Exponential Growth

Video Script

Scene		Full Transcript
1	**Tori:**	Hey guys, it's me, Tori! My buddy Blake has asked me to sit in on a business meeting with the co-founders of Live Link Tickets. They have developed a networking service that allows parents to go online and watch their child's concert, play or sporting event, live! No matter where they are in the world! Membership is growing like crazy. In fact, they already have one thousand members. Since it is an online service, one of the big concerns, is how many servers they will need to accommodate future expansion. I told Blake, it's all about exponential growth. Lets get in there and get another problem solved.
2	**Tori:**	Like I said, membership in Live Link Tickets is exploding. The company is experiencing a growth rate of forty percent each month. They're using this rate to predict the future membership. Before we look too far into the future, lets see where they'll be next month.
	Voice-Over Tori:	The company is growing by a rate of forty percent. What does that mean? It means that next months membership will be one hundred percent of the members, plus an additional forty percent of the members. That is one hundred forty percent of the members. So, we write one thousand time one hundred percent (1000(100%)) or 1 (1000(1)), plus one thousand times forty percent (1000(40%)) or four tenths (1000(0.4)), which is the same as one thousand times one hundred forty percent (1000(140%)) or one and four tenths (1000(1.4)). This gives us one thousand four hundred members. What you need to know is that one and four tenths is called the growth factor. Notice, this is one plus the growth rate. Anytime we have a factor greater than one, it represents exponential growth.
	Tori:	Four hundred new members! So we just estimated the numbers of members by the end of month one, now lets look at the table and graph to estimate the number of members by the end of month two.
3	**Kids:**	How can we use the growth factor of one and four tenths to find month two's membership? Well, we take the membership of month one and multiply it by the growth factor of one and four tenths to get one thousand nine hundred sixty members by the end of month two. If we continue our process of multiplying the new months membership by the growth factor, we predict two thousand seven hundred forty-four members by the end of month three.

		Check this out! During the first month, four hundred people joined, but during the second month, Live Link Tickets gained more than four hundred new members. Each month's membership is not found by adding the same amount each month, but by multiplying the previous months membership by the growth factor, one and four tenths.
4	**Tori:**	We can see that the pattern of multiplication continues. The team needs to predict what the membership will be in one year. They could continue to multiply by one and four tenths for each of the twelve months, but there is another way. Lets take another look at the table.
5	**Voice-Over Tori:**	We started with one thousand members and multiplied by our growth factor of one and four tenths. Then, to find the membership at the end of the second month, we multiplied our first month's membership by one and four tenths. To help us find the pattern, we are going to replace one thousand four hundred with one thousand times one and four tenths. For the third month, multiply the second month's membership by one and four tenths. Lets write one thousand nine hundred sixty as one thousand times one and four tenths, times one and four tenths. Look at the calculations through the third month. Do you see a pattern? Notice, we repeatedly multiplied by the growth factor. Great! We can use exponents to help us quickly calculate the predicted membership for any month. The exponent corresponds to the number of months. So, to calculate the membership by the end of month n, we take one thousand times one and four tenths to the n. Remember, we want to predict the membership by the end of year one. We take one thousand times one and four tenths raised to twelfth power, which is approximately fifty-six thousand six hundred ninety four members. Fifty-six thousand? I think the team will need more servers!
	Tori:	Let me show you something cool! We can calculate growth for any situation if we can identify just two important values.
7	**Voice-Over Tori:**	The value of the dependent variable when n equals 0, which is a, and the growth factor which is one plus r. If we have these two values, we can write and exponential equation to model growth. Lets look back at the team's equation to identify these two values. Remember, a, is the value of the dependent variable when n equals 0. Notice, in our equation, this value is one thousand. The second important value is the growth factor. In our example, the growth factor is one and four tenths. This is one, plus the growth rate r. To generalize, instead of using m for membership and n for number of months,

		we can replace these variables with y and x. So any exponential growth equation can be represented by y equals a times the quantity one plus r to the x power (y=a (1 + r)^x). Can you believe that in the first month, Live Link Tickets will grow by four hundred members, but by the twelfth month, they're predicting they will grow by sixteen thousand one hundred ninety-eight! Exponential growth is pretty extreme.
8	**Tori:**	I think this meeting is adjourned. There are always a lot of factors influencing actual growth, but this model shows that these should start pricing new servers. Problem solved!