

Centre Number						Candidate Number				
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Candidate Signature										



General Certificate of Secondary Education  
Higher Tier  
June 2010

# Mathematics (Specification A)

**4306/1H**

**Paper 1 Non-calculator**

**H**

**Monday 7 June 2010 1.30 pm to 3.30 pm**

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>mathematical instruments.</li> </ul> <p>You may <b>not</b> use a calculator.</p>	
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## Time allowed

- 2 hours

## 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 you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

## Advice

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

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22	
TOTAL	



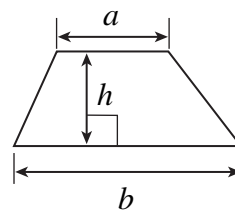
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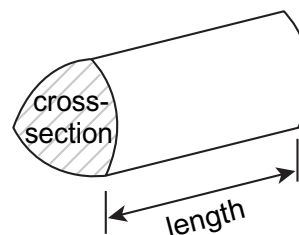
**4306/1H**

## Formulae Sheet: Higher Tier

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

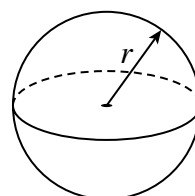


**Volume of prism** = area of cross-section  $\times$  length



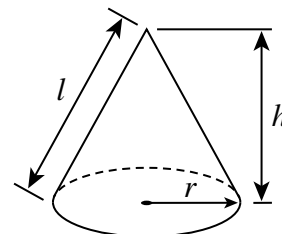
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

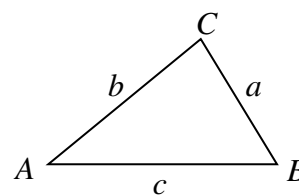


**In any triangle ABC**

**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**  $A = -9$  and  $B = 12$

Work out the value of  $\frac{4(A + 3)}{B}$

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Answer ..... (3 marks)

**2** Jack has a box of 100 coloured discs.  
The discs are Red, Blue, Green and Yellow.  
The table shows some of the probabilities of choosing a colour.

Colour	Red	Blue	Green	Yellow
Probability	0.6	0.1		0.1

**2 (a)** Jack chooses a disc at random from the box.  
Work out the probability that he chooses a Green disc.

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Answer ..... (2 marks)

**2 (b)** Jack says: 'There must be 60 Red discs in the box.'

Is Jack correct?  
Tick the correct box.

☐

Yes

☐

No

Give a reason for your answer.

Reason .....

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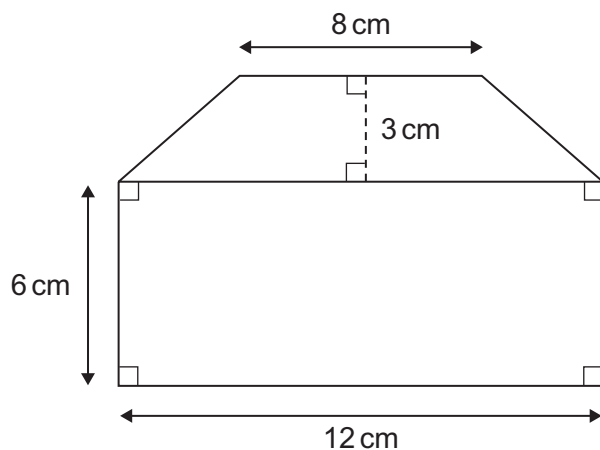
(2 marks)

7

Turn over ►



- 3 The shape is a drawing of a house.



Not drawn  
accurately

Work out the area of this shape.  
State the units of your answer.

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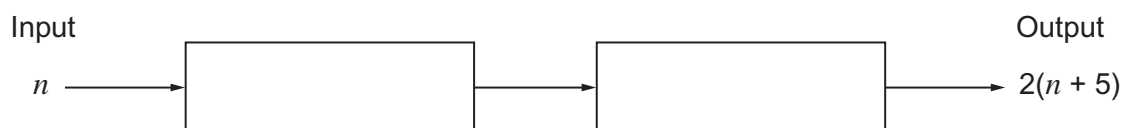
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Answer ..... (4 marks)

- 4 A flow diagram for a two-stage operation is shown.



- 4 (a) Fill in the boxes of the flow diagram so that they represent this two-stage operation. (2 marks)

- 4 (b) When the input is  $-1$ , what is the output?

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Answer ..... (1 mark)



**5** You are given that  $46 \times 137 = 6302$

Write down the answers to these calculations.

**5 (a)**  $46 \times 1.37$

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Answer ..... (1 mark)

**5 (b)**  $\frac{6302}{460}$

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Answer ..... (1 mark)

**5 (c)**  $\frac{63020}{46 \times 137}$

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Answer ..... (1 mark)

**Turn over for the next question**



**6 (a)** Solve  $\frac{28}{w} = 7$

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Answer  $w =$  ..... (1 mark)

**6 (b)** Solve  $7x - 2 = 3x + 8$

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Answer  $x =$  ..... (3 marks)

**6 (c)** Solve  $\frac{3y+11}{4} = 2$

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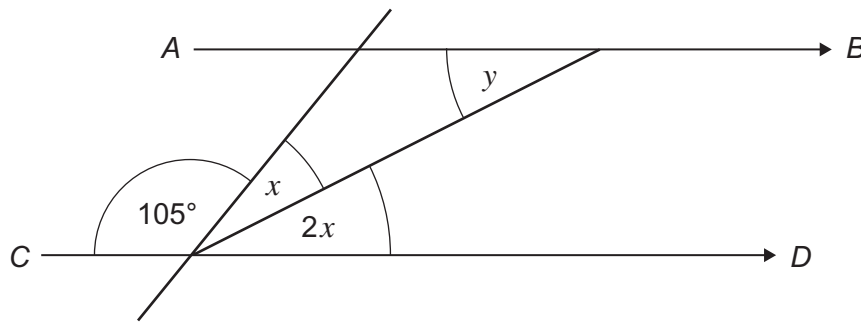
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Answer  $y =$  ..... (3 marks)



- 7 In the diagram  $AB$  is parallel to  $CD$ .



Not drawn  
accurately

- 7 (a) Work out the value of  $x$ .

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Answer ..... degrees (2 marks)

- 7 (b) Work out the value of  $y$ .  
Give a reason for your answer.

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Answer ..... degrees

Reason .....

(2 marks)



**8 (a)** Work out  $\frac{5}{6} \div \frac{3}{4}$

Give your answer in its simplest form.

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Answer ..... (3 marks)

**8 (b)** Work out  $4\frac{2}{5} - 1\frac{1}{3}$

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Answer ..... (3 marks)

- 9** Pam wants to collect information about the total number of hours of homework the students in her class did last week.

Design a suitable question she could use to find out this information.  
Remember to include response boxes.

Question .....

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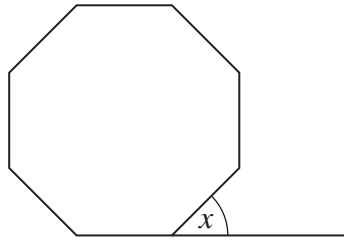
Response

(2 marks)





- 10** The diagram shows a regular octagon.



Not drawn accurately

- 10 (a)** Explain why the exterior angle of a regular octagon, marked  $x$  on the diagram, is  $45^\circ$

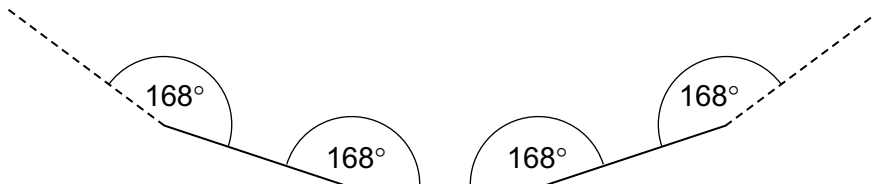
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(1 mark)

- 10 (b)** The diagram shows part of a regular polygon.  
Each interior angle is  $168^\circ$ .



Not drawn  
accurately

Calculate the number of sides of this regular polygon.

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Answer ..... (3 marks)



- 11** A restaurant offers a family discount.  
The Taylor family have a meal at this restaurant.  
Before the discount the meal costs £140  
After the discount the cost is £112

Calculate the percentage discount.

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Answer ..... % (3 marks)

- 12 (a)** Complete the table of values for  $y = x^2 - 4x + 2$

$x$	-1	0	1	2	3	4	5
$y$		2	-1		-1	2	7

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(2 marks)

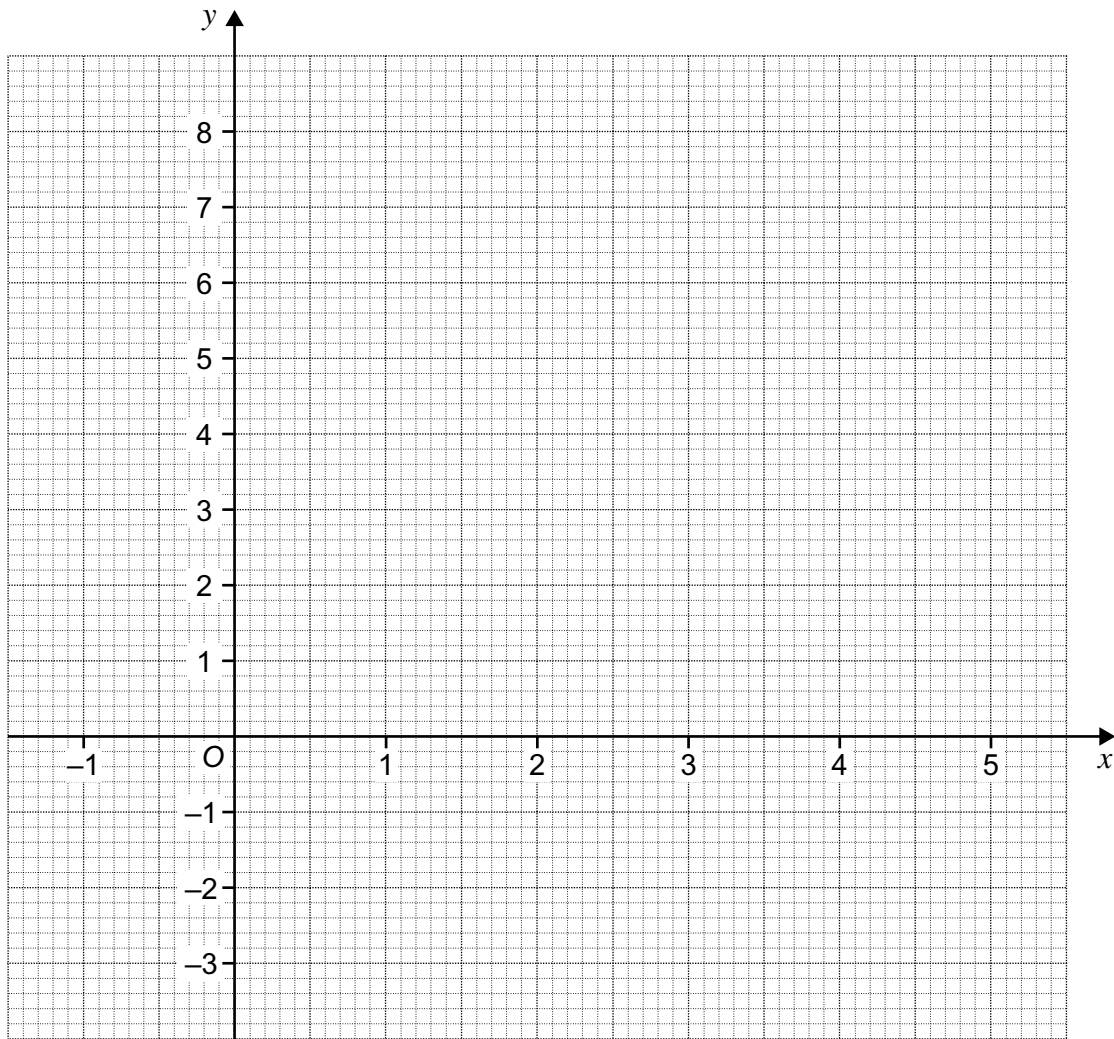
- 12 (b)** On the grid opposite, draw the graph of  $y = x^2 - 4x + 2$  for values of  $x$  from -1 to 5  
(2 marks)

- 12 (c)** Use the graph to solve the equation  $x^2 - 4x + 2 = 0$

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Answer  $x =$  ..... or  $x =$  ..... (1 mark)





Turn over for the next question



**13** These five numbers are written in standard form.

$$4.5 \times 10^5 \quad 8.7 \times 10^0 \quad 6.9 \times 10^{-3} \quad 3.2 \times 10^6 \quad 1.8 \times 10^{-1}$$

**13 (a)** Write down the smallest number.

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Answer ..... (1 mark)

**13 (b)** Write down the largest number.

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Answer ..... (1 mark)

**13 (c)** Write  $1.8 \times 10^{-1}$  as an ordinary number.

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Answer ..... (1 mark)

**13 (d)** Work out  $4.5 \times 10^5 \times 0.01$   
Give your answer in standard form.

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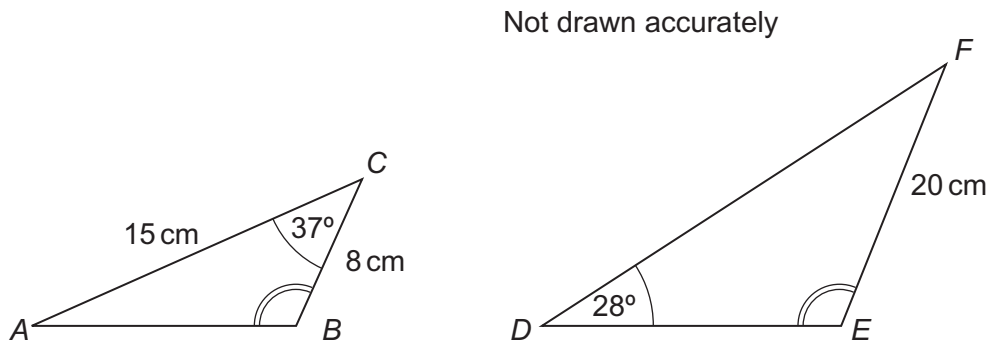
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Answer ..... (2 marks)



- 14** Triangles  $ABC$  and  $DEF$  are similar.  
Angle  $ABC = \text{angle } DEF$ .



- 14 (a)** Work out the size of angle  $DEF$ .

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Answer ..... degrees (2 marks)

- 14 (b)** Calculate the length of  $DF$ .

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Answer ..... cm (3 marks)



- 15** The table shows the profits of a small business during each quarter from March 2008 to June 2009. The March 2009 entry is missing from the table.

Date	Mar 08	June 08	Sept 08	Dec 08	Mar 09	June 09
Profits	38 000	29 000	25 000	34 000		21 000

- 15 (a)** Calculate the first four-point moving average.

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Answer £ ..... (2 marks)

- 15 (b)** The second four-point moving average is £28 000

Calculate the missing entry for March 2009.

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Answer £ ..... (2 marks)



**16 (a)** Show clearly that  $(x + 5)(x - 2) + 3(x + 1) \equiv x^2 + 6x - 7$

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(2 marks)

**16 (b)** Factorise  $x^2 + 6x - 7$

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Answer ..... (2 marks)

**16 (c)** Hence, or otherwise, solve  $(x + 5)(x - 2) + 3(x + 1) = 0$

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Answer ..... (2 marks)



**17 (a)** Factorise fully  $6x^2 - 10xy$

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Answer ..... (2 marks)

**17 (b)** Simplify  $(5a^4b)^3$

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Answer ..... (2 marks)

**18** Evaluate  $81^{0.5} \times 6^{-2}$   
Give your answer in its simplest form.

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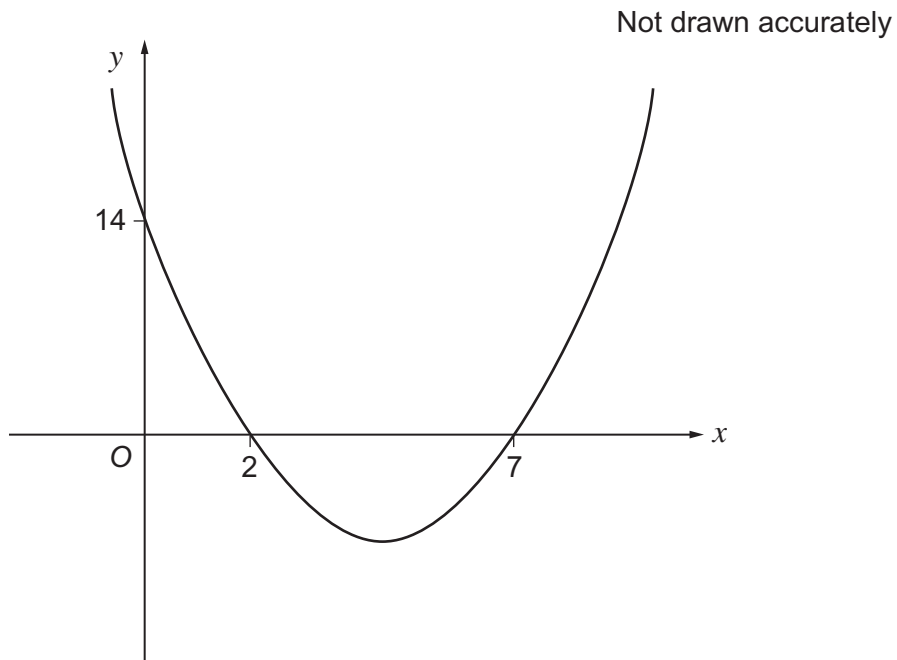
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Answer ..... (3 marks)





- 19 The diagram shows the graph of  $y = x^2 + bx + c$



Find the values of  $b$  and  $c$ .  
You **must** show all your working.

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Answer  $b = \dots\dots\dots$  ,  $c = \dots\dots\dots$  (3 marks)



**20**

A data logging machine in a car park records the length of time that cars are parked. Here are Monday's results, along with the parking charges.

Length of time (hours)	Number of cars	Charge (£)
0 – 1	90	1.20
1 – 2	130	2.00
2 – 3	80	3.50
more than 3	60	5.00

Monday's results are equivalent to a 20% sample for the whole week, stratified by the four time intervals.

Work out the car park takings for the whole week.

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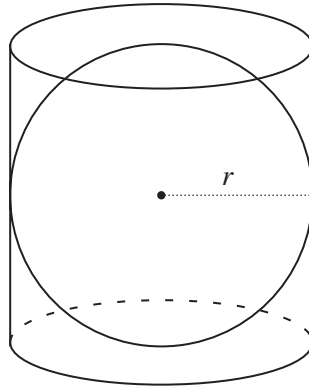
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Answer £ ..... (3 marks)



21

A tennis ball of radius  $r$  is packaged in a cylindrical box.  
The ball touches the sides, top and base of the box.



What fraction of the volume of the box is empty space?  
You **must** show all your working.

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Answer .....

(4 marks)



22

Find the value of  $w$  if  $\frac{\sqrt{w} \times \sqrt{8}}{\sqrt{3}} = 2\sqrt{3}$

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Answer ..... (3 marks)

23

Solve the equation  $x^2 - 4x - 15 = 0$

Give your answers in surd form in their simplest form.

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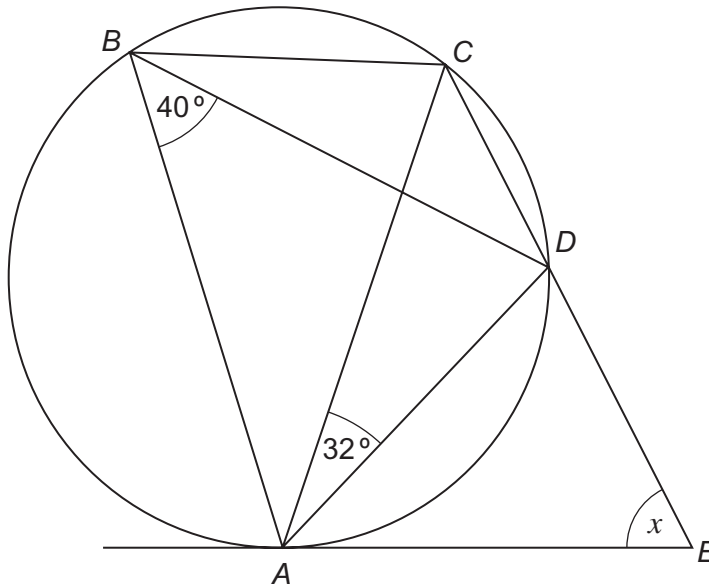
Answer ..... (3 marks)



24

$ABCD$  is a cyclic quadrilateral.  
 $AE$  is a tangent at  $A$ .  
 $CDE$  is a straight line.  
Angle  $CAD = 32^\circ$   
Angle  $ABD = 40^\circ$

Not drawn accurately



Work out the size of angle  $AED$ , marked  $x$ , on the diagram.  
You **must** show your working.  
Give reasons for any angles you work out.

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Answer ..... degrees (5 marks)

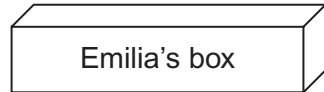


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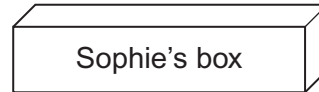
Emilia picks a chocolate at random from a box.  
All the chocolates in the box are identically wrapped.  
The probability that she picks a caramel is  $\frac{5}{8}$

Sophie picks a chocolate at random from a different box.  
All the chocolates in Sophie's box are identically wrapped.  
The probability that she picks a caramel is denoted by  $p$ .

The probability that **both** Emilia and Sophie pick a caramel is  $\frac{1}{4}$



$$P(\text{Emilia picks a caramel}) = \frac{5}{8}$$



$$P(\text{Sophie picks a caramel}) = p$$

25 (a)

Work out the value of  $p$ .

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Answer ..... (2 marks)

25 (b)

Calculate the probability that **neither** Emilia **nor** Sophie picks a caramel.

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Answer ..... (2 marks)

**END OF QUESTIONS**



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