In this tutorial, we're going to explore the ideas of probabilities that involve the word "and," versus probabilities that involve the word "or." So let's take a look.

In probability, sometimes we want to find the likelihood of two events happening at the same time, or the probability that two events happen consecutively from each other. This is called joint probability. And we can express it as either A and B, or A, and then this symbol, with B. That symbol is called intersect.

So A and B, or A intersect B are both accepted notations. So let's take a look at an example.

Suppose that on the roulette wheel, we want the event black and even. So for instance, the number two, on the roulette wheel, is a black sector. It's also even. Now by the way, on a roulette wheel, zero and double zero don't count as even.

So four is also black and even, so is six. Now not all of the blacks are even numbers, like 29 is black but not even. And not all the even numbers are black, like 12 is even but not black. It's a red.

So we can list them all out. We can say that B intersect E, black and even, are sectors two, four, six, eight, 10, 20, 22, 24, 26 and 28. All the other evens are red. And all the other blacks are odd.

In a Venn diagram, we can represent "ands" with this middle section. And so what I did here, was I wrote out all of the values-- two, four, six, eight, 10, et cetera, in the middle part. This means that they're in that even bubble and in the black bubble. They're both even and black.

So we're looking at the overlap. The other sectors fall somewhere else. The remaining evens 12, 18, 30, 34, 14, et cetera, are all even but not black. All of these, 11, 13, 15, 17, 31, et cetera, are black but not even.

And all of these out here, zero, double zero, one, five, are neither black nor even. All of these are odd. And all of these are either red or green.

Sometimes we use the word "or" to say either this, or that, but not both. And this is known as an exclusive "or." So let's take a look.

I will have chicken or fish for dinner. This is me saying, I'm going to have chicken for dinner, or I'll have fish for dinner. But I'm not going to eat chicken and fish for dinner. Do you want to buy these shoes or those shoes?

Sometimes we mean either this, or that, or both. So for instance, the inclusive "or" would include a statement like this-- I need a seven or a spade to win this poker hand. You could get a seven to win. Or you could get a spade to

win. Or you could get a card that's both a seven and a spade.

I need to wear black, or a button down shirt to school today. Maybe someone's saying it's picture day. And I need to wear a black shirt or a button down shirt.

So they might wear a button down shirt. Or they might wear a black shirt that isn't a button down shirt. Or they might wear a black button down shirt. They might wear a shirt that's both of those two things.

So here's a practice-- the scenario is a waitress at a cafe. The waitress says to Paul, do you want coffee or tea, Sir? Paul says, coffee please. Would you like cream or sugar? Both, please.

Notice the two "or's" here. Is this first "or" inclusive or exclusive? Is this "or" inclusive or exclusive?

What you should have decided, was that the first one was exclusive. He's not going to order both tea and coffee. So she's giving him a choice of coffee or tea, but not both.

But the second one, on the other hand, is inclusive. You can have cream in your coffee. Or you can have sugar in your coffee. Or you can get both in your coffee.

In probability, we always, always, always mean inclusive when we say "or." So when we say events A or B, we mean either A, or B, or both. So when we say even "or" black, we mean the ones that are black, or the ones that are even, or the ones that are both black and even.

So this idea of "or" actually encompasses three regions in the Venn diagram-- this region of even only, this region of black only, and this region of both. Even only, black only, or both-- all of those are in the event even or black.

This notation, E or B, we can also use this. This looks like an upside down intersect symbol, and it is. E union B. Union means putting them together.

So find the area in this that talks about grades and rural. So this was students who were asked, what's the most important thing about you in school, versus their school location.

So are the grades in the most important thing? Is being popular the most important thing? Or is being good at sports the most important thing?

So where is the students that are in rural schools and said grades? They are there. What about grades or rural? So this is any student who is rural, or any student who said that grades were the most important, or both.

So grades is all of these students. Rural is all of these students. These 57 are both of those two, the ones that said the grades were most important, and live in a rural area.

And so to recap, "and" probability requires that both conditions be satisfied, so that the outcome belong to both of the two events A and B. The notation is the word "and," or the intersect symbol.

"Or" probability requires that at least one of the events be occurring, so either A only, or B only, or both. We use the word "or," or the union symbol. And we can visualise both "and" and "or" probabilities in both Venn diagrams, and two-way tables.

And we did an example of each of those. So we talked about "and" probability. And we used the intersect symbol. We also talked about "or" probability, and used the union symbol. Good luck, and we'll see you next time.