

## Homework 1: Likelihoods and Gradients

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In class we showed that the likelihood in logistic regression is given by:

$$\mathbb{L}(\boldsymbol{\beta}|\mathbf{Y}, \mathbf{X}) = \prod_{i=1}^n \left( \frac{1}{1 + e^{-\boldsymbol{\beta}^\top \mathbf{x}_i}} \right)^{y_i} \left( 1 - \frac{1}{1 + e^{-\boldsymbol{\beta}^\top \mathbf{x}_i}} \right)^{1-y_i}. \quad (1.1)$$

- (a) Derive an expression for the log-likelihood.
- (b) Derive an expression for the gradient of the log-likelihood.