

Level 1 / Level 2 GCSE (9 – 1)

MATHEMATICS

Paper 3 (Calculator)

Higher Tier

Time : 1 hour 30 minutes

Paper : 1 MA1 / 3H

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.



### Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. a. Simplify  $2a^2b \times 3ab$

.....  
(2)

b. Simplify  $\frac{p^5}{p^2}$

.....  
(1)

c. Solve  $\frac{2x}{3} < 5$

.....  
(2)

(Total for Question 1 is 5 marks)

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2. Mr Ben drives 45 km from work at a speed of 60 km/h.  
Mrs Ben drives 60 km from work at a speed of 75 km/h.  
They both leave work at the same time.  
Who arrives home first?

.....

**(Total for Question 2 is 2 marks)**

3. A number,  $y$ , is rounded to 1 significant figure.  
The result is 800.  
Write down the error interval for  $y$ .

.....  $\leq y <$  .....

**(Total for Question 3 is 2 marks)**

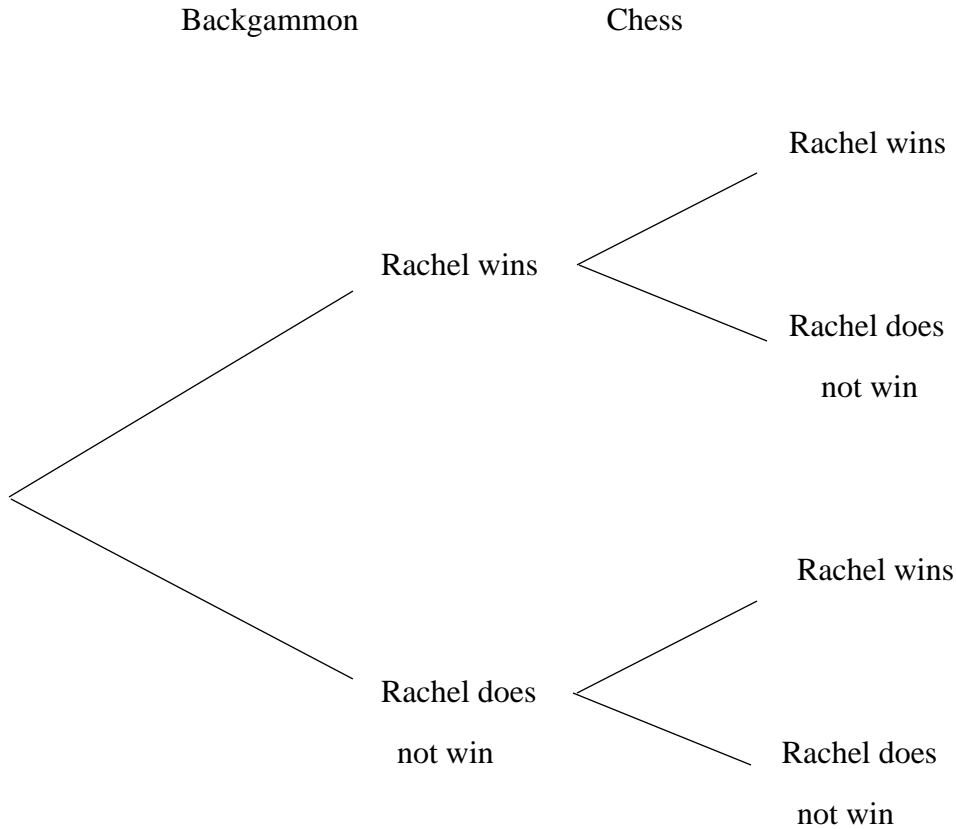


4. Rachel is going to play one game of backgammon and one game of chess.

The probability she will win the game of backgammon is 0.8

The probability that she will the game of chess is 0.4

a. Complete the probability tree diagram.



(2)

b. Work out the probability that Rachel will win both games.

.....  
(2)

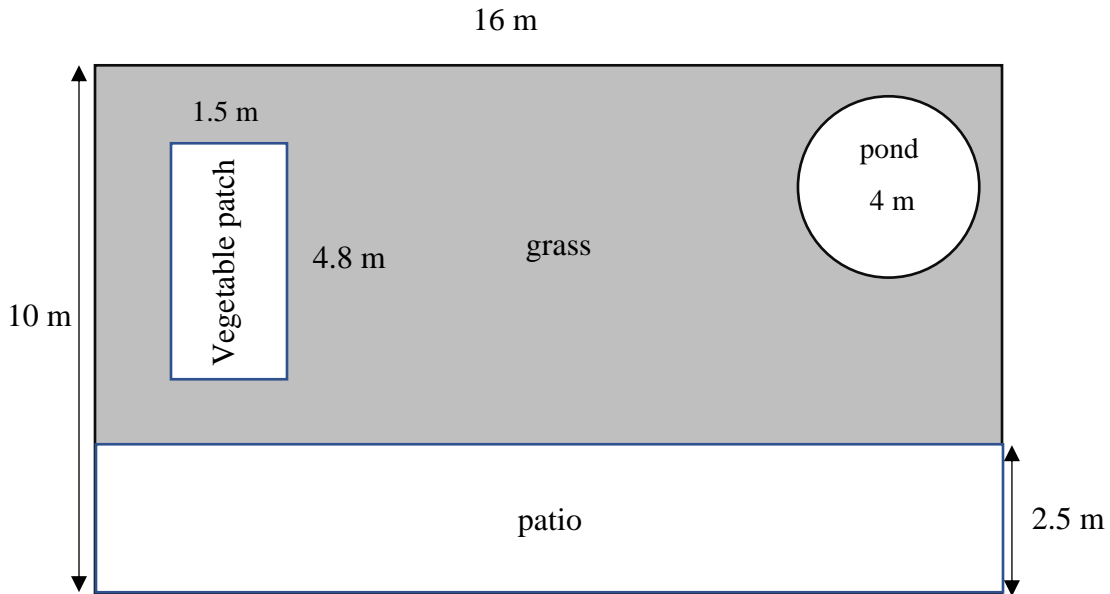
**(Total for Question 4 is 4 marks)**



5. Mr Kingdom's garden is in the shape of a rectangle.

In the garden, there is a patio in the shape of rectangle, a vegetable patch that is 4.8 m long and 1.5 m long and a pond in the shape of a circle with diameter 4 m.

The rest of the garden is grass.



Mr Kingdom wants to spread fertiliser over all the grass.

One box of fertilizer costs £4.95 and will cover 6 m by 5 m of grass.

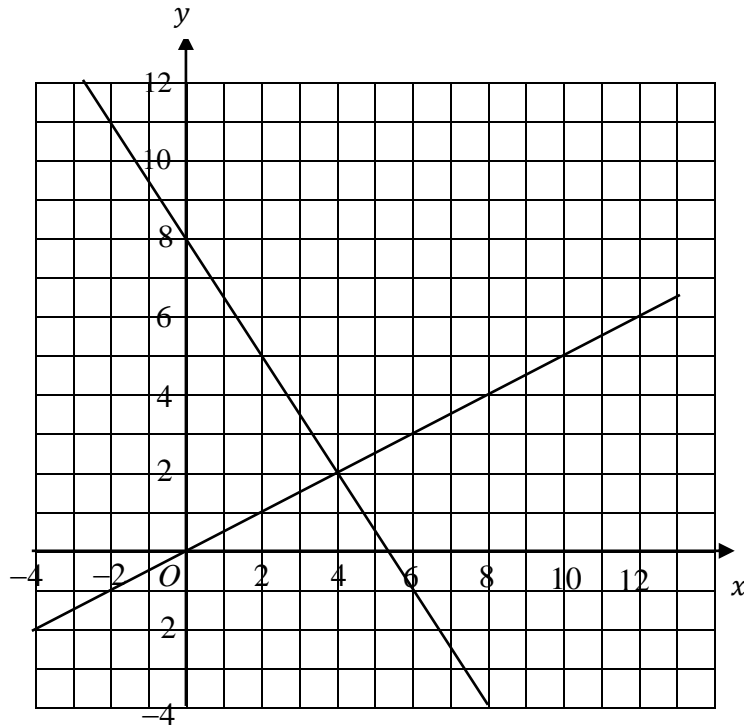
Work out the total cost to fertilise the grass.

.....  
**(Total for Question 5 is 5 marks)**





6.



a. Use the graphs to solve the simultaneous equation:

$$3x - 2y = 16$$

$$y = \frac{1}{2}x$$

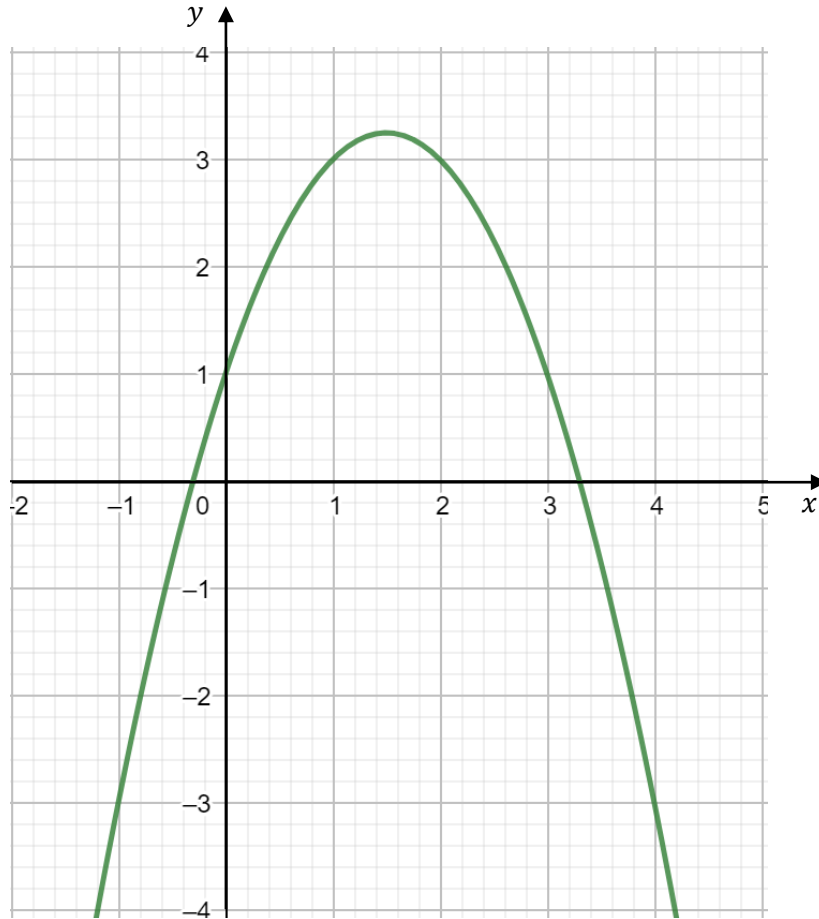
$x = \dots\dots\dots y = \dots\dots\dots$

(1)





Here is a graph of  $y = 3x + 1 - x^2$



b. i. Write down the turning point of the graph  $y = 3x + 1 - x^2$

(....., .....) (1)

ii. Use the graph to find an estimate of a solution to the equation  $x^2 = 3x + 1$

..... (2)

(Total for Question 6 is 4 marks)



7. The students in Year 9A and Year 9B take the same examination.  
There are 24 students in Year 9A and 26 students in Year 9B.  
The mean score for all students in both Years 9 is 78.  
The mean score for the students in Year 9B is 75.  
Work out the mean score for the students in Year 9A.

.....  
**(Total for Question 7 is 3 marks)**

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8. A biased spinner can land on 1, 2 or 3.  
The table shows the probability that the spinner will land on 2.

Number	1	2	3
Probability		0.32	

The probability that the spinner will land on 1 is three times the probability that spinner will land on 3.

- a. Complete the table.

**(2)**

Kelly is going to spin the spinner 200 times.

Work out an estimate for the number of times the spinner will land on 1.

.....  
**(1)**

**(Total for Question 8 is 3 marks)**

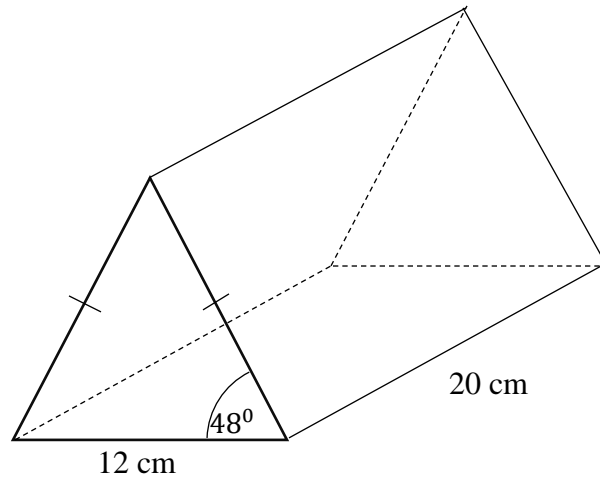
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9. The diagram shows a triangular prism.



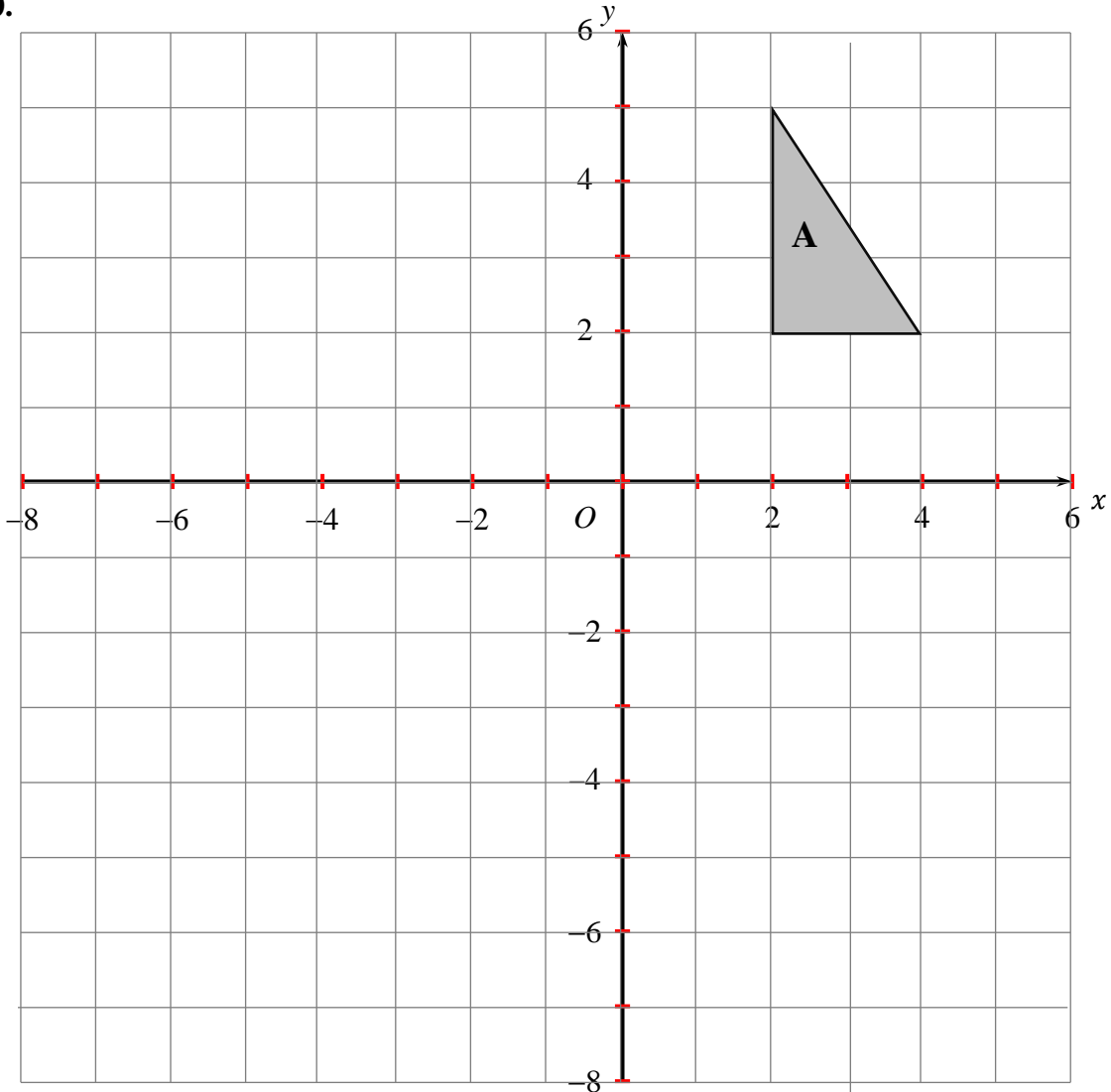
The cross-section of the prism is an isosceles triangle.  
Calculate the volume of the prism.  
Give your answer correct to three significant figures.

.....  
(Total for Question 9 is 4 marks)





10.



Triangle **A** is transformed by the combined transformation of a rotation of  $180^\circ$  about the point  $(1,0)$  followed by a translation with vector  $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$  to a triangle **B**.

Describe fully the single transformation that maps triangle **A** onto triangle **B**.

.....  
.....

(2)

Under the transformation that maps triangle **A** onto triangle **B**, the point  $P$  is invariant.

b. Write down the coordinates of  $P$ .

(....., .....) )

(1)

(Total for Question 10 is 3 marks)



**11.** The distance between Earth and Sun is 150 million kilometres.

Light travels at a speed of  $3 \times 10^8$  km/s

a. Calculate the time, in seconds, it takes for light to travel from Earth to Sun.

Give your answer in standard form.

.....  
(2)

The distance travelled by light in a vacuum during one year is equal to  $9.454 \times 10^{12}$  km.

b. How far does light travel in 1 second? (1 year = 365 days)

Give your answer in standard form correct to 1 significant figure.

.....  
(2)

**(Total for Question 11 is 4 marks)**

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12. a. Express  $\frac{2y}{y+4} - \frac{y}{y-2}$  as a single fraction in its simplest form.

.....  
(3)

b. Expand and simplify  $(2x + 3)(x - 4)^2$ .

Show your working clearly.

.....  
(3)

**(Total for Question 12 is 6 marks)**

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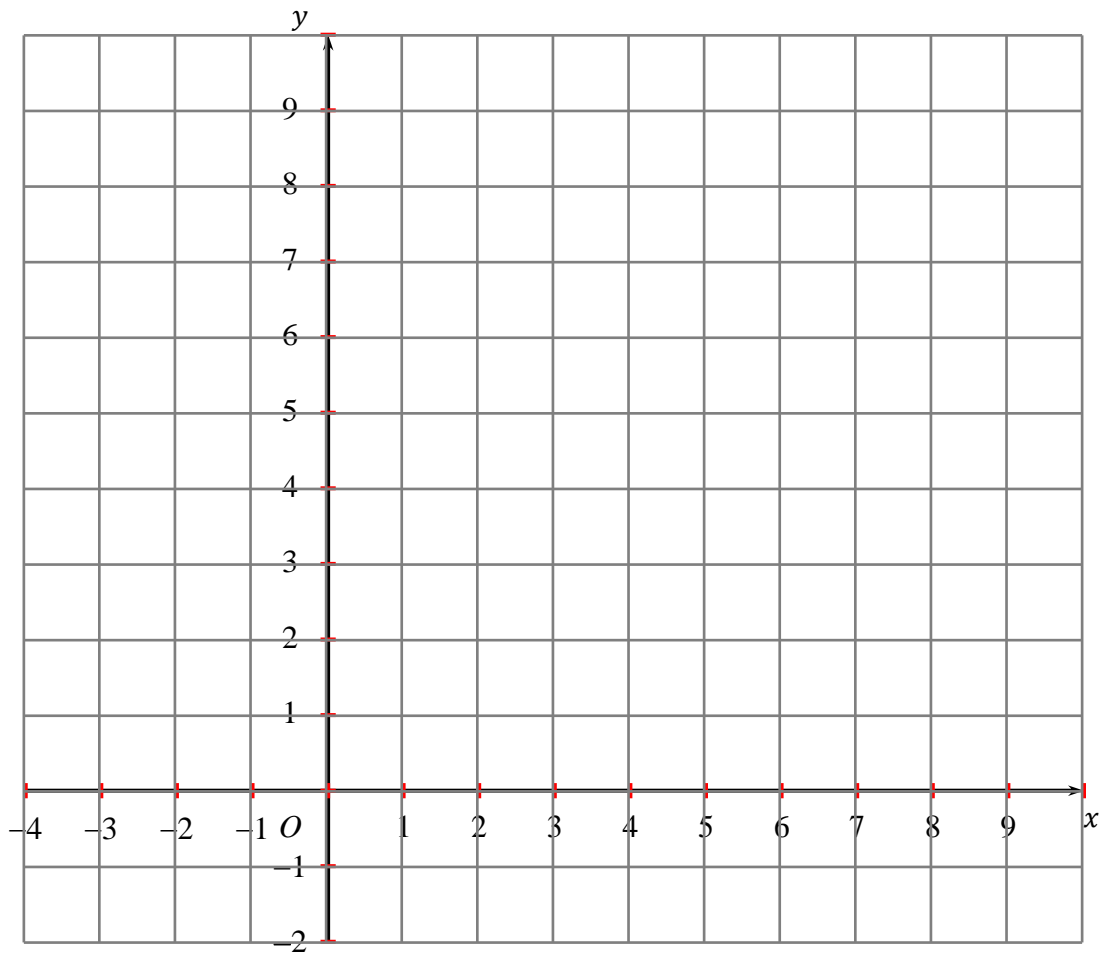


13. a. On the grid, shade the region that satisfies all these inequalities.

$$y \leq 2x + 1$$

$$3y + 2x \leq 12$$

$$y \geq 1$$



$x$  and  $y$  are both integers.

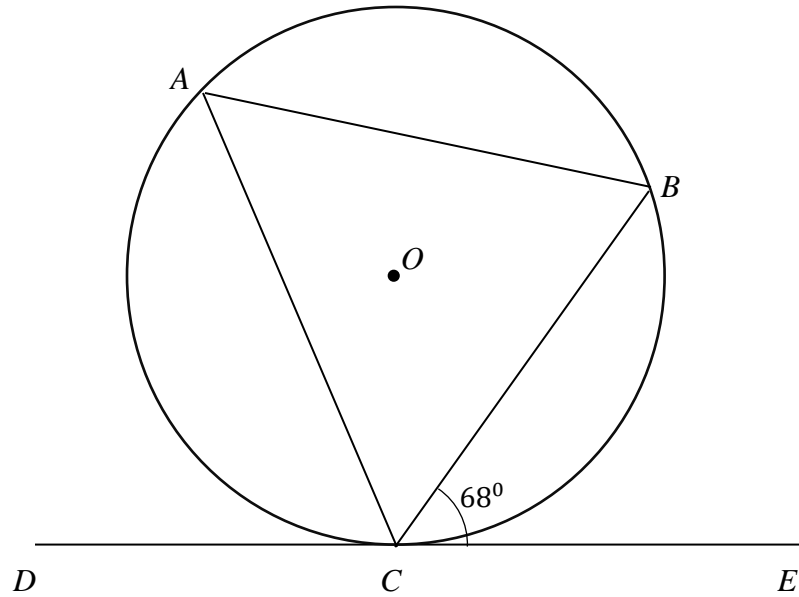
b. Mark with a cross ( $\times$ ) the points in the region that satisfy  $y = x$

(Total for Question 13 is 4 marks)





14.



$A$  and  $B$  are points on the circumference of a circle, centre  $O$ .  
 $DCE$  is a tangent to the circle.

Angle  $BCE = 68^\circ$

a. Find the size of angle  $CAB$ , giving a reason for your answer.

..... $^\circ$ (2)

b. Find the size of angle  $COB$ , giving a reason for your answer.

..... $^\circ$ (2)

**(Total for Question 14 is 4 marks)**



15. Prove algebraically that the recurring decimal  $0.0\dot{2}$  can be written as  $\frac{1}{45}$ .

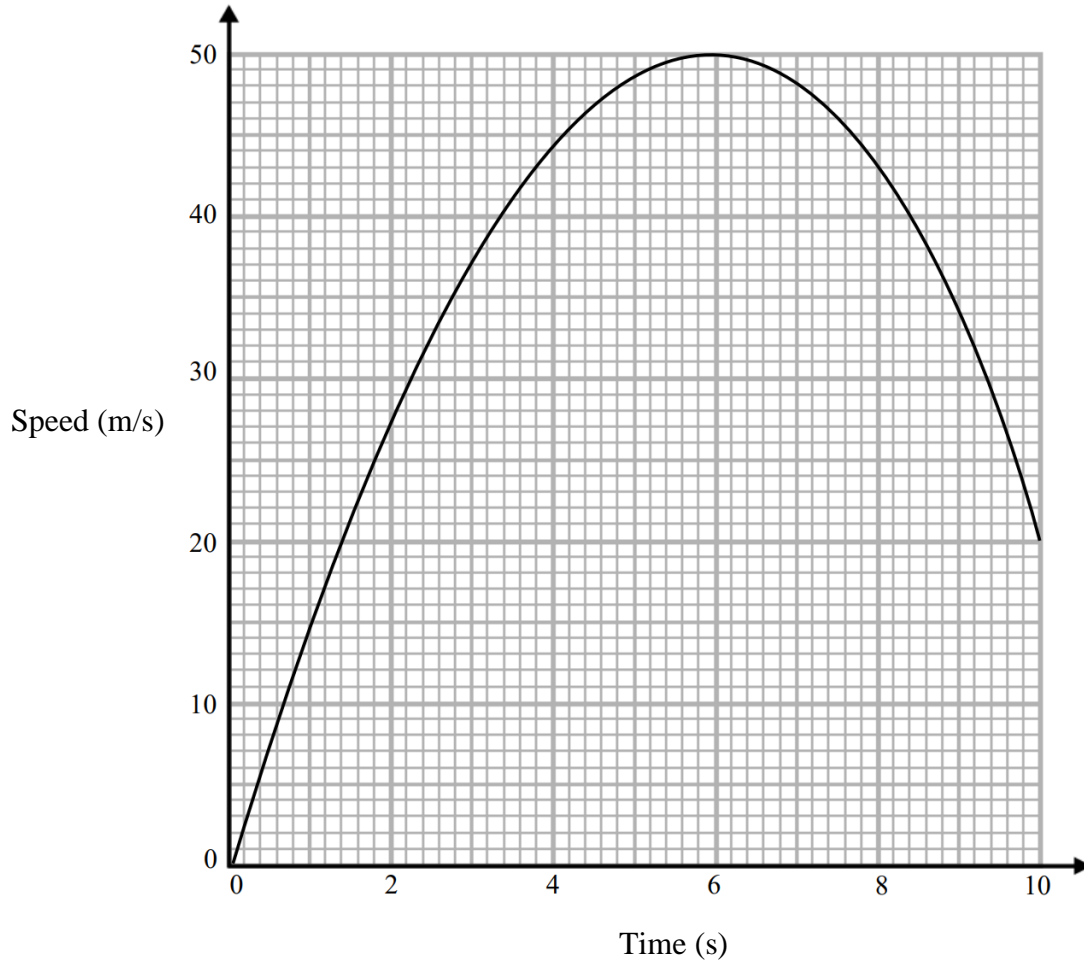
.....  
**(Total for Question 15 is 2 marks)**

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16. Here is a speed-time graph.



a. Work out an estimate for the distance travelled in the first 2 seconds.

..... m  
(2)

b. Is your answer to part (a) an underestimate or an overestimate of the actual distance?  
Give a reason for your answer.

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

(1)







c. Work out an estimate for the deceleration when  $t = 8$

.....

(2)

(Total for Question 16 is 5 marks)

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17.  $P = 3 \times 5^{43}$

$Q = 27 \times 5^{41}$

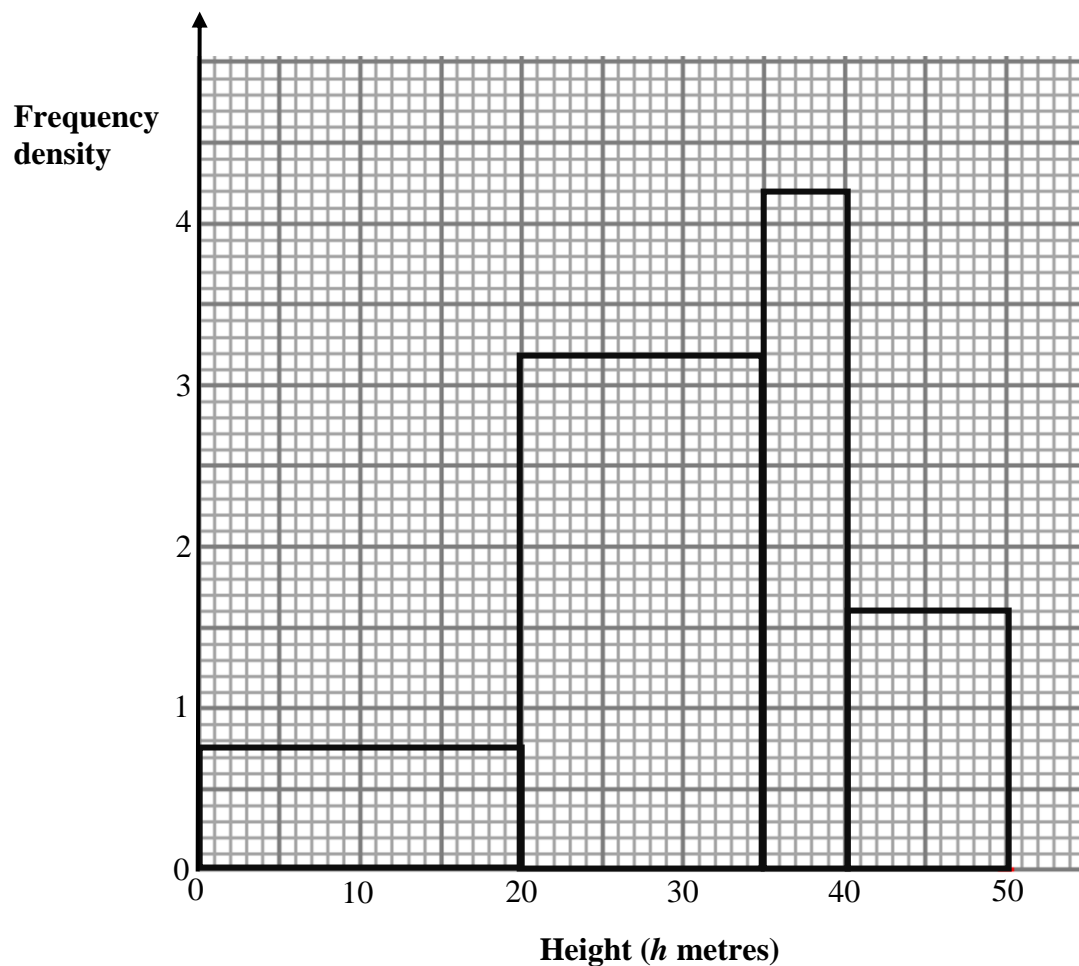
Find the highest common factor (HCF) of  $P$  and  $Q$ .

.....

(Total for Question 17 is 1 mark)



18. The histogram shows the heights of some trees.



a. Complete the grouped frequency table for the data.

Height ( $h$ metres)	Frequency
$0 < h \leq 20$	15
$20 < h \leq 35$	
$35 < h \leq 40$	
$40 < h \leq 50$	

(2)

b. Work out an estimate for the mean height of some trees.

(2)



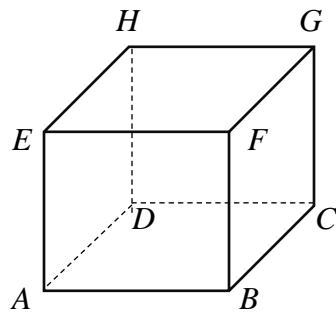


c. Work out an estimate for the number of these trees with a height greater than 30 cm.

.....  
(2)

(Total for Question 18 is 6 marks)

19. The diagram shows a cube.



The volume of a cube is  $130 \text{ cm}^3$  correct to the nearest  $10 \text{ cm}^3$ . Calculate the lower bound for the length of diagonal  $AG$ .  
You must show all your working.

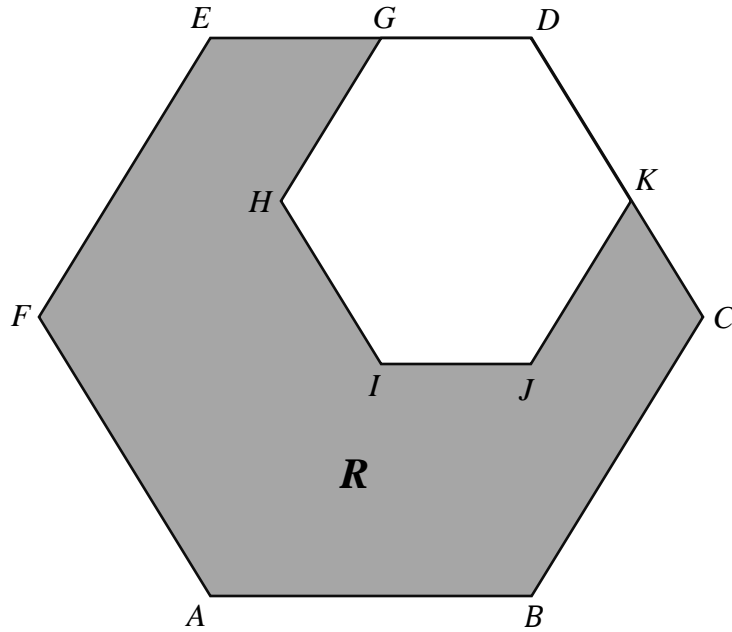
.....

(Total for Question 19 is 4 marks)





20.



$DGHIJK$  is a regular hexagon with sides of length 2 cm.  
This hexagon is enlarged, centre  $D$ , by scale factor  $p$  to give hexagon  $DEFABC$ .  
The area of the shaded region,  $R$ , in the diagram is  $\frac{15\sqrt{3}}{2}$ .  
Find the value of  $p$ .

.....  
(Total for Question 20 is 4 marks)



21  $\frac{7p}{2} + q = 2p + 5q$

a. Find the ratio  $p : q$

.....

(2)

$10a^2 = 7ab + 12b^2$  where  $a > 0$  and  $b > 0$

b. Find the ratio  $a : b$

.....

(3)

**(Total for Question 21 is 5 marks)**

**TOTAL FOR PAPER IS 80 MARKS**

