meta-calculator

# Top Statistics Formulas:

Here you will find the most common statistics equations and formulas used in high school and fundamental university courses. These include basic statistical measures and probability formulas. For more calculus based statistics formulas, please see [here.]

meta-calculator

# Top Statistics Formulas:

For more [statistics formulas]()

## Basic Equations

### Average or Mean

$$\bar{x} = \sum \frac{x_i}{N} = \frac{sum\ of\ observations}{\#\ of\ observations}$$

1, 2, 2, 4, 5

Mean = (1+2+2+4+5)/5 = 2.8

Where $x_i$ are all the individual data points, and

N is the number of points being averaged

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### Median

The middle value in the set of numbers that are arranged in ascending order. If there are an even number of values, the median is the average of the two middle values.

1, 2, $\boxed{2,}$ 4, 5

Median

1, 2, $\boxed{2,\ 4}$, 5, 6

Median = 3

If n is odd

$$\left(\frac{n+1}{2}\right)th\ term$$

If n is even

$$\left(\frac{n}{2}\right)th\ term\ + \left(\frac{n}{2} + 1\right)th\ term$$

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### Mode

The most frequently occurring value in the set of values

1, $\boxed{2}$, $\boxed{2}$, 4, 5, 6

Mode = 2

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### Percent Change

$$\%\ Change\ = \frac{New\ Value - Old\ Value}{Old\ Value} \times 100\%$$

40 → 65

% change = 25/65* 100% =38.46%

+ Means an increase

- Means a decrease

## Statistical Measures

### Standard Deviation

Standard Deviation is one measure of how spread the data is.

**Sample**

$$S = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

Where $\bar{x}$ is the sample mean and n is the number of observations

**Population**

$$\sigma = \sqrt{\frac{\sum (x_i - \bar{\mu})^2}{n}}$$

Where $\bar{\mu}$ is the population mean and n is the number of observations

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### Variance

Variance is one measure of how spread the data is. It is the standard deviation squared.

**Sample**

$$S^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$$

Where $\bar{x}$ is the sample mean and n is the number of observations

**Population**

$$\sigma^2 = \frac{\sum (x_i - \bar{\mu})^2}{n}$$

Where $\bar{\mu}$ is the population mean and n is the number of observations

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### Covariance

Covariance is a measure of two variables' joint variability, or how they will vary together.

**Sample**

$$Cov(x, y) = \frac{\sum \left(x_i - \bar{x}\right) * (y_i - \bar{y})}{n-1}$$

The measure of variance between variables x and y, where $\bar{x}$ is the sample mean of the x values, $\bar{y}$ is the mean of the y values, and n is the number of observations

**Population**

$$Cov(x, y) = \frac{\sum \left(x_i - \bar{x}\right) * (y_i - \bar{y})}{n}$$

## Chi Squared

Chi Squared tells you the difference between your observations and what you expected.

$$X^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

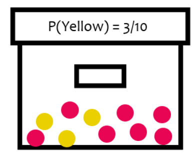
Where $O_i$ is the observed value and $E_i$ is the expected value

# Probability

## Probability of Event A

$$P(A) = \frac{f}{n}$$

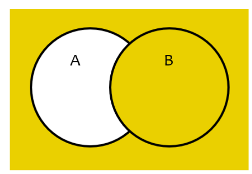
Where f is the frequency of the event and n is the sample size




## Probability of Complement of Event A

In other words, the probability of A not occurring.

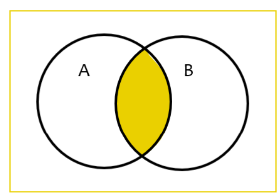
$$P(Not\ A) = 1 - P(A)$$




## Multiplication Rule Independent Events

In other words, the probability of A and B occurring independently.

$$P(A\ and\ B) = P(A) * P(B)$$




## General Multiplication Rules

To be used when one event A affects the probability of event B.

$$P(A\ and\ B) = P(A) * P(B\ given\ A)$$

$$P(A\ and\ B) = P(B) * P(A\ given\ B)$$

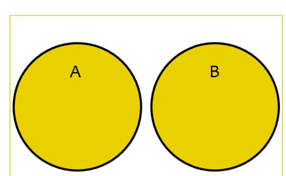
For example,

Drawing marbles out of the box without replacement will affect the probability of drawing a marble of a certain color.

## Addition Rule Mutually Exclusive Events

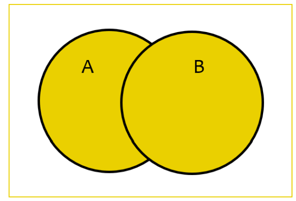
In other words, the probability of either A or B occurring.

$$P(A\ or\ B) = P(A) + P(B)$$



General Addition Rule

$$P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$$




Expected Value

Expected Value is the final predicted value of a variable, computed by multiplying each possible value by its probability and summing it.

**P(90) = 0.4**
**P(80) = 0.6**
**E[X] = 84**

$$E[X] = \sum x_i P(x_i)$$

Where $x_i$ are the values of x and $P(x_i)$ are the probabilities of each value

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