

3a)

Least square regression:-  $f(v) = \|X^T v - y\|^2$

$$\frac{\partial f(v)}{\partial v} = 2X(X^T v - y) = 0$$

$$XX^T v = Xy$$

Since  $XX^T$  is + Semi-definite matrix  $XX^T$  is invertable

$$\Rightarrow v = (XX^T)^{-1} Xy$$

CCA : From lecture  $C_{xy} w_y = \alpha C_{xx} w_x$

$$X Y^T w_y = \alpha X X^T w_x \quad \text{where } Y \in \mathbb{R}^{1 \times N} \text{ and } Y = y^T$$

notice that  $w_y \in \mathbb{R}^1$  is just a scalar

$$\frac{w_y}{\alpha} (XX^T)^{-1} (X Y^T) = w_x$$

$$\beta (XX^T)^{-1} (X Y) = w_x$$

Some scalar

$$\Rightarrow w_x = \beta v$$