How to Perform a One Sample T-Test on a TI-84 Calculator: A Step-by-Step Guide

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A **one sample t-test** is an indispensable tool in inferential statistics, engineered to assess whether the **mean** of a population, inferred from a collected sample, is statistically different from a specific, predetermined hypothesized value. This statistical procedure gains particular importance when researchers are working with smaller sample sizes and the true population **standard deviation** remains unknown--a common scenario in practical research and data analysis.

This comprehensive guide offers a precise, step-by-step methodology for executing a one sample t-test with high efficiency and accuracy using the specialized statistical functions embedded within the **TI-84 calculator**. By leveraging the calculator's built-in testing environment, students and professionals can rapidly compute the necessary test statistics and **p-values** required for robust hypothesis testing and data-driven decision-making.

The Core Statistical Principles of Hypothesis Testing

The theoretical foundation of the t-test lies in the framework of **hypothesis testing**. Every t-test begins by formally defining two opposing statements. First, the **null hypothesis** (H_0), which posits that the population mean (mu) is exactly equal to the hypothesized value (mu_0). Second, the alternative hypothesis (H_a), which asserts that the population mean is either not equal to, less than, or greater than mu_0. The t-test then provides a standardized way to quantify the magnitude of the observed difference between the sample mean and the hypothesized population mean, relative to the variability measured within the sample.

For the results of a one sample t-test to be statistically valid, several fundamental assumptions must be met. The data must originate from a simple random sample, and, ideally, the underlying population distribution should be approximately normal. However, a significant advantage comes from the **Central Limit Theorem**: when the sample size (n) is sufficiently large (typically $n geq 30$), the sampling distribution of the mean approaches normality regardless of the population's shape. This allows us to use the t-distribution reliably even if the population normality assumption is slightly violated, as is often the case in real-world applications like the one explored in our example.

A deep understanding of these principles ensures that the mechanical operations performed on the **TI-84 calculator** are complemented by sound theoretical knowledge. This synergy is essential for accurately interpreting the final output and formulating reliable conclusions based on the calculated **test statistic** and corresponding **p-value**.

Practical Application: A Vehicle Fuel Efficiency Case Study

To demonstrate the practical application of the one sample t-test, we will use a common scenario involving quality control and research. Imagine automotive engineers are conducting a study to determine if a specific car model achieves an average fuel efficiency that is truly 20 miles per gallon (mpg). This target value, $mu_0 = 20$, serves as the centerpiece of our **null hypothesis**. Given the objective is simply to check for any deviation from 20 mpg, we must execute a two-tailed test.

For the study, the researchers collected data from a random selection of 74 vehicles ($n=74$). The subsequent analysis of this sample provided the following key summary statistics: the sample mean ($bar{x}$) was calculated to be 21.29 mpg, and the sample **standard deviation** (s_x) was 5.78 mpg. Since we have these pre-calculated metrics, we can utilize the "Stats" input method on the TI-84, saving us the effort of manually entering all 74 individual data points.

Based on the study parameters, our formal hypotheses are explicitly defined as follows:

Null Hypothesis (H_0): $mu = 20$ (The true average fuel efficiency is equal to 20 mpg).
Alternative Hypothesis (H_a): $mu neq 20$ (The true average fuel efficiency is not equal to 20 mpg).

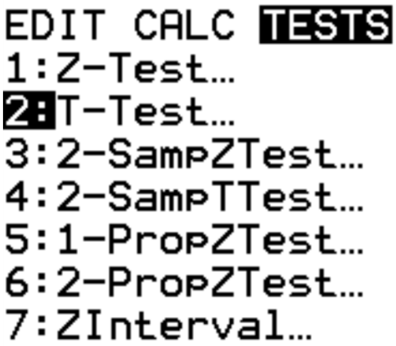
Our subsequent goal is to efficiently use the **TI-84 calculator** to compute the specific **t test-statistic** and the associated **p-value**. These two metrics are paramount for assessing the plausibility of the null hypothesis given the evidence collected from our sample.

Executing the Test: Step-by-Step TI-84 Navigation

The process of performing a hypothesis test on the TI-84 begins with navigating to the core statistical test menu. It is essential to choose the T-Test option specifically, as this test is correctly calibrated for situations where the population standard deviation is unknown--distinguishing it from the Z-Test, which requires this population parameter.

To access the required function, press the Stat button, typically located on the third row of the keypad. Once the STAT menu loads, use the arrow keys to scroll horizontally to the **TESTS** submenu. Within the list that appears, locate and highlight option **2: T-Test...**. Confirm your selection by pressing the ENTER key.

Upon selection, the calculator will display the T-Test input screen. This screen serves as the interface where you define the parameters of your test, starting with the critical choice of whether you will provide raw data from a list (Data) or summary statistics (Stats). Careful execution of this initial step ensures that the calculator prompts you for the correct subsequent information.



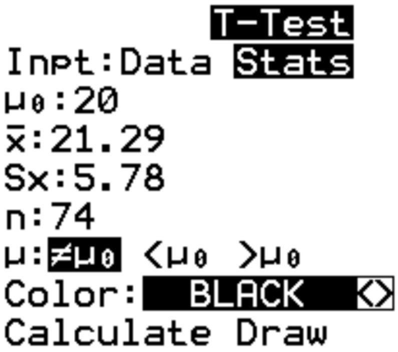
Inputting Data and Defining Hypotheses (Step 2 Detailed)

The second stage requires meticulous entry of the summary statistics derived from our fuel efficiency study into the T-Test input screen. Precision is critical here, as even minor transcription errors will directly skew the final results. Since we are using the pre-calculated mean and standard deviation, rather than a raw dataset, we must first designate the input method.

Use the arrow keys to highlight **Stats** under the Input (Inpt) prompt and press ENTER. This action configures the calculator to accept the summary values. Proceed sequentially through the fields, using ENTER to move to the next field after inputting each value:

Inpt: Ensure **Stats** is highlighted.
µ**0:** Enter the hypothesized population mean: **20**.
&bar;x: Enter the observed sample mean: **21.29**.
sx: Enter the sample standard deviation: **5.78**.
n: Enter the total sample size: **74**.
µ: This field defines the alternative hypothesis (H_a). Since we are performing a two-tailed test--checking if the mean is simply "not equal" to 20--select and highlight ≠µ**0**. (Recall that <µ0 is used for a left-tailed test and >µ0 for a right-tailed test.)

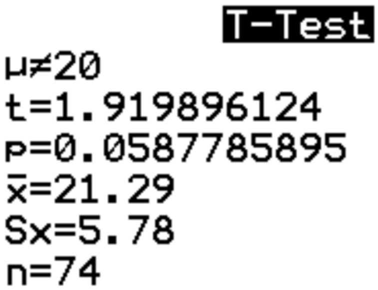
Once all the parameters are accurately entered, scroll down to highlight the **Calculate** option and press ENTER. The **TI-84 calculator** will instantly perform the necessary computations, including calculating the degrees of freedom ($df = n-1 = 73$) and deriving the final **t test-statistic** and corresponding **p-value**.



Interpreting the Output: Key Metrics (The t-Statistic and P-Value)

After the calculations are complete, the TI-84 presents a concise output screen containing all the essential statistical metrics needed to evaluate the **null hypothesis**. Understanding the meaning of each displayed value is crucial for accurate interpretation.

The output screen provides the following critical information:



µ≠**20**: This confirms the alternative hypothesis (H_a) selected for the test.
t=1.919896124: This is the calculated **t test-statistic**. This standardized value measures the distance between the observed sample mean (21.29) and the hypothesized population mean (20) in units of standard error. A large absolute value indicates a significant discrepancy.
p=0.0587785895: This is the calculated **p-value**. The **p-value** represents the probability of obtaining a sample mean as extreme as, or more extreme than, 21.29 mpg, assuming the null hypothesis (that $mu=20$) is actually true.
df=73: The degrees of freedom, calculated as $n-1$, which helps define the shape of the t-distribution used for the calculation.
&bar;x=21.29. Confirmation of the sample mean entered.
sx=5.78. Confirmation of the sample standard deviation entered.
n=74: Confirmation of the sample size.

Decision Making: Concluding the Hypothesis Test

The final and most determinative step in any **hypothesis testing** procedure is comparing the calculated p-value against the predefined significance level, denoted as $alpha$ (alpha). Conventionally, $alpha$ is set at 0.05 (or 5%), meaning we are willing to accept a 5% risk of incorrectly rejecting a true null hypothesis. The standard decision rule is simple and absolute: if $Ptext{-value} leq alpha$, we reject H_0; if $Ptext{-value} > alpha$, we fail to reject H_0.

For our fuel efficiency case study, we must compare the outputted **p-value** (0.058778) to the standard significance level ($alpha=0.05$).

The comparison yields the following result:
P-value = 0.058778 > $alpha$ = 0.05

Since the p-value exceeds the significance level, we must **fail to reject the null hypothesis** (H_0). This statistical outcome implies that the collected data does not provide sufficient evidence, at the 5% level of significance, to confidently assert that the true average fuel efficiency of the car model is different from the target of 20 mpg.

In practical terms, while the observed sample mean of 21.29 mpg is slightly higher than 20 mpg, this difference is statistically insignificant when considering the variability inherent in the sample data. The discrepancy observed can reasonably be attributed to expected random sampling variation rather than a true change in the population mean. Therefore, based on the results generated by the **TI-84 calculator**, the automotive researchers cannot definitively claim that the vehicle's average fuel efficiency differs from 20 mpg.