

How to Calculate Mean Absolute Deviation (MAD) on a TI-84 Calculator: A Step-by-Step Guide

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The Mean Absolute Deviation (MAD) is a robust measure of statistical dispersion, quantifying the average distance between each data point and the mean of the data set. While modern statistical software simplifies this calculation, the TI-84 calculator remains an indispensable tool for students and professionals. Although some newer TI-84 operating systems display MAD directly in the "1-Var Stats" output, learning the precise, manual method ensures accuracy across all hardware versions and deepens understanding of the underlying statistical principles. This guide details a step-by-step process using the list functions, ensuring a quick and accurate calculation of the Mean Absolute Deviation for any given data set.

Utilizing the TI-84's list and statistical functions allows us to efficiently manage the multi-step calculation required for MAD. We will focus specifically on using list operations to calculate the absolute deviation of each observation, followed by computing the mean of those deviations. This manual approach provides significant pedagogical value, illustrating how the calculator mimics the formulaic steps of descriptive statistics. By the end of this tutorial, you will be proficient in leveraging the power of the TI-84 to obtain this critical measure of data variability.

Understanding Mean Absolute Deviation (MAD)

The mean absolute deviation serves as an intuitive metric to gauge the spread of values within a sample or population. Unlike variance or standard deviation, which square the deviations and thus amplify the effect of outliers, MAD uses absolute values, providing a measure of spread that is easily interpreted in the original units of the data. Essentially, it answers the question: "On average, how far does each point in the data set lie from the central tendency?"

A statistical measure of dispersion is crucial for understanding data quality and reliability. If the MAD value is relatively low, it signifies that the individual observations are tightly clustered around the mean value, suggesting consistency and low variability. Conversely, a high MAD value indicates that the data points are more scattered and spread out, pointing to greater heterogeneity within the sample. Interpreting this value is often more straightforward than interpreting variance due to its direct relationship with the measurement units.

The methodology we employ on the TI-84 calculator follows the precise mathematical definition of MAD. We begin by finding the mean of the data, then calculate the absolute difference between each data point and this mean, and finally, we average these absolute differences. This systematic procedure, which we will replicate using the calculator's list operations, ensures an accurate reflection of the data's dispersion.

The Mathematical Foundation of MAD

To ensure a clear understanding of the calculator steps, it is essential to review the formal

definition of the Mean Absolute Deviation. The MAD is calculated using the following formula, which represents the summation of all absolute deviations divided by the total number of observations:

$$\text{Mean Absolute Deviation} = (\sum |x_i - \bar{x}|) / n$$

Each component of this formula corresponds directly to a step we will execute on the TI-84, ensuring that the calculator yields the correct statistical result. The use of absolute value bars ensures that negative deviations (points below the mean) do not cancel out positive deviations (points above the mean), which is fundamental to measuring spread effectively.

Σ : This Greek letter, Sigma, represents the operation of summing all subsequent terms. In this context, it means summing all the individual absolute deviations.

x_i : This denotes the i th individual data value or observation within the data set.

\bar{x} : This symbol represents the arithmetic mean of the entire data set, which serves as the central reference point.

n : This represents the total sample size or the number of data points being analyzed.

We will apply these principles to the following example data set to illustrate the calculation process on the TI-84 calculator. Our goal is to find the average dispersion for this specific sequence of values.

Example Dataset: 8, 13, 14, 16, 19, 24

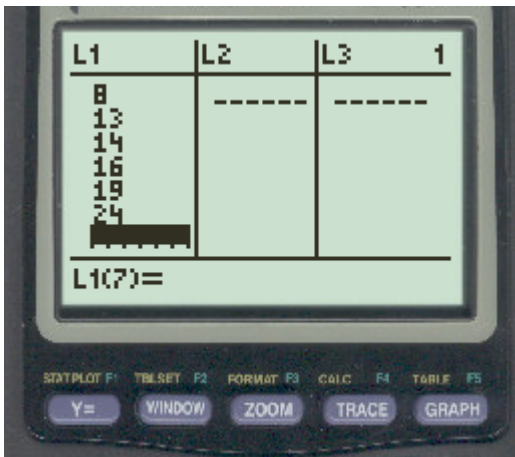
Step 1: Accessing the Statistical Editor and Inputting Data

The first critical step in any statistical calculation on the TI-84 is to correctly enter the raw data into one of the designated statistical lists. This requires accessing the STAT menu and selecting the Edit function, which opens the List Editor interface. Using the list editor is essential because it allows us to store the data and then apply various statistical operations to the list as a whole, rather than calculating each deviation individually.

To begin, press the STAT button located beneath the menu row. Use the navigation arrows to ensure that the EDIT option is highlighted, then press ENTER. This action opens the list editor where data is organized into columns labeled L1, L2, L3, and so forth. If there is existing data in L1, you should clear it by navigating up to highlight the L1 label, pressing CLEAR, and then pressing ENTER. Ensure you do not press DEL as this will delete the entire list column.

We now enter the values from our example data set (8, 13, 14, 16, 19, 24) sequentially into column L1, pressing ENTER after each entry. It is crucial to verify that every data point is entered correctly, as an input error will invalidate the final result. Once all six values are entered, your calculator screen should display a setup similar to the accompanying image, confirming that the data is ready

for the next phase of calculation.



Step 2: Defining Absolute Deviation

Once the raw data is housed in L1, the subsequent step in calculating the MAD is determining the absolute deviation of each observation from the mean. Instead of manually calculating the mean and then subtracting it from every element in L1, the TI-84 allows us to use a dynamic formula within the List Editor. This powerful feature automatically applies the necessary calculation across the entire list, providing substantial efficiency.

We need to instruct the calculator to perform the operation:

$$|x_i - \text{mean}(x)|$$

for every value in L1. The result of this calculation--the list of absolute deviations--will be stored in the adjacent column, L2. This is where the true power of the graphing calculator is leveraged, automating complex, repetitive calculations. We will define this formula at the top of the L2 column, ensuring the formula is applied to every corresponding element in L1.

To define the calculation, navigate up and highlight the label L2. The input line at the bottom of the screen will now display the formula you are typing. We must input the formula: `=abs(L1 - mean(L1))`. This single line of code tells the calculator to take the list L1, subtract the calculated mean of L1 from every element in L1, and then take the absolute value of all those differences. This resulting list, stored in L2, is the complete set of absolute deviations.

Step 3: Constructing the Absolute Deviation Formula in L2

Inputting the formula `=abs(L1 - mean(L1))` requires specific keystrokes to access the built-in

functions for absolute value and mean. Accuracy in these steps is crucial for ensuring the list L2 populates correctly with the absolute deviations.

To begin, highlight the L2 column header. Then, carefully follow these steps to construct the required formula:

=abs(L1 - mean(L1))

Accessing the Absolute Value Function: Press 2nd, then press 0 (Catalog). Scroll down to find and select abs(, or use the shortcut by pressing MATH, then right arrow to NUM, and select option 1. This inputs **abs(** into the formula line.

Entering the Data List L1: Press 2nd, then press 1. This inputs **L1**. The formula now reads **abs(L1**.

Inputting the Subtraction Operator: Press the minus - button. The formula now reads **abs(L1-**.

Accessing the Mean Function: Press 2nd, then press STAT (List). Scroll over using the right arrow key to the "MATH" submenu and then press 3 to select the **mean(** function. The formula now reads **abs(L1-mean(**.

Specifying the List for Mean Calculation: Press 2nd, then press 1 to input **L1** again. The formula now reads **abs(L1-mean(L1**.

Closing the Parentheses: Press) twice to close both the **mean()** function and the outer **abs()** function. The final, complete formula is **abs(L1-mean(L1))**.

Pressing ENTER executes the formula, and L2 will instantaneously populate with the corresponding absolute deviations for every data point in L1. This completed step confirms the deviations are calculated correctly, setting the stage for the final averaging step.



Step 4: Executing the Final MAD Calculation

The final step in determining the Mean Absolute Deviation is calculating the average of the values

stored in L2, which currently contains all the absolute deviations. Since the MAD is defined as the mean of the absolute deviations, we simply need to use the calculator's `mean()` function on list L2. This calculation must be performed on the home screen, outside of the List Editor.

To prepare for this final computation, press `2nd` and then press `MODE (QUIT)` to return to the calculator's standard home screen. This ensures that the `mean()` command is executed immediately rather than being assigned to a list column.

Now, execute the `mean(L2)` command:

Accessing the Mean Function: Press `2nd` and then press `STAT (List)`. Scroll over using the right arrow key to the "MATH" submenu and then press `3` to select `mean(`.

Specifying List L2: Press `2nd` and then press `2` to input `L2`.

Closing the Parentheses: Press the `)` button to complete the command: `mean(L2)`.

Once the full command `mean(L2)` is displayed on the home screen, press `ENTER`. The resulting numerical output is the Mean Absolute Deviation for the original data set.



Interpreting the Final Result

For our example data set (8, 13, 14, 16, 19, 24), the TI-84 calculator returns a value of **4** as the final result of the `mean(L2)` calculation. This numerical output represents the Mean Absolute Deviation. This value is a crucial summary statistic that quantifies the typical extent of variability within the data relative to its central point.

The resulting MAD value of 4 means that the average distance between any individual data point in our set and the arithmetic mean (which is 15.67, though not explicitly needed for the final step) is 4 units. This measure provides a reliable baseline for assessing consistency; if a different data set measured in the same units yielded a MAD of 8, we would immediately know that the second set

has twice the dispersion or spread as the first set.

Understanding the calculated MAD is essential for comparative statistics. The calculation performed using the list functions of the TI-84 calculator provides not only an accurate result but also a clear methodology that can be applied to any size data set. This systematic approach ensures that even without advanced statistical software, accurate measures of data dispersion are readily available for analysis and decision-making.

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