



hp calculators

HP 49G+ Hypothesis tests

The STAT menu

Hypothesis tests

Practice evaluating hypothesis tests



The STAT menu

The Statistics menu is accessed from the RED shifted function of the $\boxed{5}$ key by pressing $\boxed{\rightarrow}$ \boxed{STAT} . When pressed, a CHOOSE box is displayed with a number of problem areas within statistics where the HP 49G+ can be applied.



Figure 1

The first choice deals with calculating many values related to the statistics of a single variable, such as the average, standard deviation and others. The second choice deals with placing data within bins or classes and is useful when dealing with frequency distributions or when there is a need to summarize data within a histogram. The third choice, Fit Data.. is used to compute trend lines. The fourth choice allows for the computation of summary statistics from a data set, such as the sum of all X values, the sum of all the Y values squared, and others. The fifth choice allows for the evaluation of many different hypothesis tests and the sixth choice allows for the construction of confidence intervals around a sample mean.

To evaluate a hypothesis test, press $\boxed{5}$ \boxed{ENTER} to immediately choose the Hypoth. tests function.

Hypothesis tests

The next screen displays the choices for the different types of hypothesis tests the HP 49G+ can evaluate. A hypothesis test makes a statement about a population statistic, usually the mean, and acceptance of the hypothesis is determined by taking a sample from the population.



Figure 2

The first choice is for a hypothesis test for the population mean with either a known population variance or for a large sample (usually more than 30) with an unknown population variance.

The second choice is for a hypothesis test for the difference between two population means with either a known population variance or for a large sample (usually over 30) if the population variance is unknown.

The third and fourth choices are similar to the first two choices, except that they are applied to proportions.

The first four choices use the normal probability distribution and calculate a critical Z value.

The fifth and sixth choices are similar to the first two choices, except they deal specifically with situations where small sample sizes are present and the population variances and standard deviations are unknown. These use the Student's t probability distribution.

When chosen, each hypothesis test displays an input form where the necessary information to evaluate the hypothesis test is entered, including the proposed population statistic value, sample averages, population or sample standard deviations, size of the sample(s), and the level of significance desired for the evaluation of the hypothesis test.

Practice evaluating hypothesis tests

Example 1: Marvin is a candidate running for a local office. He believes he will win 50.01% of the vote in the election to be held

in two days. A sample of 300 voters were asked who they would vote for in this election and 140 indicated they planned to vote for Marvin, or 46.67%. Should Marvin give up hope that he will win the election? Test the null hypothesis that he will receive more than 50.01% of the vote against the alternative hypothesis that he receives less than 50.01% of the vote at the 5% significance level.

Solution: Since the sample size is over 30 and since we are evaluating a hypothesis test about the population proportion mean, we can use the third hypothesis test even though the population variance and population standard deviation are not known.

\rightarrow STAT 5 ENTER 3 ENTER . 5 0 0 / ENTER 1 4 0 ENTER 3 0 0 ENTER

```
RAD XYZ HEX R= 'X'
<HOME>
Z-TEST: 1 P
n0: 0.5001
x: 140.0000
n: 300.0000
α: 0.0500
Significance Level
EDIT HELP CANCEL OK
```

Figure 3

OK (this is to test whether the average is greater than or equal to the null value of 50.01%, so the alternative hypothesis is that the population proportion mean is less than 50.01%).

```
RAD XYZ HEX R= 'X'
<HOME>
Z-TEST: 1 P
n0:
x:
n:
α:
Alternative Hypothesis
n<0.5001
n>0.5001
n≠0.5001
Null hyp. population proportion
CANCEL OK
```

Figure 4

OK

```
RAD XYZ HEX R= 'X'
<HOME>
Accept n=0.5001 at 5.0000% LVL
Test P=0.4667
Test Z=-1.1582
Prob=0.1234
Critical Z=-1.6449
```

HELP GRAPH CANCEL OK

Figure 5

GRAPH

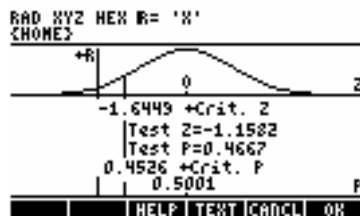


Figure 6

OK

```

RAD XYZ HEX R= 'X'
<HOME>
7:
6:
5:      Prop:0.4667
4:      Test Z:(-1.1582)
3:      Prob:0.1234
2:      Crit Z:(-1.6449)
1:      Crit X:135.7852
EDIT VIEW RCL STOP PURGE CLEAR

```

Figure 7

Answer: The critical Z value indicates the boundaries below which we would not be able to accept the null hypothesis if the calculated or test Z value were below that critical value. The critical Z value for this hypothesis test is -1.64. The test Z or calculated Z value is -1.1582, which falls above the critical Z value boundaries. We therefore would fail to reject the null hypothesis. At this significance level, Marvin still has a chance to win – the poll is not far enough way from a winning percentage as to cause him to lose hope.

Example 2: Marvin is a candidate running for a local office. He believes he will win 50.01% of the vote in the election to be held in two days. He takes a second sample of 1000 voters were asked who they would vote for in this election and 475 indicated they planned to vote for Marvin, or 47.5%. Should Marvin give up hope that he will win the election? Test the null hypothesis that he will receive more than 50.01% of the vote against the alternative hypothesis that he receives less than 50.01% of the vote at the 2% significance level.

Solution: Since the sample size is over 30 and since we are evaluating a hypothesis test about the population proportion mean, we can use the third hypothesis test even though the population variance and population standard deviation are not known.

```

RAD XYZ HEX R= 'X'
<HOME>
Z-TEST: 1 P
n0: 0.5001
x: 475.0000
n: 1,000.0000
α: 0.0200
Null hyp. population proportion
EDIT HELP CANCEL OK

```

Figure 8

(this is to test whether the average is greater than or equal to the null value of 50.01%, so the alternative hypothesis is that the population proportion mean is less than 50.01%).

```

RAD XYZ HEX R= 'X'
<HOME>
Z-TEST: 1 P
n0: 0.5001
Alternative Hypothesis
x: n<0.5001
n: n>0.5001
α: n≠0.5001
Null hyp. population proportion
CANCEL OK

```

Figure 9

```

RAD XYZ HEX R= 'X'
[HOME]
Accept n=0.5001 at 2.0000% LVL
Test P=0.4750
Test Z=-1.5875
Prob=0.0562
Critical Z=-2.0537

[HELP] [GRAPH] [CANCL] [OK]

```

Figure 10

[OK]

```

RAD XYZ HEX R= 'X'
[HOME]
7:
6:
5: Prop:0.4750
4: Test Z: (-1.5875)
3: Prob:0.0562
2: Crit Z: (-2.0537)
1: Crit X: 467.6274
[EDIT] [VIEW] [RCL] [STOP] [PURGE] [CLEAR]

```

Figure 11

Answer: The critical Z value indicates the boundaries below which we would not be able to accept the null hypothesis if the calculated or test Z value were below that critical value. The critical Z value for this hypothesis test is -2.05 . The test Z or calculated Z value is -1.58 , which falls above the critical Z value boundaries. We therefore would fail to reject the null hypothesis. At this significance level, Marvin still has a chance to win – the poll is not far enough way from a winning percentage as to cause him to lose hope. The Prob: 0.0562 indicates that the null hypothesis would have been rejected at a 6% significance level. Marvin still has a chance, but it appears to be a small chance.

Example 3: Twenty ounce boxes of cereal are to have twenty ounces of cereal in them. John is a quality assurance engineer for a manufacturer and has taken a sample of 65 boxes of this cereal and weighed the contents of each. The average weight of cereal in the boxes was 19.95 ounces. The standard deviation of this sample was 0.2 ounces. At a 5% significance level, test the hypothesis that the weight of the contents of all boxes is greater than 20 ounces. Does John have a reason to be concerned?

Solution: Since the sample size is over 30 and since we are evaluating a hypothesis test about the population mean, we can use the first hypothesis test even though the population variance and population standard deviation are not known.

[→] [STAT] [5] [ENTER] [1] [ENTER] [2] [0] [ENTER] [0] [.] [2] [ENTER] [1] [9] [.] [9] [5] [ENTER]
 [6] [5] [ENTER] [0] [.] [0] [5] [ENTER]

```

RAD XYZ HEX R= 'X'
[HOME]
Z-TEST: 1 μ, KNOWN σ
μ0: 20.0000 σ: 0.2000
x̄: 19.9500
n: 65.0000
α: 0.0500

Null hypothesis population mean
[EDIT] [HELP] [CANCL] [OK]

```

Figure 12

[OK] (this is to test whether the average is greater than or equal to the null value of 20 ounces so the alternative hypothesis is that the population proportion mean is less than 20 ounces).

```

RAD XYZ HEX R= 'X'
[HOME]
Z-TEST: 1  $\mu$ , KNOWN  $\sigma$ 
 $\mu_0$ : 20.0000
 $\bar{x}$ : Alternative Hypothesis
n: 10
 $\alpha$ : 0.05
Null hypothesis population mean
[CANCL] [OK]

```

Figure 13

[OK]

```

RAD XYZ HEX R= 'X'
[HOME]
Reject  $\mu=20.0000$  at 5.0000% LVL
Test Z=-2.0156
Prob=0.0219
Critical Z=-1.6449
Critical  $\bar{x}$ =19.9592

```

Figure 14

[OK]

```

RAD XYZ HEX R= 'X'
[HOME]
7:
6:
5:
4: Test Z: (-2.0156)
3: Prob: 0.0219
2: Crit Z: (-1.6449)
1: Crit  $\bar{x}$ : 19.9592
[EDIT] [VIEW] [RCL] [STOP] [PURGE] [CLEAR]

```

Figure 15

Answer:

The critical Z value indicates the boundaries below which we would not be able to accept the null hypothesis if the calculated or test Z value were below that critical value. The critical Z value for this hypothesis test is -1.65 . The test Z or calculated Z value is -2.02 , which falls below the critical Z value boundaries. We therefore would reject the null hypothesis. At this significance level, we are unable to accept that the population average weight of cereal in the boxes would be equal to or greater than 20 ounces. It would appear that John should be concerned about the cereal filling equipment.