Hypothesis Testing

* + 1. [What is a Hypothesis?](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/#Hypothesis)
    2. [What is Hypothesis Testing?](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/#WhatisHT)
    3. [Hypothesis Testing Examples (One Sample Z Test).](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/#HTExamples)
    4. [Hypothesis Test on a Mean (TI 83).](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/#HTMean)
    5. [Bayesian Hypothesis Testing.](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/#HTBayes)
    6. [More Hypothesis Testing Articles](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/#CVhypoarticles)

See this also

# [Hypothesis Tests in One Picture](https://www.datasciencecentral.com/profiles/blogs/hypothesis-tests-in-one-picture)

# [Critical Values](https://www.statisticshowto.com/probability-and-statistics/find-critical-values/)

# [What is the Null Hypothesis?](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/)

[critical values](https://www.statisticshowto.com/wp-content/uploads/2009/10/NULL-HYPOTHESIS-test-value-with-a-proportion.bmp)

**The main purpose of statistics is to test a hypothesis.** For example, you might run an experiment and find that a certain drug is effective at treating headaches. But if you can’t repeat that experiment, no one will take your results seriously. A good example of this was the [cold fusion](https://en.wikipedia.org/wiki/Cold_fusion) discovery, which petered into obscurity because no one was able to duplicate the results.

What is a Hypothesis?

[](https://www.statisticshowto.com/wp-content/uploads/2015/03/hypothesis.jpg)

*Andreas Cellarius hypothesis, showing the planetary motions.*

A hypothesis is an **educated guess** about something in the world around you. It should be testable, either by experiment or observation. For example:

* A new medicine you think might work.
* A way of teaching you think might be better.
* A possible location of new species.
* A fairer way to administer standardized tests.

It can really be *anything at all* as long as you can put it to the test.

**What is a Hypothesis Statement?**

If you are going to propose a hypothesis, it’s customary to write a statement. Your statement will look like this:  
**“If I…(do this to an**[**independent variable**](https://www.statisticshowto.com/independent-variable-definition/)**)….then (this will happen to the**[**dependent variable**](https://www.statisticshowto.com/dependent-variable-definition/)**).”  
For example**:

* If I (decrease the amount of water given to herbs) then (the herbs will increase in size).
* If I (give patients counseling in addition to medication) then (their overall depression scale will decrease).
* If I (give exams at noon instead of 7) then (student test scores will improve).
* If I (look in this certain location) then (I am more likely to find new species).

A good hypothesis statement should:

* Include an “if” and “then” statement [(according to the University of California).](http://www.csub.edu/~ddodenhoff/Bio100/Bio100sp04/formattingahypothesis.htm)
* Include both the independent and [dependent variables.](https://www.statisticshowto.com/dependent-variable-definition/)
* Be testable by experiment, survey or other scientifically sound technique.
* Be based on information in prior research (either yours or someone else’s).
* Have design criteria (for engineering or programming projects).

What is Hypothesis Testing?

[hypothesis testing](https://www.statisticshowto.com/wp-content/uploads/2009/10/NULL-HYPOTHESIS-test-value-with-a-proportion.bmp)  
Hypothesis testing in statistics is a way for you to test the results of a survey or experiment to see if you have meaningful results. You’re basically testing whether your results are valid by figuring out the odds that your results have happened by chance. If your results may have happened by chance, the experiment won’t be repeatable and so has little use.

Hypothesis testing can be one of the most confusing aspects for students, mostly because before you can even perform a test, you have to know what your [**null hypothesis**](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/#state) is. Often, those tricky word problems that you are faced with can be difficult to decipher. But it’s easier than you think; all you need to do is:

1. Figure out your null hypothesis,
2. [State your null hypothesis,](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/#state)
3. Choose what kind of test you need to perform,
4. Either support or [reject the null hypothesis](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/support-or-reject-null-hypothesis/).

What is the Null Hypothesis?

If you trace back the history of science, the null hypothesis is always the accepted fact. Simple examples of null hypotheses that are generally accepted as being true are:

1. DNA is shaped like a double helix.
2. There are 8 planets in the solar system (excluding Pluto).
3. Taking [Vioxx](https://usatoday30.usatoday.com/news/health/2004-10-12-vioxx-cover_x.htm) can increase your risk of heart problems (a drug now taken off the market).

How do I State the Null Hypothesis?

You won’t be required to actually perform a real experiment or survey in elementary statistics (or even disprove a fact like “Pluto is a planet”!), so you’ll be given word problems from real-life situations. You’ll need to figure out what your hypothesis is from the problem. This can be a little trickier than just figuring out what the accepted fact is. With word problems, you are looking to find a fact that is nullifiable (i.e. something you can reject).

Hypothesis Testing Examples #1: Basic Example

*A researcher thinks that if knee surgery patients go to physical therapy twice a week (instead of 3 times), their recovery period will be longer.*[*Average*](https://www.statisticshowto.com/arithmetic-mean/)*recovery times for knee surgery patients is 8.2 weeks.*

The hypothesis statement in this question is that the researcher believes the average recovery time is more than 8.2 weeks. It can be written in mathematical terms as:  
H1: μ > 8.2

Next, you’ll need to **state the null hypothesis** (See: [How to state the null hypothesis](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/#state)). That’s what will happen if the researcher is *wrong*. In the above example, if the researcher is wrong then the recovery time is less than or equal to 8.2 weeks. In math, that’s:  
H0 μ ≤ 8.2

Rejecting the null hypothesis

Ten or so years ago, we believed that there were 9 planets in the solar system. Pluto was demoted as a planet in 2006. The null hypothesis of “Pluto is a planet” was replaced by “Pluto is not a planet.” Of course, rejecting the null hypothesis isn’t always that easy—**the hard part is usually figuring out what your null hypothesis is in the first place.**

Hypothesis Testing Examples (One Sample Z Test)

The [one sample z test](https://www.statisticshowto.com/one-sample-z-test/) isn’t used very often (because we rarely know the actual population [standard deviation](https://www.statisticshowto.com/probability-and-statistics/standard-deviation/)). However, it’s a good idea to understand how it works as it’s one of the simplest tests you can perform in hypothesis testing. In English class you got to learn the basics (like grammar and spelling) before you could write a story; think of one sample z tests as the foundation for understanding more complex hypothesis testing. This page contains two hypothesis testing examples for [one sample z-tests](https://www.statisticshowto.com/one-sample-z-test/).