

module2_lecture1

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summation notation, summation, write, summing, population, sigma, notation, p2, p1, index, module, p3, consists, sequences, total population, expression, starting, nova scotia, province, quizzes

SPEAKERS

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Hi, welcome to a new module of the course, hope the course has been going well for you, and you've not only been viewing the videos, but also doing the practice problems and the quizzes. Especially in a subject like math, it's important not just to view the concepts, but to actually apply it yourself. And that's how you build a deeper understanding of the concept, get a deeper insight into what the concept actually entails. So this new module is on summations and sequences. And what we're going to start off with is looking at the summation notation. So this is a relatively simple mathematical notation, but which often throws off even my third year economics majors students when they see it, right, they are a little uncomfortable with it. So my, my aim in the first little bit of the module will be to make you comfortable with understanding what the summation notation is all about. Then we're going to deal with some properties of this of this notation, and then move on to showing you how to do summation in Excel or in Google Sheets. Then, once we do that, I'm going to talk about two particular type of summations, which is an arithmetic series and the geometric series, things which come up in different in different real life examples. And then I'm going to end the module with a related concept, which is sequences and limits of sequences.

So let's get started. So suppose we had to talk about the total population of Canada. So the total population of Canada consists of the population of its ten provinces and three territories, right. So, so I've listed the the provinces here from the East to the West. So it consists of the population of Newfoundland, Labrador, then the population of PEI, then the population on Nova Scotia, and so on. And lastly, the three territories, right? So if you add up all of this, right, add this up, add the population of Newfoundland, population of PEI, plus the population of Nova Scotia, and so on, this gives you the total population of Canada. Now, of course, this is a rather cumbersome kind of expression, especially if you have to write it again and again. This is a long, cumbersome expression, right? So how can we write it a little bit more succinctly? So a little easier way is that, so suppose you call this as province one, this is province two, this is province three, this is province four, and so on, then this becomes P1, right, the first one becomes P1, that's the population of Newfoundland, P2 is the population of PEI, P3 is the population of Nova Scotia. And you can write this as P1 plus P2 plus P3 plus P4, and so on. up to P13. So this is a slightly simpler way of writing this, this expression, right? But even then, this is a pretty long expression here, right? So it has 13 terms in it, P1, P2, P3, and on right. And just writing it, especially if you have to write it a second time or third time, right, it's going to be taxing. So the question, so what mathematicians do is that they have a simple way of writing a

sum, right? This is a sum because it's this plus this plus this plus so on up to 13 terms. So the word they use is the summation notation. So what does the summation notation consists of? Firstly, they use the letter sigma. So this is a Greek letter sigma, essentially standing for the S in the Greek letter, and it's called sigma and, and it is a short form for summation. Right? So it's the summation of the P's.

Right, because here the variable is the population, right? So this is the population of province one, this is the population province two. So this is the P's, right? So which P's, because there are lots of P's here, right. So this P1, there is P2, there is P3. So the way we denote the different P's is by an index P i. So, i is going to be a running index when i is equal to one, that means it's P1, when i is equal to two, that means this is P2, when i is three, that means this is P3, and so on. Right, so this is an index. And where does the index run from? It starts from one, and it ends up in 13. So the way to denote that the index runs from one to 13 is you write at the bottom of the sigma, the i equal to one, so that means the starting point of i. And at the top, you write the ending point of i, which is 13. Because here the last last province or territory, that's 13. So this is the summation notation. So this is a succinct way of writing a summation like this by just a simple term here, which is sigma. Over the P's, running from i equal to one, two, i equal to 13.

So this is the summation notation. It's just as simple as this. So right, so the sum, so when you see a notation like this, where someone has written this, what this just means is that this is the summation of the P's. Right, and i running from, starting from one and ending at 13. So this is just a simple thing that you're summing up P1, P2, so on up to P13. So in some sense, this is just fancy mathematical notation for a term as simple as this. But while seeing it like this means you may scoff your nose at this. But as I've told you, like, some of my students, when they first encounter something like this, they say, hey, what's this? But if you decipher it like this way, it's a pretty simple expression. So anytime you have a summation notation, so there are three elements, one is the sigma sign, right, which just denotes that you're summing over things. Secondly, what are we summing over here, we are summing over the population. So that's why we have P's. If we were summing up over, let's say, bird population, maybe you do use an appropriate variable B_i, okay? If you're summing up over the number of automobiles on the road, right, you'd probably use a notation A_i. So that's just a variable, right? You just put in whatever is appropriate to your situation. But the main thing here is this index i, because this index i tells you from where to where you're adding up. You're starting at i equal to one and ending up at i equal to 13. So that's your index. So your summation notation consists of these three elements. That sign sigma itself, what are we summing over, and starting from where and ending where.