

**Calculus** is about the very large, the very small, and how things change. The surprise is that something seemingly so abstract ends up explaining the real world.

**On the cover** we see a time lapse photograph of the star *Polaris*, commonly known as the “North Star.” If one imagines a line drawn from the South Pole to the North Pole that extends infinitely into space, the star *Polaris* appears very nearly on this line. Hence as the Earth rotates, we the inhabitants of Earth, see the stars rotate around *Polaris*. The circular star-trails in this photograph are formed by the accumulated light, over a period of time, collected the camera’s light-sensor. This process of accumulating light can be described precisely using the language of calculus as an “integral,” something that will be introduced in this book.

**The graph** shown at the bottom is suggestive of the Fundamental Theorem of Calculus. The main plot is  $y = f(x)$ , the dashed plot shows the rate that  $f$  is changing,  $y = f'(x)$ . The rectangles between the dashed plot and the axis show the (signed) area accumulated by the rate. The piecewise-linear curve is an approximation of the function  $f$ , generated by looking at average rates over a given step-size. The dashed rectangles show the average rise and run over the step-size. It is our sincerest hope that this helps show that:

**Accumulated rates of a function are equal to the value of the function.**

This is the essence of the Fundamental Theorem of Calculus, and one must not underestimate its strength and utility.

