



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier Paper 3 Calculator

Wednesday 14 June 2023

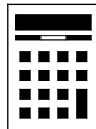
Morning

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

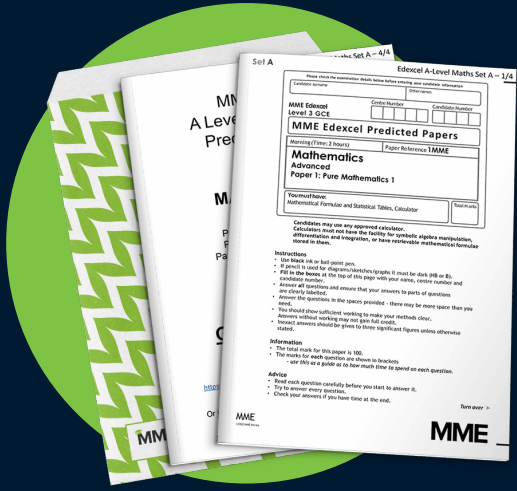
In all calculations, show clearly how you work out your answer.

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	
TOTAL	

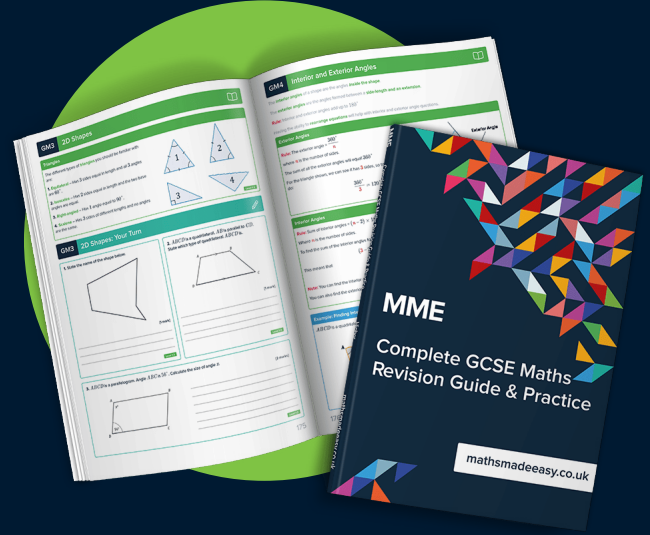


J U N 2 3 8 3 0 0 3 H 0 1

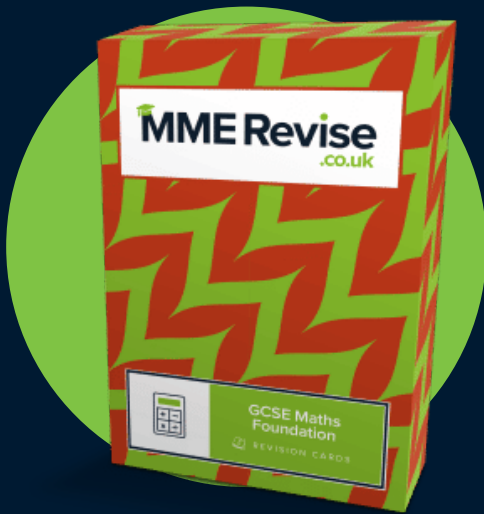
MME. GCSE Revision - GCSE Maths



GCSE Maths Predicted Papers 2024



GCSE Maths Revision Guide



GCSE Maths Revision Cards



Course in a Box – GCSE Maths (Guaranteed Pass)

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

1 The line with equation $y = 2x + 7$ intersects the y -axis at A.

Complete the coordinates of A.

*y intercept***[1 mark]**Answer (0 , 7)

2 Write down a fraction equivalent to 1.875

[1 mark]

$$\frac{1875}{1000} = \frac{15}{8}$$

Answer $\frac{15}{8}$

3 Solve $5x + 11 = 3x + 19$

[2 marks]

$$2x + 11 = 19$$

$$2x = 8$$

$$x = 4$$

x = 4

4 A map has a scale of 1 : 5000

How many **metres** are represented by a length of 4.5 cm on the map?

[2 marks]

$$\begin{array}{l} \text{map : real life} \\ 1 \text{ cm : } 5000 \text{ cm} \\ \times 4.5 \quad \quad \quad \times 4.5 \\ \hline 4.5 \text{ cm : } 22500 \text{ cm} \end{array}$$

$$22500 \text{ cm} = 22500 \div 100 \text{ m} = 225 \text{ m}$$

Answer 225 m

5 The number of hedgehogs in England is expected to **reduce** by 4% each year.
Assume there are now 1 000 000 hedgehogs in England.

Work out the expected number of hedgehogs in England after **five** years.

You **must** show your working.

[3 marks]

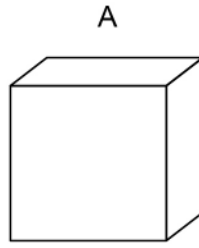
$$\text{reduce by } 4\% \text{ so } 100\% - 4\% = 96\% = 0.96$$

$$1,000,000 \times 0.96^5 = 815,372.6976$$

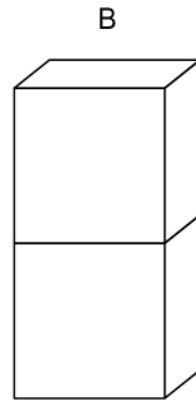
Answer 815,373 (nearest hedgehog)



6 Here is cuboid A.



Cuboid B is made from **two** of cuboid A.



volume of A : volume of B = 1 : 2

Matthew says,

“surface area of A : surface area of B must be 1 : 2 because B is made of 2 of A.”

Is Matthew correct?

Tick **one** box.

Yes

No

Cannot tell

Give a reason for your answer.

[2 marks]

A has 6 faces, B has 10 faces, so B is not double A



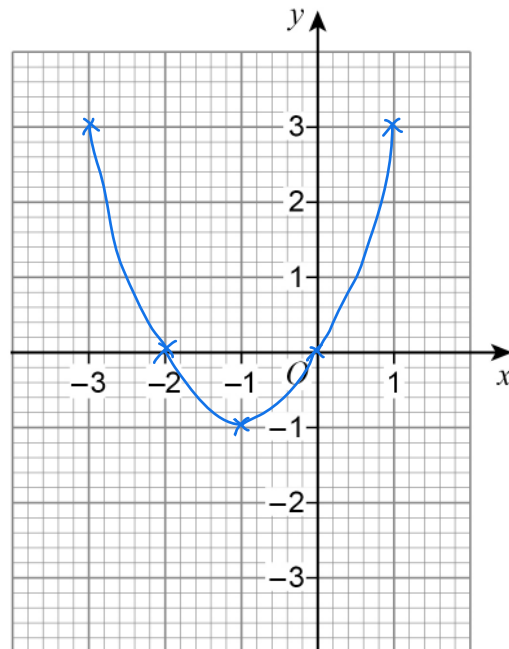
7 (a) Complete the table of values for $y = x^2 + 2x$

[2 marks]

x	-3	-2	-1	0	1
y	3	0	-1	0	3

7 (b) Draw the graph of $y = x^2 + 2x$ for values of x from -3 to 1

[2 marks]



Turn over for the next question

Turn over ►



8

Jing has £2450

She saves some and gives the rest to her four brothers.

money saved : money given to brothers = 2 : 5

She gives each of her **four** brothers the **same** amount.

Does each brother receive more than £430 ?

You **must** show your working.**[4 marks]**

$$2 + 5 = 7 \quad \text{so } 7 \text{ parts} = \pounds 2450$$

$$1 \text{ part} = \pounds 350$$

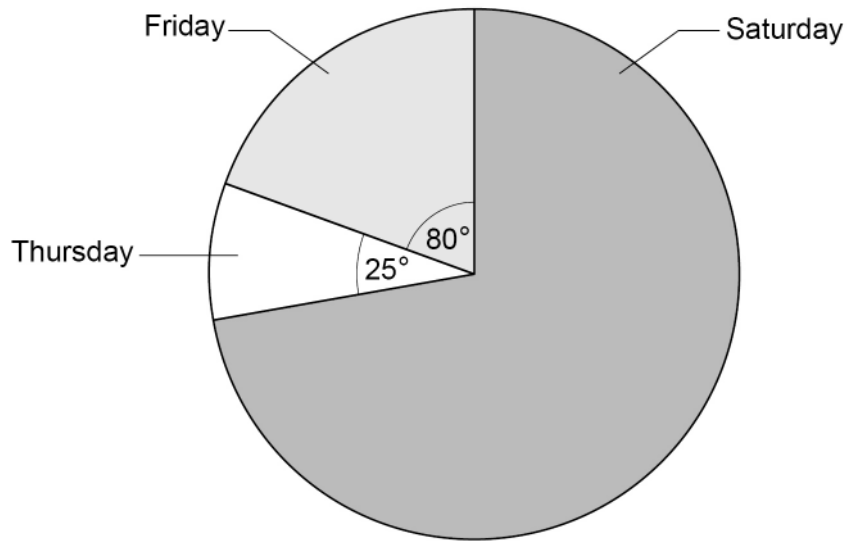
$$5 \text{ parts} = \pounds 1750 \quad \text{so } \pounds 1750 \text{ given to brothers}$$

$$\text{Each brother gets } \pounds 1750 \div 4 = \pounds 437.50$$

↑
yes, more than £430



- 9 The pie chart shows information about people at a fair during three days.



Not drawn
accurately

There were 132 **more** people on Friday than on Thursday.

Work out the number of people on Saturday.

[3 marks]

Difference between Thursday and Friday is $80 - 25 = 55^\circ$

So $55^\circ = 132$ people

$1^\circ = 2.4$ people

$\div 55$

Saturday is $360 - 80 - 25 = 255^\circ$

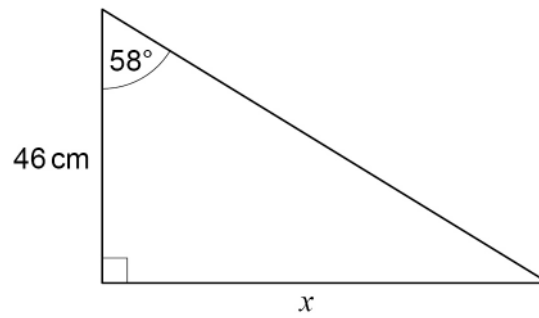
$255 \times 2.4 = 612$ people

Answer 612

Turn over for the next question



10

Use trigonometry to work out the value of x .Not drawn
accurately

[3 marks]

$$\tan 58 = \frac{x}{46}$$

$$46 \times \tan 58 = x$$

$$73.62 = x \quad (\text{to 2dp})$$

$$x = 73.62 \text{ cm}$$



11 Millie is estimating the value of $\frac{1}{(\sqrt[3]{8.34})^2 \times 10.21}$

She rounds each decimal number to 1 significant figure.

11 (a) Work out Millie's estimate.

You **must** show your working.

[2 marks]

$$\frac{1}{(\sqrt[3]{8})^2 \times 10}$$

$$= \frac{1}{2^2 \times 10}$$

$$= \frac{1}{4 \times 10}$$

$$= \frac{1}{40}$$

Answer $\frac{1}{40}$

11 (b) Millie says,

"My estimate must be more than the exact value."

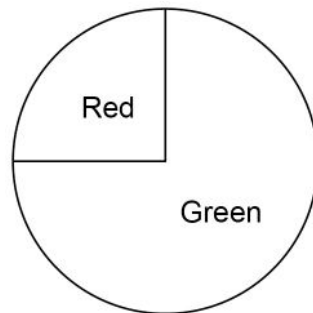
Without working out the exact value, give a reason how she can know this.

[1 mark]

Both numbers have been rounded down



12 Here is a **biased** spinner.



12 (a) Ali, Ben and Cary want to know the probability of spinning red on the biased spinner. They each spin it and count how many times it lands on red and divide by the total number of spins.

Ali says

I spun red the most times

Ben says

I spun the spinner the most times

Cary says

My relative frequency of red is 0.25

Who had the best estimate for the probability of spinning red?

Give a reason for your answer.

[1 mark]

Ben - spun the most times



12 (b) Dev spins the spinner 80 times.

He says,

“My relative frequency of red is 0.185”

Give a reason why his relative frequency must be wrong.

[1 mark]

$0.185 \times 80 = 14.8$ ← not a whole number so must be wrong

12 (c) Elena spins the spinner 125 times.

The relative frequency of red is 0.32

Work out how many times the spinner landed on **green**.

[2 marks]

landed on red $0.32 \times 125 = 40$ times

So landed on green $125 - 40 = 85$ times

Answer 85

Turn over for the next question

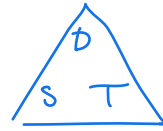


13

Charlie is driving 293 miles home.

He

- leaves at 9.00 am
- travels the first 176 miles at an average speed of 48 mph
- drives the rest of the way at an average speed of 65 mph



Will he be home by 2.30 pm?

You **must** show your working.

[4 marks]

$$\text{First part of journey: time taken} = \frac{176}{48} = 3.666\dots \text{hrs}$$

$$= 3 \text{ hrs } 40 \text{ mins}$$

$$\text{Second part of journey: travels } 293 - 176 = 117 \text{ miles}$$

$$\text{time taken} = \frac{117}{65} = 1.8 \text{ hrs}$$

$$= 1 \text{ hr } 48 \text{ mins}$$

$$\text{Total journey time} = 3 \text{ hr } 40 \text{ min} + 1 \text{ hr } 48 \text{ min}$$

$$= 4 \text{ hr } + 88 \text{ min}$$

$$= 5 \text{ hr } 28 \text{ min}$$

Sets off at 9 am so will arrive at 2:28 pm

Yes he will be home by 2:30



14 Kiran paid Income Tax and National Insurance on her annual salary.

Income Tax

0% of the first £12570 of her annual salary
20% of the rest of her annual salary

National Insurance

0% of the first £9880 of her annual salary
13.25% of the rest of her annual salary

Kiran paid £5186 Income Tax.

How much National Insurance did she pay?

[4 marks]

Earns £12570 before income tax

20% of remaining income is £5186

so whole remaining income is $5186 \div 0.2 = £25,930$

so total income is $£12570 + £25930 = £38,500$

Pays national insurance on $38500 - 9880 = £28620$

amount of national insurance is $£28620 \times 0.1325$

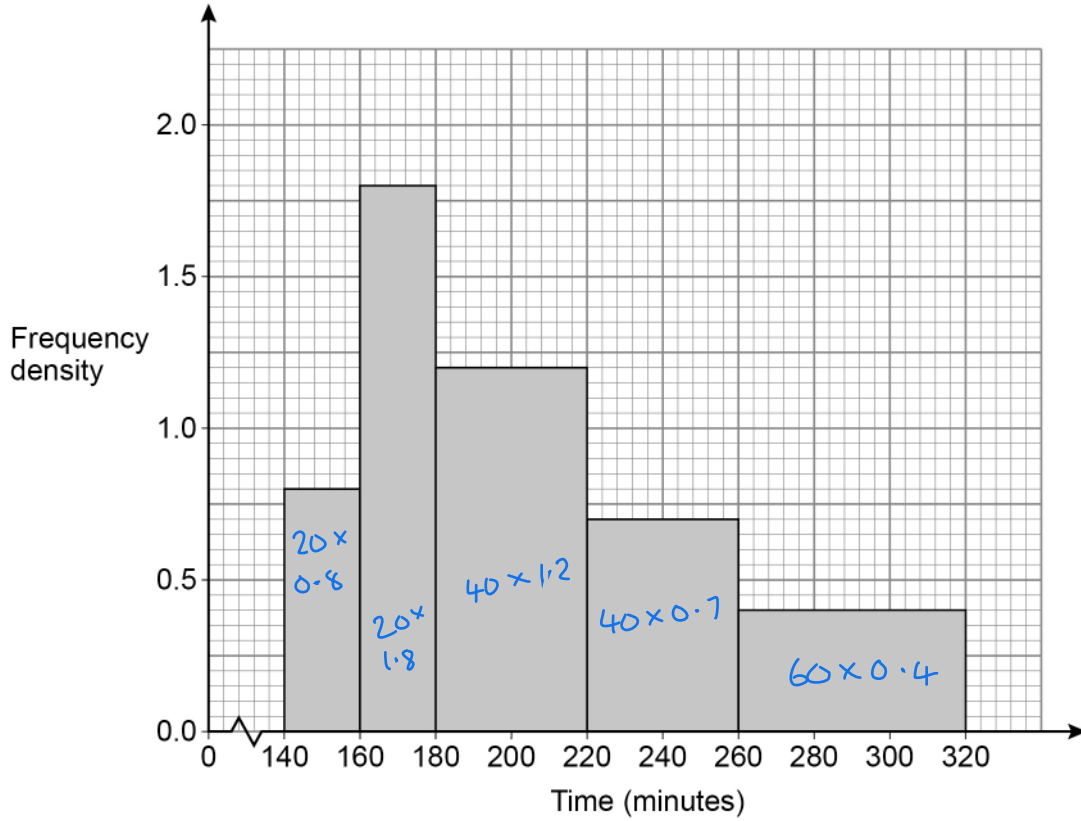
$= £3792.15$

Answer £ 3792.15



15 180 runners **started** a marathon.
Some of the runners did not complete it.

15 (a) The histogram represents the times of the runners who did complete the marathon.



How many runners did **not** complete the marathon?

[3 marks]

Total number of runners to complete marathon is:

$$(20 \times 0.8) + (20 \times 1.8) + (40 \times 1.2) + (40 \times 0.7) + (60 \times 0.4)$$

$$= 16 + 36 + 48 + 28 + 24$$

$$= 152$$

So $180 - 152 = 28$ did not complete marathon

Answer 28

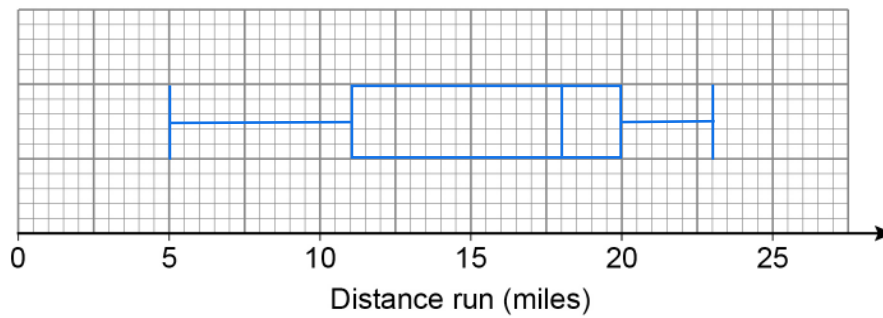


15 (b) The table shows information about the runners who did **not** complete the marathon.

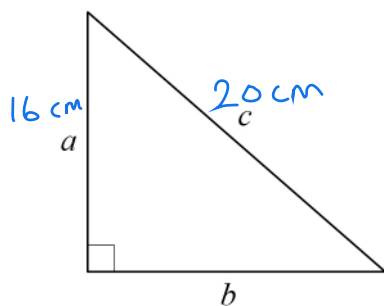
	Distance run (miles)
Least distance	5
Greatest distance	23
Lower quartile	11
Median	18
Interquartile range	9

Draw a box plot to represent the information.

[3 marks]



16

Not drawn
accurately

In this right-angled triangle,

$$a = 16 \text{ cm}$$

$$a : c = 4 : 5$$

Work out the area of the triangle.

[4 marks]

$$4 \text{ parts} = 16 \text{ cm}$$

$$1 \text{ part} = 4 \text{ cm}$$

$$5 \text{ parts} = 20 \text{ cm} \quad \text{so } c = 20 \text{ cm}$$

$$\text{By Pythagoras, } b^2 = 20^2 - 16^2$$

$$b^2 = 144$$

$$b = \sqrt{144} = 12 \text{ cm}$$

$$\text{Area} = \frac{12 \times 16}{2} = 96 \text{ cm}^2$$

Answer 96 cm²

17 Solve $\frac{x+8}{2} + \frac{9-x}{5} = 4$

[4 marks]

$$5(x+8) + 2(9-x) = 4(2)(5)$$

$$5x + 40 + 18 - 2x = 40$$

$$3x + 58 = 40$$

$$3x = -18$$

$$x = -6$$

$$x = \underline{-6}$$

Turn over for the next question

Turn over ►



18 $f(x) = x^2 + 6x$
 $g(x) = 2x + 4$

18 (a) Show that $fg(x) = 4x^2 + 28x + 40$

[3 marks]

$$\begin{aligned} f(g(x)) &= f(2x+4) \\ &= (2x+4)^2 + 6(2x+4) \\ &= (2x+4)(2x+4) + 12x + 24 \\ &= 4x^2 + 8x + 8x + 16 + 12x + 24 \\ &= 4x^2 + 28x + 40 \end{aligned}$$

18 (b) Solve $fg(x) = -5$

[3 marks]

$$\begin{aligned} 4x^2 + 28x + 40 &= -5 \\ 4x^2 + 28x + 45 &= 0 \quad a=4 \quad b=28 \quad c=45 \\ x &= \frac{-28 \pm \sqrt{28^2 - (4 \times 4 \times 45)}}{2 \times 4} \\ &= \frac{-28 \pm \sqrt{64}}{8} = \frac{-28 \pm 8}{8} = -2.5 \text{ or } -4.5 \end{aligned}$$

Answer $x = -2.5$, $x = -4.5$



19 Two integers have a difference of 6

The integers are multiplied together.

9 is then added.

Prove algebraically that the result is always a square number.

[3 marks]

Say the integers are x and $x+6$

multiply together: $x(x+6)$

add 9: $x(x+6)+9 = x^2+6x+9$

$$= (x+3)(x+3)$$

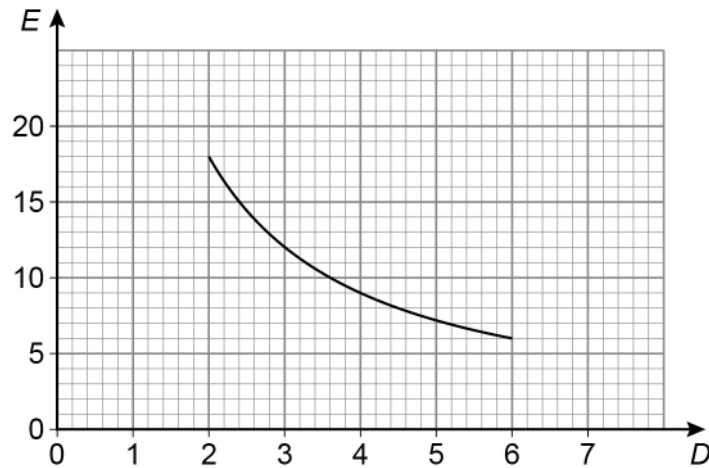
$$= (x+3)^2 \text{ which must be a square number}$$

Turn over for the next question



20 (a) Sunil thinks that E and D are linked by the equation $E = \frac{36}{D}$

The graph shows the values of D and E for $2 \leq D \leq 6$



Choose **one** point on the graph and state if Sunil's equation is correct for that point.

[1 mark]

Choose $D=6, E=6$

Try: $6 = \frac{36}{6}$ ✓ yes, equation is correct



20 (b) G is directly proportional to the square root of H .

$$G:H = 3:2 \text{ when } H = 16 \leftarrow$$

$$\begin{aligned} 2 \text{ parts} &= 16 \\ 1 \text{ part} &= 8 \\ 3 \text{ parts} &= 24 \end{aligned}$$

$$\text{So when } H = 16, G = 24$$

Work out $G:H$ when $H = 100$

[4 marks]

$$G \propto \sqrt{H} \text{ so } G = k\sqrt{H}$$

$$\text{when } H = 16, G = 24 \text{ so } 24 = k \times \sqrt{16}$$

$$24 = k \times 4$$

$$k = 6$$

$$\text{So we know } G = 6\sqrt{H}$$

$$\text{When } H = 100, G = 6 \times \sqrt{100}$$

$$G = 60$$

$$\text{So ratio of } G:H \text{ is } 60:100$$

$$3:5$$

Answer 3 : 5

Turn over for the next question



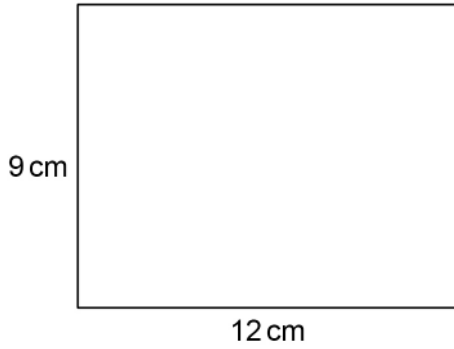
21

A solid shape is made from centimetre cubes.

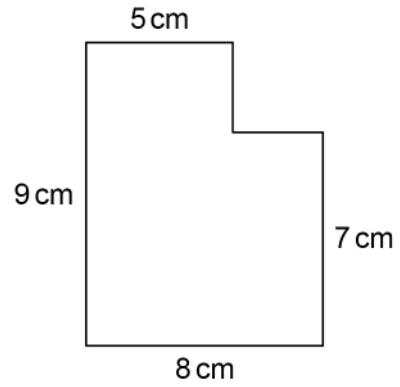
The front elevation and side elevation of the shape are shown.

Not drawn accurately

Front elevation



Side elevation



Work out

the **maximum** possible number of cubes in the shape

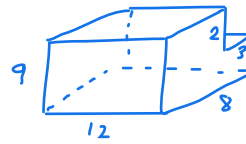
and

the **minimum** possible number of cubes in the shape.

[3 marks]

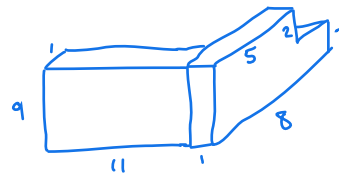
Max Solid block with corner cut out

$$(9 \times 12 \times 8) - (2 \times 3 \times 12) = 792$$



Min Two 'walls' joining at corner

$$(9 \times 11 \times 1) + (8 \times 7 \times 1) + (5 \times 2 \times 1) = 165$$

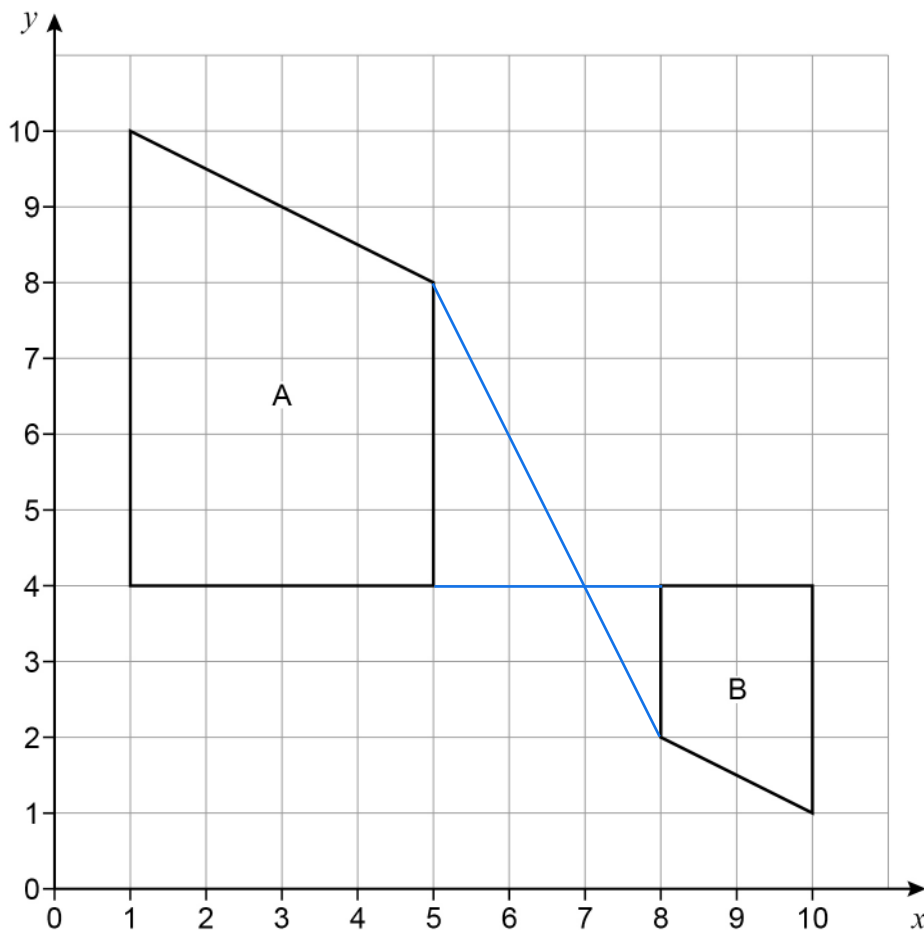


Maximum 792

Minimum 165



22 Shape A and shape B are shown on the grid.



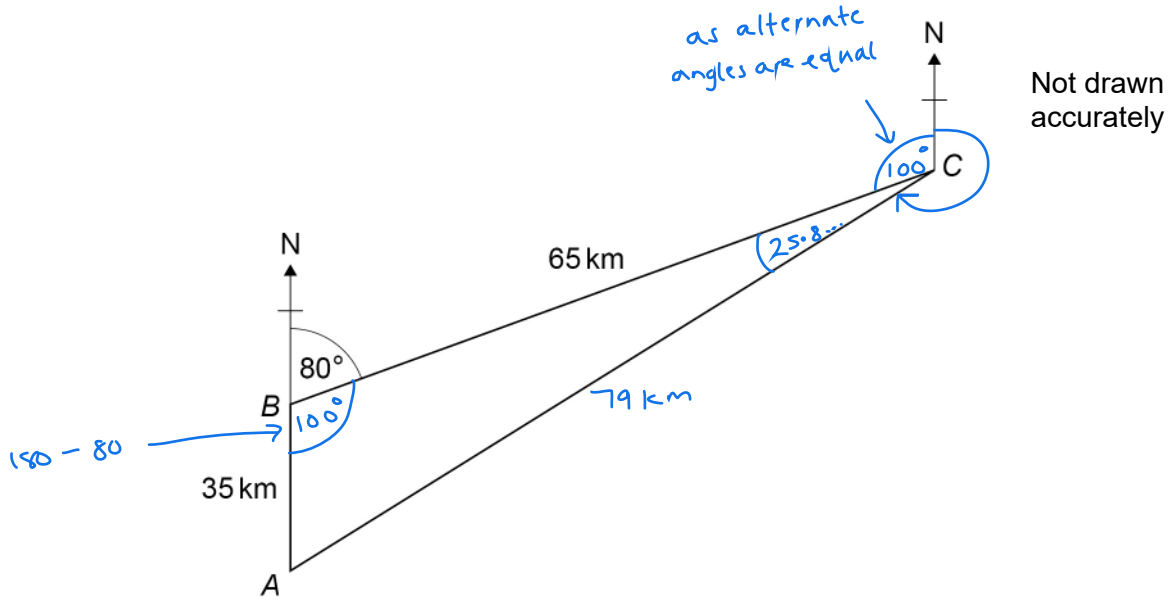
Describe the **single** transformation that maps shape A to shape B.

[3 marks]

Enlargement, scale factor $\frac{1}{2}$, centre (7, 4)



23



A boat sails 35 km North from A to B.
 From B the boat sails to C and then back to A.

23 (a) Show that the distance the boat sails from C to A is 79 km to the nearest km
 You **must** show your working.

[2 marks]

using cosine rule, $AC^2 = 35^2 + 65^2 - 2 \times 35 \times 65 \times \cos 100$

$AC^2 = 6240.099\dots$

$AC = \sqrt{6240.099\dots} = 78.99 \text{ km}$

$= 79 \text{ km (nearest km)}$



23 (b) Work out the bearing of A from C.

[4 marks]

Using sine rule, $\frac{\sin ACB}{35} = \frac{\sin 100}{79}$

$$\sin ACB = \frac{\sin 100}{79} \times 35$$

$$= 0.4363 \dots$$

$$ACB = \sin^{-1}(0.4363)$$

$$ACB = 25.8685 \dots$$

Bearing of C to A is $360 - 100 - 25.8685 \dots$

$$= 234.131 \dots$$

Answer 234 °

(to nearest degree)

END OF QUESTIONS

