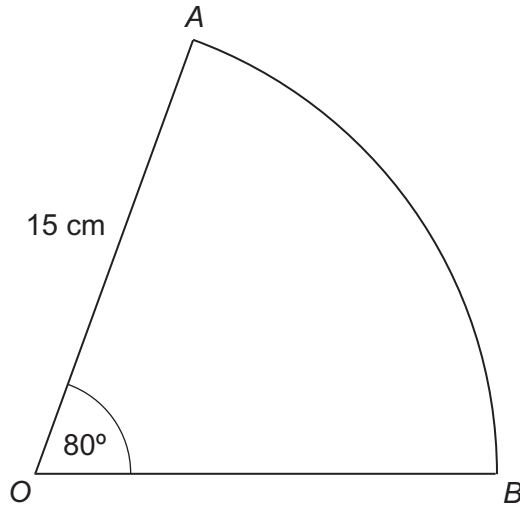
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15  $OAB$  is a sector of a circle of radius 15 cm.  
Angle  $AOB = 80^\circ$



Not drawn  
accurately

Work out the **perimeter** of the sector  $OAB$ .

[3 marks]

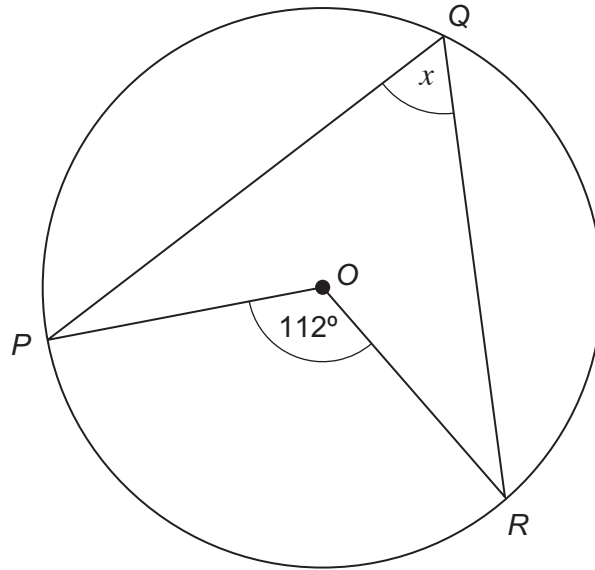
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Answer ..... cm

Turn over for the next question



**\*16 (a)**  $P$ ,  $Q$  and  $R$  are points on the circumference of a circle with centre  $O$ .



Not drawn  
accurately

Work out the size of angle  $x$ .  
Give a reason for your answer.

**[2 marks]**

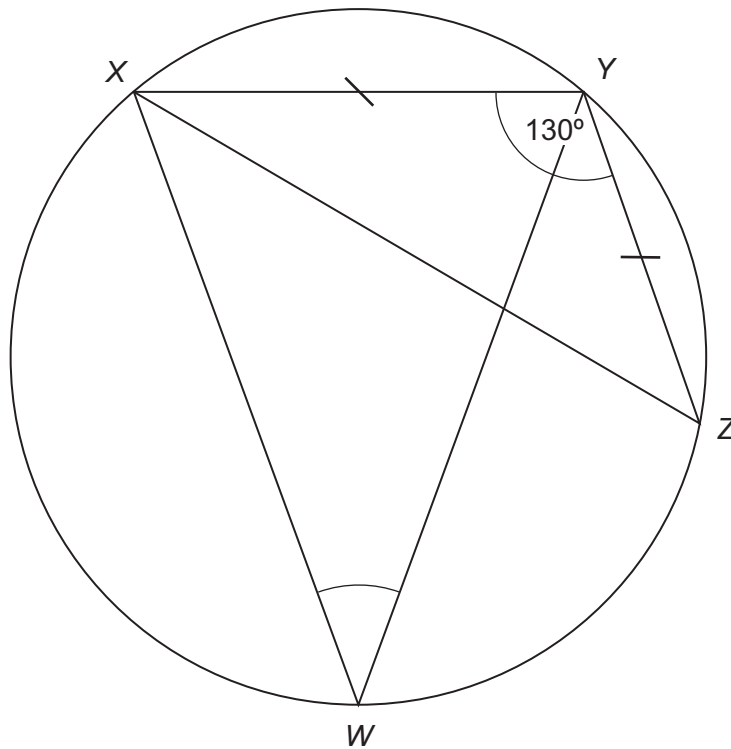
Answer ..... degrees

Reason .....

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- 16 (b)**  $W, X, Y$  and  $Z$  are points on the circumference of a circle.  
 $XY = YZ$   
 Angle  $XYZ = 130^\circ$



Not drawn  
accurately

Work out the size of angle  $XWY$ .  
 Show your working clearly, giving reasons for any angles you write down or calculate.  
**[2 marks]**

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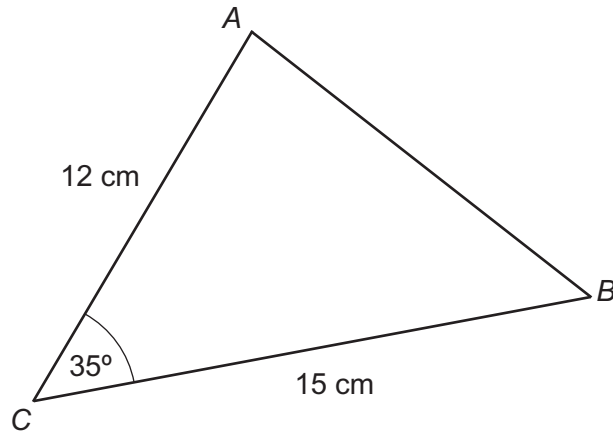
Answer ..... degrees

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Turn over ►



17



Not drawn  
accurately

Work out the area of triangle ABC.

[2 marks]

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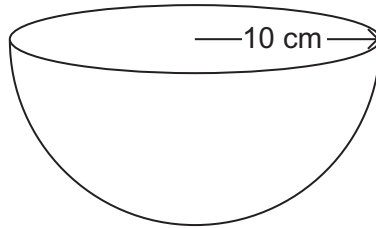
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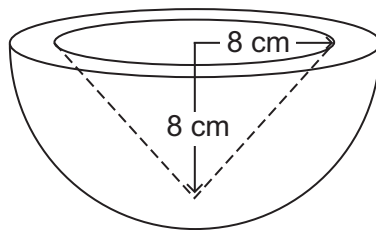
Answer ..... cm<sup>2</sup>



18 A solid hemisphere has a radius of 10 cm



A cone with base radius 8 cm and height 8 cm is cut from the hemisphere.



Work out the volume remaining.

[4 marks]

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

6
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Turn over ►



**19** Work out the  $n$ th term of this quadratic sequence.

5                    8                    12                    17                    23                    ...

**[4 marks]**

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Answer .....





**20** The solution to  $x^2 + 8x + 3 = 0$  can be written as  $a \pm \sqrt{b}$ , where  $a$  and  $b$  are integers.

Work out the values of  $a$  and  $b$ .

**[4 marks]**

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Answer  $a =$  .....  $b =$  .....

**Turn over for the next question**

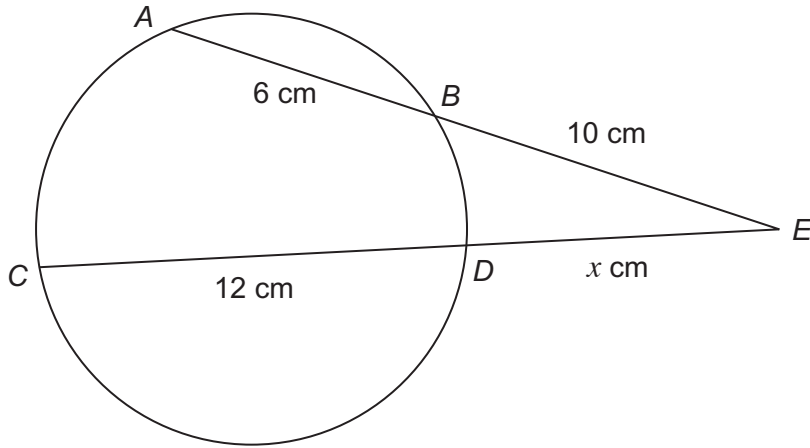
8
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**Turn over** ►



21 *AB* and *CD* are two chords of a circle.  
The extended chords intersect at *E*.

*AB* = 6 cm, *BE* = 10 cm, *CD* = 12 cm and *DE* = *x* cm



Not drawn  
accurately

Work out the value of *x*.  
You **must** show your working.

[4 marks]

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Answer ..... cm

**END OF QUESTIONS**

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ANSWER IN THE SPACES PROVIDED**



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