Notes 5.1 Arithmetic Sequences

a_n refers to term n

a_1 refers to the first term

d refers to the common difference

$d = a_n - a_{n-1}$

Recursive Formula: $a_n = a_{n-1} + d$

Explicit Formula: $a_n = a_1 + (n-1)d$

Notes 5.2 Geometic Sequences

a_n refers to term n

a_1 refers to the first term

r refers to the common ratio

$r = \frac{a_n}{a_{n-1}}$

Recursive Formula: $a_n = (a_{n-1})r$

Explicit Formula: $a_n = a_1(r)^{n-1}$

Geometric Mean: a, _?_, b, … _?_ $= \sqrt{ab}$

Notes 5.3 Mode, Median, Mean, IQR, range, and Standard Deviation

KEY VOCABULARY

Measure	What is it?	How do you find it?
mean ($\bar{X}$ - "x-bar")	The **AVERAGE** of a set of data	1. Add up your numbers 2. Divide by the number of numbers in the set of data
median	The **MIDDLE** number in a set of data (you must put the numbers in order from smallest to largest first!)	1. Write the numbers in numerical order 2. Find the middle number (if you have an even number of #'s, average the two middle numbers!)
mode	The number (or value) that occurs the **MOST** in your set of data (you can have no mode, 1 mode, or more than 1 mode)	1. Write the numbers in numerical order 2. Count how many times each number appears
range	The **DIFFERENCE of the highest and lowest** numbers (values) in a set of data	Subtract (the largest number minus the smallest number)

Notes 5.3 Mode, Median, Mean, IQR, range, and Standard Deviation (continued)

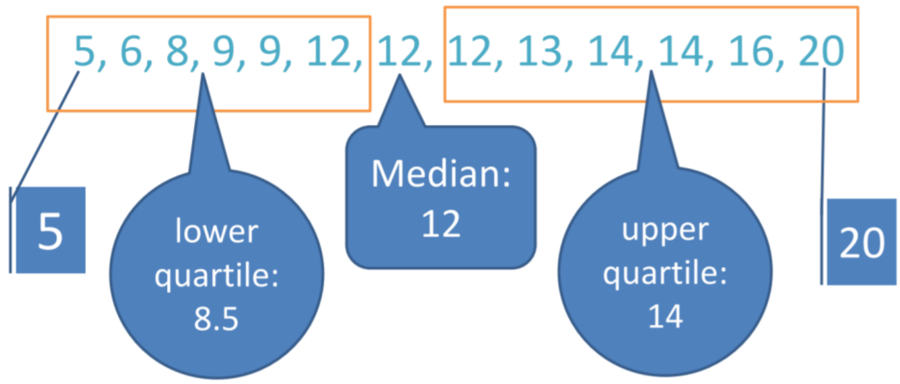
Interquartile Range or IQR:

In a "Box and Whisker" plot there are 5 parts:

Lower Extreme
Lower Quartile
Median
Upper Quartile
Upper Extreme

These parts are shown in the Example data set here:

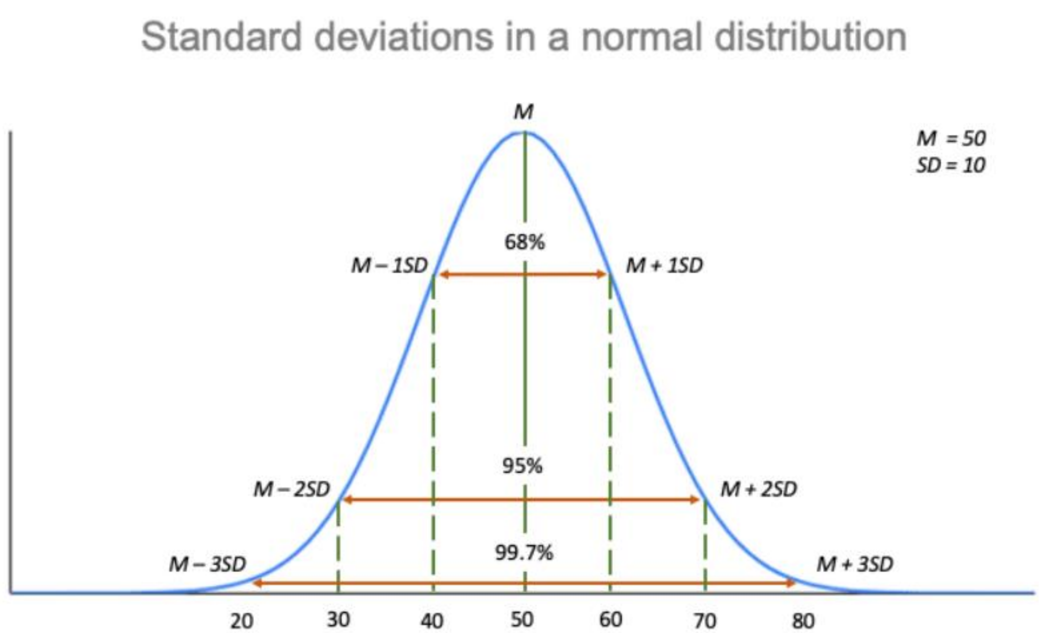
IQR:
14 – 8.5 = 5.5



The "InterQuartile Range" or IQR is the range from the lower quartile to the upper quartile.
To find the IQR, subtract the lower quartile from the upper quartile

Standard Deviation:

1 standard deviation will contain 68% of all the data
2 standard deviations will contain 95% of all the data
3 standard deviations will contain 99.7% of all the data



Standard Deviation: (continued)

Population standard deviation

When you have collected data from every member of the population that you're interested in, you can get an exact value for population standard deviation.

The **population standard deviation** formula looks like this:

Formula	Explanation
$\sigma = \sqrt{\frac{\sum (X-\mu)^2}{N}}$	• σ = population standard deviation • $\sum$ = sum of... • X = each value • μ = population mean • N = number of values in the population

Sample standard deviation

When you collect data from a sample, the sample standard deviation is used to make estimates or inferences about the population standard deviation.

The **sample standard deviation** formula looks like this:

Formula	Explanation
$s = \sqrt{\frac{\sum (X-\bar{x})^2}{n-1}}$	• s = sample standard deviation • $\sum$ = sum of... • X = each value • $\bar{x}$ = sample mean • n = number of values in the sample

Steps for calculating the standard deviation

The standard deviation is usually calculated automatically by whichever software you use for your statistical analysis. But you can also calculate it by hand to better understand how the formula works.

There are six main steps for finding the standard deviation by hand. We'll use a small data set of 6 scores to walk through the steps.

Data set					
46	69	32	60	52	41

Step 1: Find the mean

To find the mean, add up all the scores, then divide them by the number of scores.

Mean ($\bar{x}$)
$\bar{x}$ = (46 + 69 + 32 + 60 + 52 + 41) ÷ 6 = **50**

Step 2: Find each score's deviation from the mean

Subtract the mean from each score to get the deviations from the mean.

Since $\bar{x} = 50$, here we take away 50 from each score.

Score	Deviation from the mean
46	46 – 50 = **-4**
69	69 – 50 = **19**
32	32 – 50 = **-18**
60	60 – 50 = **10**
52	52 – 50 = **2**
41	41 – 50 = **-9**

Step 3: Square each deviation from the mean

Multiply each deviation from the mean by itself. This will result in positive numbers.

Squared deviations from the mean
$(-4)^2 = 4 \times 4 =$ **16**
$19^2 = 19 \times 19 =$ **361**
$(-18)^2 = -18 \times -18 =$ **324**
$10^2 = 10 \times 10 =$ **100**
$2^2 = 2 \times 2 =$ **4**
$(-9)^2 = -9 \times -9 =$ **81**

Step 4: Find the sum of squares

Add up all of the squared deviations. This is called the sum of squares.

Sum of squares
16 + 361 + 324 + 100 + 4 + 81 = **886**

Step 5: Find the variance

Divide the sum of the squares by $n - 1$ (for a sample) or N (for a population) – this is the variance.

Since we're working with a sample size of 6, we will use $n - 1$, where $n = 6$.

Variance
886 ÷ (6 – 1) = 886 ÷ 5 = **177.2**

Step 6: Find the square root of the variance

To find the standard deviation, we take the square root of the variance.

Standard deviation
$\sqrt{177.2}$ = **13.31**

From learning that *SD* = 13.31, we can say that each score deviates from the mean by 13.31 points on average.