

# How to Convert Z-Scores to Percentiles and Percentiles to Z-Scores in Excel

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March 10, 2026

## RECOMMENDED CITATION

stats writer (2026). *How to Convert Z-Scores to Percentiles and Percentiles to Z-Scores in Excel*. PSYCHOLOGICAL SCALES. Retrieved from <https://scales.arabpsychology.com/?p=134937>

Navigating the complexities of statistical analysis often requires converting abstract numerical values into relatable rankings. Within the environment of **Microsoft Excel**, the ability to translate a **z-score** into a **percentile**, and vice versa, is an essential skill for researchers, students, and data analysts. This conversion process allows for a deeper understanding of where a specific data point stands in relation to the rest of a dataset, providing a context that raw numbers alone cannot offer. By leveraging built-in computational tools, users can perform these transitions with high precision and minimal effort.

The **z-score** serves as a standardized metric that quantifies the distance between a data point and the **mean** of the population, measured in units of **standard deviation**. Conversely, a **percentile** provides a relative rank, indicating the proportion of the population that falls below a certain value. Understanding both metrics is crucial for interpreting data that follows a **normal distribution**. **Microsoft Excel** facilitates this transition through specialized functions like NORM.S.DIST and NORM.S.INV, which handle the underlying calculus of the **probability distribution** automatically.

These statistical functions are conveniently located under the formulas menu, providing a streamlined workflow for anyone looking to enhance their data reporting. Whether you are analyzing test scores, market trends, or physiological measurements, the bridge between **z-scores** and **percentiles** ensures that your findings are both mathematically sound and easy to communicate. In the following sections, we will explore the technical nuances of these functions and provide a comprehensive guide on how to implement them effectively in your spreadsheets.

## Convert Between Z-Scores and Percentiles in Excel

### The Statistical Definition of a Z-Score

A **z-score** is a fundamental unit of measurement in statistics that describes a value's relationship to the average of a group of values. Specifically, it represents the exact number of **standard deviations** a specific observation lies above or below the **mean**. If a **z-score** is zero, it indicates that the data point is identical to the average score. A positive score indicates the value is higher than the average, while a negative score indicates it is lower.

Calculating the **z-score** requires knowing both the **mean** and the **standard deviation** of the dataset. By transforming raw data into these standardized scores, analysts can compare observations from different datasets that might have entirely different scales or units. This normalization is a prerequisite for many advanced statistical tests and predictive modeling techniques used in science and finance.

In the context of a **normal distribution**, also known as a Gaussian distribution, these scores provide a way to determine the probability of a value occurring. Because the properties of the bell

curve are well-defined, knowing the **z-score** allows us to pinpoint exactly where an individual falls within the broader population. This is the primary reason why converting these scores into ranks or probabilities is so valuable for decision-making.

## Understanding Percentiles as Relative Ranks

While a **z-score** focuses on distance from the average, a **percentile** focuses on rank. A **percentile** tells us the percentage of observations in a dataset that fall below a specific value. For example, if a student scores in the 80th **percentile** on a standardized test, it means they performed better than 80% of the other test-takers. This provides an immediate sense of standing that is often more intuitive for a general audience than a standard deviation metric.

The use of **percentiles** is ubiquitous in fields like pediatrics, where growth charts are used to compare a child's height and weight against national averages. It is also a staple in human resources for benchmarking salaries. Because **percentiles** are bounded between 0 and 100, they offer a clear, finite scale for assessment. However, they do not provide information about the actual distance between values, which is why they are often used in conjunction with other statistical measures.

In **Microsoft Excel**, **percentiles** are typically represented as decimals ranging from 0 to 1 when used in formulas. For instance, the 95th **percentile** is entered as 0.95. Mastering the conversion between these ranks and their corresponding standardized scores allows for a comprehensive analysis of any normally distributed dataset, ensuring that you can answer questions about both relative position and statistical significance.

## How to Convert Z-Scores to Percentiles in Excel

To convert a **z-score** into a **percentile**, we utilize the **NORM.S.DIST** function. This function is designed specifically for the standard **normal distribution**, where the **mean** is 0 and the **standard deviation** is 1. By inputting a score, the function calculates the area under the curve to the left of that value, which represents the cumulative probability.

The syntax for this function is as follows:

**=NORM.S.DIST(z, cumulative)**

The arguments required for this calculation are defined below:

**z:** This represents the **z-score** that you wish to convert. It can be a static number or a cell reference containing the value.

**cumulative:** This is a logical value. To obtain the **percentile**, you must set this to **TRUE**, which

directs Excel to return the **cumulative distribution function**. If set to FALSE, the function returns the **probability distribution** function, which is not what we need for ranking.

For example, if you are analyzing a dataset and encounter a **z-score** of 1.78, you can determine its standing by entering the formula into an Excel cell. The visual representation of this process in the spreadsheet helps confirm that the formula is applied correctly to the specific data point in question.

	A	B	C	D	E	F
1	<b>z score</b>	1.78				
2	<b>percentile</b>	0.962462	=NORM.S.DIST(B1, TRUE)			
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

Upon execution, the function reveals that a **z-score** of 1.78 corresponds to a **percentile** of approximately **0.962**, or 96.2%. In practical terms, this indicates that a data point with this score is higher than roughly 96.2% of all other observations within the **normal distribution**. This high **percentile** highlights just how significant the value is relative to the population **mean**.

## How to Convert Percentiles to Z-Scores in Excel

There are many scenarios where you might know the desired **percentile** and need to find the corresponding **z-score**. This is common when setting thresholds--for example, identifying the score required to be in the top 10% of a group. For this inverse calculation, **Microsoft Excel** provides the **NORM.S.INV** function.

The syntax for the inverse function is straightforward:

**=NORM.S.INV(probability)**

The parameter for this function is defined as:

**probability:** This is the **percentile** you are interested in, expressed as a decimal between 0 and 1. For instance, to find the **z-score** for the 85th **percentile**, you would use 0.85 as the probability.

Consider a situation where you need to find the standardized score for the 85th **percentile**. By applying the formula in your spreadsheet, you can quickly derive the exact statistical value needed for further analysis or reporting.

	A	B	C	D	E	F
1	percentile	0.85				
2	z score	1.036	=NORM.S.INV(B1)			
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

The result shows that an 85th **percentile** corresponds to a **z-score** of approximately **1.036**. This informs the analyst that any value at this rank is 1.036 **standard deviations** above the **mean**. Such insights are invaluable when comparing performance across different metrics that have been normalized to a standard scale.

## The Geometric Relationship Between Scores and Percentiles

Understanding the relationship between these two values requires a basic grasp of the geometry of the **normal distribution**. **Z-scores** are theoretically limitless, though the vast majority of data points fall between -3 and +3. **Percentiles**, however, are strictly confined to the range of 0 to 100%, representing the total area under the probability curve.

A key benchmark to remember is that a **z-score** of 0 always corresponds to a **percentile** of exactly 0.50 (the 50th **percentile**). This is because the bell curve is perfectly symmetrical; half of the data

lies above the **mean** and half lies below. Consequently, any positive **z-score** will yield a **percentile** greater than 0.50, and any negative **z-score** will yield one less than 0.50.

Choosing which metric to emphasize depends entirely on your objective. **Z-scores** are superior for performing mathematical operations and identifying outliers in a dataset. **Percentiles** are superior for communicating results to stakeholders who may not have a background in statistics, as they provide an immediate understanding of a value's standing within a group.

### Case Study: Analyzing Individual Performance

To see these concepts in action, let us consider a practical example involving academic evaluation. Suppose a student named Jessica receives a score of 90% on a difficult exam. On the surface, this appears to be an excellent result. However, without knowing how the rest of the class performed, we cannot truly gauge the difficulty of the test or the quality of Jessica's performance relative to her peers.

By calculating the **mean** and **standard deviation** of the entire class's scores, we can determine Jessica's **z-score**. If her score results in a **z-score** of 1.23, we know she performed significantly better than the average. This specific number tells us she is 1.23 **standard deviations** above the class **mean** score.

Using the **NORM.S.DIST** function in **Microsoft Excel**, we can convert that **z-score** into a **percentile** of approximately 0.89. This final piece of information is perhaps the most descriptive: Jessica scored higher than 89% of her classmates. By combining the **z-score** and the **percentile**, we obtain a comprehensive picture of her achievement, providing both a standardized measure and a clear relative rank.