AQA

Centre number						Candidate number				

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

H

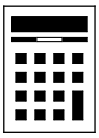
Higher Tier Paper 3 Calculator

Shadow paper based on the November 2023 paper

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:



- a calculator
- mathematical instruments.

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	
24–25	
26	
TOTAL	

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

Do not write outside the box

1 The first four terms of a linear sequence are

4 10 16 22

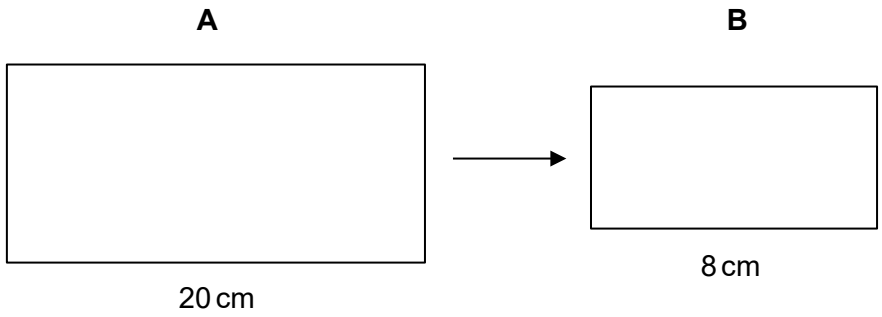
Write down the expression for the nth term.

[1 mark]

Answer _____

2 Rectangle A is enlarged to rectangle B.

Not drawn accurately



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

[1 mark]

Answer _____

Do not write outside the box

3 The length of a spring is 15 cm to the nearest centimetre.

Complete the error interval.

[2 marks]

Answer _____ cm $\leqslant$ length $<$ _____ cm

4 At what point does the graph $y = x^2 + 4$ cross the y axis?

[1 mark]

Answer (_____ , _____)

Turn over for the next question

5

Do not write outside the box

5 Annette's total annual pay = salary + bonus

	Salary	**Bonus**
Last year	£24 000	£3000
This year	3% increase	7% decrease

Work out the percentage change in her total annual pay.

State whether it is an increase or a decrease.

[4 marks]

Answer _____

Do not write outside the box

6 An exhibition

was open for 130 hours

and

had 47 372 visitors.

For $\frac{3}{5}$ of the time the exhibition was open, there were 260 visitors per hour.

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

[4 marks]

Answer _____

7 The first two square numbers are 1 and 4

Show that

the 5th square number can be written as the sum of three different prime numbers.

[3 marks]

$\square = \square + \square + \square$

11

Do not write outside the box

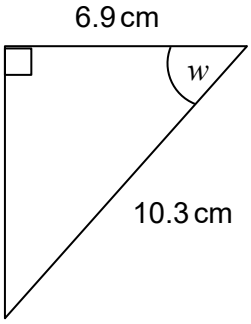
8 Circle the largest number.

[1 mark]

$6.81\dot{3}$ 6.822 $6.8\dot{2}$ 6.82

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

[3 marks]



Not drawn accurately

$w =$ _____ °

Do not write outside the box

10 Two bags contain only green discs and yellow discs.

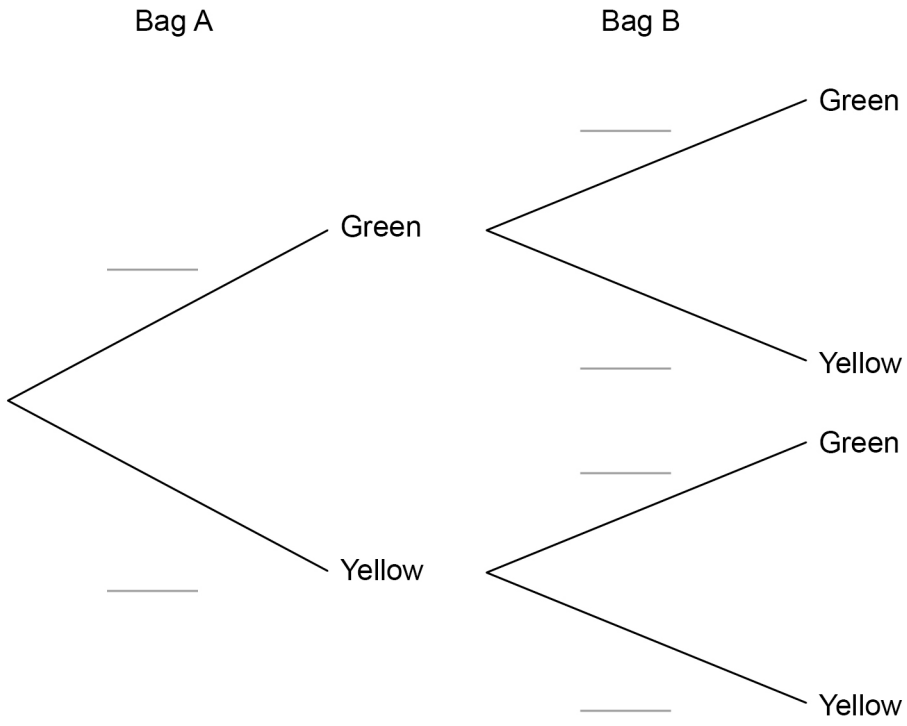
Bag A contains 2 green discs and 3 yellow discs.

Bag B contains 1 green disc and 9 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 yellow.

[2 marks]

Answer _____

8

Turn over ►

Do not write outside the box

11 Solve these simultaneous equations.

$$10x + 5y = 117$$
$$x + 5y = 18$$

[3 marks]

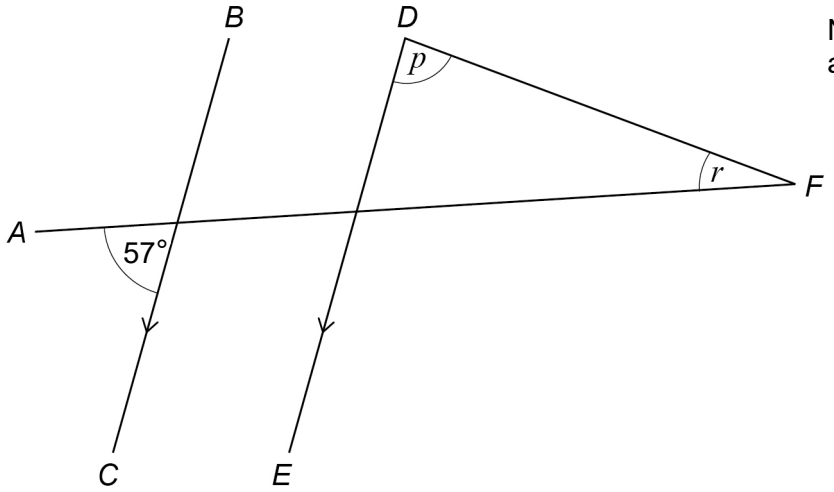
$x =$ _____ $y =$ _____

Do not write outside the box

12 *AB*, *AC*, and *AD* are straight lines.

EF and *GH* are parallel.

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



Not drawn accurately

p is two times r.

Work out the size of angle p.

[3 marks]

$p =$ _____ °

6

Turn over ►

Do not write outside the box

13 115 employees were surveyed about the time they spend commuting to their office.
The table shows information about the results.

Time, t (minutes)	Frequency
$0 \leqslant t < 5$	18
$5 \leqslant t < 15$	22
$15 \leqslant t < 30$	45
$30 \leqslant t < 60$	30

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

[1 mark]

Answer _____

13 (b) One employee is chosen at random.

Work out the probability that the employee spends **at least** 15 minutes commuting.

[1 mark]

_____

Answer _____

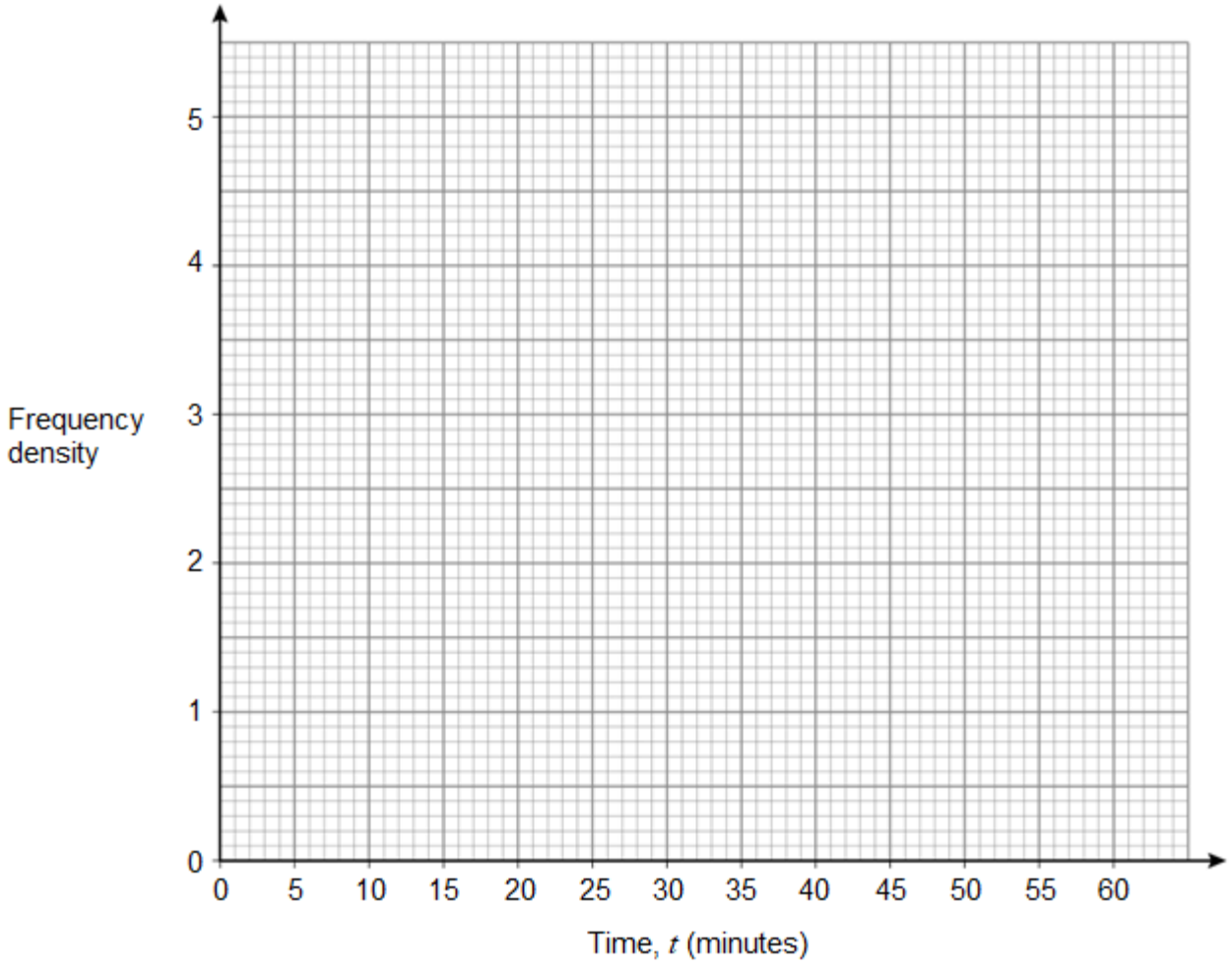
Do not write outside the box

13 (c) The table is repeated.

Time, t (minutes)	Frequency
$0 \leqslant t < 5$	18
$5 \leqslant t < 15$	22
$15 \leqslant t < 30$	45
$30 \leqslant t < 60$	30

Draw a histogram to represent the results.

[3 marks]



5

Turn over ►

Do not write outside the box

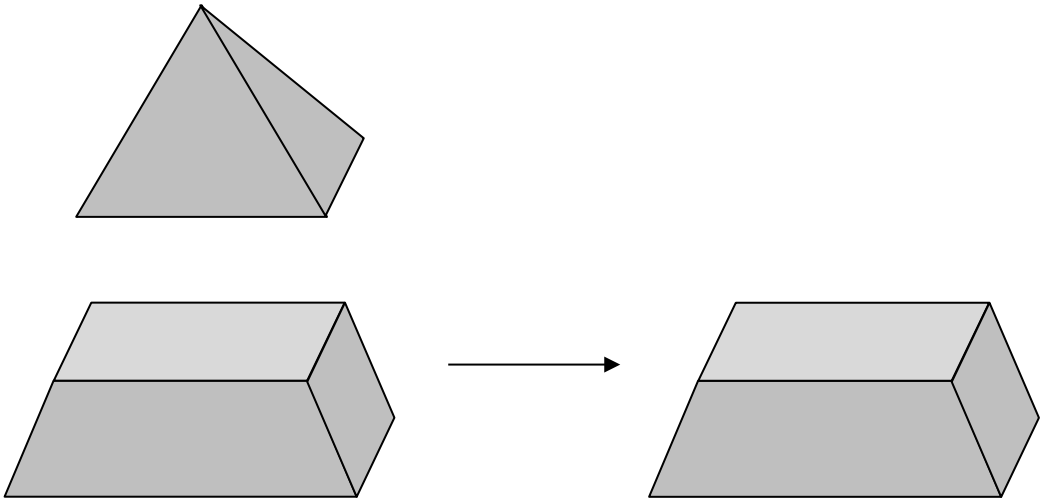
14 A solid trophy consists of a stand and a player.

Trophy

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

Large pyramid Square base, edge 12 cm Perpendicular height 18 cm

Small pyramid Square base, edge 6 cm Perpendicular height 14 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 696 cm^3

[2 marks]

14 (b) The trophy is made from a metal of density 9 grams per cm^3

The **total** mass of the trophy is 7092 grams.

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

[2 marks]

Answer _____ cm^3

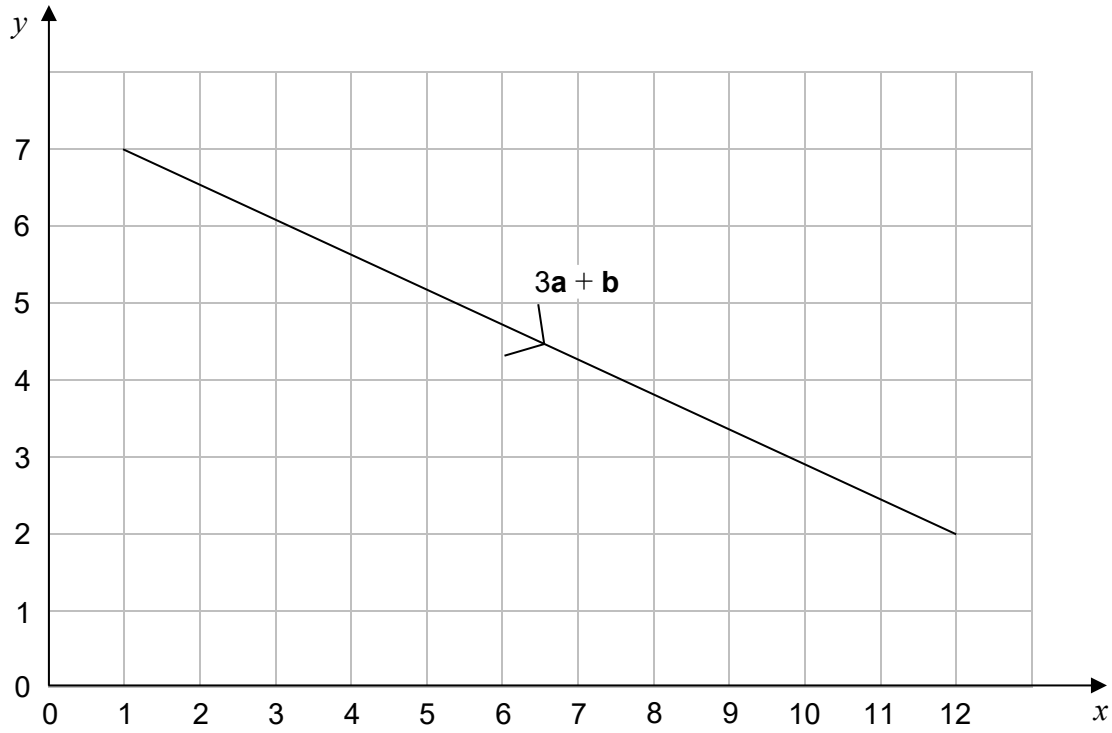
4

Turn over ►

Do not write outside the box

15 $\mathbf{a} = \begin{pmatrix} m \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -1 \\ p \end{pmatrix}$

The diagram shows the vector $3\mathbf{a} + \mathbf{b}$



Work out the values of m and p.

[4 marks]

$m =$ _____ $p =$ _____

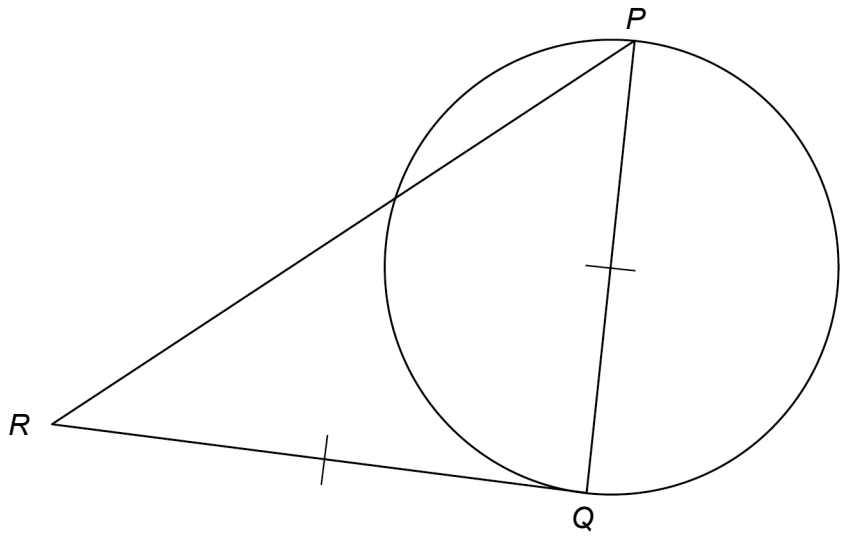
Do not write outside the box

16 PQ is a diameter of a circle.

QR is a tangent to the circle.

$PQ = QR$

$PR = 12\,\text{cm}$



Not drawn accurately

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

Give your answer as a decimal.

[3 marks]

Answer _____ cm

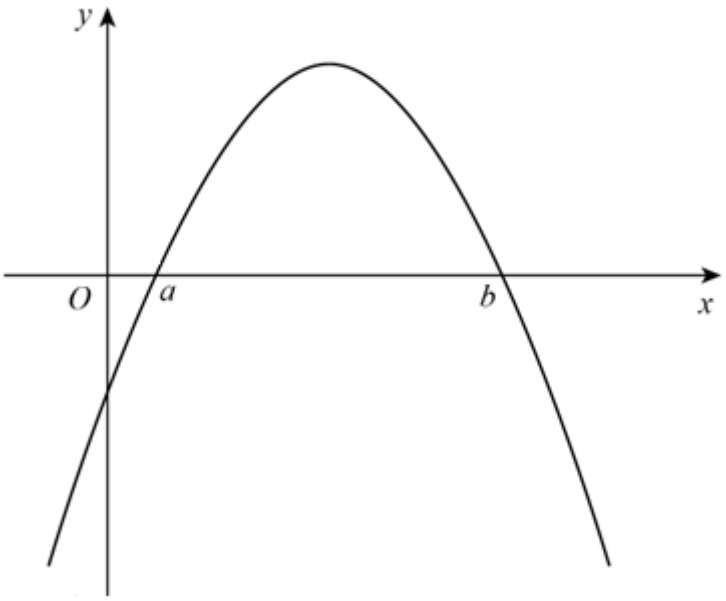
7

Turn over ►

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 _____

Do not write outside the box

18 Simplify $\dfrac{2(x+3)^6}{(x+3)^4}$

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

[3 marks]

Answer _____

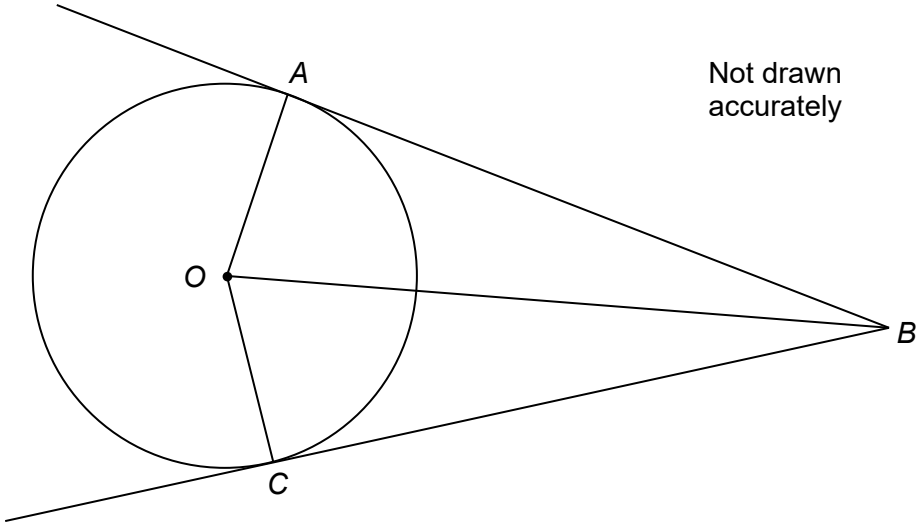
Turn over for the next question

4

Do not write outside the box

19 *A* and *C* are points on the circumference of a circle, centre *O*.

AB and *BC* are tangents to the circle.



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Prove that triangle *AOB* is congruent to triangle *COB*.
Give reasons for your answer.

[4 marks]

Do not write outside the box

20 Solve $3x(x + 8) = 7x - 24$

[4 marks]

Answer _____

Turn over for the next question

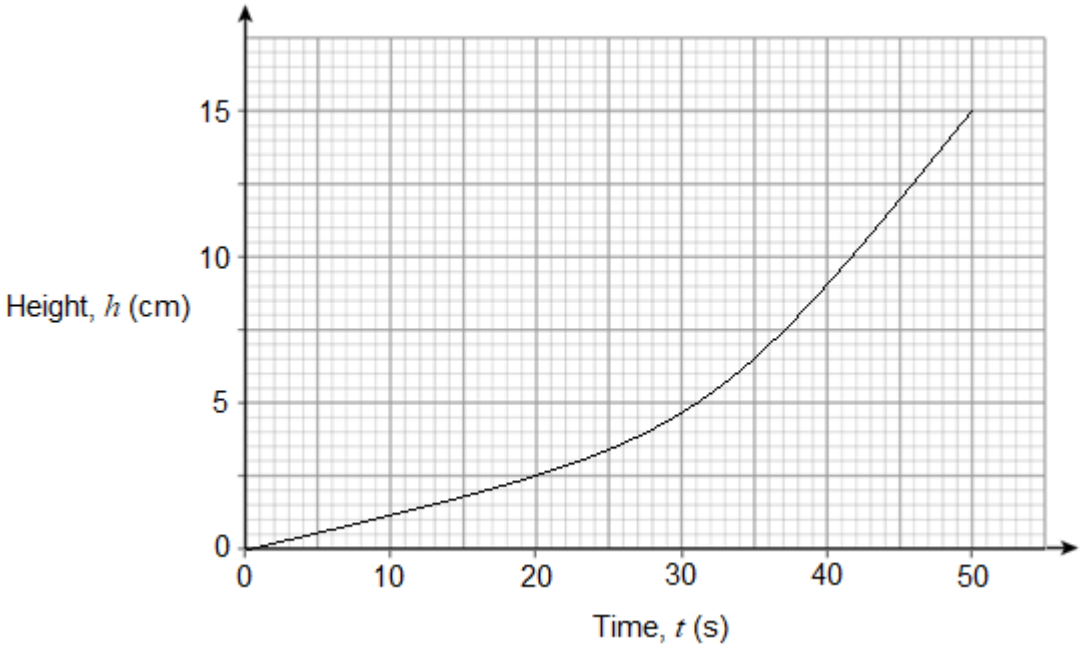
8

Do not write outside the box

21 Water is dispensed from a nozzle into a container at a constant rate.

It takes 50 seconds to fill the container completely.

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



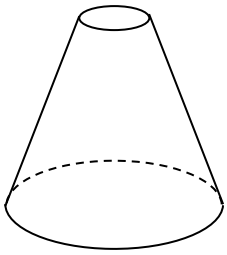
Do not write outside the box

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

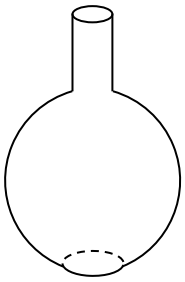
Circle the letter of the correct shape.

[1 mark]

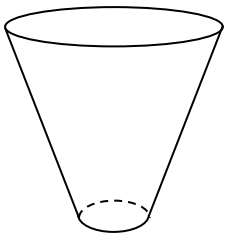
A



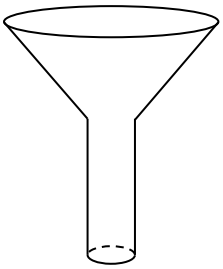
B



C



D



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 $t = 20$

[2 marks]

Answer _____ cm/s

22 Write $\frac{11}{3a^2} - \frac{7}{5a}$ as a single fraction in its simplest form.

[2 marks]

Answer _____

5

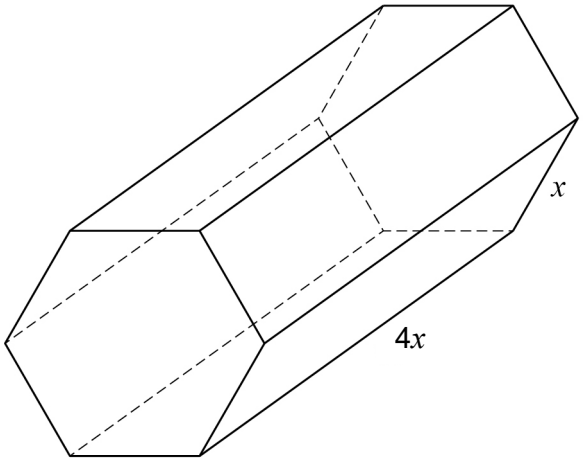
Do not write outside the box

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 $4x$



An expression for the area of the cross section, in cm^2, is $\frac{2\sqrt{5}}{3}x^2$

The **total** surface area of the box must be less than $750\,cm^2$

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

You **must** show your working.

[4 marks]

Answer _____

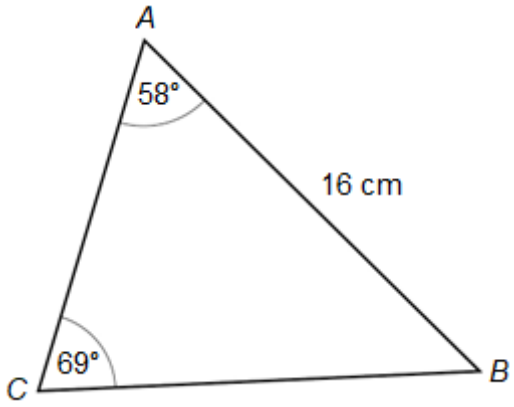
Turn over ►

Do not write outside the box

24 Work out the area of triangle *ABC*.

[4 marks]

Not drawn accurately



Answer _____ cm^2

8

Do not write outside the box

25 a is four fifths of c

$10b = 15c$

Work out the ratio $a : b : c$

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

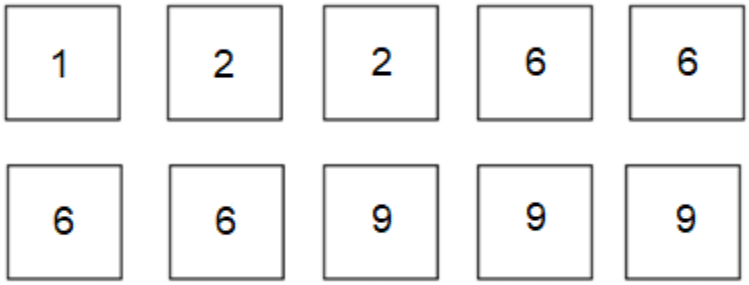
[3 marks]

Answer _____ : _____ : _____

Turn over ►

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 12

Karl plays the game once.

Work out the probability that he wins.

[4 marks]

Answer _____

7

Do not write outside the box

27 (a) The graph of $y = x^3$ is translated to the graph of $y = (x + 5)^3$

Write down the translation vector.

[1 mark]

Answer $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$

27 (b) The graph of $y = 3x - 6$ is reflected in the y-axis.

Write down the equation of the reflected graph.

[1 mark]

Answer _____

END OF QUESTIONS