EC 301, Prof. Fanis Tsoulouhas

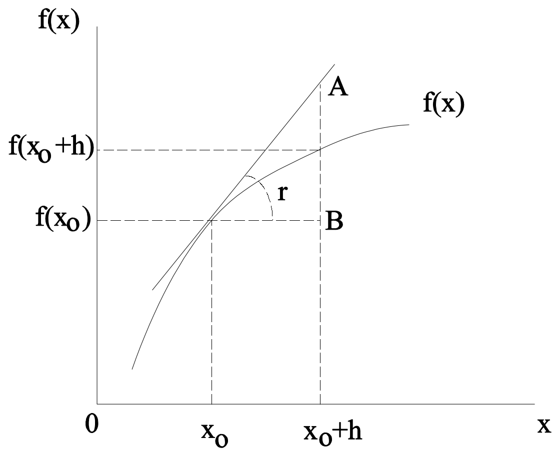
Mathematical Preliminaries: Derivatives

The derivative of f(x) is denoted as $\frac{df(x)}{dx}$ or $f'(x)$.

The derivative of f(x) evaluated at x_o, is:

$$f'(x_o) = \lim_{h \to 0} \frac{f(x_o + h) - f(x_o)}{h} = \text{slope of tangent line at point } (f(x_o), x_o) = \tan r = \frac{AB}{h}.$$

(That is, when $h \to 0$, point $(f(x_o+h), x_o+h)$ is extremely close to point A.)



<u>Rules pertaining to derivatives</u>

$$\frac{d\,[f(x) \pm g(x)]}{dx} = f'(x) \pm g'(x). \qquad \frac{d\,[f(x)g(x)]}{dx} = f'(x)g(x) + f(x)g'(x).$$

$$\frac{d\,[f(x)/g(x)]}{dx} = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}.$$

$$\frac{d\,[cf(x)]}{dx} = cf'(x), \text{ where c is a constant.}$$

$$\frac{dc}{dx} = 0. \qquad \frac{dx}{dx} = 1. \qquad \frac{dx^v}{dx} = vx^{v-1}, \text{ e.g. } (x^2)' = 2x. \qquad \frac{de^x}{dx} = e^x. \qquad \frac{d\ln x}{dx} = \frac{1}{x}.$$