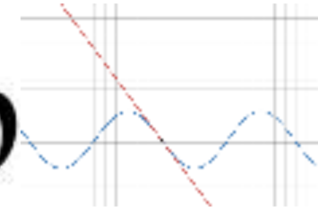
Michigan Math Club



Thursday at 4pm in EH1360
Pizza + pop outside afterwards!!

$$f^*(x) = \lim_{h\to 0}\left(\frac{f(x+h)}{f(x)}\right)^{1/h} \qquad f_*(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{\ln(x+h)-\ln(x)}$$

Abstract Calculus I

Zach Deiman — 05 October 2023

$$f^\star(x) = \underset{h\to\dot{0}}{\star\text{-}\lim}\left(\left(f(x \dot{-} h) \ddot{-} f(x)\right) \ddot{/} \phi(h)\right)$$

Consider the definition of the classical derivative f' of a function f. The construction of this concept relies on the ideas of *length* and *slope*. But if we change our perception of length and slope, then we can get some wacky new definitions of the derivative, such as the *geometric derivative* f^* which is a key part of constructing calculus in an exponential sense. We could go even further: create an *abstract arithmetic*, define derivatives in a more general abstract sense, and then observe the crazy consequences! Let's explore what happens when we alter our foundation of arithmetic and try to adapt the familiar theorems from Calculus I into Abstract Calculus I!

$$f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h} \qquad f^*_*(x) = \lim_{h\to 0}\left(\frac{f(x+h)}{f(x)}\right)^{\frac{1}{\ln(x+h)-\ln(x)}}$$