

$$5) Ax = b \Rightarrow A^T A \bar{x} = A^T b$$

$$y = ax^2 + bx + c$$

$$A^T A = \begin{bmatrix} 0 & 1 & 4 & 9 & 16 & 25 & 36 & 49 & 64 \\ 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 1 \\ 4 & 2 & 1 \\ 9 & 3 & 1 \\ 16 & 4 & 1 \\ 25 & 5 & 1 \\ 36 & 6 & 1 \\ 49 & 7 & 1 \\ 64 & 8 & 1 \end{bmatrix}$$

$$A^T A \bar{x} = \begin{bmatrix} 8772 & 1296 & 204 \\ 1296 & 204 & 36 \\ 204 & 36 & 9 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

$$A^T b = A^T \begin{bmatrix} 12 \\ 10.5 \\ 10 \\ 8 \\ 7 \\ 8 \\ 7.5 \\ 8.5 \\ 9 \end{bmatrix} = \begin{bmatrix} 1697 \\ 299 \\ 80.5 \end{bmatrix}$$

$$A^T A \bar{x} = A^T b$$

$$\begin{bmatrix} 8772 & 1296 & 204 \\ 1296 & 204 & 36 \\ 204 & 36 & 9 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1697 \\ 299 \\ 80.5 \end{bmatrix}$$

$$\left[\begin{array}{ccc|c} 8772 & 1296 & 204 & 1697 \\ 1296 & 204 & 36 & 299 \\ 204 & 36 & 9 & 80.5 \end{array} \right]$$

for easier elimination $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \Rightarrow \begin{bmatrix} x_3 \\ x_2 \\ x_1 \end{bmatrix}$

$$\left[\begin{array}{ccc|c} 9 & 36 & 204 & 80.5 \\ 36 & 204 & 1296 & 299 \\ 204 & 1296 & 8772 & 1697 \end{array} \right] \begin{array}{l} R_2 = R_2 - \frac{36}{9} R_1 \\ R_3 = R_3 - \frac{204}{9} R_1 \end{array}$$

$$\left[\begin{array}{ccc|c} 9 & 36 & 204 & 80.5 \\ 0 & 60 & 480 & -23 \\ 0 & 480 & 4148 & -127.6667 \end{array} \right] R_3 = R_3 - \frac{480}{60} R_2$$

$$\left[\begin{array}{ccc|c} 9 & 36 & 204 & 80.5 \\ 0 & 60 & 480 & -23 \\ 0 & 0 & 308 & 56.3334 \end{array} \right]$$

$$308 x_1 = 56.3334 \quad x_1 = 0.1829$$

$$60x_2 + 480(0.1829) = -23$$

$$x_2 = -1.84653$$

$$9x_3 + 36(-1.84653) + 204(0.1829) = 80.5$$

$$x_3 = 12.18483$$

$$y = 0.1829x^2 - 1.84653x + 12.18483$$