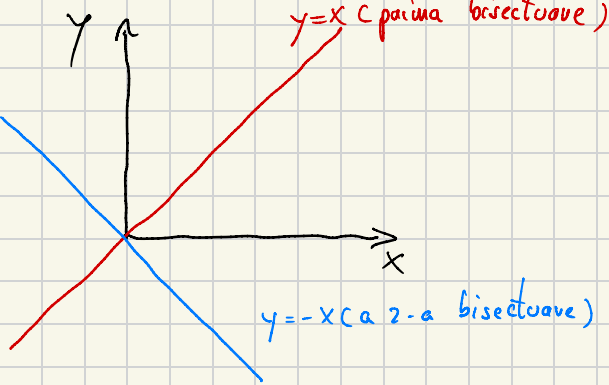
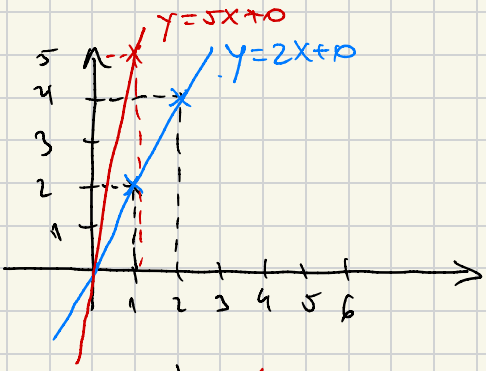
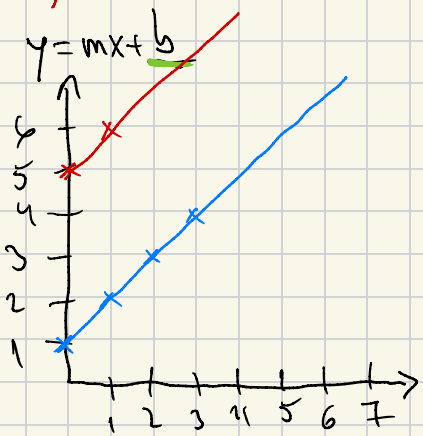
* Univariate Lineau Regression (with one variable) 28/04/2025.

$y = mx + b$ — m - panta, b - bias

pret, dimensiunea casei de exemplu.



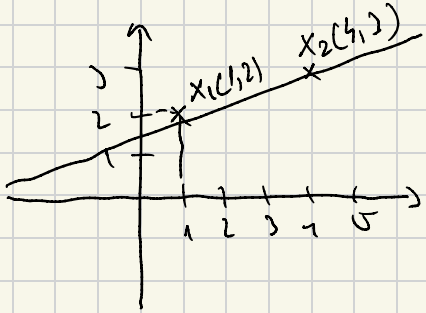




(1) $y = x + 1$

(2) $y = x \in 5$

$y = \overset{\text{slope}}{w} * x + b$ ← bias



$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-2}{4-1} = \frac{1}{3} = 0.33\ (\sim) = w$

Model: $f_{w,b}(x) = w * x + b$

Objective: w, b & minimize $J(w,b)$.

Cost function: $J(w,b)$ → so that we can predict y using x best

* Cost function

1) Mean Squared Error (error)

$$J(w,b) = \frac{1}{2*m} \sum_{i=1}^{m} (f_{w,b}(x^{(i)}) - y^{(i)})^2 .$$

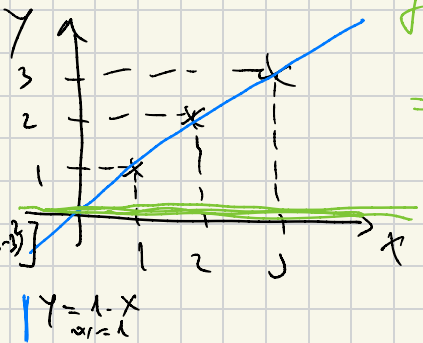
$f_{w,b}(x^{(i)})$: y predicted. $y^{(i)}$: ground truth.

Price y	Size x
1	1
2	2
3	3

$m = 3$

$b = 0$.

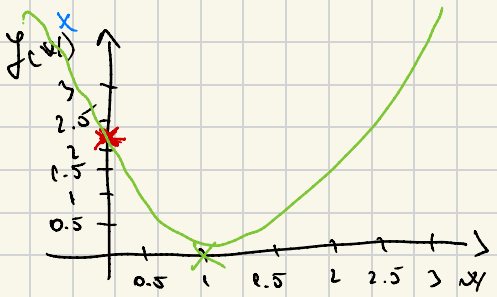
$$J(w=1) = \frac{1}{2*3}\left[(1-1)^2 + (2-2)^2 + (3-3)^2\right] = 0$$



$$J(w=0) = \frac{1}{2*3}\left[(0-1)^2 + (0-2)^2 + (0-3)^2\right]$$

$$= \frac{1}{6}(14) = 2.3$$

$J(w=0)$

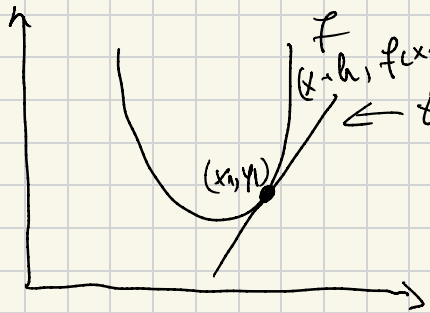


$f(x=1) = 0$

$f(x=0) = 2.25$

$f(x=0.5) = 5.25$

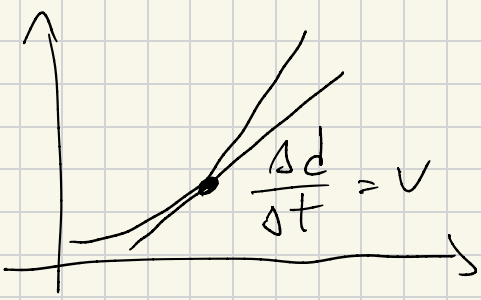
Derivată
= Panta tangentei la funcție într-un punct.



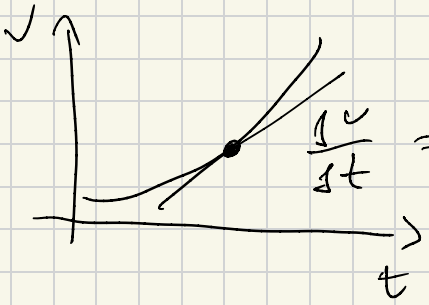
$$\lim_{h \to 0} \frac{f(x_1+h) - f(x_1)}{x_1 + h - x_1} = \frac{(x_1+h)^2 - x_1^2}{h} = \frac{x_1^2 + 2x_1 h + h^2 - x_1^2}{h} = \frac{h(2x_1 + h)}{h} = 2x_1.$$

$x_1 = 3.5$

$f'(x_1) = 2 \cdot 3.5 = 7$

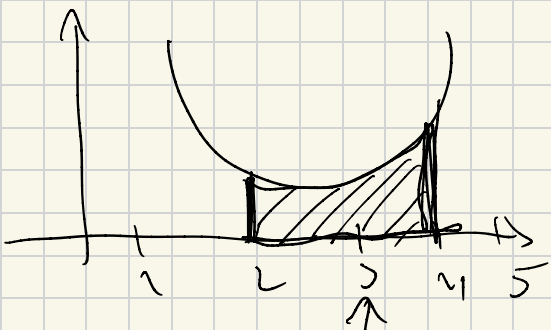


→ f' viteza.

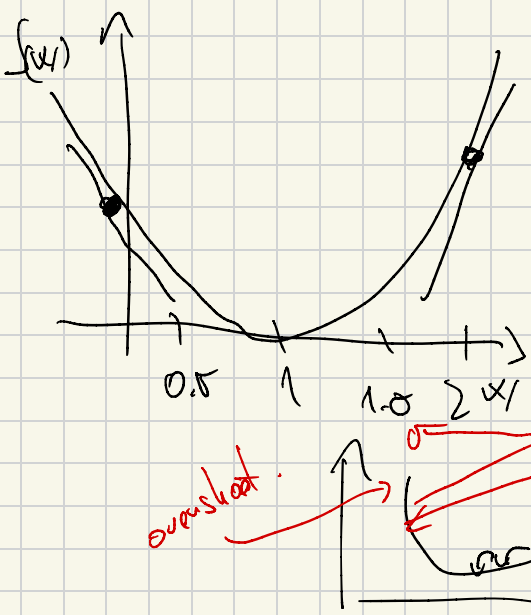


f''

$\frac{dv}{dt} = a$ - accelerație



$\int_2^4 f(x)\,dx$



$J(x)$ - Gradient Descent

$x = x - \alpha \frac{\partial}{\partial x} J(x)$.

$b = b - \alpha \frac{d}{db} J(b)$

(x repeat until convergence)

α - learning Rate

ar câț de mult să-l modific pe x din pașii (x3 x10)

$$J_{w,b}(x) = \frac{1}{2m} \sum_{i=1}^{m} (f_{w,b}(x_i) - y_i)^2$$

$$\frac{2}{2w} J_{w,b}(x)$$

$$J_{w,b}(x) = \frac{1}{2m} \sum_{i=1}^{m} (w \cdot x_i + b - y_i)^2$$

$$\frac{2}{2w} J_{w,b}(x) = \frac{1}{2m} \sum_{i=1}^{m} 2 (w \cdot x_i + b - y_i) * x_i$$

$$\frac{2}{2b} J_{w,b}(x) = \frac{1}{2m} \sum_{i=1}^{n} 2 (w x_i + b - y_i)$$