
This tutorial explains special multiplication rule. The special multiplication rule is a rule that helps us find the probability of event A and B, when A and B are independent. And as a review, independent events are two or more events, where knowing that one event has occurred does not change the probability of the other event occurring.

So an example would be like rolling a 2 and then rolling a 3. Knowing that you rolled the 2 doesn't change what can happen next. So it doesn't affect whether or not you can roll a 3. So those two things are independent.

So now, when we're talking about the special multiplication rule, the way we find it is by doing the probability of A times the probability of B. So the probability of event A happening times the probability of event B happening, and again, this is only true when A and B are independent. When A and B are not independent, there's another rule that we'll learn later that we can use then, but here, this is a way of writing that. P with the parentheses A is read P of A, and that means the probability of event A, and then times P parentheses B, P of B, the probability of event B. We'll go through several examples.

So here's our first example. It says, Example 1, what's the probability of drawing a diamond, replacing it, and then drawing a black card? So first, we need to know the probability of event A and probability event B. But before we even start with our rule, we need to check that the events are independent, and they are. Because we are replacing the card, then what we get the first time does not affect what we get the second time.

So now that we're independent, we've remembered our rule, what's the probability of event A? So what's the probability of drawing a diamond? Well, within a deck of cards, there are 52 cards total, and of that, 13 of them are diamonds. So the chance of drawing a diamond is 13 out of 52.

And then, we're going to multiply by the probability of event B which is drawing a black card. So what's the probability of drawing a black card? There are 26 out of 52 cards that are black. Now, when you multiply, you're going to multiply across the top and get a new numerator and then across the bottom and get a new denominator.

Some of you might have seen this differently and might have simplified. Instead of 13 out of 52, you might have said $\frac{1}{4}$, 1 suit out of the 4 suits is a diamond, times by $\frac{1}{2}$, because 1 of the 2 colors is black. And then here we're doing 1 times 1 is 1 for a new numerator, and 4 times 2 is 8 for a new

denominator. If you hadn't done that, and you did it this way here, like I'm going to, we're still going to get the same answer.

So here, 13 times 26 is 338, and 52 times 52 is 2,704, so 338 over 2,704. Now, when I complete this fraction, when I divide it out and say 338 divided by 2,704, I get 0.125. And when I do 1 divided by 8, I get 0.125. So those answers are both the same.

Additionally, if you'd done it with decimals the entire way through, you're going to end up with 0.125. It doesn't matter which method you approach it with, as long as you're multiplying the probabilities. So this as a percent, times by 100, is about 12.5. So we have a 12.5% chance of drawing a diamond, replacing it, and drawing a black card. You can report it either as a percent or a fraction or a decimal.

Now, in Example 2, what's the probability of rolling a 5 and drawing a 5? So now, first check, are these independent? Yes. What you rolling on a die does not affect what you can draw on a card deck, so they're independent. So now, we're going to find our two probabilities and multiply it together.

When you're rolling a die, there are six things that could come up. A 5 is one of them, so it's 1 out of 6. That's the probability for event A, times the probability of event B, rolling a 5. Within a deck of cards, there are four 5s out of the 52 total, so 4 times 52. Multiply across the top, 1 times 4 is 4. Multiply across the bottom, 6 times 52 is 312.

Now, we're going to use our calculator to turn that into a decimal. So 4 divided by 312 to get 0.0218 and on. So I'm going around that, to 0.0128. Multiply by 100 if you wanted a percent to get 1.28%. So it's a lot less likely for you to roll a 5 and then draw 5 then it is for you to draw a diamond, replace it, and then draw a black card.

So this has introduced you to the special multiplication rule. Later, we'll learn a general multiplication rule which can be used for events that are not independent, that are dependent. Thank you for watching this tutorial.