

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname *StemUp Model Solution*

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

Higher Tier

Paper 2 Calculator

Thursday 6 June 2019

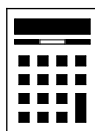
Morning

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.
- 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 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

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	
TOTAL	

Advice

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



J U N 1 9 8 3 0 0 2 H 0 1

Answer **all** questions in the spaces provided

- 1 Circle the point that lies on the curve $y = x^2 - 4x + 1$ [1 mark]

 $(-1, 4)$ $(-1, -4)$ $(-1, -2)$ $(-1, 6)$

- 2 The height of a tree is 12 metres, correct to the nearest metre.
Circle the error interval.

[1 mark]

 $11.5 \text{ m} \leq \text{height} < 12.5 \text{ m}$ $11.5 \text{ m} \leq \text{height} \leq 12.5 \text{ m}$ $11.5 \text{ m} < \text{height} \leq 12.5 \text{ m}$ $11.5 \text{ m} < \text{height} < 12.5 \text{ m}$ 

3 $2a$ is five times bigger than b .

Circle the ratio $a : b$

[1 mark]

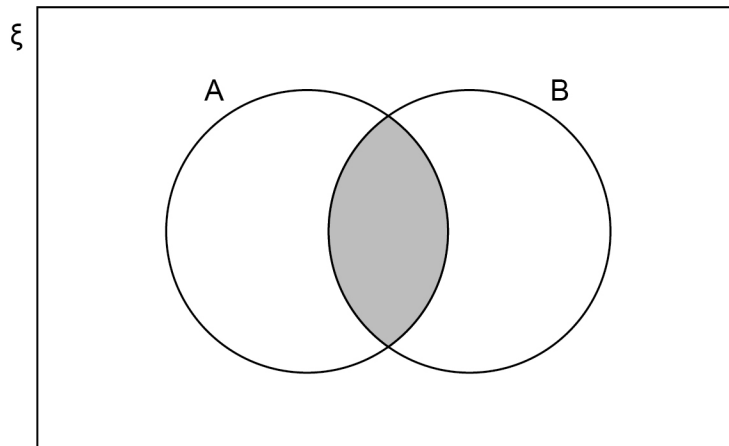
10 : 1

1 : 10

5 : 2

2 : 5

4



Which of these represents the shaded region?

Circle your answer.

[1 mark]

$A \cup B$

$(A \cap B)'$

$A \cap B$

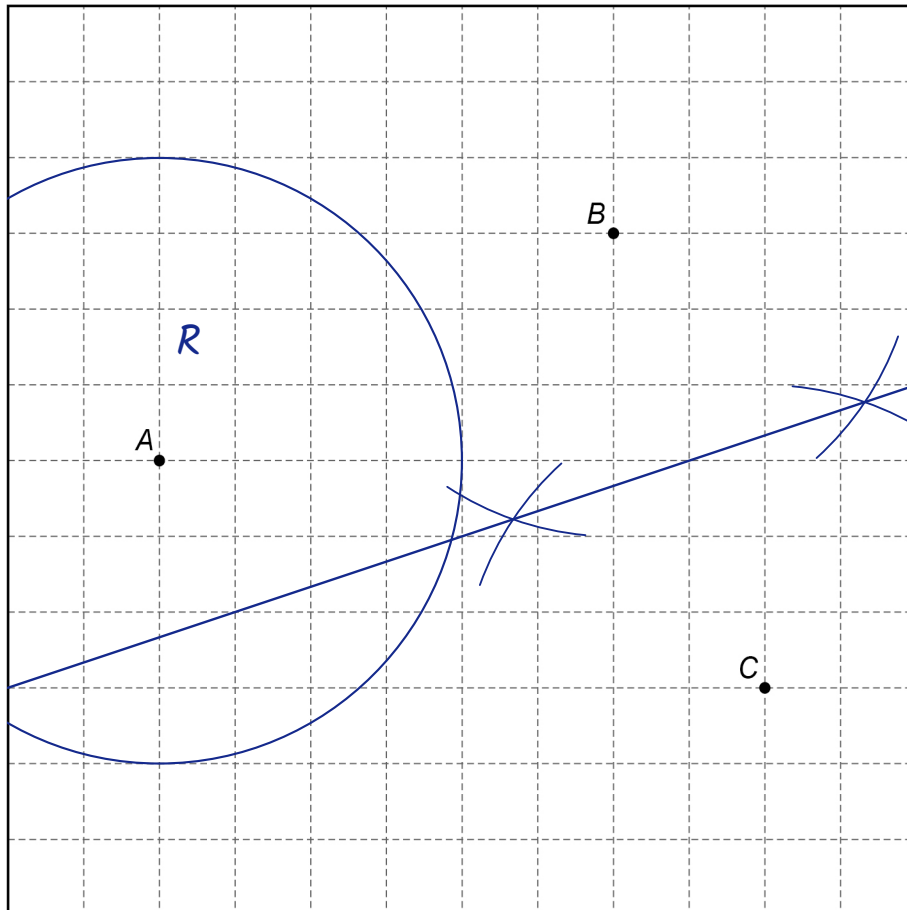
$A' \cup B'$

Turn over for the next question

Turn over ►



- 5 Using ruler and compasses, show the region inside the grid that is
less than 4 cm from A
and
nearer to B than to C .
Label the region R .
Show all your construction lines.

[3 marks]

6

Beth drives 200 miles in 4 hours.

She drives the first 18 miles at an average speed of 36 mph

Work out her average speed for the rest of the journey.

[3 marks]

$$\text{Time for first 18 miles} = 18 \div 36 = 0.5 \text{ hours}$$

$$\text{Rest of distance} = 200 - 18 = 182 \text{ miles}$$

$$\text{Rest of time} = 4 - 0.5 = 3.5 \text{ hours}$$

$$\text{Speed} = 182 \div 3.5 = 52$$

Answer 52 mph

Turn over for the next question

Turn over ►

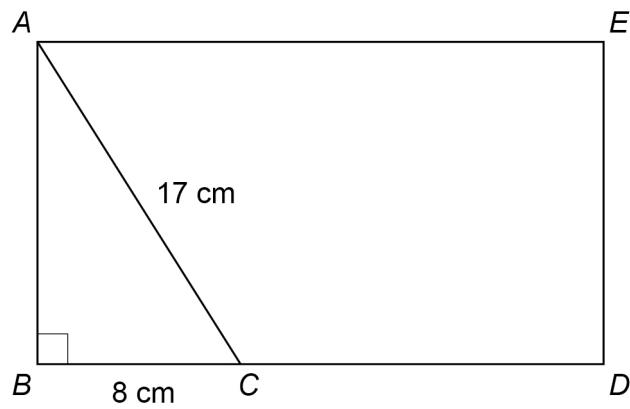


7

The diagram shows rectangle $ABDE$ and right-angled triangle ABC .

$AC = 17 \text{ cm}$

$BC = 8 \text{ cm}$



Not drawn
accurately

$BC : CD = 1 : 2$

Work out the area of rectangle $ABDE$.

[4 marks]

$$AB^2 + 8^2 = 17^2$$

$$AB^2 = 289 - 64 = 225$$

$$AB = \sqrt{225} = 15 \text{ cm}$$

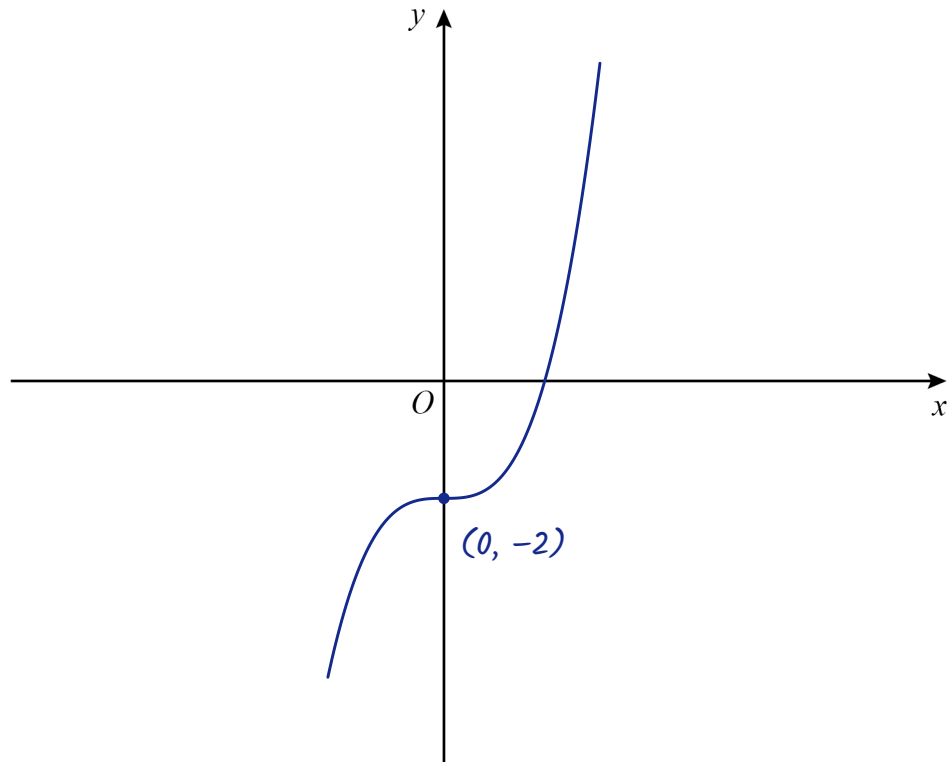
$$CD = 2 \times 8 = 16 \text{ cm, so } BD = 8 + 16 = 24 \text{ cm}$$

$$\text{Area} = 15 \times 24 = 360$$

Answer 360 cm^2



8

On the axes, sketch the curve $y = x^3 - 2$ You **must** show the coordinates of the y -intercept.**[2 marks]**

Turn over for the next question

Turn over ►



- 9 In a sport, injury time is added time played at the end of a match.
The table shows the injury time, t (minutes) played in 380 matches.

Injury time, t (minutes)	Frequency
$0 < t \leq 2$	59
$2 < t \leq 4$	158
$4 < t \leq 6$	106
$6 < t \leq 8$	45
$8 < t \leq 10$	12

- 9 (a) Circle the **two** words that describe the data.

[1 mark]

continuous

discrete

grouped

ungrouped

- 9 (b) Which class interval contains the median?

You **must** show your working.

[2 marks]

Median position: $380 \div 2 = 190$, so the 190th/191st value

Cumulative frequency: 59, $59 + 158 = 217$

190 and 191 are between 59 and 217

Answer 2 $< t \leq$ 4



- 9 (c) What percentage of the matches had **more than** 6 minutes of injury time?

[2 marks]

More than 6 minutes: $45 + 12 = 57$ matches

$$57 \div 380 \times 100 = 15$$

Answer 15 %

- 10 x is an integer.

$$-4 < x \leq 2$$

and

$$2 \leq x + 3 < 9$$

Work out all the possible values of x .

[3 marks]

$$-4 < x \leq 2 \text{ gives } x = -3, -2, -1, 0, 1, 2$$

$$2 \leq x + 3 < 9$$

$$\text{subtract 3: } -1 \leq x < 6$$

$$\text{gives } x = -1, 0, 1, 2, 3, 4, 5$$

$$\text{In both lists: } -1, 0, 1, 2$$

Answer -1, 0, 1, 2

Turn over ►



- 11 Joe and Kyle share an amount of money in the ratio $7 : n$
Joe gets 35% of the money.

Work out the value of n .

[2 marks]

$$\text{Kyle gets } 100 - 35 = 65\%$$

$$7 \text{ parts} = 35\%, \text{ so } 1 \text{ part} = 35 \div 7 = 5\%$$

$$n = 65 \div 5 = 13$$

Answer 13

- 12 A biased coin is thrown 250 times.
The relative frequency of Heads is worked out after every 50 throws.

Total number of throws	50	100	150	200	250
Relative frequency	0.4	0.29	0.4	0.32	0.3

Circle the best estimate of the probability of Heads.

[1 mark]

0.3

0.32

0.342

0.4



13

The amounts spent on clothes by 40 boys and 40 girls in one month were recorded. The table shows information about the amounts spent by the boys.

Amount, x (£)	Midpoint	Number of boys	$f \times x$
$0 \leq x < 20$	10	22	220
$20 \leq x < 40$	30	9	270
$40 \leq x < 60$	50	6	300
$60 \leq x < 80$	70	3	210
		Total = 40	1000

The mean for the girls was £35

Estimate the mean for the girls as a percentage of the mean for the boys.

[5 marks]

Midpoints 10, 30, 50, 70

$$\Sigma fx = 22 \times 10 + 9 \times 30 + 6 \times 50 + 3 \times 70$$

$$= 220 + 270 + 300 + 210 = 1000$$

$$\text{Mean for boys} = 1000 \div 40 = £25$$

$$\text{Girls as a percentage of boys} = 35 \div 25 \times 100$$

$$= 140$$

Answer 140 %

Turn over ►



14 Ali and Mel are making 3-digit codes.

The digit 0 is **not** used.

Ali only uses odd digits.

Mel only uses even digits.

14 (a) Ali can make x more codes than Mel.

Assume that digits **cannot** be repeated.

Work out the value of x .

[3 marks]

Ali: 5 odd digits, $5 \times 4 \times 3 = 60$ codes

Mel: 4 even digits, $4 \times 3 \times 2 = 24$ codes

$x = 60 - 24 = 36$

Answer 36

14 (b) In fact, digits **can** be repeated.

What does this tell you about the actual value of x ?

Tick **one** box.

[1 mark]

☒

It is bigger than my answer to part (a)

☐

It is smaller than my answer to part (a)

☐

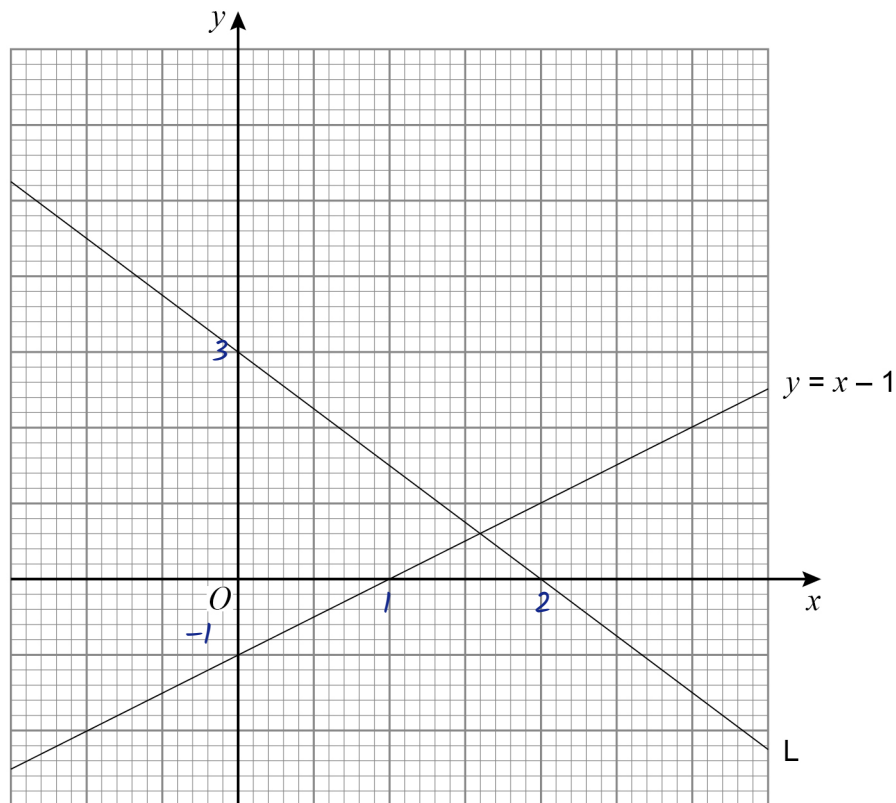
It is the same as my answer to part (a)



15

Here is line L and the graph of $y = x - 1$

The scales of the axes are not shown.

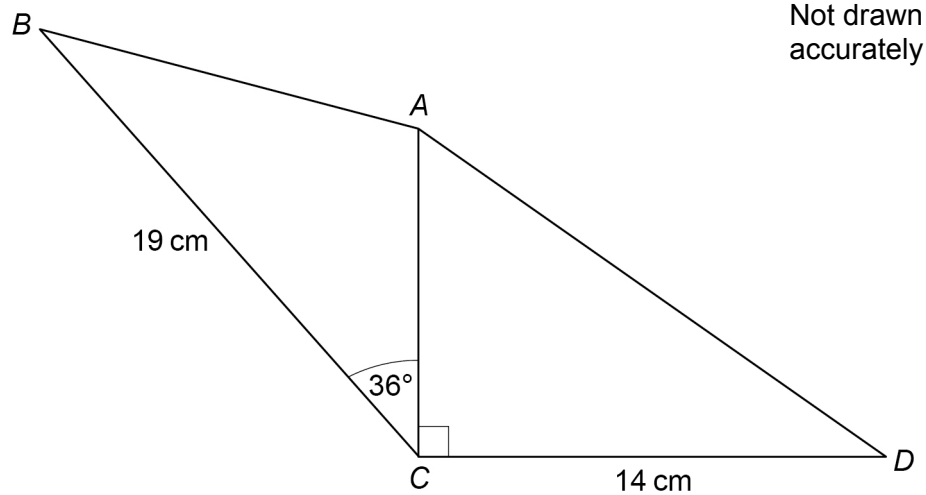


Work out the equation of line L.

[4 marks]

 $y = x - 1$ cuts the y-axis at -1 and the x-axis at 1 *so y-axis: 1 large square = 1, x-axis: 2 large squares = 1**L cuts the y-axis at 3 and the x-axis at 2**gradient of L = $-3 \div 2 = -1.5$* *$y = -1.5x + 3$* Answer *$y = -1.5x + 3$* 

16

 ABC and ACD are triangles.The area of ACD is 80.5 cm^2 Work out the area of ABC .

Give your answer to 3 significant figures.

[4 marks]

$$\frac{1}{2} \times 14 \times AC = 80.5$$

$$7 \times AC = 80.5, \quad AC = 80.5 \div 7 = 11.5 \text{ cm}$$

$$\text{Area of } ABC = \frac{1}{2} \times 19 \times 11.5 \times \sin 36^\circ$$

$$= 64.2155...$$

$$= 64.2 \text{ (3 s.f.)}$$

Answer 64.2 cm^2 

17

$$m = \frac{p - 2b}{2}$$

$p = 68.3$ correct to 1 decimal place.

$b = 8.7$ correct to 1 decimal place.

Work out the lower bound for m .

[3 marks]

Lower bound of $p = 68.25$, upper bound of $b = 8.75$

$$m = \frac{68.25 - 2 \times 8.75}{2}$$

$$= \frac{50.75}{2} = 25.375$$

Answer 25.375

Turn over for the next question

Turn over ►



18

In a bag there are blue discs, green discs and white discs.

There are four times as many blue discs as green discs.

number of blue discs : number of white discs = 3 : 5

One disc is selected at random.

Work out the probability that the disc is either blue or white.

[3 marks]

$$\text{blue : green} = 4 : 1 = 12 : 3$$

$$\text{blue : white} = 3 : 5 = 12 : 20$$

$$\text{blue : green : white} = 12 : 3 : 20$$

$$\text{Total} = 12 + 3 + 20 = 35 \text{ parts}$$

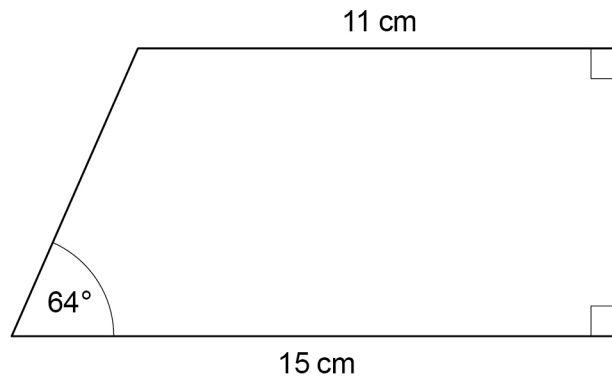
$$P(\text{blue or white}) = \frac{12 + 20}{35} = \frac{32}{35}$$

Answer $\frac{32}{35}$



19

Work out the area of the trapezium.

Not drawn
accurately**[4 marks]**

$$\text{Base of triangle} = 15 - 11 = 4 \text{ cm}$$

$$\tan 64^\circ = h \div 4$$

$$h = 4 \times \tan 64^\circ = 8.2012... \text{ cm}$$

$$\text{Area} = \frac{1}{2} \times (11 + 15) \times 8.2012...$$

$$= 106.6157...$$

$$= 106.6 \text{ cm}^2 \text{ (1 d.p.)}$$

Answer 106.6 cm²

Turn over for the next question

Turn over ►



20

Expressions for consecutive triangular numbers are

$$\frac{n(n+1)}{2} \quad \text{and} \quad \frac{(n+1)(n+2)}{2}$$

Prove that the sum of two consecutive triangular numbers is always a square number.

[4 marks]

$$\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$$

$$= \frac{n^2 + n}{2} + \frac{n^2 + 3n + 2}{2}$$

$$= \frac{2n^2 + 4n + 2}{2}$$

$$= n^2 + 2n + 1$$

$$= (n+1)^2$$

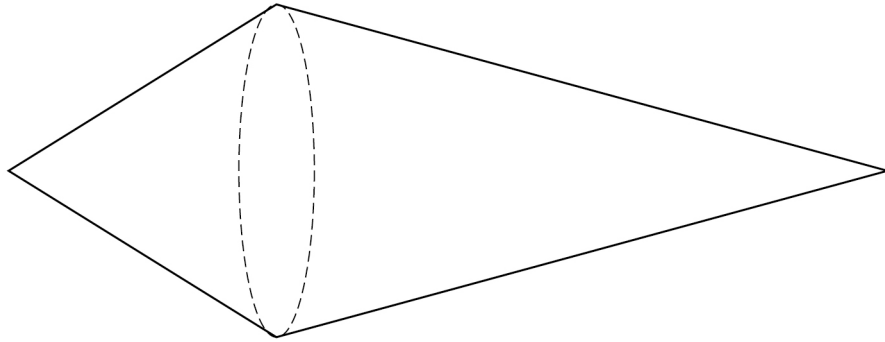
$(n+1)^2$ is a square number since $n+1$ is an integer,

so the sum is always a square number.



21

A solid shape is made by joining two cones.
Each cone has the same radius.



One cone has slant height = $2 \times \text{radius}$

The other cone has slant height = $3 \times \text{radius}$

The total surface area of the shape is $57.8\pi \text{ cm}^2$

Curved surface area of a cone = $\pi r l$ where r is the radius and l is the slant height

Work out the radius.

[3 marks]

$$\pi r \times 2r + \pi r \times 3r = 57.8\pi$$

$$2\pi r^2 + 3\pi r^2 = 57.8\pi$$

$$5r^2 = 57.8$$

$$r^2 = 11.56$$

$$r = \sqrt{11.56} = 3.4$$

Answer 3.4 cm

7

Turn over ►



22

Show that $(5\sqrt{3} - \sqrt{12})^2$ simplifies to an integer.

[3 marks]

$$\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$$

$$5\sqrt{3} - \sqrt{12} = 5\sqrt{3} - 2\sqrt{3} = 3\sqrt{3}$$

$$(3\sqrt{3})^2 = 9 \times 3 = 27$$

27 is an integer

23

A and B are similar cuboids.

surface area of A : surface area of B = 16 : 25

Work out volume of A : volume of B

Circle your answer.

[1 mark]

4 : 5

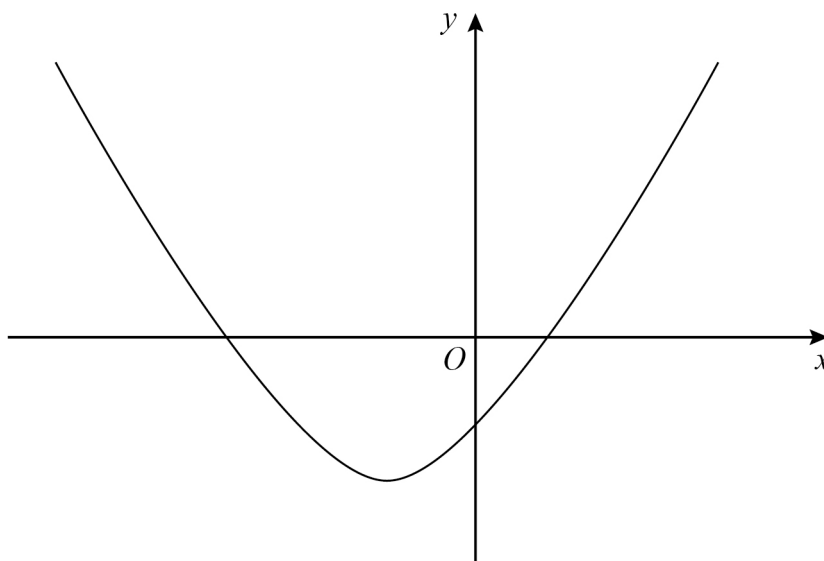
16 : 25

64 : 125

256 : 625



24

Here is a sketch of the curve $y = x^2 + 4x - 12$ Work out the values of x for which $x^2 + 4x - 12 < 0$

Give your answer as an inequality.

[3 marks]

$$x^2 + 4x - 12 = 0$$

$$(x + 6)(x - 2) = 0$$

$$x = -6 \text{ or } x = 2$$

The curve is below the x-axis between -6 and 2

Answer $-6 < x < 2$

Turn over ►



25

A sample of 50 eggs is taken from Farm A.

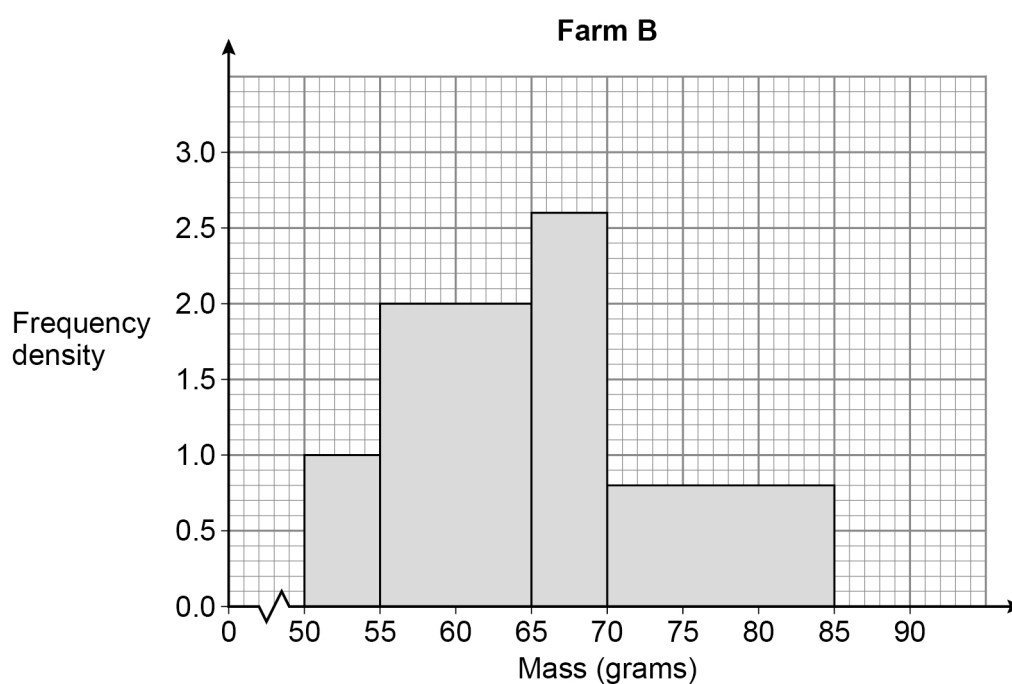
The table shows information about the masses of the eggs from Farm A.

Farm A

Mass, m (grams)	Frequency
$53 < m \leq 58$	8
$58 < m \leq 63$	19
$63 < m \leq 68$	15
$68 < m \leq 73$	8

A sample of 50 eggs is taken from Farm B.

The histogram shows information about the masses of the eggs from Farm B.



For medium eggs, $53 \text{ g} < \text{mass} \leq 63 \text{ g}$

The Farm A sample has more medium eggs than the Farm B sample.

Using the table and the histogram, estimate how many more.

You **must** show your working.

[4 marks]

$$\text{Farm A: } 8 + 19 = 27 \text{ medium eggs}$$

$$\text{Farm B, } 53 < m \leq 55: 2 \times 1.0 = 2$$

$$\text{Farm B, } 55 < m \leq 63: 8 \times 2.0 = 16$$

$$\text{Farm B: } 2 + 16 = 18 \text{ medium eggs}$$

$$27 - 18 = 9$$

Answer 9

Turn over for the next question



26

$$(x + 5)(x + 2)(x + a) \equiv x^3 + bx^2 + cx - 30$$

Work out the values of the integers a , b and c .

[3 marks]

$$5 \times 2 \times a = -30, \text{ so } a = -3$$

$$(x + 5)(x + 2) = x^2 + 7x + 10$$

$$(x^2 + 7x + 10)(x - 3)$$

$$= x^3 - 3x^2 + 7x^2 - 21x + 10x - 30$$

$$= x^3 + 4x^2 - 11x - 30$$

$$\text{so } b = 4 \text{ and } c = -11$$

$$a = \underline{\quad -3 \quad}$$

$$b = \underline{\quad 4 \quad}$$

$$c = \underline{\quad -11 \quad}$$



27

$$f(x) = \frac{2x}{5} - 1$$

Work out the value of $f^{-1}(3) + f(-0.5)$

[5 marks]

$$f^{-1}(3): \frac{2x}{5} - 1 = 3$$

$$\frac{2x}{5} = 4$$

$$2x = 20, \quad x = 10, \quad \text{so } f^{-1}(3) = 10$$

$$f(-0.5) = \frac{2 \times (-0.5)}{5} - 1$$

$$= \frac{-1}{5} - 1 = -1.2$$

$$f^{-1}(3) + f(-0.5) = 10 + (-1.2) = 8.8$$

Answer 8.8

END OF QUESTIONS



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2 8



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