

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Higher Tier  
November 2013

# Mathematics (Linear)

# 4365/2H

## Paper 2

Monday 11 November 2013 9.00 am to 11.00 am

# H

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• a calculator</li> <li>• mathematical instruments.</li> </ul>	
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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.
- 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 105.
- The quality of your written communication is specifically assessed in Questions 5, 6 and 21. These questions are indicated with an asterisk (\*).
- You may ask for more answer paper, tracing paper and graph paper. These must be tagged securely to this answer book.

### Advice

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

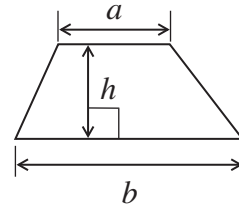
For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
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16 – 17	
18 – 19	
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24 – 25	
TOTAL	



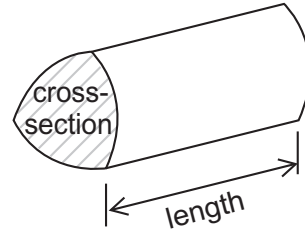
N 0 V 1 3 4 3 6 5 2 H 0 1

### Formulae Sheet: Higher Tier

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

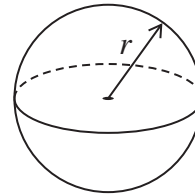


**Volume of prism** = area of cross-section  $\times$  length



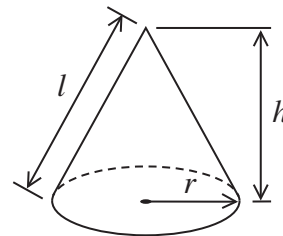
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

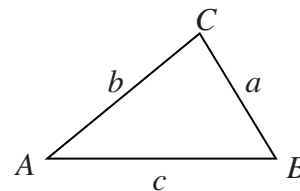


**In any triangle ABC**

**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

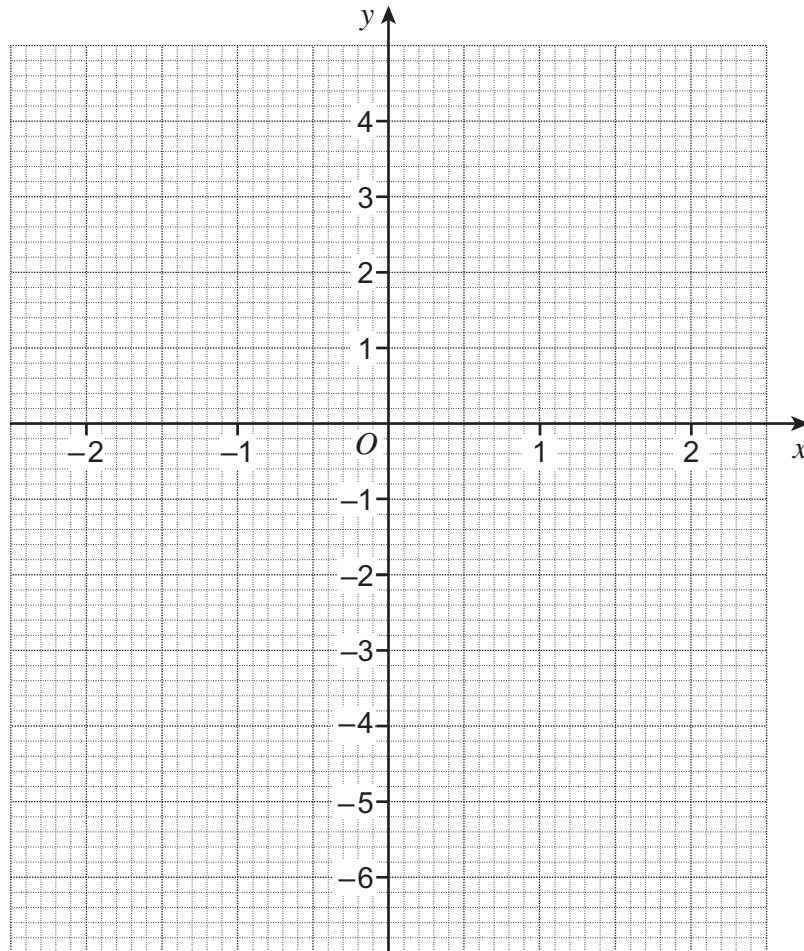
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



Answer **all** questions in the spaces provided.

- 1 On the grid, draw the graph of  $y = 2x - 1$  for values of  $x$  from  $-2$  to  $2$ .



(3 marks)

Turn over for the next question



**2** In this question, assume that the car uses the same amount of petrol for each mile it travels.

**2 (a)** A car uses 55 litres of petrol to travel 495 miles.  
How far would the car travel on 80 litres of petrol?

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.....  
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Answer ..... miles (3 marks)

**2 (b)** How much petrol would the car use on a trip of 160 miles?  
Give your answer to the nearest litre.

.....  
.....  
.....

Answer ..... litres (4 marks)



**3** Decide whether each of these sets of data is discrete or continuous.

Tick the correct box.

**3 (a)** The heights of people.

Discrete

Continuous

(1 mark)

**3 (b)** The number of coins in a bag.

Discrete

Continuous

(1 mark)

**3 (c)** The weights of bicycles.

Discrete

Continuous

(1 mark)

**3 (d)** The shoe sizes of women.

Discrete

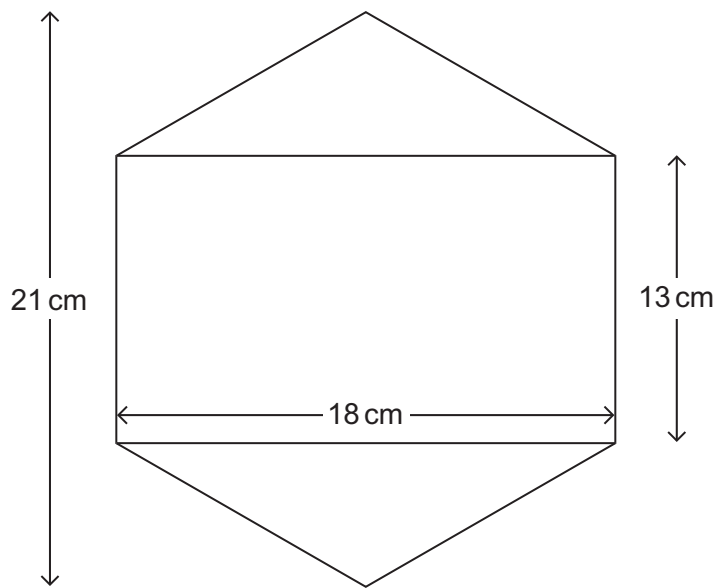
Continuous

(1 mark)

**Turn over for the next question**



4 The hexagon is made from a rectangle and two congruent triangles.



Not drawn  
accurately

Work out the area of the hexagon.

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Answer ..... cm<sup>2</sup> (5 marks)



5 20 students choose a sport.

	Tennis	Basketball	Football
Boys	4	3	5
Girls	5	2	1

5 (a) How many students did **not** choose football?

.....

Answer ..... (2 marks)

5 (b) What percentage of the students choose tennis?

.....

.....

Answer ..... % (3 marks)

\*5 (c) Considering the boys and the girls separately, compare their relative frequencies of choosing basketball.

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(3 marks)



**6 (a)** Multiply out and simplify  $2(3x + 2) - (x + 7)$

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Answer ..... (3 marks)

**\*6 (b)** Matt knows the value of  $a$  is 6 or 7 and the value of  $b$  is  $-4$  or  $-5$ .

Work out the largest and smallest possible values of  $3a - 2b$

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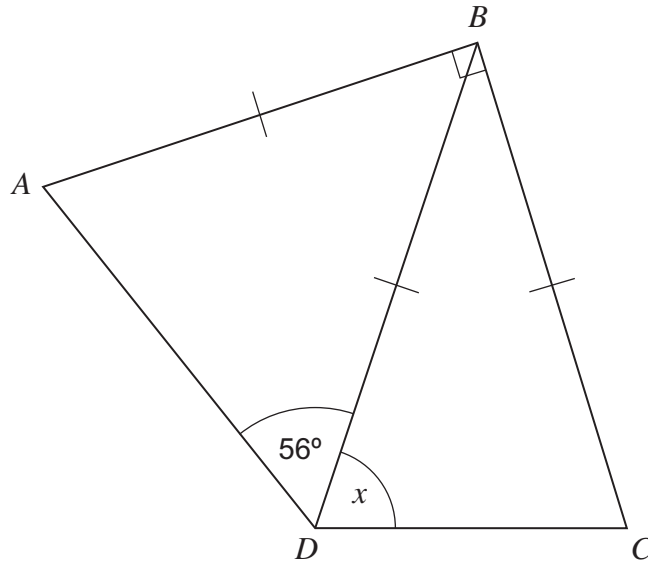
Largest .....

Smallest ..... (4 marks)





7 Triangles  $ABD$  and  $BCD$  are isosceles.  
Angle  $ABC$  is  $90^\circ$



Not drawn  
accurately

Work out the size of angle  $x$ .

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Answer ..... degrees (4 marks)



**8 (a)** Rearrange the formula to make  $w$  the subject of  $y = 3w + 8$

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Answer ..... (2 marks)

**8 (b)** Solve  $5(x + 4) = 3(x + 7) + 2$

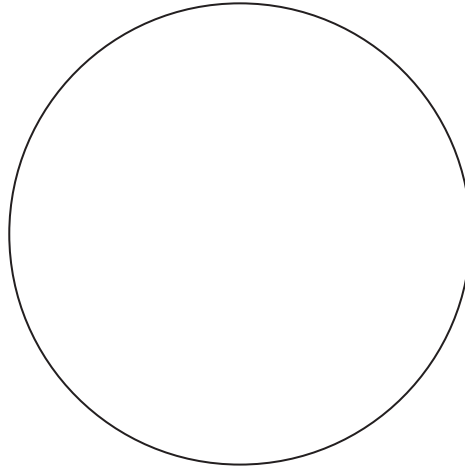
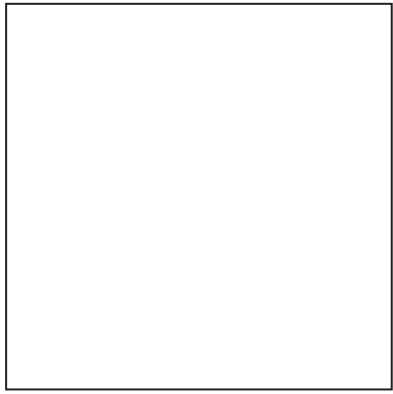
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$x =$  ..... (4 marks)



**9** A square of side 15.7 cm is made from a length of wire.  
The same length of wire is then made into a circle.

Not drawn  
accurately



Work out the diameter of the circle.

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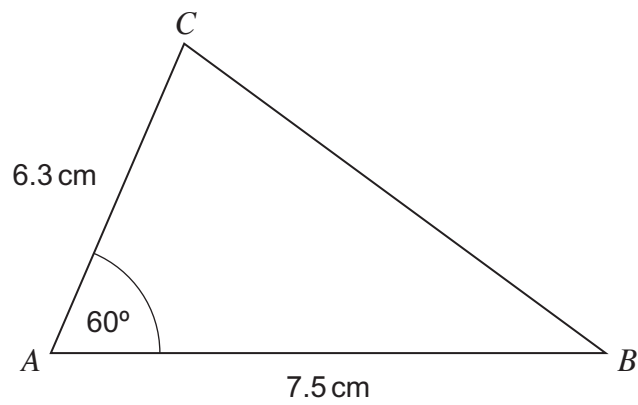
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Answer ..... cm (4 marks)



10

The diagram shows a sketch of triangle  $ABC$ .



Using ruler and compasses only, make an accurate drawing of triangle  $ABC$ .

(3 marks)



**11** The population of England in 2013 is approximately 53 million.

It is predicted that

the population in 2018 will be 4% more than the population in 2013

and the population in 2023 will be 4% more than the population in 2018.

Work out the predicted population of England in 2023.

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Answer ..... (3 marks)

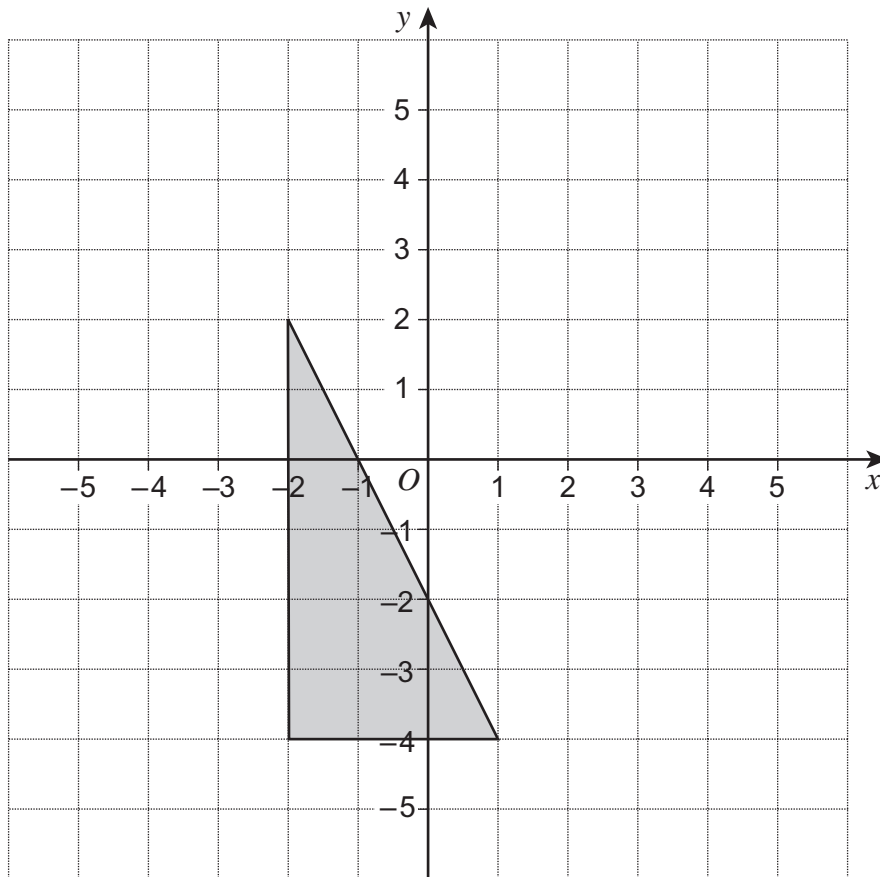
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6

**Turn over ►**



- 12 Enlarge the triangle by scale factor  $\frac{1}{3}$  with centre  $(-5, -4)$ .

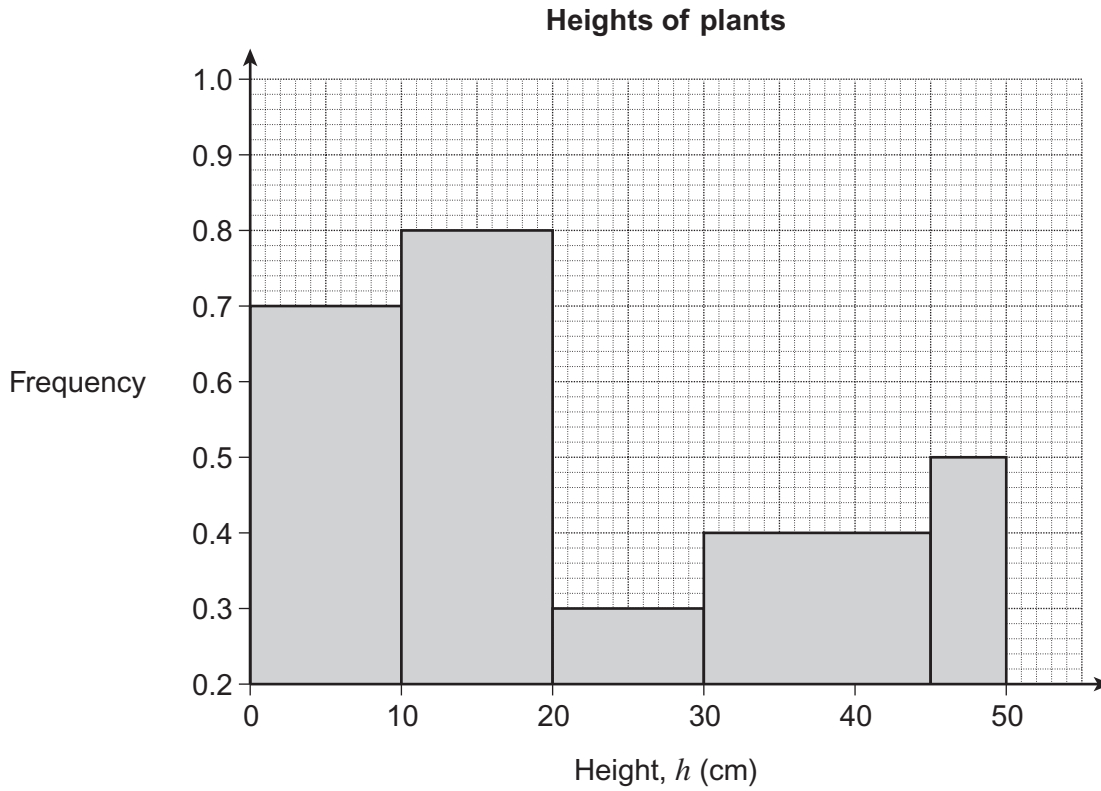


(2 marks)



13 Jon uses this data about the heights of plants ( $h$ ) to draw the histogram below.

<b>Height, <math>h</math> (cm)</b>	$0 < h \leq 10$	$10 < h \leq 20$	$20 < h \leq 30$	$30 < h \leq 45$	$45 < h \leq 50$
<b>Frequency</b>	7	8	3	6	5



Write down **three different** types of mistake that he has made.

Mistake 1 .....

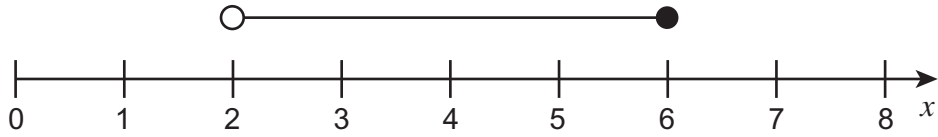
Mistake 2 .....

Mistake 3 .....

(3 marks)



**14 (a)** Circle the inequality shown by the diagram.



$2 < x < 6$

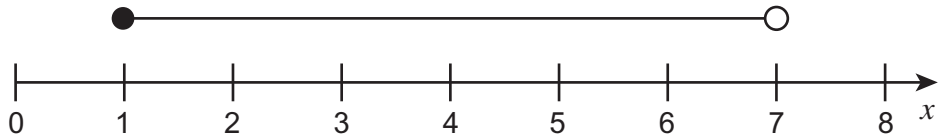
$2 \leq x < 6$

$2 < x \leq 6$

$2 \leq x \leq 6$

(1 mark)

**14 (b)** Write down the integer values satisfied by this diagram.



Answer .....

(2 marks)





15 Each number in the grid is double the previous number.  
The first **seven** numbers are shown.

1	2	4	8	16
32	64			
				$x$

Work out the number for the last cell, marked  $x$ .

Give your answer in standard form to 3 significant figures.  
You **must** show your working.

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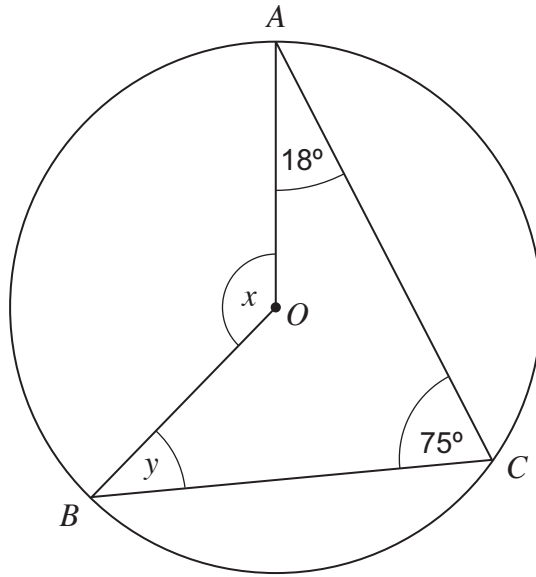
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Answer ..... (5 marks)



16 The diagram shows a circle, centre  $O$ .



Not drawn  
accurately

16 (a) Work out the size of angle  $x$ .

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Answer ..... degrees (1 mark)

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

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.....

Answer ..... degrees (3 marks)



17 (a) Simplify  $(2x^5y^4z^6) \times (7x^2y^3z)$

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Answer ..... (3 marks)

17 (b) Simplify fully  $\frac{6(x-5)^2}{3(x-5)(x+4)}$

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Answer ..... (2 marks)

17 (c) Factorise  $(x + 1)^2 + 4(x + 1)$

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Answer ..... (2 marks)

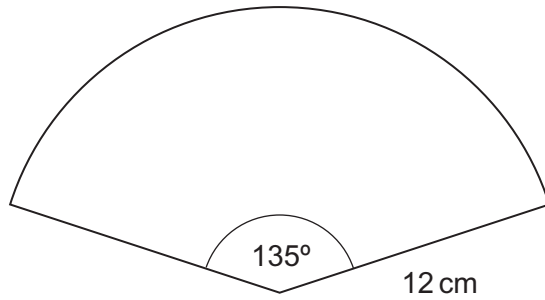
17 (d) Factorise fully  $2x^2 - 50y^2$

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Answer ..... (3 marks)



- 18 The diagram shows a sector of a circle, radius 12 cm.



Not drawn  
accurately

Show that the perimeter of the sector is greater than 52 cm.

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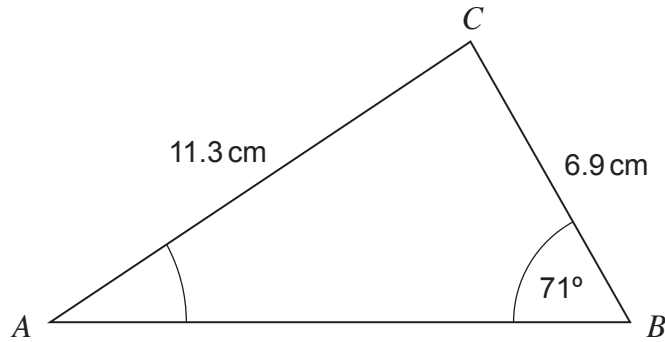
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(3 marks)



19 Work out the size of angle A.



Not drawn  
accurately

Give your answer to a suitable degree of accuracy.

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Answer ..... degrees (4 marks)

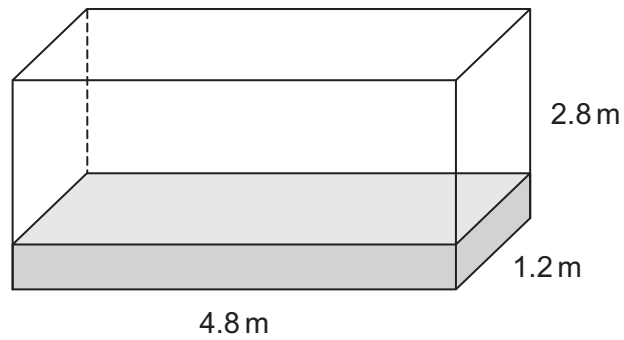
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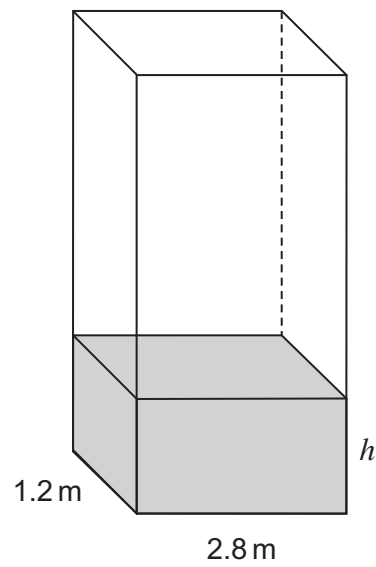
20

The measurements on this tank are exact.

Water is put in the tank to a height of 0.7 m **to the nearest tenth of a metre**.



The tank is now turned on its side as shown.



Work out the minimum height of water in the tank, marked,  $h$ .  
Give your answer to 1 decimal place.

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Answer ..... m (5 marks)

**Turn over for the next question**

5

**Turn over ►**



**\*21**  $n$  is an integer.

$$S = \frac{1}{2}n(n + 1)$$

Prove that  $8S + 1$  is an odd square number.

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(5 marks)





**22** Robin is firing arrows at a target.

The probability that he hits the target on his  $x^{\text{th}}$  attempt is  $\frac{x + 2}{x + 3}$

For example Probability (hit on his 5<sup>th</sup> attempt) =  $\frac{7}{8}$

**22 (a)** Work out the probability that he hits the target with both his 1<sup>st</sup> and 2<sup>nd</sup> attempts.

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Answer ..... (3 marks)

**22 (b)** Work out the probability that he hits the target **exactly** once on his first two attempts.

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Answer ..... (4 marks)

**END OF QUESTIONS**



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