Surname

Other Names

Candidate Signature

AQA

General Certificate of Secondary Education
Higher Tier
November 2014

Methods in Mathematics (Linked Pair)   **93652H**

Unit 2   Geometry and Algebra

H

Wednesday 12 November 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 π button, take the value of π 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.

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$
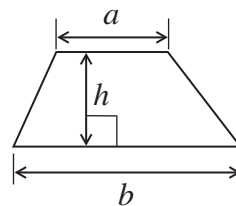
Volume of prism = area of cross section × length
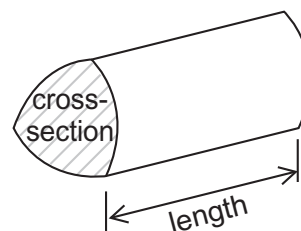
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$
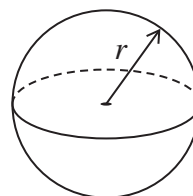
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$
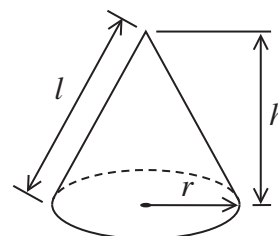
In any triangle ABC

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

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

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$
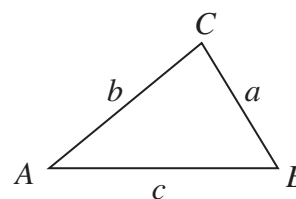
The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

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

1 The diagram shows a prism.
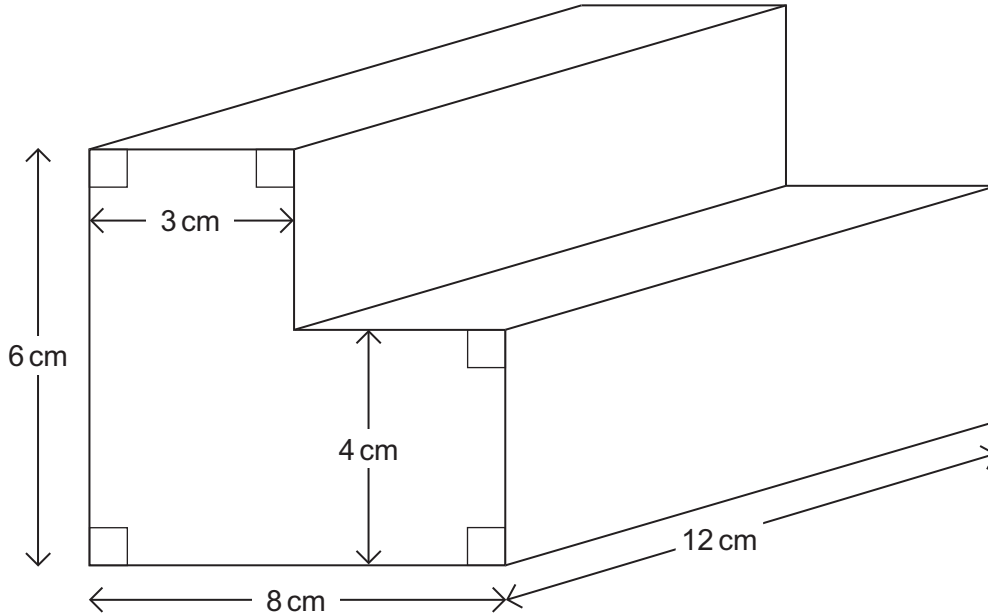
Work out the volume of the prism.
You **must** show your working.

[4 marks]

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Answer .... cm^3

4

Turn over ▶

2 Here are six quadrilaterals.

Square

Rectangle

Parallelogram

Kite

Rhombus

Trapezium
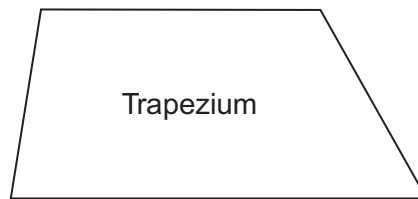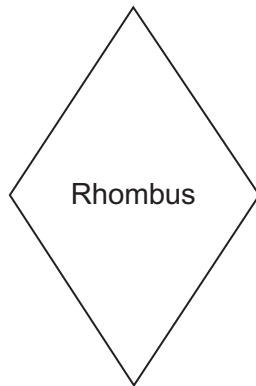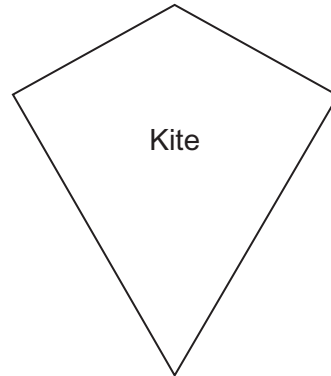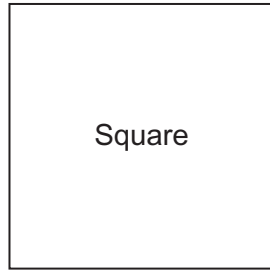
2 (a) Write down the names of the **two** quadrilaterals that have

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 90º   ☐

Diagonals bisect each other   ☐

No lines of symmetry   ☐

4

Turn over ▶

0 5

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

[2 marks]
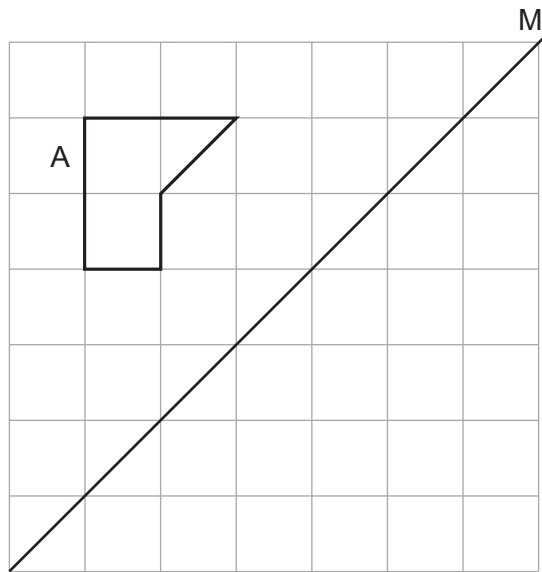
3 (b) Write down the vector that maps shape B to shape C.

[2 marks]
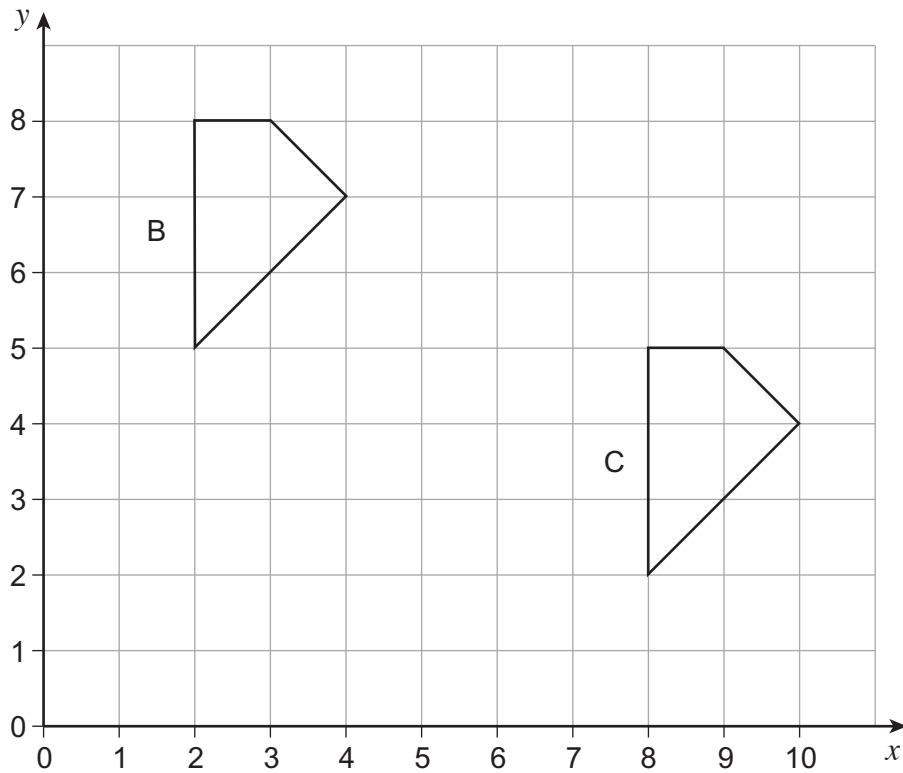
Answer $\begin{pmatrix} .... \\ .... \end{pmatrix}$

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

Turn over ▶

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 $y = x - 1$
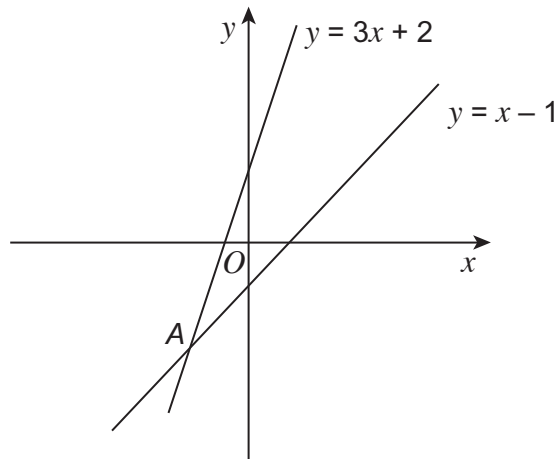
Not drawn accurately

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

Turn over ▶

*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

15 cm²

21 cm²

Not drawn accurately
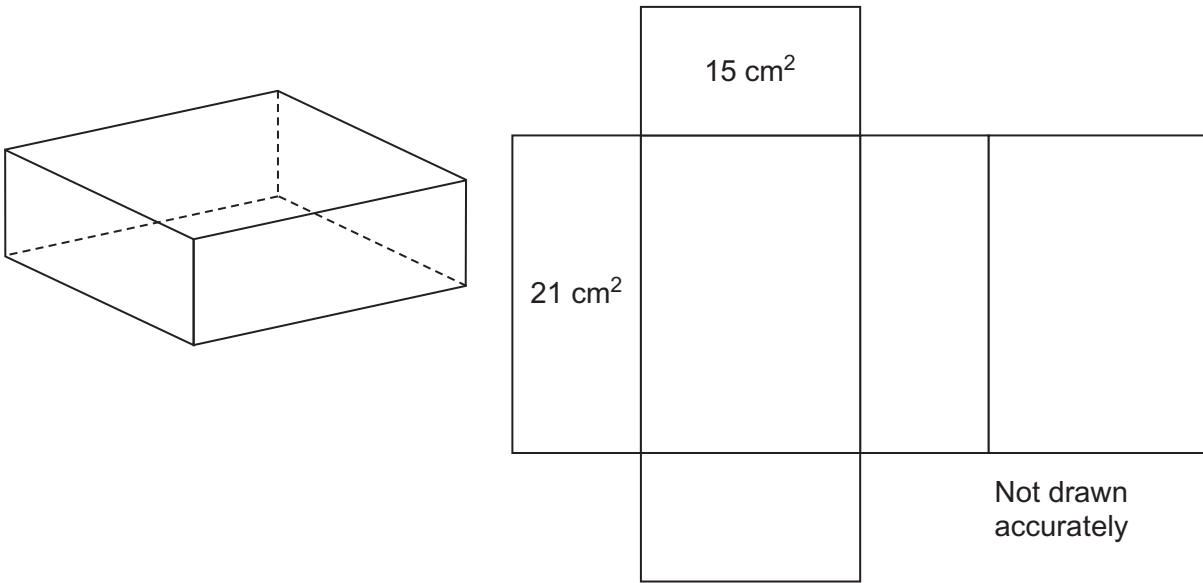
Work out the **total** surface area of the cuboid.
You **must** show your working.

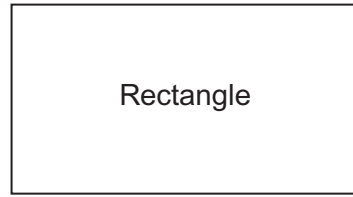**[4 marks]**

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Answer .... cm²

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

Turn over ▶

6

9 In the Venn diagram,

ξ = square and triangular shapes
B = black shapes
T = triangular shapes
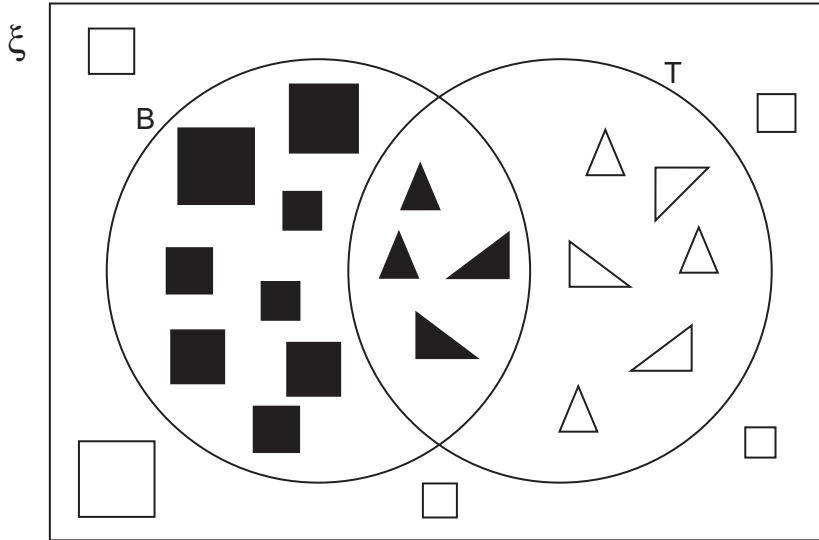
9 (a) How many shapes are black or triangular or both?

[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]
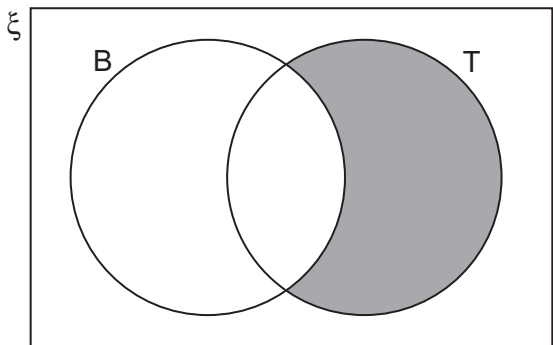
1
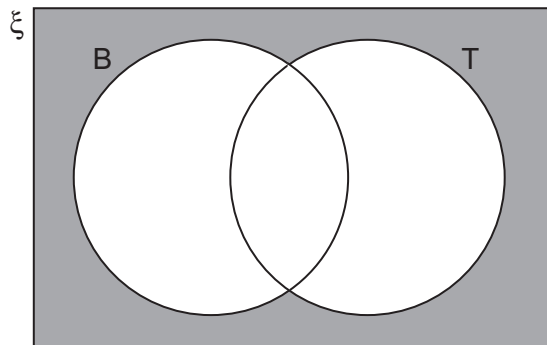
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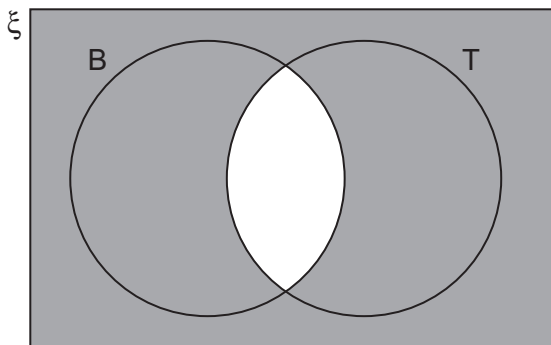
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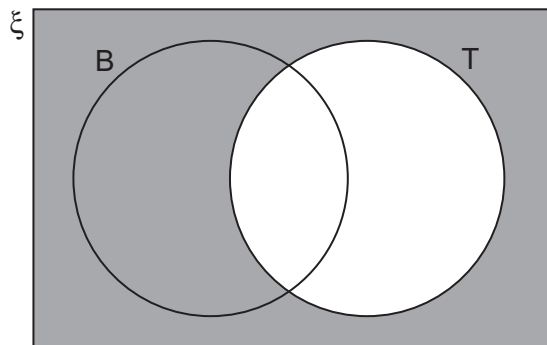
4

4

Turn over ▶

10 (a) Work out the length of x.

[3 marks]

85 cm

Not drawn accurately

x

77 cm

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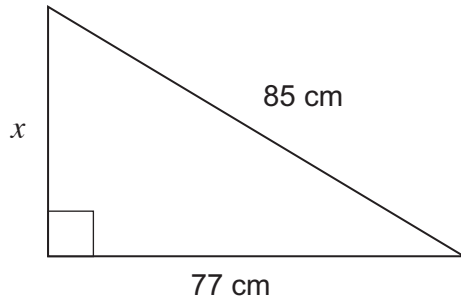
Answer .... cm

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

[3 marks]

Not drawn accurately

19 cm

37 cm
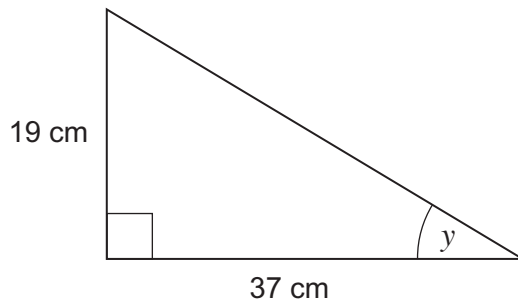
y

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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
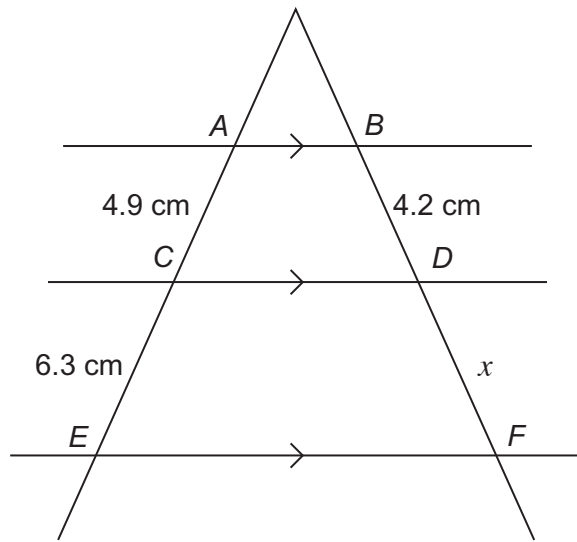
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accurately

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

[3 marks]

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Answer .... cm

Turn over for the next question

Turn over ▶

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.
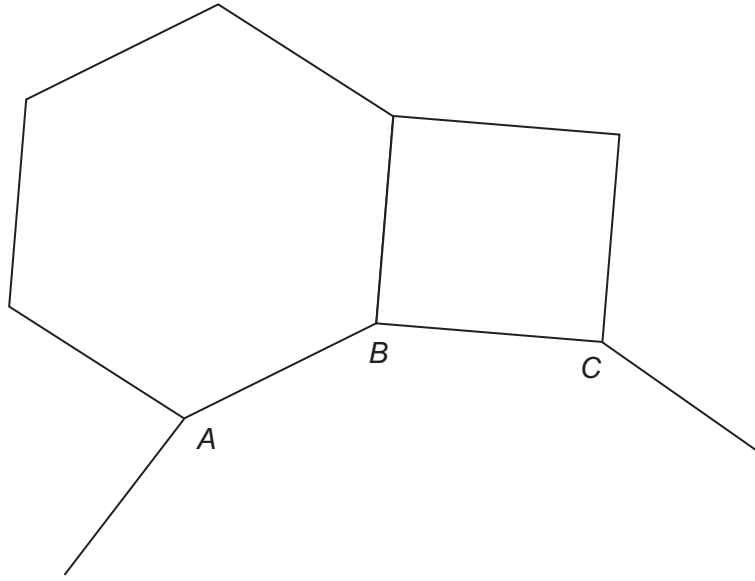
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accurately

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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Answer ....

Turn over for the next question

9

*14 The diagram shows a quadrilateral *ABCD*.
Expressions for the angles, in degrees, are shown.
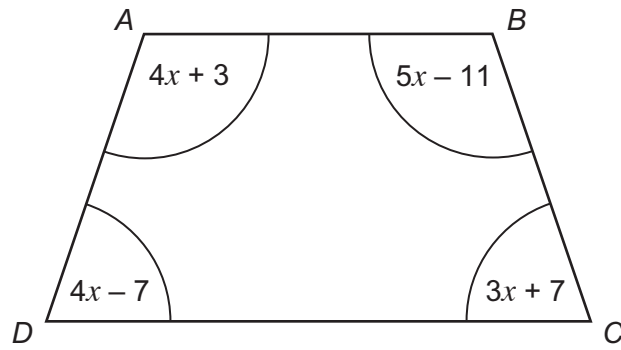
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Prove that *ABCD* is a trapezium.

[5 marks]

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15   *OAB* is a sector of a circle of radius 15 cm.
Angle *AOB* = 80º
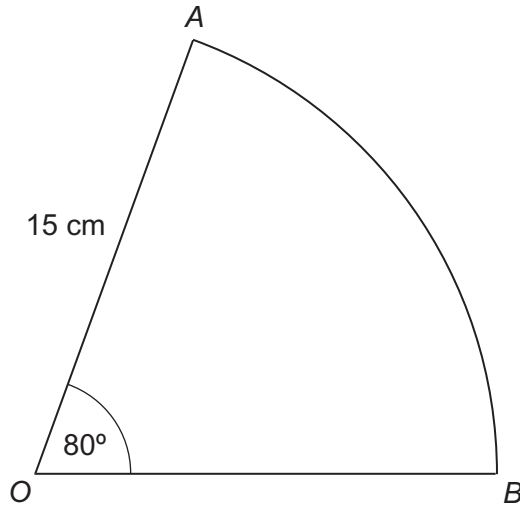
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accurately

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

[3 marks]

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Answer .... cm

Turn over for the next question

8

*16 (a)   *P*, *Q* and *R* are points on the circumference of a circle with centre *O*.
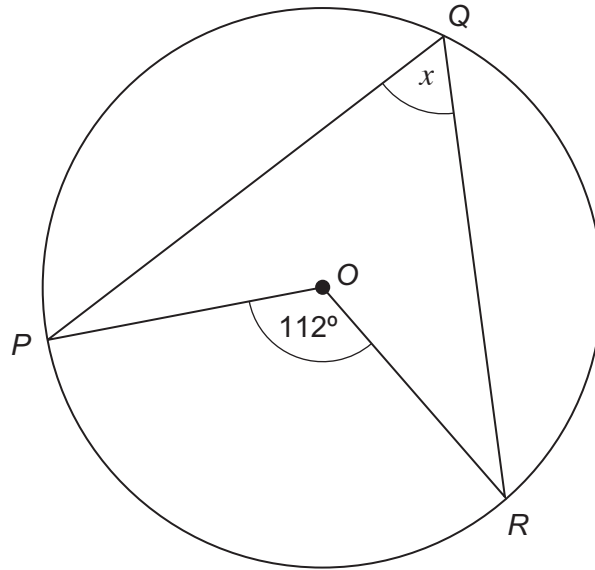
Not drawn
accurately

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* = 130º
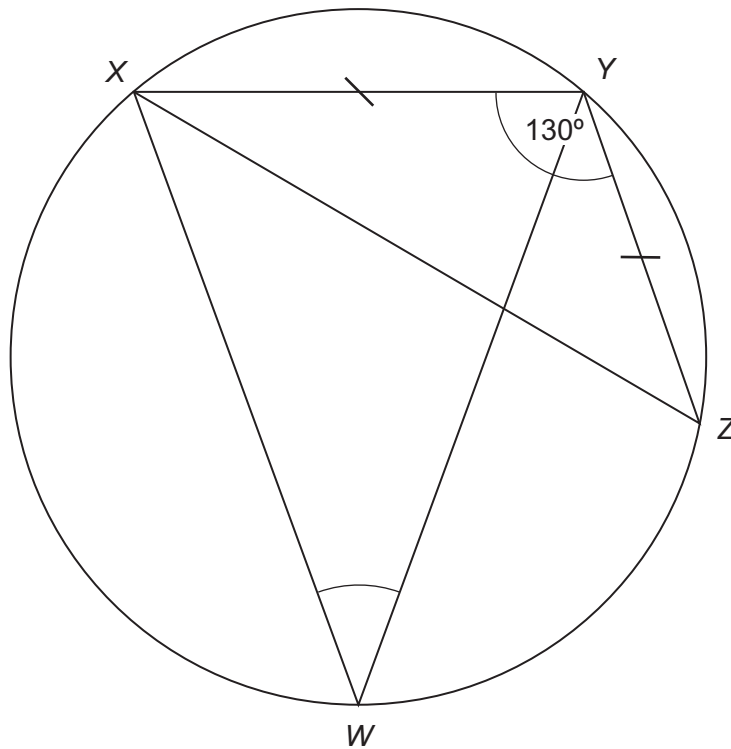
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Work out the size of angle *XWY*.
Show your working clearly, giving reasons for any angles you write down or calculate.

[2 marks]

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Answer .... degrees

4

Turn over ▶

17

A

Not drawn
accurately

12 cm

B

35°

15 cm

C
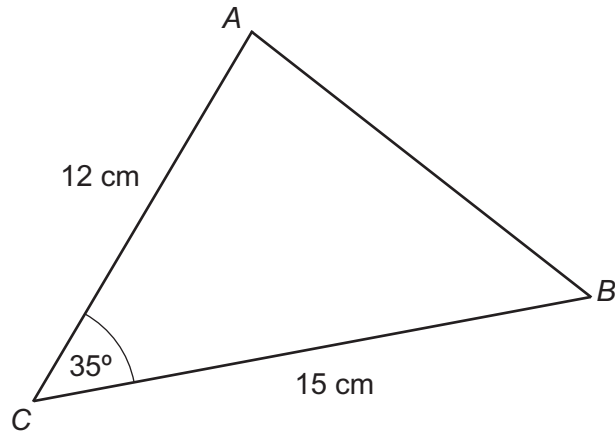
Work out the area of triangle *ABC*.

[2 marks]

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Answer .... cm^2

18   A solid hemisphere has a radius of 10 cm
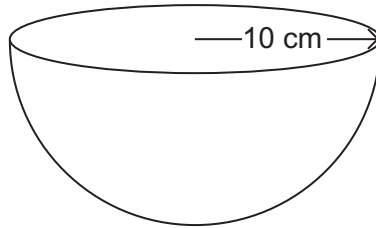
A cone with base radius 8 cm and height 8 cm is cut from the hemisphere.
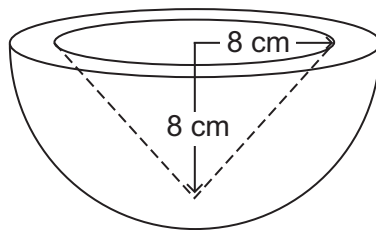
Work out the volume remaining.

[4 marks]

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Answer .... cm^3

6

Turn over ▶

19 Work out the nth 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 = ...
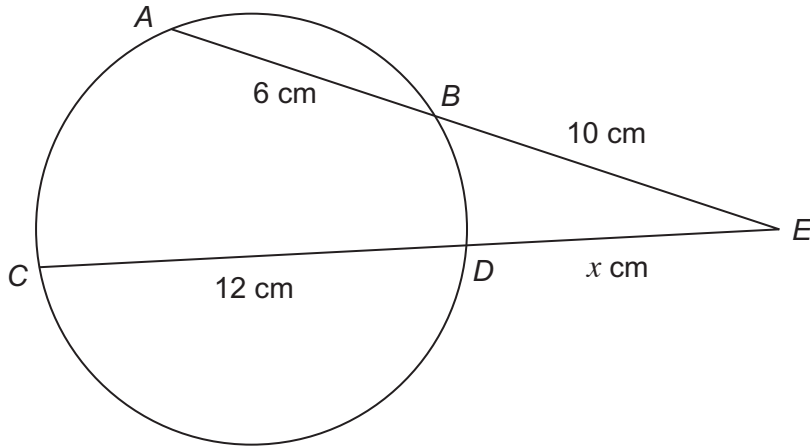
Turn over for the next question

8

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

A

6 cm

B

10 cm

Not drawn accurately

E

C

12 cm

D

x cm

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

[4 marks]

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Answer .... cm

END OF QUESTIONS

4

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