

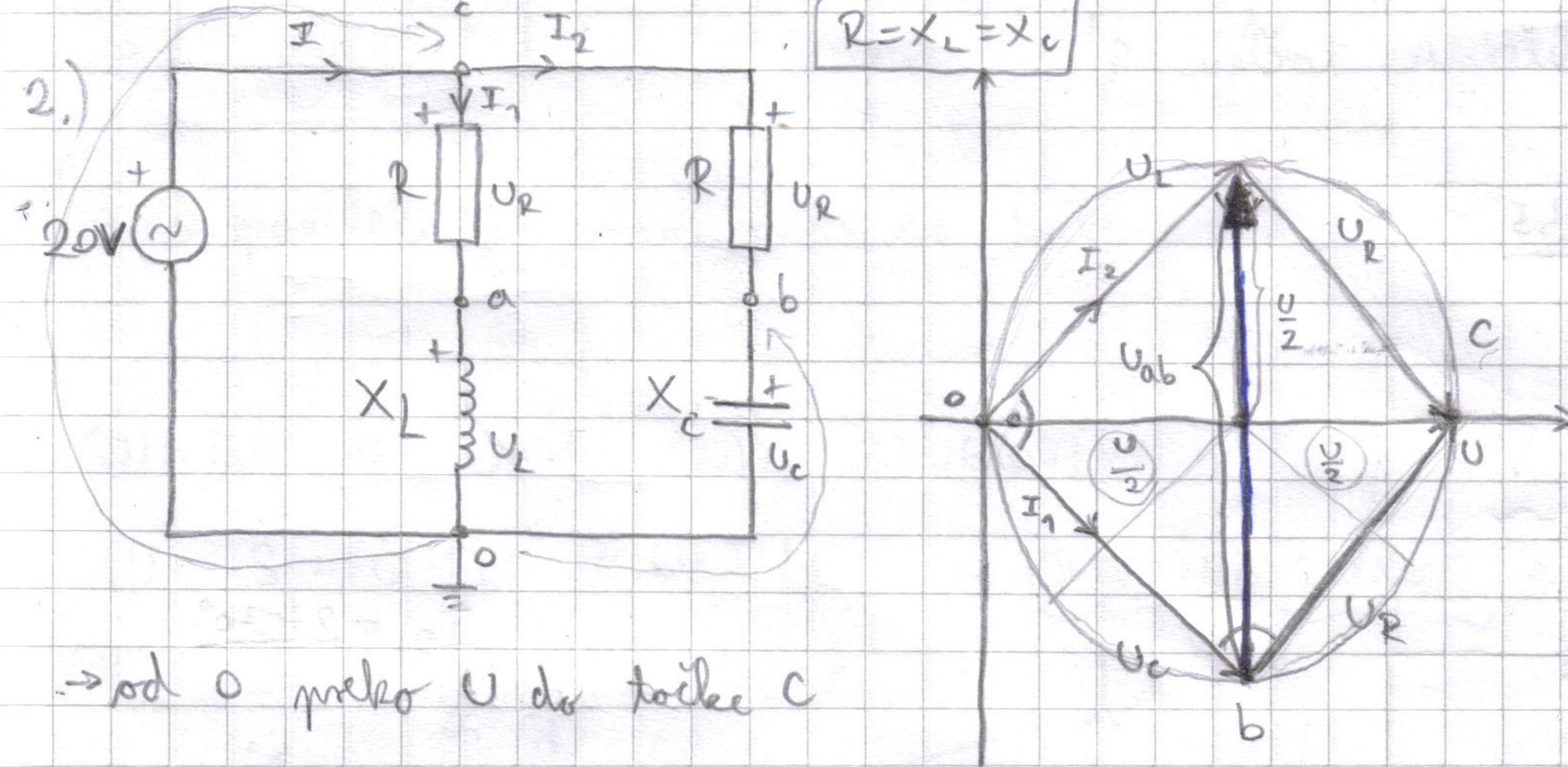
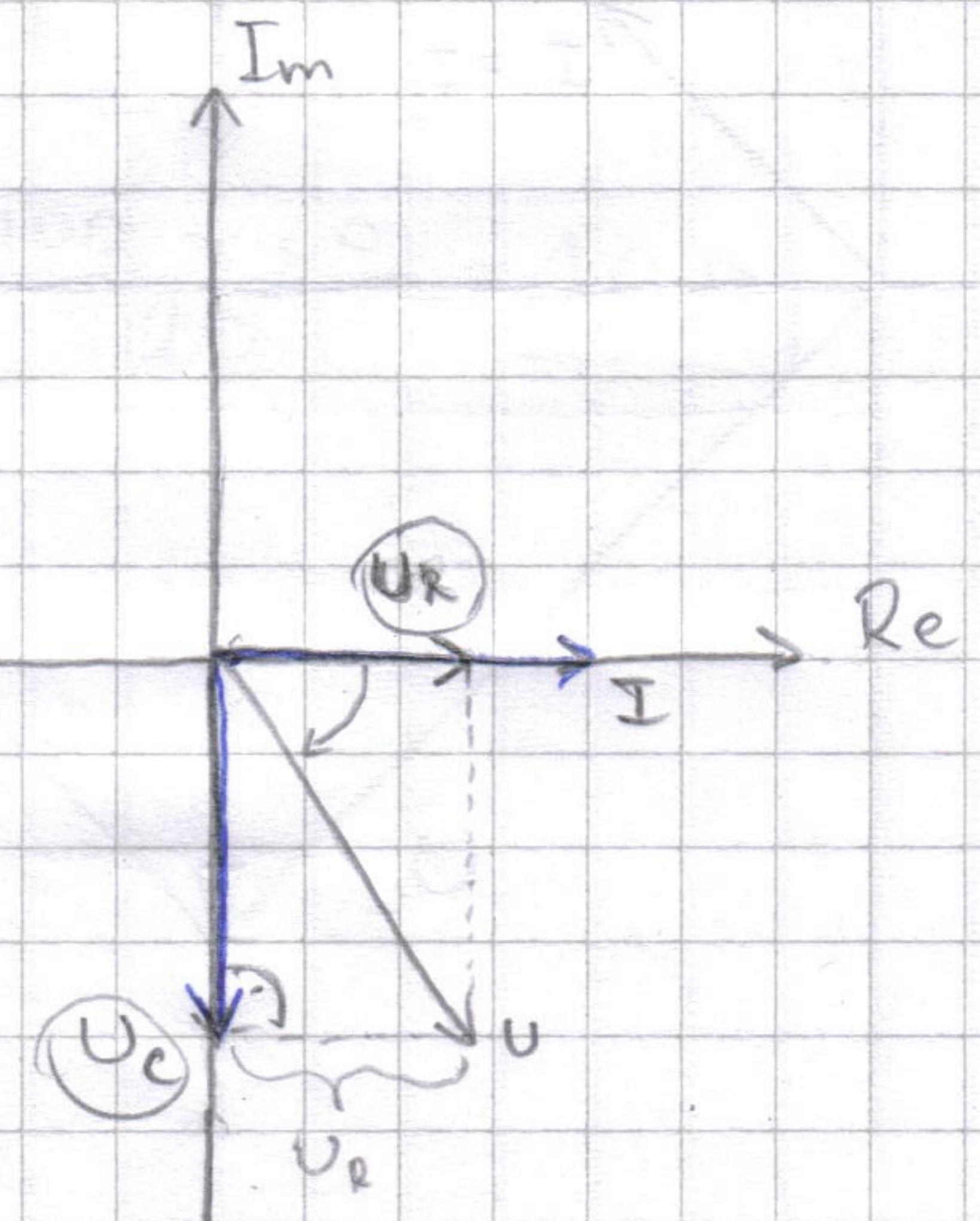
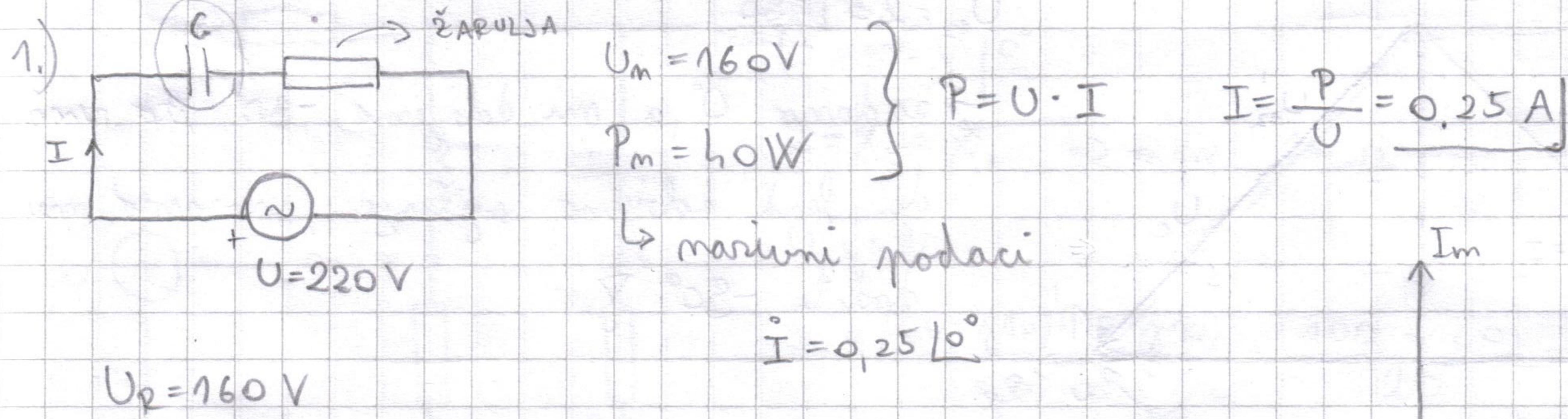
# 3. MASS iz Osnova elektrotehnike

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## Sadržaj:

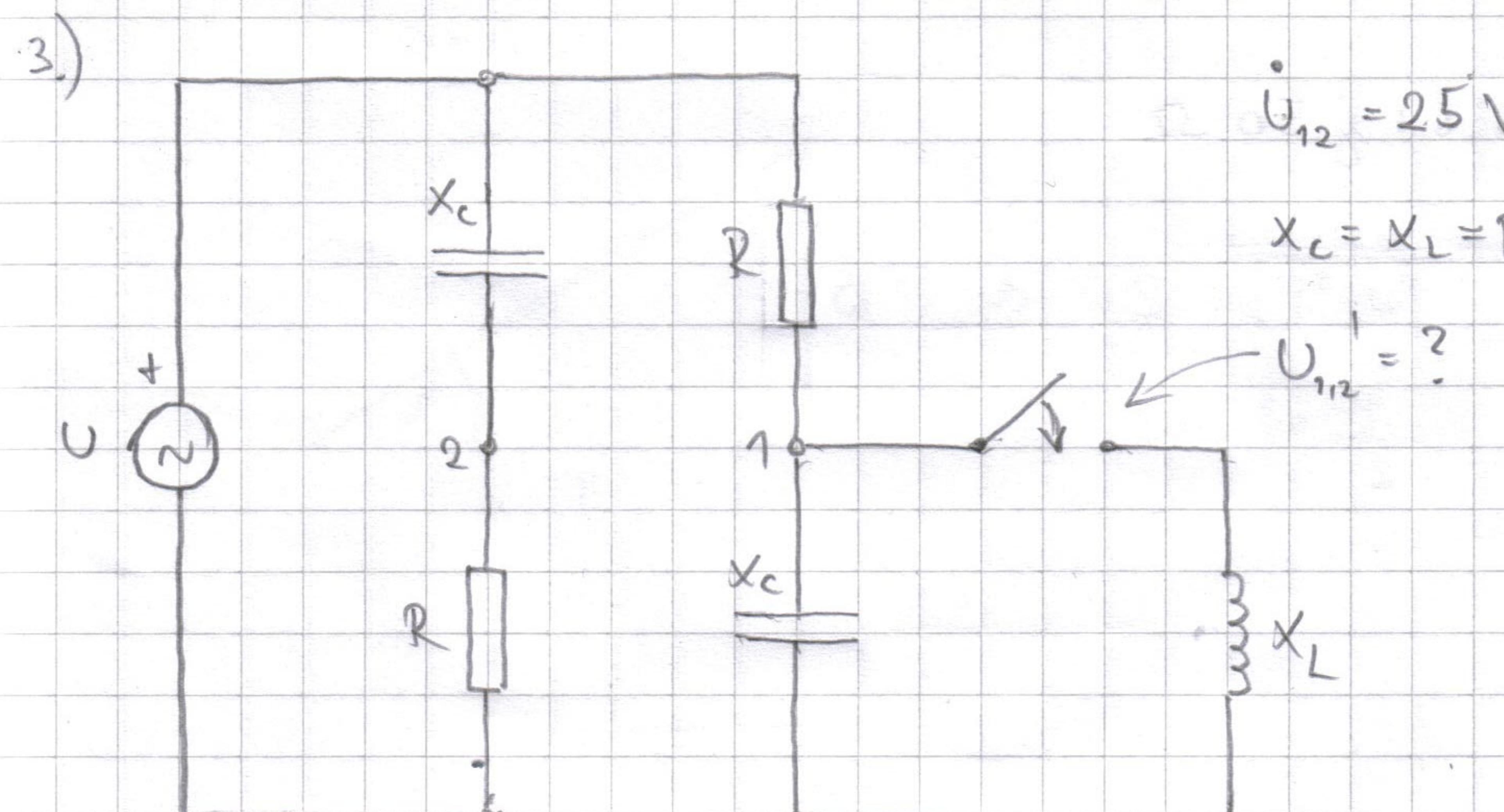
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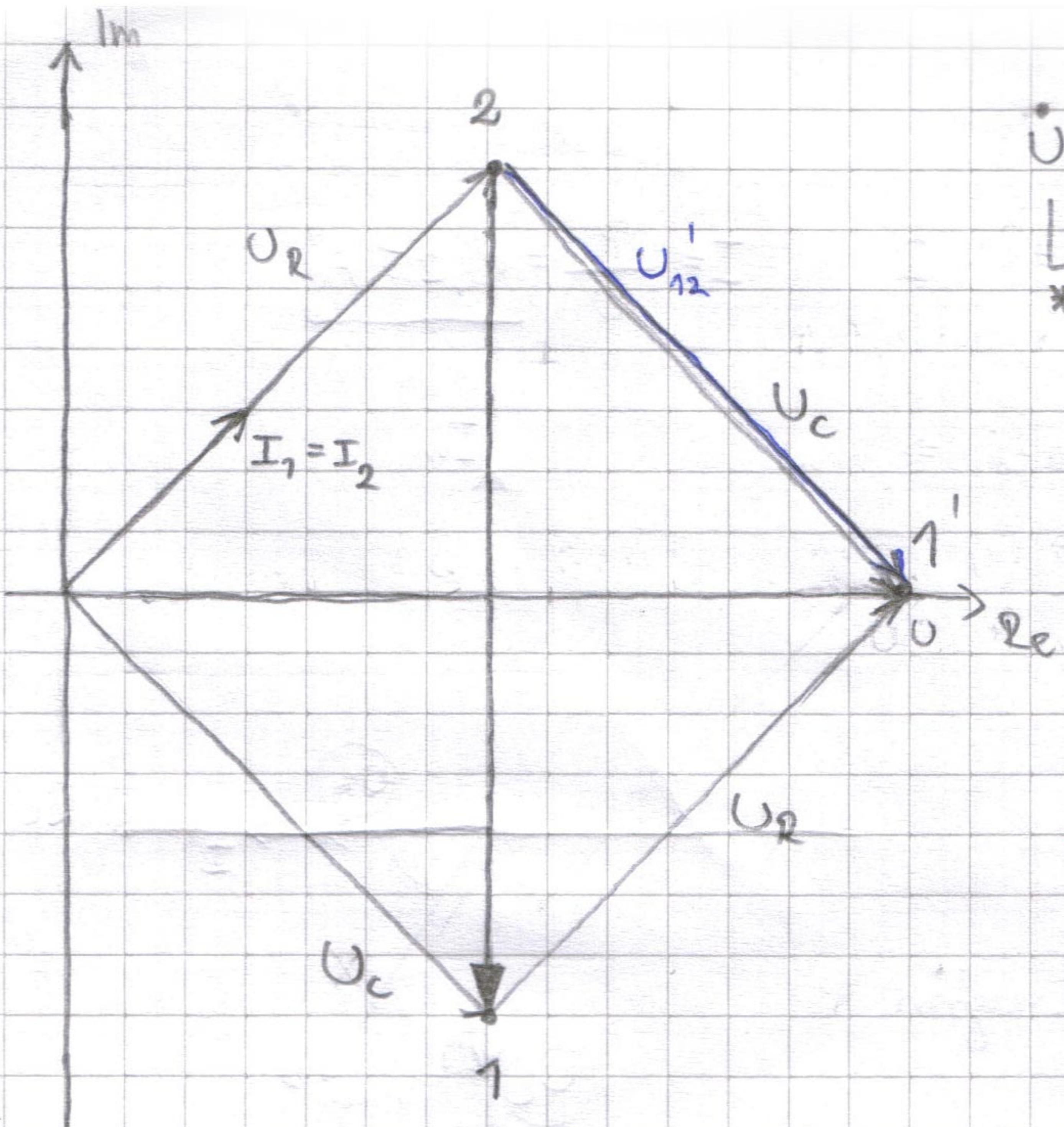
# TOPOGRAFSKI DIJAGRAMI



→ napon  $U_{ab}$  uviček gleda prema točki  $a$  (od točke  $b$ )

$$U_{ab} = \frac{U}{2} + \frac{U}{2} = U = 220V$$





$$\dot{U}_{12} = 2.5 \angle -90^\circ$$

\* radano  $0^\circ$ , a mi dobijemo  $-90^\circ$  što znači da kad dobijimo rješenje, moramo mu dodati  $90^\circ$ !

$$\dot{Z}_p = \frac{jx_L - jx_C}{jx_L + jx_C} = \infty \Rightarrow \text{znači da je struja u paraleli}$$

$$I_p = 0 \text{ A}$$

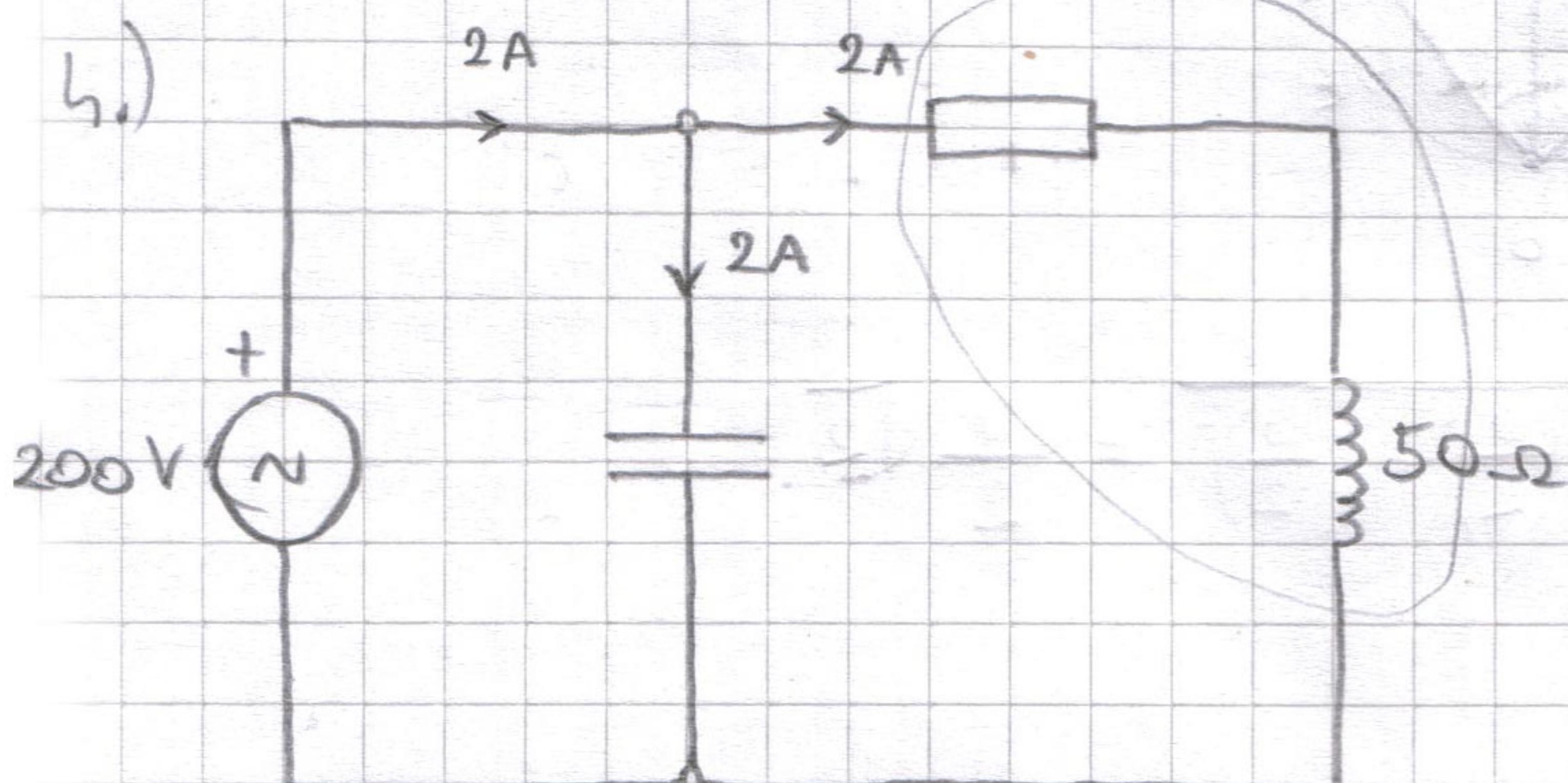
$\rightarrow$  prema tome je i napon  $U_p = 0$ , pa će točka 1' biti na istom potencijalu kao  $U$

$\rightarrow$  točka 2 ostaje na svom mjestu jer se napon u mjenja, ali točka 1 se pomije u točku 1'.

$$U_{12}' = ? = \frac{25}{2} \sqrt{2} \angle -45^\circ$$

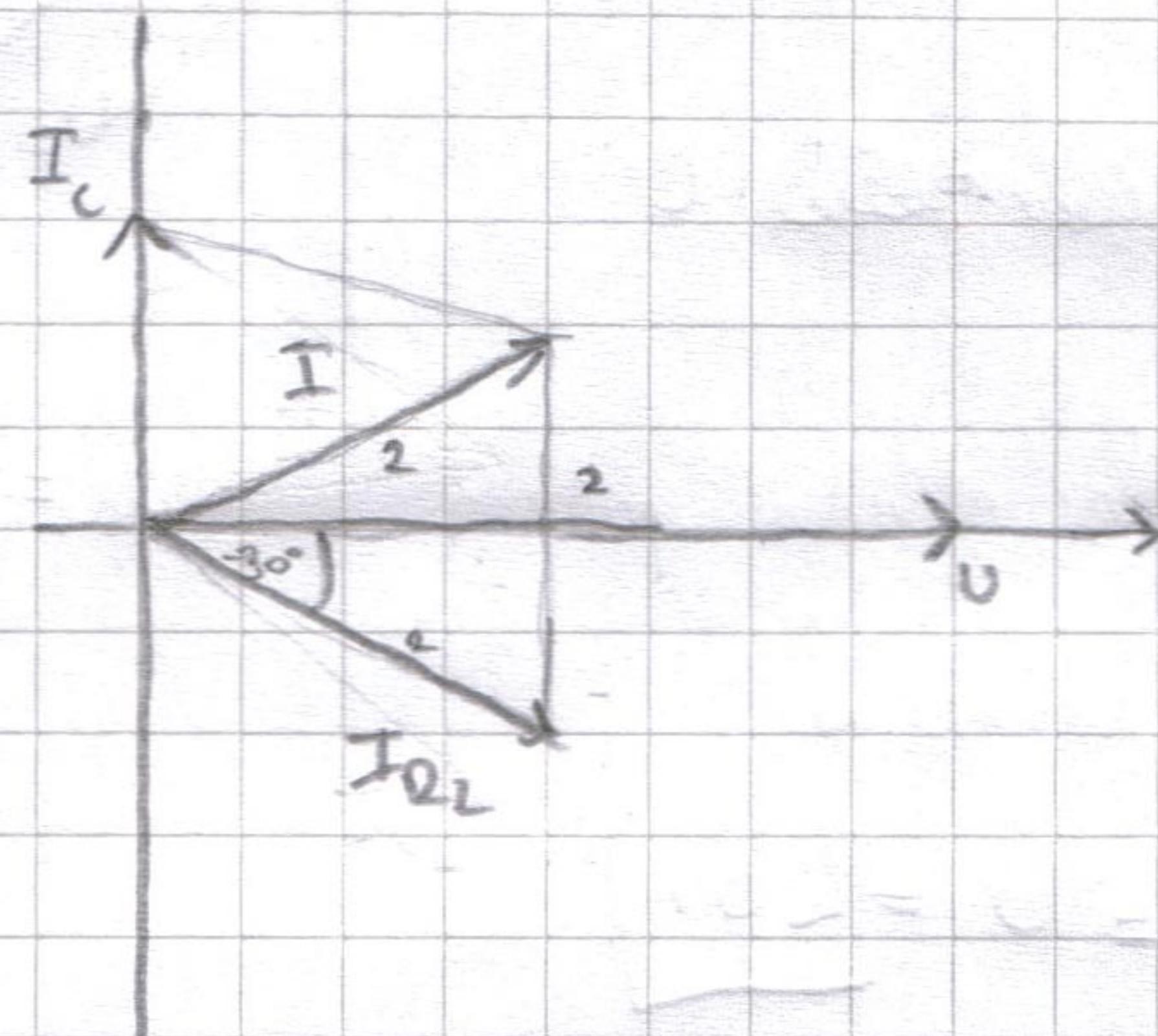
\* obrajamo  $90^\circ$

$$U_{12}' = 12.5 \sqrt{2} \angle 45^\circ \text{ V}$$

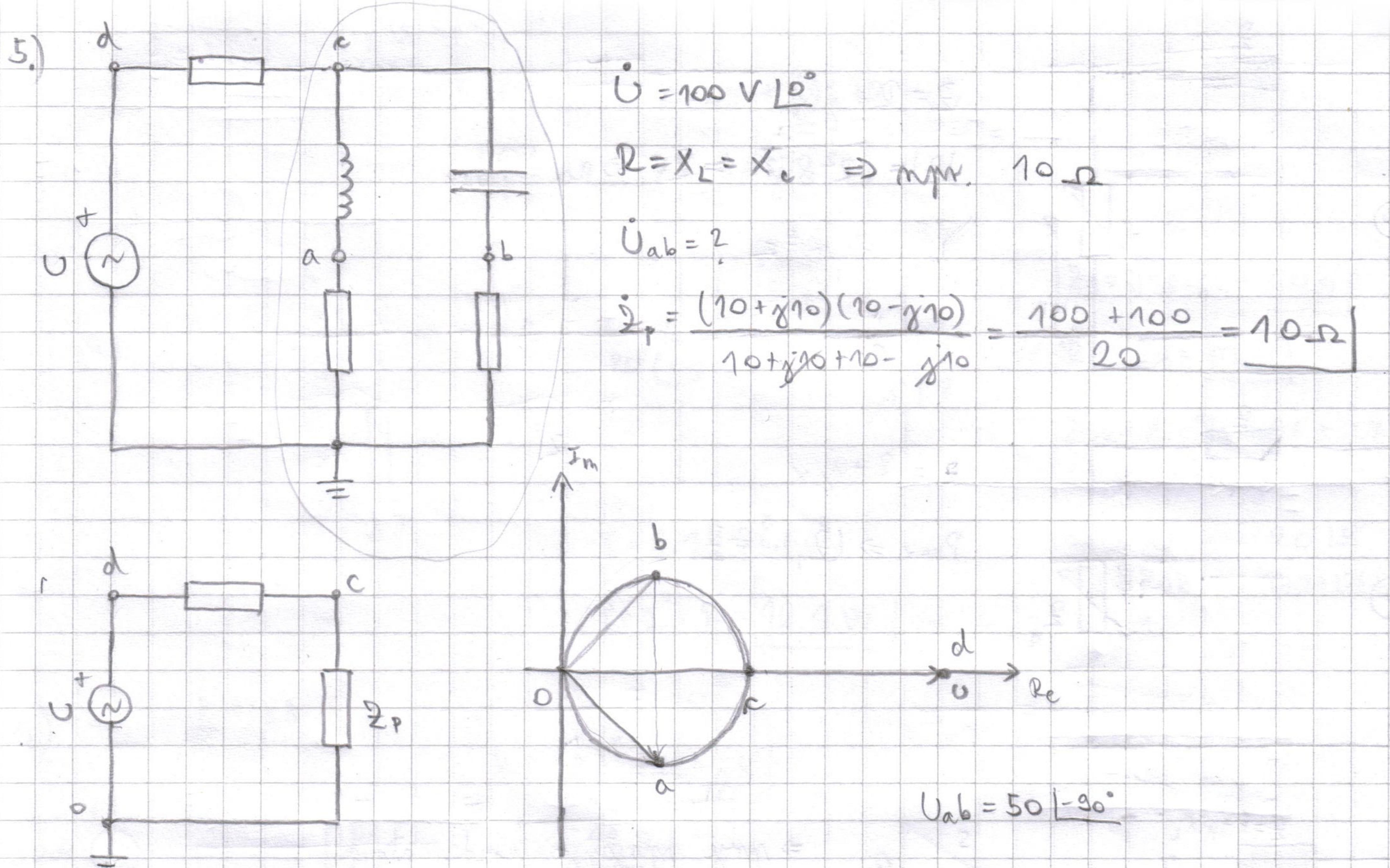


$$X_L = ?$$

$$\dot{Z}_{R_L} = \frac{\dot{U}}{\dot{I}_{R_L}} = 100 \angle 130^\circ = 86.6 + j 50 \Omega$$



$$\dot{I}_{R_L} = 2 \angle -30^\circ$$



→ na paraleli je napon od  $0$  do točke  $c$

SNAGA U IZMENJIVIM KRUGOVIMA ⇒

$$\textcircled{1} \quad \dot{S} = \dot{U} \cdot (\dot{I})^* = \underline{\underline{U \cdot I \cdot L \ell}} \Rightarrow \text{PRIVIDNA SNAGA} \Rightarrow \underbrace{U \cdot I \cdot \cos \ell + j U \cdot I \cdot \sin \ell}_{\begin{matrix} P \rightarrow \text{radna} \\ Q \rightarrow \text{galova} \end{matrix}}$$

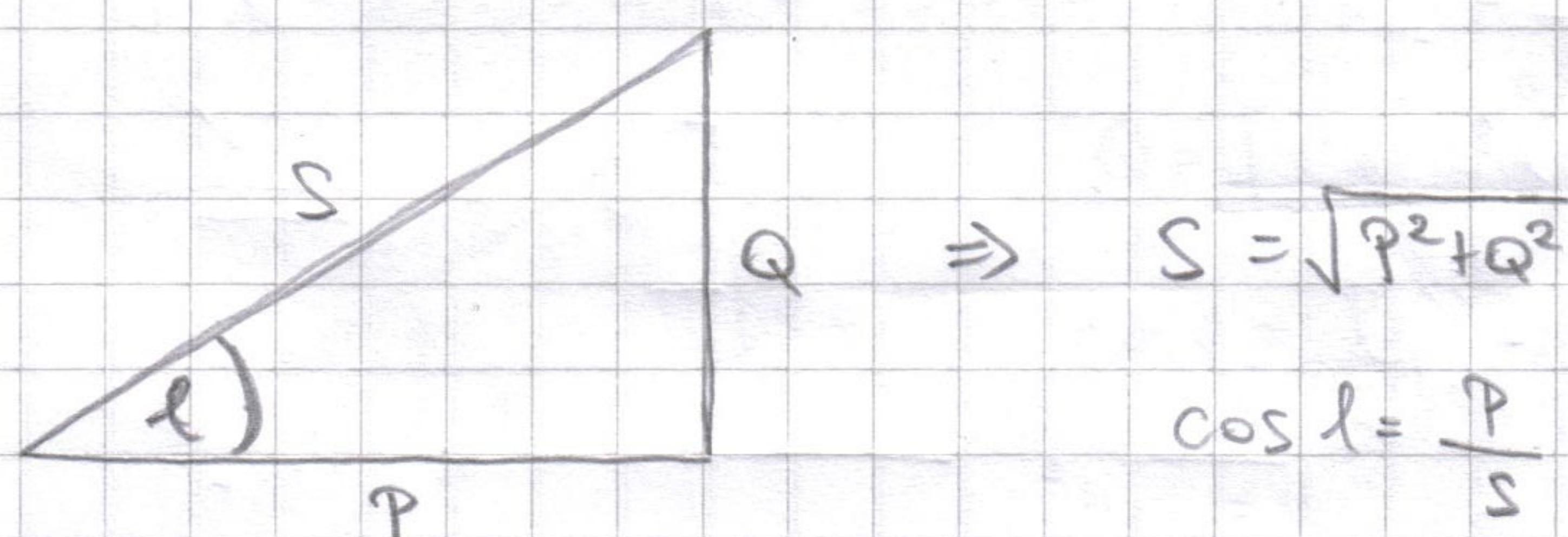
$$\begin{array}{ll} \dot{I} = 3 + 5j & \dot{I} = 5 \angle 30^\circ \\ \dot{I}^* = 3 - 5j & \text{ili} \\ \dot{I}^* = 5 \angle -30^\circ & \end{array}$$

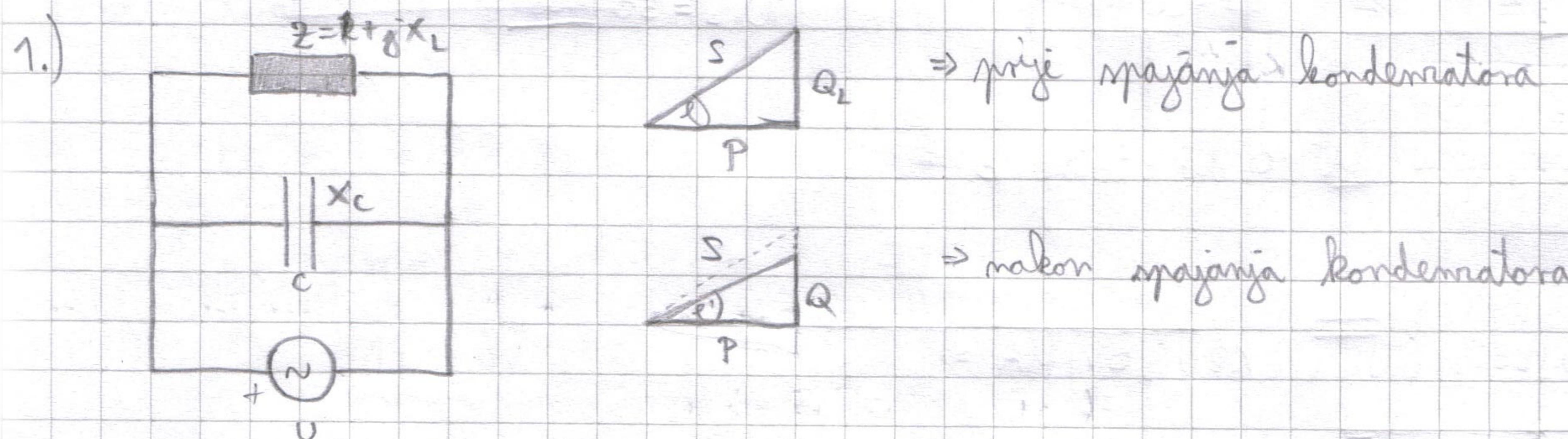
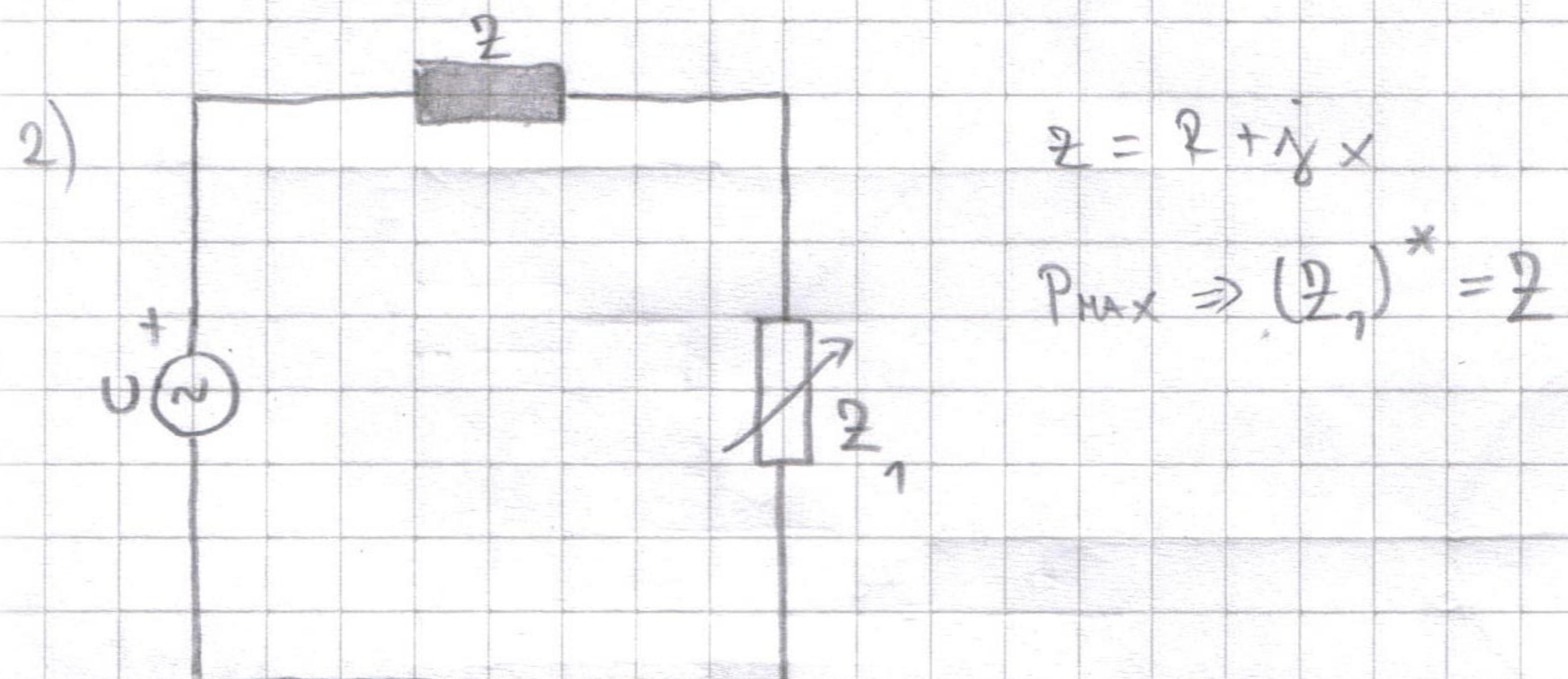
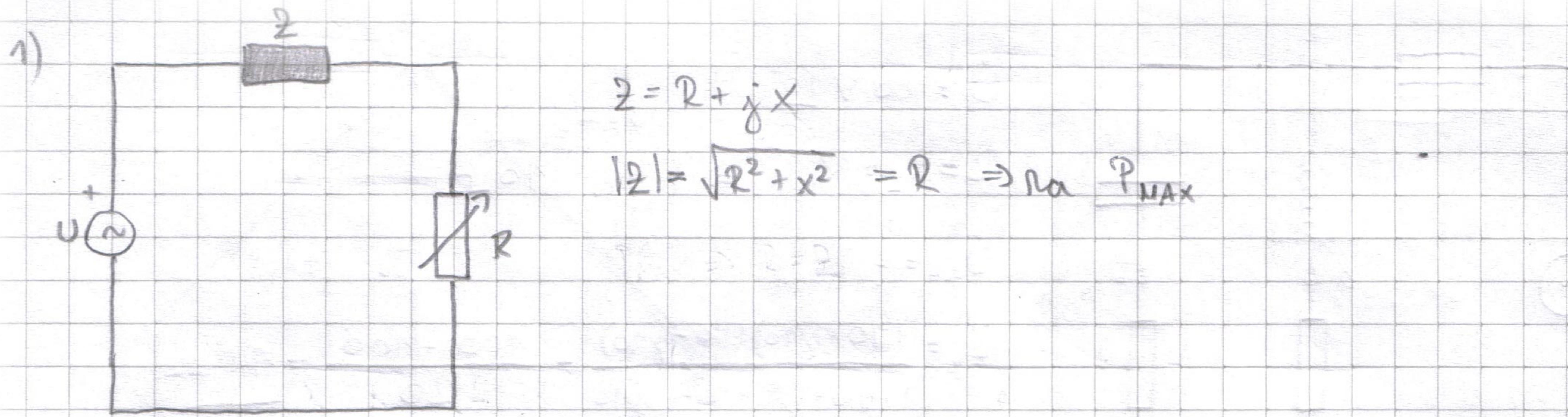
RADNA SNAGA ⇒ mo otkormicima

$$P = U \cdot I \cdot \cos \ell$$

JALOVA SNAGA ⇒ mo novojnicama i kondenzatorima

$$Q = U \cdot I \cdot \sin \ell$$





2.) a)  $p(t) = 200 + 300 \sin(400t + \ell)$   $\rightarrow$  koliko iznosi jeklova snaga?

$$p(t) = \underline{P} + \underline{S} \cdot \sin(2\omega t + \ell) \quad !$$

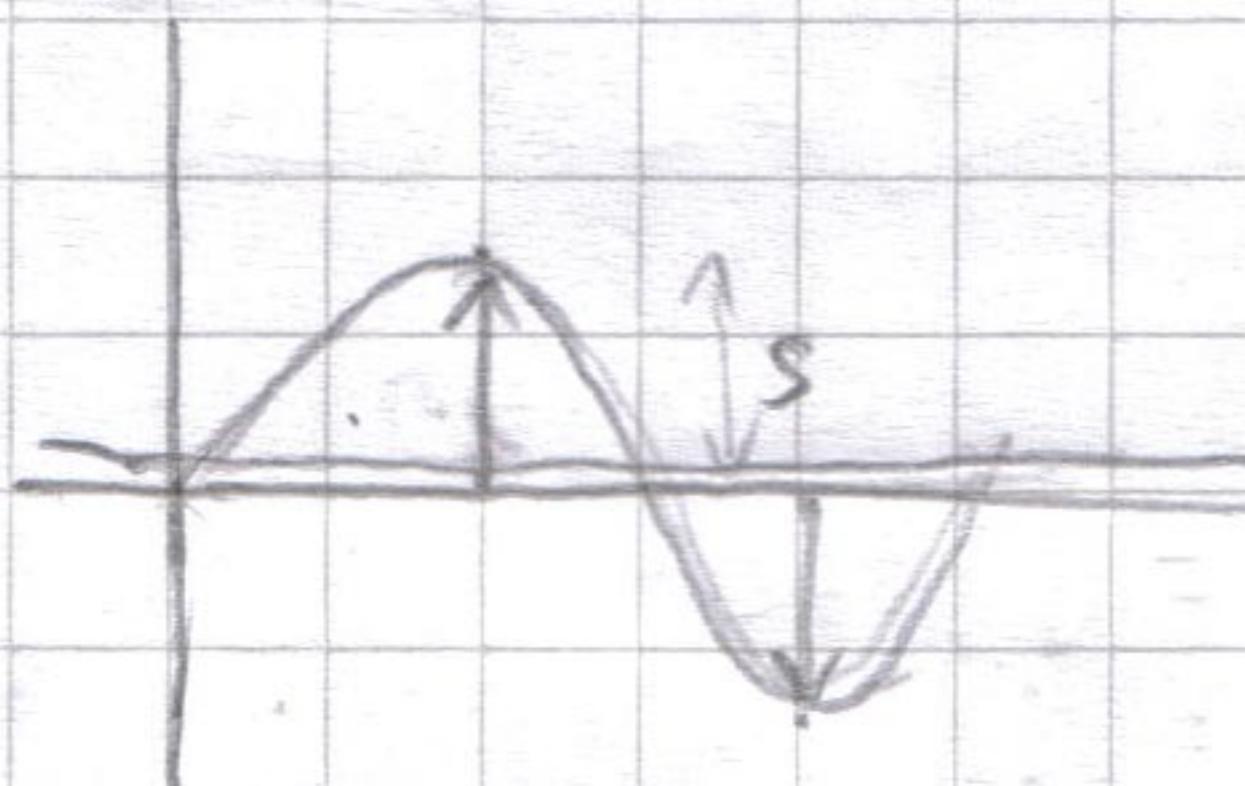
$$P = 200 \text{ W}$$

$$S = 300 \text{ VA}$$

$$Q = \sqrt{S^2 - P^2} \text{ VAR}$$

b)  $P_{\max}(t) = 400 \text{ VA}$

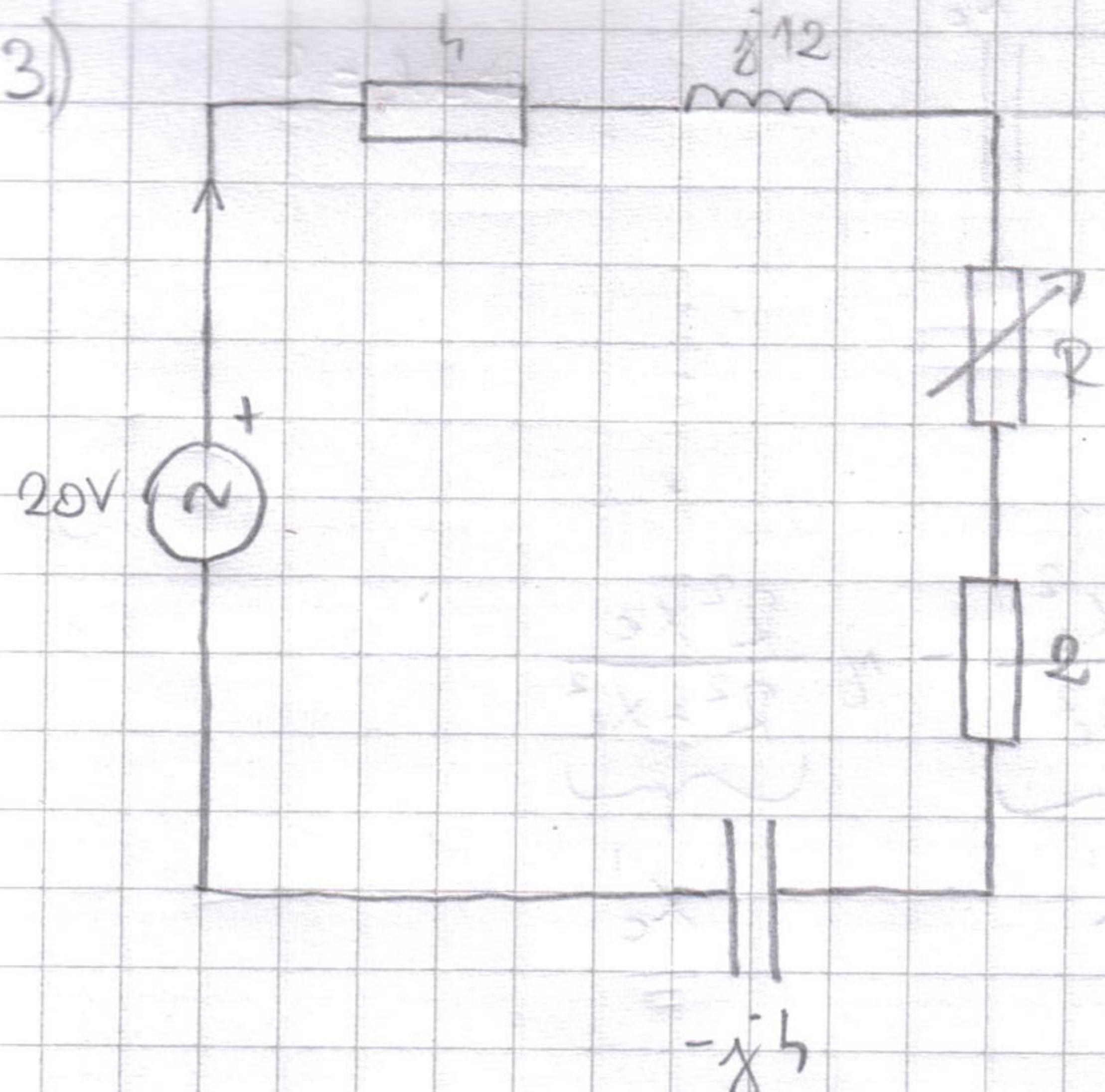
$$P_{\min}(t) = 100 \text{ VA}$$



$$S = \frac{400 + 100}{2} = 250 \text{ W}$$

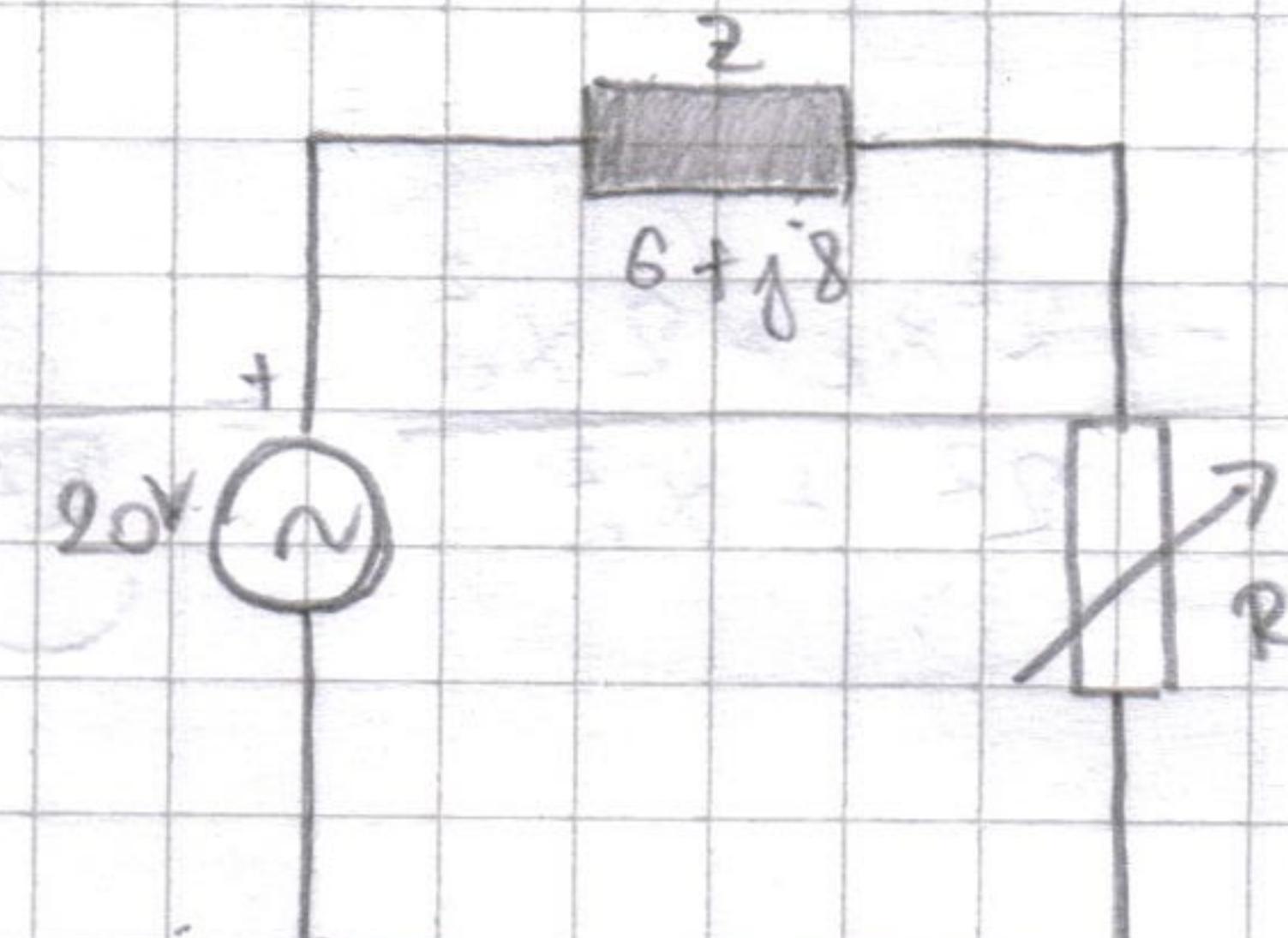
$$P = 400 - 250 = 150 \text{ VA}$$

3)



$$Z = 6 + j8$$

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$$|Z| = \sqrt{36+64} = 10 \Omega$$

$$R = |Z| = 10 \Omega$$

$$Z_{UK} = Z + R = 16 + j8$$

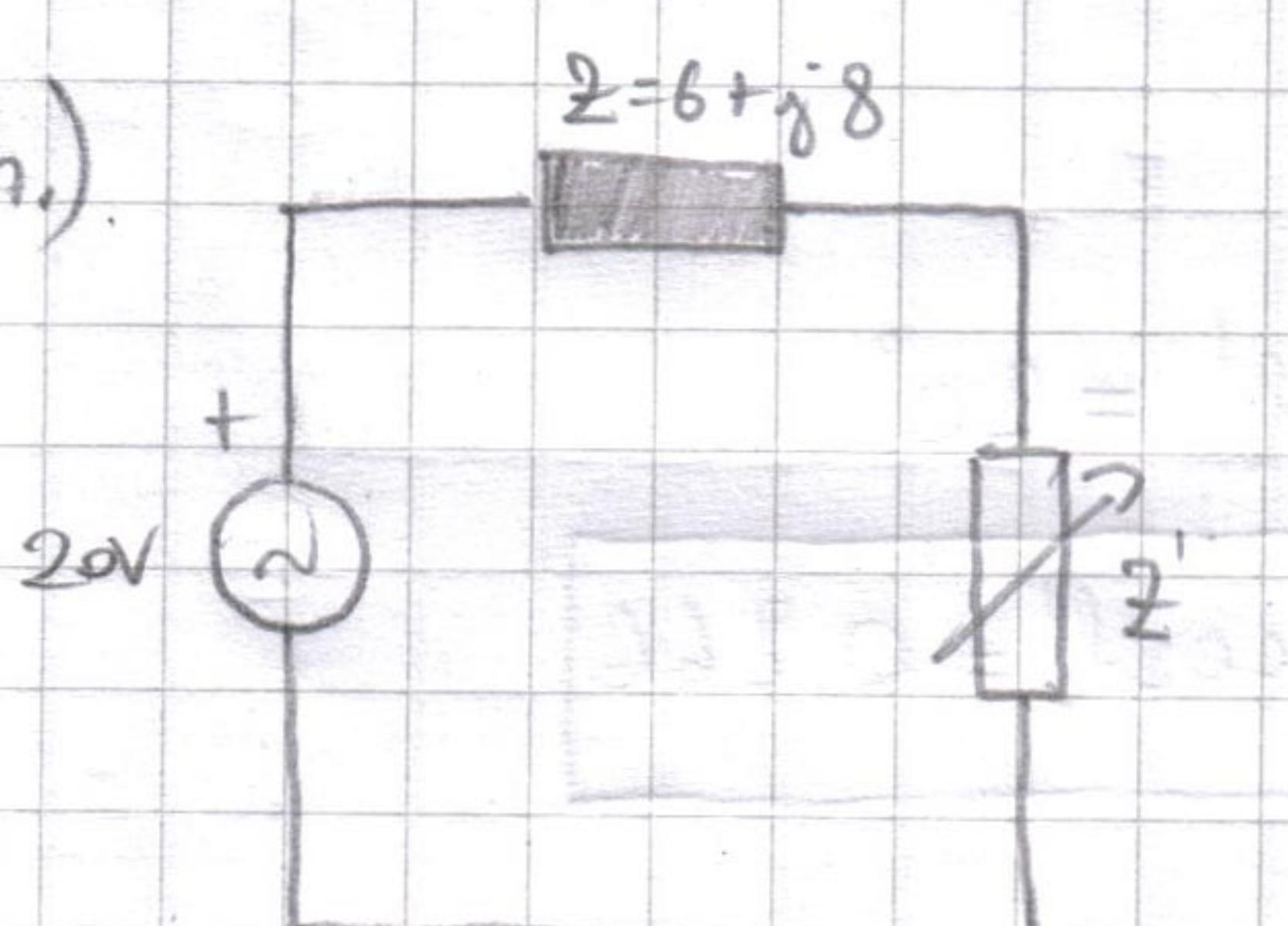
$$= 17.88 \angle 26.56^\circ$$

$$I = 1.1 \angle -26.56^\circ$$

$$P = I^2 \cdot R = 12.1 \text{ W}$$

$$I = \frac{U}{Z_{UK}} = \frac{20 \angle 0^\circ}{17.88 \angle 26.56^\circ}$$

4.)



$$Z' = (Z)^* = 6 - j8$$

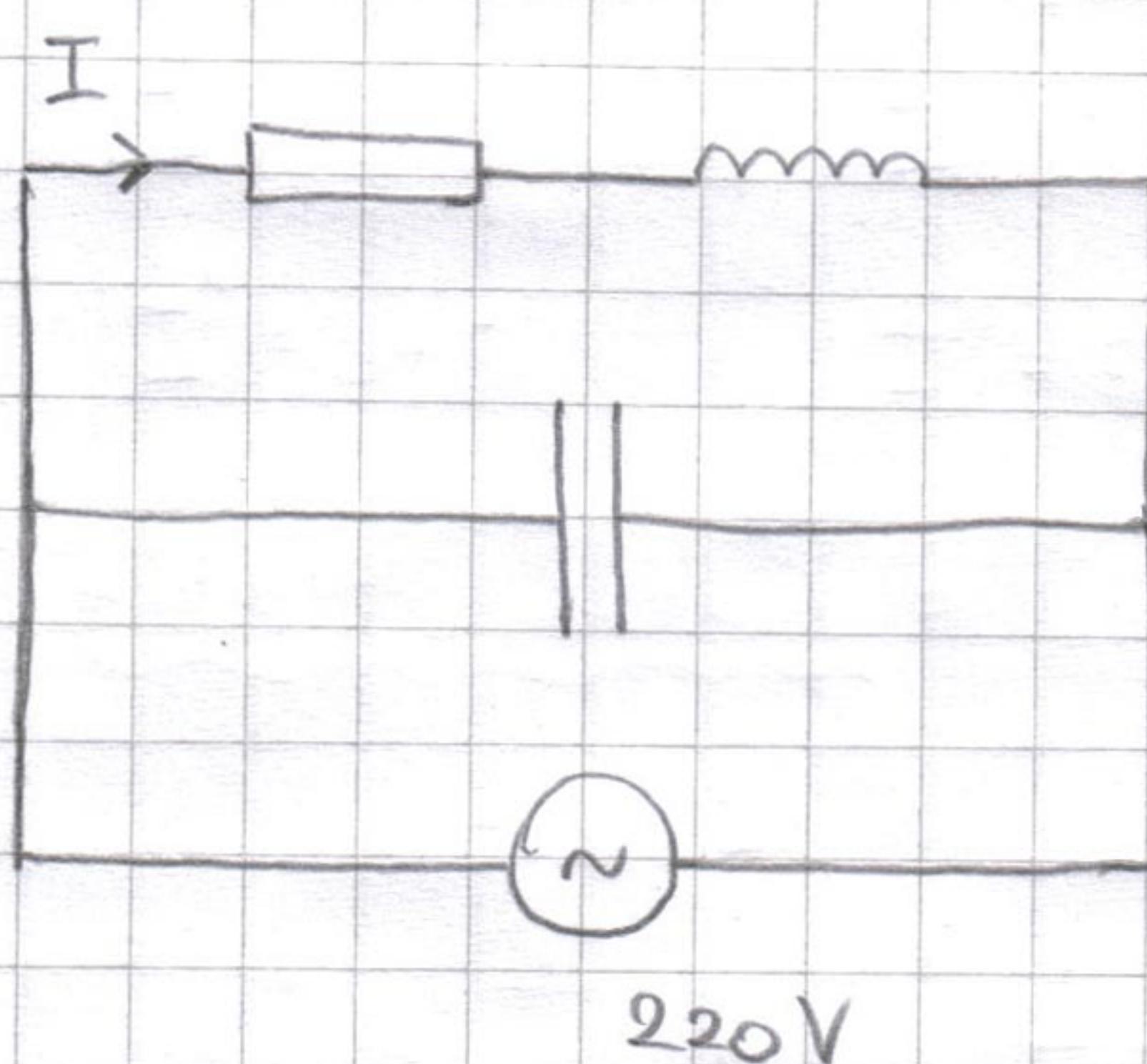
$$Z_{UK} = 12 \Omega$$

$$I = \frac{20}{12} = 1.6 \text{ A}$$

→ radna snaga se stvara samo na radnom (realnom) dijelu otpora

$$P_2' = I^2 \cdot R \Re\{Z'\} = 2.56 \cdot 6 = 15.36 \text{ W}$$

5.)



$$I = 5.5 \text{ A}$$

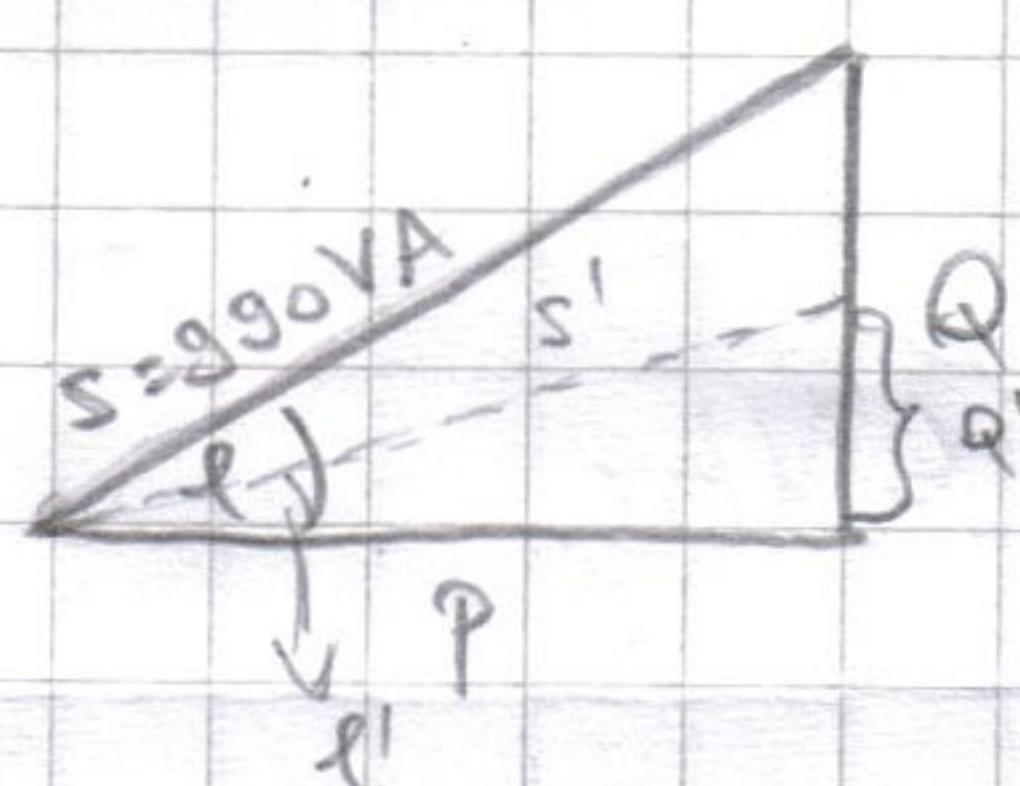
$$\cos \varphi = 0.85 \Rightarrow \text{faktor snage}$$

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

→ nakon spajanja kondenzatora hocemo povećati

$$\cos \varphi' = 0.95$$

$$S = U \cdot I = 220 \cdot 5.5 = 990 \text{ VA}$$



$$Q = \sqrt{S^2 - P^2} = 521.5 \text{ VAr}$$

$$\cos \varphi' = \frac{P}{S'} \Rightarrow S' = \frac{P}{\cos \varphi'} = \frac{P}{0.95} = 885.79 \text{ VA}$$

$$\cos \varphi = \frac{P}{S}$$

$$Q' = \sqrt{S'^2 - P^2} = 274 \text{ VAr}$$

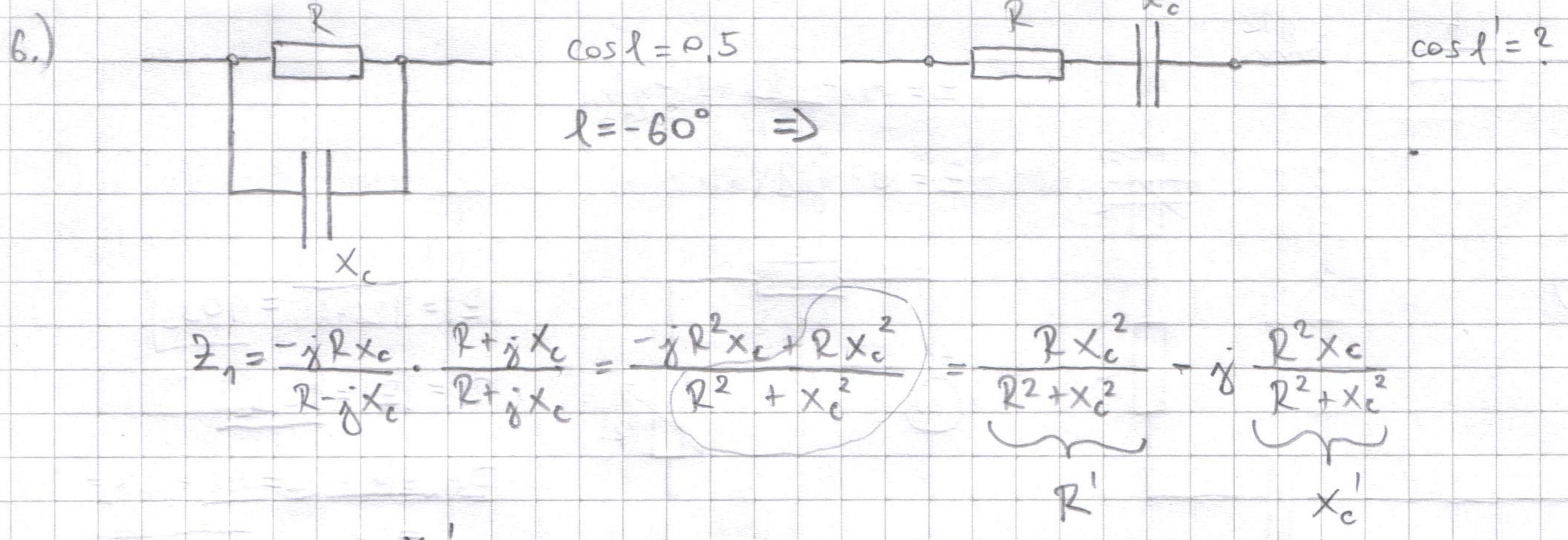
$$P = \cos \varphi \cdot S = 0.85 \cdot 990 = 841.5 \text{ W}$$

$$Q_c = 521.5 - 274 = 247.5 \text{ VAr}$$

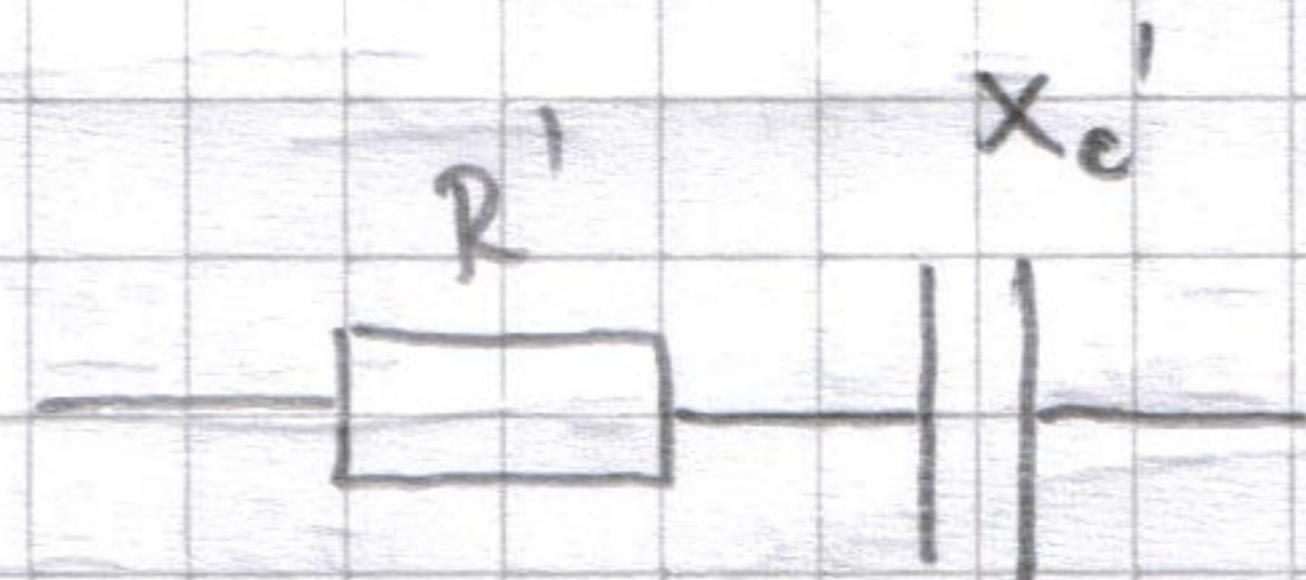
$$Q = \frac{U^2}{X_C} \Rightarrow X_C = \frac{U^2}{Q}$$

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

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



$$Z_1 = \frac{-jR X_c}{R - jX_c} \cdot \frac{R + jX_c}{R + jX_c} = \frac{-jR^2 X_c + R X_c^2}{R^2 + X_c^2} = \underbrace{\frac{R X_c^2}{R^2 + X_c^2}}_{R'} + j \underbrace{\frac{R^2 X_c}{R^2 + X_c^2}}_{X'_c}$$



$$\operatorname{tg} l = \frac{\frac{R^2 X_c}{R^2 + X_c^2}}{\frac{R^2 + X_c^2}{R^2 + X_c^2}} = \frac{R}{X_c}$$

$$\operatorname{tg} l' = \frac{X_c}{R}$$

$$\operatorname{tg} l' = \frac{1}{\operatorname{tg} l} \Rightarrow l' = 30^\circ$$

$$\boxed{\cos l' = 0.866}$$

7.) TROŠILO: 1  $\rightarrow$   $S_1 = 28,3 \text{ VA}$

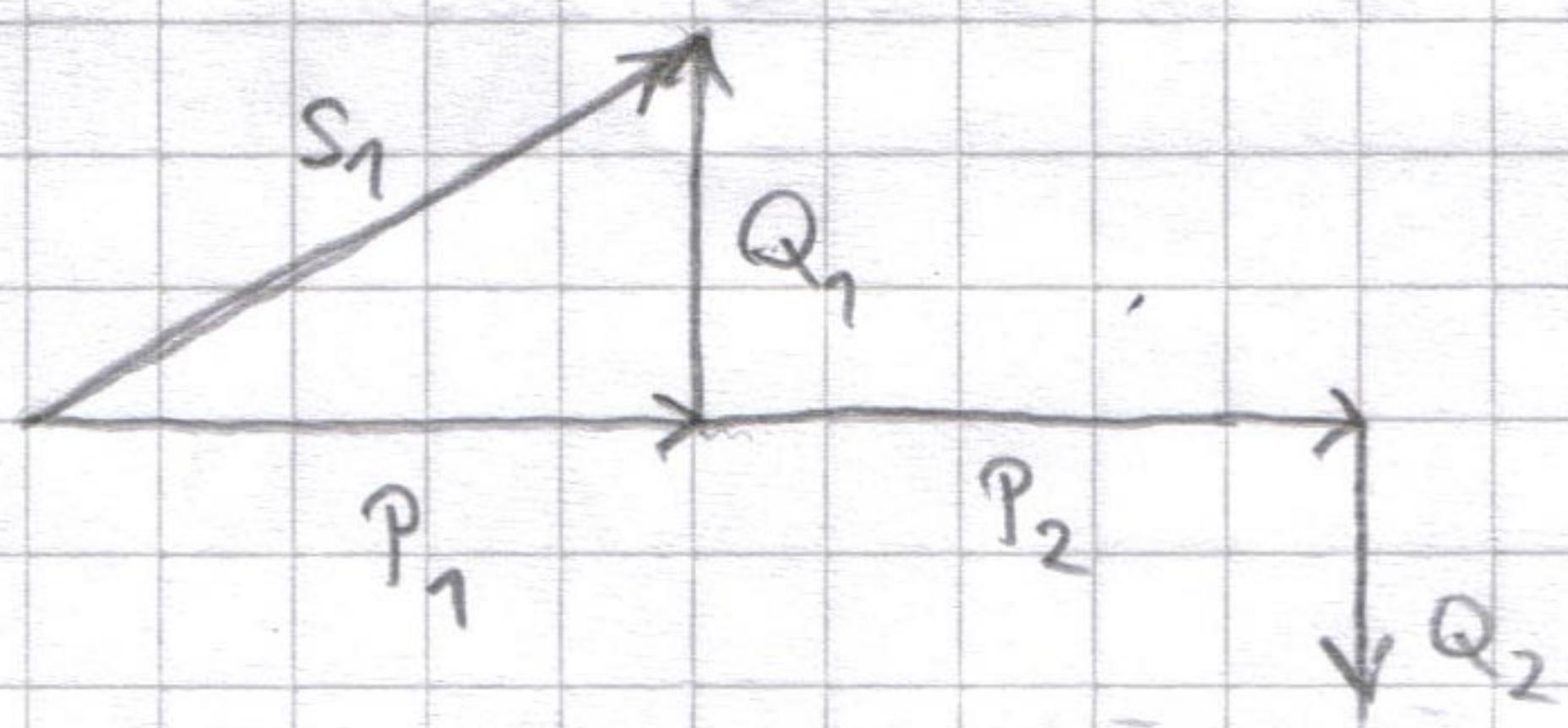
$$\cos l = 0.707 \text{ (ind)}$$

$$2 \rightarrow P_2 = 8 \text{ W}$$

$$S_2 = 10 \text{ VA}$$

(kap)

$\Rightarrow$  ukupna moga spoja = ?



$$P_1 = S_1 \cdot \cos l = 20 \text{ W}$$

$$Q_1 = \sqrt{S_1^2 - P_1^2} = 20 \text{ VAr}$$

$$\boxed{P_{UK} = 28 \text{ W}}$$

$$Q_{UK} = Q_1 - Q_2 = 14 \text{ VAr}$$

↓      ↓  
IND   KAP

$$Q_2 = \sqrt{S_2^2 - P_2^2} = 6 \text{ VAr}$$

$$P_{UK} = P_1 + P_2$$

$$\boxed{S_{UK} = \sqrt{P_{UK}^2 + Q_{UK}^2} = 31.3 \text{ VA}}$$