AQA

Please write clearly in block capitals.

Centre number ☐☐☐☐☐   Candidate number ☐☐☐☐

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
MATHEMATICS

H

Higher Tier   Paper 2 Calculator
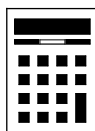
Monday 6 November 2017   Morning   Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- 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 80.
- You may ask for more answer paper, graph paper and tracing 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	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
26–27	
28–29	
TOTAL	

Please note that these worked solutions have neither been provided nor approved by AQA and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

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Answer **all** questions in the spaces provided

1 Circle the fraction that is equivalent to 3.875

[1 mark]

$$\frac{15}{4} \qquad \frac{29}{8} \qquad \frac{31}{8} \qquad \frac{15}{8}$$

Typing 3.875 into the calculator, pressing = then the SD button converts it into a fraction in its simplest form

2 What is 50 as a percentage of 20?

Circle your answer.

[1 mark]

10%   40%   150%   250%

50/20 expresses 50 as a fraction of 20. Multiplying a fraction by 100 converts it into a percentage

3 Circle the point that does **not** lie on the curve $y = x^3$

[1 mark]

$$\left(-\frac{1}{2}, -\frac{1}{8}\right) \qquad (5, 125) \qquad \left(\frac{1}{3}, \frac{1}{9}\right) \qquad (-1, -1)$$

Substituting the x-coordinate into the equation finds what the y-coordinate should be. If the y-coordinate it should be is not the same as the y-coordinate stated, it does not lie on the curve. Coordinates are in the form (x , y)

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4 Which **one** of these is a unit of density?

Circle your answer.

[1 mark]

kg/m^2 m^2/kg kg/m^3 m^3/kg

Density = mass/volume

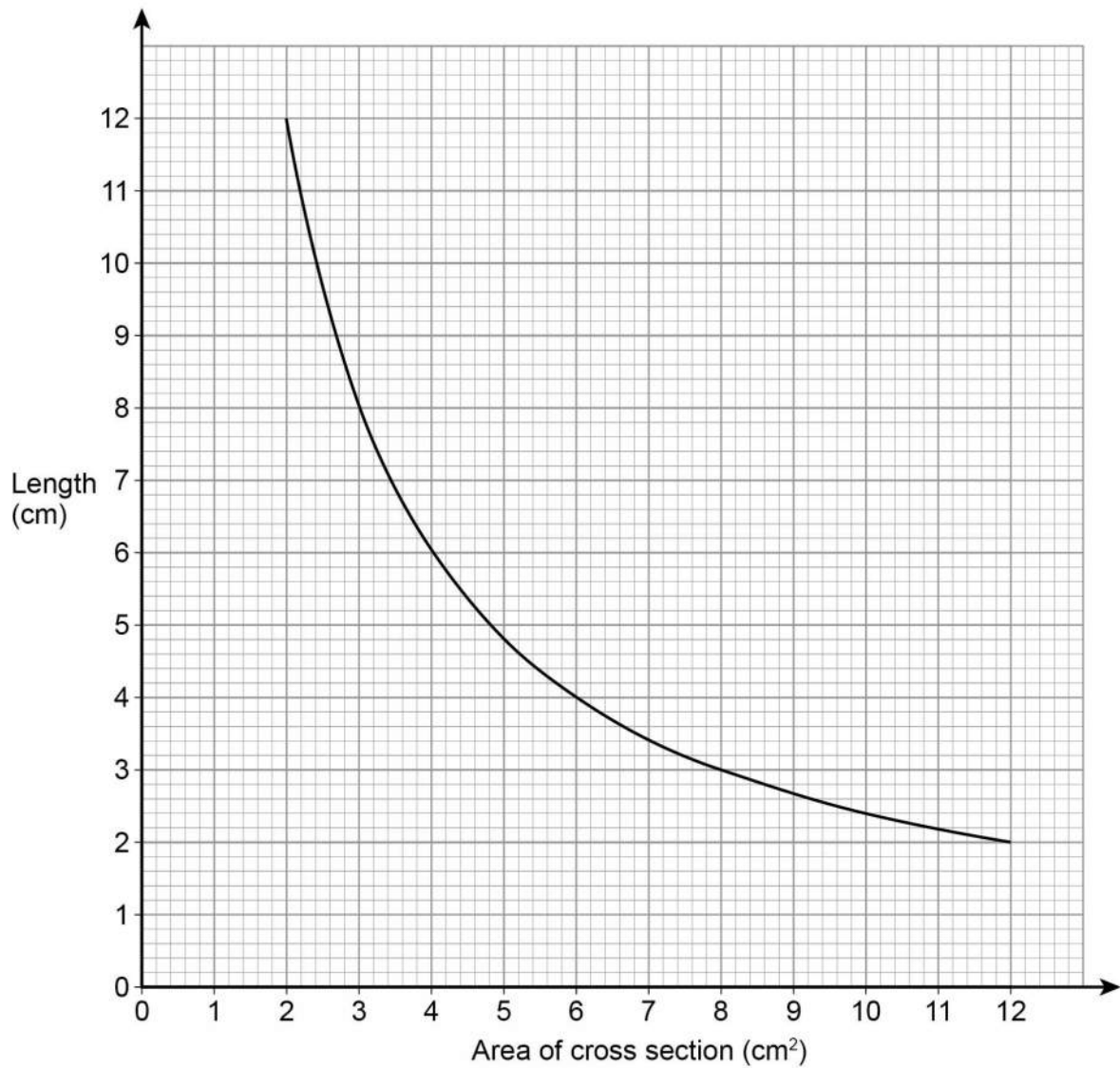**5** Solve $4(3x - 2) = 2x - 5$

[3 marks]

Expand the bracket. Collect the x terms on the side with the most x. Get the x term on its own. Then get x on its own. Do the opposite operation to both sides to get rid of something

$x =$ _____

Turn over for the next question

7

Turn over ▶

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6 The graph shows information about prisms with the same volume.
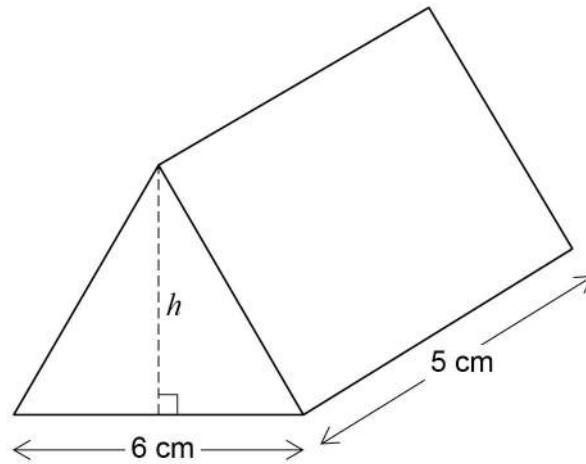

6 (a) Give **one** example to show the volume is 24 cm^3

[1 mark]

Volume of prism = area of cross section x length. Picking any point on the curve and multiplying the area of cross section by the length will give 24

6 (b)   The diagram shows a prism with volume 24 cm^3

The height of the triangular cross section is h.


Work out the height, h.

[3 marks]

Read from the graph to find the area of cross section for a prism with volume 24cm^2 and length 5cm. The cross section is a triangle and area of triangle = 1/2 x base x height. The base is 6cm and the height is h. Form an equation then rearrange to find h

Answer _____ cm

Turn over for the next question

Turn over ▶

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0 5

7 Describe fully the **single** transformation that maps triangle *A* to triangle *B*.
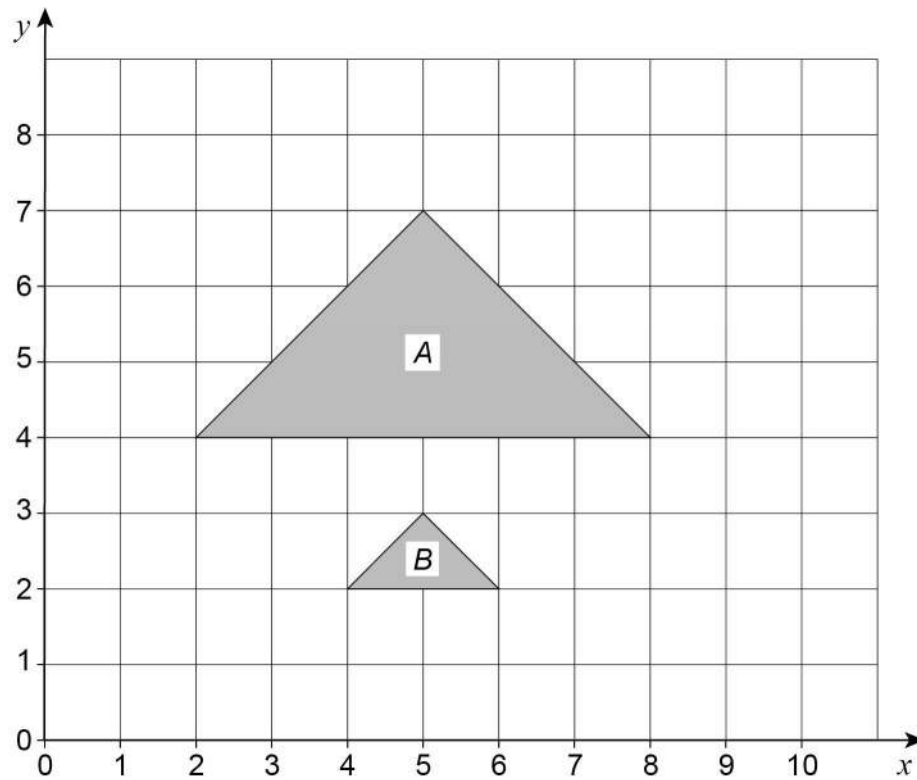
[3 marks]

Enlargement, scale factor ... , centre ...

It is an enlargement as it has changed size. The scale factor is the amount the sides on A have been multiplied by to get the sides on B. Drawing lines through the corners of both shapes then finding where they cross works out the coordinates of the centre of enlargement

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8 The table shows information about the distances walked by 120 students on their way to school one week.

Distance, x (miles)	Frequency		
$0 < x \leqslant 5$	20		
$5 < x \leqslant 10$	48		
$10 < x \leqslant 15$	30		
$15 < x \leqslant 20$	22		
	Total = 120		

Work out an estimate for the mean distance.

[3 marks]

Adding the lowest and highest distance within each category then dividing by 2 works out the midpoint of each category. Multiplying the midpoint by the frequency gives an estimate of the total distance for each category. Adding all of these totals together gives an estimate of the total distance. Dividing this by the total frequency gives an estimate of the mean

Answer _____ miles

Turn over for the next question

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0 7

9   Work out the size of angle x.

Not drawn accurately

3 cm

x

7 cm
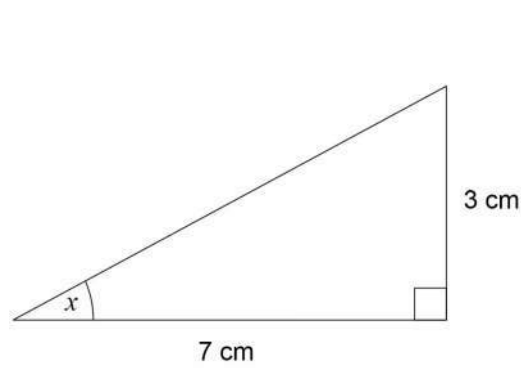
[2 marks]

$S\,^O{}_H\,C\,^A{}_H\,T\,^O{}_A$

Right angled trigonometry can be used. Tick what sides we have to decide which formula triangle can be used. Covering over what needs to be found works out how to find it. S: sin of the angle. C: cos of the angle. T: tan of the angle. O: opposite. H: hypotenuse. A: adjacent.

Answer _____ degrees

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10 Work out the next term of this quadratic sequence.

[2 marks]

+3   +6   +9

5   8   14   23   ……
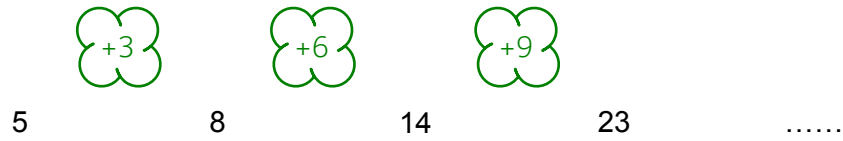
Answer _____

11 Circle the expression that is equivalent to $\dfrac{3x^2}{6x^2 + 3}$

[1 mark]

$\dfrac{x^2}{2x^2 + 3}$ $\dfrac{x^2}{6x^2 + 1}$ $\dfrac{x^2}{2x^2 + 1}$ $\dfrac{1}{2} + x^2$

The numerator and denominator is divided by 3

Turn over for the next question

5

Turn over ▶

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09

12 The table shows information about the UK and Germany.

	Population	**Area (square miles)**
UK	64 000 000	95 000
Germany	82 000 000	140 000

Population density = $\dfrac{\text{population}}{\text{area}}$
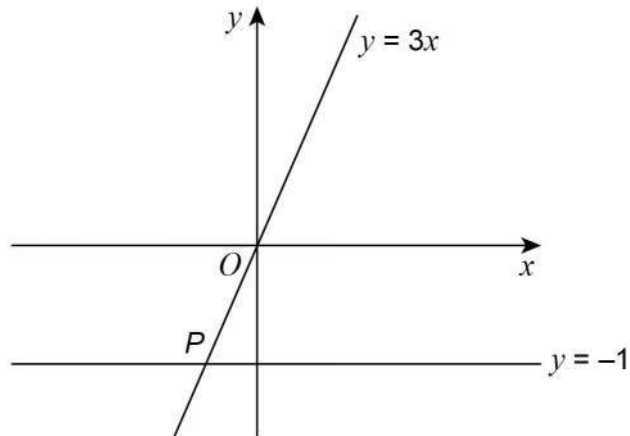
Compare the population densities of the UK and Germany.

[3 marks]

Compare the population densities by making a statement about which country has the greatest

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13 Two straight lines intersect at point *P*.

Not drawn accurately

Circle the coordinates of *P*.

[1 mark]

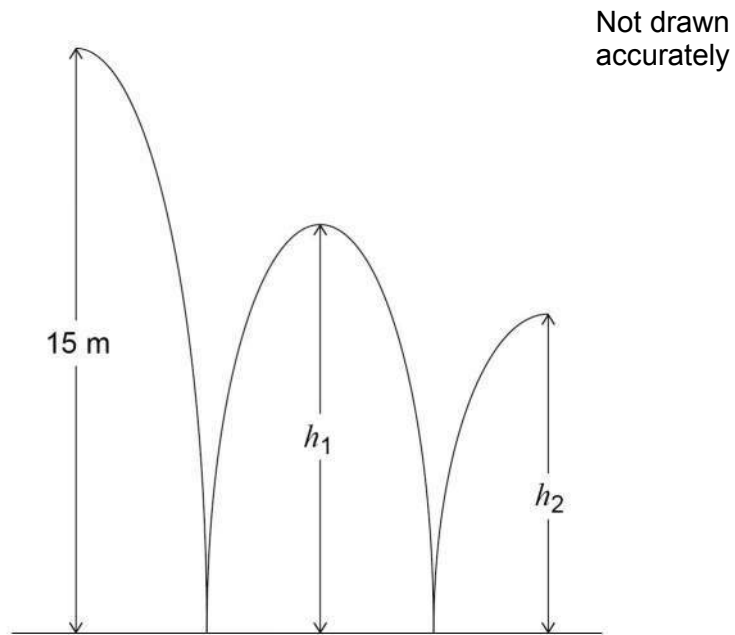$(-3, -1)$ $\left(-1, -\dfrac{1}{3}\right)$ $(-1, -3)$ $\left(-\dfrac{1}{3}, -1\right)$

The y-coordinate must be -1 as it is on the line y = -1. Substituting -1 for y in the equation of the other line then rearranging to find x gives the x-coordinate

Turn over for the next question

4

Turn over ▶

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14 A ball is thrown from a height of 15 metres.

It bounces to height h_1, then to height h_2 as shown.

Not drawn
accurately

15 m

h_1

h_2

h_1 is three quarters of the original height.

14 (a) Jack expects h_2 to be three quarters of h_1

Work out the value of h_2 that he expects.

[2 marks]

Doing 3/4 of 15m works out h1. 'Of' means to multiply

Answer _____ metres

14 (b)   In fact, h_2 is two thirds of h_1

How does this affect the answer to part (a)?

Tick a box.

☐   The ball bounced higher than he expected

☐   The ball bounced lower than he expected

Show working to support your answer.

[2 marks]

Repeat the calculation done in part (a) but do 2/3 of h1 instead. If the value calculated now is more than in part (a), the ball bounced higher than he expected

Turn over for the next question

4

Turn over ▶

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15 Mirek invests £6000 at a compound interest rate of 1.5% per year.

He wants to earn more than £1000 interest.

Work out the **least** time, in whole years, that this will take.

[3 marks]

Use table mode by pressing MENU then 3. f(x) = 6000 x (a fraction multiplier which increases it by 1.5%)ˣ. Ignore g(x). Start: 1. End: 30. Step: 1

This lists out the amount of money the investment is worth each year

Answer _____ years

16 (a) Factorise fully $9y^3 - 6y$

[2 marks]

Bring out the highest common factor of both terms and leave the rest in a bracket

Answer _____

16 (b) Factorise $3x^2 - 22x + 7$

[2 marks]

It is in the form $ax^2 + bx + c$. Multiply a by c. Look for two numbers which multiply to this and add to b. Split the middle x term into these amounts of x then factorise both halves. There should be a repeated bracket. Bring together both of the factors brought out and put them in a single bracket multiplied by the repeated bracket
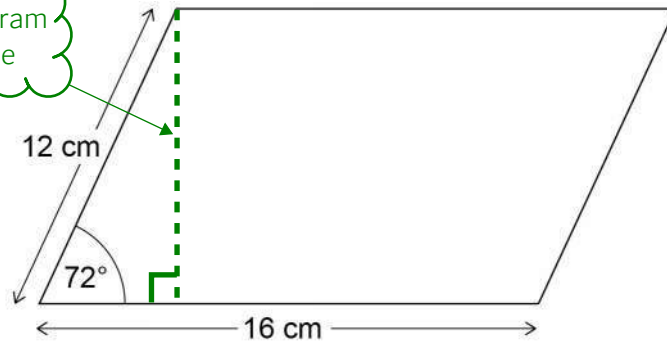
Answer _____

Turn over for the next question

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17   Work out the area of the parallelogram.

Drawing the height of the parallelogram here creates a right angled triangle

Not drawn accurately

12 cm

72°

16 cm

[3 marks]

$S^OH \, C^A H \, T^O A$

Area of parallelogram = base x height. The base is 16. The height is found by working out the opposite in the right angled triangle by using right angled trigonometry. List out SOH CAH TOA as formula triangles and tick what we have and what we are trying to find. If there are two ticks on a formula triangle, that one can be used. S: sin of the angle. C: cos of the angle. T: tan of the angle. O: opposite. H: hypotenuse. A: adjacent

Answer _____ cm²

18 (a)
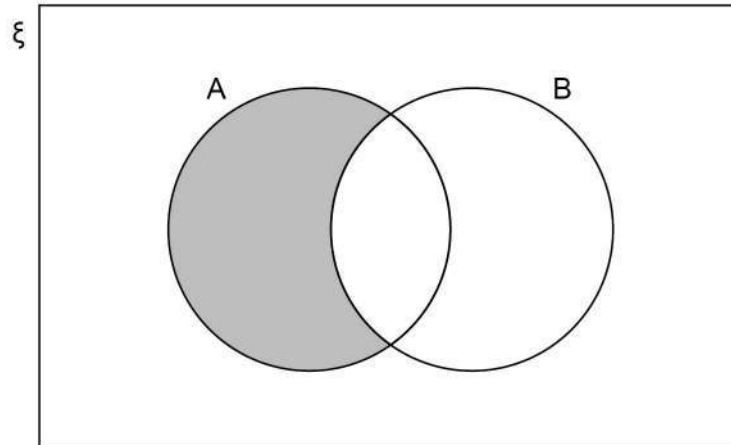
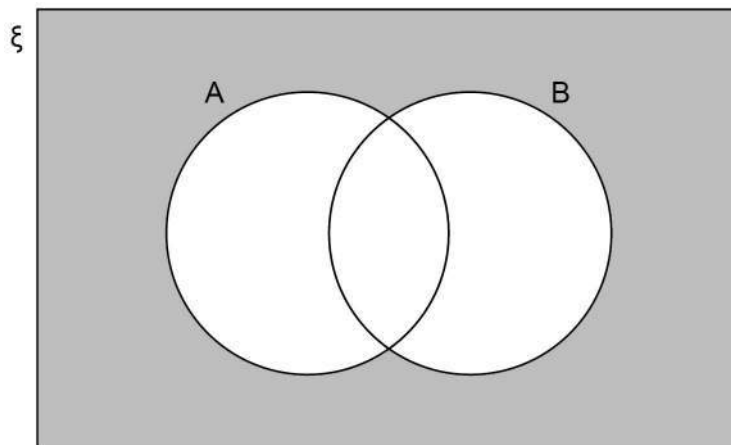Which of these represents the shaded region?

Circle your answer.

[1 mark]

A   B$'$ A ∩ B$'$ A ∪ B$'$

See hint for part (b)

18 (b)

Which of these represents the shaded region?

Circle your answer.

[1 mark]

(A ∪ B)$'$ (A ∩ B)$'$ A$'$ ∩ B   A$'$ ∪ B$'$

The ∩ means intersection, which means that if you were to highlight both of the regions in different colours it would be where it is highlighted in both colours at the same time. The U symbol means union, which means that if you were to highlight both of the regions in different colours it would be any highlighted part. The ' means that it is everything apart from that region

Turn over ▶

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19 The length of a rectangle is five times the width.

The area of the rectangle is 1620 cm^2

Not drawn accurately

Work out the width of the rectangle.

[3 marks]

$5w \times w$

Area of rectangle = length x width. let w be the width. The length will be 5w

Simplify the expression for the area, set it equal to the area given then rearrange the equation to find w

Answer _____ cm

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20 A stone is thrown upwards with a speed of v metres per second.

The stone reaches a maximum height of h metres.

h is directly proportional to v^2

When $v = 10$, $h = 5$

Work out the maximum height reached when $v = 24$

[4 marks]

$$h = Kv^2$$

h ∝ v². The right side of this can be multiplied by anything and still be directly proportional. So multiplying by k and converting it into an equation

Rearrange to find k and substitute in the values of h and v (not 24 as we don't know h for this). Substitute k back into the original equation and find h when v = 24 by substituting in 24 for v
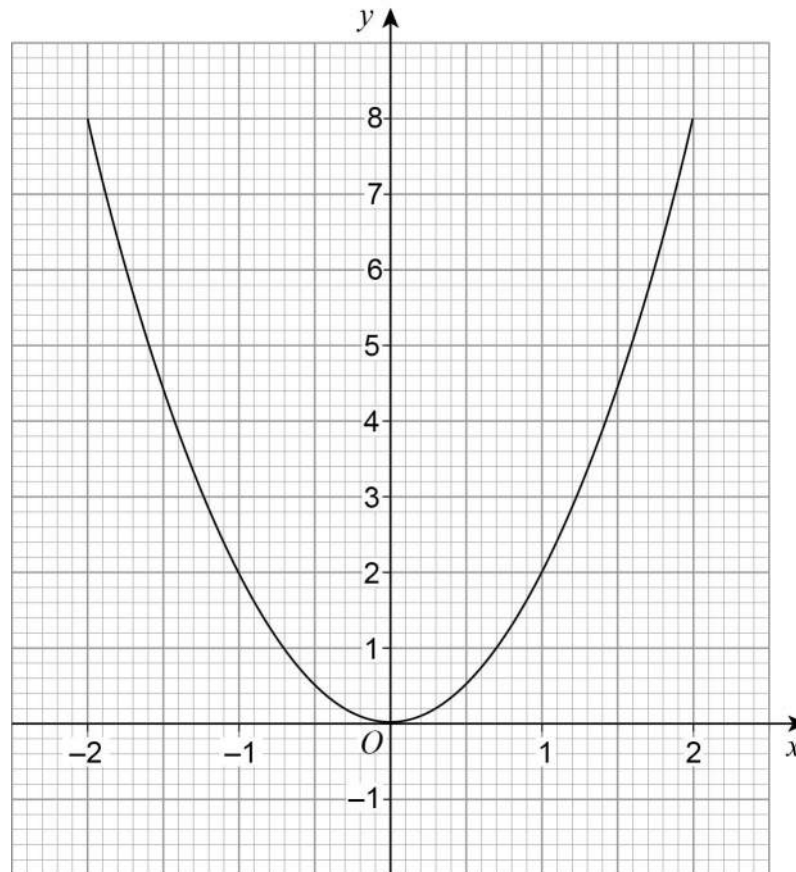
Answer _____ m

Turn over for the next question

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21 (a) Meera is using a **graphical** method to solve $2x^2 - 3x = 0$

She draws the graph of $y = 2x^2$ and a straight line graph on the same grid.

Here is the graph of $y = 2x^2$

Complete her method to solve $2x^2 - 3x = 0$

[2 marks]

Rearranging 2x² - 3x = 0 to get the 2x² on its own (as it is in the equation y = 2x²) gives 2x² = 3x. So drawing the graph of y = 3x and working out the x-coordinates where both graphs cross works out the solutions

Answer _____

21 (b) Levi is solving $2x^2 + 5x = 0$

He uses this method.

$2x^2 + 5x = 0$ subtract $5x$ from both sides

$2x^2 = -5x$ divide both sides by x ←   There is a mistake here

$2x = -5$ divide both sides by 2

$x = -2.5$

Evaluate his method and his answer.

[2 marks]

_____

_____

_____

_____

_____

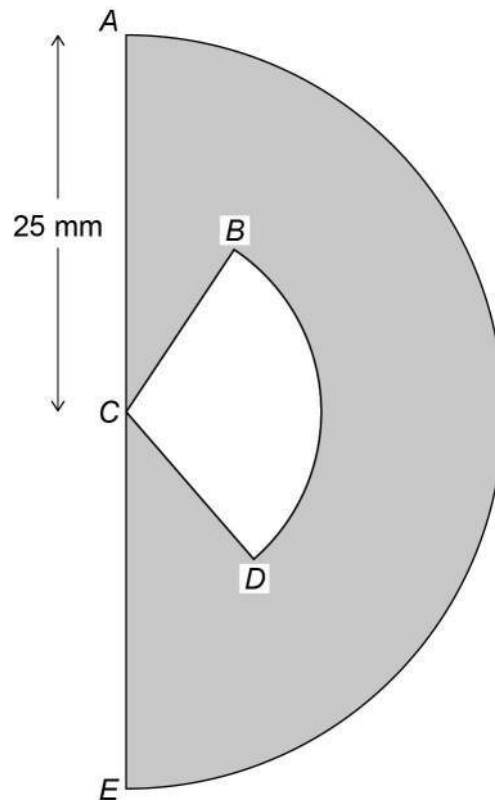**Turn over for the next question**

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4

22 The cross section of an earring is a semicircle, centre *C*, radius 25 mm

The earring is black and white.

The shaded area is black.

Not drawn accurately

25 mm

A

B

C

D

E

Sector *BCD* is white and has radius 12 mm

B

12 mm

C 150°

D

Not drawn accurately

Is more than 20% of the semicircle white?

You **must** show your working.

[5 marks]

Express the area of the white part as a fraction of the area of the whole semicircle then multiply by 100 to convert it into a percentage. Area of circle = π x radius². Multiplying by the area of the whole circle by the fraction of the circle which the sector is gives the area of the sector

Answer _____

Turn over for the next question

Turn over ▶

.CG Maths.

5

23 Here is some information about a tennis club.

Members of a tennis club

Frequency density

Age, A years
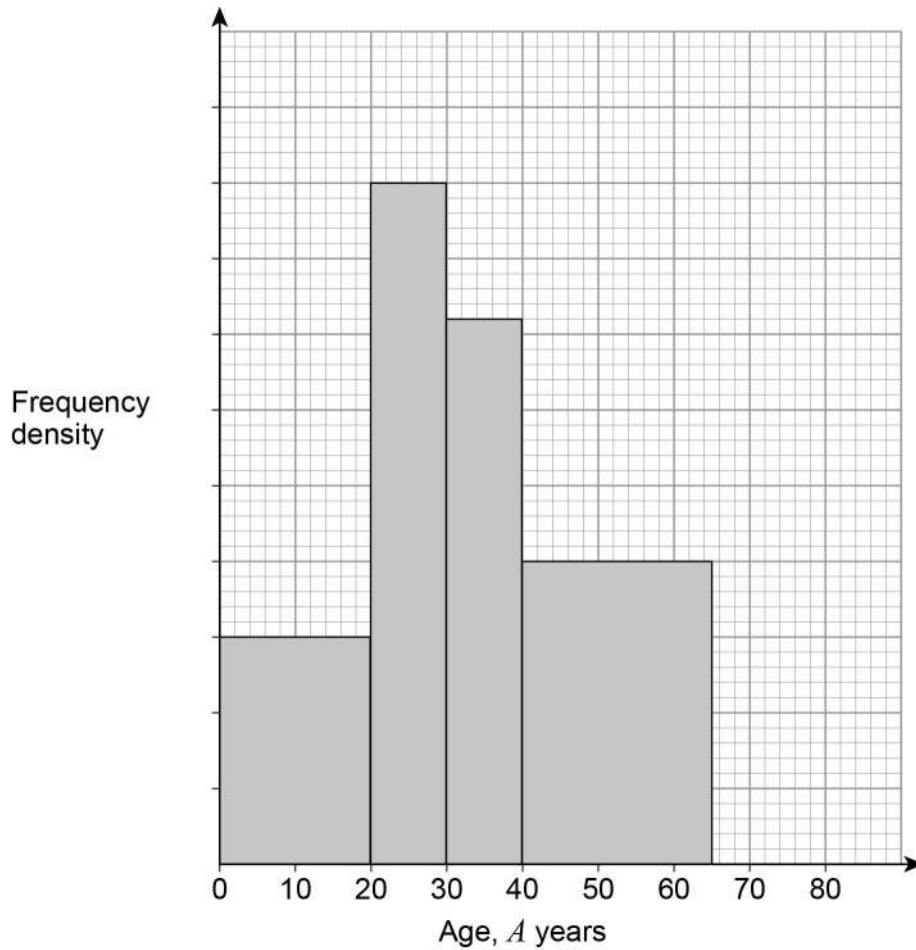
There are 30 members with $A < 20$

There are 12 members with $65 \leqslant A < 80$

There are no members with $A \geqslant 80$

23 (a) Complete the histogram.

[3 marks]

$c\,\frac{F}{d}$ ← The area of each box represents the frequency on a histogram.
Frequency = class width x frequency density. Making a formula triangle out of this

Work out the frequency density of the first bar to work out the scale on the y-axis.
Then work out the frequency density of the last bar and plot a box on for this

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23 (b) Work out the total number of members of the club.

[2 marks]

Add all of the frequencies together. Multiply the class width by the frequency density to find the frequency for each of the bars where the frequency isn't given

Answer _____

Turn over for the next question

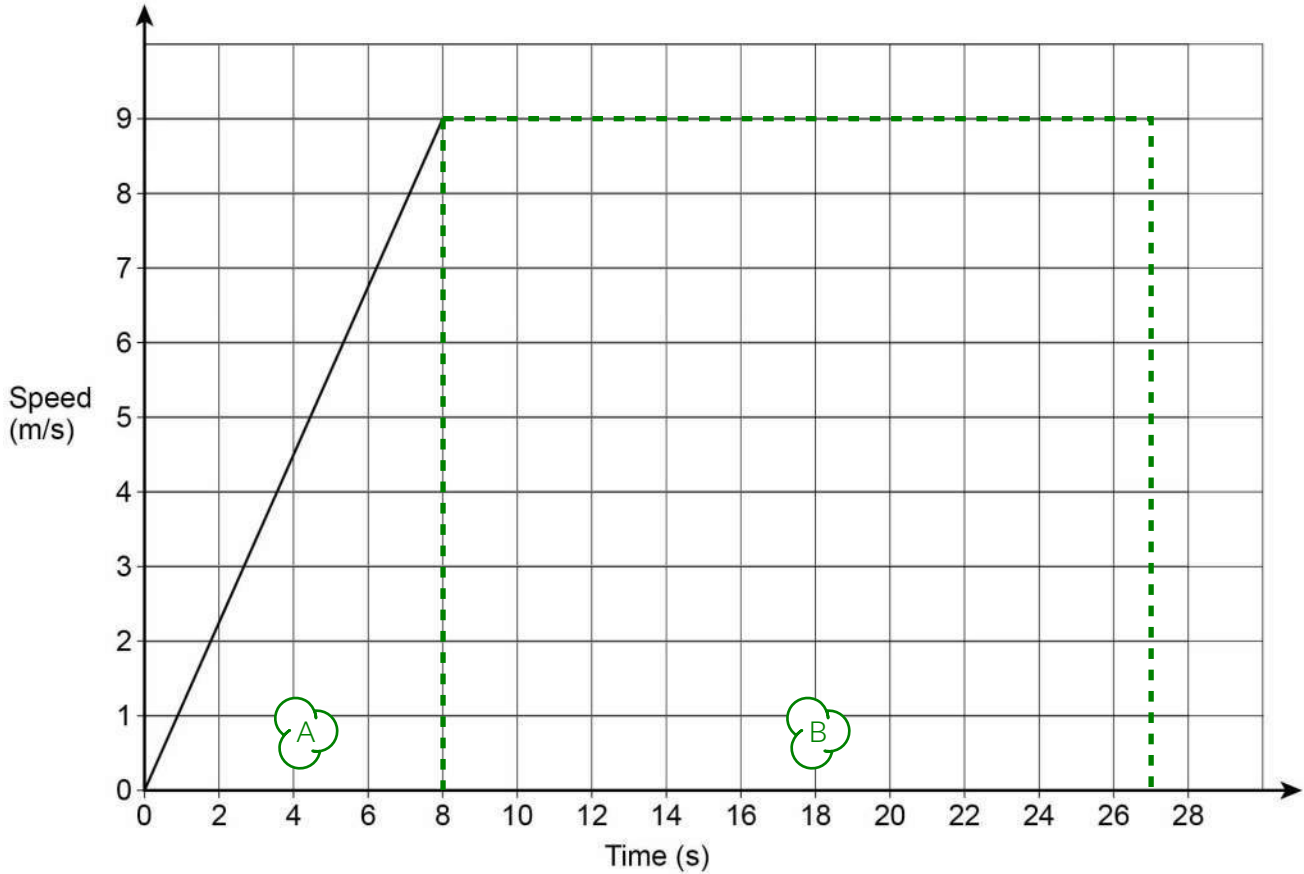**Turn over ▶**

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24 Beth ran a 200 metre race.

Here is a graph of the first 8 seconds of her race.

She completed the race at a constant speed of 9 m/s

Speed-time graph for Beth

Amy completed the race in 27 seconds.

Did Beth finish before Amy?
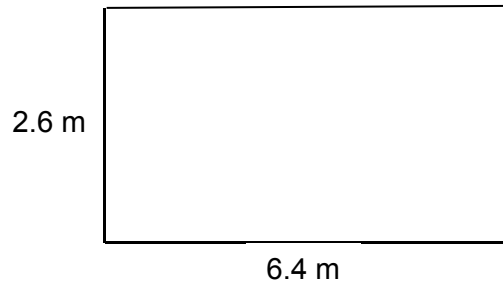
You **must** show your working.

[3 marks]

Work out the distance Beth would have done in 27 seconds. If she would have done more than 200 metres, she finishes first. Area under a speed-time graph is the distance. Adding the area of triangle A and rectangle B gives the total area. Area of triangle = 1/2 x base x height. Area of rectangle = base x height

Answer _____

25 The dimensions of a rectangular floor are to the nearest 0.1 metres.

Not drawn accurately

2.6 m

6.4 m

A force of 345 Newtons is applied to the floor.

The force is to the nearest 5 Newtons.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the upper bound of the pressure.

Give your answer to 4 significant figures.

You **must** show your working.

[5 marks]

Dividing the upper bound of the force by the lower bound of the area works out the upper bound of the pressure. The upper bound of the force is found by adding half of the resolution of the measurement, which is 5. The lower bound of the area of the rectangle is found by multiplying the lower bound of the length and the lower bound of the width. The lower bounds of the length and width are found by subtracting half of the resolution of the measurements, which is 0.1

Answer _____ N/m^2

8

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26 *ABCDE* is a pentagon.

Not drawn accurately
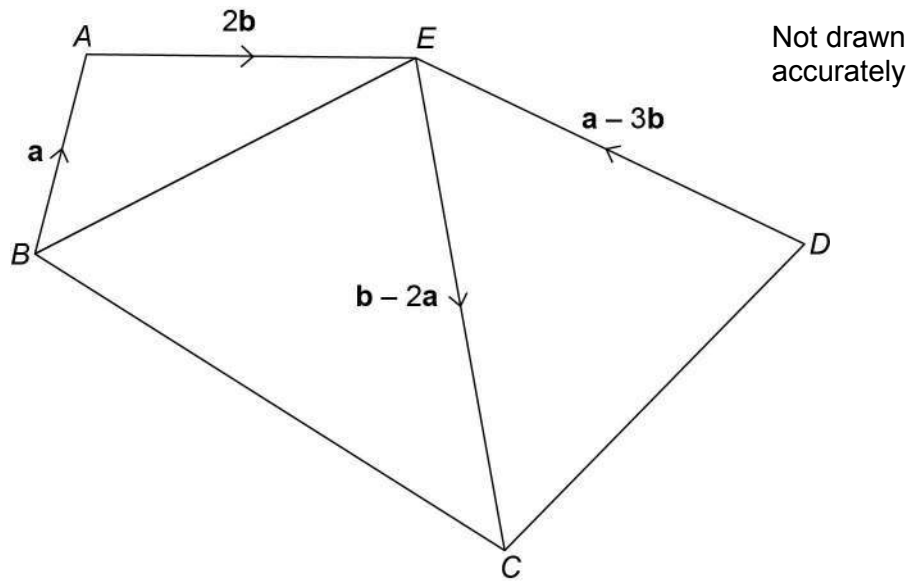
Show that *BCDE* is a parallelogram.

[3 marks]

Work out $\overrightarrow{CB}$ and show that it is equal in length and parallel to $\overrightarrow{DE}$. $\overrightarrow{CB} = \overrightarrow{CE} + \overrightarrow{EA} + \overrightarrow{AB}$. When going the opposite way to the arrow on a vector all the signs flip so positive becomes negative and negative becomes positive

27 Solve $\dfrac{x}{4} - \dfrac{2x}{x+2} = 1$

Give your solutions to 2 decimal places.

You **must** show your working.

[6 marks]

Multiplying all terms on both sides by the denominators eliminates the fractions. Expand any brackets this causes then collect all terms onto one side and leave 0 on the other to bring into the quadratic form: $ax^2 + bx + c = 0$. Use the quadratic formula to solve x

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

Answer _____

END OF QUESTIONS