Derivadas

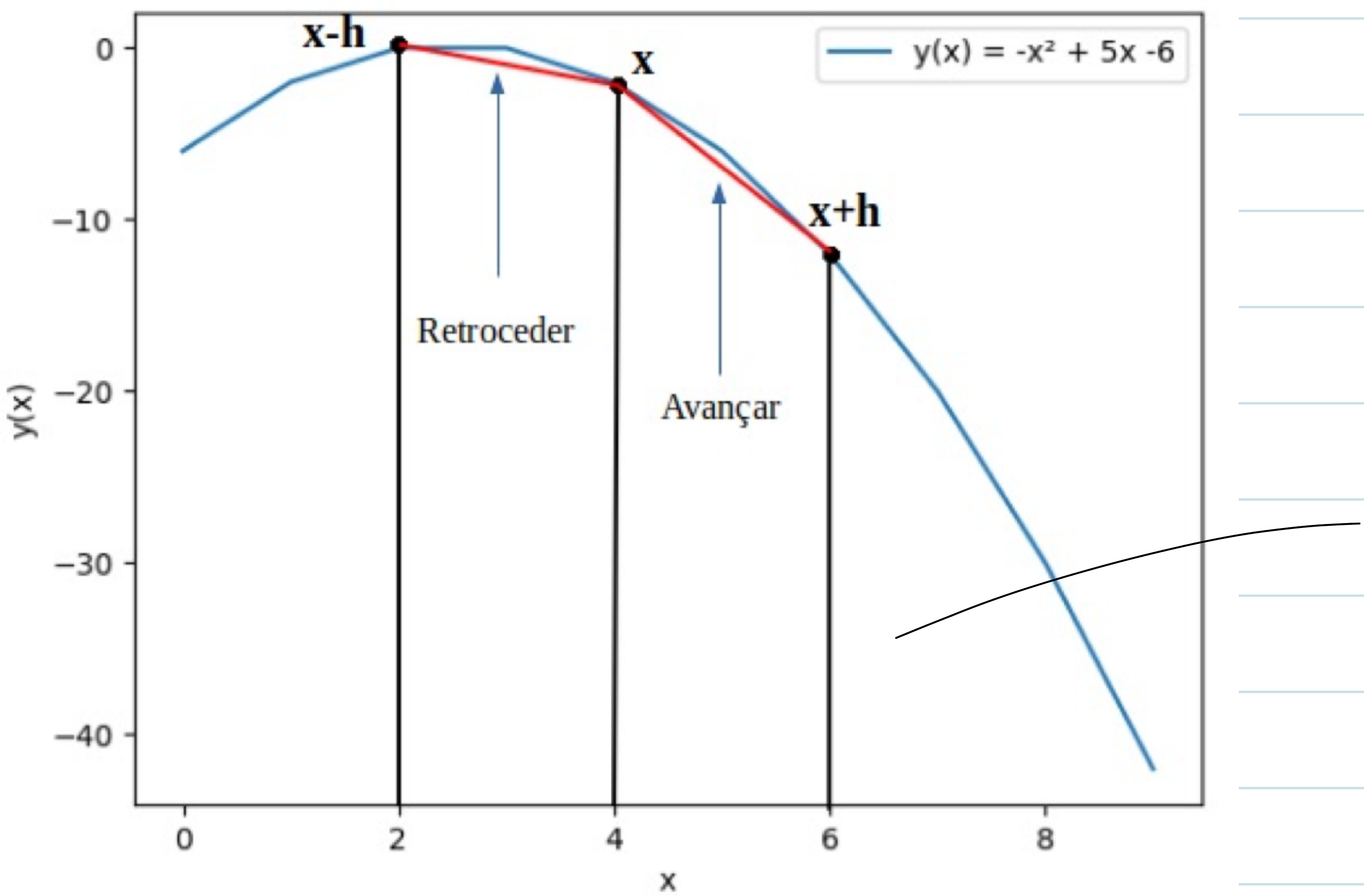
$$\frac{dy}{dx} = \lim_{x \to 0} \frac{y(x+h) - y(x)}{h} \simeq \frac{y(x+h) - y(x)}{h}$$

Metodo avancar (forward)

$$\frac{dy}{dx} \simeq \frac{y(x+h) - y(x)}{h}$$

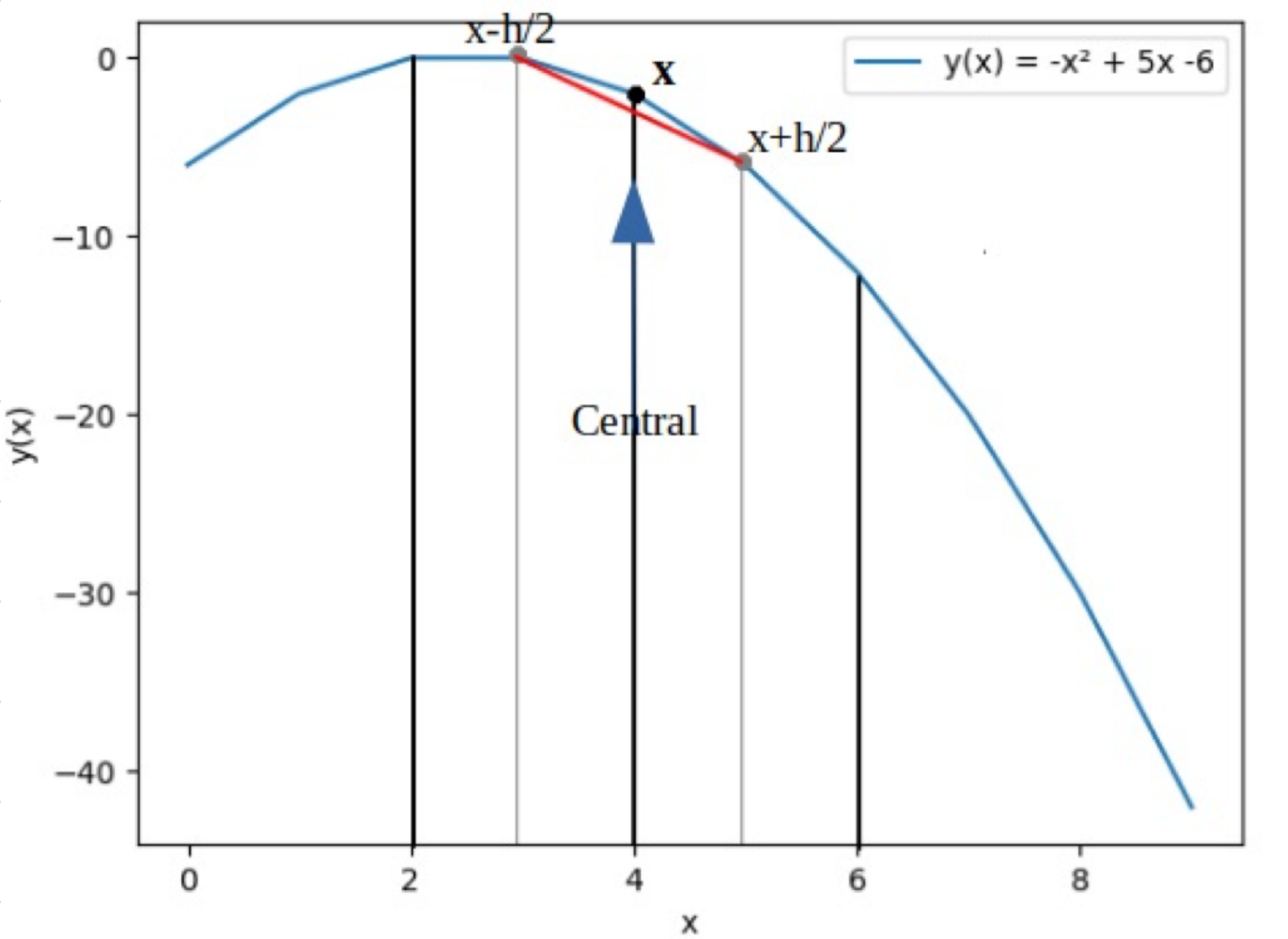
Método retroceder (backward)

$$\frac{dy}{dx} \simeq \frac{y(x) - y(x-h)}{h}$$



Método central

$$\frac{dy}{dx} \simeq \frac{y(x+h/2) - y(x-h/2)}{h} = \frac{y(x+h) - y(x-h)}{2h}$$



Usamos quando os dados estão espaçados por h

$$\frac{dy}{dx} \simeq \frac{y(x+h) - y(x-h)}{2h}$$

Segunda derivada

$$\frac{dy(x)}{dx} \simeq \frac{y(x+h/2) - y(x-h/2)}{h}$$

$$\frac{dy(x+h/2)}{dx} \simeq \frac{y(x+h) - y(x)}{h}$$

$$\frac{dy(x-h/2)}{dx} \simeq \frac{y(x) - y(x-h)}{h}$$

$$\frac{d^2y(x)}{dx^2} \simeq \frac{y'(x+h/2) - y'(x-h/2)}{h}$$

$$y''(x) \simeq \frac{y(x+h) - 2y(x) + y(x-h)}{h^2}$$

Derivadas parciais

$$F(x,y) \; ; \; \frac{\partial f(x,y)}{\partial x} \; e \; \frac{\partial f(x,y)}{\partial y}$$

$$\frac{\partial f}{\partial x} \simeq \frac{f(x+h/2,y) - f(x-h/2,y)}{h}$$

$$\frac{\partial f}{\partial y} \simeq \frac{f(x,y+h/2) - f(x,y-h/2)}{h}$$

$$\frac{\partial^2 f(x,y)}{\partial x \partial y} = \frac{\partial}{\partial x}\left(\frac{\partial f(x,y)}{\partial y}\right)$$

$$\frac{\partial^2 f(x,y)}{\partial x \partial y} = \frac{\partial}{\partial x}\left[\frac{f(x,y+h/2) - f(x,y-h/2)}{h}\right]$$

$$\frac{\partial^2 f}{\partial x \partial y} \simeq \frac{\left[\dfrac{f(x+h/2,\, y+h/2) - f(x-h/2,\, y+h/2)}{h}\right]}{h} - \frac{\left[\dfrac{f(x+h/2,\, y-h/2) - f(x-h/2,\, y-h/2)}{h}\right]}{h}$$

$$\frac{\partial^2 f}{\partial x \partial y} \simeq \left[\frac{f(x+h/2,\, y+h/2) - f(x-h/2,\, y+h/2)}{h^2}\right] - \left[\frac{f(x+h/2,\, y-h/2) - f(x-h/2,\, y-h/2)}{h^2}\right]$$