

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
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TOTAL	



General Certificate of Secondary Education  
Higher Tier  
November 2013

# Methods in Mathematics (Linked Pair Pilot)

93652H

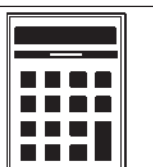
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Unit 2 Geometry and Algebra

Monday 11 November 2013 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  $\pi$  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 4, 5, 11 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.



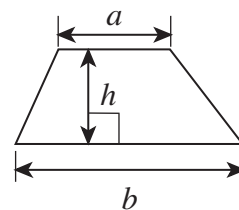
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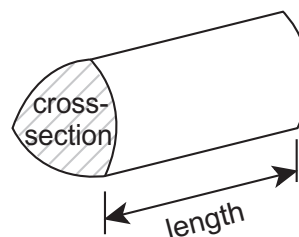
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## Formulae Sheet: Higher Tier

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

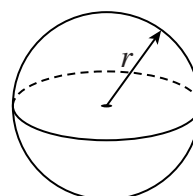


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



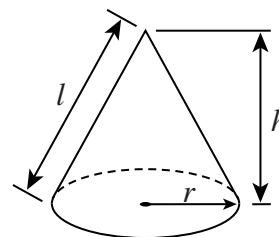
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

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

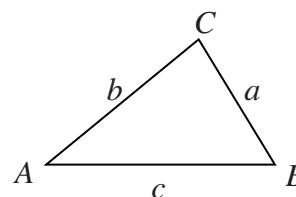


In any triangle  $ABC$

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

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

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



### 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) Use your calculator to work out  $\frac{27.4 \times 12.2}{16.3 - 4.8}$

Give your answer as a decimal.  
Write down all the figures in your calculator display.

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Answer ..... (1 mark)

1 (b) Give your answer to 1 significant figure.

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Answer ..... (1 mark)

2 Bob adds together two **different** prime numbers.

The total is **between** 24 and 30

Which two prime numbers could Bob have added?

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Answer ..... and ..... (2 marks)

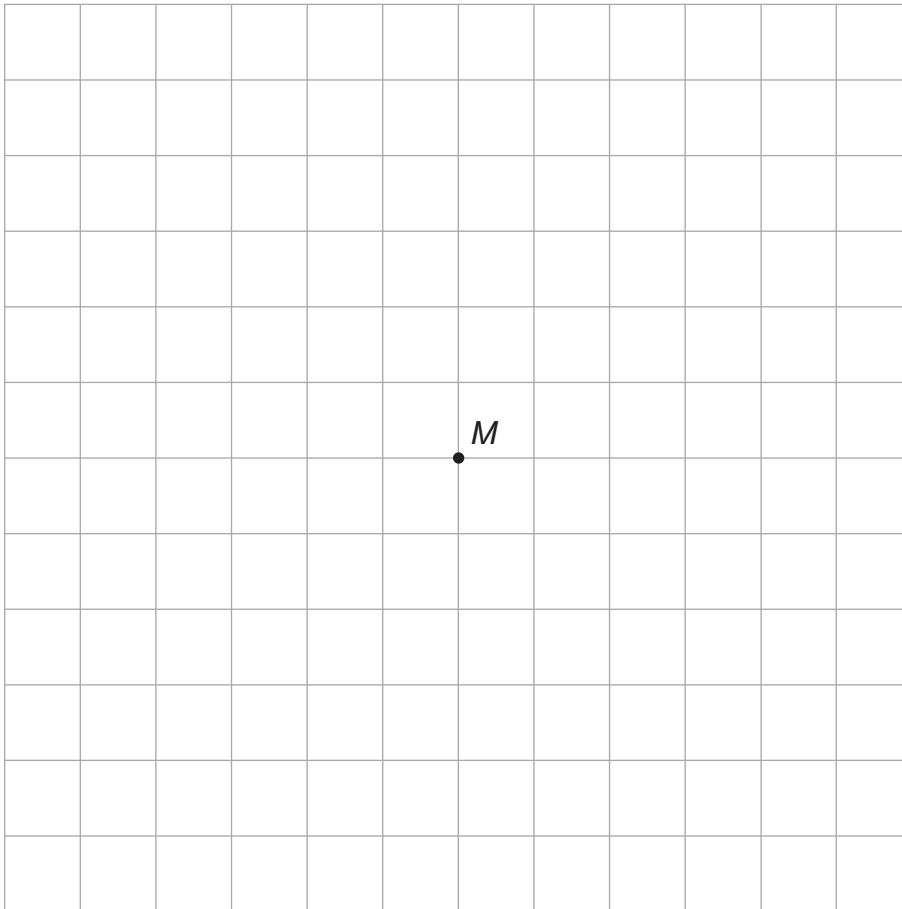
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Turn over ►



3  $M$  is the centre of a rectangle with an area of  $12 \text{ cm}^2$

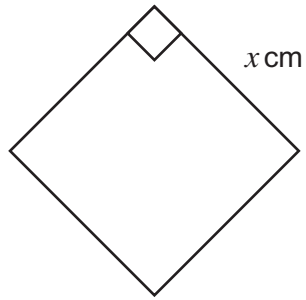
Draw a possible rectangle on grid.



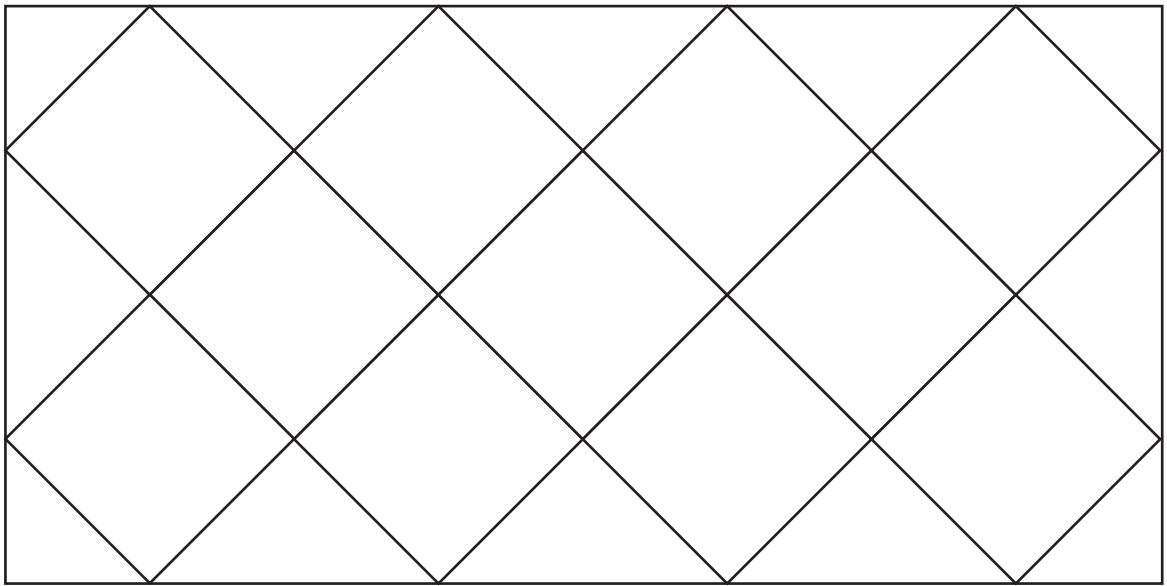
(2 marks)



\*4

This square has a side of  $x$  cm

A rectangle is drawn around 11 of these squares as shown.



Show clearly that the area of the rectangle is  $16x^2 \text{ cm}^2$   
Some of your working may be on the diagram.

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(4 marks)

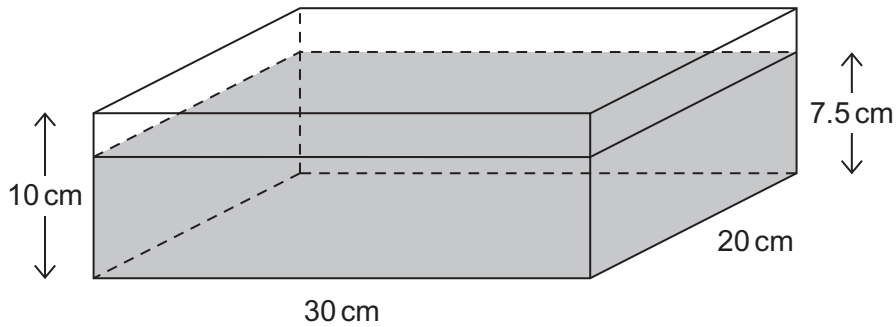
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\*5

A sealed hollow glass container is a 30 cm by 20 cm by 10 cm cuboid.  
It contains some coloured water.  
When placed on the 30 cm by 20 cm face the depth of the water is 7.5 cm



7.5 cm is three-quarters of 10 cm

The cuboid can be placed on any face.

Show that the depth of the water will always be three-quarters of the vertical height.

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(4 marks)

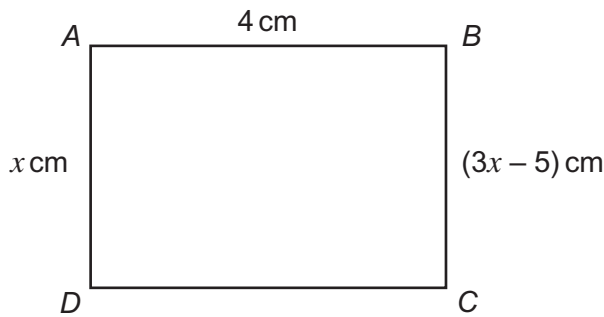


6 Solve  $4(3y - 1) = 28$

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$y =$  ..... (3 marks)

7  $ABCD$  is a rectangle.



Not drawn accurately

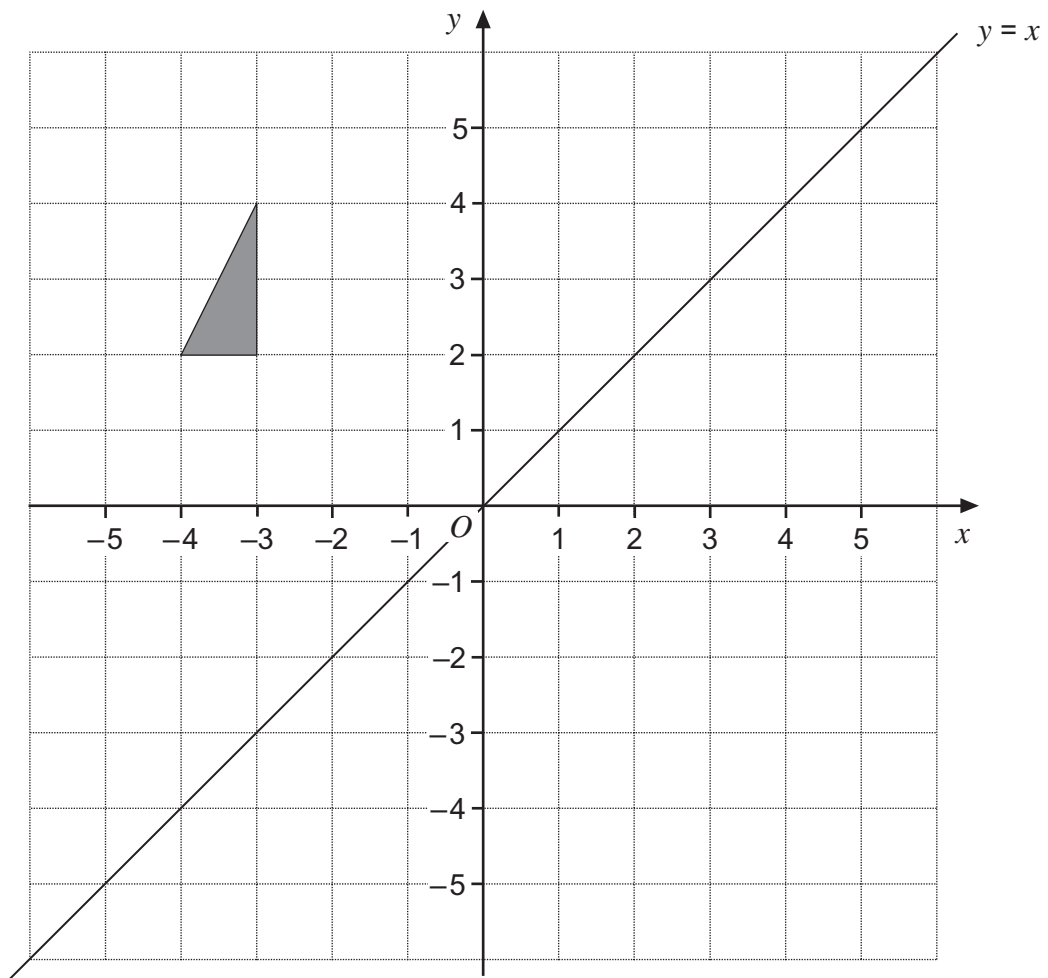
Work out the perimeter of the rectangle  $ABCD$ .

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Answer ..... cm (3 marks)



8 (a)

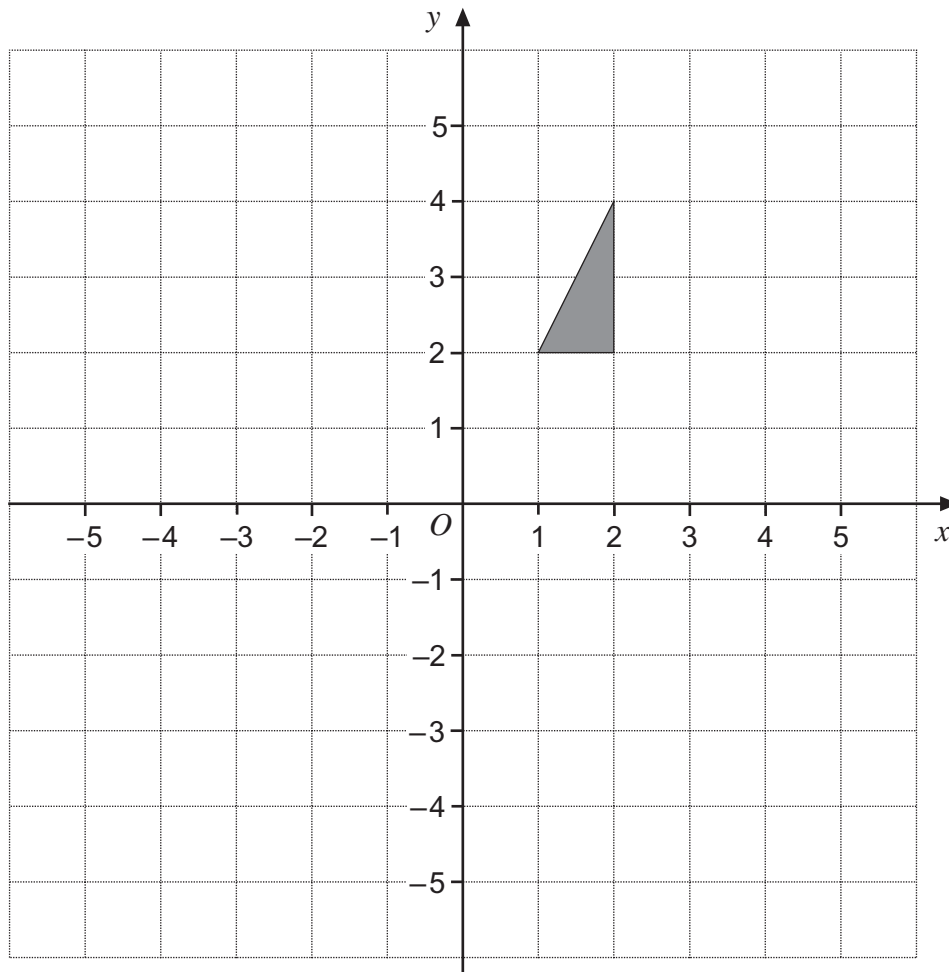
Reflect the shaded triangle in the line  $y = x$ 

(2 marks)





8 (b)



Rotate the shaded triangle  $90^\circ$  anti-clockwise about (0, 2).

(2 marks)

Turn over for the next question

Turn over ►

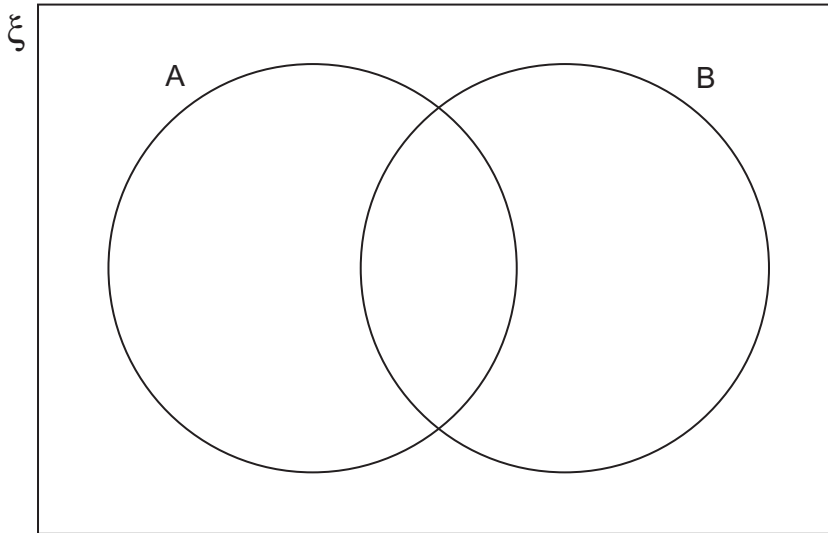


9 (a) Write the numbers from 1 to 12 inclusive in the correct position in this Venn Diagram.

$$\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$$

Set A = Factors of 12

Set B = Multiples of 3



(2 marks)

9 (b) Work out the Least Common Multiple (LCM) of the numbers in Set B.

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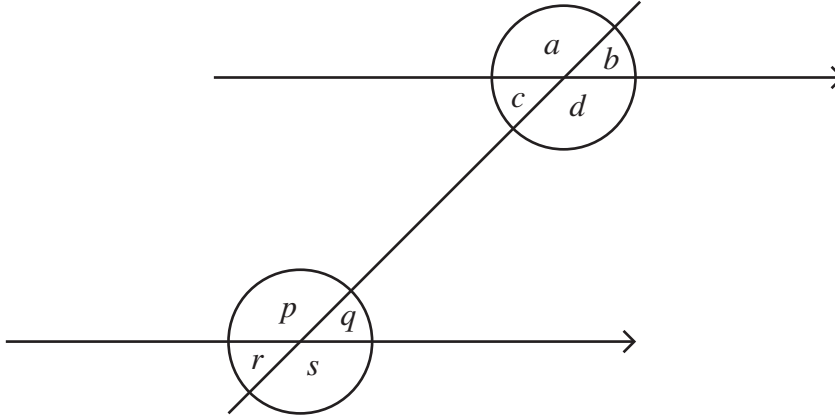
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Answer ..... (2 marks)



10 (a)



Choose pairs of angles to make these sentences true.

The first one has been done for you.

Angle  $c$  and angle  $q$  are **alternate** angles.

Angle ..... and angle ..... are **corresponding** angles.

Angle ..... and angle ..... are **vertically opposite** angles.

Angle ..... and angle ..... are **interior** angles.

(3 marks)

10 (b) A regular polygon has an exterior angle of  $45^\circ$



Not drawn accurately

How many sides does this polygon have?

.....

.....

Answer .....

(2 marks)



**11 (a)** The  $n$ th term of a linear sequence is given by  $3n - 10$

Work out the first 5 terms of the sequence.

.....  
.....

Answer ..... , ..... , ..... , ..... , ..... (2 marks)

**11 (b)** Work out the  $n$ th term of the linear sequence.

90            82            74            66            58            ...


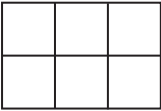
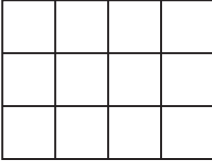
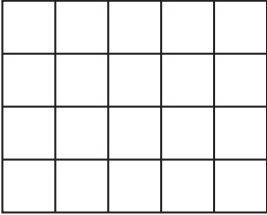
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Answer ..... (2 marks)



**\*11(c)** Centimetre squares are used to make rectangles.

Diagrams are not drawn to scale.

Rectangle number	1	2	3	4
Rectangle				
Area (cm <sup>2</sup> )	2	6	12	20

Show clearly that the area of the  $n$ th rectangle is  $(n^2 + n)$  cm<sup>2</sup>

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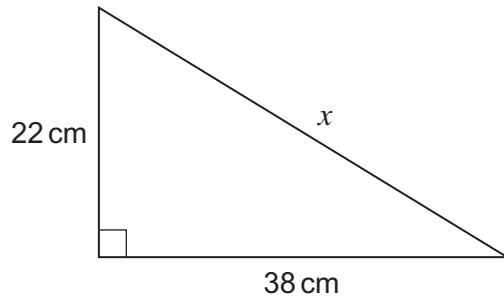
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(3 marks)

**Turn over for the next question**



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



Not drawn  
accurately

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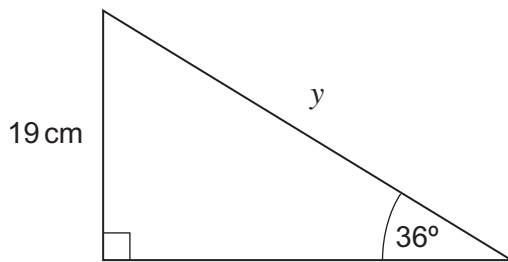
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Answer ..... cm (3 marks)

12 (b) Work out the length  $y$  in the right-angled triangle.



Not drawn  
accurately

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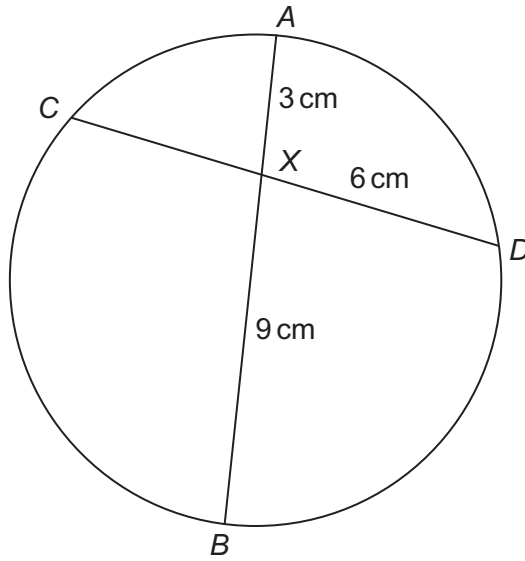
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Answer ..... cm (3 marks)



13  $AB$  and  $CD$  are two chords of a circle that intersect at  $X$ .  
 $AX = 3\text{ cm}$ ,  $XB = 9\text{ cm}$ ,  $XD = 6\text{ cm}$



Not drawn  
accurately

Calculate the length  $CX$ .

.....  
.....

Answer ..... cm (3 marks)

**Turn over for the next question**



14 Solve  $\frac{x + 1}{3} + \frac{x + 5}{4} = 1$

You **must** show your working.  
Do **not** use trial and improvement.

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$x =$  ..... (4 marks)

15 A quantity is divided in the ratio 2 : 5  
The larger share is 45 more than the smaller share.

What was the original quantity?

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Answer ..... (3 marks)





**16** Use the quadratic formula to solve  $3x^2 - 5x - 3 = 0$   
Give your answers to 2 decimal places.

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Answer ..... (3 marks)

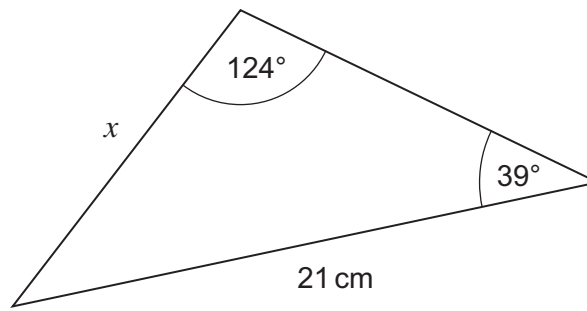
**Turn over for the next question**

10

**Turn over ►**



17 (a) Work out the length  $x$ .



Not drawn  
accurately

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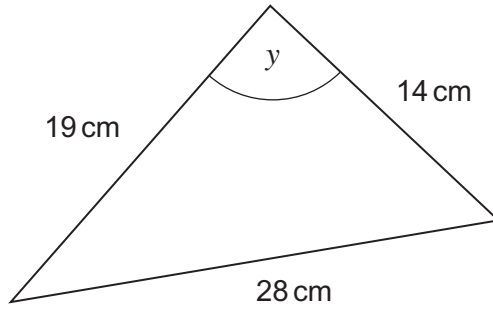
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Answer ..... cm (3 marks)



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



Not drawn  
accurately

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Answer ..... degrees (3 marks)

Turn over for the next question

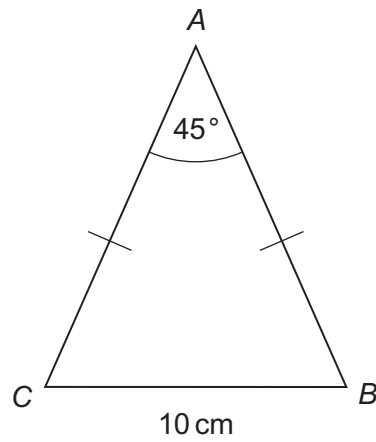
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Turn over ►



18 (a)  $ABC$  is an isosceles triangle.

Show that the area of  $ABC$  is  $60.4 \text{ cm}^2$  to 3 significant figures.



Not drawn  
accurately

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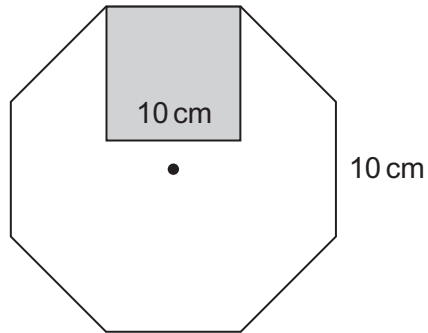
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(3 marks)



**18 (b)** A square of side 10 cm is drawn inside a regular octagon of side 10 cm



Not drawn  
accurately

Use your answer to (a) to work out what percentage of the octagon is shaded.

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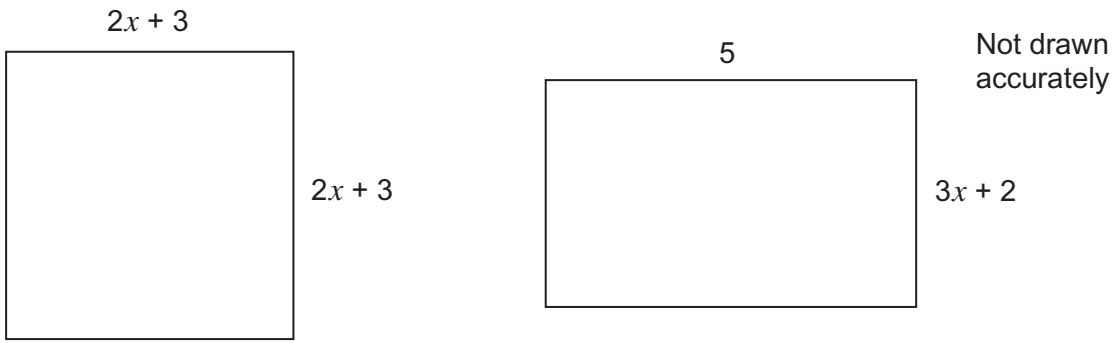
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Answer ..... % (3 marks)

**Turn over for the next question**



**19** The **square** and the **rectangle** have the same area.  
All lengths are in centimetres.



**19 (a)** Show that  $4x^2 - 3x - 1 = 0$

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(3 marks)

**\*19(b)** Work out the value of  $x$ .

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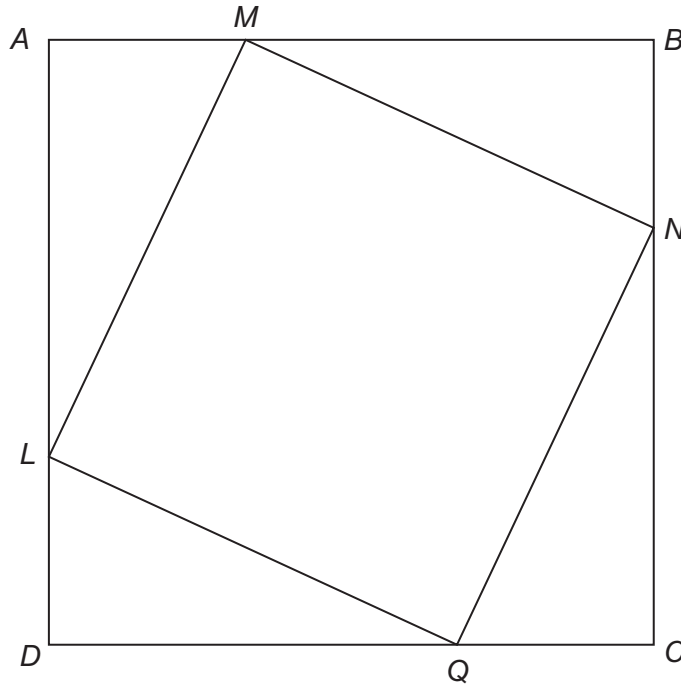
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$x =$  .....

(2 marks)



20  $ABCD$  and  $LMNQ$  are squares.  
 $AM = BN = CQ = DL$



Not drawn  
accurately

Prove that triangles  $LAM$  and  $MBN$  are congruent.

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(4 marks)

**END OF QUESTIONS**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

