CHAPTER OVERVIEW

2: Derivatives

The **derivative** of a function f is another function, f', defined as

$$f'(x) \;\equiv\; \frac{df}{dx} \;\equiv\; \lim_{\delta x\rightarrow 0} \frac{f(x+\delta x)-f(x)}{\delta x}. \tag{2.1}$$

This kind of expression is called a **limit expression** because it involves a limit (in this case, the limit where δx goes to zero).

If the derivative exists within some domain of x (i.e., the above limit expression is mathematically well-defined), then we say f is **differentiable** in that domain. It can be shown that a differentiable function is automatically continuous.

Graphically, the derivative represents the slope of the graph of $f(x)$, as shown below:

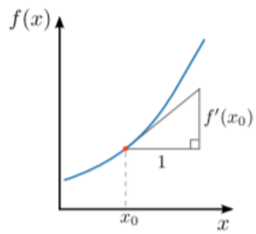

Figure 2.1

If f is differentiable, we can define its second-order derivative f'' as the derivative of f'. Third-order and higher-order derivatives are defined similarly.