Intro to Logarithms

Video Script

Scene		Full Transcript
1	**Emily:**	Hey! It's Emily. This morning, some friends and I toured this really cool biology lab. At first, all of these test tubes, microscopes, cultures and other instruments seemed pretty intimidating, but once biologist, Dr. Parker, explained what they're used for, it didn't seem quite so mysterious. Turns out it's just like when you understand logarithms. Let me show you how our tour became another problem solved.
2	**Voice-Over Emily:**	We were surprised at how much math is actually used here in the lab. For instance, Dr. Parker said the bacteria cells in this petri dish, will grow exponentially. More specifically, the cells are growing by a factor of ten each hour.
	Sarah:	How long until the sample reaches one million cells?
	Dr. Parker:	Good question, Sarah. And actually, we need to determine when this will grow to five million cells. Exponents will quickly answer your question, but for five million, it will be easier to use logarithms.
	Sarah:	Logarithms?
3	**Dr. Parker:**	Oh yeah, I know they can seem a little mysterious, until you understand what they are used for! Emily, you've brushed up on your math, care to explain?
	Emily:	Sure! Lets take a look at this petri dish. We could use the exponential growth of our bacteria cells to help us better understand logs.
4	**Voice-Over Emily:**	We'll call the time we begin growing our sample, hour zero, and start with a single bacterium. After the first hour, we would have ten bacteria, and after the second, we would have one hundred bacteria. Notice that this exponential pattern continues. We see there will be one million bacteria after six hours. But, we don't see five million bacteria in the table. The table goes from one million to ten million. To find five million, we will need to use logarithms. Lets use the answer to Sarah's question, six hours, to help us understand this problem. To answer Sarah's question, we need to know what power of ten is required to produce one million. In this case, the exponent is six. Without knowing it, we just used a logarithm. The logarithm gives us the exponent necessary to produce a desired result. Logarithms answer the question, "What power of the base is required to produce the given value?" In our example, the logarithm of one million, base ten, is six. And the notation looks like this.

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		Here's another example. If we were asked to find the log, base three of eighty-one, we would ask the question, three raised to what power is eighty-one? Three times three, times three times three, is eighty-one. Or, three raised to the fourth power equals eighty-one. The exponent is four, four is the logarithm of eighty-one, when the base is three.
5	**Dr. Parker:**	Now that example was pretty easy to calculate. When things are a little more difficult, we should be able to estimate our answer.
	Sarah:	Right.
	Voice-over Sarah:	Lets try estimating the log base ten of eight hundred twenty. First, ask yourself, ten to what power is eight hundred twenty. It's not an easy answer. But you do know that ten to the second power equals one hundred. And ten to the third power equals one thousand. Right? So, log base ten of eight hundred twenty, has to be between two, which is too small and three, which is too big. The actual value is close to two and ninety-one hundredths (2.91). Lets go back to the original question, about when the bacteria will reach five million. Looking at the number of hours and bacteria in the table and graph, we see they are plotted as a logarithm. We can estimate the answer, knowing that ten to the sixth power is one million, that's too small, and ten to the seventh power is ten million, that's too big. So we know that log base ten of five million, is between six and seven. It turns out that in approximately six and seven tenths hours (6.7), there will be five million bacteria. To help us generalize, lets look at another example. We know if ten to the sixth and seven tenth is approximately five million, then log base ten of five million, is approximately six and seven tenths. Using variables, if a base "a" raised to an exponent "y" equals a given number "x", then log base "a" of "x" is "y".
6	**Emily:**	6. 7 hours, there will be five million cells by the time you go home.
	Sarah:	That's some fast growth. Now logs make sense.
	Emily:	That's another problem solved.

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