

# What is the difference between a normal distribution and a uniform distribution?

Authored by  
**stats writer**

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## RECOMMENDED CITATION

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A normal distribution is a type of statistical distribution where the data is symmetrical around the mean. This means that the majority of the data falls around the mean and decreases as it moves further away from the mean. It is often referred to as a "bell-shaped" curve. In contrast, a uniform distribution is when the data is evenly spread out across all values, with no particular pattern or peak. This means that each data point has an equal chance of occurring. Unlike a normal distribution, a uniform distribution does not have a defined mean or standard deviation. In summary, the main difference between a normal distribution and a uniform distribution is the shape and pattern of the data.

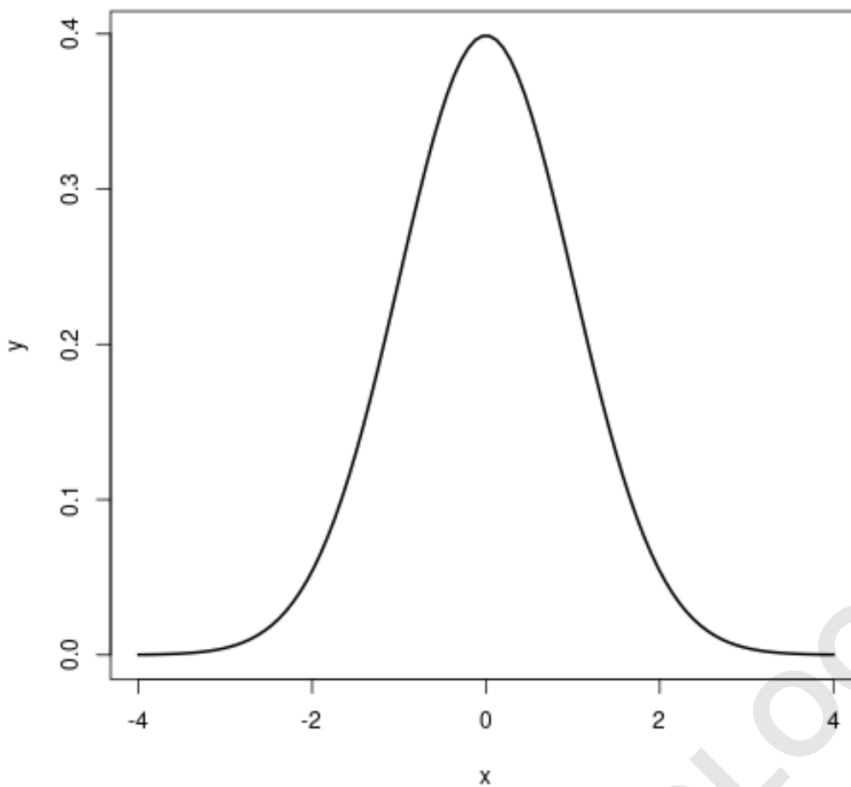
## **Normal vs. Uniform Distribution: What's the Difference?**

**The is the most commonly used probability distribution in statistics.**

**It has the following properties:**

**Symmetrical Bell-shaped**

**If we create a plot of the normal distribution, it will look something like this:**

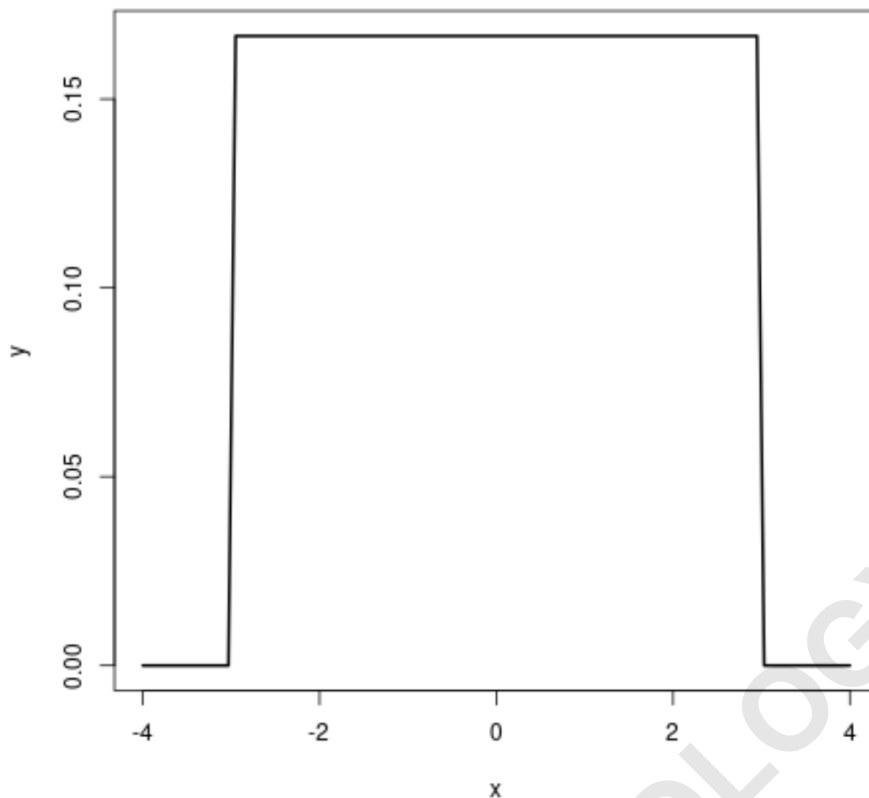


**The is a probability distribution in which every value between an interval from  $a$  to  $b$  is equally likely to occur.**

**It has the following properties:**

**Symmetrical Rectangular-shaped**

**If we create a plot of the uniform distribution, it will look something like this:**



**The normal distribution and uniform distribution share the following similarity:**

**Both distributions are symmetrical. That is, if we were to draw a line down the center of the distribution, the left and right sides of the distribution would perfectly mirror each other:**

**However, the two distributions have the following difference:**

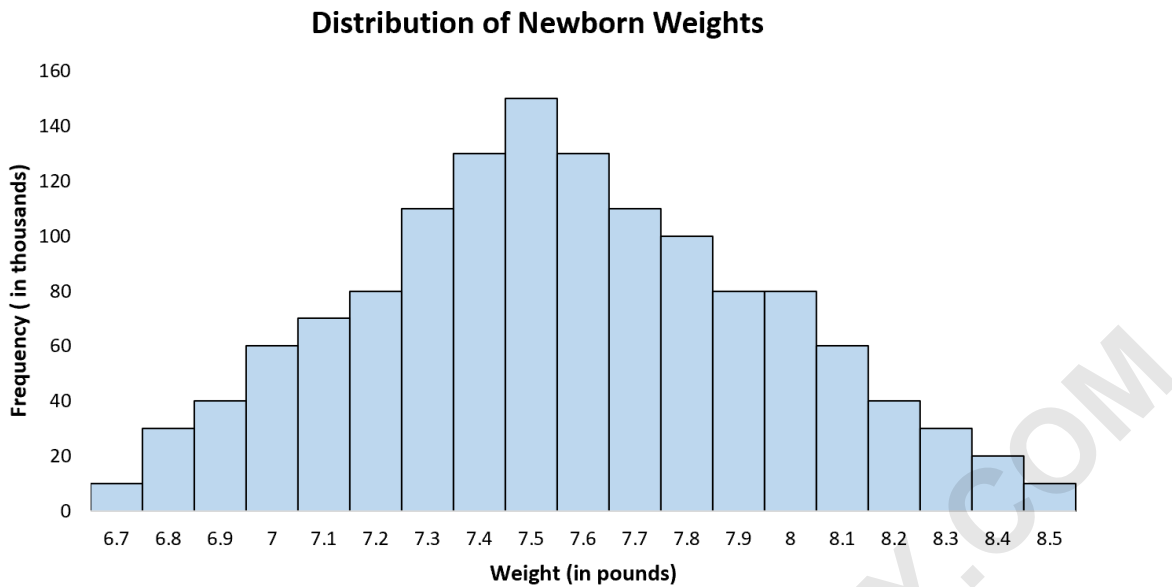
**The distributions have different shapes. The normal**

**distribution is bell-shaped, which means value near the center of the distribution are more likely to occur as opposed to values on the tails of the distribution. The uniform distribution is rectangular-shaped, which means every value in the distribution is equally likely to occur.**

#### **Normal Distribution vs. Uniform Distribution: When to Use Each**

**The normal distribution is used to model phenomenon that tend to follow a "bell-curve" shape. For example, it's well-documented that the birthweight of newborn babies is normally distributed with a mean of about 7.5 pounds.**

**The histogram of the birthweight of newborn babies in the U.S. displays a bell-shape that is typically of the normal distribution:**



**Most babies are likely to weight around 7.5 pounds, with few weighing less than 7 pounds and few weighing more than 8 pounds.**

**Conversely, the uniform distribution is used to model scenarios where each potential outcome is equally likely.**

**A classic example is rolling a die. If you roll a die one time, the probability that it falls on a number between 1 and 6 follows a uniform distribution because each number is equally likely to occur.**

**For example, there are 6 possible numbers the die can land on so the probability that you roll a 1 is 1/6.**

**Similarly, the probability that you roll a 2 is  $1/6$ .**

**Similarly, the probability that you roll a 3 is  $1/6$ .**

**And so on.**

**Bonus: How to Plot the Normal & Uniform Distribution**

**We used the following code in R to create plots of the normal and uniform distributions:**

```
#define x-axis
```

```
x <- seq(-4, 4, length=100)
```

```
#calculate normal distribution probabilities
```

```
y <- dnorm(x)
```

```
#plot normal distribution
```

```
plot(x, y, type = "l", lwd = 2)
```

```
#define x-axis
```

```
x <- seq(-4, 4, length=100)
```

```
#calculate uniform distribution probabilities
```

```
y <- dunif(x, min = -3, max = 3)
```

```
#plot uniform distribution
```

```
plot(x, y, type = "l", lwd = 2, xlim = c(-4, 4))
```

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