Oppgave 1

a) $\omega = 2\pi f = 2\pi \cdot 10^5 s^{-1} = \underline{6{,}28 \cdot 10^5 s^{-1}}$

induktiv reaktans $X_L = \omega L = 2\pi \cdot 10^5 \cdot 10^{-3} \Omega = \underline{628\,\Omega}$

kapasitiv reaktans $X_C = (\omega C_1)^{-1} = (2\pi \cdot 10^5 \cdot 10^{-9})^{-1} \Omega = \underline{1592\,\Omega}$

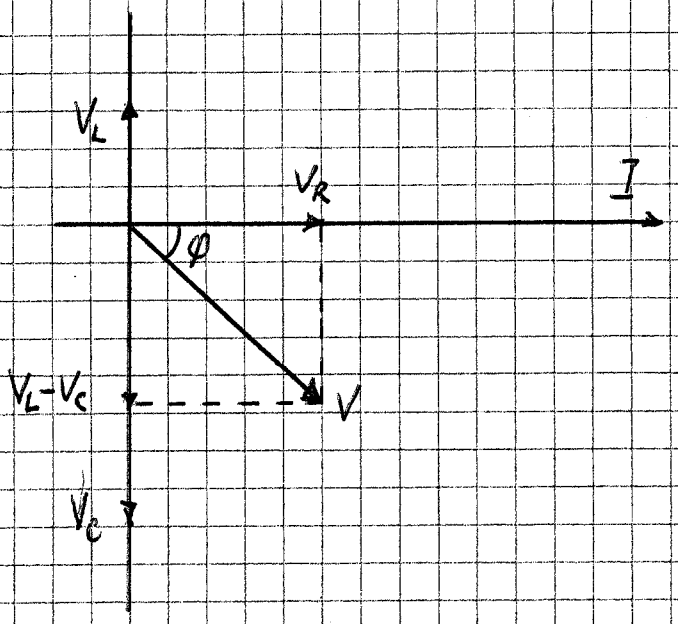
impedans $Z = \left(R_1^2 + \left(\omega L - \frac{1}{\omega C_1}\right)^2\right)^{1/2}$

$= (1000^2 + (628 - 1592)^2)^{1/2} \Omega = \underline{1389\,\Omega}$

$I_0 = \frac{V_0}{Z} = \frac{325}{1389} A = \underline{0{,}234\,A}$

$I_{eff} = \frac{I_0}{\sqrt{2}} = \frac{0{,}234}{\sqrt{2}} A = \underline{0{,}165\,A}$

$\sin\varphi = \frac{\omega L - \frac{1}{\omega C_1}}{Z} = \frac{628 - 1592}{1389} = \underline{-0{,}6940} \Rightarrow \varphi = \underline{-43{,}9°}$



b) $I = I_0 \sin \omega t$

$P_R = R \cdot I^2 = R I_0^2 \sin^2 \omega t$

$\langle P_R \rangle$ ou P_R moyen sur une période.

Mon $\langle \sin^2 \omega t \rangle = \frac{1}{2}$

$\Rightarrow \langle P_R \rangle = \frac{1}{2} R I_0^2 = \frac{1}{2} R \frac{V_0^2}{Z^2} = \frac{1}{2} \frac{R}{Z} V_0 \frac{V_0}{Z}$

$\frac{R}{Z} = \cos \varphi$

$\underline{\langle P_R \rangle = \frac{1}{2} V_0 I_0 \cos \varphi = \langle P \rangle}$

c) Når $\langle P \rangle$ skal være størst mulig, må mest mulig av spenningen ligge over R, dvs minst mulig må ligge over de andre komponentene, dvs Z må være minst mulig.

$Z = \left(R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2\right)^{1/2}$ der C er resultant-kapasitans.

Minst verdi av Z for $\omega L = \frac{1}{\omega C}$

$$\Rightarrow C = \frac{1}{\omega^2 L} = \frac{1}{6.28^2 \cdot 10^{10} \cdot 10^{-3}} F = \underline{2.53 \cdot 10^{-9} F}$$

$\Rightarrow C > C_1$

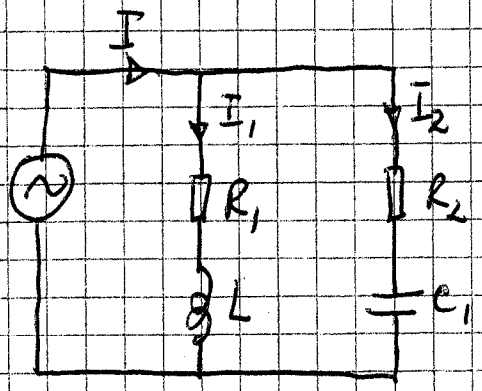
Parallellkobling: $C = C_1 + C_2 \Rightarrow C > C_1$

Seriekobling: $C^{-1} = C_1^{-1} + C_2^{-1} \Rightarrow C < C_1$

$\Rightarrow$ <u>Parallellkobling</u>

$C_2 = C - C_1 = (2.53 - 1.00)\,nF = \underline{1.53\,nF}$

a)



$V = V_0 \sin \omega t$

$Z_1 = (R_1^2 + (\omega L)^2)^{1/2} = (1000^2 + 628^2)^{1/2}\,\Omega = \underline{1181\,\Omega}$

$Z_2 = (R_2^2 + (\frac{1}{\omega C_1})^2)^{1/2} = (500^2 + 1592^2)^{1/2}\,\Omega = \underline{1669\,\Omega}$

Vi gir aktive og reaktive komponenter av strømmene indekser henholdsvis p og q.

Vi betrakter rms-verdier (effektivverdier).

$I_1 = \frac{V}{Z_1} = \frac{325}{\sqrt{2} \cdot 1181}\,A = \underline{0,195\,A}$

$I_2 = \frac{V}{Z_2} = \frac{325}{\sqrt{2} \cdot 1669}\,A = \underline{0,138\,A}$

$\sin\varphi_1 = \frac{-\omega L}{Z_1} = \frac{-628}{1181} = -0,5318 \Rightarrow \varphi_1 = \underline{-32,1^\circ}$

$\sin\varphi_2 = \frac{1/\omega C_1}{Z_2} = \frac{1592}{1669} = 0,9539 \Rightarrow \varphi_2 = \underline{72,5^\circ}$

c) Vi gir aktive og reaktive komponenter av strømmene indekser henholdsvis p og q. Vi betrakter rms-verdier (effektivverdier)

$I_{1p} = I_1 \cos\varphi_1 = 0{,}195 \cdot \cos(-32{,}1°)\,A = 0{,}165\,A$

$I_{1q} = I_1 \sin\varphi_1 = 0{,}195 \cdot \sin(-32{,}1°)\,A = -0{,}104\,A$

$I_{2p} = I_2 \cos\varphi_2 = 0{,}138 \cdot \cos 72{,}5°\,A = 0{,}041\,A$

$I_{2q} = I_2 \sin\varphi_2 = 0{,}138 \cdot \sin 72{,}5°\,A = 0{,}132\,A$

$I_p = I_{1p} + I_{2p} = (0{,}165 + 0{,}041)\,A = 0{,}206\,A$

$I_q = I_{2q} + I_{1q} = (-0{,}104 + 0{,}132)\,A = 0{,}028\,A$

$I = (I_p^2 + I_q^2)^{1/2} = (0{,}206^2 + 0{,}028^2)^{1/2}\,A = \underline{0{,}208\,A}$

$\varphi = \arctan(I_q / I_p) = \arctan\left(\frac{0{,}028}{0{,}206}\right) \Rightarrow \varphi = \underline{7{,}7°}$

(Alternativt: Bruk uttrykket Pythagoras.)