$$\text{argmin}_{\theta_0,\theta_1|x_i,y_i} \sum_{i=1}^{n}(y_i - (\theta_0 + \theta_1 x_i))^2$$

$$SSR = \sum_{i=1}^{n}(y_i - \hat{y})^2 \qquad \hat{y}_i = \beta_0 + \beta_1 x_i$$

$$\frac{\partial}{\partial \theta_0}\left[\sum_{i=1}^{n}(y_i - \theta_0 - \theta_1 x_i)^2\right] = 0$$

$$-2\sum_{i=1}^{n}(y_i - \theta_0 - \theta_1 x_i) = 0$$

$$\frac{-2\sum_{i=1}^{n}(y_i - \theta_0 - \theta_1 x_i)}{-2} = \frac{0}{-2}$$

$$\sum_{i=1}^{n} y_i - n\theta_0 - \theta_1 \sum_{i=1}^{n} x_i = 0$$

$$n\theta_0 = \sum_{i=1}^{n} y_i - \theta_1 \sum_{i=1}^{n} x_i$$

$$\theta_0 = \frac{\sum_{i=1}^{n} y_i - \theta_1 \sum_{i=1}^{n} x_i}{n}$$

$$\frac{\partial}{\partial \theta_1}\left[\sum_{i=1}^{n}(y_i - \theta_0 - \theta_1 x_i)^2\right] = 0$$

$$\frac{-2\sum_{i=1}^{n}(y_i - \theta_0 - \theta_1 x_i)x_i}{-2} = \frac{0}{-2}$$

$$\sum_{i=1}^{n} y_i x_i - \theta_0 \sum_{i=1}^{n} x_i - \theta_1 \sum_{i=1}^{n} x_i^2 = 0$$

$$\theta_1 \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} y_i x_i - \left(\frac{1}{n}\sum_{i=1}^{n} y_i - \frac{\theta_1}{n}\sum_{i=1}^{n} x_i\right)\sum_{i=1}^{n} x_i$$

$$\theta_1 = \frac{\sum_{i=1}^{n} y_i x_i - \frac{1}{n}\sum_{i=1}^{n} y_i + \frac{\theta_1}{n}\left(\sum_{i=1}^{n} x_i\right)^2}{\sum_{i=1}^{n} x_i^2 - \frac{1}{n}\sum_{i=1}^{n} x_i}$$

$$\sum_{i=1}^{n} x_i$$

$$\theta_1 = \frac{\sum_{i=1}^{n} y_i x_i - \frac{1}{n}\sum_{i=1}^{n} y_i \sum_{i=1}^{n} x_i}{\sum_{i=1}^{n} x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)^2}$$