Range and Standard Deviation

The **Standard Deviation** is a measure of how spread out. #'s are

To calculate the standard deviation of those numbers:

- 1. Work out the mean (the average of the numbers)
- 2. Then for each number: subtract the Mean and square the result
- 3. Then work out the mean of **those** squared differences
- 4. Take the square root of that and we are done!

What does it mean?

A low standard deviation means that most of the numbers are very close to the mean. (This is usually a good thing!)

A high standard deviation means that there is a wide spread in the data numbers.

very _____ to the _____. (This is usually a good thing!)

A high standard deviation means that there is a _____ spread in the data numbers.

The range is the _____ between the lowest number and the highest number in the set of data. To calculate the range;

_____ - _____ = range

Example:

Example:

Sam has 20 Rose Bushes.

The number of flowers on each bush is

9, 2, 5, 4, 12, 7, 8, 11, 9, 3, 7, 4, 12, 5, 4, 10, 9, 6, 9, 4

Work out the Standard Deviation.

Step 1. Work out the mean

Example: 9, 2, 5, 4, 12, 7, 8, 11, 9, 3, 7, 4, 12, 5, 4, 10, 9, 6, 9, 4

The mean is:

$$\frac{9+2+5+4+12+7+8+11+9+3+7+4+12+5+4+10+9+6+9+4}{20} = \frac{140}{20} = 7$$

Step 2. Then for each number: subtract the Mean and square the result

Example:

$(9 - 7)^2 = (2)^2 = \mathbf{4}$

$(2 - 7)^2 = (\quad)^2 = \mathbf{25}$

Example:

$(9 - 7)^2 = (2)^2 = \mathbf{4}$

$(2 - 7)^2 = (-5)^2 = \mathbf{25}$

$(5 - 7)^2 = (-2)^2 = 4$

$(4 - 7)^2 = (-3)^2 = 9$

$(12 - 7)^2 = (5)^2 = 25$

$(7 - 7)^2 = (0)^2 = 0$

$(8 - 7)^2 = (1)^2 = 1$

… etc….

And we get these results:

4, 25, 4, 9, 25, 0, 1, 16, 4, 16, 0, 9, 25, 4, 9, 9, 4, 1, 4, 9

Step 3. Then work out the mean of those squared differences (aka; the set of numbers you just found).

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To work out the mean, **add up all the values** then **divide by how many**.

First add up all the values from the previous step.

But how do we say "add them all up" in mathematics? We use "Sigma":Σ

The handy Sigma Notation says to sum up as many terms as we want:

Sigma Notation

We want to add up all the values from 1 to N, where N=20 in our case because there are 20 values:

Example:

$$= \frac{4+25+4+9+25+0+1+16+4+16+0+9+25+4+9+9+4+1+4+9}{20}$$

$$= \frac{178}{20}$$

$$= 8.9$$

(Note: this value is called the "Variance")

Step 4. Take the square root of that:

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Step 4. Take the square root of that:

Example :

= √(   ) $\sqrt{8.9}$

=2.98 = ... **round to the nearest tenth**

Therefore, the standard deviation is 3.0

Now calculate the range:

Range= highest number - lowest number

= 12 − 2

= 10