$\hat{b}$: $0 = -2y^T X + 2\hat{b}^T X^T X$

$+2y^T X = 2\hat{b}^T X^T X$ // T() on both sides

$X^T y = (\hat{b}^T X^T X)^T$

$= X^T X \hat{b}$

$\Rightarrow$ Least-Squares normal equations

$X^T X \hat{b} = X^T y$ / multiply by $(X^T X)^{-1}$

$\underbrace{(X^T X)^{-1}(X^T X)}_{I} \hat{b} = (X^T X)^{-1} X^T y$

$\hat{b} = (X^T X)^{-1} X^T y$

$\hat{b} = \begin{bmatrix} b_0 \\ b_1 \\ b_2 \end{bmatrix}$