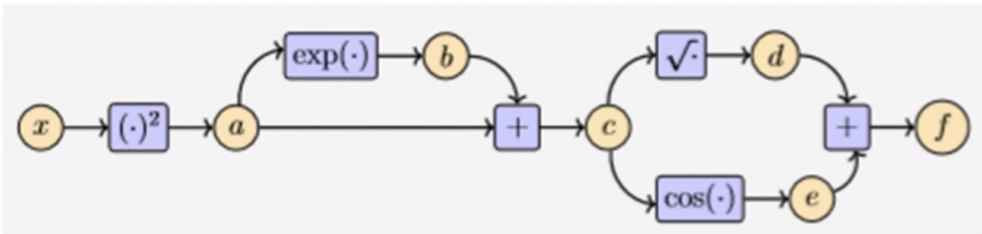


# HW 1

$$\begin{aligned}
 1. \quad f'(x) &= \frac{d}{dx} (1 + e^{-x})^{-1} = -(1 + e^{-x})^{-2} \frac{d}{dx} (1 + e^{-x}) \\
 &= -(1 + e^{-x})^{-2} \cdot e^{-x} \cdot \frac{d}{dx} (-x) = (1 + e^{-x})^{-2} \cdot e^{-x} \\
 &= \frac{e^{-x}}{(1 + e^{-x})^2} = \frac{1}{(1 + e^{-x})} \cdot \frac{e^{-x}}{(1 + e^{-x})} \\
 &= \frac{1}{1 + e^x} \cdot \frac{1 + e^{-x} - 1}{1 + e^{-x}} = \frac{1}{1 + e^x} \left( 1 - \frac{1}{1 + e^{-x}} \right) \\
 &= f(x) (1 - f(x))
 \end{aligned}$$

$$\begin{aligned}
 2. \quad \frac{dF}{dt} &= \frac{dF}{dx_1} \cdot \frac{dx_1}{dt} + \frac{dF}{dx_2} \cdot \frac{dx_2}{dt} \\
 &= 2x_1 \cdot \cos t + 2 \cdot (-\sin t) \\
 &= 2 \sin t \cdot \cos t - 2 \sin t = 2 \sin t (\cos t - 1)
 \end{aligned}$$

3.



- $a = x^2$
- $b = e^a$
- $c = a + e^a$
- $d = \sqrt{c}$
- $e = \cos c$
- $f = \sqrt{c} + \cos c$

- ▶  $\frac{\partial a}{\partial x} = 2x$
- ▶  $\frac{\partial b}{\partial a} = e^a$
- ▶  $\frac{\partial c}{\partial a} = 1 + e^a$
- ▶  $\frac{\partial d}{\partial c} = \frac{1}{2\sqrt{c}}$
- ▶  $\frac{\partial e}{\partial c} = -\sin c$
- ▶  $\frac{\partial f}{\partial d} = 1 - 2d \cdot \sin d^2$

$$\begin{aligned}
 &\text{▶ } \frac{\partial f}{\partial c} = \frac{1}{2\sqrt{c}} - \sin c \\
 &\text{▶ } \frac{\partial f}{\partial b} = \\
 &\text{▶ } \frac{\partial f}{\partial a} = \left. \begin{aligned} &\frac{1}{2\sqrt{c}} - \sin c \\ &\frac{1}{2\sqrt{c}} - \sin c \end{aligned} \right\} \text{Cf. vorherige} \\
 &\text{▶ } \frac{\partial f}{\partial x} =
 \end{aligned}$$

$$\frac{\partial f}{\partial b} = \frac{\partial f}{\partial c} \cdot \frac{\partial c}{\partial b} = \left( \frac{1}{2\sqrt{\ln b + b}} - \sin(\ln b + b) \right) \cdot \left( -\frac{1}{b} + 1 \right)$$

$$\frac{\partial(a+e^a)}{\partial e^a} = \frac{1}{a} + 1 = \frac{1}{\ln b} + 1 \quad c = \ln b + b$$

$$\begin{aligned} \frac{\partial f}{\partial a} &= \frac{\partial f}{\partial c} \cdot \frac{\partial c}{\partial a} = \left( \frac{1}{2\sqrt{c}} - \sin c \right) (1 + e^a) \\ &= \left( \frac{1}{2\sqrt{a+e^a}} - \sin(a+e^a) \right) (1 + e^a) \end{aligned}$$

$$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial c} \cdot \frac{\partial c}{\partial a} \cdot \frac{\partial a}{\partial x} = \left( \frac{1}{2\sqrt{x^2 + e^{x^2}}} - \sin(x^2 + e^{x^2}) \right) (1 + e^{x^2}) \cdot 2x$$