MME
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GCSE MATHEMATICS

AQA | Edexcel | OCR | WJEC

(Level 5 - 7)

Upper and Lower Bounds

Please write clearly in block capitals

Forename:
Surname:

Materials

For this paper you must have:
- mathematical instruments

You ***can*** use a calculator.

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.
- 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.
- You may ask for graph paper, tracing paper and more answer paper. These must be tagged securely to this answer book.

Advice

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

1(a) A wooden toy is 6 cm tall to the nearest cm. *(Level 5)*

Find the upper and lower bounds for the height of the toy.

[2 marks]

LB = 5.5 cm

UB = 6.5 cm

Answer _____

1(b) The mass of the toy is 2.2 kg to the nearest 0.1 kg.

Find the error interval, in which the true mass of the toy, m, lies

[2 marks]

2.15 kg $\leq m <$ 2.25 kg

1(c) The length of a log is measured exactly to be 55.6m

Calculate the length of the log truncated to the nearest meter.

[1 mark]

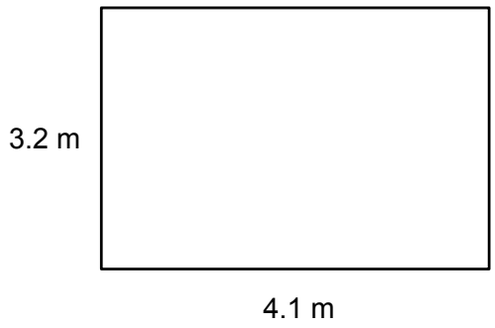
Answer 55 m

Turn over for next question

5

2 A diagram of a rectangular garden is shown below. *(Level 5)*

Each length is measured to the nearest 0.1 m



Calculate minimum and maximum possible values for area of the garden.

Give your answers to 1 decimal place.

[3 marks]

$4.05_m \leq L < 4.15_m$

$3.15_m \leq W < 3.25_m$

Min Area $= 4.05 \times 3.15 = 12.7575$

$= 12.8\ m^2$

Max Area $= 4.15 \times 3.25 = 13.4875$

$= 13.5\ m^2$

Maximum area: 13.5 m^2

Minimum area: 12.8 m^2

3 The distance from Sarah's house to Peter's house is 230 miles measured to the nearest 10 miles. *(Level 6)*

Sarah took exactly 4 hours to complete this journey.

Sarah says:

"My average speed was 60 mph for the journey to Peter's house"

Is Sarah correct?

You **must** explain your answer

[3 marks]

225 miles ≤ Distance < 235 miles

No at 60 mph time would be less than 4 hrs since distance < 240 miles

Answer _____

3

4 x and y are measured as $3.42\ m$ and $0.92\ m$, both correct to the nearest $0.01\ m$. *(Level 6)*

4(a) Find the upper and lower bounds of x and y.

[2 marks]

$3.415 \leq x < 3.425$

$0.915 \leq y < 0.925$

4(b) $z = \frac{1}{x} + y$

Find the maximum and minimum possible values of z.

Give your answer to 3 decimal places.

[2 marks]

Max $z = \frac{1}{3.415} + 0.925 = 1.2178$

$= 1.218$

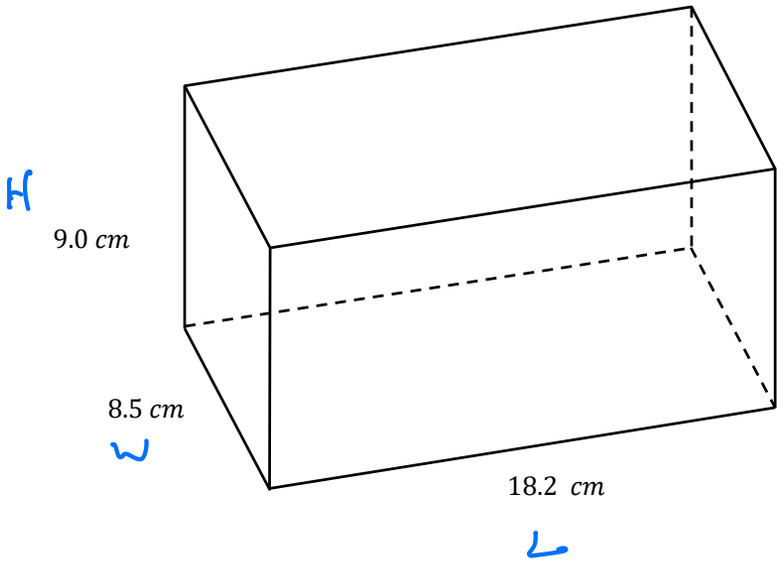
Min $z = \frac{1}{3.425} + 0.915 = 1.20697$

$= 1.207$

Answer

5 The dimensions of a cuboid container are shown below. *(Level 7)*

Each length has been measured to 1 decimal place.



5(a) Calculate the upper bound for the volume of the cuboid.

Give you answer to 2 decimal places.

[2 marks]

$18.15 \leq L < 18.25$

$8.45 \leq W < 8.55$

$8.95 \leq H < 9.05$

Upper bound for vol $= 18.25 \times 8.55 \times 9.05$

Answer $1412.139 = 1412.14$ cm^3

Question continues on next page

2

5(b) Joe has a bucket containing 1370cm^3 of water measured to the nearest 10 cm^3.

Joe Says

"If I tip my bucket of water in the cuboid container, it will **never** overflow"

Is Joe correct?

You must explain your answer

[3 marks]

$1365\text{ cm}^3 \leq \text{Bucket} < 1375\text{ cm}^3$

Min Vol of cuboid $18.15 \times 8.45 \times 8.95$

$= 1372.639$

$= 1372.64\text{ cm}^3$

$1375 > 1372.64$

so cuboid might overflow

Answer

Turn over for next question

3

6 A ball is dropped from a height of *d* meters. *(Level 7)*

The time, *t* seconds, taken for the ball to reach the ground is given by

$$t = \sqrt{\frac{2d}{g}}$$

where g is the acceleration due to gravity.

$d = 12.4\,m$ correct to 3 significant figures

g = 9.8 m/s^2 correct to 2 significant figures.

$12.35 \leq d < 12.45$

$9.75 \leq g < 9.85$

6(a) Find the lower bound of *d.*

[1 mark]

Answer $d \geq 12.35$

6(b) Find the minimum value of t.

Give your answer to 2 decimal places.

$t = \sqrt{\frac{2d}{g}}$

[3 marks]

Min $t = \sqrt{\frac{2 \times d_{min}}{g_{max}}} = \sqrt{\frac{2 \times 12.35}{9.85}}$

Answer $1.5835 = 1.58$ to 2dp

End of question

4