PROBABILITY 5 : Addition Rule Review

In this video I want to provide more examples on how the addition rule can help us find probabilities so that you completely understand it. We'll use our exercise chart as well as simple examples using coins and dice.

Addition Rule Formula

The formula can take the form of P(A or B) = P(A) + P(B) - P(A and B) or $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. They are both the same because or is the same as Union or $\cup$. Also and is the same as intersection or $\cap$.

Why Do We Subtract the Intersection of Both Possible Possibilities

Let's say we want to find the probability of flipping a Tail if we flip a coin 2 times. The $P(T_1)$ is .5 because we can only get a Head or Tail. The $P(T_2)$ is also .5. So if we add those 2 probabilities we get 1. If we flip a coin 2 times are we guaranteed every sing time to get a Tail at least once? No, so what went wrong?

If we go through our possible results, we see that we get 1 Tail in these situations. We get 2 matches when the Tail is flipped 2nd (HT & TT). Again we get 2 matches when the Tail is flipped 1st (TH & TT). Did you notice that we counted TT twice?

So, to fix our results we just need to subtract one of the TTs. So, our formula works out to $P(T_1 \cup T_2) = 1/2 + 1/2 - 1/4 = .75$ or 75% and that makes logical sense.

Mutually Exclusive Probability

There are situations in which you don't subtract the intersection and that occurs when probabilities are mutually exclusive. A mutually exclusive probability occurs when 2 probabilities don't effect each other in any way.

Previously with the dice flip we had a Non-Mutually Exclusive Event situation. If you flipped a Tail that directly affected your ability to flip a Head. You can't flip both.

However, let's say you are rolling a die 1 time. You then want to find the probability of rolling either a 1 or 2 with that one die roll. Since you can't roll both a 1 & 2 with one die roll they are mutually exclusive probabilities. In that situation $P(A \cap B) = 0$.

So, since the probability of rolling a die is 1/6, the formula we are looking for is $P(1 \cup 2) = 1/6 + 1/6 = 2/6 = 0.333$ and 1/3 makes sense because 2/6 = 1/3.

Probability of Picking an Exerciser or a Man

Let's use all we learned to find the probability of picking a Man or Exerciser using the sample data from the last video.

	NO EXERCISE	DID EXERCISE	TOTAL
MEN	78	22	100
WOMEN	83	17	100
TOTAL	161	39	200

$P(A \cup B)=P(A)+P(B)-P(A \cap B)$ is our formula. We'll then find P(A) and P(B)

- P(A) : Percentage of Men = 100/200
- P(B) : Percentage of Exercisers = 39/200
- $P(A \cap B)$: Men that Exercise = 22/200

$P(A \cup B) = .5 + .195 - .11 = .585 = 58.5\%$

Check Our Work

If we check our work we take 100 (Number of Men) + 39 (Number of Exercisers) - 22 (Men that Exercise) = 117. If we divide 117 by 200 we get .585 which matches up.

That is it for now. In the next video I'll review the Multiplication Rule to make sure you completely understand it as well.