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KEY STAGE

3

TIER

6–8

# Mathematics test

## Paper 1

### Calculator not allowed

First name \_\_\_\_\_

Last name \_\_\_\_\_

School \_\_\_\_\_

#### Remember

- The test is 1 hour long.
- You **must not** use a calculator for any question in this test.
- You will need: pen, pencil, rubber and a ruler.
- Some formulae you might need are on page 2.
- This test starts with easier questions.
- Try to answer all the questions.
- Write all your answers and working on the test paper – do not use any rough paper. Marks may be awarded for working.
- Check your work carefully.
- Ask your teacher if you are not sure what to do.

2009

## Instructions

### Answers



This means write down your answer or show your working and write down your answer.

### Calculators



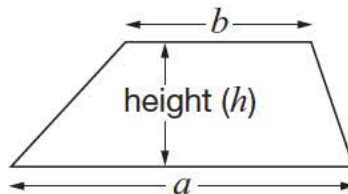
You **must not** use a calculator to answer any question in this test.

## Formulae

You might need to use these formulae

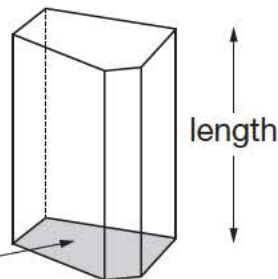
### Trapezium

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



### Prism

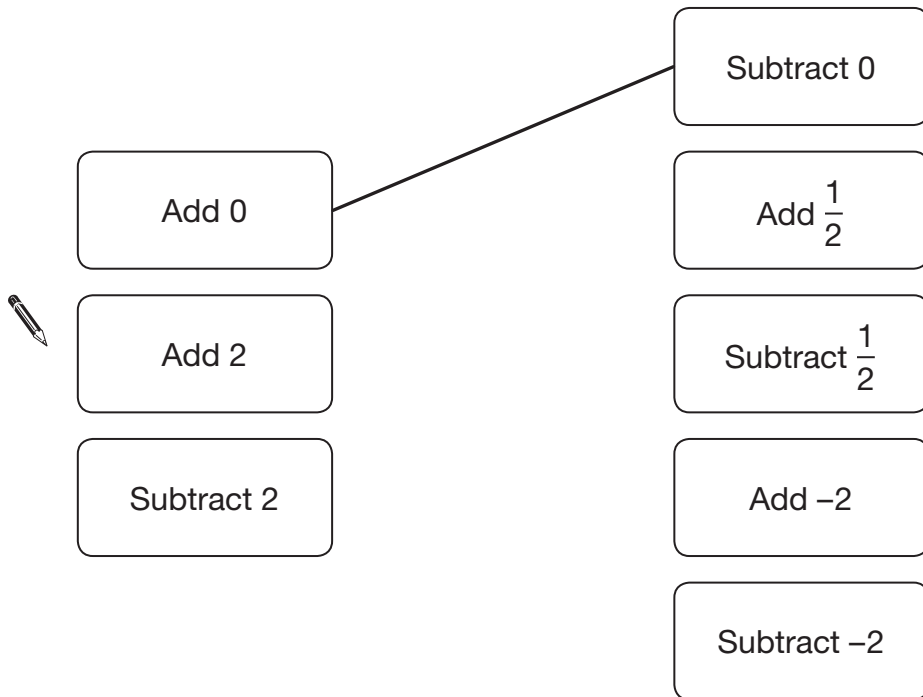
area of cross-section



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

1. Match each instruction on the left with an instruction on the right that has **the same effect**.

The first one is done for you.



1 mark



2. Pupils are investigating oak leaves.  
They want to collect a sample of oak leaves.

Here is their plan for how to collect the sample.

Plan
Choose one oak tree. Take 10 leaves from the lowest branches of the tree.

Give **two** reasons why this sample of leaves may **not be representative** of all oak leaves.



First reason:

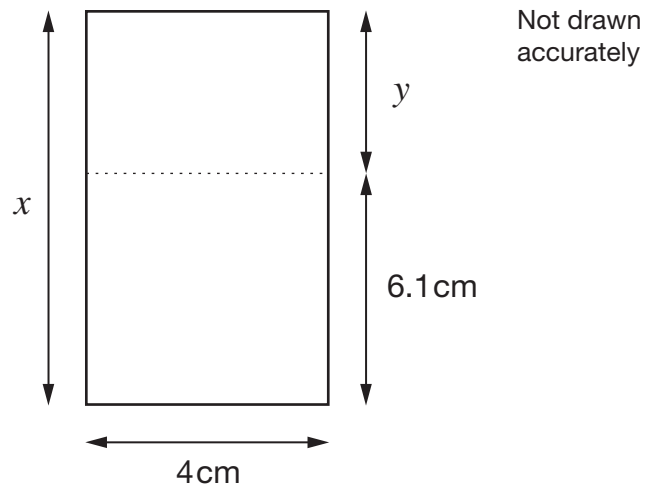
1 mark



Second reason:

1 mark

3. Look at the rectangle.



The **total area** of the rectangle is  $40\text{cm}^2$

Work out lengths  $x$  and  $y$



$x =$  \_\_\_\_\_  $\text{cm}$       $y =$  \_\_\_\_\_  $\text{cm}$

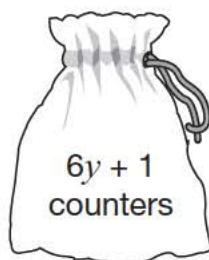
\_\_\_\_\_

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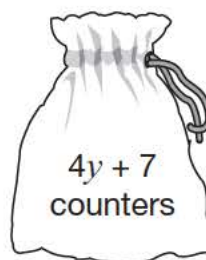
2 marks



4. (a) Bags A and B contain some counters.



Bag A



Bag B

The number of counters in each bag **is the same**.

Work out the value of  $y$

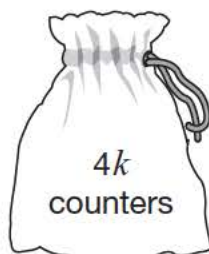


\_\_\_\_\_

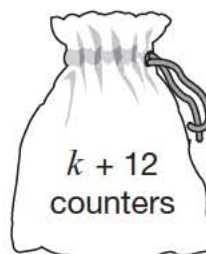
\_\_\_\_\_

2 marks

- (b) Bag **C** contains **more** counters than bag **D**.



Bag C



Bag D

What is the **smallest** possible value of  $k$ ?



\_\_\_\_\_

\_\_\_\_\_

2 marks

5. Gary took part in a quiz show and won a **million pounds**.

He spent **£20 000** on a holiday.

Then he spent **half** of the **money left** on a house.

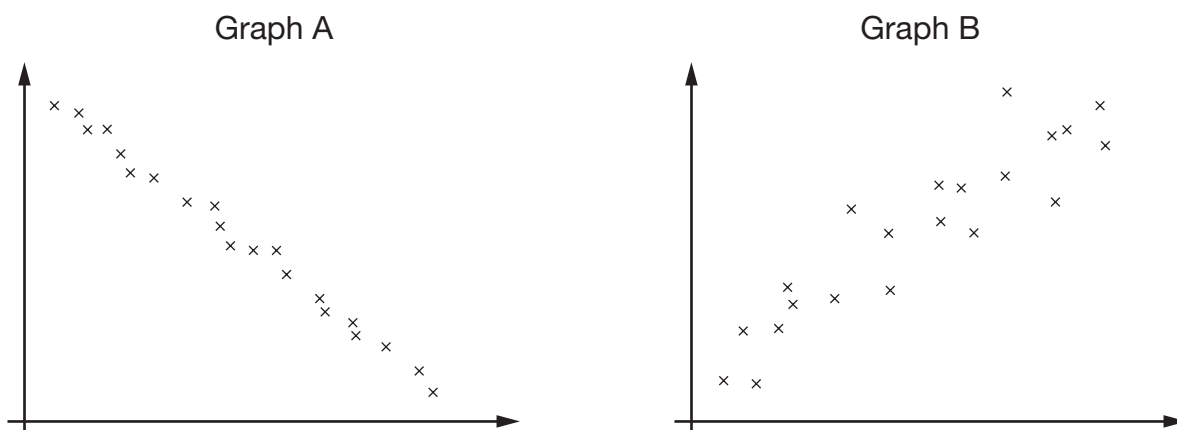
How much did Gary's house cost?



2 marks



6. Look at these two scatter graphs. They are both drawn using the same scale.



- (a) Which scatter graph shows **positive** correlation?




A

B

Explain your answer.




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 1 mark

- (b) Which scatter graph shows **stronger** correlation?




A

B

Explain your answer.

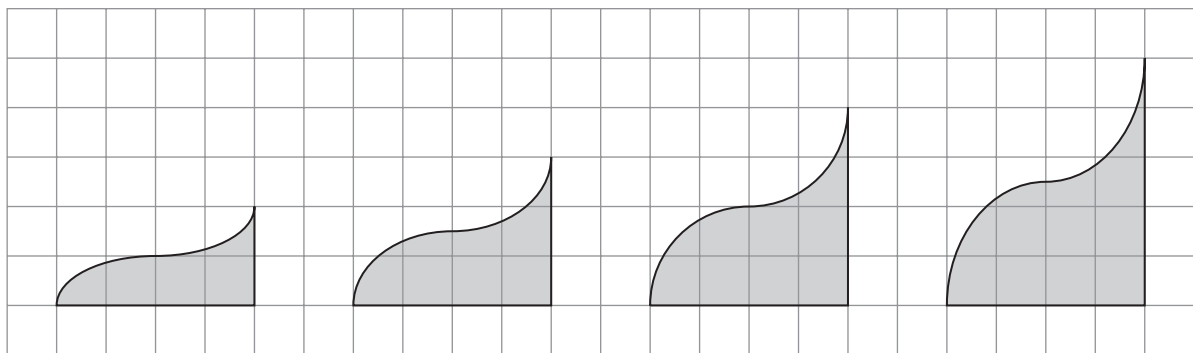



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 1 mark



7. Look at the sequence of shapes on a square grid.



Shape number 1

Shape number 2

Shape number 3

Shape number 4

The table shows information about these shapes.

Shape number $N$	Base $B$	Height $H$	Area $A$
1	4	2	4
2	4	3	6
3	4	4	8
4	4	5	10

**Rules** connect  $N$ ,  $B$ ,  $H$  and  $A$ .

Write one missing letter in each space below to complete the rule.



$$H = \underline{\hspace{2cm}} + 1$$

$$A = \underline{\hspace{2cm}} \times 2$$

$$\underline{\hspace{2cm}} = 2N + 2$$

2 marks



8. Look at this information.

$$\frac{27}{40} = 0.675$$

$$\frac{29}{40} = 0.725$$

Use this information to write the missing **decimals** below.



$$\frac{31}{40} = \underline{\hspace{2cm}}$$

1 mark



$$\frac{23}{40} = \underline{\hspace{2cm}}$$

1 mark

9. In this question,  $n$  stands for any **whole number**.
- (a) For the expression  $2n$ , tick (✓) the correct statement below.



$2n$  must be odd.

$2n$  must be even.

$2n$  could be odd or even.

Explain your answer.



1 mark

- (b) For the expression  $3n$ , tick (✓) the correct statement below.



$3n$  must be odd.

$3n$  must be even.

$3n$  could be odd or even.

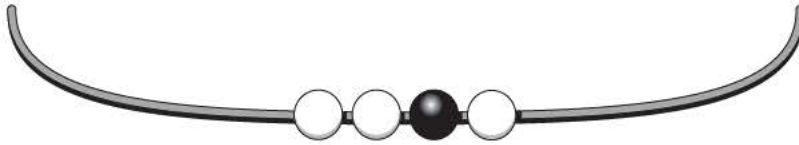
Explain your answer.



1 mark



10. (a) On this necklace the ratio of black beads to white beads is **1 : 3**



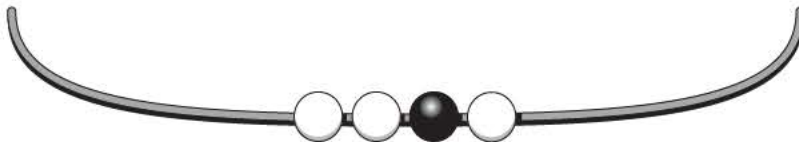
How many **more** black beads do you need to add to make the ratio of black to white **3 : 1**?



\_\_\_\_\_ black beads

\_\_\_\_\_ 1 mark

- (b) Here is the necklace again.



How many **more** black beads and white beads do you need to add to make the ratio of black to white **3 : 2**?



\_\_\_\_\_ black beads, \_\_\_\_\_ white beads

\_\_\_\_\_ 1 mark

11. Show that the **difference** between  $3^2$  and  $3^3$  is **18**



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1 mark

12. Sophie says:

If  $n$  represents a prime number, then  
 $2n + 1$  will also represent a prime number.

Use an example to explain why she is **wrong**.



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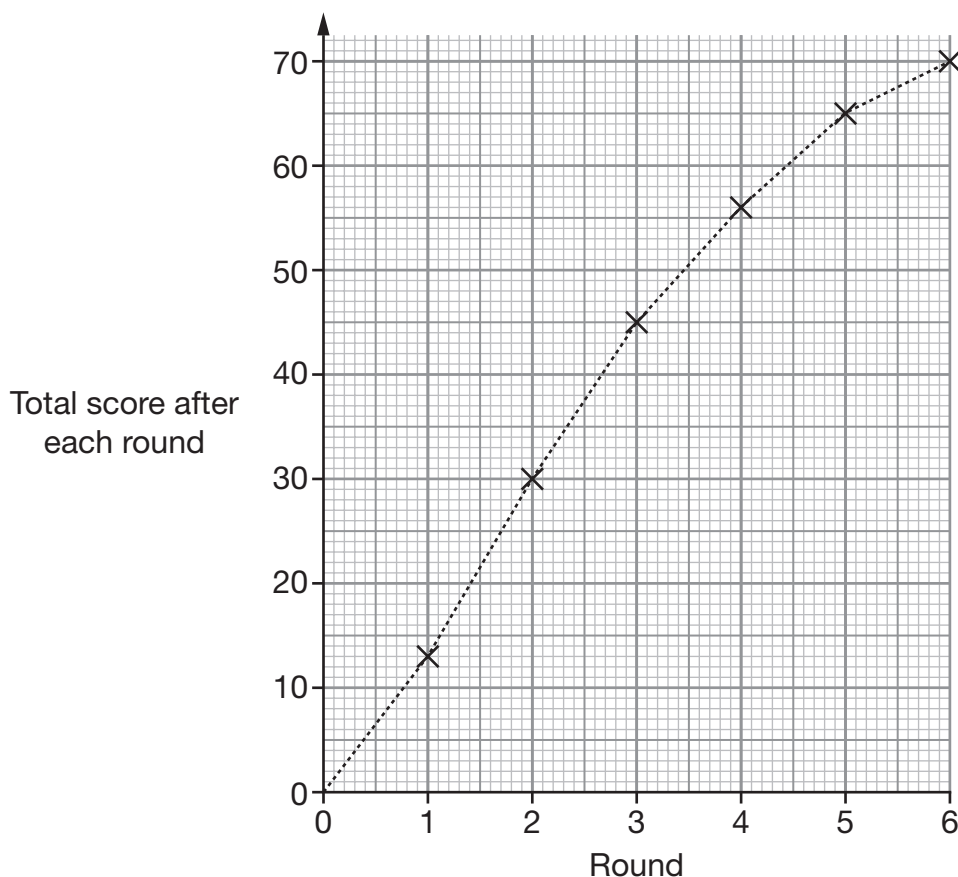
1 mark



13. A game has six rounds.

In each round of the game, the player gains points which are added to their total score.

- (a) The graph shows Sue's total score after each round of her game.



How many points did Sue gain in **round 4**?



\_\_\_\_\_

\_\_\_\_\_

2 marks

- (b) Derek plays the game.

The graph of his total score after each round is a **straight line**.

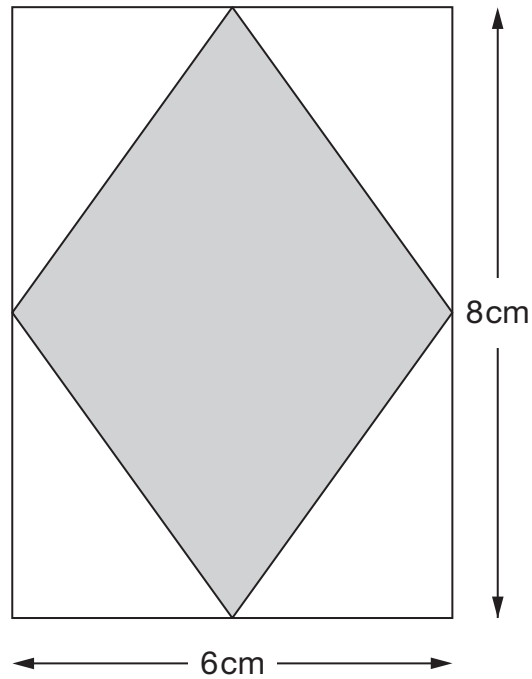
What can you say about the number of points Derek gained in each round?



\_\_\_\_\_

1 mark

14. Inside the rectangle below is a shaded rhombus.  
The vertices of the rhombus are the midpoints of the sides of the rectangle.



Not drawn accurately

What is the **area** of the shaded rhombus?



2 marks

1 mark



15. (a) Sandra is thinking of two numbers.

Her two numbers have a **negative sum**, but a **positive product**.

Give an example of what her numbers could be.



\_\_\_\_\_ and \_\_\_\_\_

1 mark

(b) Mark is also thinking of two numbers.

His two numbers have a **positive sum**, but a **negative product**.

Give an example of what his numbers could be.



\_\_\_\_\_ and \_\_\_\_\_

1 mark

16. The mean of five numbers is **10**

I add one more number and the mean is now **11**

What number did I add?



2 marks



17. Solve these simultaneous equations using an algebraic method.

$$3x + 6y = 30$$

$$x + 6y = 20$$

You **must** show your working.

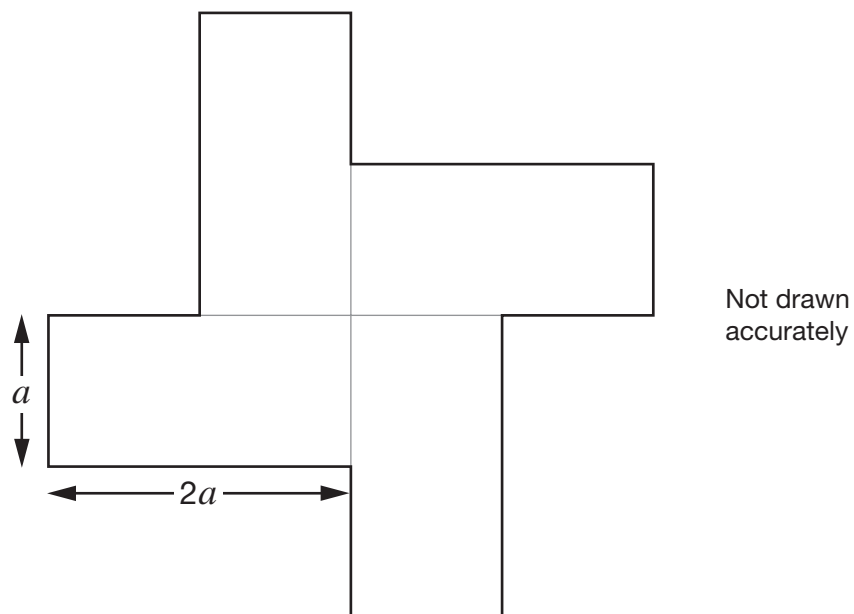


$$x = \underline{\hspace{2cm}} \quad y = \underline{\hspace{2cm}}$$

3 marks



18. This shape is made of four congruent rectangles.  
Each rectangle has side lengths  $2a$  and  $a$



The **perimeter** of the shape is **80 cm**.

Work out the **area** of the shape.



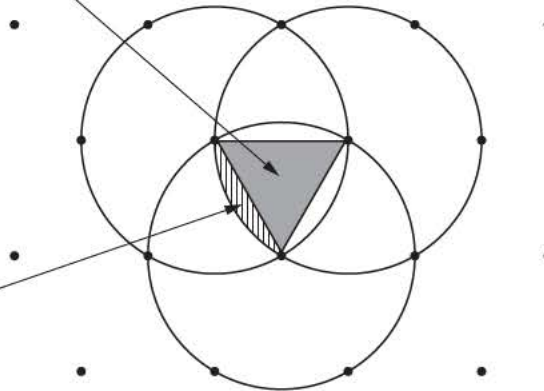
\_\_\_\_\_  $\text{cm}^2$

\_\_\_\_\_  
2 marks

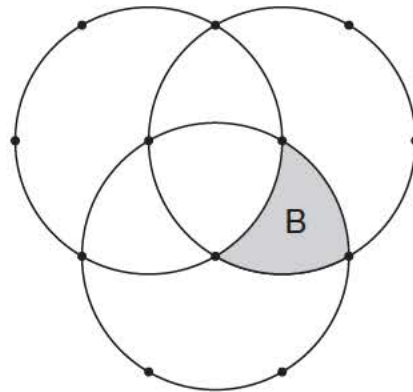
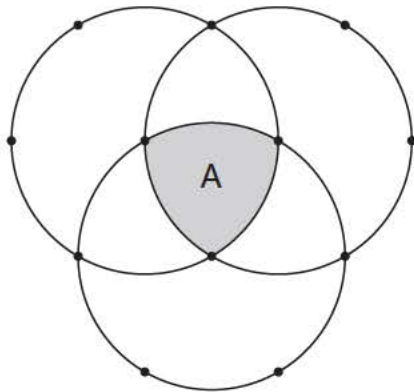
19. The diagram shows three congruent circles drawn on an isometric grid.

The area of this equilateral triangle is  $y$

The area of this segment is  $w$



Write expressions, using  $y$  and  $w$ , for area A and area B.



Area A = \_\_\_\_\_

Area B = \_\_\_\_\_

1 mark

1 mark



20. (a) A pupil wrote:

For all numbers  $j$  and  $k$ ,  
 $(j + k)^2 = j^2 + k^2$

Show that the pupil is **wrong**.



2 marks

(b) A different pupil wrote:

For all numbers  $j$  and  $k$ ,  
 $(j + k)^2$  can **never** be equal to  $j^2 + k^2$

Show that this pupil is also **wrong**.



1 mark

21. I have two fair four-sided dice.

The dice are both numbered **3, 4, 5** and **6**

I am going to roll both dice and **multiply** the scores.

What is the probability that the product is a **multiple of 3**?



2 marks



22. Solve these equations using an algebraic method.

You **must** show your working.

$$\frac{5(3y - 4)}{2y} = 7$$



$$y = \underline{\hspace{2cm}}$$

2 marks

$$(x + 4)(x - 4) = 9$$

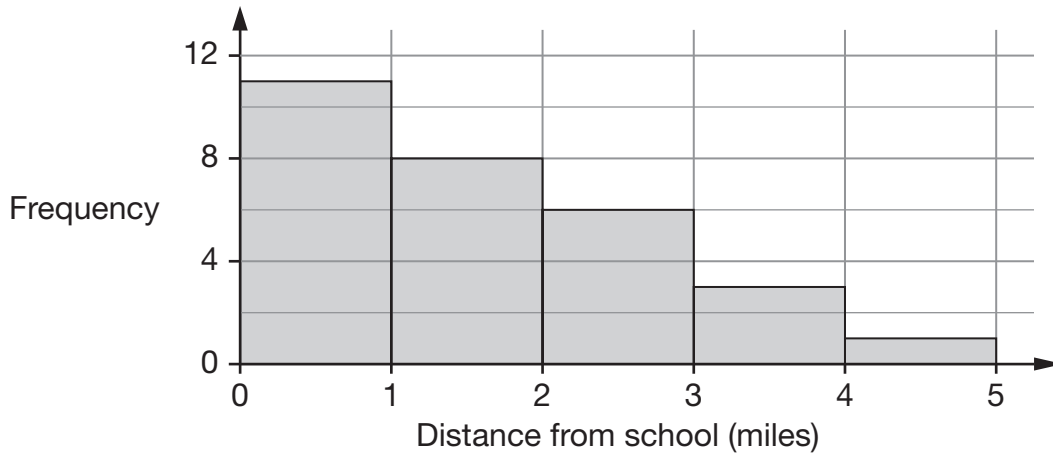


$$x = \underline{\hspace{2cm}} \quad \text{or} \quad x = \underline{\hspace{2cm}}$$

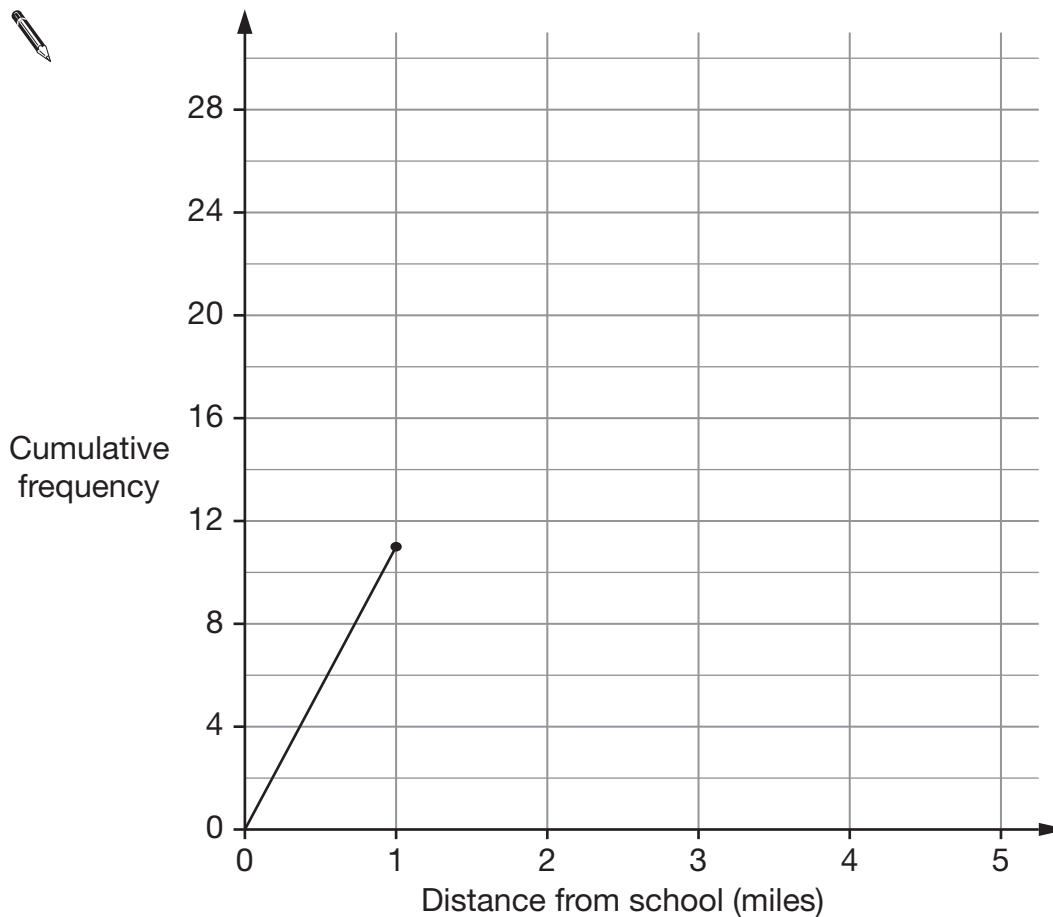
2 marks

23. Pupils in a class investigated how far they live from school.

The frequency diagram shows the results.



(a) Complete the **cumulative frequency** graph below to show these results.



2 marks

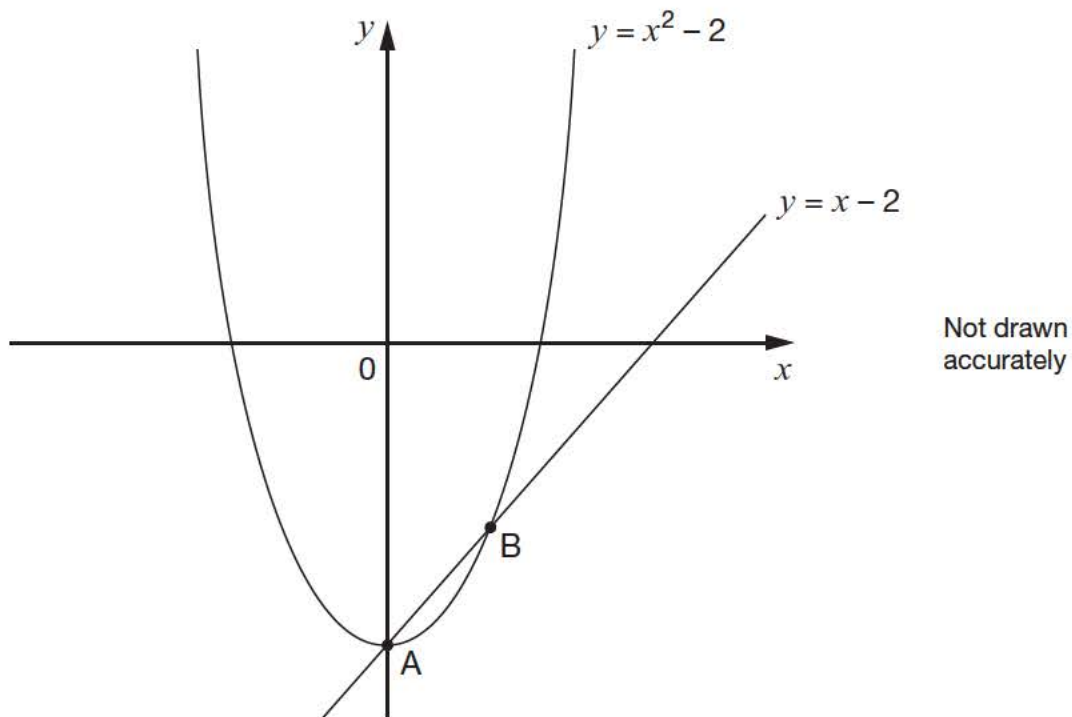
(b) Estimate the median distance from school for this class.



miles

1 mark

24. Look at the graph.



At points A and B,  $y = x - 2$  and  $y = x^2 - 2$

What are the coordinates of A and B?



A is ( \_\_\_\_\_ , \_\_\_\_\_ )

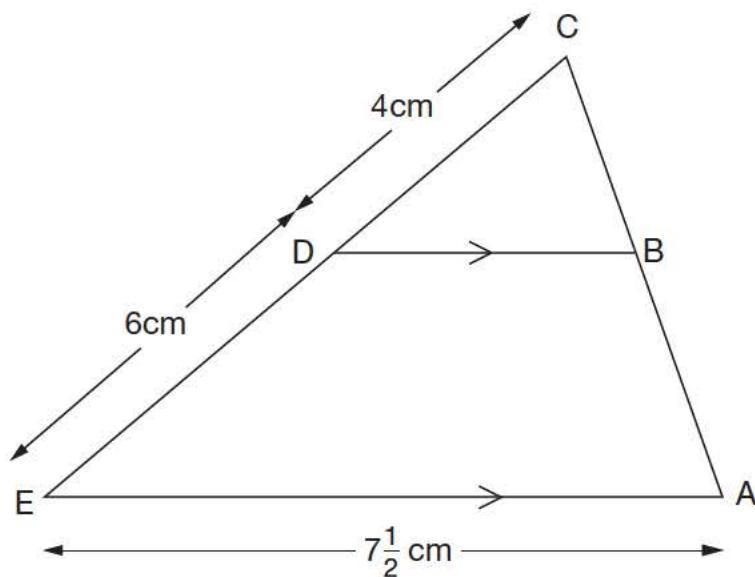
\_\_\_\_\_   
 1 mark

B is ( \_\_\_\_\_ , \_\_\_\_\_ )

\_\_\_\_\_   
 1 mark



25. In the diagram triangle BCD is mathematically similar to triangle ACE.



Not drawn accurately

Work out the length of BD.



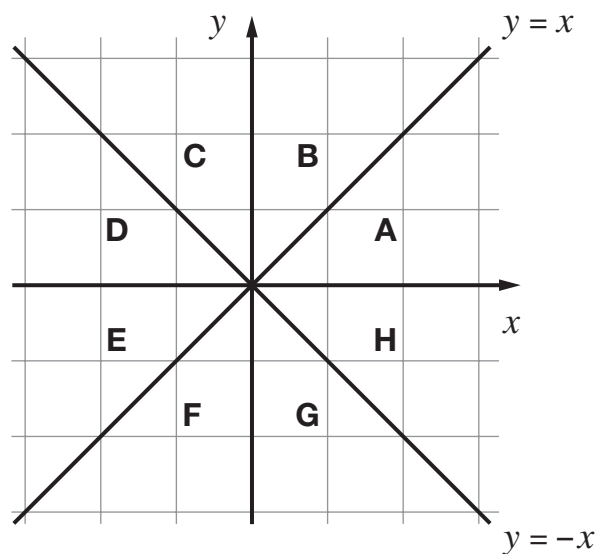
\_\_\_\_\_ cm

2 marks



26. Look at the graph.

The  $x$ -axis, the  $y$ -axis and the lines  $y = x$  and  $y = -x$  divide the graph into eight regions, A to H.



(a) Write down the letters of the four regions where  $x \geq 0$



\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_

1 mark

(b) Write down the letters of the four regions where  $y \geq x$



\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_

1 mark

(c) Write down the letters of the four regions where  $xy \geq 0$



\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_

1 mark

- 27.** A cyclist went 1 km up a hill at 15 km per hour.  
Then she went 1 km down the hill at 30 km per hour.  
Show that her **average** speed for the 2 km was **20 km per hour**.



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2 marks



**END OF TEST**