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# 8.5 Skewness and Kurtosis

## 8.5.1 Skewness

The normal distribution has a well-defined shape (p168), which is defined by

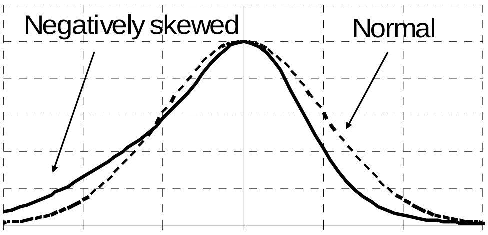
- **mean value, $\mu$**, describing the **'location'** along the abscissa, and
- **standard deviation, $\sigma$**, describing the **'width'** of the distribution.

The standard deviation is calculated by first finding the **squares** of the deviation of each data value from the mean value (p126).

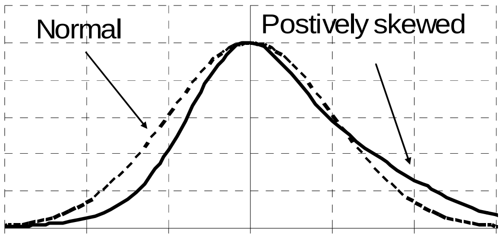
**Skewness** is a measure of the extent to which a given distribution has an **unsymmetrical** shape.
Skewness describes whether the given distribution has a shape that is either

- extended to the **right** (positive skewness), or
- extended to the **left** (negative skewness)

compared to the symmetrical bell-shaped normal distribution.




Negatively skewed
*skewness* ≈ -0.4




Positively skewed
*skewness* ≈ +0.4

The quantitative value for skewness is calculated by finding the **third power** of the deviation of each data value from the mean value.
Note that there is a **large uncertainty** in the best-estimate for the population *skewness* unless the sample size is very large.

## 8.5.2 Kurtosis

The normal distribution has a well-defined shape (p168), which is defined by

- **mean value, $\mu$**, describing the **'location'** along the abscissa, and
- **standard deviation, $\sigma$**, describing the **'width'** of the distribution.

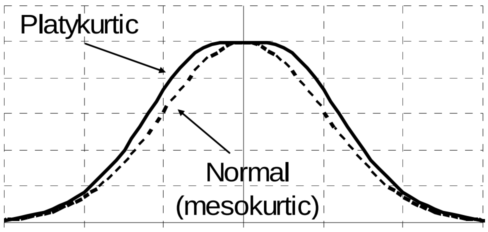
The standard deviation is calculated by first finding the **squares** of the deviation of each data value from the mean value (p126).

**Kurtosis** is a measure of the extent to which a given distribution differs from the **shape** of the normal distribution.

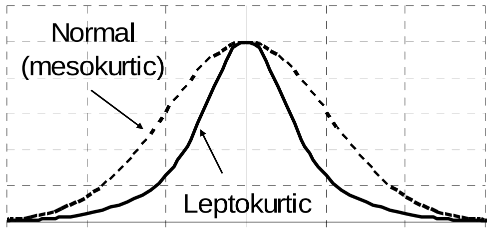
Kurtosis describes whether the given distribution has a central peak that is either

- flatter (platykurtic), or
- more pointed (leptokurtic)

than the standard bell-shaped normal distribution (mesokurtic).




Platykurtic
*kurtosis* ≈ -0.4




Leptokurtic
*kurtosis* ≈ +0.5

The quantitative value for kurtosis is calculated by finding the **fourth power** of the deviation of each data value from the mean value.

- A normal (mesokurtic) distribution will have a zero value for *kurtosis*.
- The flatter playkurtic distribution will have a negative value for *kurtosis*.
- The more pointed, leptokurtic distribution will have a positive value for *kurtosis*.

Note that there is a **large uncertainty** in the best-estimate for the population *kurtosis* unless the sample size is very large.