

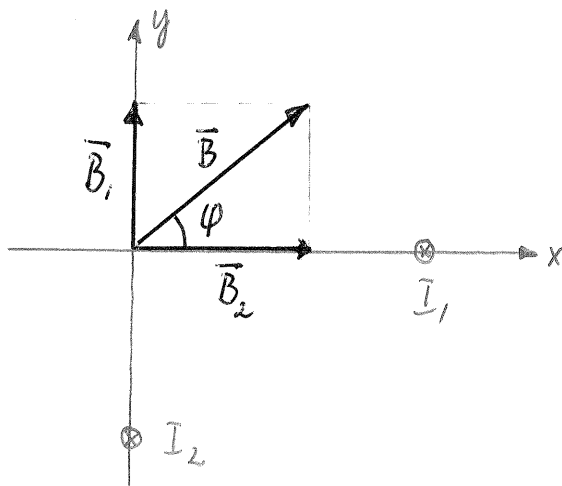
## Oppgave 1

$$a) B_1 = \frac{\mu_0 I_1}{2\pi a} = \frac{4\pi \cdot 10^{-7} \cdot 40}{2\pi \cdot 0.08} \text{ T} = \underline{1.0 \cdot 10^{-4} \text{ T}}$$

$$B_2 = \frac{\mu_0 I_2}{2\pi b} = \frac{4\pi \cdot 10^{-7} \cdot 30}{2\pi \cdot 0.05} \text{ T} = \underline{1.2 \cdot 10^{-4} \text{ T}}$$

$$B = \sqrt{B_1^2 + B_2^2} = 10^{-4} \sqrt{1.0^2 + 1.2^2} \text{ T} = \underline{1.6 \cdot 10^{-4} \text{ T}}$$

$$\tan \varphi = \frac{B_1}{B_2} = \frac{1.0}{1.2} = 0.8333 \quad \Rightarrow \varphi = \underline{39.8^\circ}$$



## Oppgave 2

$$b) \text{ Induktiv reaktans } X_L = \omega L = 2\pi fL = 2\pi \cdot 50 \cdot 5 \cdot 10^{-2} \Omega = \underline{15.7 \Omega}$$

$$\text{Kapasitiv reaktans } X_C = \frac{1}{\omega C} = \frac{1}{2\pi fC} = \frac{1}{2\pi \cdot 50 \cdot 50 \cdot 10^{-6}} \Omega = \underline{63.7 \Omega}$$

$$\text{Impedans } Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{100^2 + (15.7 - 63.7)^2} \Omega = \underline{110.9 \Omega}$$

$$i) \cos \varphi = \frac{R}{Z} = \frac{100}{110.9} = \underline{0.90} \quad \Rightarrow \varphi = \pm 25.6^\circ$$

$X_C > X_L \Rightarrow$  Strømmen er faseforskiøvet foran spenningen  
 $\varphi$  er derfor negativ  $\Rightarrow \varphi = \underline{-25.6^\circ}$

$$\begin{aligned}
 \text{ii) } \langle P \rangle &= I_{\text{rms}}^2 \cdot R = \frac{E_{\text{rms}}^2}{Z^2} \cdot R = \frac{V_0^2}{Z^2} \cdot \frac{1}{2} \cdot R \\
 &= \frac{315^2}{110,9^2} \cdot \frac{1}{2} \cdot 100 \text{ W} = \underline{403 \text{ W}}
 \end{aligned}$$

Alternativt:

Effekten som utvecklas i R är lika effekten som tillföres kretsen:

$$\begin{aligned}
 \langle P \rangle &= E_{\text{rms}} \cdot I_{\text{rms}} \cdot \cos \varphi = \frac{V_0}{\sqrt{2}} \cdot \frac{V_0}{Z} \cdot \cos \varphi \\
 &= \frac{315^2}{2 \cdot 110,9} \cdot 0,90 \text{ W} = \underline{403 \text{ W}}
 \end{aligned}$$

iii)

$$X_C = X_L \Rightarrow \frac{1}{2\pi f C} = 2\pi f L$$

$$C = \frac{1}{4\pi^2 f^2 L} = \frac{1}{4\pi^2 \cdot 50^2 \cdot 5 \cdot 10^{-2}} \text{ F} = \underline{203 \mu\text{F}}$$