# ANATOMY OF A STANDARD DEVIATION

**5) In step 2, we squared the differences to get rid of negatives, we need to undo this. Taking the square root cancels out the squaring we did in step 2.**

**2) Square the difference to get rid of any negative signs**

**1) Subtract the mean from an observation**

$$\sqrt{\frac{\sum(y - \bar{y})^2}{n-1}}$$

**3) Add up all the terms**

**4) Divide the numerator by n-1, where n is the number of observations. Subtracting 1 is to "penalize" us for using a sample, not population. In a sense, we are averaging the difference between observation and the mean.**

# Example

Suppose we measure the lengths of homeruns hit in a baseball game. The distances are 510, 545, 520, 601, and 580 feet. Find the mean and standard deviation.

**Mean (average)**

$$\frac{510 + 545 + 520 + 601 + 580}{5} = 551.2 \text{ feet per homerun}$$

**Standard Deviation**

Step 1 Step 2

$510 - 551.2 = -41.2^2 = 1{,}697.44$
$545 - 551.2 = -6.2^2 = 38.44$
$520 - 551.2 = -31.2^2 = 973.44$
$601 - 551.2 = 49.8^2 = 2{,}480$
$580 - 551.2 = 28.8^2 = 795$

Step 3

$1697.44+38.44+973.44+2{,}480+795=5{,}979.32$

Step 4

$$\frac{5{,}979.32}{5-1} = 1{,}494.83$$

Step 5

So far, we have found the variance, which is 1,494,83 feet per homerun squared. This is akward since we want to know "feet per homerun." Thus, $\sqrt{1{,}494.83} = 38.79$. So the standard deviation is 38.79 feet per homerun. That means that the average homerun is 551.2 feet, give or take 38.79 feet.

Notice when we subtract the standard deviation from the mean (i.e., 551.2-38.79=512.41) is not less than our smallest measurement (e.g. 510 feet). Likewise, adding the two (e.g. 551.2+38.79=589.99) is no bigger than 601--the largest observation. This, in fact, is a rule.

read after step 5

Created by Tom Schenk Jr. 6/2/2006.