$$\min_{\beta \in \mathbb{R}^d} \sum_{i=1}^{n} w_i (\underbrace{z_i^T \beta}_{\text{scalar}} - y_i)^2 + \underbrace{\lambda \sum_{j=1} \beta_j^2}_{\lambda \beta^T \beta}$$

convert to matrix form

matrix form: $(Z^T\beta - Y)^T W (Z^T\beta - Y) + \lambda \beta^T \beta =$

$(\beta^T Z - Y^T) W (Z^T \beta - Y) + \lambda \beta^T \beta =$

$(\beta^T Z W - Y^T W)(Z^T \beta - Y) + \lambda \beta^T \beta =$

take derivative

$\beta^T Z W Z^T \beta - \beta^T Z W Y - Y^T W Z^T \beta + \cancel{Y^T W Y} + \lambda \beta^T \beta =$ $\to 0$

$\to 2\lambda\beta$

$(ZWZ^T + (ZWZ^T)^T)\beta - ZWY - Y^TWZ^T + 2\lambda\beta = 0$

$(WZ^T)^T Z^T \quad Z(ZW)^T$

$ZW^TZ^T \quad ZW^TZ^T \to$ since W is symmetrical, $W = W^T$

$(ZWZ^T + (ZWZ^T)^T + 2\lambda)\beta = ZWY + Y^TWZ^T$

$(ZWZ^T + ZWZ^T + 2\lambda)\beta = ZWY + Y^TWZ^T$

$\beta = (2ZWZ^T + 2\lambda)^{-1}(ZWY + Y^TWZ^T)$