

Exercise walk-through

1.3.2

Bounds

AQA · GCSE · Mathematics

14. Indices, surds, standard form and bounds (N7–N9, N14–N16)

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Bounds (N16, H): upper bound of a length 9 m to the nearest metre is 9.5; in calculations, for positive inputs, an upper product bound uses upper input bounds and an upper quotient bound uses upper numerator divided by lower denominator. Check signs first; these shortcuts need not hold for negative inputs. Track strict endpoints; give the answer to an appropriate degree of accuracy (often the bound width decides).

19. Checklist before you call this topic done

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Four operations on fractions/mixed numbers and negatives without a calculator; BIDMAS traps. Prime decomposition $\rightarrow$ HCF/LCM; product rule for counting (H). Index laws including negative and fractional; simplify and rationalise surds (H). Standard form arithmetic; rounding and error intervals; upper/lower bounds through a formula (H). FDP conversions including recurring decimals (H); percentage multipliers and reverse percentages.

114. Reasoning and check

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$7.95 \leq l < 8.05$ and $2.95 \leq w < 3.05$, in cm. Positivity makes product and quotient monotonic in the needed directions. Thus $23.4525 \leq A < 24.5525$ in square centimetres. For the dimensionless quotient, $7.95/3.05 < l/w < 8.05/2.95$, or $159/61 < l/w < 161/59$. Neither quotient endpoint is attained, since each requires one excluded upper measurement bound. The area lower bound is attained, since both lower bounds are allowed. Blindly using “upper over lower” without sign and endpoint checks is insufficient.

Exercises 2.1·2.3

2.1 (Higher) Find the lower bound of 3.4 rounded to the nearest 0.1.

2.2 (Higher) Find the upper bound of 250 rounded to the nearest 10.

2.3 (Higher) A distance is at most 105 m and time at least 20 s. Find the upper speed bound.

3 Exam-style questions

Exercises 2.1·2.3

2.1 (Higher) Find the lower bound of 3.4 rounded to the nearest 0.1.

2.1 Half the rounding unit is 0.05. Lower bound = $3.4 - 0.05 = 3.35$.

2.2 (Higher) Find the upper bound of 250 rounded to the nearest 10.

2.2 Half of 10 is 5. Upper bound = $250 + 5 = 255$; the upper endpoint is excluded.

2.3 (Higher) A distance is at most 105 m and time at least 20 s. Find the upper speed bound.

3 Exam-style questions

2.3 For positive d and t , the largest quotient uses the greatest d and least t : $105/20 = 5.25$.

Exercise 3.1

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: The greatest value of positive d/t uses the greatest d and greatest t .

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3.1 False. With $8 \leq d < 9$ and $2 \leq t < 3$, $8.9/2 = 4.45$ exceeds $8.9/2.9 \approx 3.07$. Increase the numerator and decrease the positive denominator; distinguish a supremum from an attained maximum.

Local review guidance: show the chosen method; give the checked result; explain the condition or failed shortcut. This is authored classroom guidance.