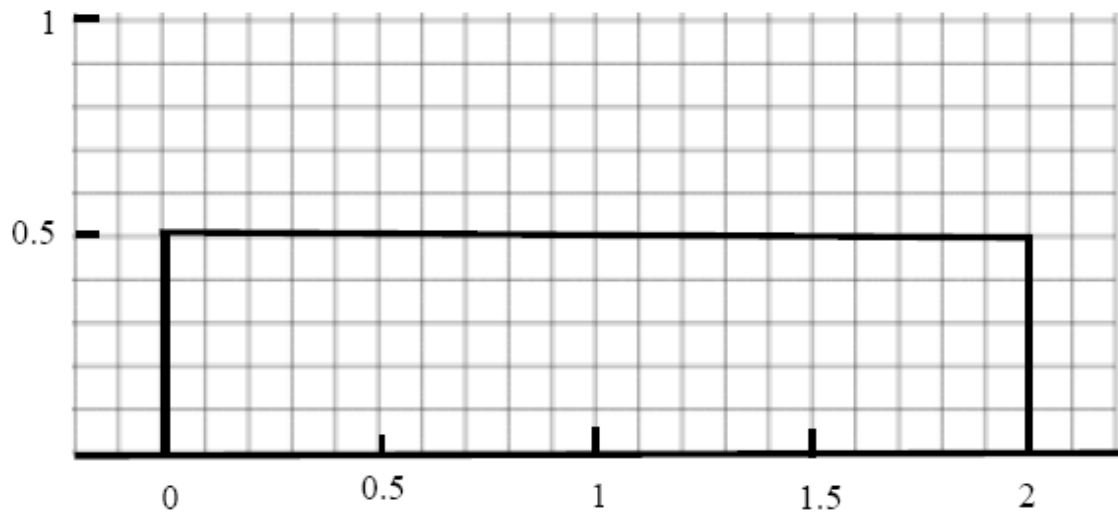


## AP Statistics – Ch 2 – The Normal Distributions

### Ch 2.1 – Density Curves and the Normal Distributions

#### Density Curves

- A *density curve* is a smooth curve that can approximate an actual distribution.
- Density curves, like distributions, come in many shapes.
- Properties of all density curves:
  - The curve is always on or above the horizontal axis
  - The area underneath the curve is always equal to 1
- The area under the curve and above any range of values is the proportion of all observations that fall in that range.
- Example – Uniform Distribution
  - Uniform Density Curve

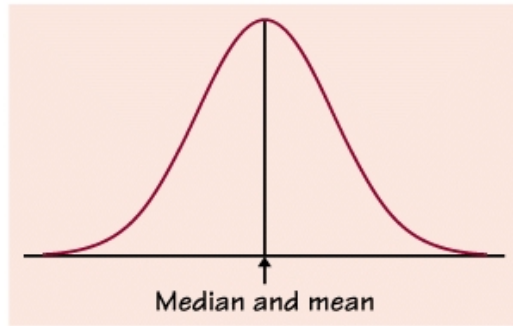


- Verify that the graph above is a valid density curve.
- What percent of the observations lie below 0.3
- What percent of the observations lie above 1.2?
- What percent of the observations lie between 0.6 and 1.6?
- What is the median of this density curve?
- What are  $Q_1$  and  $Q_3$  of this density curve?

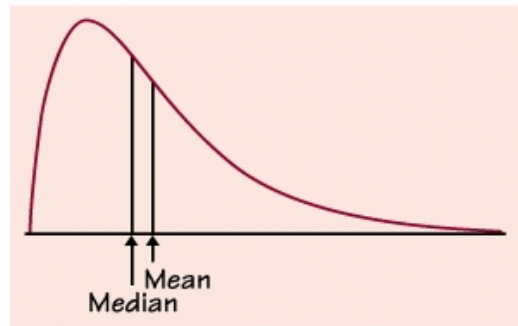
## AP Statistics – Ch 2 – The Normal Distributions

- Normal density curves are symmetric, single-peaked, and bell-shaped.
- The median of a density curve is the equal-areas point.
- The mean is the point at which the density curve would balance if made of solid material.
- The mean and median of a symmetric density curve are equal and lie at the center of the curve.
- The mean of a skewed density curve is pulled away from the median in the direction of the tail.

**Normal Density Curve**



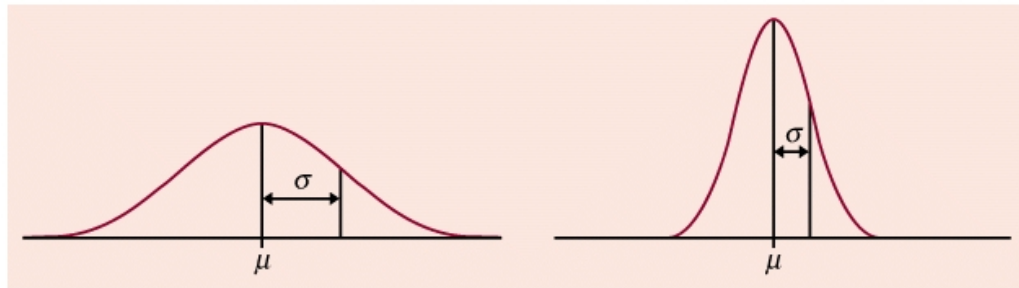
**Right-Skewed Density Curve**



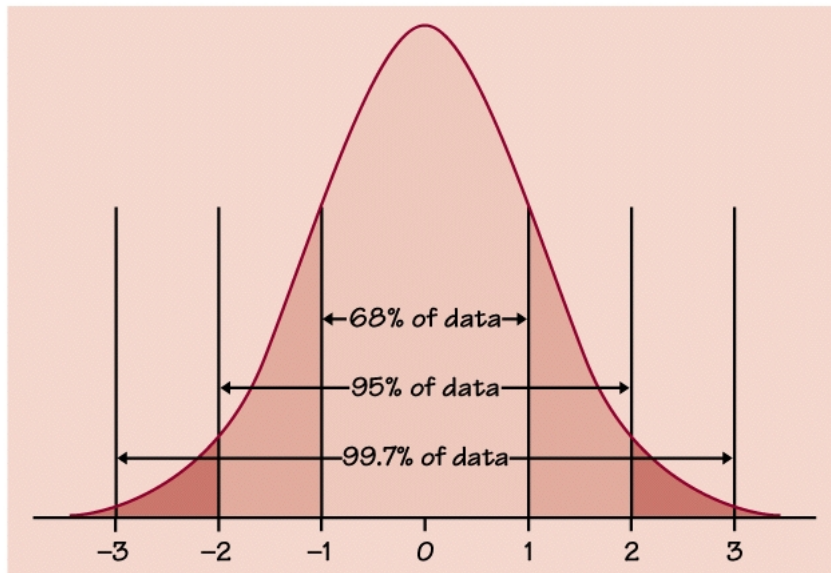
## AP Statistics – Ch 2 – The Normal Distributions

### Normal Distributions

- A special family of bell-shaped symmetric density curves, called *normal curves*, describes *normal distributions*.
- The mean  $\mu$  and standard deviation  $\sigma$  completely specify a normal distribution  $N(\mu, \sigma)$ .
- The mean is the center of the curve, the same place as the median, and the standard deviation controls the spread.
- *Inflection points* are where the curvature changes and are located at a distance  $\sigma$  on either side of the mean  $\mu$ .



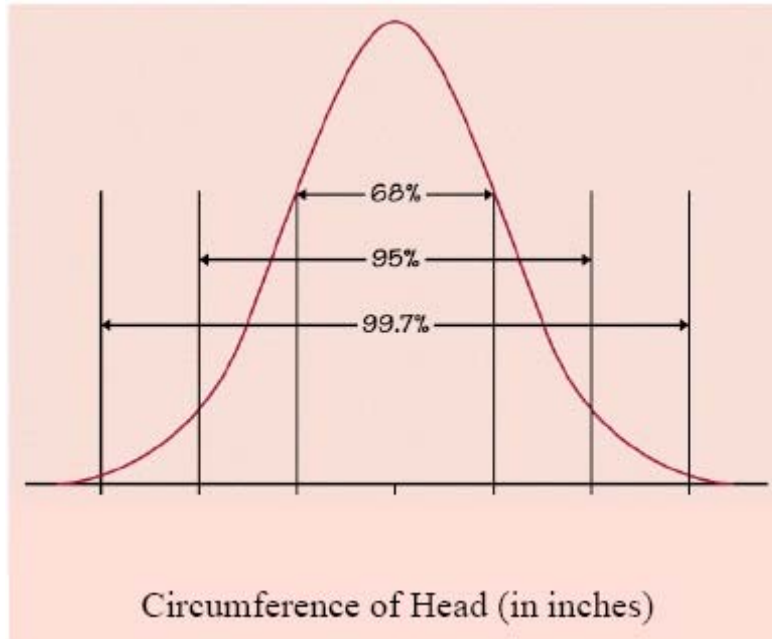
- All normal distributions with mean  $\mu$  and standard deviation  $\sigma$  obey the “empirical rule”:
  - 68% of the observations fall within  $\sigma$  of the mean  $\mu$ .
  - 95% of the observations fall within  $2\sigma$  of the mean  $\mu$ .
  - 99.7% of the observations fall within  $3\sigma$  of the mean  $\mu$ .



- An observation's percentile is the percent of the distribution that is at or to the left of the observation.

## AP Statistics – Ch 2 – The Normal Distributions

- Example – Helmet Size
  - The army reports that the distribution of head circumference among male soldiers is approximately normal with mean 22.8 inches and standard deviation 1.1 inches.
  - Label the x-axis of the normal curve below.



- What percent of soldiers have head circumference greater than 23.9 inches?
- A head circumference of 23.9 inches would be what percentile?
- What percent of soldiers have head circumference between 21.7 inches and 23.9 inches?