## Sec 2.7: Derivatives and Rates of Change

• Tangent Line: The Tangent Line to the curve y = f(x) at the point P(a, f(a)) is the line through P with slope

$$m = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

provided that this limit exists.

• Instantaneous Velocity: Let s = f(t) be the displacement (directed distance) of the object from the origin at time t. The Instantaneous Velocity v(a) at time t = a is given by

$$v(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

provided that this limit exists.

• **Derivative of a Function:** The derivative of a function at a number a, denoted by f'(a), is

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

provided that this limit exists.

• Instantaneous Rate of Change: The instantaneous rate of change of y with respect to x at  $x = x_1$ , is interpreted as the slope of the tangent line to the curve y = f(x) at  $P(x_1, f(x_1))$  and is given by

instantaneous rate of change =  $f'(x_1) = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \lim_{\Delta x \to 0} \frac{f(x_2) - f(x_1)}{x_2 - x_1}$ 

provided that this limit exists.