1 Gradient Descent

$$C' = \lim_{\epsilon \to 0} \frac{C(w_i + \epsilon) - C(w_i)}{\epsilon} \tag{1}$$

1.1 "Twice"

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

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

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

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

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

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

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

$$\tag{9}$$

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

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

$$\tag{12}$$