Section 3.4 Increasing and Decreasing Functions

Definition • A function $f(x)$ is increasing if $f(x_0) \leq f(x_1)$ whenever $x_0 < x_1$. It is strictly increasing if $f(x_0) < f(x_1)$ whenever $x_0 < x_1$.

• A function $f(x)$ is decreasing if $f(x_0) \geq f(x_1)$ whenever $x_0 < x_1$. It is strictly decreasing if $f(x_0) > f(x_1)$ whenever $x_0 < x_1$.

Note that "an increasing" function preserves the "order" between two points, where as a decreasing one "reverses" it. So intuitively, a function is increasing if outputs don't get smaller as inputs get bigger. Similarly, a function is decreasing if outputs don't get bigger as inputs get bigger.

Geometrical Observations:

The function below is a graph of a function that is increasing. It also has the tangent lines drawn to it at several points. Note that the slopes of these tangent lines are all positive. Hence f' appears to be positive everywhere.