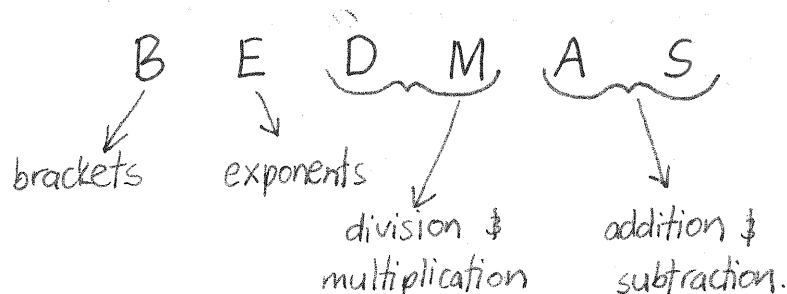


Number Unit 1

Order of Operations

Mathematical operations are carried out in a particular order. This is given by:



Rules

- perform the operations within brackets first.
- calculate any part involving exponents.
- left to right, perform division & multiplication in the order they occur.
- restart left to right, perform addition & subtraction in the order they occur.

Brackets & Division

- If more than one, set work from the innermost outwards.
- A division line acts as a grouping symbol. Calculate numerator & denominator separately before doing the division.

Examples:

$$\begin{aligned} 1) & 23 - 10 \div 2 \\ & = 23 - 5 \\ & = 18 \end{aligned}$$

$$\begin{aligned} 2) & [12 + (9 \div 3)] - 11 \\ & = [12 + 3] - 11 \\ & = 15 - 11 \\ & = 4 \end{aligned}$$

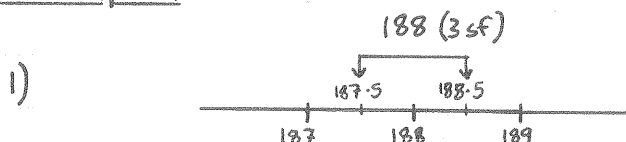
$$\begin{aligned} 3) & \frac{-15 - 5}{6 - 8 \div 4} \\ & = \frac{-20}{6 - 2} \\ & = \frac{-20}{4} = -5 \end{aligned}$$

Limits of Accuracy

Working backwards from a rounded number to a range of values it might have come from is called finding limits of accuracy.

To calculate limits of accuracy for a number N , go half way up or down to the closest numbers that have the same number of significant figures as N .

Example:



187.5 & 188.5 are the limits of accuracy for the number 188 (3 sf)

Formally,

$$187.5 \leq N < 188.5$$

2) For $N = 189.54$, limits of accuracy are

$$189.535 \leq N < 189.545$$

Standard Form (scientific notation)

Very large and very small numbers are clumsy to write.

Generally we express them in standard form. A number in standard form has two components

- a number between 1 and 10
- a power of ten.

Examples:

$$\begin{array}{lll} 4.06 \times 10^5 & \text{or} & 406,000 \\ 3.1 \times 10^{-4} & \text{or} & 0.00031 \\ 9.1 \times 10^0 & \text{or} & 9.1 \end{array}$$

Writing a number in Standard Form

Place the decimal point after the first significant figure. The power of ten is given by the number of places the decimal point is moved. Large numbers have positive powers. Small (decimal) numbers have negative powers.

Examples:

$$1) 82,000,000 = 8.2 \times 10^7$$

$$2) 0.00000124 = 1.24 \times 10^{-6}$$

Converting to Ordinary Numbers

The power of ten gives the number of places to move the decimal point

- ~ to the right to make bigger if positive
- ~ to the left to make smaller if negative.

eg. $4.03 \times 10^5 = 403,000$
 $7.82 \times 10^{-5} = 0.0000782$

On the calculator

To enter 4.03×10^5 on the Casio

$$4.03 \text{ [EXP] } 5 \text{ [=]}$$

This will be 403,000.

To convert back to standard form, Casio

$$403,000 \text{ [MODE] [MODE] [MODE] [2] [9] [=]}$$

Calculations in Standard Form

Examples:

$$\begin{aligned} 1) & 4.06 \times 10^4 \times 3.2 \times 10^2 \\ &= 4.06 \times 3.2 \times 10^4 \times 10^2 \\ &= 12.992 \times 10^6 \\ &= 1.2992 \times 10^1 \times 10^6 \\ &= 1.2992 \times 10^7 \end{aligned}$$

$$\begin{aligned} 2) \quad \frac{3.21 \times 10^4}{7.26 \times 10^2} &= \frac{3.21}{7.26} \times 10^2 \\ &= 0.44 \times 10^2 \\ &= 4.4 \times 10^{-1} \times 10^2 \\ &= 4.4 \times 10^1 \end{aligned}$$

3) Write 1000 times 3.61×10^4 in scientific notation

$$1 \times 10^3 \times 3.61 \times 10^4 = 3.61 \times 10^7$$

4) How many times larger is 4.06×10^4 than 3.2×10^2 ?

$$\frac{4.06 \times 10^4}{3.2 \times 10^2} = \frac{4.06}{3.2} \times 10^2$$
$$= 1.26875 \times 10^2$$

or ≈ 127 times larger

Solving Linear Equations

Steps: Get rid of fractions.

Expand brackets

Combine like terms

Variables on the same side solve

Examples:

1) $\frac{4x}{5} = 8$

$$4x = 40$$

$$x = 10$$

3) $6 - 2x = 8$
 $-2x = 2$
 $x = -1$

4) $3(x + 9) - 8 = 9$
 $3x + 27 - 8 = 9$
 $3x = -10$
 $x = \frac{-10}{3}$

2) $\frac{5x}{3} - 4 = 6$

$$\frac{5x}{3} = 10$$

$$x = 10 \times \frac{3}{5}$$
$$x = 6$$

5) $5x + 5 = 3 - 2x$
 $7x + 5 = 3$
 $7x = -2$
 $x = \frac{-2}{7}$