



Adding and Subtracting Polynomials

Transcript

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Narrator: Hello, and welcome to video number nine in this series. In this video, I'll be discussing polynomials and reviewing how to add and subtract them. So here's the algebraic expression that represents a general polynomial of degree N . So there's just a whole bunch of terms that are added together. And so N here is a non negative integer, and the A s are the coefficients, and those are all real numbers.

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Narrator: And the only constraint there is that the first one, which is called the leading coefficient, A_N is not equal to zero. And each of these pieces, so the A and X to the N , an minus one, X to the N minus one, and so on, these are all called terms. And then the very last coefficient a zero is called the constant. So here's an example. So we're going to have two X cubed minus four X squared.

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Narrator: Plus one. This is a degree three polynomial because of the three here, the leading term is two X cubed. The leading coefficient is two. The coefficient on X squared is minus four. I don't have an X in this polynomial, so we could think of the coefficient on X as being zero, but there's no need to write that here because it's just zero.

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Narrator: Then the constant term is plus one. And so we can think about adding polynomials together. And so when we do that, let's have another example. Let's have three X cubed and five X squared. And in this second polynomial, I will put an X term.

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Narrator: So two X and then minus four. And so if I want to add these two polynomials together, I need to add like terms. So I'm going to add X cube terms, X squared terms, X

terms, and then constant terms. And so it's nice, actually, if we line things up. So what I'm going to do here is, I'm just going to move that one over here.

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Narrator: So that it lines up in the constant column, and then we can see explicitly that we don't have any exits to worry about in that first polynomial. So now I'm just going to add down the columns. I've got two and three for the cubed term. That's going to give me five X cubed, and then we've got minus four plus five, so we've got one X squared. We've got two X, and then plus one minus four minus three.

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Narrator: So that's when we add the two polynomials together. We got to also think about subtracting this second polynomial from the first one. So let's see what they look like if I subtract them. Same kind of idea. I'm just looking at terms in the columns.

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Narrator: So now I've got two minus three. So I'll have minus X cubed, and we've got minus four minus five minus nine X squared. We don't have any Xs and we're subtracting two X, that will leave us with minus two X. Then we've got for the constant term plus one minus minus four, that's plus one plus four plus five. To multiply polynomials.

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Narrator: We can think of this just as repeated addition or subtraction. So what I mean by that is, let's take this first polynomial again and let's multiply it by two. So two times two X cubed minus four X squared plus one. And we can think of this as just repeated addition. So it's one of these.

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Narrator: And then another one. And we know how to do addition because we just did it a few minutes ago. So we'll have four cubed, and we'll have minus eight X squared plus two. And so thinking about multiplication in these terms, repeated addition, we can also have repeated subtraction if we have a negative number that we're multiplying by. And we don't need to write this out in full each time.

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Narrator: So as another example, if we did minus three times this polynomial, then I could write it out two cubed minus four X squared plus one, and then another one, and then another one, and then we're going to subtract because we've got minus three. But instead, I'll just kind of do this just thinking through what I'm doing. So I've got minus three times two cubed. So it'll be minus six cubed. And then we got minus three times minus four X squared.

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Narrator: That'll be plus 12 X squared. And then we got minus three times plus one. So we got minus three. We can also combine these ideas, combine the idea of addition subtraction with multiplication and do an example like say two X squared plus three X minus two. This

is one polynomial, and then we're going to subtract two times another polynomial, minus three X cubed minus X squared plus one.

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Narrator: And to minimize the amount of writing I'm doing and reorganizing, I'm going to think ahead to end up with a polynomial where the highest power of X is written first and in descending order all the way down to the constant. Just looking at this, I can see my highest power is x cubed, and I've got minus two times minus three x cubed. That will be plus six x cubed. And then next, we've got X squared. We've got two X squared here, and then over here, we've got minus two times minus X squared.

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Narrator: So that will be plus two X squared. So overall, we've got four X squared. And then next, we've got an X term. We don't have an X term over here, but we have one here, so we've got plus three X . And then finally the constant.

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Narrator: We've got minus two here, and minus two times plus one, which is minus two, so we'll have minus four. We can apply the same approach to add and subtract polynomials with more than one variable. So as an example, let's do two times and then three X squared, and XY . I'm bringing in a second variable here and two Y plus one. And then let's subtract another polynomial that involves X and Y , X squared minus two Y squared plus three X minus four Y .

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Narrator: So similar idea to when we were just looking at a single variable, which is wanting to add terms that have similar X s and Y s and the corresponding exponents for those. So again, trying to minimize the amount of work we do. Let's just be kind of organized with the way we do the calculation and write things down. So let's pick out the X squared terms first. So we got two times three here, so that would be six, and then we got minus one here.

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Narrator: So we got five X squared. And let's maybe pick out the Y squared term next. So there's no Y squared in the first polynomial, but there's minus minus two for the second polynomial. So that would be plus two Y squared. And then next, we could pick out the XY . So there's one here.

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Narrator: There aren't any over here, so we just got the one here, but we're multiplying it by two. So two XY . And then let's do the X term. There's no X term in the first one. There's a plus three here, but there's a minus sign in front of it, so that would be minus three X .

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Narrator: And then Y, we've got two times two. We got four here, and then minus minus four, so another plus four. So we've got eight Y. And then what have we got left? Just the constant term is left.

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Narrator: There's no constant term in the second polynomial. So we're gonna have two times one for the constant term. So two. So at this point, pause the video and see if you can do the next two polynomial addition, subtraction multiplication problems and then come back to the video and see if you got the correct answers. So for the first one, I'd like you to do two times X cubed minus three X squared.

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Narrator: Plus four, and then subtract three times minus two X squared, minus X plus three. And then for the second one, let's do let's introduce Y for the second one. Let's do X squared, and three X Y. Plus four X minus Y. And then let's add two times four y squared minus three X Y minus two X plus two.

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Narrator: Okay, so let's see how you did. So for this first one, we've got let's look for the highest exponent for the xs. So we got an X cube times two. So two X cubed. And then the X squared, we got two times minus three, so minus six.

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Narrator: And then minus three times minus two is plus six. So the X squared terms goes away. We end up with zero times X squared, so I won't even bother writing that down. And then next, we've got the X term. There's no X term here.

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Narrator: But there is here minus three times minus one plus three X. And then the constant term, two times four is eight and minus three times plus three minus nine, eight minus nine minus one. And then for the second one. So let's do the X squareds first. We don't have any in the second term, so we've just got the one in the first term to worry about.

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Narrator: Then let's do Y squared. We don't have any Y squared in the first term, in the second term, we have eight Y squared. And then let's do X Y. We've got plus three here, and then plus two times minus three, so minus six. So we'll have minus three, X Y.

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Narrator: And let's do X next. Four x, and then plus two times minus two minus four, so plus four minus four, the Xs go away. And then Y, we've got minus Y here, and we don't have Ys here, so just minus Y. And then finally the constant term, no constant term in the first one. But in the second one, we've got plus two times plus two, so plus four.

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Narrator: So that's it for this video. In the next video, we'll stay with polynomials. We've talked about adding them, subtracting them, multiplying them by constants. But in the next video, I'll talk about multiplying entire polynomials together.