Problem 5.

$$J = -\log y_1$$

$$y_1 = \frac{e^{z_1}}{e^{z_1} + e^{z_2}}$$

$$\therefore J = -\log\left(\frac{e^{z_1}}{e^{z_1} + e^{z_2}}\right)$$

$$= -\left[\log e^{z_1} - \log(e^{z_1} + e^{z_2})\right]$$

$$= -\underset{①}{z_1} + \underset{②}{\log(e^{z_1} + e^{z_2})}$$

$$\frac{\partial J}{\partial w_1} = \frac{\partial ①}{\partial w_1} + \frac{\partial ②}{\partial w_1}$$

$$\frac{\partial ①}{\partial w_1} = -\frac{\partial z_1}{\partial w_1} = -\left(\frac{\partial z_1}{\partial h_1}\frac{\partial h_1}{\partial g_1}\frac{\partial g_1}{\partial w_1} + \frac{\partial z_1}{\partial h_2}\frac{\partial h_2}{\partial g_2}\frac{\partial g_2}{\partial w_1}\right) \leftarrow (A)$$

$$\frac{\partial ②}{\partial w_1} = \frac{\partial}{\partial w_1}\log(e^{z_1} + e^{z_2})$$

$$= \frac{1}{e^{z_1} + e^{z_2}} \cdot \frac{\partial}{\partial w_1}(e^{z_1} + e^{z_2})$$

$$= \frac{1}{e^{z_1} + e^{z_2}} \cdot \left[e^{z_1} \cdot \frac{\partial z_1}{\partial w_1} + e^{z_2}\frac{\partial z_2}{\partial w_1}\right]$$

Same as $-A$

can be solved by a similar manner as A