

Standard Deviation (S.D.)

It is defined as "the square root of the arithmetic mean of the squares of deviations from the arithmetic mean."

S.D. or σ for ungroup data (individual series)

$$= \sqrt{\frac{\sum x^2}{N}}$$

$$= \sqrt{\frac{\sum x^2}{N-1}} \quad \text{when } N \text{ is less than } = 30$$

Where $N = \text{NO. of observation.}$

Let's example.

- 23, 22, 20, 24, 16, 17, 18, 19, 21
- Mean deviation $\bar{x} = \frac{\sum x}{N} = \frac{16+17+18+19+20+21+22+23+24}{9} \Rightarrow \frac{180}{9} \Rightarrow 20$

x	$x - \bar{x}$	x	x^2
16	16-20	-4	16
17	17-20	-3	9
18	18-20	-2	4
19	19-20	-1	1
20	20-20	0	0
21	21-20	+1	1
22	22-20	+2	4
23	23-20	+3	9
24	24-20	+4	16

$\sum x^2 = 180$

S.D. or $\sigma = \sqrt{\frac{\sum x^2}{N-1}}$ is applied.

$= \sqrt{\frac{60}{9-1}} \Rightarrow \sqrt{\frac{60}{8}} \Rightarrow \sqrt{7.5} \Rightarrow 2.75$

- ⇒ Standard deviation is a number used to tell how measurements for a group are spread out from the average or mean or expected value.
- ⇒ A low standard deviation means that most of the numbers are close to the average.
- ⇒ A ~~star~~ high standard deviation means that the numbers are more spread out.

Thus, Standard deviation is a ~~static~~ statistical term used to measure the amount of variability or dispersion around an average. Dispersion is the difference between the actual & the average value. The larger this dispersion is the higher is the standard deviation.

Advantages - ① It measures the deviation from the mean, which is very important ~~static~~ statistics.

- ② It squares & makes the negative numbers positive.
- ③ The square is the nice function.

- Steps:
1. Work out the mean (the simple average of the numbers)
 2. Then for each number, subtract the mean & square the result
 3. Work out the mean of these squared differences.
 4. The square root of that are done.

$\frac{20}{-2.75}$
17
(4)