$$MSE(\alpha, \beta) = \frac{1}{n} \sum_{i=1}^{n} (y_i - \alpha - \beta x_i)^2$$

$$\frac{\partial}{\partial \alpha} MSE(\alpha, \beta) = \frac{1}{n} \sum_{i=1}^{n} \underbrace{\frac{\partial}{\partial \alpha} (y_i - \alpha - \beta x_i)^2}_{2(y_i - \alpha - \beta x_i)^1 \cdot \underbrace{\frac{\partial}{\partial \alpha}(-\alpha)}_{-1}}$$

chain rule.

$$= \frac{2}{n} \sum_{i=1}^{n} (y_i - \alpha - \beta x_i)$$

$$= \frac{2}{n} \left(\underbrace{\sum_{i}^{n} y_i}_{n\bar{y}} - \alpha \underbrace{\sum_{i}^{n} 1}_{n} - \beta \underbrace{\sum_{i}^{n} x_i}_{n\bar{x}} \right)$$

$$= 2 (\bar{y} - \alpha - \beta \bar{x})$$

$$\frac{\partial}{\partial \alpha} MSE \Big|_{\hat{\alpha}, \hat{\beta}} = 0 \implies \underline{\bar{y} - \hat{\alpha} - \hat{\beta} \bar{x} = 0}$$