

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Higher Tier
June 2010

Mathematics (Specification A)

4306/2H

Paper 2 Calculator

H

Friday 11 June 2010 9.00 am to 11.00 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • mathematical instruments. <p>You may use a calculator.</p>	
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Time allowed

- 2 hours

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top 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. 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 100.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 - 5	
6 - 7	
8 - 9	
10 - 11	
12 - 13	
14 - 15	
16 - 17	
18 - 19	
20 - 21	
22 - 23	
24	
TOTAL	



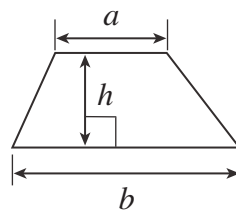
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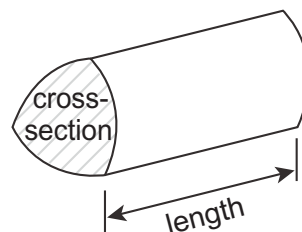
4306/2H

Formulae Sheet: Higher Tier

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

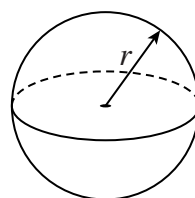


Volume of prism = area of cross-section \times length



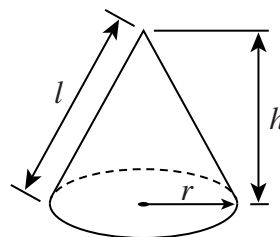
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

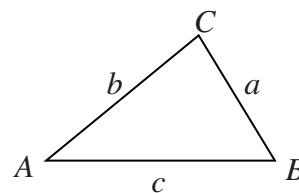


In any triangle ABC

Area of triangle = $\frac{1}{2}ab \sin C$

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

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



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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



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

- 1** Use your calculator to evaluate

$$\frac{9.3 + 7.9}{4.6 - 2.7}$$

- 1 (a)** Write down your full calculator display.

Answer (1 mark)

- 1 (b)** Write down your answer to a suitable degree of accuracy.

Answer (1 mark)

- 2** Naismith's rule is used to calculate an approximate time for mountain walks.

Allow 1 hour for every 5 km walked,
plus
30 minutes for every 300 metres of ascent.

The walk from Dungeon Ghyll to the top of Scafell Pike in the Lake District is a distance of 18 km.

The total ascent is 1400 metres.

Lannie calculates an approximate time of 6 hours.

Show that Lannie is correct.

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(4 marks)



- 3** Share £47 between Adam and Beth so that Adam gets four times as much as Beth.

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Answer Adam £

Beth £ (2 marks)

- 4** The table shows the year group and gender of a sample of 50 pupils.

Gender	Year Group					Total
	Yr7	Yr8	Yr9	Yr10	Yr11	
Number of boys	3	5	6	2	6	22
Number of girls	4	5	7	6	6	28

- 4 (a)** What percentage of the sample is in Year 11?

.....

Answer % (1 mark)

- 4 (b)** A pupil from the sample is picked at random.

What is the probability that the pupil is in Year 8?
Give your answer as a fraction in its lowest terms.

.....

Answer (2 marks)

- 4 (c)** There are 1500 pupils in the school altogether.

Use the table to estimate the number of boys in the school.

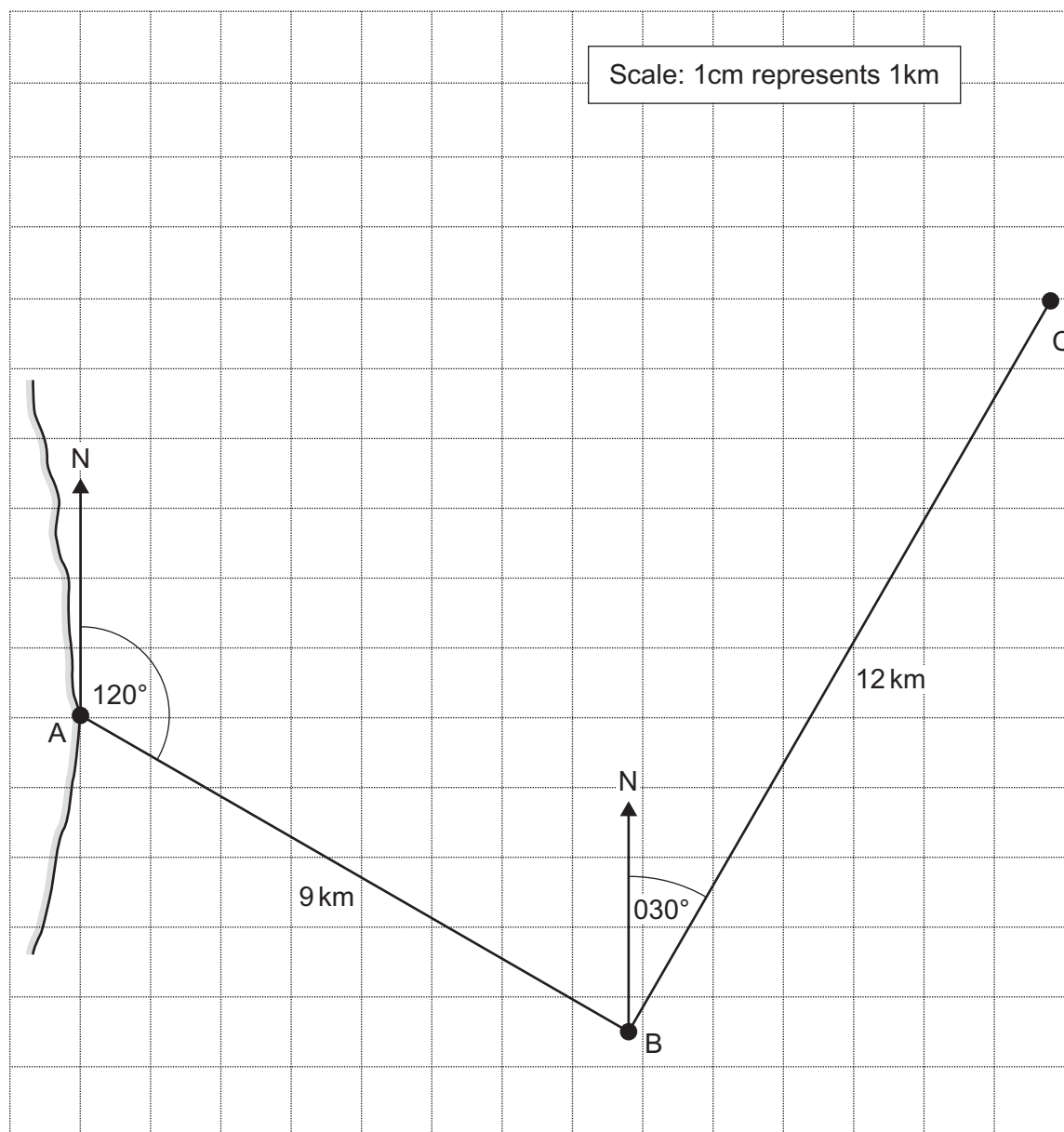
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Answer (2 marks)



5

A ship leaves port A and travels 9 km on a bearing of 120° to point B. The ship then turns and travels 12 km on a bearing of 030° to point C. This journey is shown on the scale drawing below.



The ship then turns and travels directly back from C to A.

Use a ruler and protractor to work out the distance and bearing of the journey from C to A

Distance km

Bearing $^\circ$ (3 marks)



6 (a) Expand $3(2w - 4)$

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Answer (1 mark)

6 (b) Factorise $x^2 - 3x$

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Answer (1 mark)

6 (c) Expand and simplify $3(y - 1) - 2(y + 4)$

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Answer (2 marks)

6 (d) Solve the equation $3(4z + 1) = 21$

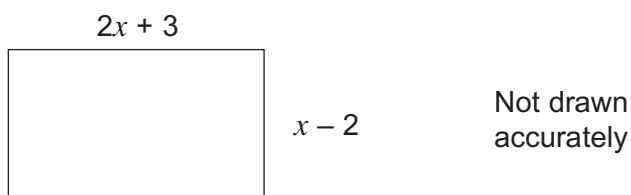
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Answer $z =$ (3 marks)

7 A rectangle has sides of $(2x + 3)$ cm and $(x - 2)$ cm.
The perimeter is 32 cm.



Work out the value of x .

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Answer $x =$ (3 marks)



- 8 (a)** Complete the table to show some properties of quadrilaterals.
The first one has been done for you.

	Both pairs of opposite angles equal	Diagonals equal in length	Rotational symmetry of order 2
Parallelogram	✓	✗	✓
Square			
Rhombus			
Kite			

(3 marks)

- 8 (b)** The four quadrilaterals in part (a) are

Parallelogram Square Rhombus Kite

Give a reason why the parallelogram is the odd one out.

The parallelogram is the odd one out because

.....
(1 mark)

- 9** In a sale the price of a bike is reduced by 15%.
The sale price is £178.50

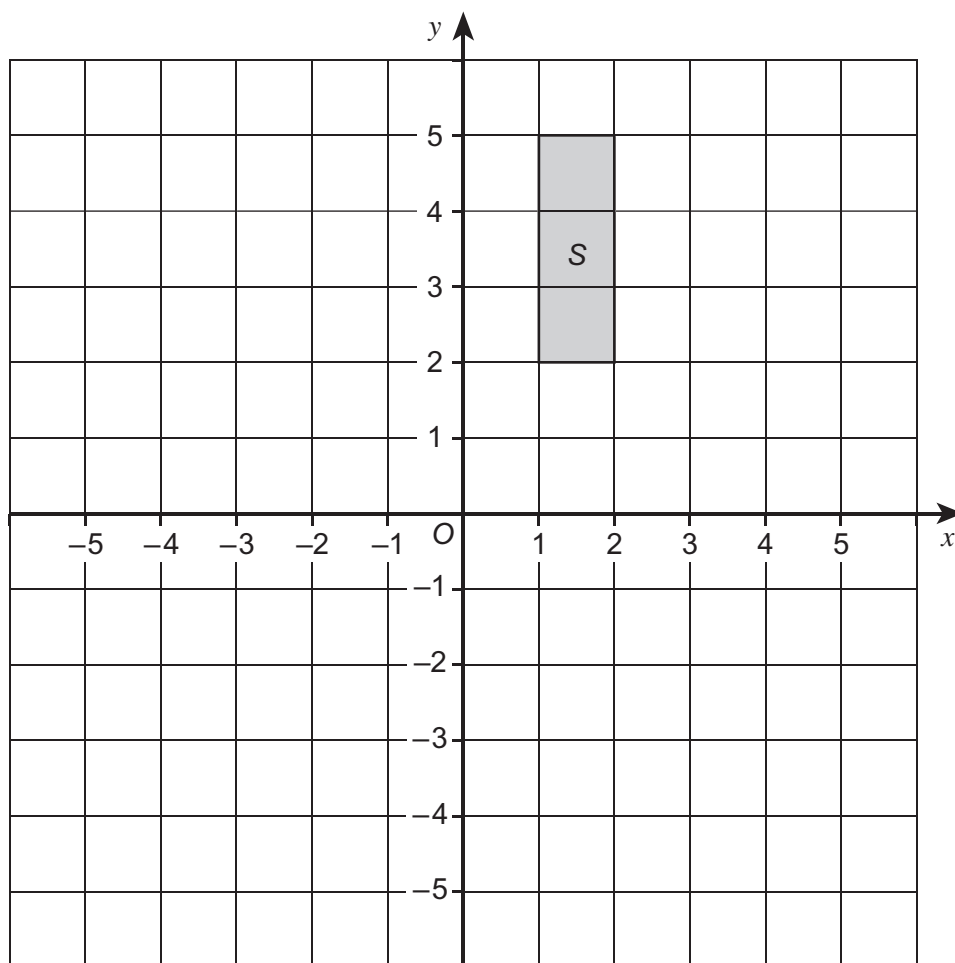
What was the price of the bike before the reduction?

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Answer £ (3 marks)



10



- 10 (a)** Reflect shape S in the line $y = x$
Label it R .

(2 marks)

- 10 (b)** Translate shape S by the vector $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$
Label it T .

(2 marks)



11

At a concert, the ratio of adults to children in the audience is 2 : 3
There are 786 children in the audience.
An adult ticket costs twice as much as a child ticket.
The total box office takings for the concert are £11 921

Work out the cost of an adult ticket.

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Answer £ (5 marks)

Turn over for the next question



- 12 (a)** Amy, Dev and Kaz are playing with a normal fair dice.
They each predict the next seven throws.

Amy	1	2	1	2	1	2	1
Dev	3	5	2	2	4	6	1
Kaz	4	4	4	4	4	4	4

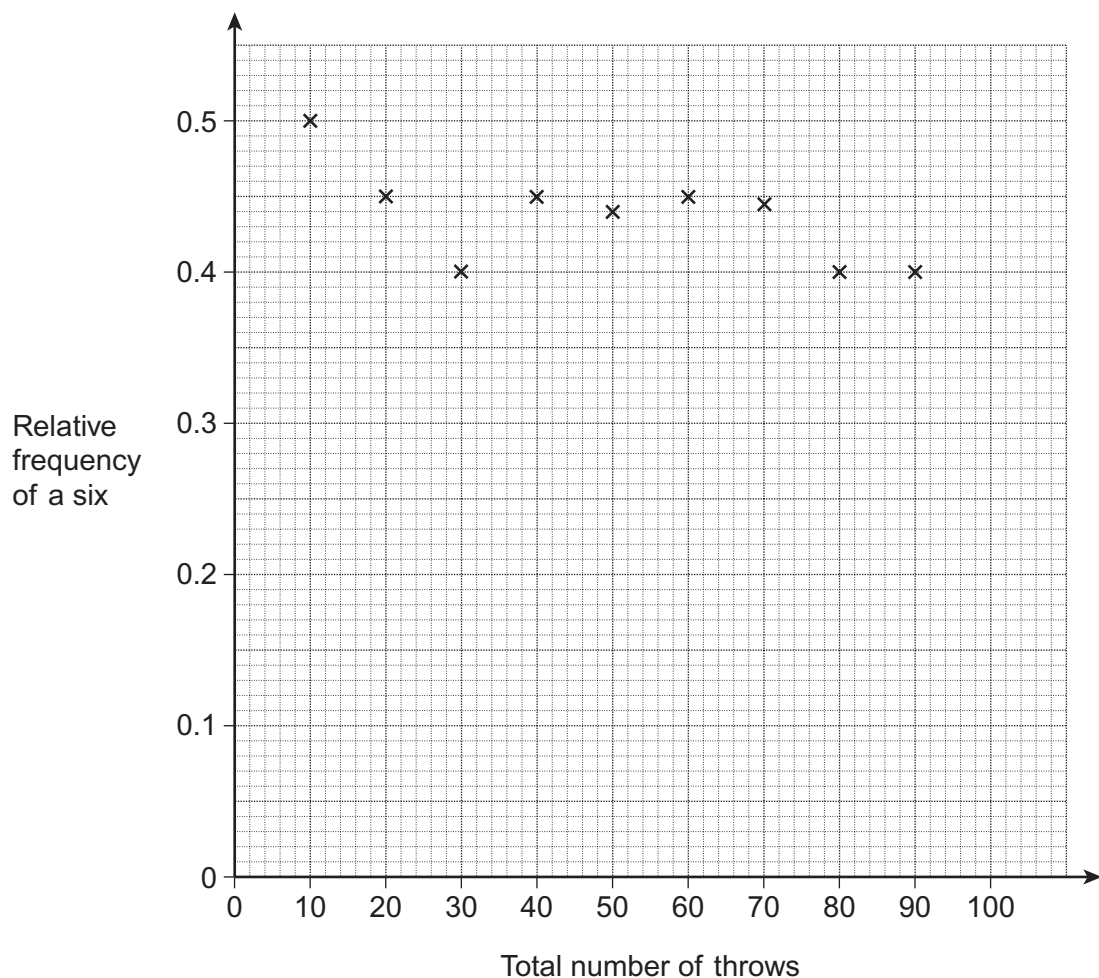
Which, if any, of these predictions is the most likely?
Circle your choice and explain your answer.

Amy Dev Kaz All are equally likely

Explanation

..... (2 marks)

- 12 (b)** Mia makes a six-sided dice.
To test the dice she throws it 100 times.
After each 10 throws she records the number of sixes thrown.
The relative frequencies for the first 90 throws are shown on the graph.



12 (b) (i) How many sixes were there in the first 10 throws?

Answer (1 mark)

12 (b) (ii) After 100 throws there were 42 sixes.

Calculate and plot the relative frequency of a six after 100 throws.

..... (1 mark)

12 (b) (iii) How many sixes would you expect to get after 100 throws of a **fair** dice?

.....
Answer (1 mark)

12 (b) (iv) Is Mia's dice fair?

Tick the correct box.

☐

Yes

☐

No

Give a reason for your answer.

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..... (1 mark)

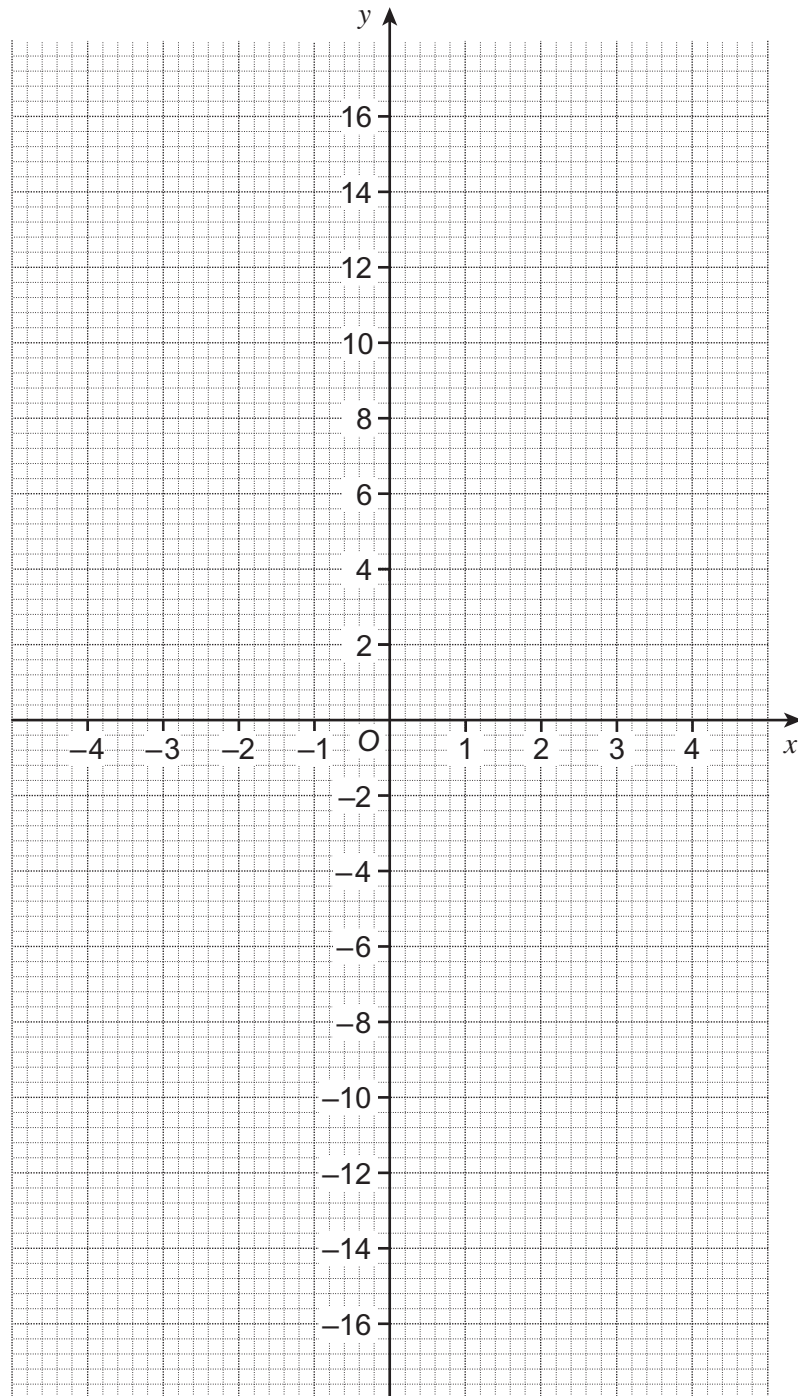


13 (a) On the grid draw the line $y = 3x + 2$ for $-4 \leq x \leq +4$

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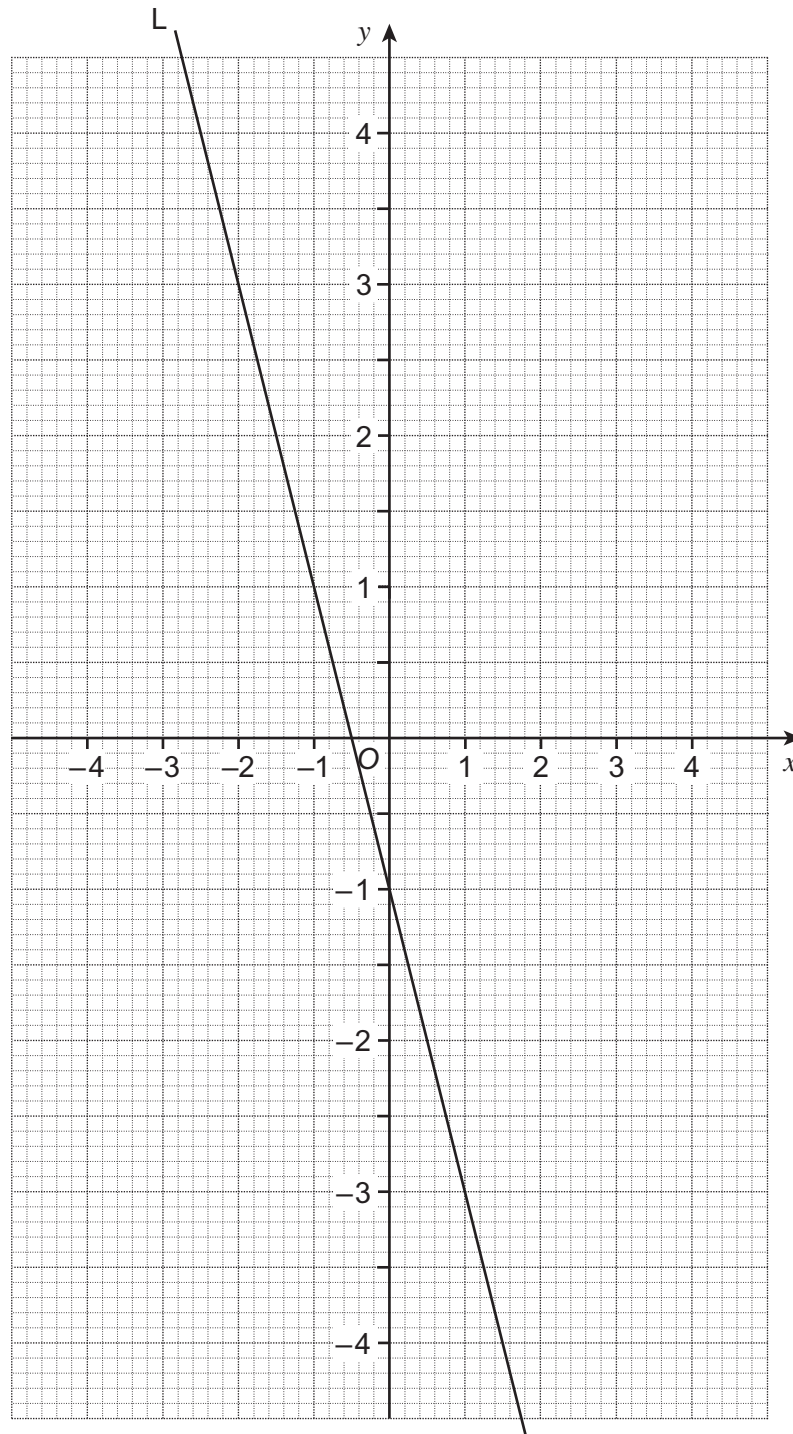
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(3 marks)



13 (b)



What is the equation of the line L?

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Answer

(3 marks)

6

Turn over ►



- 14** One hundred Year 11 students were asked how many text messages they received in a day.
The results are shown in the table.

Number of text messages, t	Frequency	
$0 \leq t < 10$	6	
$10 \leq t < 20$	15	
$20 \leq t < 30$	26	
$30 \leq t < 40$	32	
$40 \leq t < 50$	15	
$50 \leq t < 60$	6	

- 14 (a)** On the grid opposite draw a cumulative frequency diagram for the data. (3 marks)

- 14 (b)** Use the diagram to estimate the median number of text messages received.

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Answer (1 mark)

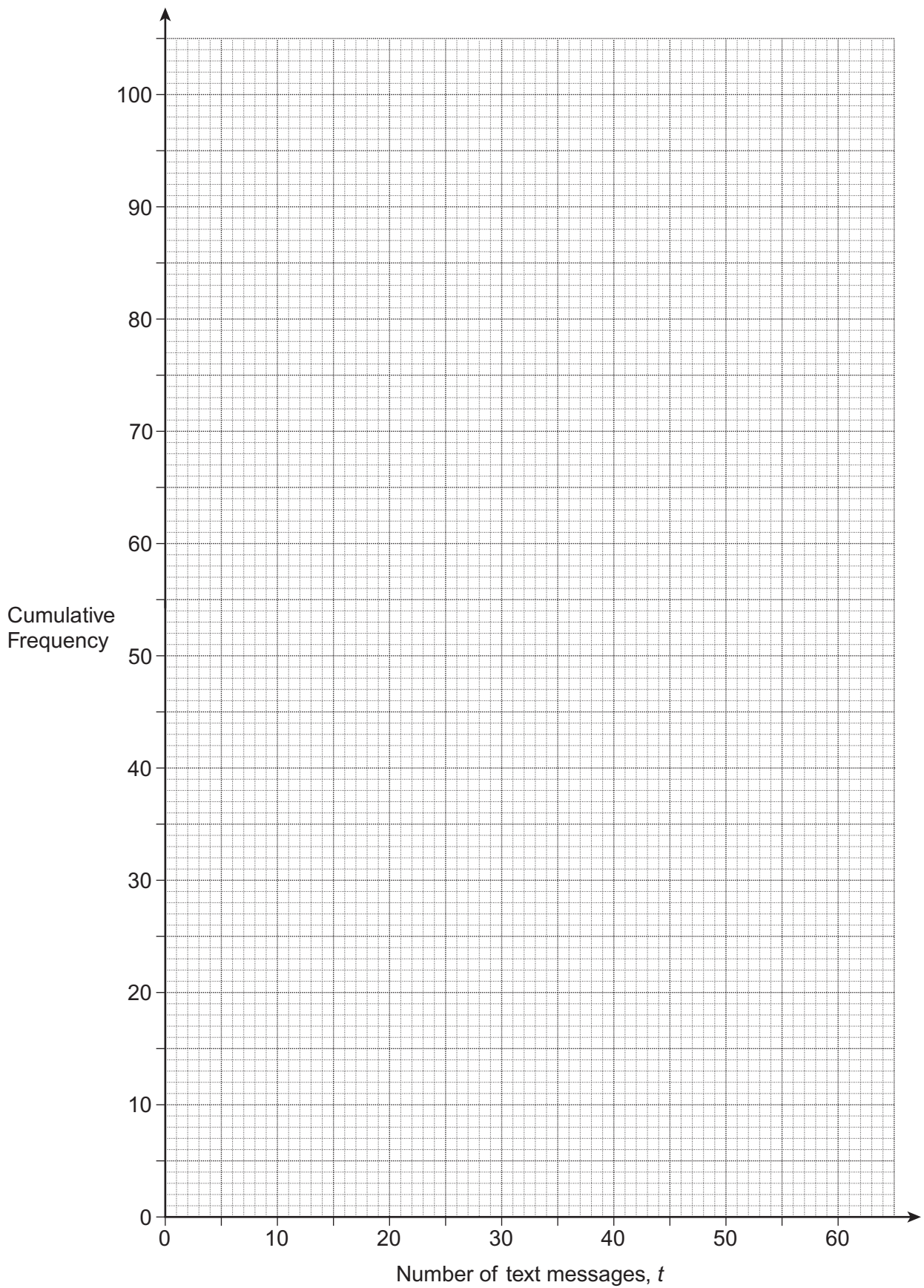
- 14 (c)** Use the diagram to estimate the interquartile range of the number of text messages received.

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Answer (2 marks)





15 p is a prime number.

15 (a) Is the expression $p^2 + 6$ always even, always odd or could it be either odd or even?

Tick the correct box.

☐

Always even

☐

Always odd

☐

Could be either
odd or even

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(1 mark)

15 (b) n and p are **both** prime numbers.

Work out values of n and p so that

$$n = p^2 + 6$$

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Answer $n =$ $p =$ (2 marks)

15 (c) Rearrange the formula $n = p^2 + 6$ to make p the subject.

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Answer (2 marks)



16

Use Trial and Improvement to find a solution to the equation $2x^3 - x = 80$
Give your answer to 1 decimal place.

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Answer $x =$ (4 marks)



17

The length of Al's shoe is 22 cm, correct to the nearest centimetre.
The length of Bob's shoe is 18 cm, correct to the nearest centimetre.

They both measure the length of a corridor.
Al measures the corridor as exactly 45 of his shoe lengths.
Bob measures the corridor as exactly 54 of his shoe lengths.

Work out the distances between which the actual length of the corridor must lie.

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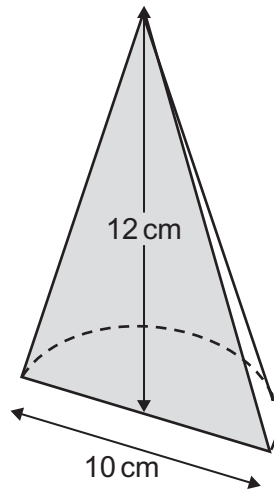
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Answer cm \leq length < cm (4 marks)



18

A cone has a base diameter of 10 cm and a vertical height of 12 cm.
The cone is cut in half vertically through the vertex.
The diagram shows one of the half-cones.



Not drawn
accurately

Calculate the **total** surface area of this half-cone.

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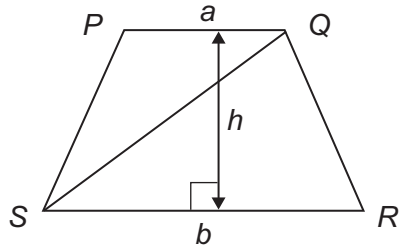
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Answer cm^2 (5 marks)



19

 $PQRS$ is a trapezium. $PQ = a$ and $SR = b$ The distance between PQ and SR is h .

The area of the trapezium $PQRS$ is $1\frac{2}{3}$ times the area of the triangle QRS .

Find the length a in terms of b .

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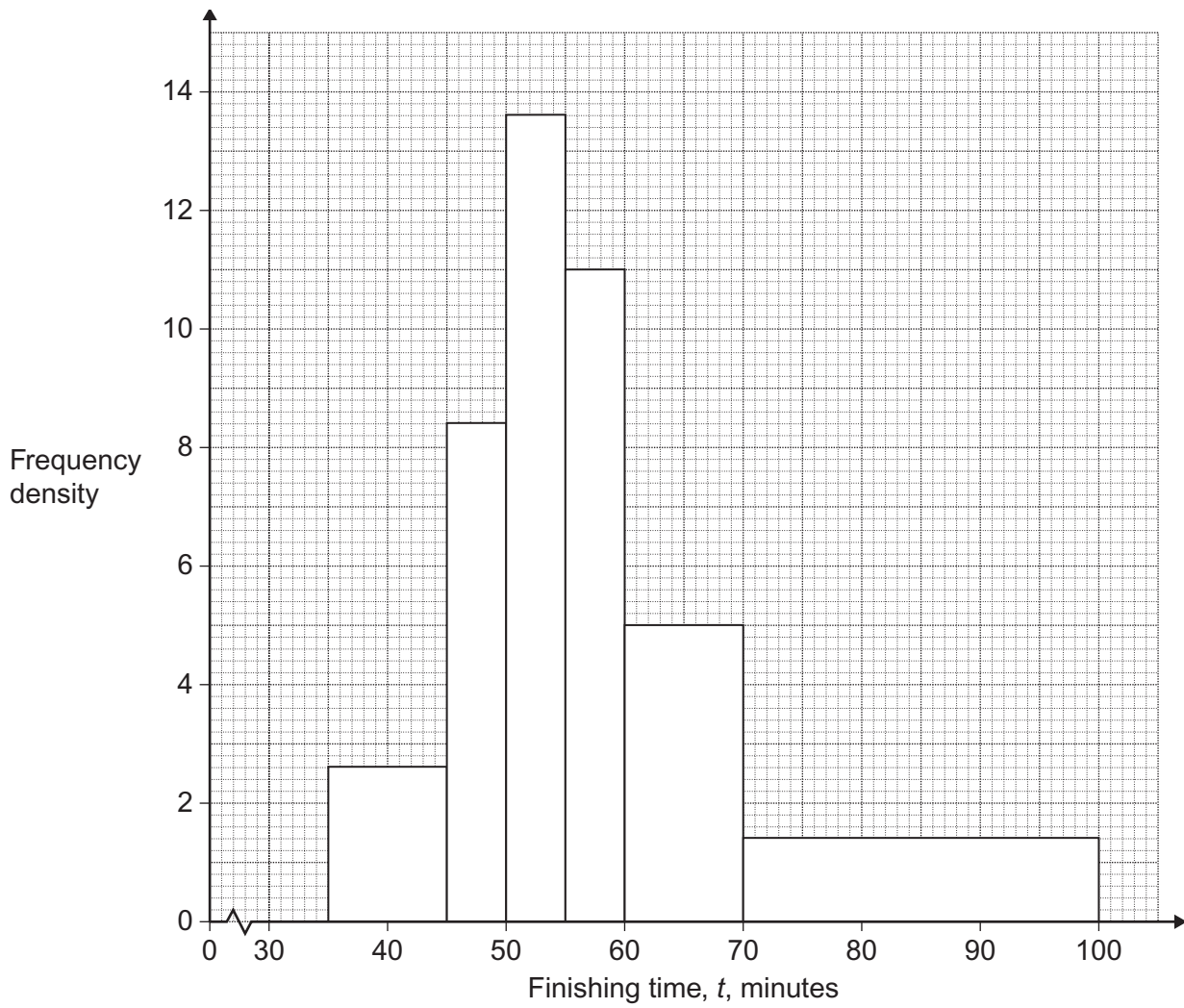
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Answer (4 marks)



20

The histogram shows the finishing times of runners in a 6 mile cross-country race.



How many runners were in the race?

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Answer (3 marks)



21

Simplify fully

$$\frac{6x^2 + x - 1}{4x^2 - 1}$$

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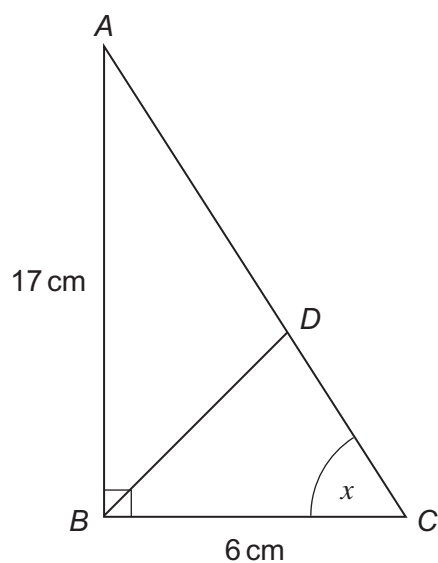
Answer

(4 marks)



22

ABC is a right-angled triangle.
 $AB = 17$ cm and $BC = 6$ cm.
 The line BD bisects the angle ABC .



Not drawn
accurately

- 22 (a) Write down the value of $\tan x$.

Answer (1 mark)

- 22 (b) Calculate the length BD .

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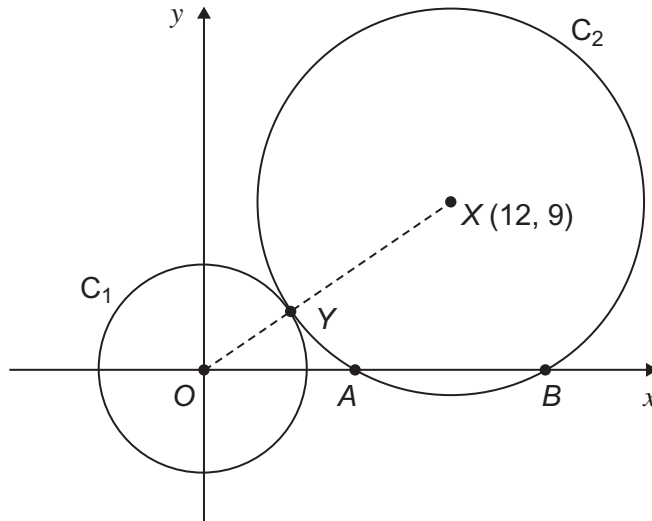
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Answer cm (5 marks)



23

The diagram shows two circles, C_1 and C_2 .
 The centre of C_1 is at the origin, O .
 The centre of C_2 is at $X(12, 9)$.
 The radius of C_2 is twice the radius of C_1 .
 The circles touch at the point Y .
 The circle C_2 crosses the x -axis at A and B .



Not drawn
accurately

Calculate the distance AB .

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Answer cm (5 marks)

END OF QUESTIONS

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