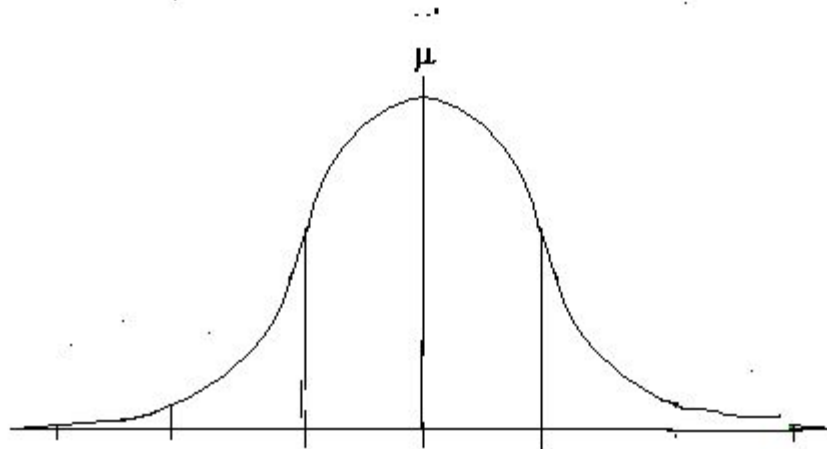
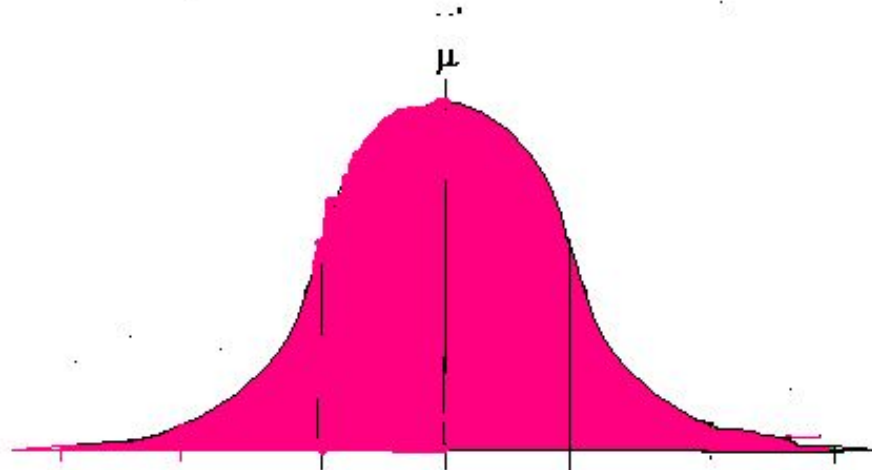


# The Normal Distribution

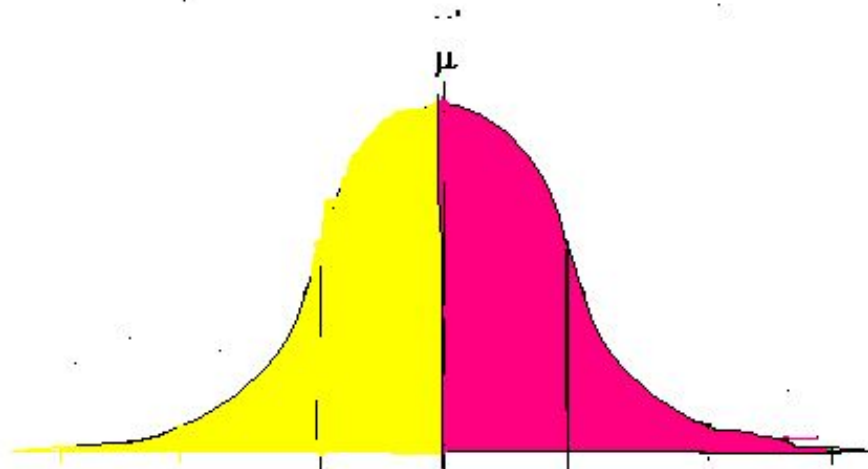


# The Area under the curve



The area under the curve represents everything:  
100%.

# The mean is in the middle.

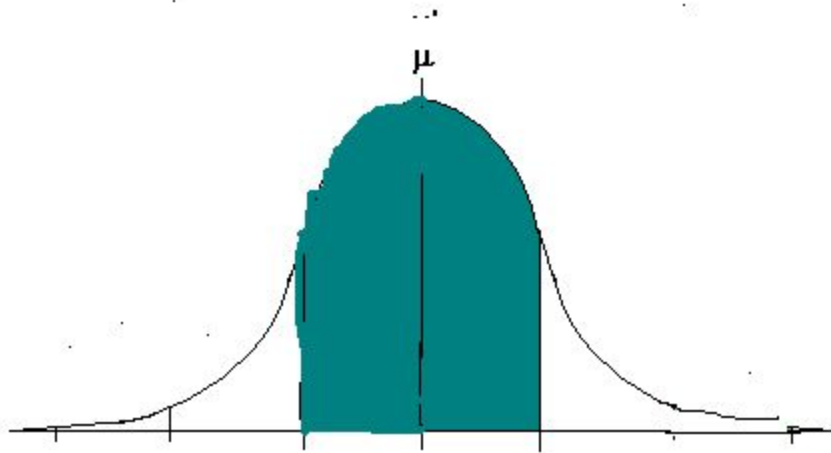


50% of the data is below the mean.

50% of the data is above the mean.

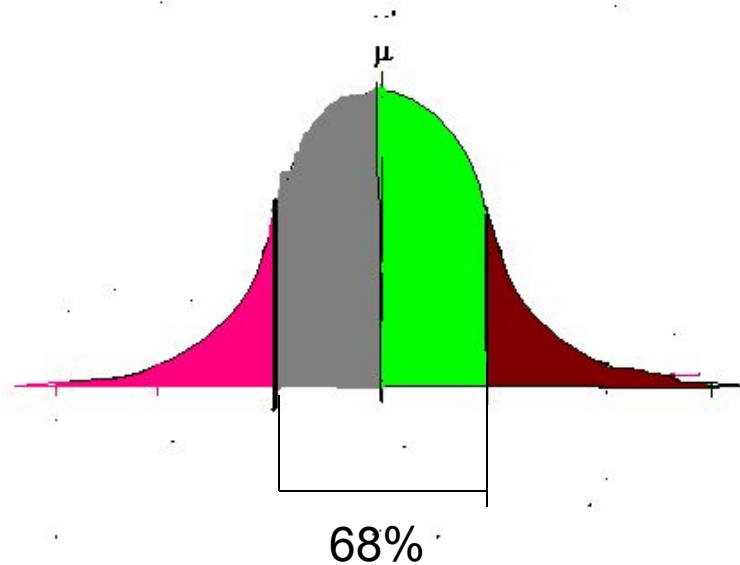
Remember that the mean=median=mode!

# Within one standard deviation



$$P(-1 < Z < 1) = 68\%$$

# What percent of the data is between 0 and 1?

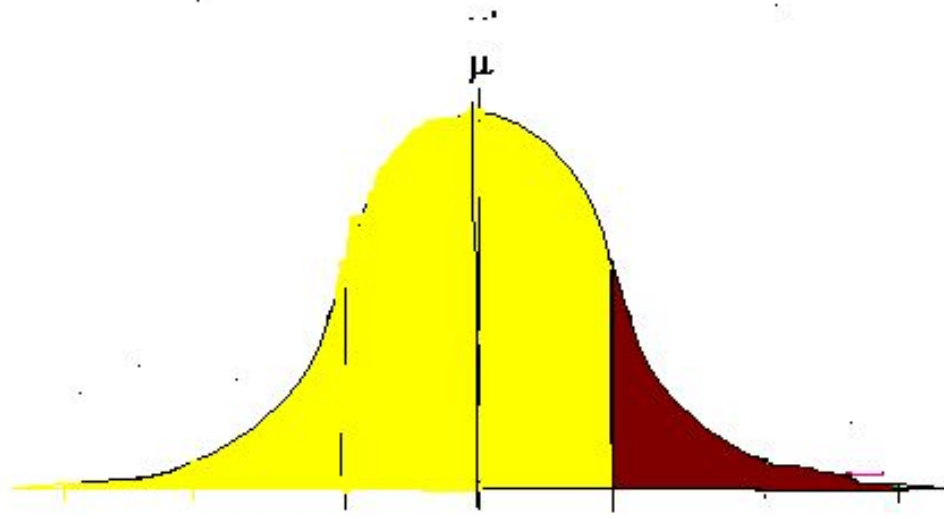


$$P(0 < Z < 1)$$

$$P(z < 1)$$

$$P(z > 1)$$

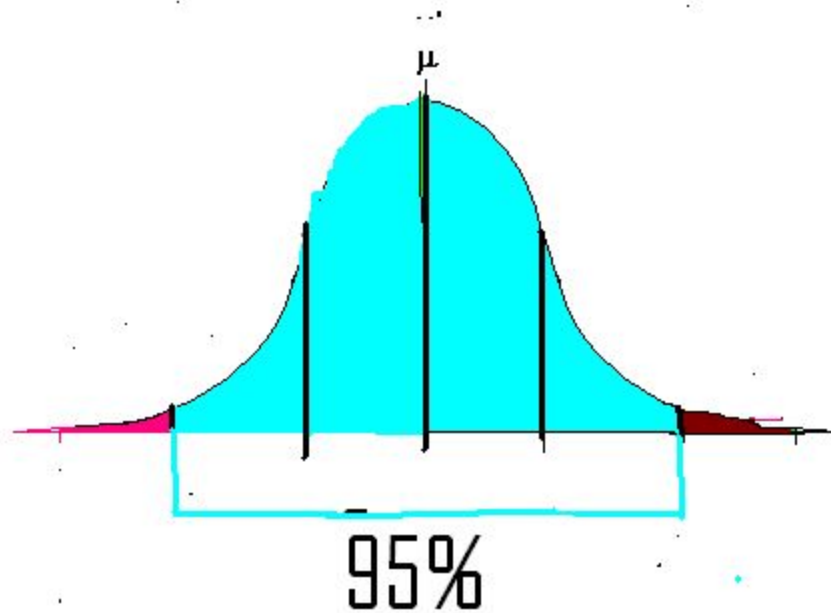
$$\text{Part (Yellow)} + \text{Part (Brown)} = 100$$



$$100 - \text{Part (Yellow)} = \text{Part (Brown)}$$

$$100 - 84 = 16$$

# Within two standard deviations

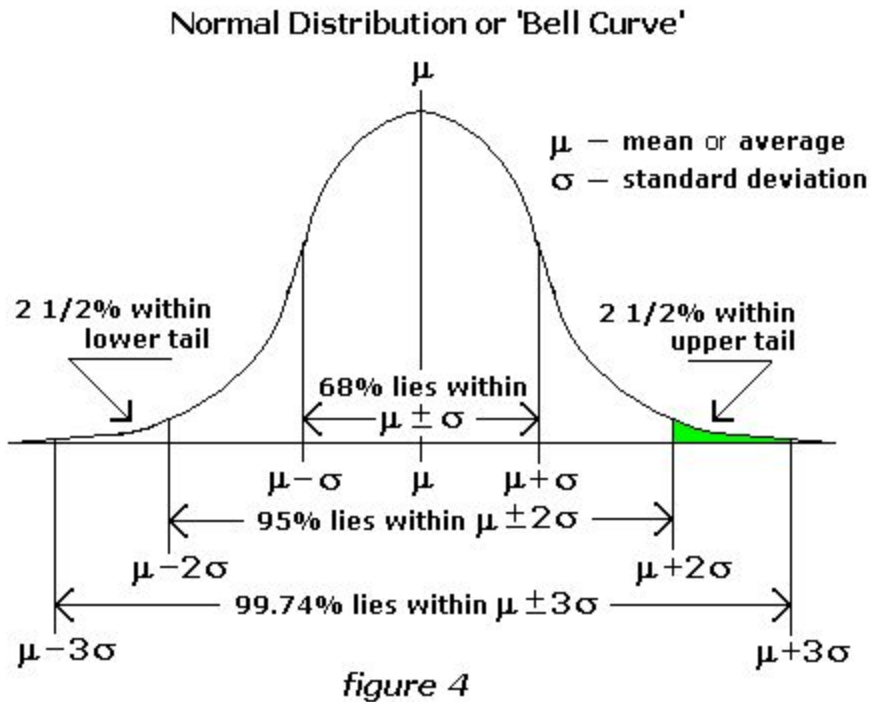


$$P(-2 < Z < 2)$$

$$P(1 < Z < 2)$$

$$P(Z < 2)$$

# The Normal Distribution



- ❖ A normal curve is bell shaped.
- ❖ The highest point on the curve is the mean of the distribution.
- ❖ The mean, median and mode are the same.
- ❖ The curve is symmetric with respect to its mean.
- ❖ The total area under the curve is one.
- ❖ Roughly 68% of the data is within one standard deviation from the mean, 95% of the data are within two standard deviations and 99.7% are within three standard deviations.

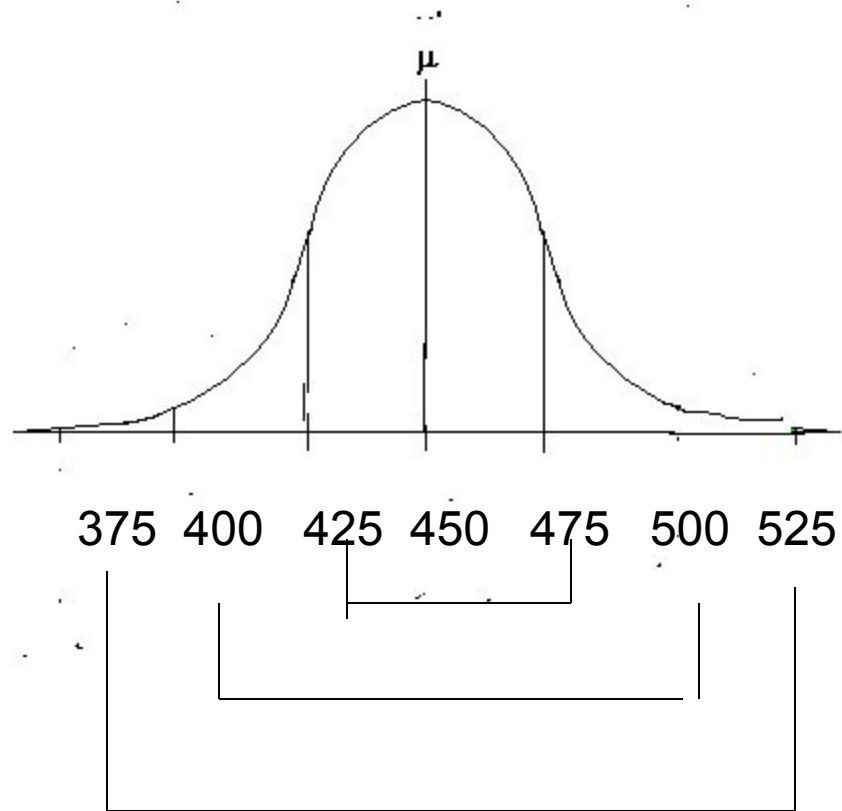


# Example 1

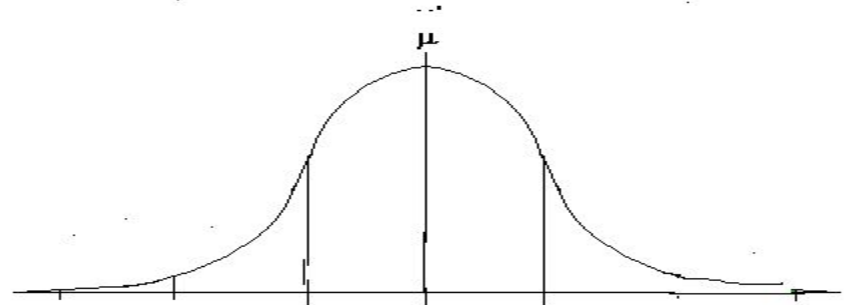
- 1,000 students take an intelligence test
- The mean is 450 and the standard deviation is 25.
- Label the horizontal axis.
- Show the Rule for the intervals for within 1 standard deviation, within 2 and within 3.

What percent of the data would be between 425 and 475?

How many scores would be between 425 and 475?

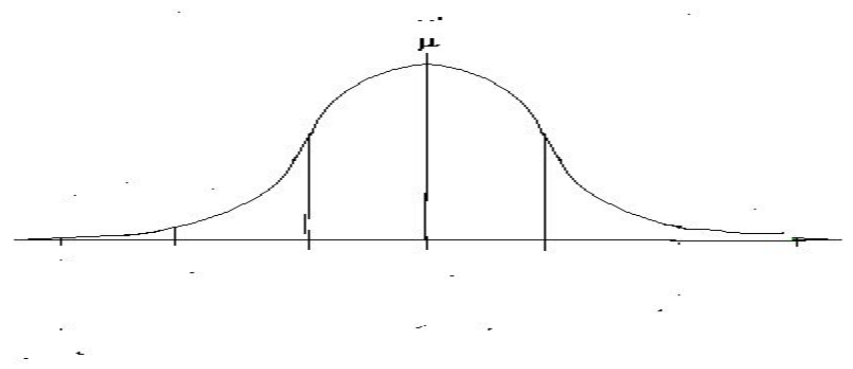


# Label the bell!



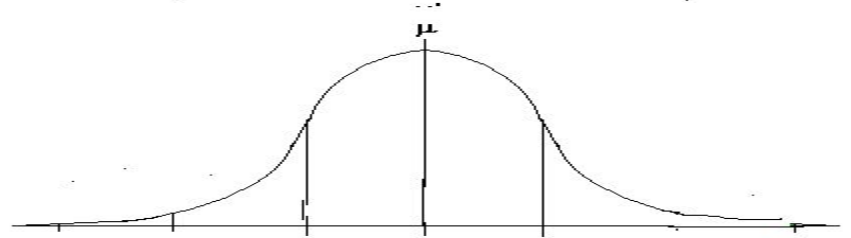
The mean value of land and buildings per acre from a sample of farms is \$1000 with a standard deviation of \$200. The data distribution has a bell shape. Estimate the percent of farms whose land and building values per acre are between \$800 and \$1200.

# Label the bell!



- The mean value of land and buildings per acre from a sample of farms is \$1200 with a standard deviation of \$350. Between what two values does about 95% of the data lie?

# Label the bell!



- The mean price of new homes from a sample of houses is \$155,000 with a standard deviation of \$15,000. The data has a bell shaped distribution.
- Between what two prices do 95% of the houses fall?
- What is the median price?
- What percent is less than \$110,000?

# Convert x to z

- Z is the standardized value
- $Z = \frac{(x - \mu)}{\sigma}$
- Convert  $x = 55$  with a mean of 50 and the standard deviation of 10.

# The Calculator

## Finding $P(a < x < b)$

- 2<sup>nd</sup> VARS □ DISTR Normalcdf
- ❖ In words:  
(lower limit, upper limit, mean, standard deviation)
- ❖ In variables:  
(a, b,  $\mu$ ,  $\sigma$ )
- ❖ For example with an x:  
Find the probability that x is between 40 and 60 in a distribution with a mean of 50 and a standard deviation of 10.  
 $P(40 < x < 60) = \text{normalcdf}(40, 60, 50, 10)$

Write the normalcdf for each  
 $\mu=50$  and  $\sigma=10$

- $P(20 < x < 60) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
- $P(20 < x < 50) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
- $P(70 < x < 80) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
- $P(14 < x < 43) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

$$\infty = 1E99$$

$$-\infty = -1E99$$

- $P(50 < x < \infty) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
- $P(55 < x < \infty) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
- $P(-\infty < x < 30) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
- $P(-\infty < x < 60) = \text{normalcdf}(\underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}})$



# Let's Do A Graph

- Normal curves are graphed by `normalpdf`