



Mean, Variance, SD & SEM

Mean ($\bar{x}$)	The average value of a data set and a measure of central tendency (where data typically clusters) $\bar{x} = \frac{\sum x}{N} \quad \text{SAMPLES} \quad \mu = \frac{\sum x}{N} \quad \text{POPULATION}$
Variance (s^2 or σ^2)	A measure of how far each data value is from the mean or how far a data set is spread out from its mean $s^2 = \frac{\sum (x - \bar{x})^2}{N-1} \quad \text{SAMPLES} \quad \sigma^2 = \frac{\sum (x - \bar{x})^2}{N} \quad \text{POPULATION}$
Standard Deviation (s or σ)	A measure of variation in a data set from its mean (same as variance). Expressed in the same units as the mean $s = \sqrt{s^2} \quad \text{SAMPLES} \quad \sigma = \sqrt{\sigma^2} \quad \text{POPULATION}$
Standard Error of the Mean (SEM)	A measure of how much a sample mean ($\bar{x}$) differs from the true population mean (μ). The SEM decreases if the SD is small or if N is large. With a larger sample size (N), the sample mean is closer to μ and is more accurate. $SEM = \frac{SD}{\sqrt{N}} \quad \text{where } N = \text{size of the sample}$

EXAMPLE: Find the standard deviation of the scores below.

Team A	4	3	8	11	7	9
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STEP ONE: Calculate the mean

$$\bar{x} = \frac{\sum x}{N} = \frac{4 + 3 + 8 + 11 + 7 + 9}{6} = 7$$

The mean of the sample (N=6) is 7.

STEP TWO: Find the variance.

$$\sigma^2 = \frac{\sum (x - \bar{x})^2}{N} = \frac{(4 - 7)^2 + \dots}{6}$$

$$\sigma^2 = 9.2$$

STEP THREE: Find the SD.

$$\sigma = \sqrt{\sigma^2} = \sqrt{9.2} = 3.03 \cong 3$$



Instructions: Answer the questions below.

1

The test scores for a sample of math students are shown below.

Year 10 scores	87%	92%	68%	90%	71%	62%
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(a) Find the average test score.

(b) Find the variance and standard deviation of the test scores.

2

Jackson has a choice between two different routes to drive to work. He decides to sample each route and record the time taken (minutes) to get to work from 7AM each morning across fourteen days ($N=14$).

City route	83	71	69	80	77	95	65
Suburban route	74	66	92	58	83	70	74

(a) Calculate the average time taken for each route.



(b) Calculate the standard deviation for both routes.

(c) Which route would you recommend? Explain your answer.

3

The average height of a population of 214 Year 10 students is 162cm with a standard deviation of 6.6cm.

(a) Find the values of μ and σ .

(b) Suppose that a random sample of 12 students is taken from the population. Calculate the standard error of the mean.



4

The rainfall in a small coastal region of Madagascar is recorded weekly across a period of three years ($N=156$). $\sigma = 438\text{mm}$.

(a) Suppose that the average rainfall is 1352mm across the three-year period. What statistic should be used to represent this value?

(b) A random sample of observations ($N=12$) taken during the three-year period is shown in the table below.

Weekly recorded rainfall (mm)					
900	852	718	875	683	668
918	1132	1578	1496	1220	743

Calculate the sample mean and SEM of this data set ($\text{Mean} \pm \text{SEM}$). Round to one decimal place.

(c) If two more observations are included in the sample above, explain whether the sample mean becomes more or less accurate.
