

GCSE
Mathematics
Specification (8300/1H)

H

Paper 1 Higher tier

Date

Morning

1 hour 30 minutes

Materials

<p>For this paper you must have:</p> <ul style="list-style-type: none"> mathematical instruments <p>You must not use a calculator</p>	
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*Model
Answers*

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the bottom 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.
- In all calculations, show clearly how you work out your answer.

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.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature _____

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

- 1 Circle the calculation that increases 400 by 7% [1 mark]

400×0.07

400×0.7

400×1.07

400×1.7

$$100\% + 7\% = 107\% \\ = 1.07$$

- 2 Simplify $3^4 \times 3^4$
Circle the answer. [1 mark]

3^8

9^8

3^{16}

9^{16}

$$3^4 \times 3^4 \rightarrow 3^{4+4} = 3^8$$

- 3 Circle the area that is the same as 5.5 m^2 [1 mark]

550 cm^2

$5\,500 \text{ cm}^2$

$55\,000 \text{ cm}^2$

$5\,500\,000 \text{ cm}^2$

$$1 \text{ m}^2 = 100 \text{ cm} \times 100 \text{ cm} = 10,000 \text{ cm}^2$$

$$5.5 \text{ m}^2 = 55,000 \text{ cm}^2$$

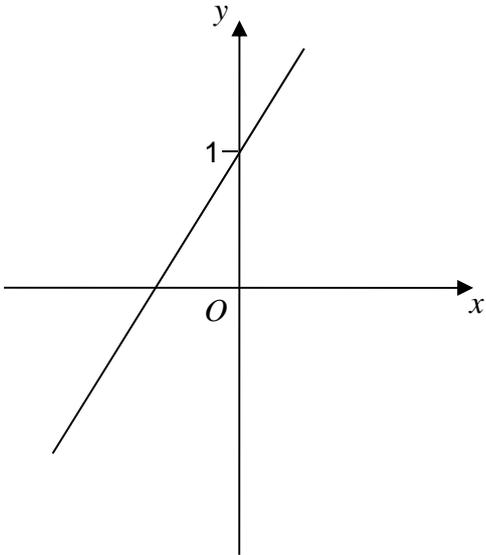
4 One of these graphs is a sketch of $y = 1 - 2x$

Which one?

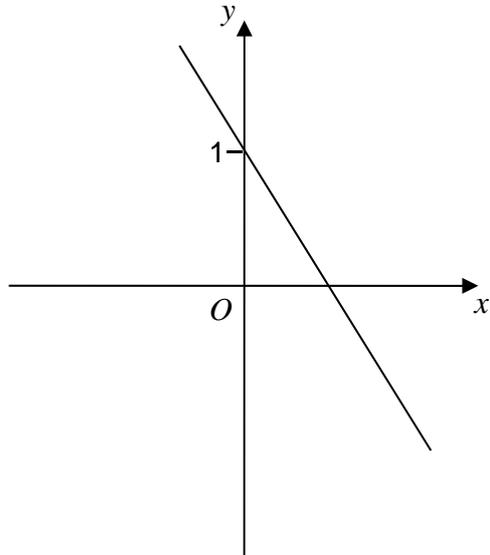
Circle the correct letter.

[1 mark]

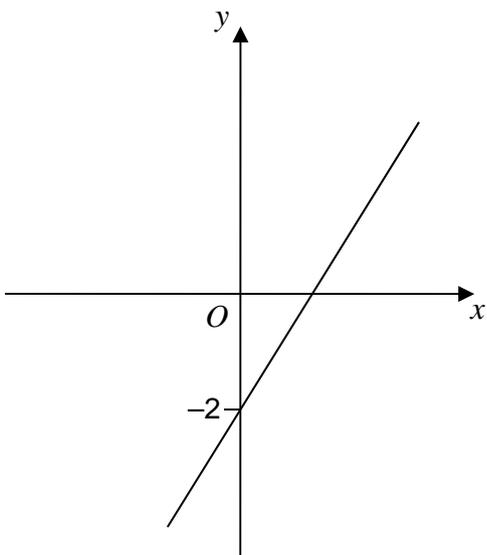
A



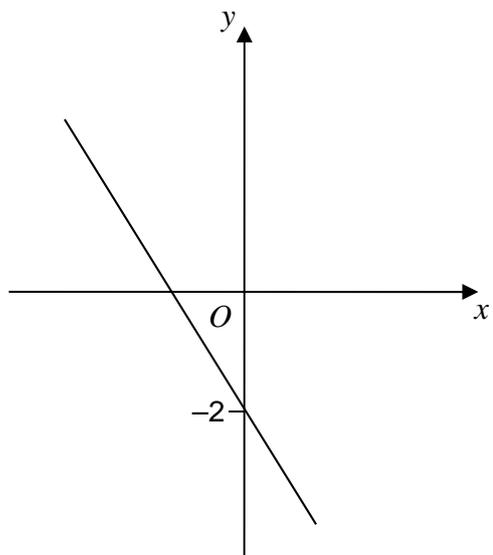
B



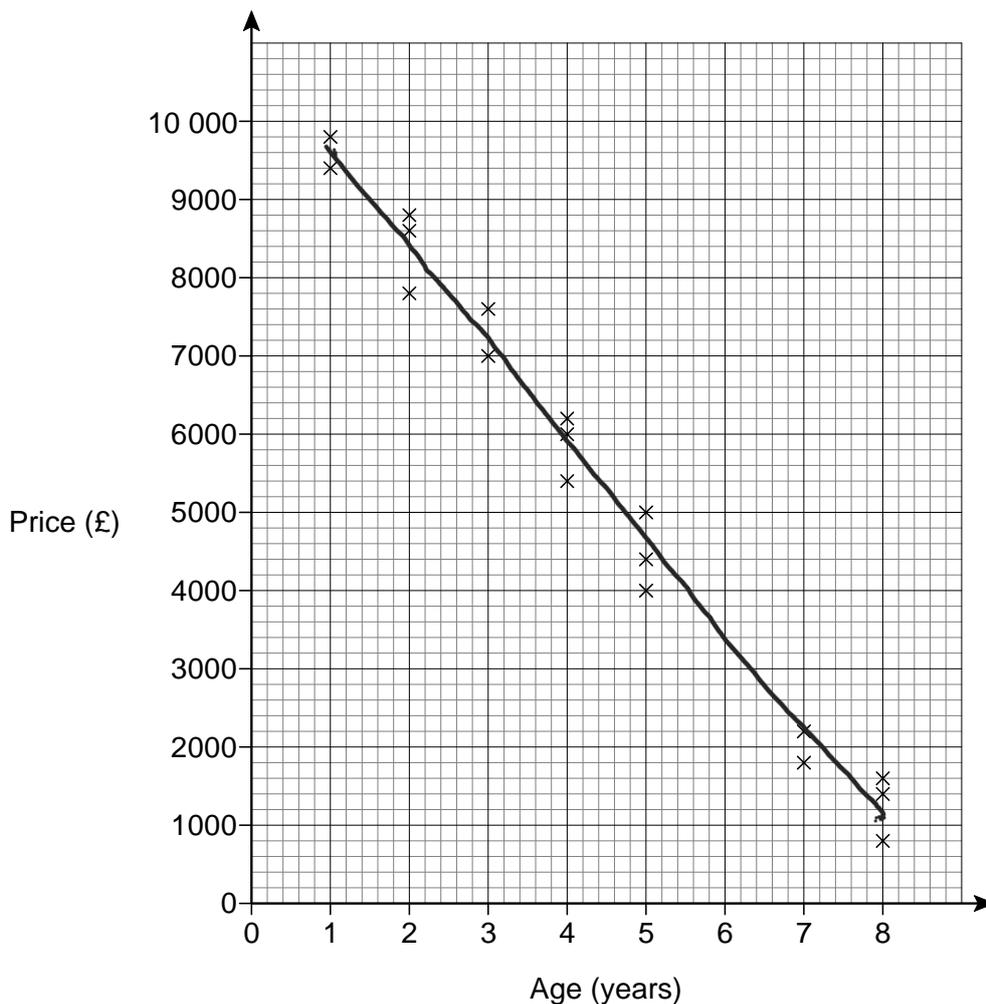
C



D



- 5 The scatter graph shows the age and the price of 18 cars.
The cars are all the same make and model.



Use a line of best fit to estimate the price of a 6-year old car.

[2 marks]

Answer £ 3400

- 6 Kelly is trying to work out the two values of w for which $3w - w^3 = 2$
Her values are 1 and -1

Are her values correct?

You **must** show your working.

[2 marks]

$$\underline{w=1} \rightarrow 3(1) - (1)^3 = 2 \rightarrow 3 - 1 = 2 \quad \checkmark$$

$$\underline{w=-1} \rightarrow 3(-1) - (-1)^3 = 2 \rightarrow -3 - (-1) = -2 \quad \times$$

- 7 Work out $2\frac{3}{4} \times 1\frac{5}{7}$

Give your answer as a mixed number in its simplest form.

[3 marks]

$$2\frac{3}{4} \rightarrow \frac{11}{4}$$

$$1\frac{5}{7} \rightarrow \frac{12}{7}$$

$$\frac{11}{4} \times \frac{12}{7} = \frac{33}{7} = \underline{\underline{4\frac{5}{7}}}$$

Answer $4\frac{5}{7}$

8 Solve $5x - 2 > 3x + 11$

[2 marks]

$$5x - 2 > 3x + 11$$

$$2x > 13$$

$$x > 13/2$$

$$\underline{\underline{x > 6.5}}$$

Answer $x > 6.5$

9 The n th term of a sequence is $2n + 1$ The n th term of a different sequence is $3n - 1$ Work out the **three** numbers that are

in both sequences

and

between 20 and 40

[3 marks]

$$2n + 1 \rightarrow \dots 21, \textcircled{23}, 25, 27, \textcircled{29}, 31, 33, \textcircled{35}, 37, 39$$

$$3n - 1 \rightarrow \dots 20, \textcircled{23}, 26, \textcircled{29}, 32, \textcircled{35}, 38$$

Answer 23 , 29 , 35

- 10 White paint costs £2.80 per litre.
 Blue paint costs £3.50 per litre.
 White paint and blue paint are mixed in the ratio 3 : 2

Work out the cost of 18 litres of the mixture.

[4 marks]

$$3 + 2 = 5 \text{ parts total}$$

$$18 \text{ Litres} / 5 = \underline{3.6 \text{ L per part}}$$

$$\text{White} \rightarrow 3 \times 3.6 \text{ L} = 10.8 \text{ L}$$

$$10.8 \text{ L} \times \pounds 2.80 = \underline{\underline{\pounds 30.24}}$$

$$\begin{array}{r} 10.8 \\ \times 2.8 \\ \hline 0.64 \\ 8.00 \\ 1.60 \\ \hline 20.00 \\ \hline 30.24 \end{array}$$

$$\text{Blue} \rightarrow 2 \times 3.6 \text{ L} = 7.2 \text{ L}$$

$$7.2 \text{ L} \times \pounds 3.50 = \underline{\underline{\pounds 25.20}}$$

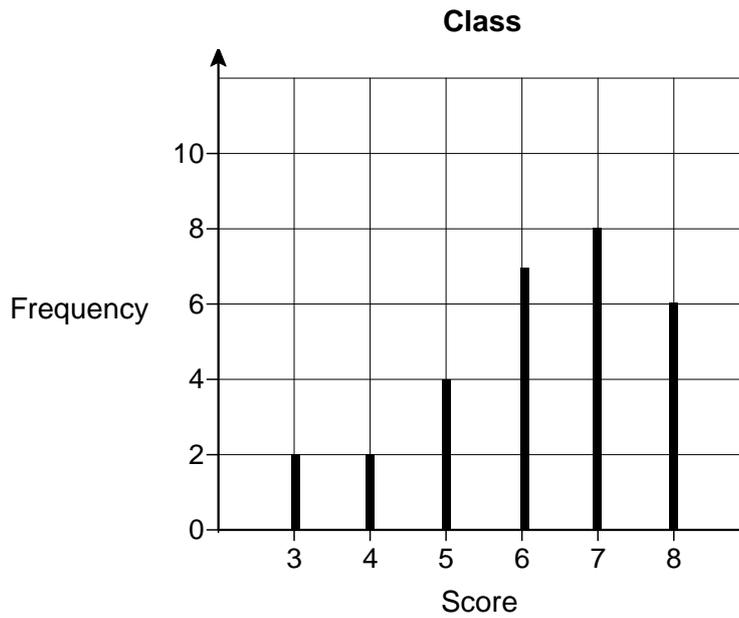
$$\begin{array}{r} 7.2 \\ \times 3.5 \\ \hline 0.1 \\ 3.5 \\ 0.6 \\ \hline 21.0 \\ \hline 25.2 \end{array}$$

$$\underline{\underline{\text{Total cost}}} \rightarrow \pounds 30.24 + \pounds 25.20 = \underline{\underline{\pounds 55.44}}$$

Answer £ 55.44

Turn over for the next question

- 11 Students in a class took a spelling test.
The diagram shows information about the scores.



Lucy is one of the 29 students in the class.
Her score was the same as the **median** score for her class.

Work out her score.

[2 marks]

$$\text{Median position} \rightarrow \frac{29+1}{2} = \frac{30}{2} = 15^{\text{th}} \text{ place}$$

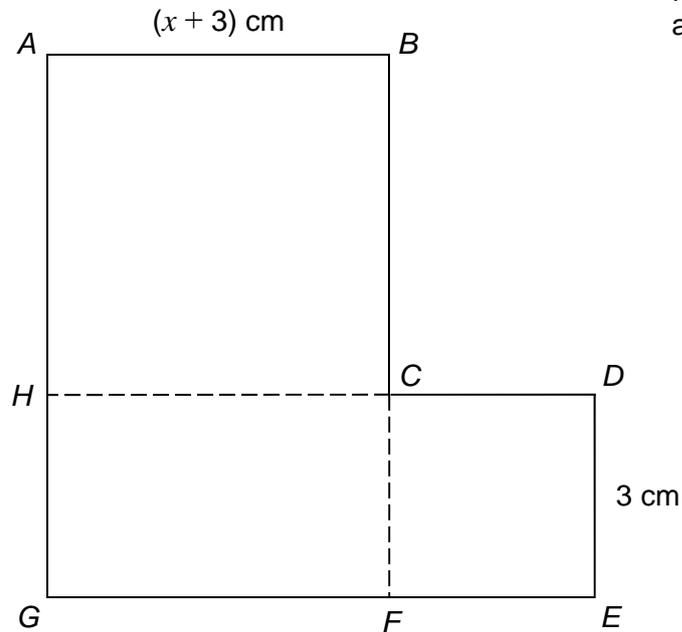
$$\text{So median} = 6$$

Answer 6

12

 $ABCH$ is a square. $HCFG$ is a rectangle. $CDEF$ is a square.

They are joined to make an L-shape.

Not drawn
accuratelyShow that the total area of the L-shape, in cm^2 , is $x^2 + 9x + 27$

[4 marks]

$$\text{area of } ABCH = (x+3)^2$$

$$\text{area of } HCFG = 3(x+3)$$

$$\text{area of } CDEF = 3^2 = 9$$

$$\text{total area} = (x+3)(x+3) + 3(x+3) + 9$$

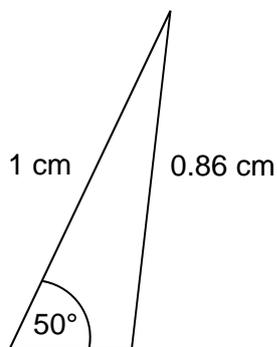
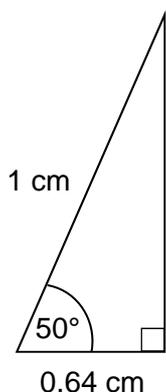
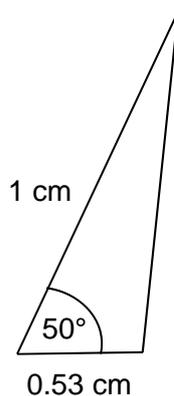
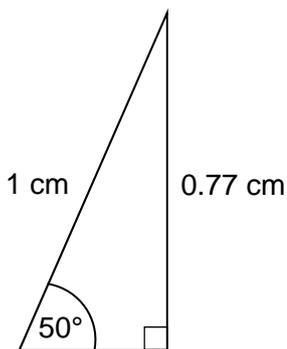
$$= x^2 + 3x + 3x + 9 + 3x + 9 + 9$$

$$= x^2 + (3x + 3x + 3x) + (9 + 9 + 9)$$

$$= \underline{\underline{x^2 + 9x + 27}}$$

13 Here are sketches of four triangles.

Not drawn accurately



In each triangle

the longest side is **exactly** 1 cm

the other length is given to 2 decimal places.

13 (a) Circle the value of $\cos 50^\circ$ to 2 decimal places.

[1 mark]

0.77

0.53

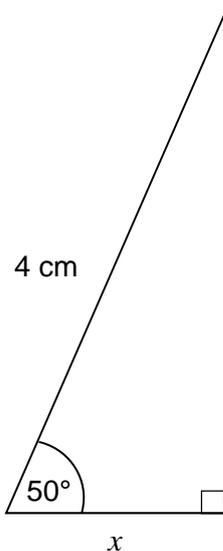
0.64

0.86

$$\cos 50 = \frac{0.64}{1} = 0.64$$

↑ $\cos x = \frac{\text{adjacent}}{\text{hypotenuse}}$, for a right-angled triangle.

- 13 (b)** Work out the value of x .
Give your answer to 1 decimal place.



Not drawn
accurately

[2 marks]

$$\textcircled{1} \cos 50 = \frac{x}{4} \rightarrow 0.64 = \frac{x}{4}$$

$$\textcircled{2} x = 0.64 \times 4 = 2.56 \text{ cm} = \underline{\underline{2.6 \text{ cm (1 dp)}}}$$

Answer 2.6 cm

Turn over for the next question

- 14** A prime number between 300 and 450 is chosen at random.
The table shows the probability that the number lies in different ranges.

Prime number, n	Probability
$300 \leq n < 330$	0.16
$330 \leq n < 360$	0.24
$360 \leq n < 390$	x
$390 \leq n < 420$	0.16
$420 \leq n < 450$	0.24

- 14 (a)** Work out the value of x .

[2 marks]

$$x + 0.16 + 0.24 + 0.16 + 0.24 = 1$$

$$x + 0.8 = 1$$

$$x = 1 - 0.8 = 0.2$$

Answer 0.2

- 14 (b)** Work out the probability that the prime number is greater than 390

[1 mark]

$$0.16 + 0.24 = 0.4$$

Answer 0.4

- 14 (c) There are four prime numbers between 300 and 330

How many prime numbers are there between 300 and 450?

[2 marks]

0.16 represents 4 numbers

$$\frac{0.16}{4} = 0.04 \text{ (represents 1 number)}$$

$$\frac{1}{0.04} = \frac{1}{\frac{4}{100}} = 1 \times \frac{100}{4} = \underline{\underline{25 \text{ numbers}}}$$

Answer 25

- 15 $a \times 10^4 + a \times 10^2 = 24\,240$ where a is a number.

Work out $a \times 10^4 - a \times 10^2$

Give your answer in standard form.

[2 marks]

$$\begin{array}{l} \textcircled{1} 2.4 \times 10^4 = 24000 \\ \textcircled{2} 2.4 \times 10^2 = 240 \end{array} \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array}} \right\} a = 2.4$$

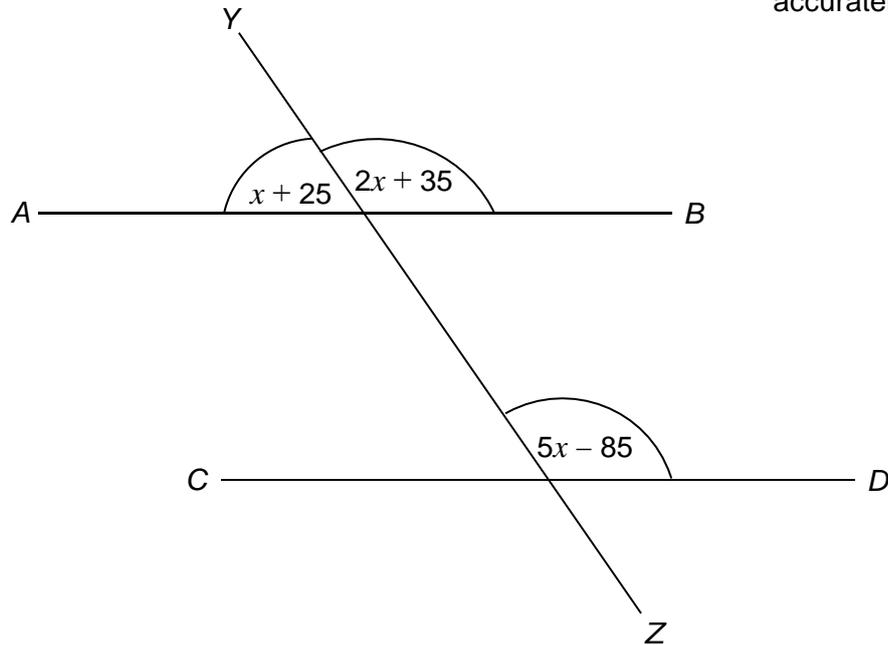
$$\begin{aligned} a - b &= \textcircled{1} - \textcircled{2} = 24000 - 240 = 23760 \\ &= \underline{\underline{2.376 \times 10^4}} \end{aligned}$$

Answer 2.376×10^4

16

 AB , CD and YZ are straight lines.

All angles are in degrees.

Not drawn
accuratelyShow that AB is parallel to CD .

[4 marks]

$$x + 25 + 2x + 35 = 180$$

$$3x + 60 = 180$$

$$3x = 120$$

$$x = 40^\circ$$

$$2x + 35 = 2(40) + 35 = 80 + 35 = 115^\circ$$

$$5x - 85 = 5(40) - 85 = 200 - 85 = 115^\circ$$

Corresponding angles are equal, so AB
and CD must be parallel.

- 17 To complete a task in 15 days a company needs
4 people each working for 8 hours per day.

The company decides to have
5 people each working for 6 hours per day.

Assume that each person works at the same rate.

- 17 (a) How many days will the task take to complete?
You **must** show your working.

[3 marks]

Task takes $15 \times 4 \times 8 = 60 \times 8 = 480$ hours

$480 \div 5 \text{ people} \div 6 \text{ hours per day} = 80 \div 5 = \underline{\underline{16 \text{ days}}}$

Answer 16 days

- 17 (b) Comment on how the assumption affects your answer to part (a).

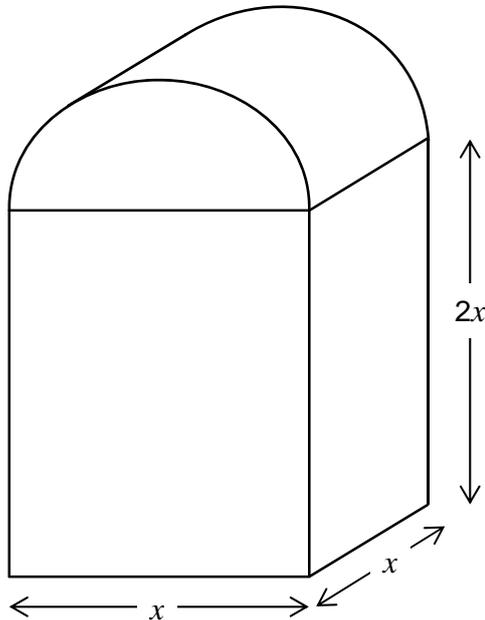
[1 mark]

If some people work at a slower rate, it will take longer to complete the task.

18 In this question all dimensions are in centimetres.

A solid has uniform cross section.

The cross section is a rectangle and a semicircle joined together.



Work out an expression, in cm^3 , for the **total** volume of the solid.

Write your expression in the form $ax^3 + \frac{1}{b}\pi x^3$ where a and b are integers.

[4 marks]

$$\underline{\text{Vol of cuboid}} \rightarrow x \times x \times 2x = 2x^3$$

$$\underline{\text{Vol half cylinder}} \rightarrow \text{Surface area of cross section (semi circle)} \times \text{Length}$$

$$\frac{1}{2} \times \pi \times \left(\frac{x}{2}\right)^2 \times x$$

$$= \frac{1}{2} \pi \times \frac{x^2}{4} \times x$$

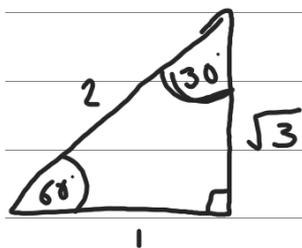
$$= \frac{1}{8} \pi x^3$$

$$\underline{\underline{\text{Total volume} = 2x^3 + \frac{1}{8}\pi x^3 \text{ cm}^3}}$$

Answer $2x^3 + \frac{1}{8}\pi x^3$ cm^3

- 19 Show that $12 \cos 30^\circ - 2 \tan 60^\circ$ can be written in the form \sqrt{k} where k is an integer.

[3 marks]



$$\cos 30 = \frac{\sqrt{3}}{2}$$

$$\tan 60 = \frac{\sqrt{3}}{1}$$

$$12 \times \frac{\sqrt{3}}{2} - 2 \times \sqrt{3} = 6\sqrt{3} - 2\sqrt{3} = 4\sqrt{3}$$

$$4\sqrt{3} = \sqrt{16 \times 3} = \sqrt{48}$$

$$\text{So } \underline{\underline{K = 48}}$$

Turn over for the next question

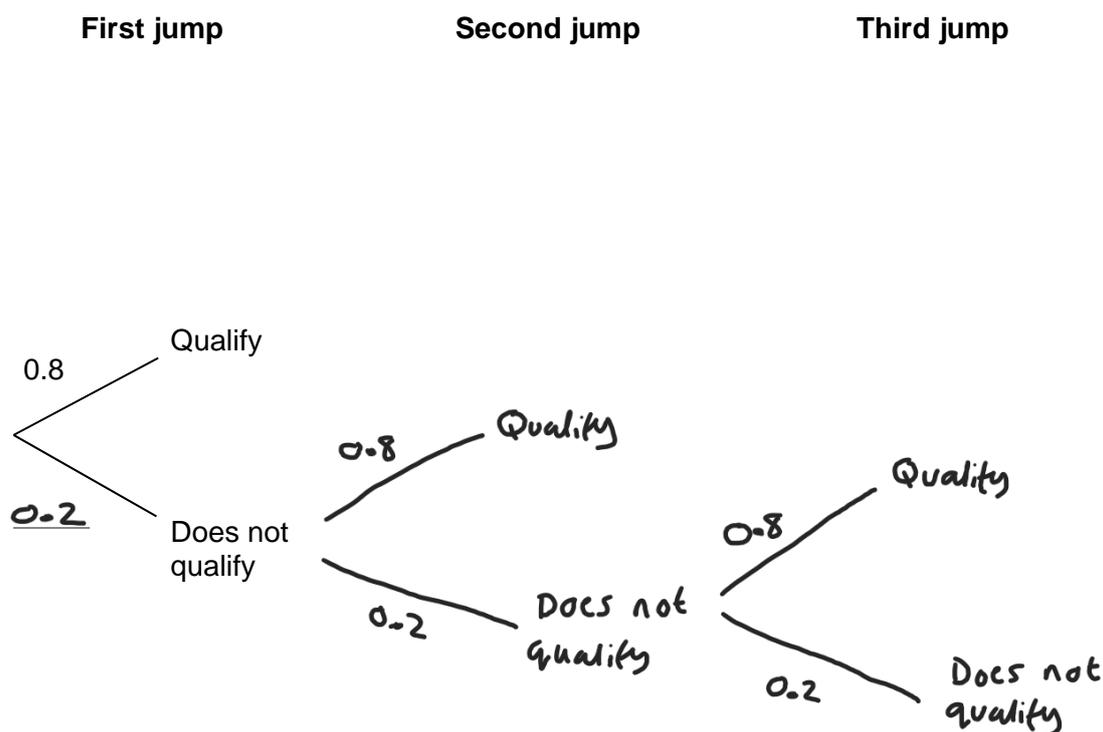
20 On Friday, Greg takes part in a long jump competition.
He has to jump at least 7.5 metres to qualify for the final on Saturday.

- He has up to three jumps to qualify.
- If he jumps at least 7.5 metres he does **not** jump again on Friday.

Each time Greg jumps, the probability he jumps at least 7.5 metres is 0.8
Assume each jump is independent.

20 (a) Complete the tree diagram.

[2 marks]



20 (b) Work out the probability that he does **not** need the third jump to qualify.

[2 marks]

So qualifies after first or second jump

$$0.8 + (0.2 \times 0.8)$$

$$0.8 + 0.16 = \underline{\underline{0.96}}$$

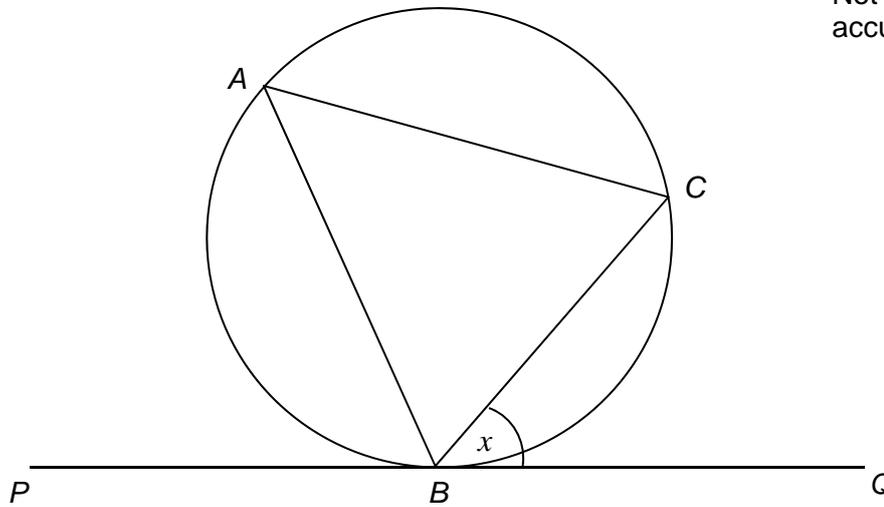
Answer 0.96

21

A , B and C are points on a circle.

- BC bisects angle ABQ .
- PBQ is a tangent to the circle.

Not drawn
accurately



Angle $CBQ = x$

Prove that $AC = BC$

[3 marks]

Angle $ABC = x$ as BC bisects angle ABQ

Angle $BAC = x$ because of alternate segment theorem

Two equal angles, so triangle ABC is isosceles.

Therefore $AC = BC$

Turn over for the next question

22

Steph is solving a problem.

Cube A has a surface area of 150 cm^2

Cube B has sides half the length of cube A

What is the volume of cube B?

To solve this problem, Steph decides to

- halve the surface area
- calculate the square root of the answer
- then divide by 6
- then cube this answer to work out the volume.

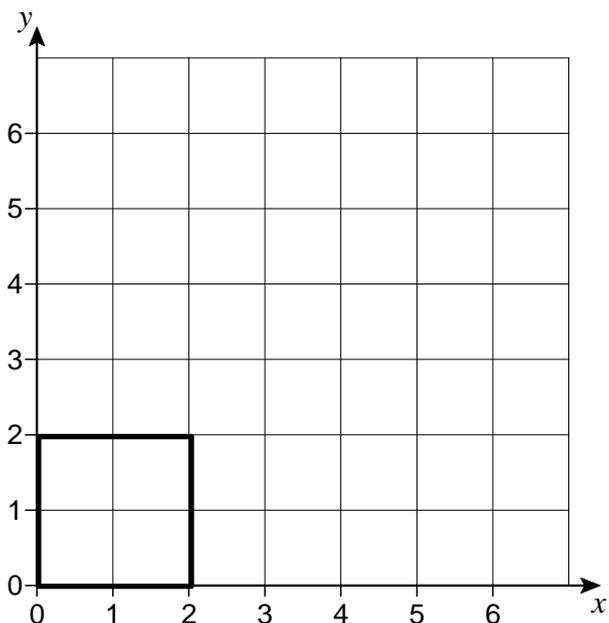
Evaluate Steph's method.

[2 marks]

- Divide by 6 first to find the surface area of one face of cube A
- Then calculate the square root to find the length of one side of cube A
- Halve this length to find length of one side of cube B.
- Cube this answer to calculate volume of cube B.

23 Square $OABC$ is drawn on a centimetre grid.

O is $(0, 0)$ A is $(2, 0)$ B is $(2, 2)$ C is $(0, 2)$



23 (a) $OABC$ is translated by the vector $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$

Circle the number of invariant points on the perimeter of the square.

[1 mark]

0 1 2 4

23 (b) $OABC$ is enlarged, scale factor 2, centre $(0, 0)$

Circle the number of invariant points on the perimeter of the square.

[1 mark]

0 1 2 4

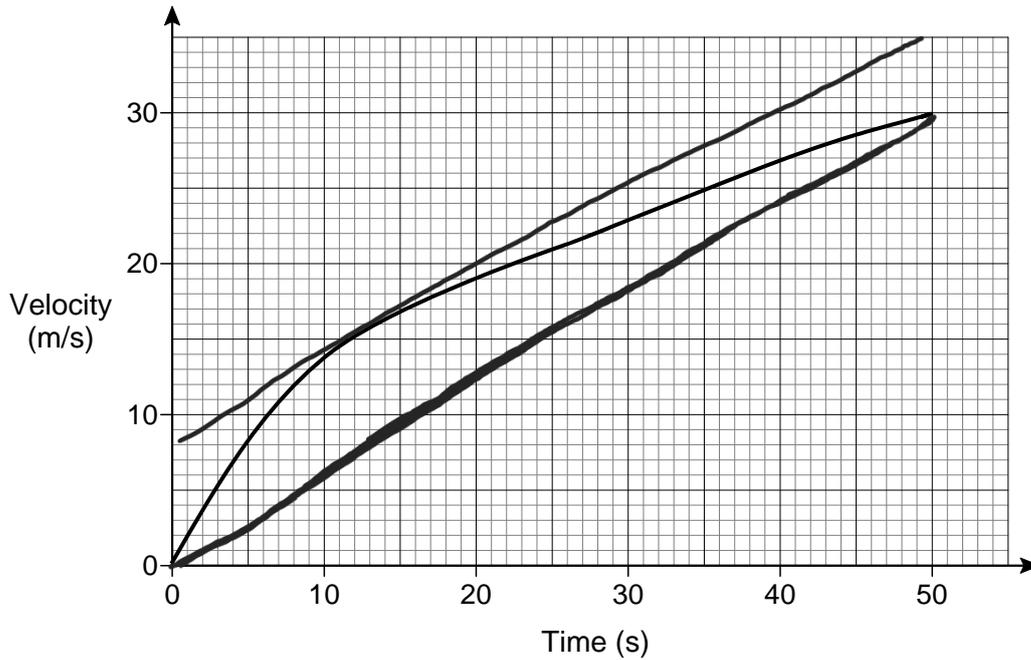
23 (c) $OABC$ is reflected in the line $y = x$

Circle the number of invariant points on the perimeter of the square.

[1 mark]

0 1 2 4

24 Here is the velocity-time graph of a car for 50 seconds.



24 (a) Work out the average acceleration during the 50 seconds.
Give the units of your answer.

[2 marks]

$$a = \frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

$$a = \frac{30 - 0}{50} = \frac{30}{50} = \frac{3}{5} = \underline{\underline{0.6 \text{ m/s}}}$$

Answer 0.6 m/s

24 (b) Estimate the time during the 50 seconds when
the instantaneous acceleration = the average acceleration

You **must** show your working on the graph.

[2 marks]

(11, 14) coordinates

Answer 14 seconds

25

$$f(x) = 2x + c$$

$$g(x) = cx + 5$$

$$fg(x) = 6x + d$$

c and d are constants.

Work out the value of d .

[3 marks]

$$\text{put } g \text{ into } f(x) \rightarrow 2(cx+5) + c = 6x + d$$

$$2cx + 10 + c = 6x + d$$

$$2cx = 6x \rightarrow \underline{c=3}$$

$$10 + c = d \rightarrow \underline{\underline{10 + 3 = d = 13}}$$

Answer 13

Turn over for the next question

26

Rationalise the denominator and simplify

$$\frac{10}{3\sqrt{5}}$$

[2 marks]

$$\frac{10 \times \sqrt{5}}{3\sqrt{5} \times \sqrt{5}} = \frac{10\sqrt{5}}{3 \times 5} = \frac{10\sqrt{5}}{15} = \frac{2\sqrt{5}}{3}$$

Answer $\frac{2\sqrt{5}}{3}$

27

Convert $0.1\dot{7}2$ to a fraction in its lowest terms.

[3 marks]

$$\begin{array}{r}
 x = 0.1\dot{7}27272 \\
 100x = 17.2\dot{7}27272 \\
 \hline
 99x = 17.1\dot{7}27272 \quad \div 9 \\
 \hline
 x = \frac{17.1\dot{7}27272}{99} = \frac{171\dot{7}27272}{990} = \frac{19}{110}
 \end{array}$$

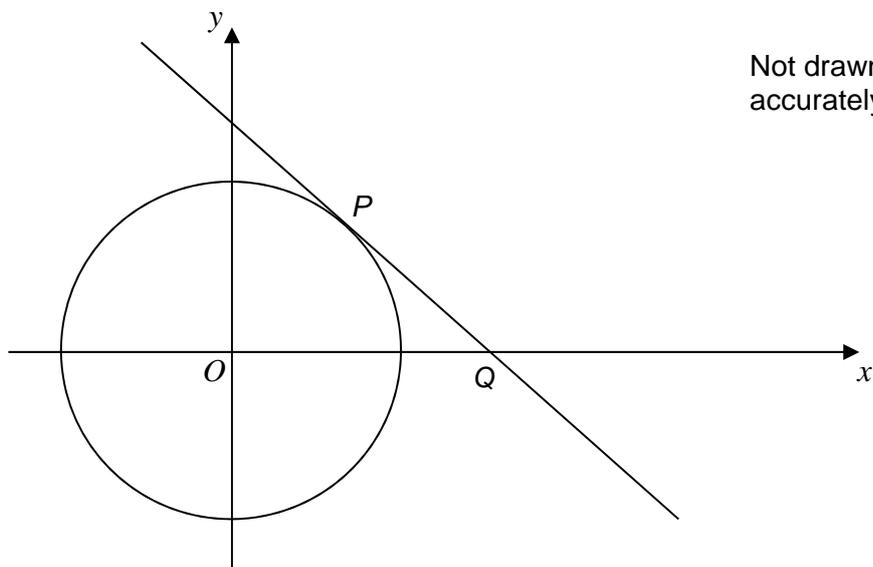
$9 \overline{) 019}$
 $\underline{18}$
 172
 $\underline{178}$
 42

Answer $\frac{19}{110}$

28 The diagram shows the circle $x^2 + y^2 = 10$

P lies on the circle and has x -coordinate 1

The tangent at P intersects the x -axis at Q .



Work out the coordinates of Q .

[5 marks]

$$x = 1 \rightarrow 1^2 + y^2 = 10$$

$$y^2 = 9 \rightarrow y = 3$$

So P is at $(1, 3)$

$$\text{Gradient of line } OP \rightarrow \frac{3-0}{1-0} = 3$$

$$\text{Gradient of tangent} \rightarrow -1/3 \rightarrow y = -1/3x + c$$

$$\text{Use point } P \text{ in } y = -1/3x + c \rightarrow 3 = -1/3(1) + c$$

$$3 + 1/3 = c = \frac{10}{3}$$

$$\text{So } y = -\frac{1}{3}x + \frac{10}{3}$$

$$\text{At } Q, y = 0 \rightarrow 0 = -\frac{1}{3}x + \frac{10}{3}$$

$$-\frac{10}{3} = -\frac{1}{3}x$$

$$-10 = -x \rightarrow x = 10$$

Answer (10 , 0)

END OF QUESTIONS

There are no questions printed on this page

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