

Introduction to Maxima and Minima

Suppose you have a function like the one in Figure 1. Find the maximum value of the function. Then find the minimum.

To find the maximum value the function could output, we look at the graph and find the highest point. To find the lowest possible value we find the lowest point on the graph.

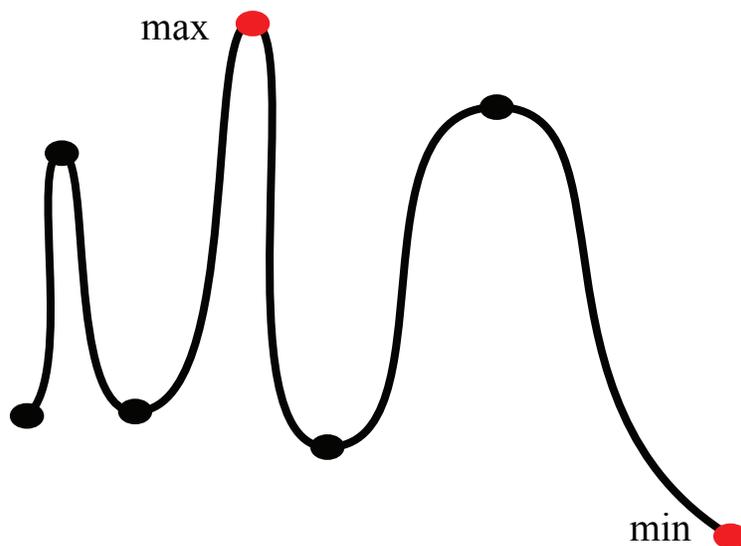


Figure 1: Search for max and min among critical points and endpoints

If you have a sketch, it is very easy to find max and the min. The problem is that the sketch is a lot of work. We don't want to do all that work every single time we need to find a maximum and minimum. Our goal is to use shortcuts; all we need to know is whether the graph is up or down.

Key to Finding Maxima and Minima: We only need to look at critical points *and* endpoints *and* points of discontinuity.

Looking back at our graph of $f(x) = \frac{x}{\ln x}$ we see five places to look for maxima and minima: $x = 0^+$, $x = 1^-$, $x = 1^+$, $x = e$ and $x = \infty$. Of these five points, only one is a critical point; we can't allow ourselves to forget about endpoints and points of discontinuity.

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18.01SC Single Variable Calculus
Fall 2010

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