

Calculating Standard Deviation

Calculating by Hand Using the Table Method

NOTE: These instructions are for calculating a population standard deviation (σ). To calculate sample standard deviation (s), see the modifications noted in square brackets [] after certain steps.

- 1) Start with a column labeled x , and list each data value in that column.
- 2) At the bottom of that first column, calculate the sum of your data, Σx .
- 3) Count the number of data values you have, n .
- 4) Calculate the mean, μ (mu, pronounced “myoo”), by dividing the sum by n .
[For samples, the mean is \bar{x} (“x-bar”).]
- 5) In the next column, subtract μ from each x . (These values are called the “errors”).
[For samples, take $x - \bar{x}$.]
- 6) In the third column, square the values from the previous column. (These are the “squared errors”).
- 7) At the bottom of the third column, find the sum of the values in that column (the “sum of squares”, or SS).
- 8) Divide the sum by n to get the variance, often denoted σ^2 .
[For samples, divide by $n-1$; variance is s^2 .]
- 9) Take the square root of variance to get the standard deviation σ .
[For samples, the standard deviation is referred to with an s .]

TIP: Don’t round any of the values during your calculations; wait to round until the end.

Example of the table method:

x	$x - \mu$	$(x - \mu)^2$
73	$73 - 77.625 = -4.625$	$(-4.625)^2 = 21.390625$
82	$82 - 77.625 = 4.375$	$(4.375)^2 = 19.140625$
68	$68 - 77.625 = -9.625$	$(-9.625)^2 = 92.640625$
70	$70 - 77.625 = -7.625$	$(-7.625)^2 = 78.140625$
78	$78 - 77.625 = 0.375$	$(0.375)^2 = 0.140625$
90	$90 - 77.625 = 12.375$	$(12.375)^2 = 153.140625$
84	$84 - 77.625 = 6.375$	$(6.375)^2 = 40.640625$
76	$76 - 77.625 = -1.625$	$(-1.625)^2 = 2.640625$
$\Sigma x = 621$ $n = 8$ $\mu = \Sigma x / n$ $= 77.625$		$\Sigma(x - \mu)^2 = 407.875$ $\text{var} = \sigma^2 = \Sigma(x - \mu)^2 / n$ $= 407.875 / 8$ $= 50.984375$ $\text{SD} = \sigma = \sqrt{(\text{var})}$ $= \sqrt{50.984375}$ ≈ 7.1

Using the Table Method in Excel:

NOTE: These instructions are for calculating a population standard deviation (σ). To calculate sample standard deviation (s), use “ x -bar” in place of “ μ ” and divide the sum of column C by $n+1$ instead of n .

- 1) Enter the headings “ x ”, “ $x - \mu$ ”, and “ $(x - \mu)^2$ ” in row 1.
- 2) Enter your data into column A below the “ x ” heading.
- 3) Use the formulas shown in the example below (e.g. “=SUM(A2:A9)”) to calculate sums, mean, variance, and standard deviation from the data.

	A	B	C
1	x	x - μ	$(x - \mu)^2$
2	73	=A2-A\$12	=B2^2
3	82	=A3-A\$12	=B3^2
4	68	=A4-A\$12	=B4^2
5	70	=A5-A\$12	=B5^2
6	78	=A6-A\$12	=B6^2
7	90	=A7-A\$12	=B7^2
8	84	=A8-A\$12	=B8^2
9	76	=A9-A\$12	=B9^2
10	=SUM(A2:A9)		=SUM(C2:C9)
11	=COUNT(A2:A9)		=C10/A11
12	=A10/A11		=SQRT(C11)

Tips for doing math in Excel:

- To do calculations in Excel, click on the cell you want the answer to go in, then type an equals sign =. You can either click on a cell to include it, or type the coordinates (e.g., “B4”).
- Operations:
 - Use + and - for addition and subtraction.
 - For multiplication, use an asterisk *, and use a slash / for division.
 - Exponents are written using a caret ^.
 - Don't forget to use parentheses () for order of operations!
- To use a formula, start with an equals sign =, then start typing the keyword for the formula. (Excel will suggest formulas as you type.) After the opening parenthesis (, select the cell(s) to use in the formula. Click and drag to select a range, or type the starting and ending cells with a colon : in between.
- For columns B and C, you can take a shortcut on filling in the formulas:
 - Type the formula in the top cell and hit Enter.
 - Select the cell with the formula in it (single-click) and hover your mouse over the bottom right corner of the cell until your cursor turns into a black plus sign.
 - Click using the plus sign and then drag downwards to select all of the boxes you want the formula in.
 - The dollar sign \$ in the formula in B2 tells Excel to always use cell A12 for that formula, instead of moving down a cell like it does with A2, A3, A4, etc.

Using a Calculator

TI-83 or TI-84 graphing calculator:

- 1) Hit the **STAT** button to open the statistics menu.
- 2) Hit **1**, or select **1: Edit** and then **ENTER**. This takes you to a data table with columns **L1** through **L6**.
- 3) Use the arrow keys to highlight **L1**, the header for the first column. Hit the **CLEAR** button and then **ENTER**.
- 4) Enter your data into **L1**: typing a value and then hit **ENTER**, repeating until all your data values are listed under **L1**.
- 5) Now hit **STAT** again. This time, hit the right arrow once to select the **CALC** tab.
- 6) Hit **1**, or select **1: 1-Var Stats** and hit **ENTER**.
- 7) Press the **2nd** button and then **1** to select **L1** as the dataset.
- 8) Use the down arrow to highlight **Calculate**, then hit **ENTER**.
- 9) Scroll down to see **Sx** (for sample SD) or **σ_x** (for population SD).
- 10) The calculator results will also include **Σx** , the sum of your data values, and **\bar{x}** , the mean.

Excel:

Use the formula `STDEV()`. You can either list the data values inside the parentheses (separated by commas), or select the cells that contain the data. For example, using the same data from the spreadsheet above, you could type either `=STDEV(73, 82, 68, 70, 78, 90, 84, 76)` or `=STDEV(A2:A9)`.

Desmos:

Go to desmos.com/calculator. In the formula bar on the left-hand side:

- For sample standard deviation, type `stdev(your list of numbers)`.
 - Example: `stdev(73, 82, 68, 70, 78, 90, 84, 76)`
- For population standard deviation, use the formula `stdevp(your list of numbers)`.
 - Example: `stdevp(73, 82, 68, 70, 78, 90, 84, 76)`

Desmos updates its calculations in real-time, so this is a fun way to explore how standard deviation is affected by outliers and other changes in data values. Try adding an extra value that's way outside your data range; or five copies of the same middle-ish value; or whatever else you can think of!

Wolfram Alpha:

Go to [WolframAlpha.com](https://www.wolframalpha.com) and type "standard deviation" in the search bar, then hit Enter or click on the orange equals sign. The resulting page lets you enter/edit data, choose population or sample standard deviation, and click Compute to calculate the result.