About the Mathematics

The Riemann Rectangle Errors document uses the area interpretation for the definite integral of a positive function. For a monotonic function (one that is strictly increasing or decreasing), right and left rectangle Riemann sum approximations also represent circumscribed and inscribed rectangles (upper and lower Riemann sums), and hence "trap" the actual value within a bounded interval. The size of this interval can be quantified easily, and a very nice way to see this is to consider the smaller rectangles formed by the tops of the left and right rectangles over the same regular partition and then stack them into one tall rectangle (possible since they are all of the same width). This document provides the opportunity to see this.
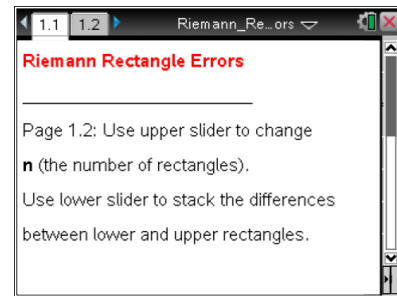
Math Objective

*   Students will have the opportunity to see graphically how to quantify the difference between the right and left rectangle Riemann sum approximations for a definite integral of a monotonic (strictly increasing or decreasing) function.
*   Students will construct viable arguments and critique the reasoning of others. (CCSS Mathematical Practice)
*   Students will reason abstractly and quantitatively. (CCSS Mathematical Practice)
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TI-Nspire™ Technology Skills:
*   Download a TI-Nspire document
*   Open a document
*   Move between pages
*   Click on a minimized slider

Tech Tip:
*   Make sure the font size on your TI-Nspire handheld is set to Medium.

Lesson Materials:
Riemann_Rectangle_Errors.tns

Using the Document

On page 1.2, the upper slider allows the user to easily change the number **n**, representing the size of the regular partition. The lower slider allows one to stack the rectangles formed by the partition points and the tops of the left and right rectangles.

Possible Application

Note that for a monotonic function, the difference between the lower rectangle approximation and upper rectangle approximation is always simply $\left| f(b) - f(a) \right| \dfrac{(b-a)}{n}$. Hence, one can get a predetermined accuracy from the rectangle approximations without knowing the exact definite integral value.