Inspiring Greatness

ISD

INDEPENDENCE SCHOOL DISTRICT

Math Virtual Learning

Probability and Statistics

April 13, 2020

Probability and Statistics
Lesson: April 13, 2020

Objective/Learning Target:

Students will be able to calculate the standard deviation for a set of data without the use of technology

Standard Deviation ???

Standard deviation is a measure of how spread out the numbers in a data set are from the mean (average). The variance from the existing average

- If the Standard Deviation is 0, then there is no spread
- If the Standard Deviation is small, then the numbers in the data set are close to the mean; like if almost everyone on the team hits a home run.
- If the Standard Deviation is large, then the numbers in the data set are more spread out from the mean; like the ages of the people at the school carnival.

Symbols

Some symbols that you need to know for Standard Deviation

- $\overline{x}$ = Sample Average (population average is μ)
- Σ = The sum of a set of numbers
- s (or Sx) = Sample Standard Deviation (population standard deviation is σ)

Formula for Sample Standard Deviation:

(Don’t let this scare you, we will break it down to be less confusing!!)

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

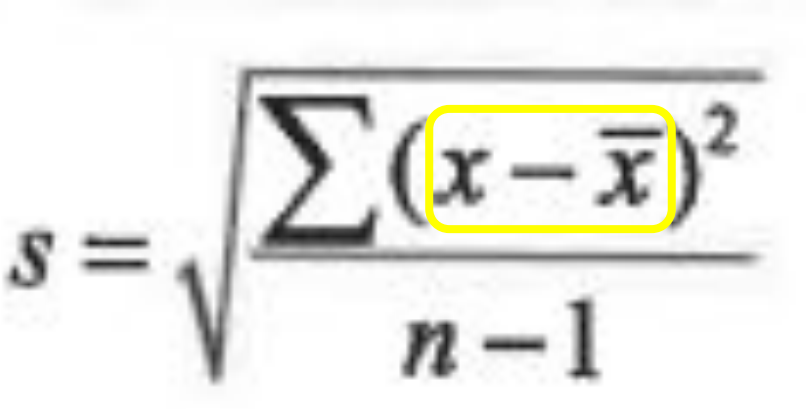
Let's breakdown that complicated looking Formula into 6 steps: We will actually work from the inside out

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

STEP ONE:

Find the Mean

(add all the numbers up and divide by n)



$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

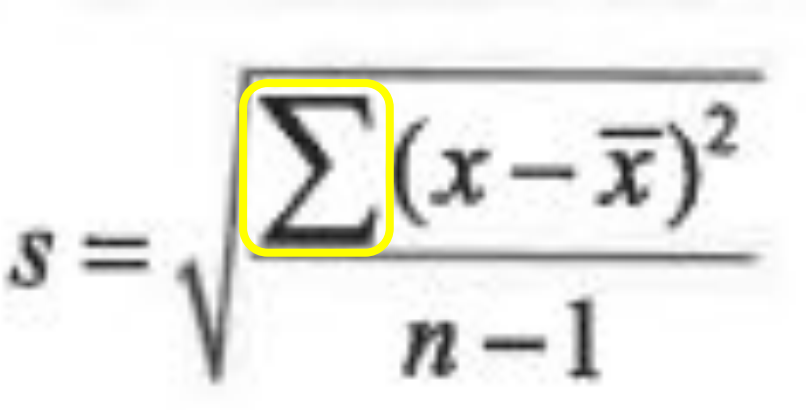
STEP TWO:

Subtract the mean from each data point

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

STEP THREE:

Take <u>each</u> of the difference you found in Step Two and square them



$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

STEP FOUR:

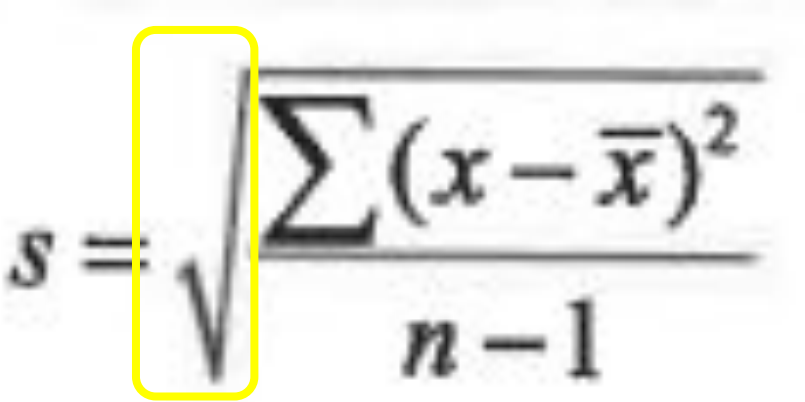
Sum (add) all of the squared results from Step Three

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

STEP FIVE:

Divide your sum from Step Four by n - 1

This answer is called the variance



$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

STEP SIX:

Square Root the variance from Step Five

This answer is your STANDARD DEVIATION

Example One Data Set: 4, 26, 18, 30, 7, 12

(6 numbers so n = 6)

Step One: Find the mean	4 + 26 + 18 + 30 + 7 + 12 = 97 97 / 6 = 16.17
Step Two: Subtract the mean from each data point in the set	4 - 16.17 = -12.17 26 - 16.17 = 9.83 18 - 16.17 = 1.83 30 - 16.17 = 13.83 7 - 16.17 = -9.17 12 - 16.17 = -4.17
Step Three: Square each of your answers from Step Two	$(-12.17)^2$ = 148.1089 $(9.83)^2$ = 96.6289 $(1.83)^2$ = 3.3489 $(13.83)^2$ = 191.2689 $(-9.17)^2$ = 84.0889 $(-4.17)^2$ = 17.3889 Make sure you put the number in () before squaring it or it may not square correctly

Example One Data Set: 4, 26, 18, 30, 7, 12

(6 numbers so n = 6)

Step Four: Sum all the squared results	148.1089 + 96.6289 + 3.3489 + 191.2689 + 84.0889 + 17.3889 = 540.8384
Step Five: Divide the Sum by n - 1 (FYI - this answer is called the Variance)	n = 6, so n-1 = 5 540.8384/5 = 108.16668 The variance is 108.16668
Step Six: Square Root your Variance from Step Five (Round to the nearest hundredth)	$\sqrt{108.16668} = 10.40$ Standard Deviation = 10.40

Example Two Data Set: 3, 5, 12, 6, 8

(5 numbers so n = 5)

Step One: Find the mean	3 + 5 + 12 + 6 + 8 = 34 34 / 5 = 6.8
Step Two: Subtract the mean from each data point in the set	3 - 6.8 = -3.8 5 - 6.8 = -1.8 12 - 6.8 = 5.2 6 - 6.8 = -0.8 8 - 6.8 = 1.2
Step Three: Square each of your answers from Step Two	$(-3.8)^2$ = 14.44 $(-1.8)^2$ = 3.24 $(5.2)^2$ = 27.04 $(-0.8)^2$ = 0.64 $(1.2)^2$ = 1.44 Make sure you put the number in () before squaring it or it may not square correctly

Example Two Data Set: 3, 5, 12, 6, 8

(5 numbers so n = 5)

Step Four: Sum all the squared results	14.44 + 3.24 + 27.04 + 0.64 + 1.44 = 46.8
Step Five: Divide the Sum by n - 1 (FYI - this answer is called the Variance)	n = 5, so n-1 = 4 46.8 / 4 = 11.7 The variance is 11.7
Step Six: Square Root your Variance from Step Five (Round to the nearest hundredth)	$\sqrt{11.7} = 3.42$ Standard Deviation = 3.42

Lesson Practice

On the next 4 slides are two practice problems for you to try on your own!

There are Answer Slides at the end of the presentation so you can check your work

Lesson Practice Data Set #1: 4, 8, 5, 9, 10, 2, 6

(___ numbers so n = __)

Step One: Find the mean	
Step Two: Subtract the mean from each data point in the set	
Step Three: Square each of your answers from Step Two	Make sure you put the number in () before squaring it or it may not square correctly

Lesson Practice Data Set #1: 4, 8, 5, 9, 10, 2, 6

(___ numbers so n = __)

Step Four: Sum all the squared results	
Step Five: Divide the Sum by n - 1 (FYI - this answer is called the Variance)	
Step Six: Square Root your Variance from Step Five (Round to the nearest hundredth)	

Lesson Practice Data Set #2: 31, 52, 41, 16, 29

(___ numbers so n = __)

Step One: Find the mean	
Step Two: Subtract the mean from each data point in the set	
Step Three: Square each of your answers from Step Two	Make sure you put the number in () before squaring it or it may not square correctly

Lesson Practice Data Set #2: 31, 52, 41, 16, 29

(___ numbers so n = __)

Step Four: Sum all the squared results	
Step Five: Divide the Sum by n - 1 (FYI - this answer is called the Variance)	
Step Six: Square Root your Variance from Step Five (Round to the nearest hundredth)	

ANSWERS Practice Data Set #1: 4, 8, 5, 9, 10, 2, 6

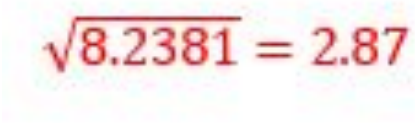
(7 numbers so n = 7)

Step One: Find the mean	4 + 8 + 5 + 9 + 10 + 2 + 6 = 44 44 / 7 = 6.29
Step Two: Subtract the mean from each data point in the set	4 - 6.29 = -2.29 8 - 6.29 = 1.71 5 - 6.29 = -1.29 9 - 6.29 = 2.71 10 - 6.29 = 3.71 2 - 6.29 = -4.29 6 - 6.29 = -0.29
Step Three: Square each of your answers from Step Two	$(-2.29)^2 = 5.2441$ $(1.71)^2 = 2.9241$ $(-1.29)^2 = 1.6641$ $(2.71)^2 = 7.3441$ $(3.71)^2 = 13.7641$ $(-4.29)^2 = 18.4041$ $(-0.29)^2 = 0.0841$

Make sure you put the number in () before squaring it or it may not square correctly

ANSWERS Practice Data Set #1: 4, 8, 5, 9, 10, 2, 6

(7 numbers so n = 7)

Step Four: Sum all the squared results	5.2441 + 2.9241 + 1.6641 + 7.3441 + 13.7641 + 18.4041 + 0.0841 = 49.4287
Step Five: Divide the Sum by n - 1 (FYI - this answer is called the Variance)	n = 7, so n-1 = 6 49.4287 / 6 = 8.2381
Step Six: Square Root your Variance from Step Five (Round to the nearest hundredth)	 Standard Deviation = 2.87

ANSWERS Practice Data Set #2: 31, 52, 41, 16, 29

(5 numbers so n = 5)

Step One: Find the mean	31 + 52 + 41 + 16 + 29 = 169 169 / 5 = 33.8
Step Two: Subtract the mean from each data point in the set	31 - 33.8 = -2.8 52 - 33.8 = 18.2 41 - 33.8 = 7.2 16 - 33.8 = -17.8 29 - 33.8 = -4.8
Step Three: Square each of your answers from Step Two	$(-2.8)^2 = 7.84$ $(18.2)^2 = 331.24$ $(7.2)^2 = 51.84$ $(-17.8)^2 = 316.84$ $(-4.8)^2 = 23.04$ Make sure you put the number in () before squaring it or it may not square correctly

ANSWERS Practice Data Set #2: 31, 52, 41, 16, 29

(___ numbers so n = __)

Step Four: Sum all the squared results	7.84 + 331.24 + 51.84 + 316.84 + 23.04 = 730.8
Step Five: Divide the Sum by n - 1 (FYI - this answer is called the Variance)	n = 5, so n-1 = 4 730.8 / 4 = 182.7
Step Six: Square Root your Variance from Step Five (Round to the nearest hundredth)	$\sqrt{182.7} = 13.52$ Standard Deviation = 13.52