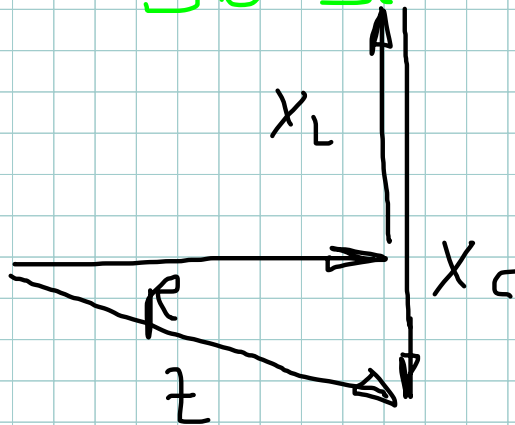


$$23.1 \quad X_L = 1,5 \text{ k}\Omega \rightarrow 3 \text{ cm}$$

$$X_C = 2 \text{ k}\Omega \rightarrow 4 \text{ cm}$$

$$R = 1,2 \text{ k}\Omega \rightarrow 2,4 \text{ cm}$$

$$500 \Omega \stackrel{!}{=} 1 \text{ cm}$$



$$Z: 2,7 \text{ cm} \Rightarrow 1,35 \text{ k}\Omega$$

$$3 \text{ cm} \rightarrow 1,5 \text{ k}\Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{1,2 \text{ k}^2 + (1,5 \text{ k} - 2 \text{ k})^2} = 1,3 \text{ k}\Omega$$

$$23.2 \quad L = 1 \text{ H} \quad C = 8 \mu\text{F}$$

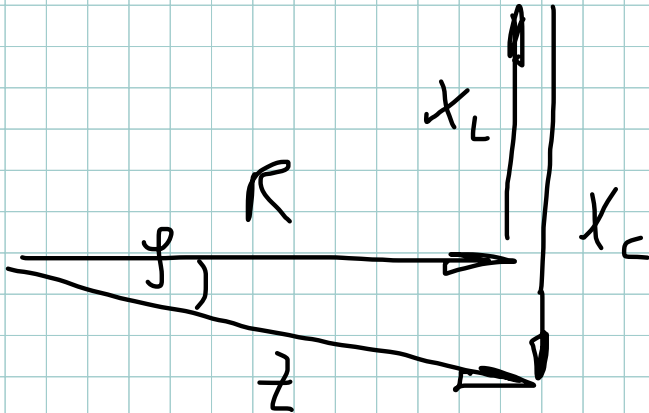
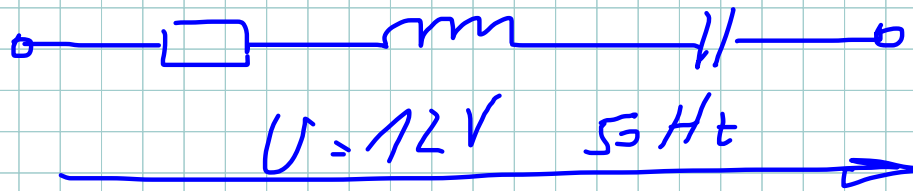
$$R = 100 \Omega \quad f = 50 \text{ Hz}$$

$$X_L = 2 \pi f L = 2 \cdot \pi \cdot 50 \cdot 1 = 314 \Omega$$

$$X_C = \frac{1}{2 \pi f C} = \frac{1}{2 \pi \cdot 50 \cdot 8 \mu} = 397,9 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} =$$
$$= \sqrt{100^2 + (314 - 398)^2} = 130,4 \Omega$$

23.3  $R = 80 \Omega$   $L = 250 \text{mH}$   $C = 40 \mu\text{F}$



$$X_L = 2 \cdot \pi \cdot f \cdot L = 2 \cdot \pi \cdot 50 \cdot 0,25 = 78,5 \Omega$$

$$X_C = \frac{1}{2 \pi f C} = \frac{1}{2 \cdot \pi \cdot 50 \cdot 40 \mu} = 79,6 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{80^2 + (78,5 - 79,6)^2} = 80 \Omega$$

$$I = \frac{U}{Z} = \frac{12}{80} = 0,15 \text{ A}$$

$$U_R = I \cdot R = 0,15 \cdot 80 = 12 \text{ V}$$

$$U_L = I \cdot X_L = 0,15 \cdot 78,5 = 11,8 \text{ V}$$

$$U_C = I \cdot X_C = 0,15 \cdot 79,6 = 11,9 \text{ V}$$

23.4

$$L = 700 \text{ mH}$$

$$R = 65 \, \Omega$$

$$U = 230 \text{ V}$$

$$f = 50 \text{ Hz}$$

$$C = 10 \, \mu\text{F}$$

$$a) \quad X_L = 2\pi fL = 2 \cdot \pi \cdot 50 \cdot 0,7 = 220 \, \Omega$$

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{65^2 + 220^2} = 229 \, \Omega$$

$$I = \frac{U}{Z} = \frac{230}{229} = 1 \text{ A}$$

$$b) \quad X_C = \frac{1}{2\pi fC} = \frac{1}{2 \cdot \pi \cdot 50 \cdot 10 \, \mu} = 318,3 \, \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$= \sqrt{65^2 + (220 - 318,3)^2} = 118 \, \Omega$$

$$I = \frac{U}{Z} = \frac{230}{118} = 1,95 \text{ A}$$

$$23.5 \quad L = 1,3 \text{ H} \quad R = 60 \Omega$$

$$Z = 200 \Omega$$

$$U = 24 \text{ V} \quad f = 50 \text{ Hz}$$

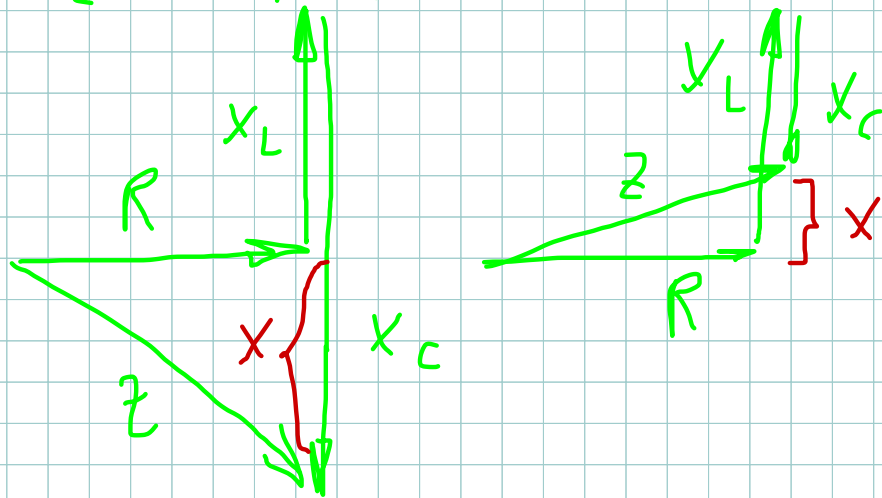
a)

$$X_L = 2\pi fL = 2 \cdot \pi \cdot 50 \cdot 1,3 = 408,4 \Omega$$

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{60^2 + 408,4^2} = 413 \Omega$$

b)

$$100 \Omega \stackrel{!}{=} 1 \text{ cm}$$



$$Z = 200 \Omega \quad \text{mit } C$$

$$X = \sqrt{Z^2 - R^2} = \sqrt{200^2 - 60^2} = 190,8 \Omega$$

Lösung 1:

$$X_c = X_L + X = 408,4 + 190,8 = 599,2 \Omega$$

$$C = \frac{1}{2 \pi f X_c} = \frac{1}{2 \cdot \pi \cdot 50 \cdot 599,2} = 5,3 \mu F$$

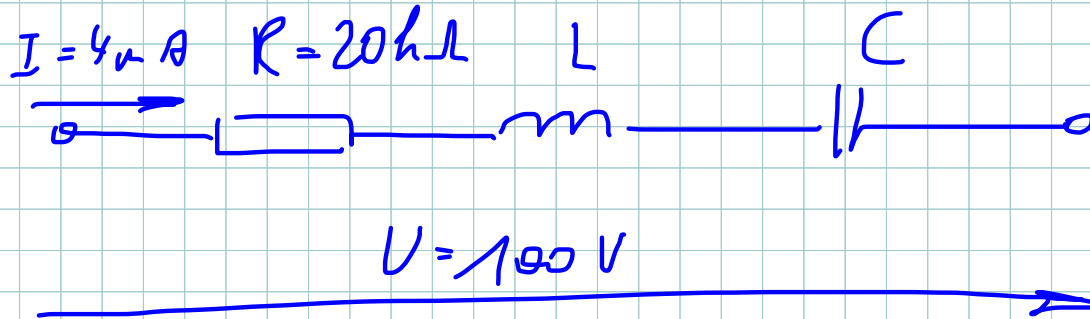
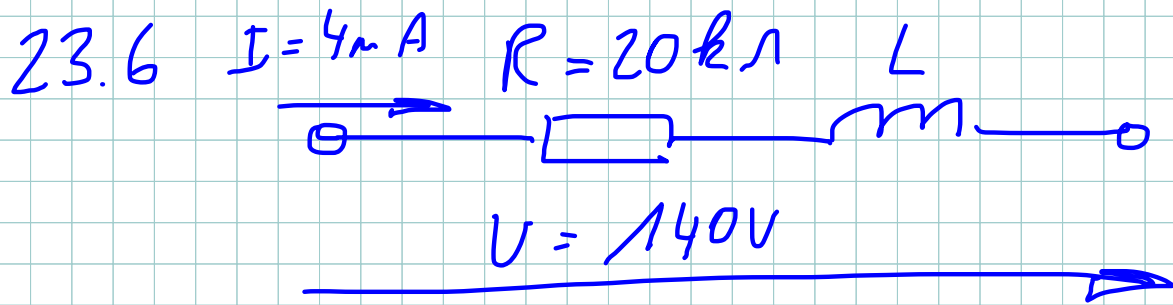
Lösung 2:

$$X_c = X_L - X = 408,4 - 190,8 = 217,6 \Omega$$

$$C = \frac{1}{2 \cdot \pi \cdot f \cdot X_c} = \frac{1}{2 \cdot \pi \cdot 50 \cdot 217,6} =$$

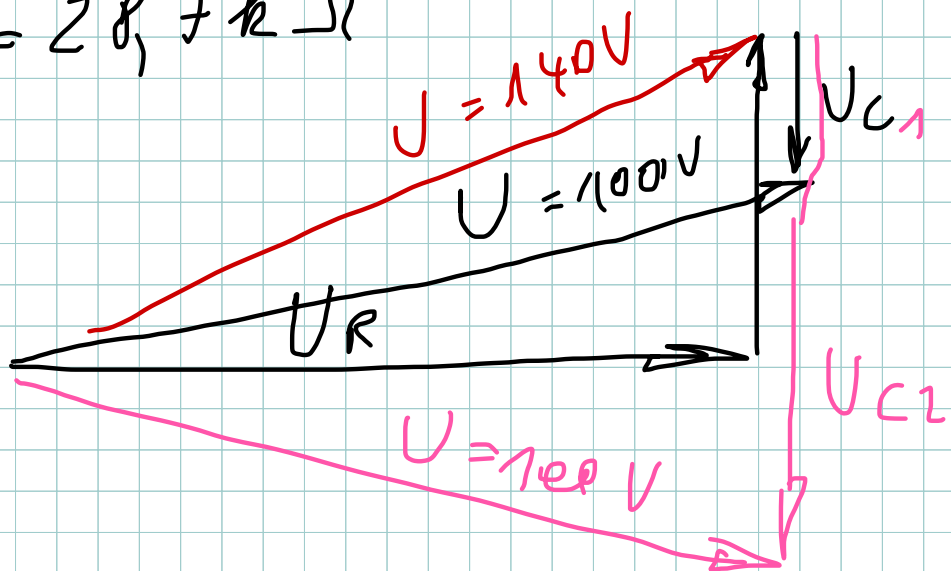
$$c) I = \frac{U}{Z} = \frac{24}{200} = 120 \text{ mA}$$

$$U_L = I \cdot X_L = 120 \text{ mA} \cdot 408,4 = 49 \text{ V}$$



a)  $Z = \frac{U}{I} = \frac{140}{4 \mu A} = 35 k\Omega$

$$X_L = \sqrt{Z^2 - R^2} = \sqrt{35 k^2 - 20 k^2} = 28,7 k\Omega$$





$$b) \quad Z = \frac{U}{I} = \frac{100}{4 \text{ mA}} = 25 \text{ k}\Omega$$

$$X = \sqrt{Z^2 - R^2} = \sqrt{25 \text{ k}^2 - 20 \text{ k}^2} =$$

$$= 15 \text{ k}\Omega$$

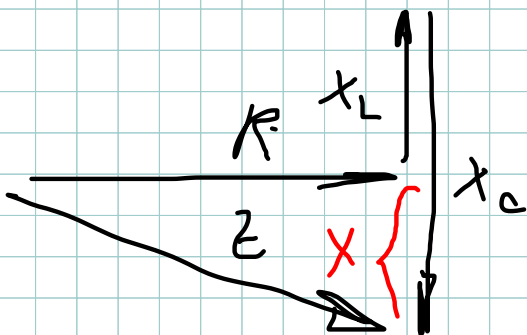
$$5000 \Omega \stackrel{!}{=} 1 \text{ cm}$$



$$X_C = X_L - X =$$

$$= 28,7 \text{ k} - 15 \text{ k}$$

$$= 13,7 \text{ k}\Omega$$



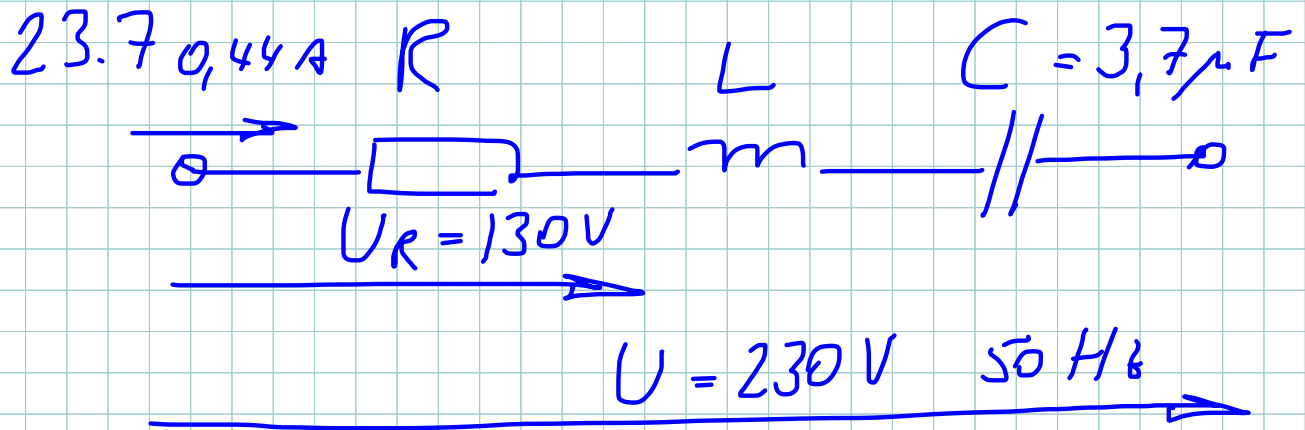
$$X_C = X_L + X =$$

$$= 28,7 \text{ k} + 15 \text{ k} =$$

$$= 43,7 \text{ k}\Omega$$

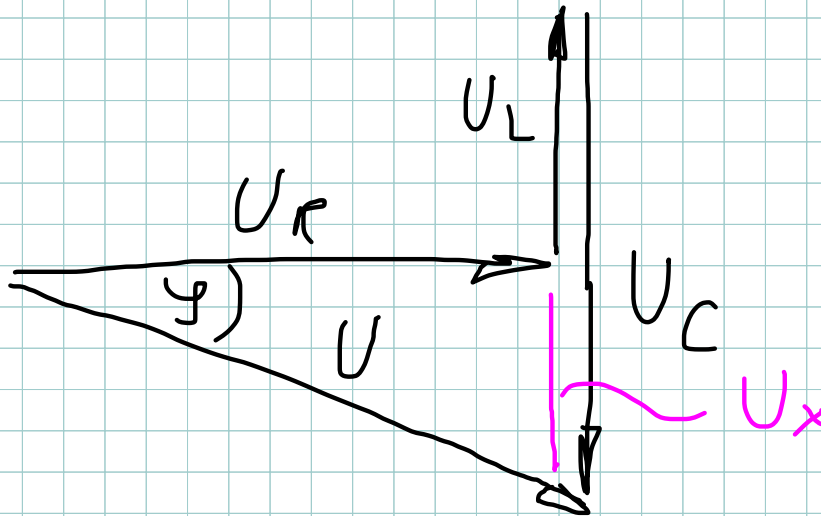
$$C = \frac{1}{2 \pi f X_C} = \frac{1}{2 \cdot \pi \cdot 50 \cdot 13,7 \text{ k}} = 232 \mu\text{F}$$

$$= \frac{1}{2 \cdot \pi \cdot 50 \cdot 43,7 \text{ k}} = 73 \mu\text{F}$$



$$X_C = \frac{1}{2\pi f C} = \frac{1}{2 \cdot \pi \cdot 50 \cdot 3,7 \mu} = 860 \Omega$$

$$U_C = I \cdot X_C = 0,44 \cdot 860 = 378,5 \text{ V}$$



$$U_X = \sqrt{U^2 - U_R^2} = \sqrt{230^2 - 130^2} = 189 \text{ V}$$

$$U_L = U_C - U_X = 378,5 - 189 = 189 \text{ V}$$

$$X_L = \frac{U_L}{I} = \frac{189}{0,44} = 430 \Omega$$

$$L = \frac{X_L}{2\pi f} = \frac{430}{2\pi 50} = 1,37 \text{ H}$$

$$23.8 \quad \text{LSL} \quad U = 230 \text{ V} \quad f = 50 \text{ Hz}$$

$$P = 78 \text{ W} \quad I = 0,7 \text{ A}$$

$$C = 6 \mu\text{F}$$

$$X_c = \frac{1}{2\pi f C} = \frac{1}{2\pi \cdot 50 \cdot 6 \mu} = 530,5 \Omega$$

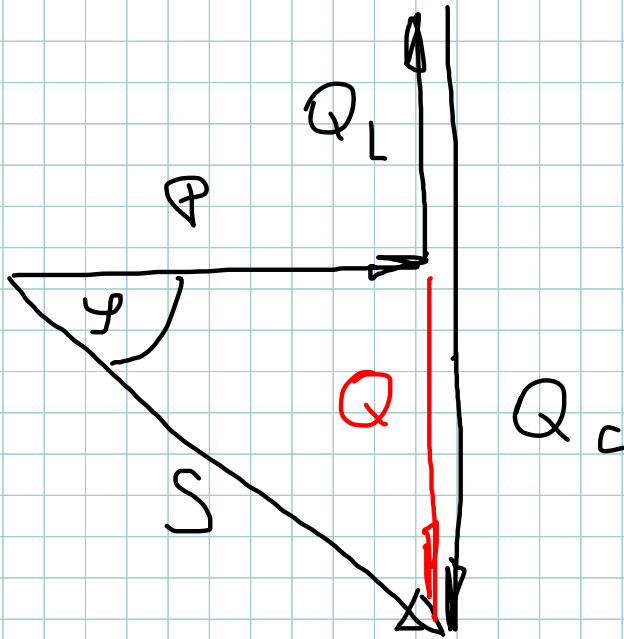
$$S = U \cdot I = 230 \cdot 0,7 = 161 \text{ VA}$$

$$a) \cos \varphi = \frac{P}{S} = \frac{78}{161} = 0,484$$

$$U_c = I \cdot X_c = 0,7 \cdot 530,6 = 371,4 \text{ V}$$

$$c) Q_c = U_c \cdot I = 371,4 \cdot 0,7 = 260 \text{ Var}$$

$$b) Q = \sqrt{S^2 - P^2} = \sqrt{161^2 - 78^2} = 140,8 \text{ Var}$$



d)

$$Q_L = Q_c - Q = 260 - 140,8 = 119,2 \text{ Var}$$

e) ohne C

$$S = \sqrt{P^2 + Q_L^2} =$$

$$I = \frac{S}{U} = \underline{\quad} =$$

$$23.9 \quad L = 160 \text{ mH} \quad R = 150 \Omega$$

$$C = 22 \mu\text{F}$$

$$f_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{160\text{m} \cdot 22\mu}} = 2682,55 \text{ Hz}$$

$$X_L = 2\pi \cdot f_0 \cdot L = 2\pi \cdot 2683 \cdot 160\text{m} = 2696 \Omega$$

$$X_C = \frac{1}{2\pi f_0 C} = \frac{1}{2\pi \cdot 2683 \cdot 22\mu} = 2696 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{150^2 + (2696 - 2696)^2} = 150 \Omega$$

$Z = R$  bei  $f_0$

$$23.10 \quad R = 40 \Omega \quad L = 180 \mu\text{H}$$

$$f = 1,2 \text{ MHz}$$

$$X_L = X_C \quad \text{für Resonanz}$$

$$X_L = 2\pi fL = 2 \cdot \pi \cdot 1,2 \text{ M} \cdot 180 \mu =$$
$$= 1357 \Omega$$

$$C = \frac{1}{2\pi f X_C} = \frac{1}{2 \cdot \pi \cdot 1,2 \text{ M} \cdot 1357} =$$
$$= 98 \text{ pF}$$
$$= 98 \cdot 10^{-12} \text{ F}$$
$$= 9,8 \cdot 10^{-11} \text{ F}$$
$$= 0,000 \ 000 \ 000 \ 098 \text{ F}$$