

$$\mathcal{L}(w_0, w_1) \approx -\nabla_{\underline{w}} \mathcal{L} = \begin{pmatrix} -\partial \mathcal{L} / \partial w_0 \\ -\partial \mathcal{L} / \partial w_1 \end{pmatrix} \quad (1)$$

$$\underline{w} \leftarrow \begin{pmatrix} w_0 \\ w_1 \end{pmatrix} - \alpha \nabla_{\underline{w}} \mathcal{L}$$

$$w_0 \leftarrow w_0 - \alpha \frac{\partial \mathcal{L}}{\partial w_0}$$

$$\sum_{k=0}^1 x^k w_k \quad 1 \cdot \cancel{x} w_0 + x w_1$$

$$\underline{w}^T \underline{x} = (w_0 \ w_1) \cdot \begin{pmatrix} 1 \\ x \end{pmatrix} = w_0 \cdot 1 + w_1 \cdot x$$

$$\underline{x}_n = \begin{pmatrix} 1 \\ x_n \end{pmatrix}$$

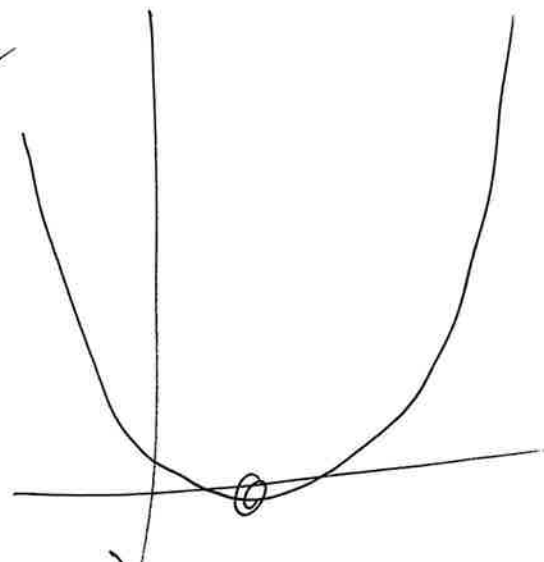
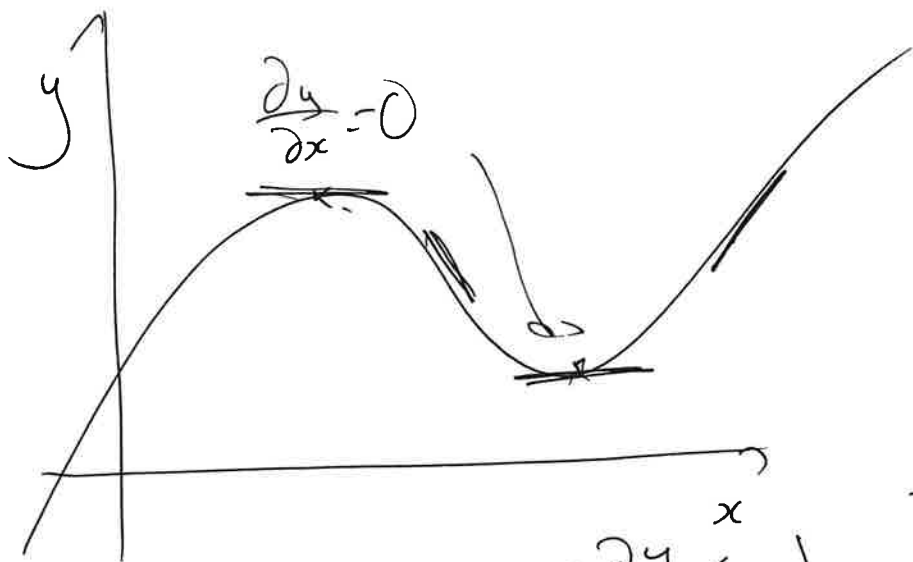
$$\underline{a} = \begin{pmatrix} a_0 \\ a_1 \\ \vdots \end{pmatrix} \Rightarrow \underline{a}^T \underline{a} = (a_0 \ a_1 \ \dots) \begin{pmatrix} a_0 \\ a_1 \\ \vdots \end{pmatrix}$$

$$= (a_0 \times a_0) + a_1 \times a_1 + \dots$$

$$= a_0^2 + a_1^2 \dots$$

$$= \sum_k a_k^2$$

$$\underline{X} \cdot \underline{w} = \underset{\substack{\uparrow \\ N}}{\begin{pmatrix} 1 & x_1 & x_2 \\ \vdots & \vdots & \vdots \end{pmatrix}} \cdot \begin{pmatrix} w_0 \\ w_1 \end{pmatrix} = \underset{\sim}{\begin{pmatrix} 1 \cdot w_0 + x_1 w_1 \\ 1 \cdot w_0 + x_2 w_1 \\ \vdots \end{pmatrix}} \quad (2)$$



$$\nabla_{\underline{w}} \mathcal{L} = \underline{0} \Rightarrow \begin{pmatrix} \frac{\partial \mathcal{L}}{\partial w_0} \\ \frac{\partial \mathcal{L}}{\partial w_1} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$\nabla_{\underline{w}} \left[\frac{1}{N} (\underline{t} - \underline{X}\underline{w})^T (\underline{t} - \underline{X}\underline{w}) \right]$$

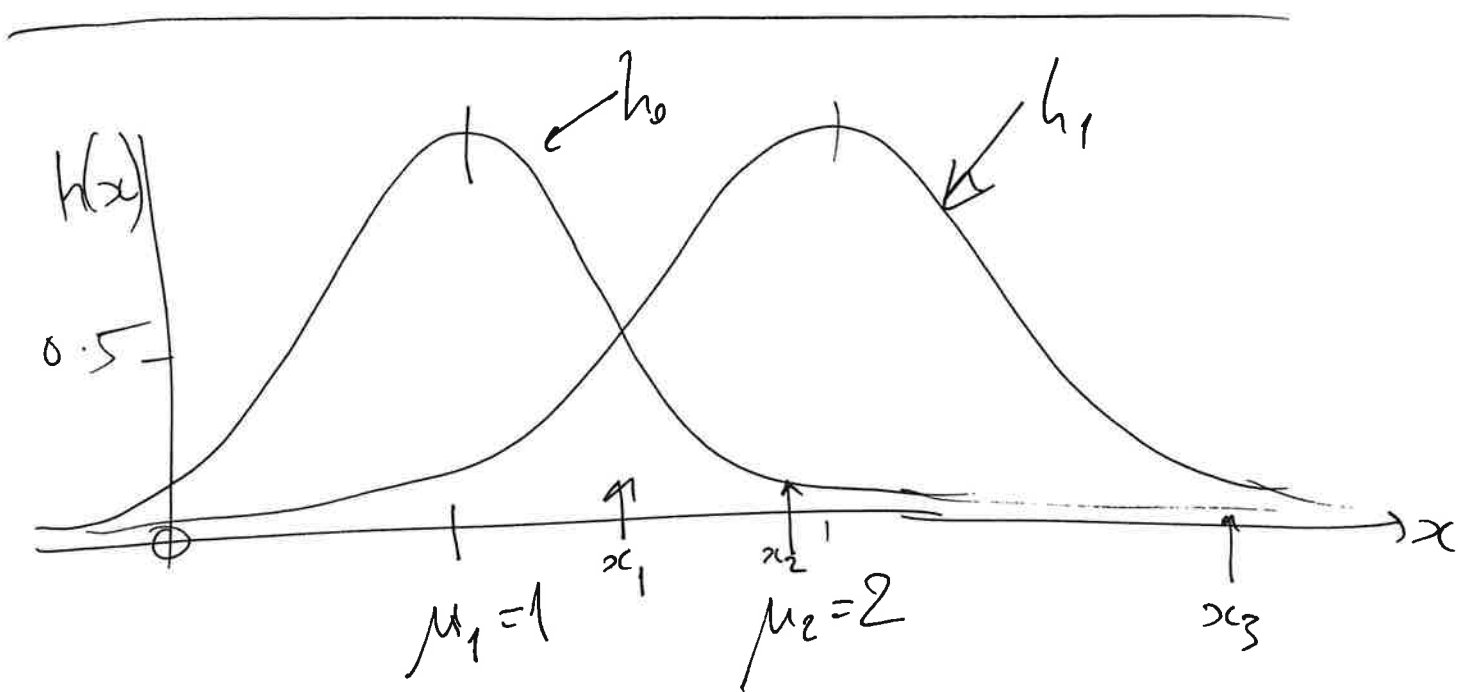
$$= \frac{-2}{N} (\underline{X}^T \underline{t} - \underline{X}^T \underline{X} \underline{w}) = \underline{0}$$

$$\Rightarrow \underline{X}^T \underline{t} = (\underline{X}^T \underline{X}) \underline{w}$$

$$\Rightarrow (\underline{X}^T \underline{X})^{-1} \underline{X}^T \underline{t} = (\underline{X}^T \underline{X})^{-1} (\underline{X}^T \underline{X}) \underline{w}$$

(3)

$$W = (\underline{X}^T \underline{X})^{-1} \underline{X}^T \underline{t}$$



$$\underline{X} = \begin{pmatrix} h_0 & h_1 \\ 0.5 & 0.5 \\ 0.1 & 0.9 \\ 0.0 & 0.1 \end{pmatrix} \begin{matrix} \leftarrow x_1 \\ \leftarrow x_2 \\ \leftarrow x_3 \end{matrix}$$