In this tutorial you're going to learn about the fundamental counting principle. It sounds really easy. But it can be a little tricky at times. So we'll go through it.

So consider a chance experiment where the die above here is rolled, and this spinner is spun. Now each of these spinning sections is not equally likely. But there are, in fact, four sections. How many different outcomes of this experiment are possible?

One way to visualize this is with something we call a tree diagram. So we're going to first enumerate all the possible outcomes that could happen from the first chance experiment, which is the rolling the die. So we're going to make a tree with six possibilities. All the possibilities for the die 1, 2, 3, 4, 5, and 6. Then if I roll a 1 I might spin A, B, C, or D. If I roll a 2 I might spin A, B C, or D, et cetera.

So I first show the possibilities for the die then the possibilities for the spinner off of each possibility for the die. When I count up the total number of paths, starting from back here all the way to the end, this is one path. This is another path. This is another path, 1, C. And then 1 and D is a fourth path. What you end up seeing is there are 24 different outcomes.

Now 24 seems like a reasonable number when you think about a die and this spinner. There are six branches for the die, each of which has four outcomes for the spinner. So it's like doing 6 times 4. And, in fact, that's what the fundamental counting principle says. It says if you do two chance experiments, A and B, that experiment a has x potential outcomes. And experiment b has y potential outcomes. Then there are x times y potential outcomes when A and B are done together.

And we can actually extend this beyond just two experiments. We can extend it to three, or four, or five, or however many experiments we're doing together by simply multiplying the number of potential outcomes for each consecutive experiment. So in this case we had six outcomes for the time die, four outcomes for the spinner, therefore there are 24 potential outcomes.

So let's take a look at another example where a family is going to have three children. How many different orderings of children are there in terms of boys and girls? Well let's take a look. Another tree diagram, I think, is in order.

The first child could be a boy or a girl. And if you start with a boy you could have a boy and a girl again. If you start with a girl you could have a boy and girl again. And then the third child if you start boy, boy could be another boy or it could be a girl. If you start boy, girl it could be a boy or a girl, et cetera, et cetera. Looking at all the tree diagram branches here there are 1, 2, 3, 4, 5, 6, 7, 8 if you counted on the tree diagram.

An easier way to do it would have been to realize first child two options, second child two options, third child two options. 2 times 2 times 2 is 8 outcomes. So we don't necessarily have to draw the tree diagram. We can just multiply however many choices there are for each of the children, each outcomes for the children.

And so to recap the fundamental counting principle is used to determine the total number of different outcomes that could result from several chance experiments done either at the same time or one right after the other. The number of potential outcomes is equal to the product of the number of trials for each experiment. So we did 6 times 4. We did 3 times 3 times 3. And you know what, tree diagrams really are useful tools for visualizing all the different permutations, all the different paths, that these chance experiments could take.

So we talked about the fundamental counting principle and the visualization based on tree diagrams. Good luck. And we'll see you next time.