AQA

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I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier

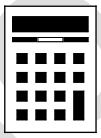
Paper 3 Calculator

Shadow paper based on November 2021 question 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 b is 4 less than the square root of a.

Circle the correct equation.

[1 mark]

$b = \sqrt{a} - 4$ $b = \sqrt{a} + 4$ $b = \sqrt{a - 4}$ $b = \sqrt{a + 4}$

2 Circle the smallest number.

[1 mark]

$0.\dot{6}$ 0.66 0.656 $0.6\dot{5}\dot{6}$

3 A line has equation $4y = 2x - 3$

Circle the coordinates of the intercept of the line with the y-axis.

[1 mark]

(0, 2) (0, –2) $\left(0, \frac{3}{4}\right)$ $\left(0, -\frac{3}{4}\right)$

Do not write outside the box

4 Factorise $y^2 - 81$

Circle your answer.

[1 mark]

$(y + 9)^2$ $(y - 9)^2$ $(y + 9)(y - 9)$ $y(y - 81)$

5 Five positive numbers have

a mean of 8

a range of 10

Three of the numbers are 3 7 12

Work out the other two numbers.

[3 marks]

Answer _____ and _____

7

Turn over ►

Do not write outside the box

6 At an adventure park there is a zoo, a fair and a cafe.

The table shows the prices per person to visit the park.

	Price per person
Cafe only	Free
Zoo and fair	£27.50
Zoo only	£18
Fair only	£17

One day, 4200 people visit the adventure park.

67 visit the cafe **only**.

45% visit the zoo **and** the fair.

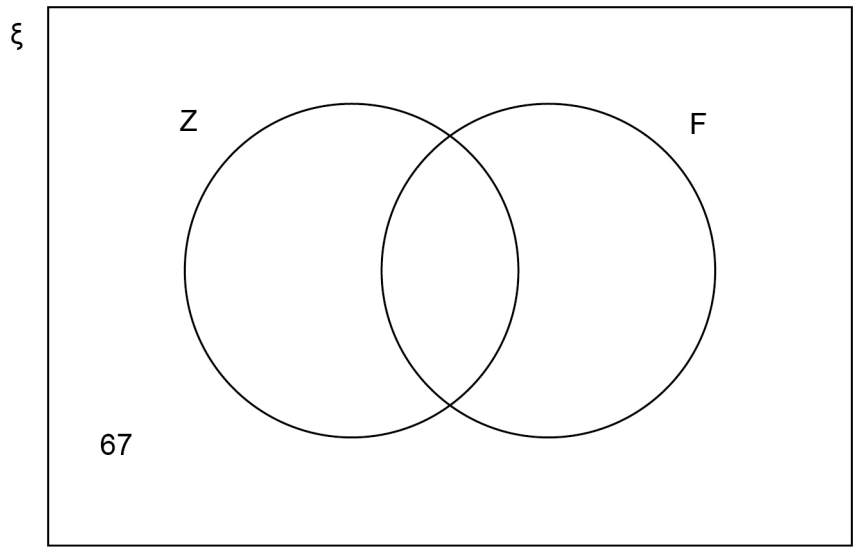
$\frac{2}{7}$ visit the zoo **only**.

The rest visit the fair **only**.

In total, how much do the 4200 people pay to visit the adventure park?

You may use the Venn diagram to help you.

[5 marks]



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Answer £ _____

7 Adam and Kitty share £312 in the ratio Adam : Kitty = 3.8 : 1

How much **more** than Kitty does Adam get?

[3 marks]

Answer £ _____

8

Turn over ►

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8 A widget compressor exerts a pressure of 258 pounds per square inch.

Convert this pressure into kilograms per square centimetre.

Use

1 pound = 0.45 kilograms

1 square inch = 6.25 square centimetres

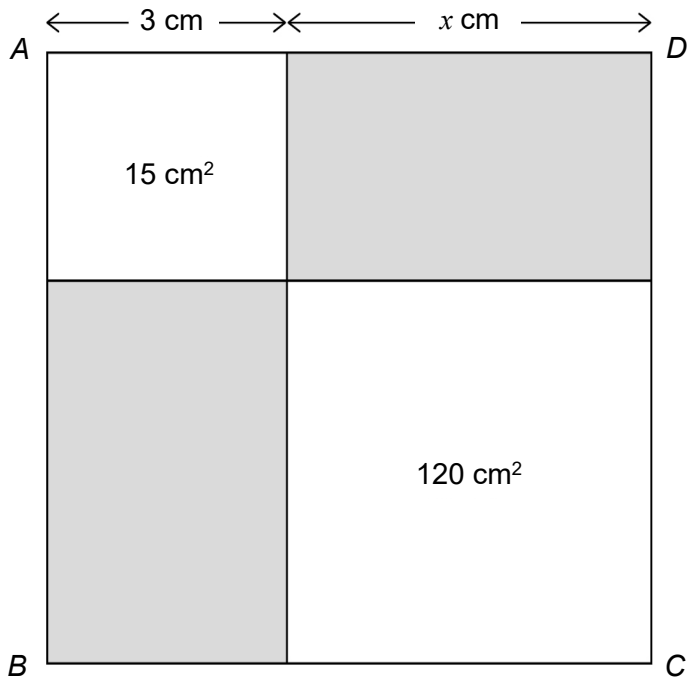
[3 marks]

Answer _____ kg/cm^2

Do not write outside the box

9 Square *ABCD* is split into four smaller rectangles.

Two of the smaller rectangles are shaded.



Not drawn accurately

$3 : x = 1 : 4$

For square *ABCD*, work out the ratio shaded area : unshaded area

Give your answer in its simplest form.

[4 marks]

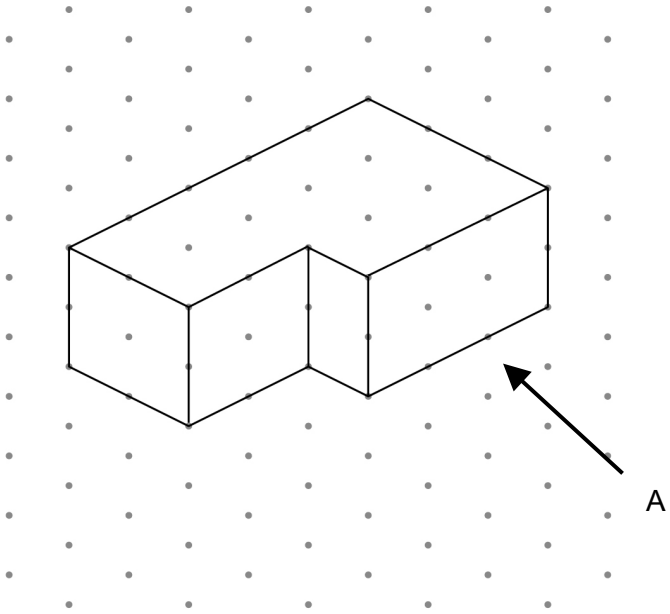
Answer _____ : _____

7

Turn over ►

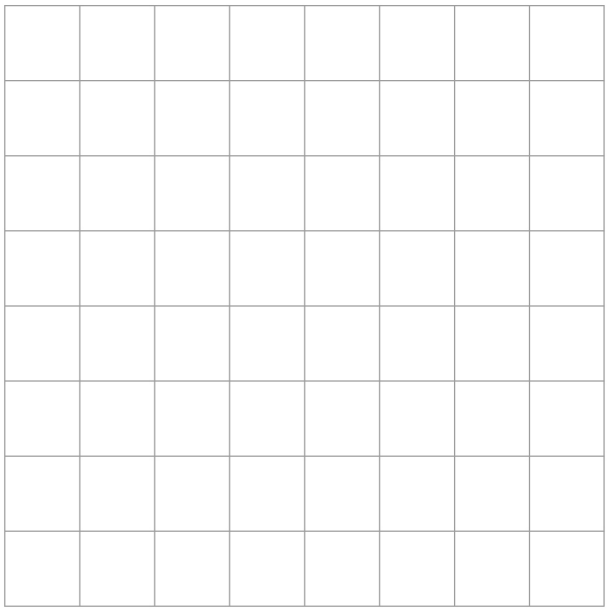
Do not write outside the box

10 A solid shape is drawn on isometric paper.



10 (a) On the centimetre grid, draw the elevation of the shape from A.

[1 mark]



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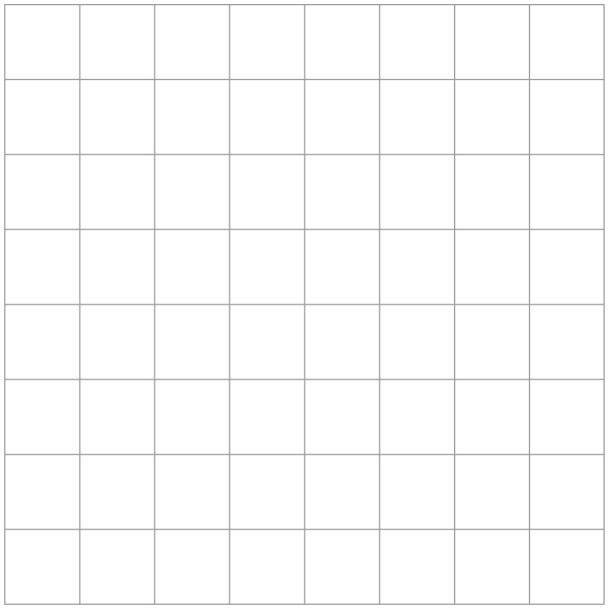
10 (b) On the centimetre grid, draw a plan of the shape.

[1 mark]



11 Eloise thinks of a prime number between 30 and 40

Her number is x% of 121

Work out **one** possible value of x.

[3 marks]

Answer _____

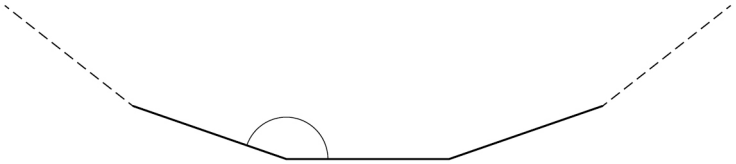
5

Turn over ►

Do not write outside the box

12 Part of a regular polygon with 20 sides is shown.

Not drawn accurately



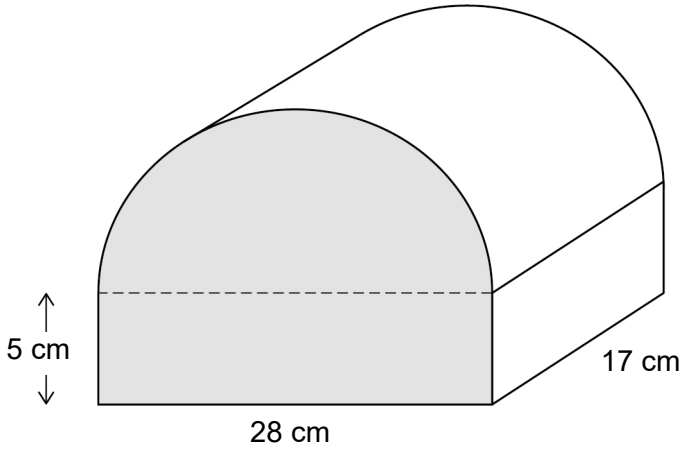
Work out the size of an **interior** angle.

[2 marks]

Answer _____ degrees

Do not write outside the box

13 A box is the shape of half a cylinder on top of a cuboid.



Work out the volume of the box.

[4 marks]

Answer _____ cm^3

6

Turn over ►

Do not write outside the box

14 James sells bathroom tiles.

He increases the original price of each tile by 15% to £13.80

A month later he announces a sale.

James says,

"The tiles will be back to their original price, because each change was by 15%"

Is he correct?

Tick a box.

☐ Yes ☐ No

Show working to support your answer.

[3 marks]

Do not write outside the box

15 A biased spinner can land on A, B or C.

The table shows the probabilities, in terms of k, of A, B and C.

	A	**B**	**C**
Probability	$3.3k$	$6k - 0.25$	$0.7k$

Work out the probability of B.

[3 marks]

Answer _____

Turn over for the next question

6

Turn over ►

Do not write outside the box

16 *P* is the point (6, 15)

Q is the point (8, 12)

R is the point (5, 10)

Use gradients to show that angle *PQR* is a right angle.

[3 marks]

Do not write outside the box

17 $\frac{m^2}{2} > 18$

Circle the possible value of m.

[1 mark]

$-5\frac{7}{8}$ 5.8 6 $-\frac{13}{2}$

18 Simplify $x^2 \times w^0$

Circle your answer.

[1 mark]

x^2w w^2 xw x^2

19 The equation of a circle is $x^2 + y^2 = 17$

Work out the length of the **diameter**.

Circle your answer.

[1 mark]

$\sqrt{17}$ $2\sqrt{17}$ $\sqrt{34}$ 34

Turn over for the next question

6

Turn over ►

Do not write outside the box

20 $\frac{a}{b} = 5c$

$\frac{b}{c} = 3$

Work out the value of a when $c = 6$

[3 marks]

Answer _____

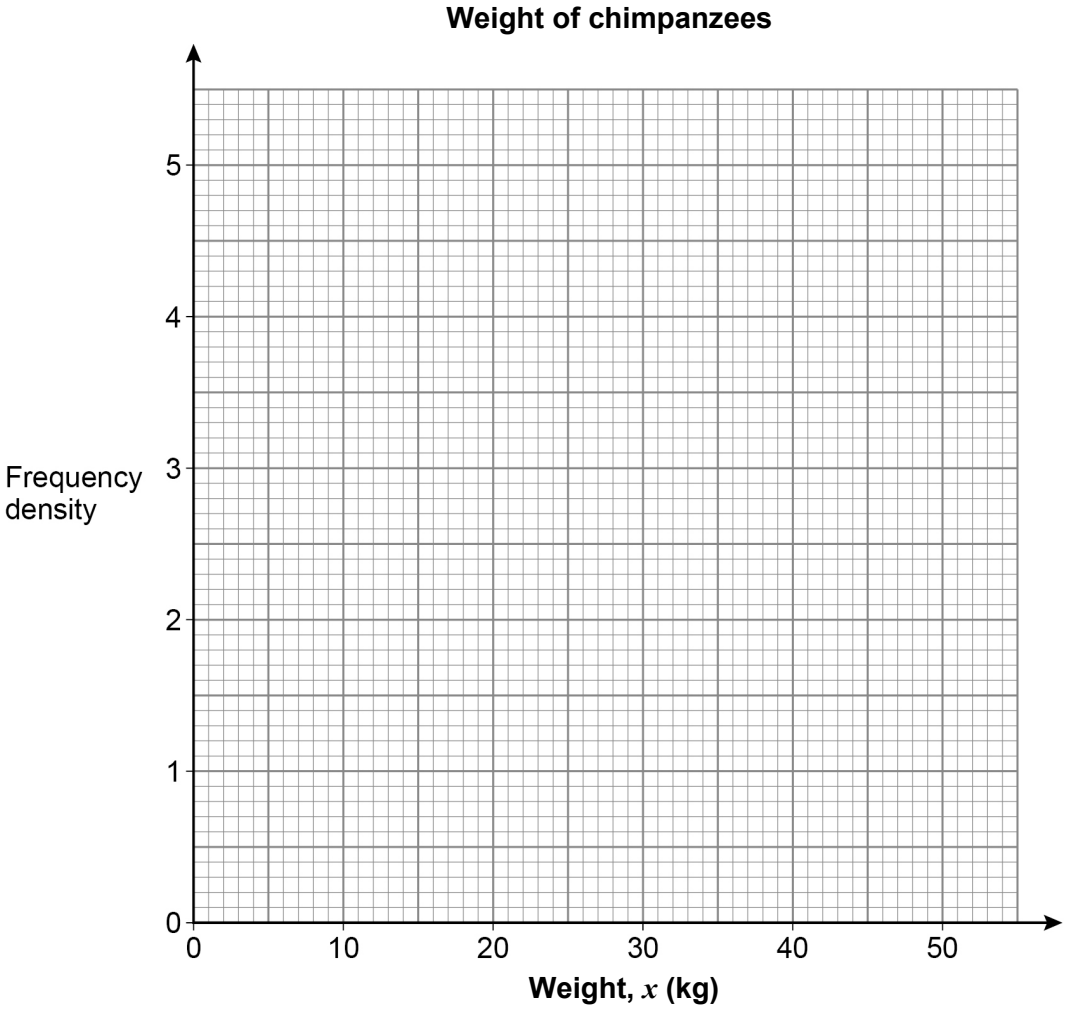
Do not write outside the box

21 Here is some information about the weights of chimpanzees in a forest.

Weight, x (kg)	Frequency		
$0 \leq x < 20$	20		
$20 \leq x < 25$	23		
$25 \leq x < 35$	27		
$35 \leq x < 50$	33		

Draw a histogram to represent the information.

[4 marks]



7

Turn over ►

Do not write outside the box

22 A sequence of patterns is made using horizontal sticks and vertical sticks.

Pattern 1 Pattern 2 Pattern 3

The table shows the number of horizontal sticks and vertical sticks in each pattern.

Pattern	Number of horizontal sticks	Number of vertical sticks
1	2	2
2	4	3
3	6	4

What fraction of the total number of sticks in Pattern n are vertical?

Give your answer in terms of n.

[3 marks]

Answer _____

Do not write outside the box

23 The equation of a curve is $y = 3^{2x}$

23 (a) Circle the point that lies on the curve.

[1 mark]

(2, 27) (27, 2) (2, 81) (81, 2)

23 (b) A different point on the curve has y-coordinate $\frac{1}{3}$

Work out the x-coordinate.

[1 mark]

Answer _____

24 $a^b = 5$ where a is an integer and b is a proper fraction.

Work out **one** possible pair of values of a and b.

[1 mark]

$a =$ _____ $b =$ _____

6

Turn over ►

Do not write outside the box

25 Expand and simplify fully $(2x + 2)(x - 3)(x - 4)$

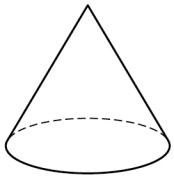
[3 marks]

Answer _____

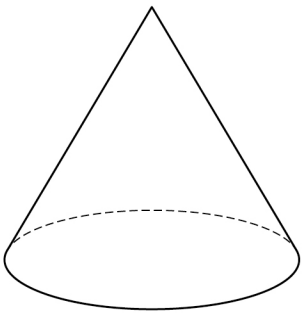
Do not write outside the box

26 Here are two similar cones.

Cone A



Cone B



The surface area of cone A is 5 m^2

The surface area of cone B is 7.2 m^2

Work out the ratio radius of cone A : radius of cone B

Give your answer in the form 1 : n

[3 marks]

Answer _____ : _____

6

Turn over ►

Do not write outside the box

27 In the diagram

$\overrightarrow{DE} = \mathbf{a}$

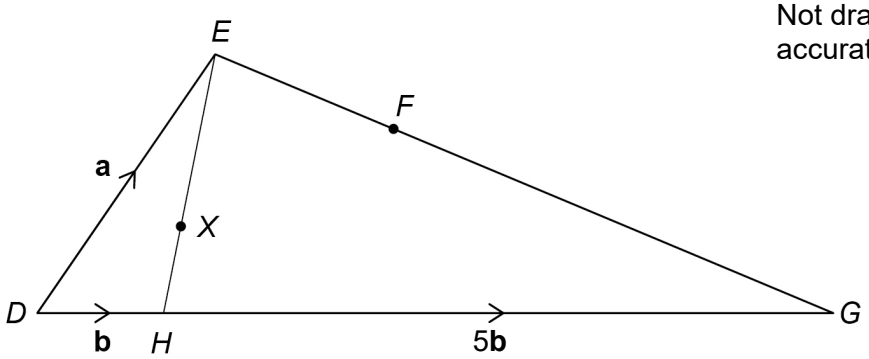
$\overrightarrow{DH} = \mathbf{b}$

$\overrightarrow{HG} = 5\mathbf{b}$

$EX : XH = 3 : 2$

$EF : FG = 1 : 4$

Not drawn accurately



27 (a) Show that $\overrightarrow{DX} = \frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$

[2 marks]

Do not write outside the box

27 (b) Is *DXF* a straight line?

Show working to support your answer.

[4 marks]

Turn over for the next question

6

Do not write outside the box

28 $a = 5.83$ to 3 significant figures.

$b = 116$ to 3 significant figures.

Work out the lower bound of $\frac{a}{b}$

You **must** show your working.

[3 marks]

Answer _____

Do not write outside the box

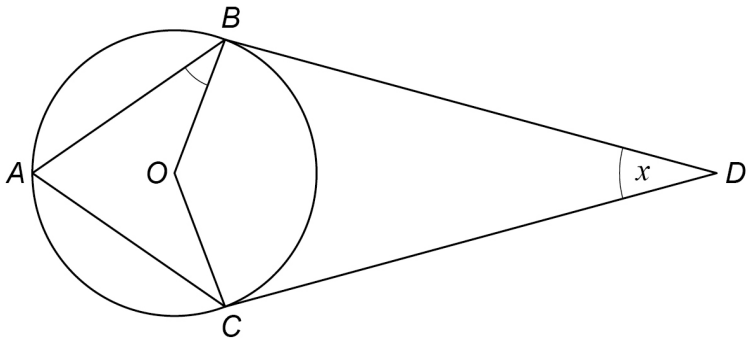
29 *A*, *B* and *C* are three points on the circumference of a circle, centre *O*.

BD and *CD* are tangents to the circle.

ABDC is a kite.

Angle *BDC* is x

Not drawn accurately



Find an expression for the size of angle *ABO*. Give a reason for each stage of your working.

[4 marks]

7

Turn over ►

Do not write outside the box

30 A sphere has radius r cm

An approximate value of r can be found using the iterative formula

$$r_{n+1} = \sqrt{\frac{141}{r_n}}$$

The starting value is $r_1 = 5$

30 (a) Work out the values of r_2 and r_3

[2 marks]

$r_2 =$ _____

$r_3 =$ _____

30 (b) Continue the iteration to work out the radius to 1 decimal place.

[1 mark]

Answer _____ cm

END OF QUESTIONS

3

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