Arithmetic Mean.

Arithmetic mean is the most important among the mathematical mean.
According to Horace Secrist,
"The arithmetic mean is the amount secured by dividing the sum of values of the items in a series by their number."

(1) **Simple arithmetic mean in individual series (Ungrouped data)**

(i) **Direct method:**If the series in this case be $x_1, x_2, x_3, ..., x_n$ then the arithmetic mean $\bar{x}$ is given by

$$\bar{x} = \frac{\text{Sum of the series}}{\text{Number of terms}}, \text{ i.e., } \bar{x} = \frac{x_1 + x_2 + x_3 + ... + x_n}{n} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

(ii) **Short cut method**

Arithmetic mean $(\bar{x}) = A + \frac{\sum d}{n}$,

Where, A = assumed mean, d = deviation from assumed mean = x – A, where x is the individual item,

Σd = sum of deviations and n = number of items.

(2) **Simple arithmetic mean in continuous series (Grouped data)**

(i) **Direct method:**If the terms of the given series be $x_1, x_2, ..., x_n$ and the corresponding frequencies be $f_1, f_2, ...f_n$, then the arithmetic mean $\bar{x}$ is given by,

$$\bar{x} = \frac{f_1 x_1 + f_2 x_2 + ... + f_n x_n}{f_1 + f_2 + ... + f_n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}.$$

(ii) **Short cut method:**Arithmetic mean $(\bar{x}) = A + \frac{\sum f(x - A)}{\sum f}$

Where A = assumed mean, f = frequency and x – A = deviation of each item from the assumed mean.

(3) **Properties of arithmetic mean**

(i) Algebraic sum of the deviations of a set of values from their arithmetic mean is zero. If x_i / f_i, i = 1, 2, ..., n is the frequency distribution, then

$\sum_{i=1}^{n} f_i(x_i - \bar{x}) = 0$, $\bar{x}$ being the mean of the distribution.

(ii) The sum of the squares of the deviations of a set of values is minimum when taken about mean.

(iii) **Mean of the composite series :** If $\bar{x}_i, (i = 1, 2, ..., k)$ are the means of k-component series of sizes $n_i, (i = 1, 2, ..., k)$ respectively, then the mean $\bar{x}$ of the composite series obtained on combining the component series is given by the formula

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + ... + n_k\bar{x}_k}{n_1 + n_2 + ... + n_k} = \sum_{i=1}^{n} n_i\bar{x}_i \Big/ \sum_{i=1}^{n} n_i .$$