Ex 2

1.

(a) $\tanh(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$.

let $u(x) = e^x - e^{-x}$, $v(x) = e^x + e^{-x}$

$u'(x) = e^x + e^{-x} = v(x)$ $v'(x) = e^x - e^{-x} = u(x)$

$$\frac{d}{dx}\tanh(x) = \frac{u'(x)v(x) - u(x)v'(x)}{v(x)^2}$$

$$= \frac{v(x)^2 - u(x)^2}{v(x)^2}$$

$$= 1 - \frac{u(x)^2}{v(x)^2}$$

$$= 1 - \tanh^2(x)$$

(b)

$$\frac{\partial L}{\partial \tilde{z}^{(2)}} = \frac{\partial L}{\partial \hat{y}} \cdot \frac{\partial \hat{y}}{\partial \tilde{z}^{(2)}}$$

$$= \left(\frac{\hat{y} - y}{\hat{y}(1-\hat{y})}\right) \cdot \left(\hat{y}(1-\hat{y})\right)$$

$$= \hat{y} - y$$