# Derivada primeira com erro de ordem 2 e filosofia central

1. $f(xi + \Delta x) = f(xi) + \frac{1}{1!}\frac{df(xi)}{dx}(\Delta x)^1 + \frac{1}{2!}\frac{d^2f(xi)}{dx^2}(\Delta x)^2 + \frac{1}{3!}\frac{d^3f(xi)}{dx^3}(\Delta x)^3$

2. $f(xi - \Delta x)\alpha = f(xi)\alpha - \frac{1}{1!}\frac{df(xi)}{dx}(\Delta x)^1\alpha + \frac{1}{2!}\frac{d^2f(xi)}{dx^2}(\Delta x)^2\alpha - \frac{1}{3!}\frac{d^3f(xi)}{dx^3}(\Delta x)^3\alpha$

$$\frac{1}{2!}\frac{d^2f(xi)}{dx^2}(\Delta x)^2(1 + \alpha) = 0$$

$\alpha = -1$

$$f(xi + \Delta x) = f(xi) + \frac{1}{1!}\frac{df(xi)}{dx}(\Delta x)^1 + \frac{1}{2!}\frac{d^2f(xi)}{dx^2}(\Delta x)^2 + \frac{1}{3!}\frac{d^3f(xi)}{dx^3}(\Delta x)^3$$

$$-f(xi - \Delta x) = -f(xi) + \frac{1}{1!}\frac{df(xi)}{dx}(\Delta x)^1 - \frac{1}{2!}\frac{d^2f(xi)}{dx^2}(\Delta x)^2 + \frac{1}{3!}\frac{d^3f(xi)}{dx^3}(\Delta x)^3$$

$$f(xi + \Delta x) - f(xi - \Delta x) = \frac{2}{1!}\frac{df(xi)}{dx}(\Delta x)^1 + \frac{2}{3!}\frac{d^3f(xi)}{dx^3}(\Delta x)^3$$

$$\frac{2}{1!}\frac{df_i}{dx}(\Delta x)^1 = f_{i+1} - f_{i-1} - \frac{2}{3!}\frac{d^3f_i}{dx^3}(\Delta x)^3$$

$$\frac{df_i}{dx} = \frac{1}{2\Delta x}(f_{i+1} - f_{i-1}) - \frac{\frac{d^3f_i}{dx^3}(\Delta x)^2}{6}$$