**NEW SPECIMEN PAPERS PUBLISHED JUNE 2015**

AQA

# GCSE
# Mathematics
# Specification (8300/3H)

**H**

Paper 3 Higher tier

Date Morning 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.
- Fill in the boxes at the bottom 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.
- In all calculations, show clearly how you work out your answer.

**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.

Please write clearly, in block capitals, to allow character computer recognition.

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

Surname

Forename(s)

Candidate signature _____

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

**1** Work out the square root of 100 million.

Circle your answer.

**[1 mark]**

1000 | 10 000 | 100 000 | 1 000 000

**2** $\mathbf{a} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$

Circle the vector $\mathbf{a} - \mathbf{b}$

**[1 mark]**

$\begin{pmatrix} -3 \\ -5 \end{pmatrix}$ | $\begin{pmatrix} 7 \\ 1 \end{pmatrix}$ | $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ | $\begin{pmatrix} 7 \\ -5 \end{pmatrix}$

**3** Circle the decimal that is closest in value to $\frac{2}{3}$

**[1 mark]**

0.6 | 0.66 | 0.667 | 0.67

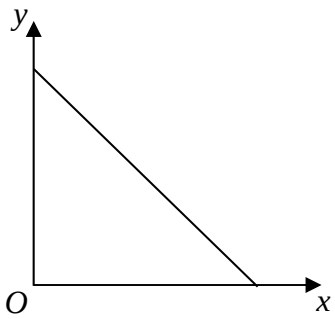
**4** $y$ is directly proportional to $x$.

Which graph shows this?

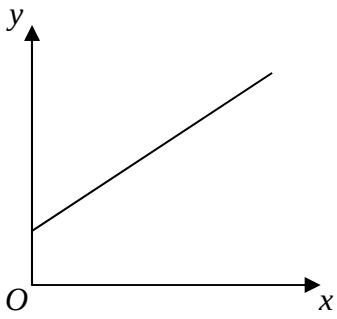
Circle the correct letter.

**[1 mark]**

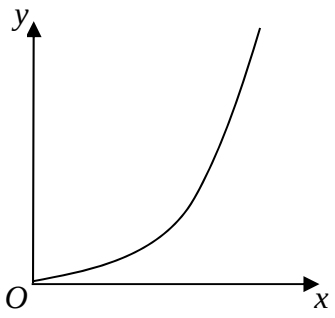
**A**



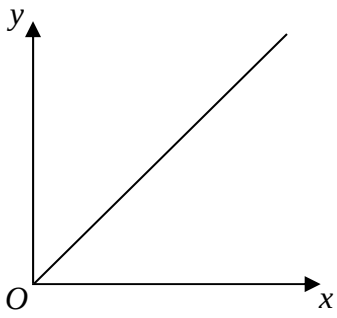

**B**




**C**




**D**




**Turn over for the next question**

**5** In 1999 the minimum wage for adults was £3.60 per hour.
In 2013 it was £6.31 per hour.

Work out the percentage increase in the minimum wage.

**[3 marks]**

Answer _____ %

**6** A bag contains counters that are red, blue, green or yellow.

| | **red** | **blue** | **green** | **yellow** |
|---|---|---|---|---|
| **Number of counters** | 9 | $3x$ | $x - 5$ | $2x$ |

A counter is chosen at random.

The probability it is **red** is $\frac{9}{100}$

Work out the probability it is green.

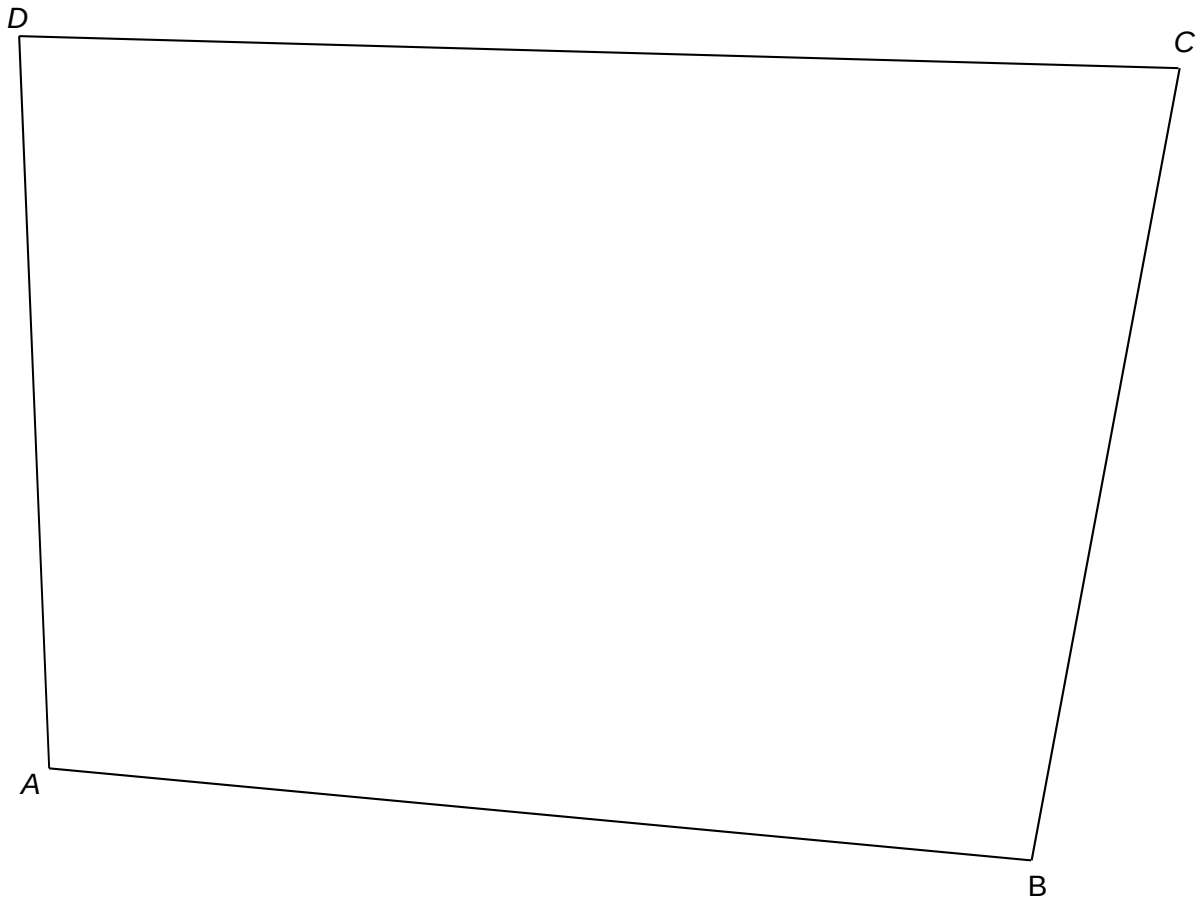
**[4 marks]**

Answer _____

**7** Use ruler and compasses to answer this question.

Point *P* is

- the same distance from *AB* and *AD*
- 6 cm from *C*.




Show the position of *P* on the diagram.

**[3 marks]**

**Turn over for the next question**

**8 (a)** Use your calculator to work out $19.42^2 - \sqrt[3]{1006} \div 4.95$

Write down your full calculator display.

**[1 mark]**

Answer _____

**8 (b)** Use approximations to check that your answer to part (a) is sensible.

You **must** show your working.

**[2 marks]**

**9** The exterior angle of a regular polygon is 45°

Circle the name of the regular polygon.

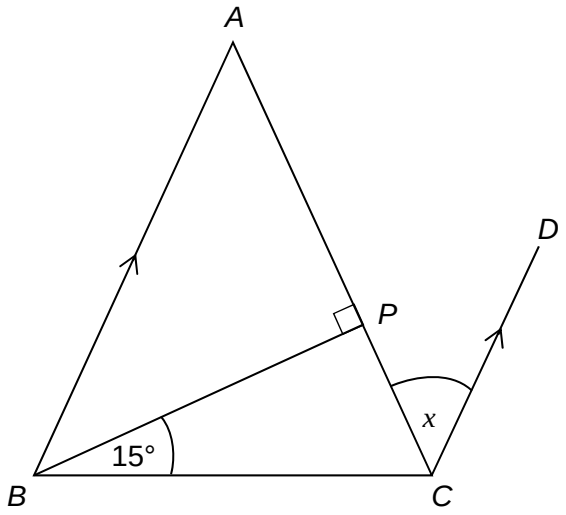
**[1 mark]**

pentagon hexagon octagon decagon

**10** *ABC* is a triangle with $AB = AC$

*BA* is parallel to *CD*.

Not drawn accurately




Show that angle $x = 30°$

**[3 marks]**

**11** The pressure at sea level is 101 325 Pascals.

Any rise of 1 km above sea level decreases the pressure by 14%

For example,

at 3 km above sea level the pressure is 14% less than at 2 km

Work out the pressure at 4 km above sea level.

Give your answer to 2 significant figures.

**[4 marks]**

Answer _____ Pascals

**12** Tick whether each statement is true or false.

Give a reason for your answer.

**12 (a)** When $x^2 = 16$ the **only** value that $x$ can be is 4

**[1 mark]**

True ☐ False ☐

Reason _____

_____

_____

**12 (b)** When $n$ is a positive integer, the value of $2n$ is **always** a factor of the value of $20n$.

**[1 mark]**

True ☐ False ☐

Reason _____

_____

_____

**12 (c)** When $y$ is positive, the value of $y^2$ is **always** greater than the value of $y$.

**[1 mark]**

True ☐ False ☐

Reason _____

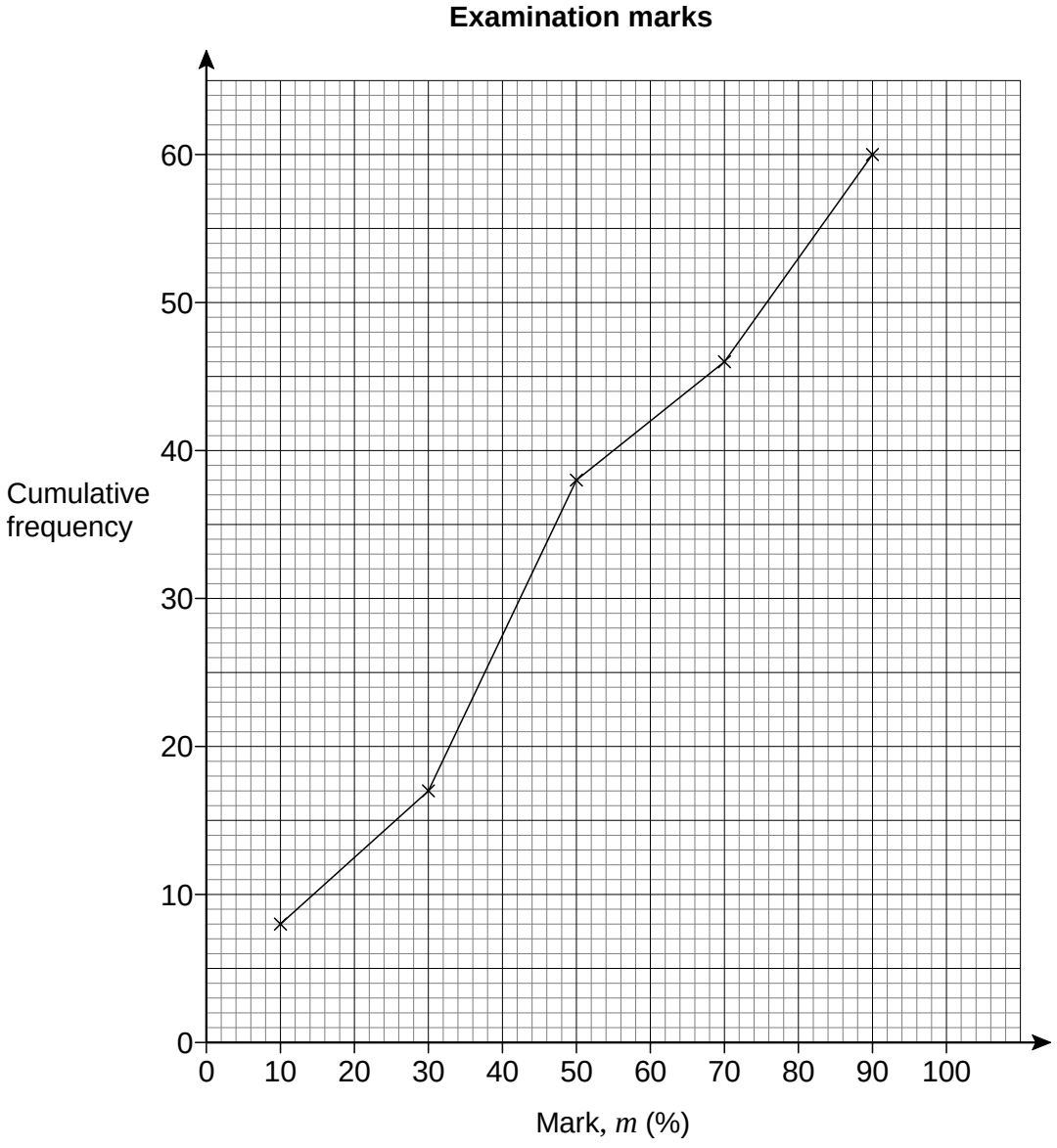
_____

_____

**13** Here are the examination marks for 60 pupils.

| **Mark, *m* (%)** | **Frequency** |
|---|---|
| $0 \leqslant m < 20$ | 8 |
| $20 \leqslant m < 40$ | 9 |
| $40 \leqslant m < 60$ | 21 |
| $60 \leqslant m < 80$ | 10 |
| $80 \leqslant m < 100$ | 12 |

Molly drew this cumulative frequency graph to show the data.



Make **two** criticisms of Molly's graph.

**[2 marks]**

Criticism 1 _____

_____

_____

Criticism 2 _____

_____

_____

**Turn over for the next question**

**14 (a)** The $n$th term of a sequence is $2^n + 2^{n-1}$

Work out the 10th term of the sequence.

**[1 mark]**

Answer _____

**14 (b)** The $n$th term of a different sequence is $4(2^n + 2^{n-1})$

Circle the expression that is equivalent to $4(2^n + 2^{n-1})$

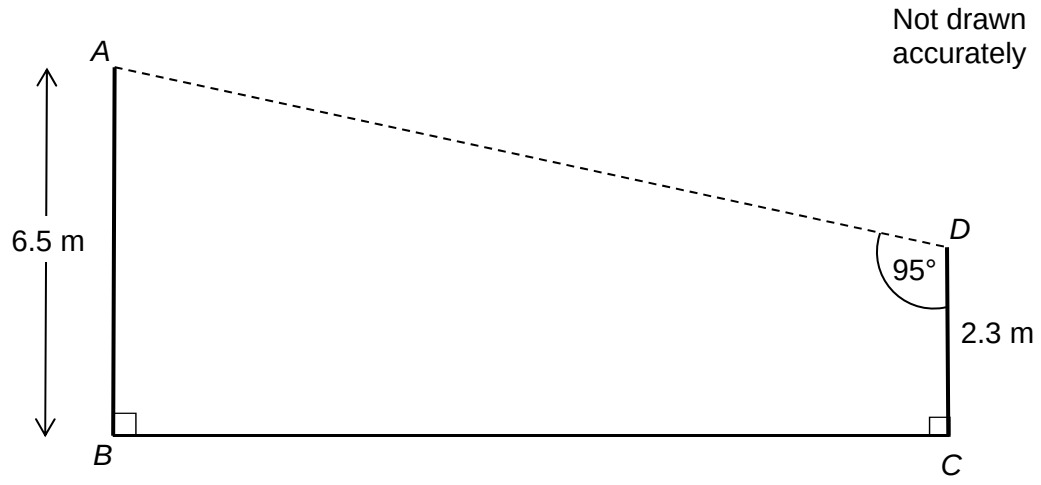
**[1 mark]**

$2^{n+2} + 2^{n+1}$ $2^{2n} + 2^{2(n-1)}$

$8^n + 8^{n-1}$ $2^{n+2} + 2^{n-1}$

**15** The diagram shows a design for a zipwire.

The zipwire will run between the top of two vertical posts, *AB* and *CD*.




Work out the distance *AD*.

**[4 marks]**

Answer _____ m

**16** During a game, players can win and lose counters.

At the start of the game

Rob, Tim and Zak share the counters in the ratio 5 : 6 : 7

At the end of the game

Rob, Tim and Zak share the **same number** of counters in the ratio 7 : 9 : 8

Show that Rob ends the game with more counters than he started with.

**[3 marks]**

**17** Factorise $3x^2 + 14x + 8$

**[2 marks]**

Answer _____

**18** Here is some information about the number of books read by a group of people in 2014

One of the frequencies is missing.

| Number of books | Frequency | Midpoint | |
|---|---|---|---|
| 0 – 4 | 16 | 2 | |
| 5 – 9 | | 7 | |
| 10 – 14 | 20 | 12 | |
| 15 – 19 | 10 | 17 | |

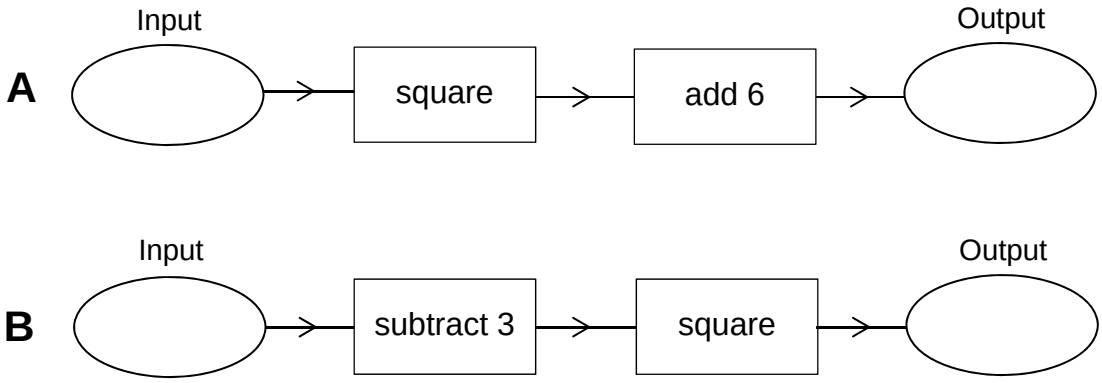
Midpoints are used to work out an estimate for the mean number of books read.
The answer is 8.5

Work out the missing frequency.

**[5 marks]**

Answer _____

**19** Here are two function machines, **A** and **B.**




Both machines have the same input.

Work out the range of input values for which

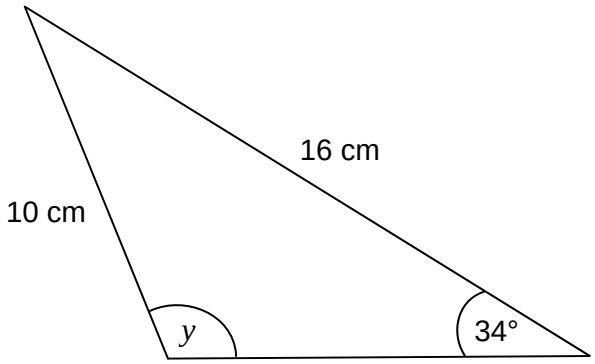
the output of **A** is **less** than the output of **B**.

**[4 marks]**

Answer _____

**20** In the triangle, angle $y$ is obtuse.

Not drawn accurately




Work out the size of angle $y$.

**[3 marks]**

Answer _____ degrees

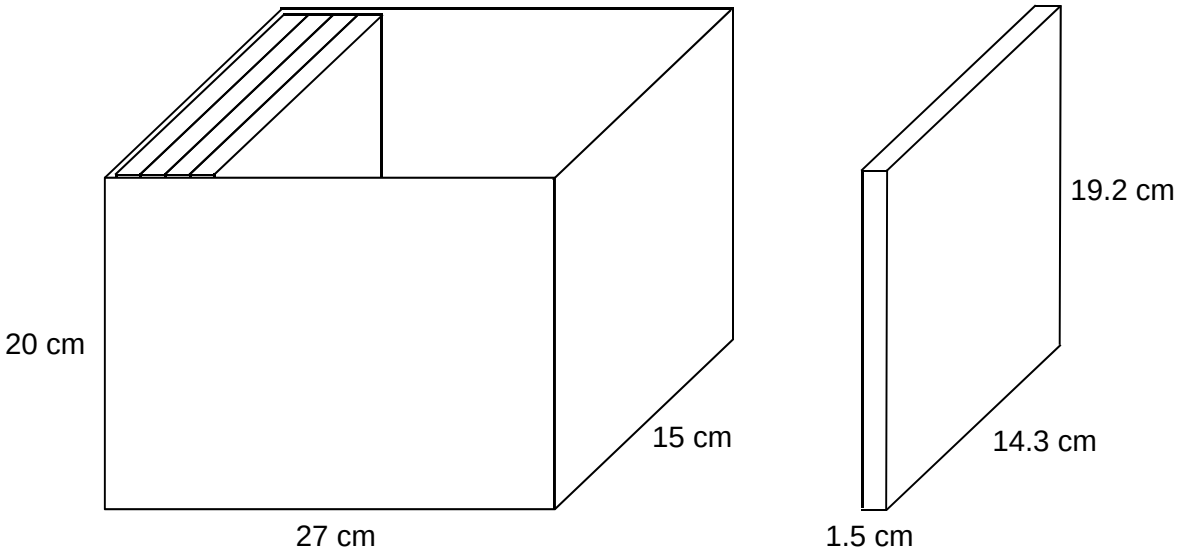
**Turn over for the next question**

**21** A box is a cuboid with dimensions 27 cm by 15 cm by 20 cm

These dimensions are to the nearest **centimetre**.

DVD cases are cuboids with dimensions 1.5 cm by 14.3 cm by 19.2 cm

These dimensions are to the nearest **millimetre**.




Show that 17 DVD cases, stacked as shown, will definitely fit in the box.

**[4 marks]**

**22** Bag X contains 9 blue balls and 18 red balls.

Bag Y contains 7 blue balls and 14 red balls.

Liz picks a ball at random from bag X.

She puts the ball into bag Y.

Mike now picks a ball at random from bag Y.

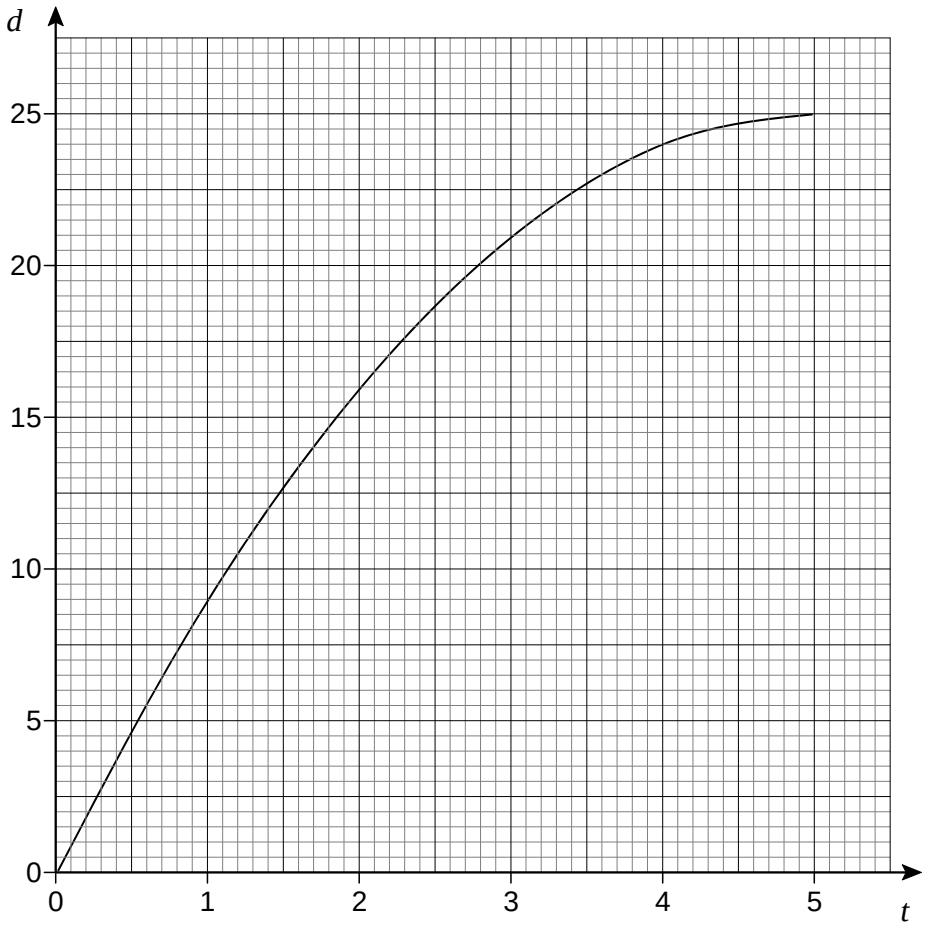
Show that

P (Liz picks a blue ball) = P (Mike picks a blue ball)

**[4 marks]**

**23** A container is filled with water in 5 seconds.

The graph shows the depth of water, $d$ cm, at time $t$ seconds.



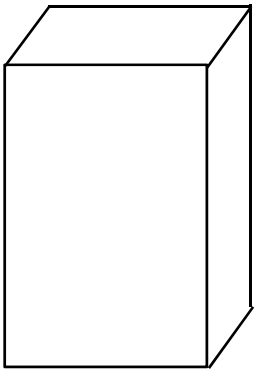
**23 (a)** The water flows into the container at a constant rate.

Which diagram represents the container?

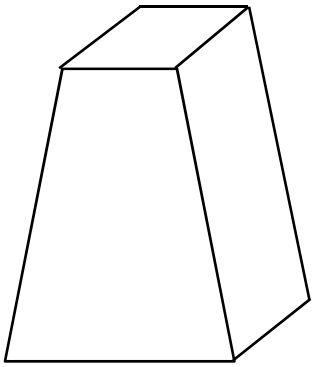
Circle the correct letter.

**[1 mark]**

**A**



**B**



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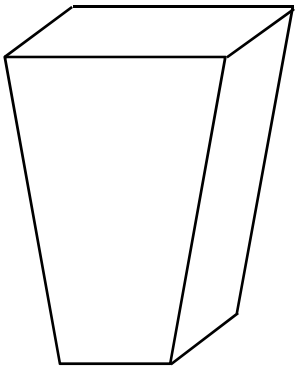
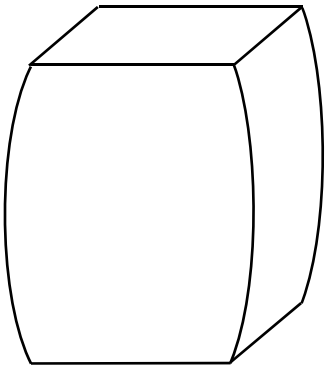


**D**



**23 (b)** Use the graph to estimate the rate at which the depth of water is increasing at 3 seconds.

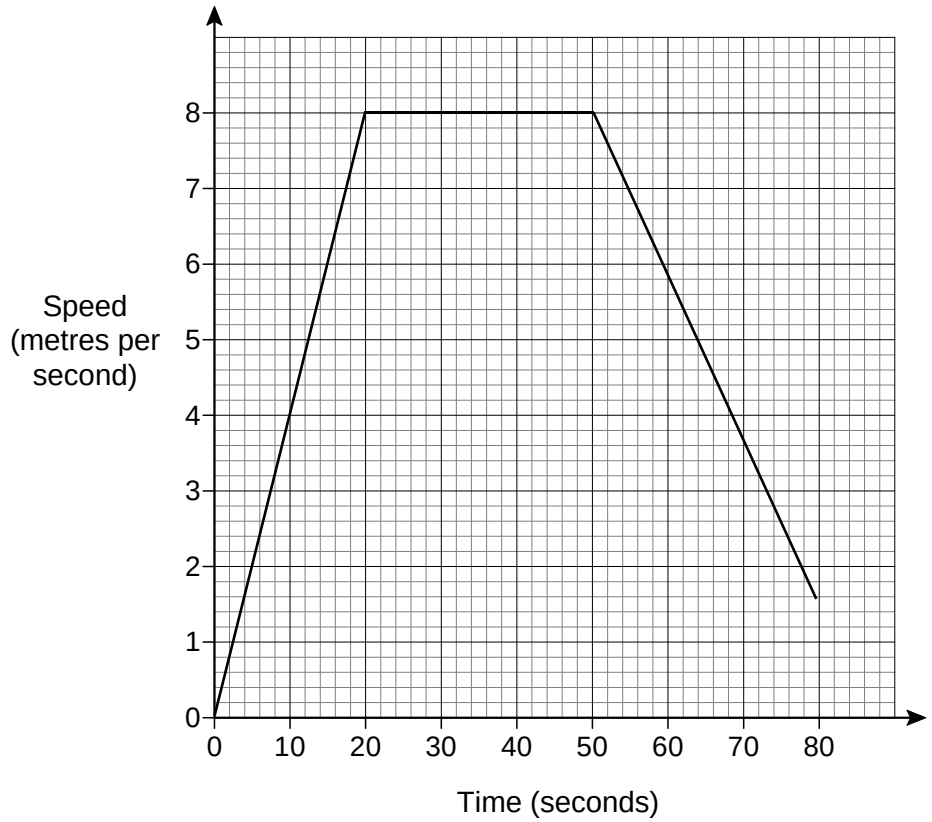
You **must** show your working.

**[2 marks]**

Answer _____ cm/s

**24** Amina and Ben had a cycle race.

Here is Amina's speed-time graph from the start of the race.



**24** The distance of the race was 400 metres.

Ben cycled the 400 metres in 64 seconds.

Who won the race?

You **must** show your working.

**[4 marks]**

Answer _____

**Turn over for the next question**

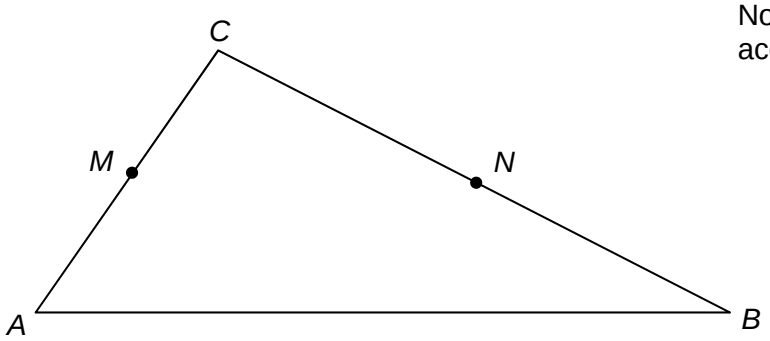
**25** In triangle $ABC$

$M$ is the midpoint of $AC$

$N$ is the point on $BC$ where $BN : NC = 2 : 3$

$\overrightarrow{AC} = 2\mathbf{a}$

$\overrightarrow{AB} = 3\mathbf{b}$

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**25 (a)** Work out $\overrightarrow{MN}$ in terms of **a** and **b**.

Give your answer in its simplest form.

**[3 marks]**

Answer _____

**25 (b)** Use your answer to part (a) to explain why $MN$ is **not** parallel to $AB$.

**[1 mark]**

**26** An approximate solution to an equation is found using this iterative process.

$$x_{n+1} = \frac{(x_n)^3 - 3}{8} \quad \text{and} \quad x_1 = -1$$

**26 (a)** Work out the values of $x_2$ and $x_3$

**[2 marks]**

$x_2 =$ _____

$x_3 =$ _____

**26 (b)** Work out the solution to 6 decimal places.

**[1 mark]**

$x =$ _____

**27** The curve with equation $y = x^2 - 5x + 2$ is reflected in the $x$-axis.

Circle the equation of the reflected curve.

**[1 mark]**

$y = x^2 - 5x - 2$

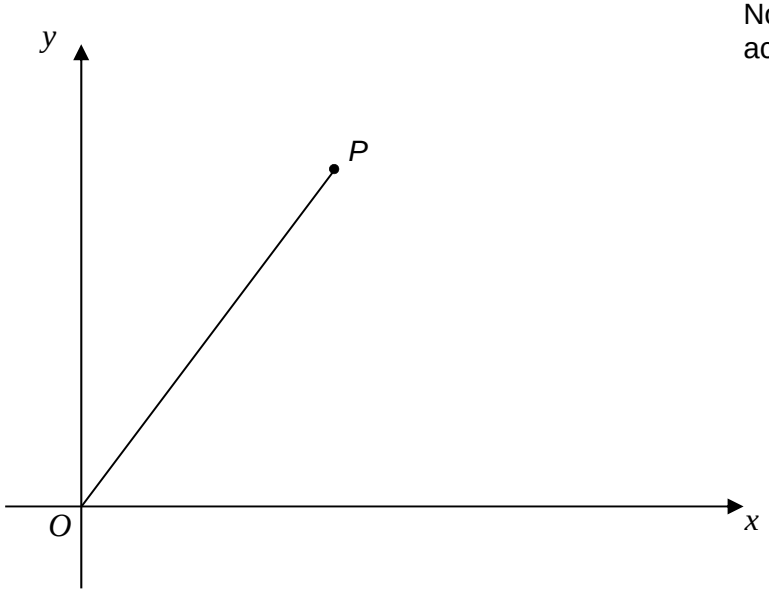
$y = -x^2 + 5x + 2$

$y = -x^2 + 5x - 2$

$y = x^2 + 5x + 2$

**28** The diagram shows a line joining $O$ to $P$.

Not drawn accurately




The gradient of the line is 2

The length of the line is $\sqrt{2645}$

Work out the coordinates of $P$.

**[4 marks]**

Answer ( _____ , _____ )

**END OF QUESTIONS**

**There are no questions printed on this page**

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