AQA - H - Nov 13th '23

P3

Do not write outside the box

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

1 The first four terms of a linear sequence are

6 13 20 27 +7

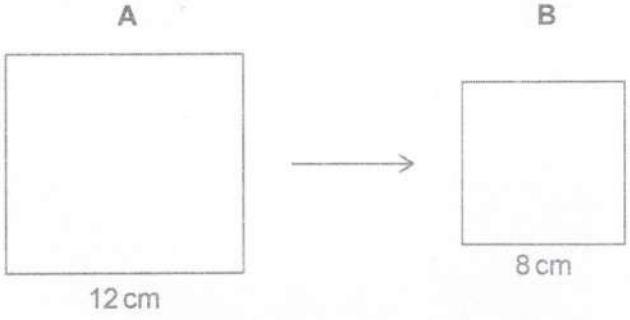
Write down the expression for the nth term.

7n 7 14 21 28 -1

[1 mark]

Answer 7n - 1

2 Square A is enlarged to square B.



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Write down the scale factor of the enlargement as a fraction.

[1 mark]

Answer $\frac{8}{12}$ or $\frac{2}{3}$

Do not write outside the box

3 The length of a line is 8 cm to the nearest centimetre.

Complete the error interval.

[2 marks]

Answer 7.5 cm ⩽ length < 8.5 cm

4 At what point does the graph $y = x^3 - 1$ cross the y axis?

[1 mark]

Answer (0 , -1)

Turn over for the next question

5

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5 Carly's total annual pay = salary + bonus

		Salary	Bonus
A	Last year	£26 000	£4000
B	This year	6% increase	9% decrease

Work out the percentage change in her total annual pay.

State whether it is an increase or a decrease.

[4 marks]

A = 30000

B = (26000 x 1·06) + (4000 x 0·91)

= 27560 + 3640

= 31200

$$\% \text{ inc} = \frac{31200 - 30000}{30000} \times 100$$

Answer 4% increase

Do not write outside the box

6 An exhibition

was open for 240 hours

and

had 29760 visitors.

For $\frac{2}{5}$ of the time the exhibition was open, there were 172 visitors per hour.

For the remaining time, how many visitors per hour were there?

[4 marks]

$240 \times \frac{2}{5} \times 172 = 16512$

$29760 - 16512 = 13248$ v in

$240 \times \frac{3}{5} = 144$ hrs

per hr $= \frac{13248}{144}$

Answer 92

7 The first two cube numbers are 1 and 8, 27

Show that

the 3rd cube number can be written as the sum of three different prime numbers.

2 3 5 7 11 13 17

[3 marks]

27 = 3 + 5 + 19

or 3 7 17

or 3 11 13

11

Do not write outside the box

8 Circle the largest number.

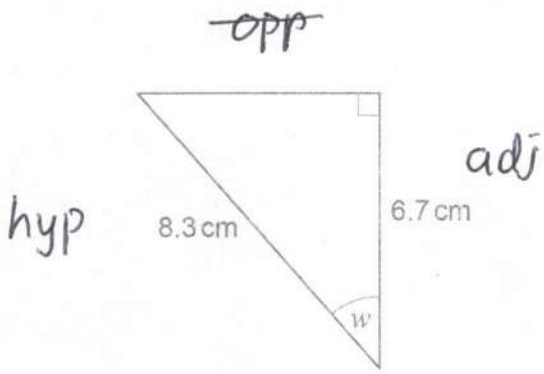
[1 mark]

~~5304~~
5·344
~~5·340~~
5·3444

5.30$\dot{4}$ 5.344 5.34 5.3$\dot{4}$

9 Use trigonometry to work out the size of angle w.

[3 marks]



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SOH CAH

$w = \cos^{-1}\left(\frac{6.7}{8.3}\right)$

$= 36.17...$

$w =$ 36.2° .

Do not write outside the box

10 Two bags contain only green discs and yellow discs.

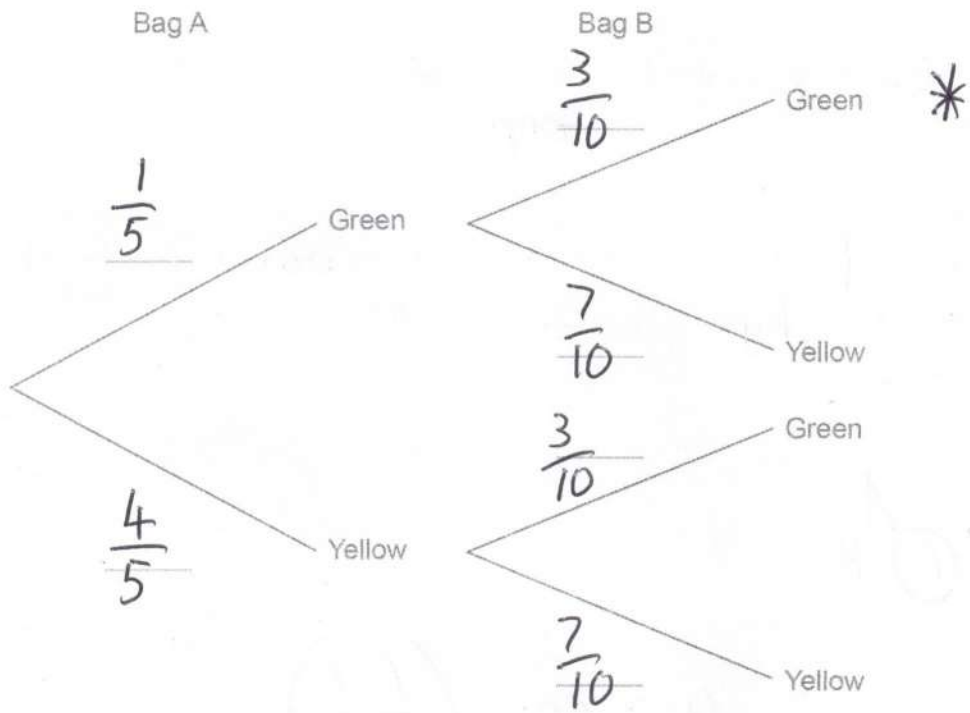
Bag A contains 1 green disc and 4 yellow discs.

Bag B contains 3 green discs and 7 yellow discs.

One disc is picked at random from each bag.

10 (a) Complete the tree diagram with the correct probabilities.

[2 marks]



10 (b) Work out the probability that **both** discs are green.

[2 marks]

$GG = \frac{1}{5} \times \frac{3}{10}$

Answer $\frac{3}{50}$

8

Do not write outside the box

11 Solve these simultaneous equations.

$7x + 2y = 100$

$3x + 2y = 48$ −

[3 marks]

$4x = 52$

$x = \frac{52}{4} = 13$

$3 \times 13 + 2y = 48$

$39 + 2y = 48$

$2y = 9$

$y = 9 \div 2$

$x =$ 13 $y =$ 4.5

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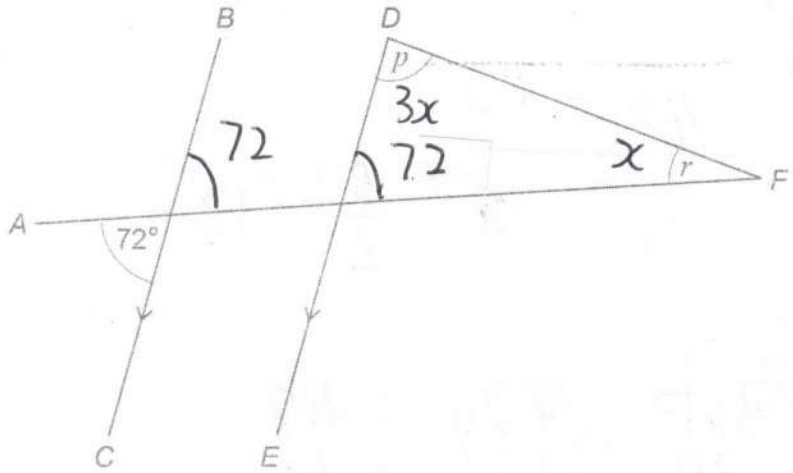
12 *AF*, *BC*, *DE* and *DF* are straight lines.

BC and *DE* are parallel.



Not drawn accurately

p is three times r.

Work out the size of angle p.

[3 marks]

$4x + 72 = 180$

$4x = 108$

$x = \frac{108}{4} = 27$

$p = 3x = 3 \times 27$

$p =$ 81 °

6

Do not write outside the box

13 100 people were asked about the distance they travel from home to work.
The table shows information about the results.

Distance, d (miles)	Frequency
$0 \leqslant d < 5$	21
$5 \leqslant d < 10$	24
$10 \leqslant d < 20$	37
$20 \leqslant d < 40$	18

13 (a) Write down the **greatest** possible number of people who work from home.

[1 mark]

Answer 21

13 (b) One person is chosen at random.

Work out the probability that the person travels **at least** 10 miles.

[1 mark]

37+18 = 55

Answer $\frac{55}{100}$ etc

Do not write outside the box

13 (c) The table is repeated.

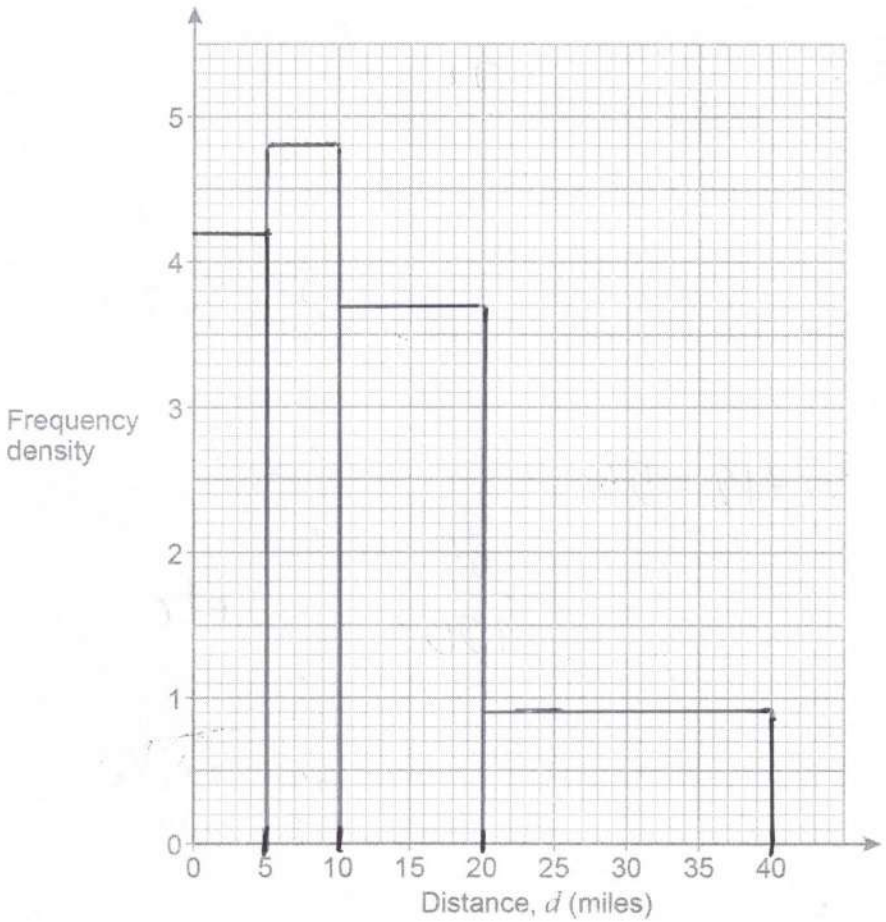
Width Area Height (fd)

Distance, d (miles)	Frequency
5 $0 \leqslant d < 5$	21
5 $5 \leqslant d < 10$	24
10 $10 \leqslant d < 20$	37
20 $20 \leqslant d < 40$	18

4·2
4·8
3·7
0·9

Draw a histogram to represent the results.

[3 marks]



5

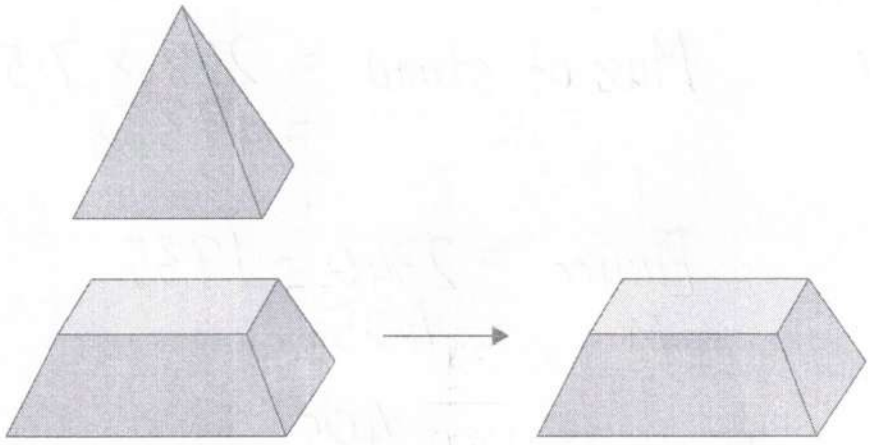
Do not write outside the box.

14 A solid trophy consists of a stand and a player.

Trophy

The stand is made by removing a small pyramid from a large pyramid.

Large pyramid	Square base, edge 8 cm	Perpendicular height 16 cm
Small pyramid	Square base, edge 5 cm	Perpendicular height 10 cm



Stand

Volume of a pyramid $= \frac{1}{3} \times$ area of base $\times$ perpendicular height

Do not write outside the box

14 (a) Show that the volume of the **stand** is 258 cm^3

[2 marks]

$V = \left(8^2 \times 16 \times \frac{1}{3}\right) - \left(5^2 \times 10 \times \frac{1}{3}\right)$

$= \frac{1024}{3} - \frac{250}{3}$

$= 258\ cm^3$

14 (b) The trophy is made from a metal of density 7.5 grams per cm^3

The **total** mass of the trophy is 2340 grams.

Work out the volume of the **player**.

[2 marks]

$\begin{matrix} M \\ D\ V \end{matrix}$

Mass of stand $= 258 \times 7.5$

$= 1935g$

Player $= 2340 - 1935$

$M = 405g$

Player Vol $= \frac{405}{7.5}$

54

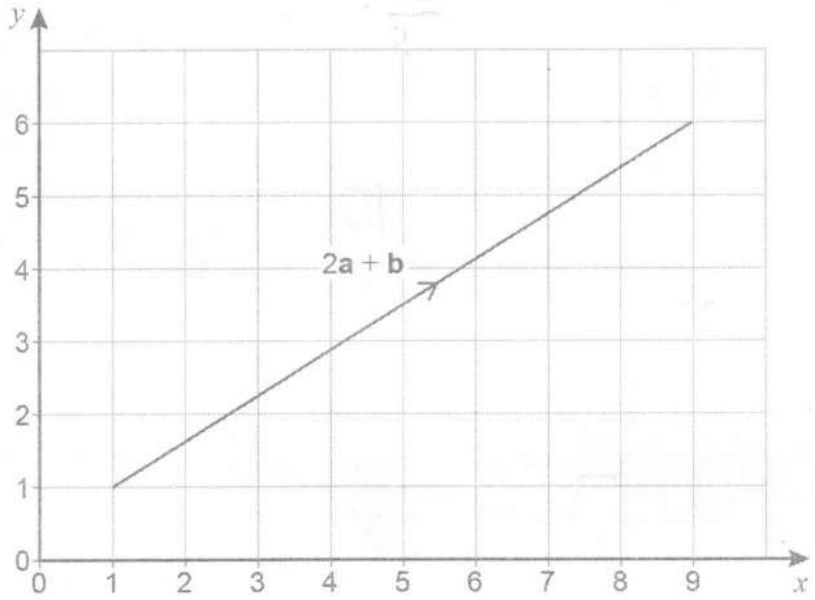
Answer _____ cm^3

4

Do not write outside the box

15 $\mathbf{a} = \begin{pmatrix} m \\ 3 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -4 \\ p \end{pmatrix}$

The diagram shows the vector $2\mathbf{a} + \mathbf{b}$



Work out the values of m and p.

[4 marks]

$$2\begin{bmatrix} m \\ 3 \end{bmatrix} + \begin{bmatrix} -4 \\ p \end{bmatrix} = \begin{bmatrix} 8 \\ 5 \end{bmatrix}$$

$2m - 4 = 8$ | $6 + p = 5$

$2m = 12$ | $p = 5 - 6$

$m = 6$

$m = 6$ $p = -1$

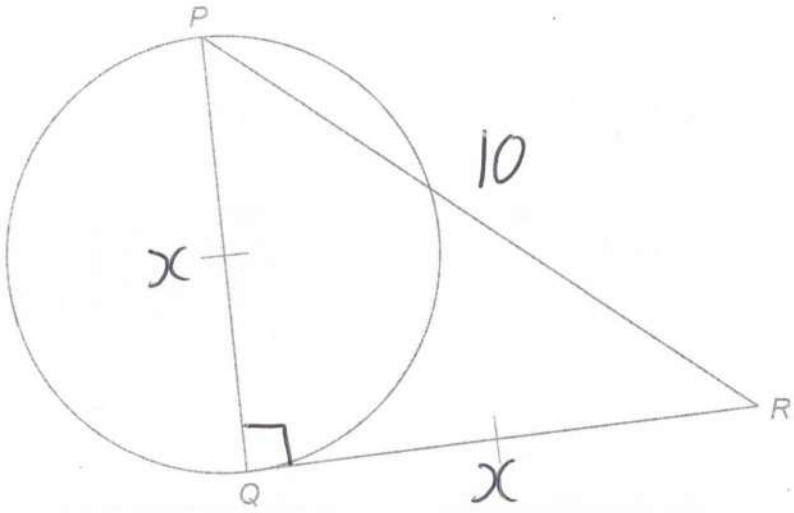
Do not write outside the box

16 PQ is a diameter of a circle.

QR is a tangent to the circle.

$PQ = QR$

$PR = 10\,\text{cm}$



Not drawn accurately

Work out the **radius** of the circle.

Give your answer as a decimal.

[3 marks]

$x^2 + x^2 = 10^2$

$2x^2 = 100$

$x^2 = 50$

$x = \sqrt{50} = 5\sqrt{2}$

radius $= 5\sqrt{2} \div 2 = 3.5355...$

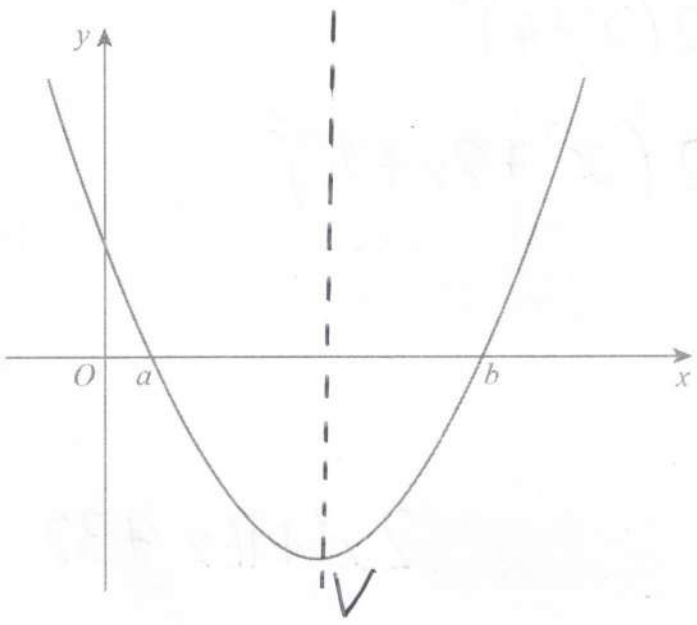
Answer 3.54 cm

7

Do not write outside the box

17 Here is a sketch of the quadratic graph $y = f(x)$

The graph crosses the x-axis at $x = a$ and $x = b$



Write an expression for the x-coordinate of the turning point.

[1 mark]

Answer $\frac{a+b}{2}$

Do not write outside the box

18 Simplify $\dfrac{2(x+4)^{\cancel{3}\,2}}{\cancel{(x+4)^3}}$

Give your answer in the form $ax^2 + bx + c$ where a, b and c are integers.

[3 marks]

$= 2(x+4)^2$

$= 2(x^2+8x+16)$

Answer $2x^2+16x+32$

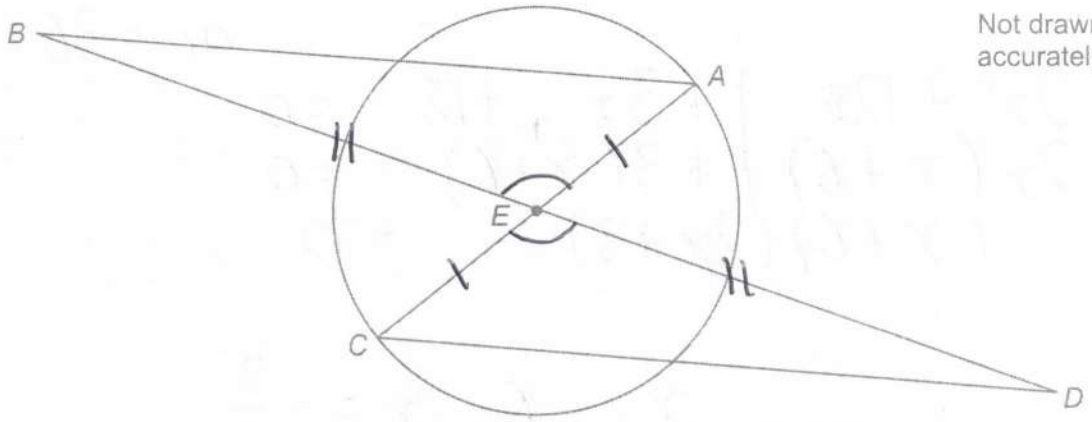
Turn over for the next question

4

Do not write outside the box.

19 *AC* is a diameter of a circle, centre *E*.

E is the midpoint of *BD*.



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Prove that triangle *ABE* is congruent to triangle *CDE*.

[4 marks]

$AE = EC$ (both radii)

$\angle BEA = \angle CED$ (opposite angles are equal)

$BE = ED$ (E is the mid pt)

SAS hence congruent

Do not write outside the box

20 Solve $2x(x + 10) = 5x - 18$

[4 marks]

$2x^2 + 20x = 5x - 18$

$2x^2 + 15x + 18 = 0$

$ac = 36$

$2x^2 + 12x \mid +3x + 18 = 0$

$2x(x+6) \mid +3(x+6) = 0$

$(x+6)(2x+3) = 0$

Answer $x = -6, \; x = -\frac{3}{2}$

Turn over for the next question

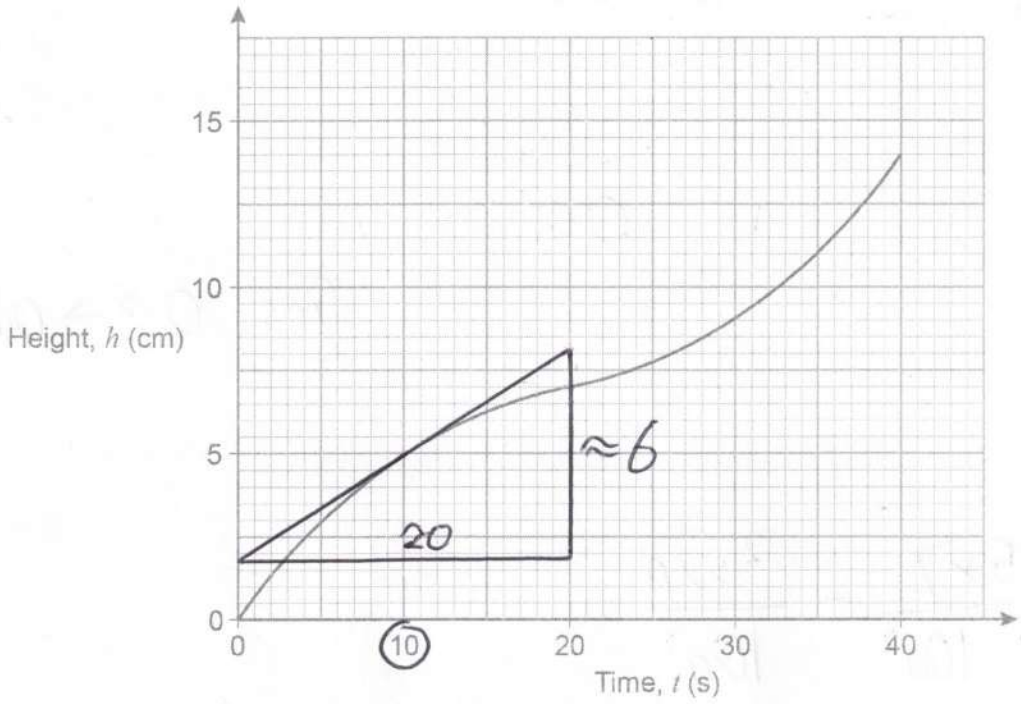
8

Do not write outside the box.

21 Water flows from a tap at a constant rate.

A container is filled with water from the tap in 40 seconds.

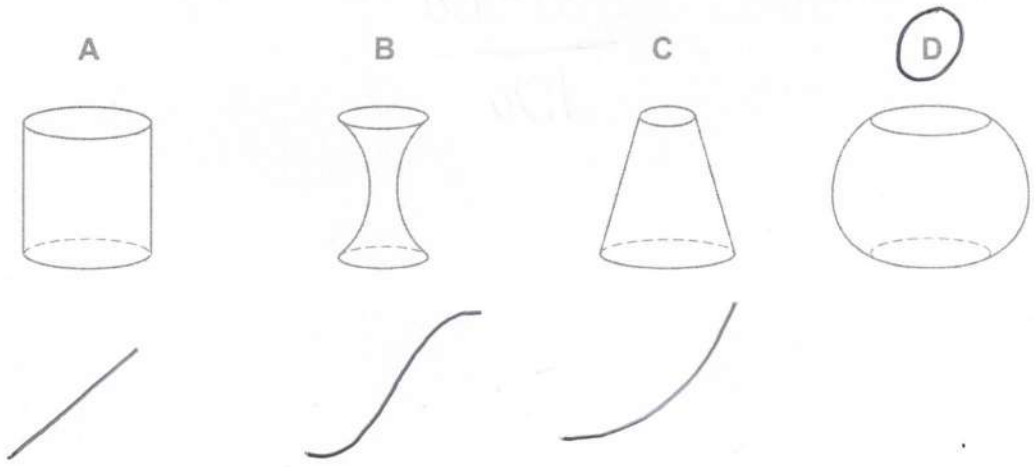
The graph shows the height, h centimetres, of the water after time, t seconds.



21 (a) The container is one of these shapes.

Circle the letter of the correct shape.

[1 mark]



Do not write outside the box

21 (b) By drawing a tangent on the graph,

estimate the rate at which the height is increasing when $t = 10$

[2 marks]

$6 \div 20$

Answer 0·3 cm/s

[ms 0·3 → 0·4]

22 Write $\frac{7}{2a^2} - \frac{3}{5a}$ as a single fraction in its simplest form.

[2 marks]

$\frac{5 \times 7}{10a^2} - \frac{3 \times 2a}{10a^2}$

$= \frac{35}{10a^2} - \frac{6a}{10a^2}$

Answer $\frac{35 - 6a}{10a^2}$

5

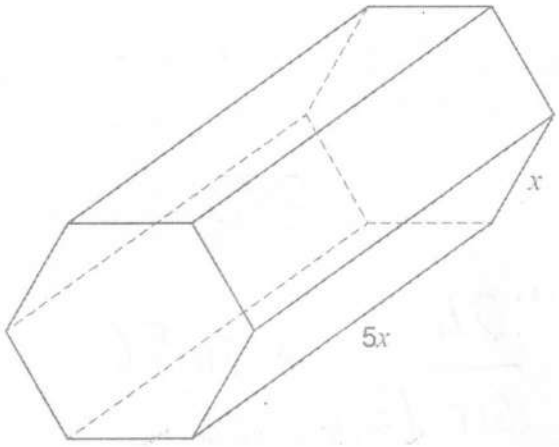
Do not write outside the box

23 A chocolate box in the shape of a prism is being designed.

All lengths are in centimetres.

The cross section is a regular hexagon with side x

The length is $5x$



An expression for the area of the cross section, in cm^2, is $\frac{3\sqrt{3}}{2}x^2$

The **total** surface area of the box must be less than 650 cm^2

Work out the largest possible **integer** value of x.

You **must** show your working.

[4 marks]

Surface Area $= 2\left(\frac{3\sqrt{3}}{2}\right)x^2 + 6(5x \times x)$

$= 3\sqrt{3}x^2 + 30x^2 < 650$

$x^2(3\sqrt{3} + 30) < 650$

$x^2 < \frac{650}{3\sqrt{3}+30}$

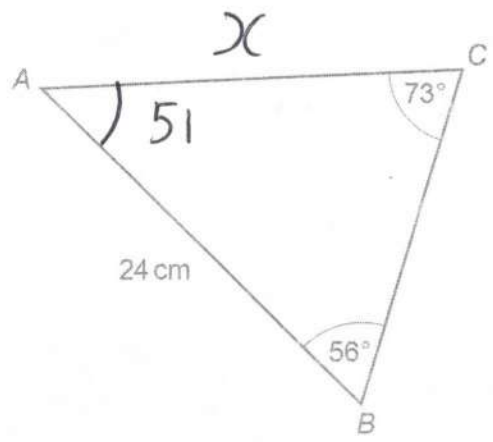
$x < 4.297...$

Answer 4

Do not write outside the box

24 Work out the area of triangle *ABC*.

[4 marks]



Not drawn accurately

$\frac{x}{\sin 56} = \frac{24}{\sin 73} \times \sin 56$

$x = 20.806...$

Area $= \frac{1}{2} \times 20.806... \times 24 \times \sin 51$

$= 194.0318...$

Answer 194.0 cm^2

[ms 193.9 → 194.1]

8

Do not write outside the box

25 a is three quarters of c

$6b = 5c$ $\longrightarrow$ $b = \frac{5}{6}c$

Work out the ratio $a : b : c$

Give your answer in its simplest form, where a, b and c are integers.

[3 marks]

a : b : c

3 4

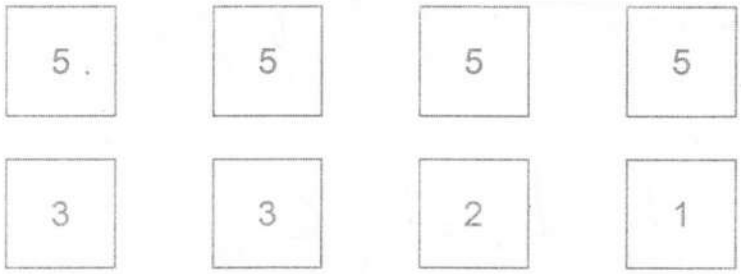
x3 x3

10 : 12

Answer 9 : 10 : 12

Do not write outside the box

26 In a game, these numbered tiles are in a bag.



To play the game

Choose tiles at random one at a time and do not replace the tiles.

You win if at any stage the total of the numbers on your tiles is 10

Amber plays the game once.

Work out the probability that she wins.

[4 marks]

$5,5 = \frac{4}{8} \times \frac{3}{7} = \frac{12}{56}$

W → $5,3,2$ any order $= 6 \times \left(\frac{4}{8} \times \frac{2}{7} \times \frac{1}{6}\right) = \frac{8}{56}$

$\frac{12}{56} + \frac{8}{56}$

Answer $\frac{5}{14}$ OE

7

Do not write outside the box

27 (a) The graph of $y = x^3$ is translated to the graph of $y = (x-2)^3$

Write down the translation vector.

$\rightarrow 2$

[1 mark]

Answer $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

27 (b) The graph of $y = 5x + 4$ is reflected in the y-axis.

Write down the equation of the reflected graph.

"x" $x -1$

[1 mark]

Answer $y = -5x + 4$

END OF QUESTIONS

2