- Final form:

$$y = X\beta + Zu + e$$

$$\underbrace{\begin{bmatrix} y_{12,1,1} \\ y_{13,1,1} \\ \vdots \\ \vdots \\ y_{27,2,1} \end{bmatrix}}_{y} = \underbrace{\begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ \vdots & \vdots & \vdots \\ 1 & 0 & 1 \end{bmatrix}}_{X} \underbrace{\begin{bmatrix} \mu \\ \beta_1 \\ \beta_2 \end{bmatrix}}_{\beta} + \underbrace{\begin{bmatrix} 0\,0\,0\,0\,0\,0\,0 \cdots 1\,0 \cdots 0 \\ 0\,0 \cdots\cdots\cdots 0\,1\,0 \cdots 0 \\ \vdots \\ 0 \cdots\cdots\cdots\cdots 1 \end{bmatrix}}_{Z} \underbrace{\begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ \vdots \\ u_{27} \end{bmatrix}}_{u} + e$$

From Scalar notation:

$$2.61 = y_{12,1,1} = \mu + \beta_1 + \boxed{1 \cdot u_{12}} + e_{12,1,1}$$

$$= \underbrace{1 \cdot \mu + 1 \cdot \beta_1 + 0 \cdot \beta_2}_{\text{encoded into the dot product of the first row of matrix } X \text{ times the vector } \beta.} + u_{12} + e_{12,1,1}$$

$$3.16 = y_{27,2,1} = 1 \cdot \mu + 0 \cdot \beta_1 + 1 \beta_2 + u_{27} + e_{27,2,1}$$