AQA

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

Monday 10 June 2024 Morning 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	
TOTAL	

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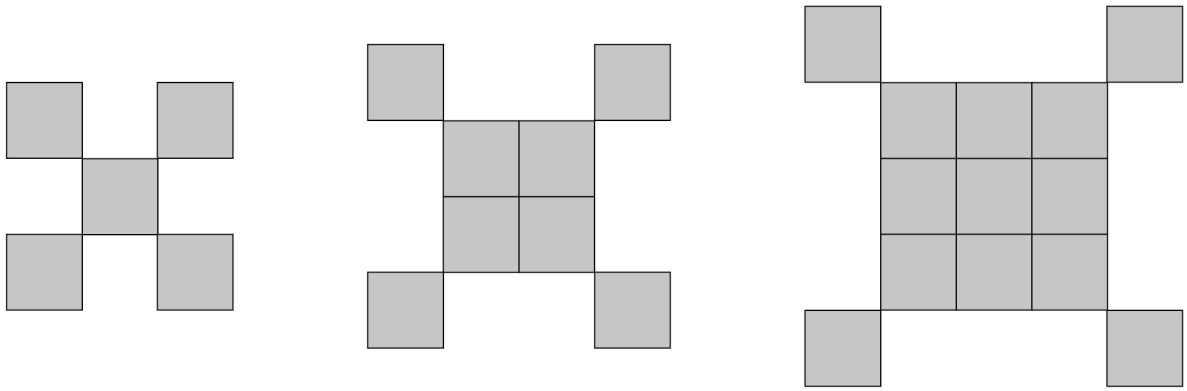
Answer **all** questions in the spaces provided.

1 Here are the first three Patterns in a sequence made up of small squares.



Pattern 1 Pattern 2 Pattern 3

1 (a) On the grid, draw Pattern 4

[1 mark]

Do not write outside the box

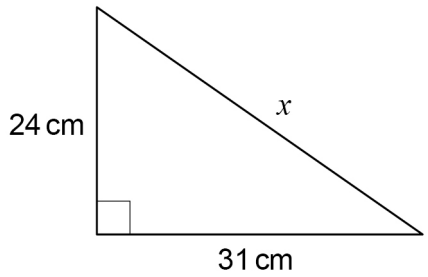
1 (b) The expression for the number of small squares in Pattern n is $n^2 + 4$

Work out the least value of n for which the number of small squares is greater than 500

[1 mark]

$n =$ _____

2



Not drawn accurately

Use Pythagoras' theorem to work out the value of x.

Give your answer as a decimal.

[3 marks]

Answer _____ cm

5

Turn over ►

Do not write outside the box

3 Rick claims most of the flats in his 8-floor building are energy efficient.

He samples 45 flats from floors 1 to 5

Give a reason why this sample may **not** be useful in testing Rick's claim.

[1 mark]

4 $3(x - 1) \equiv 3x - 3$ is an identity.

Tick **one** box.

[1 mark]

☐ It is true for **all** values of x

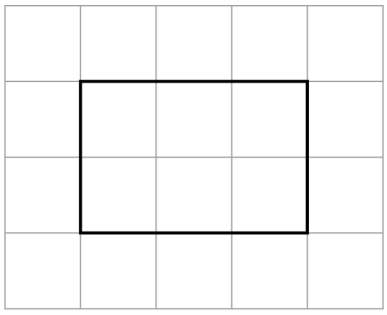
☐ It is true for **some** values of x

☐ It is true for **no** values of x

Do not write outside the box

5 The front elevation of a cuboid is shown on this centimetre grid.

Front elevation

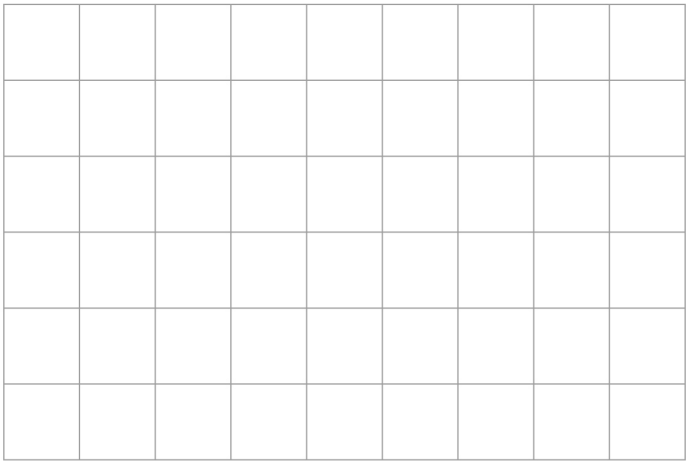


The volume of the cuboid is $42\,\text{cm}^3$

Draw the **side elevation** on this centimetre grid.

[2 marks]

Side elevation



4

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6 (a) On Monday, Larrs swims 50 metres in 40 **seconds** at a constant speed.
On Tuesday, Larrs swims 1.5 kilometres.

Assume he swims at the same constant speed as on Monday.

How many **minutes** does he swim for on Tuesday?

[5 marks]

Answer _____ minutes

6 (b) In fact, on Tuesday Larrs swims at a slower constant speed than on Monday.

What does this mean about the number of minutes he swims for on Tuesday?
Tick the correct box.

[1 mark]

☐ It is less than the answer to part (a)

☐ It is the same as the answer to part (a)

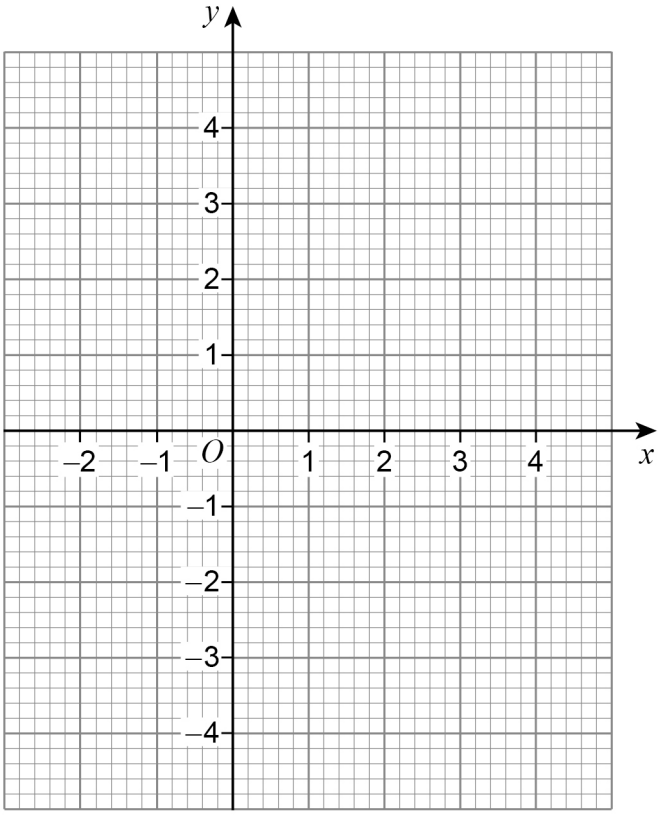
☐ It is greater than the answer to part (a)

☐ It is not possible to say

Do not write outside the box

7 Draw the graph of $y = 1 - \frac{1}{2}x$ for values of x from –2 to 4

[3 marks]



9

Turn over ►

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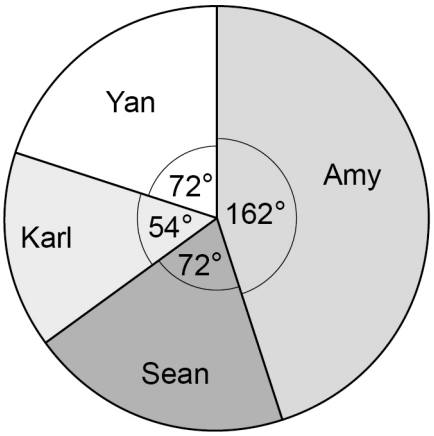
8 Four people are taking part in a television talent show.

Here are Amy's marks from the 6 judges.

8	9	9	6	9	10

The pie chart represents the phone vote.



Amy's total score is found by

4 × the **mean** of her marks

+

her **percentage** of the phone vote

Do not write outside the box

Work out Amy's total score.

[4 marks]

Answer _____

Turn over for the next question

4

Do not write outside the box

9 Town A has

a population of 84 000

an area of 7 **square miles**.

Town B has a population density of 4695 people per **square kilometre**.

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

Which town has the greater population density?

Use 1 square mile = 2.6 square kilometres

Tick a box.

Town A ☐ Town B ☐

Show working to support your answer.

[3 marks]

Do not write outside the box

10 On a biased dice,

$$P(\text{lands on } 6) = 0.38$$

This dice is rolled 150 times.

How many times would you expect the dice **not** to land on 6 ?

[3 marks]

Answer _____

Turn over for the next question

6

Do not write outside the box

11 Write a number in each box to make the calculations correct.

[2 marks]

$$\boxed{10} \div \boxed{-2} \times \boxed{} = \boxed{5}$$

$$\boxed{\frac{1}{3}} \times \boxed{} \times \boxed{6} = \boxed{8\pi}$$

Do not write outside the box

12 Cards are either gold or not gold.

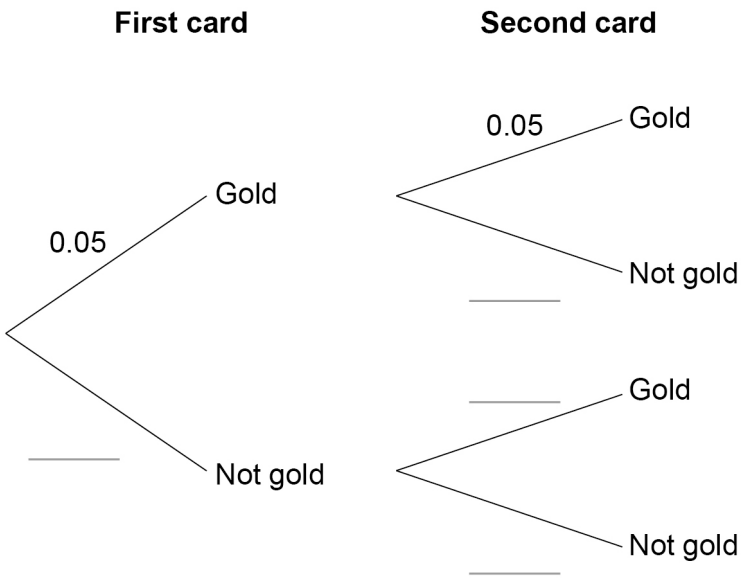
P(gold) = 0.05

Harim chooses a card at random and replaces it.

He then chooses a second card.

12 (a) Complete the tree diagram.

[2 marks]



12 (b) What is the probability that **at least one** of Harim's cards is gold?

[3 marks]

Answer _____

7

Turn over ►

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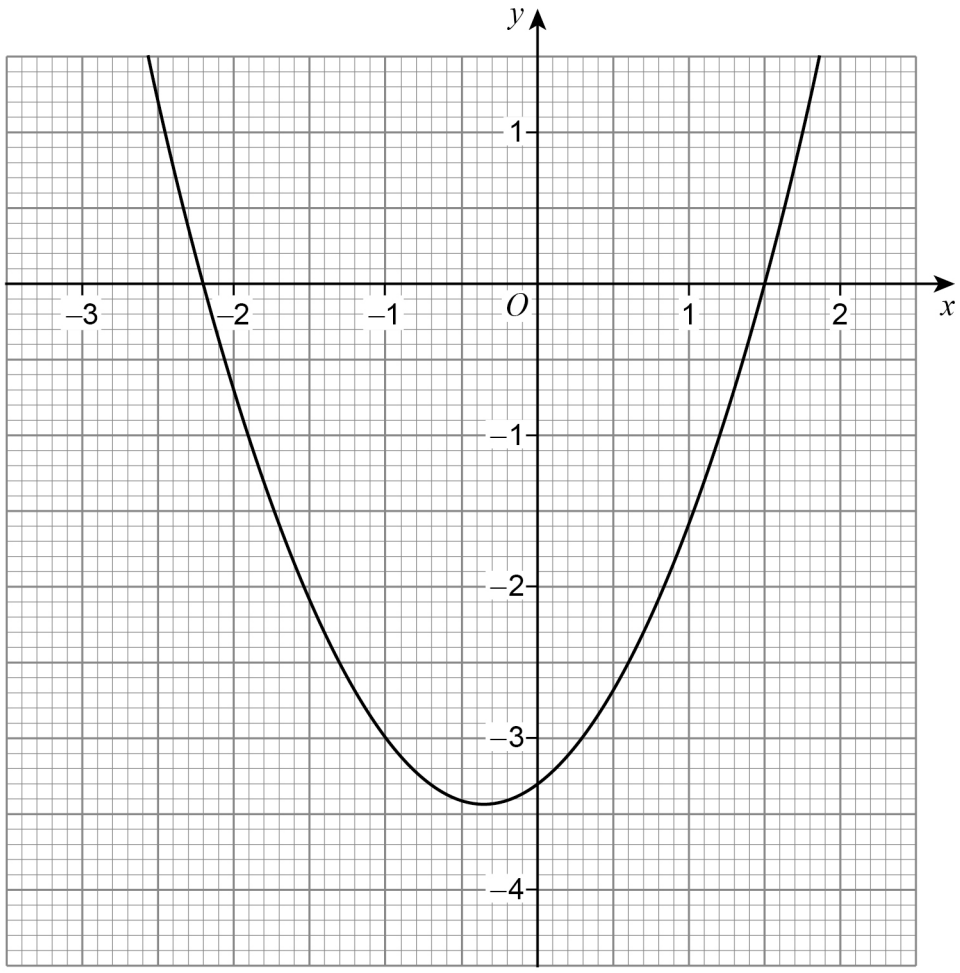
13 Here is a quadratic graph with equation $y = \mathrm{f}(x)$



Write down the roots of the equation $\mathrm{f}(x) = 0$

[2 marks]

Answer _____

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14

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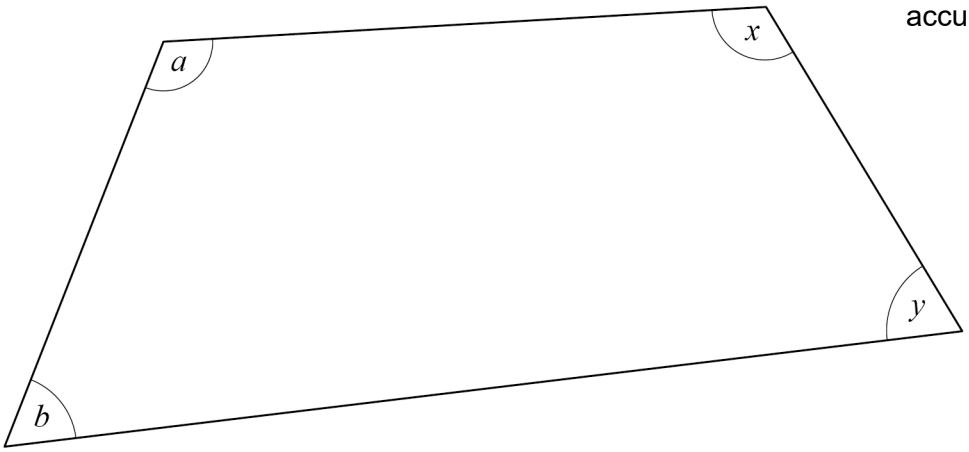


$b = 45°$ and $a : b = 7 : 3$ and $x : y = 4 : 1$

Show that $a : y = 5 : 2$

[3 marks]

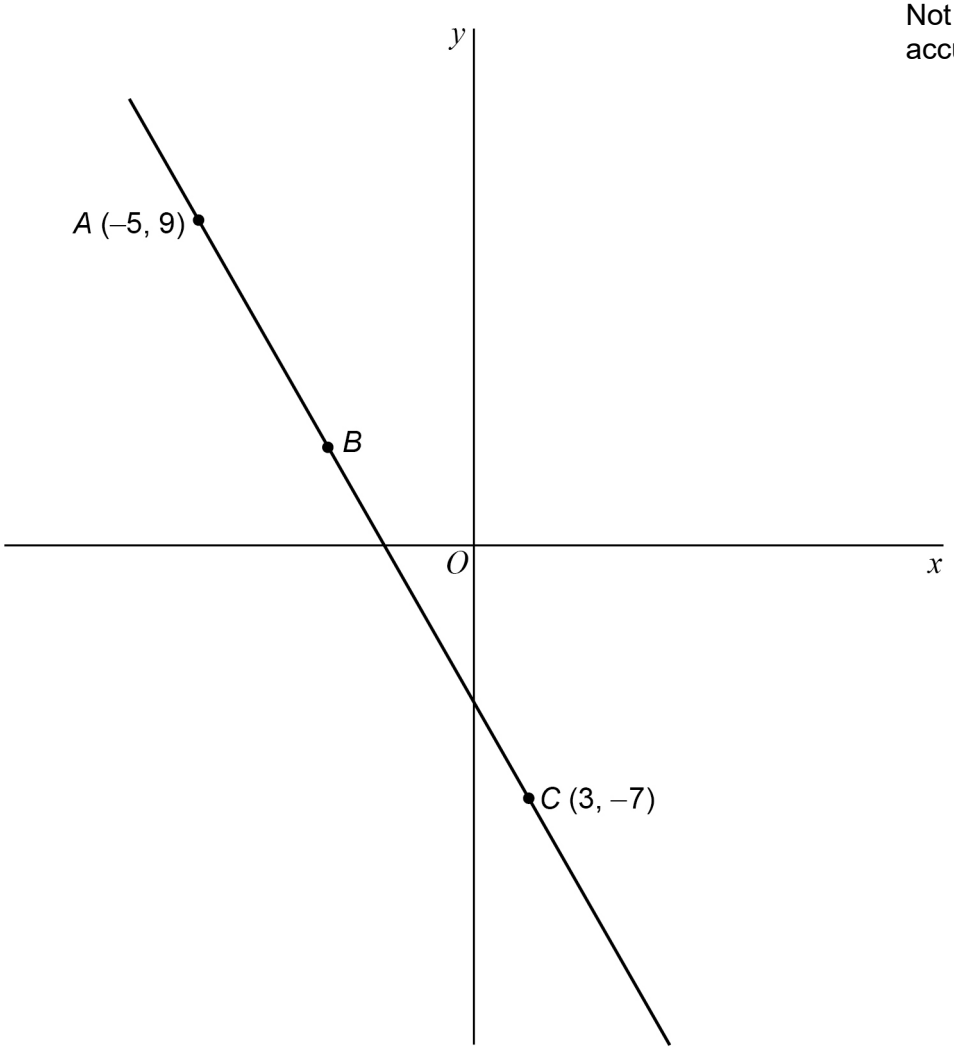
5

Turn over ►

Do not write outside the box

15 A straight line passes through points A (–5, 9), B and C (3, –7).

Not drawn accurately



15 (a) $AB : BC = 1 : 3$

Work out the coordinates of point B.

[3 marks]

Answer (_____ , _____)

Do not write outside the box

15 (b) Work out the equation of the line perpendicular to *AC* that passes through *C*.

[4 marks]

Answer _____

Turn over for the next question

7

Do not write outside the box

16 Jing rolls a fair six-sided dice 72 times.

	1	**2**	**3**	**4**	**5**	**6**
Frequency	16	11	10	8	14	13

Is the relative frequency of rolling a 5 greater than the theoretical probability?

Tick a box.

Yes ☐ No ☐

Give a reason for your answer.

[3 marks]

Do not write outside the box

17 (a) a and b are different prime numbers.

$a^3 \times b^2 = 200$

Work out the value of $a^4 \times b$

[3 marks]

Answer _____

17 (b) c and d are different prime numbers.

Circle the equation for which $c^4 \times d^2 \times e$ is a cube number.

[1 mark]

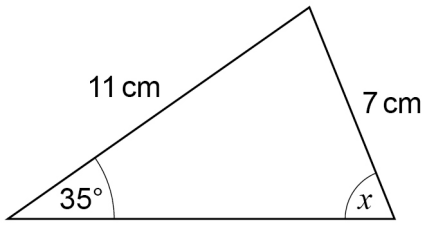
$e = cd$ $\quad$ $e = c^2d$ $\quad$ $e = c^2d^2$ $\quad$ $e = c^3d^3$

Turn over for the next question

7

Do not write outside the box

18 Here is triangle A.



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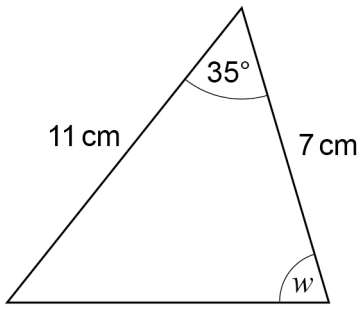
18 (a) Use the sine rule to show that $x = 64°$ to the nearest degree.

[3 marks]

Do not write outside the box

18 (b) Here is triangle B.



Not drawn accurately

Anna thinks that w must be 64° to the nearest degree.

She says,

"This is because triangle B has two sides and one angle the same as triangle A."

Without further calculation, is she correct?

Tick a box.

Yes ☐ No ☐

Give a reason for your answer.

[1 mark]

Turn over for the next question

4

Do not write outside the box

19 $f(x) = x - 3 \quad g(x) = 4x - 7$

19 (a) Work out the value of fg(6)

[2 marks]

Answer _____

19 (b) Solve $(f(x))^2 = g(x)$

[4 marks]

Answer _____

Do not write outside the box

20 P, Q, and R have positive values.

P is directly proportional to Q

When $P = 8$, $Q = 2$

R is inversely proportional to Q^2

When $R = 10$, $Q = 3$

Work out the value of R when $P = 0.5$

[5 marks]

$R =$ _____

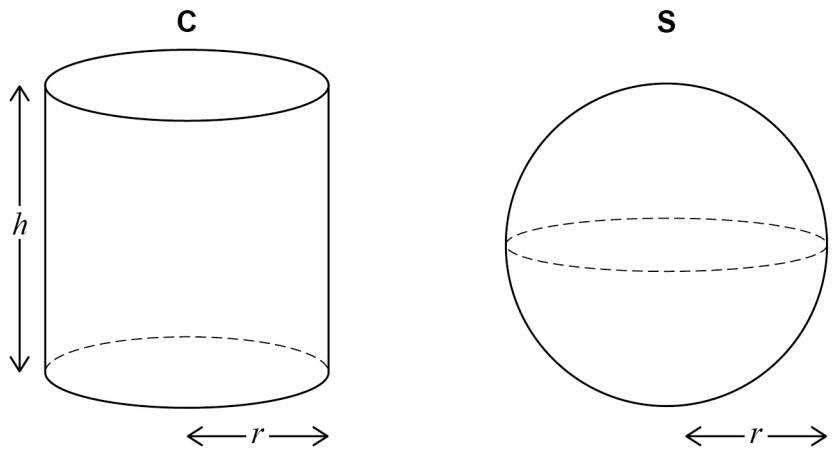
Turn over for the next question

11

Do not write outside the box

21 A cylinder, C, and a sphere, S, each have radius r

C has height h



Volume of a sphere $= \frac{4}{3}\pi r^3$

where r is the radius

21 (a) volume of C = volume of S

Work out the ratio $r : h$

You **must** show your working.

[3 marks]

Answer _____ : _____

Do not write outside the box

21 (b) A **different cylinder** has radius $3r$ and height $2h$.

How many times bigger is the volume of this cylinder than the volume of C?

[2 marks]

Answer _____

22 Fatima is choosing a 4-digit code.

Each digit is a whole number from 0 to 9

She decides

all her digits will be odd numbers

no digits will be repeated.

How many different codes can she make?

[2 marks]

Answer _____

7

Turn over ►

Do not write outside the box

23 Quadrilateral *ABCD* is reflected in edge *BC*.

How many of the vertices are invariant?

Circle your answer.

[1 mark]

1 2 0 4

24 Write $2x^2 - 12x + 7$ in the form $d(x + e)^2 + f$

where d, e and f are integers.

[3 marks]

Answer _____

END OF QUESTIONS

4

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