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Introducing the Concept of Derivative via the Calculus Triangle.

Typical treatments of derivative do not clearly convey that the derivative function represents the original function's rate of change. In this presentation, we argue that revealing the relationship between a function and its rate of change function for static values of x does not facilitate productive ways of thinking about generating the rate of change function or allow students to anticipate the graphical behavior of the rate of change function through examining a graph of the original function. Accordingly, we propose an approach to introducing derivative that maintains the centrality of rate of change as a conceptual underpinning of derivative. We propose the concept of a calculus triangle to support students in attending explicitly to quantities, and constructing a method for creating and tracking the ratio of changes in quantities to produce a rate of change function. We have found that the calculus triangle allows students to reason flexibly across mathematical domains such as differentiation, accumulation, as well as across graphical representations. (Received August 18, 2011)