Normal Distribution
Video Script

Scene		Full Transcript
1	**Tori:**	Oh, hey. If you have ever dreamed about soaring above the clouds at the speed of sound, then you'll be envious of what I am doing this morning. I'm touring the flight simulation facility with Darin from the University of Iowa's Operator Performance Lab where director Tom Schnau and his team develop support systems for training military pilots.
	Voice-Over Tori:	Tom's been explaining to me all the requirements individuals have to meet to become a pilot. One I never considered is a person's height. Pilots are restricted to a certain height range because of the design of the cockpits.
	Tori:	A lot of people want to fly, but I wonder what percentage of adults would actually meet the height requirement. Let's use the normal distribution of the height data to find out and get another *Problem Solved*.
2	**Tori:**	This is incredible. It may look like we're in an actual airplane, but this is a flight simulator.
3	**Voice-Over Tori:**	Now, in order to become a pilot, your height must be between 64 and 77 inches. In the United States, the average height of a man is approximately 70 inches, or 5 foot 10, and women average 64 inches, or 5 foot 4. Interesting, but it doesn't tell us much about the percentage of adults whose heights fall within the range required for being a pilot. Let's look at a dot plot to get more information. The horizontal axis is height in inches. We are representing the heights, rounded to the nearest inch, of a random sample of 100 men. Recall that the average height of a man is 70 inches. Notice that many men are shorter than 70 inches while others are taller. The height data is close to being symmetrical about the mean. As we gather height data for more and more men, the plot is even more symmetrical about the mean.
4	**Tori:**	Let's create a histogram for this data.
5	**Voice-Over Tori:**	Here, our intervals for height data are 3 inches wide. If we use narrower and narrower intervals, we see a bell shape emerge. A distribution with this type of bell shape is called a normal distribution. Due to the symmetric nature of the normal distribution, the values of the mode, median, and mean are the same. This is not true for all distributions. When the data is skewed left or skewed right, the mean, median, and mode are not the same, so it is not a normal distribution.

6	**Tori:**	Let's take a closer look at the normal distribution. Watch out for that mountain!
7	**Voice-Over Tori:**	Remember the average height is 70 inches. Observe that many men are between 67 and 73 inches tall. It looks like about a third of the population falls between 70 and 73 inches. And, another third of the population falls between 67 and 70 inches. So, about two thirds of the population is within 3 inches of the mean.
8	**Tori:**	Three inches is an important value for our data set. We call it the standard deviation. The standard deviation of a distribution is a measure of the spread of the data. Every normal distribution has a unique standard deviation and certain percentages of the data fall within one, two, and three standard deviations from the mean.
9	**Voice-Over Tori:**	It turns out that for every normal distribution, 68% of the data fall within one standard deviation of the mean. Ok, so we were right. A little more than two thirds of the men are between 67 and 73 inches tall.
10	**Voice-Over Tori:**	Now, let's look at what's happening within two standard deviations of the mean. That takes us down to 64 inches and up to 76 inches. About 95 percent of the population lies within two standard deviations of the mean. Be careful! When we say "within two standard deviations of the mean," we are referring to two standard deviations above the mean and two standard deviations below mean.
11	**Voice-Over Tori:**	Finally, let's look at three standard deviations above the mean, up to 79 inches, and three standard deviations below the mean, down to 61 inches. Ninety-nine and seven-tenths percent of men's heights are within this three standard deviation interval. Remember that to be a pilot, your height must be between 64 and 77 inches. This was close to our two standard deviation interval, which means slightly more than 95% of men meet the height requirement for pilots.
12	**Tori:**	Ninety-five percent? That's a lot, but what about women? Let's figure it out.
13	**Voice-Over Tori:**	Women's heights are also normally distributed, but the mean is 64 inches. If the standard deviation is the same as the men's, the shape of the distribution would be the same but centered about the mean of 64 inches, instead of 70 inches. If the standard deviation is larger than the men's, then the shape of the distribution will widen. If the standard deviation is smaller than the men's, then

		the shape of the distribution will narrow. According to current research, the standard deviation for the height of women is approximately 2½ inches, so the shape of the normal distribution is slightly narrower.
14	**Tori:**	We are now ready to find out what percentage of women meet the height requirement to be a pilot.
15	**Voice-Over Tori:**	Any woman whose height is between 64 inches, 5 foot 4, and 77 inches, 6 foot 5, meets the height requirement. Notice that the minimum height is the average height of a woman and very few women are taller than 77 inches, the maximum height. So, we can say about 50% of women meet the height requirement.
16	**Tori:**	Today, we used the normal distribution to look at heights, but many sets of data like standardized test scores, the weight of a newborn baby, and the life of a cell phone battery, are normally distributed – all with the following defining features:
17	**Voice-Over Tori:**	Bell shaped curve Symmetric about the mean 68% of the data fall within one standard deviation of the mean, 95% of the data fall within two standard deviations of the mean, and 99.7% of the data fall within three standard deviations of the mean.
18	**Tori:**	*Problem Solved.*