A New Approach for the Divergence of the Improper Integral $\int_1^\infty \frac{1}{x}\,dx$

Lovejoy Das and Frederick Johnson

Lovejoy Das is a professor of mathematics at Kent State University. He was the recipient of the Kent State University Distinguished Teacher Award in 2004 and was given the 2005 Northeast Ohio Council of Higher Education Award for Teaching Excellence. Professor Das was also recognized in 2006 by the *Ohio* magazine for their Outstanding Achievements in Teaching. He has published more than 50 research papers both nationally and internationally. His current interests include mathematics education and differential geometry.

Frederick Johnson received his bachelor of science from Kent State University. He holds an undergraduate degree in leisure studies with a concentration in sports management. Frederick is currently furthering his education in adolescent and young adult education in mathematics at Notre Dame College. Frederick also plans to get his master's degree in education as well. Currently, he is a student of Professor Das's Calculus II class at Kent State

Abstract

When we define a definite integral

$$\int_a^b f(x)\,dx$$

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we consider the function *f*, on a finite interval [*a*, *b*]. The Fundamental Theorem of Calculus states that: If *f*(*x*) is continuous on [*a*, *b*], then

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

where *F* is any function such that *F*'(*x*) = *f*(*x*) for all *x* in [*a*, *b*]. The Fundamental Theorem of Calculus requires that [*a*, *b*] is finite and *f* is bounded on [*a*, *b*], but sometimes we need [*a*, *b*] to be an infinite interval. When we consider improper integrals, our interval could be infinite. The purpose of this article is to provide another numerical approach to look at the divergence of the improper integral

$$\int_1^\infty \frac{1}{x}\,dx$$

because calculus students have a difficult time visualizing the divergence of this integral. This new approach will help students to comprehend the concepts of convergence and divergence of improper integrals.

University, Tuscarawas Campus.	