In this tutorial, you're going to learn about the standard normal distribution. Now, the standard normal distribution is a normal distribution. It's a specific kind that uses standard scores. Standard scores are also known as z-scores.

So, let's start with an example. Men's heights, normally distributed with a mean of 68 inches-- that's five foot eight-- and a standard deviation of 3 inches. The question that I'm going to put forth is fairly simple. What percent of men are over six feet tall? Six feet, by the way, is 72 inches.

Now, by this point, you should be aware of the 68, 95, 99.7 rule which says that 68% of the data points fall within one standard deviation of the mean. Which means that 68% of men's heights will fall within three inches of 68. 95% will fall within two standard deviations, and 99.7% percent will fall within three standard deviations. Let's see if we can use that here.

Here's the distribution of men's heights, normally distributed with a mean of 68 and a standard deviation of 3. But where's 72? It falls between the first and second standard deviation above the mean. And we want the percent of men that are taller than that. Well, this becomes problematic. Because it's not on an integer standard deviation, it becomes an issue. But we're not lost yet because we have our way out of the box.

What we're going to do is we're going to take these men's heights and standardize them. We're going to take all of these values and turn them into z-scores. Z-scores are how many standard deviations away from the mean an observation is. So, this 71 is one standard deviation above. It will turn into a positive one. This 74 is two standard deviations above the mean. It'll turn into a positive two. Et cetera.

So, now look at what we've done here. We've changed the 68 into a 0, and all the other ones into the integer number of standard deviations away that they were. But remember, 72 wasn't an integer number of standard deviations. It was between one and two standard deviations away. If we calculate the z-score for that cutoff point of 72 inches, it's actually here at 1.33 standard deviations above the mean. Positive 1.33. And we want to find the area above that. We want to find the percent of values that are above that.

All right. So, this is our way out of the box. And I know the print is small, but we'll zoom in more on it in a second. This is what's called a standard normal table. It's a table of probabilities that lie below particular z-scores. And don't be concerned with the word "probability". All we need is the percent of values that fall at or below a particular z-score.

And notice, it's always below. Below on the left side, below on the right side. These are negative z-scores. They fall to the left of the mean. These are positive z-scores. They fall to the right of the mean. You're only going to need to use one of these tables at a time. These tables are attached to the website below the video if you want to download them as a PDF.

So, let's zoom in on the one that we're going to be use. Because our z-score was positive 1.33, we're going to use the positive z-score table. This column represents the tenths place of your z-score. So, our z-score was 1.33. We're going to find 1.3 as our tenths. The row across the top that creates the columns are the hundredths place of your z-score. In this case, our tenths place was 1.3 and our hundredths place was also three-- 1.33. So, the 1.3 is from here, and that hundredths place of 0.03 is right here. What we're going to do is look in the table for the value that corresponds to the row of 1.3 and the hundredths place a 0.03.

What this is going to give us is the amount of area below. And by area, I mean the percent of men shorter than 72 inches tall. 90.82% of men are shorter than six feet tall. But if you recall, I wasn't asking for that in the problem. I was asking what percent of men are taller than that? Well, that's a pretty simple proposition to figure out. All we do is subtract from 100%, and find that it's 9.18% of men that have height over 72 inches.

Congratulations! Have a smiley face, you earned it. This was a tough problem. And we can do all sorts of problems this way. The same process can be used to find percents above a particular value. Just like we just did, you get the table value and subtract from 100%. You can find the percents below a particular value, which is actually an easier version of the problem. All you have to do is not subtract from 100% because the table gives you the percents below. Or, you can find the percent between two values. And you have to subtract the table values. We'll do an example of that.

So, what percent of men are between the five foot six and five foot nine? That's 66 and 69 inches tall. So, this is our area, here. This orange area is what we're looking for. And to save time, I've already solved the z-scores for you. Negative 0.67 and positive 0.33. What you can do is you can find the table values that correspond to positive 0.33, which is 0.6293 from the table. And also, find the table value for negative 0.67, which is 0.2514, and subtract.

Visually, the orange area is equal to the combined yellow and orange minus the yellow. The combined yellow and orange is what the table value is for positive 0.33. The yellow is the table value for negative 0.67. And when we subtract them, we end up with about 38%. And so, this area here contains about 38%-- 37.79%-- of all men fall in between those two values. Another smiley face for you.

And finally, recap. It's possible to find the percent of values above or below a particular value using something other than the 68, 95, 99.7 rule. What we use is the z-scores on the normal distribution. And then, we use the normal probability table which, again, is attached as a PDF below this video, to find the percent of values below--

again, always below a particular z-score-- and subtract, as necessary. Either subtract from 100% or subtract from two table values, as we just did in the previous example. And so, we talked about the standard normal table. You're going to want to use this fairly often. Good luck and we'll see you next time.