1 Gradient Descent

$$dC(\omega) = \lim_{\varepsilon \to 0} \frac{C(\omega + \varepsilon) - C(\omega)}{\varepsilon} \tag{1}$$

$$\tag{2}$$

1.1 "Computing The Derivitive of Twice"

$$C(w) = \frac{\sum_{i=1}^{n} (x_i \cdot w - y_i)^2}{n} \tag{3}$$

$$C'(w) = \left(\frac{\sum_{i=1}^{n} (x_i \cdot w - y_i)^2}{n} \right)' = \tag{4}$$

$$= \left(\frac{1}{n} \cdot \sum_{i=1}^{n} (x_i \cdot w - y_i)^2 \right)' = \tag{5}$$

$$= \frac{1}{n} \cdot \left(\sum_{i=1}^{n} (x_i \cdot w - y_i)^2 \right)' = \tag{6}$$

$$= \frac{1}{n} \cdot \sum_{i=1}^{n} \left((x_i \cdot w - y_i)^2 \right)' = \tag{7}$$

$$= \frac{1}{n} \cdot \sum_{i=1}^{n} \left(2 \cdot (x_i \cdot w - y_i)(x_i \cdot w - y_i)' \right) = \tag{8}$$

$$= \frac{1}{n} \cdot \sum_{i=1}^{n} \left(2 \cdot (x_i \cdot w - y_i) \cdot x_i \right) \tag{9}$$

$$C(w) = \frac{\sum_{i=1}^{n} (x_i \cdot w - y_i)^2}{n} \tag{10}$$

$$C'(w) = \frac{1}{n} \cdot \sum_{i=1}^{n} \left(2 \cdot (x_i \cdot w - y_i) \cdot x_i \right) = \tag{11}$$

$$\tag{12}$$