Order of Operations & Rounding

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BIDMAS (Order of Operations)

B	Brackets	( ) first
I	Indices	3^2, $\sqrt{16}$
D/M	Div & Mult	left to right
A/S	Add & Sub	left to right

- D & M have **equal** priority (left → right).
- A & S have **equal** priority (left → right).
- Fraction bars = implied brackets.

The Rounding Rule

Look at the **deciding digit** (the digit right after the rounding position):

- **0, 1, 2, 3, 4** ⟶ Round **down**
- **5, 6, 7, 8, 9** ⟶ Round **up**

"Five or above — give it a shove.
Four or below — let it go."

Keep trailing zeros! 7.203 → 2 d.p. = 7.20, not 7.2.

Decimal Places vs. Significant Figures

Decimal Places (d.p.)
Count digits **after** the decimal point.

Example: 8.2641 → 1 d.p. = 8.3
8.2641 → 2 d.p. = 8.26
4.997 → 2 d.p. = 5.00 (carry!)

Significant Figures (s.f.)
Count from the **first non-zero** digit.

Rules:
- Non-zero digits always count.
- Zeros *between* non-zero digits count.
- Leading zeros do **NOT** count.
- Trailing zeros after "." **DO** count.

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Truncation

Cut off digits **without rounding** — always "rounds down" for positive numbers.

Number	Rounded	Truncated
6.273	6.3	6.2
8.961	9.0	8.9

Estimation

Round every number to **1 s.f.** then calculate.

- Use the ≈ symbol.
- For $\sqrt{\ }$: round to the nearest **perfect square** (e.g. 63.4 ≈ 64).
- Round **ALL** numbers, not just some.

Upper & Lower Bounds

Formula:

$\text{LB} = x - \frac{1}{2}\,\text{unit}$ $\text{UB} = x + \frac{1}{2}\,\text{unit}$

$\text{LB} \leq \text{actual} < \text{UB}$

Rounded to	Half unit
Nearest integer	0.5
1 d.p.	0.05
2 d.p.	0.005
Nearest 10	5
Nearest 100	50

Bounds in Calculations:

Op.	Max	Min
$a+b$	UB + UB	LB + LB
$a-b$	UB − LB	LB − UB
$a\times b$	UB × UB	LB × LB
$a\div b$	UB ÷ LB	LB ÷ UB

For ÷: big top ÷ small bottom = MAX.

Common Traps & Pitfalls

1. $-5^2 = -25$ but $(-5)^2 = 25$ — brackets change the base!
2. $15 - 6 + 3 = 12$, **not** 6 — A/S are left to right, not S before A.
3. Leading zeros are **not** significant: 0.0058 has **2** s.f., not 4.
4. For bounds with ÷: do **NOT** use both upper bounds to find the maximum.

Quick Exam Keyword Guide

"Work out" / **"Evaluate"** → BIDMAS • **"Correct to ... d.p."** → Round to d.p. • **"Correct to ... s.f."** → Round to s.f.

"Estimate" → Round to 1 s.f. then calculate • **"Truncate"** → Chop without rounding

"Upper/Lower bound" / **"Limits of accuracy"** → Use bounds formulae • **Always show working!**

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