1. Magnetfeld eines asymmetrischen Leiters

a) $r = \sqrt{x^2 + y^2}$

$$\begin{aligned}
I_+ &= I(1 + \tfrac{a^2}{R^2}) \\
I_- &= -I\,\tfrac{a^2}{R^2} \\
B_+ &= \tfrac{\mu_0 I_+}{2r\pi} = \tfrac{\mu_0 I_+}{2\pi\sqrt{x^2+y^2}} \\
B_- &= \tfrac{\mu_0 I_-}{2r\pi} = \tfrac{\mu_0 I_-}{2\pi\sqrt{(x-b)^2+y^2}} \\
B &= B_+ + B_- = \tfrac{\mu_0 I_+}{2\pi\sqrt{x^2+y^2}} + \tfrac{\mu_0 I_-}{2\pi\sqrt{(x-b)^2+y^2}} = \\
&= \tfrac{\mu_0 I}{2\pi}\left[\tfrac{1}{\sqrt{x^2+y^2}} + \tfrac{a^2}{R^2}\left(\tfrac{1}{\sqrt{x^2+y^2}} - \tfrac{1}{\sqrt{(x-b)^2+y^2}}\right)\right] \\
B(2R,0) &= \underline{\underline{\tfrac{\mu_0 I}{4R\pi}\left[1 + \tfrac{a^2}{R}\left(\tfrac{1}{R} - \tfrac{1}{R-b}\right)\right]}}
\end{aligned}$$

b)

$$B(0,2R) = \underline{\underline{\tfrac{\mu_0 I}{2R\pi}\left[\tfrac{1}{2} + \tfrac{a^2}{R}\left(\tfrac{1}{2R} - \tfrac{1}{\sqrt{b^2+4R^2}}\right)\right]}}$$

2. Induktion

$$\vec{B} = B_x\hat{x}$$

a)

$$\Phi(t) = \int \vec{B}\,\mathrm{d}\vec{A} = B\cos(\omega t)\int 1\,\mathrm{d}\vec{A} = r^2\pi B\cos(\omega t)$$

$$U(t) = -\frac{\mathrm{d}\Phi}{\mathrm{d}t} = \underline{\underline{r^2\pi\omega B\sin(\omega t)}}$$

b)

c)

$$
\begin{aligned}
I &= \tfrac{U}{R} \\
\frac{\mathrm{d}Q}{\mathrm{d}t} &= -\tfrac{1}{R}\frac{\mathrm{d}\Phi}{\mathrm{d}t} \\
\Delta Q &= -\tfrac{r^2\pi B}{R}\int\limits_0^{\pi/2\omega}\cos(\omega t)\,\mathrm{d}t = \underline{\underline{\tfrac{r^2\pi B}{R}}}
\end{aligned}
$$

3. Indunktionsspannung - Stab

a)

b)

c)