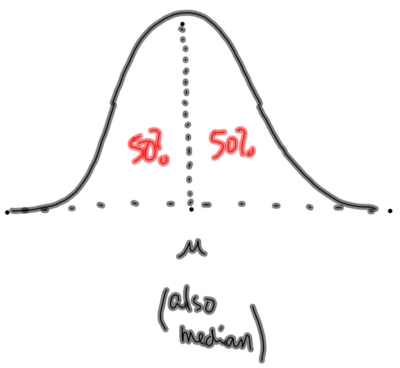
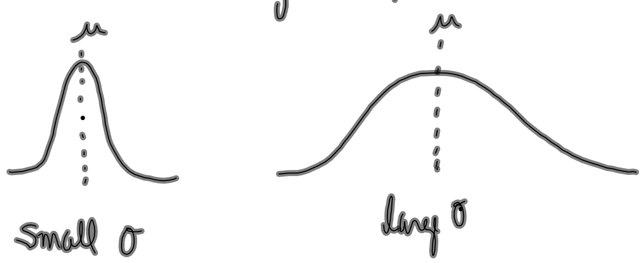
Normal Curve

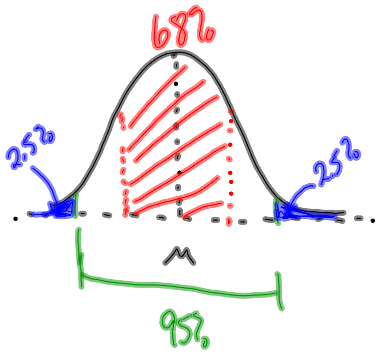


Normal Distribution
- symmetrical
- "bell curve"
- single peak (occurs at the mean or median)
- mean and median are the same.
- μ is the population mean
- $\bar{x}$ is the sample mean
- 50% of the data is above the mean
- 50% of the data is below the mean

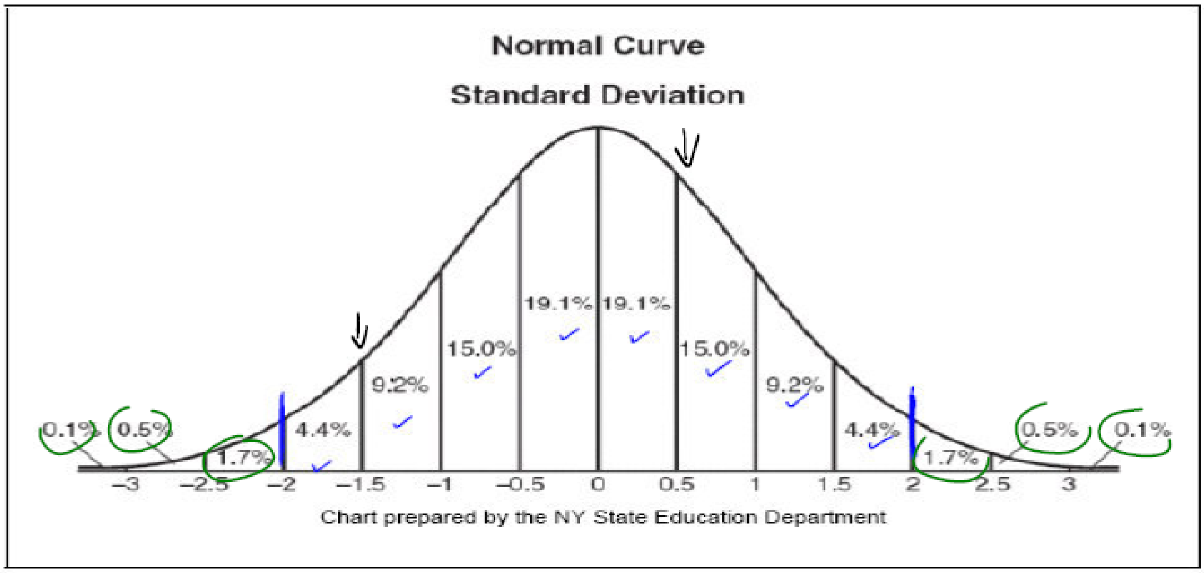
The spread of the data in a normal distribution is controlled by the standard deviation (σ)
The smaller the standard deviation, the more clustered around the mean. A larger standard deviation will result in the data being more spread out.



68% of the data will fall within 1 standard deviation
95% of the data will fall within 2 standard deviation



* These percentages are only approximate ..... use the following chart for more precise percentages.



Reading from the chart, we see that approximately 19.1% of normally distributed data is located between the mean (the peak) and 0.5 standard deviations to the right (or left) of the mean. (The percentages are represented by the area under the curve.)

Understand that this chart shows only percentages that correspond to subdivisions up to one-half of one standard deviation. Percentages for other subdivisions require a statistical mathematical table or a graphing calculator.

Example Find the percentage of data that lies within ± 2 standard deviations from the mean:

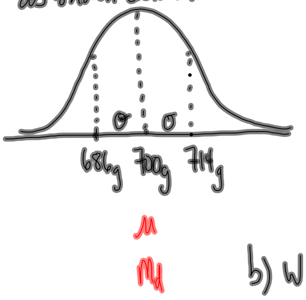
$4.4+9.2+15.0+19.1+19.1+15.0+9.2+4.4 = 95.4\%$

or $0.1+0.5+1.7+0.1+0.5+1.7 = 4.6\%$

$100\% - 4.6\% = 95.4\%$

Example

Oreo cookies have weights that are normally distributed as shown below:



a) What is the average weight of a bag of oreos?

$\mu = 700g$ (mean)

$M_d = 700g$ (median)

b) What is the standard deviation?

$\sigma = 714g - 700g = 14g$

OR

$\sigma = 700g - 686g = 14g$

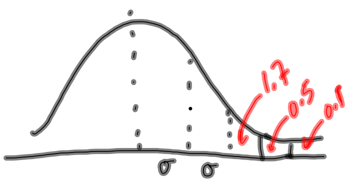
$\sigma = 14g$

c) If bags of cookies that weigh more than 728g are considered to be overweight, what % of bags are overweight? (i.e. what % of the population is greater than 728g)

$$\frac{x-\mu}{\sigma} = \#\text{ of st. dev units away from mean.}$$

value → x; mean → μ; st. dev → σ

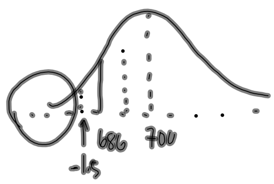
$$\frac{728-700}{14} = \frac{28}{14} = 2$$ ← What % lies above 2 sd units



so: $1.7 + 0.5 + 0.1 = 2.3\%$

So what this means is that 2.3% of oreo cookies will be overweight (i.e. > 728g)

d) Bags of cookies that are 1.5 standard deviations below the mean are considered underweight. If they sell 1000 bags at Sobeys, how many will be underweight?



$0.1 + 0.5 + 1.7 + 4.4 = 6.7\%$ will be below 1.5 sd units.

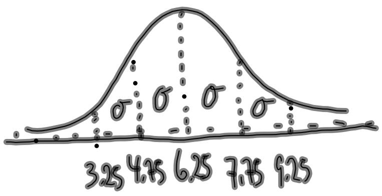
so..... 6.7% of $1000 =$

$0.067 \times 1000 = 67$

Example

From past records, it is found that a hair dryer used everyday has a mean life of 6.25 years with a standard deviation of 1.5 years. The data is normally distributed.

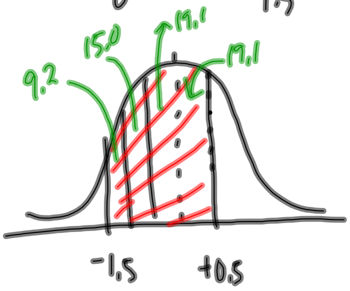
↑ you must be told it is normal to use the z's



a) What % of the hair dryers last between 4 and 7 yrs?

$$\frac{x-\mu}{\sigma} = \frac{4-6.25}{1.5} = \frac{-2.25}{1.5} = -1.5 \quad \left(\begin{array}{c}\text{1.5 st. dev}\\ \text{below}\end{array}\right)$$

$$\frac{x-\mu}{\sigma} = \frac{7-6.25}{1.5} = \frac{0.75}{1.5} = 0.5 \quad \left(\begin{array}{c}\text{0.5 st. dev}\\ \text{above}\end{array}\right)$$

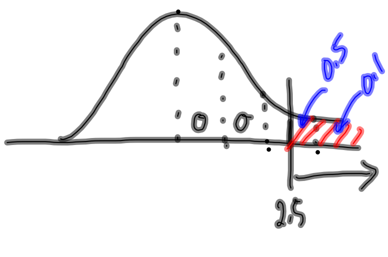


9.2 + 15.0 + 19.1 + 19.1 = 62.4%

62.4% of the hair dryers will last between 4 and 7 years.

b) What is the probability that a randomly selected hair dryer will last more than 10 yrs?

$$\frac{x-\mu}{\sigma} = \frac{10-6.25}{1.5} = \frac{3.75}{1.5} = 2.5 \text{ st. dev units.}$$



0.5 + 0.1 = 0.6%

There is a 0.6% probability that a randomly selected hair dryer will last for more than 10 yrs.