

Linear Regression with the TI-84 Calculator: A Step-by-Step Guide

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Fundamentals of Simple Linear Regression

[Linear regression](#) is a cornerstone analytical methodology utilized extensively across disciplines ranging from social sciences to engineering and finance. Its primary utility lies in establishing and modeling the linear correlation between two continuous variables. The core objective is to predict the value of a **response variable** (Y), which is dependent upon the magnitude of an [explanatory variable](#) (X). This robust statistical framework allows analysts to precisely quantify the direction and strength of the observed association, serving as an indispensable tool for empirical forecasting and deeper comprehension of fundamental statistical relationships.

The output of linear regression is a mathematical construct known as the best-fit line or the **regression model**. This model is paramount for generating reliable predictions and deriving statistical inferences. While sophisticated software packages are the standard for large-scale or multivariate analysis, the ubiquitous **TI-84 calculator** possesses all the necessary computational power to execute and visualize simple linear regression effectively. Mastering this procedure on the calculator is critically important for students and professionals who require instantaneous calculation and visualization of introductory statistical models without relying on external computer access.

This definitive guide provides an exhaustive, step-by-step walkthrough detailing the precise mechanics required to conduct a thorough linear regression analysis using your [TI-84 calculator](#). We will not only focus on the mechanics of generating the statistical output but, more importantly, we will emphasize the correct interpretation of the resulting regression coefficients (intercept and slope) and the crucial metric of the [coefficient of determination](#) (R-squared).

Practical Application: Modeling Study Hours and Exam Scores

To effectively demonstrate the procedure for performing linear regression, we will apply the technique to a highly relatable scenario: investigating the correlation between the amount of time a student invests in studying and the final grade they subsequently achieve on an examination. Our central, testable hypothesis is that an increase in study time--designated as our **explanatory variable** (X)--will result in a proportional increase in exam scores, which functions as our **response variable** (Y).

In this context, the number of **hours studied** must be treated as the independent variable, driving the variance, while the resulting **exam score** is the dependent variable, whose outcome we seek to predict. The ultimate goal of this exercise is to derive a concise mathematical expression--the [regression equation](#)--that optimally represents the linear trend observed among the collected data points. The resulting regression line will serve two main functions: enabling the prediction of potential exam scores for various levels of study commitment and providing a quantitative measure

of the overall model fit.

Accurate execution of the forthcoming steps on the **TI-84 calculator** is essential for producing reliable statistical results that faithfully capture the relationship between these two variables. Prior to engaging the calculation functions, we must confirm that the raw data is structured correctly and input methodically into the calculator's designated memory registers.

Step 1: Systematic Data Preparation and Input

The foundational stage of any statistical analysis involves the precise and error-free entry of raw data into the calculator's list editor. A single transposition error at this juncture can invalidate the entire subsequent regression analysis. Ensure your **TI-84 calculator** is powered on and ready for immediate data input before proceeding.

To initiate the data entry process, locate and press the Stat button, which is typically found centrally on the keypad. When the STAT menu appears, select the EDIT option, which is invariably the first choice (1:Edit). This action opens the primary list editor interface, displaying columns labeled L1, L2, L3, and so forth. Following standard convention, we will allocate L1 for our [explanatory variable](#) (hours studied) and L2 for our **response variable** (exam score).

It is crucial to enter the corresponding paired data values with meticulous care. The integrity of the analysis depends entirely on maintaining the pairing: the observation in L1 must correlate precisely with the observation in L2 for the identical sample unit (e.g., the same student). Input all values for L1 sequentially, pressing **Enter** after each observation, and then navigate horizontally to L2 to enter the corresponding response values, ensuring alignment.

L1	L2	L3	L4	L5	1
1	76	-----	-----	-----	
2	78				
2	85				
4	88				
2	72				
1	69				
5	94				
4	94				
2	88				
4	92				
-----	-----				

L1(11)=

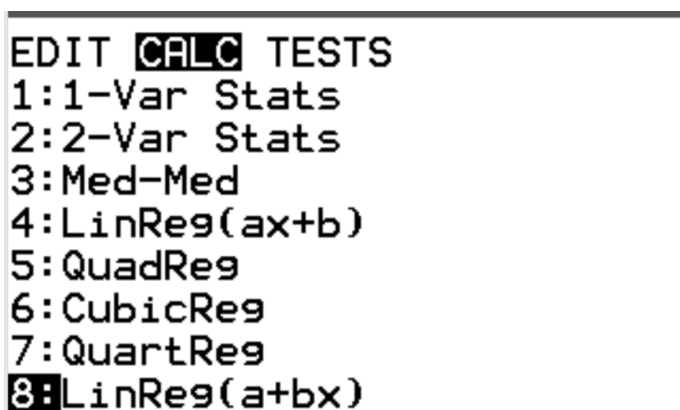
The visual confirmation above illustrates the correctly structured data set, with the independent measures (X values) stored in L1 and the dependent outcomes (Y values) stored in L2. A thorough double-check of every data point is highly recommended before advancing to the computation

phase to guarantee the accuracy and reliability of the final statistical output.

Step 2: Executing the Linear Regression Computation

Once the complete data set is reliably stored within lists L1 and L2, we can proceed to command the calculator to perform the linear regression calculation. Begin by returning to the primary statistical menu by pressing the **Stat** button once more. Instead of choosing the **EDIT** option this time, use the right arrow key to scroll until the **CALC** menu is prominently highlighted. The **CALC** menu houses all the advanced functions required for rigorous statistical computation and analysis.

Scroll down through the comprehensive list of computational options until you locate **8: LinReg(a+bx)**. It is important to recognize that the TI-84 typically offers two linear regression formulations; we specifically select option 8 because its algebraic structure, where the Y-intercept (a) precedes the slope (b) multiplied by X, aligns most closely with standard statistical notation. Select option 8 and press **Enter**.

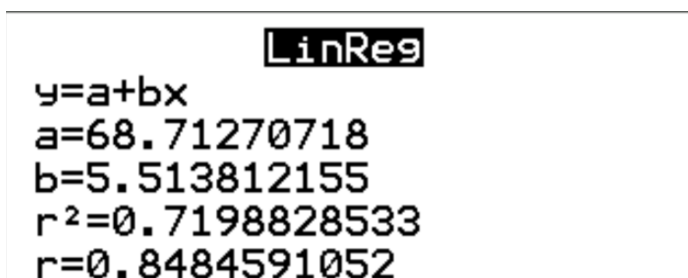


The calculator will prompt the user to confirm or specify several parameters. It is imperative to ensure that the **Xlist** is correctly designated as L1 and the **Ylist** is set to L2, maintaining the alignment established during the data entry phase. The **FreqList** should be left empty or set to 1 for this simple regression analysis. Finally, scroll down to the **Calculate** command and press **Enter** to execute the computation and generate the model parameters.

Step 3: Analyzing the Regression Output and Coefficients

Immediately following the execution of the calculation, the [TI-84 calculator](#) displays the comprehensive results of the linear regression analysis. This output contains all the essential numerical parameters required to construct the empirical [regression equation](#), alongside key metrics that describe the model's overall goodness of fit. The results strictly conform to the specified model form: $y = a + bx$, where 'y' is the predicted response.

The output shown below provides the calculated coefficients specifically derived from our study hours versus exam performance data set:

A screenshot of a TI-84 calculator screen showing the results of a linear regression. The title 'LinReg' is at the top. Below it, the equation 'y=a+bx' is displayed. The calculated values are: 'a=68.71270718', 'b=5.513812155', 'r^2=0.7198828533', and 'r=0.8484591052'.

```
LinReg
y=a+bx
a=68.71270718
b=5.513812155
r^2=0.7198828533
r=0.8484591052
```

Using these calculated values, we can formally construct the predictive regression equation tailored to our specific study hours example:

$$\text{Predicted Exam Score} = 68.7127 + 5.5138 * (\text{Hours Studied})$$

This formula represents the precise mathematical representation of the calculated best-fit line, minimizing the squared distances between the line and all observed data points.

Interpreting the Regression Parameters and Making Predictions

The calculated coefficients--the intercept (a) and the slope (b)--are not merely numerical values but provide direct, interpretable insights into the relationship under study. The **intercept (a)**, determined here as **68.7127**, represents the expected mean value of the response variable (exam score) when the explanatory variable (hours studied) is exactly zero. In the practical context of this study, this suggests that a student who dedicates zero hours to studying is statistically predicted to achieve a baseline score of approximately 68.71 points.

Conversely, the **slope (b)**, calculated as **5.5138**, is the coefficient associated with the hours studied variable. This parameter is arguably the most critical result, as it quantifies the marginal effect of the independent variable. We interpret the slope as follows: for every single-unit increase in the explanatory variable (i.e., each additional hour studied), the exam score is expected to increase by an average of **5.5138 points**. The positive sign of this slope strongly affirms the initial hypothesis of a positive linear relationship.

The derived model allows us to easily predict outcomes for observations not included in the original data set. For instance, if a new student studies for exactly three hours, their predicted exam score is calculated by substituting $X=3$ into the equation:

$$\text{Predicted Exam Score} = 68.7127 + 5.5138 * (3) = 68.7127 + 16.5414 = \mathbf{85.2541}.$$

Evaluating Model Efficacy: The Coefficient of Determination (R^2)

Beyond the core coefficients, the regression output provides crucial statistics regarding the overall effectiveness and explanatory power of the model. The most important of these is R-squared (r^2), formally recognized as the [coefficient of determination](#). This metric is constrained between 0 and 1, providing a standardized measure of how successfully the calculated regression line accounts for the variability present in the actual observed data points.

In our specific example, the output provides an r^2 value of **0.7199**. This figure translates to the powerful conclusion that 71.99% of the total observed variation in the response variable (exam scores) can be statistically explained by the variations in the [explanatory variable](#) (hours studied). This percentage indicates a reasonably strong and highly predictive model fit.

Consequently, the remaining 28.01% of the variation is attributed to unexplained factors, random error, or variables not incorporated into this specific simple linear model. A sufficiently high [coefficient of determination](#) confirms the empirical relevance and [statistical validity](#) of the calculated linear relationship between study commitment and academic performance.

Advanced Diagnostics and Further Statistical Exploration

While the TI-84 calculator provides the fundamental parameters necessary for simple linear regression, advanced inferential analysis often necessitates additional diagnostic checks. Chief among these is the examination of [residuals](#), which must be analyzed to confirm crucial assumptions underlying the model, such as linearity, normality of errors, and homoscedasticity (equal variance). Verification of these assumptions is vital for ensuring the statistical validity of any conclusions drawn from the regression output.

For users relying on the [TI-84 calculator](#) for comprehensive model diagnostics and further statistical depth, the following resources and topics are recommended for continued exploration:

[How to Create a Residual Plot on a TI-84 Calculator](#), which is essential for checking assumptions. Methods for calculating and interpreting the standard error of the estimate, which measures the average distance of data points from the regression line.

Detailed steps for performing a complete linear regression t-test on the calculator to assess the statistical significance of the slope coefficient (b).