

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
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TOTAL	



General Certificate of Secondary Education  
Higher Tier  
June 2013

# Methods in Mathematics (Linked Pair Pilot)

## 93652H

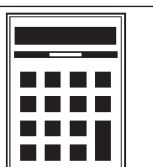
Unit 2      Geometry and Algebra

Friday 21 June 2013      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 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 6, 14 and 20. 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.



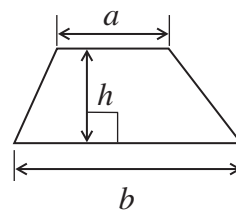
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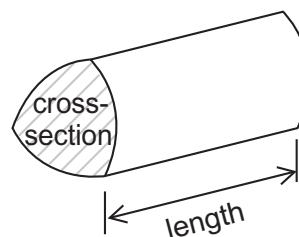
## 93652H

## Formulae Sheet: Higher Tier

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

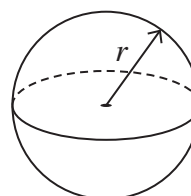


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



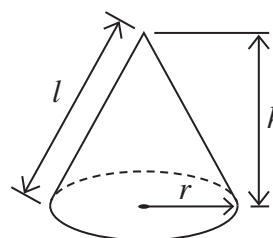
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

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

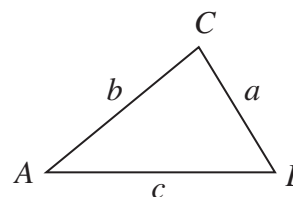


In any triangle  $ABC$

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

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

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



### 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 Decrease 390 by 5.5%

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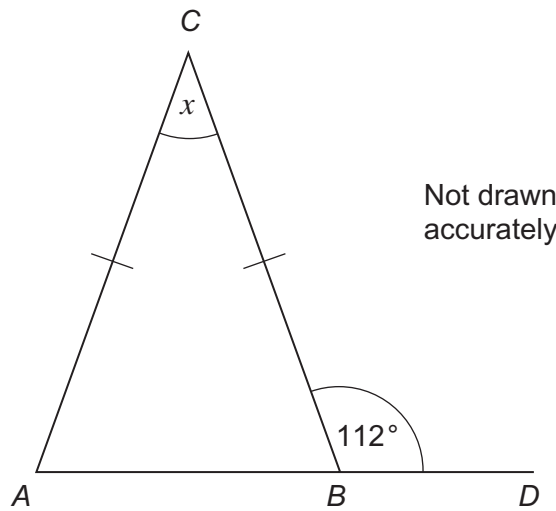
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Answer ..... (3 marks)

2 *ABC* is an isosceles triangle.  
*ABD* is a straight line.  
 Angle *CBD* = 112°



Work out the size of angle *x*.  
 You **must** show your working, which may be on the diagram.

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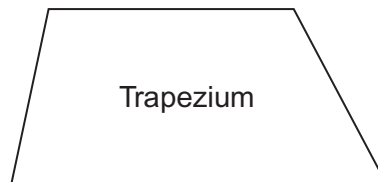
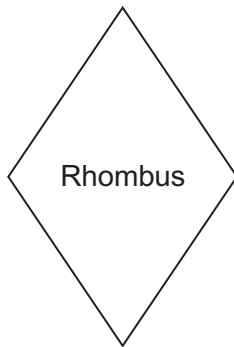
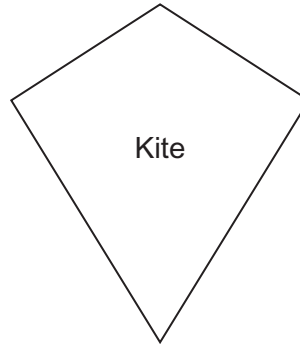
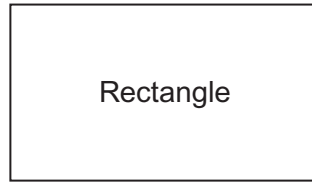
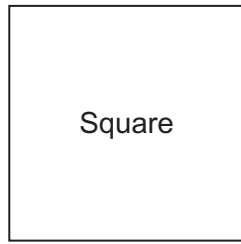
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Answer ..... degrees (3 marks)

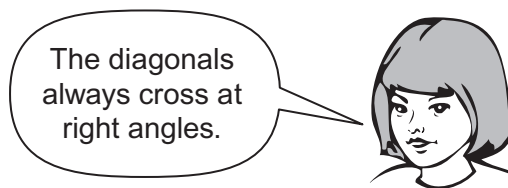
Turn over ►



3 Here are six quadrilaterals.



3 (a) Dana is describing a quadrilateral.



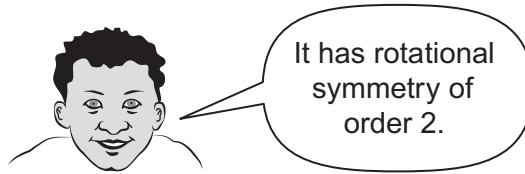
The rhombus is one possible quadrilateral she could be describing.

Write down the names of the other **two** quadrilaterals she could be describing.

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



3 (b) Amir is describing a quadrilateral.



The rhombus is one possible quadrilateral he could be describing.

Write down the names of the other **two** quadrilaterals he could be describing.

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

3 (c) Ed is describing a rhombus.



All quadrilaterals have 4 sides and 4 angles.

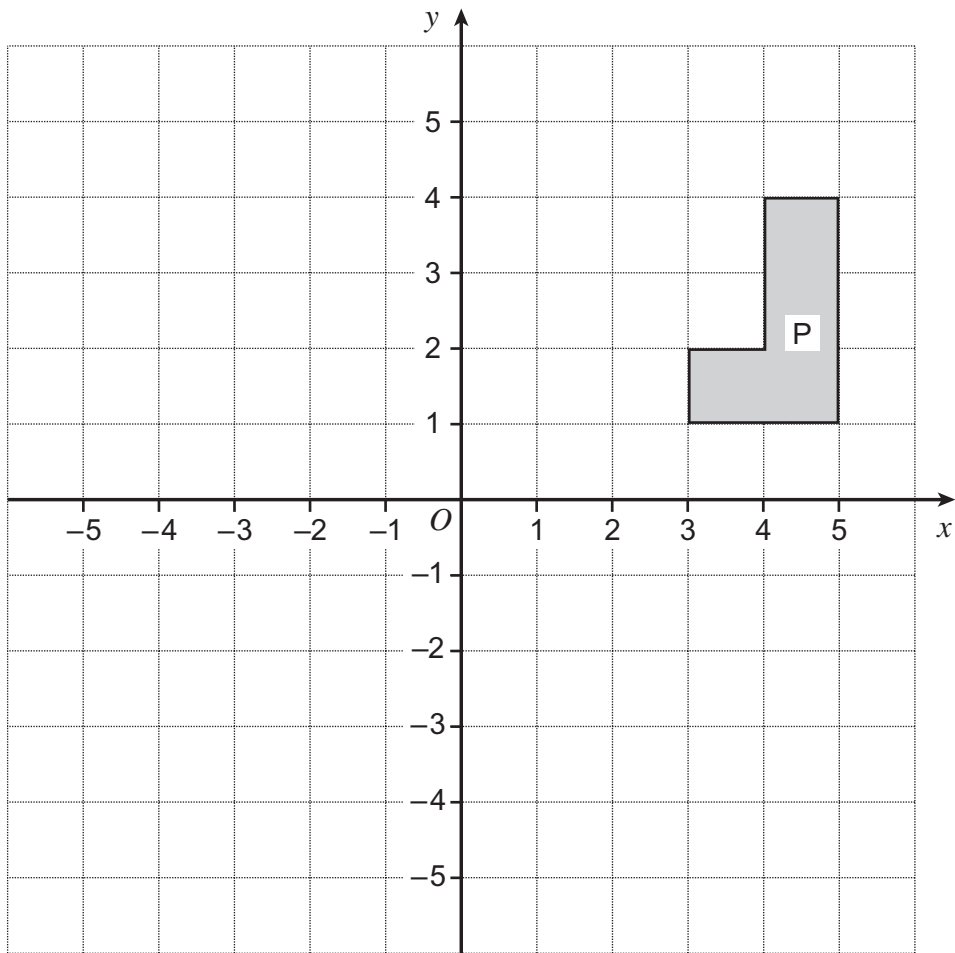
Fill in the empty speech bubble with **another** property of a rhombus.

(1 mark)

Turn over for the next question



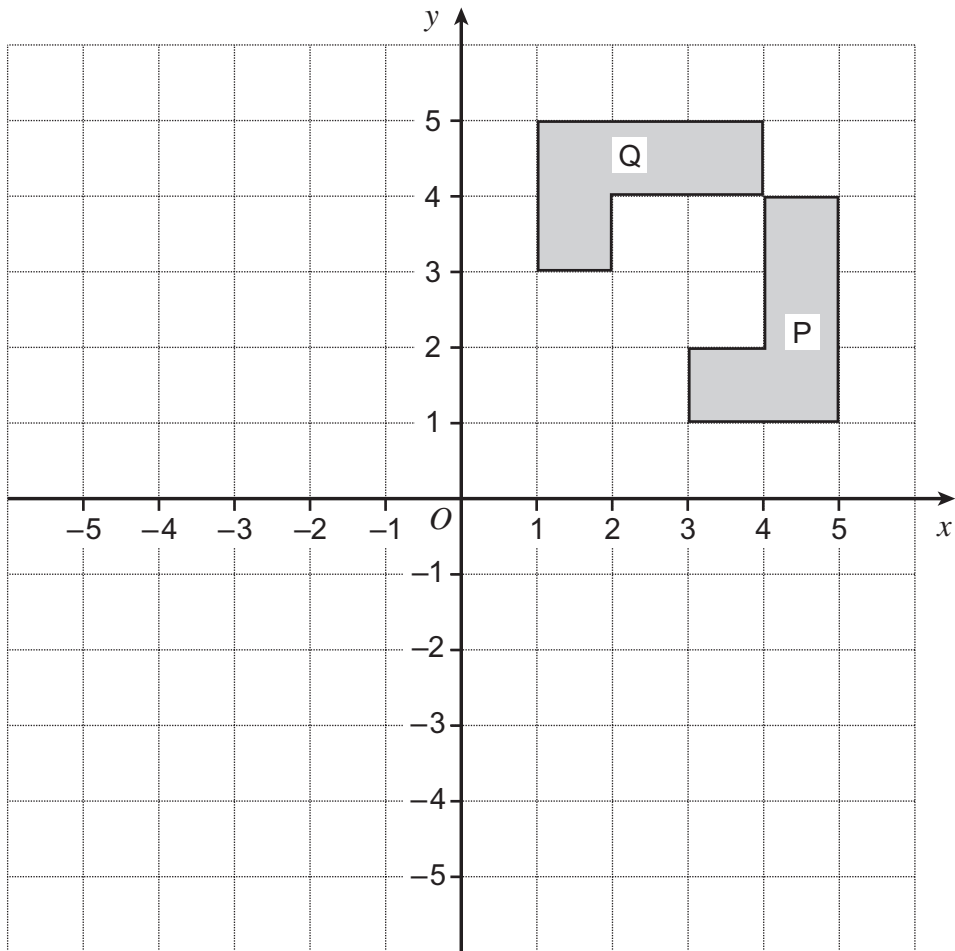
4 (a) Reflect shape P in the line  $x = 1$



(2 marks)



4 (b)



Describe the **single** transformation that takes shape P to shape Q.

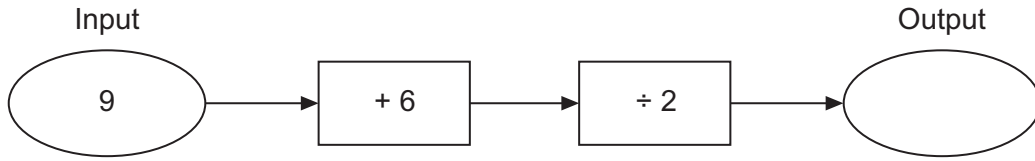
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(2 marks)



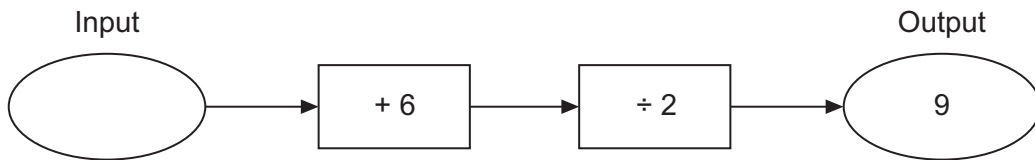
5 (a) Here is a number machine.



Work out the output when the input is 9.

Answer ..... (1 mark)

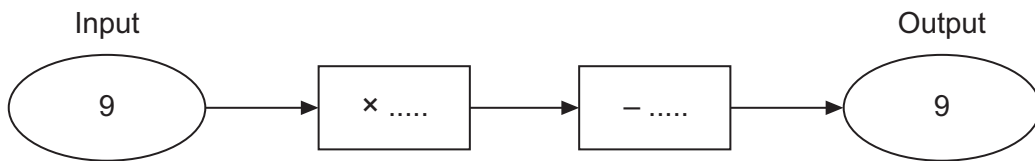
5 (b) Here is the same number machine.



Work out the input when the output is 9.

Answer ..... (1 mark)

5 (c) Here is a different number machine.



Complete possible operations for this number machine.

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(1 mark)



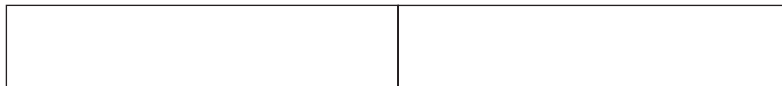


\*6 This rectangle has an area of  $48 \text{ cm}^2$ .  
The perimeter is  $32 \text{ cm}$ .



Not drawn accurately

Two of the rectangles are put together.



Not drawn accurately

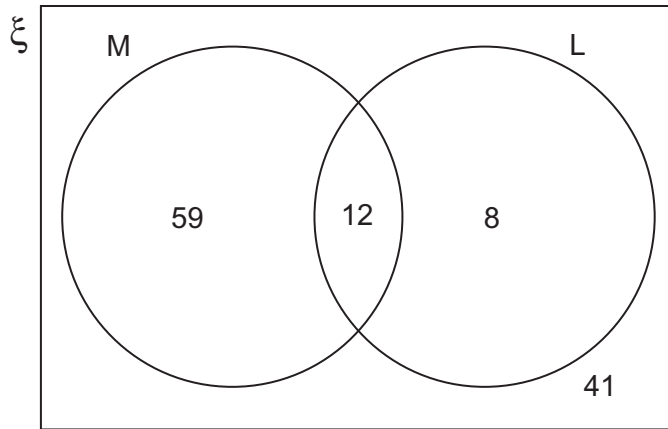
Work out the perimeter of the new shape.

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Answer ..... cm (4 marks)



- 7 The Venn diagram shows information about members of a club.  
The number of men is shown in set M.  
The number of left-handed members is shown in set L.



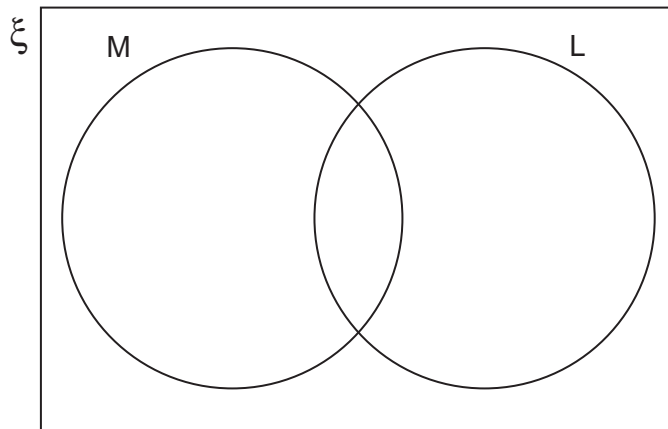
- 7 (a) How many members are in the club altogether?

.....

Answer ..... (1 mark)

- 7 (b) 3 right-handed men leave.  
1 left-handed man joins.  
  
2 left-handed women leave.  
5 right-handed women join.

Complete this Venn Diagram to show the members of the club now.



(2 marks)



8 (a) Calculate the area of a circle of radius 4.5 cm.

Give your answer to 3 significant figures.

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Answer ..... cm<sup>2</sup> (3 marks)

8 (b) Calculate the radius of a circle with circumference 93 cm.

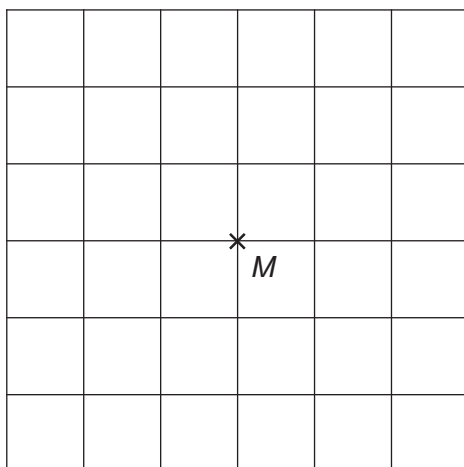
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Answer ..... cm (3 marks)

9 This is a centimetre square grid.

Draw a square on the grid so that

*M* is the centre of the square  
the **area** of the square is 8 cm<sup>2</sup>.



(2 marks)

Turn over ►



**10 (a)** Expand and simplify  $5(x - 3) - 3(x - 1)$

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Answer ..... (3 marks)

**10 (b)** Solve the equation  $\frac{x + 2}{2} + \frac{2x + 1}{8} = 0$

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



11  $x = 2^2 \times 3 \times 5$        $y = 2 \times 3^2 \times 5^2$

11 (a) Work out the Highest Common Factor (HCF) of  $x$  and  $y$ .

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Answer ..... (1 mark)

11 (b) Work out the Least Common Multiple (LCM) of  $x$  and  $y$ .

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Answer ..... (2 marks)

**Turn over for the next question**



12 Here is a formula  $F = \frac{X}{Y}$

X **increases** by 25%.

Y **decreases** by 20%.

Work out the percentage increase in  $F$ .

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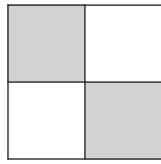
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Answer ..... % (4 marks)

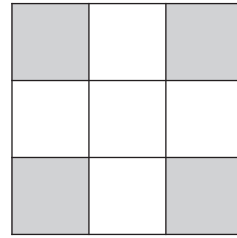


13

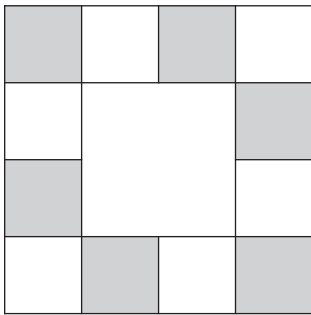
A square pattern is made from shaded and plain tiles.  
Jon counts how many shaded tiles are in each square pattern.



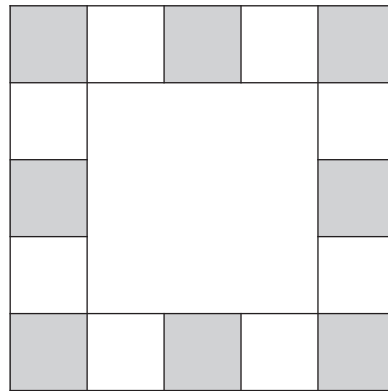
2 shaded tiles



4 shaded tiles



6 shaded tiles



8 shaded tiles

Jon counts 162 shaded tiles around the edges of a square pattern.

How many tiles are along one side of the square?

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Answer .....

(3 marks)

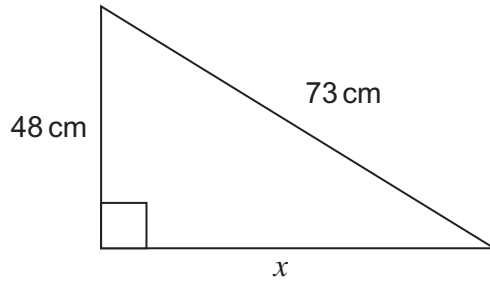
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Turn over ►



**\*14 (a)** Calculate the length  $x$ .

You **must** show your working.



Not drawn  
accurately

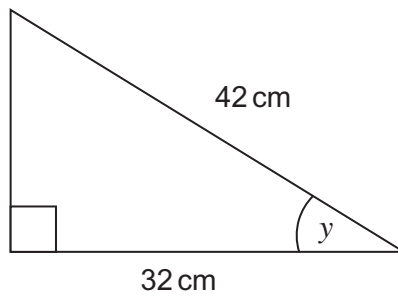
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Answer ..... cm (3 marks)

**14 (b)** Calculate the angle  $y$ .



Not drawn  
accurately

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Answer ..... degrees (3 marks)





15 (a) Show that  $(x - 9)(x - 1) \equiv x^2 - 10x + 9$

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(1 mark)

15 (b) Solve  $x^2 - 10x + 9 = x - 1$

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$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  (3 marks)

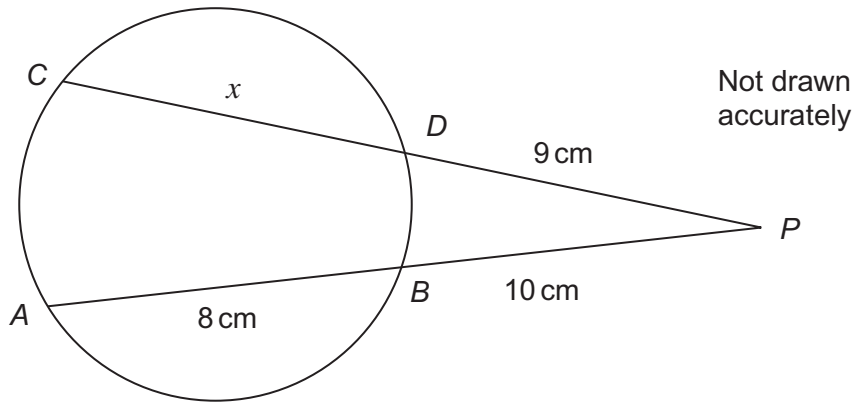
Turn over for the next question



16

$AB$  and  $CD$  are two chords of a circle that intersect outside the circle at  $P$ .

$DP = 9\text{ cm}$ ,  $AB = 8\text{ cm}$ ,  $BP = 10\text{ cm}$ .



Work out the length of  $CD$  marked  $x$  in the diagram.

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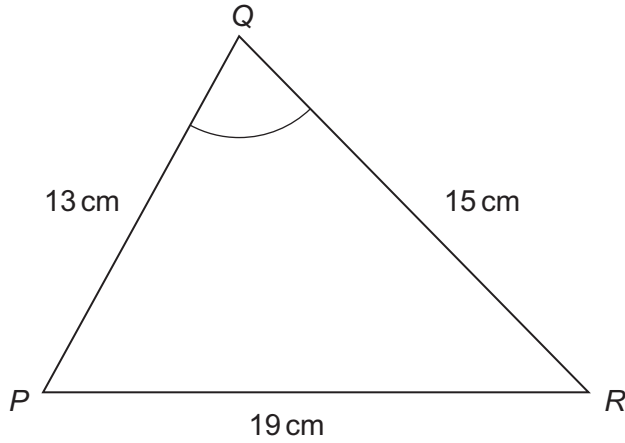
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Answer ..... cm (3 marks)



17 Work out the size of angle  $PQR$ .



Not drawn  
accurately

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Answer ..... degrees (3 marks)

Turn over for the next question



18

Simplify fully

$$\frac{4x^2 - 9}{2x^2 + x - 3}$$

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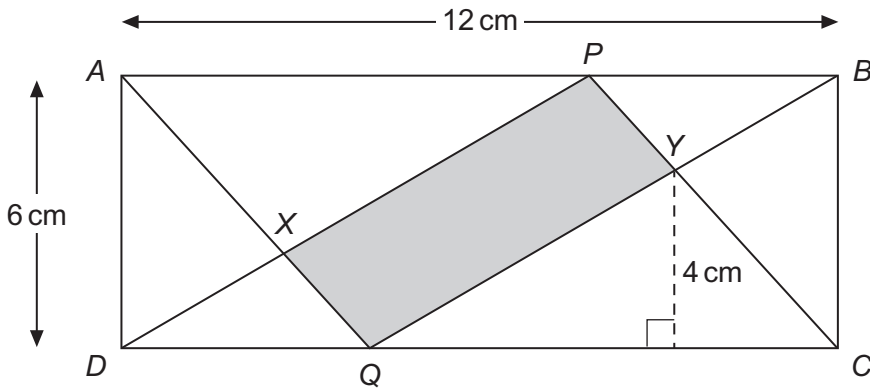
Answer ..... (4 marks)



19

$ABCD$  is a rectangle.

$P$  and  $Q$  are such that  $AP : PB = CQ : QD = 2 : 1$



Not drawn accurately

Show that the shaded area is  $16 \text{ cm}^2$ .

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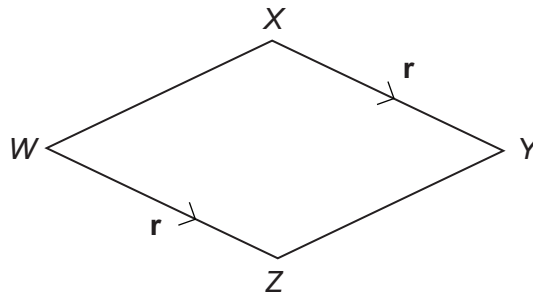
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(4 marks)



\*20 (a) WXYZ is a quadrilateral.

$\vec{WZ} = \mathbf{r}$  and  $\vec{XY} = \mathbf{r}$



Not drawn accurately

Explain why WXYZ must be a parallelogram.

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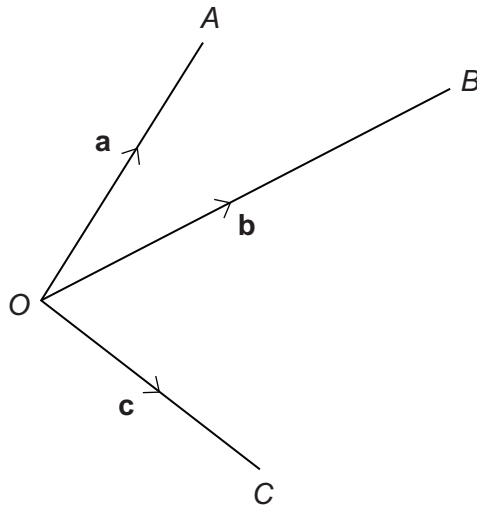
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(1 mark)

20 (b) O, A, B and C are four points.

$\vec{OA} = \mathbf{a}$ ,  $\vec{OB} = \mathbf{b}$  and  $\vec{OC} = \mathbf{c}$



Not drawn accurately

The vector  $\vec{AC} = \mathbf{c} - \mathbf{a}$

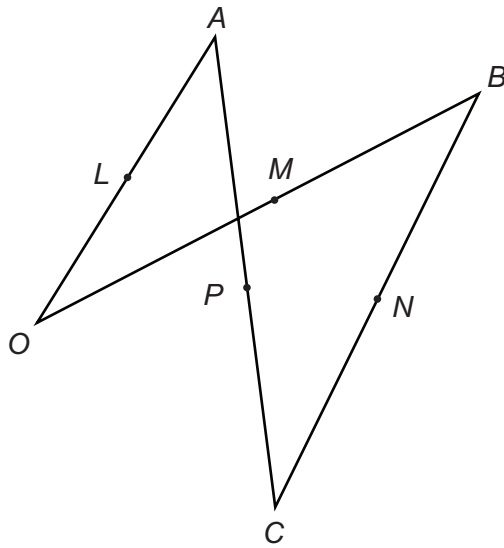
Write down the vector  $\vec{CB}$  in terms of  $\mathbf{b}$  and  $\mathbf{c}$ .

Answer .....

(1 mark)



- 20 (c) The four points  $O, A, B$  and  $C$  are joined as shown.  
 $L, M, N$  and  $P$  are the midpoints of  $OA, OB, CB$  and  $AC$  respectively.



Not drawn  
accurately

Show that  $\vec{LP} = \frac{1}{2} \mathbf{c}$

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(2 marks)

- 20 (d) Prove that  $LMNP$  is a parallelogram.

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(2 marks)

**END OF QUESTIONS**



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

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

