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Problem 1. (5 points)

$$L = \frac{1}{m} \sum_{i=1}^m -\ln p_i + \frac{\lambda}{m} \sum_{j=1}^n w_j^2$$

Answer:

$$\begin{aligned} \frac{\partial L}{\partial w_k} &= \frac{\partial L}{\partial w_k} \frac{1}{m} \sum_{i=1}^m -\ln p_i + \frac{\partial L}{\partial w_k} \frac{\lambda}{m} \sum_{j=1}^n w_j^2 \\ &= \frac{1}{m} \sum_{i=1}^m \frac{-1}{p_i} \frac{\partial p_i}{\partial w_k} + \frac{2\lambda}{m} w \\ &= \frac{1}{m} \sum_{i=1}^m \frac{-1}{p_i} p_i (1 - p_i) \frac{\partial y_i w^T x_i}{\partial w_k} + \frac{2\lambda}{m} w \\ &= \frac{1}{m} \sum_{i=1}^m -(1 - p_i) y_i x_i + \frac{2\lambda}{m} w \end{aligned}$$