

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! $7.203 \rightarrow 2 \text{ d.p.} = 7.20$, not 7.2.

Decimal Places vs. Significant Figures

Decimal Places (d.p.)

Count digits **after** the decimal point.

Example: $8.2641 \rightarrow 1 \text{ d.p.} = 8.3$

$8.2641 \rightarrow 2 \text{ d.p.} = 8.26$

$4.997 \rightarrow 2 \text{ d.p.} = 5.00$ (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.

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

Upper & Lower Bounds

Formula:

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

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

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
$a + b$	$UB + UB$	$LB + LB$
$a - b$	$UB - LB$	$LB - UB$
$a \times b$	$UB \times UB$	$LB \times LB$
$a \div b$	$UB \div LB$	$LB \div UB$

$$a + b \quad UB + UB \quad LB + LB$$

$$a - b \quad UB - LB \quad LB - UB$$

$$a \times b \quad UB \times UB \quad LB \times LB$$

$$a \div b \quad UB \div LB \quad LB \div UB$$

For $\div$: big top $\div$ 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 $\div$: do **NOT** use both upper bounds to find the maximum.

Quick Exam Keyword Guide

- “Work out” / “Evaluate” $\rightarrow$ BIDMAS
- “Correct to ... d.p.” $\rightarrow$ Round to d.p.
- “Correct to ... s.f.” $\rightarrow$ Round to s.f.
- “Estimate” $\rightarrow$ Round to 1 s.f. then calculate
- “Truncate” $\rightarrow$ Chop without rounding
- “Upper/Lower bound” / “Limits of accuracy” $\rightarrow$ Use bounds formulae
- Always show working!**