

## QUESTION 1

### 1.1 AUGMENTED DATA MATRIX

$$\tilde{D} = \begin{bmatrix} 1 & 1.2 & 3.0 \\ 1 & 2.0 & 2.5 \\ 1 & 3.0 & 4.0 \end{bmatrix}, Y = \begin{bmatrix} 180 \\ 210 \\ 290 \end{bmatrix}$$

### 1.2 CALCULATE $\tilde{D}^T \tilde{D}$

$$\begin{aligned} \tilde{D}^T \tilde{D} &= \begin{bmatrix} 1 & 1 & 1 \\ 1.2 & 2.0 & 3.0 \\ 3.0 & 2.5 & 4.0 \end{bmatrix} \begin{bmatrix} 1 & 1.2 & 3.0 \\ 1 & 2.0 & 2.5 \\ 1 & 3.0 & 4.0 \end{bmatrix} \\ &= \begin{bmatrix} 3 & 6.2 & 9.5 \\ 6.2 & 14.44 & 20.6 \\ 9.5 & 20.6 & 31.25 \end{bmatrix} \end{aligned}$$

### 1.3 CALCULATE $\tilde{D}^T Y$

$$\tilde{D}^T Y = \begin{bmatrix} 1 & 1 & 1 \\ 1.2 & 2.0 & 3.0 \\ 3.0 & 2.5 & 4.0 \end{bmatrix} \begin{bmatrix} 180 \\ 210 \\ 290 \end{bmatrix} = \begin{bmatrix} 680 \\ 1506 \\ 2225 \end{bmatrix}$$

### 1.4 SOLVE $\tilde{w} = (\tilde{D}^T \tilde{D})^{-1} \tilde{D}^T Y$



$$\text{adj} = \begin{bmatrix} 3 & 6.2 & 9.5 & 3 & 6.2 \\ 6.2 & 14.44 & 20.6 & 6.2 & 14.44 \\ 9.5 & 20.6 & 31.25 & 9.5 & 20.6 \\ 3 & 6.2 & 9.5 & 3 & 6.2 \\ 6.2 & 14.44 & 20.6 & 6.2 & 14.44 \end{bmatrix}$$

$$= \begin{bmatrix} 14.44 & 20.6 & 6.2 & 14.44 \\ 20.6 & 31.25 & 9.5 & 20.6 \\ 6.2 & 9.5 & 3 & 6.2 \\ 14.44 & 20.6 & 6.2 & 14.44 \end{bmatrix}$$

$$= \begin{bmatrix} 26.89 & 1.95 & -9.46 \\ 1.95 & 3.5 & -2.9 \\ -9.46 & -2.9 & 4.88 \end{bmatrix}$$

$$\det = 26.89(3) + 1.95(6.2) + (-9.46)(9.5)$$

$$\det = 80.67 + 12.09 + (-89.87)$$

$$\det = 2.89$$

$$(\hat{D}^T \hat{D})^{-1} = \begin{bmatrix} 9.30 & 0.67 & -3.27 \\ 0.67 & 1.21 & -1.00 \\ -3.27 & -1.00 & 1.69 \end{bmatrix}$$



$$\tilde{w} = (\tilde{D}^T \tilde{D})^{-1} \tilde{D}^T Y$$

$$= \begin{bmatrix} 9.30 & 0.67 & -3.27 \\ 0.67 & 1.21 & -1.00 \\ -3.27 & -1.00 & 1.69 \end{bmatrix} \begin{bmatrix} 680 \\ 1506 \\ 2225 \end{bmatrix} = \begin{bmatrix} 57.27 \\ 52.86 \\ 30.65 \end{bmatrix}$$