

Surname	Centre Number	Candidate Number
Other Names		0



**GCSE**

4353/02



S16-4353-02

**MATHEMATICS (UNITISED SCHEME)  
UNIT 3: Calculator-Allowed Mathematics  
HIGHER TIER**

A.M. TUESDAY, 14 June 2016

1 hour 45 minutes

**ADDITIONAL MATERIALS**

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

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

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

Take  $\pi$  as 3.14 or use the  $\pi$  button on your calculator.

**INFORMATION FOR CANDIDATES**

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question 7(a).

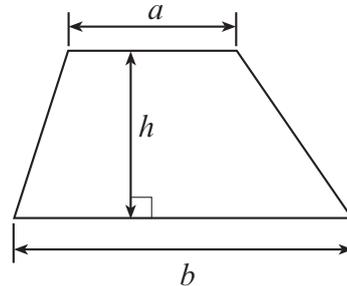
For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	3	
2.	4	
3.	4	
4.	2	
5.	5	
6.	5	
7.	10	
8.	5	
9.	2	
10.	3	
11.	4	
12.	4	
13.	8	
14.	3	
15.	2	
16.	6	
17.	3	
18.	6	
19.	7	
20.	4	
<b>Total</b>	<b>90</b>	



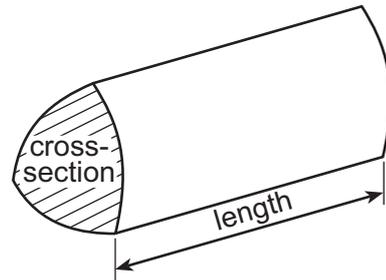
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## Formula List

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

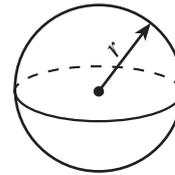


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



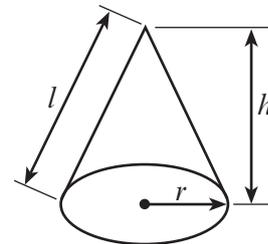
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

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

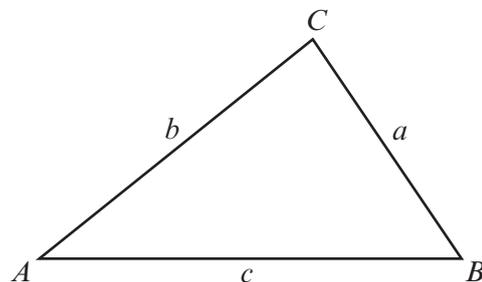


In any triangle  $ABC$

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

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

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



### The Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$  are given by

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



1. (a) Factorise  $8x + 6y$ . [1]

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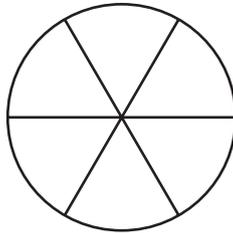
- (b) Evaluate  $\sqrt[3]{\left(\frac{9.8}{3.1-1.7}\right)^2}$ . Give your answer correct to 2 decimal places. [2]

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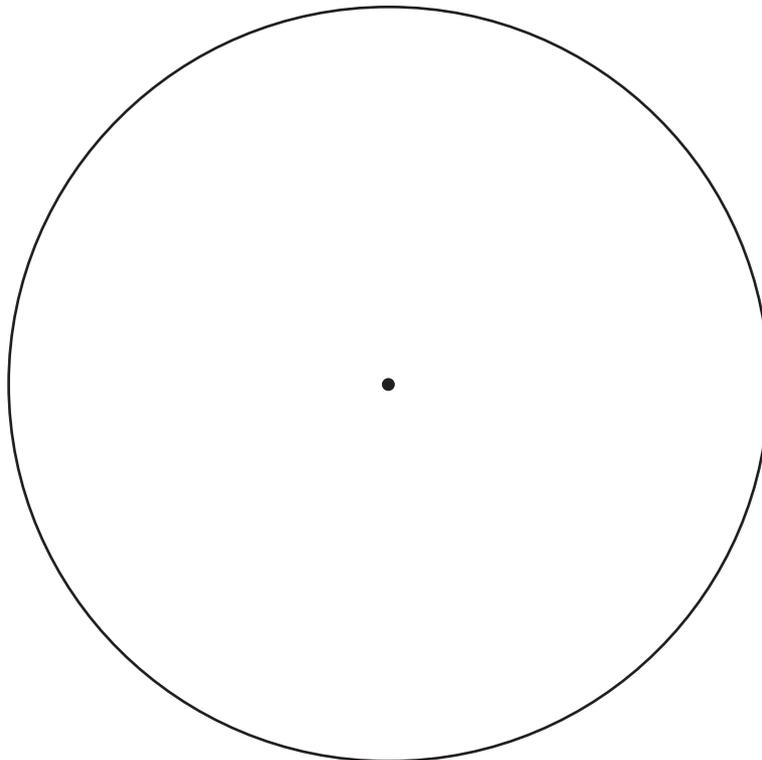
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2. A company's logo consists of a circle split into 6 equal sectors as shown in the diagram below.



A version of the logo with the circle of radius 5 cm is to be put on the packaging of some of the company's products.

Using a ruler and compasses only, construct an accurate diagram of this version of the logo. You must show your construction arcs. [4]

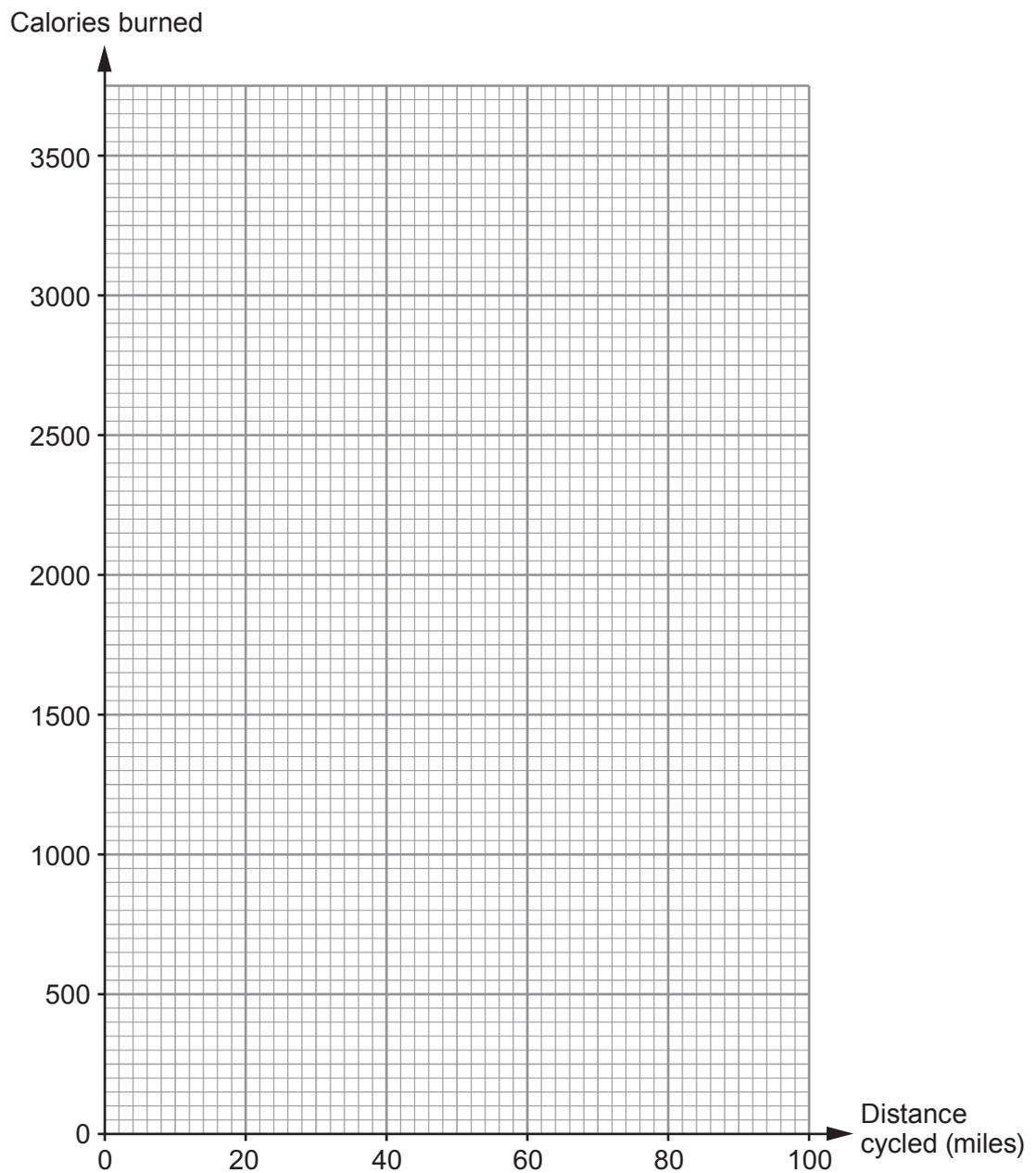


3. A cyclist used an App on his mobile phone to record the distance he cycled and the calories he burned, on each of his last six rides. His results are shown in the table below.

Distance cycled (miles)	60	28	86	52	24	76
Calories burned	2100	1500	3500	2500	800	3000

- (a) Draw a scatter diagram of this data.

[2]



(b) What type of correlation is shown in the scatter diagram? [1]

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(c) Give a possible reason why the cyclist burned fewer calories on the 60 mile ride than he did on the 52 mile ride. [1]

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4. Jamal has a number of 3 kg bags of potatoes and a different number of 8 kg bags of potatoes. The mean weight of the bags of potatoes is 6 kg. What is the least number of 3 kg and 8 kg bags of potatoes that Jamal has? [2]

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Jamal has ..... 3 kg bags and ..... 8 kg bags

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5. Emrys drove to visit his sister who lives 240 miles away from him. He set out at 9 a.m., travelling the first 110 miles at an average speed of 50 mph. After travelling 110 miles, Emrys stopped for a break. At 12 p.m. he continued on his way, arriving at his sister's house at 3 p.m.

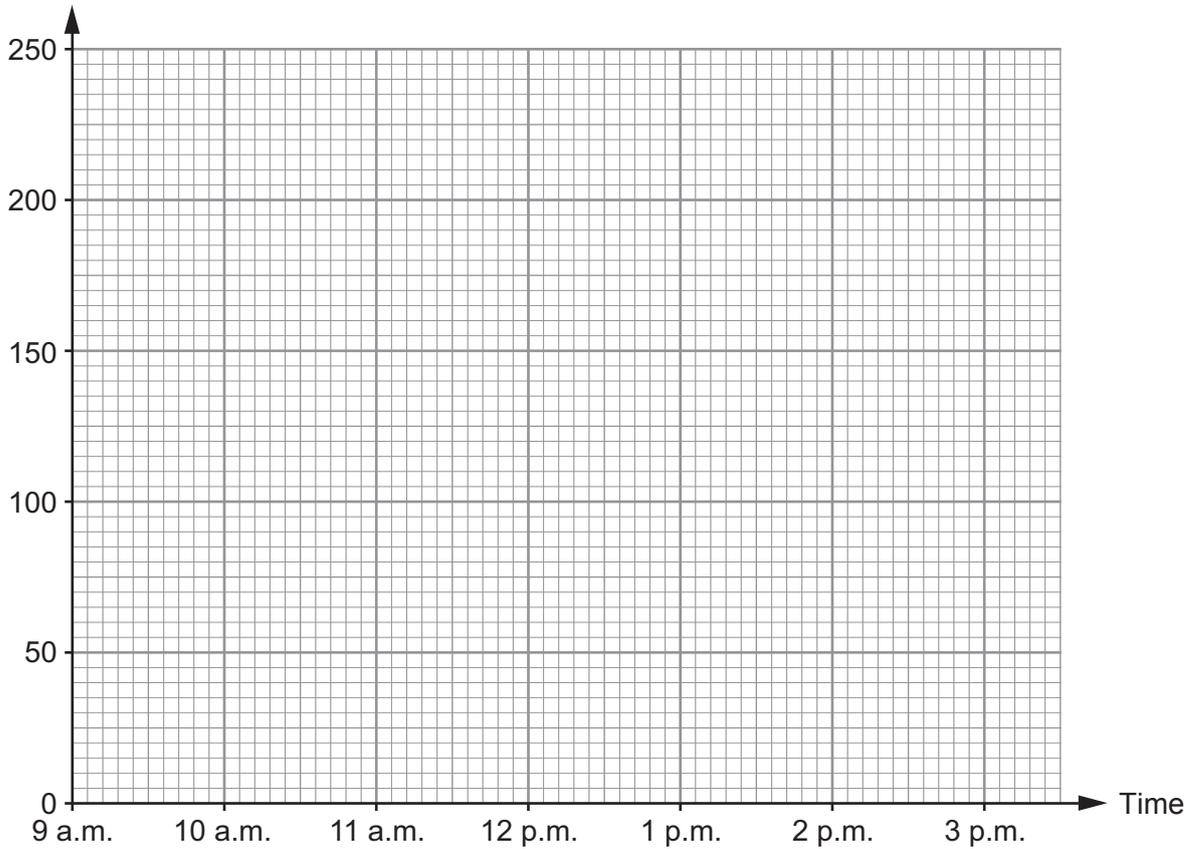
(a) Use the information above to draw a distance-time graph of Emrys's journey. [3]

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Distance from Emrys's house (miles)



(b) Calculate Emrys's average speed, in mph, between 9 a.m. and 3 p.m. [2]

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6. (a) Solve the equation  $\frac{x+5}{6} = 3$  .

[2]

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(b) Solve the equation  $5(2x - 3) - 8x = 10$ .

[3]

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8. Catherine had a stall at a charity event to raise money for two local charities.

(a) Catherine made a fruit juice drink to sell at her stall.  
 She started by thoroughly mixing 200 ml of lime juice with 300 ml of cranberry juice.  
 Catherine drank 100 ml of the mixture to test its taste, and decided it was too bitter.  
 She then mixed in 400 ml of lemonade, and decided that she was happy with this new mixture.  
 Write down the ratio of lime juice to cranberry juice to lemonade for Catherine's new fruit juice drink. [3]

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lime juice : cranberry juice : lemonade

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(b) Catherine made a profit of £84.80 from selling her fruit juice drink at the charity event.  
 She decided to share the money between the charities in the ratio 5 : 3.  
 Calculate the amount of money she gave to each of the two charities. [2]

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9. A regular polygon has exterior angles of  $24^\circ$ .  
 How many sides does the regular polygon have? [2]

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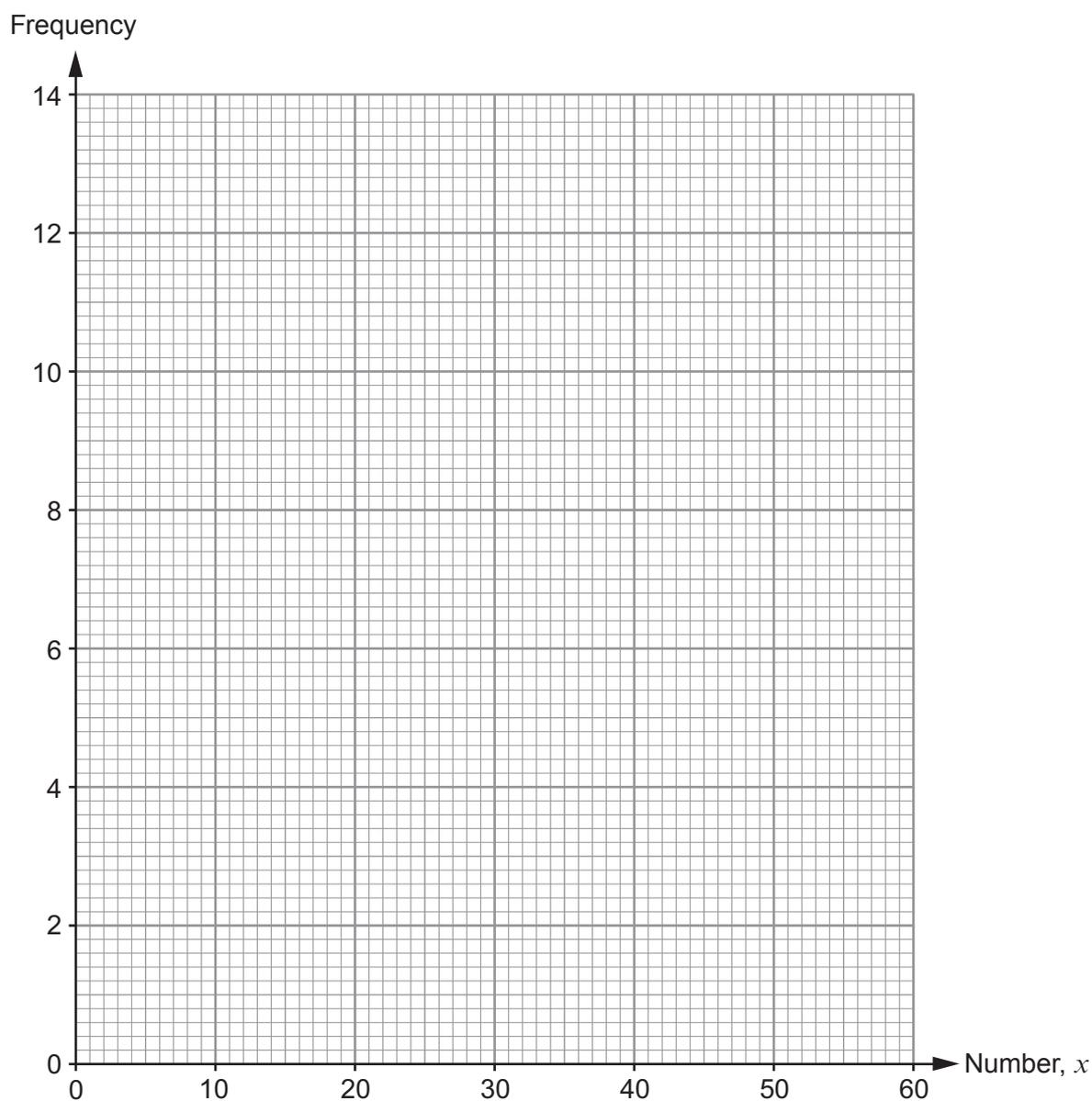


10. A list of 50 numbers has been summarised in the grouped frequency table below.

Number, $x$	Frequency
$0 \leq x < 10$	3
$10 \leq x < 20$	5
$20 \leq x < 30$	9
$30 \leq x < 40$	13
$40 \leq x < 50$	12
$50 \leq x < 60$	8

(a) Draw a frequency polygon to show this data.

[2]



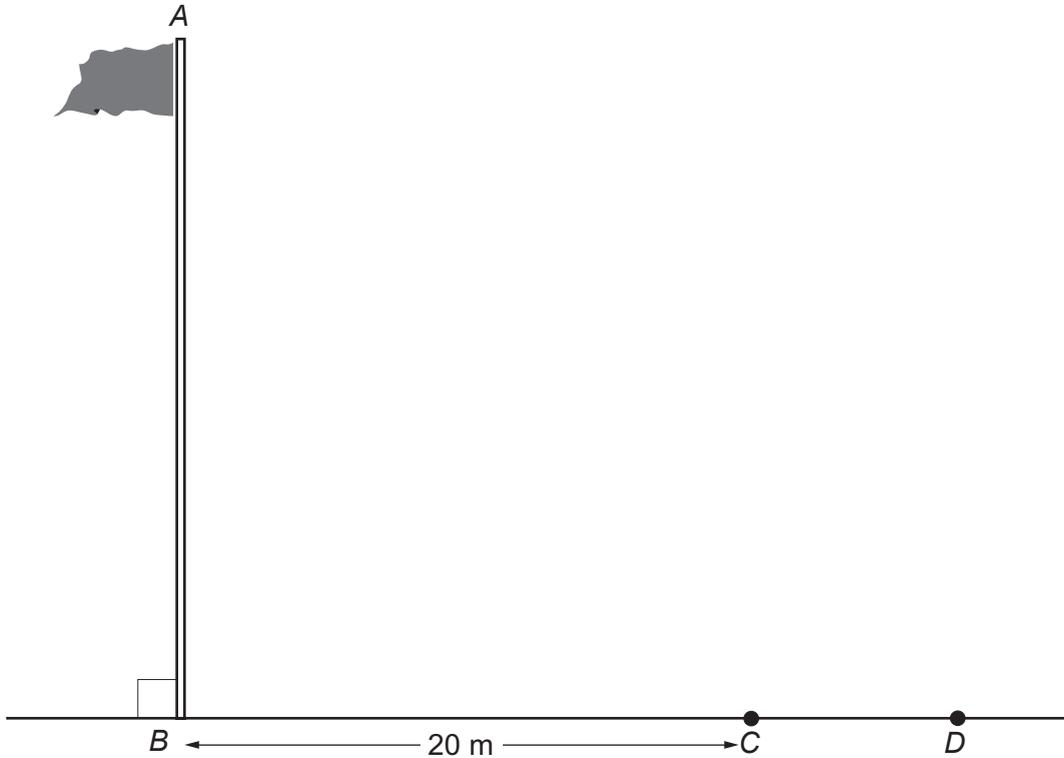
(b) Write down the group that contains the median.

[1]

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11. A vertical flagpole,  $AB$ , is of height 40 m.  
 The points  $B$ ,  $C$  and  $D$  lie on level ground, and  $BCD$  is a straight line.  
 Point  $C$  is 20 m from the base of the flagpole.  
 The angle of elevation of the top of the flagpole from point  $D$  is  $51^\circ$ .



*Diagram not drawn to scale*

How far apart are points  $C$  and  $D$ ?

[4]

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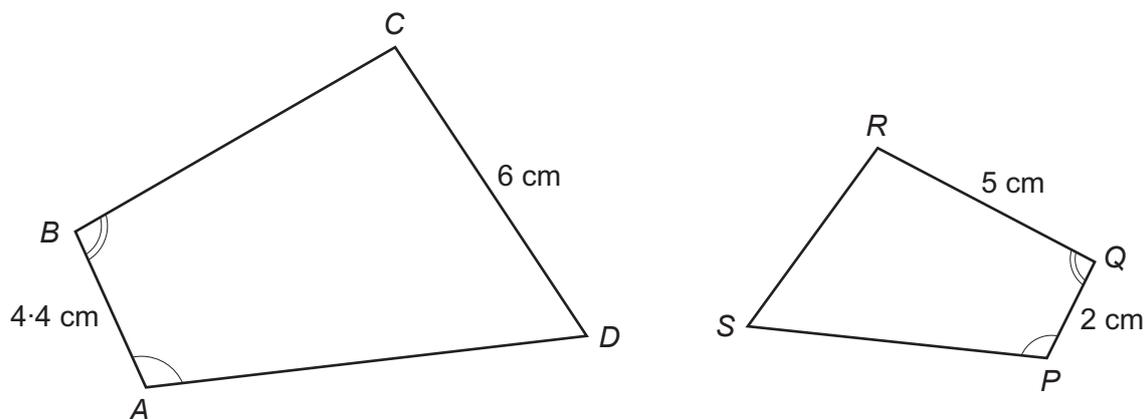
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12. The diagram shows two similar quadrilaterals,  $ABCD$  and  $PQRS$ .



*Diagrams not drawn to scale*

(a) Calculate the length  $BC$ .

[2]

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(b) Calculate the length  $RS$ .

[2]

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13. A right-angled triangle is shown below.

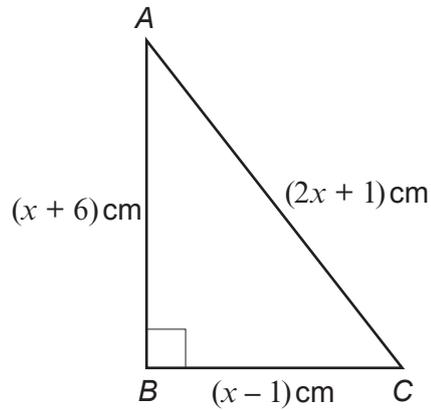


Diagram not drawn to scale

(a) Show that  $x^2 - 3x - 18 = 0$ .

[4]

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(b) Factorise the expression  $x^2 - 3x - 18$ , and hence solve the equation  $x^2 - 3x - 18 = 0$ . Write down the lengths of the sides of the right-angled triangle.

[4]

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$AB =$  ..... cm     $AC =$  ..... cm     $BC =$  ..... cm



14. At an average speed of 80 km/h, it would take approximately 90 years to travel over the entire road network of the world.  
Use this information to calculate the approximate length of the road network of the world in kilometres.  
Give your answer in standard form, correct to 2 significant figures. [3]

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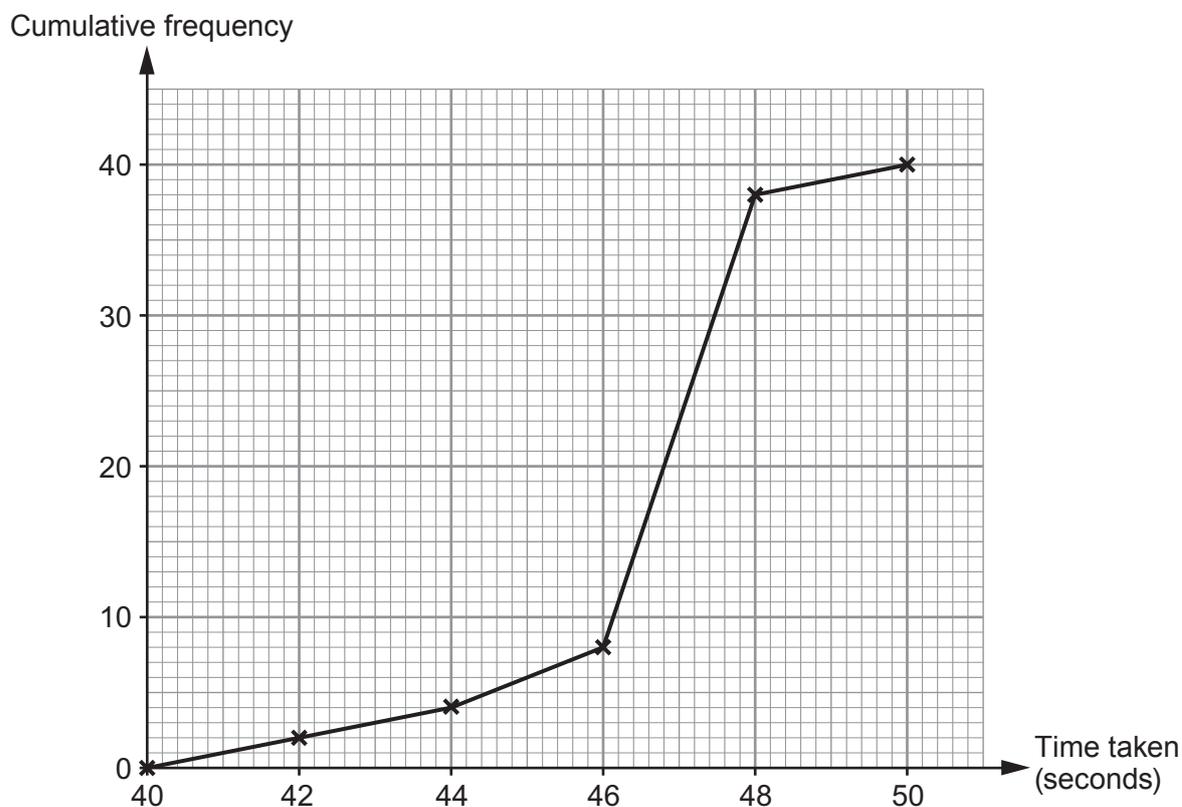
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15. At the start of a new football season, a coach recorded the times taken by the 40 players in his squad to carry out a fitness drill. He grouped the times taken by the 40 players and drew the cumulative frequency diagram shown below.



- (a) What was the median time taken to complete the fitness drill? [1]

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- (b) The coach sets a target over the next week to get the median time for the fitness drill down to 46 seconds. Of the players who took more than 46 seconds, how many need to improve their times to 46 seconds or under, so that the median time would be 46 seconds? [1]

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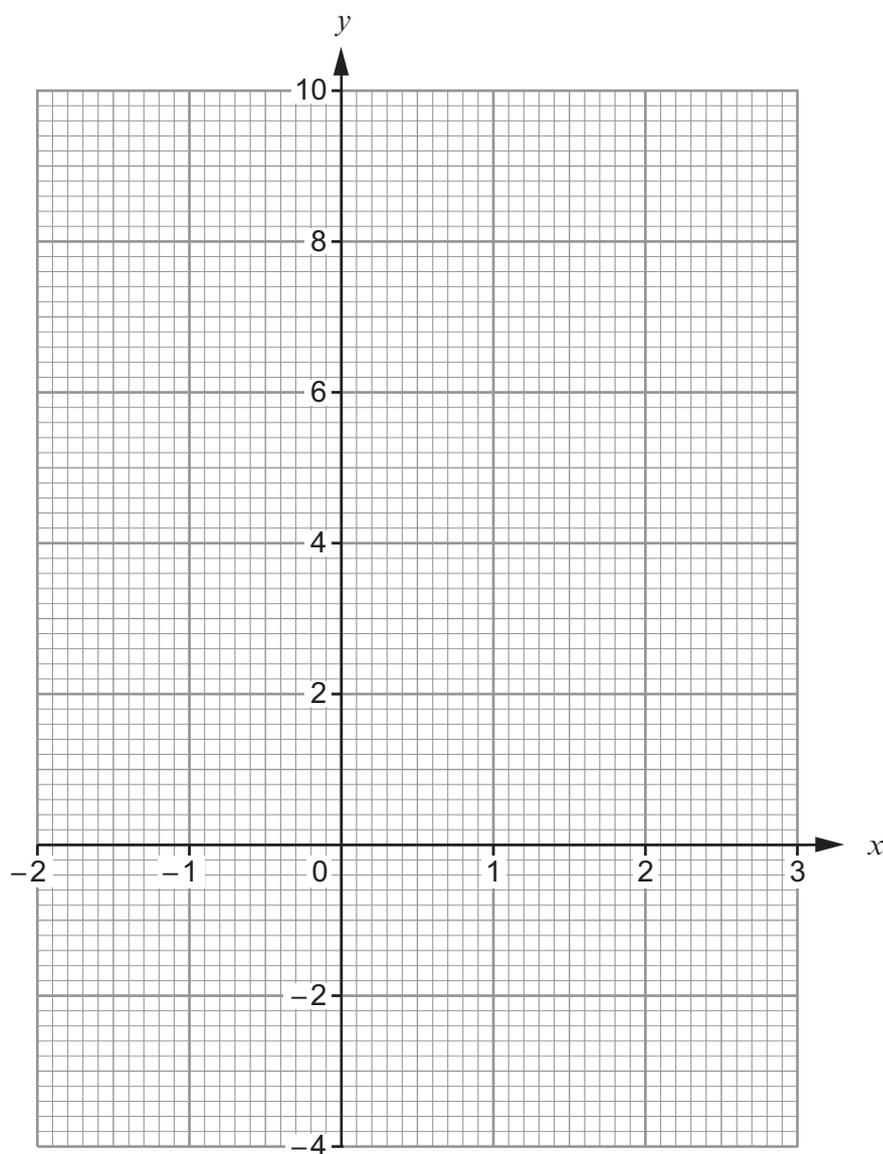
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16. (a) Complete the table below that shows some of the values of  $y = x^2 - 2x - 2$ , for values of  $x$  from  $-2$  to  $3$ . [1]

$x$	$-2$	$-1$	$0$	$1$	$2$	$3$
$y = x^2 - 2x - 2$	.....	$1$	$-2$	$-3$	$-2$	$1$

- (b) On the graph paper below, draw the graph of  $y = x^2 - 2x - 2$ , for values of  $x$  from  $-2$  to  $3$ . [2]



(c) By drawing an appropriate line, solve the quadratic equation  $x^2 - 2x - 2 = -x + 1$ . [3]

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17. Solve the quadratic equation  $5x^2 - 10x + 3 = 0$ , giving your answers correct to 2 decimal places. [3]

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18. It is known that  $y$  is inversely proportional to  $x^3$ , and  $y = 2$  when  $x = 2$ .

(a) Find an expression for  $y$  in terms of  $x$ .

[3]

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(b) Calculate  $y$  when  $x = -4$ .

[1]

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(c) Calculate  $x$  when  $y = 0.016$ .

[2]

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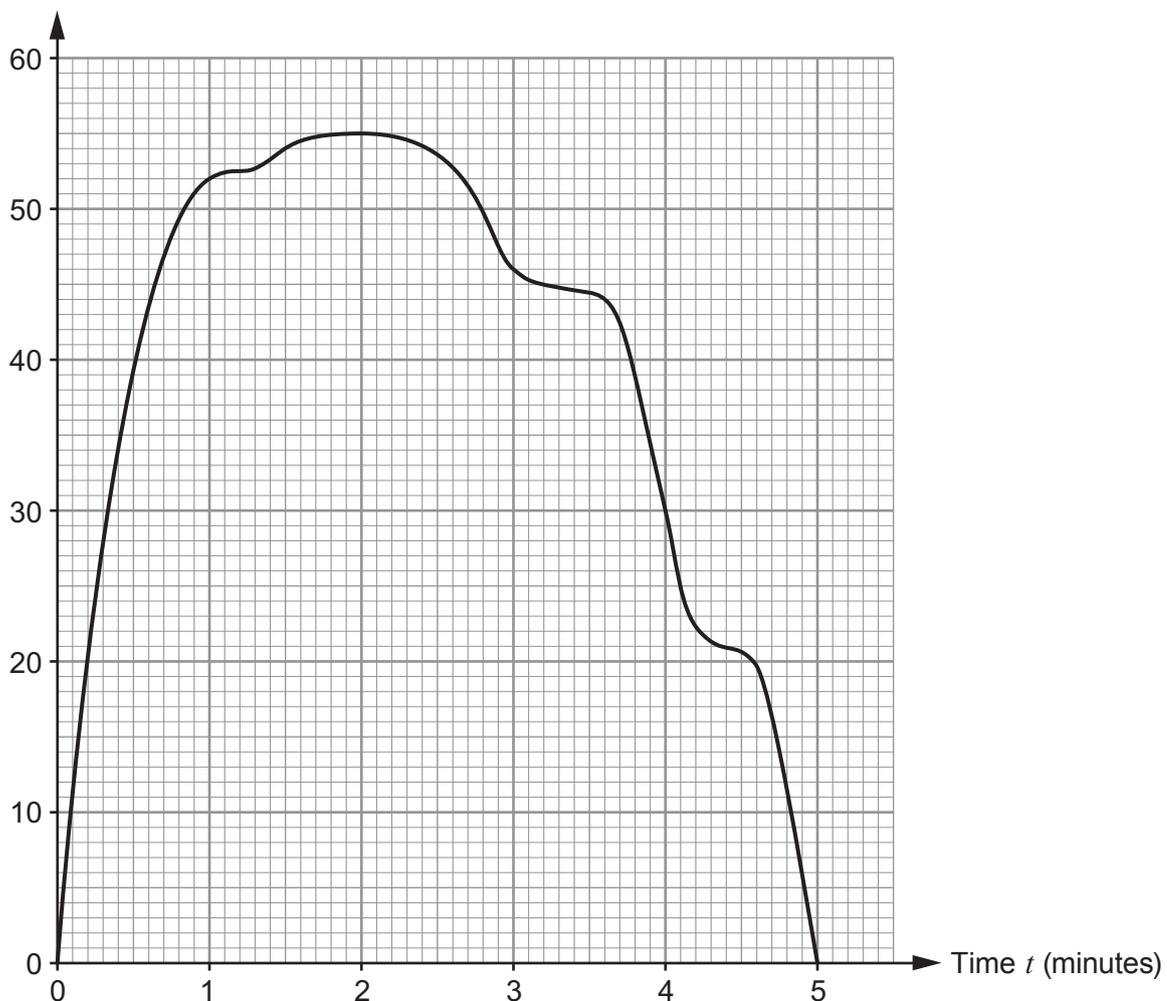
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20. An empty tank is to be filled with water.  
The graph below shows the rate of flow of water through a pipe during the controlled filling of the tank.  
After 5 minutes the tank is full and the water is turned off.

Rate of flow (litres per minute)



Using the ordinates  $t = 0$ ,  $t = 1$ ,  $t = 2$ ,  $t = 3$ ,  $t = 4$  and  $t = 5$ , estimate the volume of water in the tank when it is full. State the units of your answer. [4]

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