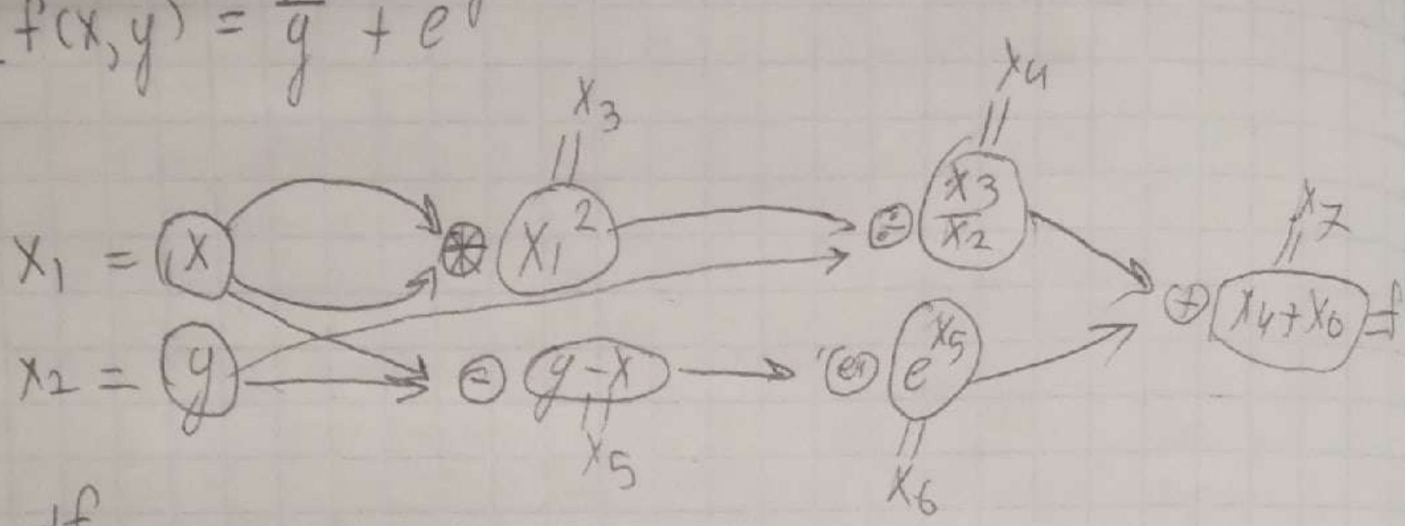
1 $f(x,y) = \frac{x^2}{y} + e^{(y-x)}$



$\frac{df}{dx_7} = 1 \; (f = x_7)$

$\frac{df}{dx_6} = \frac{df}{dx_7} \cdot \frac{dx_7}{dx_6} = 1$

$\frac{df}{dx_4} = \frac{df}{dx_7} \cdot \underbrace{\frac{dx_7}{dx_4}}_{1} = 1$

$\frac{df}{dx_5} = \frac{df}{dx_7} \cdot \frac{dx_7}{dx_6} \cdot \underbrace{\frac{dx_6}{dx_5}}_{e^{x_5}} = e^{x_5}\left(e^{(y-x)}\right)$

$\frac{df}{dx_3} = \frac{df}{dx_7} \cdot \frac{dx_7}{dx_4} \cdot \frac{dx_4}{dx_3} = \frac{1}{x_2}\left(\frac{1}{y}\right)$

$\frac{df}{dx} = \frac{df}{dx_1} = \frac{df}{x_7} \cdot \frac{dx_7}{dx_4} \cdot \frac{dx_4}{dx_3} \cdot \frac{dx_3}{dx_1} + \frac{df}{dx_7} \cdot \frac{dx_7}{dx_6} \cdot \frac{dx_6}{dx_5} \cdot \frac{dx_5}{dx_1} = 1 \cdot 1 \cdot \frac{1}{x_2} \cdot 2x_1 + 1 \cdot 1 \cdot e^{x_5} \cdot (1) = \frac{2x_1}{x_2} - e^{x_5} = \frac{2x}{y} - e^{(y-x)}$

$\frac{df}{dy} = \frac{df}{dx_2} = \frac{df}{dx_5} \cdot \frac{dx_5}{dx_2} + \frac{df}{dx_4} \cdot \frac{dx_4}{dx_2} = e^{x_5} \cdot 1 + 1\left(-\frac{x_3}{x_2^2}\right) = e^{x_5} - \frac{x_3}{x_2^2} = e^{(y-x)} - \frac{x^2}{y^2}$

② Sub:

$$\frac{d(x-y)}{dx} = 1 \qquad \frac{d(x-y)}{dy} = -1$$

Sum:

$$\frac{d(x+y)}{dx} = \frac{d(x+y)}{dy} = 1$$

mul

$$\frac{d(x \cdot y)}{dx} = y \qquad \frac{d(x \cdot y)}{dy} = x$$

power

$$\frac{d(x^e)}{dx} = e x^{e-1}$$

Sigmoid:

$$y = \frac{1}{1+e^{-x}}$$

$$\frac{dy}{dx} = y(1-y)$$