Aufgabe 3.1

a) $i_0 = \dfrac{U_q}{2\,R} = 0,75\,\mathrm{A}\ , \quad q_\infty = C\,U_q = 1,5\,\mathrm{C}$

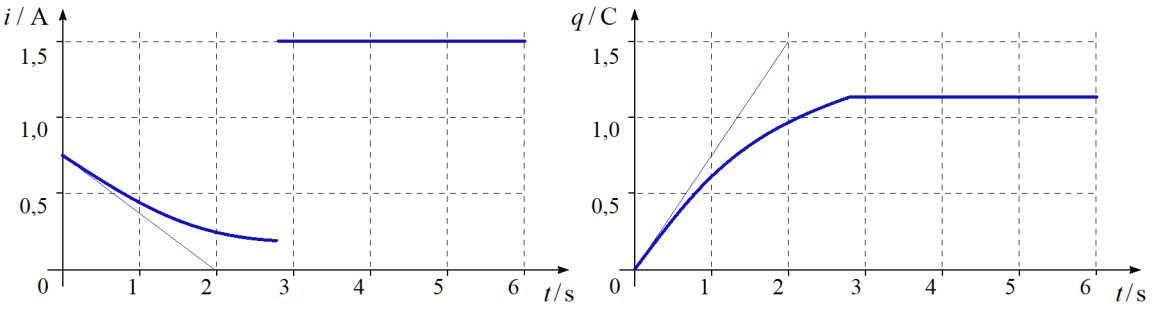
b) $q(t) = C\,U_q\left(1 - e^{-t/(2\,RC)}\right)\ , \quad i(t) = \dot{q}(t) = \dfrac{U_q}{2\,R}\,e^{-t/(2\,RC)}$

$$q(t_1) = C\,U_q\left(1 - e^{-t_1/(2\,RC)}\right) = \frac{3}{4}\,C\,U_q \quad \Rightarrow \quad t_1 = -2\,RC\ln\left(\frac{1}{4}\right) \approx 2,77\,\mathrm{s}$$

$$i(t_1) = \frac{U_q}{2\,R}\,e^{-t_1/(2\,RC)} = \frac{1}{4}\cdot\frac{U_q}{2\,R} = 0,1875\,\mathrm{A}$$

c) $i_2 = \dfrac{U_q}{R} = 1,5\,\mathrm{A}\ , \quad q_2 = q(t_1) = \dfrac{3}{4}\,C\,U_q = 1,125\,\mathrm{C}$

d)



Aufgabe 3.2

a) $\underline{Z} = \underline{Z}_L + \underline{Z}_{RC}\ , \quad \underline{Z}_L = \mathrm{j}\,\omega\,L\ , \quad \dfrac{1}{\underline{Z}_{RC}} = \dfrac{1}{R} + \mathrm{j}\,\omega\,C$

$$\Rightarrow \quad \underline{Z} = \mathrm{j}\,\omega\,L + \frac{1}{1/R + \mathrm{j}\,\omega\,C}$$

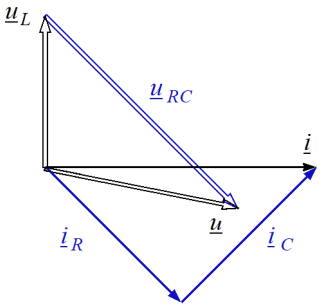
$$\Rightarrow \quad \underline{Z} = \mathrm{j}\,200\,\mathrm{s}^{-1}\cdot 1\,\mathrm{H} + \frac{1}{1/500\,\Omega + \mathrm{j}\,200\,\mathrm{s}^{-1}\cdot 10^{-5}\mathrm{F}}$$

$$= \mathrm{j}\,200\,\Omega + \frac{1}{0,002 + \mathrm{j}\,0,002}\,\Omega$$

$$= \mathrm{j}\,200\,\Omega + \frac{0,002 - \mathrm{j}\,0,002}{0,002^2 + 0,002^2}\,\Omega$$

$$= \mathrm{j}\,200\,\Omega + 250\,\Omega - \mathrm{j}\,250\,\Omega = 250\,\Omega - \mathrm{j}\,50\,\Omega$$

b)



$$\underline{u} = \underline{Z}\,\underline{i} = (250\,\Omega - \mathrm{j}\,50\,\Omega)\cdot 0,1\,\mathrm{A} = 25\,\mathrm{V} - \mathrm{j}\,5\,\mathrm{V}$$

$$\Rightarrow \quad \widehat{u} = |\underline{u}| = \sqrt{25^2 + 5^2}\,\mathrm{V} = 5\sqrt{26}\,\mathrm{V} \approx 25,5\,\mathrm{V}$$

$$\Delta\varphi = \tan^{-1}\left(\frac{\Re(\underline{Z})}{\Im(\underline{Z})}\right) = \tan^{-1}\left(\frac{-5}{25}\right) = \tan^{-1}\left(-\frac{1}{5}\right) \approx -11,3^\circ$$