Learning to Create and Interpret Residual Plots on a TI-84 Calculator for Regression Analysis

Authored by

Mohammed looti

November 4, 2025

A residual plot is an indispensable diagnostic tool in statistical analysis, particularly following a regression analysis. Its fundamental role is to provide a visual assessment of the fitted model's quality and suitability. Specifically, a residual plot helps statisticians determine whether core assumptions underlying the regression model--such as the independence and homoscedasticity (constant variance) of the residuals--have been met.

When a statistical model is correctly specified, the resulting residual plot should ideally show a random scattering of points distributed evenly around the horizontal axis (the zero line). This pattern signifies that the model has effectively captured all systematic relationships within the data. Conversely, the presence of any discernible structure--such as a parabolic curve, a wedge or cone shape (indicating heteroscedasticity), or tight clustering--strongly suggests a violation of the regression assumptions. Such violations necessitate careful revision of the model or the transformation of the variables to achieve a more robust fit.

This comprehensive guide offers a precise, step-by-step tutorial for generating a residual plot using a TI-84 calculator. We will utilize the small, illustrative dataset provided below as our continuous working example throughout the entire process:

x	y
1	8
3	9
4	14
7	19
8	22
12	21

Setting Up the Data Lists on the TI-84

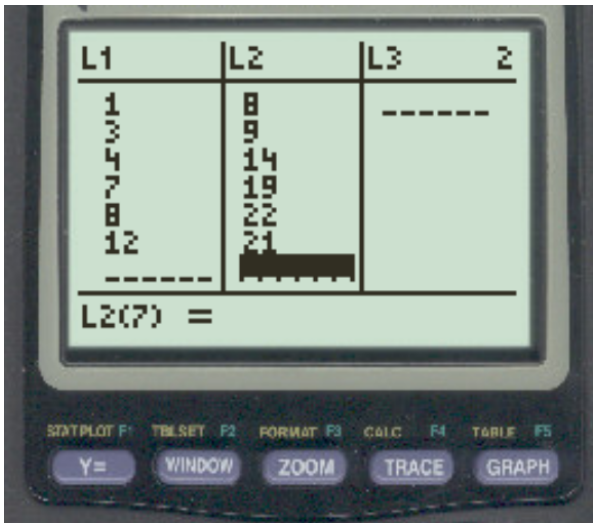
Before the calculator can compute the necessary residuals, we must correctly input the bivariate data into the calculator's dedicated statistical lists. A critical initial step for ensuring computational accuracy is to clear any existing data from the lists, typically L1 and L2, which prevents interference from previous calculations.

To access the list editing environment, first press the Stat button, then choose option 1, which is EDIT. This action immediately displays the list editor screen, providing columns where you can either input new data or quickly clear old entries.

If L1 or L2 currently contain data, you must clear them. To do this efficiently, use the arrow keys to

scroll up until the list name (e.g., L1) is highlighted. Press CLEAR, and then definitively press ENTER. This sequence executes the command, clearing all entries in that specific column.

Once the lists are empty and prepared, proceed to enter the X-values (the **independent variable**) into column L1 and the corresponding Y-values (the **dependent variable**) into column L2. It is vital to ensure that the data pairs are perfectly aligned; any misalignment will inevitably lead to incorrect computation of the line of best fit and, consequently, inaccurate residual values.

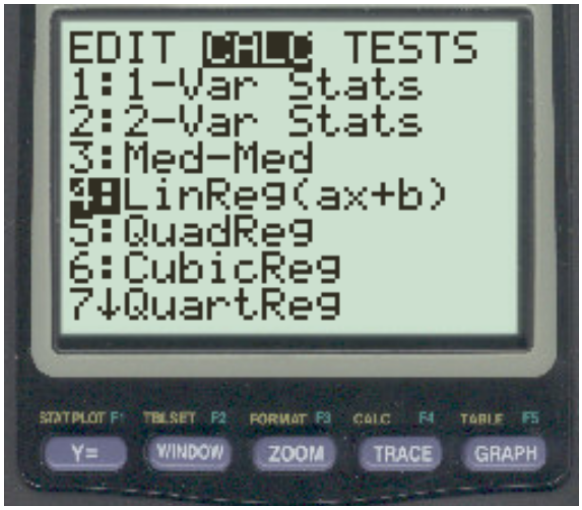


Executing the Linear Regression Calculation

To generate the necessary residual data points, the TI-84 calculator must first successfully run the linear regression calculation. This critical procedure determines the equation for the line of best fit and, most importantly for visualizing residuals, automatically computes and stores all associated residuals in a temporary, dedicated memory location named RESID.

To initiate and execute the regression function, follow these precise steps:

Press the Stat button to access the main statistical menu.
Use the right arrow key to navigate to the CALC menu tab.
Scroll down and select option 4: LinReg(ax+b). This selection uses the standard formula where L1 serves as the independent variable list (X) and L2 serves as the dependent variable list (Y).



After selecting LinReg(ax+b), the calculator will prompt you with a setup screen, which may vary slightly depending on your operating system version. Verify that the **Xlist** is set to L1 and the **Ylist** is L2. Scroll down to the final option, Calculate, and press ENTER to process the data.

The results of the linear regression will then be displayed, showing the key parameters: the slope (represented by **a**) and the y-intercept (represented by **b**). For our sample dataset, the calculated fitted regression model is approximately: **y = 7.397 + 1.389x**. Crucially, this successful calculation confirms that the required residuals are now stored internally and are ready to be plotted.

Setting Up the STAT PLOT to Display Residuals

The next essential phase involves correctly configuring the TI-84's statistical plotting feature specifically for graphing the residuals. Unlike a standard scatter plot that uses L1 vs. L2, a residual plot mandates that the calculator plot the independent variable values (X-list) against the newly

calculated residual values (Y-list).

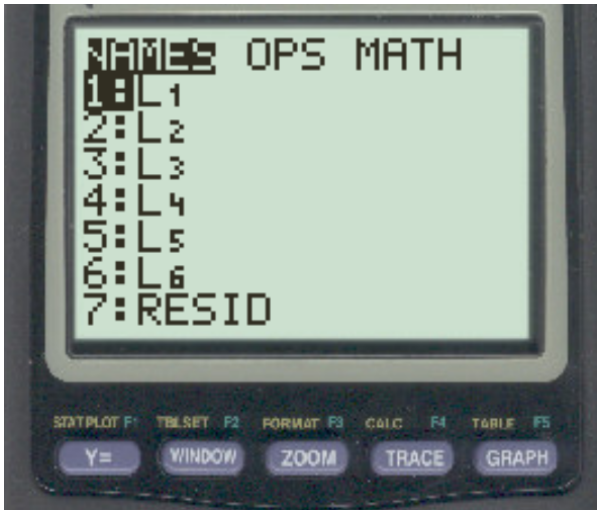
To access the plot setup menu, press 2nd followed immediately by Y= (this secondary function is labeled STAT PLOT). Select the first plot option (Plot1) by highlighting it and pressing ENTER.

Within the Plot1 configuration screen, ensure you make the following critical adjustments for a residual plot:

Set the plot status to **ON**.
Select the first Type option, which is the **Scatter Plot** (the standard visualization for individual data points).
Ensure the **Xlist** remains set to L1, as the horizontal axis must represent the original independent variable values.

The single most important adjustment is defining the Ylist. We must override the default L2 and instruct the calculator to plot the internally stored residuals. To access this specialized list, press 2nd and then STAT (which corresponds to the LIST menu). Navigate down the list of names until you locate and select the option labeled **RESID**. Select it either by pressing its corresponding number or by pressing ENTER.

Once successfully selected, the acronym "RESID" will be displayed adjacent to the Ylist setting, confirming that the vertical axis will now represent the statistical distance between the observed values and the values predicted by the linear regression line.

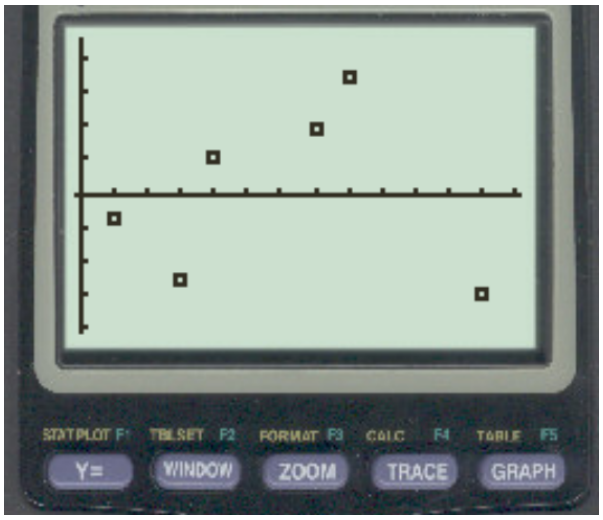


Displaying the Plot and Conducting Visual Interpretation

With the statistical plot properly configured to graph the calculated residuals, the final operational step is to display the graph using the specialized statistical zoom function. This feature, known as ZoomStat, is essential because it automatically calibrates the viewing window to optimally encompass all generated data points, guaranteeing a complete and accurate visualization of the residual plot.

To execute this function, press the ZOOM button. Scroll down the extensive menu until you find option 9, labeled ZoomStat, and press ENTER.

The calculator will immediately generate and display the residual plot. Note that the horizontal axis represents the original X-values from your L1 list, while the vertical axis represents the calculated residuals (the distance from the regression line).



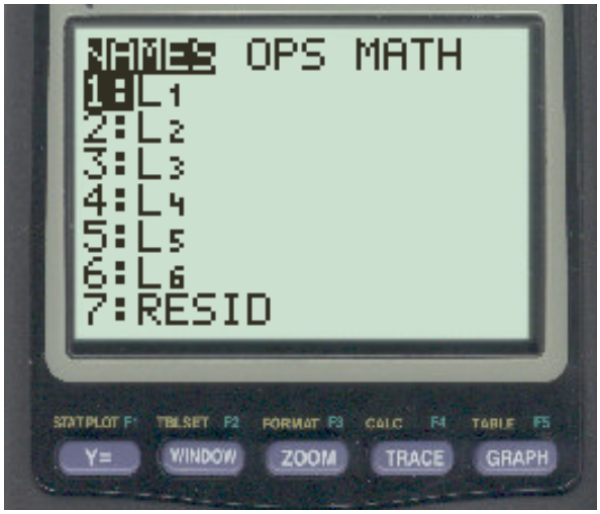
The most important part of this exercise is the interpretation. For a regression analysis to be considered valid and appropriate, the data points in the residual plot must be scattered randomly and uniformly above and below the horizontal zero line (**y=0**). If the plot reveals any systematic pattern--such as a discernible curve, a megaphone shape (signifying increasing variance), or tight clusters--it is a strong statistical indicator that the chosen linear model is inadequate for describing the relationship, or that fundamental assumptions about the error variance have been violated. In the plot generated for our example, the scattering appears relatively random, which suggests that the linear model provides a reasonable and statistically sound fit for this specific dataset.

Viewing the Numerical Residual Data

While the visual plot is the primary and most powerful diagnostic tool for assessing model fit, it is often useful to examine the actual numerical values of the residuals. This step is particularly helpful when screening for **extreme outliers**, performing manual verification of calculations, or exporting data for further analysis.

To view these computed numbers, first return to the home screen by pressing 2nd followed by MODE (the QUIT function). Next, access the list of statistical variables by pressing 2nd and then STAT (which opens the LIST menu).

From the LIST menu, scroll down until you reach the **RESID** option (this is typically option 7 or 8 on most TI-84 calculator models) and press ENTER. This action places the variable name **RESID** onto the main calculation line.



Press ENTER once more to execute the command. The calculator will then display the numerical list of residuals, enclosed in curly braces, on the home screen.

You can scroll horizontally within this list to view every calculated residual value corresponding to each observation in your original dataset. Remember that these numerical values represent the precise vertical distance between each observed data point and the fitted regression line.

Conclusion and Best Practices for Model Validation

Creating a residual plot on the TI-84 is an absolutely fundamental skill for anyone performing regression analysis and validating statistical models. By diligently executing the steps--from accurate data entry and performing the linear regression calculation, to correctly configuring the STAT PLOT to use the internal residuals--you gain access to a powerful visual diagnostic tool essential for rigorous statistical reporting.

Always remember that a truly successful residual plot is characterized by the **absence of any discernible pattern**. This random scatter confirms that the linear model is appropriate for the data and, crucially, that the assumption of constant variance of the errors is satisfied across all predicted values. If a pattern emerges, it is a clear signal that further investigation, variable transformation, or the use of more advanced non-linear modeling techniques is required to accurately represent the underlying relationship.