Measures of Variability:

- Range
- Interquartile range
- Standard Deviation

Gives an indication of how spread out the data is,
or how much variation there is in the data.

Range: Max Value - Min Value

Gives a measure of the Spread in a data set

Range by itself doesn't describe the whole data set because it is found using only 2 data values.

Which would be more significant?
A small range OR A large range?

A smaller range means the data is packed closely together whereas when a range is large all you really know is that the min and max are far apart but you don't know where the remaining data is within that range.

Interquartile Range:

Upper Quartile - Lower Quartile

Gives a measure of how spread out the middle 50% is

Similar to Range is doesn't tell the whole story because it is found using only 2 data values.

Standard Deviation:

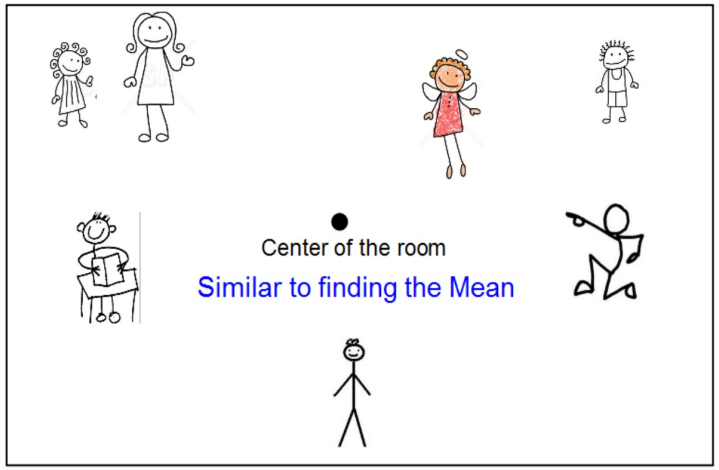
A measure of how much variation there is in a set of data.

Used by itself it doesn't tell you that much about a data set

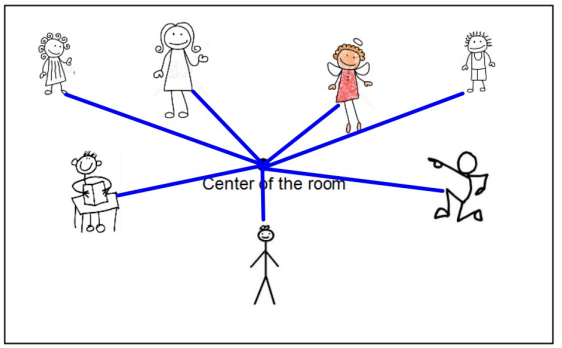
Best used to compare sets of data

Standard Deviation is a measure of how far on average each data value is from the mean.

Bigger Standard Deviation means more variation

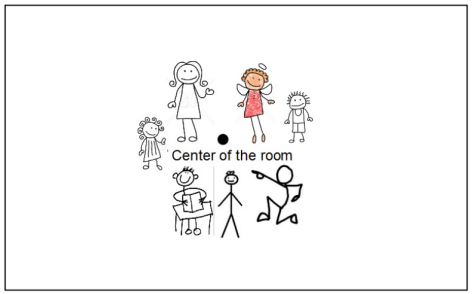


Standard Deviation is similar to the average distance each person is from the center of the room



Large or small Standard Deviation?

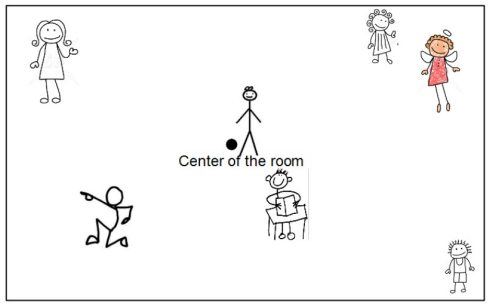
Is there a little or a lot of variation in the data set?



Small: They are all "pretty" close to the center of the room and all about the same distance from the center.

Large or small Standard Deviation?

Is there a little or a lot of variation in the data set?



Larger: Their distances from the center of the room vary more and are for the most part further away than the previous picture.

Symbol for Standard Deviation: σ Lower case Sigma

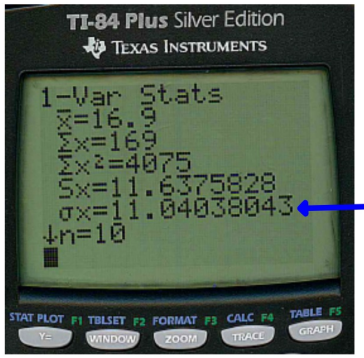
Standard Deviation Formula:

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

Using this set of numbers: 5, 6, 7, 9, 13, 15, 20, 23, 31, 40

Find the Standard Deviation using the graphing calculator. It's found on the same screen as the one used to find Mean ($\bar{x}$).

$$\sigma_x = 11.04$$



σ_x

Population Standard Deviation:
Uses all data values

Using Excel to find Standard Deviation

	A	B	C
1		5	15
2		6	20
3		7	23
4		9	31
5		13	40
6			
7			11.0404

=stdevp(B1:C5)

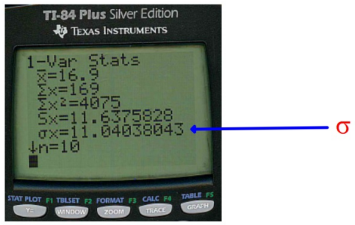
=stdevp(B1:C5)

p stands for Population which means you are using ALL the data.

Population Standard Deviation: Uses all the data available - the Population.

Use the formula on page 669: $\sigma = \sqrt{\frac{\Sigma(x-\overline{x})^2}{n}}$

This will match what you get when using the graphing calculator:



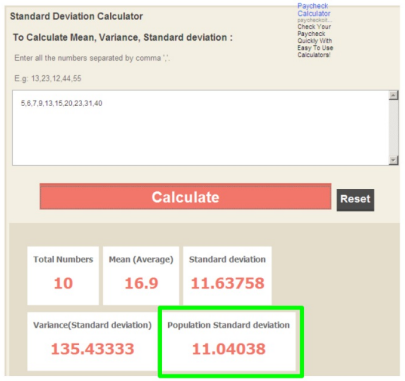
σ

Standard Deviation Calculator Link on my blog:

Population Standard Deviation - uses all of the data values

These will also match what you get when:

Using the link from my Blog:



Using Excel:

	A	B	C
1		5	15
2		6	20
3		7	23
4		9	31
5		13	40
6			
7			11.0404

=stdevp(B1:C5)

matches the value from both the calculator and spreadsheet

Standard Deviation:
Mostly used to compare two sets of data

Which set of data has more variation?

Set 1: 95, 100, 105, 110, 115, 120, 125, 130

$\sigma = 11.456$

Set 2: 26, 27, 37, 39, 44, 50, 58, 61

$\sigma = 12.224$

The greater the Standard Deviation the more variation there is in the set of data.

Set 2 has more variation because its Standard Deviation is larger

Which set of data has more variation?

Set A: 12, 17, 22, 27, 32, 37, 42, 47, 52, 57

Set B: 85, 78, 79, 83, 81, 84, 86, 75, 82, 81

Find the standard deviation of each set:

Set A: $\sigma_x = 14.36$ Set B: $\sigma_x = 3.2$

Set A has more variation because its Standard Deviation is larger

Which set of data has more variation?

Set 1: 5,6,8,10,13,15,19

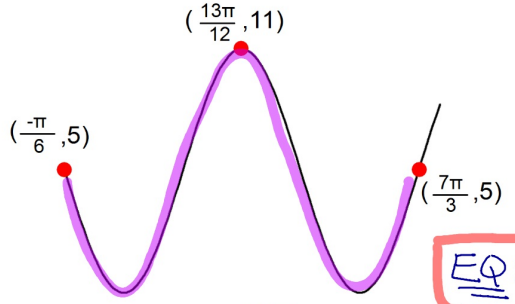
Set 2: 48,50,51,53,56,57,60

Find the standard deviation of each set:

Set 1: $\sigma = 4.703$ Set 2: $\sigma = 3.959$

Set 1 has more variation because its Standard Deviation is larger

Write either a Sin or Cos equation for this graph.



Amp = 11 − 5 = 6

midline: $y = 5$

If START AT $-\frac{\pi}{6}$:

- upside down Sin eq.
- phase shift $\frac{\pi}{6}$ left

EQ: $y = -6\sin\left(\frac{6}{5}\left(x + \frac{\pi}{6}\right)\right) + 5$

period $= \frac{\frac{7\pi}{3} - -\frac{\pi}{6}}{1\frac{1}{2}\text{ cycles}} = \frac{\frac{14\pi}{6} + \frac{\pi}{6}}{3/2} = \frac{15\pi}{6} \cdot \frac{2}{3} = \frac{5\pi}{3}$

$b = \frac{2\pi}{\text{period}} = \frac{2\pi}{\frac{5\pi}{3}} = 2\pi \cdot \frac{3}{5\pi} = \frac{6}{5}$

Find a positive coterminal angle. Give answer in radians.

$\theta = \frac{-14\pi}{3}$ add 2π in the form $\frac{6\pi}{3}$ until θ becomes positive

① $-\frac{14\pi}{3} + \frac{6\pi}{3} = -\frac{8\pi}{3}$

② $-\frac{8\pi}{3} + \frac{6\pi}{3} = -\frac{2\pi}{3}$

③ $-\frac{2\pi}{3} + \frac{6\pi}{3} = \frac{4\pi}{3}$

Evaluate to the nearest hundredth.

$$\text{Cot}\left(\frac{7\pi}{8}\right)$$

$$= \frac{1}{\text{Tan}\left(\frac{7\pi}{8}\right)} = -2.41$$

make sure the calculator is in radian mode!

Find the EXACT value of each. Simplify and rationalize.

$$\text{Csc}\left(\frac{-23\pi}{3}\right)$$

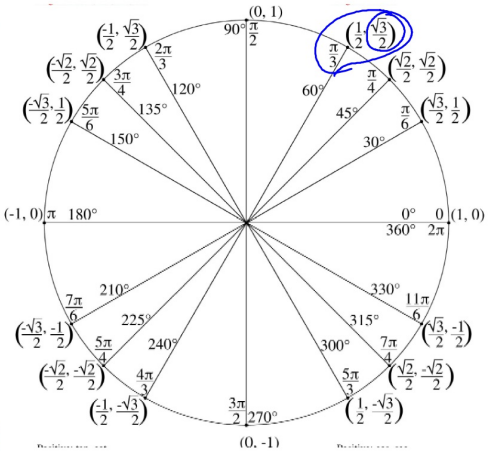
$$-\frac{23\pi}{3} + \frac{6\pi}{3} + \frac{6\pi}{3} + \frac{6\pi}{3} + \frac{6\pi}{3}$$

$$= \frac{\pi}{3}$$

$$\Rightarrow \csc\frac{\pi}{3} = \frac{1}{\sin\frac{\pi}{3}}$$

$$= \frac{1}{\frac{\sqrt{3}}{2}} = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{2\sqrt{3}}{3}$$



Tan(−690°)

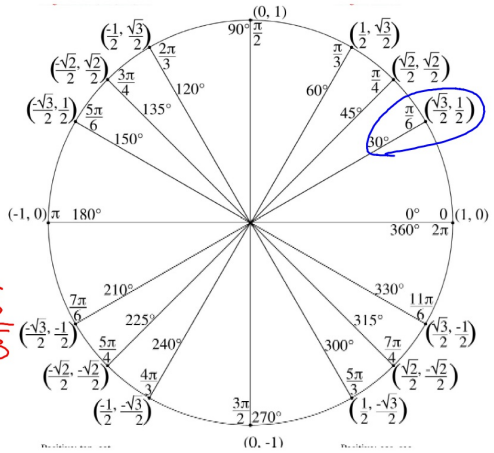
$$-690° + 720° = 30°$$

$$= \text{Tan } 30°$$

$$= \frac{y}{x} \text{ at } 30°$$

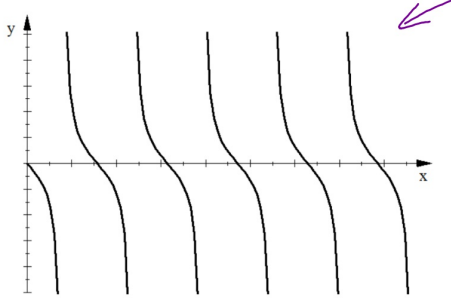
$$= \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \frac{1}{2} \cdot \frac{2}{\sqrt{3}} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{\sqrt{3}}{3}$$



Write the equation of this Tangent Function.

The window is 0 to $\frac{3\pi}{8}$



Neg Tan graph

$$y = -\text{Tan } bx$$

$$\Rightarrow y = -\text{Tan}\frac{44x}{3}$$

$$\text{period} = \frac{\frac{3\pi}{8}}{5\frac{1}{2}} = \frac{\frac{3\pi}{8}}{\frac{11}{2}} = \frac{3\pi}{4\cancel{8}} \cdot \frac{\cancel{2}^{1}}{11} = \frac{3\pi}{44}$$

$$b = \frac{\pi}{\text{period}} = \frac{\pi}{\frac{3\pi}{44}} = \pi \cdot \frac{44}{3\pi}$$

$$= \frac{44}{3}$$