AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
METHODS IN MATHEMATICS (LINKED PAIR)

H

Higher Tier Unit 2 Geometry and Algebra

Tuesday 10 November 2015 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

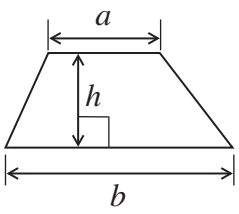
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want 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 4, 6, 7 and 8. 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.

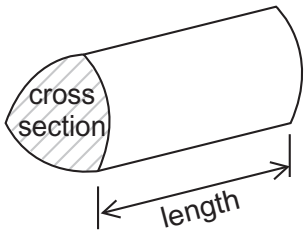
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

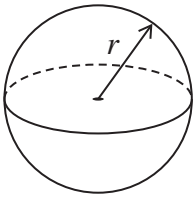


Volume of prism = area of cross section × length



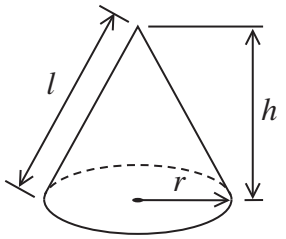
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

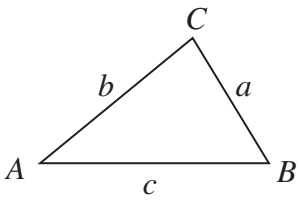
Curved surface area of cone = $\pi r l$



In any triangle ABC

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

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



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 (a) Circle the number that is the square of a prime number.

[1 mark]

16 36 81 121 225

1 (b) Jim subtracts a **single-digit** prime number from a **two-digit** prime number.
The result is a square number.

Work out two possible prime numbers Jim could have used.

[2 marks]

.....

.....

.....

.....

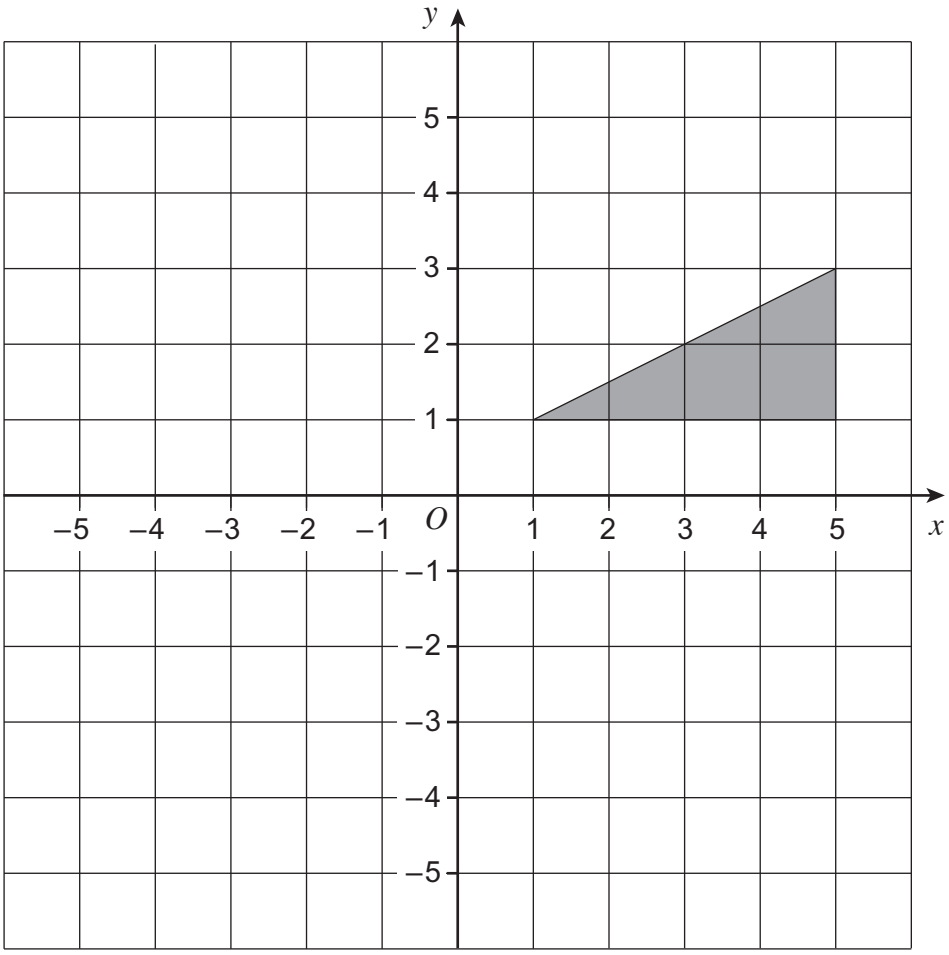
Answer ..... and .....

Turn over for the next question

3

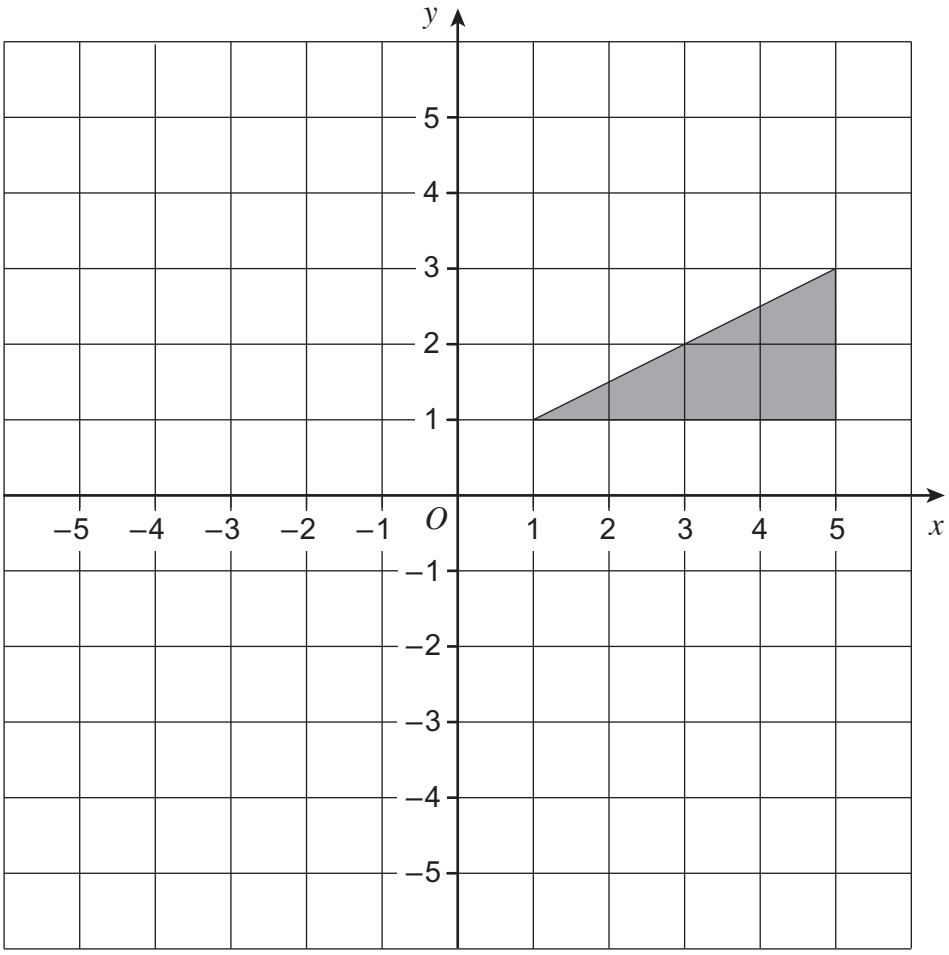
2 (a) Reflect the triangle in the line $y = 0$

[2 marks]



2 (b) Rotate the triangle through 180º about the origin.

[2 marks]

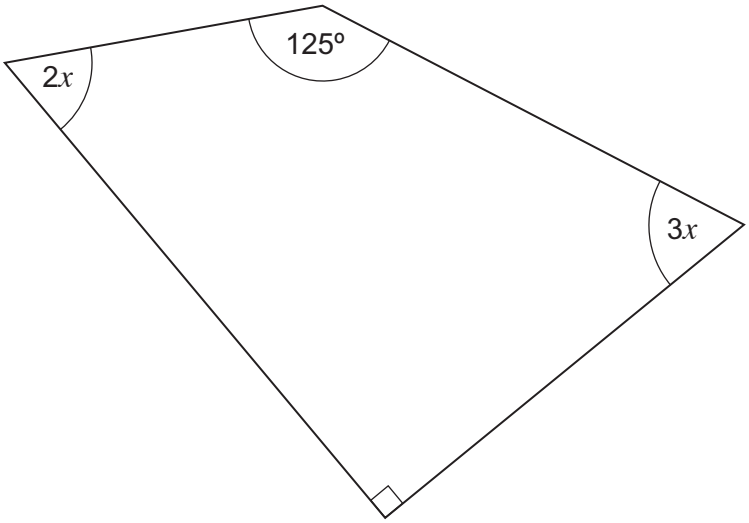


Turn over for the next question

4

3 Work out the value of x.

[4 marks]



Not drawn accurately

.....

.....

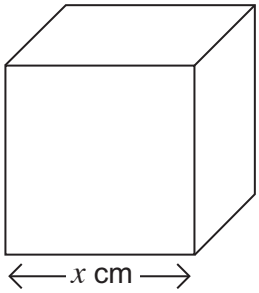
.....

.....

.....

Answer ..... degrees

***4**



This is how to work out the surface area of a cube with an edge of length x cm

Step 1 Square x

Step 2 Multiply by 6

Work out the **volume** of a cube with a surface area of 121.5 cm^2

[3 marks]

.....

.....

.....

.....

.....

Answer ..... cm^3

Turn over for the next question

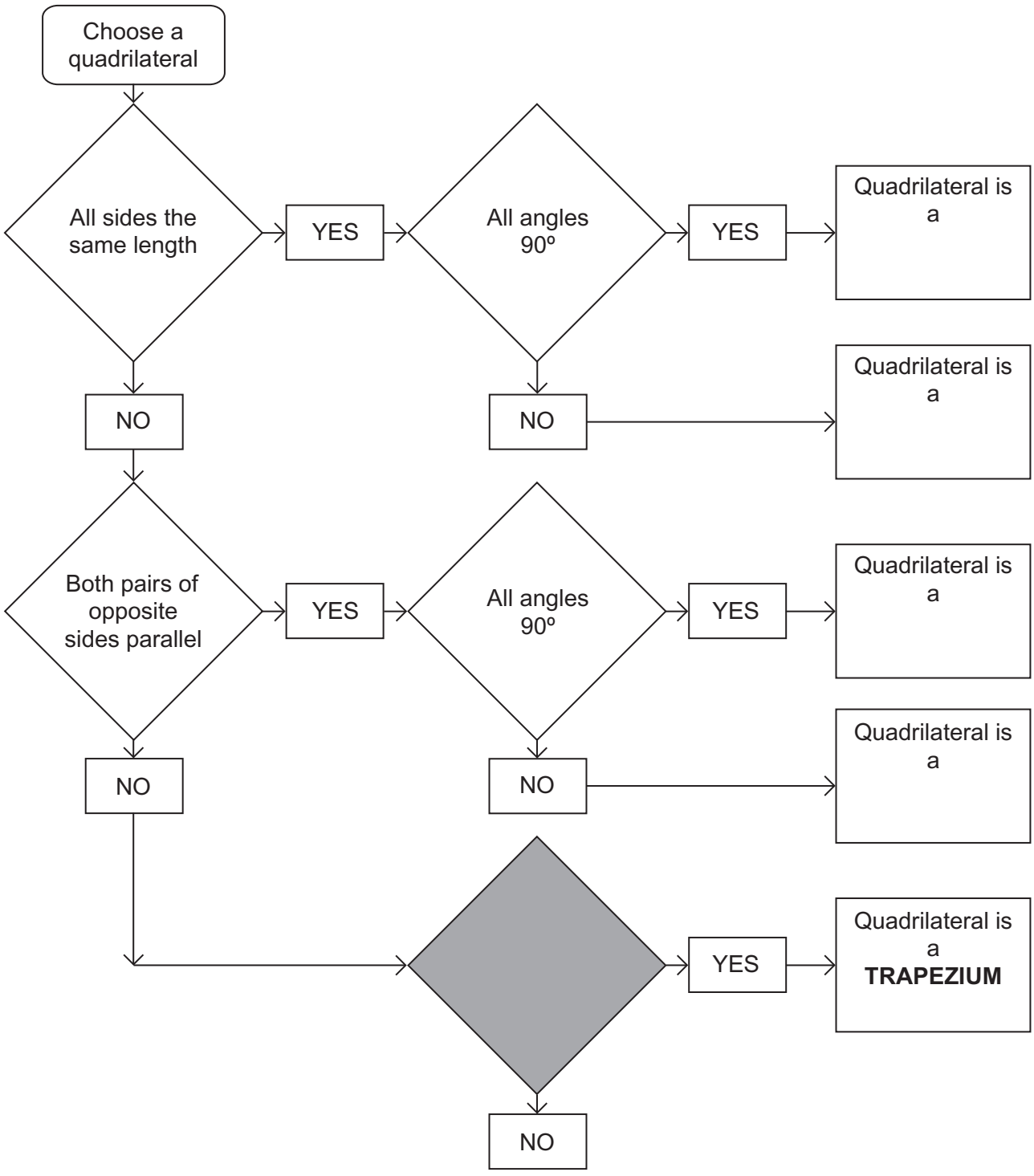
7

5 (a) The diagram below is used to sort some quadrilaterals.
A trapezium has already been sorted.

Use the diagram to sort

a parallelogram, a rectangle, a rhombus and a square.

[2 marks]



5 (b) A trapezium has been sorted in the diagram on the opposite page.

Write a statement, using the properties of quadrilaterals, that could go into the shaded box.

[1 mark]

.....

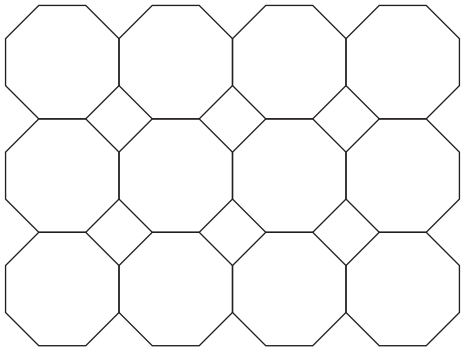
.....

.....

Turn over for the next question

3

***6** The diagram shows a tessellation made from regular octagons and squares.



Give working to show why these regular octagons and squares will tessellate.
You may use a diagram to help you show your answer.

[3 marks]

.....

.....

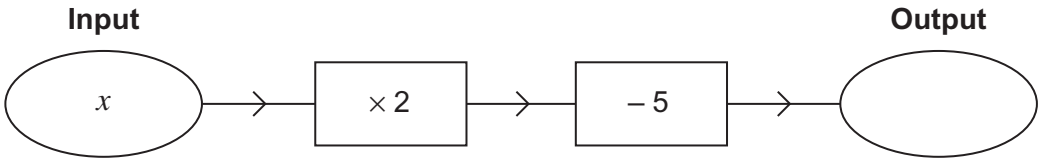
.....

.....

.....

.....

***7** Here is a number machine.



The output is four times the input.

Use algebra to work out the value of x.
You **must** show your working.

[4 marks]

.....

.....

.....

.....

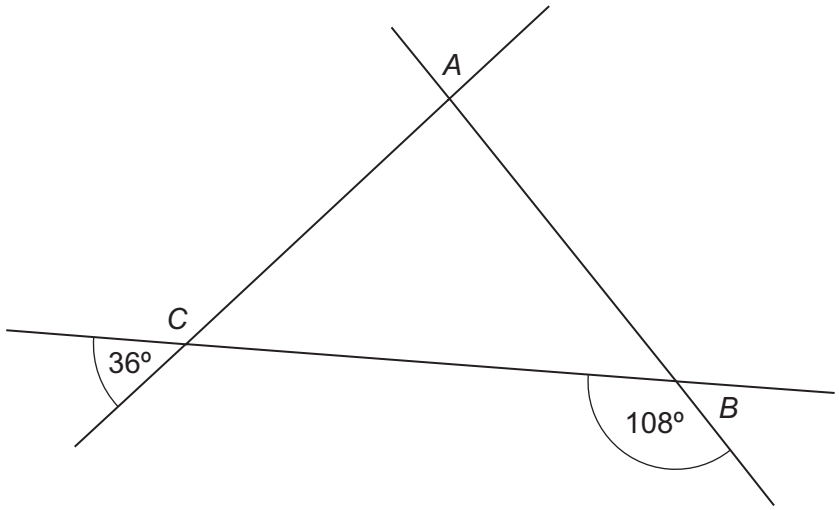
.....

x = ...

Turn over for the next question

7

***8** Three straight lines cross as shown.



Not drawn accurately

Show that triangle *ABC* is isosceles.

[4 marks]

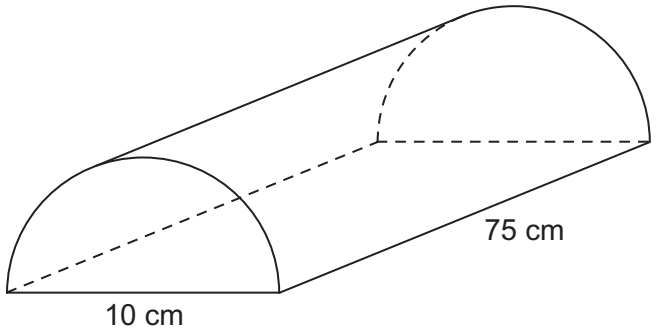
.....

.....

.....

.....

9 A prism has a semicircular cross section with a diameter of 10 centimetres.
The prism is 75 centimetres long.



Work out the volume of the prism.

[4 marks]

.....

.....

.....

.....

.....

.....

.....

.....

Answer ..... cm^3

Turn over for the next question

8

10 (a) Expand and simplify $(2x + 3)(x - 6)$

[2 marks]

.....

Answer .....

10 (b) Factorise $x^2 - 16$

[1 mark]

.....

.....

Answer .....

10 (c) Simplify fully $\dfrac{x^2 - 16}{2x^2 + 7x - 4}$

[3 marks]

.....

.....

.....

.....

.....

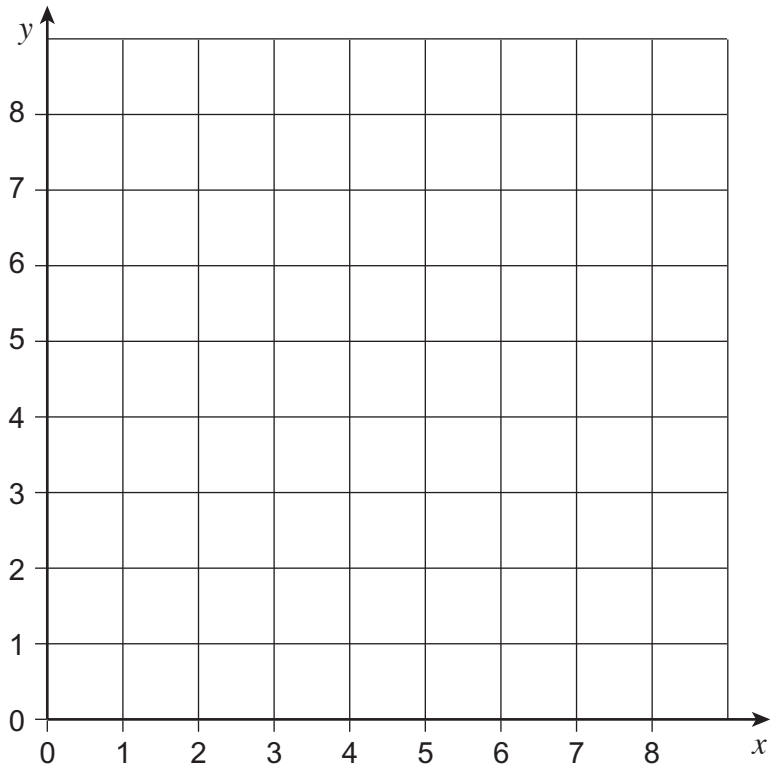
.....

Answer .....

11 A square with an area of 8 cm^2 is drawn on a centimetre coordinate grid.
The coordinates of the centre of the square are (5, 6)

Work out the coordinates of **two** possible corners of the square.
You may use the grid to help you.

[3 marks]



.....

.....

.....

.....

.....

.....

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

9

12 (a) Use your calculator to work out $\dfrac{\sqrt{24^2 + 18 \div 8}}{3.2^3}$

Write down your full calculator display.

[1 mark]

.....

Answer .....

12 (b) Write your answer to part (a) to 4 significant figures.

[1 mark]

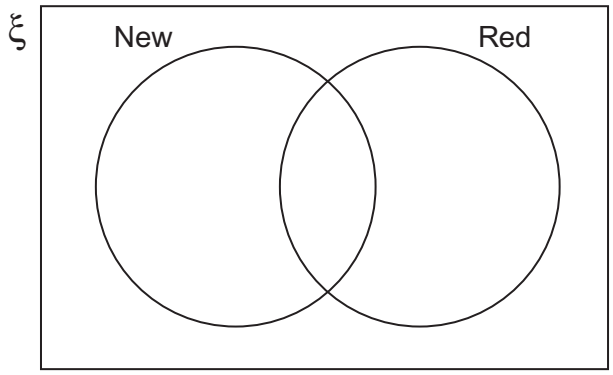
.....

Answer .....

13 A car dealer has 9 **new** cars and 12 **red** cars in her showroom.
There are no other cars.
She sells both new and used cars.
The ratio new red cars : used red cars is 1 : 2

How many cars are in the showroom?
You may use the Venn diagram to help you.

[2 marks]



.....

.....

.....

.....

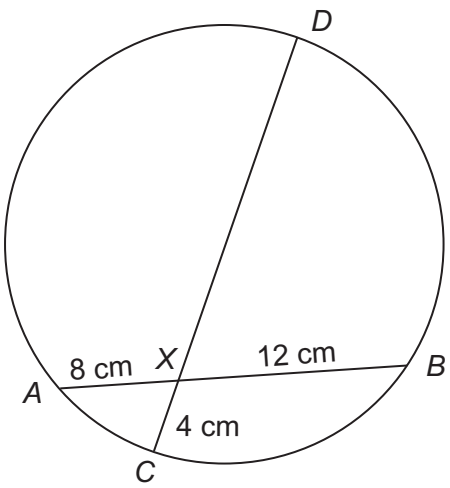
Answer .....

Turn over for the next question

4

14 *AB* and *CD* are chords of a circle.
The chords intersect at *X*.

AX = 8 cm, *BX* = 12 cm and *CX* = 4 cm



Not drawn accurately

Calculate the length of *DX*.

[2 marks]

.....

.....

.....

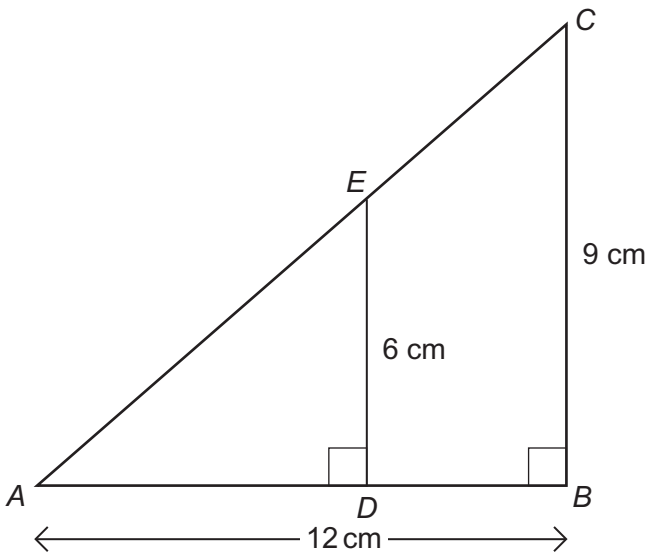
.....

.....

Answer ..... cm

15 *ABC* and *ADE* are similar triangles.

AB = 12 cm, *DE* = 6 cm and *BC* = 9 cm



Not drawn accurately

Calculate the length of *AD*.

[3 marks]

.....

.....

.....

.....

.....

Answer ..... cm

Turn over for the next question

5

16 The nth term of a quadratic sequence is $n^2 + 2n + 3$

Show, **algebraically**, that 258 is a term in the sequence.
Do **not** use Trial and Improvement.

[4 marks]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

17 The least common multiple (LCM) of x and y in prime factor form is $2^4 \times 3 \times 5 \times 7$

The highest common factor (HCF) of x and y in prime factor form is $2^3 \times 5$

$x > 100$ and $y > 100$

Work out a possible pair of values for x and y.

[3 marks]

.....

.....

.....

.....

.....

.....

.....

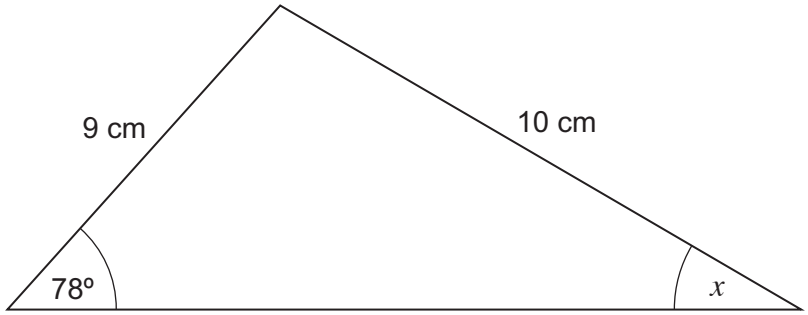
.....

x = ... y = ...

Turn over for the next question

7

18 Work out the size of angle x.



Not drawn accurately

[3 marks]

.....

.....

.....

.....

.....

Answer ..... degrees

19 A, B and C are such that

$$A : B = 1 : 5$$

$$B \text{ is } \frac{3}{4} \text{ of } C$$

Work out the ratio A : C

[3 marks]

.....

.....

.....

.....

.....

.....

.....

.....

.....

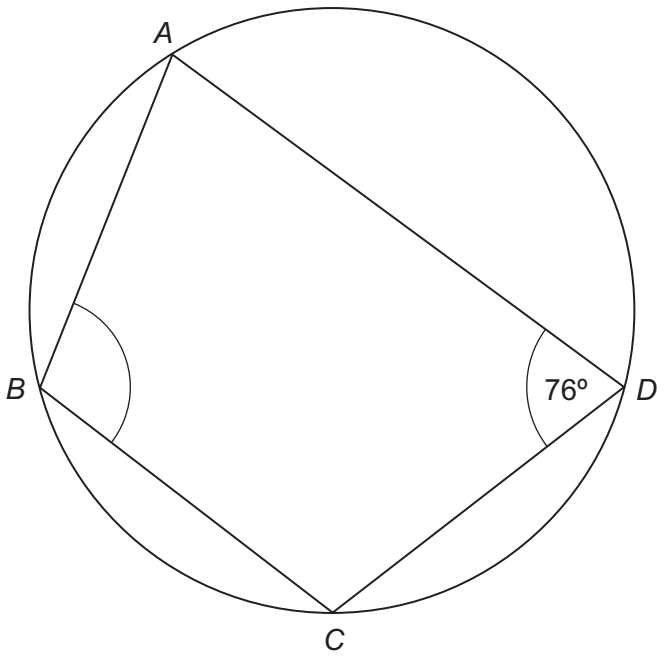
Answer ..... : .....

Turn over for the next question

6

20 (a) Work out the size of angle *ABC*.

[1 mark]

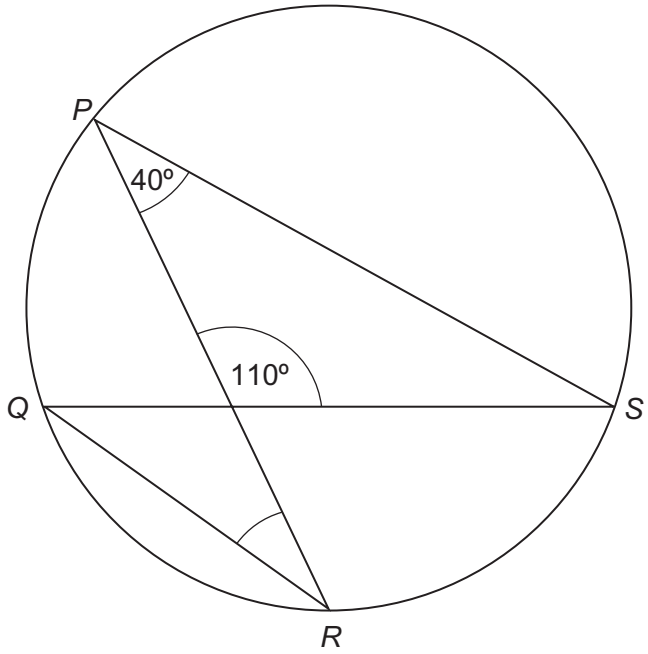


Not drawn accurately

Answer ..... degrees

20 (b) Work out the size of angle *PRQ*.

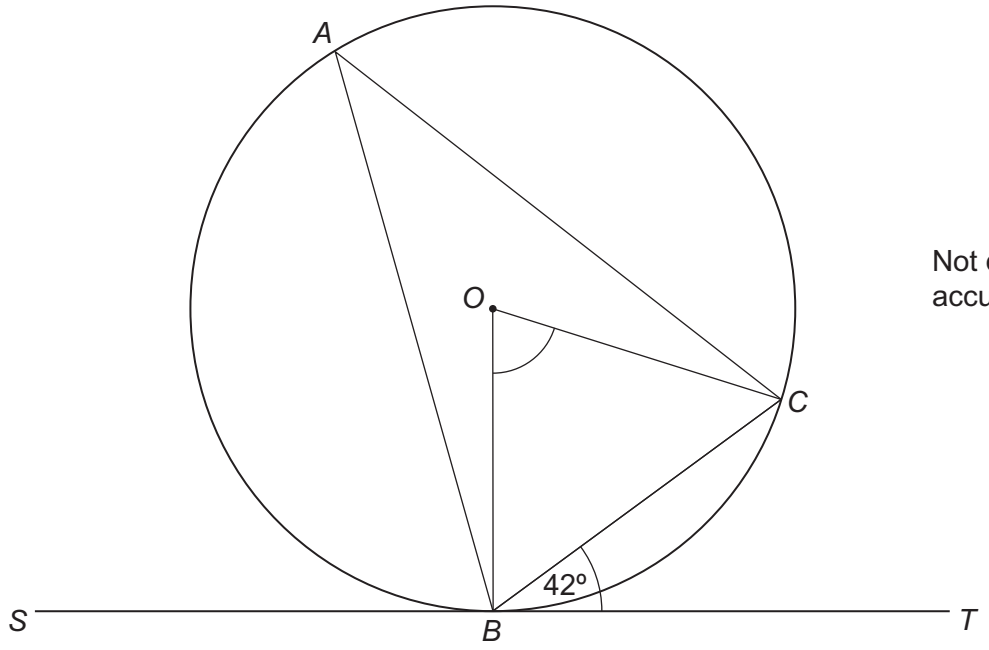
[1 mark]



Not drawn accurately

Answer ..... degrees

20 (c) *A*, *B* and *C* are points on a circle, centre *O*.
SBT is a tangent to the circle.



Not drawn accurately

Work out the size of angle *BOC*.

[2 marks]

.....

.....

.....

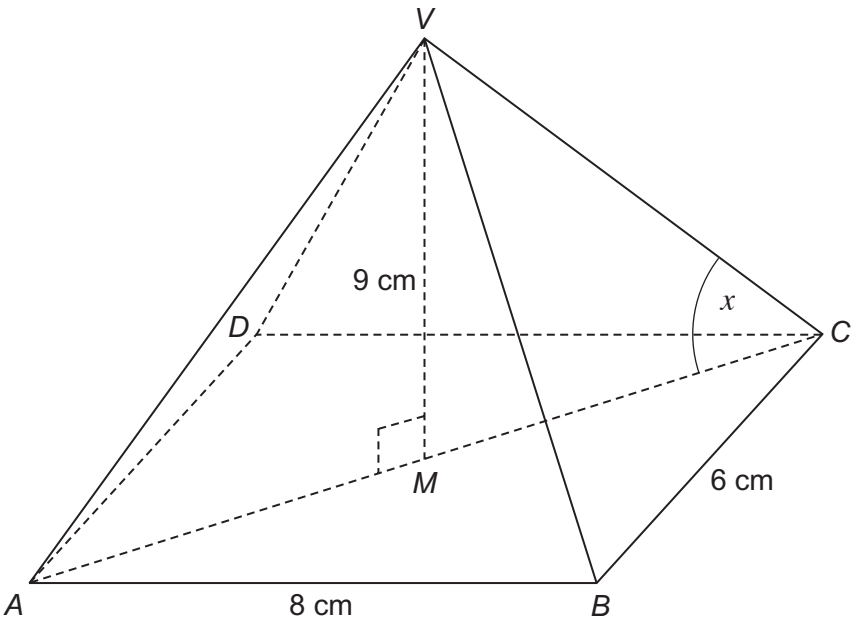
Answer ..... degrees

Turn over for the next question

4

21 *VABCD* is a rectangular based pyramid.
M is the centre of rectangle *ABCD*.
V is vertically above *M*.

VM = 9 cm, *AB* = 8 cm and *BC* = 6 cm



Work out the angle between *VC* and *AC*.
The angle is marked x on the diagram.

[5 marks]

.....

.....

.....

.....

.....

.....

.....

.....

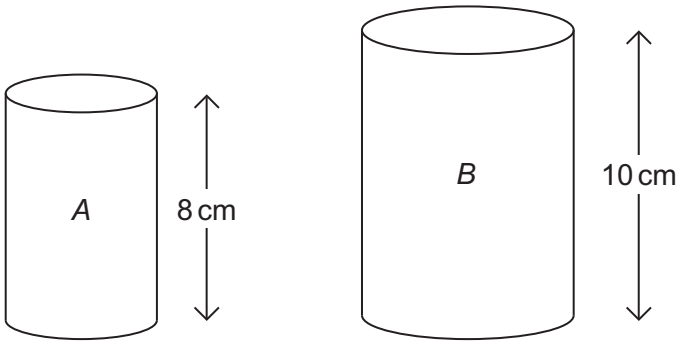
.....

.....

.....

Answer ..... degrees

22 Cylinders *A* and *B* are similar.



The volume of cylinder *A* is 200 cm^3

Calculate the volume of cylinder *B*.

[3 marks]

.....

.....

.....

.....

.....

.....

.....

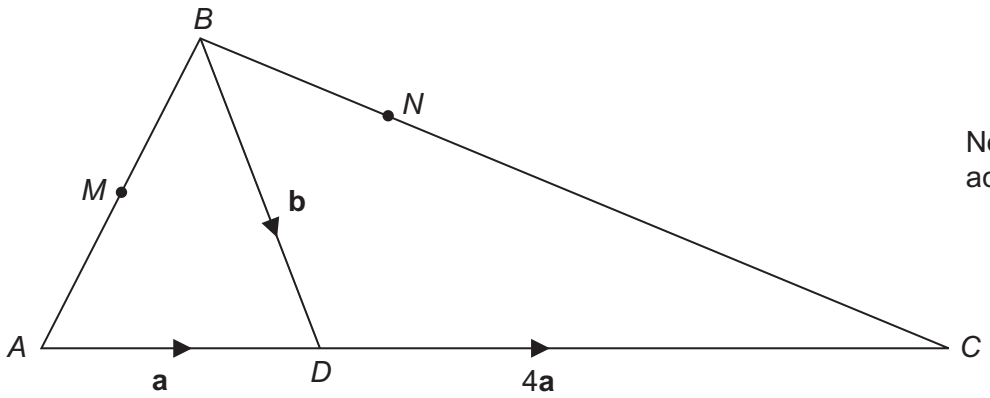
Answer ..... cm^3

Turn over for the next question

8

23 The diagram shows points A, B, C, D, M and N.

$\overrightarrow{AD} = \mathbf{a}$ $\overrightarrow{BD} = \mathbf{b}$ $\overrightarrow{DC} = 4\mathbf{a}$



Not drawn accurately

23 (a) M is the midpoint of AB.

Work out $\overrightarrow{MB}$ in terms of **a** and **b**.

[2 marks]

.....

.....

Answer .....

23 (b) $BN : NC = 1 : 3$

Work out $\overrightarrow{BN}$ in terms of **a** and **b**.

[3 marks]

.....

.....

.....

.....

.....

Answer .....

END OF QUESTIONS

5

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED