Sabbatical Proposal for Dustin Potter, Ph.D.
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Sabbatical Leave Period: August 2024 - December 2024

Abstract

The power of mathematics lies in the formal definition and the rigorous logic used to extend these definitions into realms unimagined by their creators/discoverers. Calculus is a great example with applications reaching from distant stars to quantum particles. First-year students, however, often fail to find the beauty, let alone relevance, in the traditional epsilon-delta definitions as presented in a standard Calculus I course and instead stumble through the course with little intuition or actual understanding. A more intuitive formalization of calculus relies on infinitesimals, a concept that can be traced back to ancient Greek mathematics. However, it was not until 1960 that Robinson demonstrated the definition of hyperreals (which contain infinitesimals) was as mathematically rigorous as any "standard" approach to calculus.

If approved, I would begin writing an OER textbook for a first semester calculus course designed around the infinitesimal definition. The textbook would be developed within the MyOpenMath course management system in order to take advantage of their existing open-source technologies that will allow for:

- free development and delivery of the material.
- embedding of algorithmically generated problems directly in the text.
- direct embedding of the text and homework in Canvas.
- integration across all standard web-browsers.
- interpretation of mathematical expressions by online-readers through the native use of MathJax.