

Limits Of Accuracy

Quick revision notes [Open it online](#)

Name: _____

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At a glance

Upper and lower bounds of rounded values and of calculations that use them.

1. Bounds of a rounded value
2. Bounds of calculations
3. Giving an answer to a suitable accuracy

1. Bounds of a rounded value

☐ I revised this

- A measurement rounded to some accuracy could have been anything within **half a unit** either side.
- Lower bound = value – half the unit; upper bound = value + half the unit.
- The upper bound itself would round up, so the error interval is **lower** $\leq x <$ **upper**.

Given as	Unit	Lower bound	Upper bound
7.4 cm (1 d.p.)	0.1	7.35	7.45
3400 (nearest 100)	100	3350	3450
12 kg (nearest kg)	1	11.5	12.5
0.36 (2 s.f.)	0.01	0.355	0.365

Worked example

A length is 7.4 cm to the nearest mm. Write its error interval.

1. Nearest mm = nearest 0.1 cm.
2. Half of 0.1 = 0.05.

$7.35 \leq l < 7.45$

2. Bounds of calculations

☐ I revised this

- To make an answer as **large** as possible, choose the bounds that push it up; for as **small** as possible, the opposite.
- Adding and multiplying: upper with upper gives the upper bound.
- Subtracting and dividing: one of each. The biggest difference is upper – lower; the biggest quotient is upper $\div$ lower.

Calculation	Upper bound	Lower bound
$a + b$	$Ua + Ub$	$La + Lb$
$a \times b$	$Ua \times Ub$	$La \times Lb$
$a - b$	$Ua - Lb$	$La - Ub$
$a \div b$	$Ua \div Lb$	$La \div Ub$

Worked example

A car travels 120 m (nearest 10 m) in 15.2 s (1 d.p.). Find the lower bound of its speed.

1. Lower distance = 115 m; upper time = 15.25 s.
2. Lower speed = $115 \div 15.25 = 7.540\dots$

7.54 m/s (3 s.f.)

Exam tip: Write the bounds you are using before calculating — they earn method marks.

3. Giving an answer to a suitable accuracy

☐ I revised this

- Work out both the upper and lower bound of the result.
- Round both to fewer and fewer figures until they agree: that is the accuracy you can trust.
- Example: bounds 7.54 and 7.81 agree only to 1 s.f. → answer 8.

Worked example

The bounds of a length are 4.4637 m and 4.4762 m. Give the length to a suitable accuracy.

1. To 3 s.f.: 4.46 and 4.48 — different.

2. To 2 s.f.: 4.5 and 4.5 — the same.

4.5 m

Common mistakes

Don't write	Write instead
✗ Upper bound of 7.4 (1 d.p.) is 7.49	✓ It is 7.45 — the boundary
✗ Error interval $11.5 \leq x \leq 12.5$	✓ Upper end is strict: $11.5 \leq x < 12.5$
✗ Upper bound of $a \div b = Ua \div Ub$	✓ Divide by the smallest: $Ua \div Lb$
✗ Upper bound of $a - b = Ua - Ub$	✓ Subtract the smallest: $Ua - Lb$

In the exam

- Find the unit first ('nearest 5' → half unit 2.5; '2 s.f.' on 360 → nearest 10).
- Keep full calculator values for bounds; round only the final answer.
- For a mixed calculation (like speed = d/t or density = m/V) decide each bound separately.

My notes

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