

5.3 Standard Deviation

As we have seen, there are many ways to analyze data. Sometimes, measures of central tendency are adequate. At other times, we may want or need to “see” what is happening and graphs are beneficial. Today we look at the data in more detail, considering precise data in a more in-depth manner than just measures of central tendency.

A teacher has two chemistry classes. She gives the same tests to both classes. Compare the two classes.

Test	Class A (%)	Class B (%)
1	94	84
2	56	77
3	89	76
4	67	81
5	84	74

Deviation _____

Standard deviation _____

- Low standard deviation means _____
- High standard deviation means _____
- Which class do you think has a greater standard deviation? Explain.

We can calculate standard deviation using paper and pencil and/or technology, including graphing calculator or spreadsheet software on a computer.

How does calculating standard deviation work?

Mr. Bahia is analyzing the statistics of some of the players on his team. Near the end of one game, the score is tied and the best starting guard has fouled out. Mr. Bahia needs to make a substitution. Who should he substitute into the game?

Player	Field Goal Percent in Last 10 Basketball Games									
Anna	36	41	43	39	45	27	40	37	31	28
Patrice	36	39	36	38	35	37	35	36	38	34
Morgan	34	41	38	37	48	19	33	43	21	44
Paige	34	35	33	35	33	34	33	35	34	33
Star	41	33	39	36	38	36	29	34	38	39

The most consistent player who appears to be _____.

1. Calculate the mean of the data for this player and use it to complete the table:

_____’s Field Goal (%)	Deviation ($x - \bar{x}$)	Square of Deviation $(x - \bar{x})^2$
34		
35		
33		
35		
33		
34		
33		
35		
34		
33		

2. Determine the mean of the squares of the deviations.

3. Determine the square root of the mean of the squares in the step above to get the **standard deviation**.

To use your graphing calculator to calculate the standard deviation:

Enter the data (from %) into your list(s)

- STAT CALC 1: 1-Var Stats 2nd L1 (or L2...) Enter.
- S_x is the standard deviation for a sample rather than a population. It has a corrective factor “built in” and is NOT the standard deviation we are looking for.
- σ_x is the standard deviation of the population and IS the standard deviation we are looking for!

Enter all of the data into your calculator.

- Verify the results you calculated already.
- Calculate the mean and standard deviation for the other players in the table.

Player	Mean	Standard deviation
Anna		
Patrice		
Morgan		
Paige		
Star		

Compare the means for the five players. Who should Mr. Bahia substitute into the game based on this information? Explain.

Compare the standard deviations. Who is the most consistent player?

Who is the least consistent player?

How do you know?

Who should Mr. Bahia substitute into the game based on this information? Explain.

Formulas for Mean and Standard Deviation:

$$\bar{x} = \frac{\sum x}{n}$$

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

Determining the standard deviation of grouped data:

Janessa conducts a survey of grade 11 females in her school. She organized her results in this frequency table.

Gaming Hours per Week for Grade 11 Females	
Hours	Frequency
3-5	7
5-7	11
7-9	16
9-11	19
11-13	12
13-15	5

To get your calculator to consider the frequency information:

- Enter the midpoint of the interval as L1 and the frequency as L2.
- STAT CALC 1: 1-Var Stats L1, L2 Enter.

What is the mean and standard deviation for this data?

Jack conducted a similar survey of Grade 11 boys and found the mean time was 12.84 h and the standard deviation was 2.16 h. Compare the results of the two surveys.

Key Ideas:

- To determine how scattered or clustered data is, we calculate the _____ which measure the _____ of data about the _____.

Need to Know:

- When data is clustered close to the mean, _____ is _____ and visa versa.
- When calculating the standard deviation, _____, your calculator follows this process:
 - Find the _____ of the deviation of each data point from the mean.
 $(x - \bar{x})^2$
 - Determine the _____ of all of the squared deviations.
 - Take the _____ of the above step.
- Standard deviation is often used as a measure of _____.
Data with a _____ standard deviation is considered to be _____ consistent than data that is scattered far from the mean.