How to Calculate Normal CDF Probabilities in R: A Step-by-Step Guide

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December 2, 2025

RECOMMENDED CITATION

stats writer (2025). *How to Calculate Normal CDF Probabilities in R: A Step-by-Step Guide*. PSYCHOLOGICAL SCALES. Retrieved from https://scales.arabpsychology.com/?p=103674

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The Normal CDF (cumulative distribution function) is a function in R which is used to calculate the probability that a random variable falls within a given range of values. It uses the cumulative probability distribution of a given normal distribution to calculate the probability. It is used to calculate the area under the curve of a normal distribution. Examples of how to use the Normal CDF in R can be found in the R documentation.

You can use the following methods to work with the normal CDF (cumulative distribution function) in R:

Method 1: Calculate Normal CDF Probabilities

```
#calculate probability that random value is less than 1.96 in normal CDF
pnorm(1.96)

#calculate probability that random value is greater than 1.96 in normal CDF
pnorm(1.96, lower.tail=FALSE)
```

Method 2: Plot the Normal CDF

```
#define sequence of x-values
x <- seq(-4, 4, .01)

#calculate normal CDF probabilities
prob <- pnorm(x)

#plot normal CDF
plot(x, prob, type="l")
```

The following examples show how to use these methods in practice.

Example 1: Calculate Normal CDF Probabilities

The following code shows how to calculate the probability that a random variable takes on a value less than 1.96 in a standard normal distribution:

```
#calculate probability that random value is less than 1.96 in normal CDF
pnorm(1.96)
```

0.9750021

The probability that a random variables takes on a value less than 1.96 in a standard normal

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distribution is **0.975**.

We can also find the probability that a random variable takes on a value greater than 1.96 by using the **lower.tail** argument:

```
#calculate probability that random value is greater than 1.96 in normal CDF
pnorm(1.96, lower.tail=FALSE)
```

0.0249979

And we can use the following syntax to find the probability that a random variable takes on a value between two values in a standard normal distribution:

```
#calculate probability that random value takes on value between -1.96 and 1.96
pnorm(1.96) - pnorm(-1.96)
```

0.9500042

The probability that a random variable takes on a value between -1.96 and 1.96 in a standard normal distribution is **0.95**.

Example 2: Plot the Normal CDF

The following code shows how to plot a normal CDF:

```
#define sequence of x-values
x <- seq(-4, 4, .01)

#calculate normal CDF probabilities
prob <- pnorm(x)

#plot normal CDF
plot(x, prob, type="l")
```

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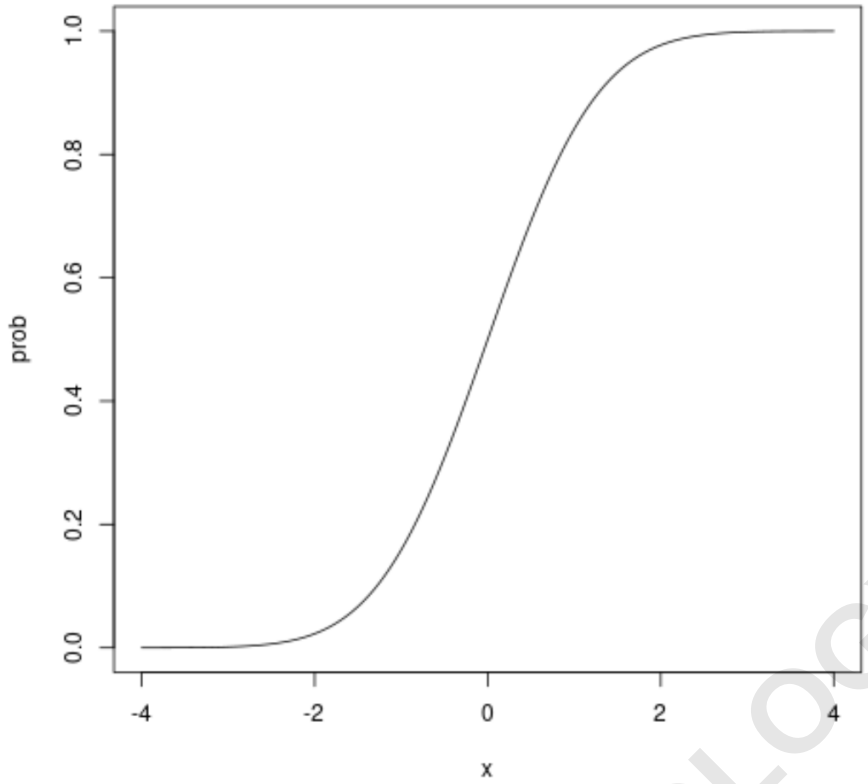

The x-axis shows the values of a random variable that follows a standard normal distribution and the y-axis shows the probability that a random variable takes on a value less than the value shown on the x-axis.

For example, if we look at x = 1.96 then we'll see that the cumulative probability that x is less than 1.96 is roughly **0.975:**

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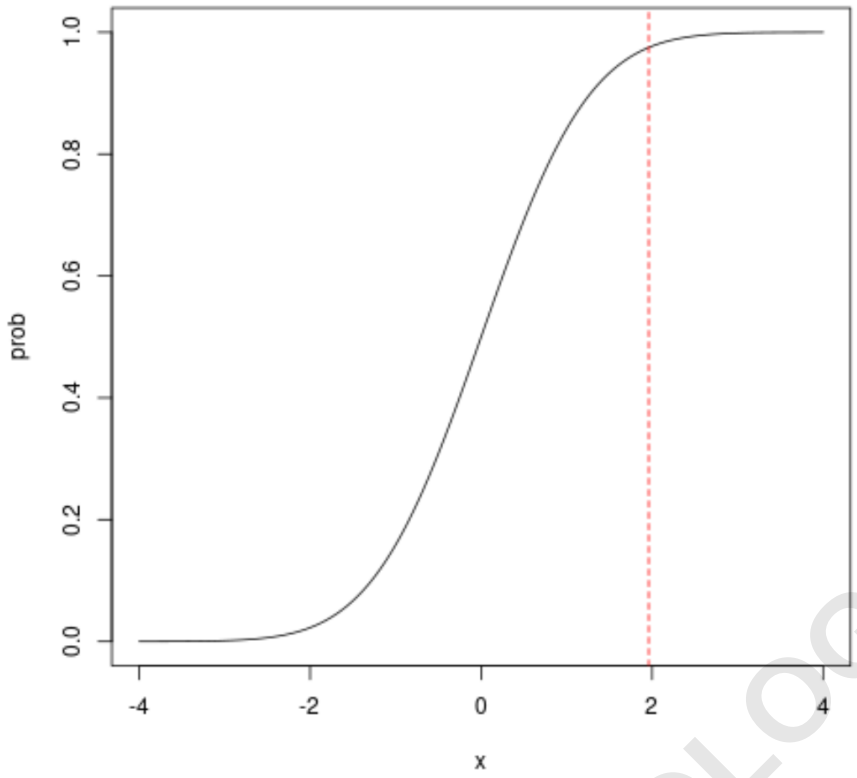

Note that you can modify the aesthetics of the normal CDF plot as well:

```
#define sequence of x-values
x <- seq(-4, 4, .01)

#calculate normal CDF probabilities
prob <- pnorm(x)

#plot normal CDF
plot(x, prob, type='l', col='blue', lwd=2, main='Normal CDF', ylab='Cumulative Prob')
```

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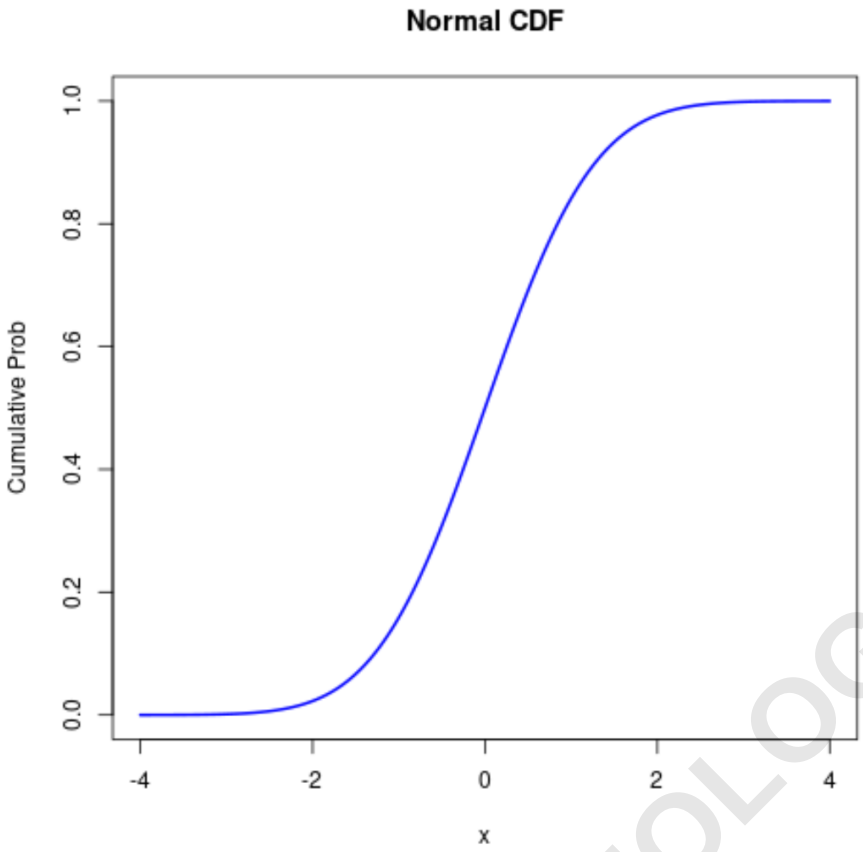

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