How to Run a One-Sample t-Test on Your TI-84 Calculator

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Mastering the One Sample t-test is fundamental for statistical inference, allowing researchers to determine if the mean of a single population differs significantly from a hypothesized value. While complex statistical software exists, the TI-84 calculator remains an indispensable tool for students and professionals requiring immediate, portable calculations. This comprehensive guide details the precise, step-by-step procedure required to execute a t-test using the calculator's built-in statistical functions. We will explore how to input raw data or summary statistics, set the appropriate hypotheses, and correctly interpret the resulting **t-statistic** and **p-value**.

The core objective of the One Sample t-test is to compare a **sample mean** (x) against a known or assumed population mean (mu_0). Before diving into the calculator steps, understanding the underlying principles—specifically the setup of the null hypothesis (H_0) and the alternative hypothesis (H_a)—is critical for accurate interpretation of the results and establishing statistical significance. If you have raw data, you would typically enter it into a list first; however, the TI-84 calculator also efficiently handles pre-calculated summary statistics, streamlining the process considerably. We prioritize a clean, effective workflow for calculating this crucial measure.

The One Sample t-test is used specifically to test whether the true mean of a population is statistically equal to, greater than, or less than a specific numerical value. This value is often derived from theoretical expectations or historical data.

This tutorial focuses on leveraging the powerful statistical computation capabilities available directly on your TI-84 calculator to conduct this test efficiently and accurately.

Defining the Purpose of the One Sample t-Test

The One Sample t-test is a parametric statistical test designed to assess whether the mean of a single group differs from a baseline or hypothesized value, mu_0. It is particularly useful when the sample size (n) is small, or when the population standard deviation is unknown, forcing us to rely on the sample standard deviation (s_x) for calculations.

Understanding the fundamental hypotheses is the first step in any statistical analysis. The **null hypothesis** (H_0) always posits that there is no difference—meaning the true population mean (mu) is equal to the hypothesized mean (mu_0). Conversely, the **alternative hypothesis** (H_a) suggests a difference exists. This difference can be non-directional ($mu neq mu_0$, a two-tailed test) or directional ($mu < mu_0$ or $mu > mu_0$, a one-tailed test). The choice of H_a dictates how the p-value is calculated and subsequently interpreted.

The flexibility of the TI-84 calculator allows users to bypass tedious manual calculations of the t-statistic and degrees of freedom, presenting the final decision metrics instantaneously. The key outputs—the t-value and the corresponding p-value—are the foundation for drawing conclusions about whether to reject or fail to reject the null hypothesis at a chosen significance level (α).

Case Study: Setting Up the Test Parameters

To illustrate the precise steps on the calculator, we will use a common scenario in quality control or market research. It is essential to accurately define the sample parameters before interacting with the calculator interface.

Researchers want to know if a certain type of car gets 20 miles per gallon (mpg) or not. They obtain a random sample of 74 cars and find that the mean mileage is 21.29 mpg while the standard deviation is 5.78 mpg. Use this data to perform a One Sample t-test to determine if the true mpg for this type of car is equal to 20 mpg.

In this example, the hypothesized population mean (μ_0) is 20 mpg. Since the researchers are simply asking if the mileage "is or is not" 20 mpg, this indicates a two-tailed test. We have been provided with the **summary statistics** rather than raw data, which simplifies the input process on the calculator. The formal hypotheses are set as follows:

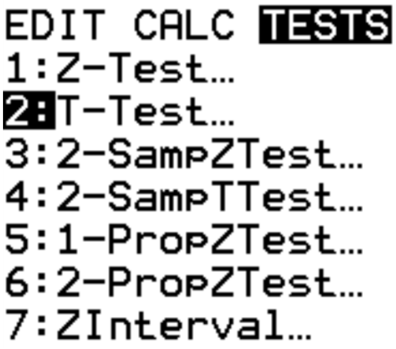
Null Hypothesis (H_0): $\mu = 20$ (The true mean mileage is 20 mpg).
Alternative Hypothesis (H_a): $\mu \neq 20$ (The true mean mileage is not 20 mpg).

The critical values we will input into the TI-84 are $\mu_0=20$, the sample mean ($\bar{x}=21.29$), the sample standard deviation ($s_x=5.78$), and the sample size ($n=74$). Having these values organized ensures a smooth execution of the subsequent calculator steps, preventing input errors that could invalidate the results.

Step 1: Accessing the t-Test Function

The first operational step is locating the specific statistical test within the menu system of the TI-84 calculator. All inference procedures are grouped under the dedicated TESTS submenu.

Press the Stat key to access the main statistics menu. Scroll horizontally using the arrow keys until you highlight the **TESTS** option at the top. Scroll down through the list of available tests until you find **T-Test** (it is usually option 2). Press ENTER to select the appropriate procedure for a one sample t-test.



The screen should now prompt you to configure the test. It is crucial to note that the TI-84 differentiates between Z-Tests and T-Tests. Since the population standard deviation ($sigma$) is unknown (we are using s_x), the T-Test is the statistically correct choice. Selecting the wrong test at this stage will lead to incorrect degrees of freedom and an inaccurate p-value.

Step 2: Inputting Data or Statistics

The calculator will initially ask you to define how the input information is provided: either as raw data stored in a list or as pre-calculated summary statistics.

The calculator will ask for the following information:

Inpt: Choose whether you are working with raw data (Data) or summary statistics (Stats). In this case, since we were given bar{x}, s_x, and n, we will highlight **Stats** and press ENTER. (If using raw data, you would select Data and specify the List where the data is stored.)
mu_0: The hypothesized population mean to be used in the null hypothesis (H_0). We will type **20** and press ENTER.
x: The sample mean (bar{x}). We will type **21.29** and press ENTER.
s_x: The sample standard deviation. We will type **5.78** and press ENTER.
n: The sample size. We will type **74** and press ENTER.
mu: The alternative hypothesis (H_a) setting. This is critical for determining whether the test is one-tailed or two-tailed.

Ensure that every numerical entry is double-checked for accuracy before proceeding. Errors in input, particularly concerning the sample size (n) or the standard deviation (s_x), are common pitfalls that lead to incorrect test outcomes. Once the statistical values are correctly entered, the focus shifts to defining the nature of the inequality in the alternative hypothesis.

Step 3: Defining the Alternative Hypothesis

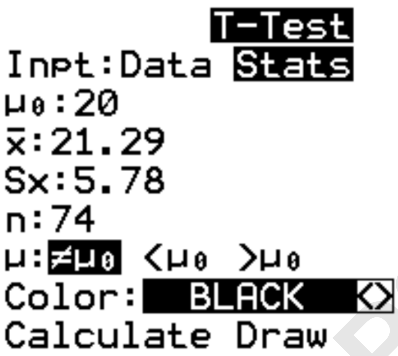
The final crucial configuration step before calculation is selecting the correct form of the alternative hypothesis (H_a). This selection dictates whether the rejection region lies in both tails, the left tail, or the right tail of the t-distribution.

For the alternative hypothesis (mu), you are presented with three options:

$neq mu_0$: Used for a **two-tailed test**, where we are testing simply if the mean is different (either greater or smaller) than mu_0.
$< mu_0$: Used for a **left-tailed test**, where we hypothesize the mean is less than mu_0.
$> mu_0$: Used for a **right-tailed test**, where we hypothesize the mean is greater than mu_0.

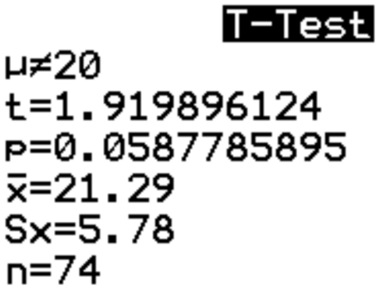
Since our case study requires us to determine if the true mpg is equal to 20 mpg (implying we are checking for any difference), we are performing a two-tailed test. Therefore, we will highlight **$neq mu_0$** and press ENTER. This indicates that our alternative hypothesis is $mu neq 20$.

After setting the alternative hypothesis, scroll down to highlight **Calculate**. Press ENTER. The TI-84 calculator will then quickly process the inputs and display the results screen, providing all the necessary metrics for statistical decision-making.



Step 4: Interpreting the Output Results

Once the calculation is complete, our calculator will automatically produce the key results of the One Sample t-test on a dedicated output screen. Understanding each element of this output is essential for deriving correct statistical conclusions.



Here is a detailed breakdown of how to interpret the results displayed by the TI-84:

$mu neq 20$: This is a confirmation of the selected alternative hypothesis (H_a) for the test.
$t=1.919896124$: This is the calculated **t-statistic**. This value represents how many standard errors the sample mean ($bar{x}$) is away from the hypothesized population mean (mu_0). A larger absolute t-value suggests a greater difference.
$p=0.0587785895$: This is the **p-value** that corresponds to the test-statistic. It is the probability of observing a sample mean as extreme as 21.29 (or more extreme) if the null hypothesis ($H_0: mu=20$) were actually true.
$df=73$: This is the degrees of freedom ($n-1$). With a sample size of $n=74$, the degrees of freedom are $74-1=73$. This value is crucial for determining the critical t-value if using the traditional critical value method.
x=21.29: This confirms the sample mean that was entered.
$s_x=5.78$: This confirms the sample standard deviation that was entered.
$n=74$: This confirms the sample size used in the calculation.

Step 5: Assessing Statistical Significance

The final step involves comparing the calculated p-value to the predetermined level of statistical significance ($alpha$), typically set at 0.05. The comparison dictates whether we reject the null hypothesis (H_0) or fail to reject it.

In our example, the calculated p-value is $p approx 0.0588$. If we adopt the conventional $alpha=0.05$ significance level, we compare these two values: p (0.0588) vs. $alpha$ (0.05). Since $p > alpha$, we **fail to reject the null hypothesis**. This means that, based on our sample data, there is insufficient evidence to conclude that the true average mileage for this type of car is statistically different from 20 mpg.

If the p-value had been smaller than $alpha$ (e.g., $p=0.04$), we would reject H_0, concluding that the difference between the sample mean (21.29 mpg) and the hypothesized population mean (20 mpg) is statistically significant. The TI-84 calculator automates the calculation of the t-statistic and the p-value, enabling quick and reliable statistical decisions in various applied settings.