Centre Number						Candidate Number				
Surname										
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	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2012

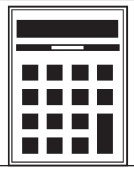
Methods in Mathematics (Linked Pair Pilot) 93652H

Unit 2 Geometry and Algebra

Wednesday 13 June 2012 9.00 am to 10.30 am

H

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



Time allowed
- 1 hour 30 minutes

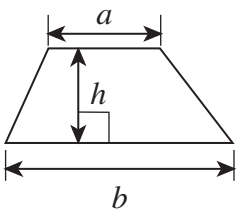
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. 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 3, 4 and 19.
  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 booklet.
- You are expected to use a calculator where appropriate.

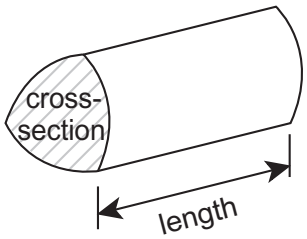
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

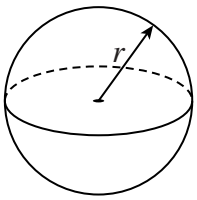


Volume of prism = area of cross-section × length



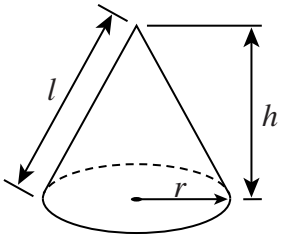
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

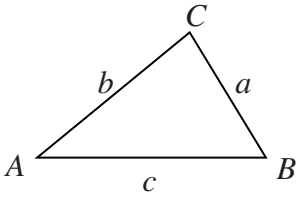
Curved surface area of cone = $\pi r l$



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) Expand $4(x - 3)$

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Answer ..... *(1 mark)*

1 (b) Factorise $y^2 - 7y$

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Answer ..... *(1 mark)*

1 (c) Solve the equation $3(p + 2) = 18$

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Answer p = ... *(3 marks)*

2 P is a two-digit prime number.
Q is a **different** two-digit prime number.
Both P and Q are less than 60.

The number half-way between P and Q is also a prime number.

Work out a possible pair of values for P and Q.

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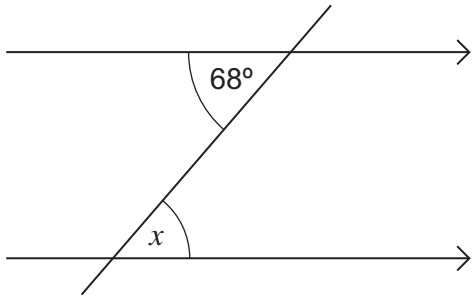
Answer P = ... Q = ... *(3 marks)*

8

Turn over ▶

***3 (a)** Write down the size of angle x.
Give a reason for your answer.



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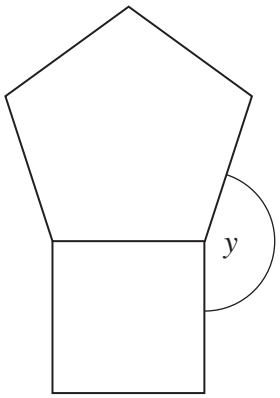
Answer ..... degrees

Reason .....

(2 marks)

3 (b) A regular pentagon and a square have sides the same length.
They are joined as shown.



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Calculate the size of angle y.

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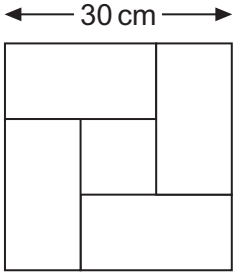
Answer ..... degrees *(4 marks)*

*4 Rectangular and square blocks are used to make a patio.
They are fitted together to make a larger square.
The length of the rectangle is twice its width.
The side of the larger square is 30 cm.



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4 (a) What is the area of the small square block in the middle?

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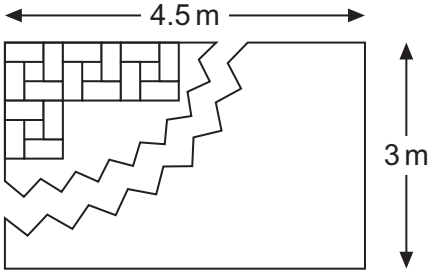
Answer ..... cm^2 *(2 marks)*

4 (b) The patio is 3 metres by 4.5 metres.
Large squares, as shown above, are used to make the patio.



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How many small square blocks and rectangular blocks are needed to make the patio?

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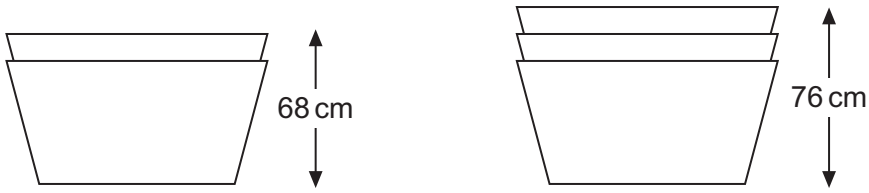
Answer Small square blocks .....

Rectangular blocks ..... *(4 marks)*

12

5 Sanjit stacks boxes as shown.

When two boxes are stacked they have a total height of 68 centimetres.
When three boxes are stacked they have a total height of 76 centimetres.



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5 (a) What is the height when five boxes are stacked?

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Answer ..... cm *(3 marks)*

5 (b) Work out an expression for the height of n stacked boxes.

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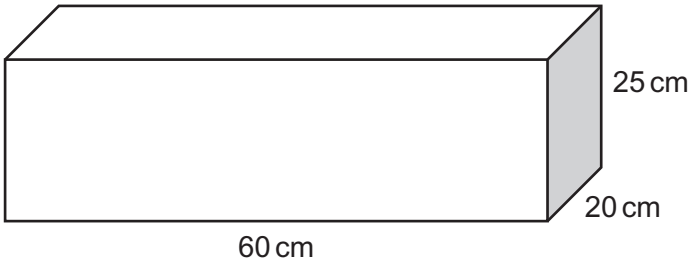
Answer ..... cm *(2 marks)*

6 Scrap metal with a volume of 630 000 cm^3 is melted down into blocks as shown below.



6 (a) How many blocks can be made?

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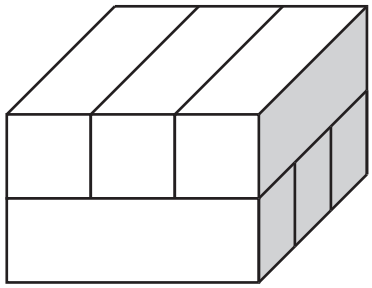
Answer ..... *(3 marks)*

6 (b) Blocks are stacked in layers of three as shown.



How high will a stack of 27 blocks be?
Give your answer in metres.

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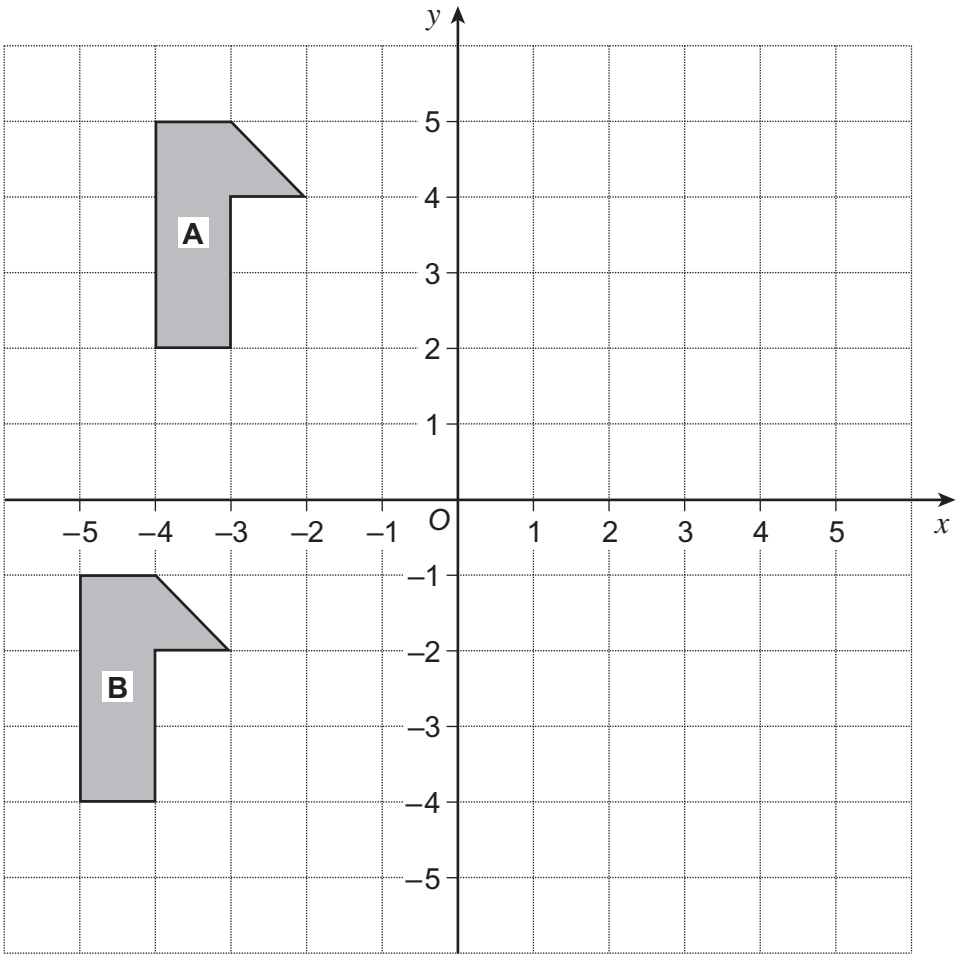
Answer ..... m *(3 marks)*

11

7 Shapes A and B are shown on the grid.



7 (a) Translate shape A by the vector $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$

Label the new shape C. *(2 marks)*

7 (b) Work out the vector that translates shape A to shape B.

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Answer $\begin{pmatrix} \ldots\ldots \\ \ldots\ldots \end{pmatrix}$ *(2 marks)*

8 The number of students taking an examination increases from 32 518 to 36 420.

Work out the percentage increase.
Give your answer to the nearest whole number.

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Answer ..... % *(3 marks)*

9 Solve the equation $\frac{x + 1}{2} + \frac{x + 4}{3} = 2$

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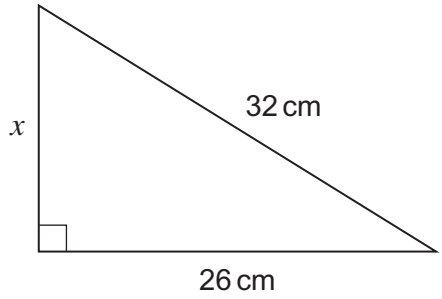
Answer x = ... *(4 marks)*

11

10 (a) Work out the length x in the right-angled triangle.



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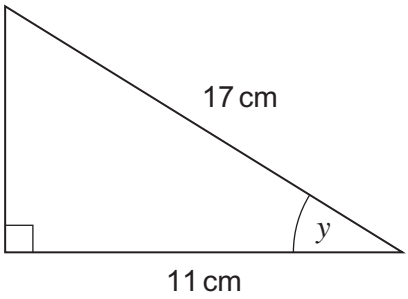
Answer ..... cm *(3 marks)*

10 (b) Work out the angle y in the right-angled triangle.



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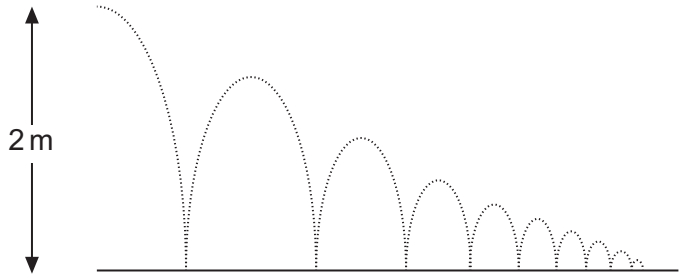
Answer ..... degrees *(3 marks)*

11 A ball is thrown from a height of 2 metres onto a solid floor.
On each bounce it reaches 60% of the previous height.



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Calculate the height the ball reached on the 9th bounce.
Give your answer in centimetres.

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Answer ..... cm *(3 marks)*

12 Solve $x^2 - 7x + 10 = 0$

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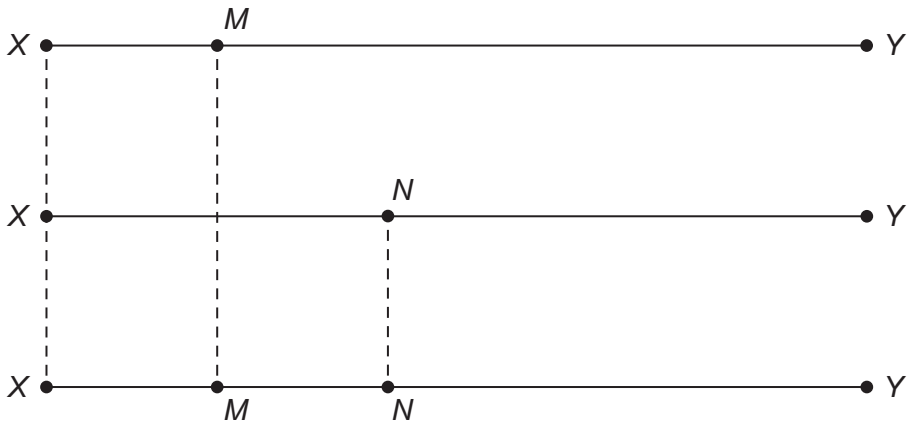
Answer ..... *(3 marks)*

12

13 *M* divides the line *XY* in the ratio 1 : 5

N divides the line *XY* in the ratio 7 : 11



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Work out the ratio *XM* : *MN* : *NY*

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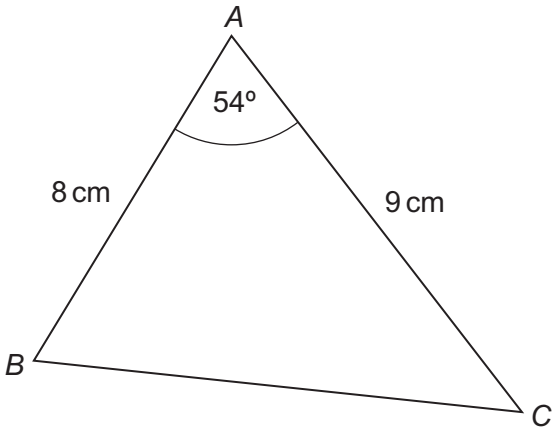
Answer ..... : ..... : ..... *(3 marks)*

14 *ABC* is a triangle.



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Calculate the length *BC*.

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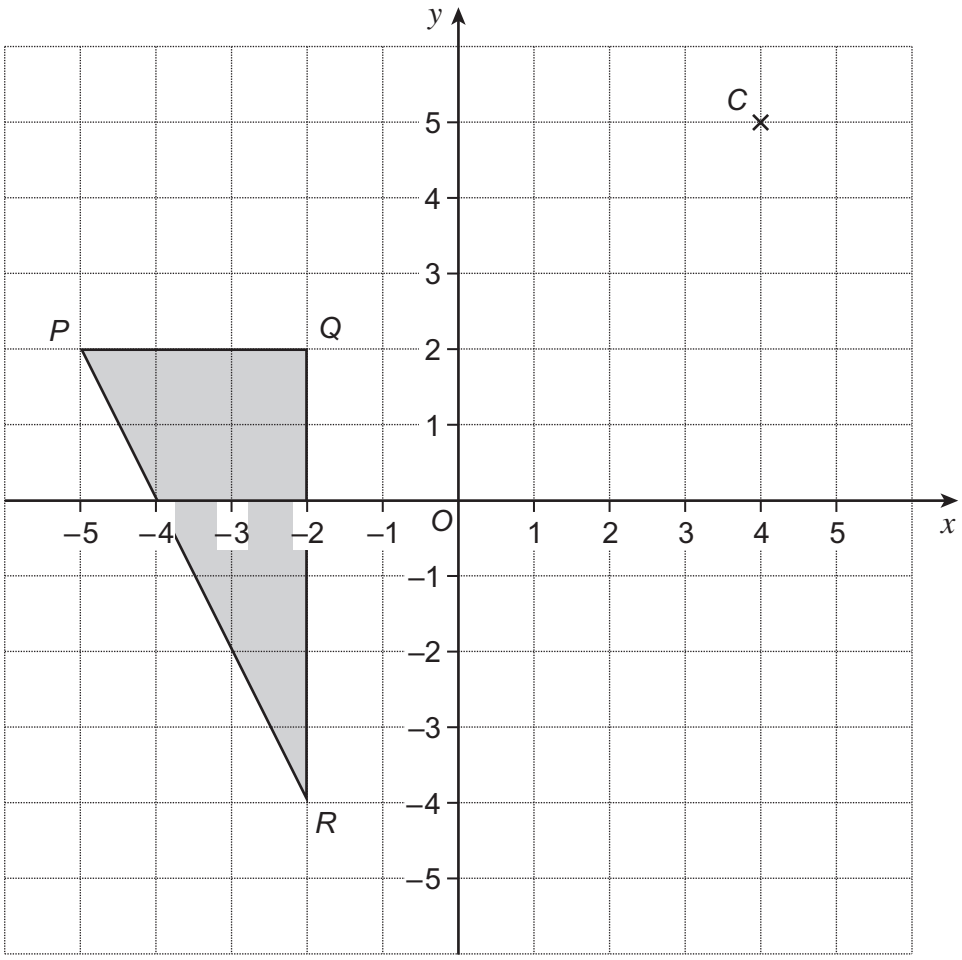
Answer ..... cm *(3 marks)*

Turn over for the next question

6

15 Triangle *PQR* is shown on the grid.



15 (a) Enlarge triangle *PQR* by scale factor $\frac{1}{3}$ with centre of enlargement *C* (4, 5).

(2 marks)

15 (b) Triangle *PQR* is enlarged by scale factor –3 with centre of enlargement *C* (4, 5).

P is mapped onto (31, 14).

Calculate the coordinates of the point that *Q* is mapped onto.

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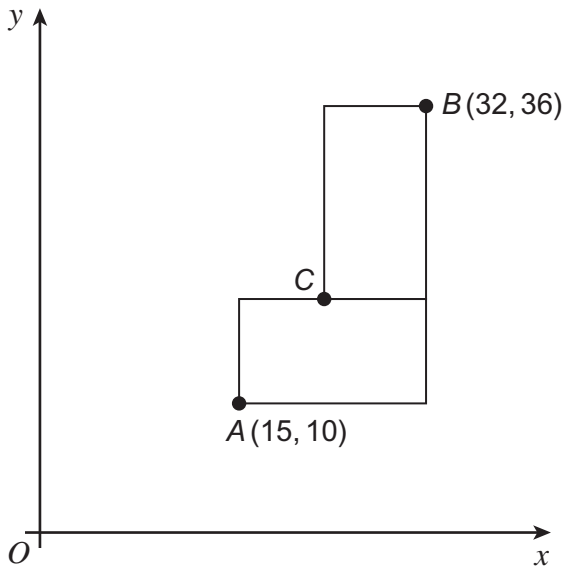
Answer *Q* is mapped onto (..... , ...) *(2 marks)*

16 The diagram shows two **identical** rectangles.

The rectangles have their sides parallel to the axes.



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Work out the coordinates of point *C*.

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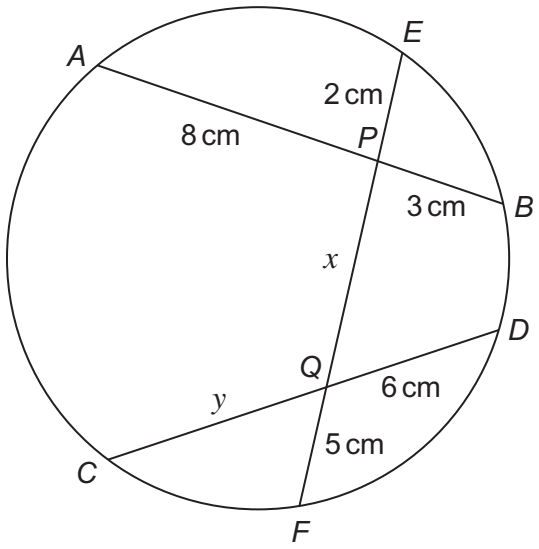
Answer (..... , ...) *(4 marks)*

8

Turn over ▶

17 *AB*, *CD* and *EF* are chords of a circle.
AB and *EF* intersect at *P*.
CD and *EF* intersect at *Q*.

AP = 8 cm, *PB* = 3 cm
EP = 2 cm, *PQ* = x cm, *QF* = 5 cm
CQ = y cm, *QD* = 6 cm



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Work out the lengths x and y.

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Answer x = ... cm

y = ... cm *(4 marks)*

18 Solve the equation $x^2 + 4x - 8 = 0$ by the method of completing the square.

Show that the solutions are $x = -2 \pm 2\sqrt{3}$

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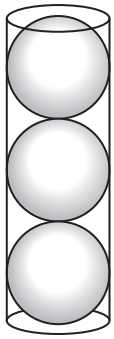
(4 marks)

Turn over for the next question

8

***19** Three spheres of radius r just fit inside a cylinder.



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Show that the **total** volume of the three spheres is $\frac{2}{3}$ of the volume of the cylinder.

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(4 marks)

END OF QUESTIONS

4

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