Simplification

In simplification an expression, we must remove the brackets strictly in the order ( ), { }, [ ] and then we must apply the operations:
Of, Division, Multiplication, Addition and Subtraction.

'BODMAS' where B stands for bracket, O for of ('Of' means multiplication); D for division; M for Multiplication, A for Addition and S for Subtraction strictly in the order.

Division Algorithm: Dividend = (Divisor × Quotient) + Remainder

Modulus or Absolute value : The absolute value of a real number X is denoted by the symbol |x| and is defined as –

$$|x| = \begin{cases} x, \ if \ \ x > 0 \\ -x, \ if \ x < 0 \\ 0, \ \ if \ x = 0 \end{cases}$$

Ex. : |5| = 5, |-5| = -(-5) = 5

In multiplication and division, when both the numbers carry similar sign, we get positive sign in the result otherwise we get negative sign in the result i.e.

(+) × (+) = +
(+) × (-) = -
(-) × (+) = -
(-) × (-) = +
(+) × (+) = +
(+) × (-) = -
(-) × (+) = -
(-) × (-) = +

Important terms:

Identity elements of Addition: '0' (zero) is called identity element of addition of '0' in any number does not affect that number.
e.g. x + 0 = x (x ∈ Q)

Identity element of Multiplication: '1' is called identity element of multiplication as multiplication of '1' in any number does not affect that number.
e.g. x × 1 = x

Inverse element of Addition / Negative element of Addition / Additive Inverse: The number is called "Additive inverse" of a certain number, when it is added to the certain number and result becomes '0' (zero).

Ex.

(i) x + (-x) = 0

Here (-x) is Additive inverse of x.

(ii) (9) + (-9) is Additive inverse of '9'

Inverse element of Multiplication / Reciprocal element / Multiplicative Inverse: The number is called "Multiplicative inverse" of a certain number, when the product of number and multiplication inverse is 1.

Ex. $x \times \frac{1}{x} = 1$

Here, $\frac{1}{x}$ is multiplicative inverse of 'x'

CONTINUED FRACTION: A continued fraction consists of the fractional denominators

Ex. The value of $\frac{1}{2+\frac{1}{8+\frac{1}{5}}}$ is:

Sol. $\frac{1}{2+\frac{1}{8+\frac{1}{5}}} = \frac{1}{2+\frac{1}{41/5}}$

$= \frac{1}{2+\frac{5}{41}} = \frac{1}{\frac{87}{41}} = \frac{41}{87}$

Componendo and dividendo (C & D): It is a theorem on proportions that allows for a quick way to perform calculations and **Reduce** the amount of expansions **needed** It is particularly useful when dealing with equations involving fractions or rational functions.

Ex. $\frac{a}{b}, \frac{a+b}{a-b}, \frac{a+kb}{a-kb}$

If a, b, c and d are numbers such that b and d are non – zero and $\frac{a}{b} = \frac{c}{d}$, then

Some Points

1. Componendo $\frac{a+b}{b} = \frac{c+d}{d}$
2. Dividendo $\frac{a-b}{b} = \frac{c-d}{d}$
3. for k ≠ $\frac{a}{b}$, $\frac{a+kb}{a-kb} = \frac{c+kd}{c-kd}$
4. for k ≠ $\frac{-b}{a}$, $\frac{a}{b} = \frac{a+kc}{b+kd}$

Ex. If $\frac{a}{b} = \frac{16}{3}$, Find the value $\frac{a+b}{a-b}$

Sol. If $\frac{a}{b} = \frac{c}{d}$

Then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$

The value . $\frac{a}{b} = \frac{16}{3}$

$\frac{a+b}{a-b} = \frac{16+3}{16-3} = \frac{19}{13}$

Recurring Number:

Pure recurring decimals: These are recurring decimals where the recurrence starts immediately after the decimal point.

Ex: $0.4444\ldots\ldots\ldots = 0.\overline{4}$

$232323\ldots\ldots\ldots = 3.\overline{23}$

$0.564564564 = 0.\overline{564}$

Impure recurring decimals: Unlike pure recurring decimals, in these decimals, the recurrence occurs after a certain number of digits in the decimal.

Ex: $0.43542542\ldots\ldots\ldots = 0.43\overline{542}$

$0.546666\ldots\ldots\ldots = 0.54\overline{6}$