

Visualizing and Understanding the Chain Rule in Calculus

Sheldon P. Gordon, *Farmingdale State College* (retired)

Florence S. Gordon, *New York Institute of Technology* (retired)

We demonstrate how the chain rule can be introduced using graphical, numerical, and dynamic methods to increase the level of understanding for most students. In the process, this provides many opportunities to reinforce most fundamental behavioral characteristics of sinusoidal functions. Simultaneously, it provides opportunities to reinforce key concepts on the nature and interpretation of the derivative of a function as both the rate of change and the slope of the tangent line at a point using dynamic spreadsheets. To accomplish this, we use a carefully selected series of examples of increasingly more complicated functions to help students see the underlying pattern rather than the more usual scattershot of all manner of functions.

Keywords: chain rule, derivative, sinusoidal functions, calculus, rate of change, slope of tangent line, dynamic software



Sheldon Gordon is SUNY distinguished teaching professor of mathematics (emeritus) at Farmingdale State College in New York. Throughout his career, he has been deeply involved in efforts to revitalize the undergraduate mathematics curriculum, particularly from the perspective of the use of technology to enhance student understanding of mathematical concepts and methods. Shelly has authored more than 230 papers, a dozen textbooks and monograph volumes, and hundreds of software programs for mathematics education.



Florence S. Gordon is professor of mathematics (emeritus) at New York Institute of Technology in New York. She is a coauthor of *Functioning in the Real World*, coauthor of *Contemporary Statistics: A Computer Approach*, and coeditor of the MAA Notes volumes, *Statistics for the Twenty First Century* and *A Fresh Start for Collegiate Mathematics: Rethinking the Courses Below Calculus*. She has published extensively in mathematics and statistics education.