

# Stokes' Theorem: Vectors vs. Differential Forms

Tyler Masthay

University of Dayton

**Abstract:** Green's Theorem and its generalization Stokes' Theorem are two of the most famous results studied in an introductory multivariable calculus course. Many problems often deal with integrating flux across the boundary of a region in two-space or three-space. As is often the case with problems such as this, it is very natural to describe the system in terms of vector-valued functions. However, trying to develop the theory using this notation becomes rather unwieldy and because of this, the concept of a differential form is introduced and is central to the development. I will introduce the fundamentals of this notation as well as present the graphical motivation behind why this notation is used rather than vector notation. I will end the discussion by going through how differential forms lead to a simple and elegant proof of Stokes' Theorem.