HW2

2.

$$W_1 = \begin{pmatrix} 2 & 1 \\ 0 & 1 \end{pmatrix} \quad W_2 = \begin{pmatrix} 1 & 2 \\ 1 & 2 \end{pmatrix}$$

$$S_2 = W_1^T X = \begin{pmatrix} 2 & 0 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$Y_2 = r(S_2) = S_2$$

$$S_3 = W_2^T S_2 = \begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix} \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 10 \end{pmatrix}$$

$$Y_3 = r(S_3) = S_3$$

For W_2 layer: $\delta_2 = (Y_3 - T) = \begin{pmatrix} 5 \\ 10 \end{pmatrix}$

$$\Delta = \delta_2 \cdot S_2$$

$$= \begin{pmatrix} 5 \\ 10 \end{pmatrix} (2 \ 3)$$

$$= \begin{pmatrix} 10 & 15 \\ 20 & 30 \end{pmatrix}$$

For W_1 layer:

$$\delta_1 = W_2 \delta_2$$

$$= \begin{pmatrix} 25 \\ 25 \end{pmatrix}$$