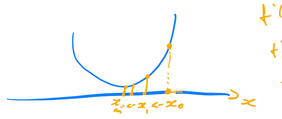
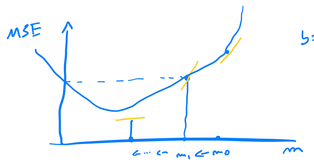
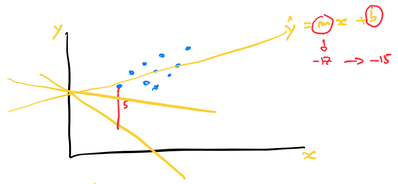


$f'(x_0) = 14$

$f'(x_1) = 5$

$f'(x_n) = 0$





$$\hat{y} = \frac{1}{1 + e^{-(\beta_1 x_1 + \dots + \beta_n \cdot x_n + \beta_0)}}$$

$$\text{Sigmoid}(x) = \frac{1}{1 + e^{-x}}$$

$$CE(y, \hat{y}) = \underbrace{y}_{1} \cdot \log \hat{y} + \underbrace{(1-y)}_{1-1=0} \cdot \log(1-\hat{y})$$

$$\frac{\partial CE}{\partial \beta_1}$$

$\log \hat{y}$, $y = 1$

$\log 1 - \hat{y}$, $y = 0$

$$MSE = \frac{1}{N} \sum_{i}^{N} (y_i - \hat{y}_i)^2$$

$$\partial x^m = m \times x^{m-1} \times \partial x$$

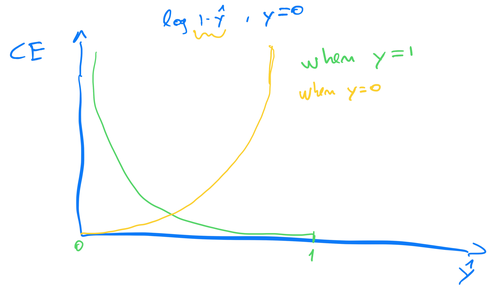
$$\frac{\partial MSE}{\partial m} = \frac{1}{N} \left(\frac{\partial (y_1 - \hat{y}_1)^2}{\partial m} + \frac{\partial (y_2 - \hat{y}_2)}{\partial m} + \dots + \frac{\partial (y_N - \hat{y}_N)}{\partial m} \right)$$

$$\frac{\partial}{\partial m} (y_1 - m x_1 + b)^2 = 2 \times (SE_1) \times (-x_1)$$
$$= 2 \times 5 \times (-3) = -30$$

$$z = \beta_1 x_1 + \beta_2 x_2 + \beta_0$$

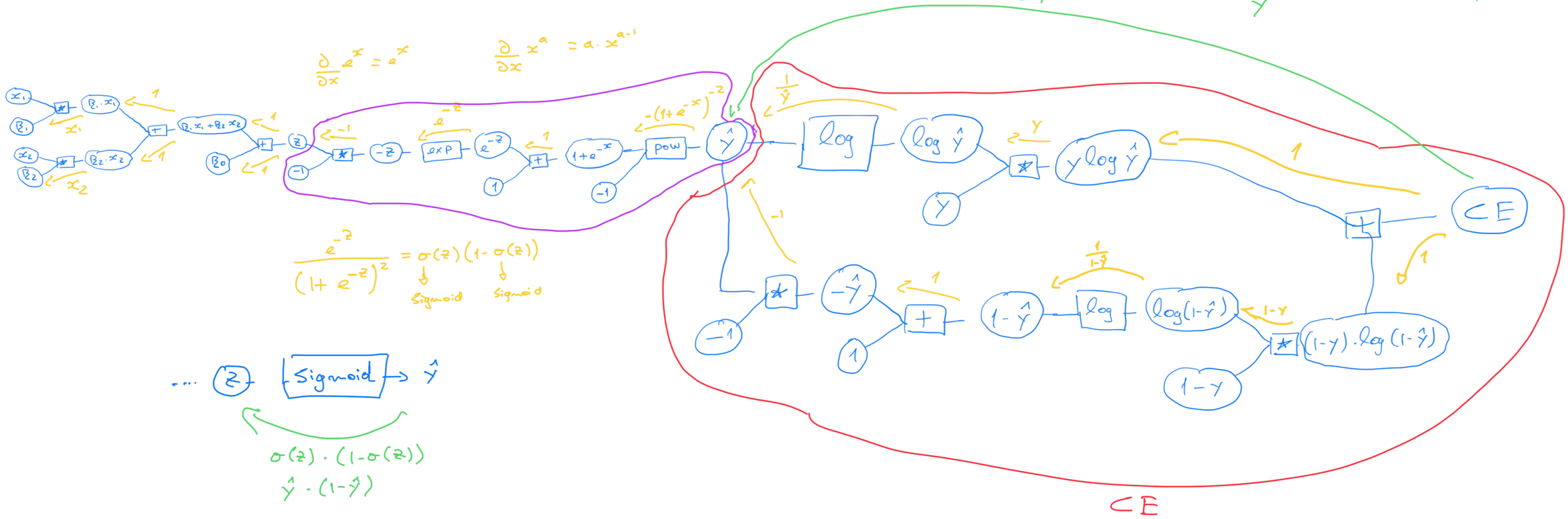
$$\text{Sigmoid}(x) = \frac{1}{1 + e^{-x}}$$

$x_1 \quad x_2 \to y$



Computational graph of the logistic regression for 2 features and its respective Cross Entropy loss.

$$\frac{\partial CE}{\partial \hat{y}} = 1 \cdot y \cdot \frac{1}{\hat{y}} = \frac{y}{\hat{y}} + 1 \cdot (1-y) \cdot \frac{1}{1-\hat{y}} (-1) = \frac{y}{\hat{y}} - \frac{1-y}{1-\hat{y}}$$



$$\frac{\partial CE}{\partial \beta_0} = \begin{cases} \frac{1}{\cancel{\hat{y}}} \cdot \cancel{\hat{y}} \cdot (1-\hat{y}) \cdot 1 = (1-\hat{y}) & , \text{if } y = 1 \\ -\frac{1}{\cancel{1-\hat{y}}} \cdot \hat{y} \cancel{(1-\hat{y})} = -\hat{y} & , \text{if } y = 0 \end{cases}$$

$$\frac{\partial CE}{\partial \beta_1} = \frac{\partial CE}{\partial \beta_0} \cdot x_1$$