Investigation 46 Standard Normal Distributions Name:_____

What is normal?

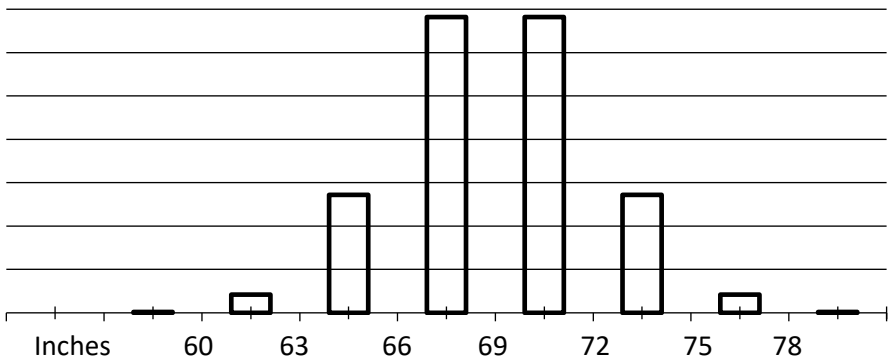
Problem

The following table lists the heights of 1,000 American men. The mean (average) height is 69" (5'9") and the standard deviation is 3".

Height Range	Number of Men (out of 1,000)	Probability	Percent likelihood
Under 60"	1	$\frac{1}{1000} = 0.001$	0.1%
60" – 63	21	$\frac{21}{1000} = 0.021$	2.1%
63" – 66"	136	$\frac{136}{1000} = 0.136$	13.6%
66" – 69"	342	$\frac{342}{1000} = 0.342$	34.2%
69" – 72"	342	$\frac{342}{1000} = 0.342$	34.2%
72" – 75"	136	$\frac{136}{1000} = 0.136$	13.6%
75" – 78"	21	$\frac{21}{1000} = 0.021$	2.1%
Above 78"	1	$\frac{1}{1000} = 0.001$	0.1%

1. What is the sum of all the probabilities?_____

Below is a histogram of the probability for each category of heights.



2. Draw a point at the midpoint of the top of each bar.
3. Connect the data points with a smooth curve
4. What do you observe about the graph's shape?

5. What do you observe about the graph's symmetry?

6. What do you observe about the graph's highest point?

7. What do you observe about the graph's mean/median/mode probability?

8. In the box below, read about the characteristics of a normal curve, and then describe how the curve you drew compares to a normal curve.

The graph of a normal distribution is a normal curve.
Every normal curve has the following characteristics:

- **The mean, median, and mode are approximately equal.**
- **They are bell-shaped and symmetrical about the mean.**
- **The curve never touches the *x*-axis, but it comes closer to the *x*-axis as it gets farther from the mean.**
- **The total area under the curve is equal to 1.**

Some examples of things that would make Normal Distributions are:

- LDL cholesterol levels in adults
- IQ scores
- SAT and ACT scores
- The width of stripes on a zebra
- The acidity of rainfall in the Shenandoah Mountains
- The length of time it takes milk to spoil
- The size of eggs produced by young hens

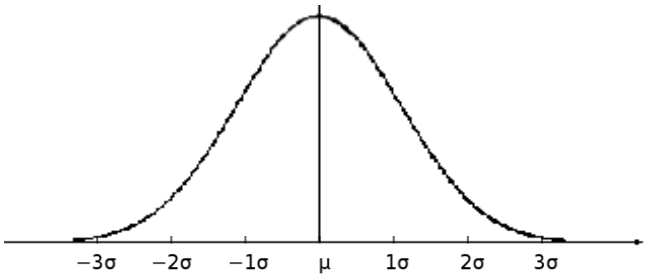
What is another example that you can think of?

All of these things would make a curve with the four characteristics listed above!

What makes normal curves different?

The Standard Normal Curve –

The Standard Normal Curve has $\mu = 0$ (mean is zero) and $\sigma = 1$ (standard deviation is one). This is like a "parent function" that we will transform to get other normal curves.



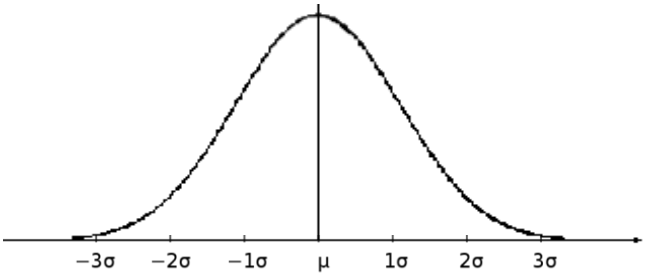
We typically mark 3σ's above and below the mean on the *x*-axis. Notice that these would represent _____ of ±1, ±2, and ±3.

When we draw any normal curve,

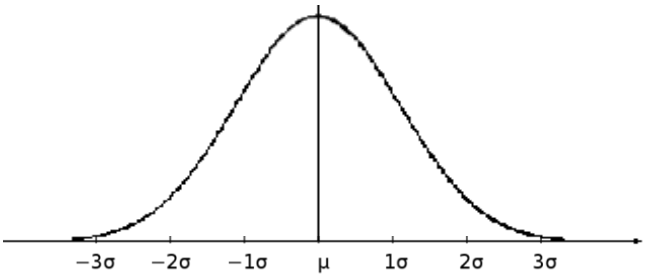
- the mean is always in the middle at the peak
- the curve is bell shaped
- ±3σ marks are always on the tails of the curve, near the asymptote of the *x*-axis
- the area represented is 1 (but we never draw a *y*-scale in this class)

The Empirical Rule – The 68-95-99.7 Rule

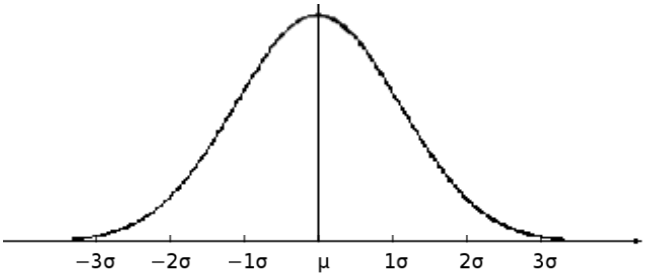
In a Normal Distribution 68% of the data lies within one standard deviation of the mean.



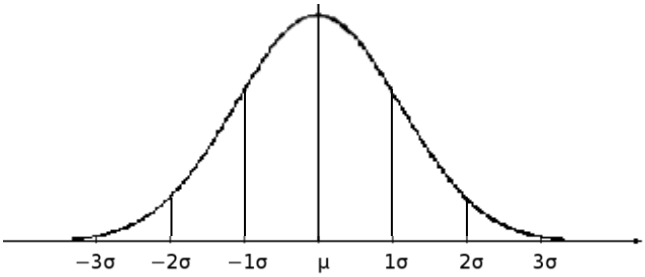
In a Normal Distribution 95% of the data lies within two standard deviations of the mean.



In a Normal Distribution 99.7% of the data lies within three standard deviations of the mean.

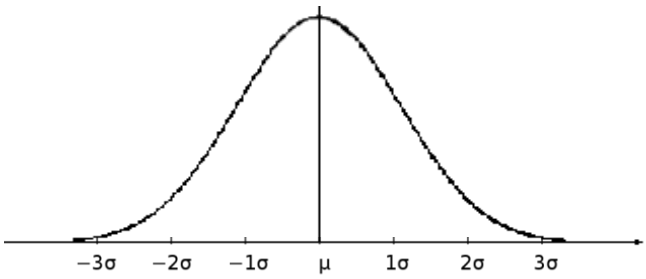


Label the percentage of the distribution contained in each section of the graph.



Problem – Men's Heights

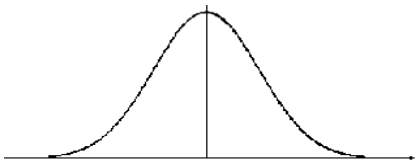
The heights of 1,000 American men were measured. The mean (average) height is 69" and the standard deviation is 3".



1. Label the horizontal axis with the heights that each tick mark represents.

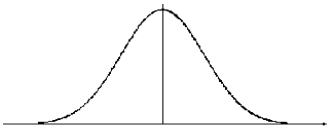
2. What is the <u>probability</u> that a man chosen is over 69"?

3. What <u>percentage</u> of men are over 69"?

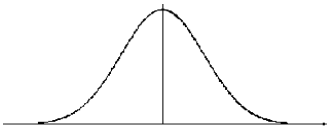


4. How many men are <u>expected</u> to be above 69"?

5. What percent of men are between 66" and 72"?

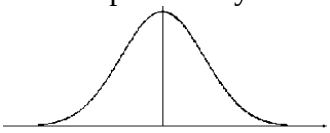


6. What is the probability that a man chosen at random is between 66" and 75"?

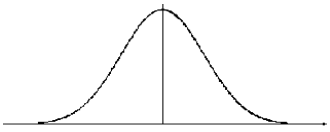


7. How many men are <u>expected</u> to be between 66" and 75"?

8. What is the probability that a man chosen at random is less than 66" or over 75"?



9. How many men are <u>expected</u> to be under 66"?



10. A man who is 66" is in the _____ percentile.