

How to Easily Calculate the 90th Percentile in Excel

Authored by
stats writer

December 5, 2025

RECOMMENDED CITATION

stats writer (2025). *How to Easily Calculate the 90th Percentile in Excel*. PSYCHOLOGICAL SCALES. Retrieved from <https://scales.arabpsychology.com/?p=105467>

Calculating the **90th percentile** is a fundamental step in various forms of statistical analysis, particularly when evaluating performance, risk, or resource allocation. The 90th percentile serves as a critical threshold, identifying the value below which 90 percent of observations fall. Mastering this calculation in Excel is essential for anyone working with large **data sets**.

While the process is straightforward, choosing the correct Excel function--specifically navigating the differences between `PERCENTILE.INC` and `PERCENTILE.EXC`--is crucial for ensuring accurate results. This comprehensive guide provides an in-depth, formal explanation of how to leverage Excel's powerful statistical functions to determine the 90th percentile precisely, along with practical examples and contextual notes for professional application.

Understanding the 90th Percentile Concept

The concept of a percentile provides a measure used in statistics indicating the value below which a given percentage of observations in a group of observations fall. Specifically, the **90th percentile** is the score or value that separates the bottom 90% of the distribution from the top 10%. If you score at the 90th percentile on a standardized test, it means your score is higher than 90% of the scores achieved by others who took the test.

In practical business and scientific applications, the 90th percentile is frequently used to establish benchmarks. For instance, network engineers often use it to define acceptable levels of latency or bandwidth usage, ensuring that performance meets the requirements for 90% of all users during peak times. Similarly, in finance, it might be used to assess risk, defining the worst-case scenario that occurs only 10% of the time. Recognizing this value allows analysts to focus attention on the extreme 10% of data points that exceed this threshold, which are often indicative of outliers or high-performance metrics.

Before proceeding with calculations in Excel, it is necessary to organize the input data, or the **array**, into a structured format within the spreadsheet. While Excel's functions do not strictly require the data to be sorted beforehand, having a clean, continuous range of values ensures clarity and minimizes the risk of calculation errors. The ability to quickly determine the 90th percentile provides significant analytical advantages, allowing for rapid decision-making based on robust statistical measures.

Selecting the Appropriate Excel Percentile Function

Excel provides three primary functions for calculating percentiles, each derived from slightly different methodological approaches: `PERCENTILE` (the legacy function), `PERCENTILE.INC`, and `PERCENTILE.EXC`. While the original content mentioned using `PERCENTILE.EXC`, the recommended and most commonly used function for general statistical analysis today is `PERCENTILE.INC`, as it aligns with common definitions that include the endpoints (0 and 1).

The function `=PERCENTILE(array, k)` is the older version, but it remains fully functional and is mathematically identical to `=PERCENTILE.INC(array, k)`. Both of these functions calculate the percentile rank inclusive of the 0th and 100th percentiles, meaning that the input value for **k** (the percentile) can range from 0 to 1, including both 0 and 1 themselves. For finding the 90th percentile, we set **k** equal to 0.9. This inclusive method is generally preferred because it covers the entire range of possibilities within the **data set**.

Conversely, the `=PERCENTILE.EXC(array, k)` function calculates the percentile exclusive of the 0th and 100th percentiles. This means that **k** must be strictly greater than 0 and strictly less than 1 ($0 < k < 1$). This function is less common in standard descriptive statistics but can be useful in specific fields where interpolation requires avoiding the boundary values. Because its results might differ slightly from the inclusive method, particularly with smaller **arrays**, careful consideration must be given to which definition best suits the context of the statistical analysis being performed.

To summarize the available functions:

=PERCENTILE(array, k): Legacy function, inclusive calculation (k can be 0 to 1).

=PERCENTILE.INC(array, k): The modern standard for inclusive calculation (k can be 0 to 1). This is generally the default choice.

=PERCENTILE.EXC(array, k): Exclusive calculation (k must be between 0 and 1). Use only when the exclusive method is explicitly required.

Defining the Syntax and Arguments

Regardless of the function chosen, the syntax required for all three percentile functions in Excel is extremely straightforward, requiring only two mandatory arguments: `=FUNCTION_NAME(array, k)`.

The first argument, **array**, refers to the range of cells containing the quantitative **data values** for which the percentile is being calculated. This range must contain numerical data; any text or logical values within the range will be ignored, potentially leading to inaccurate results if data is misrepresented. For example, if your student scores are listed in cells B2 through B21, the array argument would be defined as **B2:B21**. It is essential that this range be clearly defined and contain all observations pertinent to the study.

The second argument, **k**, represents the percentile coefficient expressed as a decimal value between 0 and 1. Since our objective is to determine the **90th percentile**, the value used for **k** will be **0.9**. It is critical to use the decimal format; entering '90' or '90%' will cause Excel to return an error, specifically the **#VALUE!** error, because the function expects a numeric value between 0 and 1. This parameter controls the specific point in the data distribution that the function seeks to identify.

If we decide to use the standard inclusive method, the formula structure for calculating the 90th percentile of data located in cells A1 to A50 would look like this:

```
=PERCENTILE.INC(A1:A50, 0.9)
```

Executing this command will instruct Excel to sort the data internally, locate the value corresponding to the 90th percentile position based on a weighted average calculation (interpolation), and then return that final numerical result to the cell containing the formula.

Detailed Example: Calculating Student Exam Scores

To solidify the understanding of these functions, let us walk through a practical scenario involving educational data. Suppose we are tasked with analyzing the final exam scores of 20 students in a college course. We wish to identify the 90th percentile score to determine the minimum score required for a student to be considered in the top 10% of the class performance.

First, the scores must be meticulously entered into the Excel spreadsheet. We will assume the scores range from 55 to 100 and occupy cells B2 through B21 in our worksheet. This represents our primary **data set** or **array**.

We will use the `PERCENTILE.INC` function for this calculation, as it is the industry standard for inclusive statistical measurement. The formula is structured by referencing the array (B2:B21) and setting the percentile coefficient (k) to 0.9.

Suppose we have the following dataset that shows the final exam scores of 20 students in a particular class:

	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							

To obtain the result, we enter the following precise formula into an empty cell (e.g., cell D2):

=PERCENTILE.INC(B2:B21, 0.9)

Upon execution, Excel processes the **array**, determines the interpolated value at the 90th position, and returns the result. Visualizing this step in the spreadsheet confirms the implementation:

	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								

Interpreting the Calculation Results

Following the execution of the function using the provided student score data, the calculated 90th percentile is determined to be **94.1**. This numerical result carries significant analytical weight and must be interpreted correctly within the context of the study.

The result 94.1 signifies that 90% of the students in the class received a score equal to or less than 94.1. Conversely, only 10% of the students scored higher than 94.1 on the final exam. This value acts as a performance benchmark. If a new student scores 95, they have performed better than 90% of their peers; if a student scores 90, they fall within the bottom 90% of the distribution.

It is important to understand that the percentile value calculated by Excel--like 94.1 in this instance--may not necessarily be a value that actually exists within the original **data set**. Excel uses a method called linear interpolation when the exact position of the desired percentile falls between two existing data points. Percentiles are statistical estimates, and interpolation ensures that the calculated value accurately reflects the distribution of the data, even when the data is discrete.

This calculated value is critical for making informed decisions. For instance, an instructor might use this score to set a performance goal for high-achieving students or to identify potential criteria for granting special recognition, focusing attention only on those who meet or exceed this high threshold.

Key Considerations for Accurate Percentile Calculation

While the functions are powerful, there are several key notes and potential pitfalls that users must keep in mind to ensure the accuracy and validity of their statistical analysis when using Excel's percentile functions.

The Range of k: The primary constraint on the percentile coefficient (k) is that it must be a numerical value between 0 and 1, inclusive (for `.INC`) or exclusive (for `.EXC`). Entering a percentage (e.g., 90%) or a number outside this range (e.g., 2) will immediately trigger an error. Always use the decimal representation of the desired percentile (e.g., 0.9 for the 90th percentile).

Handling Non-Numeric Data: The `array` argument must consist of numbers. If you attempt to enter text, dates formatted as text, or other non-numeric characters for k, Excel will return the `#VALUE!` error, indicating an incorrect data type input. If the **array** contains non-numeric cells, those cells will be ignored, but the overall calculation might still run, potentially misleading the user if key data points were excluded.

Sorting is Optional: A common misconception is that the input **data set** must be sorted from lowest to highest before applying the percentile function. This is incorrect. Excel's statistical functions handle the internal sorting and ranking necessary for the calculation automatically. While sorting the data manually can aid in visual inspection and verification, it is not a prerequisite for the functions (`PERCENTILE`, `PERCENTILE.INC`, or `PERCENTILE.EXC`) to operate correctly.

Distinction between .INC and .EXC: As datasets become larger, the difference between the results produced by `PERCENTILE.INC` and `PERCENTILE.EXC` typically diminishes. However, with small arrays, the difference can be significant. Analysts should always confirm which definition (inclusive or exclusive) is standard practice within their specific industry or academic field before publishing results.

Advanced Applications of the 90th Percentile

Beyond simple academic score analysis, the calculation of the **90th percentile** finds critical use in various advanced analytical domains. Understanding these applications enhances the value of mastering the Excel functions.

In **Quality Control and Manufacturing**, the 90th percentile might define the maximum acceptable

size or weight for 90% of manufactured goods, ensuring consistency. If a component dimension exceeds the 90th percentile threshold, it might signal an efficiency loss or potential defect in the top 10% of production runs, necessitating process adjustments.

In **Network Performance Monitoring**, the 90th percentile is a standard metric for measuring service level agreements (SLAs). For example, if a company guarantees that network latency will be below 50ms for 90% of connections, the 90th percentile calculation provides the exact latency value. If this calculated value is 55ms, the SLA has been breached, signaling poor quality of service for the top 10% of requests.

In **Financial Risk Management**, analysts frequently use percentiles to calculate Value at Risk (VaR). The 90th percentile of historical loss data, for instance, provides a conservative estimate of the maximum loss expected to occur 90% of the time. This helps institutions reserve adequate capital against unexpected, though still probable, downturns. The versatility of the `PERCENTILE.INC` function makes it a cornerstone tool for handling large, complex financial **arrays** effectively.

Troubleshooting Common Excel Errors

When working with percentile functions, users may encounter several standard Excel errors. Knowing how to troubleshoot these ensures a smooth analytical workflow.

#VALUE! Error: This error almost always indicates a problem with the data type. Check the `k` argument first; ensure it is a numerical decimal (e.g., 0.9) and not text (e.g., "0.9") or a percentage (e.g., 90%). Next, verify that the array range contains only numerical data relevant to the calculation. If text is accidentally included in the data range, the calculation may proceed but if text is used for `k`, the error will appear.

#NUM! Error: This error typically arises when the relationship between the arguments is mathematically impossible or when the array is invalid. For the `PERCENTILE.EXC` function, the **#NUM!** error will appear if `k` is less than or equal to 0 or greater than or equal to 1. For both functions, if the specified array is empty or contains fewer than two data points, this error may also be returned, as statistical interpolation requires a minimum number of observations.

Incorrect Result Due to Missing Data: While not a formal Excel error code, obtaining an incorrect percentile value often stems from referencing an incomplete or incorrect **data set**. Before calculating the percentile, always visually confirm the exact range used in the formula (e.g., B2:B21) matches the entirety of the intended observations. Missing even one data point can significantly skew the calculated 90th percentile, especially in small samples.