

Candidate Name	Centre Number	Candidate Number
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**GCSE**

185/09

**MATHEMATICS**

**HIGHER TIER**

**PAPER 1**

A.M. THURSDAY, 5 November 2009

2 hours

**CALCULATORS ARE  
NOT TO BE USED  
FOR THIS PAPER**

**INSTRUCTIONS TO CANDIDATES**

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.

Take  $\pi$  as 3.14.

**INFORMATION FOR CANDIDATES**

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

Unless stated, diagrams are not drawn to scale.

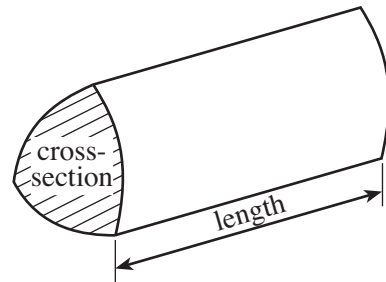
Scale drawing solutions will not be acceptable where you are asked to calculate.

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

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

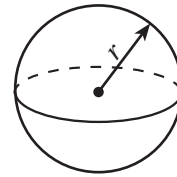
### Formula List

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



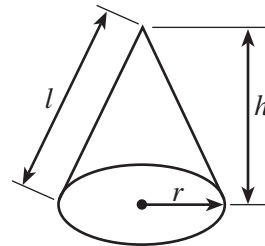
**Volume of sphere** =  $\frac{4}{3} \pi r^3$

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



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

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

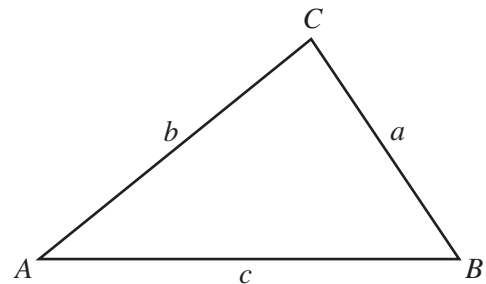


**In any triangle ABC**

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

**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

**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

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

### Standard Deviation

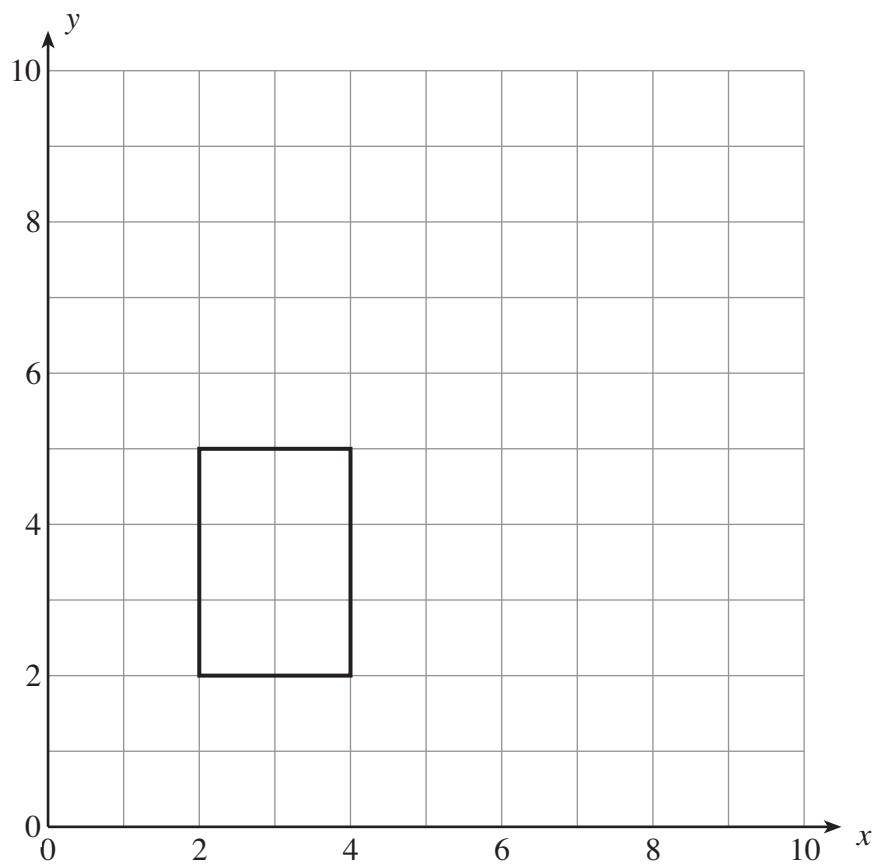
Standard deviation for a set of numbers

$x_1, x_2, \dots, x_n$ , having a mean of  $\bar{x}$  is given by

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad \text{or} \quad s = \sqrt{\frac{\sum x^2}{n} - \left\{ \frac{\sum x}{n} \right\}^2}$$

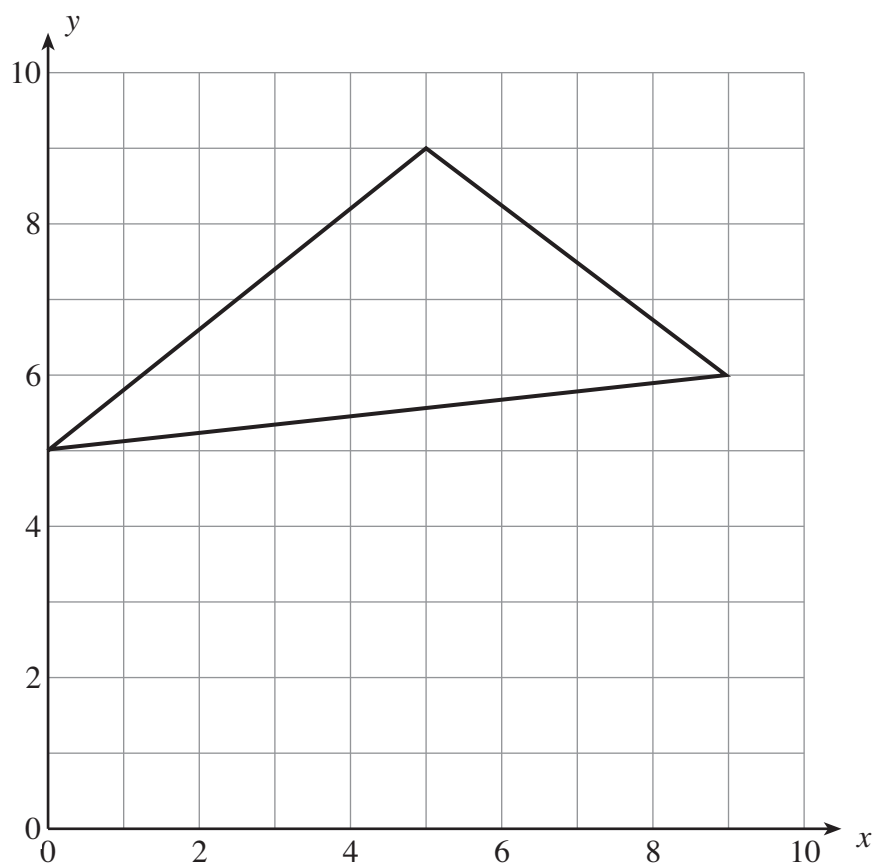
1. (a) Translate the rectangle shown 5 units to the right and 3 units up.

[1]

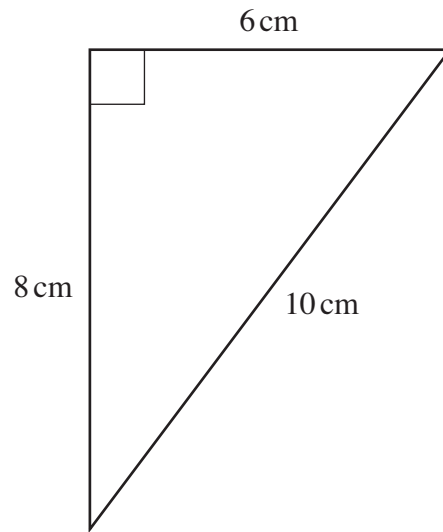


- (b) Draw the reflection of the triangle shown in the line  $y = 5$ .

[2]

**Turn over.**

2. (a) Calculate the area of the following triangle, stating the units of your answer.



*Diagram not drawn to scale.*

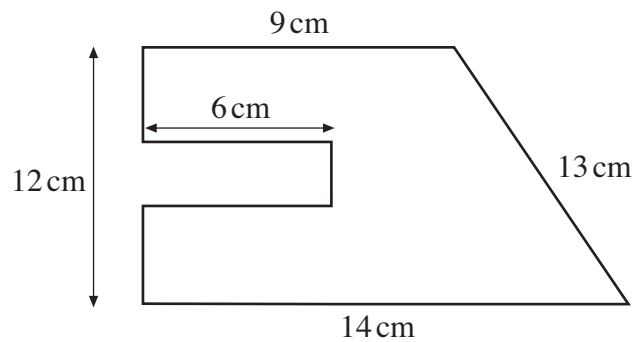
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[3]

- (b) Calculate the perimeter of the shape shown in the diagram below.



*Diagram not drawn to scale.*

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[2]

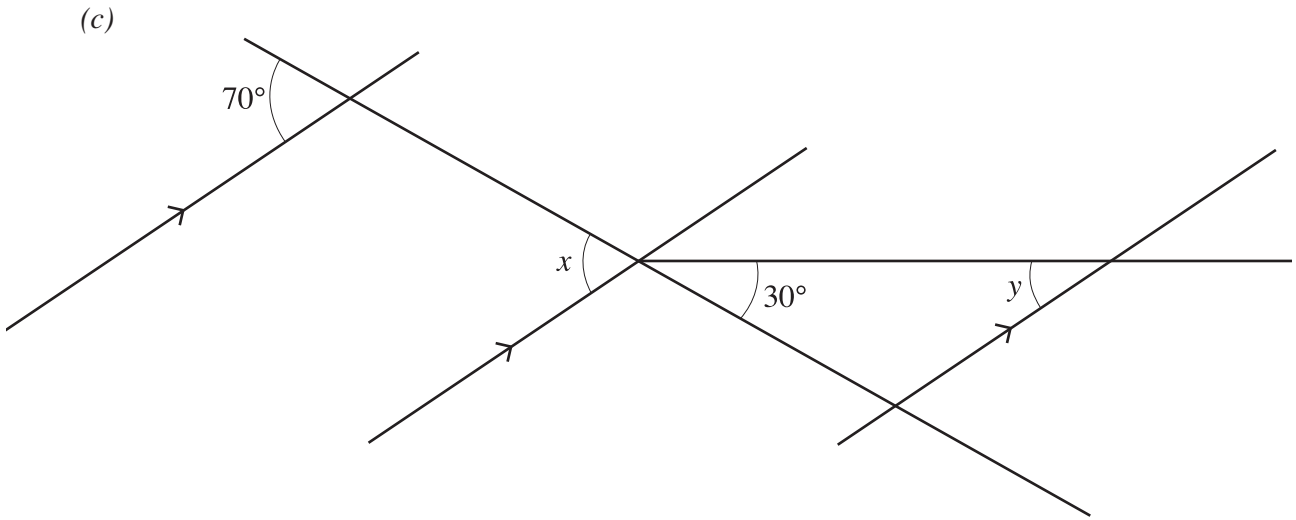


Diagram not drawn to scale.

Find the sizes of the angles marked  $x$  and  $y$ .

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$x = \dots\dots\dots^\circ$        $y = \dots\dots\dots^\circ$

[3]

3. Five numbers have a median of 9, a mode of 10, a range of 5 and mean of 8.  
Find the five numbers.  
Write your numbers in order in the boxes.

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[4]

4. (a) Solve  $\frac{x}{4} = 20$ .

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[1]

- (b) Factorise  $y^2 - 4y$ .

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[1]

- (c) Solve  $5x + 2 = 6 - 3x$ .

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[3]

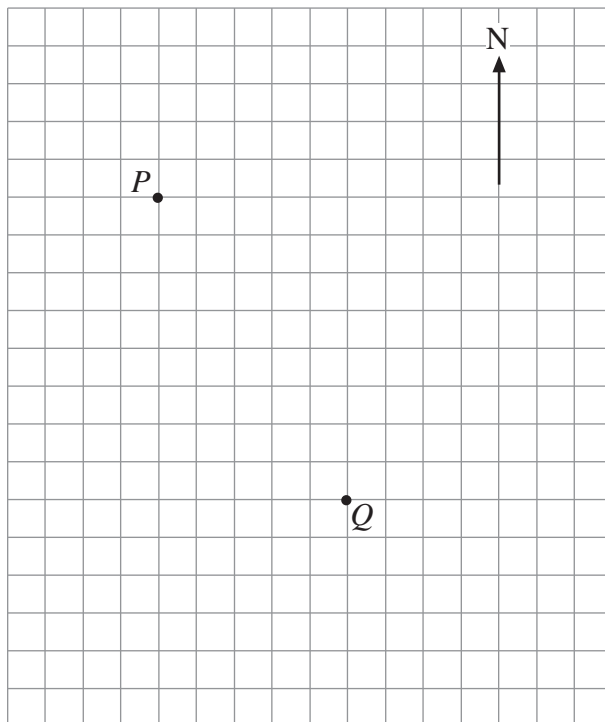
- (d) Expand  $x(5x^2 + 6)$ .

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[2]

5. (a) The points  $P$  and  $Q$  on the grid represent two towns.



- (i) Find the bearing of  $P$  from  $Q$ .

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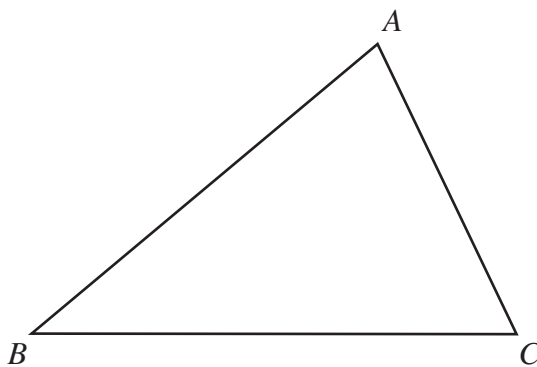
- (ii) Another town,  $R$ , is on a bearing  $270^\circ$  from  $Q$  and  $180^\circ$  from  $P$ . Mark  $R$  on the grid.

[3]

- (b) Find and shade the region of points inside triangle  $ABC$  that satisfy both the following conditions.

- (i) The points are nearer to  $BC$  than to  $AB$ .  
 (ii) The points are less than 5 cm from  $B$ .

[3]



6. (a) Estimate the value of  $\sqrt{902}$ .

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[1]

- (b) Write down the square number which is closest to 90.

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[1]

- (c) Estimate the value of  $\frac{39 \times 403}{79}$ .

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[2]

- (d) What is half of a quarter?

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[1]



7. (a) Solve  $\frac{x+5}{3} = 14$ .

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(b) Simplify  $5(2y+3) - 2(4y-7)$ .

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(c) Make  $g$  the subject of the formula  $t = 5g - 8$ .

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8. (a) Share £600 in the ratio 3 : 2.

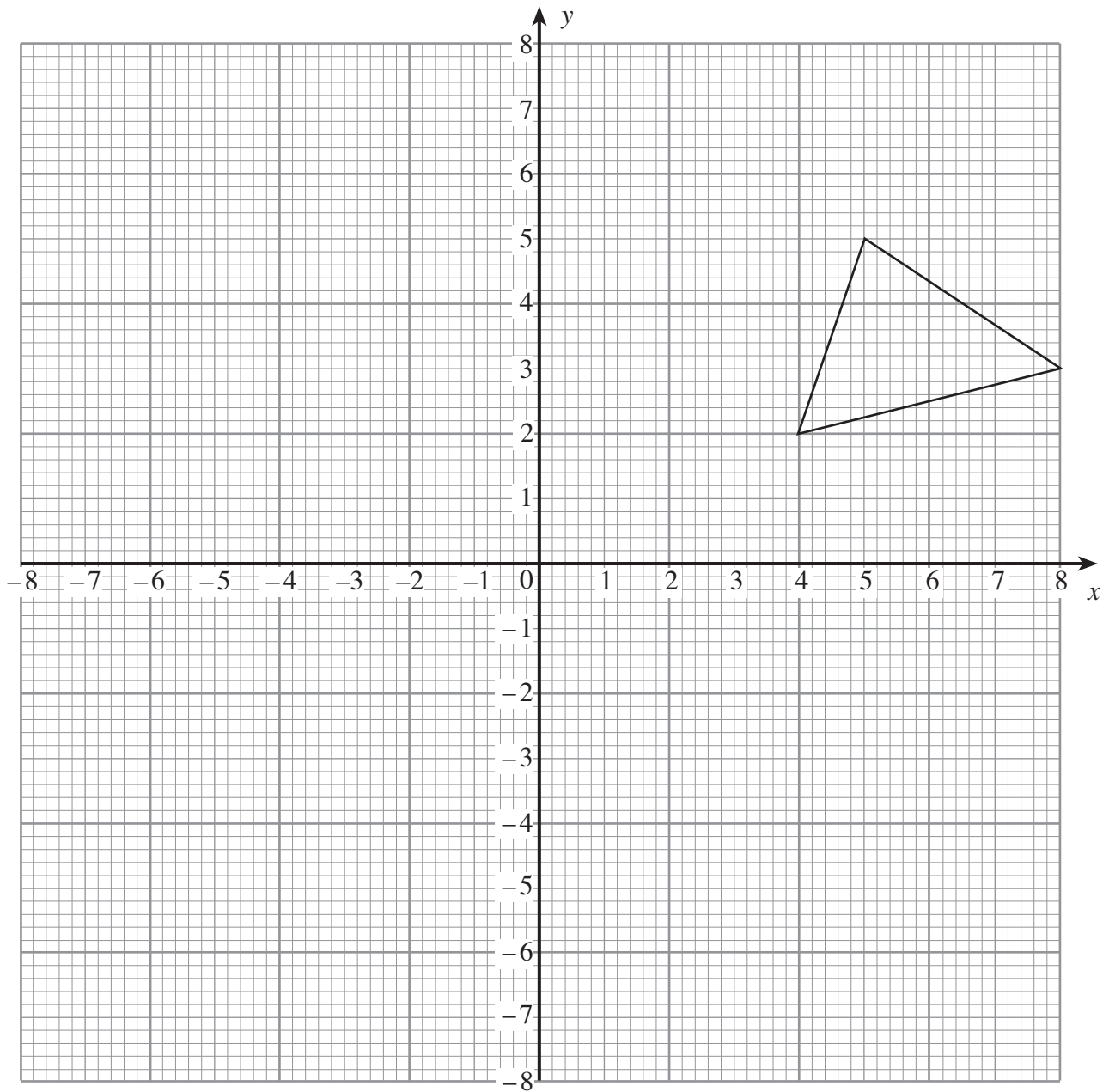
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(b) Express 126 as a product of prime numbers using index notation.

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9. (a) Rotate the triangle through  $90^\circ$  anticlockwise about the point  $(3, 1)$ .

[2]



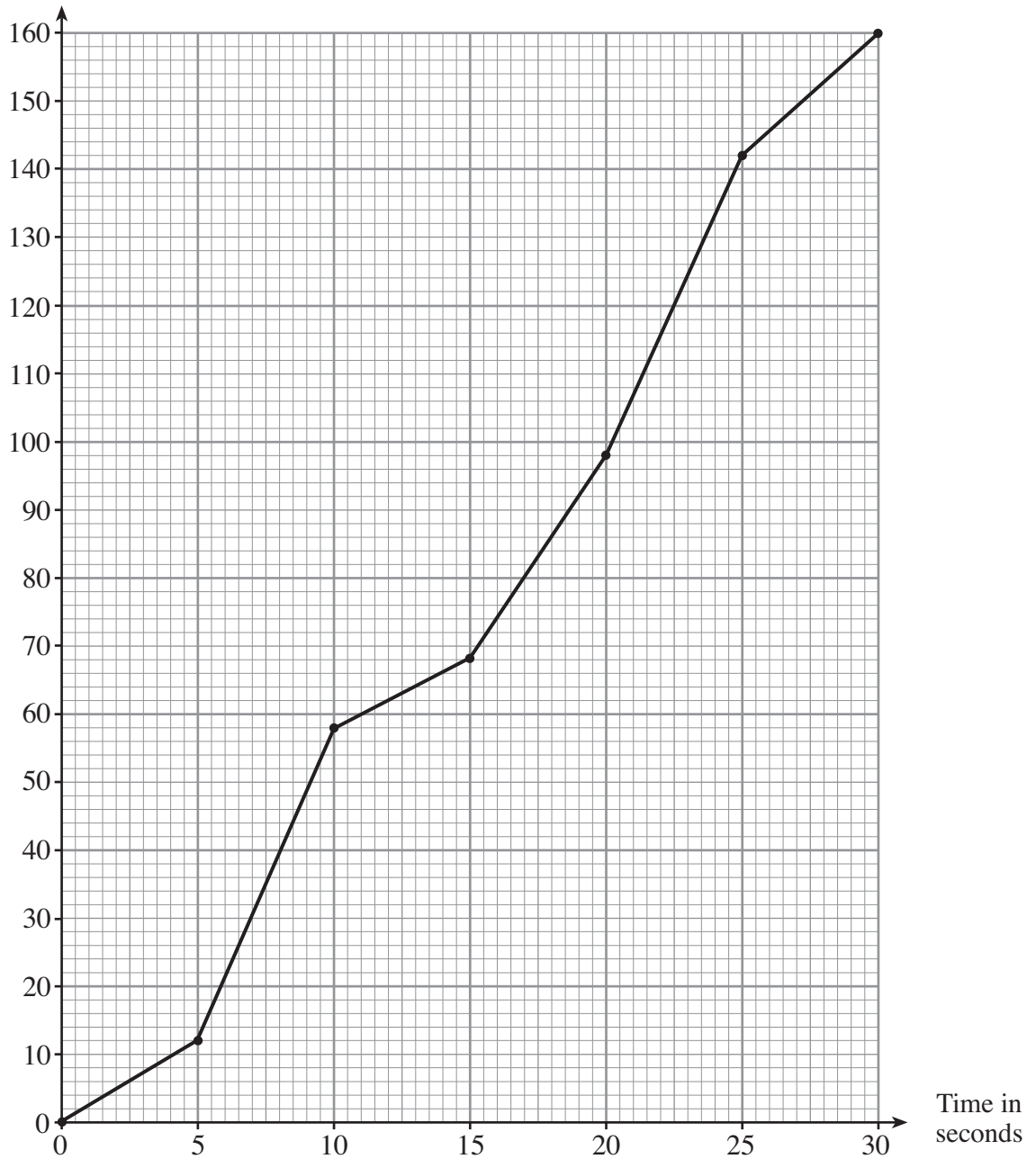
- (b) On the grid below, draw the enlargement of the given shape using a scale factor of 3 and centre  $O$ .

[3]



10. The times taken by one operator at a call centre to answer the telephone were recorded. The cumulative frequency diagram of the results is shown below.

Cumulative frequency



Use the cumulative frequency diagram to find an estimate for

(a) the median,

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[1]

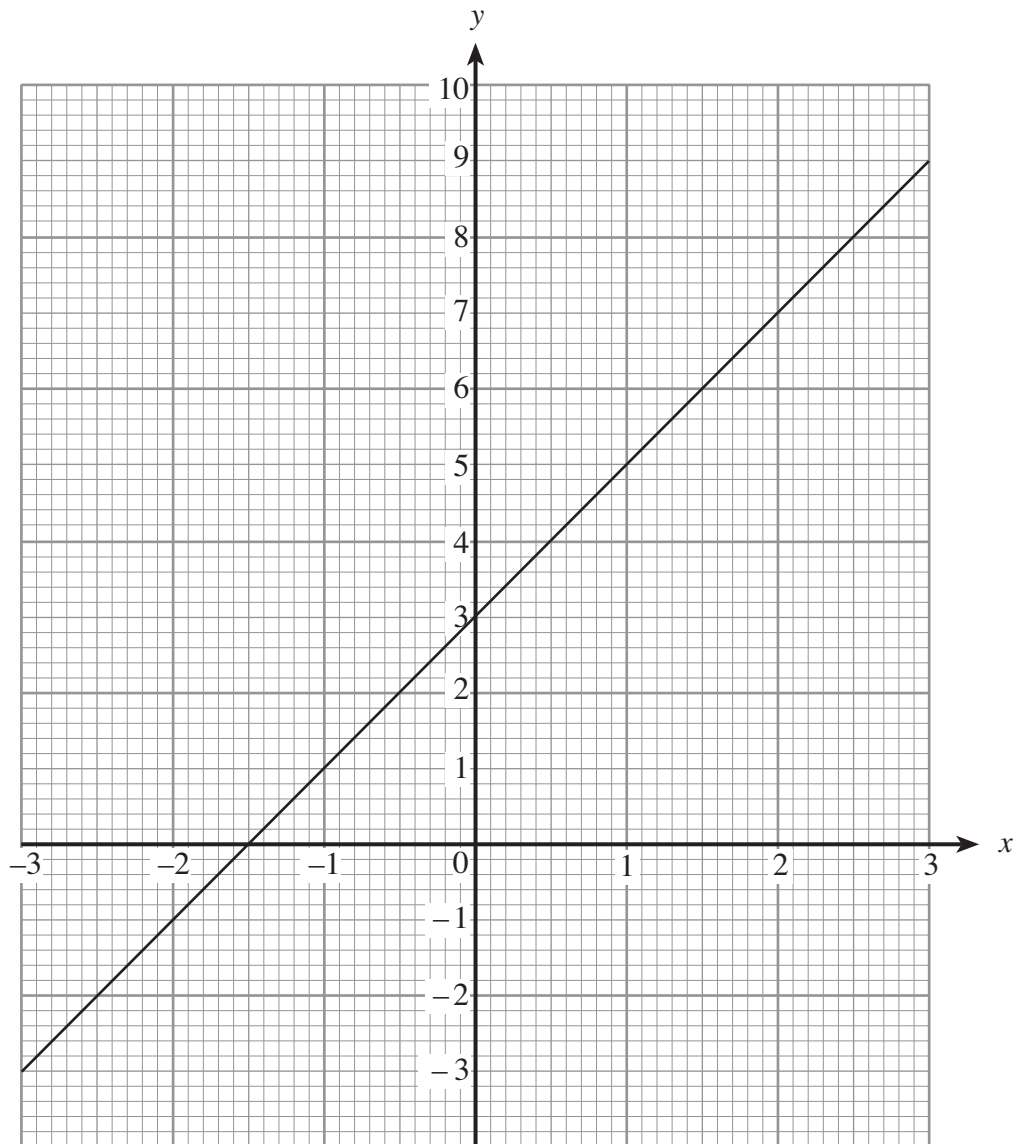
(b) the inter-quartile range,

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[2]

(c) the number of calls that took longer than 7 seconds to be answered.

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11. The diagram shows a straight line graph.



(a) Find the gradient of the straight line.

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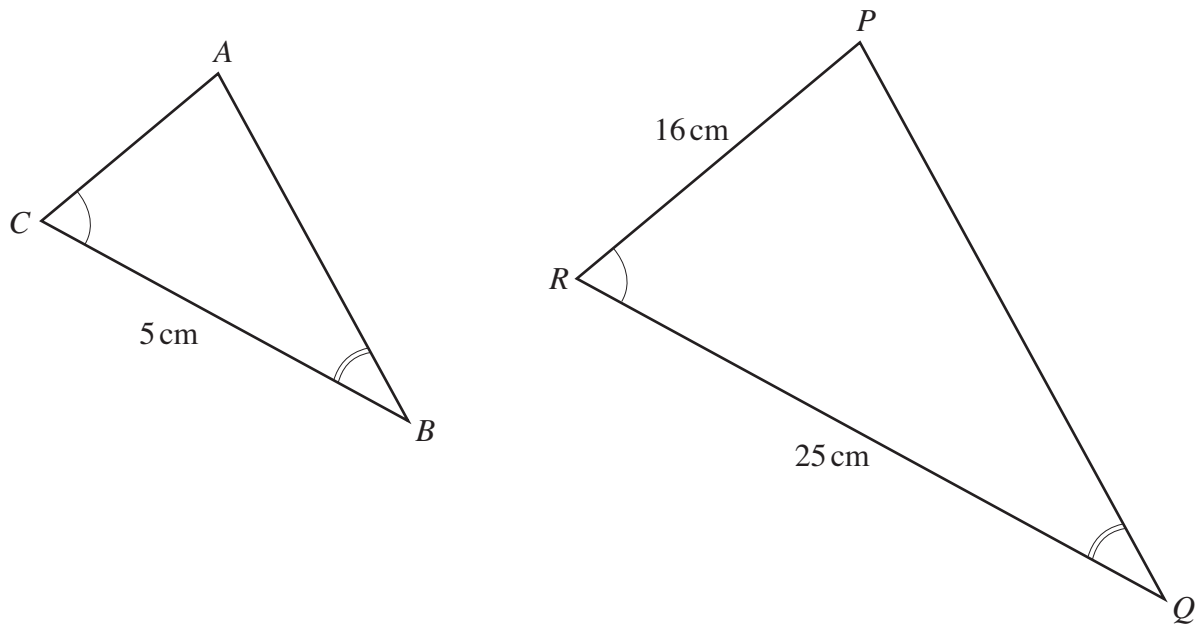
[2]

(b) Write down the equation of the straight line in the form  $y = mx + c$ .

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[1]

12. The diagram shows two similar triangles,  $ABC$  and  $PQR$ .



*Diagram not drawn to scale.*

Given that  $CB = 5\text{ cm}$ ,  $RQ = 25\text{ cm}$  and  $PR = 16\text{ cm}$ , find the length of  $AC$ .

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[2]

13. On the graph paper below, draw the region which satisfies **all** of the following inequalities.

$$\begin{aligned}y &\leq 6 \\y &\geq x - 3 \\x &\leq 4 \\y &\geq -3x\end{aligned}$$

**Make sure that you clearly indicate the region that represents your answer.**

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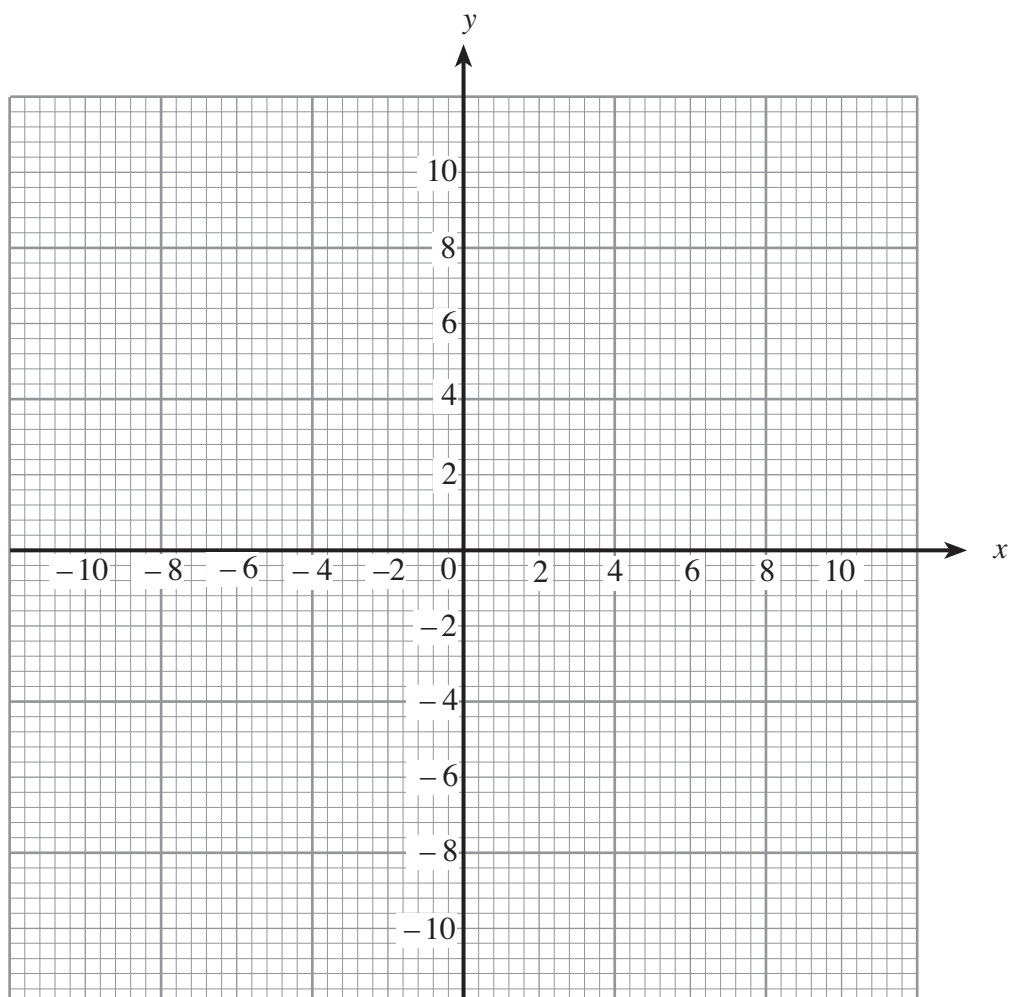
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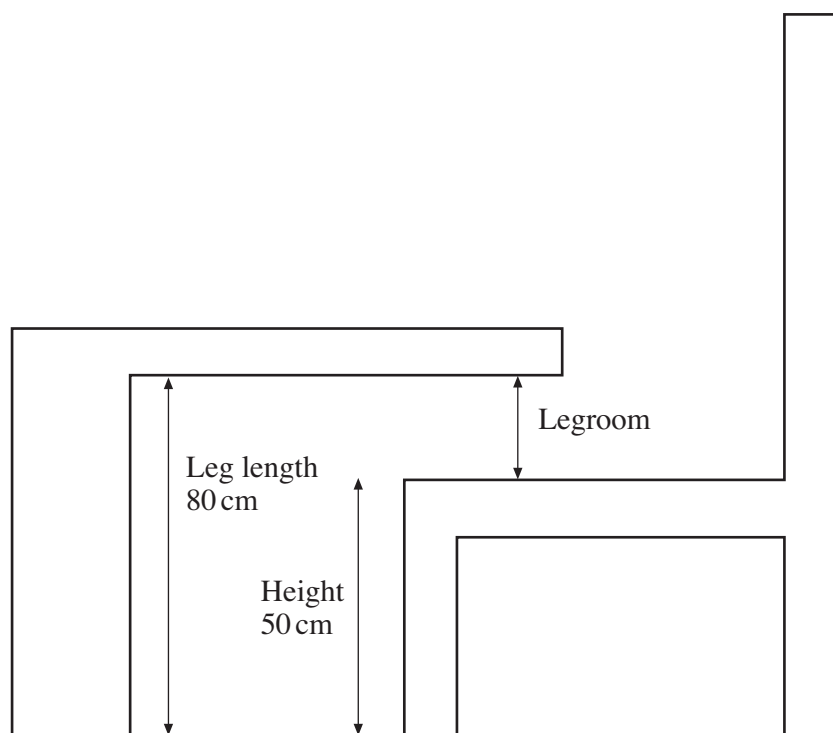
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[4]





14.



*Diagram not drawn to scale.*

The legroom between a table and a chair is calculated by finding the difference between the length of the leg of a table and the height of the chair. In the diagram, both the height of the chair and the length of the leg of the table are given correct to the nearest cm.

Find, in centimetres, the least and greatest possible values of the legroom.

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Least ..... cm      Greatest ..... cm

[4]

15. (a) Simplify  $\frac{(y+5)^6}{(y+5)^2}$ .

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(b) Factorise  $4a^2 - 81$ .

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(c) Factorise the expression  $10x^2 + 23x - 5$  and hence solve the equation  $10x^2 + 23x - 5 = 0$ .

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16. (a) Write **each** of the following numbers in standard form.

(i) 3500

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(ii) 0.3

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[2]

(b) Arrange the following in ascending order.

$3 \times 10^4$

$3 \times 10^{-4}$

$10^2 \times 10^5$

$10^0$

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Smallest

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Largest

[2]

(c) Expand and simplify  $(3 + \sqrt{2})(5 + \sqrt{2})$ .

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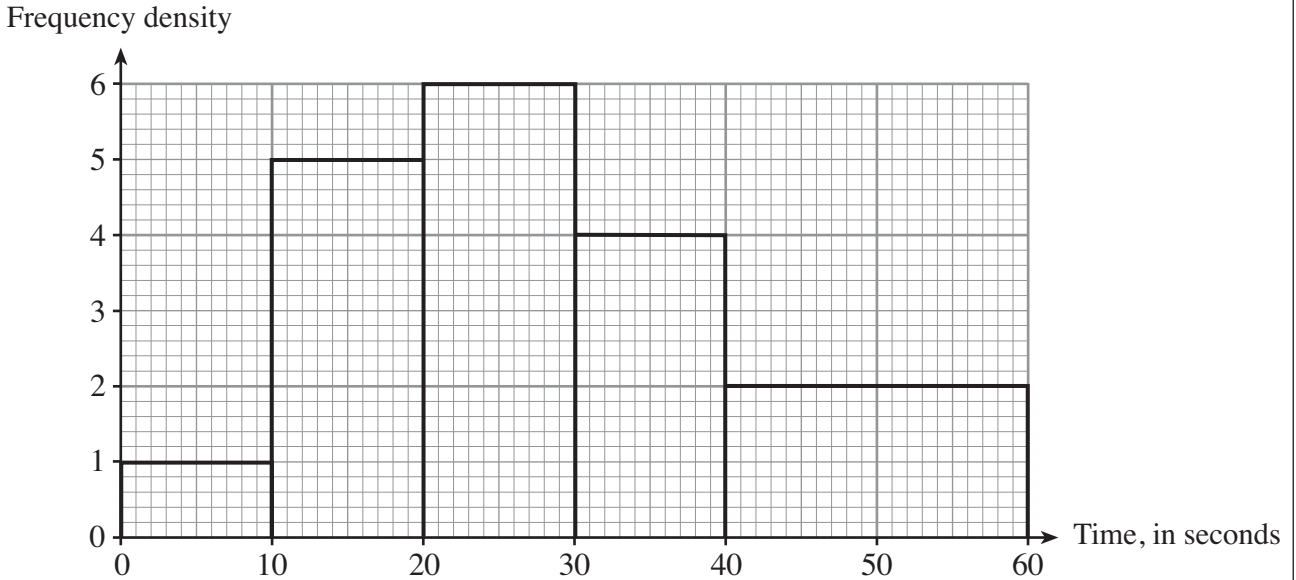
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[2]

17. As part of an investigation, the time taken to complete a physical challenge in a gym was measured for each pupil in a group of thirteen-year-olds. The histogram below illustrates the results obtained.

Times for the 13-year-olds



- (a) Use the histogram to calculate the number of thirteen-year-olds in this group.

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(b) The time taken to complete the same challenge was measured for each pupil in a group of 200 sixteen-year-olds. The following grouped frequency distribution was obtained.

Time, $t$ seconds	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 60$
Number of pupils	30	70	50	40	10

(i) Find an estimate for the median of this distribution.

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(ii) Draw a histogram to illustrate the distribution on the graph paper below.

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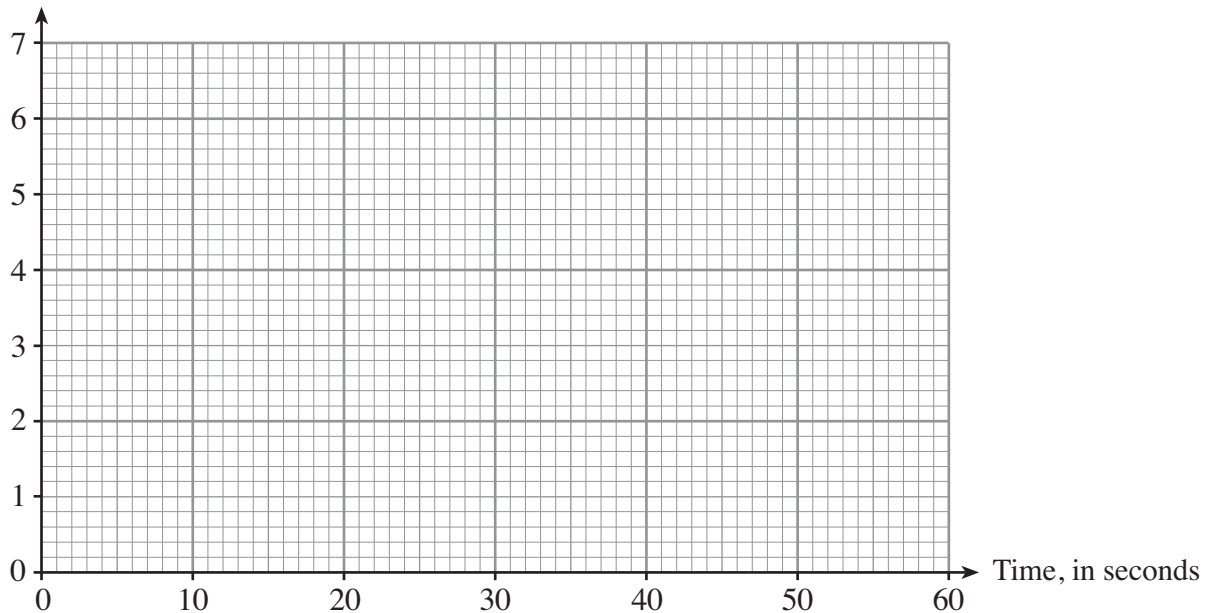
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Times for the 16-year-olds

Frequency density



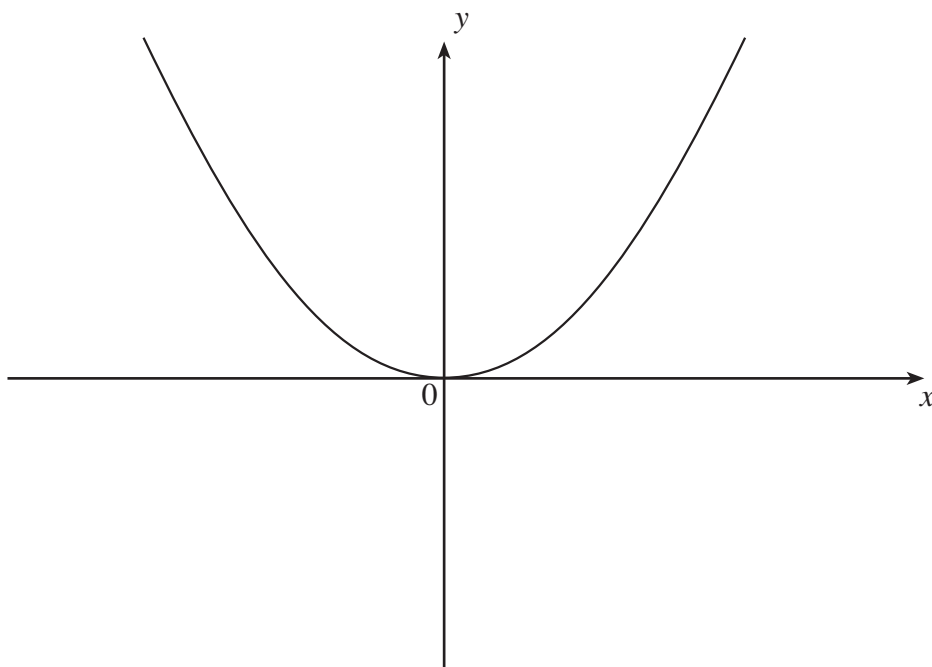
(c) State, with a reason, which of the two groups is the quicker, on average, to complete the challenge.

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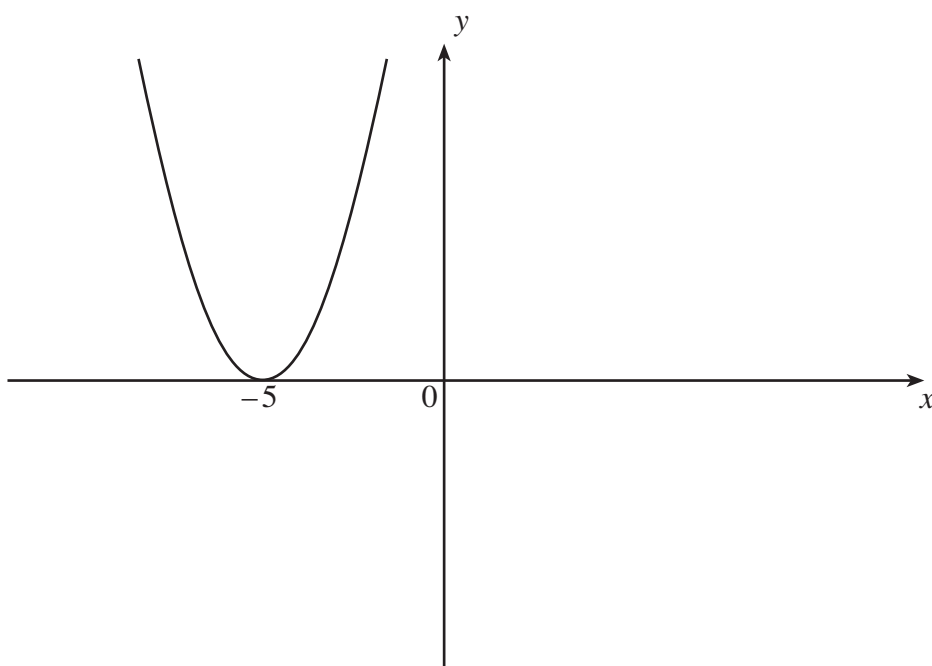
[1]

18. (a) The diagram shows a sketch of  $y = x^2$ .  
On the same diagram sketch the curve  $y = x^2 - 4$ .  
Mark clearly the coordinates of the point where the curve meets the  $y$ -axis.



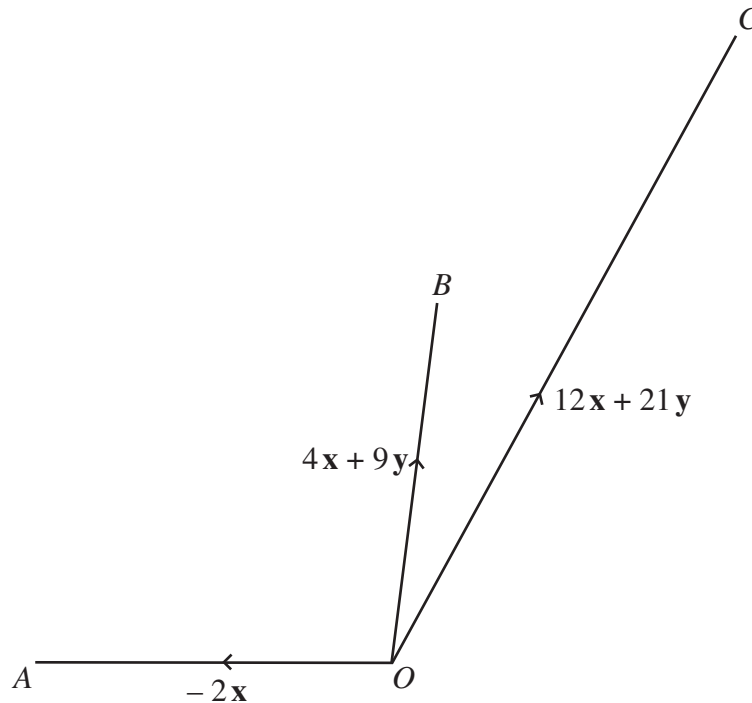
[2]

- (b) The diagram shows the sketch of  $y = f(x)$ .  
On the same diagram sketch the curve  $y = f(x - 5)$ .  
Mark clearly the point where the curve meets the  $x$ -axis.



[2]

19. The diagram shows vectors  $\mathbf{OA}$ ,  $\mathbf{OB}$  and  $\mathbf{OC}$ .



*Diagram not drawn to scale.*

You are given that  $\mathbf{OA} = -2\mathbf{x}$ ,  $\mathbf{OB} = 4\mathbf{x} + 9\mathbf{y}$  and  $\mathbf{OC} = 12\mathbf{x} + 21\mathbf{y}$ .  
Show that the points  $A$ ,  $B$  and  $C$  lie on a straight line and find the ratio  $AB : BC$ .

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[4]

20. A bag contains 20 beads. There are 3 green, 4 yellow and 13 red beads in the bag. Two beads are selected at random without replacement from the bag.

(a) Calculate the probability that both selected beads are yellow.

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(b) Calculate the probability that the two beads are different colours.

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