The Slope of a Secant Line The slope of a secant line through a point x and another point h units away will be the rise ($\triangle y$) divided by the run ($\triangle x$). Plugging in for the points $(x, f(x))$ and $(x+h, f(x+h))$, we get

$$\frac{f(x+h)-f(x)}{x+h-x}$$

which solves to

$$\frac{f(x+h)-f(x)}{h}$$

0.1 The Derivative

The derivative is a tool that can find the slope of a tangent line at (almost) any point on a graph. While we can't find the slope between one point and itself because there is no difference, we can find the slope between some point and another that is **really** close to that point. We can minimize the difference between these two points by using a limit! We will find the difference between a point and a point whose position is almost zero units away:

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

This is the derivative! If you were to plug in 0 for h immediately, you would divide by zero. Therefore, you must use the reduction technique for solving equations of this type. The derivative is often abbreviated $\frac{d}{dt}f(t)$ with respect to some variable t and some function f; or simply $f'(x)$. If you take n more derivatives of the same function past the first one, we call it the n^{th} order derivative. Derivatives beyond the first order are labeled $\frac{d^2}{dt^2}f(t)$ or $f''(t)$ for the second order; $\frac{d^3}{dt^3}f(t)$ or $f'''(t)$ for the third order; etc. We say the derivative is taken "with respect to" something else. In a pretty standard Calculus case, the objective is to find the change in *y with respect to x.* We use the notation to describe this relationship as $\frac{dy}{dx}$. Extending this, the second order derivative of *y with respect to x* is denoted $\frac{d^2y}{dx^2}$. When the derivative of a variable is taken with respect to itself, i.e. $\frac{dx}{dx}$, we do not write it as it is equal to 1.