This is the tutorial on conditional probability. Now, conditional probability is used when one probability influences another probability. Another way of saying this is you're finding the probability of event A happening given that event B has already happened.

So for example, if you have event A being pulling a red card, what's the probability of getting a red card and then something that it depends on given that you already drew a black card? So those two probabilities influence each other because you're not replacing them and because the probabilities are not independent.

Similarly, if you're trying to find the probability of wearing pink given that the person you're looking at is a woman, the fact that it's a woman changes the probability of wearing pink because men wear pink less often than women do. So when the two events are influencing each other, and you're trying to find the probability of one when you know that the other one has already happened, that's conditional probability.

Now, a way of writing this kind of with math symbols is this right here-- P of A given that B. So this straight up and down bar here-- that's read as given that, and then we have a formula that can help us to calculate conditional probability. So the probability of A given that B, that bar, again, meaning given that, is the same as the probability of A and B occurring divided by the probability of B. We'll see some examples.

Here we have a chart showing a Venn diagram actually with people who like hamburgers and people who like fries. So there's 50 people who like both, 170 that like just hamburgers, 160 that just like fries, and 15 that don't like anything. Now, the first problem wants us to find the probability of liking hamburgers given that they like fries.

Now, I like to start by just remembering that's event A and that's event B. So if we're trying to find this probability out, we could actually start by looking at our Venn diagram. So what's the probability of liking hamburgers given that you like French fries? So we already know that the person likes fries. So we know that they have to be in that circle there.

Now, what's the probability of them liking hamburgers if they're in that circle? Well, there's 50 people in that circle who like hamburgers out of a total of 210 people. So that is our conditional probability there-- 50 over 210.

Now, we could have also found this using that formula. Here's how that would be. So the formula on the top is the probability of A and B, the probability of liking hamburger-- sorry-- the probability, yes, of liking hamburgers and liking French fries. So hamburgers and French fries is 50 out of the total so how many people there are all together.

So there's 170 plus 50 is 220 plus another 160 is 380 plus 15 is 395. So we have that on the top and then divided by the probability of B, the probability of liking fries. There are 210 people that like fries over 395 total people again.

Now, when we simplify this fraction down, we get the same answer, 50 over 210. So both the formula and kind of looking at the Venn diagram to figure out those parts, both will get us to the same answer. Let's look at another example.

Here, we want to find the probability of liking fries given that you like hamburgers. Now, we've already said that fries is B and hamburgers is A. So now, we're trying to find the probability of B given that A. Well, our formula showed the opposite. And there's actually another formula for the probability of B given that A. It's really simple. And it's not very different.

This time, it's still the probability of A and B. But this time, instead of dividing by the probability of B, we divide by the probability of A. So for the conditional probabilities, when you change the order of A and B, the formulas are very similar. It's only the bottom, the denominator, that changes.

So in this problem here for the probability of B given that A, we again could do it by looking at it. So here, we know that you like hamburgers. So we know you're in this circle. And out of those people who like hamburgers, how many like French fries? Well, it's the 50 people like French fries out of this red circle for hamburgers out of the total 220.

So now, let's look at it using the formula. What's the probability of A and B? Well, there's 50 people out of the total 395. So our numerator is 50 over 395. The denominator-- what's the probability of event A this time, the probability of liking hamburgers? Well, it's both together. So it's 220 over 395. And again, this fraction here will simplify down to 50 over 220.

So the formula again is going to get us to the same answer as kind of looking at the picture and thinking about what this is telling us. The formula is going to work all the time. Sometimes, it's going to be a little bit harder in order to see kind of what the conditional probability is. But it's good to know both ways. This has been your tutorial on conditional probability.