

Learning to Calculate Binomial Probabilities Using a TI-84 Calculator

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November 8, 2025

RECOMMENDED CITATION

Mohammed loot (2025). *Learning to Calculate Binomial Probabilities Using a TI-84 Calculator*. PSYCHOLOGICAL STATISTICS. Retrieved from <https://statistics.arabpsychology.com/?p=13286>

The [Binomial Distribution](#) stands as one of the most foundational and frequently utilized discrete probability distributions within the field of [Statistics](#). This powerful model enables students and researchers to accurately analyze situations characterized by a fixed series of independent trials, where each trial yields only two possible results: a designated success or a designated failure. For anyone navigating introductory or advanced statistical coursework, mastering the swift and accurate calculation of these probabilities is absolutely essential. This comprehensive tutorial is dedicated to guiding you through the effective use of the integrated functions available on the [TI-84 calculator](#), allowing for efficient determination of binomial probabilities without the need for laborious manual application of complex formulas.

The TI-84 graphing calculator significantly simplifies these statistical computations by providing two specialized functions tailored specifically for the Binomial Distribution. A critical first step in mastering this process is clearly understanding the conceptual difference between these two core functions: the probability density function (PDF) and the cumulative distribution function (CDF). Proper application requires the user to input specific, well-defined parameters that govern the distribution of interest, ensuring that the resulting [Probability](#) accurately models the scenario under investigation. The subsequent sections will meticulously detail how to access, distinguish, and correctly apply both the PDF and CDF functions.

The TI-84 provides the following essential functions for binomial probability calculations:

[binompdf](#)(**n**, **p**, **x**) calculates the probability associated with the exact outcome ($P(X = x)$), representing the [Binomial Probability Mass Function \(PMF\)](#) for a discrete variable.

[binomcdf](#)(**n**, **p**, **x**) calculates the cumulative probability ($P(X \leq x)$), which represents the sum of probabilities from zero up to the specified number of successes, utilizing the [Binomial Cumulative Distribution Function \(CDF\)](#).

To define the specific scenario for the TI-84, the following parameters are required for both functions:

n = The total number of fixed, **independent trials** or observations comprising the statistical experiment.

p = The fixed, constant probability of success occurring on any given trial (expressed as a decimal).

x = The specific number of successes that the calculation is focused on.

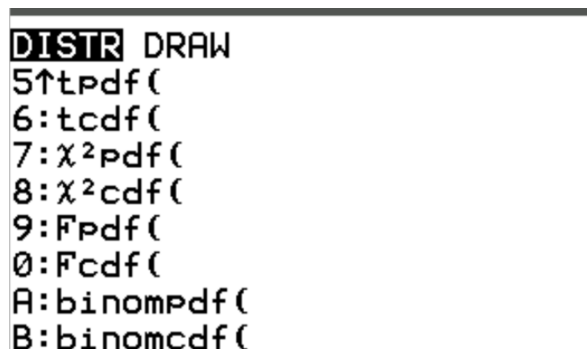
Accessing the Binomial Probability Functions on the TI-84

The design of the TI-84 calculator centralizes all statistical distributions within a single, dedicated menu. This organization makes the binomial functions highly accessible, provided you understand

the required navigation sequence. Familiarity with accessing this menu is vital, as it is the gateway not only to binomial calculations but also to other essential distributions frequently used in statistical analysis, such as the Normal, Poisson, and Geometric distributions.

To initiate access to the distribution menu, press the standard secondary function key, labeled 2nd. Immediately after, you must press the key labeled vars. While the vars key is primarily associated with variable memory functions, pressing it in conjunction with the 2nd key activates the specialized **DISTR** (Distribution) menu. Once inside this menu, you will need to scroll down through the extensive list of distributions until you find the required **binompdf()** (usually option A) and **binomcdf()** (usually option B) options, listed sequentially among the discrete and continuous models.

Upon selection of the desired function, the calculator will transition to a prompt screen, requiring you to enter the precise values for **n** (number of trials), **p** (probability of success), and **x** (number of successes). It is absolutely crucial to input the probability **p** using its decimal equivalent (e.g., convert 60% into 0.60). The visual aid below provides context by illustrating the typical location of these essential functions within the calculator's hierarchical menu structure, helping to guide users through the initial setup process:



```
DISTR DRAW
5:tpdf(
6:tcdf(
7:χ²pdf(
8:χ²cdf(
9:Fpdf(
0:Fcdf(
A:binompdf(
B:binomcdf(
```

The following detailed, practical examples serve to bridge the gap between theoretical knowledge and real-world application. By using a consistent scenario, we will demonstrate the exact methodology required to apply both **binompdf()** and **binomcdf()** effectively, addressing diverse statistical questions that rely on the Binomial Distribution.

Case Study 1: Calculating the Probability of Exactly X Successes (binompdf)

The most straightforward calculation within the framework of the Binomial Distribution involves determining the exact probability of achieving a specific, single number of successes. This is mathematically expressed as $P(X = x)$. This specific calculation is handled exclusively by the **binompdf** function, where PDF stands for Probability Density Function (or more accurately, the Probability Mass Function for discrete variables).

Scenario Question: Consider Nathan, a basketball player known for a consistent free-throw success rate of 60%. If Nathan attempts a total of 12 free throws during a dedicated practice session, what is the precise probability that he successfully makes exactly 10 of those shots?

To solve this, we must first clearly define our parameters: the total number of independent trials (n) is 12; the constant probability of success (p) is 0.60; and the specific number of successes sought (x) is 10. Since the goal is to find the probability of a single, discrete outcome (exactly 10 successes), the **binompdf** function is the required tool for this calculation.

Calculation and Result: We input the parameters directly into the function **binompdf(n , p , x)**:

$$\text{binomialpdf}(12, .60, 10) = 0.0639$$

The resulting value shows that there is approximately a 6.39% chance that Nathan will successfully sink precisely 10 out of his 12 attempted free throws. This calculation represents the height of the distribution curve at that single point, confirming the utility of the PDF function for exact values.

Case Study 2: Calculating Cumulative Probabilities (Less Than or At Most)

In practical statistics, interest often lies not in a single outcome, but in the probability associated with a range of possible outcomes. This requirement necessitates the use of the Cumulative Distribution Function (CDF). The **binomcdf** function is designed to calculate the probability of obtaining "x or fewer" successes, which is mathematically denoted as $P(X \leq x)$. This function accumulates all probabilities from zero up to the specified value of x .

When calculating the probability of "less than x" successes, expressed as $P(X < x)$, a subtle but critical adjustment must be made due to the **discrete nature** of the Binomial Distribution (i.e., outcomes must be whole numbers). The probability of making less than 10 shots is mathematically identical to the probability of making 9 shots or fewer, $P(X \leq 9)$. This adjustment--shifting the upper bound down by one--is fundamental to correctly utilizing the CDF function when dealing with strict inequalities.

Scenario Question (Less Than): Continuing with Nathan's 60% free-throw rate over 12 shots, determine the probability that he achieves less than 10 free throws (meaning he makes 0, 1, 2, ..., up to 9 shots).

Calculation (Less Than): We must calculate $P(X \leq 9)$, requiring the function **binomialcdf(n , p , $x-1$)**:

$$\text{binomialcdf}(12, .60, 9) = 0.9166$$

This result indicates a relatively high probability (91.66%) that Nathan will make 9 or fewer free throws. Next, we consider the "at most" case, which represents the direct application of the CDF function.

Scenario Question (At Most): What is the probability that Nathan makes at most 10 free throws (meaning $X \leq 10$)?

Calculation (At Most): This scenario is a direct application of the CDF, where $x = 10$. We use the function **binomialcdf(n, p, x)**:

$$\text{binomialcdf}(12, .60, 10) = 0.9804$$

In summary, remember that **binomcdf(n, p, x)** inherently solves for $P(X \leq x)$. Therefore, for strict inequalities such as $P(X < x)$, you must always input the value of $x-1$ into the function's x parameter.

Case Study 3: Calculating Inverse Cumulative Probabilities (More Than or At Least)

When a statistical query requires calculating the probability of achieving "more than x " or "at least x " successes, we must rely on the [complement rule](#) of [Probability](#) theory. The complement rule is necessary because the **binomcdf** function is only designed to calculate cumulative probabilities starting from zero ($P(X \leq x)$). To find the probability of events above a certain threshold, we use the principle that the probability of an event occurring is equal to 1 minus the probability of the event not occurring, $P(A) = 1 - P(A')$.

Scenario Question (More Than): What is the probability that Nathan makes more than 10 free throws (i.e., $X > 10$)?

The outcomes satisfying $X > 10$ are 11 or 12 successes. The complement set that covers all other possibilities is $X \leq 10$. Therefore, the calculation required is $P(X > 10) = 1 - P(X \leq 10)$. This means we must use the **binomcdf** function with the parameter x set to 10.

Calculation (More Than): Use the function **1 - binomialcdf(n, p, x)**:

$$1 - \text{binomialcdf}(12, .60, 10) = 1 - 0.9804 = 0.0196$$

This calculation reveals a low probability (1.96%) of Nathan achieving 11 or 12 successful free throws.

Scenario Question (At Least): What is the probability that Nathan makes at least 10 free throws (i.e., $X \geq 10$)?

The required outcomes for $X \geq 10$ are 10, 11, or 12 successes. The complement set is $X < 10$, which, given the discrete nature of the data, is equivalent to $X \leq 9$. Therefore, the formula becomes $P(X \geq 10) = 1 - P(X \leq 9)$. We must utilize the **binomcdf** function, setting the upper limit parameter x to 9.

Calculation (At Least): Use the function **1 - binomialcdf(n, p, x-1)**:

$$1 - \text{binomialcdf}(12, .60, 9) = 1 - 0.9166 = 0.0834$$

This result demonstrates an 8.34% chance that Nathan will sink 10 or more free throws. Accurate computation of all probability ranges is ensured by the proper application of the complement rule, combined with a robust understanding of the discrete properties inherent in the Binomial Distribution, all facilitated by the powerful functions built into the [TI-84 calculator](#).