

Learning to Calculate the 90th Percentile in Excel: A Step-by-Step Guide

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Grasping the Power and Precision of the 90th Percentile

The [percentile](#) is a cornerstone concept in [descriptive statistics](#), providing an immediate and clear way to quantify the distribution of values within any given [dataset](#). Specifically, the 90th percentile defines the critical threshold below which 90 percent of all observations fall. By extension, it stands as the demarcation point that separates the bottom 90 percent of data values from the crucial top 10 percent, assuming the entire collection of data points has been meticulously sorted from the minimum to the maximum value.

Understanding and calculating the 90th percentile is vital across numerous professional disciplines, including quantitative finance, rigorous quality control, and detailed educational assessment. For instance, in performance engineering and latency measurement, the 90th percentile of response times (often denoted as P90) provides a far more meaningful measure of user experience than a simple arithmetic mean. It quantifies the maximum delay experienced by the vast majority (90%) of users, offering a robust metric that is less susceptible to distortion by a few extreme outliers or anomalous maximum values.

When dealing with large volumes of numerical data within a powerful spreadsheet environment like [Excel](#), determining this statistical measure is highly efficient due to specialized, built-in functions. These functions are sophisticated enough to handle the necessary mathematical [interpolation](#) required when the exact 90th percentile value does not align perfectly with an existing data point within the collected observations. This automation ensures accuracy and consistency regardless of the data scale.

Selecting the Correct Excel Function for Percentile Calculation

To accurately calculate the 90th percentile of a [dataset](#) in [Excel](#), users are generally presented with a choice of three function variants. While the original syntax is maintained for necessary backward compatibility, modern versions of Excel introduced explicit suffixes (like .INC and .EXC) to clearly define how the calculation handles boundary conditions--specifically, whether the percentile calculation includes or excludes the 0% and 100% bounds.

For calculating percentiles that are ****inclusive**** of the 0 and 1 boundaries (meaning the function can return the minimum or maximum value of the data range), the following functions are utilized:

=PERCENTILE(array, k): The original function, maintained for legacy support.

=PERCENTILE.INC(array, k): The preferred, modern function that is functionally identical to the original.

It is strongly recommended that analysts use **PERCENTILE.INC** in contemporary spreadsheets, as it clearly communicates the calculation methodology. Both the legacy **PERCENTILE** and the

modern **PERCENTILE.INC** utilize the same statistical algorithm and are suitable for nearly all standard applications where the percentile calculation must encompass the full range of observed values.

In contrast, the function **=PERCENTILE.EXC(array, k)** is designed for calculating percentiles that are ****exclusive**** of the 0 and 1 bounds. This means it only calculates values between 0% and 100%, and will not return the absolute minimum or maximum data point. Unless a specific statistical methodology explicitly mandates the exclusive method, the inclusive functions (**PERCENTILE** or **PERCENTILE.INC**) should always be selected when seeking the 90th [percentile](#).

Defining the Syntax: Array and K Arguments

Successful execution of percentile functions hinges on correctly supplying the two primary arguments required by both **PERCENTILE** and **PERCENTILE.INC**. These arguments define both the scope of the data to be analyzed and the specific quantile being sought.

The first argument is the ****array****, which refers to the contiguous range of numerical data values in your [dataset](#). This [array](#) argument must enclose all the scores, measurements, or observations that need analysis. For example, if you are analyzing a column of test scores located in cells A1 through A20, your [array](#) range input would be designated as `A1:A20`.

The second argument, denoted as ****k****, specifies the target [percentile](#) that the function must calculate. It is crucial that this value is entered as a decimal fraction between 0 and 1 (inclusive for the INC version). To find the 90th percentile, the ****k**** argument must be set to **0.9**. Likewise, if you needed the 25th percentile, you would enter 0.25, and the median (50th percentile) would be represented by 0.5. Entering a value for k outside the 0 to 1 range will trigger an error, which is a common oversight for new users.

To calculate the 90th percentile for the student scores listed in A1:A20, the fully formed function call using the modern, inclusive syntax is: `=PERCENTILE.INC(A1:A20, 0.9)`. This formula precisely instructs [Excel](#) to determine the boundary value within the specified range that successfully separates the top 10% of results from the lower 90%.

A Practical Demonstration with Student Examination Data

To solidify the understanding of the percentile function, let us examine a concrete scenario involving the final examination results of 20 students. Our objective is to calculate the 90th percentile score, establishing the minimum benchmark required to be categorized among the top-performing students in the cohort.

The following [dataset](#) of raw scores has been systematically entered into an [Excel](#) spreadsheet,

ready for analysis:

| | A | B | C | D | E | F | G |
|----|-------------------|---|---|---|---|---|---|
| 1 | Exam Score | | | | | | |
| 2 | 65 | | | | | | |
| 3 | 67 | | | | | | |
| 4 | 68 | | | | | | |
| 5 | 68 | | | | | | |
| 6 | 70 | | | | | | |
| 7 | 74 | | | | | | |
| 8 | 78 | | | | | | |
| 9 | 80 | | | | | | |
| 10 | 81 | | | | | | |
| 11 | 81 | | | | | | |
| 12 | 81 | | | | | | |
| 13 | 82 | | | | | | |
| 14 | 83 | | | | | | |
| 15 | 84 | | | | | | |
| 16 | 87 | | | | | | |
| 17 | 88 | | | | | | |
| 18 | 93 | | | | | | |
| 19 | 94 | | | | | | |
| 20 | 95 | | | | | | |
| 21 | 97 | | | | | | |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | | | | | | | |
| 25 | | | | | | | |
| 26 | | | | | | | |

Assuming these scores occupy the range from cell B2 down to cell B21, we proceed by implementing the **PERCENTILE.INC** function. The formula is placed into a designated output cell (e.g., cell E2) to clearly display the calculated result:

| | A | B | C | D | E | F | G | H |
|----|-------------------|---|------------------------|------------------------------|---|---|---|---|
| 1 | Exam Score | | 90th percentile | | | | | |
| 2 | 65 | | 94.1 | =PERCENTILE.INC(A2:A21, 0.9) | | | | |
| 3 | 67 | | | | | | | |
| 4 | 68 | | | | | | | |
| 5 | 68 | | | | | | | |
| 6 | 70 | | | | | | | |
| 7 | 74 | | | | | | | |
| 8 | 78 | | | | | | | |
| 9 | 80 | | | | | | | |
| 10 | 81 | | | | | | | |
| 11 | 81 | | | | | | | |
| 12 | 81 | | | | | | | |
| 13 | 82 | | | | | | | |
| 14 | 83 | | | | | | | |
| 15 | 84 | | | | | | | |
| 16 | 87 | | | | | | | |
| 17 | 88 | | | | | | | |
| 18 | 93 | | | | | | | |
| 19 | 94 | | | | | | | |
| 20 | 95 | | | | | | | |
| 21 | 97 | | | | | | | |
| 22 | | | | | | | | |
| 23 | | | | | | | | |
| 24 | | | | | | | | |
| 25 | | | | | | | | |
| 26 | | | | | | | | |
| 27 | | | | | | | | |

Upon execution of the formula `=PERCENTILE.INC(B2:B21, 0.9)`, the output generated by [Excel](#) is **94.1**. This interpolated value is the precise 90th [percentile](#) for the provided examination scores.

Interpreting the Result and Handling Edge Cases

The calculated value of **94.1** provides a powerful interpretation tool in the context of academic performance. It definitively establishes the minimum score a student must achieve to be classified within the top decile (the highest 10%) of all students who took the exam. Therefore, any student whose score is 94.1 or higher has statistically outperformed 90% of their peers in the course.

Beyond education, this analytical approach is fundamental in operational settings. For instance, companies often use the 90th percentile to define stringent Service Level Agreements (SLAs). If an SLA dictates that 90% of customer tickets must be resolved within a specific time frame, the P90 calculation of resolution times allows management to verify compliance and identify operational bottlenecks that affect the top 10% of cases.

When utilizing these functions, it is essential to be aware of two common error types. First, the

argument for **k** must strictly fall between 0 and 1. Inputting an invalid value, such as 1.5 or -0.2, will immediately trigger a **#NUM!** error. Second, the user must ensure that the data within the [array](#) argument is numeric. If the [dataset](#) contains any non-numeric entries (text or symbols), the function will return a **#VALUE!** error, indicating a data type mismatch.

A crucial nuance of [Excel](#)'s percentile functions is that they automatically handle data sorting internally. Although the student score list was visually presented in a sorted order for clarity in the example, the user does not need to manually sort the source data range. The function correctly sorts the values and performs the necessary interpolation regardless of the initial arrangement of the data points within the spreadsheet.

Expanding Analysis: Quartiles and Other Quantiles

While the 90th percentile is frequently used for high-performance benchmarking, the percentile functions in [Excel](#) provide the flexibility to calculate any quantile required for a complete statistical profile.

Among the most frequently requested percentiles are the 25th, 50th (median), and 75th percentiles. These three values are collectively known as [quartiles](#), which effectively divide the [dataset](#) into four equal segments. For these specific values, Excel offers a dedicated function that simplifies the input process compared to using the general percentile function:

=QUARTILE.INC(array, quart): This function calculates the desired quartile, where the second argument `quart` is an integer ranging from 1 to 4.

The value of `quart` corresponds to: 1 (25th percentile), 2 (50th percentile/median), 3 (75th percentile), or 4 (100th percentile/maximum).

Functionally, this specialized quartile function is mathematically consistent with **PERCENTILE.INC**, providing a convenient shortcut for calculating these common distribution points.

By mastering the use of the **PERCENTILE.INC** function, analysts can accurately define performance boundaries, gain critical insights into data distribution skewness, and generate robust statistical summaries, whether they are focused on establishing the 90th [percentile](#) for high-end performance, or the 10th percentile for identifying low-end thresholds.