2

a. $\frac{dy}{dx_1} = w_5 \cdot w_1 \cdot u_1 + w_6 \cdot w_3 \cdot u_2$

$u_1 = \begin{cases} 1 & \text{for } w_1 x_1 + w_2 x_2 + b_1 > 0 \\ 0 & \text{for } w_1 x_1 + w_2 x_2 + b_1 < 0 \end{cases}$

$u_2 = \begin{cases} 1 & \text{for } w_3 x_1 + w_4 x_2 + b_2 > 0 \\ 0 & \text{for } w_3 x_1 + w_4 x_2 + b_2 < 0 \end{cases}$

for variables given:

$\frac{dy}{dx_1} = -2 \cdot 1 \cdot 1 + 5 \cdot 1 \cdot 0 = -2$

b 1 $\frac{dy}{dw_1} = w_5 \cdot \frac{dy}{dh_1} \frac{dh_1}{dw_1} = w_5 \cdot x_1 \cdot u_1 = -6$

2 $\frac{dy}{dw_2} = \frac{dy}{dh_2} \frac{dh_2}{dw_2} = w_5 \cdot x_2 \cdot u_1 = 4$

3 $\frac{dy}{dw_3} = \frac{dy}{dh_2} \frac{dh_2}{dw_3} = w_6 \cdot x_1 \cdot u_2 = 0$

4 $\frac{dy}{dw_4} = \frac{dy}{dh_2} \frac{dh_2}{dw_4} = w_6 \cdot x_2 \cdot u_2 = 0$

5 $\frac{dy}{dw_5} = h_1 = ReLU(w_1 x_1 + w_2 x_2 + b_1) = 8$

6 $\frac{dy}{dw_6} = h_2 = ReLU(w_3 x_1 + w_4 x_2 + b_2) = 0$

c $\frac{dy}{db_1} = \frac{dy}{dh_1} \frac{dh_1}{db_1} = w_5 \cdot u_1$

$\frac{dy}{db_2} = \frac{dy}{dh_2} \frac{dh_2}{db_2} = w_6 \cdot u_2$

$\frac{dy}{db_3} = 1$