

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

## Example-Problem Past Paper

# F

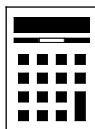
Foundation Tier      Paper 2    Calculator

June 2023

### Materials

For this paper you must have:

- a calculator
- mathematical instruments.



### Instructions

- Engage with the fully-worked solutions in full before attempting the shadow questions.
- Explain the fully-worked solutions to yourself, anticipating the next steps in the worked solutions, making links between the problems and the mathematics used to solve them.
- Apply the methods learnt from the fully-worked solutions to the shadow questions, writing down all workings in the spaces provided. Your thought process is important.
- Do all rough work in this book.

### Information

- The marks for questions are shown in brackets.
- You may ask for more answer paper, graph paper and tracing paper.
- You should ask your teacher for help on a question if you do not understand a part of the fully-worked solution. Remember to be specific, understanding why the step was completed, rather than simply getting the correct answer.

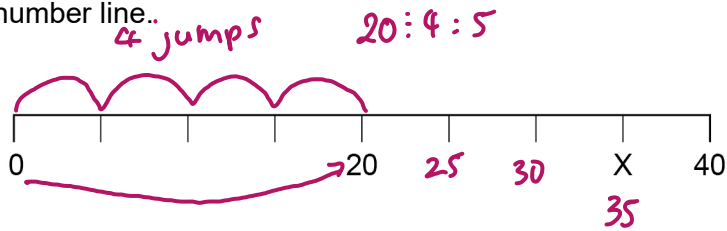
### Advice

In all calculations, show clearly how you work out your answer.

Where a calculator has been used, show clearly what you entered into the calculator.

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

1 (a) Here is a number line..

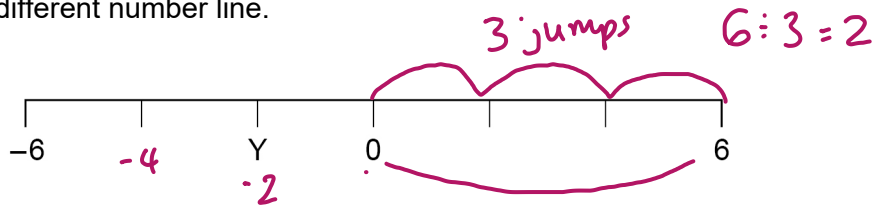


What number is at X?

[1 mark]

Answer 35

1 (b) Here is a different number line.



What number is at Y?

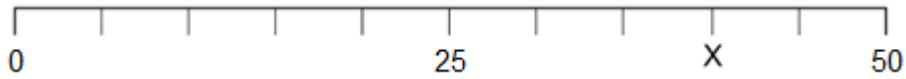
[1 mark]

Answer -2

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

Do not write  
outside the  
box

- 1 (a) Here is a number line.

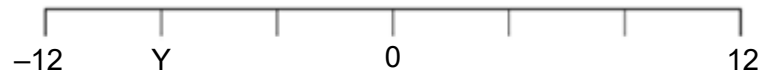


What number is at X?

[1 mark]

Answer \_\_\_\_\_

- 1 (b) Here is a different number line.



What number is at Y?

[1 mark]

Answer \_\_\_\_\_

Turn over ►

2

Match each expression on the left with the simplified expression on the right.

One has been done for you.

**[4 marks]**

Left column expressions:

- $3a + 4a$
- $14a - 2a$
- $3a \times 3a$
- $6 \times 3a$
- $12a \div 4$

Right column expressions:

- $12a$
- $7a$
- $3a$
- $18a$
- $9a^2$
- $6a$

Handwritten pink notes:

- Below  $3a \times 3a$ :  $3 \times a \times 3 \times a = 3 \times 3 \times a \times a = 9 \times a^2$
- Below  $6 \times 3a$ :  $6 \times 3 \times a = 18 \times a$

2

Match each expression on the left with the simplified expression on the right.

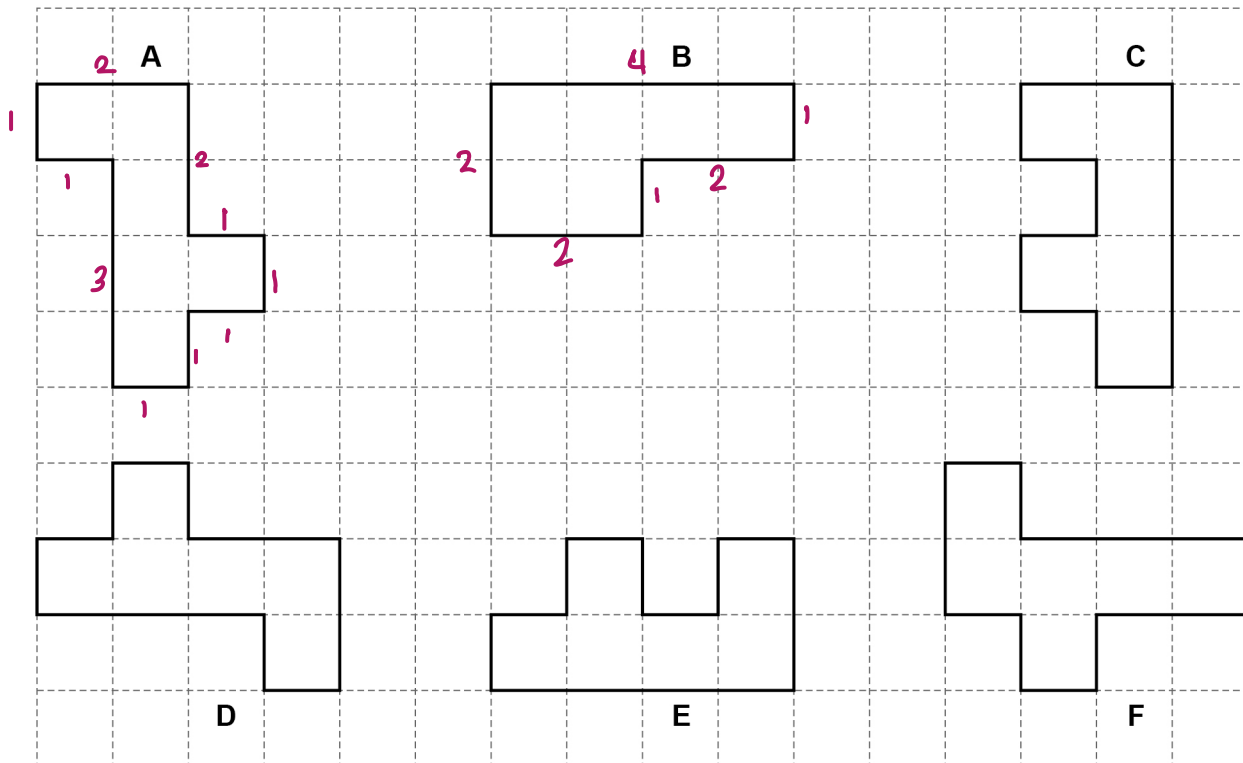
One has been done for you.

**[4 marks]**

$4y + 5y$	$14y$
$16y - 2y$	$25y^2$
$5y \times 5y$	$5y$
$7 \times 3y$	$9y$
$15y \div 3$	$21y$
	$25y$

**Turn over ►**

- 3 Here are some shapes.  
Each shape has an area of six square centimetres.



- 3 (a) Which has the bigger perimeter, shape **A** or shape **B**?

You **must** show the lengths of both perimeters.

[2 marks]

$$\text{Perimeter A} = 2 + 2 + 1 + 1 + 1 + 1 + 1 + 3 + 1 + 1 = 14$$

$$\text{Perimeter B} = 4 + 1 + 2 + 1 + 2 + 2 = 12$$

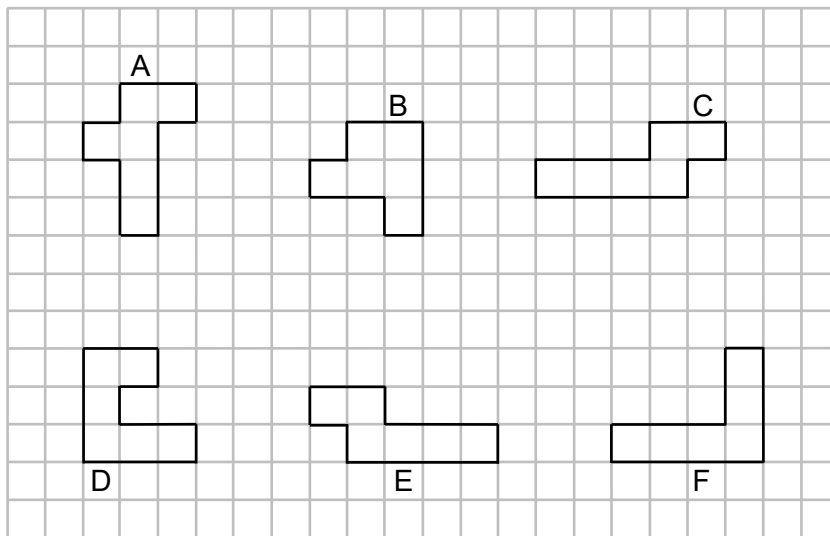
Answer A

- 3 (b) Which shape is congruent to shape **A**?

[1 mark]

Answer D

- 3** Here are some shapes.  
Each shape has an area of six square centimetres.



- 3 (a)** Which has the bigger perimeter, shape **A** or shape **B**?  
You **must** show the lengths of both perimeters.

[2 marks]

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Answer \_\_\_\_\_

- 3 (b)** Which shape is congruent to shape **C**?

[1 mark]

Answer \_\_\_\_\_

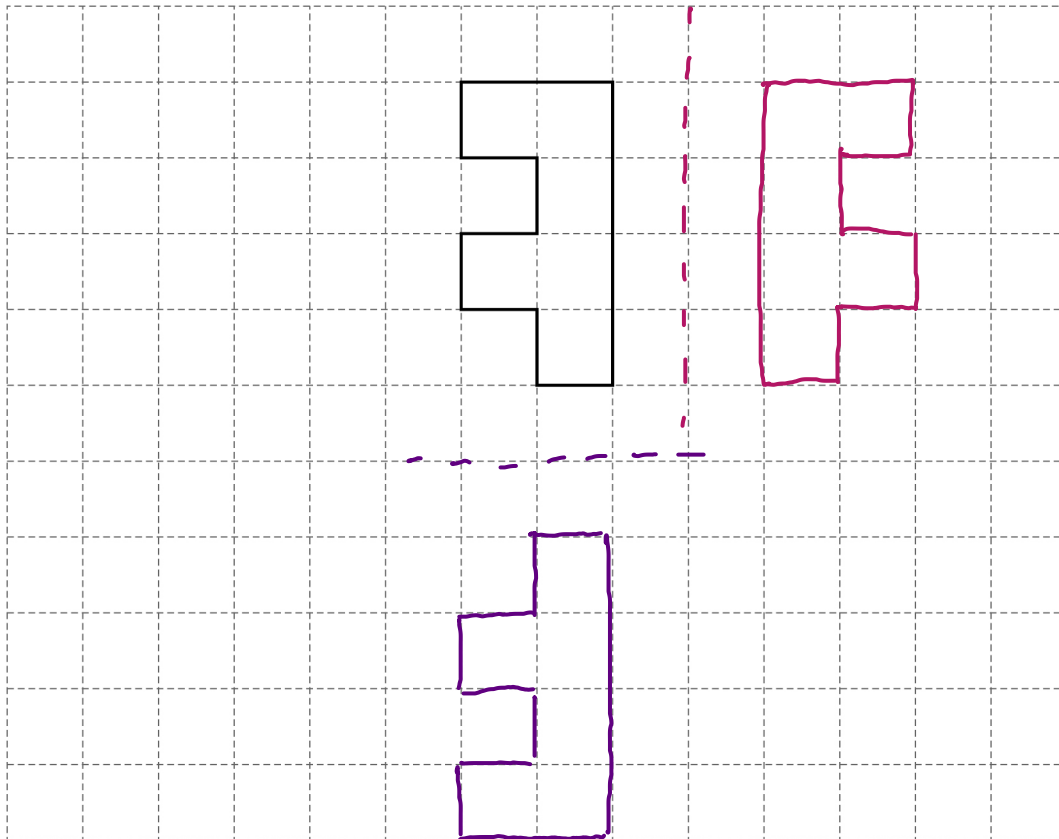
- 3 (c) Which **two** shapes fit together to make a rectangle?

[1 mark]

Answer     C     and     E    

- 3 (d) On this grid draw a reflection of shape C.  
Show your mirror line.

[2 marks]





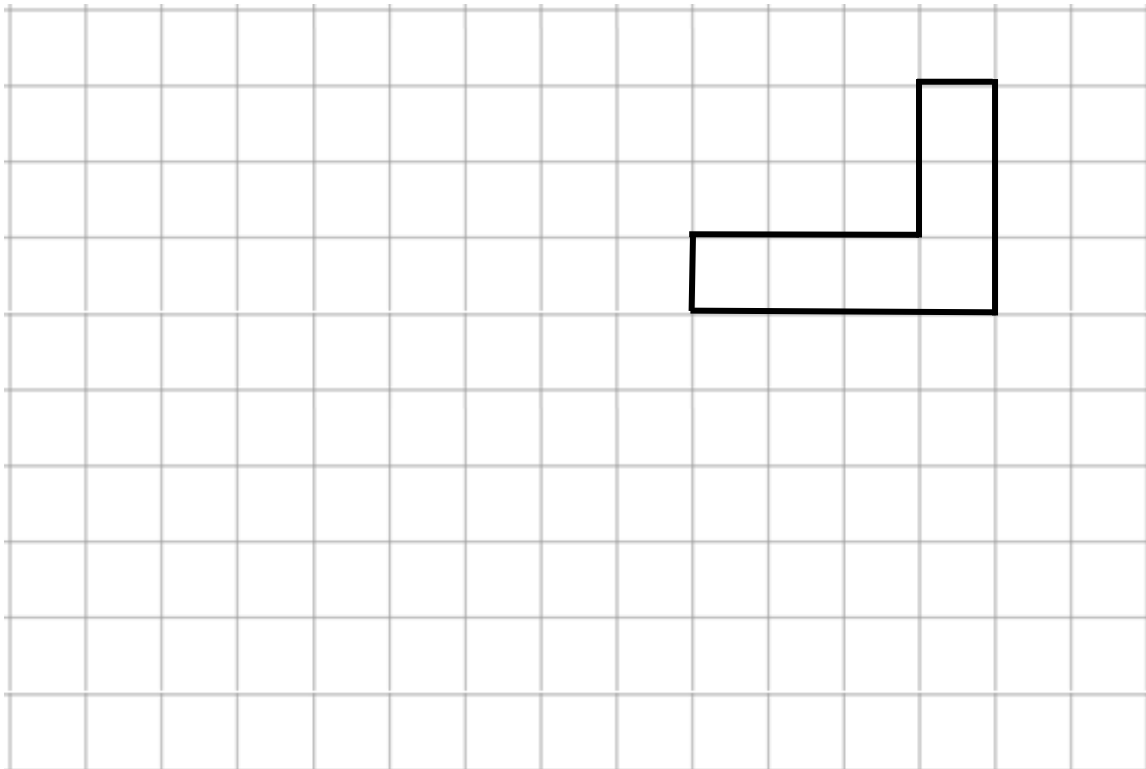
- 3 (c) Which **two** shapes fit together to make a rectangle?

[1 mark]

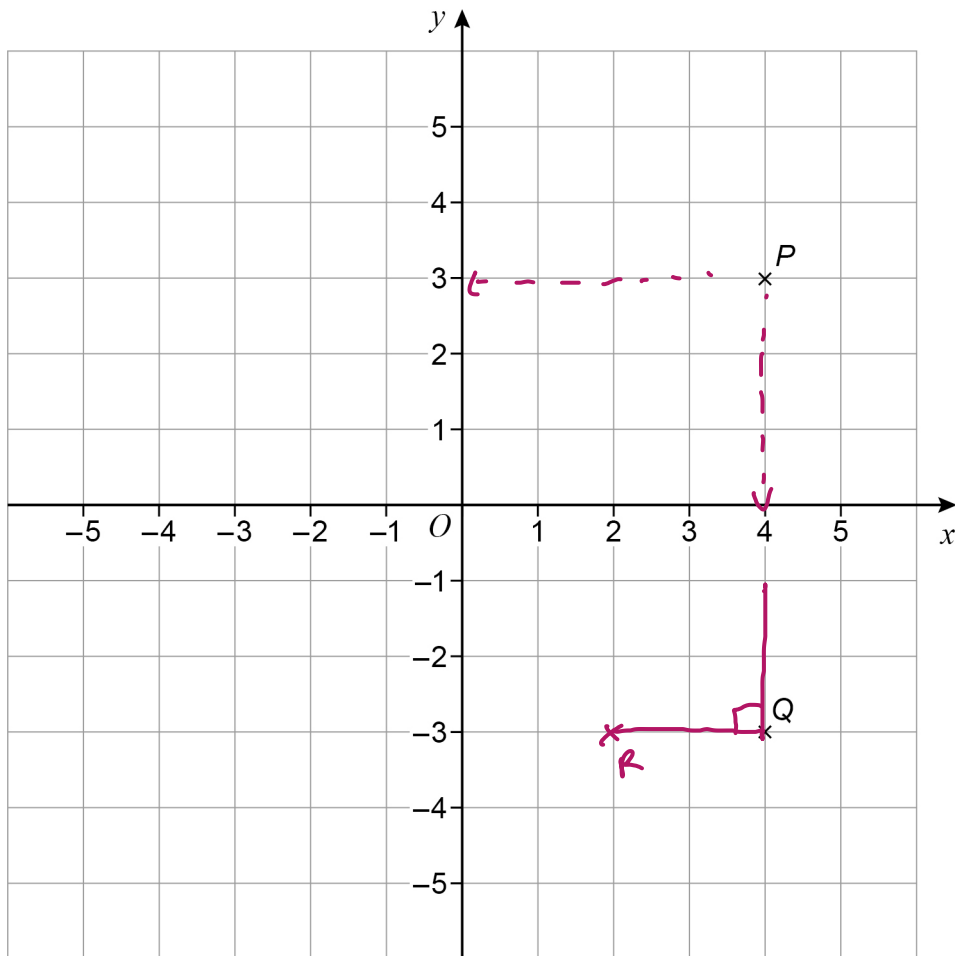
Answer \_\_\_\_\_ and \_\_\_\_\_

- 3 (d) On this grid draw a reflection of shape **F**.  
Show your mirror line.

[2 marks]



- 4 Points  $P$  and  $Q$  are shown on the grid.



- 4 (a) Write down the coordinates of  $P$ .

(  $x$  ,  $y$  )

[1 mark]

Answer ( 4 , 3 )

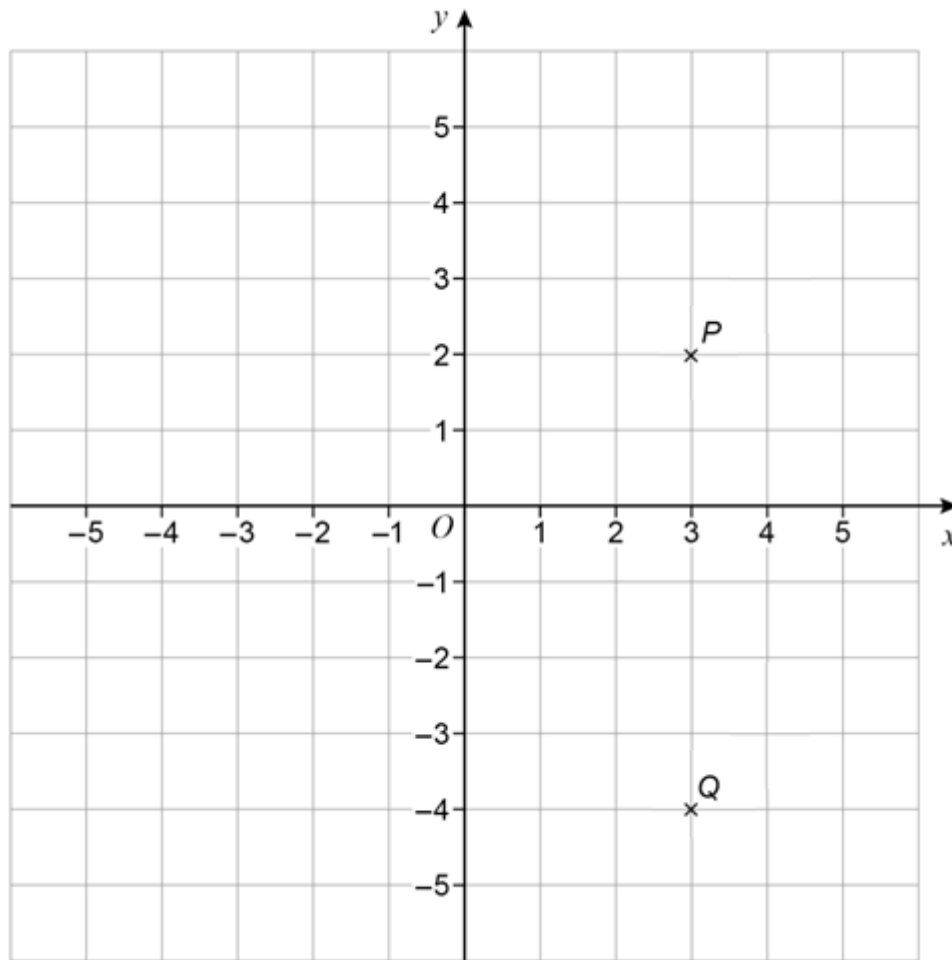
- 4 (b) Angle  $PQR$  is a right angle.

Work out possible coordinates for  $R$ .

[1 mark]

Answer ( 2 , -3 )

- 4 Points  $P$  and  $Q$  are shown on the grid.



- 4 (a) Write down the coordinates of  $P$ .

[1 mark]

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

- 4 (b) Angle  $PQR$  is a right angle.  
Work out possible coordinates for  $R$ .

[1 mark]

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

- 5 (a) A shop sells bottles of orange juice.  
Each bottle costs 75p

Work out the greatest number of bottles that can be bought with £5

[2 marks]

$$\begin{aligned} \text{£}5 &= 500\text{p} \\ 500\text{p} \div 75\text{p} &= 6.6 \end{aligned}$$

Answer 6

- 5 (b) Two shops sell bottles of apple juice.

**Shop X**

pack of 4 bottles

Was £2.50

Now 10% off

**Shop Z**

pack of 12 bottles

£7

At which shop is it cheaper to buy 24 bottles?

Show working to support your answer.

[4 marks]

① 10% of £2.50 = 25p  
£2.50 - 25p = £2.25

4 bottles	24 bottles
£2.25	£13.50

②

12 bottles	24 bottles
£7	£14

Answer Shop X

- 5 (a)** A shop sells bottles of cola.

Each bottle costs 65p

Work out the greatest number of bottles that can be bought with £5

**[2 marks]**

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Answer \_\_\_\_\_

- 5 (b)** Two shops sell bottles of lemonade.

**Shop D**

pack of 8 bottles

Was £5.50

Now 10% off

**Shop F**

pack of 20 bottles

£13

At which shop is it cheaper to buy 40 bottles?

Show working to support your answer.

**[4 marks]**

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Answer \_\_\_\_\_

6 A game has four cards labelled A, B, C and D.

Ellie picks two of the cards at random.

Complete the list of the **six** possible pairs of cards she could pick.

[2 marks]

AB
AC
AD
BC
BD
CD

7 (a) Complete the boxes using  
two **different** even numbers  
and  
two **different** odd numbers.

[2 marks]

$$\begin{array}{c} \boxed{2} \\ \text{even} \end{array} + \begin{array}{c} \boxed{4} \\ \text{even} \end{array} + \begin{array}{c} \boxed{19} \\ \text{odd} \end{array} + \begin{array}{c} \boxed{21} \\ \text{odd} \end{array} = 46$$

- 6** A game has four cards labelled W, X, Y and Z.  
Holly picks two of the cards at random.  
Complete the list of the **six** possible pairs of cards she could pick.
- [2 marks]**

WX

- 7 (a)** Complete the boxes using  
two **different** even numbers  
and  
two **different** odd numbers.
- [2 marks]**

$$\square + \square + \square + \square = 38$$

- 7 (b) Complete the boxes using  
a factor of 12  
and  
a factor of 40

[2 marks]

$$\boxed{3} \times \boxed{10} = 30$$

<u>12</u>	<u>40</u>
$1 \times 12$	$1 \times 40$
$2 \times 6$	$2 \times 20$
$\textcircled{3} \times 4$	$4 \times \textcircled{10}$

- 7 (c) Complete the boxes using  
a square number  
and  
a prime number.

[2 marks]

$$\boxed{36} \div \boxed{2} = 18$$

Squares: 1, 4, 9, 16, 25,  $\textcircled{36}$ , 49, 64, 81, ...

Primes:  $\textcircled{2}$ , 3, 5, 7, 11, ...



- 7 (b) Complete the boxes using  
a factor of 24  
and  
a factor of 50.

[2 marks]

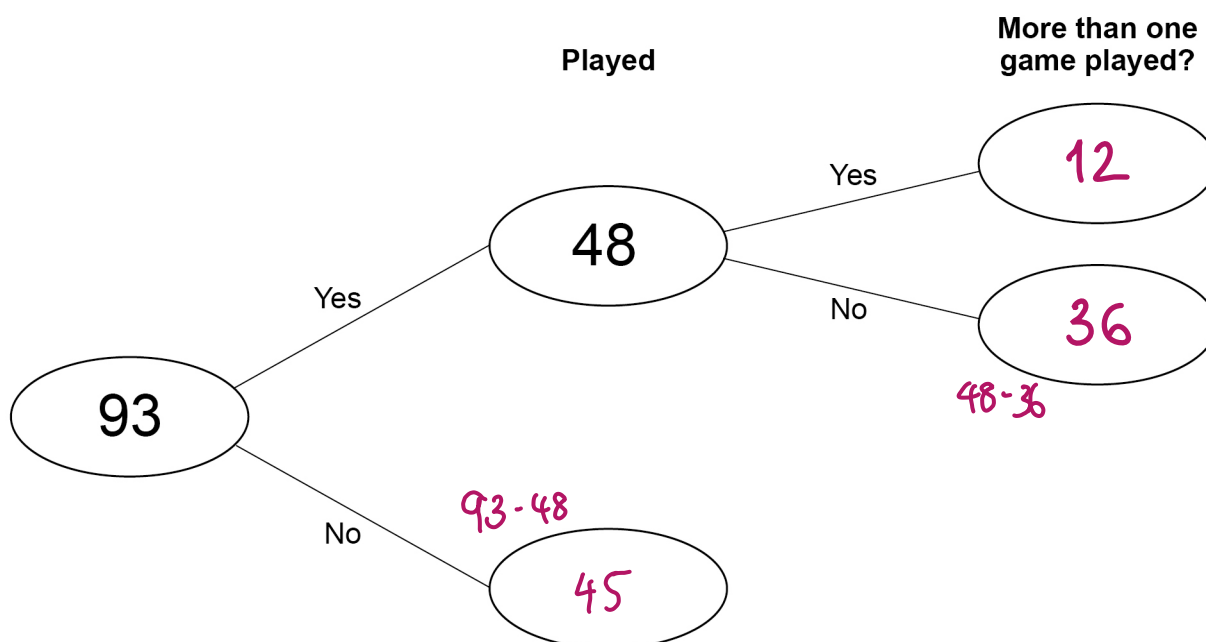
$$\square \times \square = 40$$

- 7 (c) Complete the boxes using  
a square number  
and  
a prime number.

[2 marks]

$$\square \div \square = 32$$

- 8 93 people were asked if they played online games one day.  
The frequency tree shows some information about their answers.



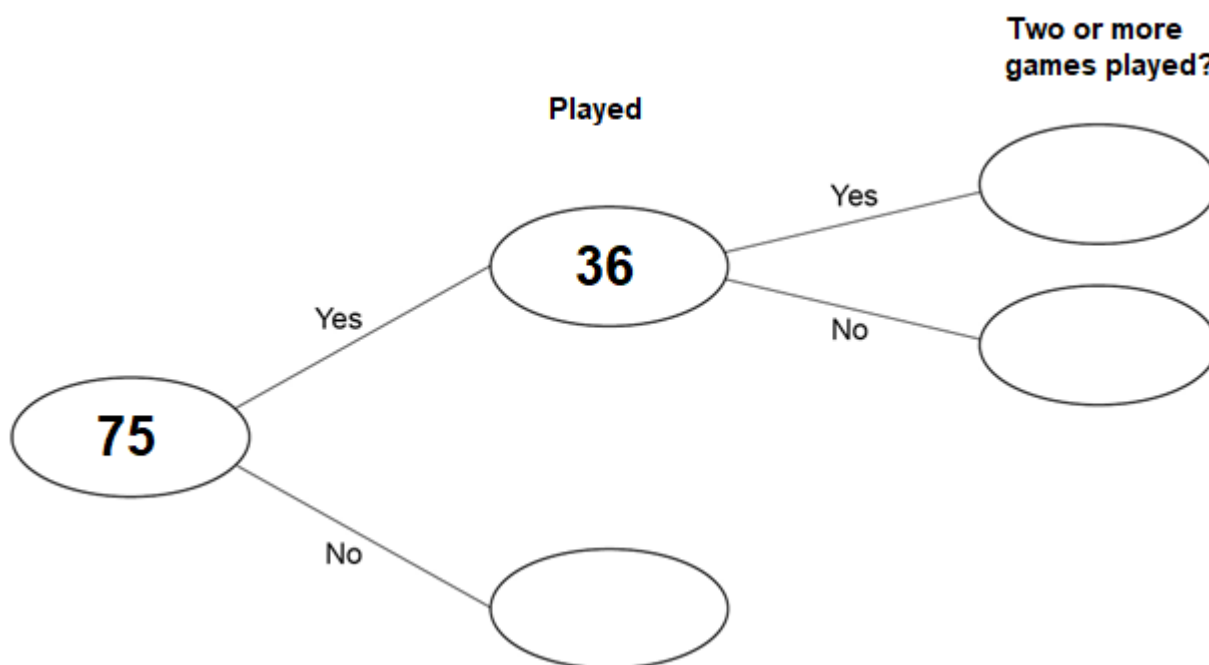
- 8 (a) 75% of the people who answered Yes played one game.

Complete the frequency tree.

[3 marks]

$$75\% = \frac{3}{4} \quad \frac{3}{4} \text{ of } 48 = (48 \div 4) \times 3 = 36$$

- 8 75 people were asked if they played online games one day.  
The frequency tree shows some information about their answers.



- 8 (a) 75% of the people who answered Yes played one game.

Complete the frequency tree.

[3 marks]

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- 8 (b) One of the 93 people is chosen at random.

P(used social media) is **more than** 0.68

What is the **smallest** possible number of people who used social media?

[2 marks]

$$0.68 \times 93 = 63.24$$

Answer 64

- 8 (b) One of the 75 people is chosen at random.

$P(\text{used social media})$  is **more than** 0.63

What is the **smallest** possible number of people who used social media?

[2 marks]

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Answer \_\_\_\_\_

- 9 (a) The cost of a TV streaming service is  
£6 per month for the first 4 months  
then  
£11 per month for the rest of the year. (12 - 4 = 8 months)

Work out the **total** cost for the year.

[2 marks]

$$\begin{array}{r} £6 \times 4 = £24 \\ £11 \times 8 = £88 \\ \hline 112 \end{array}$$

Answer £ 112

- 9 (b) A TV series has ten episodes.  
Nine episodes are each 50 minutes long.  
One episode is 1 hour 42 minutes long.

Work out the **total** length of the series.

Give your answer in hours and minutes.

[3 marks]

$$\begin{array}{r} 1\text{h } 42\text{m} = 102\text{m} \\ 9 \times 50\text{m} = 450\text{m} \\ 450 + 102 = 552 \text{ minutes} \\ 552 \div 60 = 9.2 \text{ hours} \\ 9 \text{ hours} = 9 \times 60 = 540 \text{ minutes} \\ 552 - 540 = 12 \end{array}$$

Answer 9 hours 12 minutes

- 9 (a)** The cost of a TV streaming service is  
£9 per month for the first 2 months  
then  
£16 per month for the rest of the year.

Work out the **total** cost for the year.

**[2 marks]**

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Answer £ \_\_\_\_\_

- 9 (b)** A TV series has twelve episodes.  
Eleven episodes are each 40 minutes long.  
One episode is 1 hour 22 minutes long.

Work out the **total** length of the series.

Give your answer in hours and minutes.

**[3 marks]**

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Answer \_\_\_\_\_ hours \_\_\_\_\_ minutes

**Turn over ►**

- 10 (a) There are 1020 books in a box.

$\frac{2}{5}$  of the books are blue.

How many are blue?

[2 marks]

$$\frac{2}{5} \text{ of } 1020 = (1020 \div 5) \times 2 = 408$$

Answer 408

- 10 (b) There are green pens and red pens in the box.

The ratio of green : red is 4 : 3

What fraction of the pens are green?

[1 mark]

G G G G R R R

Answer  $\frac{4}{7}$

- 10 (c) There are some calculators in the box.

220 are scientific.

30 are not.

What percentage of the calculators are scientific?

[2 marks]

$$220 + 30 = 250 \quad \frac{220}{250} = 0.88 = 88\%$$

Answer 88 %



- 10 (a)** There are 1440 books in a library.

$\frac{2}{3}$  of the books are fiction.

How many are fiction?

**[2 marks]**

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Answer \_\_\_\_\_

- 10 (b)** There are milk chocolates and dark chocolates in a box.

The ratio of milk : dark is 7 : 4

What fraction of the chocolates are milk?

**[1 mark]**

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Answer \_\_\_\_\_

- 10 (c)** There are some pens in the box.

114 are black.

36 are not.

What percentage of the pens are black?

**[2 marks]**

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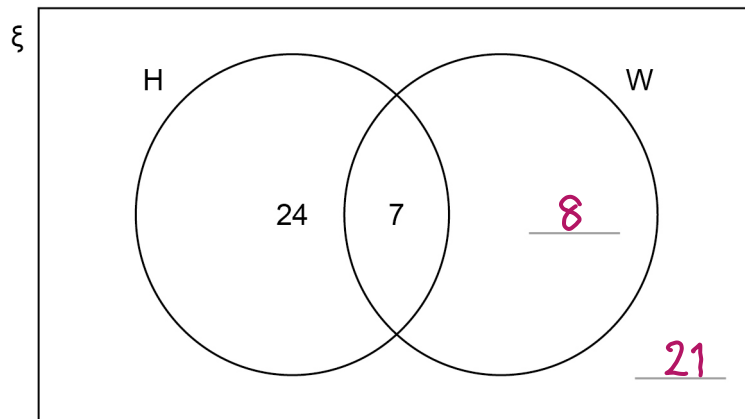
Answer \_\_\_\_\_ %

11 Here is a Venn diagram.

$\xi = 60$  people

H = people who own a gaming headset

W = people who own a smart watch



11 (a) 15 of the people own a smart watch.

Complete the Venn diagram.

[2 marks]

$$15 - 7 = 8 \qquad 60 - (24 + 7 + 8) = 60 - 39 = 21$$

11 (b) One of the 60 people is chosen at random.

What is the probability that they own **both** a gaming headset and a smart watch?

[1 mark]

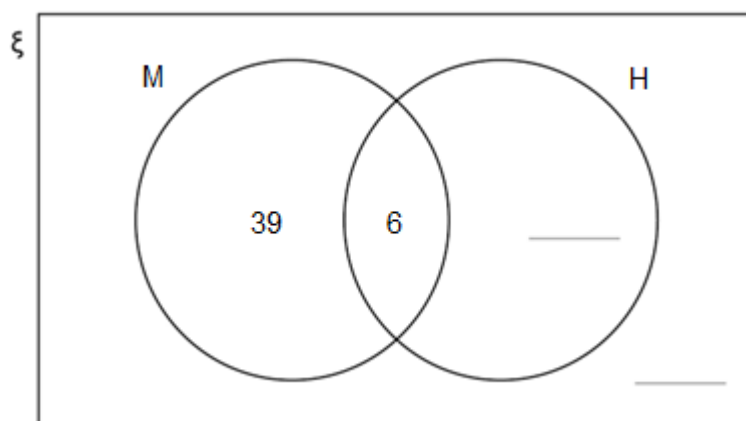
Answer  $\frac{7}{60}$

11 Here is a Venn diagram.

$\xi = 60$  students

M = people who own a mobile phone

H = people who own headphones



11 (a) 11 of the people own headphones.

Complete the Venn diagram.

[2 marks]

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11 (b) One of the 60 students is chosen at random.

What is the probability that they own **both** a mobile phone and headphones?

[1 mark]

Answer \_\_\_\_\_

- 11 (c)** Marek is going to buy a gaming headset that costs £35  
He already has £19  
He plans to save the rest in two equal amounts over the next two weeks.  
He uses this method to work out in pounds how much to save each week.

$$35 - 19 \div 2$$

What is wrong with his method?

[1 mark]

*This calculation will complete division first.*

*Marek should work out  $(35 - 19) \div 2$*

- 11 (c)** Charlie is going to buy headphones that cost £45  
He already has £17  
He plans to save the rest in four equal amounts over the next four weeks.  
He uses this method to work out in pounds how much to save each week.

$$45 - 17 \div 4$$

What is wrong with his method?

**[1 mark]**

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12

Kai says that  $3 : 2$  is an equivalent ratio to  $9 : 6$

Jo says that  $1.5 : 1$  is an equivalent ratio to  $9 : 6$

Who is correct?

Tick **one** box.

☐

Both of them

☒

Kai only

☐

Jo only

☐

Neither of them

Give reasons for your answer.

[2 marks]

Equivalent ratios are not written in the form  $n:1$ .

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12

Sune says that  $2 : 5$  is an equivalent ratio to  $6 : 15$

Peter says that  $1.2 : 3$  is an equivalent ratio to  $6 : 15$

Who is correct?

Tick **one** box.

☐

Both of them

☐

Sune only

☐

Peter only

☐

Neither of them

Give reasons for your answer.

[2 marks]

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Turn over ►

13

28 is increased by 25%

40 is decreased by 15%

Which answer is bigger?

Show how you decide.

[4 marks]

$$28 \times 1.25 = 35$$

$$40 \times 0.85 = 34$$

Answer 28 increased by 25%



**13**

40 is increased by 15%

64 is decreased by 25%

Which answer is bigger?

Show how you decide.

**[4 marks]**

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Answer \_\_\_\_\_

**Turn over ►**

14 Factorise  $12a + 15b$ 

[1 mark]

$$2 \times 2 \times 3 \times a + 3 \times 5 \times b = 3(2 \times 2 \times a + 5 \times b)$$

Answer  $3(4a + 5b)$

15 Write down all the integers that satisfy the inequality

$$-3 \leq x < 2$$

can be equal to  $-3$  (can not be equal to 2)

[2 marks]

Answer  $-3, -2, -1, 0, 1$

16 A linear sequence starts

$$7 \quad 10 \quad 13 \quad 16$$

$\underbrace{\quad}_{+3}$      $\underbrace{\quad}_{+3}$      $\underbrace{\quad}_{+3}$

Work out an expression for the  $n$ th term of the sequence.

[2 marks]

$3n = 3$	$6$	$9$	$12$
$3n + 4 = 7$	$10$	$13$	$16$

Answer  $3n + 4$

**14** Factorise  $14x + 21y$

**[1 mark]**

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Answer \_\_\_\_\_

**15** Write down all the integers that satisfy the inequality

$$-1 \leq x < 4$$

**[2 marks]**

Answer \_\_\_\_\_

**16** A linear sequence starts

7                      12                      17                      22

Work out an expression for the  $n$ th term of the sequence.

**[2 marks]**

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Answer \_\_\_\_\_

17

Jess saves 2p, 5p and 10p coins.

She has

- 45 10p coins
- 8 times as many 2p coins as **10p coins**
- £17.70 in total.

Work out total **value** of 2p coins : total **value** of 5p coins

Give your answer in its simplest form.

**[4 marks]**

$$45 \times 10p = £4.50 \quad (10p \text{ coins})$$

$$8 \times 45 = 360 \quad 360 \times 2p = £7.20 \quad (2p \text{ coins})$$

$$4.50 + 7.20 = 11.70 \quad 17.70 - 11.70 = £6.00 \quad (5p \text{ coins})$$

$$£7.20 : £6.00$$

$$\div 10 \downarrow 720p : 600p \downarrow \div 10$$

$$\div 12 \downarrow 72 : 60 \downarrow \div 12$$

$$6 : 5$$

Answer 6 : 5

She has

- Work out    total **value** of 2p coins : total **value** of 5p coins

Give your answer in its simplest form.

**[4 marks]**

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

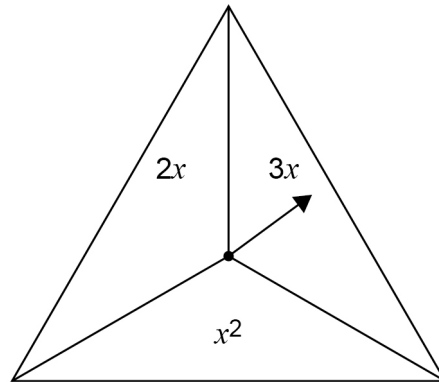
4

**Turn over ►**

18

In a game,

- an ordinary fair six-sided dice is rolled
- the fair spinner shown is spun.



The score is the dice number **substituted** into the spinner expression.

18 (a) Complete the table to show all of the possible scores.

[2 marks]

	1	2	3	4	5	6
$2x$	2	4	6	8	10 ✓	12 ✓
$3x$	3	6	9	12 ✓	15 ✓	18 ✓
$x^2$	1	4	9	16 ✓	25 ✓	36 ✓

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- 18 (b)** A player wins the game if their score is 10 or more.

Work out the probability that they win the game.

[1 mark]

8 scores of 10 or more.

18 scores

Answer  $\frac{8}{18} = \frac{4}{9}$

- 18 (c)** The game is played 711 times.

Estimate the number of games that are won.

[2 marks]

$\frac{4}{9} \times 711 = 316$

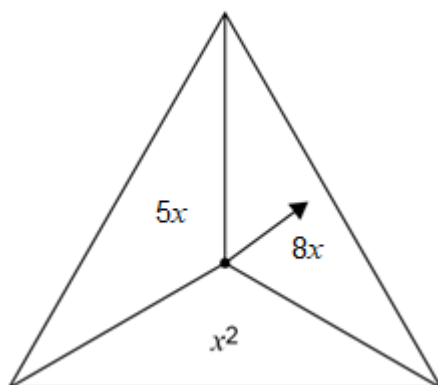
Answer 316

Turn over ►

18

In a game,

- an ordinary fair six-sided dice is rolled
- the fair spinner shown is spun.



The score is the dice number **substituted** into the spinner expression.

18 (a) Complete the table to show all of the possible scores.

[2 marks]

	1	2	3	4	5	6
$5x$						30
$8x$		16				
$x^2$				16		

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- 18 (b)** A player wins the game if their score is 30 or more.

Work out the probability that they win the game.

**[1 mark]**

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Answer \_\_\_\_\_

- 18 (c)** The game is played 756 times.

Estimate the number of games that are won.

**[2 marks]**

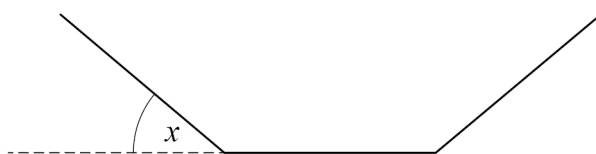
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Answer \_\_\_\_\_

- 19 (a) Part of a regular polygon is shown.



Not drawn  
accurately

Assume that the polygon is an octagon. (8 angles)

Work out the size of angle  $x$ .

[2 marks]

Exterior angles add up to  $360^\circ$

$$360 \div 8 = 45$$

Answer 45 °

- 19 (b) In fact, the polygon has **more** sides than an octagon.

What does this mean about the size of angle  $x$ ?

Tick **one** box.

[1 mark]

☐

It is more than the answer to part (a)

☐

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

☒

It is less than the answer to part (a)

☐

It could be any of the above

- 19 (a)** Part of a regular polygon is shown.



Not drawn  
accurately

Assume that the polygon is a hexagon.

Work out the size of angle  $x$ .

**[2 marks]**

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Answer \_\_\_\_\_ °

- 19 (b)** In fact, the polygon has **fewer** sides than a hexagon.

What does this mean about the size of angle  $x$  ?

Tick **one** box.

**[1 mark]**

☐

It is more than the answer to part (a)

☐

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

☐

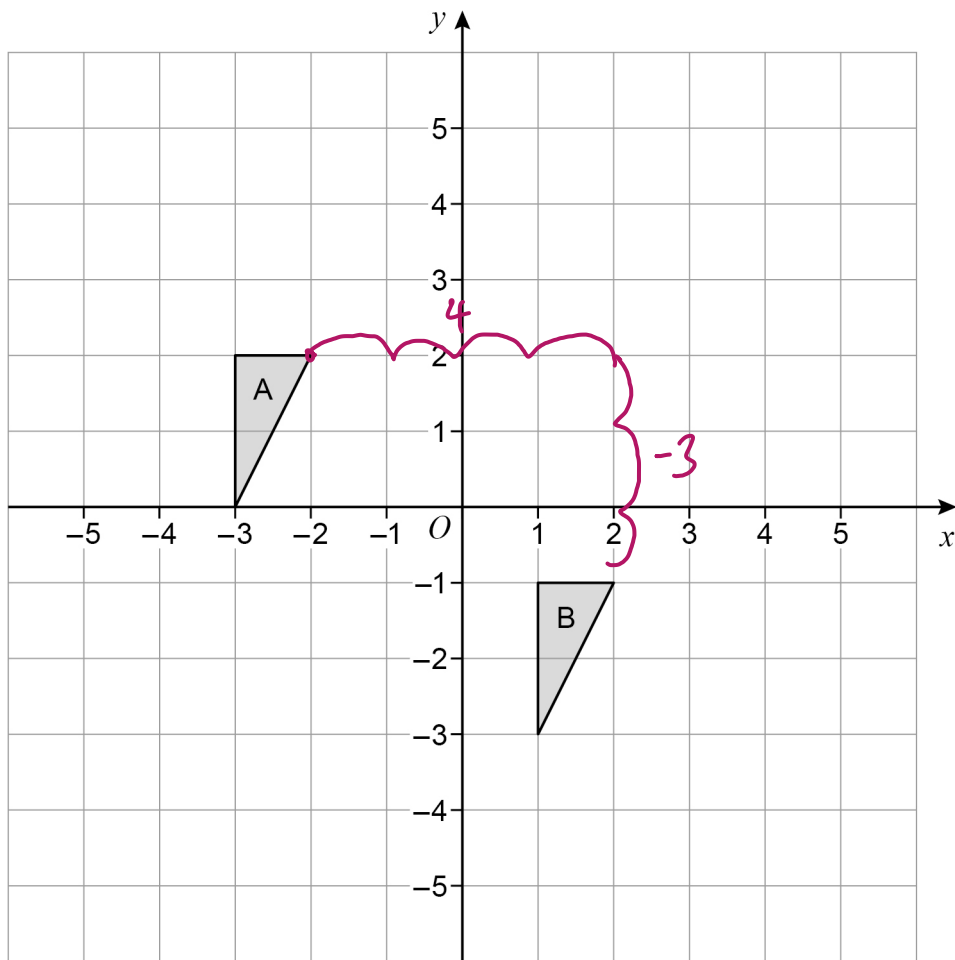
It is less than the answer to part (a)

☐

It could be any of the above

20

Write down the translation vector that maps shape A onto shape B.

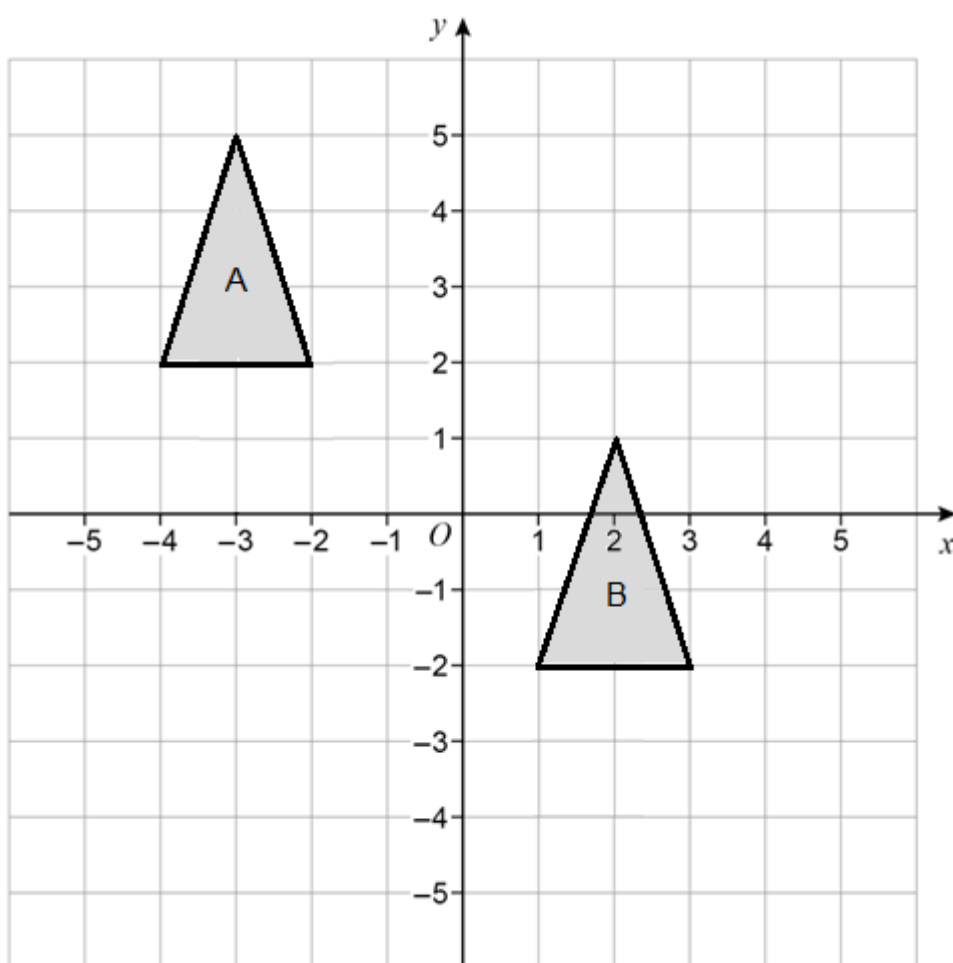
**[2 marks]**

Answer \_\_\_\_\_

 $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$

20

Write down the translation vector that maps shape A onto shape B.

**[2 marks]**

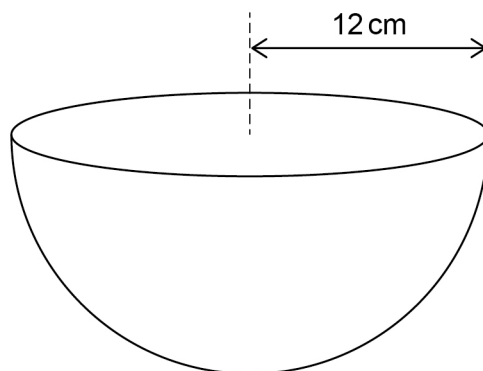
Answer \_\_\_\_\_

**Turn over ►**

21

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

A bowl is a hemisphere with radius 12 cm



Water is poured into the bowl  
at a rate of  $325 \text{ cm}^3$  per second  
for 8 seconds.

Does the water fill **more than** 70% of the bowl?

You **must** show your working.

[4 marks]

$$325 \text{ cm}^3/\text{s} \times 8 \text{ s} = 2600 \text{ cm}^3 \text{ (water)}$$

$$\frac{4}{3} \times \pi \times 12^3 = 7,238.229473871$$

$$7,238.229473871 \div 2 = 3,619.114736935 \text{ (volume of the bowl)}$$

$$3,619.114736935 \times 0.7 = 2,533.380315855 \text{ cm}^3$$

$$\text{Yes. } 2600 > 2533.38$$

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

A diagram of a hemispherical bowl. A vertical dashed line extends from the center of the circular rim to the bottom of the bowl. A horizontal double-headed arrow indicates the radius from this dashed line to the rim, labeled "9 cm".

Does the water fill **more than** 80% of the bowl?  
You **must** show your working.

**[4 marks]**

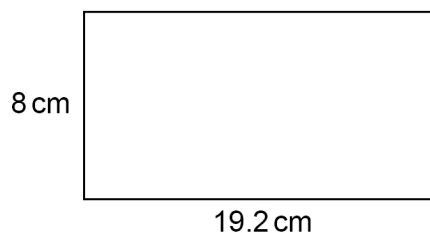
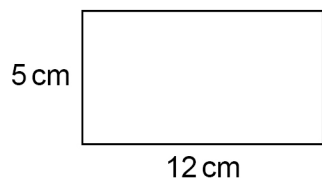
4

**Turn over ►**

22

Show that these two rectangles are similar.

[2 marks]

Not drawn  
accurately

$$\frac{8}{5} = 1.6 \quad \frac{19.2}{12} = 1.6$$

$$\text{Scale factor} = 1.6$$

23

A factory packs  $x$  boxes of teabags per hour.

Each box contains 80 teabags.

Show that the factory packs  $\frac{4x}{3}$  teabags per minute.

[2 marks]

$$80 \times x = 80x \text{ teabags per hour}$$

$$80x \div 60 = \text{tea bags per minute}$$

$$\frac{80x}{60} = \frac{4x}{3}$$

*(Handwritten cancellation: 80 and 60 are both divided by 20, leaving 4 and 3 respectively.)*

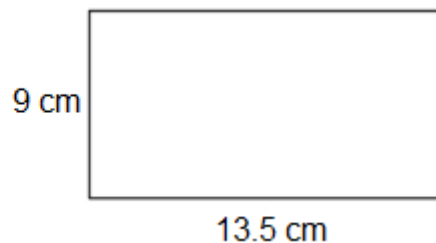
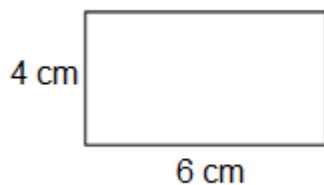


22

Show that these two rectangles are similar.

[2 marks]

Not drawn  
accurately




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23

A factory packs  $x$  boxes of plasters per hour.

Each box contains 100 plasters.

Show that the factory packs  $\frac{5x}{3}$  plasters per minute.

[2 marks]

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**END OF QUESTIONS**

Do not write  
outside the  
box