Q2) $x = [1 \ \ 2]$ $\quad W^{(1)} = \begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix}$ $\quad W^{(2)} = \begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix}$

$T = [0 \ \ 0]$

$$\frac{\partial L}{\partial w^{(2)}} = \sum -(y_n - \hat{y}_n) \cdot \frac{\partial \hat{y}_n}{\partial s^{(3)}} \cdot \frac{\partial s^{(3)}}{\partial w^{(2)}}$$

$$= Y_2^T \times (-T + Y_3) \odot [1 \ \ 1].$$

$$= \begin{bmatrix} 2 \\ 3 \end{bmatrix} \times [5 \ \ 10] \odot [1 \ \ 1].$$

$$\boxed{\frac{\partial L}{\partial w^{(2)}} = \begin{bmatrix} 10 & 20 \\ 15 & 30 \end{bmatrix}}$$

$$\frac{\partial L}{\partial w^{(1)}} = X^T \times (Y_3 - T) \times W^{(2)T}$$

$$= \begin{bmatrix} 1 \\ 2 \end{bmatrix} \times [5 \ \ 10] \times \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}.$$

$$= \begin{bmatrix} 1 \\ 2 \end{bmatrix} \times [25 \ \ 25].$$

$$\boxed{\frac{\partial L}{\partial w^{(1)}} = \begin{bmatrix} 25 & 25 \\ 50 & 50 \end{bmatrix}.}$$