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fractions, numerator, denominator, multiply, divided, rules, equal, write, placeholders, quarter, bd, dimes, negative, ad, suppose, cents, cancel, problems, ab, ac

## SPEAKERS

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Hi, welcome back Robert J McKeown here. Today we're going to talk about fractions. It's really important for your university career to master fractions, often, you're going to be dealing with placeholders. So instead of dealing with numbers like 2,3,4,5, you could be dealing with placeholders like A, B, X and Y. And the rules of fractions become more important when you're dealing with placeholders. For example, you can just take a fraction converted into an approximate decimal place, and then solve it using your calculator. When you have fractions, you have to remember the rules of fractions and manipulate algebraic expressions accordingly. So what we're going to do is I'm going to show you the rules of fractions. And then we're going to do a whole bunch of practice problems and get you applying those rules to a variety of problems. Alright, here we go. Let's jump into fractions.

So we have four placeholders A, B, C, D, and they're all positive integers. That means they're whole numbers like two, three, and four, that sort of thing, or maybe 2 million. Now, if we have A over B, is like A divided by B, and we're going to call these, the numerator and denominator, that's the only terminology you need. The rest is knowing a few rules, I'm going to show you the rules that you need to keep in mind, and then practice applying them. Start by applying them to simpler problems, and then to more complicated ones where students often make mistakes. Alright, let's start off with something really simple. Suppose we have two multiplied by one over four. That's like having two quarters. And having two quarters is sort of like, well, one plus four, over one plus four, which is going to give us two over four. And if we simplify this, you can simplify it by dividing the numerator and the denominator by two, you can see that if we've got two quarters, we've got one half, so maybe you have literally two quarters in your pocket, that's going to be worth half \$1, it's going to be worth 50 cents. Right? You know how to do that.

Why am I showing you this, well suppose we have something more abstract like two A over B, that's going to be equal to while the same, you could write it out like A over B plus A over B. And that would be like A plus A over B, because they have the same denominator, we can bring the B's together, notice we still got the plus in the numerator. That's going to be equal to two A over B. But of course, when you're working on your own, you don't want to write out all these steps, you don't have to you can just say well, we're going to multiply the two by the numerator, so we're gonna have to a over b,

like so. Now, even more generally, maybe I'm going to have something like  $CD$  times  $A$  over  $B$ , well, that's going to be equal to  $ACD$  over  $B$ . So for multiplying something that looks like this, it goes in the numerator, and it's not affecting the denominator denominator stays the same.

Now next example, let's take something like negative  $A$  over  $B$ . If we've got negative  $A$  over  $B$ , that's like writing negative one times  $A$  over  $B$ . And we can factor out the negative one. And write it like that or more simply like so. Now let's compare this situation to negative  $A$  over negative  $B$ , well negative  $A$  over negative  $B$ . Also, we have negative one times  $A$  in the numerator, and we have negative one times  $B$ , this time I'm putting them in brackets. I didn't have to but I am, and our negative ones are going to cancel each other out negative one divided by negative one is just equal to one. And so we have  $A$  over  $B$ . That's just going to be  $A$  over  $B$ .

Now let's look at multiplying two fractions. So we'll start off with a fairly easy one, one you probably know how to do. Suppose I have one quarter of one half, this is saying, we have one quarter of one half. What's that equal to? Well, if I drew a box, and I cut it in half, so up here is one half. And then I took that one half and I cut it into quarters. I'm going to have one quarter of one half, and that's going to be equal to one eighth. So we know that or, you know, I should say that one quarter times one half is equal to one eighth. Now, what's the rule? How can we get one eighth out of this? Well, we can just multiply the numerators and multiply the denominators, and we get one over eight. Now more generally, maybe I want to multiply  $A$  over  $B$  times  $C$  over  $D$ , we're going to multiply numerator to numerator and denominator to denominator, and we get  $AC$  over  $BD$ .

So there's multiplication. Now let's look at division. Suppose I want to know how many dimes it takes to have 60 cents. So suppose I'll write this as six over 10. So that's my 60 cents. And I'll divide this by one over 10 which a dime is worth,  $1/10$  of \$1. And 60 cents is worth six tenths of \$1. So how am I going to get the answer, you probably know that there are six dimes to get 60 cents. So we know what our answers before we get started, well, I can rewrite this as six over 10 multiplied by this denominator flipped 10 over one, that's going to give me 600 over whoops, 600, it's going to give me 60 over 10, which is equal to six. So there's six, it takes six dimes to have 60 cents. Now, what's the general rule here? Well, the general rule is that we have  $A$  over  $B$ , all that divided by  $C$  over  $D$ , then we're going to multiply  $A$  by the denominator of the denominator  $AD$  over  $BC$ , or another way to write this as  $A$  over  $B$  multiplied by  $D$  over  $C$ .

You just saw some rules on how to add fractions together, how to multiply them, divide them, and then a little bit of this and that when it comes to negative values. Next, we're going to look at the lowest common denominator, how to and basically, it's going to teach you how to add and subtract fractions that had different denominators. Remember, your key is to master fractions. You want to master this material. So you want it to become second nature. How do you get something to become second nature, you just practice it, you have to practice it every day. And we're going to do some practice soon where we look at more challenging problems.

Let's look at adding fractions that have different denominators. Suppose I told you that I had 50 cents, and I added a quarter. So I could write that in fractions as say, one half, 50 cents is half of \$1 plus one quarter. their name tells you what it's worth. It's a quarter of \$1. Now, you know that the

plus one quarter, then name tells you that it's worth two quarters of  $\frac{1}{2}$ . Now, you know that the answer is going to be 75 cents or three quarters. And how can we get that using a rule? Well, one approach would be the lowest common denominator approach, or the approach is the lowest common denominator approach. So I could take this term here, this one half, I see I've got a four there, a half there. I could multiply that first term, the numerator and denominator by two and so I'm not actually changing the value of that fraction. Because I'm doing this same thing to the numerator as I am to the denominator. And we end up with two plus one over four, one quarter. And we have two plus one divided by four can bring those denominators together because they're the same. And of course, that's just going to give us three over four. Now let's write out the rule. If we've got A over B, plus C over D, I want to make the common denominator BD. And to do that, I'm going to multiply A over B, I'm going to multiply that by D over D. So I've got AD over BD, plus, now I want to take C over D, and I want to multiply that by B over B. So I'm going to have BC over BD. We've now got common denominators they're common. So we're gonna have AD plus BC over BD.

Now, before you rush on to the next topic, I want you to take a look at this here, notice that this expression cannot be simplified. There's no way to cancel out any terms in this expression. Yes, there's a D here and a D here. There's also a B here and a B here. But that doesn't mean they can be canceled out. To cancel out terms, they must be common to both the numerator and denominator. Maybe we'll have something like AB plus AC. Plus, oh, I guess that's enough. We don't need any more pluses, divided by AD. Notice that we could rewrite this as AB plus C divided by AD. And then the A's cancel each other out because the A is common to all the terms in the numerator. And it's common to all the terms in the denominator, and we're just left with B plus C over D.

Another example might be AB plus AC divided by AD plus A squared. So we could write that as AB plus C and the numerator AD plus A and the denominator, and then our A's cancel each other out, we get B plus C over A plus D. All right, in an alphabetical order. So there you go on the lowest common denominator. I hope you found this video useful and a good refresher for the fractions that you would have learned younger in life. But now, as you're going into university, you're required to master the understanding of fractions because you get to see them so very often in economics and business. And you can't just convert the fractions into decimals and work with decimals that you're more comfortable with. Because when it comes to theory, we very much like working in fractions