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SPEAKERS

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Hello, and welcome to our module on fractions and exponents. My name is Robert J. McKeown. I have a PhD in economics, and I'm also a CFA charter holder. And I'm really glad that you decided to check out our module today. The purpose of this module is to help prepare you for more advanced studies in mathematics. A common problem that students have at university is making mistakes with fractions and exponents, they think they might know the rules. But when it comes to applying those rules in different situations, they make common mistakes. We are here to help you. And we are here to prepare you so that when the time comes, you won't be making those mistakes, whatever your level of study.

Now, we have a great series of videos lined up for you. They're interactive, there's lots of problems embedded in them, we've got extra practice problems for you to work on after. But when you're watching these videos, I highly recommend that you have a pen with you. And you work along to the problems, you want to have your mind active, you want to have your mind on and you want to be engaged in active learning. With these videos, that's going to help the lesson stick with you. And it's going to help you master fractions and exponents, fractions and exponents. That's the foundation of other algebra. And you want to have a strong foundation so that it can support your future learning. Now that said, get your pen, have a piece of paper, could be an e-pen, a pencil or an ink pen, it doesn't matter, but have your brain on and ready to learn. That said, let's get started. A natural question is, what do we use exponents for? Maybe mathematicians, they love numbers. But what do we use it for in the social sciences, business and economics? Now, when it comes to exponents, their basic use is it's a simpler way of expressing multiplication. So if we want to multiply a number by itself many times, we can succinctly write that using exponents, much easier than writing out the multiplication that might take up lines and lines and lines.

Another reason for you to perhaps consider working very hard in this module is that exponents appear all the time in economics and business. They're very, very useful if we're talking about compound interest, or we're talking about sums of money, that are changing over time, if we're looking at how populations, or subsets of population, so could be the population of Canada could be

the population of the United States, or it could be a subset of that population. So perhaps a specific demographic group within one of those two countries. We also use exponents for modeling, we want to model some of this growth behavior. For example, you might want to model the growth of bacteria or the growth of viruses. If you're looking at if you're interested in how disease is affecting the human population. So there's some motivation about why you want to learn about exponents and how to manipulate them. Now let's look at the rules for exponents that will let you manipulate them and use them to answer interesting questions in the social sciences. I'm going to write out an example here. So suppose we have four times four times four times four, we can use exponents to represent this expression as follows. We have four to the power of four, just like if we had three times three is three times three, we have three to the power of four. We can generalize this results. So I'm going to write this out slowly. You're going to see this many times throughout the course. Suppose that we have the letter A and the letter A is a placeholder. And a more formal name for that is to say that it's an unknown variable. So A is a unknown variable.

But or I'll say we know it is a real number. So it's some number. So it could be, it could be a fraction like one half. Or it could be something like 3.14, or maybe square root of 46. Something like that. Some real number. So it could be rational, irrational, as long as it's a real number. And if I have A times A times A, that's going to be equal to A to the power of three. And so on. So I can write it like. So even, even if I don't know exactly what number A is, other than that it's a real number. Now, A could be something like two over three, say I have two over three times two over three, that's going to be equal to two over three (one two) to the power of two. And we'll talk more about fractions a little bit later in this series in this module. But if I have two over three to the power of two, I can rewrite this as two. That's two times two, over three times three, and that's going to give us four over nine.

So far, I've demonstrated how exponents can represent a series of multiplications. Now let's look at rule one, which is really adding and subtracting exponents. Suppose I write two times two times two, and I'll put them in square brackets. And I want to multiply that by two times two, I could rewrite this entire expression here as two to the power of three times two to the power of two. But notice, I could have also written this as two to the power of five. So you know that the order of multiplication doesn't matter, we've got two multiplied by itself four times or five twos in that expression. So we could write two to the power of five. And notice that this was equivalent to writing two to the power of three plus two. So we are adding the exponents.

Now suppose we have the letters M and N, they're unknown variables are going to be our placeholders. So suppose M and N are real numbers. Or better yet, let's let them be positive integers. So what's a positive integer? Well, something like three, five it's not one half or the square root of four. Let's call it the square root of five. Something it's not one of the rational irrational, or radicals. Our positive integer is going to be a whole number, positive whole number, it's another word for positive integer. I can now write A to the power of M multiplied by A to the power of N is going to be equal to A to the power of M plus N, like so. And this is rule one. So this is you can think of this as rule one, you want to remember this. So here we call A the base, and M and N are exponents, also known as powers. If we're multiplying two numbers with exponents, and they have the same base, then we can add the exponents together. If you multiply two numbers together with the same base then add the exponents. For example, if we have 12 to the power of four times 12 to the power of two, the bases are the same, both bases are 12. And we can write this as 12 to the power of six.

Now what about division? What if we're dividing two numbers that have the same base, same base. So we could have something like five to the power of four divided by five to the power of two. Now, you already saw what these exponents mean, we could rewrite this as five times five, five times five, divided by five, times five. And you probably remember that if we got five divided by five, that's just equal to one. And how many fives go into five is just one. So we could cancel those fives out and what are we left with? We're left with five times five. And that's equal to five to the power of two. I'm going to call this rule one B. If we have five to the power of four, divided by five to the power of two, it's like five, power four minus two, which is going to give us five to the power of two. And written in its general form, if we had something like A^M divided by A^N . We could answer this more simply by writing A^{M-N} and that's rule one B. There you go. You worked through the first video in this module series on fractions and exponents. You learned about what an exponent is. It's essentially a short hand way of expressing multiplication. You learned what a base was. You saw what an exponent was. And you learned the first rule of working with exponents where if they have the same if two numbers have the same base, and then multiplied together, you're going to add the exponents. Similarly, if you have two numbers, one divided by the other, you're going to divide or I should say, subtract one exponent from the other