$$P_5(x) = \underline{a_0} + \underline{a_1}x + \underline{a_2}x^2 + \underline{a_3}x^3 + \underline{a_4}x^4 + \underline{a_5}x^5 \rightarrow \{1, x, x^2 \ldots x^5\}$$

$$P_2(x) = a_0 + a_1 x + a_2 x^2 \longrightarrow \{1, x, x^2\}$$

$$\cancel{\{1, x, 2x, 3x\}} \qquad \{1, \sin x, e^{-x}\}$$

x	y
x_0	y_0
x_1	y_1
x_2	y_2

$$p(x) = a_0 + a_1 x + a_2 x^2$$

$$y_0 = a_0 + a_1 x_0 + a_2 x_0^2$$

$$y_1 = a_0 + a_1 x_1 + a_2 x_1^2$$

$$y_2 = a_0 + a_1 x_2 + a_2 x_2^2$$

$$\begin{array}{cc} & 3 \\ 3 & \begin{bmatrix} 1 & x_0 & x_0^2 \\ 1 & x_1 & x_1^2 \\ 1 & x_2 & x_2^2 \end{bmatrix} \end{array} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \end{bmatrix} = \begin{bmatrix} y_0 \\ y_1 \\ y_2 \end{bmatrix}$$

$$f(g(x))$$

Diferenciación numerica

$$\frac{df}{dx} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \to 0} \frac{f(x) - f(x-h)}{h}$$

$$= \lim_{h \to 0} \frac{f(x+h) - f(x-h)}{2h}$$

$$f(x+h) = f(x) + f'(x)h + \frac{f''(x)h^2}{2} + \frac{f'''(x)h^3}{6} + \cdots$$

Landau

$$f(x+h) = f(x) + f'(x)h + O(h^2)$$

$$f(x+h) \approx f(x) + f'(x)h$$

$$f'(x) \approx \frac{f(x+h) - f(x)}{h}$$ Diferencia finita. FD.

$$f'(5) \approx \frac{f(5+0.1) - f(5)}{0.1}$$ OK!

$$\approx \frac{f(5+4) - f(5)}{4}$$ XXX

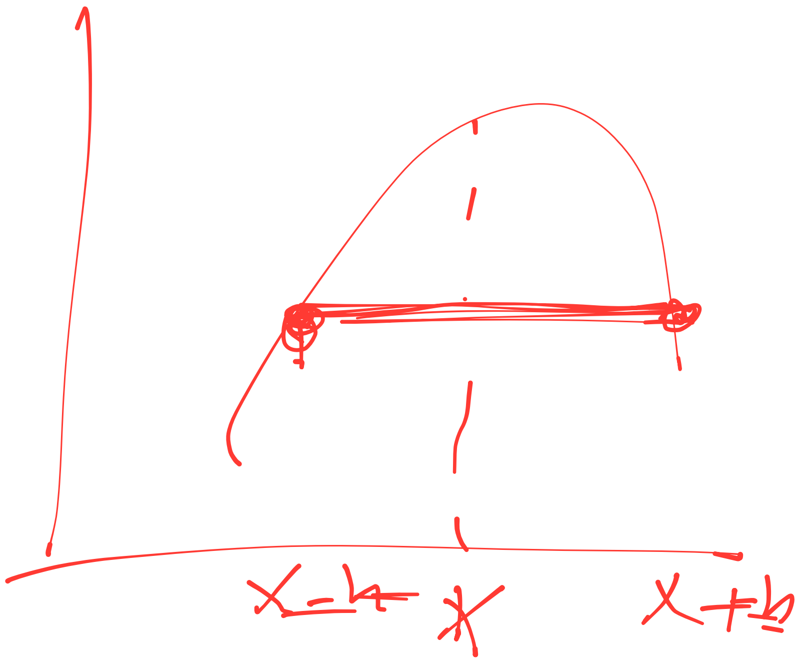
$h \propto \epsilon^{1/2} \|x\|$ $\qquad$ $h \approx 1 \cdot 10^{-3} |x|$

$$f'(x) \approx \frac{f(x+h) - f(x)}{h}$$

$$h = \overset{0.001}{\epsilon} \cdot |x|$$

$x = 5 \qquad h = 4$

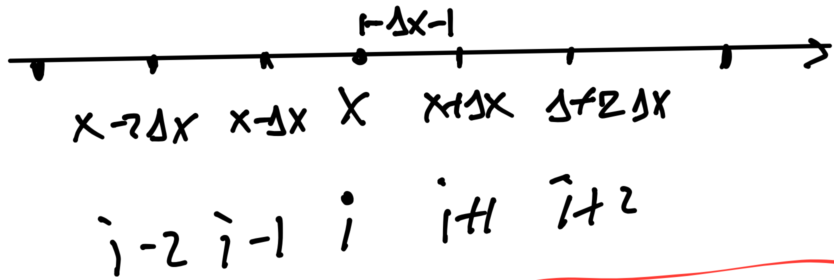
$h = 1,\ 0.1$



$$\frac{dP}{dT} = \frac{P(T+h) - P(T)}{h} \qquad h = 0.1$$

$$P'(T=50) \qquad P'(50) = \frac{P(50.1) - P(50)}{0.1}$$

$f(x)$, $f(x+\Delta x)$, $f(x-\Delta x)$, $f(x+2\Delta x)$....



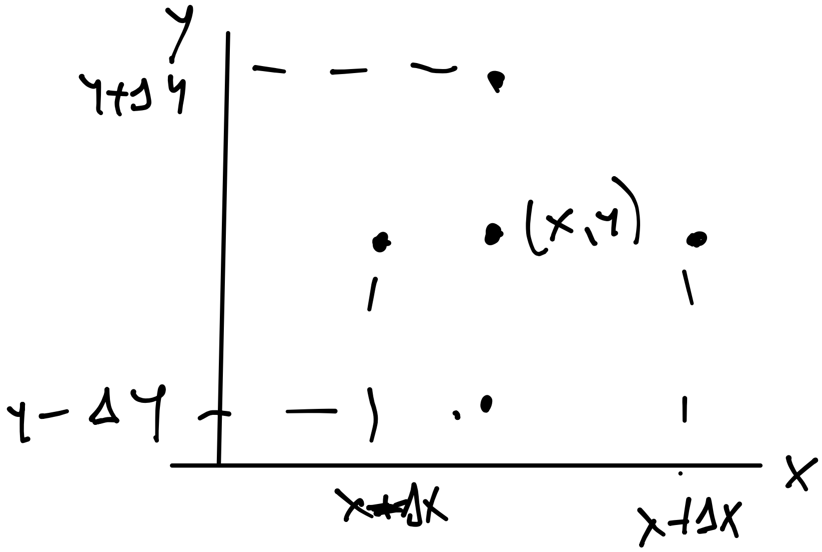
$$f'(x) = \frac{f(x+\Delta x) - f(x-\Delta x)}{2\Delta x} = \frac{f_{i+1} - f_{i-1}}{2\Delta x}$$

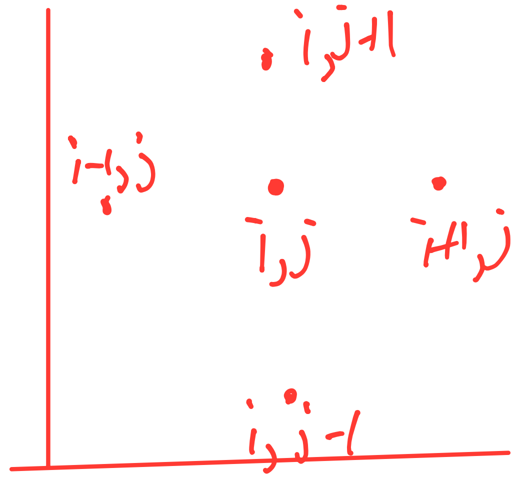
$f(x,y) = x^2 + y^2$ $\quad \frac{\partial f}{\partial x} = 2x \quad \frac{\partial f}{\partial y} = 2y$

$$\frac{\partial f}{\partial x} = \frac{f(x+\Delta x, y) - f(x-\Delta x, y)}{2\Delta x}$$

$$\frac{\partial f}{\partial y} = \frac{f(x, y+\Delta y) - f(x, y-\Delta y)}{2\Delta y}$$

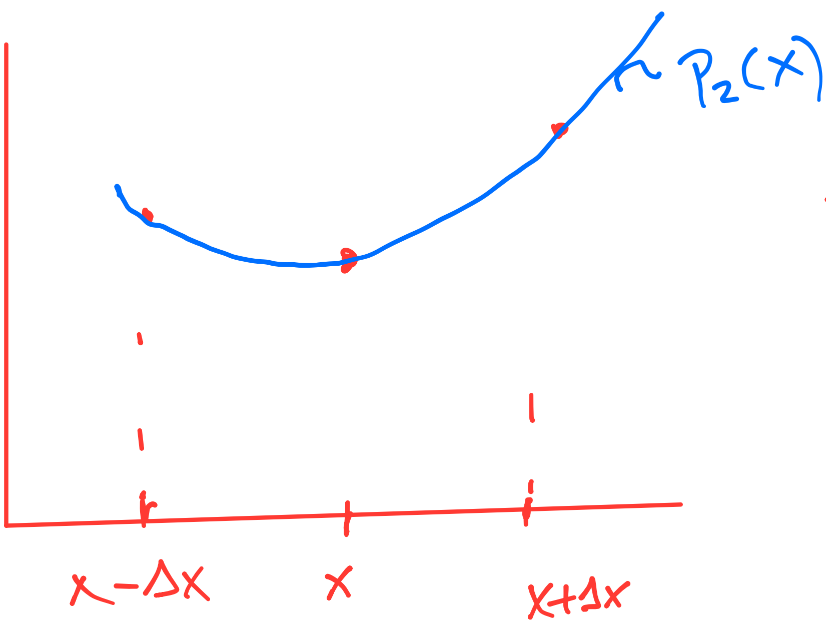
$f(x,y) = xy^2$ $\quad \frac{\partial f}{\partial x} = y^2 \quad \frac{\partial f}{\partial y} = 2xy$





$$h = x^2 + y^2 \qquad x = 1 \qquad y = 3$$

$$\frac{\partial h}{\partial x} = 2x \qquad \frac{\partial h}{\partial y} = 2y \qquad \frac{\partial h}{\partial x} = 2 \qquad \frac{\partial h}{\partial y} = 6$$

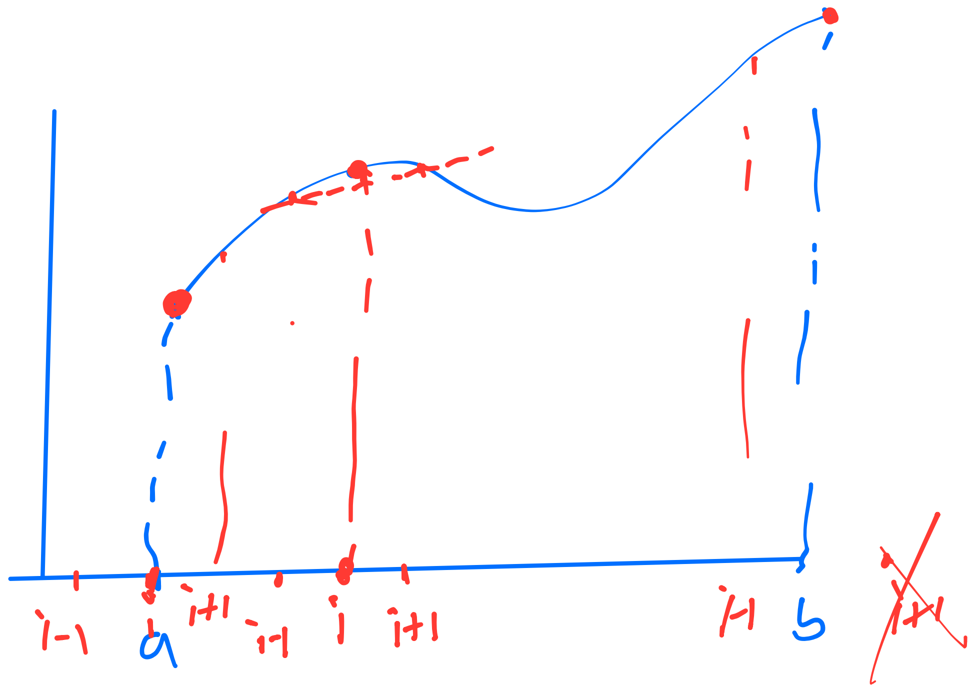


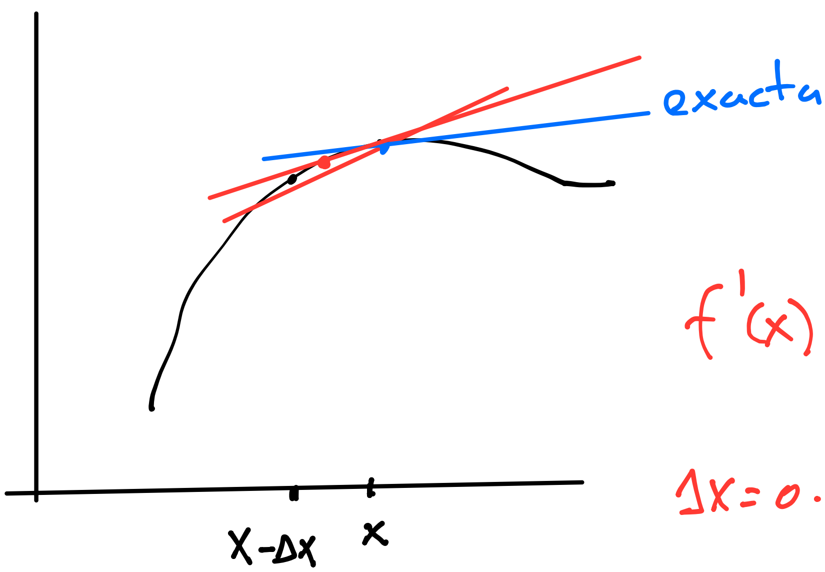
x	y
$x-\Delta x$	y_{i-1}
x	y_i
$x+\Delta x$	y_{i+1}

$$P_2(x) = a_0 + a_1 x + a_2 x^2$$

1 2 3

$$P_2'(x) = a_1 + 2a_2 x$$





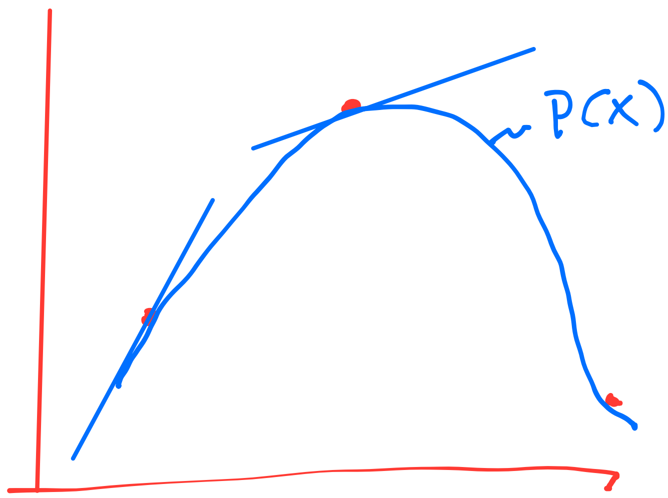
$$f'(x) \approx \frac{f(x)-f(x-\Delta x)}{\Delta x} + O(\Delta x)$$

$\Delta x = 0.1 \quad O(\Delta x) \propto 0.1$

$$f'(x) \approx \frac{f(x+\Delta x) - f(x-\Delta x)}{2\Delta x} + O(\Delta x^2)$$

$\Delta x = 0.1 \quad O(\Delta x^2) = \underline{0.01}$

x	$f(x)$
$x-\Delta x$	$f(x-\Delta x)$
x	$f(x)$
$x+\Delta x$	$f(x+\Delta x)$



$$P_2(x) = a_0 + a_1 x + a_2 x^2$$

$$f'(x) \approx P_2'(x)$$

$$P_2'(x) = a_1 + 2a_2 x$$

$$P_2'(x-\Delta x) = a_1 + 2a_2(x-\Delta x)$$

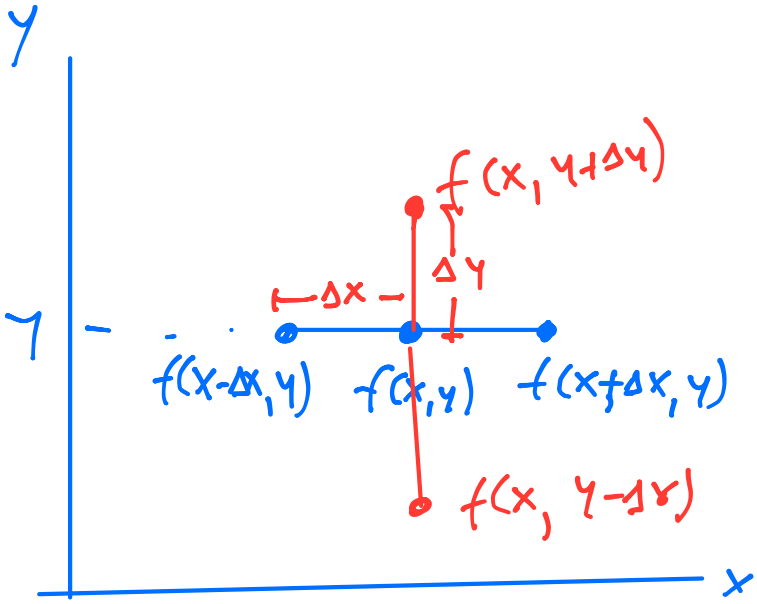
$$f(x,y) = x^2 + y^2$$

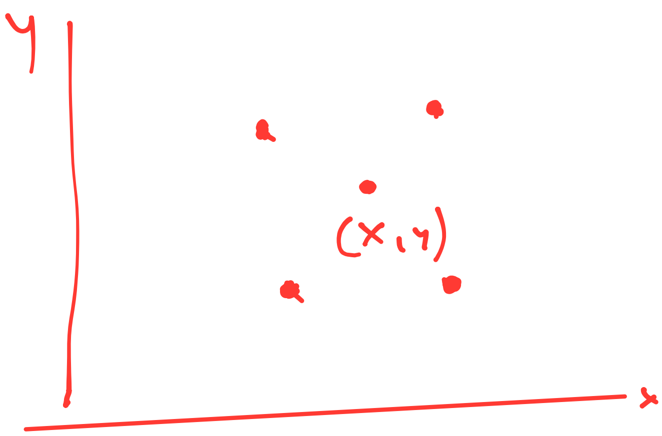
$$f_x = \frac{\partial f}{\partial x} = 2x \qquad \frac{\partial f}{\partial y} = 2y$$

$x = y$
$y = 3$

$$\frac{\partial^2 f}{\partial x^2} = 2 \qquad \frac{\partial^2 f}{\partial y^2} = 2 \qquad \frac{\partial^2 f}{\partial x \partial y} = 0 \quad f_{xy}$$

$f_{,xxy}$


y
f(x, y+Δy)
Δy
Δx
y
f(x-Δx, y)
f(x, y)
f(x+Δx, y)
f(x, y-Δy)
x


y
(x, y)
x

$$P(x) = 0.0375x^5 - 0.525x^4 + 2.6625x^3 - 4.775x^2 + 4.5x + 0$$

$$P'(x) = 5 \times 0.0375x^4 - 4 \times 0.525x^3 + 3 \times 2.6625x^2 - 2 \times 4.775x + 4.5$$

t	$x(t)$
t_1	x_1
t_2	t_2
$\vdots$	
t_N	x_N

$$v = \frac{dx}{dt}$$