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SPEAKERS

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Welcome back everyone, we're going to pick up where we left off last time. Last time you learned about what an extreme point was. That extreme point was a maximum or a minimum, or where the function reaches its maximum or its minimum. And we looked at point C, when point C was a maximum, we defined a extreme point where FC is going to be larger than F of X for any X not equal to C. Now that's sort of the maximum case. Now let's look at the minimum case. So what's going to be our exact definition of a minimum extreme point when we're talking about a minimum, and so let's do that now. And then we'll look at some other properties associated with extreme points.

Let's take a look at the negative of the function that we dealt with in the previous video. So in case you don't remember the last video, that's okay, just look at the slide in front of you. Can you tell me, does this function have an extreme point? And if it does, can you tell me what that extreme point is? Now the answer is this two right here. The, there is an extreme point when X is equal to two. And when X is equal to two, I walk along, I walk north till I touch the function, then I walk West, until I get to the label, we can see that this function is minimized when X is equal to two. So when X is equal to two, and F of, well negative F of X is minimized, negative negative F of two is equal to negative three plus two minus two squared. And we're just left with negative three, which is what we have right over there.

Notice that before I start writing that we've got this point D here, and if I walk up, D minimizes the function G of X at G of D. And so we can say, if D is in the domain, E is in the domain. And it is a minimum point for F, the function F, or I should say, in this case, we're not dealing with a function FR, we were dealing with the function G. This implies G of D is less than or equal to G of X for any X in the domain. All this is saying very formally, very specifically, is that if you pick a value of X, say X one over here, and you walk up till you touch the function, and then walk west to the Y axis, we're going to have G of X one here. And that G of X one is going to be larger than G of D. Because G of D is the minimum value for this function G.

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Now, if I show you the two graphs that I showed you before, there is something peculiar going on here. Right at the top kind of tells us, it says that the max of F of X was equal to the minimum of negative F of X. So we've got two and two here. Notice that 2, X equals two maximizes F of X. But X equal two minimizes negative F of X. And this is not just a coincidence. It turns out in general, that this is true. If the max of F of X occurs at point C, or I should say, at the point where X is equal to C, the value C, whatever that value may be, then the minimum of negative F of X also occurs at C. And this is useful. Maybe not so much at this point, but it's a useful thing to know, certainly helped me finish my thesis back when I was earning my PhD. And because it turns out that if you're maximizing F of X, that's equivalent to minimizing negative F of X. And so you can kind of flip flop problems around. Suppose minimizing negative F of X is difficult, for some reasons, a mathematical reason, you could turn things on its head and just maximize F of X. And then you could do that instead of it's easier.

Here is a another example. So we've got the function F of X, and we've got the function negative F of X. And you can see that they're both going to be well, there's going to be an extreme point at X equals A for both of them. And in this case, at point. at X equals A, F of X is maximized for the negative F of X. It's minimized when X is equal to A. And of course, you can kind of see that there's a symmetry here, they look like they're F of X and negative F of X look like they're kind of mirror images of each other. Here's another example. Read the question. Look at the function itself. Can you tell me what, if any, are the extreme points of this function G of X? Well, if we graph the function, and notice that there's, that's our X axis there, or at least there's a line representing where Y is equal to zero I've just drawn in. And you can see that this expression here is minimized. It's minimized when X is equal to five. And if X is less than five, G of X is undefined. Right, we don't know, you know, we only are interested in real numbers. In this course, we're not interested in the square roots of negative numbers, which are called imaginary numbers, we're just going to say that they're undefined. And the extreme point here occurs when X is equal to five, which is right here. It's also one of the endpoints. Endpoints, we'll talk about the importance of endpoints in our next video.

Now, we saw a couple optimization problems, I gave you some functions, I asked you to find any extreme points. And unfortunately, most optimization problems are not that simple. Even with single variables. It's not quite that easy. And so going forward, what we're really going to want to do is we're going to want to introduce some tools to help you. Now, another problem with optimization is that in some ways, solving the problem can be moderately difficult, it can be fairly challenging, but the largest challenge is often being able to correctly model a real world problem as a function. And that can be quite a challenge because what you're trying to do is take something very complicated in the social sciences, and they are complicated, like human behavior and how people act. And then you're trying to reduce those actions into a function that does a reasonably good job of capturing human behavior. Not an easy thing to do, but one for which you could be have quite a good career if you're decently good at it. Next video, we're going to introduce calculus to you, and calculus can really help with these optimization problems, can make them a lot easier to deal with under certain conditions. And these conditions are very common when it comes to business theory, economic theory and theory in the social sciences.