Hypothesis Test for Mean Using Given Data
(Standard Deviation Known-z-test)

A hypothesis test is conducted when trying to find out if a claim is true or not. And if the claim is true, is it significant. The calculator makes hypothesis testing easier by performing the computations.

After inputting the data that you have for a problem, the calculator will give you a p-value. The relationship between the p-value and the given level of significance for the problem will determine your decision. If $p < \alpha$, then you will reject the null hypothesis. If $p > \alpha$, then you will fail to reject the null hypothesis.

Hypothesis testing for the mean will fall into one of two categories. In addition to the many values needed for input into the calculator, you need to determine if you know the population standard deviation or not. If you do, you will perform a z-test. If you do not, you will perform at t-test (see next lesson).

Regardless of whether you use z or t, you will need to have the following information for the hypothesis test:
the null hypothesis
the alternative hypothesis (this will tell you if you are using a one-sided or two-sided test)
the mean of the sample data
the standard deviation of the population (z test) or the sample (t test)
the number in your sample (n)

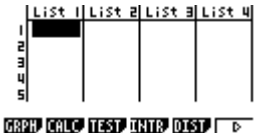
Problem:
A recent report indicated that waiters and waitresses at casual dining restaurants make an average of $100 per night in tips with a standard deviation of $15. Maureen works in a casual dining restaurant and doesn't think this is correct. She feels she makes much less than this in an average night. Over the next five work nights, she computes her tips and the average is $93. Does Maureen make significantly less than what the report stated at the .05 level of significance?

Solution:
Ho: $\mu=\mu o$ Ha: $\mu<\mu o$ (since Maureen thinks she makes less)
$\mu o = 100$ $\bar{x} = 93$ standard deviation = 15 n = 5

Inputting this information into the calculator gives p = .14835. Since this value is greater than the stated level of significance, we fail to reject the null hypothesis. In other words, there is not sufficient evidence to support Maureen's claim.

Keystrokes for the *fx*-9750G Plus

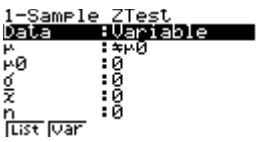
From the main menu, go to STAT and press EXE. You will see lists that may or may not have data in them. For this problem, we will not be using lists. You will also see choices along the bottom of the screen. We are performing a hypothesis test so choose "TEST" which is F3.



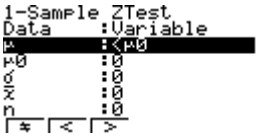
Since we are given the population standard deviation, we are using a z-test. Press F1.

We are only looking at one sample so choose "1-S" which is F1.

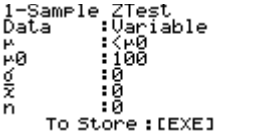
You have to indicate whether you are using data that is input into a list (not the case here) or that is already given, which is the case in this example. Press F2.



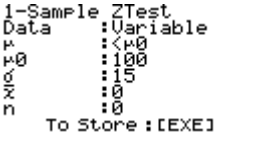
Input the type of test. In this problem, we are using <, so press F2.



Now input the hypothesized mean (the value in Ho) which is 100.



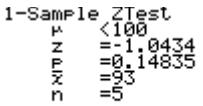
Enter the population standard deviation of 15.



Enter the mean amount from the sample taken (93).

Enter the sample size of 5.

Press F1 to have the calculator do the computations.



Hypothesis Test for Mean Using Given Data
(Standard Deviation Unknown-t-test)

A hypothesis test is conducted when trying to find out if a claim is true or not. And if the claim is true, is it significant. The calculator makes hypothesis testing easier by performing the computations.

After inputting the data that you have for a problem, the calculator will give you a p-value. The relationship between the p-value and the given level of significance for the problem will determine your decision. If $p < \alpha$, then you will reject the null hypothesis. If $p > \alpha$, then you will fail to reject the null hypothesis.

Hypothesis testing for the mean will fall into one of two categories. In addition to the many values needed for input into the calculator, you need to determine if you know the population standard deviation or not. If you do, you will perform a z-test (see previous lesson). If you do not, you will perform at t-test.

Regardless of whether you use z or t, you will need to have the following information for the hypothesis test:
the null hypothesis
the alternative hypothesis (this will tell you if you are using a one-sided or two-sided test)
the mean of the sample data
the standard deviation of the population (z test) or the sample (t test)
the number in your sample (n)

Problem:
The national average SAT score is 1000. One high school feel that their students are performing above the national average. The high school counselor chose 20 students at random and found their average SAT score was 1120 and the standard deviation of the sample was 20. Is there evidence to support the high school's hypothesis that their scores are above the national average at a significance level of .05?

Solution:
Ho: $\mu=\mu o$ Ha: $\mu>\mu o$ (since the school thinks they are above the average)
$\mu o = 1000$ $\bar{x} = 1120$ sample standard deviation = 20 n = 20

Inputting this information into the calculator gives $p = 1 \times 10^{-15}$ which is incredibly close to 0 Since this value is less than the stated level of significance, we reject the null hypothesis. In other words, there is sufficient evidence to support the school's claim that their students perform better on the SAT.

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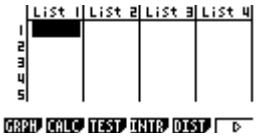
Keystrokes for the *fx*-9750G Plus

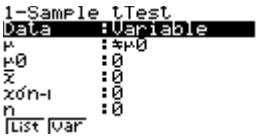
From the main menu, go to STAT and press EXE. You will see lists that may or may not have data in them. For this problem, we will not be using lists. You will also see choices along the bottom of the screen. We are performing a hypothesis test so choose "TEST" which is F3.



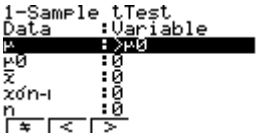
Since we do not know the population standard deviation, we are using a t-test. Press F2.

We are only looking at one sample so choose "1-S" which is F1.

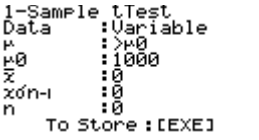
You have to indicate whether you are using data that is input into a list (not the case here) or that is already given, which is the case in this example. Press F2.



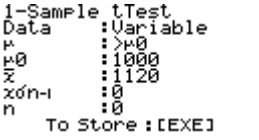
Input the type of test. In this problem, we are using >, so press F3.



Now input the hypothesized mean (the value in Ho) which is 1000.

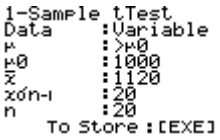


Enter the sample mean which is 1120.

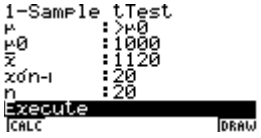


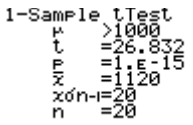
Enter the sample standard deviation which is 20.

Enter the sample size of 20.



Press F1 to have the calculator do the computations.





Hypothesis Test for Mean Using A Set Of Data
(Standard Deviation Unknown-t-test)

A hypothesis test is conducted when trying to find out if a claim is true or not. And if the claim is true, is it significant. The calculator makes hypothesis testing easier by performing the computations.

After inputting the data that you have for a problem, the calculator will give you a p-value. The relationship between the p-value and the given level of significance for the problem will determine your decision. If $p < \alpha$, then you will reject the null hypothesis. If $p > \alpha$, then you will fail to reject the null hypothesis.

When doing a hypothesis test using a set of data, you will need to input that data into a list in the calculator. In most cases, you will not know the population standard deviation, which means you will need to use a t-test. In the rare instance that you do know the population standard deviation, you can use a similar procedure to the one outlined here to conduct a one-sample z-test.

In addition to putting this data into a list, you will need to also
the null hypothesis
the alternative hypothesis (this will tell you if you are using a one-sided or two-sided test)

Problem:
Cans of paint usually advertise how much area one gallon of paint will cover. Super Paint claims that one gallon of its paint will cover 400 square feet. To test this hypothesis, 10 gallons of paint were tested and the actual area covered by each can is shown below. Do the data indicate that the average coverage differs from the company's claim of 400 square feet at the .05 level of significance?

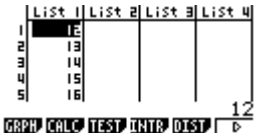
310 315 415 365 445 375 300 410 365 350

Solution:
Ho: $\mu=\mu o$ Ha: $\mu\neq\mu o$ (since the problem only wants to know if there is a difference)
$\mu o = 400$
Inputting this information into the calculator gives p = .047674 Since this value is less than the stated level of significance, we reject the null hypothesis. In other

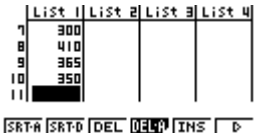
words, there is sufficient evidence to say that the average coverage is not 400 square feet. Note that if the problem had given a significance level of .01, we would fail to reject the null hypothesis and reach a different conclusion. Always be careful of the significance level in the problem.

Keystrokes for the *fx*-9750G Plus

From the main menu, go to STAT and press EXE. You will see lists that may or may not have data in them. For this problem, we will be using lists. If there is data in List 1, clear it by pressing F6 (for more options), followed by F4 (to delete all) and then F1.

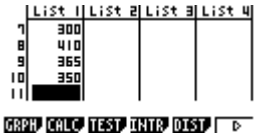


Now input your data into List 1 by entering the values from the data set followed by EXE until all 10 points have been entered.

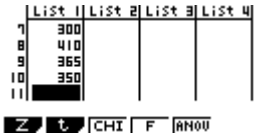


Press F6 (for more options).

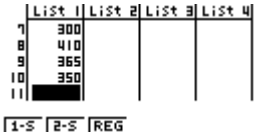
Since we are performing a hypothesis test choose "TEST" which is F3.



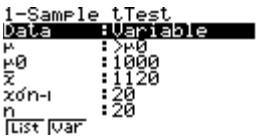
We are performing at t-test so press F2.



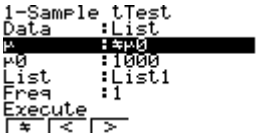
We are only looking at one sample so choose "1-S" which is F1.



You have to indicate whether you are using data that is input into a list (which we are) so press F1.



Input the type of test. In this problem, we are using $\neq$, so press F1.



Now input the hypothesized mean (the value in Ho) which is 400.

Indicate the list where you have put the data.

Indicate the frequency of the data, which in this case is 1.

Press F1 to have the calculator do the computations.