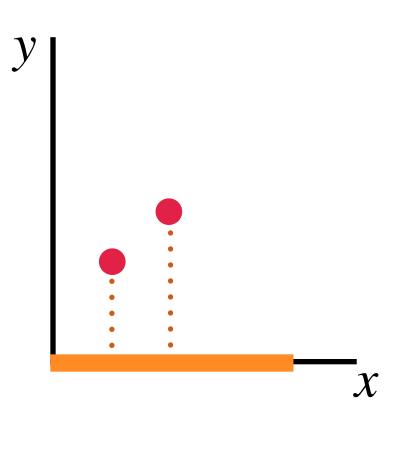
## Example: Very Simple Linear Regression

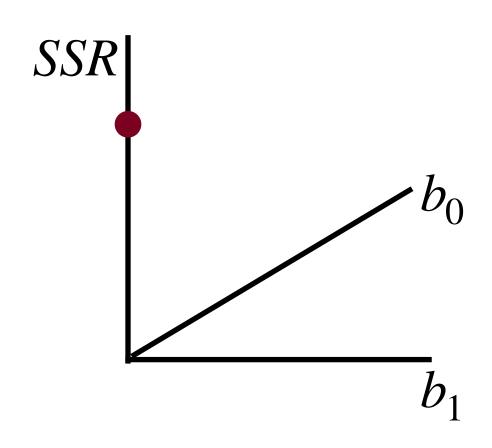
## **Gradient:**

$$\begin{bmatrix} \frac{\partial RSS}{\partial b_0} \\ \frac{\partial RSS}{\partial b_1} \end{bmatrix} = \begin{bmatrix} -2\sum_{i}^{N} (y_i - (b_0 + b_1 x_i)) \\ -2\sum_{i}^{N} x_i (y_i - (b_0 + b_1 x_i)) \end{bmatrix}$$

Initialize the gradient algorithm at (0,0)

$$\implies \begin{bmatrix} -2\sum_{i}^{N}(y_{i}) \\ -2\sum_{i}^{N}x_{i}(y_{i}) \end{bmatrix} = \begin{bmatrix} -2(2+3) \\ -2(1\cdot2+2\cdot3) \end{bmatrix} = \begin{bmatrix} -10 \\ -16 \end{bmatrix}$$





Compute loss function value:

$$SSR = \sum_{i=1}^{N} (y_i - b_0 - b_1 x_i)^2 = (2 - 0 - 0 \cdot 1)^2 + (3 - 0 - 0 \cdot 3)^2 = 13$$

## Example: Very Simple Linear Regression

## **Gradient:**

$$\begin{bmatrix} \frac{\partial RSS}{\partial b_0} \\ \frac{\partial RSS}{\partial b_1} \end{bmatrix} = \begin{bmatrix} -2\sum_{i}^{N} (y_i - (b_0 + b_1 x_i)) \\ -2\sum_{i}^{N} x_i (y_i - (b_0 + b_1 x_i)) \end{bmatrix}$$

Apply the changes (learning rate 0.01):

$$\begin{bmatrix} b_{0_{new}} \\ b_{1_{new}} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} - 0.01 \begin{bmatrix} -10 \\ -16 \end{bmatrix}$$

$$\implies \begin{vmatrix} b_{0_{new}} \\ b_{1_{new}} \end{vmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} + 0.01 \begin{bmatrix} 10 \\ 16 \end{bmatrix} = \begin{bmatrix} 0.10 \\ 0.16 \end{bmatrix}$$

