

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

Higher Tier

Paper 2 Calculator

Thursday 6 June 2019

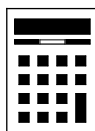
Morning

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.



Answer **all** questions in the spaces provided

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

should be $(-1, 6)$

$(-1, 4)$

$(-1, -4)$

$(-1, -2)$

$(-1, 6)$

$$\begin{aligned} &(-1)^2 - 4(-1) + 1 \\ &= 6 \end{aligned}$$

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

Circle the error interval.

all round to 12m

doesn't include 12.5
but includes 11.5

[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 $a : b$
 $5 : 2$

[1 mark]

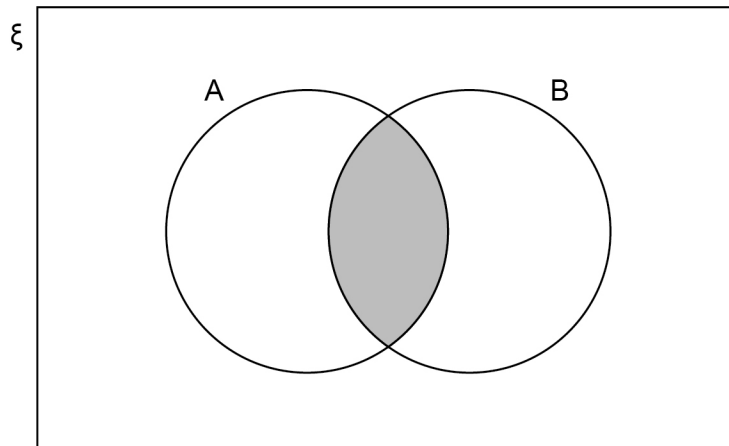
10 : 1

1 : 10

5 : 2

2 : 5

4



Which of these represents the shaded region?

Circle your answer.

A and B

[1 mark]

 $A \cup B$ $(A \cap B)'$ $A \cap B$ $A' \cup B'$

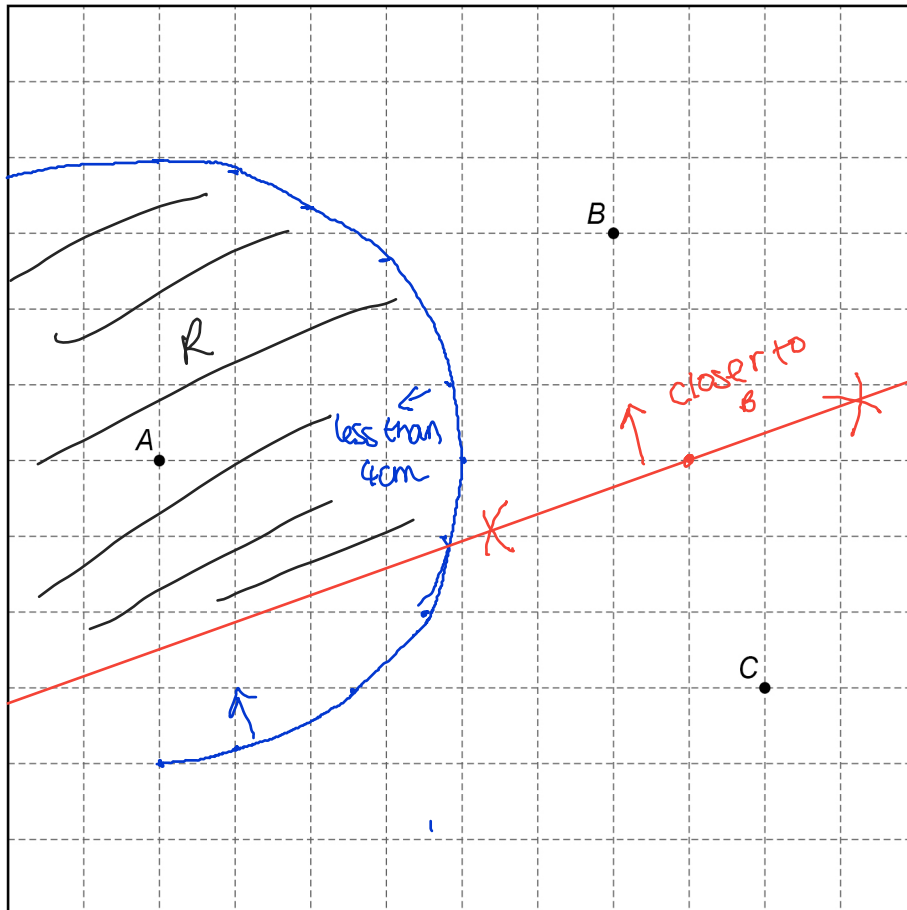
Turn over for the next question

Turn over ►



- 5 Using ruler and compasses, show the region inside the grid that is
less than 4 cm from A *inside circle centre A, $r = 4$*
and
nearer to B than to C. *perpendicular bisector between B and C*
Label the region R.
Show all your construction lines.

[3 marks]

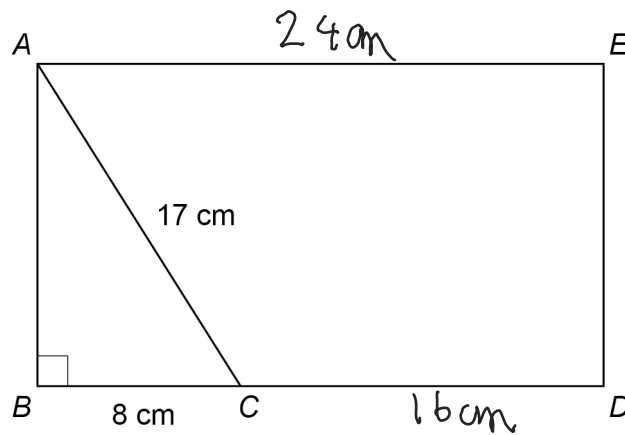


7

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]

$$CD = 8 \times 2 = 16 \text{ cm}$$

$$BD = 16 + 8 = 24 \text{ cm}$$

$$\text{Pythagoras: } a^2 + b^2 = c^2$$

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

$$AB^2 = 289 - 64$$

$$= 225$$

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

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

Answer 360 cm^2

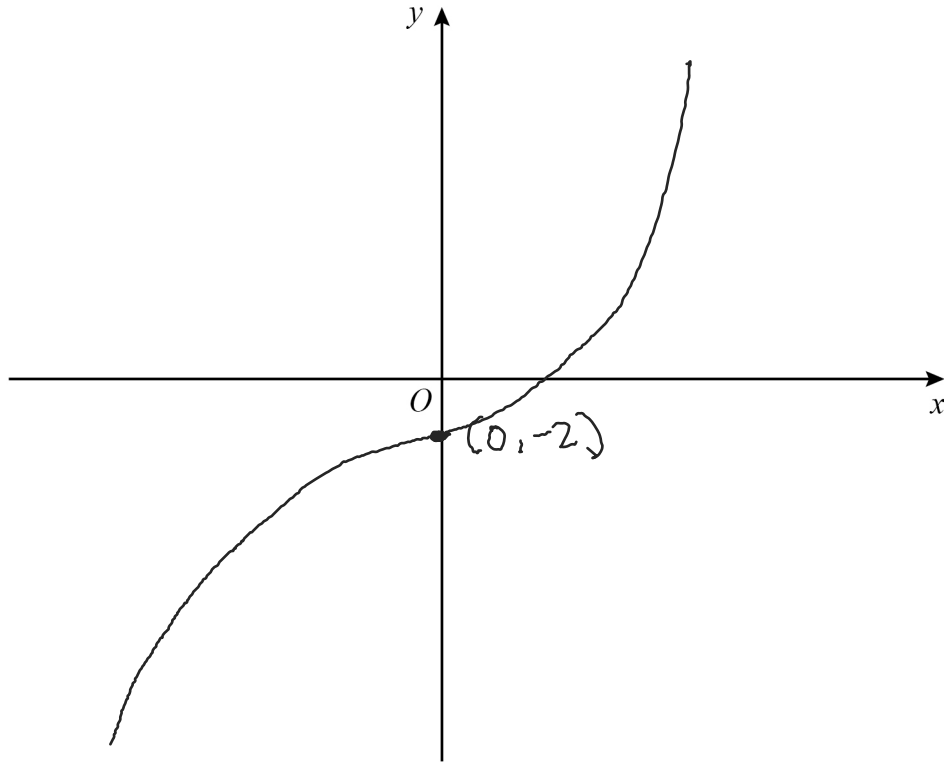


8 On the axes, sketch the curve $y = x^3 - 2$

You **must** show the coordinates of the y-intercept.

$$x=0 \quad y=-2$$

[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

59
217

- 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]

$$\frac{380}{2} = 190$$

190 fall between

Answer 2 $< t \leq$ 4



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

[2 marks]

$$\text{Matches more than 6min} : 45 + 12 = 57$$

$$\text{Total} = 380$$

$$\text{Percentage} : \frac{57}{380} \times 100$$

$$\text{Answer } \underline{\hspace{2cm}} 15 \underline{\hspace{2cm}} \%$$

- 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]

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

$$-1 \stackrel{-3}{\leq} x < \stackrel{-3}{6}$$

$$\text{Between } -1 \leq x < 6 \text{ and } -4 < x \leq 2$$

$$\text{SO } -1 \leq x \leq 2$$

$$\text{Answer } \underline{\hspace{2cm}} -1, 0, 1, 2 \underline{\hspace{2cm}}$$



- 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]

$$35\% = \frac{7}{20}$$

$$\frac{n}{20} = 1 - \frac{7}{20} = \frac{13}{20}$$

$$n = 13$$

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	Midpoint \times ^{no of} boys
$0 \leq x < 20$	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	Total = 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]

$$\text{Mean} = \frac{\sum fx}{\sum f} = \frac{1000}{40} = \pounds 25$$

$$\text{Percentage: } \frac{35}{25} \times 100$$

$$= 1.4 \times 100$$

Answer 140 %



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 can't be repeated so take away 1

$$5 \times 4 \times 3 = 60 \text{ codes}$$

Mel : 4 even

$$4 \times 3 \times 2 = 24 \text{ codes}$$

$$60 - 24 = 36$$

Answer 36

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

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

Tick **one** box.

It is bigger than my answer to part (a)

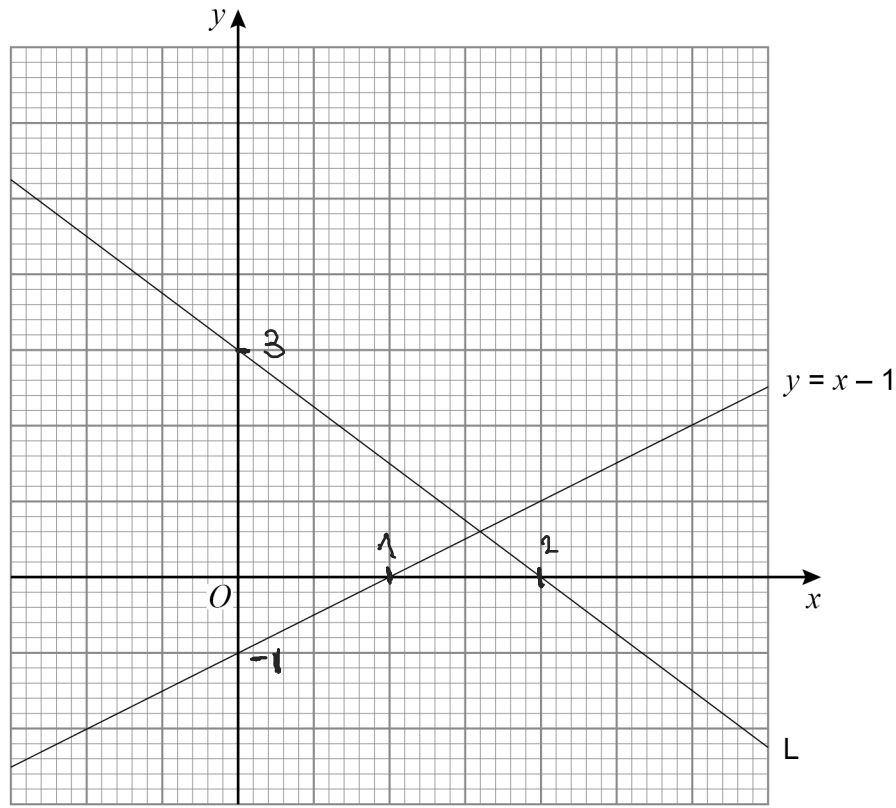
It is smaller than my answer to part (a)

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

There will be a larger gap now [1 mark]



- 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]

$$y \text{ intercept} = 3 \quad c = 3$$

$$y = x - 1 : \text{ When } y = 0 \quad x = 1$$

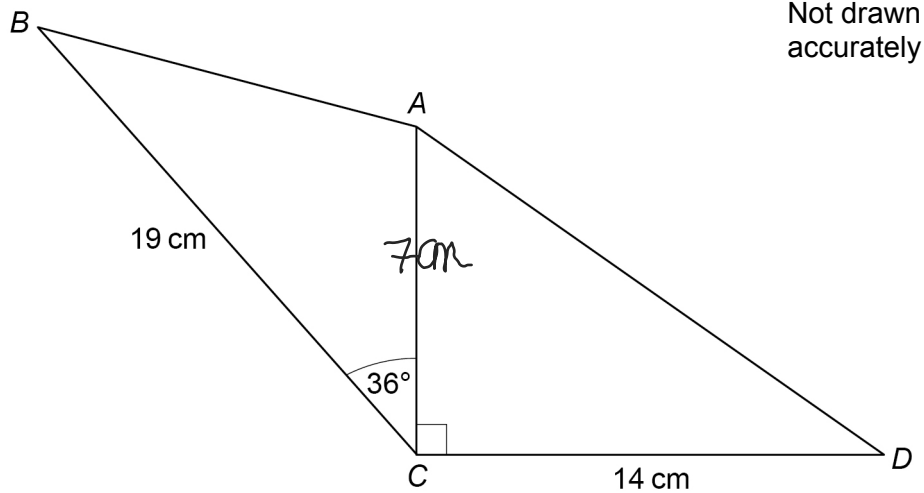
$(0, 3)$ and $(2, 0)$ are on L

$$\text{Gradient} = \frac{y_1 - y_2}{x_1 - x_2} = \frac{0 - 3}{2 - 0} = \frac{-3}{2} = m$$

Answer $L: y = -\frac{3}{2}x + 3$



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]**

$$\text{Area} = \frac{1}{2} \times CD \times AC$$

$$80.5 = 0.5 \times 14 \times AC$$

$$11.5 = AC$$

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

$$= \frac{1}{2} \times 11.5 \times 19 \times \sin 36$$

$$= 64.21 \dots \text{cm}^2$$

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 . $\frac{LB}{UB} = \frac{LB - UB}{2}$

[3 marks]

$$p: \quad 68.25 \leq p < 68.35$$

$$b: \quad 8.65 \leq b < 8.75$$

$$\text{Lower:} \quad \frac{68.25 - 2(8.75)}{2} = \frac{50.75}{2}$$

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]

$$\begin{array}{cc} b : g & b : w \\ \hline 4 : 1 & 3 : 5 \\ \hline \times 3 & \times 4 \end{array}$$

$$\begin{array}{cc} 12 : 3 & 12 : 20 \end{array}$$

$$\begin{array}{c} b : g : w \\ \hline 12 : 3 : 20 \end{array}$$

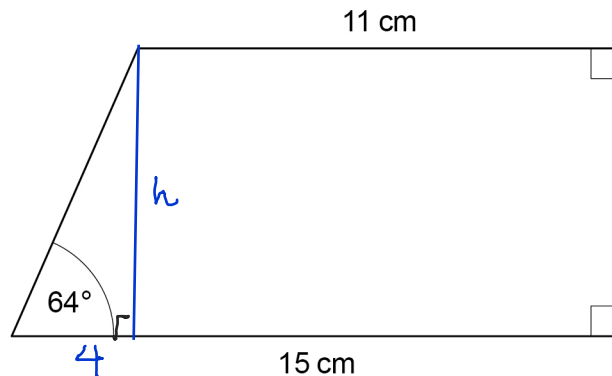
$$P(b \text{ or } w) = \frac{12 + 20}{12 + 3 + 20} = \frac{32}{35}$$

Answer $\frac{32}{35}$



19

Work out the area of the trapezium.

Not drawn
accurately

$$15-11$$

$$\tan x = \frac{\text{opp}}{\text{adj}}$$

[4 marks]

$$\tan 64 = \frac{h}{4}$$

$$h = 4 \tan 64$$

$$\text{Area of trap: } \frac{1}{2}(a+b) \times h$$

$$= \frac{1}{2}(11+15) \times 4 \tan 64$$

$$= 52 \tan 64 = 106.615 \dots \text{ cm}^2$$

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]

$$\text{Sum: } \frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$$

$$= \frac{n^2 + n + n^2 + n + 2n + 2}{2} \quad \text{Expand}$$

$$= \frac{2n^2 + 4n + 2}{2} \quad \text{simplify}$$

$$= n^2 + 2n + 1 \quad \div 2 \text{ top and bottom}$$

$$= (n+1)^2 \quad \text{factorise}$$

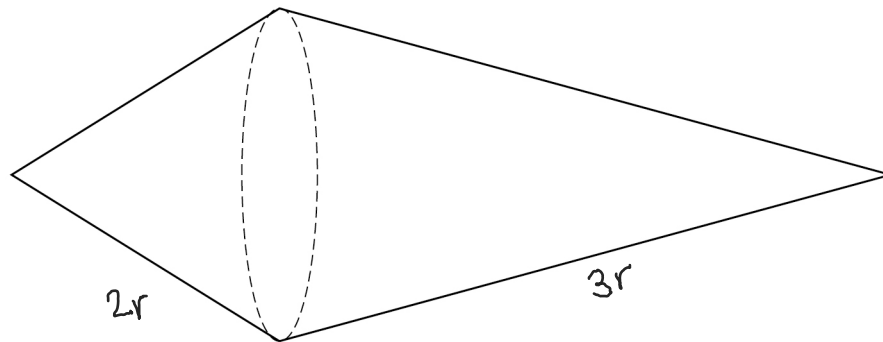
Therefore the sum is a square number



21

A solid shape is made by joining two cones.

Each cone has the same radius.



One cone has slant height = $2 \times$ radius

①

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

②

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]

$$\text{SA of } \textcircled{1} = \pi r \times 2r = 2r^2\pi$$

$$\text{SA of } \textcircled{2} = \pi r \times 3r = 3r^2\pi$$

$$\text{Total SA} = 5r^2\pi$$

$$5r^2\pi = 57.8\pi$$

$$r^2 = \frac{57.8}{5}$$

$$r^2 = 11.56$$

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

Answer 3.4 cm

Turn over ►



22

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

[3 marks]

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

$$(5\sqrt{3} - 2\sqrt{3})^2 = (3\sqrt{3})^2$$

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

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.

linear = 4:5
volume = 64:125

[1 mark]

4 : 5

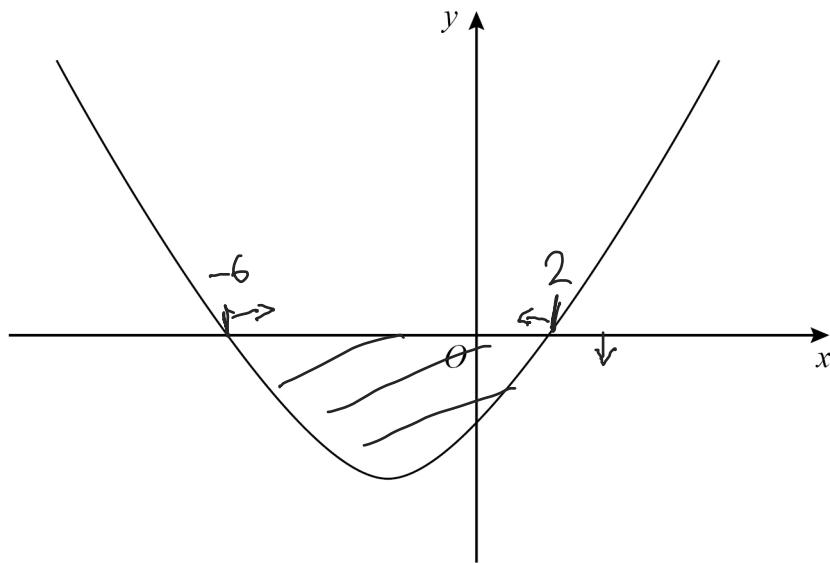
16 : 25

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]

Factorise :

\times to -12 6 and -2

$+$ to 4

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

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

Answer $-6 < x < 2$



25

A sample of 50 eggs is taken from Farm A.

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

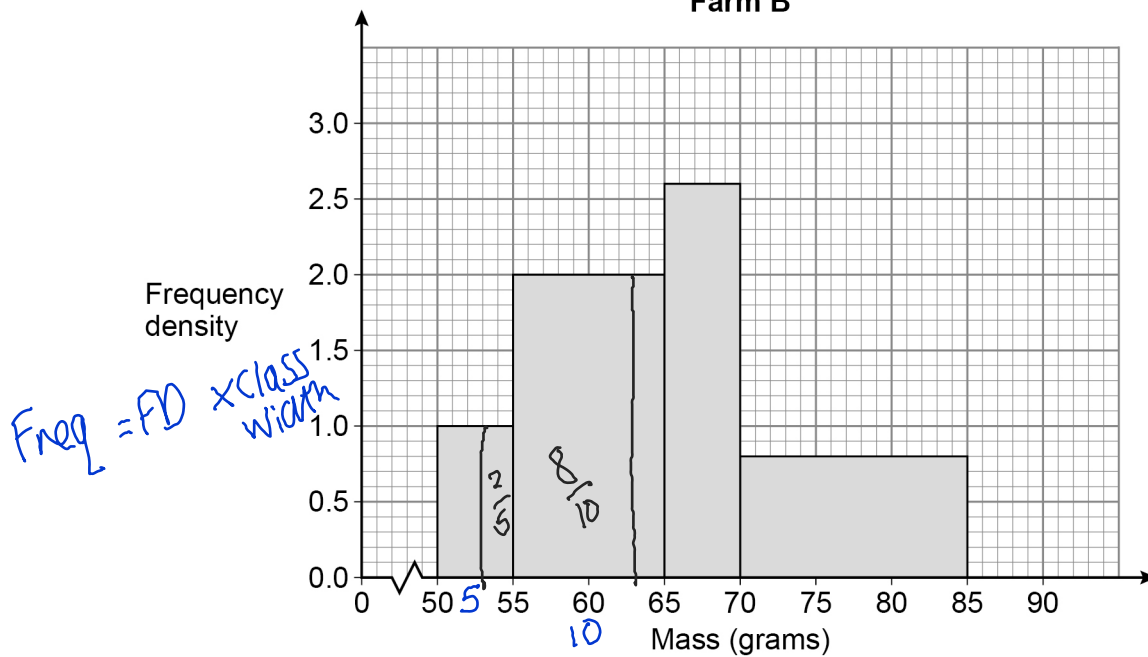
Farm A

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.

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]

$$8 + 19 = 27 \quad \text{Farm A}$$

$$\begin{array}{r} \text{Farm B: } 1 \times 5 \times \frac{2}{5} = 2 + \\ 2 \times 10 \times \frac{8}{10} = 16 \\ \hline 18 \end{array}$$

$$27 - 18 = 9$$

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]

$$5 \times 2 \times a = -30 \quad a = \frac{-30}{10} = -3$$

$$(x+5)(x+2)(x-3)$$

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

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

$$= x^3 + \underbrace{4x^2}_b - \underbrace{11x}_c - 30$$

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

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

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



27

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

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

[5 marks]

$$f(-0.5) = \frac{-1}{5} - 1 = -1.2$$

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

$$y + 1 = \frac{2}{5}x$$

$$\frac{5(y+1)}{2} = x$$

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

$$f^{-1}(3) = \frac{5(3+1)}{2} = \frac{5 \times 4}{2} = 10$$

$$10 - 1.2 =$$

Answer

$$8.8$$

END OF QUESTIONS

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2 8



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