$$(\vec{a} + \vec{b}) \cdot \vec{c} = ac + bc$$

$$y_i = \sum_j \theta_j \cdots x_{ij}$$

$$(X\Theta)^T = \Theta^T X^T$$

$$\|y - X\Theta\|^2 = (y - X\Theta)^T (y - X\Theta) = y^T y - [\Theta^T x^T y] - y^T X\Theta + \Theta^T x^T \cdot X\Theta \quad \text{Transpose}$$

$$0 = \frac{d\Delta}{d\Theta} = \frac{d(-2y^T X\Theta + \Theta^T x^T X\Theta)}{d\Theta} = -2y^T x + 2\Theta^T \cdot x^T \cdot x \implies \Theta^T x^T x = y^T x \impliedby x^T X\Theta = x^T y$$

$$y = (x^T \cdot x)^{-1} \cdot x^T \cdot y$$
$$\downarrow \text{inverse}$$

$$\frac{d}{d}(\vec{x^2}) \qquad x^T \cdot Ax = 2x^T A$$

$$x^T A x \geqslant 0 \rightarrow PSD$$

$$2x^T A$$

$$\min_{a, c} \|y - X\Theta\|^2 + \rho\|\Theta\|^2 \rightarrow \qquad \rho \Theta^T \Theta$$

$$-2y^T x + 2\Theta^T x^T x + 2\rho \Theta^T \qquad \qquad \rho\Theta^T \cdot I \cdot \Theta$$

$$= 2\Theta^T x^T x + 2\rho\Theta = 2y^T x$$

$$= \Theta^T x^T x + \rho\Theta^T I = y^T x$$
$$\underbrace{[^T \Theta \rho]}_{I} \quad ?$$

$$xy^T = x^T x\Theta + \rho I\Theta$$
$$= x^T x + \rho I)\Theta$$

when A is PSD
$$\Theta = (x^T x + \rho I)^{-1} x^T \cdot y$$

Eigenvalues $\Bigg\{ \begin{array}{l} x^T(A + \rho I) \cdot x \geqslant 0 \\ x^T A x + x^T \rho I \cdot x \geqslant 0 \\ \qquad \downarrow \\ \qquad I \end{array}$