

4-1. Find the derivative of the function with respect to b
(ANS: $2\sum(\phi X_i/b)$)

$$\frac{d \sum_{i=1}^m (\phi X_i + b)^2}{d b}$$

4-2. Find the derivative of the log function with respect to h_i
(ANS: $\sum ((-Y_i/h_i) + (1-Y_i)/(1-h_i))$)

$$\frac{d \sum_{i=1}^m -(y_i \log h_i + (1-y_i) \log(1-h_i))}{d h_i}$$

4-1

$$A = \phi X_i + b$$

$$\frac{d \sum_{i=1}^m (\phi X_i + b)^2}{d b}$$

$$\Rightarrow \frac{d \sum_{i=1}^m A^2}{d A} \cdot \frac{d A}{d b} = 2 \sum_{i=1}^m A \cdot \frac{d A}{d b}$$

$$\Rightarrow 2 \sum_{i=1}^m (\phi X_i + b) \cdot 1$$

4-2.

$$\frac{d \sum_{i=1}^m -(y_i \log h_i + (1-y_i) \log(1-h_i))}{d h_i}$$

$$\Rightarrow \sum_{i=1}^m \left(- \frac{d y_i \log h_i}{d h_i} - \frac{d (1-y_i) \log(1-h_i)}{d (1-h_i)} \frac{d (1-h_i)}{d h_i} \right)$$

$$\Rightarrow \sum_{i=1}^m -y_i \frac{1}{h_i} + (1-y_i) \frac{1}{1-h_i} \cdot (-1)$$

$$= \sum_{i=1}^m \left(- \frac{y_i}{h_i} + \frac{1-y_i}{1-h_i} \right)$$

4-3. Find the derivative of the exponential function with respect to x
(ANS: $(-2X)^e e^{(1-X^2)}$)

$$\frac{d e^{(1-x^2)}}{d x}$$

4-4. Find the derivative of the fractional function with respect to x.
(ANS: $(3X^2-6X+1)/((1-X)^2)$)

$$\frac{d\left(\frac{1-3x^2}{1-x}\right)}{d x}$$

4-3

$$\begin{aligned} \frac{d e^{(1-x^2)}}{d x} &= e^{(1-x^2)} \frac{d(1-x^2)}{d x} \\ &= e^{(1-x^2)} \cdot (-2x) \\ &= -2x e^{(1-x^2)} \end{aligned}$$

4-4

$$\begin{aligned} \frac{d\left(\frac{1-3x^2}{1-x}\right)}{d x} &= \frac{d(1-3x^2)}{d x} (1-x)^{-1} + (1-3x^2) \frac{d(1-x)^{-1}}{d x} \\ &= (-6x)(1-x)^{-1} + (1-3x^2) \cdot -1 (1-x)^{-2} \cdot -1 \\ &= \frac{-6x(1-x)}{(1-x)^2} + \frac{(1-3x^2)}{(1-x)^2} \\ &= \frac{-6x+6x^2+1-3x^2}{(1-x)^2} = \frac{3x^2-6x+1}{(1-x)^2} \end{aligned}$$