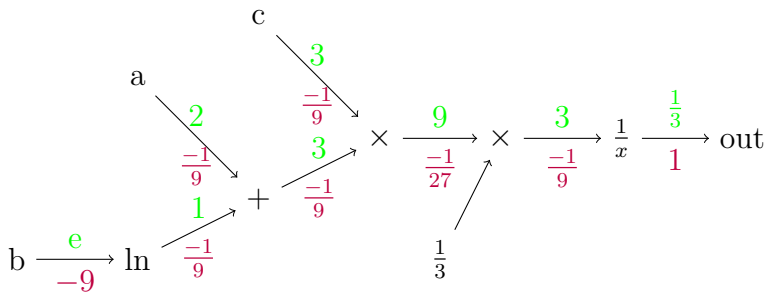
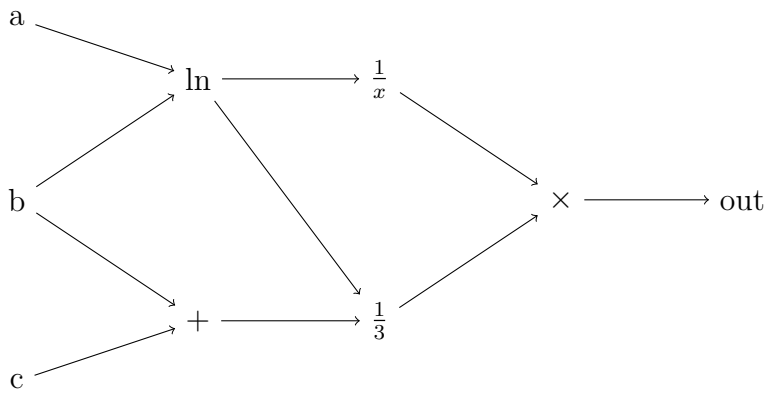
2.a) a = 2, b = e, c = 3



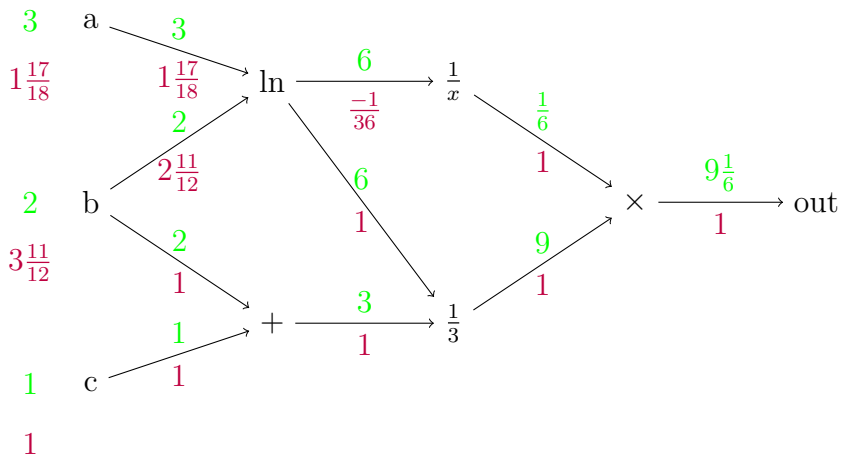
out = $\frac{1}{3}$, $\frac{dout}{da} = \frac{-1}{9}$, $\frac{dout}{db} = -9$, $\frac{dout}{dc} = \frac{-1}{9}$

2.b) a = 2, b = e, c = 3



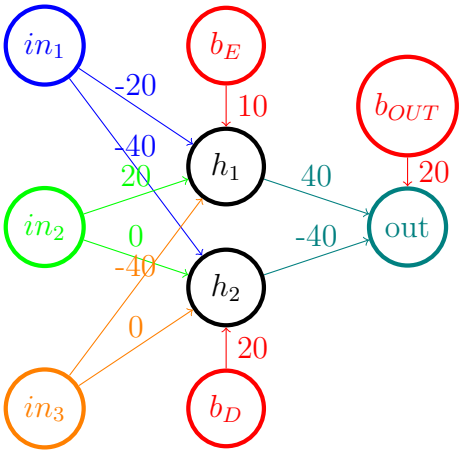
out = ?, $\frac{dout}{da} = ?$, $\frac{dout}{db} = ?$, $\frac{dout}{dc} = ?$

2.b) Musterlösung



out $= 9\frac{1}{6}$, $\frac{dout}{da} = 1\frac{17}{18}$, $\frac{dout}{db} = 3\frac{11}{12}$, $\frac{dout}{dc} = 1$

3.a) (Farben nur zur Übersichtlichkeit)



3.b)

$$x_1 = [0,1,1], x_2 = [1,1,0], x_3 = [1,0,1], bias_{hidden} = [10,20], bias_{out} = 20, g(z) = \begin{cases} 0 & z \leq -10 \\ 1 & z \geq 10 \\ 0.5 & \text{sonst} \end{cases}$$

$$Input = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}, Hidden = \begin{pmatrix} -20 & 20 & -40 \\ -40 & 0 & 0 \end{pmatrix}, Hidden^T = \begin{pmatrix} -20 & -40 \\ 20 & 0 \\ -40 & 0 \end{pmatrix}$$

$$Input \times Hidden^T + = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} \times \begin{pmatrix} -20 & -40 \\ 20 & 0 \\ -40 & 0 \end{pmatrix} = \begin{pmatrix} -20 & 0 \\ 0 & -40 \\ -60 & -40 \end{pmatrix}$$

$$\begin{pmatrix} -20 & 0 \\ 0 & -40 \\ -60 & -40 \end{pmatrix} + bias_{hidden} = \begin{pmatrix} -20+10 & 0+20 \\ 0+10 & -40+20 \\ -60+10 & -40+20 \end{pmatrix} = \begin{pmatrix} -10 & 20 \\ 0 & -20 \\ -60 & -20 \end{pmatrix}$$

$$g(\begin{pmatrix} -10 & 20 \\ 0 & -20 \\ -60 & -20 \end{pmatrix}) \times bias_{out} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \\ 0 & 0 \end{pmatrix} \times \begin{pmatrix} 40 \\ -40 \end{pmatrix} = \begin{pmatrix} -40 \\ 40 \\ 0 \end{pmatrix}$$

$$g(\begin{pmatrix} -40 \\ 40 \\ 0 \end{pmatrix} + 20) = g(\begin{pmatrix} -20 \\ 60 \\ 20 \end{pmatrix}) = \underline{\begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}}$$