The t test (also called Student’s T Test) compares two [averages](https://www.statisticshowto.datasciencecentral.com/average/)([means](https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/statistics-definitions/mean-median-mode/#mean)) and tells you if they are different from each other. The t test also tells you how [significant](https://www.statisticshowto.datasciencecentral.com/what-is-statistical-significance/)the differences are; In other words it lets you know if those differences could have happened by chance.

**A very simple example:** Let’s say you have a cold and you try a naturopathic remedy. Your cold lasts a couple of days. The next time you have a cold, you buy an over-the-counter pharmaceutical and the cold lasts a week. You survey your friends and they all tell you that their colds were of a shorter duration (an [average](https://www.statisticshowto.datasciencecentral.com/average/)of 3 days) when they took the homeopathic remedy. What you *really* want to know is, are these results repeatable? A t test can tell you by comparing the means of the two groups and letting you know the probability of those results happening by chance.

**Another example:** Student’s T-tests can be used in real life to compare means. For example, a drug company may want to test a new cancer drug to find out if it improves life expectancy. In an experiment, there’s always a [control group](https://www.statisticshowto.datasciencecentral.com/control-group/) (a group who are given a placebo, or “sugar pill”). The control group may show an average life expectancy of +5 years, while the group taking the new drug might have a life expectancy of +6 years. It would seem that the drug might work. But it could be due to a fluke. To test this, researchers would use a Student’s t-test to find out if the results are repeatable for an entire population.

The T Score.

The [t score](https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/t-distribution/t-score-formula/) is a [ratio](https://www.statisticshowto.datasciencecentral.com/ratios-and-rates/)between the **difference between two groups and the difference within the groups**. The larger the t score, the more difference there is between groups. The smaller the t score, the more similarity there is between groups. A t score of 3 means that the groups are three times as different *from* each other as they are within each other. When you run a t test, the bigger the t-value, the more likely it is that the results are repeatable.

* A large t-score tells you that the groups are different.
* A small t-score tells you that the groups are similar.

### T-Values and P-values

How big is “big enough”? Every t-value has a [p-value](https://www.statisticshowto.datasciencecentral.com/p-value/) to go with it. A p-value is the [probability](https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/probability-main-index/) that the results from your sample data occurred by chance. P-values are from 0% to 100%. They are usually written as a decimal. For example, a p value of 5% is 0.05. **Low p-values are good**; They indicate your data did not occur by chance. For example, a p-value of .01 means there is only a 1% probability that the results from an experiment happened by chance. In most cases, a p-value of 0.05 (5%) is accepted to mean the data is valid.

The function t.test is available in R for performing t-tests. Let's test it out on a simple example, using data simulated from a normal distribution.

> x = rnorm(10)

> y = rnorm(10)

> t.test(x,y)

        Welch Two Sample t-test

data:  x and y

t = 1.4896, df = 15.481, p-value = 0.1564

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

 -0.3221869  1.8310421

sample estimates:

 mean of x  mean of y

 0.1944866 -0.5599410