Hi. Welcome to recitation. Last time in lecture we graphed some trigonometric functions and some inverse trigonometric functions. And there was a slight error in one of the graphs that Professor Jerison did. So I just wanted to talk a little bit about it and about what the problem was and with the correction is.

So the function in question is the arctangent or the inverse tangent. And so I like to write arctan, where Professor Jerison usually writes tan to the minus 1. But they just mean-- they're just two different names for the same function. So the inverse function of tangent. Now I've got a graph set up here. And what I've graphed are the lines, y equals x-- that's this diagonal line-- and the graph y equals tangent of x-- so that's this curve-- and here I've got one of the asymptotes of y equals tangent x at pi over 2. Right? So as x approaches pi over 2 from the right, tangent of x shoots off to infinity getting closer and closer to this line. And, you know, it does something similar down here. And then of course, it's a periodic function so there are many copies of this.

So one thing to notice about this is that the tangent comes in here. The graph y equals tan x comes in and it is tangent to the line y equals x at the origin. So the slope of tan x is just its derivative. So we saw in an earlier recitation that d over dx of tan x is equal to secant squared of x. And so the derivative at 0 is secant squared of 0, which is 1 over 1 squared, which is just 1.

So the slope is 1. And in fact, a stronger thing is true, which is that for positive x, tangent of x is larger than x. So this falls away. So you can figure that out, for example by looking at the difference and higher derivatives if you wanted to.

So the result of this, is that the graph of the arctangent, that is what you get when you reflect this graph across the line y equals x, and because of the way these graphs-- because of this property that this graph has, that it lies above the line y equals x for positive x, when you reflect it what you get is something that lies just below the line y equals x. When you reflect this whole picture, that the piece, this piece gets reflected and comes entirely on the other side of that line.

So the height here will be pi over 2. That'll be the horizontal asymptote. And it'll come below-- so this is y equals arctan x. So it will come below that line. And similarly, over here it'll come, it'll be the reflection, so it'll come above that line. And again it has an asymptote, horizontal asymptote, at minus pi over 2. So the one feature I want to point out is specifically these two curves only intersect at the origin. So in the graph Professor Jerison showed you, they looked more like square root of x and x squared, which have a later intersection point. But here, for x bigger than 0, y equals tan x is always bigger than x, which is always bigger than y equals arctan x.

And then they come in and right at the origin, their tangent to each other, they both have derivative 1 here. And then for negative x, and then they cross. And so arctan x is larger than x is larger than tan x when x is less than 0.

So that was all I wanted to share with you, just this slightly cleaner picture of the arctan of x that I get by being able to put it up on the board ahead of time. So that's that.