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| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

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| For Examiner's Use | |
| Examiner's Initials | |
| Pages | Mark |
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| 4 – 5 | |
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| TOTAL | |



General Certificate of Secondary Education
Higher Tier
June 2012

Methods in Mathematics (Linked Pair Pilot)

93652H

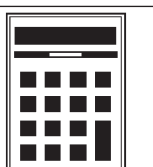
Unit 2 Geometry and Algebra

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.



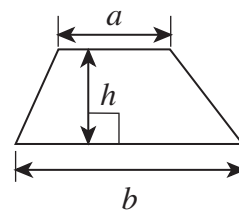
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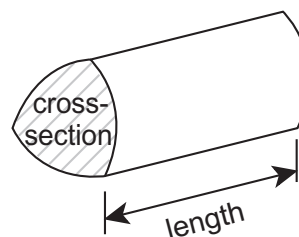
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Formulae Sheet: Higher Tier

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

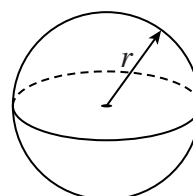


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



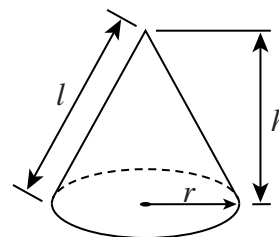
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$

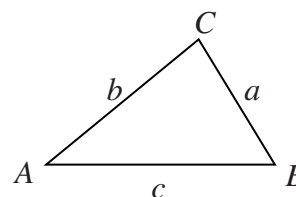


In any triangle ABC

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

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

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$



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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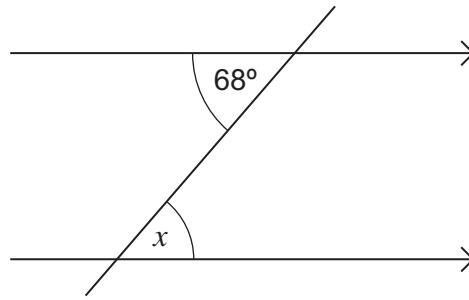
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Answer $P =$ $Q =$ (3 marks)

Turn over ►



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

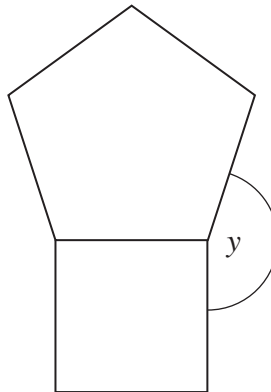


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accurately

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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accurately

Calculate the size of angle y .

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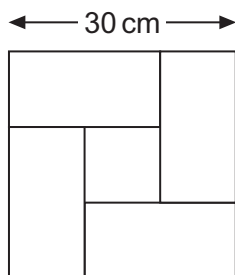
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Answer degrees (4 marks)



- *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.



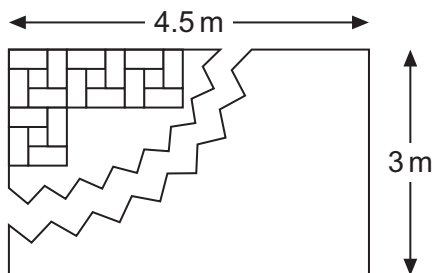
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- 4 (a) What is the area of the small square block in the middle?

.....

Answer cm² (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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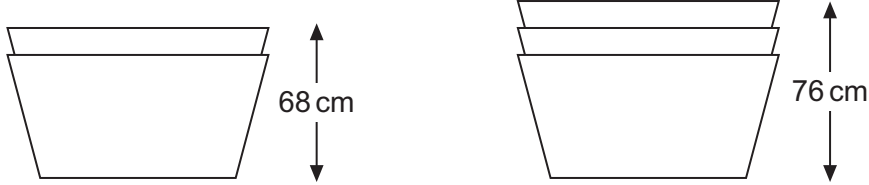
Answer Small square blocks

Rectangular blocks (4 marks)



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.



Not drawn
accurately

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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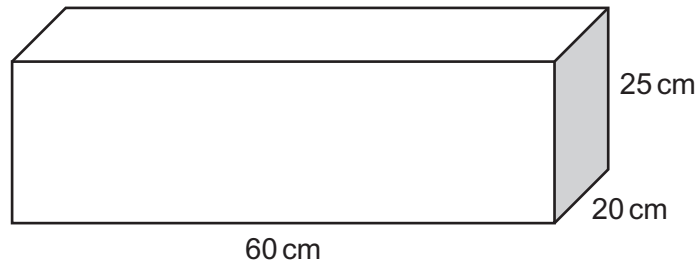
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Answer cm (2 marks)



6 Scrap metal with a volume of $630\,000\text{ cm}^3$ is melted down into blocks as shown below.



6 (a) How many blocks can be made?

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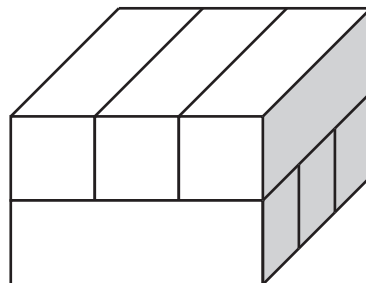
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Answer (3 marks)

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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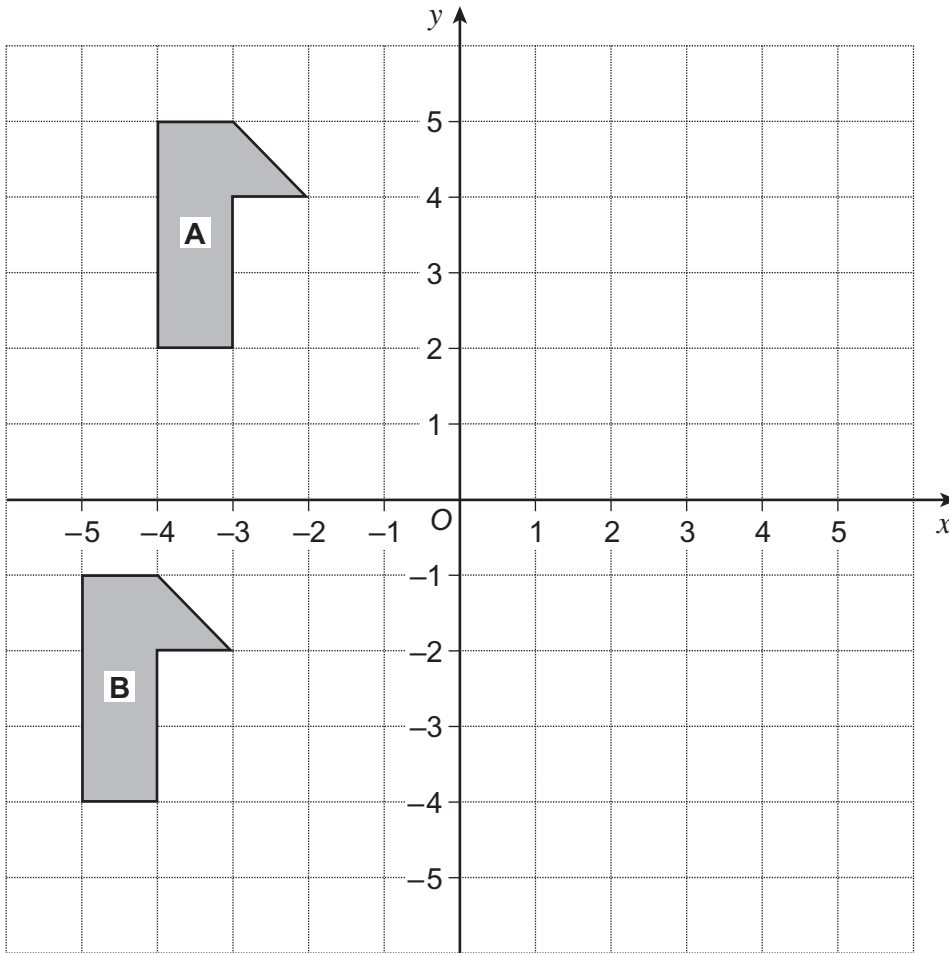
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Answer m (3 marks)



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 $\begin{pmatrix} \text{.....} \\ \text{.....} \end{pmatrix}$ (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)

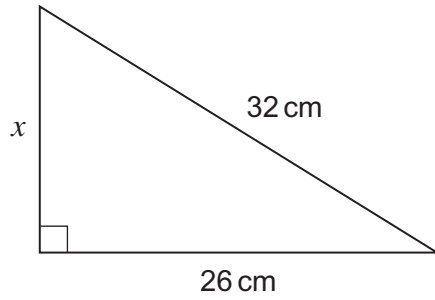
9 Solve the equation $\frac{x + 1}{2} + \frac{x + 4}{3} = 2$

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Answer $x =$ (4 marks)



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



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accurately

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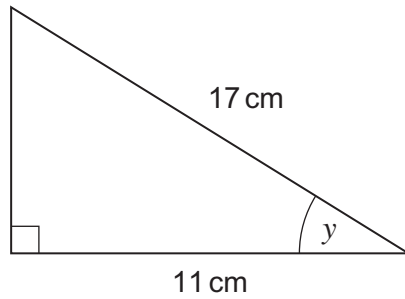
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Answer cm (3 marks)

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



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accurately

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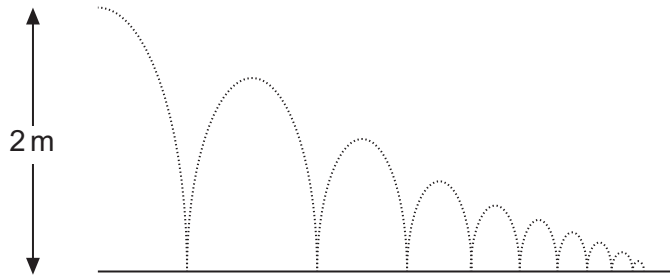
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Answer degrees (3 marks)



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.



Not drawn
accurately

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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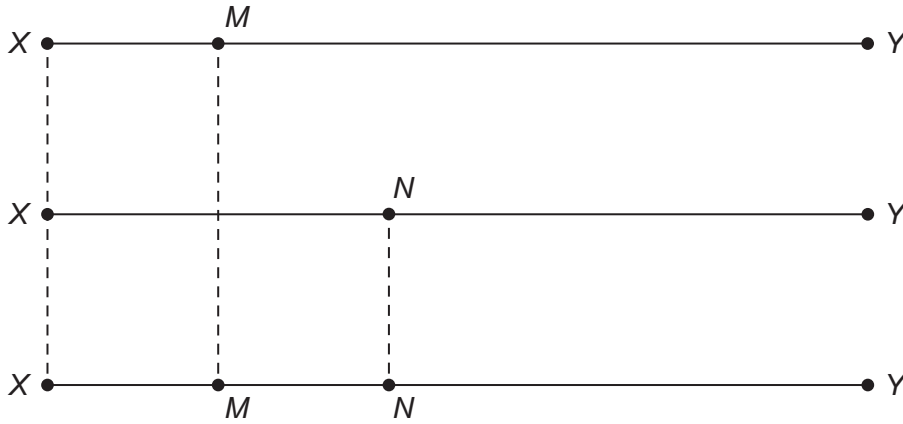
Answer (3 marks)



13

M divides the line XY in the ratio 1 : 5

N divides the line XY in the ratio 7 : 11



Not drawn accurately

Work out the ratio $XM : MN : NY$

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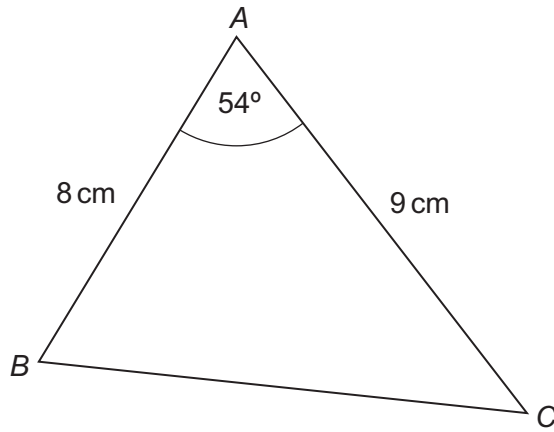
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Answer : : (3 marks)



14 ABC is a triangle.



Not drawn
accurately

Calculate the length BC.

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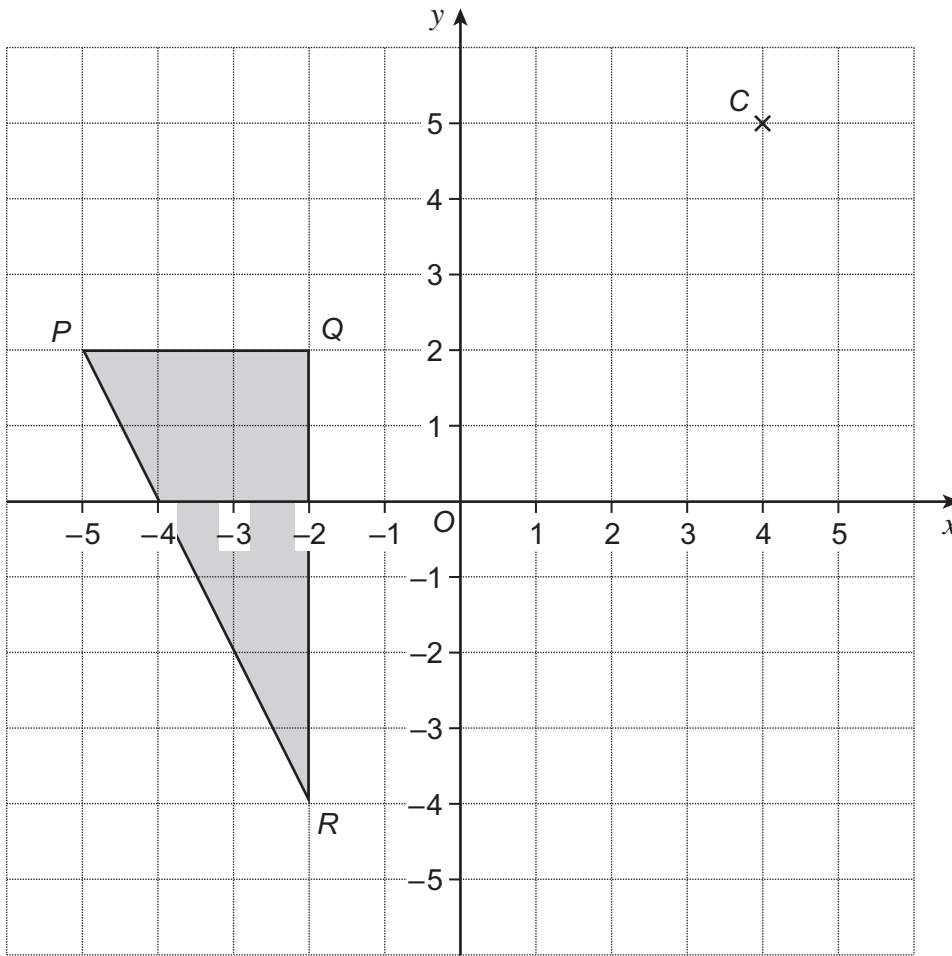
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Answer cm (3 marks)

Turn over for the next question



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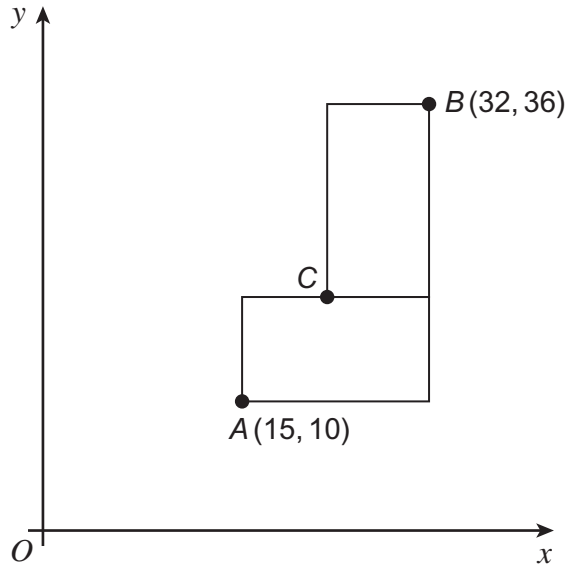
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Answer Q is mapped onto (..... ,) (2 marks)



16 The diagram shows two **identical** rectangles.
The rectangles have their sides parallel to the axes.



Not drawn
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Work out the coordinates of point C.

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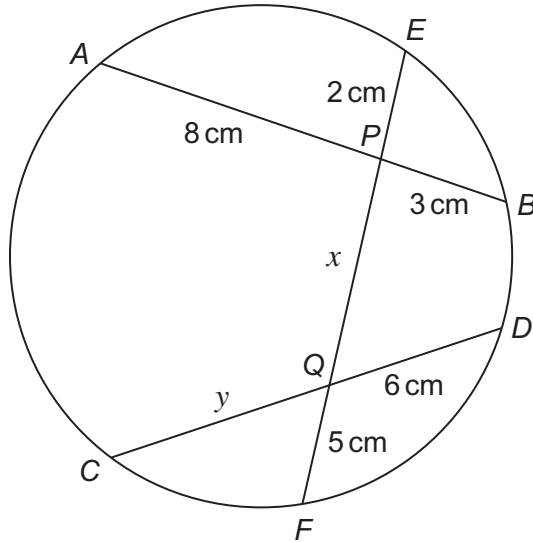
Answer (..... ,) (4 marks)



17

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

$AP = 8\text{ cm}$, $PB = 3\text{ cm}$
 $EP = 2\text{ cm}$, $PQ = x\text{ cm}$, $QF = 5\text{ cm}$
 $CQ = y\text{ cm}$, $QD = 6\text{ cm}$



Not drawn
accurately

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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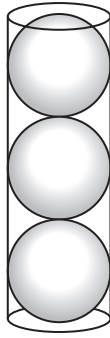
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(4 marks)

Turn over for the next question



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



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accurately

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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