A Modular Presentation System
for the Calculus Sequence

2.7 Tangents, Velocities, and Other Rates of Change

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Secants

A **secant** line at a point P on a graph $y = f(x)$ is a line which passes through P and another point Q on the same graph.

The word secant comes from a Latin root meaning "cutting". Think of secant lines as lines that cut a curve.

Tangents

The **tangent line** to a graph $y = f(x)$ at a point P is the line which passes through P having slope equal to the limit of the slopes of the secant lines through P.

Often the tangent line at a point just touches the curve at that point. In fact, the word tangent comes from a Latin root meaning "touching".

Finding Tangent Lines

EXAMPLE: Find an equation for the tangent line to $f(x) = x^2$ at the point $(3, 9)$.

EXAMPLE: Find an equation for the tangent line to $f(x) = \frac{1}{x}$ at the point $\left(2, \frac{1}{2}\right)$.

Free Fall on Mars

EXAMPLE: The equation for free fall at the surface of Mars is $s = 1.86t^2$ m, with t in seconds. Assume that a rock is dropped from the top of a 200-m cliff. Find the speed of the rock at $t = 1$ sec.

Academic Funding by Congress

The funding F (in millions of dollars) earmarked by the U.S. Congress for collegiate academic programs from 1993 to 1997 is shown in the table.

Year	1993	1994	1995	1996	1997
Funding	763	651	600	296	440

(a) Let P represent the point corresponding to 1997 and Q the point for any one of the previous years. Make a table of the slopes possible for the secant line PQ.

(b) Based on the computations, make a prediction about the rate of change of congressional funding in 1997. Are you confident about your prediction?