

CHAPTER OVERVIEW

2: Derivatives

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

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

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:

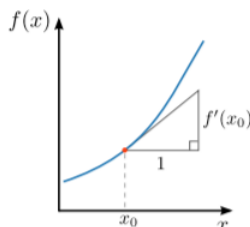


Figure 2.1

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.

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[2.2: Taylor Series](#)

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