TI-83/84 Plus

Statistics Tutorial

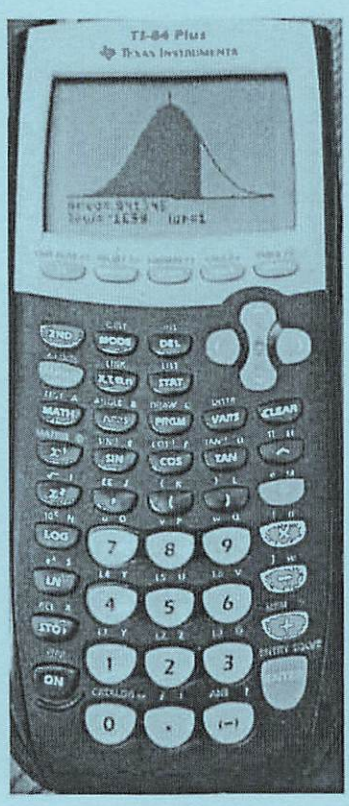
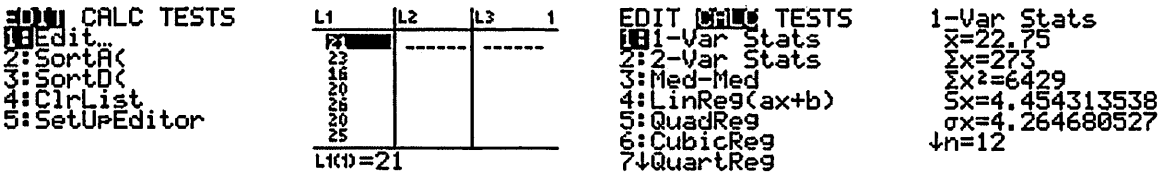


Table Of Contents

TI-83/84 Plus Statistics Tutorial

Finding One Variable Statistics for a list of data

First enter the data in list L1 by pressing **STAT**, then selecting **EDIT** and pressing the **ENTER** key. After the data values have been entered, press **STAT** and select **CALC**, then select **1-Var Stats** and press the **ENTER** key *twice*. The display will include the mean $\bar{x}$, the median, the minimum value, and the maximum value. Use the down-arrow key to see the results that don't fit on the initial display.



Summary Statistics

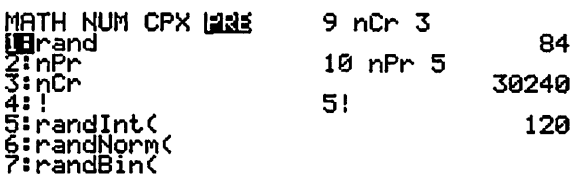
$\bar{x}$	the mean or average	
$\sum x$	the sum of all the data	
$\sum x^2$	the sum of the squares	
Sx	the sample standard deviation	
σx	the population standard deviation	
n	the number of elements	
$minX$	the minimum element	5-Number Summary
Q_1	the first quartile	
Med	the median of the data	
Q_3	the third quartile	
$maxX$	the maximum element	

Calculating Permutations, Combinations, and Factorials

To calculate a permutation, first enter the value for n, then press **MATH**, select **PRB** and **nPr**, then enter the value for r, and press the **ENTER** key.

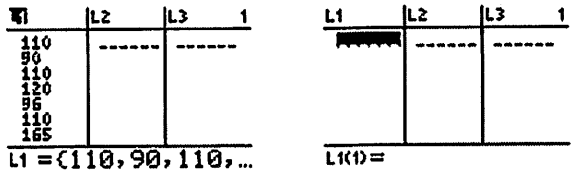
To calculate a combination, enter the value for n, then press **MATH**, select **PRB** and **nCr**, then enter the value for r, and press the **ENTER** key.

To calculate a factorial, first enter the number, then press **MATH** and select **PRB** and menu item 4.

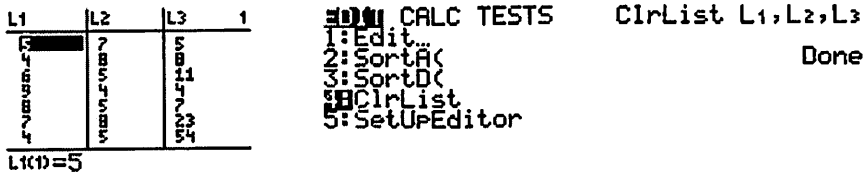


Clearing Lists

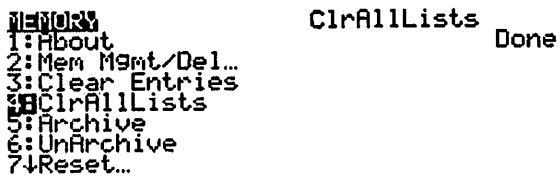
To clear a list from the data editor, move the cursor up to highlight the list name as shown below. Now, press **CLEAR** and then **ENTER**.



To clear multiple lists, select **STAT**, then select **Edit** and choose option **4:ClrList** and enter the lists separated by commas as shown below.

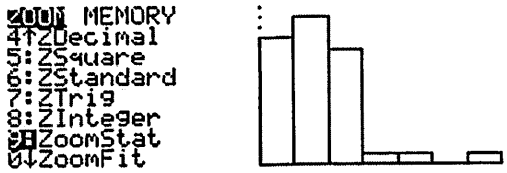


To clear *all* lists go to **MEM** and select **4:ClrAllLists**, then press **ENTER**.



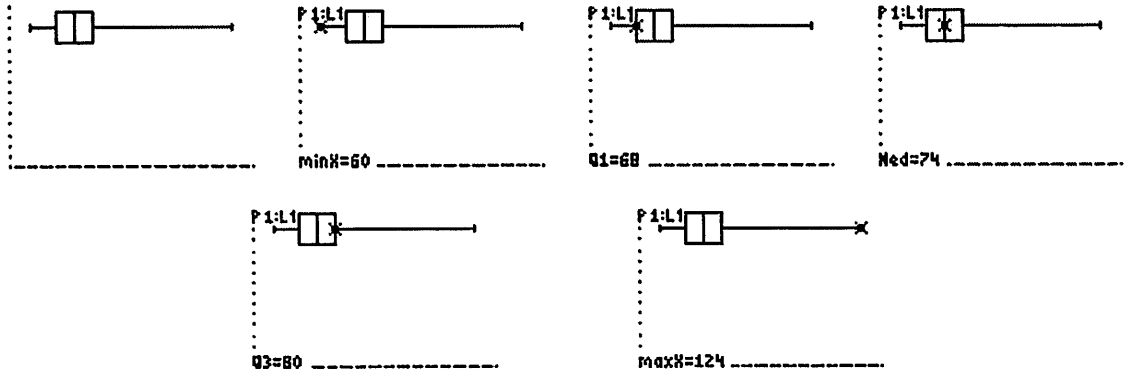
Histograms

First enter the data in list L1. Then press **2nd** and **Y=** (to get **STAT PLOT**). Press **ENTER** to select the first plot and then turn the plot on. Now select the graph type that resembles a histogram and set *X*-list to L1. If you want to let the calculator determine the class width and starting point, press the **ZOOM** button and arrow down to **ZoomStat** to get a histogram with default settings. To enter your own class width and class boundaries, press the **WINDOW** button and enter the maximum and minimum values. The Xscl value will be the class width. Then press **GRAPH** to obtain the graph.



Box-and-Whisker Plot

To obtain a box-and-whisker plot, simply select the graph type that is positioned in the middle of the second row and follow the same steps as before for the histogram. Press the **TRACE** button and use the arrow keys to view the minimum value, first quartile, median, third quartile, or maximum value. Each screen shot below shows the trace cursor in a different location along with the value of *minX*, Q_1, *Med*, Q_3, and *maxX* at the bottom left corner.



Calculating a Binomial Probability

To get to the binomial probability commands, press **2nd VARS** (to get **DISTR**, which denotes "distributions"), then select the option identified as **binompdf(**. or **binomcdf(**, depending on the probability we are trying to find. The variable n represents the fixed number of trials, p is the probability of success, and x is the number of successes. See the table below to determine which command to use and how to input the values. **The displays for the TI-83 and TI-84 calculators may be different when inputting the values of n, p, and x.**

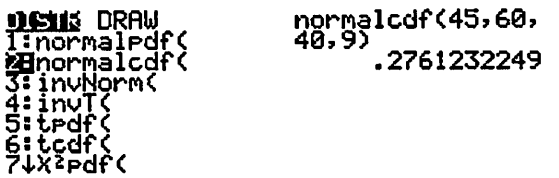
Verbal Phrase	Symbol	Command
Probability of **exactly** x successes Probability of **getting** x successes	$P(X = x)$	binompdf(n, p, x)
Probability of **at most** x successes Probability of **less than or equal to** x successes	$P(X \leq x)$	binomcdf(n, p, x)
Probability of **fewer than** x successes Probability of **less than** x successes	$P(X < x)$	binomcdf($n, p, x - 1$)
Probability of **at least** x successes Probability of **greater or equal to** x successes	$P(X \geq x)$	1 – binomcdf($n, p, x - 1$)
Probability of **more than** x successes Probability of **greater than** x successes Probability of **exceeding** x successes	$P(X > x)$	1 – binomcdf(n, p, x)

Note that you only use the **binompdf** command when finding probabilities of the form $P(X = x)$.

Calculating a Normal Probability

1. Find probabilities of the form $P(x_1 < X < x_2)$

Press **2nd VARS**, then use the down arrow key to select **2:normalcdf** (normal cumulative density function), press the **ENTER** key, then enter the lower value x_1, upper value x_2, mean μ, and standard deviation σ, i.e., **normalcdf**(x_1, x_2, μ, σ). For example, the probability $P(45 < X < 60)$ would be entered as follows in the calculator (with $\mu = 40$ and $\sigma = 9$):

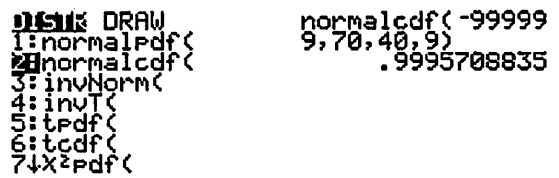


2. Finding probabilities of the form $P(X > x)$

Suppose we are asked to find $P(X > 60)$ when $\mu = 40$ and $\sigma = 9$. In this example, there is no specific upper value, so we use this trick: for the upper limit, enter a value that is excessively large to represent infinity, such as 999999 (or E99).

3. Finding probabilities of the form $P(X < x)$

Suppose now that we want to find $P(X < 70)$ when $\mu = 40$ and $\sigma = 9$. There is no specific lower value, so we enter an excessively large negative value to represent negative infinity, such as -999999 (or –E99).



Calculating a *Standard* Normal Probability

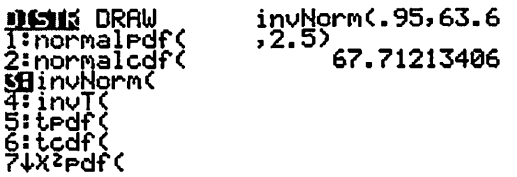
We can calculate a standard normal probability using the same procedures as above, except it's not necessary to enter values for μ and σ since the calculator uses $\mu = 0$ and $\sigma = 1$ by default (Recall that a standard normal distribution has mean $\mu = 0$ and standard deviation $\sigma = 1$). For example, to calculate the probability $P(-1 < z < 1)$, we enter it in the following manner: **normalcdf(-1, 1)**.

Finding an x-value given a Normal Probability

To find values given a probability (or percentage), press **2nd**, **VARS**, **3** (for **invNorm**) and proceed to enter the following values, including the commas:

(total area to the *left*, μ, σ)

For example, assume that women's heights are normally distributed with a mean of 63.6 in. and a standard deviation of 2.5 in., and suppose we want to find the minimum height of the tallest 5% of women. The minimum height separates the bottom 95% from the top 5%; thus, the total area to the *left* is 0.95. The minimum height (67.7 in) is calculated as follows:

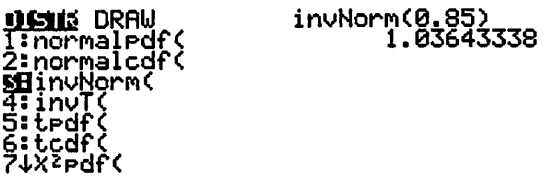


Note: Remember to use the area to the *left* of the desired value. In the above example, the area to the left of the minimum height of the tallest 5% of women is 0.95 and the area to the right of it is 0.05.

Finding a z-score given a *Standard* Normal Probability

We can find a z-score by using the command **invNorm(*p*)**, where p is the standard normal probability. In other words, $p = P(z < z_1)$, which is the area under the standard normal curve to the left of some unknown z-score z_1.

For example, to calculate z_1 given a standard normal probability of $p = 0.85$, which is the area under the standard normal curve to the left of the unknown z-score z_1, we enter it as follows:



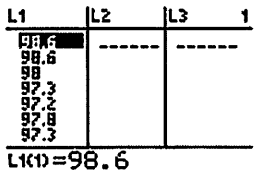
Calculating a Poisson Probability

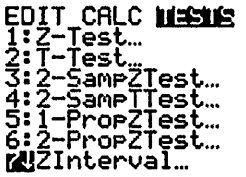
Press **2nd VARS** (to get **DISTR**), then select **poissonpdf(**. Now press **ENTER**, then proceed to enter μ, x (including the comma). For μ, enter the value of the mean; for x, enter the desired number of occurrences.

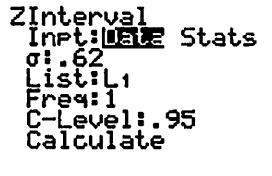
Finding a Confidence Interval for the Mean (σ Known)

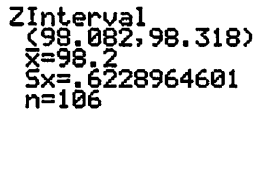
We can generate confidence intervals for original sample values stored in a list, or you can use the summary statistics n, $\bar{x}$, and σ (highlight **Stats**, then press **ENTER**). Either enter the data in list L1 or have the summary statistics available, then press the **STAT** key. Now select **TESTS** and choose **ZInterval** if σ is known.

1. Finding a confidence interval *given a list of data*

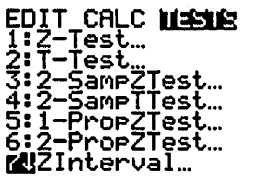


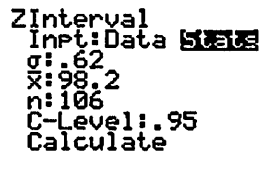


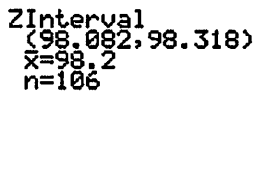




2. Finding a confidence interval *given statistics*

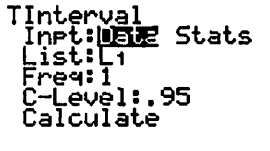


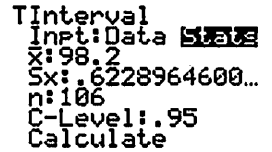




Finding a Confidence Interval for the Mean (σ Unknown)

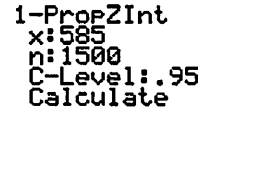
Follow the same procedure as above, except use **TInterval** (option 8) instead of **ZInterval**. Since σ is unknown, we will use s as an approximation to σ.

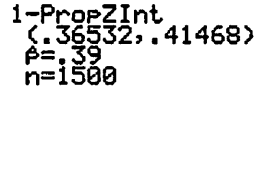




Finding a Confidence Interval for a Proportion

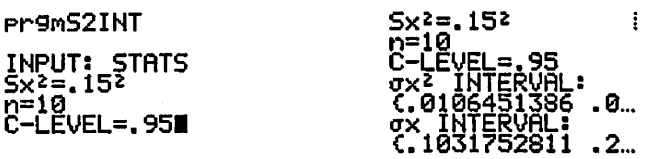
Press **STAT**, select **TESTS**, then select **1-PropZInt** and proceed to enter the required items.





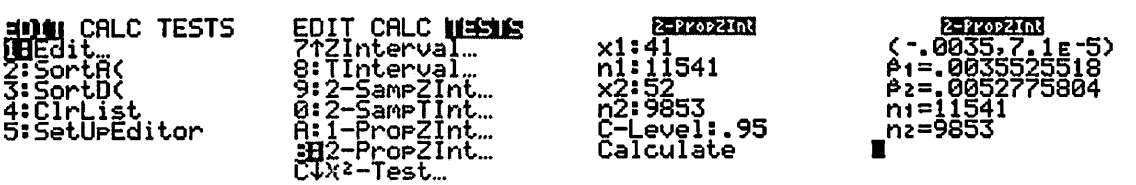
Finding a Confidence Interval for a Population Standard Deviation or Variance

You can use the **S2INT** to find confidence intervals for a population standard deviation or variance. You can access the program by going to **PRGM**, then arrow down until you find **S2INT**. If your calculator does not have **S2INT**, go up to the TMARC counter and we will transfer the programs to your calculator. If your calculator does have **S2INT**, select it and press **ENTER** and press **ENTER** again to run the program. Then enter the sample variance s^2, the sample size n, and the confidence level (such as 0.95). Press the **ENTER** key, and wait a while for the display of the confidence interval limits for σ^2. Press **ENTER** again to display the confidence interval limits for σ. To exit the program, press **ENTER** one more time.



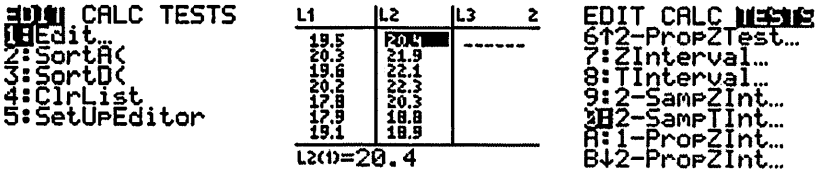
Finding a Confidence Interval for Two Population Proportions

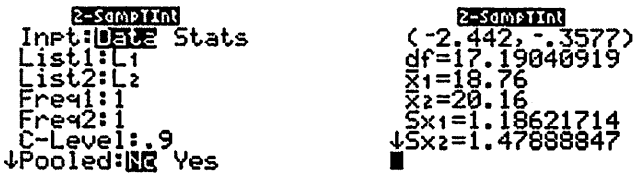
Press **STAT**, then select **TESTS** and arrow down to find **2-PropZInt** and proceed to enter the required items. You will also be asked to enter the confidence level (such as 0.95). Arrow down to highlight **Calculate** and then press the **ENTER** key. The confidence interval will be displayed along with the sample proportions $\hat{p}_1$ and $\hat{p}_2$ and the sample sizes n_1 and n_2.



Finding a Confidence Interval for Two Means: Independent Samples

First enter the data in list L1 and L2 if you are given data. Then press **STAT**, select **TESTS**, and then choose **2-SampTInt**. Highlight **Data**, press **ENTER**, and make sure you are working with lists L1 and L2. Input the confidence level , highlight **No** for Pooled, highlight **Calculate** and press **ENTER**.

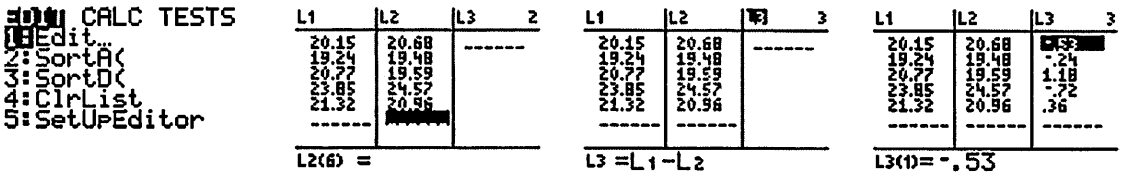


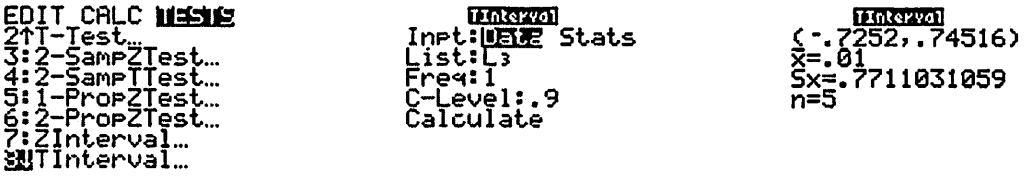


If you are given summary statistics, follow the same steps as above except highlight **Stats** instead of **Data**. Then proceed to enter the required items.

Finding a Confidence Interval for Two Means: Dependent Samples (Matched Pairs)

First enter the data in list L1 and L2. Then highlight L3 as shown in the third screen shot below, input **L1-L2**, and then press the **ENTER** key. List L3 will now contain the individual differences *d*. Now press **STAT**, then select **TESTS**, and choose the option **TInterval**. Use the input option of **Data**. For the list, enter L3. Also enter the confidence level (such as 0.95). Press **ENTER** when done.

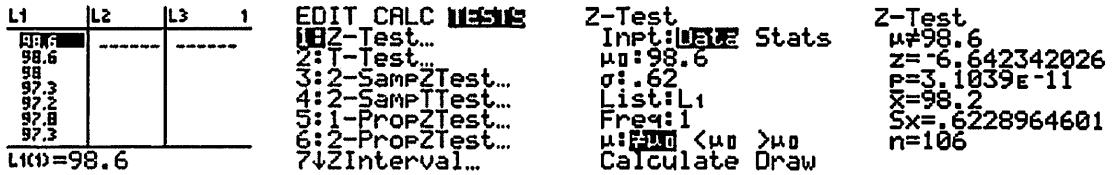




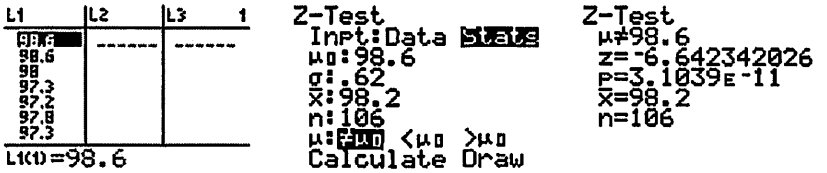
Hypothesis Test for the Mean (σ is known)

Press **STAT**, then select **TESTS** and choose the first option, **Z-Test.** You can use the original data or the summary statistics (**Stats**) by providing the entries indicated in the window display. You will also be asked to select the alternative hypothesis, which will be one of the following: $\mu \neq \mu_0$, $\mu < \mu_0$, or $\mu > \mu_0$. The first three items of the results will include the alternative hypothesis, the test statistics, and the P-value.

1. Given a list of data



2. Given statistics

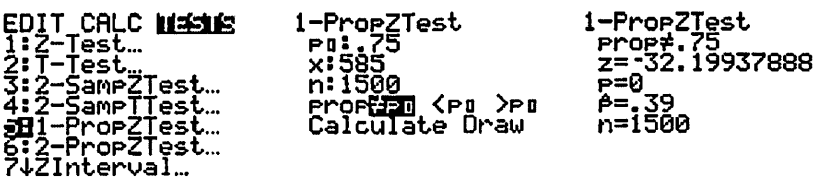


Hypothesis Test for the Mean (σ Unknown)

Follow the same procedure as above, except use **T-Test** instead of **Z-Test.** Since σ is unknown, we will use s as an approximation to σ.

Hypothesis Test for a Proportion

Press **STAT**, select **TESTS**, and then select **1-PropZTest.** Enter the claimed value of the population proportion for p_0, then enter the values for x and n, and then select the alternative hypothesis. Highlight **Calculate**, then press the **ENTER** key.

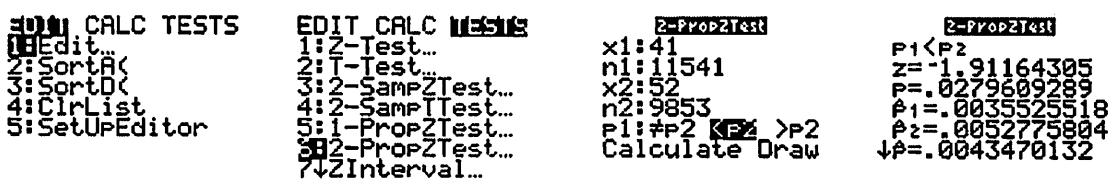


Hypothesis Test for Standard Deviation or Variance

You can use **S2TEST** for a hypothesis test for the standard deviation or variance. You can access the program by going to **PRGM**, then arrow down until you find **S2TEST**. If your calculator does not have **S2TEST**, go up to the TMARC counter and we'll transfer the programs to your calculator. If your calculator does have **S2TEST**, select it and press **ENTER** and press **ENTER** again to run the program. You will be asked to input the *population* variance σ^2, the sample variance s^2, and the sample size n. Then select the format used for the alternative hypothesis and press the **ENTER** key. The test statistic and P-value will be displayed.

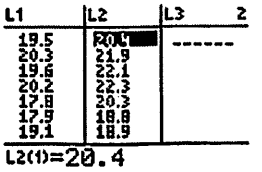
Hypothesis Test for Two Proportions

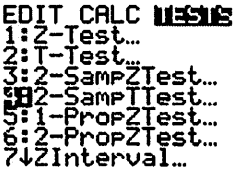
Press **STAT**, select **TESTS**, and then select **2-PropZTest** and proceed to enter the required items. Then select the format used for the alternative hypothesis and press the **ENTER** key. The calculator will then output the test statistic, the P-value, the sample proportions $\hat{p}_1$ and $\hat{p}_2$, the pooled sample proportion $\bar{p}$, and the sample sizes n_1 and n_2.

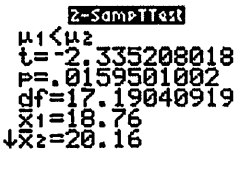


Hypothesis Test for Two Means: Independent Samples

First enter the data in list L1 and L2 if you are given data. Then press **STAT**, select **TESTS**, and then choose **2-SampTTest**. Highlight **Data**, press **ENTER**, and make sure you are working with lists L1 and L2. Then select the format for the alternative hypothesis, highlight **No** for Pooled, highlight **Calculate** and press **ENTER**.



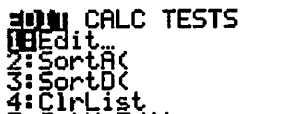


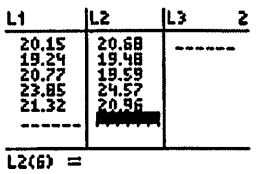


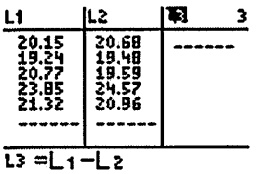
If you are given summary statistics, follow the same steps as above except highlight **Stats** instead of **Data**. Then proceed to enter the required items.

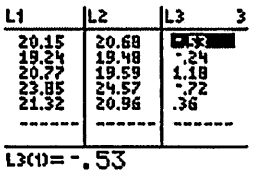
Hypothesis Test for Two Means: Dependent Samples (Matched Pairs)

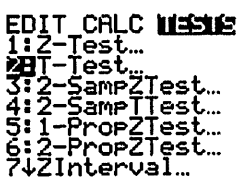
First enter the data in list L1 and L2. Then highlight L3 as shown in the third screen shot below, input **L1-L2**, and then press the **ENTER** key. List L3 will now contain the individual differences *d*. Now press **STAT**, then select **TESTS**, and choose the option **T-Test**. Use the input option of **Data**. For the list, enter L3. Also enter the assumed value of the population mean difference (typically 0) for μ_0 and select the format for the alternative hypothesis. Press **ENTER** when done.

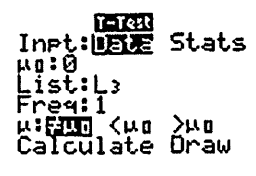


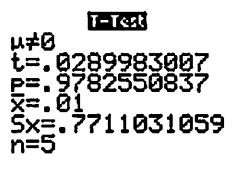






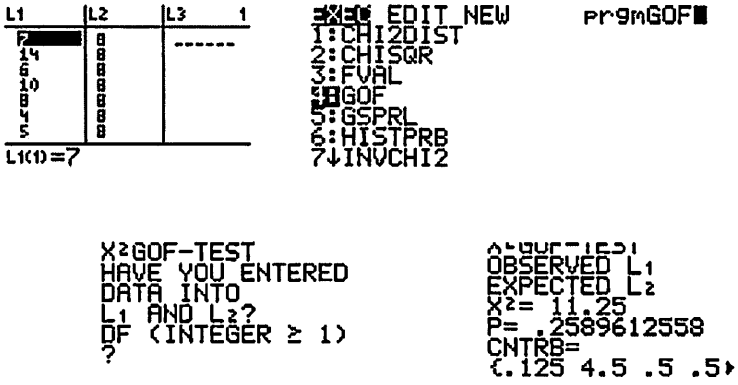






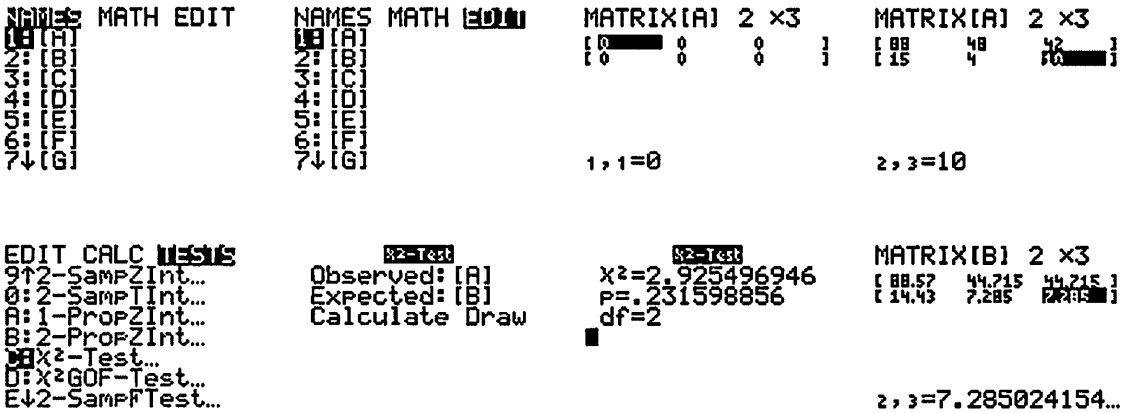
Goodness-of-Fit

First enter the data in list L1 and L2. The observed frequencies go in list L1 and the expected frequencies go in list L2. Then press **PRGM** and select **GOF** (or **X2GOF**). Press **ENTER** to execute the program. Input the degrees of freedom and press **ENTER**. The final display will show the test statistic χ^2 and the P-value.



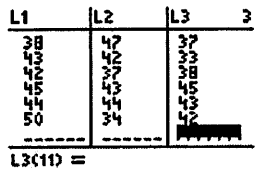
Contingency Tables

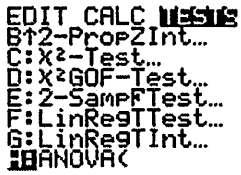
First enter the contingency table as a matrix. Press **2nd** followed by the x^{-1} key (to get **MATRIX**). Arrow to the right to highlight **EDIT**, then press **ENTER** to edit matrix **[A]**. Now enter the dimensions of the matrix (rows by columns) and proceed to enter the individual frequencies. When you're done entering the contingency table, press **STAT**, highlight **TESTS**, and select χ^2**-Test**. Set **Observed** to matrix **[A]** and **Expected** to matrix **[B]** and then highlight **Calculate** and press **ENTER**. The final display will show the test statistic, the P-value, and the degrees of freedom. The expected frequencies are stored in matrix **[B]**.

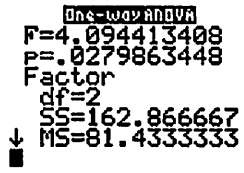


One-Way ANOVA

First enter the data in lists L1, L2, L3, … then press **STAT**, select **TESTS**, and choose the option **ANOVA**. We will then enter the lists L1, L2, L3, … separated with commas. Then press **ENTER**.

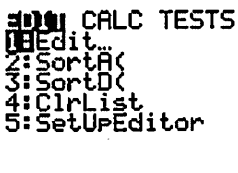


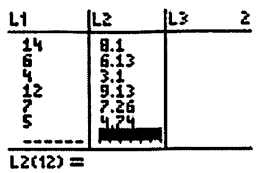


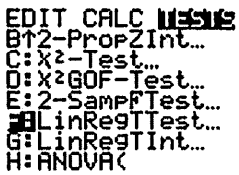


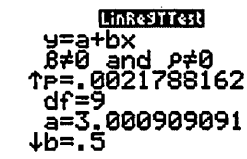
Correlation and Regression

Enter the paired data in lists L1 and L2, then press **STAT** and select **TESTS**. Using the option of **LinRegTTest** will result in several displayed values, including the value of the linear correlation coefficient r. Set the X-list to L1 and the Y-list to L2. Choose $\neq$ **0** for the alternative hypothesis, highlight **Calculate** and then press the **ENTER** key. Use the up and down arrow key to display other values.



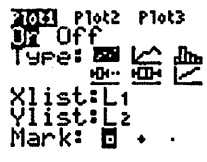


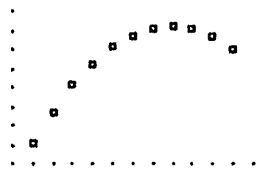




The regression line has the format $y = a + bx$, where $a = 3.000909091$ and $b = .5$ in the example above (see the last screen shot above). In other words, the regression line for the example above is $y = 3.000909091 + .5x$.

To obtain a scatterplot, press **2nd**, then **Y=** (for STAT PLOT). Select the first option and press **ENTER**. Press enter again to turn Plot 1 on, then select the first graph type, which resembles a scatterplot. Set the X-list to L1 and the Y-list to L2. Now press the **ZOOM** key and select **ZoomStat**. It will now display a scatterplot as shown below.





If you would also like to display the regression line along with the scatterplot, press the **Y=** button and enter the regression line for **Y1=** by going to **VARS**, then select **Statistics**, highlight **EQ**, and choose option **1:RegEQ**. Then press the **GRAPH** button. It will now display the scatterplot along with the regression line as shown in the last screen shot below.