

C1.10 Limits of accuracy

Name: _____ Class: _____ Date: _____

Total: 20 marks

KEY WORDS lower bound 下界 • upper bound 上界 • rate 比率 • decimal place 小数位
• decimal 小数

Objective

Use limits of accuracy to solve Core IGCSE Mathematics problems.

You must be able to:

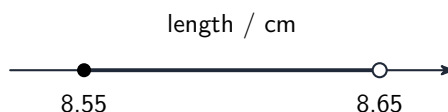
- Identify the rounding step and half-step
- State lower-inclusive and upper-exclusive measurement bounds
- Test whether a proposed true reading fits the reported measurement

1 Key knowledge and worked examples

■ Key knowledge: Limits of accuracy

Rounded measurements represent intervals. The rounding step is 1 for nearest unit, 0.1 for one decimal place and 10 for nearest ten. Subtract half the step for the lower bound; add half for the upper bound. Include the lower endpoint and exclude the upper: $L \leq x < U$. Core requires bounds of measurements, not bounds of calculations with them.

■ Worked example: Limits of accuracy



A length is 8.6 cm to the nearest 0.1 cm.

- Half the rounding step is $h = 0.1/2 = 0.05$ cm.
- Lower bound: $L = 8.6 - 0.05 = 8.55$ cm.
- Upper bound: $U = 8.6 + 0.05 = 8.65$ cm.
- Thus $8.55 \leq l < 8.65$ in cm. The upper endpoint rounds to 8.7, so is excluded.

■ Method check

Bounds describe all true values consistent with a rounded measurement. The upper endpoint is excluded because it rounds to the next reported value.

2 Practice

2.1 A mass is 24 kg to the nearest kg. Give its lower and upper bounds. [2]

2.2 A distance is 370 m to the nearest 10 m. Write its bounds as an inequality. [2]

2.3 A time is 6.42 s to two decimal places. Give both bounds. [2]

2.4 A height is 1.8 m to one decimal place. Could the true height be 1.84 m? Explain. [2]

3 Exam-style questions

3.1 Apply the limits of accuracy methods below. Show working and include units where appropriate.

(a) A length is 125 cm to the nearest cm. State the rounding step. [2]

(b) Give its lower and upper bounds. [2]

(c) Decide whether 125.5 cm is a possible true length. Explain. [2]

3.2 A parcel is labelled 2.4 kg, rounded to the nearest 0.1 kg. A service accepts only parcels strictly below 2.45 kg.

(a) Write the full interval for the true mass and state whether every possible mass meets the service rule. [3]

(b) Consider true masses 2.35 kg, 2.44 kg and 2.45 kg. State which could give the label 2.4 kg, with an explanation of the boundary case. [3]

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

- Half-step is 0.5 kg: $L = 24 - 0.5 = \mathbf{23.5}$ kg; $U = 24 + 0.5 = \mathbf{24.5}$ kg.

2.2

- Half-step is 5 m, so $365 \leq d < 375$ in metres.

2.3

- Half-step is 0.005 s: **6.415 s** and **6.425 s**.

2.4

- The interval is $1.75 \leq h < 1.85$. Since 1.84 lies inside it, **yes**.

3.1

(a)

- The step is **1 cm**.

(b)

- Half-step is 0.5 cm: $124.5 \leq l < 125.5$ in cm.

(c)

- **No**. 125.5 cm is excluded and rounds up to 126 cm.

3.2

(a)

- Half-step is $h = 0.1/2 = 0.05$ kg.
- Interval **2.35** $\leq$ **m** $<$ **2.45** kg.
- **Every possible mass meets the rule**, since all are strictly less than 2.45 kg.

(b)

- **2.35 and 2.44 kg are possible**.
- **2.45 kg is not possible**: at that upper boundary it rounds to 2.5 kg, so the interval excludes it.