Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____
I declare this is my own work.

GCSE
MATHEMATICS

H

Higher Tier Paper 3 Calculator

Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).

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	
26–27	
TOTAL	

Do not write outside the box

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

1 Circle the smallest number.

[1 mark]

4.31 $\quad 4.\dot{3} \quad$ 4.301 $\quad$ 4.33

2 Work out $\begin{pmatrix} -4 \\ 8 \end{pmatrix} - \begin{pmatrix} 3 \\ -2 \end{pmatrix}$

Circle your answer.

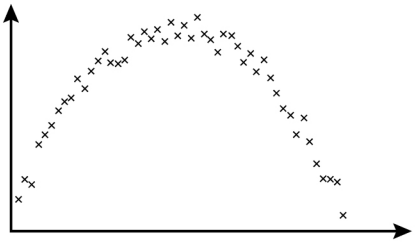
[1 mark]

$\begin{pmatrix} -7 \\ 10 \end{pmatrix} \quad \begin{pmatrix} -7 \\ 6 \end{pmatrix} \quad \begin{pmatrix} -1 \\ 10 \end{pmatrix} \quad \begin{pmatrix} -1 \\ 6 \end{pmatrix}$

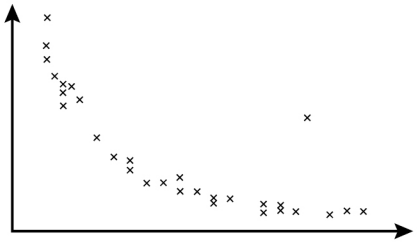
Do not write outside the box

3 Here are four scatter graphs.

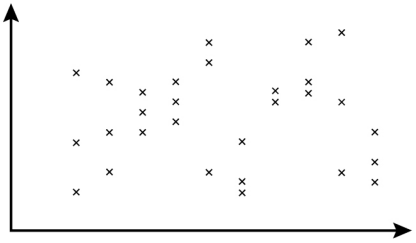
Graph A



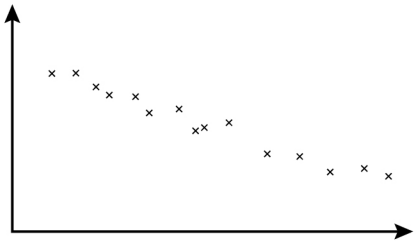
Graph B



Graph C



Graph D



3 (a) For which graph is a straight line of best fit appropriate?
Circle your answer.

[1 mark]

A B C D

3 (b) Which graph has **one** outlier?
Circle your answer.

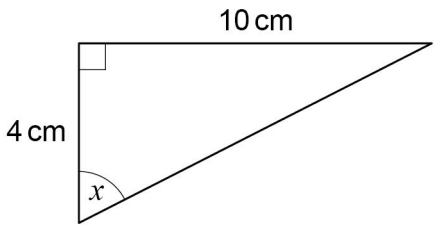
[1 mark]

A B C D

4

Do not write outside the box

4 Use trigonometry to work out the size of angle x.



Not drawn accurately

[3 marks]

$x =$ _____ °

Do not write outside the box

5 Laura works in a shop.

The table shows the number of hours she works on two weekends.

	Saturday	**Sunday**
Weekend 1	3	2
Weekend 2	$5\frac{1}{2}$	$3\frac{1}{2}$

Work out the percentage increase in her **total** hours from Weekend 1 to Weekend 2

[3 marks]

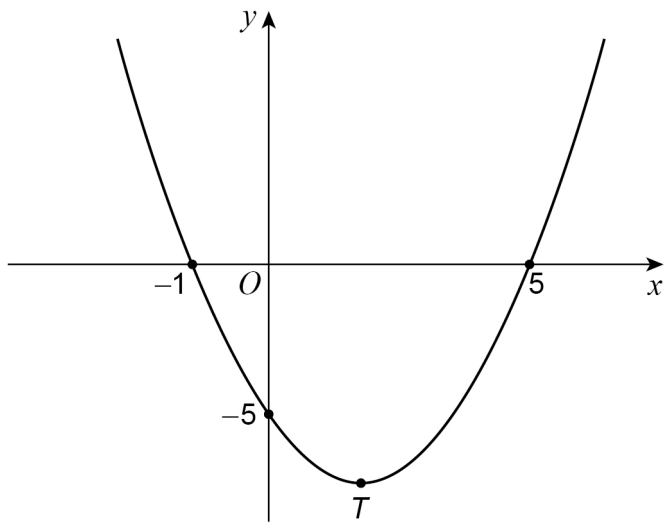
Answer _____ %

Turn over for the next question

6

Do not write outside the box

6 Here is a sketch of the curve $y = x^2 - 4x - 5$



6 (a) Write down the **two** roots of $x^2 - 4x - 5 = 0$

[1 mark]

Answer _____ and _____

6 (b) Work out the coordinates of *T*, the turning point of the curve.

[2 marks]

_____

_____

_____

Answer (_____ , _____)

Do not write outside the box

7 A is an **arithmetic** progression.

Here are the first four terms.

13 16 19 22

G is a **geometric** progression.

Here are the first four terms.

2 4 8 16

nth term of A = 8th term of G

Work out the value of n.

[4 marks]

$n =$ _____

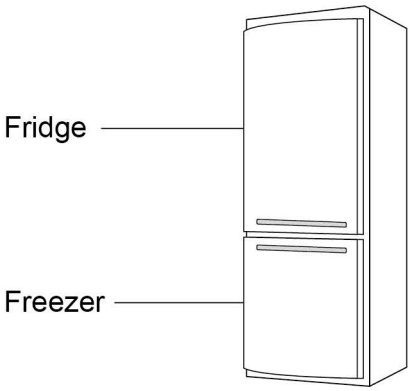
7

Turn over ►

Do not write outside the box

8 Information about two fridge-freezers, A and B, is shown.

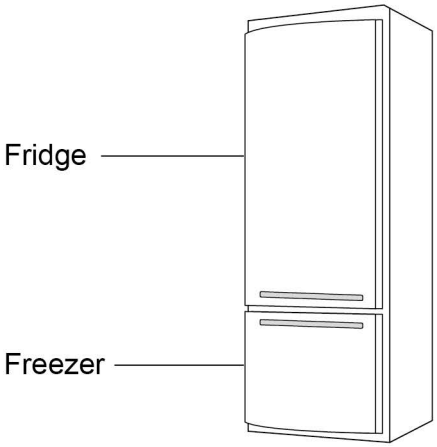
A



Total capacity is 330 litres

fridge capacity : freezer capacity = 3 : 2

B



Fridge capacity is 294 litres

fridge capacity : freezer capacity = 7 : 3

Do not write outside the box

Grace buys one of these fridge-freezers.

She buys the one with the greater **freezer** capacity.

Which one does she buy?

You **must** show your working.

[4 marks]

Answer _____

Turn over for the next question

4

Do not write outside the box

9 Tom and Adil are the two runners in a 200-metre race.

Tom completes the race in 24 seconds.

Adil completes the race at an average speed of 28.8 kilometres per hour.

Who wins the race?

You **must** show your working.

[3 marks]

Answer _____

Do not write outside the box

10 The mass of a baby is 3.6 kilograms to 1 decimal place.

What is the error interval for the mass in kilograms?

Tick **one** box.

[1 mark]

☐ $3.5 \leqslant \text{mass} \leqslant 3.6$

☐ $3.55 \leqslant \text{mass} \leqslant 3.65$

☐ $3.5 \leqslant \text{mass} < 3.6$

☐ $3.55 \leqslant \text{mass} < 3.65$

11 A quadrilateral has angles 70°, 110°, 130° and 50°

Circle the possible type of quadrilateral.

[1 mark]

kite parallelogram rhombus trapezium

Turn over for the next question

5

Do not write outside the box

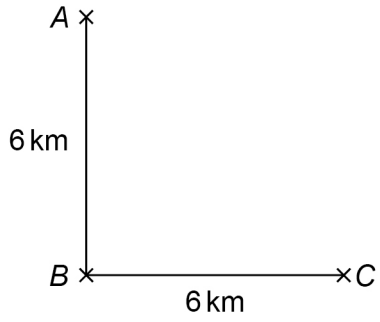
12 (a) *B* is

6 km due South of *A*

and

6 km due West of *C*.

Not drawn accurately



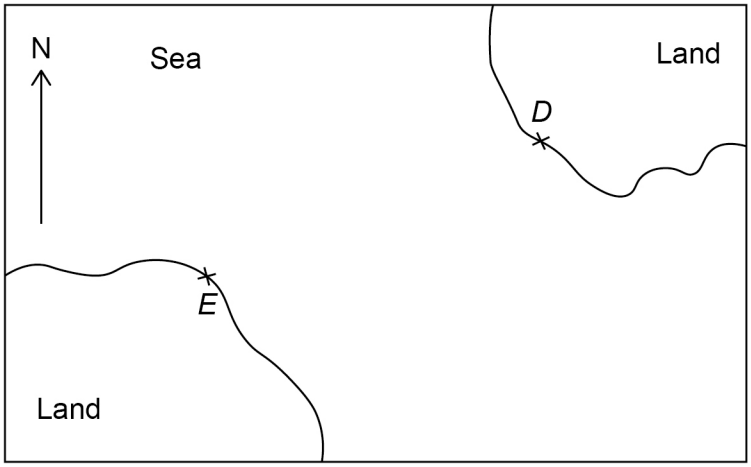
Work out the bearing of *A* from *C*.

[2 marks]

Answer _____ °

Do not write outside the box

12 (b) Here is a scale drawing.



A ship is going to sail from *D* to *E*.

Mia works out that the ship needs to sail on a bearing of 068°

Why must Mia be wrong?

[1 mark]

13 Simplify $\sqrt{5}\,a + \sqrt{5}\,a$

Circle your answer.

[1 mark]

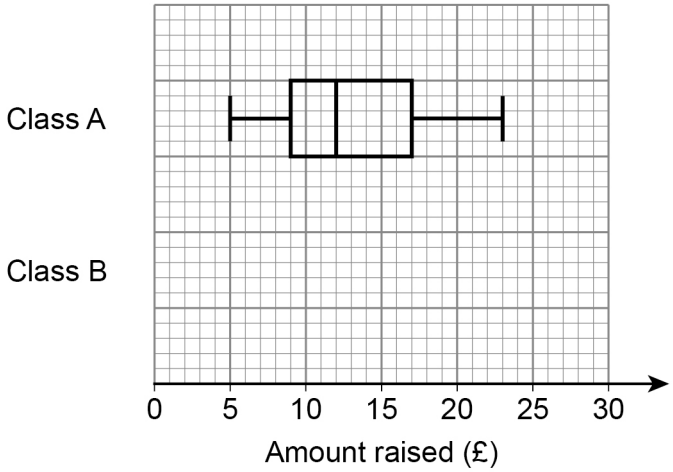
$5a$ $\quad$ $5a^2$ $\quad$ $2\sqrt{5}\,a$ $\quad$ $\sqrt{10}\,a$

4

Do not write outside the box

14 Students in two classes, A and B, raised money for charity.

The box plot for class A is shown on the grid.



For class B,

- the lowest amount was £3 and the highest amount was £26
- the lower quartile was £11
- the median was £2 greater than the class A median
- the interquartile range was $1\frac{1}{2}$ times greater than the class A interquartile range.

Draw the box plot for class B on the grid.

[4 marks]

Do not write outside the box

15 A town has

a population density of 278 people per km^2

and

a population of 158 460

$$\text{population density} = \frac{\text{population}}{\text{area}}$$

The population increases to 168 720

Work out the population density after the increase.

[3 marks]

Answer _____ people per km^2

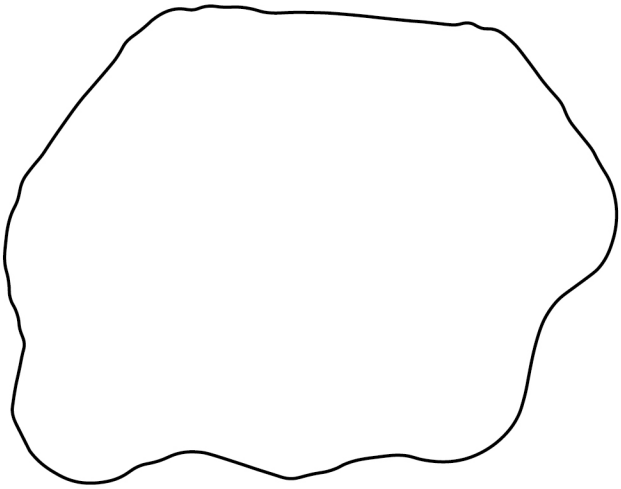
7

Turn over ►

Do not write outside the box

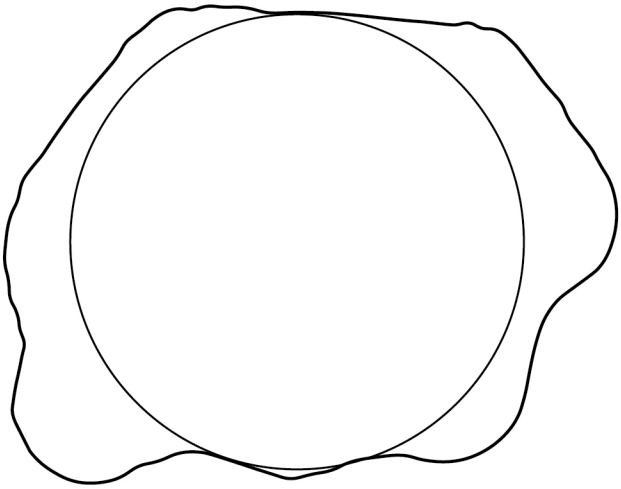
16 Here is a scale drawing of a reservoir.

Scale: 1 cm represents 500 m



Virat wants to estimate the volume of water in the reservoir.

He draws on the scale drawing a circle with radius 3 cm



Do not write outside the box

16 (a) Virat estimates the volume of the reservoir by assuming that

- the reservoir is a cylinder whose cross section is the circle
- the depth of the reservoir is 17 metres.

Work out Virat's estimate in cubic metres.

[3 marks]

Answer _____ m^3

16 (b) In fact,

- the depth of the reservoir is 13.8 metres
- the reservoir is **not** a cylinder (see diagram).

Which statement about the actual volume of the reservoir is correct?

Tick **one** box.

☐ It is less than Virat's estimate

☐ It is greater than Virat's estimate

☐ It could be less than or greater than Virat's estimate

Give a reason for your answer.

[2 marks]

5

Do not write outside the box

17 In a video game, players make their own character.

They choose one of each from

8 faces

4 bodies

5 hairstyles.

17 (a) How many different characters can be made?

[2 marks]

Answer _____

17 (b) Two characters are made at random.

What is the probability that they are exactly the same?

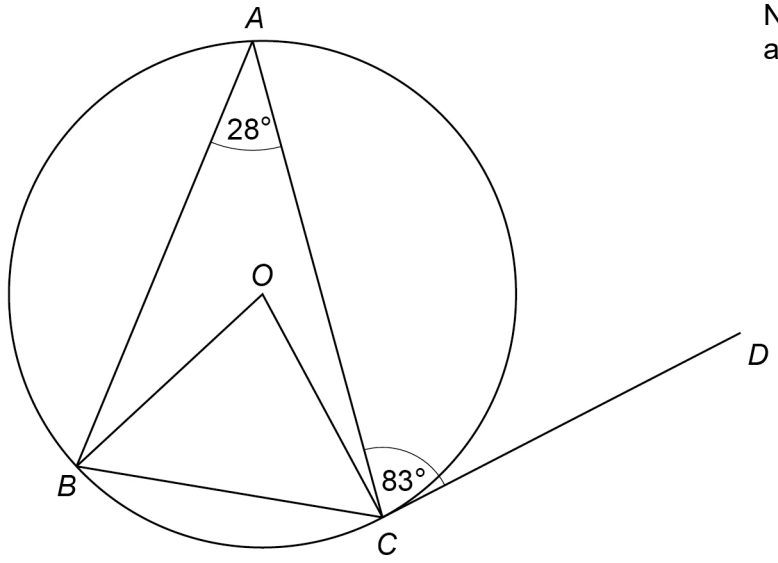
[1 mark]

Answer _____

Do not write outside the box

18 *A*, *B* and *C* are points on a circle, centre *O*.

DC is a tangent to the circle.



Not drawn accurately

Show that angle *ABO* : angle *ACO* = 3 : 1

[5 marks]

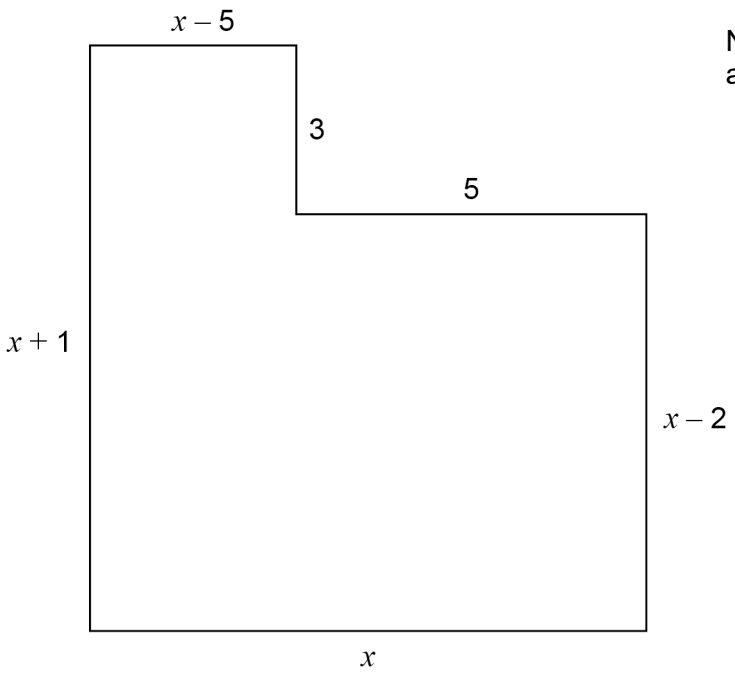
8

Turn over ►

Do not write outside the box

19 Here is the plan of the floor of an L-shaped room.

All lengths are in metres.



Not drawn accurately

19 (a) The area of the floor is $75\,\text{m}^2$

Show that $x^2 + x - 90 = 0$

[3 marks]

Do not write outside the box

19 (b) By factorising $x^2 + x - 90$ work out the value of x.

You **must** show your working

[2 marks]

$x =$ _____

20 £2448 is invested in an account at a rate of compound interest.
One year after the investment there is £2496.96 in the account.

How much is in the account four years after the investment?

[3 marks]

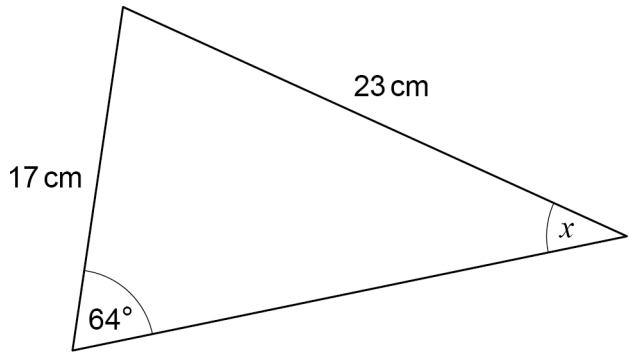
Answer £ _____

8

Turn over ►

Do not write outside the box

21



Not drawn accurately

Use the sine rule to work out the size of angle x.

[3 marks]

$x =$ _____ °

22 $f(x) = 3x$ and $g(x) = x^2$

Circle the expression for $fg(x)$

[1 mark]

$3x^2$ $9x^2$ $3x^3$ $9x^4$

Do not write outside the box

23 Here are two simultaneous equations.

$$y = x^2 + 7x - c$$

and

$$y = 3x + d$$

There is a solution when $x = 5$

Work out the value of $c + d$

[3 marks]

Answer _____

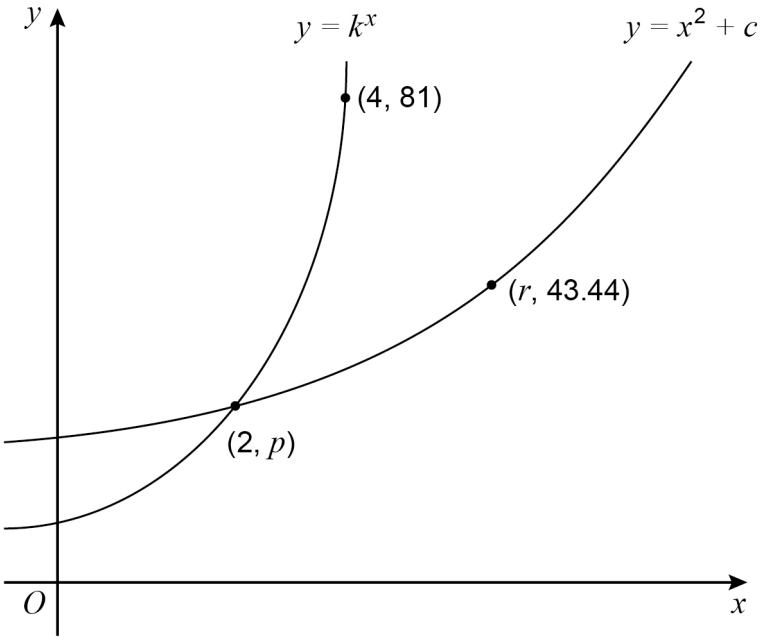
Turn over for the next question

7

Do not write outside the box

24 Here is a sketch of the graphs of $y = k^x$ and $y = x^2 + c$

k and c are positive constants.



Work out the value of r.

[4 marks]

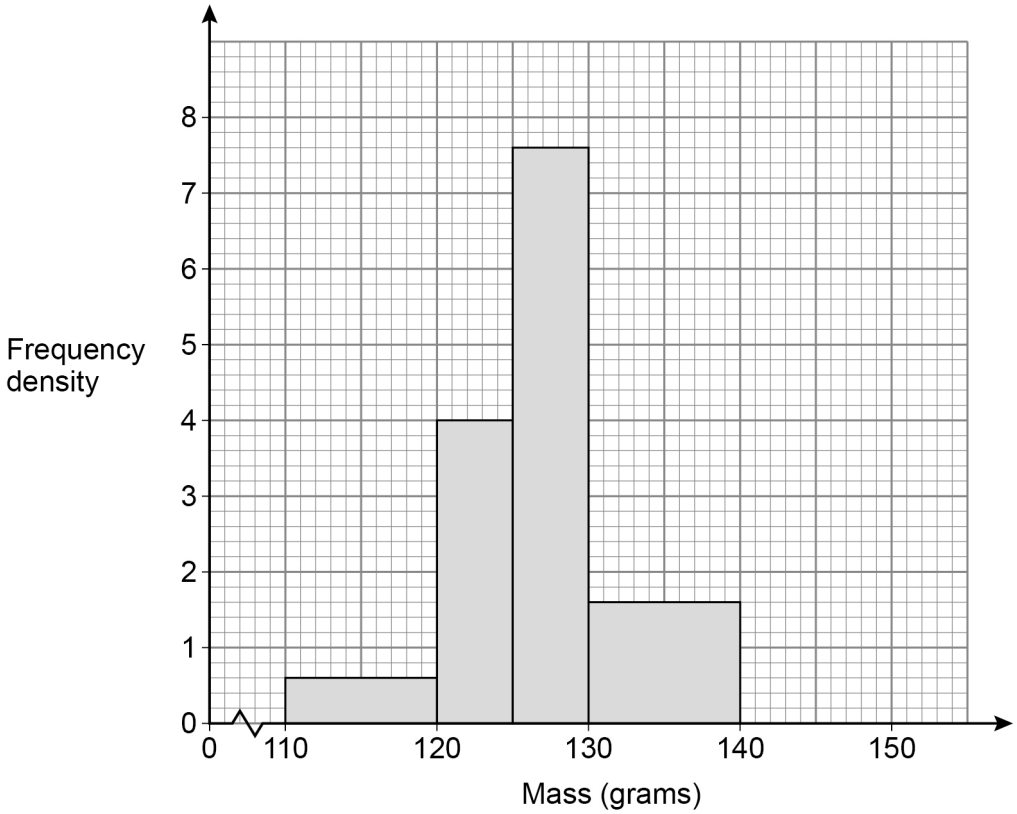
$r =$ _____

Do not write outside the box

25 A company makes tubes of toothpaste.

The masses of 80 tubes are checked.

A histogram is drawn to represent the data.



The company makes 28 000 tubes each day.

Estimate how many tubes each day have a mass **less than** 122 grams.

[4 marks]

Answer _____

8

Turn over ►

Do not write outside the box

26 Q and R are two numbers.

As a product of prime factors,

$$Q = 2^3 \times 3 \times a^3$$

$$R = 2^4 \times 3^2 \times a^2$$

26 (a) The highest common factor (HCF) of Q and R is 4056

Work out the value of a.

[2 marks]

$a =$ _____

26 (b) Work out the lowest common multiple (LCM) of Q and R.

[2 marks]

Answer _____

Do not write outside the box

27 Expand and simplify fully $(x - 3)(x - 4)(x + 8)$

[3 marks]

Answer _____

END OF QUESTIONS

7

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Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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