

Centre Number									Candidate Number						
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For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
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18–19	
20–21	
TOTAL	



General Certificate of Secondary Education  
Higher Tier  
November 2011

# Mathematics (Specification A)

## 4306/1H

Paper 1 Non-calculator

# H

Wednesday 9 November 2011 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 must <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

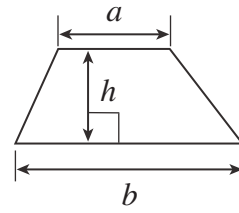
- In all calculations, show clearly how you work out your answer.



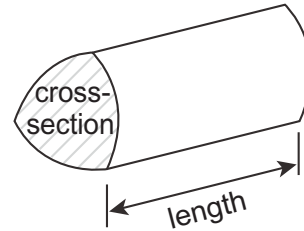
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### Formulae Sheet: Higher Tier

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

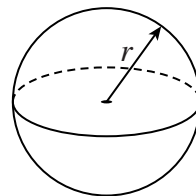


**Volume of prism** = area of cross-section  $\times$  length



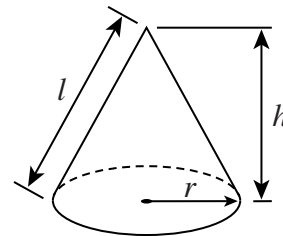
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

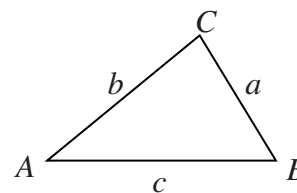


**In any triangle ABC**

**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

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

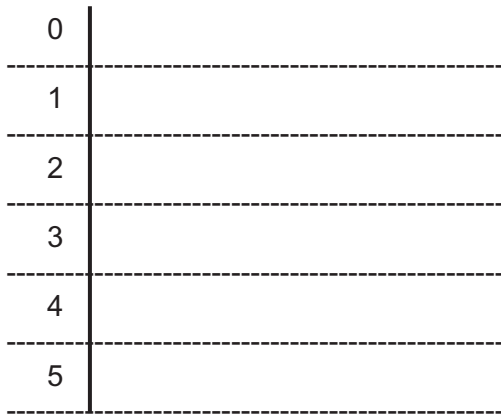


Answer **all** questions in the spaces provided.

**1** Twenty people recorded their journey times to work one morning. The times, in minutes, are

24 12 5 16 35 8 46 30 24 11  
38 18 20 43 16 51 9 12 13 22

**1 (a)** Complete an ordered stem-and-leaf diagram to represent this data. Remember to complete the key.



Key ..... | ..... represents ..... minutes

(3 marks)

**1 (b)** What is the median time for the journeys?

.....

Answer ..... minutes (1 mark)

**1 (c)** One person gave a time of 18 minutes when it should have been 28 minutes.

State the median time when this has been corrected.

.....

Answer ..... minutes (1 mark)

5

Turn over ►



2 Estimate the value of  $\frac{19.8^2}{4.7 \times 9.93}$

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Answer ..... (3 marks)

3 A box contains 7 apples, 11 yoghurts and some drinks.  
Two-thirds of the items are drinks.

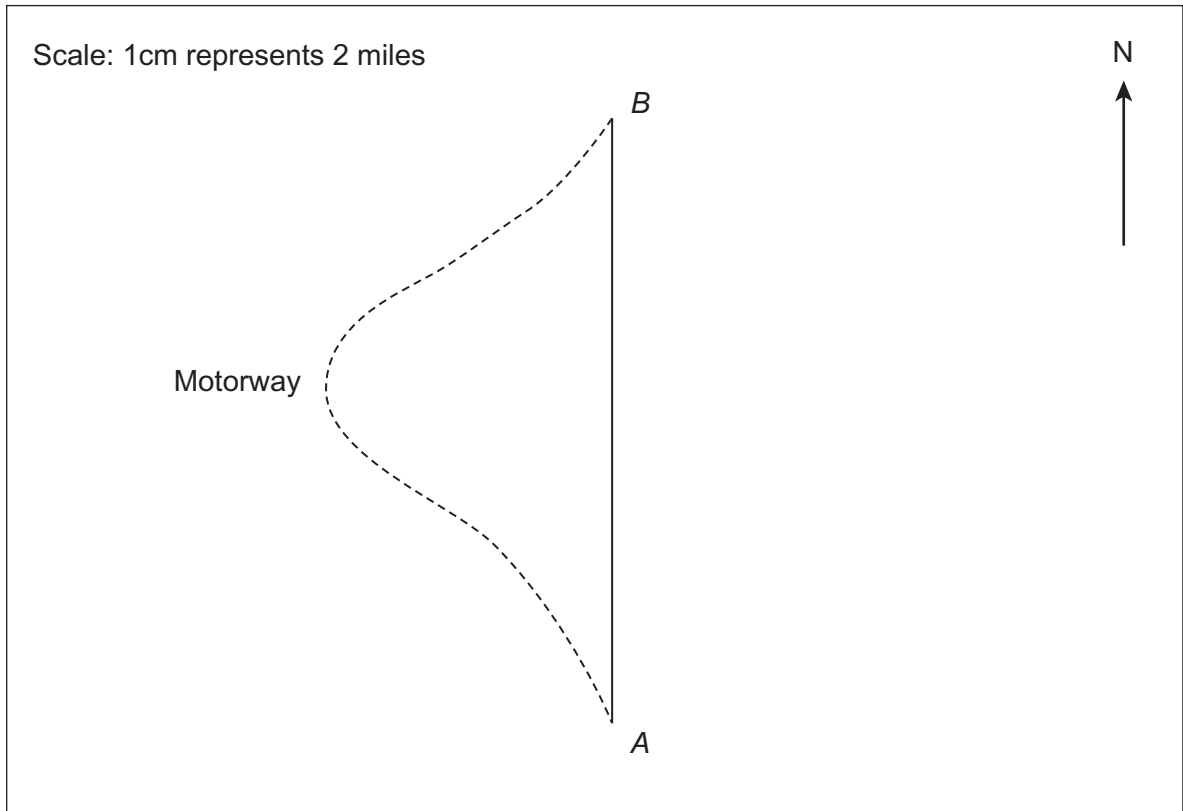
How many drinks are there?

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Answer ..... (3 marks)



- 4 An aeroplane flies due North from *A* to *B*.  
The distance from *A* to *B* on the motorway is 23 miles.



- 4 (a) How much further is it from *A* to *B* on the motorway than by aeroplane?

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Answer ..... miles (3 marks)

- 4 (b) *C* is 12 miles north-east of *A*.

- 4 (b) (i) Write down the three-figure bearing of *C* from *A*.

Answer ..... ° (1 mark)

- 4 (b) (ii) Mark with a cross the point *C* on the diagram.

(2 marks)

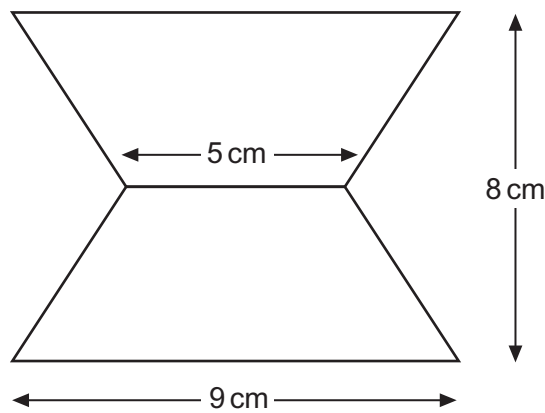


5 (a) Use  $\pi = 3.14$  to work out the area of a circle of radius 10 cm.  
State the units of your answer.

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Answer ..... (3 marks)

5 (b) The diagram shows a shape made from two identical trapezia.



Not drawn  
accurately

Work out the area of the shape.

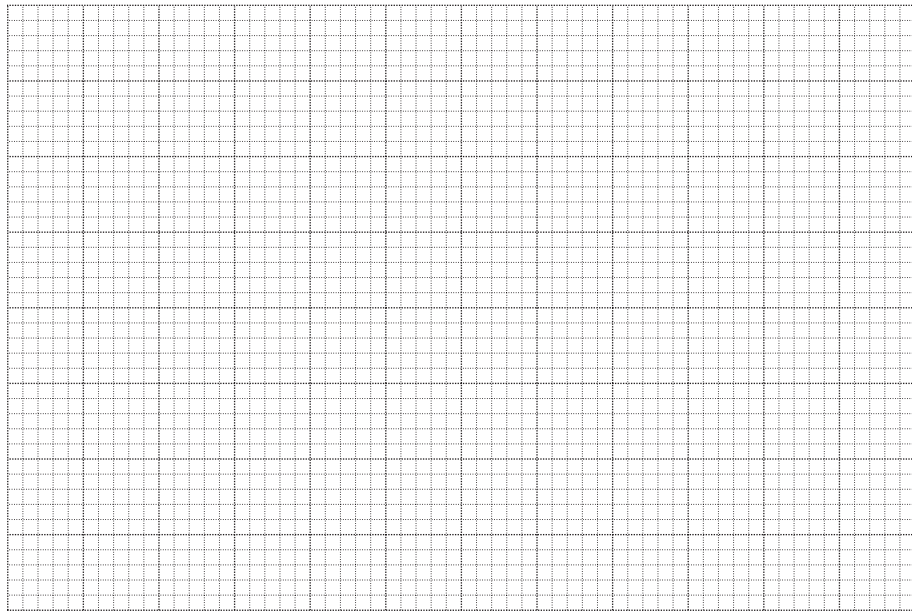
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Answer ..... (3 marks)



6 The line  $y = x - 1$  crosses the line  $y = 5$  at the point  $P$ .

Work out the coordinates of the point  $P$ .  
You may use the graph paper to help you.



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Answer ( ..... , ..... ) (3 marks)

7 Here is a sequence.

1            5            9            13            17            .....

7 (a) Work out an expression for the  $n^{\text{th}}$  term of the sequence.

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Answer ..... (2 marks)

7 (b) How many terms of this sequence are less than 300?

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Answer ..... (2 marks)



**8 (a)** Solve  $4(3w - 7) = 32$

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

**8 (b)** Solve  $\frac{26-y}{5} = 4$

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Answer  $y =$  ..... (2 marks)

**8 (c)** Work out the smallest integer value of  $t$  that satisfies the inequality  $4t + 1 > 25$

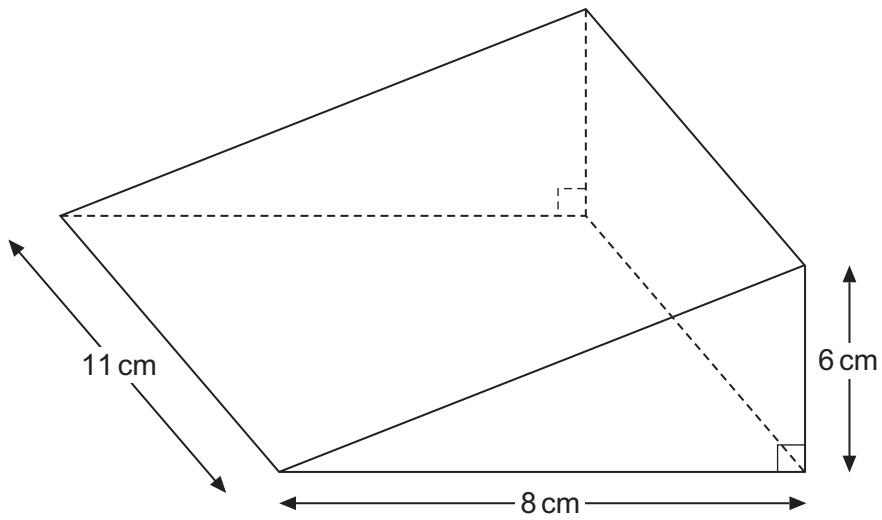
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Answer ..... (3 marks)





9 The diagram shows a solid triangular prism made of wood.



The density of the wood is 0.5 grams per  $\text{cm}^3$ .

Work out the mass of the prism.

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Answer ..... grams (4 marks)

Turn over for the next question



**10 (a)** The table shows information about the times taken by a group of 50 girls to complete a challenge.

Time taken, $t$ (minutes)	Frequency		
$0 < t \leq 10$	6		
$10 < t \leq 20$	10		
$20 < t \leq 30$	20		
$30 < t \leq 40$	8		
$40 < t \leq 50$	6		

Calculate an estimate of the mean time taken for the girls to complete the challenge.

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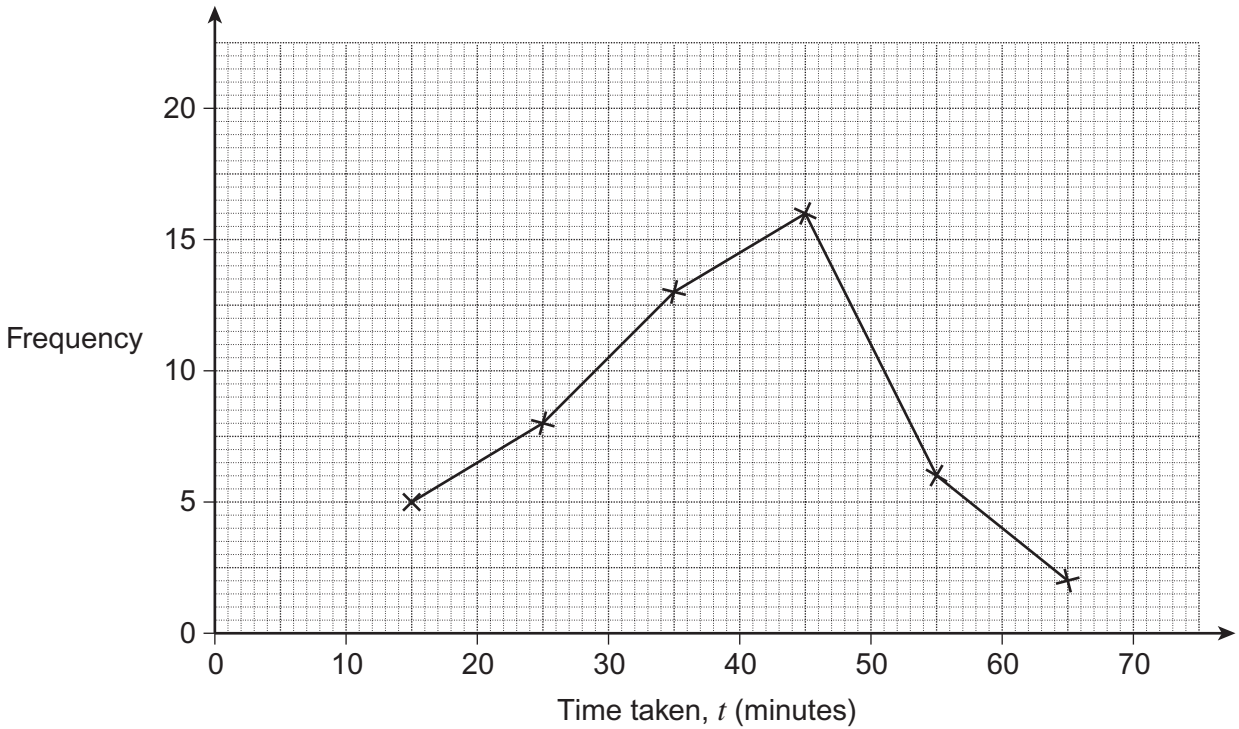
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Answer ..... minutes (4 marks)



10 (b) The frequency polygon shows the times taken by a group of 50 boys to complete the same challenge.



10 (b) (i) On the same grid, draw a frequency polygon to show the times taken by the girls to complete the challenge. (2 marks)

10 (b) (ii) Make **two** comments to compare the times taken by the boys and the times taken by the girls to complete the challenge.

Comment 1 .....

.....

Comment 2 .....

..... (2 marks)



11 Amy and Jo are buying pens and rulers.

Amy buys three pens and two rulers for 75p.

Jo buys four pens and one ruler for 65p.

Work out the cost of a pen and the cost of a ruler.

You **must** show your working.

Do **not** use trial and improvement.

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Answer Cost of a pen = ..... p, Cost of a ruler = ..... p (4 marks)



**12** The distance of Mars from the Sun is approximately  $2.4 \times 10^{11}$  metres.  
 Light from the Sun travels at  $3 \times 10^8$  metres per second.  
 Approximately how long, **in minutes**, does it take light from the Sun to reach Mars?

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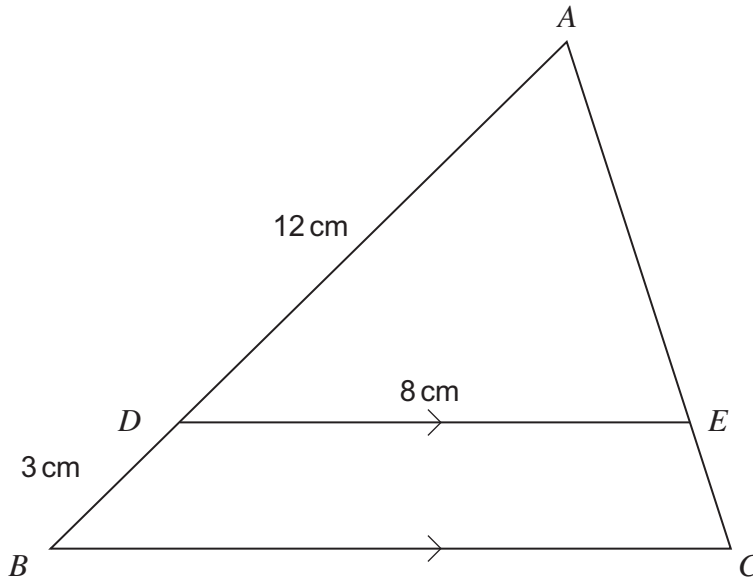
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Answer ..... minutes (3 marks)

**13** *ABC* is a triangle.  
*BC* is parallel to *DE*.  
*AD* = 12 cm, *DB* = 3 cm and *DE* = 8 cm.



Not drawn accurately

Work out the length of *BC*.

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Answer ..... cm (3 marks)

10
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Turn over ►



**14** Here are six equations of straight lines.

A  $y = 3x + 2$

B  $y = 2x + 3$

C  $2x + 3y = 6$

D  $3x + 2y = 6$

E  $x = 3y + 2$

F  $x = 2y + 3$

**14 (a)** Which lines pass through the point (0, 3)?

Answer ..... (2 marks)

**14 (b)** Which line has gradient 3?

Answer ..... (1 mark)

**14 (c)** Which line has gradient  $-\frac{2}{3}$ ?

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Answer ..... (1 mark)

**14 (d)** Which lines pass through the point (5, 1)?

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Answer ..... (2 marks)



15 (a) Simplify fully  $5m^6t^2 \times m^3t^5$

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Answer ..... (2 marks)

15 (b) (i) Make  $y$  the subject of  $x = \frac{1 - 2y}{y - 6}$

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Answer ..... (4 marks)

15 (b) (ii) Given that  $x = \frac{1 - 2y}{y - 6}$

work out the value of  $y$  when  $x = -1$

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Answer ..... (2 marks)



**16 (a)** Write down the value of  $11^0$

Answer ..... (1 mark)

**16 (b)** Work out  $1000^{\frac{2}{3}}$

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Answer ..... (2 marks)

**16 (c)** Work out  $2^{-1} \times 64^{0.5}$

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Answer ..... (2 marks)







18

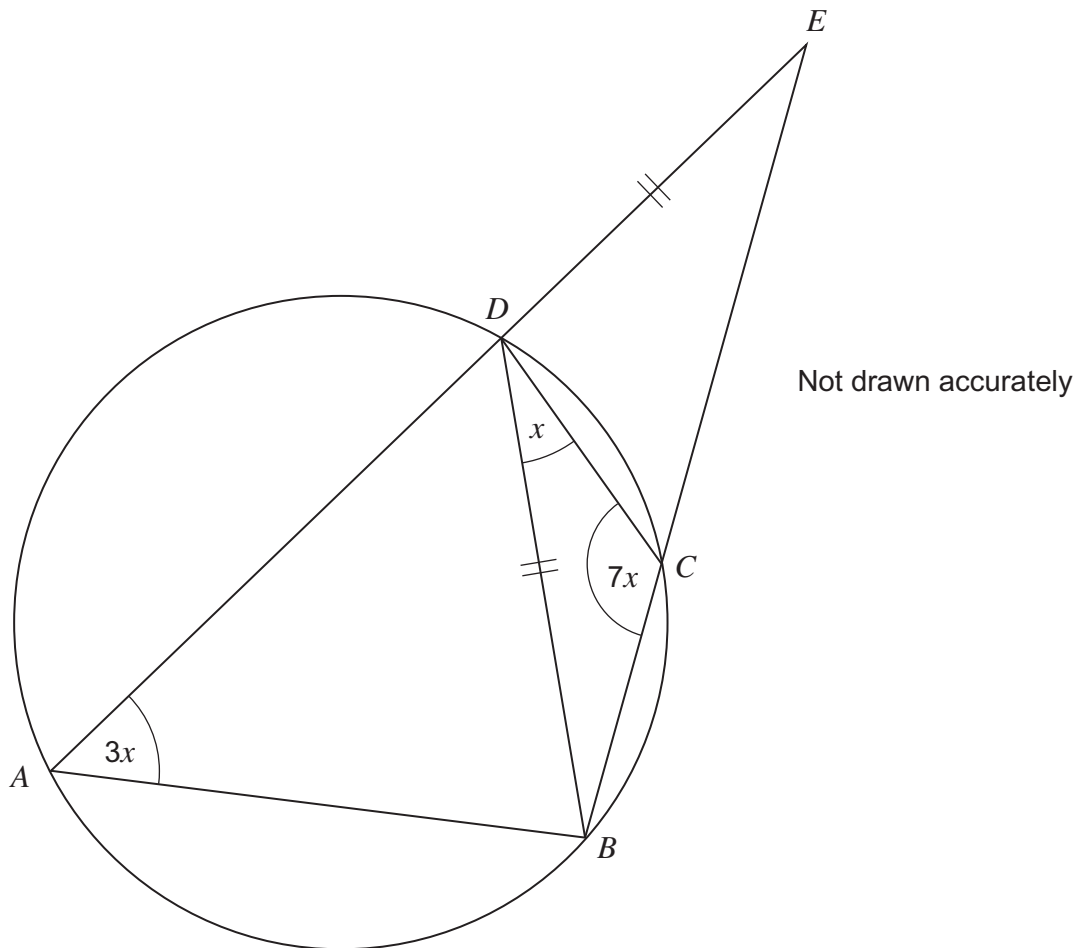
The diagram shows a cyclic quadrilateral  $ABCD$ .  
The straight lines  $AD$  and  $BC$  are extended and meet at  $E$ .

$$DB = DE$$

$$\text{Angle } BAD = 3x$$

$$\text{Angle } BCD = 7x$$

$$\text{Angle } BDC = x$$





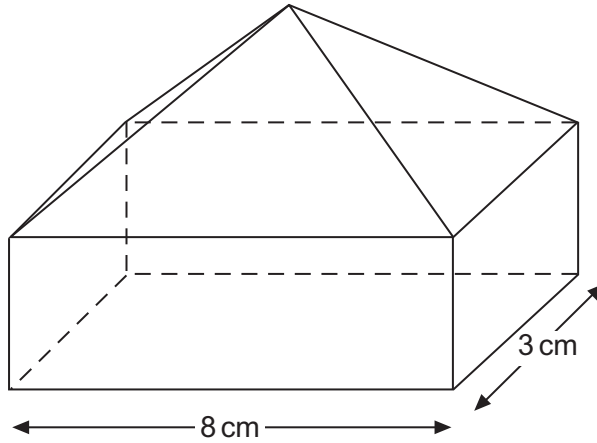
19

The diagram shows a shape made from a cuboid and a pyramid.  
The cuboid and the pyramid have the same height.

The length of the cuboid is 8 cm.  
The width of the cuboid is 3 cm.

The total volume of the shape is  $160 \text{ cm}^3$ .

Not drawn  
accurately



You are given

$$\text{Volume of a pyramid} = \frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$$

Work out the height of the shape.

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Answer ..... cm (5 marks)



20 (a)  $(\sqrt{50x} + \sqrt{2x})^2 = kx$  where  $k$  is an integer.

Work out the value of  $k$ .  
You **must** show your working.

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Answer ..... (4 marks)

20 (b) Hence, or otherwise, work out the value of  $(\sqrt{150} + \sqrt{6})^2$

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Answer ..... (2 marks)

**END OF QUESTIONS**



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