

third through n th derivative functions. A number of notations exist for higher-order derivative functions. For example, $f''(x)$ can be written as $\frac{d}{dx}f'(x)$. Also, if the relation involves x and y , then $f''(x)$ may be written as $\frac{d^2y}{dx^2}$, $\frac{d^2}{dx^2}(y)$ or $\frac{d}{dx}\left(\frac{dy}{dx}\right)$. By convention, for fourth-order derivatives and up, instead of using primes, we write $f^{(4)}(x)$, $f^{(5)}(x)$, etc. The symbol $f^{(0)}(x)$ stands for a function that is differentiated no times; thus, $f^{(0)}(x) = f(x)$. If we are given a function f that is twice differentiable on the domain D , that is, $f''(x)$ exists for all $x \in D$, then to evaluate $f''(a)$, we often find $f''(x)$ and then replace x by a . Thus, we could write

$$f''(a) = \left. \frac{d}{dx}f'(x) \right|_{x=a}.$$