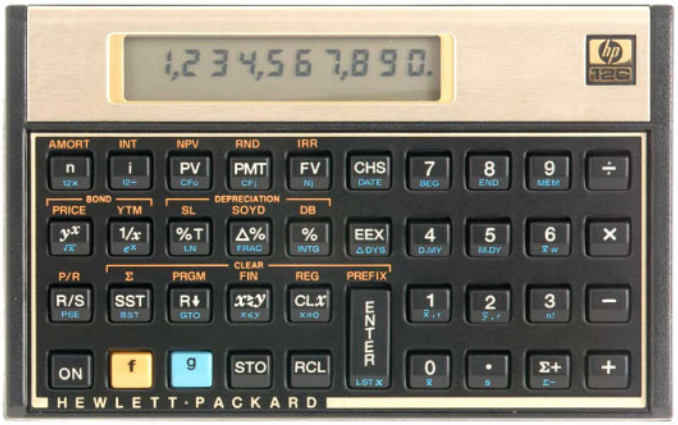
hp calculators



HP 12C Statistics - average and standard deviation

Average and standard deviation concepts

HP12C average and standard deviation

Practice calculating averages and standard deviations with one or two variables

Average and standard deviation concepts

Statistics can be understood as a set of tools involving the study of methods and procedures used for collecting, classifying, and analyzing data. Statistical tools also offer the means for making scientific inferences from such resulting summarized data. Two of these tools are the Average and the Standard Deviation.

Given a set of collected data, the average is defined as a measure of central tendency and is the most commonly used. Its value is computed as the sum of all data points divided by the number of data points included. The standard deviation is one index of variability used to characterize the dispersion among the data in a given population or a sample. It is measures dispersion around the average. The property of the standard deviation is such that when the underlying data is normally distributed, approximately 68% of all values will lie within one standard deviation on either side of the mean, and approximately 95% of all values will lie within two standard deviations on either side of the mean. This has application to many fields, particularly when trying to decide if an observed value is unusual by being significantly different from the mean.

HP12C average and standard deviation

On the HP12C, statistics data are stored as a set of summations resulting from the originally collected data. The collected data set must be typed in prior to use any statistics features available in the HP12C because all values produced by these statistics tools depend on them. The HP12C memory organization allows the study of statistic data organized as one- or two-variable samples. As a general procedure, data is always collected as a pair of numbers, or (x,y) values, and the HP12C computes the following summations:

$$\sum x_n \qquad \sum y_n \qquad \sum (x_n)^2 \qquad \sum (y_n)^2 \qquad \sum (x_n \times y_n)$$ Figure 1

With these values updated and stored in memory, the HP12C computes the average ($\bar{x}$, $\bar{y}$) for each variable with the following expressions:

$$\bar{x} = \frac{\sum x_n}{n} \quad \text{and} \quad \bar{y} = \frac{\sum y_n}{n}$$ Figure 2

The following expressions are used by the HP12C to compute the standard deviation of a sample:

$$Sx = \sqrt{\frac{n\sum (x_n)^2 - \left(\sum x_n\right)^2}{n(n-1)}} \quad \text{and} \quad Sy = \sqrt{\frac{n\sum (y_n)^2 - \left(\sum y_n\right)^2}{n(n-1)}}$$ Figure 3

Practice finding average sale prices and standard deviations

Example 1: The sales price of the last 10 homes sold in the Parkdale community were: $198,000; $185,000; $205,200; $225,300; $206,700; $201,850; $200,000; $189,000; $192,100; $200,400. What is the average of these sales prices and what is the sample standard deviation? Would a sales price of $240,000 be considered unusual in the same community?

Solution: Be sure to clear the statistics / summation memories before starting the problem.

f Σ

Figure 4

Each entered data value causes the display to change and display the number of current entries (n). Now enter each data value with Σ+:

1 9 8 0 0 0 Σ+

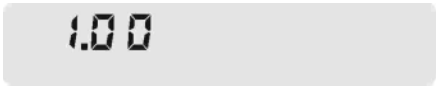


Figure 5

The display represented in Figure 2 shows current n value of 1.

1 8 5 0 0 0 Σ+ 2 0 5 2 0 0 Σ+
2 2 5 3 0 0 Σ+ 2 0 6 7 0 0 Σ+
2 0 1 8 5 0 Σ+ 2 0 0 0 0 0 Σ+
1 8 9 0 0 0 Σ+ 1 9 2 1 0 0 Σ+
2 0 0 4 0 0 Σ+

Figure 6

Figure 6 represents the display after the last entry. With all data already entered, all summations are ready and it is possible to compute both the average and the standard deviation. To compute the average press:

g x̄

Figure 7

x̄ is the blue function on the front, slanted face of the 0 key, so g (the blue prefix key) must be pressed first.

To compute the standard deviation, press:

g s

Figure 8

[s] is the blue function on the front, slanted face of the [•] key.

Based on these figures, approximately 68% of the prices are in the range $200,355.00 ± $11,189.04. Approximately 95% of the prices are in the range $200,355.00 ± 2×($11,189.04). The following keystroke sequence gives the lower boundary:

[g] [$\bar{x}$] [ENTER] [g] [s] [2] [X] [x≷y] [R↓] [−]

Figure 9

The display shows the lower boundary. To compute higher boundary, if no operation has been performed after the above keystrokes, press:

[x≷y] [g] [LSTx] [+]

Figure 10

The display shows the higher boundary.

Answer: $240,000.00 is an unusual price for a home at the Parkdale community based on the last 10 sales prices.

Practice with average and standard deviation with two variables

Example 2: A land researcher wants to compute the relationship between the constructed area and the land area of eight homes located in his neighborhood. Initially he needs to know the average and the standard deviation for both parameters. His measurements allowed him to build the following chart:

Land Area (sq yards)	Construction Area (sq yards)	Land Area (sq yards)	Construction Area (sq yards)
12000	3120	9000	2080
10000	2560	10000	2700
11000	2920	13000	3280
14000	3300	12000	3080

Solution: Be sure to clear the statistics / summation memories before starting the problem.

[f] [Σ]

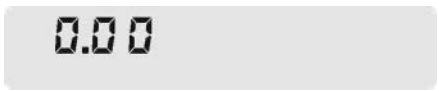


Figure 11

Each pair must be entered to add it to the statistics summations.

3 1 2 0 ENTER 1 2 0 0 0 Σ+

Figure 12

The first entered value (construction area) is computed as the y variable and the second value (land area) is computed as the x variable. The display shows the number of entries. Make sure that all data is entered:

2 5 6 0 ENTER 1 0 0 0 0 Σ+
2 9 2 0 ENTER 1 1 0 0 0 Σ+
3 3 0 0 ENTER 1 4 0 0 0 Σ+
2 0 8 0 ENTER 9 0 0 0 Σ+
2 7 0 0 ENTER 1 0 0 0 0 Σ+
3 2 8 0 ENTER 1 3 0 0 0 Σ+
3 0 8 0 ENTER 1 2 0 0 0 Σ+

Figure 13

To compute the average:

g $\bar{x}$

Figure 14

Average land area: 11,375 sq yards.

x≷y

Figure 15

Average construction area: 2,880 sq yards.

To compute the standard deviation:

g s

Figure 16

Standard deviation for land area: 1,685.02 sq yards.

x≷y

Figure 17

Standard deviation for construction area: 415.83 sq yards.

Answer: The average land area for this sample is 11,375 sq yards and the standard deviation is 1,685.02 sq yards. For the construction area, the average is 2,880 sq yards and the standard deviation is 415.83 sq yards.