Candidate Surname	Candidate Forename(s)

Centre Number	Candidate Number	Candidate Signature

GCSE

Mathematics — Higher Tier

Paper 1 (Non-Calculator)

Practice Paper

Time allowed: 1 hour 30 minutes

You must have:
Pen, pencil, eraser, ruler, protractor, pair of compasses.
You may use tracing paper.

You are **not allowed** to use a calculator.

Instructions to candidates

- Use **black** ink to write your answers.
- Write your name and other details in the spaces provided above.
- Answer **all** questions in the spaces provided.
- In calculations show clearly how you worked out your answers.
- Do all rough work on the paper.

Information for candidates

- The marks available are given in brackets at the end of each question.
- You may get marks for method, even if your answer is incorrect.
- There are 24 questions in this paper. There are no blank pages.
- There are 80 marks available for this paper.

Get the answers online

Worked solutions to this practice paper are available online for you to download or print.
Go to **www.cgpbooks.co.uk/gcsemathsanswers** to get them.

Answer ALL the questions.

Write your answers in the spaces provided.

You must show all of your working.

1 A is 60% of B.
B is 30% of C.

What percentage of C is A? Circle the correct answer.

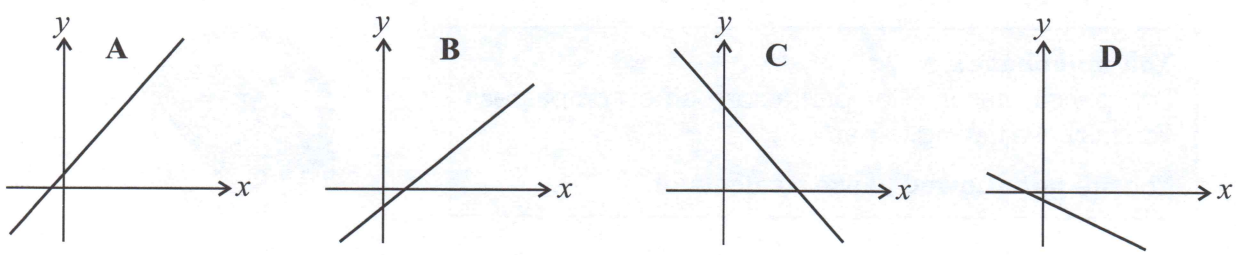
18% 28% 30% 90%

[Total 1 mark]

---

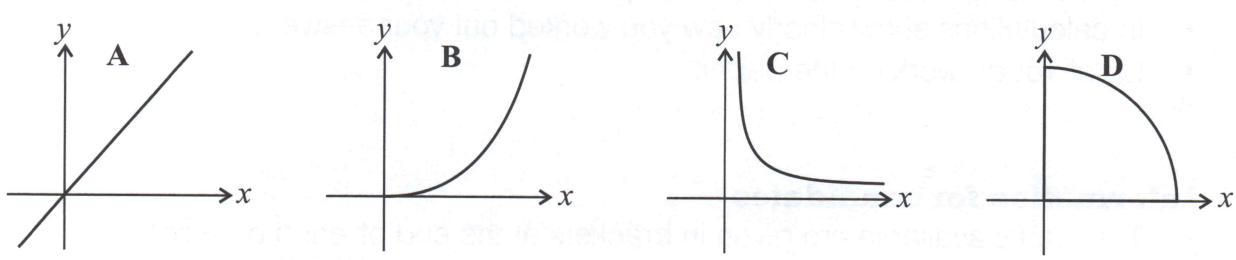
2 Circle the graphs that match the following descriptions.

(a) A straight line has equation $y = mx + c$ where $m > 0$ and $c < 0$.



[1]

(b) y is inversely proportional to x.



[1]

[Total 2 marks]

---

3 Find 27.68×4.6

.....

[Total 3 marks]

---

4 Simplify $\frac{20x^6}{4x^2}$.

Circle the correct answer.

$5x^8$ $5x^3$ $16x^4$ $5x^4$

[Total 1 mark]

---

5 A solid shape has a volume of 2680 mm^3.

What is its volume in cm^3? Circle the correct answer.

268 cm^3 26.8 cm^3 2.68 cm^3 0.268 cm^3

[Total 1 mark]

---

6 Estimate the value of

$$\sqrt[3]{\frac{785.3 \times 2.156}{0.1972}}$$

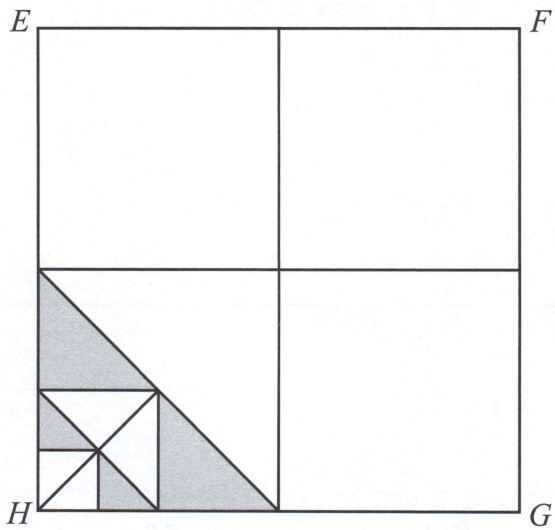
Show the numbers you used to work out your estimate.

.....

[Total 3 marks]

---

7 The diagram shows a square *EFGH*.
The square has been divided into smaller squares and isosceles triangles.



What fraction of the square *EFGH* has been shaded?

.....

[Total 3 marks]

---

8 The nth term of a sequence is given by the formula $n^2 + 2n + 5$

(a) Fran says "The 4th term in the sequence is a prime number."
Is Fran correct? Tick a box.

Yes ☐ No ☐

Show how you worked out your answer.

.....

.....

[2]

(b) A different sequence begins 2, 5, 7, 12, 19, ...
Write down the next two terms in the sequence.

..... and .....

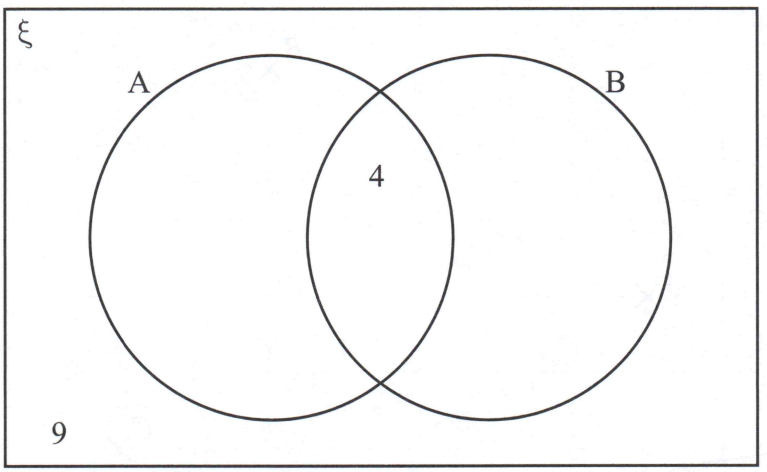
[2]

[Total 4 marks]

---

9 $\xi = \{1, 2, 3, \ldots, 10\}$
$A = \{x : 2 < x \leq 6\}$
$B = \{x : x \text{ is a factor of } 12\}$

Complete the Venn diagram to show the elements of each set.



[Total 3 marks]

10 (a) Find values of a and b such that $3a + 2b = 17$
$2a + b = 10$

$a =$ .....

$b =$ .....

[3]

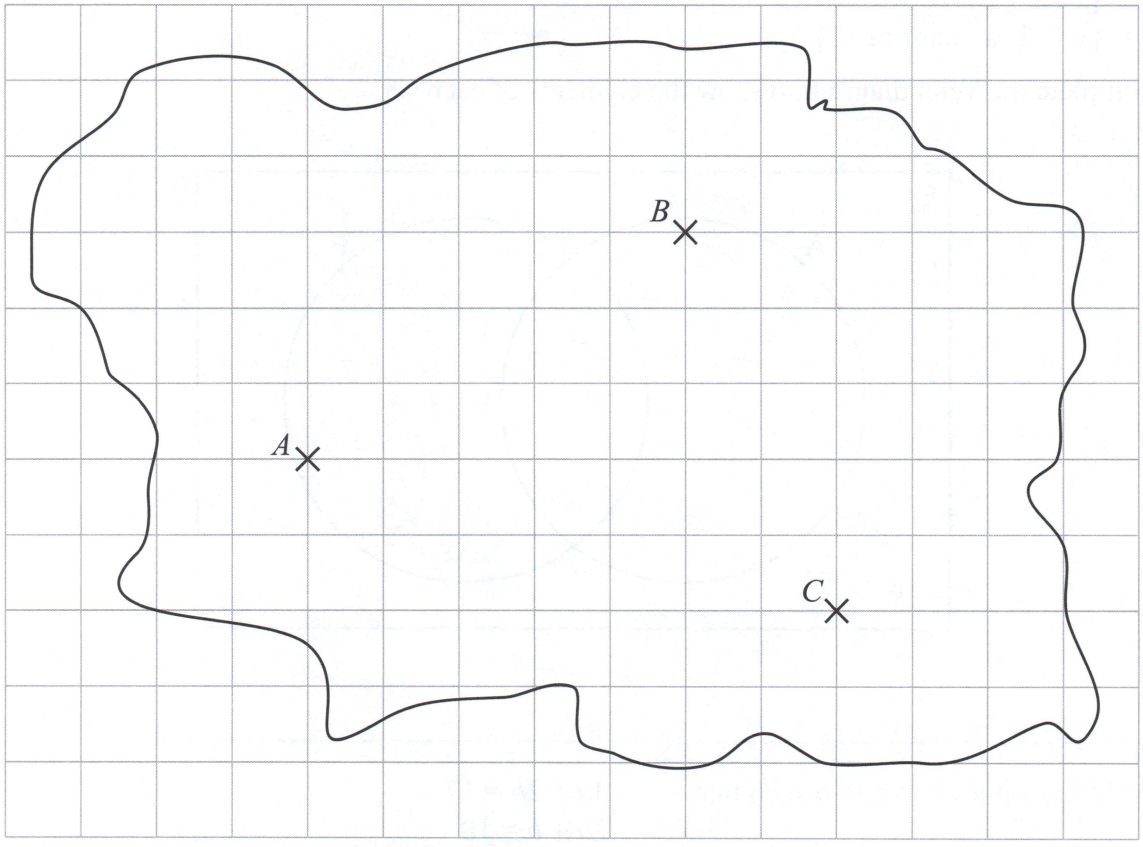
(b) Hence, work out $a\begin{pmatrix}2\\1\end{pmatrix} - b\begin{pmatrix}3\\2\end{pmatrix}$

.....

[2]

[Total 5 marks]

11 The scale drawing shows the position of three hospitals, A, B and C, on an island.



Scale: 1 cm = 10 miles

An ambulance takes a patient to hospital A if they are within a 30 mile radius of this hospital.
Otherwise it will take the patient to hospital B or C depending on which is closer.

Sara calls from her home for an ambulance.
The ambulance takes her to hospital B.

Show on the map the region where Sara could live.

[Total 3 marks]

---

12 $p = 2^3 \times 3^2 \times 5 \times 7$ $\quad q = \frac{6}{7}p$ $\quad r = \frac{4}{15}p$

Work out the highest common factor of q and r.

.....

[Total 3 marks]

---

13 Find $(4 \times 10^6) \times (8 \times 10^{-3})$.
Give your answer in standard form.

.....

[Total 2 marks]

---

14 A block of wood with a weight of 72 N is resting on a horizontal table top.
The base of the block is flat and has area 120 cm^2.

Find the pressure exerted by the block on the table, giving your answer in N/m^2.

..... N/m^2

[Total 2 marks]

---

15 A museum bought a valuable painting in January 2013.

In January 2014 the painting was worth 10% more than when the museum bought it.
In January 2015 the painting was worth 30% less than in January 2014.

A newspaper report said: "Overall, the value of the painting decreased by 20% between January 2013 and January 2015."

Was the newspaper correct? Expain your answer.

.....

.....

.....

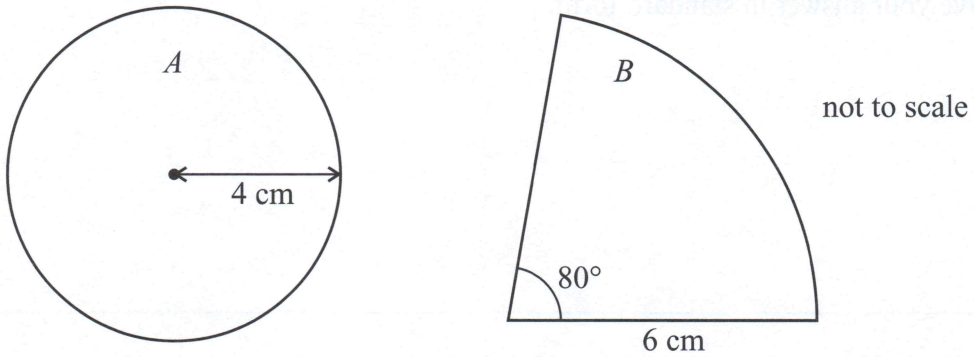
.....

.....

[Total 2 marks]

---

16 The diagram shows a circle A and a sector B.



Show that the area of A is twice the area of B.

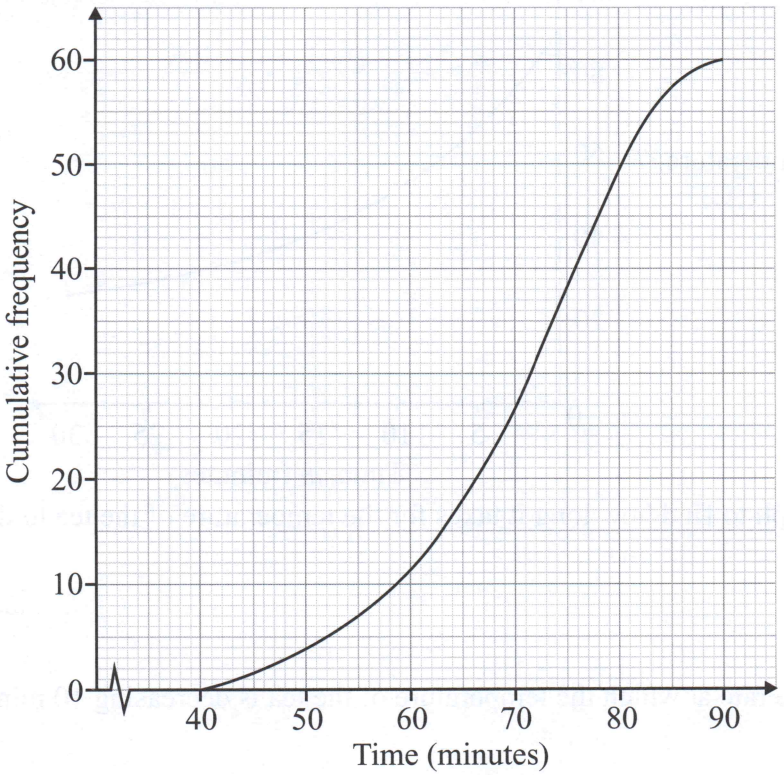
[Total 3 marks]

17 Calculate $\left(2\frac{1}{4}\right)^{-\frac{1}{2}} \div \frac{2}{9}$

.....

[Total 4 marks]

18 Sixty teams took part in a charity pram race in 2014.
The cumulative frequency graph shows the times that the teams took to complete the course.



The table below summarises the times that teams took to complete the pram race in 2013.

2013 Pram Race Times	
Median	76 minutes
Interquartile range	18 minutes
Winning time	37 minutes

(a) What is the smallest possible difference between the winning times in 2013 and 2014?

..... minutes
[2]

(b) On average were the teams faster in 2013 or 2014? Explain your answer.

.....

.....

.....

[2]

(c) Were the times more consistent in 2013 or 2014? Explain your answer.

.....

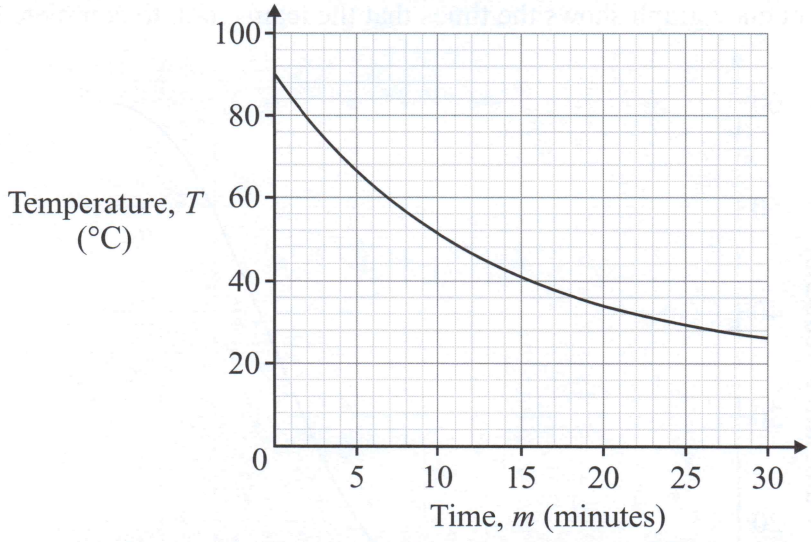
.....

.....

[2]

[Total 6 marks]

19 The diagram shows the temperature, T °C, of a cup of tea m minutes after it is made.



(a) Use the graph to find how long it takes for the temperature of the tea to drop to 32 °C.

..... minutes

[1]

(b) Estimate the rate at which the temperature of the tea is decreasing 10 minutes after it is made.

..... °C/minute

[3]

[Total 4 marks]

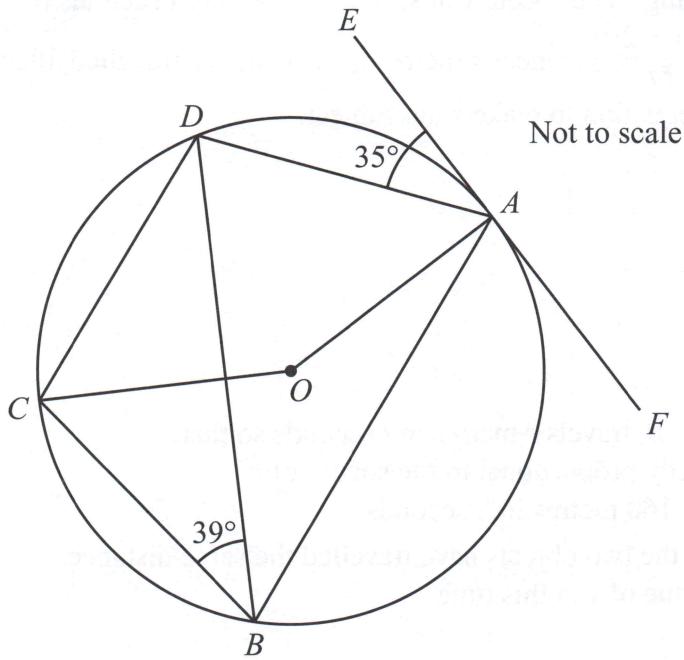
---

20 Write $\frac{6}{\sqrt{3}} + \sqrt{27}$ in the form $k\sqrt{3}$.

.....

[Total 3 marks]

21



A, B, C and D are points on the circumference of a circle centre O.
EF is a tangent to the circle at A.
Angle $EAD = 35°$ and angle $DBC = 39°$

Work out the size of angle DCO.
Show all of your working, some of which may be on the diagram.

[Total 5 marks]

22 Object A is accelerating. The speed, x m/s, of object A after t seconds ($t > 0$) can be found using the equation $x = \dfrac{18(s + 2t^2)}{5t}$, where s metres is the distance travelled after t seconds.

(a) Rearrange this equation to make s the subject.

$s =$ .....

[2]

(b) A second object, B, travels s metres in t seconds so that:

- s is directly proportional to the square of t.
- it travels 160 metres in 8 seconds.

After 6 seconds the two objects have travelled the same distance.
Calculate the value of x at this time.

$x =$ .....

[5]

[Total 7 marks]

---

23 (a) Expand $(n + 1)(n - 1)(n + 4)$.

.....

[3]

(b) n is a positive integer.
Prove that the value of $n(n + 3)(n + 1) - (n + 1)(n - 1)(n + 4)$ is a multiple of 4.

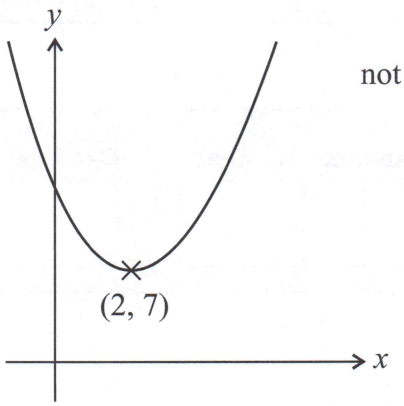
.....

[3]

[Total 6 marks]

---

24 The diagram shows a quadratic graph.



not to scale

The equation of the graph can be written in the form $y = (x - a)^2 + b$
The turning point of the quadratic has coordinates (2, 7).
A point on the graph has coordinates (k, 128)

Calculate the two possible values of k.

$k =$ ..... or $k =$ .....

[Total 4 marks]

[TOTAL FOR PAPER = 80 MARKS]

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GCSE

Mathematics Higher Tier

Paper 2 (Calculator)

Practice Paper

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Answer ALL the questions.

Write your answers in the spaces provided.

You must show all of your working.

1 The length of a leaf is 11 cm to the nearest centimetre.

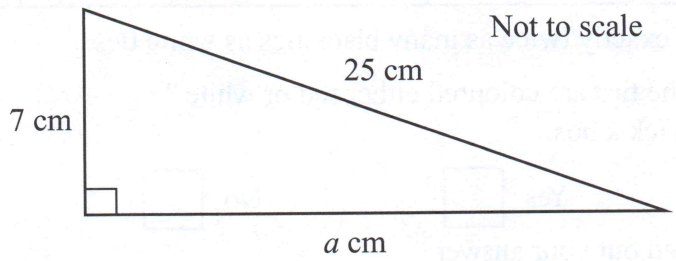
Put a ring around the upper bound for the length of the leaf.

11 cm 11.4 cm 11.5 cm 12 cm

[Total 1 mark]

---

2 The diagram shows a right-angled triangle.



Circle the correct value of a.

18 24 25.96 32

[Total 1 mark]

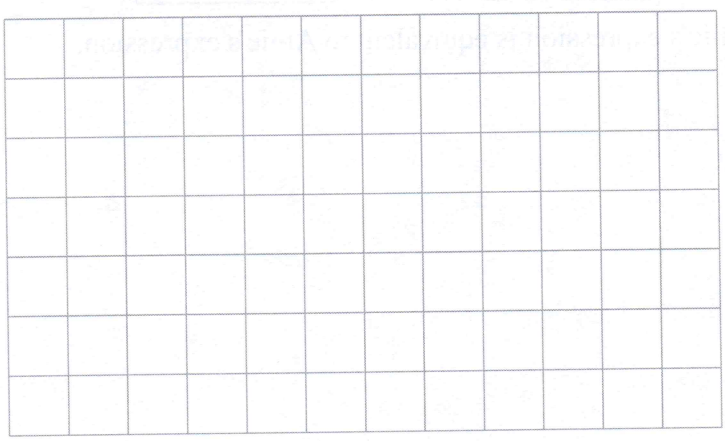
---

3 Farah's teacher asks her to draw a quadrilateral with these three properties:

- one line of symmetry
- exactly two sides that are equal in length
- two pairs of equal angles

Farah says, "There is no quadrilateral which has all these properties."

Draw a shape on the grid to show that Farah is wrong.



[Total 2 marks]

---

4 Calculate the value of $\dfrac{18.4 \times 2.56}{\sqrt{21.6 - 4 \times 1.55}}$. Give your answer correct to 3 significant figures.

.....

[Total 2 marks]

5 A drawer contains ties that are coloured either red or green or white or black.
George picks a tie at random from the drawer. The table shows some of the probabilities.

Colour of tie	Red	Green	White	Black
Probability	0.35	0.20		

The drawer contains exactly twice as many black ties as white ties.

George says, "Half the ties are coloured either red or white."
Is George correct? Tick a box.

Yes ☐ No ☐

Show how you worked out your answer.

[Total 3 marks]

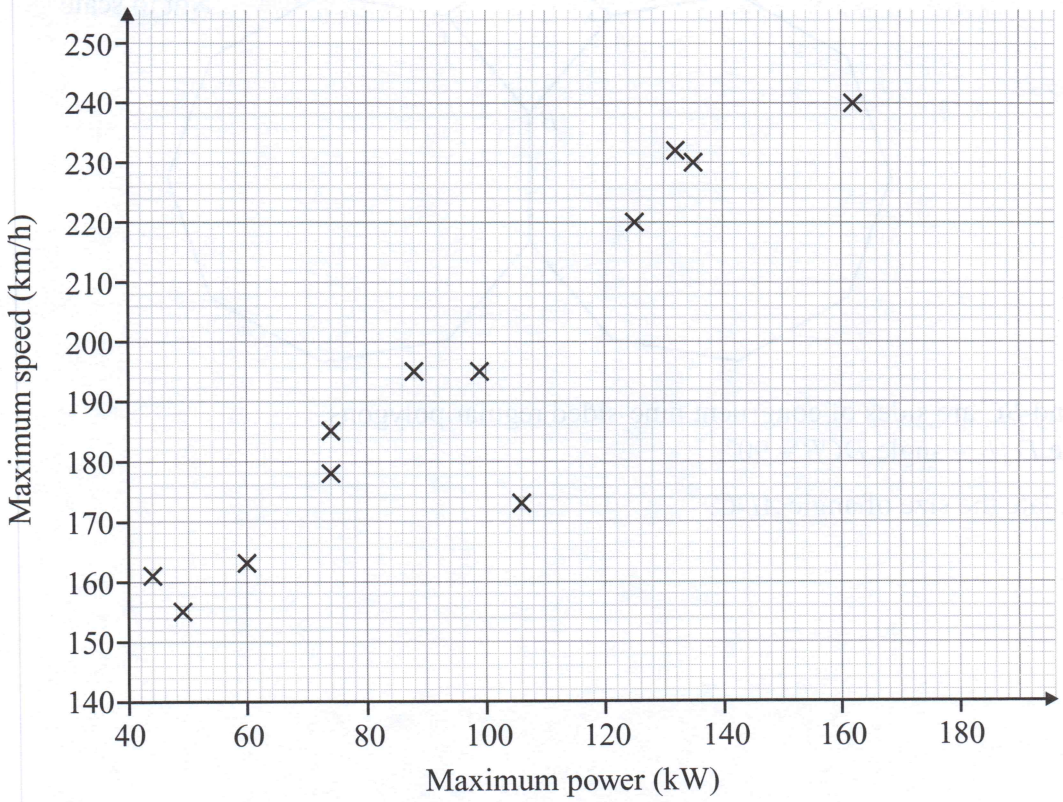
6 Ollie and Amie each have an expression.

Ollie	Amie
$(x + 4)^2 - 1$	$(x + 5)(x + 3)$

Show clearly that Ollie's expression is equivalent to Amie's expression.

[Total 3 marks]

7 The scatter graph shows the maximum power (in kW) and the maximum speed (in km/h) of a sample of cars.



(a) One of the cars has a maximum speed of 220 km/h.
Write down the maximum power of this car.

..... kW
[1]

(b) One of the points is an outlier as it does not fit in with the trend.
Draw a ring around this point on the graph.

[1]

(c) Ignoring the outlier, describe the correlation shown on the scatter graph.

..... correlation
[1]

(d) A different car has a maximum power of 104 kW.
By drawing a suitable line on your scatter graph, estimate the maximum speed of this car.

..... km/h
[2]

(e) Explain why it may not be reliable to use the scatter graph to estimate the maximum speed of a car with a maximum power of 190 kW.

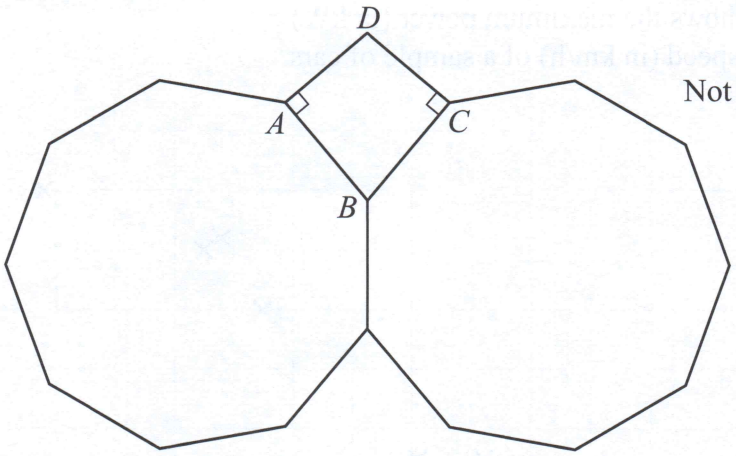
.....

.....

[1]

[Total 6 marks]

8



Not to scale

AB and *BC* are sides of congruent nine-sided regular polygons.
Angle *DAB* = angle *DCB* = 90°.

Calculate the size of angle *ADC*.

.....°

[Total 3 marks]

---

9 The functions f(x) and g(x) are shown below.

f(x) = $2x - 15$ g(x) = $x^2 + c$, where c is a constant.

(a) Find f(–6)

.....

[1]

(b) Solve f(a) = 5

.....

[1]

fg(4) = 25

(c) Use this to find the value of c.

.....

[2]

[Total 4 marks]

---

10 Orange juice and lemonade are mixed in the ratio 3 : 5 to make orangeade.

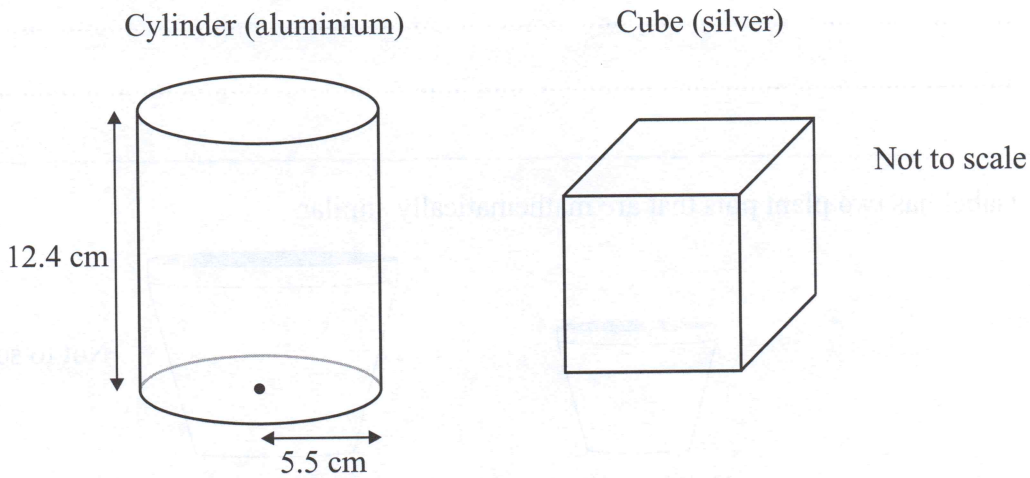
Orange juice costs £1.60 per litre.
Lemonade costs £1.20 per litre.

What is the cost of making 18 litres of orangeade?

£ .....

[Total 4 marks]

11 The diagram shows a solid aluminium cylinder and a solid silver cube.



The cylinder and the cube have the same mass.
The density of aluminium is 2.7 g/cm^3 and the density of silver is 10.5 g/cm^3.

Calculate the side length of the cube. Give your answer correct to two significant figures.

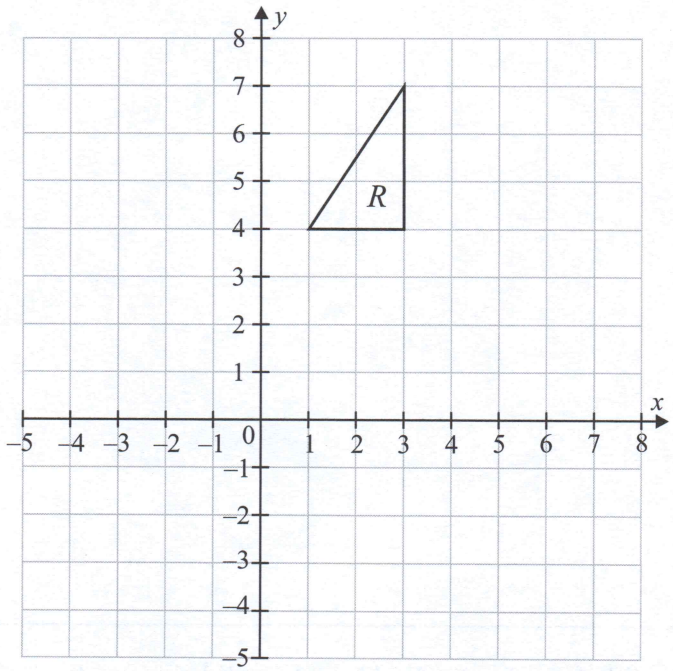
..... cm

[Total 5 marks]

12 Describe fully the single transformation equivalent to

- a reflection in the line $y = x$, followed by
- a reflection in the line $y = 0$.

Use the grid to help you.

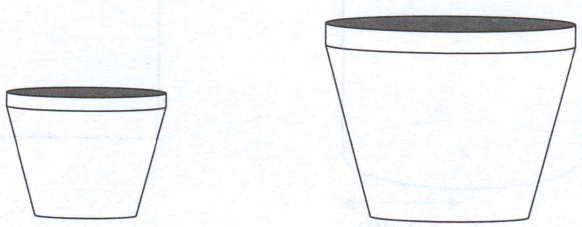


.....

.....

[Total 3 marks]

13 Isabel has two plant pots that are mathematically similar.



Not to scale

Height = 10 cm
Capacity = 250 ml

Height = 16 cm

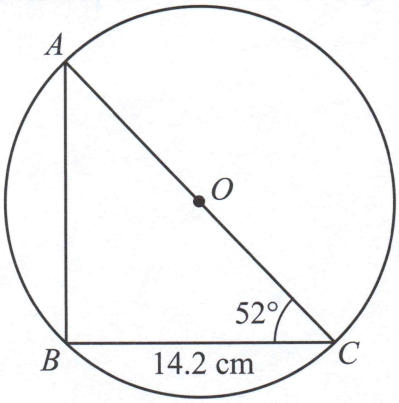
Will the large plant pot hold one litre of compost? Tick a box.

Yes ☐ No ☐

Show how you worked out your answer.

[Total 3 marks]

14 A, B and C are points on the circumference of a circle with centre O.



Not to scale

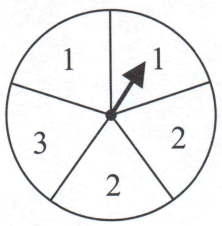
$BC = 14.2$ cm and angle $ACB = 52°$.

Calculate the circumference of the circle. Give your answer to 3 significant figures.

..... cm

[Total 4 marks]

15 A funfair stall runs a game played using this spinner. The rules of the game are shown below.



50p a go
Spin the spinner twice.
Win £2 if your total score is 5 or more.

(a) Estimate the profit that the stall will make if the game is played 200 times.
Show how you worked out your answer.

£ .....

[5]

(b) Write down one assumption that you made about the spinner when you answered part (a).

.....

.....

[1]

[Total 6 marks]

16 Show, using algebra, that the recurring decimal $0.34\dot{7}$ is equal to the fraction $\frac{313}{900}$.

[Total 2 marks]

17 (a) Bayonie has £6000, which he wants to invest for three years.
He is choosing between two savings accounts which each pay compound interest.

Account 1
2.5% per annum
Fixed for 3 years

Account 2
Year 1: Interest rate 1.0%
Year 2: Interest rate 1.5%
Year 3: Interest rate 5.0%

Which account should he choose if he wants to receive the greatest possible amount of interest? Show how you worked out your answer.

.....

[4]

(b) Sally invests a sum of money in an account for two years.
The account pays 2% per annum compound interest.
She receives a total of £606 interest.

Work out the amount of money she invested initially.

£ .....

[3]

[Total 7 marks]

18 Work out the values of a and b so that

$$\frac{ax+b}{2x^2-32} \times (x^2 - 2x - 8) = 3x + 6$$

$a =$ .....

$b =$ .....

[Total 4 marks]

---

19 (a) Show that the equation $x^3 - 5x + 2 = 0$ has a solution in the interval $0 < x < 0.5$.

[2]

(b) Show that $x^3 - 5x + 2 = 0$ can be written as $x = \frac{x^3+2}{5}$.

[1]

The iteration formula $x_{n+1} = \frac{x_n^3+2}{5}$ can be used with starting value $x_0 = 0$ to find the solution to $x^3 - 5x + 2 = 0$ which lies in the interval $0 < x < 0.5$.

(c) Find this solution correct to 4 decimal places.

.....

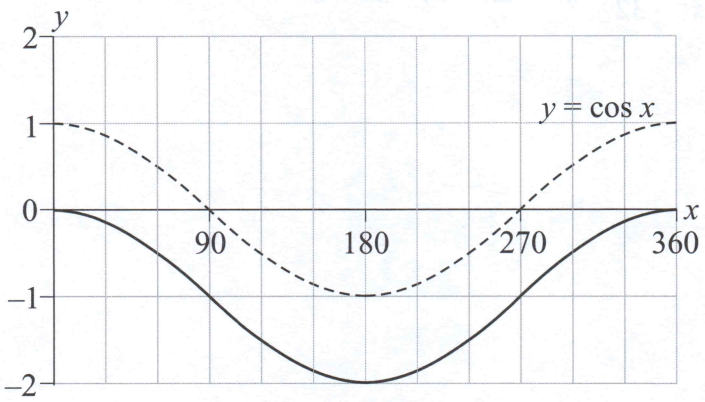
[3]

[Total 6 marks]

---

20 For each part, work out a possible equation of the curve shown by the solid line.
The curve shown by a dotted line on each grid is $y = \cos x$.

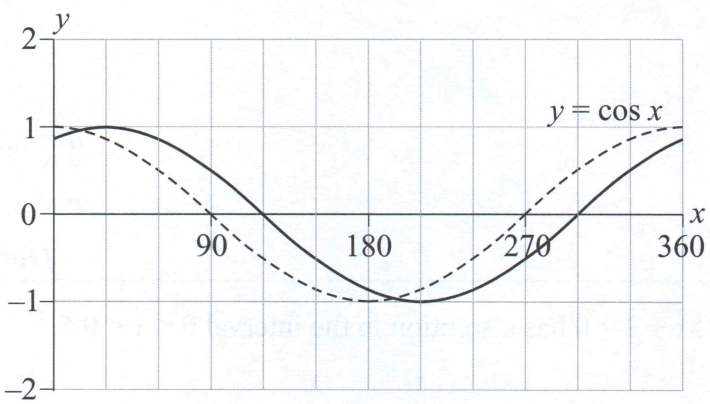
(a)



$y =$ .....

[1]

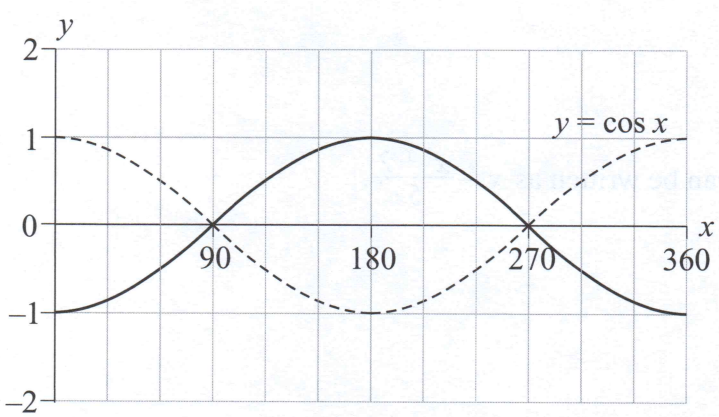
(b)



$y =$ .....

[1]

(c)

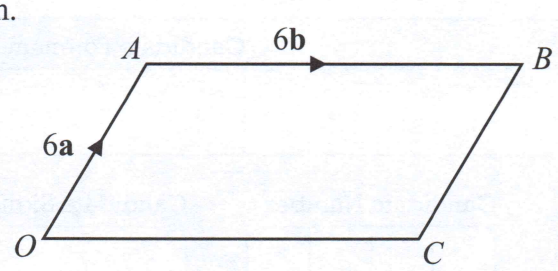


$y =$ .....

[1]

[Total 3 marks]

21 $OABC$ is a parallelogram.



Not to scale

(a) Find the vector $\overrightarrow{AC}$.

.....

[1]

When OC is extended, D is a point such that OD is twice OC.
M is the point with position vector $\overrightarrow{OM} = 4\mathbf{a}$.
N is the point on BD such that $BN : ND = 1 : 2$.

(b) Prove that MN is parallel to AB.

.....

[3]

[Total 4 marks]

22 A curve has equation $x^2 + y^2 = 10$. The point $P(3, 1)$ is a point on the curve.

Work out the equation of the tangent to the curve at P.

.....

[Total 4 marks]

[TOTAL FOR PAPER = 80 MARKS]

Candidate Surname	Candidate Forename(s)

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GCSE

Mathematics — Higher Tier

Paper 3 (Calculator)

Practice Paper

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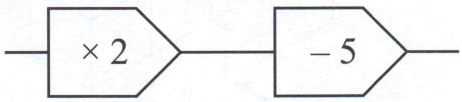
Answer ALL the questions.

Write your answers in the spaces provided.

You must show all of your working.

1 A function is represented by this number machine.



The output of the machine is 17. Circle the input.

7 11 14.5 29

[Total 1 mark]

---

2 Phil and Samira each throw an ordinary six-sided dice once.

Circle the probability that they both throw a number greater than 4.

$\frac{1}{9}$ $\frac{1}{4}$ $\frac{1}{3}$ $\frac{2}{3}$

[Total 1 mark]

---

3 Which of the numbers below is closest to $\frac{7}{9}$? Circle the correct answer.

0.77 0.7778 0.7 0.78 0.778

[Total 1 mark]

---

4 Natalie thinks of a whole number between 10 and 30.
Her number is not a prime number and when she squares her number, the final digit is 1.

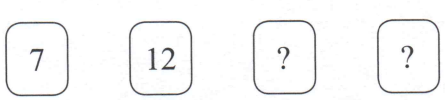
What number did Natalie think of?

.....

[Total 2 marks]

---

5 Ben has four number cards.



His four numbers have a median value of 12 and a mean of 13.
Work out the range of Ben's four numbers. Show how you worked out your answer.

.....

[Total 3 marks]

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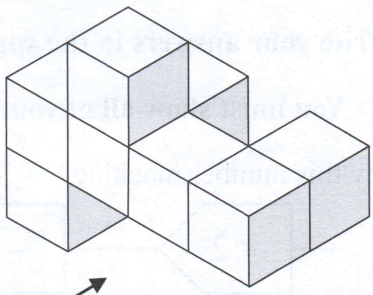
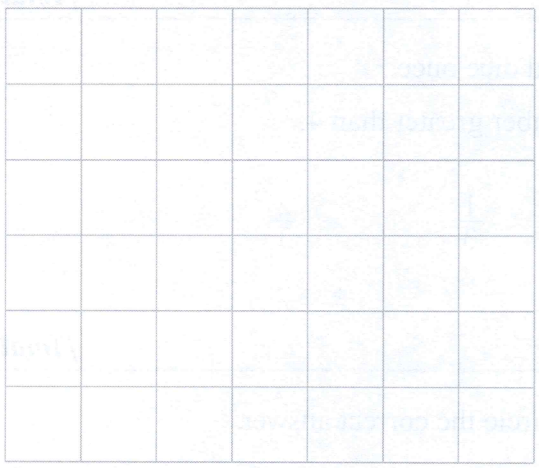
6 The diagram shows an object made from 8 centimetre cubes.



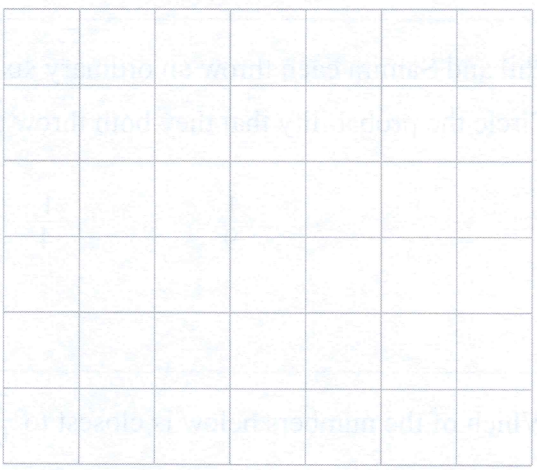
Front elevation

Draw on the grid below the plan view and the front elevation of the object.

Plan view



Front elevation



[Total 2 marks]

7 Anna and Carl both think of a sequence of numbers.

Anna's sequence

4th term = 17

Term-to-term rule is:
Add 3

Carl's sequence

Term-to-term rule is:
Add 6

The 1st term of Anna's sequence is twice the 1st term of Carl's sequence.

Work out the 5th term of Carl's sequence.

.....

[Total 3 marks]

8 Here are the equations of five straight lines.

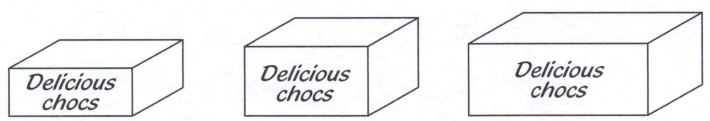
$y = 2$ $\quad 2y = x$ $\quad y = 2x + 1$ $\quad y - 2x = -3$ $\quad 3y = 2x + 2$

Write each of the equations in the correct position in this table.
The first equation has been put in for you.

	Gradient equal to 2	Gradient not equal to 2
Passes though the point (2, 1)		
Does not pass though the point (2, 1)		$y = 2$

[Total 2 marks]

9 A chocolate manufacturer makes boxes of chocolates in three different sizes.



Box A $\quad$ Box B $\quad$ Box C

Box A contains c chocolates.
Box B contains 4 more chocolates than Box A.
Box C contains twice as many chocolates as Box B.
Altogether there are 60 chocolates.

Work out how many chocolates there are in each box.

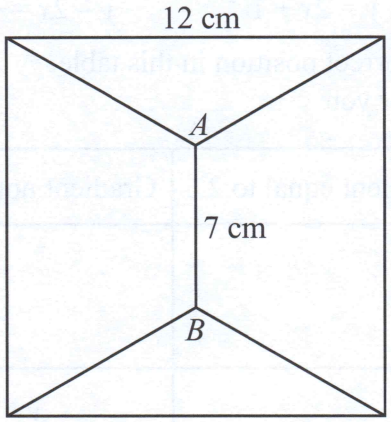
Box A: .....

Box B: .....

Box C: .....

[Total 5 marks]

10 Two congruent trapeziums and two triangles fit inside a square of side 12 cm as shown.



Not to scale

$AB = 7$ cm

Work out the area of each trapezium.

..... cm^2

[Total 2 marks]

---

11 A route between Guilford and Bath has a distance of 180 kilometres.
Dave drives from Guilford to Bath. He takes 3 hours.

Olivia drives the same route. Her average speed is 15 kilometres per hour faster than Dave's.

(a) How long does it take Olivia to drive from Guilford to Bath?
Give your answer in hours and minutes

..... hours ..... minutes

[3]

(b) Why is it important to your calculation that Olivia drives the same route as Dave?

.....

.....

.....

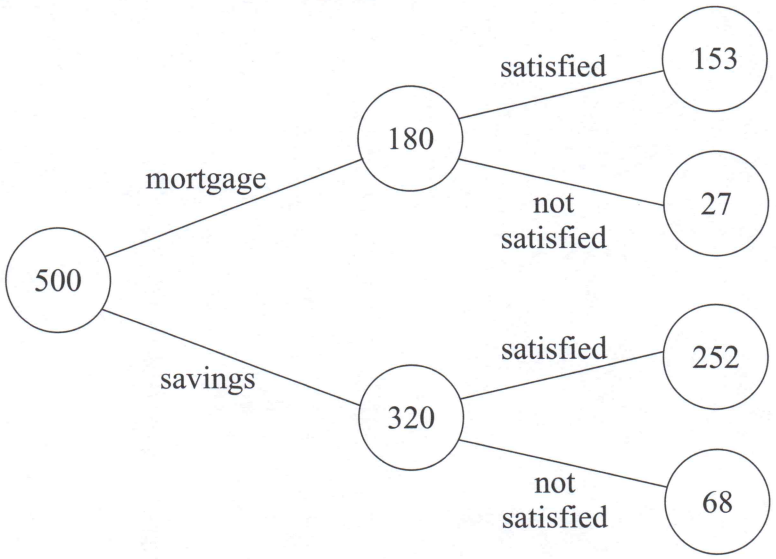
[1]

[Total 4 marks]

---

12 A bank interviews a sample of 500 of its customers to find out whether they are satisfied with the service the bank provides. The bank has both savings and mortgage customers.

The frequency tree summarises the responses.



Comment on how satisfied the savings customers are in comparison with the mortgage customers. Give calculations to support your answer.

.....

.....

.....

.....

.....

.....

.....

[Total 3 marks]

---

13 Simplify

(a) $(a^4)^3$

.....

[1]

(b) a^0

.....

[1]

(c) $3a^2b \times 2a^3b^2$

.....

[2]

[Total 4 marks]

---

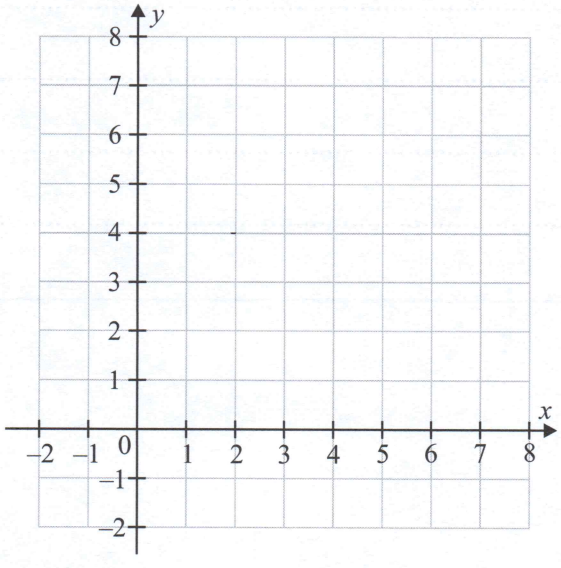
14 The ratio of angles in a triangle is 2 : 3 : 5.
Show that this a right-angled triangle.

[Total 3 marks]

15 x and y satisfy these inequalities.

$$x \geq 1 \qquad y \geq \frac{x}{2} \qquad x + 2y \leq 8$$

(a) Show the region on the grid which satisfies these inequalities.



[4]

(b) How many different pairs of integer solutions satisfy all three inequalities?
Explain your answer.

.....

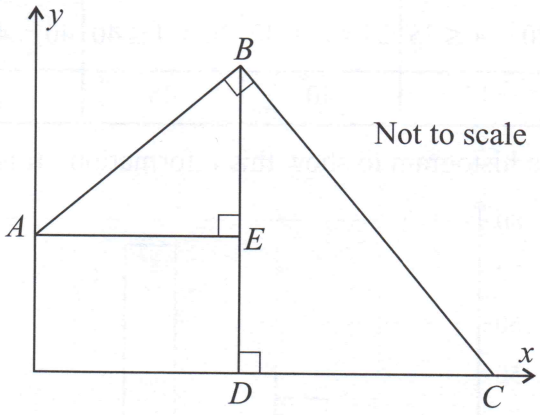
.....

.....

[2]

[Total 6 marks]

16 AB and BC are perpendicular lines.



B has coordinates (12, 18).
C has coordinates (27, 0).
A is a point on the y-axis.

(a) Explain why triangles AEB and BDC are similar.

.....

.....

.....

[2]

(b) Write the ratio $AE : BD$ in its simplest form.

..... : .....

[2]

(c) Work out the coordinates of E.

(..... , ...)

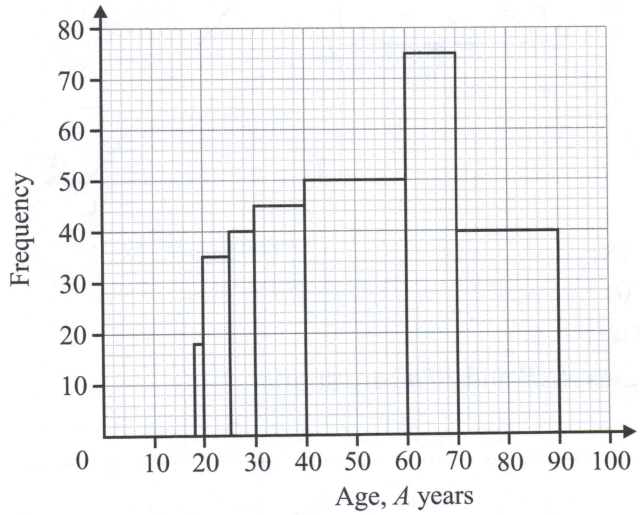
[3]

[Total 7 marks]

17 The table shows some information about the ages of the adult members of a gym.

Age, A years	$18 < A \leq 20$	$20 < A \leq 25$	$25 < A \leq 30$	$30 < A \leq 40$	$40 < A \leq 60$	$60 < A \leq 70$	$70 < A \leq 90$
Frequency	18	35	40	45	50	75	40

The gym manager draws a histogram to show this information. It is incorrect.



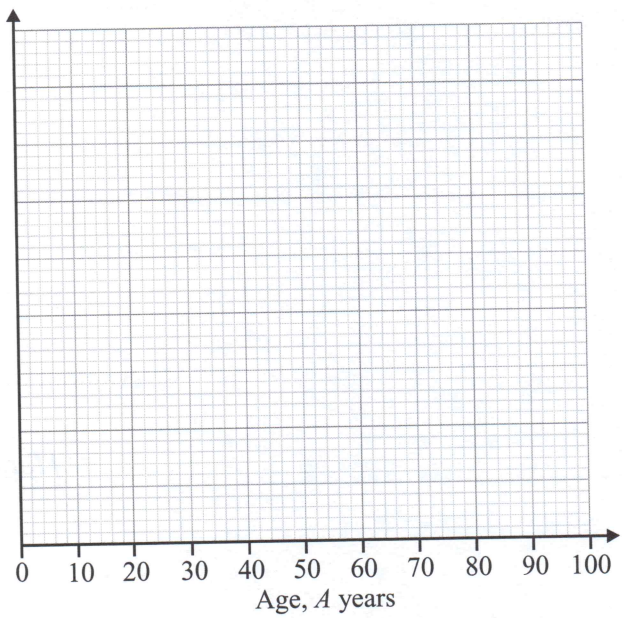
(a) Explain what error the manager has made when drawing the histogram.

.....

.....

[1]

(b) Draw the histogram correctly on the grid below.



[3]

(c) The mean age of the adult members of the gym is 47 years.
Explain why the mean does not give a very typical age for the members of this gym.

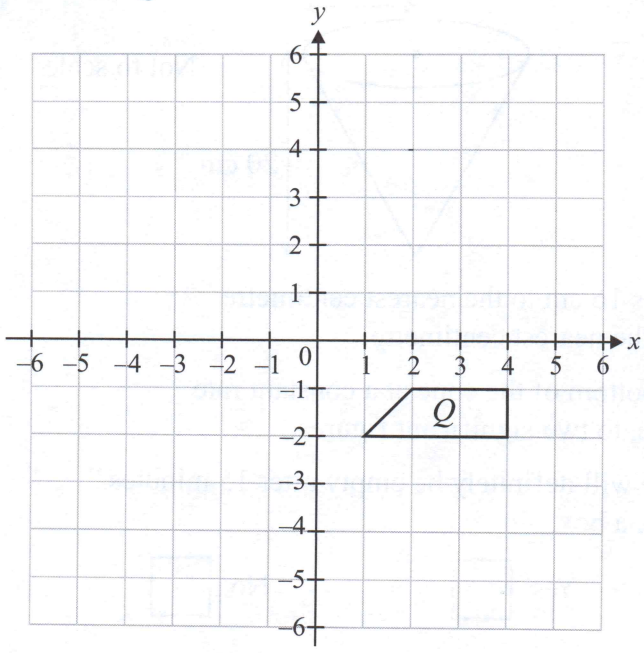
.....

.....

[1]

[Total 5 marks]

18 The grid shows a quadrilateral Q.

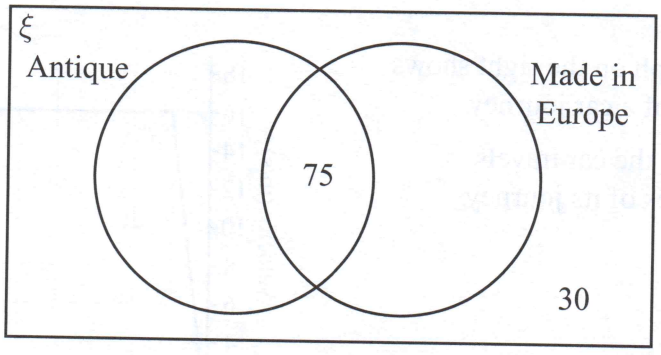


Draw the enlargement of Q using scale factor -2 and centre $(2, 0)$. Label the image R.

[Total 3 marks]

19 A museum has a collection of 200 thimbles.
The two-way table and the Venn diagram show some information about the thimbles.

	Made in Europe	**Made outside Europe**	**Total**
Antique			
Not antique			
Total		80	200



(a) Complete the table and the Venn diagram.

[3]

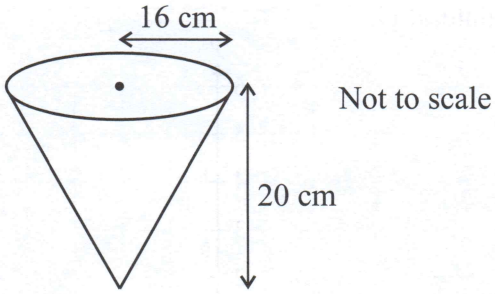
(b) Find the probability that a randomly chosen thimble is antique, given that it is made in Europe.

.....

[2]

[Total 5 marks]

20 This cone is filled with water.



The radius of the cone is 16 cm to the nearest centimetre.
The height is 20 cm to the nearest centimetre.

Water leaks out of the bottom of the cone at a constant rate of 0.39 litres per minute, to two significant figures.

Marion says, "The cone will definitely be empty after 15 minutes."
Is Marion correct? Tick a box.

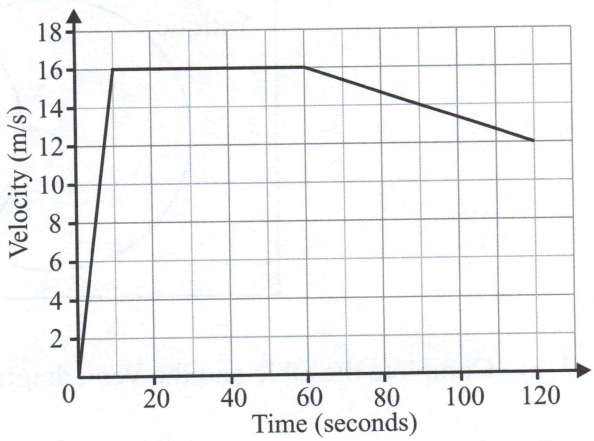
Yes ☐ No ☐

Explain your answer.

[Total 5 marks]

21 The velocity-time graph on the right shows the first two minutes of a car journey.

Calculate the distance the car travels in the first two minutes of its journey.

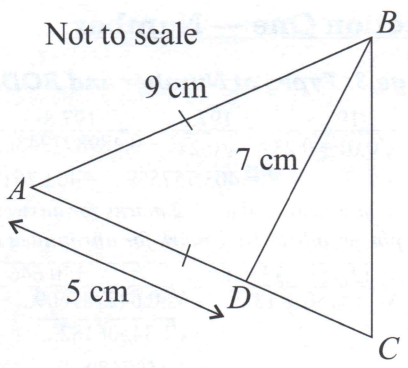


..... m

[Total 4 marks]

22 ABC is an isosceles triangle with $AB = AC = 9$ cm.
D is the point on AC such that $AD = 5$ cm and $BD = 7$ cm.

Calculate length BC.



..... cm

[Total 4 marks]

23 Hannah and Tim both think of a number.
Hannah's number is negative. Tim's number is one more than Hannah's.
They each take the reciprocal of their numbers. The sum of the reciprocals is $\frac{5}{6}$.
Use algebra to work out Hannah's original number.

.....

[Total 5 marks]

[TOTAL FOR PAPER = 80 MARKS]