Hi, this tutorial covers theoretical probability, sometimes known as the a priori method. So there are three ways to make a probability statement. Number one, theoretical probability, again, known as the a priori method. The second way is experimental probability, also known as relative frequency probability. And the third way is subjective probability. So what we're going to concentrate on today is theoretical probability. All right, so let's start with a definition.

Theoretical probability is a method of calculating probability where the probability is the ratio of the number of equally likely ways an event can occur to the number of possible outcomes. Remember, a ratio is division. So we're going to take the number of equally likely ways, and divide it by the number of possible outcomes. So this is also known as the a priori method or the classical approach to probability. You'll see that in either of those three ways.

All right, so now putting that definition into a formula, if all of the outcomes of an experiment are equally likely, equally likely is very important, the probability of an event, E, denoted as P of E-- this is what we call "probability notation." And probability notation, the capital P just stands for "probability," and then whatever's in the parentheses is whatever event we want the probability of. So this is the probability of event E. And that's notated as-- or the formula for P of E equals the number of outcomes favorable to E divided by the number of outcomes in the sample space. So we're going to divide those two numbers.

All right, so let's apply this formula. But first, let's set up a chance experiment here. So the chance experiment is to draw a card, and then note the cards suit and value. And then, we're going to define two events, event a, the event of drawing a queen; and event B, the event of drawing a red card.

OK, so I'll actually perform the chance experiment and see if event A happened or if event B happened. All right, so I'll just shuffle up the deck, give it two shuffles here. And we'll draw a card, then note the suit and the value. All right, so we end up getting the queen of spades. OK, so event A did occur. I did draw a queen. Event B did not occur because I got a spade, which is a black card, not a red card.

All right, so now, what we want to do is calculate the theoretical probability of each of the two events. So I want to see, well, how likely is it that I got a queen and how likely is it that I did not get a red card or that I did get a red card? All right, so we're going to do these using the theoretical probability.

So probability of A-- remember it's a ratio-- so on the top, we want the outcome, the number of outcomes favorable to E or, in this case, favorable to A. So we want to know how many queens are possible. And in every deck of cards, there are four cards of each value, one of each suit, so there are four Queens in the deck. So there are four outcomes favorable to drawing a queen.

And the number of outcomes in the sample space, as you may know, there are 52 cards in the deck, so on the bottom, I'm going to put 52. So my ratio is 4 to 52, so 4 out of 52. Now many times, we will take this fraction and divide the two numbers, usually easiest to do it in a calculator, to determine what that probability is as a decimal. So I will do that.

So 4 divided by 52 ends up being about 0.769, so approximately equal to 0.769. All right, so there's about between a 7% and 8% chance that I will draw a queen. And I did draw a queen on my deal, so that was a pretty rare outcome.

All right, so now, let's do event B, probability of event B. Again, we want a fraction. The number of outcomes in the sample space is going to be the same, so I'm still drawing from a regular deck, so the bottom number is going to be 52. But now, on the top, I want the number of outcomes favorable to drawing a red card.

Now the two types of red cards are your diamonds and your hearts. There are 13 diamonds in every deck, and 13 hearts in every deck. So that means there are 26 red cards in each deck. So the outcomes favorable to drawing a red-- 26. Now since 26 is half of 52, I really don't even need a calculator for this. I know that this probability is going to be 0.5. So there's a 50% chance I will draw a red card.

All right, so what we just did is calculated two probabilities using theoretical probability. So in theory, this is what should or shouldn't happen. All right, that has been your tutorial on theoretical probability, also known as the a priori method. Thanks for watching.