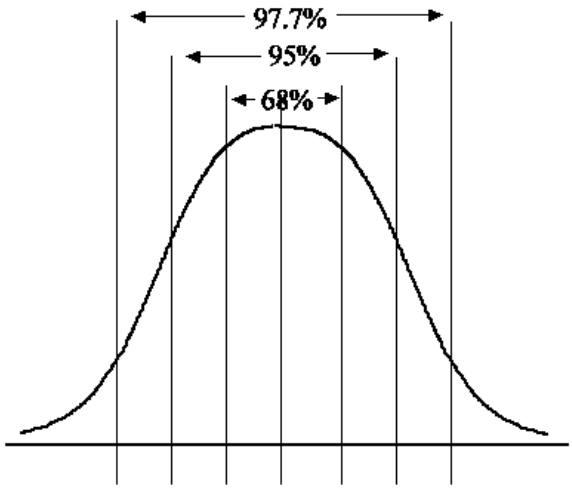
Section 12.4 – The Normal Distribution

Homework (pg 708) problems 1-32

- *Definition*: The **normal distribution** is a frequency distribution (graph of frequencies) where the mean, median and mode are all equal and located at the center. These distributions are symmetric, meaning if you draw a line through the middle they are a mirror image on the right and left sides.

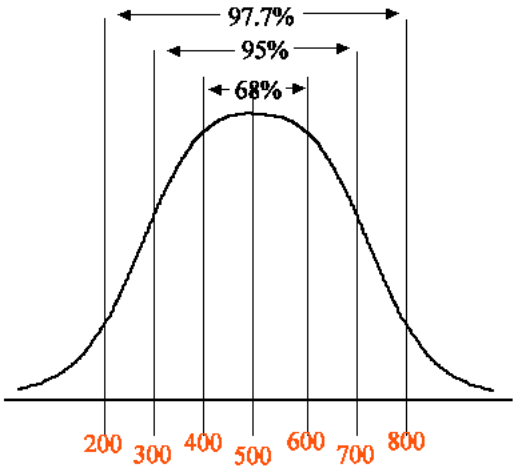
- The rule for normal distributions is characterized by the standard deviation.
  68% of the data items are within 1 standard deviation away from the mean
  95% are within 2 standard deviations away, and
  99.7% are within 3 standard deviations from the mean.
  This is known as the **68-95-99.7 Rule**



- *Example (Checkpoint 1)*: The distribution of heights of young men is approximately normal with a mean of 70 inches and a standard deviation of 2.5 inches. Find the height that is
  a) 3 standard deviations above the mean
  b) 2 standard deviations below the mean

  Solution:
  a) If you are 3 standard deviations above the mean, you are 70 + 3(2.5) = 77.5 inches
  b) If you are 2 standard deviations below the mean, you are 70 – 2(2.5) = 65 inches

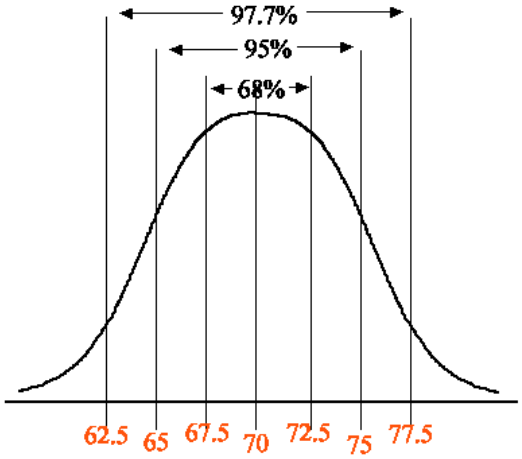
- *Example (Checkpoint 2)*: SAT scores are normally distributed with a mean of 500 and a standard deviation of 100. Find the percentage of seniors who score
  a) between 300 and 700
  b) between 500 and 700
  c) above 600



Solution: First we need to have a picture of the distribution.
One standard deviation above is 500 + 100 = 600
Two standard deviations above is 500 + 2(100) = 700, etc.
One standard deviation below is 500 – 100 = 400
Two standard deviations below is 500 – 2(100) = 300, etc

95% are between 300 and 700, so half are between 300 and 500 → 47.5%
Again, 47.5% are between 500 and 700
68% are between 400 and 600. So (100 – 68) = 32% are below 400 and above 600. So half are above 600 → 16%

- *Example*: Let's go back to the height problem. Heights of young men are normally distributed with a mean of 70 inches and a standard deviation of 2.5 inches.
  a) What percentage of men are above 77.5 inches tall?
  b) What percentage of men are below 65 inches tall?
  c) What percentage of men are between 72.5 and 75 inches tall?



Solution:
Again, we picture the distribution
97.7% are between 62.5 and 77.5. So 100 – 97.7 = 2.3% are below 62.5 or above 77.5. So half are taller than 77.5 inches → 1.15%
95% are between 65 and 75 inches. So 5% are below 65 or above 75. So half are below 65 inches → 2.5%
34% are between 70 and 72.5, and 47.5% are between 70 and 75. So 47.5 – 34 = 13.5% are between 72.5 and 75 inches