Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

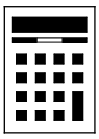
H

Higher Tier Paper 3 Calculator

Monday 11 November 2024 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:



- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).

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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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.

Advice

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

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	
TOTAL	

N 0 V 2 4 8 3 0 0 3 H 0 1

IB/M/Nov24/G4008/E10

Please note that these worked solutions have neither been provided nor approved by AQA and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue should be written in the exam.

Anything written in green in a rectangle doesn't have to be written in the exam.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

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

Do not write outside the box

1 Work out the reciprocal of $\frac{10}{3}$

Give your answer as a decimal.

[2 marks]

$\frac{3}{10}$ ← Reciprocal can mean to flip the fraction

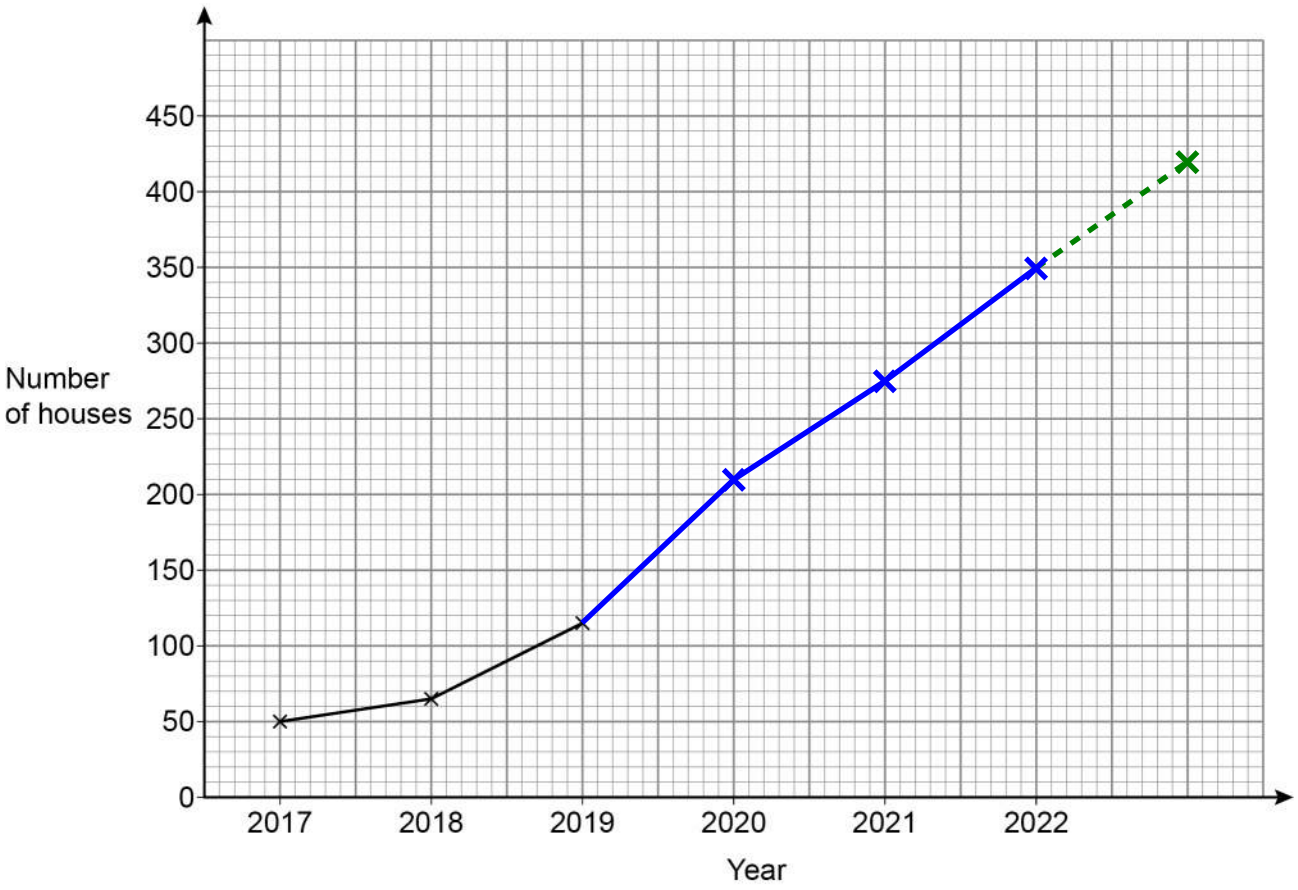
Answer 0.3

↑ Formatting it as a decimal

Do not write outside the box

2 The table shows information about the number of houses with solar panels in a town.

Year	2017	2018	2019	2020	2021	2022
Number of houses	50	65	115	210	275	350



2 (a) Complete the graph.

[2 marks]

2 (b) Use the graph to estimate the number of houses with solar panels in 2023

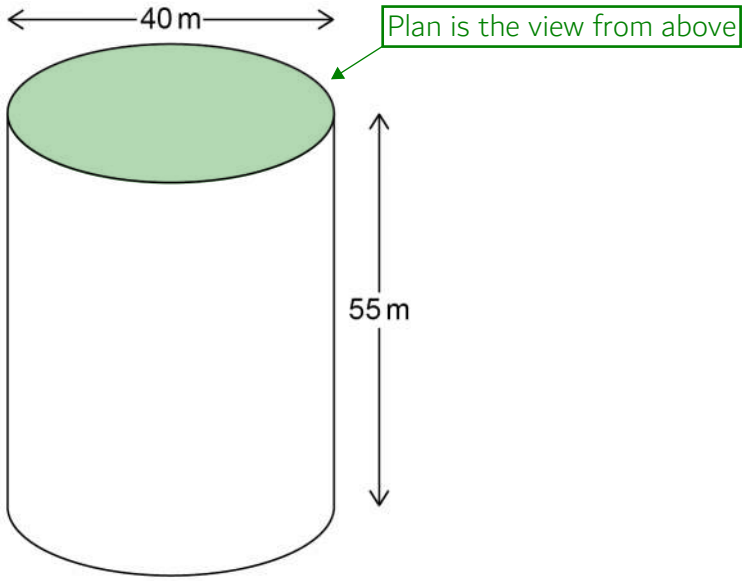
[1 mark]

Answer 420

5

Do not write outside the box

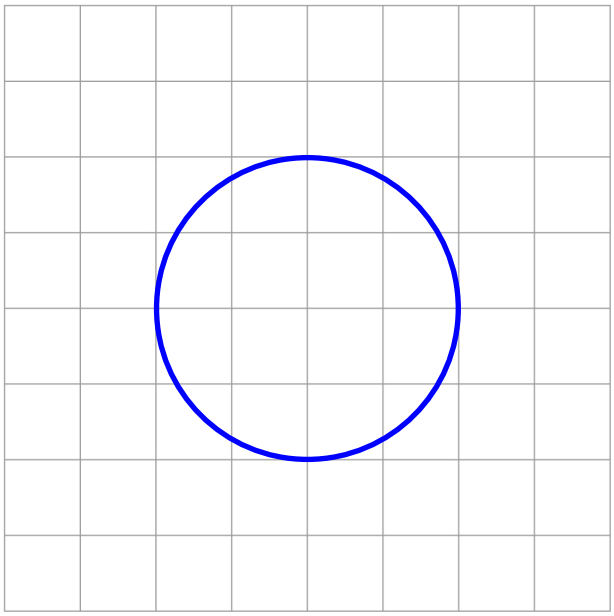
3 A building in the shape of a cylinder has diameter 40 m and height 55 m



3 (a) On the centimetre grid, draw a **plan** of the building.

Use a scale of 1 cm to 10 m

[2 marks]



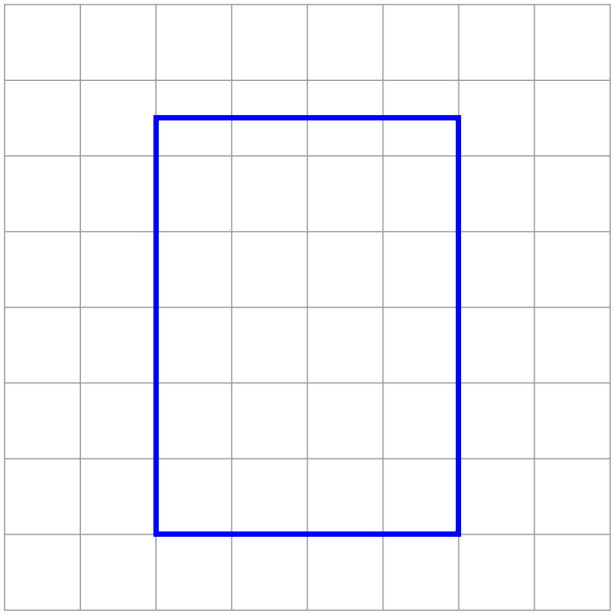
The circle is visible from above. Dividing the 40 m diameter by 10 works out that the diameter on the drawing will be 4 cm. Dividing this by 2 works out that the radius of the circle on the drawing will be 2 cm. Using a compass, drawing a circle with radius 2 cm

Do not write outside the box

3 (b) On this centimetre grid, draw the **front elevation** of the building.

Use a scale of 1 cm to 10 m

[2 marks]



A rectangle is visible from the front elevation. Dividing both the length and width by 10 works out how many centimetres should be drawn for the length and width. 55 ÷ 10 = 5.5 and 40 ÷ 10 = 4

Turn over for the next question

4

Do not write outside the box

4 To the **nearest pound**, Rosie has £12

She wants to buy 6 drinks.

Each drink costs £1.89

Show that Rosie **definitely** has enough money to buy the 6 drinks.

[3 marks]

$12 - \frac{1}{2} = 11.50$ ← Subtracting half of £1 from £12 works out that the lowest amount of money Rosie can have is £11.50

$1.89 \times 6 = 11.34$ ← Multiplying the cost of each drink by 6 works out that the cost of 6 drinks is £11.34

So Rosie definitely has enough money as the £11.50 is more than the £11.34

5 The total cost of a taxi ride is calculated by adding

a fixed charge of £4

and

a charge of £2 per mile.

Write a formula to work out the total cost, £C, of a journey of m miles.

[2 marks]

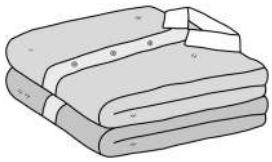
$C = 2m + 4$

Multiplying the number of miles m by 2 expresses the charge for the miles. Adding the fixed charge of £4 to this expresses the total cost. C is equal to this

Do not write outside the box

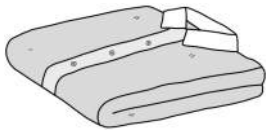
6 Three shops sell shirts.

Shop A



Pack of 2 £19.00

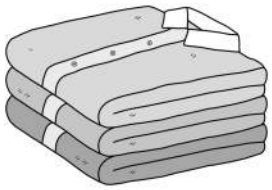
Shop B



Was £12.40

Now 25% off

Shop C



Pack of 3 £37.40

Buy one pack, get another pack half price

At which shop is it cheapest to buy **6 shirts**?

Show working to support your answer.

[5 marks]

$19 \times 3 = 57$ ← 3 packs of 2 are needed to get 6 shirts. Multiplying the cost of a pack of 2 from Shop A by 3 works out that it costs £57 for 6 shirts from Shop A

$\frac{25}{100} \times 12.40$ ← Putting 25% over 100 expresses 25% as a fraction. Multiplying this by the £12.40 works out that 25% of £12.40 is £3.10

$12.40 - 3.10$ ← Subtracting the value of 25% from the £12.40 works out that it costs £9.30 for a shirt from Shop B

$9.30 \times 6 = 55.80$ ← Multiplying the cost of a shirt from Shop B by 6 works out that it costs £55.80 for 6 shirts from Shop B

$37.40 \div 2$ ← This works out that half of the the price of a pack of 3 from Shop C is £18.70

$37.40 + 18.70 = 56.10$ ← 2 packs of 3 are needed to get 6 shirts. Adding the full cost of a pack of 3 and half of the price of a pack of 3 from Shop C works out that it costs £56.10 for 6 shirts from Shop C

Answer B

They cost £57 from Shop A. They cost £55.80 from Shop B. They cost £56.10 from Shop C. £55.80 is the cheapest

10

Do not write outside the box

7 (a) At a school

there are 912 students

the ratio of students to teachers is 15.2 : 1

The number of students stays the same.

The number of teachers increases by 2

Work out the new ratio of students to teachers.

Give your answer in the form n : 1

[3 marks]

912 ÷ 15.2 ← Dividing the 912 students by the 15.2 parts of the ratio which represent them works out that 1 part of the ratio is worth 60. So there were originally 60 teachers

60 + 2 ← The number of teachers increases by 2 so there are now 62 teachers

912 ÷ 62 ← The ratio could be written as 912 : 62. Dividing both sides by 62 gets 1 on the right

Answer 456 / 31 : 1

7 (b) On a school trip, one teacher is needed for every group of 10 or fewer students.

72 students want to go on the trip.

Lexi tries to work out how many teachers are needed.

> 72 ÷ 10 = 7.2
>
> 7 teachers are needed.

What is wrong with her answer?

[1 mark]

8 teachers are needed ← The 7.2 needs to be rounded up as 7 is not enough

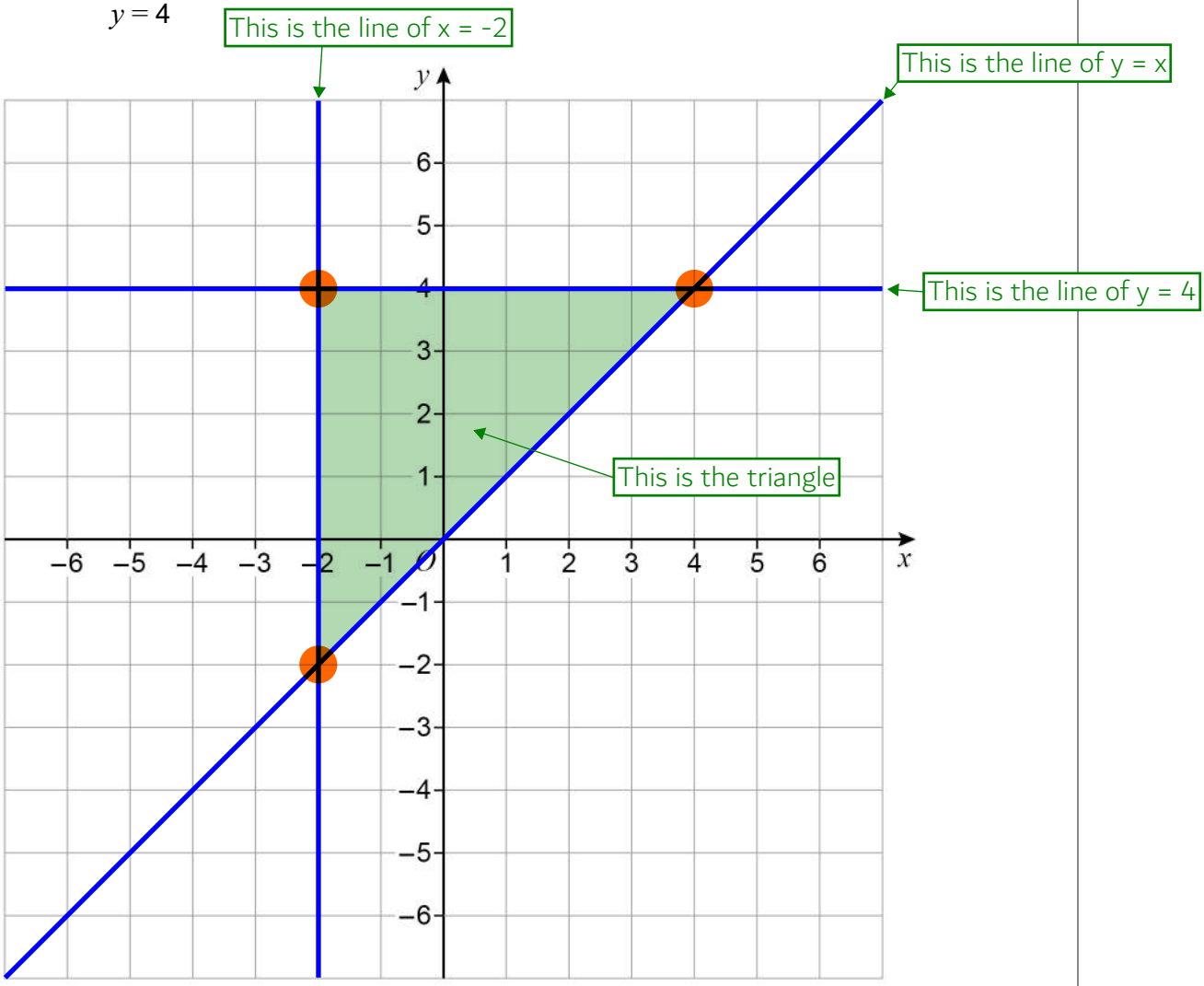
Do not write outside the box

8 A triangle is drawn using the lines

$y = x$

$x = -2$

$y = 4$



Work out the coordinates of the **three** vertices of the triangle.

[4 marks]

The vertices are the corners, highlighted in orange

Answer (-2 , 4)

(4 , 4)

(-2 , -2)

x-coordinate y-coordinate

8

Do not write outside the box

9 When x is divided by 2 the remainder is 1

This means that x is 1 more than a multiple of 2, so must be odd

When x is divided by 3 the remainder is 1

This means that x is 1 more than a multiple of 3

When x is divided by 4 the remainder is 1

This means that x is 1 more than a multiple of 4

Work out **two** possible values of x.

[2 marks]

5, 9, 13, 17, 21, 25

Listing out the numbers which are 1 more than a multiple of 4 until two possible values which are odd and are 1 more than a multiple of 3 are found

$x =$ 13 and $x =$ 25

Do not write outside the box

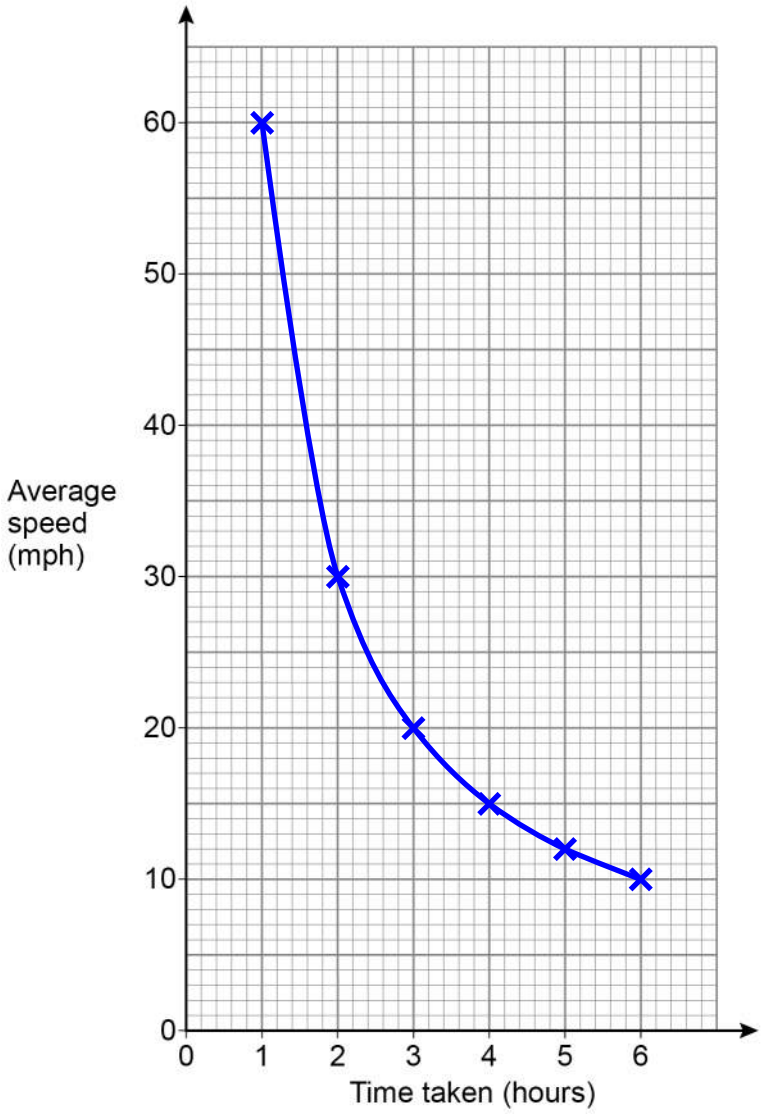
10 A car will travel 60 miles.

Draw a graph to show the **average speed** of the car for times taken between 1 hour and 6 hours.

You may use the table to help you.

[3 marks]

Time taken (hours)	1	2	3	4	5	6
Average speed (mph)	60	30				10



Miles per hour can be worked out by dividing the distance in miles by the time in hours.
Using table mode, define f(x) = 60 ÷ x, then set the table range to start: 1, end: 6, step 1.
This completes the table of values. Then plot on the points and join them up with a curve

5

Do not write outside the box

11 Factorise fully $12t + 4t^3$

[2 marks]

Answer $4t(3 + t^2)$

4 is the highest common factor of 12 and 4. t is the highest common factor of t and t^3. So bringing 4t out as a factor and leaving the result of dividing both terms by this in a bracket

12 The population of a country is now 67 200 000

The population is predicted to

increase by 1% per year for 6 years

and then

decrease by 1.2% per year for 2 years.

Work out the predicted population of the country 8 years from now.

Give your answer to 3 significant figures.

[4 marks]

$\frac{100 + 1}{100}$ ← Adding 1% to 100% expresses the percentage it increases to each year if increasing by 1%. Putting this over 100 works out that the decimal multiplier equivalent to increasing by 1% is 1.01

$\frac{100 - 1.2}{100}$ ← Subtracting 1.2% from 100% expresses the percentage it increases to each year if decreasing by 1.2%. Putting this over 100 works out that the decimal multiplier equivalent to decreasing by 1.2% is 0.988

$67200000 \times 1.01^6 \times 0.988^2$ ← Multiplying by 1.01 6 times increases the population by 1% 6 times and then multiplying by 0.988 2 times decreases the population by 1.2% 2 times

Answer 69600000

696324.0... is rounded to 3 significant figures

Do not write outside the box

13 A bag contains one £5 note, one £10 note, one £20 note and one £50 note.

Amaan picks **two** of the notes at random without replacement.

Work out the probability that he has picked **at least** £30

[2 marks]

	5	10	20	50
5	-	×	×	✓
10	×	-	✓	✓
20	×	✓	-	✓
50	✓	✓	✓	-

Writing the possible notes for the first pick against the possible notes for the second pick. Putting a dash if it is not possible (for example if the first pick is £5, the second pick cannot be £5 as the notes are not replaced), putting a cross if the total is not at least £30 and putting a tick if the total is at least £30

Answer $\frac{8}{12}$

8 out of the 12 possibilities give a total of at least £30

Turn over for the next question

8

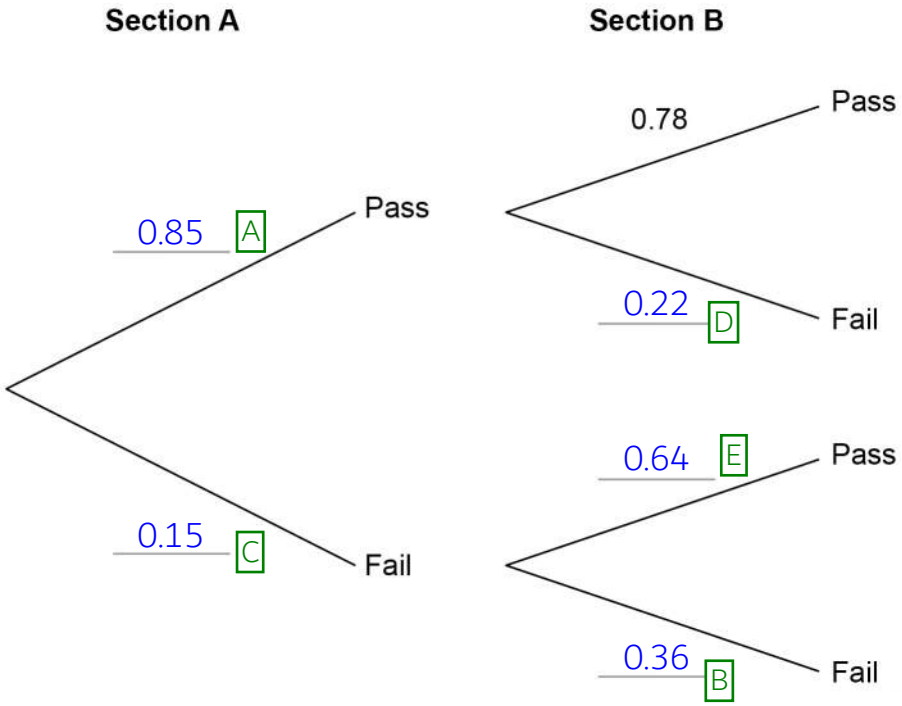
Do not write outside the box

14 A test consists of two sections, A and B.

- 85% of people pass section A.
- 78% of people who **pass** section A also **pass** section B.
- 36% of people who **fail** section A also **fail** section B.

14 (a) Complete the tree diagram.

[2 marks]



A: 85% of people pass section A.

B: 36% of people who fail section A also fail section B.

C: 1 - 0.85 = 0.15.

D: 1 - 0.78 = 0.22.

E: 1 - 036 = 0.64.

Do not write outside the box

14 (b) 40% of people who fail **at least** one section take the test again.

5000 people take the test.

How many of these 5000 people are expected to take the test again?

[4 marks]

0.85×0.78 ← This works out that the probability of passing both sections of the test is 0.663. Pass AND pass. AND means to multiply the probabilities

$1 - 0.663$ ← It is certain to either pass both sections of the test or to fail at least one section of the test. So subtracting the probability of passing both sections of the test from 1 works out that the probability of failing at least one section of the test is 0.337

0.337×5000 ← Multiplying the probability of failing at least one section of the test by the 5000 people who take the test estimates that 1685 people fail at least one section of the test

$\frac{40}{100} \times 1685$ ← Putting 40% over 100 converts it into a fraction. Multiplying this by the estimated 1685 people who fail at least one section of the test works out that 674 people are expected to take the test again

Answer 674

Turn over for the next question

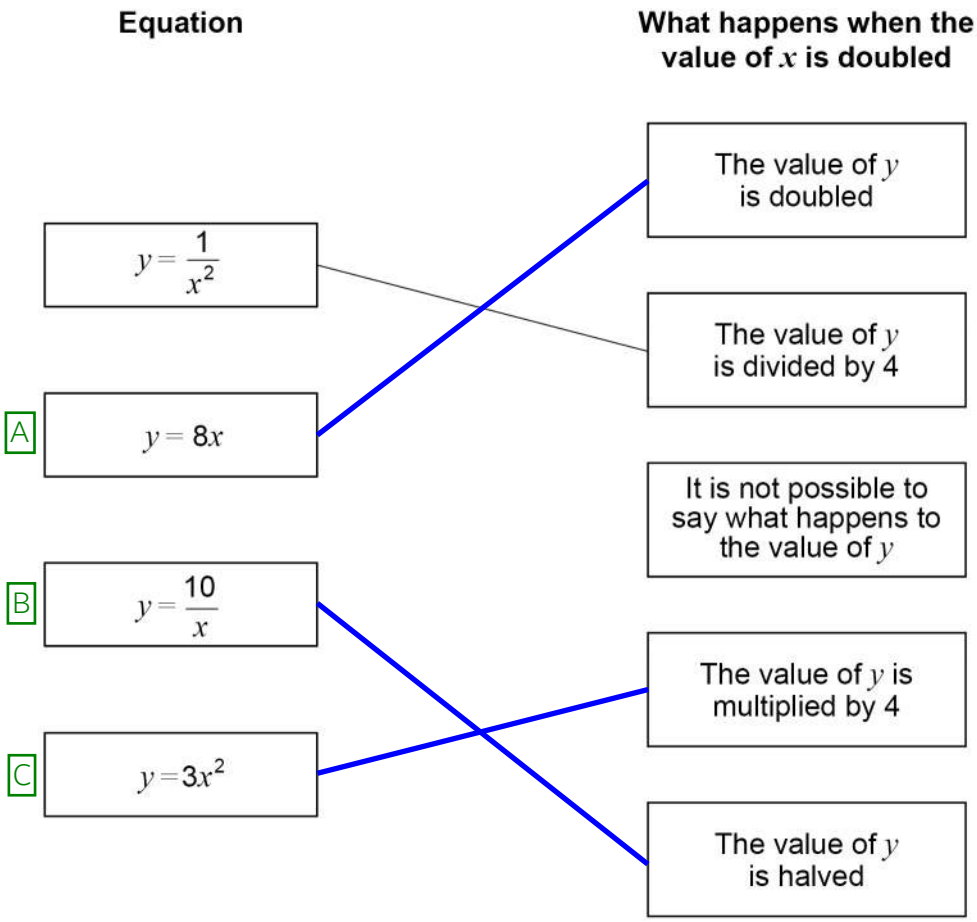
6

Do not write outside the box

15 Match each equation to a statement to show what happens when the value of x is doubled.

One has been done for you.

[3 marks]



A: When x = 1, y = 8(1) = 8. When x = 2, y = 8(2) = 16. Doubling x has doubled the value of y.

B: When x = 1, y = 10/1 = 10. When x = 2, y = 10/2 = 5. Doubling x has halved the value of y.

C: When x = 1, y = $3(1)^2$ = 3. When x = 2, y = $3(2)^2$ = 12. Doubling x has multiplied the value of y by 4.

Do not write outside the box

16 Rearrange $y = \sqrt{\left(\frac{x}{2} + 1\right)}$ to make x the subject.

[3 marks]

$y^2 = \frac{x}{2} + 1$ ← Squaring both sides eliminates the square root on the right. The brackets are no longer needed

$y^2 - 1 = \frac{x}{2}$ ← Subtracting 1 from both sides eliminates the +1 on the right

Multiplying both sides by 2 eliminates the 2 as the denominator and gets x on its own

Answer $x = 2(y^2 - 1)$

17 A stone falls vertically from 300 metres above ground.

- The stone falls d metres in t seconds.
- d is directly proportional to the square of t.
- The stone falls 20 metres in the first 2 seconds.

Work out the **total** time taken for the stone to reach the ground.

[4 marks]

$d \propto t^2$ ← Writing the proportion

$d = kt^2$ ← Multiplying the right side by k (which represents an unknown value which needs to be found) converts the proportion into an equation

$20 = k(2)^2$ ← Substituting the 20 metres for d and the 2 seconds for t

$20 \div 2^2 = k$ ← Dividing both sides by 2^2 finds that k = 5

$300 = 5t^2$ ← Substituting the 300 metres for d and 5 for k into the equation

$60 = t^2$ ← Dividing both sides by 5 eliminates the 5 on the right

Square rooting both sides gets t on its own

Answer $\sqrt{60}$ seconds

10

Do not write outside the box

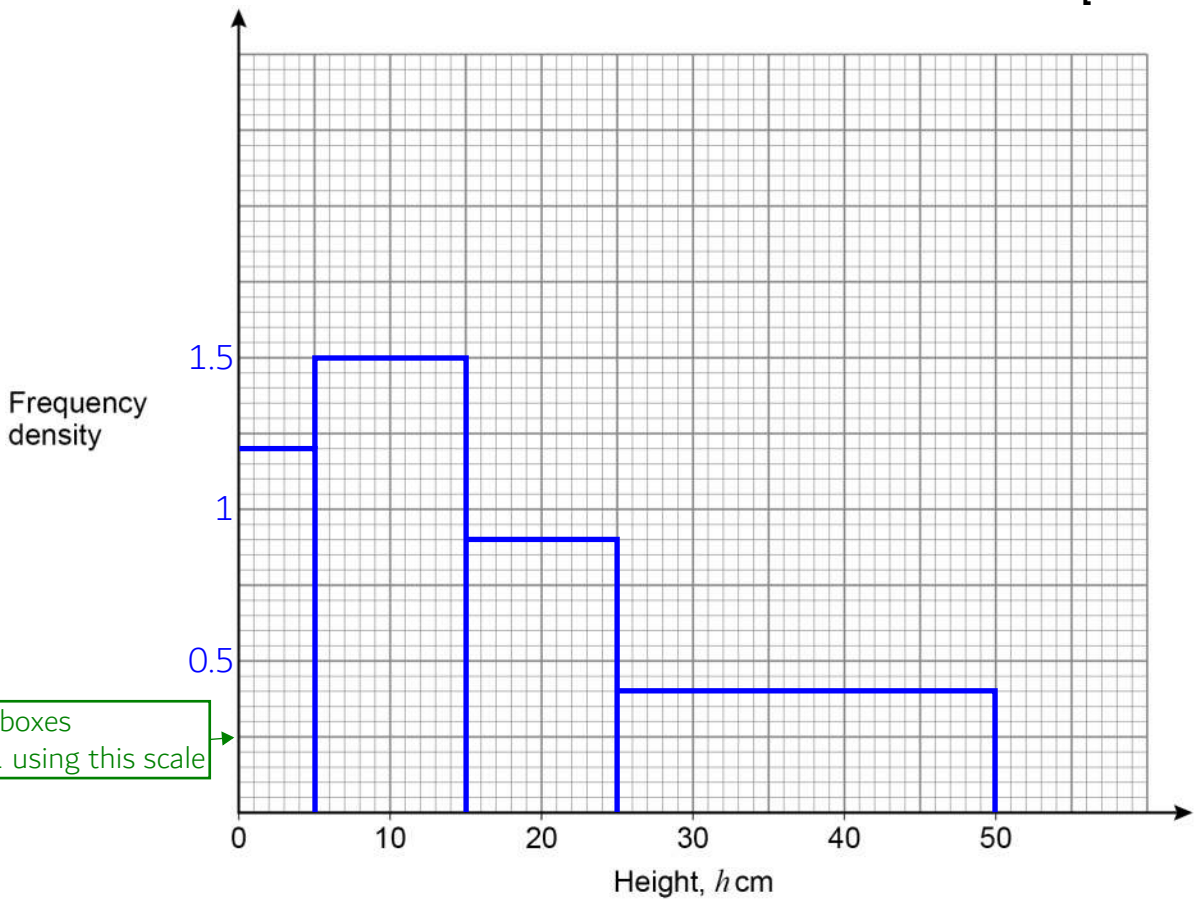
18 The table shows information about the height of 40 plants.

Height, h cm	Frequency	Class width	
$0 \leqslant h < 5$	6	5	1.2
$5 \leqslant h < 15$	15	10	1.5
$15 \leqslant h < 25$	9	10	0.9
$25 \leqslant h < 50$	10	25	0.4

A B

Draw a histogram to represent the heights.

[4 marks]



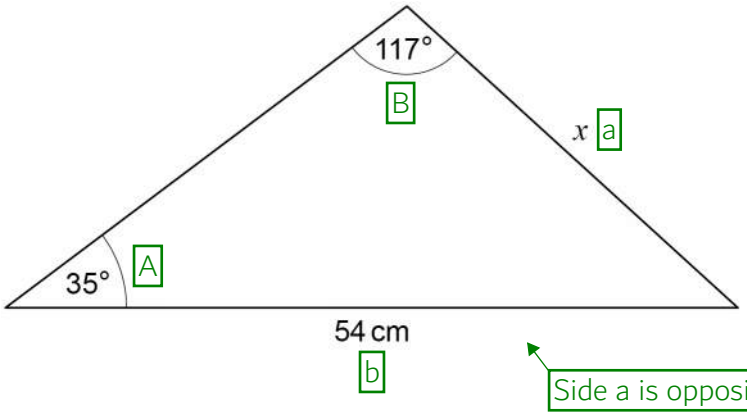
Every 2 small boxes represents 0.1 using this scale

A: The class widths are how wide each bar is on the histogram. For example, for $15 \leqslant h < 25$ the class width is 10 as it goes from 15 to 25.

B: The frequency densities. The frequency on a histogram can be found be working out the area of each bar. Area of rectangle = base × height. So height = area ÷ height, or frequency density = frequency ÷ class width.

Do not write outside the box

19



Not drawn accurately

Side a is opposite angle A and side b is opposite angle B

Use the sine rule to work out length x.

You **must** show your working.

[3 marks]

$\frac{x}{\sin 35} = \frac{54}{\sin 117}$ ← $\frac{a}{\sin A} = \frac{b}{\sin B}$

$x = \frac{54\sin 35}{\sin 117}$ ← Multiplying both sides by sin35 gets x on its own

$x =$ 34.8 cm

20 Factorise fully $3x^2 + 23x + 30$ ← It is in the form $ax^2 + bx + c$

[2 marks]

$3x^2 + 5x + 18x + 30$ ← Multiplying a by c gives 90. Two numbers which multiply to this 90 and add to b (which is 23) are 5 and 18. Splitting the middle x term into these numbers of x

$x(3x + 5) + 6(3x + 5)$ ← Factorising the left two terms and factorising the right two terms

Bringing the x and +6 together into a bracket. Writing the repeated bracket once

Answer $(x + 6)(3x + 5)$

9

Do not write outside the box

21 A bag contains 25 discs.

11 are red, 9 are blue and 5 are yellow.

Ashley picks three of the discs at random without replacement.

Ashley's first disc is red.

Work out the probability that all three discs are different colours.

[3 marks]

B & Y OR Y & B ← Listing out the next two outcomes which will result in all three discs being different colours. Blue AND yellow OR yellow AND blue

$\frac{9}{24} \times \frac{5}{23} + \frac{5}{24} \times \frac{9}{23}$ ← AND means to multiply, OR means to add. There are 24 discs in total for the second pick. There are 23 discs in total for the third pick

Answer $\frac{15}{92}$

Do not write outside the box

22 The metal used to make a sphere costs £4320

The metal costs £3.60 per gram.

Each cubic centimetre of metal has a mass of 17.3 grams. ← This is the density

Work out the radius, r, of the sphere.

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

[4 marks]

$d = \frac{m}{v}$ ← Writing the formula triangle for density, mass, volume

$4320 \div 3.60$ ← Dividing the £4320 by the £3.60 per gram works out that the mass of the sphere is 1200 grams

$1200 \div 17.3$ ← Covering v in the formula triangle finds that volume = mass ÷ density. So the volume of the sphere is 69.3... cm^3

$69.3... = \frac{4}{3}\pi r^3$ ← Substituting the volume of the sphere into the formula

$16.5... = r^3$ ← Dividing both sides by 4/3 π to get r^3 on its own

$r =$ 2.5 cm

Cube rooting both sides gets r on its own

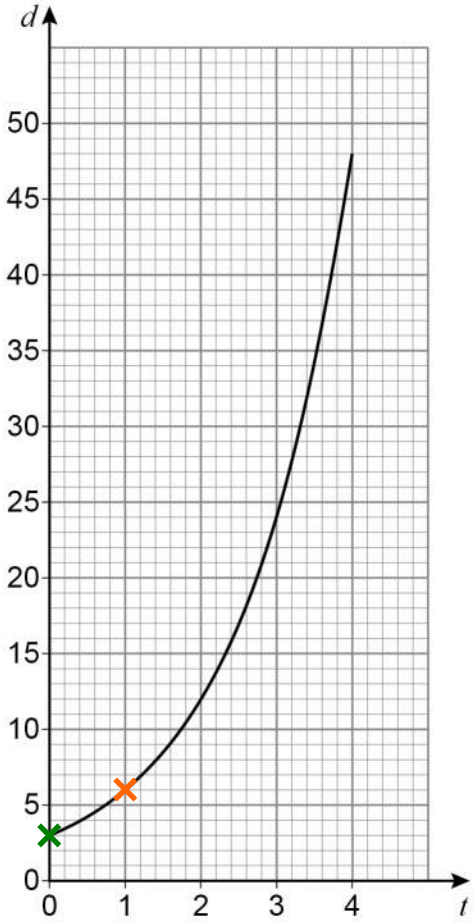
Turn over for the next question

7

Do not write outside the box

23 The distance of a particle from a point is d metres after t seconds.

$d = a \times b^t$ where a and b are constants



Work out the values of a and b.

[3 marks]

$3 = a \times b^0$ ← Substituting the t and d-coordinates from the green cross into the equation. Anything to the power of 0 is 1 so $b^0 = 1$. Then a × 1 = a. So a = 3

$6 = 3 \times b$ ← Substituting the t and d-coordinates from the orange cross into the equation. $b^1 = b$. So b = 2 as 3 × 2 = 6

$a =$ 3 $b =$ 2

Do not write outside the box

24 A curve has the equation $y = x^2 + 4x - 4$ ← 1st equation

A straight line has the equation $y = 3x - 2$ ← 2nd equation

Work out the **two** points of intersection of the curve and the straight line.

[5 marks]

$0 = x^2 + x - 2$ ← Subtracting the 2nd equation from the 1st equation cancels out the y and gets an equation just in terms of x, which is in the quadratic form $ax^2 + bx + c = 0$

$\frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times -2}}{2 \times 1}$ ← $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ← Solving the equation using the quadratic formula. So x = 1 or x = -2

$y = 3(1) - 2$

$y = 3(-2) - 2$

← Substituting the x-coordinates into the 2nd equation to find the y-coordinates

Answer (1 , 1) and (-2 , -8)

x-coordinate, y-coordinate

END OF QUESTIONS

8