

Bounds and error intervals

Topic cliff notes / objectives, key ideas and examples

Learning objectives

- Write an error interval for a rounded measurement.
- Choose bounds that produce an extreme calculated value.

Key ideas

- For usual rounding of positive measurements, use half the rounding unit on each side.

$$v - \frac{u}{2} \leq x < v + \frac{u}{2}$$

- Positive values truncated to one decimal place keep the stated lower endpoint.

$$v \leq x < v + 0.1$$

- For positive measurements, use opposite bounds; the denominator lower bound must be strictly positive.

$$\text{upper bound} = \frac{a_U}{b_L}, \quad \text{lower bound} = \frac{a_L}{b_U}$$

- Keep intermediate bounds exact. An upper bound may not be attained.

Worked example

Distance is 120 km to the nearest km; time is 2.4 hours to the nearest 0.1 hour. Find the speed upper bound.

$$119.5 \leq d < 120.5 \text{ km}$$

$$2.35 \leq t < 2.45 \text{ hours}$$

Use the distance upper bound and time lower bound.

$$v_U = \frac{120.5}{2.35} = 51.276595 \dots \text{ km/h}$$

Answer

$$v_U \approx 51.28 \text{ km/h}$$

Quick example

A length is 4.7 cm to the nearest 0.1 cm. Write the interval.

$$\frac{0.1}{2} = 0.05 \text{ cm}$$

Answer

$$4.65 \leq l < 4.75 \text{ cm}$$

Watch out

Do not use the denominator upper bound for an upper quotient bound. Rounding and truncation give different intervals.

