Deviations from the Mean, Variability and Standard Deviation

Deviations from the mean:

To **deviate** means to drift away from what is expected. In statistics the data deviates from the balance point. We can measure the amount of the **deviation** by finding the difference from any data point to the balance point (also known as the mean)

The mean is represented by $\bar{x}$ as we have seen on the graphing calculator.

- **For any given value in a data set, the deviation from the mean is the value minus the mean. Written algebraically, this is $x - \bar{x}$.**

EX: Given {2, 7, 7, 8} the mean, $\bar{x}$, is equal to 6. The table shows the deviations from the mean.

Snow fall over a 4 day period	2	7	7	8
Deviations from the mean	-4	1	1	2

Practice finding the deviation from the mean:

1) Five people were asked approximately how many hours of TV they watched per week. Their responses were as follows.

6   4   6   7   8

A) What is the mean number hours of TV watched for these five people. ___6.2___

B) Find the deviations from the mean for these five data values.

Hours Watching TV in a week	6	4	6	7	8
Deviations from the mean	-0.2	-2.2	-0.2	0.8	1.8

2) Five different people were asked approximately how many hours of TV they watched per week. Their responses were as follows.

1   2   10   2   16

A) What is the mean number hours of TV watched for these five people. ___6.2___

B) Find the deviations from the mean for these five data values.

Hours Watching TV in a week	1	3	11	2	14
Deviations from the mean	-5.2	-3.2	4.8	-4.2	7.8

3) Which group showed a greater deviation from the mean? ___the second group___

> **Variability** is the term used to describe the spread of the data. The **greater the variability** of the distribution , the **greater the deviations from the mean.**

Standard Deviation is a measure of how far spread out the numbers in a distribution are. Here are the steps for the procedure used to find the standard deviation:

1. Find the mean of the data set
2. Calculate the deviations from the mean
3. Square the deviations from the mean
4. Add up the squared deviations
5. Divide by $n - 1$ (if you are working with a data from a sample, which is usually the case)
6. Take the square root.

- The unit of the standard deviation is always the same as the unit of the original data set.
- The larger the standard deviation, the greater the spread (variability) of the data set.

EX: Jenna has bought a new hybrid car. Each week for a period of seven weeks, she has noted the fuel efficiency (in miles per gallon) of her car. The results are shown below.

$$45 \quad 44 \quad 43 \quad 44 \quad 45 \quad 44 \quad 43$$

Calculate the standard deviation of these results to the nearest hundredth.

First determine the mean: $\bar{x} = 44$

Fuel Efficiency (miles per gallon)	45	44	43	44	45	44	43
Deviations from the mean	1	0	-1	0	1	0	-1
Squared Deviations from the mean	1	0	1	0	1	0	1

The sum of the squared deviations is 4. Next divide the sum of the squared deviations by n − 1.

$$n = 7; \frac{4}{6} \approx 0.667$$

The standard deviation is $\sqrt{0.667} \approx 0.82$ miles per gallon.

What is the meaning of the standard deviation in the context of this problem:

The standard deviation, 0.82 miles per gallon, is a typical deviation of a weekly fuel efficiency value from the mean weekly fuel efficiency.