β_is called y_i's

t_i : -1 0 1 2
y_i : -1 1 2 0

$$t_i = \begin{vmatrix} -1 \\ 0 \\ 1 \\ 2 \end{vmatrix} \qquad yi = \begin{vmatrix} -1 \\ 1 \\ 2 \\ 0 \end{vmatrix}$$

$\varphi(t) = \xi_1 + \xi_2 t + \xi_3 t^2$
$\varphi_1 (t) = 1$
$\varphi_2 (t) = t$
$\varphi_2 (t) = t^2$

f_1 = function φ_1 evaluated at the t_i's

$$f1 = \begin{vmatrix} 1 \\ 1 \\ 1 \\ 1 \end{vmatrix}$$

f2 function φ_2 evaluated at the t_i's

$$f_2 = \begin{vmatrix} -1 \\ 0 \\ 1 \\ 2 \end{vmatrix}$$

f3 function φ_3 evaluated at the t_i's

$$\begin{vmatrix} 1 \\ 0 \\ 1 \\ 4 \end{vmatrix}$$

$$F \quad x \quad \approx \quad b$$

$$\begin{vmatrix} 1 & -1 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \\ 1 & 2 & 4 \end{vmatrix} \qquad \begin{vmatrix} -1 \\ 1 \\ 2 \\ 0 \end{vmatrix}$$

$$F \qquad\qquad b$$

$\min || b - F x||_2$

Fx = b <== no solution [rectangular system: more eqns. than unknonwns]

==

$\| b - F (x + \delta) \|_2^2 = ((b - Fx) - F \delta, (b - Fx) - F \delta)$

$$= ((b - Fx), (b - Fx)) - (F\delta, b-Fx) - (b-Fx, F\delta) + (F\delta, F\delta)$$
$$= ((b - Fx), (b - Fx)) - 2(F\delta, b-Fx) + (F\delta, F\delta)$$
$$= ((b - Fx), (b - Fx)) - 2(\delta, F^T(b-Fx)) + (F\delta, F\delta)$$

Result: min is reached iff $F^T(b - Fx) = 0$

if $F^T(b - Fx) = 0$ then $\| b - F(x + \delta) \|_2^2 \geq \| b - Fx \|_2^2$