2.1. Given $w^1(0) = 1$, $b^1(0) = -2$, $w^2(0) = 1$, $b^2(0) = 1$
$f^1(n) = n^2$, $f^2(n) = \frac{1}{n}$, $p=1$, $t=1$, $\alpha=1$.

① Forward Propagation

$$a^1 = f^1(n^1) = (w^1p+b^1)^2 = (1\times1-2)^2 = 1$$

$$a^2 = f^2(n^2) = \frac{1}{(w^2a^1+b^2)} = \frac{1}{(1\times1+1)} = \frac{1}{2}.$$

$$e = t - a = 1 - \frac{1}{2} = \frac{1}{2}$$

② Transfer Function Derivatives

$$\dot{f}^1(n) = \frac{d}{dn}(n^2) = 2n. \quad \dot{f}^2(n) = \frac{d}{dn}\left(\frac{1}{n}\right) = -\frac{1}{n^2}$$

③ Backpropagation

$$s^2 = -2\dot{f}^2(n^2)\cdot(t-a) = -2\times\left(-\frac{1}{4}\right)\times\frac{1}{2} = \frac{1}{4}$$

$$s^1 = \dot{f}^1(n^1)\cdot(W^2)^T s^2 = 2\times(-1)\times1\times\frac{1}{4} = -\frac{1}{2}$$

④ Weight Update

$$W^2(1) = w^2(0) - \alpha s^2(a^1)^T = 1 - 1\times\frac{1}{4}\times1 = \frac{3}{4}$$

$$b^2(1) = b^2(0) - \alpha s^2 = 1 - 1\times\frac{1}{4} = \frac{3}{4}$$

$$W^1(1) = W^1(0) - \alpha s^1(a^0)^T = 1 - 1\times\left(-\frac{1}{2}\right)\times1 = \frac{3}{2}$$

$$b^1(1) = b^1(0) - \alpha s^1 = -2 - 1\times\left(-\frac{1}{2}\right) = -\frac{3}{2}$$