MEAN

The **mean** of a set of data is the sum of the data values divided by the number of values.

Example

During the track season, Marci ran four races, with times of 12.8 seconds, 13.4 seconds, 12.6 seconds, and 13.1 seconds. What is the mean of her race times?

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$$\frac{12.8+13.4+12.6+13.1}{4} = 12.975$$

Question

Marci baked four batches of cookies, with the following quantities: 24, 30, 27, and 33 cookies. What is the mean number of cookies per batch?

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$$\frac{24+30+27+33}{4} = 12.975$$

Question

A survey was conducted in a town where 80 households were asked about their monthly grocery expenses, rounded to the nearest $10. The results are summarized in the table below.

Grocery Expenses (dollars)	Frequency
150	5
160	10
170	14
180	18
190	16
200	9
210	5
220	3

What is the mean average monthly grocery expense for households in this town?

MEDIAN

The **median** of a set of data is the value in the middle when the data is in order.

To find the median, begin by listing the data in order from smallest to largest, or largest to smallest.

If the number of data values, N, is odd, then the median is the middle data value. This value can be found by rounding N/2 up to the next whole number.

If the number of data values is even, there is no one middle value, so we find the mean of the two middle values (values N/2 and N/2 + 1)

Example

Steve has the following list of his daily step counts for the last 30 days and wants to calculate the median:

4,500 4,600 4,800 5,000 5,200 5,500 5,700 5,800 6,000 6,200 6,500 6,500 6,800 7,000 7,100 7,200 7,400 7,600 7,800 8,000 8,200 8,300 8,500 8,600 8,800 9,000 9,200 9,400 9,600 10,000

What is the median step count value?

Example

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What is the median step count value?

As N is **even**, the median will be the average of the 15th and 16th values in ascending order. Thus the median is

$$\frac{7{,}100 + 7{,}200}{2} = 7{,}150$$

Question

A group of employees tracked the number of emails they sent in a day, listed in increasing order:

5, 13, 7, 8, 17, 10, 11, 12, 19, 14, 15, 16, 9, 18, 6

What is the median number of emails sent?"

Example

A city conducted a survey on the number of hours people spent volunteering in a month. The results are summarized in the table below.

Hours Volunteered	Frequency
5	8
10	12
15	15
20	18
25	14
30	10
35	7
40	6

What is the mean number of hours spent volunteering?

MODE

The **mode** is the element of the data set that occurs most frequently.

It is possible for a data set to have more than one mode if several categories have the same frequency, or no modes if each every category occurs only once.

Example

In a survey of favorite fruits among a group of friends, the following data was collected:

Fruit	Frequency
Apple	4
Banana	6
Cherry	2
Date	3
Elderberry	5

Which fruit is the mode?

Example

In a survey of favorite fruits among a group of friends, the following data was collected:

Fruit	Frequency
Apple	4
Banana	6
Cherry	2
Date	3
Elderberry	5

Which fruit is the mode?
Bananas occur with a maximum freqency of 6, thus bananas are the mode.

Question

In a survey of customer satisfaction with a new service, the following data was collected on the number of issues reported:

Number of Issues	Frequency
0	12
1	15
2	8
3	5
4	3

Find:

The average number of issues reported

The median number of issues reported

The mode of the number of issues reported

RANGE

The **range** is the difference between the *maximum value* and the *minimum value* of the data set.

Example

In a study of the number of hours worked per week by employees in a department, the following data was collected:

Hours Worked per Week: 38, 42, 45, 37, 50, 41, 39, 48

What is the range of this data?

Example

In a study of the number of hours worked per week by employees in a department, the following data was collected:

Hours Worked per Week: 38, 42, 45, 37, 50, 41, 39, 48

What is the range of this data?

Range = maximum value - minimum value

= 50 - 37

= 13

STANDARD DEVIATION

The **standard deviation** is a measure of variation based on measuring how far each data value deviates, or is different, from the mean. A few important characteristics:

Standard deviation is always positive. Standard deviation will be zero if all the data values are equal, and will get larger as the data spreads out.
Standard deviation has the same units as the original data.
Standard deviation, like the mean, can be highly influenced by outliers.

STANDARD DEVIATION

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

TO COMPUTE THE STANDARD DEVIATION

1. Calculate the mean
2. Find the deviation of each data from the mean. In other words, subtract the mean from the data value.

2. Square each deviation.

3. Add the squared deviations.

4. Divide by n, the number of data values, if the data represents a whole population; divide by n – 1 if the data is from a sample.

5. Compute the square root of the result.

Example

The temperatures recorded in five different cities for a particular day were 72°F, 68°F, 75°F, 70°F, and 80°F. Find the standard deviation of the temperatures.

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$$\text{mean} = \mu = \frac{72+68+75+70+80}{5} = \frac{365}{5} = 73$$

difference from the mean:	Squaring the difference:	Adding the values:
$72 - 73 = -1$	$(72 - 73)^2 = (-1)^2 = 1$	$1 + 25 + 4 + 9 + 49 = 88$
$68 - 73 = -5$	$(68 - 73)^2 = (-5)^2 = 25$	
$75 - 73 = 2$	$(75 - 73)^2 = (2)^2 = 4$	$88/5 = 17.6$ Dividing by the number of values
$70 - 73 = -3$	$(70 - 73)^2 = (-3)^2 = 9$	$\sqrt{17.6} = 4.19523539268$ taking square root
$80 - 73 = 7$	$(80 - 73)^2 = (7)^2 = 49$	≈ 4.20

Question

The number of miles run each day for a week by a runner were: 4, 6, 5, 7, 8, 6, and 5. Calculate the standard deviation of the number of miles run.

Question

The number of items sold by a small shop over seven days were: 20, 25, 22, 30, 27, 24, and 26. Calculate the standard deviation of the number of items sold.

Question

The number of attendees at five different workshops were: 45, 50, 55, 60, and 52. Calculate the standard deviation of the number of attendees.

Question

The number of calls received by a customer service center each hour over an 8-hour shift were: 32, 27, 35, 30, 28, 31, 29, and 34. Calculate the standard deviation of the number of calls received.