

Wednesday 11 June 2025 – Morning**GCSE (9–1) Mathematics****J560/06 Paper 6 (Higher Tier)****Time allowed: 1 hour 30 minutes****You must have:**

- the Formulae Sheet for Higher Tier (inside this document)

You can use:

- a scientific or graphical calculator
- geometrical instruments
- tracing paper

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

First name(s)

Last name

INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined page at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Use the π button on your calculator or take π to be 3.142 unless the question says something different.

INFORMATION

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [].
- This document has **24** pages.

ADVICE

- Read each question carefully before you start your answer.

Please note that these worked solutions have neither been provided nor approved by OCR 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

- 1 A fair four-sided dice is numbered 3, 4, 5 and 6.
The dice is rolled twice and the two scores are multiplied together.

(a) Complete the table to show all the possible outcomes.

		First roll			
Second roll	×	3	4	5	6
	3	9	12	15	18
	4	12	16	20	24
	5	15	20	25	30
	6	18	24	30	36

$$\begin{aligned} 3 \times 3 &= 9 \\ 5 \times 5 &= 25 \\ 6 \times 6 &= 36 \end{aligned}$$

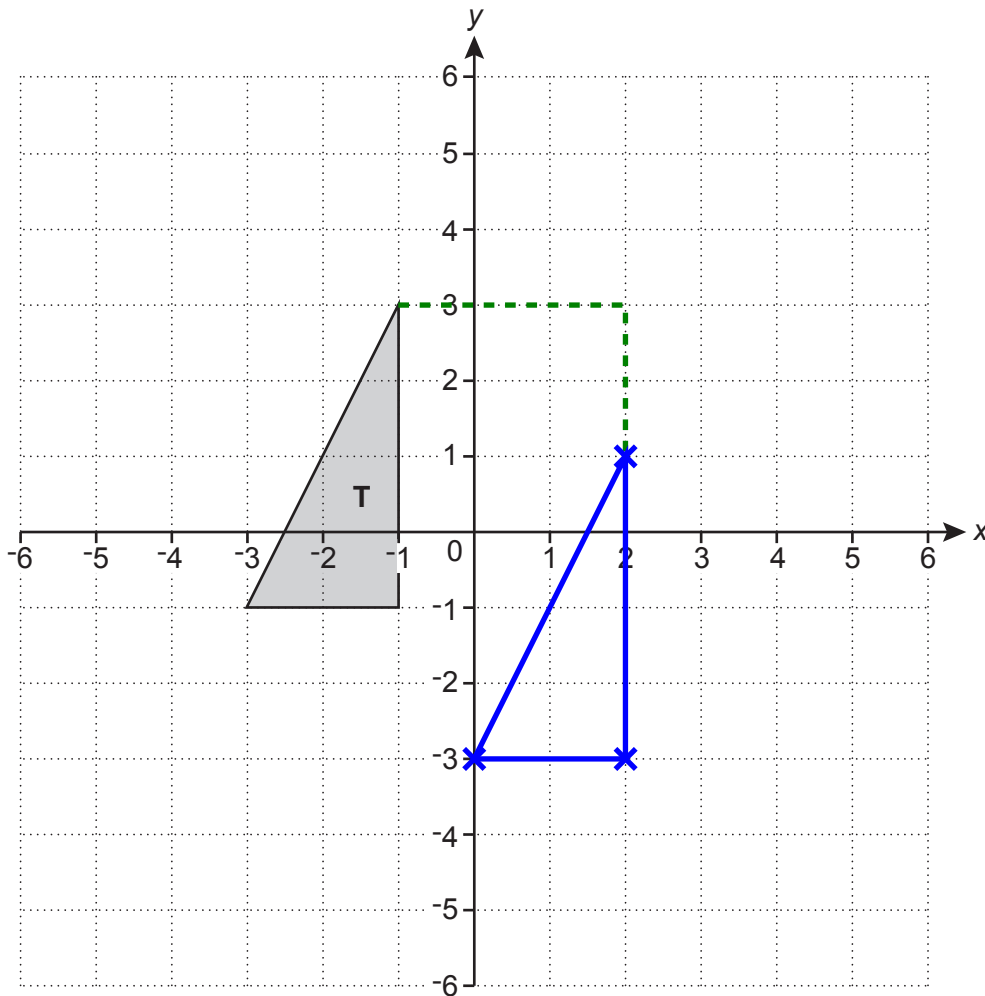
[1]

(b) Find the probability that the outcome is a multiple of 8.

The outcomes which are multiples of 8 are highlighted in green. This is 3 out of the 16 possible outcomes

(b) $\frac{3}{16}$ [2]

- 2 Triangle T is drawn on a coordinate grid.



Translate triangle T by vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$.

Moving the triangle 3 in the x-direction (3 to the right) and -2 in the y-direction (2 down)

[2]

- 3 (a) The price of a laptop is reduced in a January sale from £450 to £382.50.

Work out the percentage reduction in the price of the laptop.

$$450 - 382.50$$

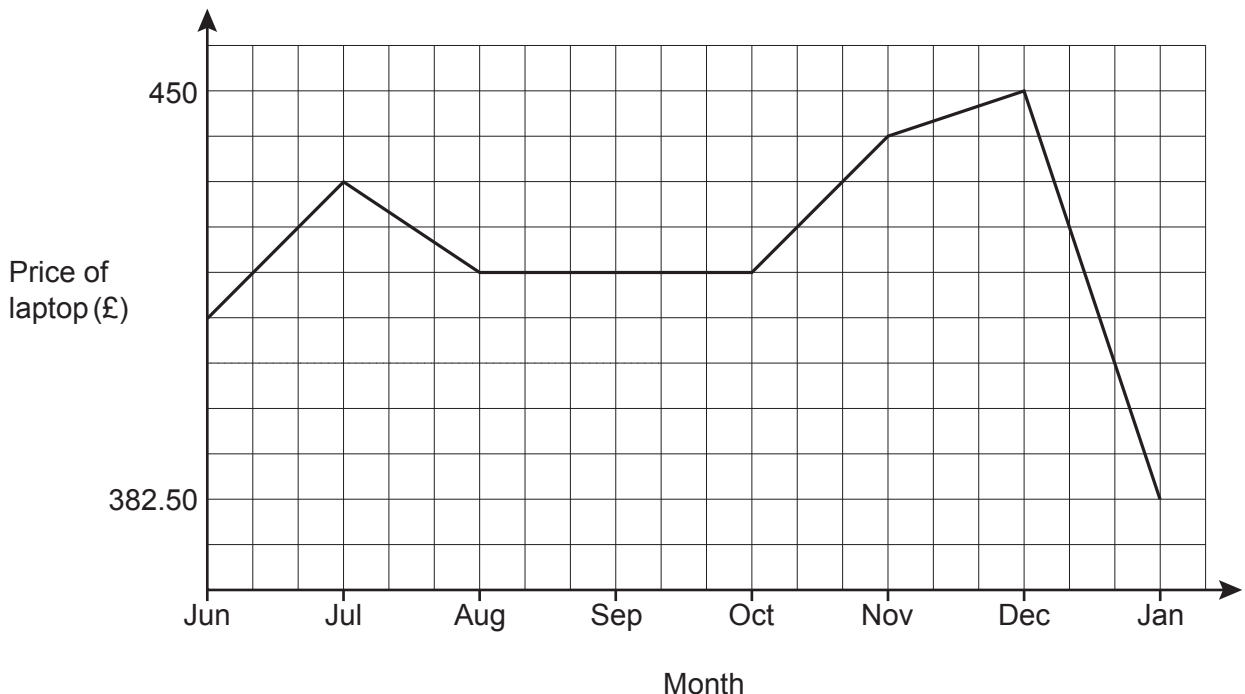
Subtracting the £382.50 from the original £450 finds that the reduction is £67.50

$$\frac{67.50}{450} \times 100$$

Putting the £67.50 reduction over the original 450 expresses the reduction as a fraction of the original price. Multiplying this by 100 converts the fraction to a percentage

(a) 15 % [3]

- (b) The graph shows the price of the laptop in the months before the January sale.



Explain why this graph is misleading.

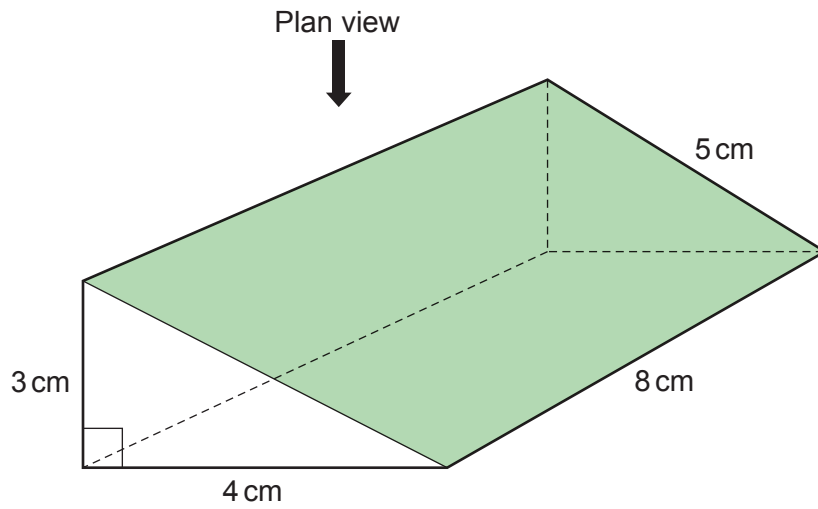
Vertical axis does not start at 0

This could be misleading as it looks like there is a huge drop in price from December to January, but it is only a 15% drop

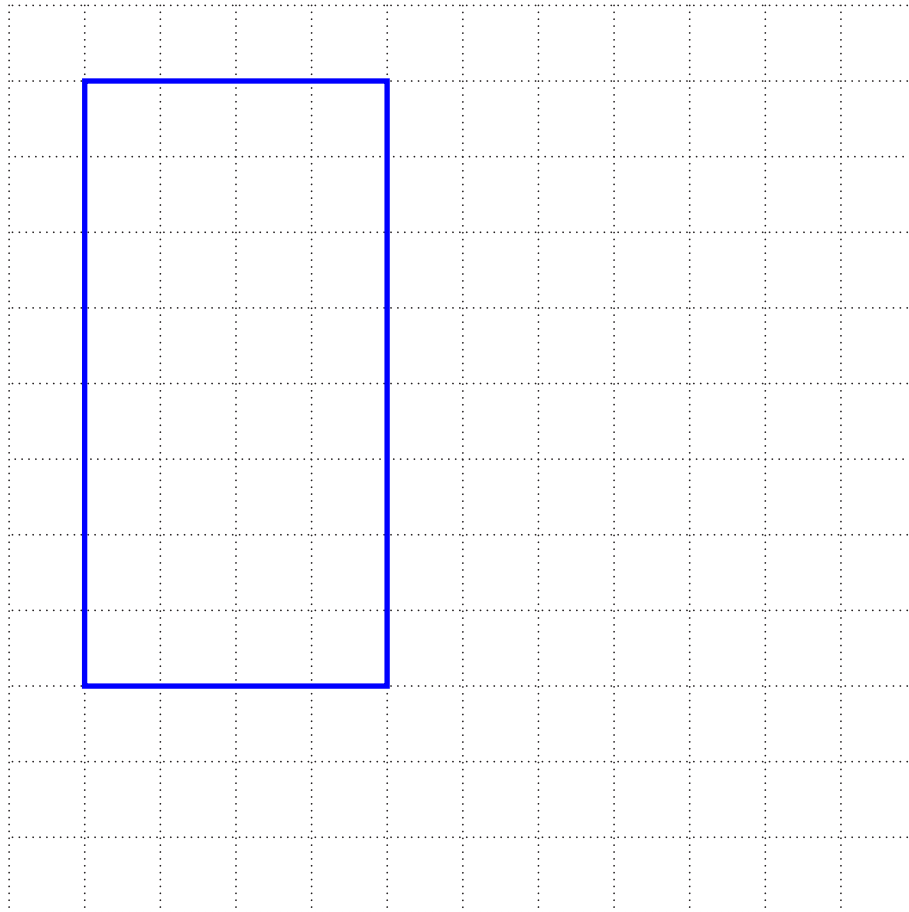
[1]

4

- 4 The diagram shows a prism of length 8 cm.
The cross-section of the prism is a right-angled triangle.



Draw an accurate plan view of the prism on the one-centimetre grid below.



Only the highlighted rectangle is visible for the plan (the view from above). It will appear 8 cm long and 4 cm wide (not all the 5 cm is visible as it is slanted)

[2]

- 5 A teacher asks their class which of the following values is the smallest.

$$2^{-1} \quad 4^{-3} \quad 10^{-2}$$

One student says

2^{-1} is the smallest because 2 is smaller than 4 and 10.

Explain the error made by the student in their **reasoning** and write down the smallest value.

$$\frac{1}{2} \quad \frac{1}{64} \quad \frac{1}{100}$$

Putting each into the calculator and giving them as fractions. As they all have the same numerator, the largest denominator makes the number the smallest

The error is: The powers were ignored

..... The smallest value is 10^{-2} [2]

- 6 A kitchen has space for a fridge.

- (a) The width, w , of the space is 70 cm, correct to the nearest centimetre.

Complete the error interval for the width, w .

$$70 \pm \frac{1}{2}$$

Adding and subtracting half of what it is correct to the nearest (1 cm) finds the upper and lower bound

$$\begin{array}{ccc} \text{Lower bound} & & \text{Upper bound} \\ \downarrow & & \downarrow \\ \text{(a)} \quad 69.5 & \leq w < & 70.5 \end{array} \quad [2]$$

- (b) A fridge is advertised as having a width of 69.5 cm, correct to 1 decimal place.

Show that this fridge may **not** fit in the space. [2]

$$69.5 + \frac{0.1}{2}$$

Adding half of what it is correct to the nearest (0.1 cm as it is correct to 1 decimal place) finds the upper bound for the width of the fridge is 69.55 cm

$$69.54 > 69.5$$

The width of the fridge must be less than the upper bound of 69.55 cm so could be 69.54 cm, which is greater than the lower bound of the space 69.5 cm

7 Each member of a tennis club is classed as a junior, an adult or a senior.

- 16% of the members are seniors.
- The ratio of the number of juniors to the number of adults is 9 : 5.
- There are 95 more juniors than seniors.

Work out the **total** number of members of the tennis club.

You must show your working.

$100 - 16$

Subtracting the 16% who are seniors from the full 100% finds that 84% are juniors or seniors

$84 \div 14$

$9 + 5 = 14$ parts in total in the ratio, which represent the 84% who are juniors or seniors. So dividing the 84% by the 14 parts finds that 1 part of the ratio is worth 6%

6×9

Multiplying the value of 1 part of the ratio by the 9 parts which represent the juniors finds that 54% of the members are juniors

$54 - 16$

Subtracting the 16% seniors from the 54% juniors finds that there is 38% more for the juniors than seniors

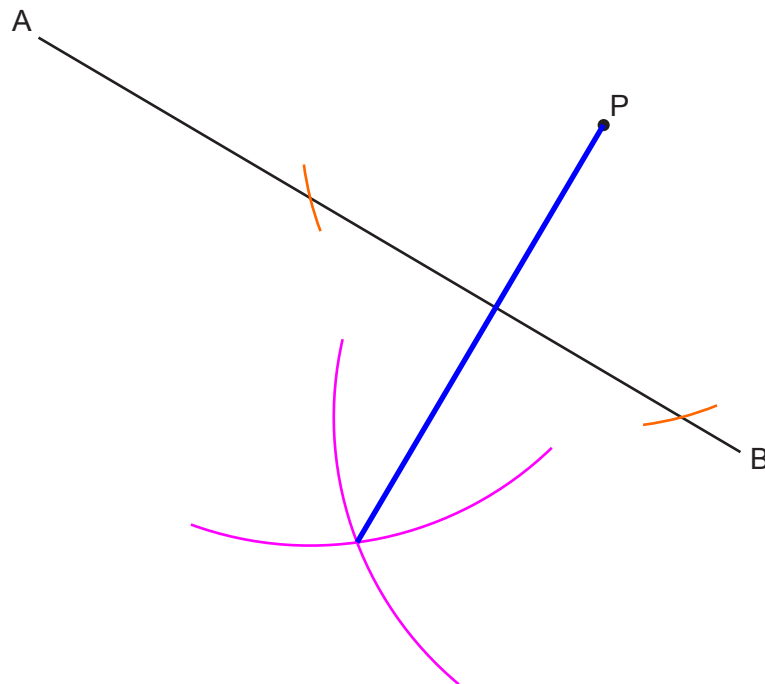
$95 \div 38$

The 95 is represented by 38%. Dividing the 95 by 38 finds that 1% of the members is 2.5

2.5×100

Multiplying the value of 1% by 100 finds that 100% of the members is 250

- 8 Construct the perpendicular from the point P to the line AB.
Show all of your construction lines.



[2]

Using a compass, scribe two arcs on line AB from point P (shown in orange).

Using a compass, scribe arcs from both of the orange arcs on AB (shown in pink).

Using a ruler, draw a straight line from P to where the two pink arcs meet (shown in blue)

9 (a) Solve.

$$8x - 11 = 6x + 3$$

$$2x - 11 = 3 \quad \leftarrow \text{Subtracting } 6x \text{ from both sides to get all the } x \text{ on the same side}$$

$$2x = 14 \quad \leftarrow \text{Adding } 11 \text{ to both sides to eliminate the } -11 \text{ and get the } x \text{ term on its own}$$

Dividing both sides by 2 gets x on its own

7

(a) $x = \dots\dots\dots$ [3]

(b) Solve by factorising.

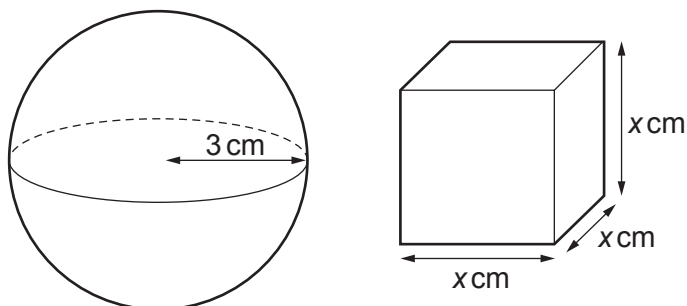
$$x^2 + 15x - 16 = 0$$

$$(x + 16)(x - 1) = 0 \quad \leftarrow \text{Factorised by finding two numbers which add to the } 15 \text{ and multiply to the } -16. 16 \text{ and } -1 \text{ do this. Putting these two numbers in brackets with } x$$

Either $x + 16 = 0$ (so $x = -16$) or $x - 1 = 0$ (so $x = 1$)

(b) $x = \dots\dots\dots -16$ or $x = \dots\dots\dots 1$ [3]

- 10 The diagram shows a sphere with radius 3 cm and a cube with side length x cm.



The surface area of the sphere is equal to the surface area of the cube.

Work out the side length, x cm, of the cube.
You must show your working.

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

$$4\pi \times 3^2 = 6x^2$$

Substituting the radius of 3 cm into the formula for the surface area of the sphere expresses the surface area of the sphere. This must be equal to the surface area of the cube, which is $6x^2$ as area of square = length² and there are 6 square faces on the surface

$$6\pi = x^2$$

Dividing both sides by 6 gets x^2 on its own

Square rooting both sides gets x on its own

4.34

.....cm [5]

- 11 Amit invests some money at a rate of 4% per year compound interest. After 2 years the value of Amit's investment is £1352.

Work out how much money Amit invested.

$$P\left(1 + \frac{4}{100}\right)^2 = 1352$$

Using the compound interest formula. P is the principal amount, which is how much was originally invested

Dividing both sides by $(1 + 4/100)^2$ gets P on its own

£ 1250 [4]

12 You may use these kinematics formulae to answer this question.

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

where a is the constant acceleration, u is the initial velocity, v is the final velocity, s is the displacement and t is the time taken.

A particle has an initial velocity of 2 m/s.

After 6 seconds the particle has a velocity of 11 m/s.

The particle had constant acceleration.

Work out the distance the particle has travelled in the 6 seconds.

$$11 = 2 + a \times 6 \leftarrow \text{Substituting the known values into the 1st formula}$$

$$6a = 9 \leftarrow a \times 6 = 6a. \text{ Subtracting 2 from both sides gets the } a \text{ term on its own}$$

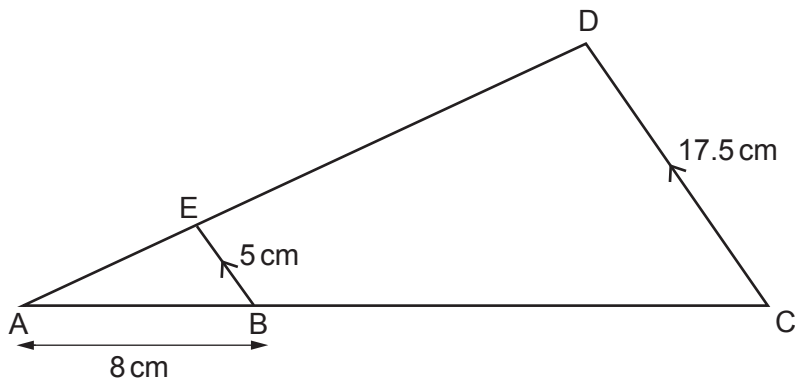
$$a = 1.5 \leftarrow \text{Dividing both sides by 6 gets } a \text{ on its own. So the acceleration is } 1.5 \text{ m/s}^2$$

$$s = 2 \times 6 + \frac{1}{2} \times 1.5 \times 6^2 \leftarrow \text{Substituting the known values into the 2nd formula}$$

s , the displacement, gives the distance

..... 39 m [4]

13 The diagram shows two similar triangles, AEB and ADC.



AB = 8 cm, BE = 5 cm and CD = 17.5 cm

Work out the length of BC.

$$17.5 \div 5$$

DC is the longer version of EB. So dividing the 17.5 cm by the 5 cm finds that the scale factor (what all the sides are multiplied by from the smaller triangle to the larger triangle) is 3.5

$$3.5 \times 8$$

Multiplying the scale factor by AB finds that AC is 28 cm

$$28 - 8$$

Subtracting AB from AC finds BC

BC = ...20.....cm [3]

14 $16807 = 7^5$.

Write 16807000000 as a product of its prime factors.

The number is too big for the calculator to give as a product of prime factors

$$7^5 \times 10^6$$

16807 is multiplied by 10 6 times to get the 16807000000

$$10 = 2 \times 5$$

Using the calculator to express 10 as a product of its prime factors

$$7^5 \times (2 \times 5)^6 = 7^5 \times 2^6 \times 5^6 = 2^6 \times 5^6 \times 7^5$$

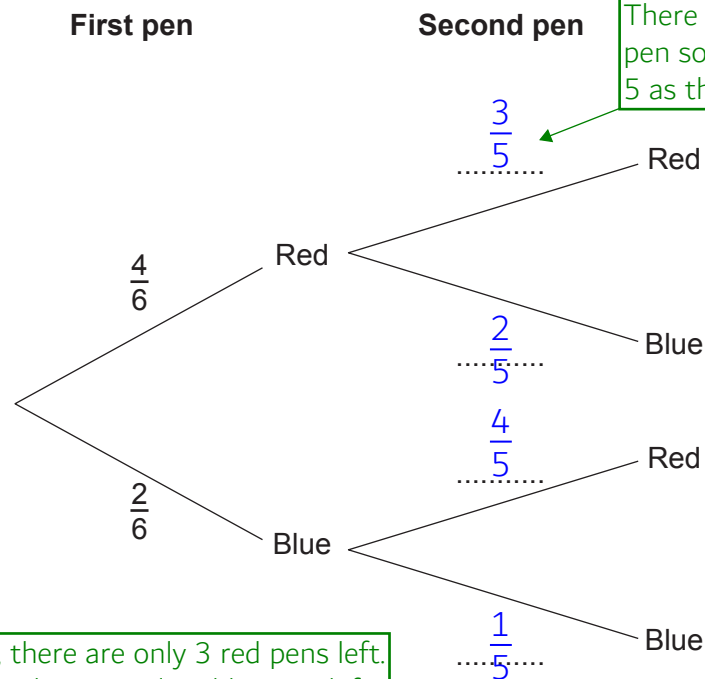
$$2^6 \times 5^6 \times 7^5$$

..... [3]

- 15 A packet of 6 pens contains 4 red pens and 2 blue pens.

A pen is taken at random from the packet and is not replaced.
A second pen is then taken at random from the packet.

- (a) Complete the tree diagram.



There is one fewer pen for the second pen so the denominator decreases to 5 as there are now 5 pens in total

If a red pen is taken first, there are only 3 red pens left.
If a blue pen is taken first, there is only 1 blue pen left

[2]

- (b) Find the probability of taking two pens of the same colour.

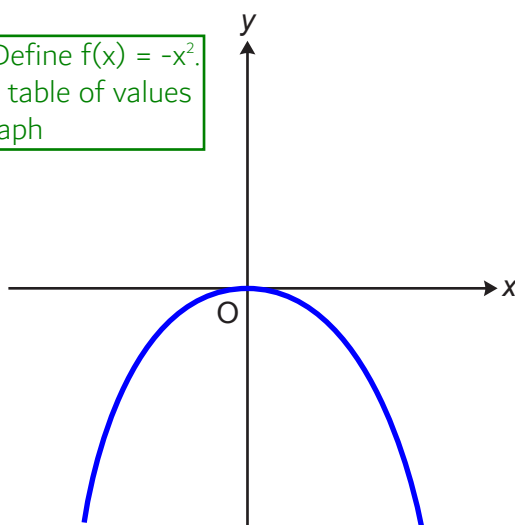
$$\frac{4}{6} \times \frac{3}{5} + \frac{2}{6} \times \frac{1}{5}$$

Red AND red OR blue AND blue. AND means to multiply the probabilities. OR means to add the probabilities

(b) $\frac{7}{15}$ [3]

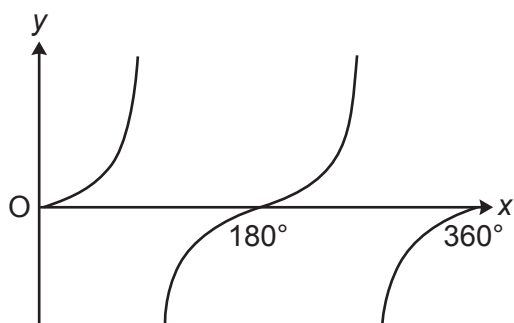
- 16 (a) On the axes below, sketch the graph $y = -x^2$.

Using table mode on the calculator. Define $f(x) = -x^2$.
Start: -5. End: 5. Step: 1. This gives a table of values
which can be used to visualise the graph



[2]

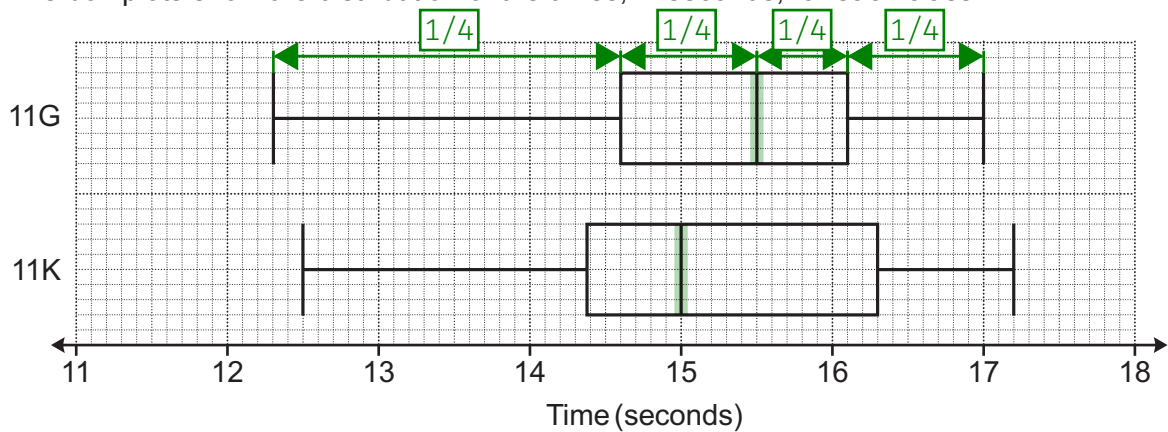
- (b) Write down a possible equation for the graph sketched below.



(b) $y = \dots\dots\dots \tan x \dots\dots\dots$ [1]

It is probably a trig graph as it repeats and involves degrees. Table mode could be used to give a table of values for $y = \sin x$, $y = \cos x$ and $y = \tan x$. Both $\sin$ and $\cos$ curves go up and down with no breaks so it must be the $y = \tan x$

- 17 Two Year 11 classes, 11G and 11K, record their times for a race. The box plots show the distribution of the times, in seconds, for each class.



- (a) Write down the percentage of students in **11G** who took longer than 14.6 seconds.

$3/4$ of the data is above 14.6 seconds

(a) 75 % [1]

- (b) Which class, 11G or 11K, was fastest on average?
Include values to support your decision.

Class 11K because the median of 11G was 15.5 seconds and the median of 11K was 15 seconds

The medians are highlighted in green. Less time is faster

[2]

18 Sasha creates a four-digit passcode.

They use four digits from 0 to 9.

They do not use any digit more than once.

Work out how many of the possible four-digit passcodes are even.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ← Listing the digits from 0 to 9

$$10 \times 9 \times 8 \times 7 \leftarrow$$

Using the product rule for counting to find how many possible four-digit passcodes there can be. After a digit is used, it cannot be used again so there will be one fewer possible digit. There are 10 possibilities for the 1st digit (it can start with 0). There are 9 possibilities for the 2nd digit. There are 8 possibilities for the 3rd digit. There are 7 possibilities for the 4th digit. Multiplying the number of possibilities for each digit finds that there are 5040 possible four-digit codes

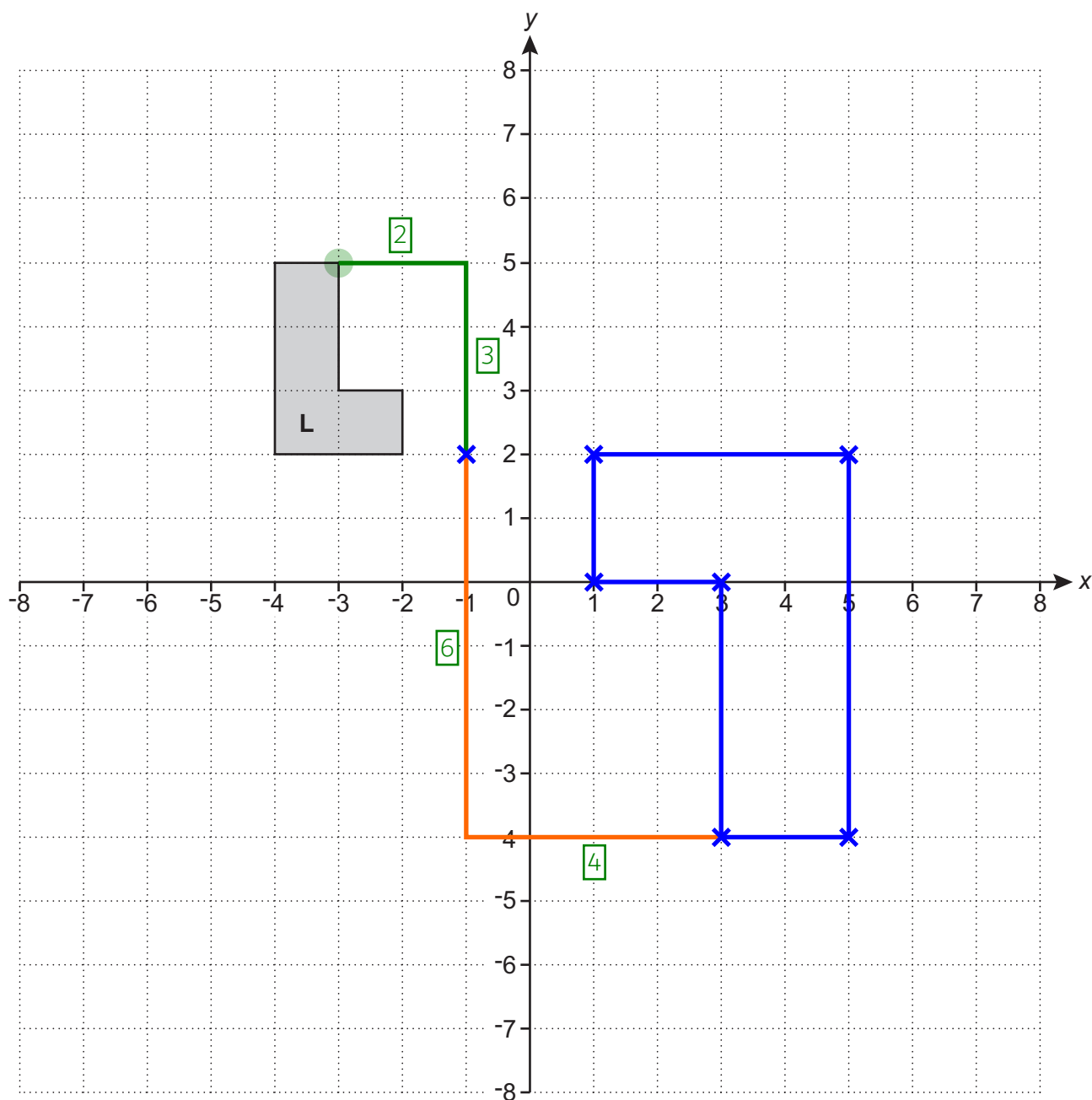
$$5040 \div 2 \leftarrow$$

5 out of the 10 digits are even so 5/10 of the passcodes will be even. This is half of them. So dividing the 5040 possible passcodes by 2 finds that there are 2520 possible four-digit passcodes which are even

2520

[4]

19 Shape **L** is drawn on the grid.



Enlarge shape **L** with scale factor -2 and centre of enlargement at $(-1, 2)$.

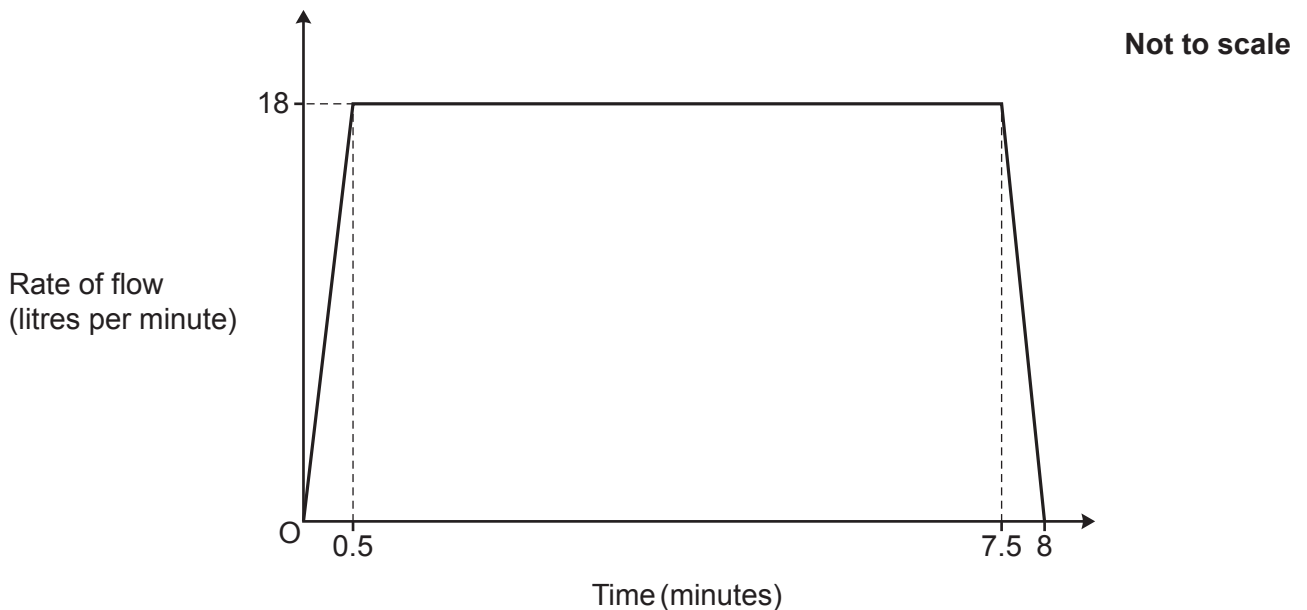
[3]

Marking the centre of enlargement. Multiplying the distance in the x-direction and in the y-direction from the centre to each corner by 2 and doing these distances in the opposite direction.

For example: it is 2 to the left and 3 up from the centre to the highlighted corner. So going 4 to the right and 6 down from the centre gives the new corner

- 20 A container takes 8 minutes to be filled with water.

The graph shows the rate of flow, in litres per minute, of the water into the container during the 8 minutes.



- (a) Show that 126 litres of water flows into the container between 0.5 minutes and 7.5 minutes.

$$7 \times 18 = 126$$

The graph can be treated like a speed-time graph. The rate of flow is the speed and the amount of water is the distance. So the area under the line on the graph is the amount of water. From 0.5 minutes to 7.5 minutes the shape under the line is a rectangle. Area of rectangle = base $\times$ height. The base is 7 and the height is 18

- (b) Work out the average rate of flow, in litres per minute, of water into the container during the 8 minutes.

$$0.5 \times 0.5 \times 18$$

The area under the line on the graph is the amount of water. From 0 minutes to 0.5 minutes the shape under the line is a triangle. From 7.5 minutes to 8 minutes the shape under the line is a triangle. Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$. The base for both triangles is 0.5 and the height for both triangles is 18. So the area of each triangle is 4.5, which represents 4.5 litres of water

$$4.5 + 126 + 4.5$$

Adding the 4.5 litres represented by the 1st triangle, the 126 litres represented by the rectangle and the 4.5 litres represented by the last triangle finds that the total amount of water is 135 litres

$$135 \div 8$$

Litres per minute means to divide the number of litres by the number of minutes

- (b) 16.9..... litres per minute [4]

- 21 The graph of $y = -3x$ intersects the graph of $x^2 + y^2 = 70$ at two points.

Work out the exact coordinates of the two points.

You must show your working.

$(-3x)^2$ ← Substituting $-3x$ for y in y^2

$x^2 + 9x^2$ ← $(-3x)^2 = 9x^2$. Substituting this for y^2 in the left side of the 2nd equation

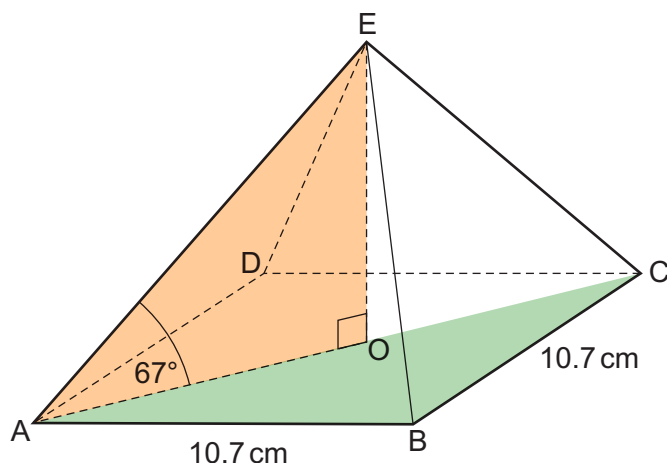
$10x^2 = 70$ ← Collecting like terms and writing the right side of the equation

$x^2 = 7$ ← Dividing both sides by 10 to get the x^2 on its own. Then doing the positive and negative square root of both sides finds the x-coordinates of the intersection

$(\sqrt{7}, -3\sqrt{7})$ and $(-\sqrt{7}, 3\sqrt{7})$ [5]

Substituting the x-coordinates into the 1st equation finds the y-coordinates

- 22 The diagram shows a square-based pyramid ABCDE. O is the centre of the base.



The length of the base is 10.7 cm.
Angle EAO is 67° .

Calculate the length of AE.
You must show your working.

$$10.7^2 + 10.7^2 = AC^2$$

Using Pythagoras' Theorem in the green right-angled triangle to find AC.
 $a^2 + b^2 = c^2$, where a and b are the shorter sides and c is the longest side

$$AC = \sqrt{228.98}$$

Square rooting both sides finds AC

$$15.1... \div 2 = 7.5...$$

AO is half of AC so dividing AC by 2 finds AO

$$\begin{array}{c} \text{O} \quad \checkmark \quad \text{A} \quad \checkmark \\ \text{S} \quad \text{H} \quad \text{C} \quad \text{H} \quad \text{T} \quad \text{A} \\ \text{O} \quad \checkmark \quad \text{O} \quad \checkmark \end{array}$$

Using right-angled trigonometry in the green right-angled triangle.
Ticking A as AO is the adjacent. Ticking H as AE is the hypotenuse.
There are two ticks on the CAH formula triangle so this one can be used

$$\frac{7.5...}{\cos 67}$$

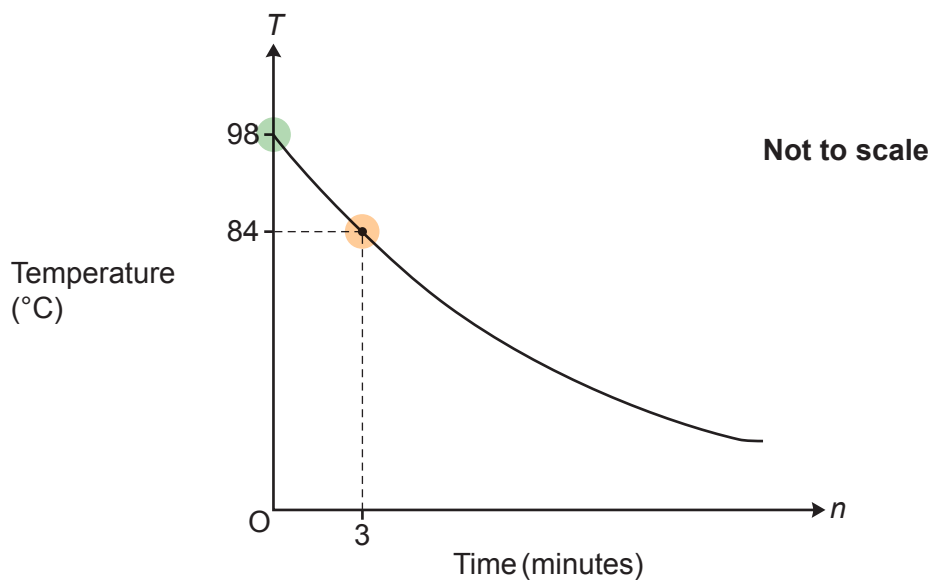
Covering H in the CAH formula triangle finds
that hypotenuse = adjacent/cos of the angle

$$AE = \dots\dots\dots 19.4 \dots\dots\dots \text{ cm [6]}$$

- 23 A pot of tea is made using boiling water and left to cool.
The temperature, $T^{\circ}\text{C}$, of the pot of tea after n minutes is given by the formula

$$T = ab^n.$$

The graph shows some information about the temperature of the pot of tea.



Find the value of a and the value of b .

$$98 = ab^0$$

Substituting in the values of T and n from the point highlighted in green. Anything to the power of 0 is 1 so it becomes $98 = a \times 1$, so $a = 98$

$$84 = 98 \times b^3$$

Substituting in the values of T and n from the point highlighted in orange. Also substituting a for 98

$$b^3 = 0.85\dots$$

Dividing both sides by 98 gets the b^3 on its own

$$a = \dots\dots\dots 98$$

$$\text{Cube rooting both sides finds } b \rightarrow b = \dots\dots\dots 0.95 \quad [3]$$

Turn over

- 24 (a)** Show that the equation $x^4 + 3x^2 - 2x - 5 = 0$ has a solution between $x = 1$ and $x = 2$. **[3]**

$$1^4 + 3(1)^2 - 2(1) - 5 = -3$$

Substituting 1 for x in the left side of the equation gives a negative result which is less than 0

$$2^4 + 3(2)^2 - 2(2) - 5 = 19$$

Substituting 2 for x in the left side of the equation gives a positive result which is greater than 0

Change in sign so there is a solution between $x = 1$ and $x = 2$

As it is a continuous function (there are no breaks in the curve), the line must go through the y-coordinate of 0 at some point between $x = 1$ and $x = 2$ as it goes from less than 0 to greater than 0

- (b)** Find this solution correct to 1 decimal place.
You must show calculations to support your answer.

Using table mode on the calculator, define $f(x) = x^4 + 3x^2 - 2x - 5$. For the table range, start: 1, end: 2, step: 0.1. This substitutes all values between $x = 1$ and $x = 2$ to 1 decimal place into the left side of the equation. There is a change in sign between $x = 1.2$ and $x = 1.3$ so the solution must be between $x = 1.2$ and $x = 1.3$

$$1.27^4 + 3(1.27)^2 - 2(1.27) - 5 = -0.09...$$

$$1.28^4 + 3(1.28)^2 - 2(1.28) - 5 = 0.03...$$

Using table mode on the calculator, define $f(x) = x^4 + 3x^2 - 2x - 5$. For the table range, start: 1.2, end: 1.3, step: 0.01. This substitutes all values between $x = 1.2$ and $x = 1.3$ to 2 decimal places into the left side of the equation. There is a change in sign between $x = 1.27$ and $x = 1.28$ so the solution must be between $x = 1.27$ and $x = 1.28$

Both 1.27 and 1.28 round to 1.3 to 1 decimal place

(b) $x = \dots\dots\dots 1.3$ **[4]**

- 25** A bag contains only round tiles and square tiles.
Each tile is either black or white.

The ratio of round tiles to square tiles is 3 : 1.

45% of all the tiles are round black tiles.

9% of all the tiles are square white tiles.

Show that the proportion of round tiles that are black is less than the proportion of square tiles that are black. [6]

	B	W	
R	45		75
S	16	9	25
			100

Doing a two-way table with the percentages. R stands for round, S stands for square, B stands for black and W stands for white. There is 100% in total and dividing this in the ratio 3 : 1 gives 75% and 25%. Subtracting the 9% which are white and square from the 25% which are square finds that 16% are black and square

$$\frac{45}{75} \times 100 = 60\%$$

45/75 expresses the fraction of the round tiles which are black. Multiplying this by 100 converts it to a percentage

$$\frac{16}{25} \times 100 = 64\%$$

16/25 expresses the fraction of the square tiles which are black. Multiplying this by 100 converts it to a percentage

$$60\% < 64\%$$

60% of the round tiles are black, which is less than the 64% of the square tiles which are black

END OF QUESTION PAPER

This image shows a blank sheet of white paper designed for writing. It features a series of evenly spaced horizontal blue lines across its entire width. A single vertical red line runs down the left side, creating a narrow margin. The paper is otherwise completely empty, with no text or markings.