

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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I declare this is my own work.

# GCSE MATHEMATICS

# H

Higher Tier Paper 3 Calculator

Monday 10 June 2024

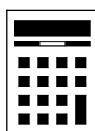
Morning

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           |      |
| <b>TOTAL</b> |      |

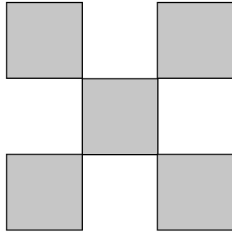


J U N 2 4 8 3 0 0 3 H 0 1

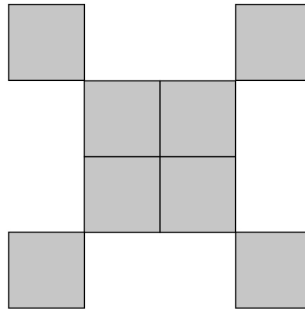
Answer **all** questions in the spaces provided.

Do not write  
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box

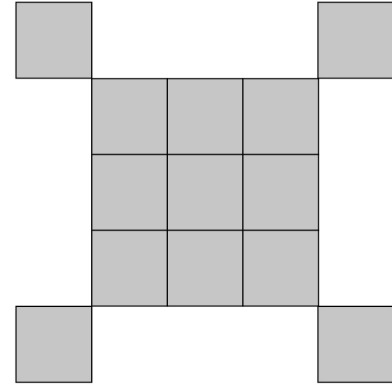
- 1** Here are the first three Patterns in a sequence made up of small squares.



Pattern 1



Pattern 2



Pattern 3

- 1 (a)** On the grid, draw Pattern 4

**[1 mark]**



- 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]

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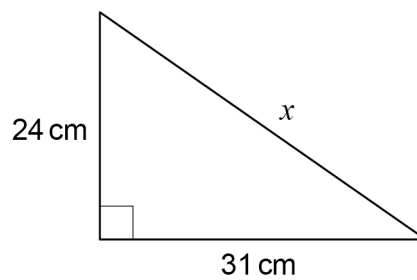
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$n =$  \_\_\_\_\_

2



Not drawn  
accurately

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

Give your answer as a decimal.

[3 marks]

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Answer \_\_\_\_\_ cm



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]

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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  $x$

☐

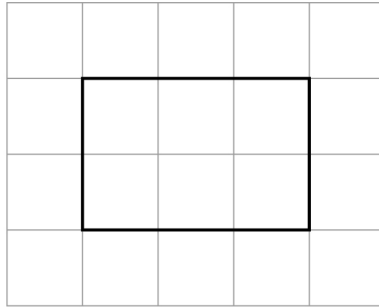
It is true for **no** values of  $x$



5

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

**Front elevation**

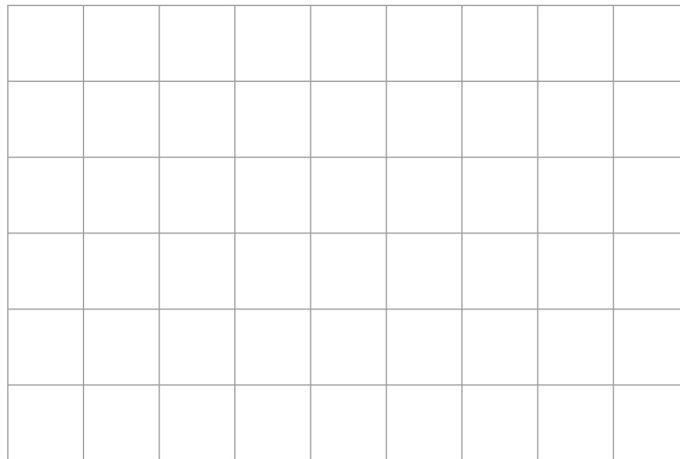


The volume of the cuboid is  $42 \text{ cm}^3$

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

**[2 marks]**

**Side elevation**



- 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]**

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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)

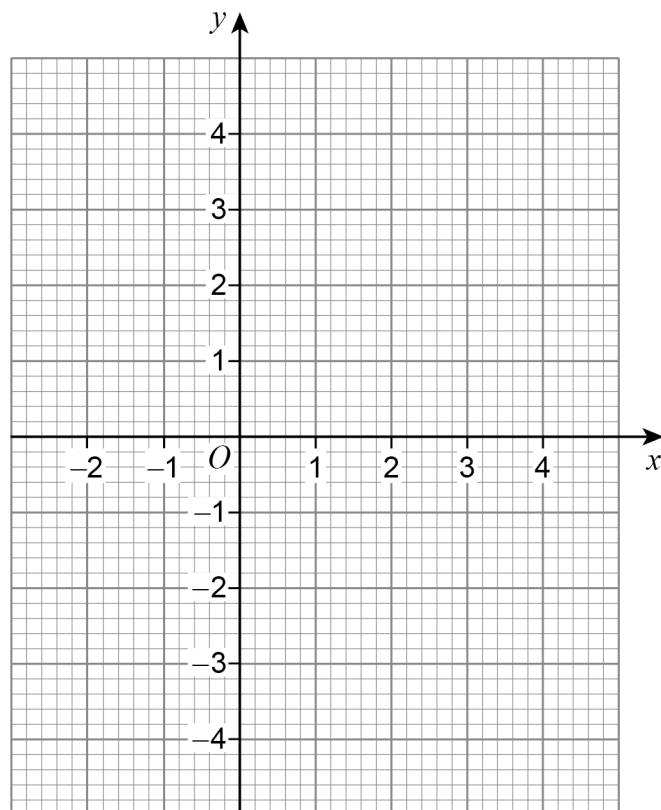
☐

It is not possible to say



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

[3 marks]



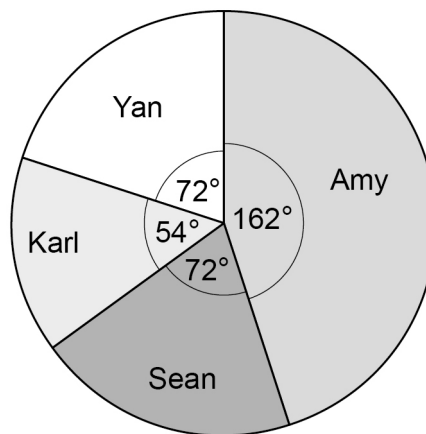
8

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

$4 \times \text{the mean of her marks}$   
 $+$   
 her **percentage** of the phone vote



**[4 marks]**

Answer \_\_\_\_\_

**Turn over for the next question**

4

**Turn over ►**



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]**

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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]**

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Answer \_\_\_\_\_

**Turn over for the next question****Turn over ►**

11

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

[2 marks]

$$\boxed{10} \div \boxed{-2} \times \boxed{\phantom{00}} = \boxed{5}$$

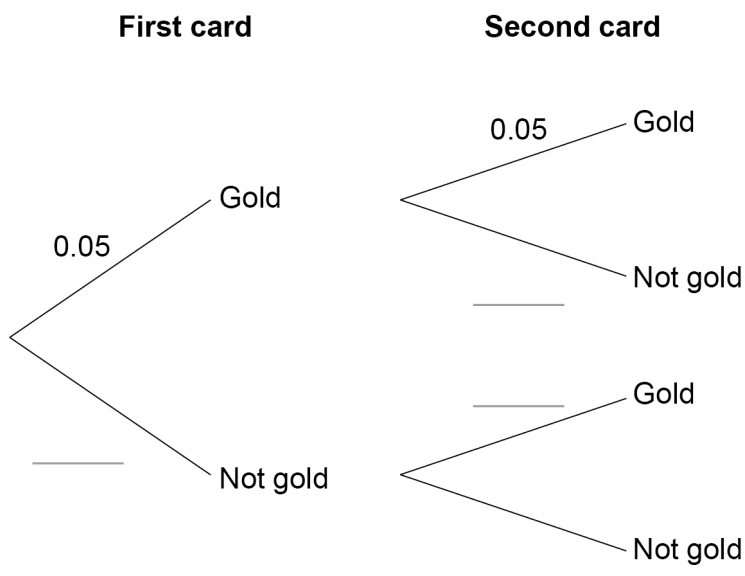
$$\boxed{\frac{1}{3}} \times \boxed{\phantom{00}} \times \boxed{6} = \boxed{8\pi}$$



- 12** Cards are either gold or not gold.  
 $P(\text{gold}) = 0.05$   
 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]**

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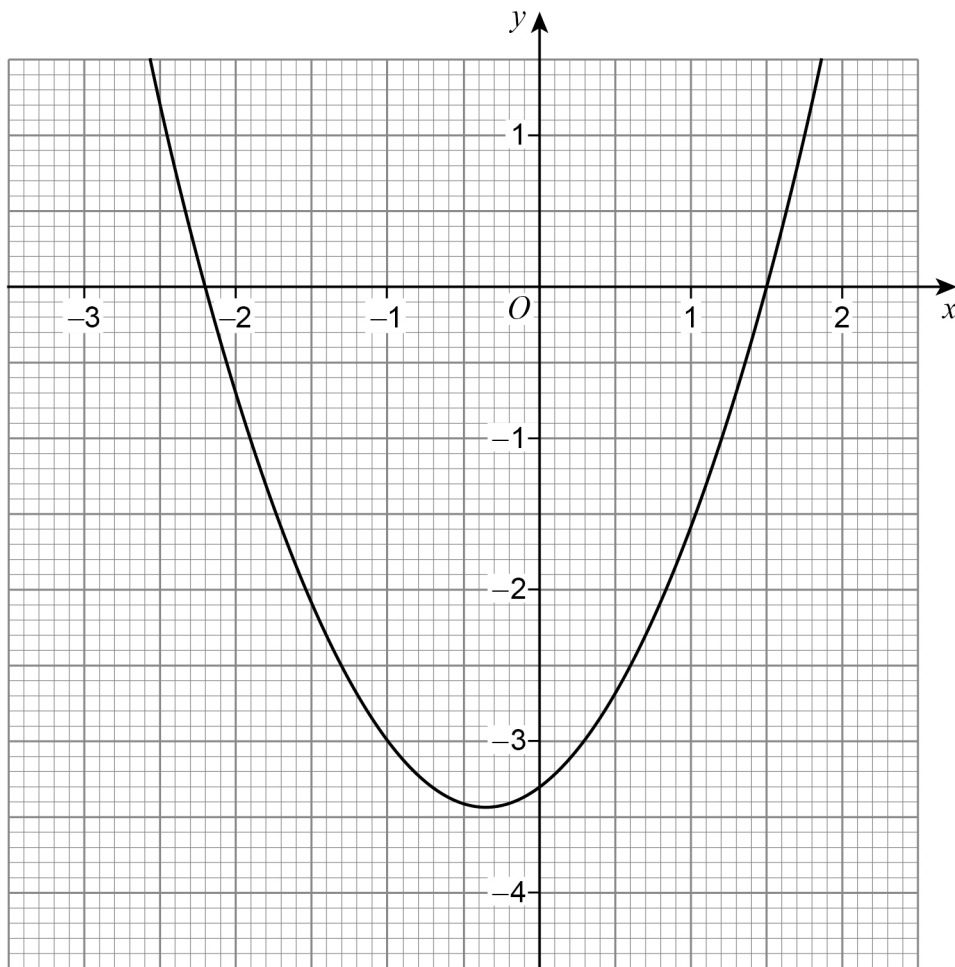


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Answer \_\_\_\_\_



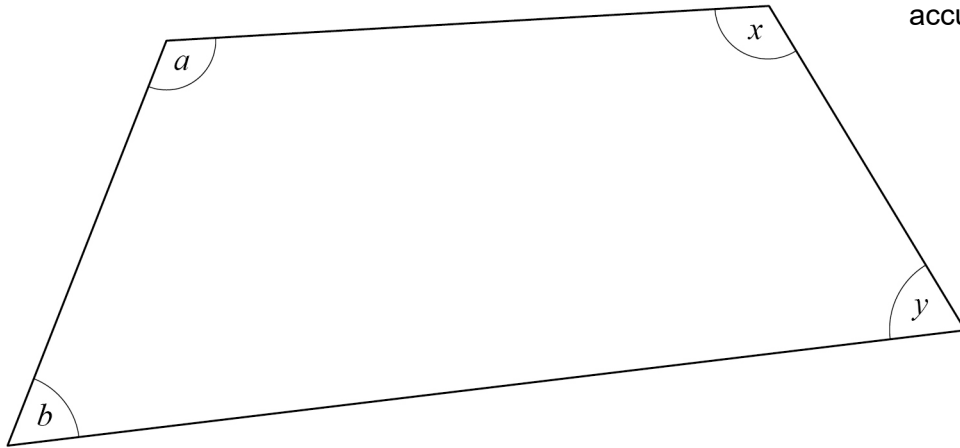
13

Here is a quadratic graph with equation  $y = f(x)$ Write down the roots of the equation  $f(x) = 0$ **[2 marks]**

Answer \_\_\_\_\_



Not drawn accurately



Show that  $a : y = 5 : 2$

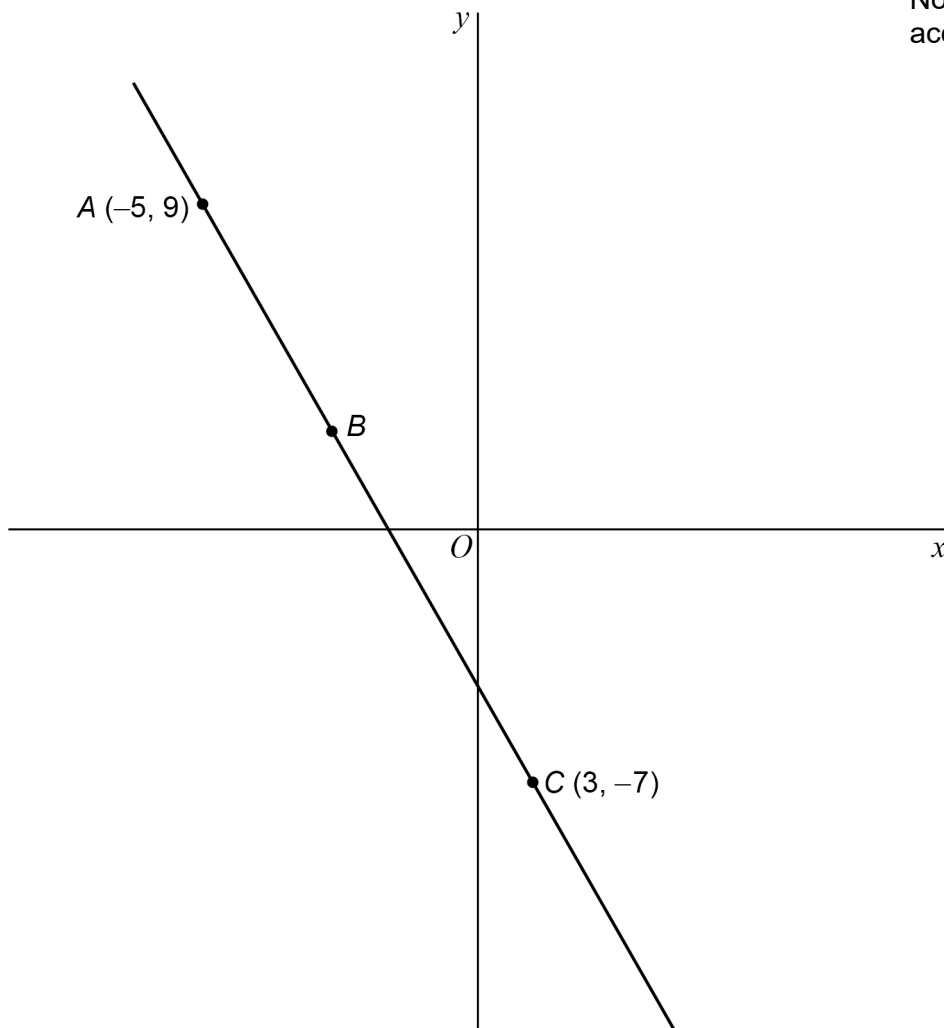
**[3 marks]**



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]

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Answer ( \_\_\_\_\_ , \_\_\_\_\_ )



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

**[4 marks]**

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Answer \_\_\_\_\_

**Turn over for the next question**

7

**Turn over ►**



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]**

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**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]**

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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]**

$$e = cd$$

$$e = c^2d$$

$$e = c^2d^2$$

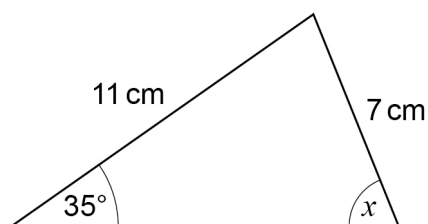
$$e = c^3d^3$$

**Turn over for the next question**

**Turn over ►**



**18** Here is triangle A.



Not drawn  
accurately

**18 (a)** Use the sine rule to show that  $x = 64^\circ$  to the nearest degree.

**[3 marks]**

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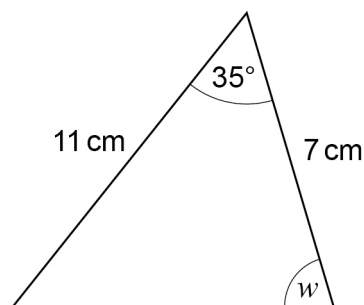
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18 (b) Here is triangle B.



Not drawn  
accurately

Anna thinks that  $w$  must be  $64^\circ$  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]

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Turn over for the next question



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

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

**[2 marks]**

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Answer \_\_\_\_\_

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

**[4 marks]**

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Answer \_\_\_\_\_



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]**

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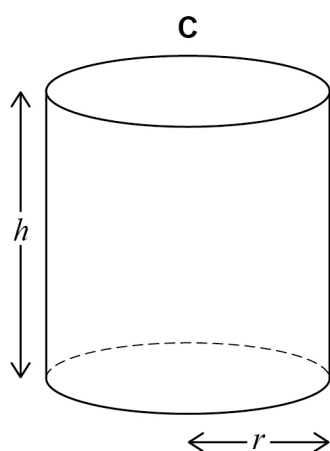
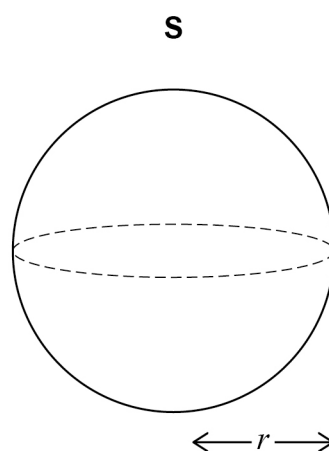
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$R =$  \_\_\_\_\_

Turn over for the next question



- 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]**

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Answer \_\_\_\_\_ : \_\_\_\_\_



**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]**

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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]**

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Answer \_\_\_\_\_

|   |
|---|
| 7 |
|---|

Turn over ►



**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]**

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Answer \_\_\_\_\_

**END OF QUESTIONS**



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3 2



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