Hi. This tutorial covers "And" Probability for Independent Events. So let's consider the following chance experiment. A jar is filled with six red marbles and four blue marbles. The marbles are mixed up, and a marble is chosen without looking.

The color is noted, and the marble is replaced in the jar. The marbles are mixed again, and a second marble is chosen. The color is noted. So we're going to let event A be the event that the first marble is blue, and let event B be that the second marble is blue.

So first of all, are events A and B independent? OK? So if we know that A occurs, does that affect the probability of B, the probability of getting a blue marble? OK? And I would say no. OK? The reason why is that so there's a 6 out of 10 chance of getting a red, and a 4 out of 10 chance of getting a blue.

Now, because we're replacing, we're sampling with replacement, the probabilities aren't going to change. So the probabilities will always be 6 out of 10 and 4 out of 10. OK? So are the events independent? Yes, because we have replacement.

OK. So now, let's consider the outcomes of this experiment by making a sample space. OK? Now, we're going to make the sample space a little bit different. So what I'm going to do is I'm going to make a square here. for the square, we're going to think about, we're going to put the outcomes of the first draw along that side, and we're going to put the outcomes of the second draw over here.

OK. So the way we're going to split this up is, with the first draw, we knew that there was a 60% chance of getting a red and a 40% chance of getting a blue. OK? So we're going to put red here, and I'm going to put 0.6. OK? So what we're going to do is try to split it so it's about 60% of this square. So we'll move it over a little bit past midway, so that's going to be about 60% there. OK? So then the rest of my outcome here would then be blue, so blue would be 0.4 OK?

Now, again, these are independent events, so what I'm going to look at now is I'm going to do this kind of the same breakdown. So if I draw 2, I still have a 60% chance of a red, 40% chance of a blue. So I'm going to split this up again, so that it's at about 60. It's about a 60-40 split, so about like so. So now, this is red at 0.6, and this is blue at 0.4.

OK. Now, this whole side represents a probability of 1. This whole side represents a probability of 1. Now, if we're thinking about area as probability, 1 times 1 is 1. So the probability of all of these outcomes added together will be 1. OK?

If we use that same idea to think about this outcome, getting a red on the first and a red on a second, if we multiply those together, that would be 0.36 which is 0.6 times 0.6. OK? If we do a blue first and then a red second, it'd be 0.4 times 0.6 which would be 0.24. So it would be 0.4 times 0.6. OK?

Down here, a red first and then a blue, that probability is the same as a blue then a red. I'll just write it as 0.6 times 0.4. OK? And then a blue and a blue is 0.16, so 0.4 times 0.4. OK?

And we can see that these four probabilities will add to 1. 0.24 plus 0.16 equals 0.4, and 0.36 plus 0.24 add up to 0.6. So altogether, these will end up being 1. OK?

What that was an example of was what is called the special multiplication rule. The general multiplication rule, which can be used in all circumstances, will come in a later lesson. Now, what the special multiplication rule reads is that, if events A and B are independent, the probability of A and B equals the probability of A times the probability of B. OK?

So just to kind of recap what we just looked at, the probability that the first draw was a blue ended up being 0.4, and the probability that the second marble was blue also 0.4. So the probability that they both turned up blue, the probability of A and B, was simply 0.4 times 0.4 equals 0.16. So because the two draws of the marbles did not have an effect on each other, we can apply this rule by just multiplying these two probabilities to get 0.16.

All right. So let's apply that to a new example. This time, we're going to be rolling dice. So a die is rolled, and the value is noted. The die is rolled again, and the value is noted. So if we define event A as the event that the first roll shows an odd number and event B be the event that the second roll shows either a 1 or 2.

OK. So let's first of all, determine the probabilities of these two events, A and B. So the probability of event A, the first roll shows an odd number, well, there are three odd numbers, and there are six total outcomes if we roll a die. So this probability would simply be 3/6, and event B is the event that the second roll shows a 1 or a 2. OK? So 1 or 2 constitute two outcomes out of six possible. So this probability would be 2/6. OK?

So now, we want the probability of A and B, so the probability that we should get an odd on the first roll and either a 1 or a 2 on the second roll. Since these two events are independent, the outcome of the first roll of the die will have no effect on the outcome of the second roll. So that means that A and B are independent. So what we can do is just simply multiply these two probabilities together.

So we would take the probability of A times the probability of B. OK? The probability of A We said was 3/6. The probability of B was 2/6. So if we multiply those two fractions, 3 times 2 is 6, 6 times 6 is 36, and if we then convert that to a decimal, that's going to be approximately 0.167. So there is a 0.167 probability of getting a first roll of the dice being an odd number and the second roll of the dice being either a 1 or 2. OK?

So that was, again, an example of applying the special multiplication rule. All right. This has been your tutorial on "And" Probability for Independent Events. Thanks for watching.