

How to Calculate Linear Regression on Your TI-84 Calculator

Authored by
stats writer

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Executing Linear regression on a graphing calculator, such as the TI-84 calculator, is a fundamental skill for students and professionals engaged in statistical analysis. This statistical technique allows us to model the relationship between two variables, providing a predictive equation and measures of model fit. The process involves systematically inputting bivariate data into the calculator's list editor, executing the appropriate statistical command under the STAT menu, and finally, interpreting the resulting coefficients and diagnostic statistics.

The standard output provided by the TI-84 when performing linear regression includes the coefficients (slope and intercept) necessary to construct the line of best fit, alongside the correlation coefficient (r) and the r-squared value. This powerful summary provides the foundation for interpreting the strength and direction of the linear relationship between the chosen variables and drawing statistically sound conclusions about the dataset. Mastery of this procedure ensures efficient and accurate quantitative analysis in various academic and practical settings.

Linear regression is a powerful tool in regression analysis used to quantify and understand the linear relationship between an explanatory variable, typically denoted as x , and a response variable, denoted as y . It operates on the principle of finding the line that minimizes the sum of squared residuals, known as the Least Squares Method. This method yields a mathematical model that can be used for prediction or simply for describing the observed association between the variables.

This detailed tutorial explains the necessary steps and best practices for successfully executing and interpreting linear regression using the robust functions available on the TI-84 calculator. We will navigate the data entry process, command execution, and the critical step of synthesizing the statistical output.

Understanding Linear Regression Fundamentals

Linear regression aims to fit a straight line to a set of data points, mathematically defined by the equation $\hat{y} = a + bx$, where $\hat{y}$ represents the predicted value of the response variable, x is the explanatory variable, b is the slope (rate of change), and a is the y-intercept (the predicted value of y when x is zero). The quality of this line--the degree to which it accurately represents the data--is crucial for reliable conclusions.

The core assumption underlying simple Linear regression is that the relationship between the two variables is approximately linear. While the TI-84 is excellent for computation, it is vital that the analyst first visually inspects a scatter plot of the data to confirm linearity. Failing to meet this basic assumption can lead to a regression model that provides misleading or entirely inaccurate interpretations of the underlying relationship.

Furthermore, understanding the difference between the explanatory variable (the input, often

influencing the outcome) and the response variable (the output, being measured or predicted) is paramount. In the context of a TI-84 analysis, the explanatory variable is conventionally placed in List 1 (L1) and the response variable in List 2 (L2), ensuring the calculator performs the calculation correctly, minimizing the vertical distances (residuals) from the data points to the fitted line.

The Role of the TI-84 Calculator in Data Analysis

The TI-84 calculator serves as a comprehensive tool for performing complex statistical calculations quickly, bypassing the need for manual computations. Its built-in statistical functions are designed to handle common tasks like descriptive statistics, hypothesis testing, and regression analysis. For linear modeling, the calculator uses the built-in 'LinReg(ax+b)' or 'LinReg(a+bx)' function to automatically calculate the regression coefficients based on the input data stored in the lists.

The calculator's efficiency lies in its ability to execute the Least Squares computation almost instantaneously, saving significant time compared to traditional methods. However, users must ensure their calculator's diagnostic settings are activated if they wish to view the correlation coefficient (r) and the r-squared value in the output summary. If these values are missing, the user must navigate to the CATALOG menu and turn on "DiagnosticOn" before proceeding with the regression calculation.

For this tutorial, we will utilize the standard LinReg function available under the STAT menu. This streamlines the process of moving from raw data to a complete regression model, providing all necessary parameters for both the predictive equation and the assessment of model fit. This systematic approach ensures reproducibility and accuracy in statistical reporting.

Example: Linear Regression on a TI-84 Calculator

Suppose we are interested in rigorously understanding the relationship between the number of hours a student dedicates to studying for a major examination and the resulting exam score they achieve. This scenario establishes a clear causal structure where study hours are the independent variable and the score is the dependent variable.

To explore this crucial relationship empirically, we will execute a simple linear regression using a dataset containing paired observations. We will designate the **hours studied** as the explanatory variable (x) and the **exam score** as the response variable (y). The following steps detail the precise sequence of commands required on a TI-84 calculator to generate the statistical model.

Step 1: Inputting Data into the List Editor

The first critical phase involves accurately inputting the raw data into the calculator's statistical memory lists. This ensures the subsequent computation uses the correct paired observations. To

access the list editor, press the **STAT** key, and then select option **EDIT** (usually option 1). This action opens the list editor interface, typically displaying columns L1, L2, L3, and so forth.

We must carefully enter the values corresponding to the explanatory variable (hours studied) into column **L1** and the corresponding values for the response variable (exam score) into column **L2**. It is imperative that the data points remain correctly paired across the rows; an error in pairing will lead to invalid results. For our example, use the following data entries:

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)=					

After entering the data, double-check all inputs to prevent calculation errors. Use the arrow keys to scroll through the lists and confirm that the numbers match the original dataset precisely. Accurate data entry is the foundational requirement for obtaining reliable regression outputs.

Step 2: Executing the Linear Regression Command

Once the data is securely entered into L1 and L2, the next step is to initiate the Linear regression computation. Begin by pressing the **STAT** key again. Instead of selecting EDIT, scroll right using the arrow keys until the **CALC** menu is highlighted. This menu contains all available statistical computation functions.

Scroll down through the CALC options until you locate **8: LinReg(a+bx)**. This function specifies the form of the regression equation the calculator will use ($y = a + bx$, where 'a' is the intercept and 'b' is the slope). Press the **ENTER** key to select this function. Note that some TI-84 models may default to 4: LinReg(ax+b); either option is acceptable, provided the user recognizes which coefficient corresponds to the slope and which corresponds to the intercept in the final output.

```
EDIT CALC TESTS
1:1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7:QuartReg
8:LinReg(a+bx)
```

The calculator will prompt the user for configuration details. Ensure that **Xlist** is set to L1 and **Ylist** is set to L2, as these hold our explanatory and response variables, respectively. The **FreqList** field should be left blank unless weighted data is being used. Finally, scroll down to **Calculate** and press **ENTER**. The TI-84 will then display the complete summary output:

```
LinReg
y=a+bx
a=68.71270718
b=5.513812155
r2=0.7198828533
r=0.8484591052
```

Step 3: Interpreting the Regression Output

The output displayed by the TI-84 calculator provides all the essential parameters needed to define the line of best fit. Based on the coefficients a and b , we can immediately formulate the estimated regression analysis equation. Using the values derived from our example, where $a \approx 68.7127$ and $b \approx 5.5138$, the estimated regression equation is constructed as follows:

$$\text{exam score} = 68.7127 + 5.5138(\text{hours studied})$$

The value of b (the slope, 5.5138) represents the expected change in the response variable (exam score) for every one-unit increase in the explanatory variable (hours studied). Therefore, we interpret this coefficient to mean that for each additional hour a student studies, their exam score is expected to increase by **5.5138** points, on average. This coefficient is the most critical element for understanding the strength and direction of the relationship.

The value of a (the intercept, 68.7127) represents the predicted exam score when the number of

hours studied is zero ($x=0$). We interpret this intercept to mean that the expected exam score for a student who performs absolutely zero hours of study is **68.7127**. While statistically correct, the intercept must always be interpreted cautiously within the context of the data range; it only makes practical sense if studying zero hours is a realistic possibility within the data collected.

Applying the Predictive Equation

Once the regression equation has been established, it can be used for predictive modeling--estimating the response variable for a given input value of the explanatory variable, provided that input value falls within the range of the original data (a concept known as interpolation). Extrapolating beyond the observed range is strongly discouraged due to potential inaccuracies.

For instance, if we wanted to predict the expected score for a student who studies for exactly three hours, we substitute $x=3$ into our derived equation:

$$\text{exam score} = 68.7127 + 5.5138*(3)$$

Performing the calculation yields: $68.7127 + 16.5414 = 85.2541$. Therefore, a student who studies for three hours is expected to receive an exam score of approximately **85.25**. This demonstrates the practical utility of the regression line.

This predictive capability is the primary objective of building a regression model. By accurately calculating the slope and intercept, the TI-84 provides a reliable mechanism for making informed estimates about the outcome variable based on inputs within the observed statistical domain.

Understanding the Coefficient of Determination (R-squared)

The regression output also includes the coefficient of determination, denoted as R^2 (r-squared). In our example, the r-squared value is $R^2 \approx \mathbf{0.7199}$. This statistic is critical for evaluating the goodness-of-fit of the model; it measures the proportion of the total variation in the response variable (exam score) that is explained by the linear relationship with the explanatory variable (hours studied).

Interpreting R^2 involves converting the decimal value to a percentage. In this specific case, 0.7199 translates to 71.99%. This means that **71.99%** of the variation observed in the exam scores can be attributed to, or explained by, the variation in the number of hours the students studied. The remaining percentage ($100\% - 71.99\% = 28.01\%$) is unexplained variation, likely due to other latent variables, such as natural ability, test anxiety, or external factors not accounted for in this model.

A higher R-squared value indicates a better fit, meaning the regression line is closer to the actual data points. While 71.99% represents a reasonably strong model fit in many social science

contexts, it is important to remember that R^2 alone does not confirm causation, only association. A high R^2 value suggests a strong predictive relationship, validating the model's use for estimation within the observed data range.

Conclusion and Further Analysis

The [TI-84 calculator](#) provides a robust and accessible platform for performing [Linear regression](#), quickly generating the necessary statistical metrics required for analysis. By systematically following the steps of data entry (L1 and L2) and command execution (STAT CALC LinReg), users can derive the predictive equation and assess its reliability using the R-squared statistic.

While the output summary is comprehensive, true statistical expertise requires moving beyond the basic coefficients. Further analysis often involves examining the residuals (the differences between the observed and predicted y-values) to check key assumptions, such as the normality of errors and homoscedasticity. The TI-84 can also be used to create residual plots, which visually confirm whether the assumptions underlying the linear model have been met. A valid regression requires not just a high R-squared, but also residuals that are randomly scattered, indicating the linear model is appropriate.

Mastering linear regression on the TI-84 ensures that students and analysts can efficiently transform raw data into actionable insights, providing a strong foundation for more complex statistical modeling and decision-making processes.

Related Statistical Resources

[How to Create a Residual Plot on a TI-84 Calculator](#)