Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2021

Mathematics

StemUp Model Solution

Unit M7 Paper 1
(Non-Calculator)
Higher Tier



[GMC71]

GMC71

THURSDAY 2 DECEMBER, 9.15am–10.30am

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You are provided with Higher Tier Additional Support Materials for use with this paper.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all fourteen** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **must not** use a calculator for this paper.

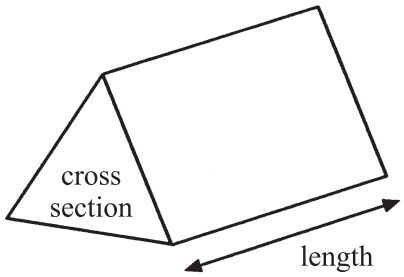
INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a ruler, compasses and a protractor.
The Formula Sheet is on page 2.

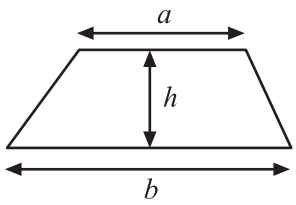
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Formula Sheet

Volume of prism = area of cross section × length

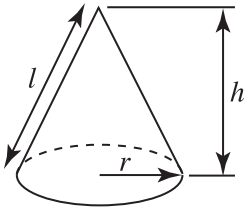


Area of trapezium = $\frac{1}{2}(a+b)h$



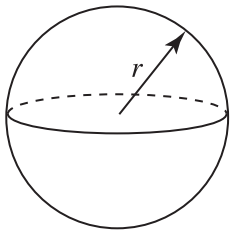
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$

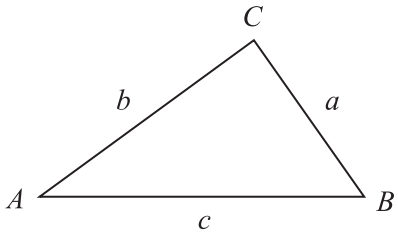


Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



In any triangle *ABC*



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle = $\frac{1}{2}ab\sin C$

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1 800 students attend Clarendon College.

15% of them are in Year 11

10% of Year 11 students are in the Spanish class.

Of **all** the students in Clarendon College, how many **are not** in the Year 11 Spanish class?

15% of 800 = 0.15 × 800 = 120 (Year 11)

10% of 120 = 12 (Year 11 Spanish class)

800 − 12 = 788

Answer 788 [3]

[Turn over

2 Each new number in a sequence is found using the rule

multiply the previous number by 3 and then subtract 5

Find the next two numbers in this sequence.

2 , 1 , −2

$2 \times 3 - 5 = 6 - 5 = 1$

$1 \times 3 - 5 = 3 - 5 = -2$

[2]

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3 A bag contains five counters, each one a different colour.

The colours are red (R), green (G), blue (B), white (W) and yellow (Y).

Daniel takes a counter at random from the bag.

Daniel now tosses a fair coin.

One possible outcome is (red, heads), which can be written as (R, H).

(a) List all the possible outcomes for this experiment in this way in the two-way table below.

One has already been done for you.

		Counter (colour)				
		R	**G**	**B**	**W**	**Y**
Coin	**H**	(R, H)	(G, H)	(B, H)	(W, H)	(Y, H)
	T	(R, T)	(G, T)	(B, T)	(W, T)	(Y, T)

[2]

(b) What is the probability that the outcome is (B, H)?

10 equally likely outcomes, one of which is (B, H)

Answer $\frac{1}{10}$ [1]

(c) What is the probability that the outcome of this experiment contains a green (G) or a tail (T) or both of these?

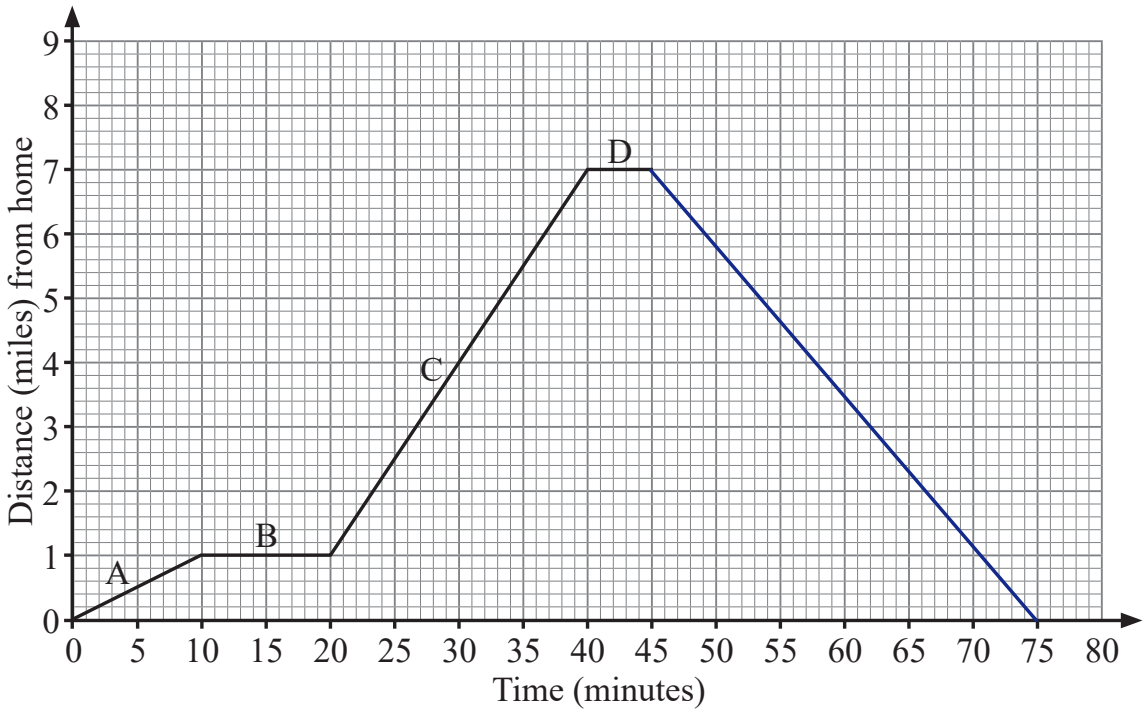
(G, H) and the 5 tails: 1 + 5 = 6 outcomes out of 10

Answer $\frac{6}{10}$ [2]

[Turn over

4 Mike is out for a bicycle ride. He starts from home.

The graph shows four stages of his ride labelled A, B, C and D.



(a) Which stage of the graph shows Mike repairing an **early** puncture?

Answer B [1]

(b) What is Mike's average speed during stage C?

C: 7 − 1 = 6 miles in 20 minutes, 6 × 3 = 18 mph

Answer 18 mph [1]

(c) Mike travels home at an average speed of 14 mph.

Complete the final stage of Mike's bicycle ride on the graph. [2]

7 miles at 14 mph: 7 ÷ 14 = ½ hour = 30 minutes

45 + 30 = 75 minutes, so line from (45, 7) to (75, 0)

5

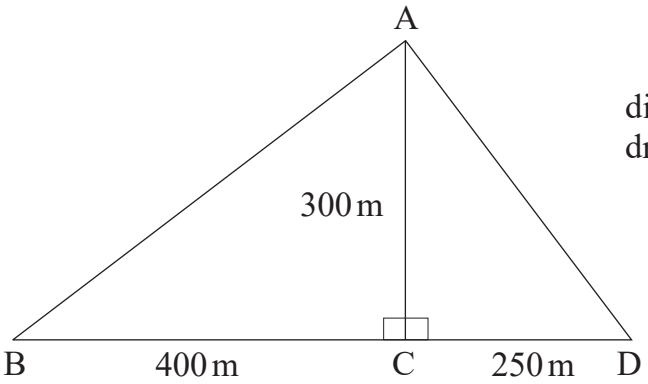
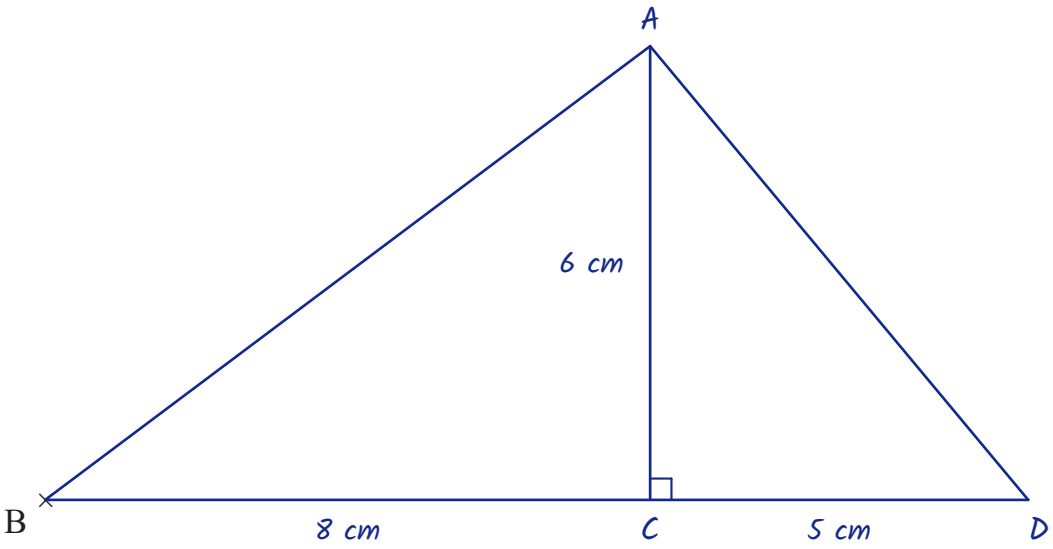


diagram not drawn accurately

(a) In the space below, make a scale drawing of the diagram ABCD shown above.

Use a scale of 1 cm to 50 m.

400 ÷ 50 = 8 cm, 250 ÷ 50 = 5 cm, 300 ÷ 50 = 6 cm



[3]

(b) Use your scale drawing to calculate the actual length of AB.

AB measures 10 cm, 10 × 50 = 500 m

Answer AB = 500 m [1]

[Turn over

6 This recipe makes 16 scones with the following ingredients.

Ingredients

- 250 g flour
- 1 tsp baking powder
- 40 g butter
- 25 g sugar
- 1 large egg
- about 100 ml milk



Source: © Getty Images

(a) Paul wants to make 20 scones.

How much butter will he need?

20 scones = 16 ÷ 4 × 5

40 ÷ 4 × 5 = 10 × 5 = 50 g

Answer 50 g [2]

(b) Paul has 300 g of flour.

Has he enough flour to make 20 scones?

Show all your working.

Flour for 20 scones:

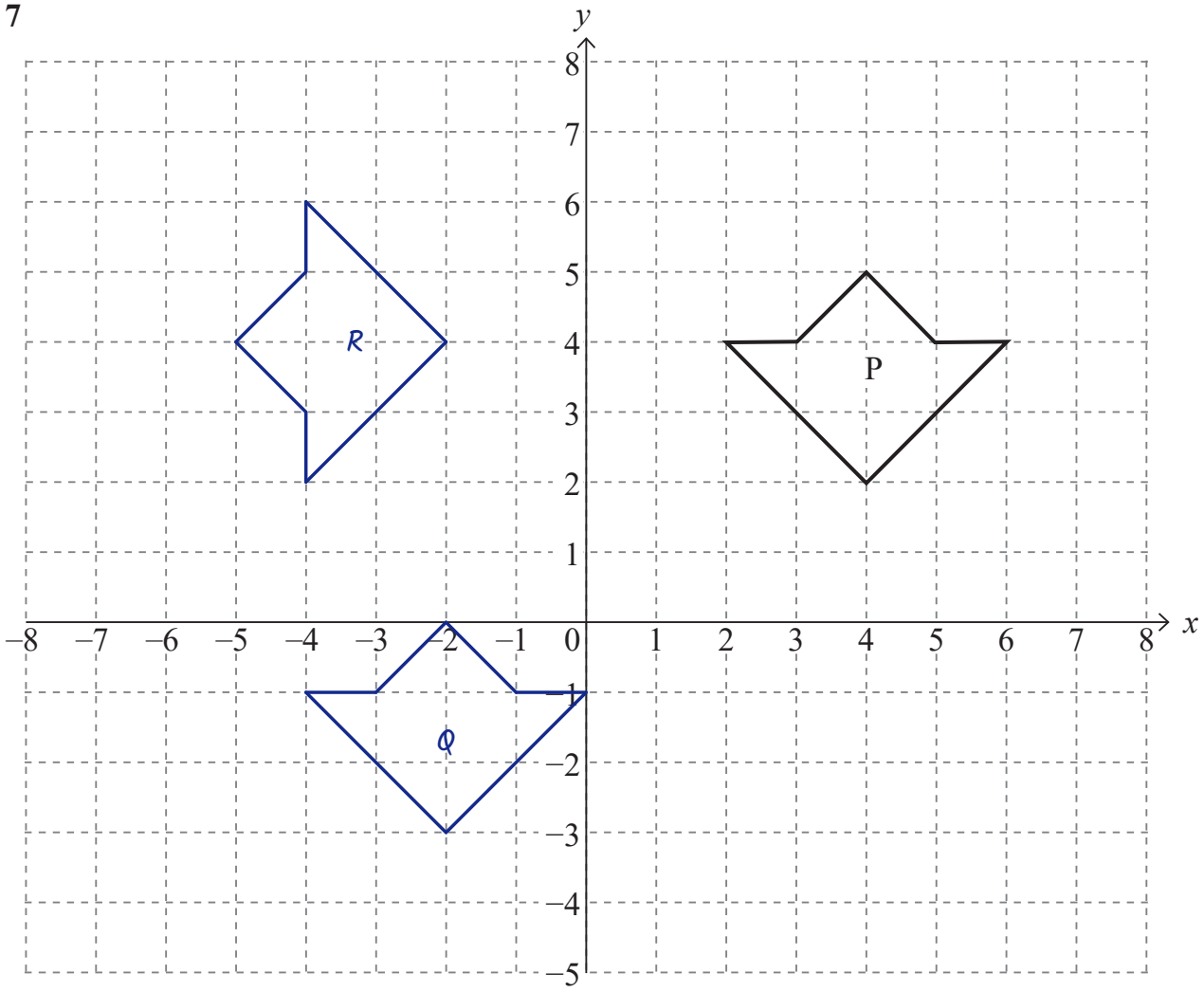
250 ÷ 4 = 62.5

62.5 × 5 = 312.5 g

312.5 g > 300 g, 312.5 − 300 = 12.5 g short

Answer No because he needs 312.5 g, which is 12.5 g more than 300 g [2]

7



(a) On the grid above translate the shape P 6 units left and 5 units down.

Label the new shape Q. [1]

(b) On the same grid, rotate the shape P 90° anticlockwise about the origin.

Label the new shape R. [3]

[Turn over

8 A 6-sided dice is biased.

The table below gives the probabilities of getting a 1, 2, 3, 4 and 5 when this dice is rolled.

Outcome	1	2	3	4	5	6
Probability	0.13	0.17	0.2	0.11	0.14	0.25

Work out the probability of getting a 6 when this dice is rolled.

$1 - (0.13 + 0.17 + 0.2 + 0.11 + 0.14)$

$= 1 - 0.75$

$= 0.25$

Answer 0.25 [2]

9 **(a)** Solve $2x - 1 \leq -5$

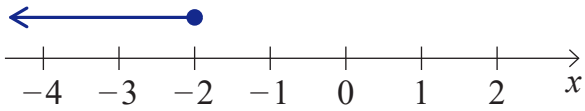
$2x \leq -5 + 1$

$2x \leq -4$

$x \leq -2$

Answer $x \leq -2$ [2]

(b) Show your solution on the number line.



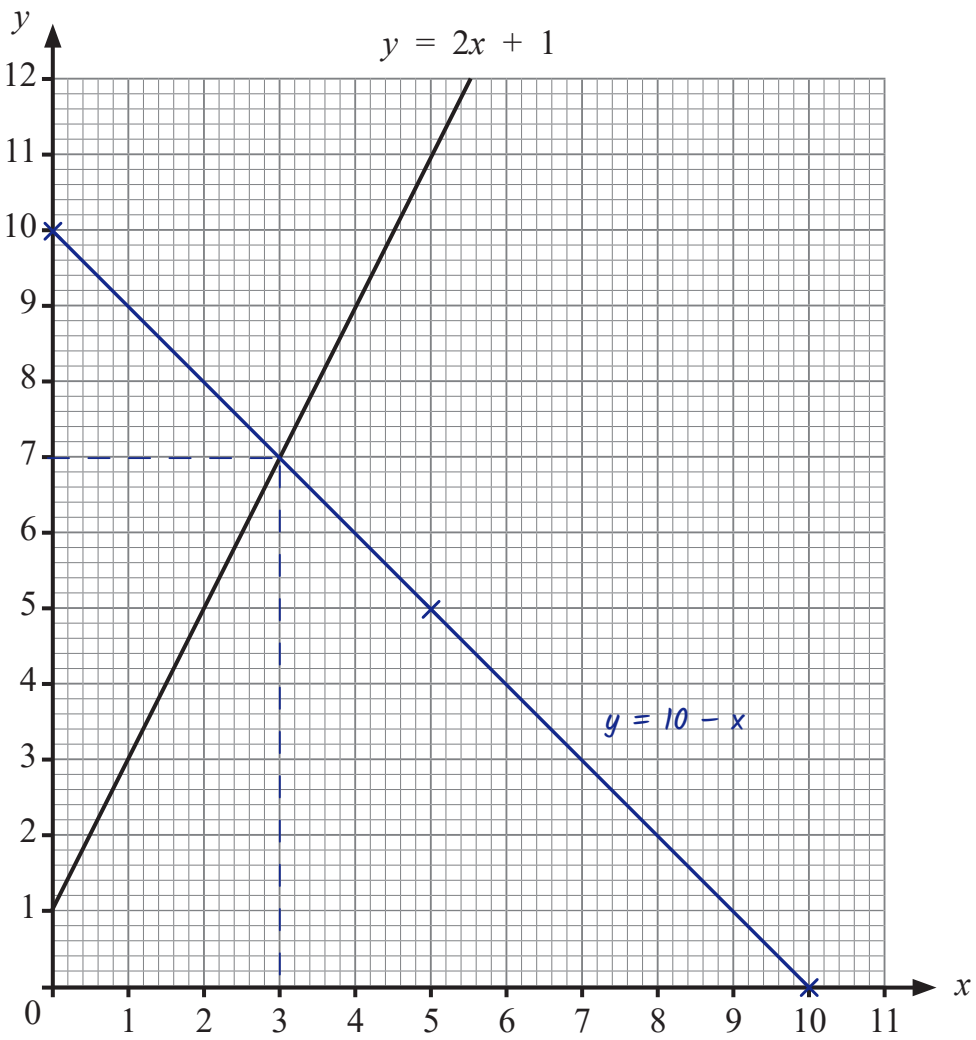
[1]

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10 Use graphs to solve the simultaneous equations

$$y = 2x + 1 \quad \text{and} \quad y = 10 - x$$

The graph of $y = 2x + 1$ has already been drawn for you.



$y = 10 - x$: $x = 0, y = 10$; $x = 5, y = 5$; $x = 10, y = 0$

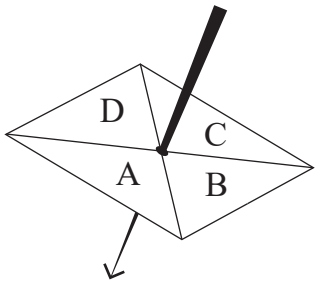
The lines cross at (3, 7)

Answer $x =$ 3 and $y =$ 7 [4]

[Turn over

11 A spinner has sections labelled A, B, C and D.

The spinner is spun, and the relative frequency of landing on D is recorded after every 10 spins.



Some of the results are recorded in the table below.

Number of spins	Relative frequency of D
10	0.5
20	0.3
30	0.4
40	0.35
50	0.38
60	0.45

(a) After 50 spins the spinner had landed on D 19 times.

Fill in the missing relative frequency in the table above. [1]

(b) How many times had the spinner landed on D after 60 spins?

Number of Ds = 0.45 × 60 = 27

Answer 27 [1]

(c) Do you think that the spinner is biased? Give a reason for your answer.

Answer Yes because if fair, rel freq of D should be about 0.25

(about 15 Ds in 60 spins) but it is 0.45 (27 Ds), far higher [2]

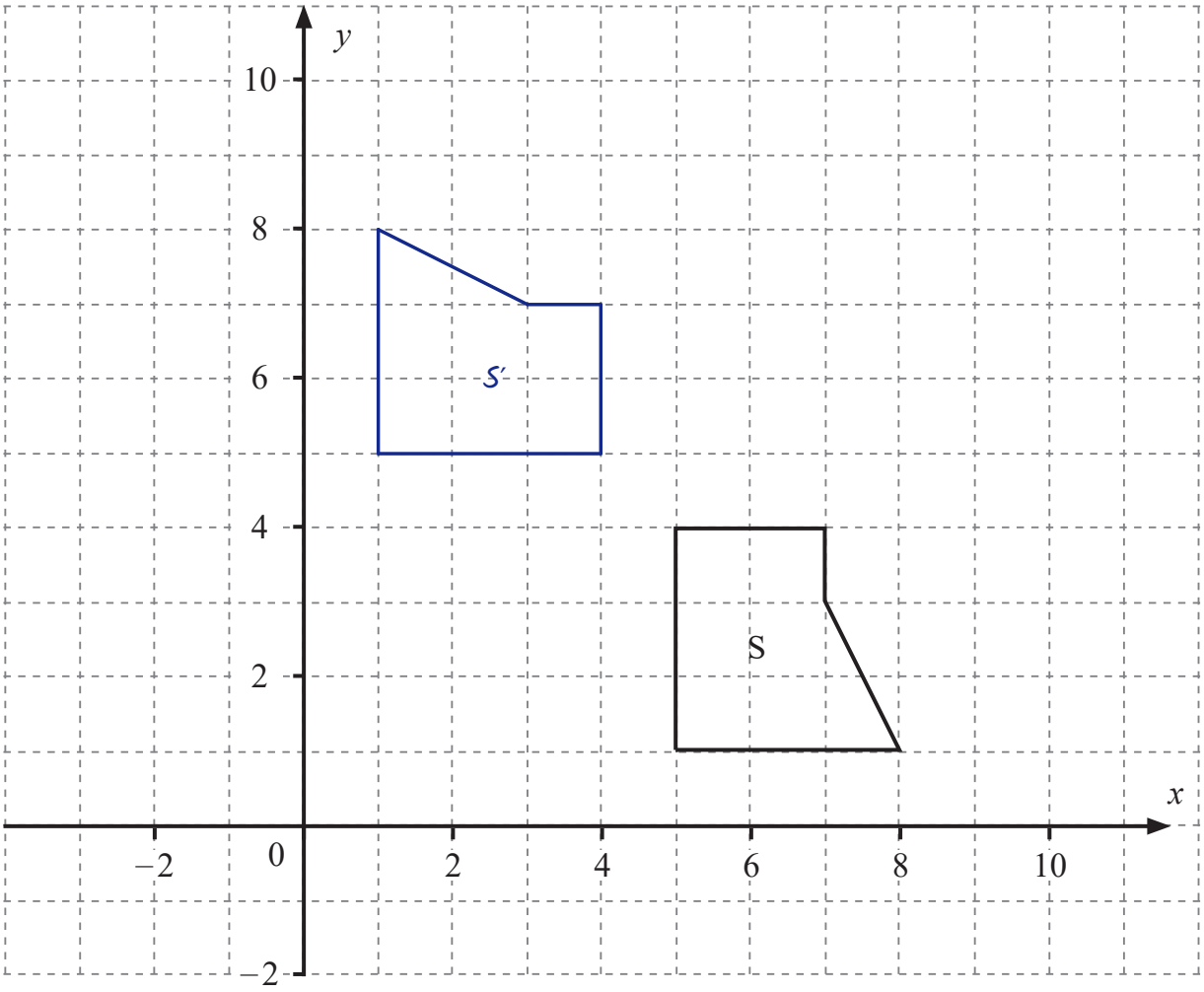
(d) If the spinner is spun 400 times how many times would you expect it to land on D?

400 × 0.45 = 180

Answer 180 [2]

[Turn over

12 On the grid reflect shape S in the line $y = x$



[2]

13 Andy and Zoe have the same rates of pay.

Andy worked 12 hours normal time and 8 hours overtime and earned £238

Zoe worked 10 hours normal time and 15 hours overtime and earned £315

Calculate the rates of pay for normal time and overtime.

A solution by trial and improvement will not be accepted.

Normal rate £x per hour, overtime rate £y per hour

12x + 8y = 238 (1)

10x + 15y = 315 (2)

(1) × 10: 120x + 80y = 2380

(2) × 12: 120x + 180y = 3780

Subtract: 100y = 1400

y = 14

Sub into (1): 12x + 8 × 14 = 238

12x + 112 = 238

12x = 126

x = 10.50

Answer normal £ *10.50* per hour; overtime £ *14.00* per hour

[5]

[Turn over



14 $1\,000\,000\,cm^3$ of gas has mass of 1.5×10^4 g.

Giving your answer in standard form, calculate the mass of one cubic centimetre of the gas.

$1\,000\,000 = 10^6$

$1.5 \times 10^4 \div 10^6$

$= 1.5 \times 10^{4-6}$

$= 1.5 \times 10^{-2}$

Answer 1.5×10^{-2} g [2]

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