



Adding and Subtracting Fractions

Transcript

Instructor: Iain Pardoe

00:00:00:00 - 00:00:30:32

Instructor: Hello, and welcome to video number five in this series. In this video, I'll review how fraction addition and subtraction works. Let's start with a case where we are adding two fractions with the same denominator. A over B plus C over B . All we do is keep the denominator and then add the numerators.

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Instructor: So for example, we could have three fifths. Plus one fifth. We'll keep the denominator, the five and then add the numerators three plus one is four. The answer is four fifths. Why does that make sense?

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Instructor: Well, if we think about a fraction strip, if I divide it into fifths, one, two, three, four, five, oh. Let's have another fraction strip. One, two, three, four, five, then let's have three fifths shaded in the first fraction strip, and then one fifth shaded in the second fraction strip. Then if I add those pieces together in a third fraction strip, then in total, I'll have the three pieces here, and then the one piece here. I'll have four in total.

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Instructor: So that's if we have the same denominator. But what if we have different denominators? Oh, no. Boom. Back that up.

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Instructor: I got to do subtraction first. That's adding fractions with the same denominator. What about subtracting fractions with the same denominator? For example, let's do three fifths minus one fifth. Again, because we've got the same denominator, we can see that we can subtract one fifth from three fifths fairly easily.

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Instructor: It's just a matter of subtracting the numerators. We'll keep the same denominator again, the five, and then three minus one is two. So that's when we have the

same denominator in both fractions. What if we have different denominators though? For example, how could we add three fifths and one third?

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Instructor: Now we have different denominators. We've got fifths and we've got thirds. Now if I try and draw it the way I drew it over here with the fraction strips, we're going to have a fraction strip divided into fifths. And we'll have three fifths shaded. And then we'll have a fraction strip divided in two thirds and one third shaded.

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Instructor: And over here we could add the pieces or we could strap the pieces because they're all the same size. But now we can't do that because the pieces are different sizes, and so it's not possible to add them together or subtract them from each other. We need a way to make the pieces in the fraction strips have the same size. We talked in a previous video about creating equivalent fractions and the idea is going to be to create equivalent fractions for these two that have the same denominator. So to do that, in general, we're going to have now A over B and C over D.

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Instructor: How can we create equivalent fractions for these two that are going to have the same denominator? One way to do that is if I take this first fraction, A over B, and I multiply it by the number one, then its value won't change, but I can change the denominator depending on the fraction I multiply by. Let's multiply it by a fraction that's equal to one that consists of the denominator for the other fraction in the numerator and the denominator. D over D. Then the other fraction, we can see that the new denominator for the first fraction is going to be B times D. I need

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Instructor: to get the denominator for the other fraction equal to B times D. If I multiply this fraction by B over B, then I'll end up with the same denominator for both fractions. I'm multiplying the first fraction by a fraction that's equivalent to one consisting of D divided by D and D is the denominator of the second fraction, and then I'm multiplying the second fraction by a fraction equivalent to one that consists of B divided by B where B is the denominator of the first fraction. A lot of words going on here for something that in practice is hopefully straightforward. In total, I'll have a fraction that's got a common denominator of BD, and then I just apply this.

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Instructor: I just add the numerators. AD and BC. So let's see how this works in practice with our example up here, we'll have three fifths and then we'll multiply by something, and then we've got one third and we've got to multiply that by something too. What are the things we have to multiply by? The first fraction, we've got to look at the denominator of the second fraction and but 3/3 here.

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Instructor: Then the second fraction, we've got to look at the denominator of the first fraction and put $5/5$. Now we'll have five times three in the denominator, so 15 and we'll have three times three and five times one. Overall, we'll have $14/15$. Why does this work? I mean, we can see how it works algebraically, but it's nice if we got an intuitive sense of why this works too.

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Instructor: Let's go back to our fraction strip picture. We've got three fifths up here. What we did was we multiplied by $3/3$. It's like we're taking these fifths and breaking them up into three pieces in each piece. So We've got nine smaller rectangles there, three times three.

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Instructor: Then in the other fraction strip with the one third, we're multiplying that by $5/5$, we're breaking up the thirds into five pieces each. There's only one of the thirds is shaded, so I'll only break that piece up into five pieces. Now I've got five smaller pieces equal to five times one. Now all these small rectangles up here are the same size. That's put me back into this situation here and I can add the nine small rectangles in the first fraction strip to the five in the second fraction strip and end up with 14 in total.

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Instructor: That's how fraction addition works when we have different denominators. Fraction subtraction when we have different denominators would be similar. We would just do subtraction in this step, but otherwise multiplying by the fractions equivalent to one would be the same. Let's work through a few more examples where we have different denominators. Let's start with one third and three eighths.

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Instructor: I'll just write down the two fractions again, leaving a little bit of space, and I'm going to multiply each fraction by a fraction that's equivalent to one to make us have common denominators. For the first fraction, I need to multiply by $8/8$. The second fraction, I'm going to multiply by $3/3$. So we'll have three times eight in the denominator, 24, and then we'll have one times eight, which is eight and three times three, which is nine. We'll have 17 out of 24.

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Instructor: Then let's do a subtraction example. Let's do three fifths minus two sevenths. Write down my fractions again. I'll leave some space so I can fill in the fractions that are equivalent to one. So the first fraction, I'm going to pick up the denominator from the other fraction and the second fraction, I'll pick up the denominator from the first fraction.

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Instructor: I'm going to have five times seven, 35 in the denominator, and then I'll have three times seven, 21 minus five times two, ten, I'll have $11/35$. Then let's do one more

example. Let's do five eighths. Let's do an addition, one sixth. So five eighths times $6/6$, then we'll have $8/8$ times one sixth.

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Instructor: Now we'll have six times eight or eight times six is 48 and five times six is 38 times one is eight. I'll have $38/48$. That one's not in lowest terms because there's a common factor there. There's a common factor of two, I think. We're going to have $19/24$.

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Instructor: In previous videos we've talked about, always look for shortcuts when you can often involving pulling out common factors. Here, if I'd been a bit paying a bit more attention, I could have seen here that to get a common denominator for eight and six, I don't need to go all the way to 48. I could use 24 instead. If I multiply eight by three, I'll get 24 and if I multiply six by four, I'll get 24. Instead of doing what I did before, I could do $3/3$ times the first fraction and $4/4$ times the second fraction.

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Instructor: That way, I get straight to the answer without having to do this last step because I got 24 in the denominator, eight times three or four times six. In the numerator, I'll have five times three, 15, and four times one, four, I'll have $19/24$. So pause the video here and see if you can work the next two fraction, addition and subtraction problems yourself. Again, try and resist using calculator, use the methods we've shown and see what you can come up with for these two examples. We'll do one quarter plus four sevenths and for the second one do five ninth minus one third.

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Instructor: For the first one, we've got one quarter plus four sevenths. If we do one quarter times $7/7$, and then four sevenths times $4/4$, we'll have 28 in the denominator and then we'll have one time 77, four times four is 16 and seven and 16 is 23. For the second one. We've got five ninths and we got one third subtracting. We want a common denominator here.

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Instructor: I could multiply nine by three and use a common denominator of 27, or I could use one of these shortcuts that we're always looking for and notice that nine is actually a common denominator here. This first fraction I don't really need to do anything to, multiply it by $1/1$. The second one, multiply it by $3/3$. Now we've got nine as the common denominator. In the numerator, we're going to have five times one is five minus three times one is three, five minus three is two.

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Instructor: So that's all for this video. In the next video, we're going to switch gears and we're going to start looking at numbers with exponents.