The Empirical Rule

- About 68% of the data values are between 1 SD from the mean
- About 95% of the data values are between 2 SD's from the mean
- About 99.7% if the data values are between 3 SD's from the mean
Z-Score

tells us, how many SD's any given value is from the mean.

\[
Z = \frac{x - \mu}{\sigma}
\]

If "Z" is "+" the value is above the \( \mu \).
If "Z" is "-" the value is below the \( \mu \).
Find the z-score is the mean is 39, SD = 3.1, and $x = 18$.

$$Z = \frac{x - \mu}{\sigma}$$

$$Z = \frac{18 - 39}{3.1} = -6.77$$

6.77 $o's$ below the $\mu$. 
Find the z-score if the mean is 89, x = 81, and SD = 11.5

\[ Z = \frac{x - \mu}{\sigma} = \frac{81 - 89}{11.5} = -0.70 \]

.70 σ's below the μ.
Find $x$ if the mean is 39, SD = 8.2, and $z = 0.73$

\[
\frac{z}{1} = \frac{x - \mu}{\sigma}
\]

\[
0.73 = \frac{x - 39}{8.2}
\]

\[
5.99 = x - 39
\]

\[
x = 44.99
\]
How do I read this thing?
The mean life span of an average tire is 31,066 miles and the SD = 1,644 miles.

\[ Z = \frac{30,000 - 31,066}{1,644} \]

\[ P(x < 30,000) = P(Z < -0.65) = 0.2578 = 25.7\% \]
The mean life span of an average tire is 31,066 miles and the SD = 1,644 miles.

\[ z = \frac{15,000 - 31,066}{1,644} \]

\[ P(x < 15,000) = \]

\[ P(z < -9.77) = .0001 = .01 \% \]
The mean life span of an average tire is 31,066 miles and the SD = 1,644 miles.

\[ Z = \frac{30,000 - 31,066}{1,644} \]

\[ Z = \frac{32,000 - 31,066}{1,644} \]

\[ P(30,000 < x < 32,000) = \]

\[ P(-0.65 < z < 0.57) \]

\[ \downarrow \quad \downarrow \]

\[ 0.2578 \quad 0.7157 \]

\[ 31,066 \]

\[ \text{Area} = 0.7157 - 0.2578 = 0.4579 \]
The mean life span of an average tire is 31,066 miles and the SD = 1,644 miles.

\[ z = \frac{35,000 - 31,066}{1,644} \]

\[ P(x > 35,000) = \]

\[ P(z > 2.39) = 1 - .9916 = .0084 = .84\% \]
In the United States, the average IQ is 100, with a standard deviation of 15. What percentage of the population would you expect to have an IQ lower than 85?

\[ P(x < 85) \]

\[ P(z < -1.00) = 0.1587 = 15.87\% \]
In the United States, the average IQ is 100, with a standard deviation of 15. What percentage of the population would you expect to have an IQ between 90 and 100?

\[ P(90 < x < 100) \]

\[
P(-0.67 < z < 0) = 0.5000 - 0.2514 = 0.2486
\]