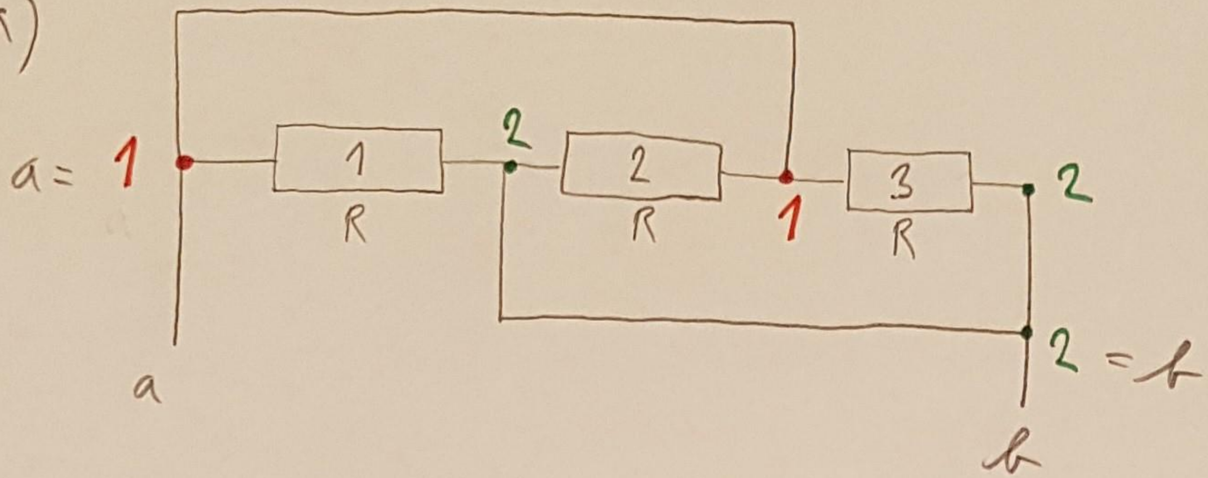
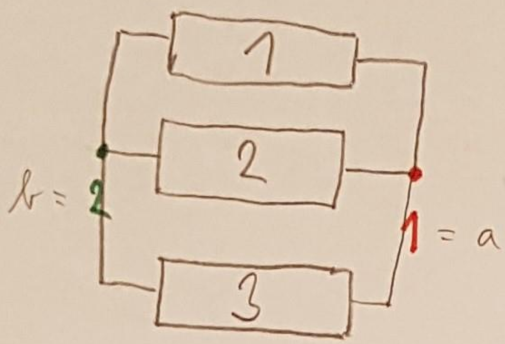
11.2-9 $\boxed{R = 10\,\Omega}$

a)



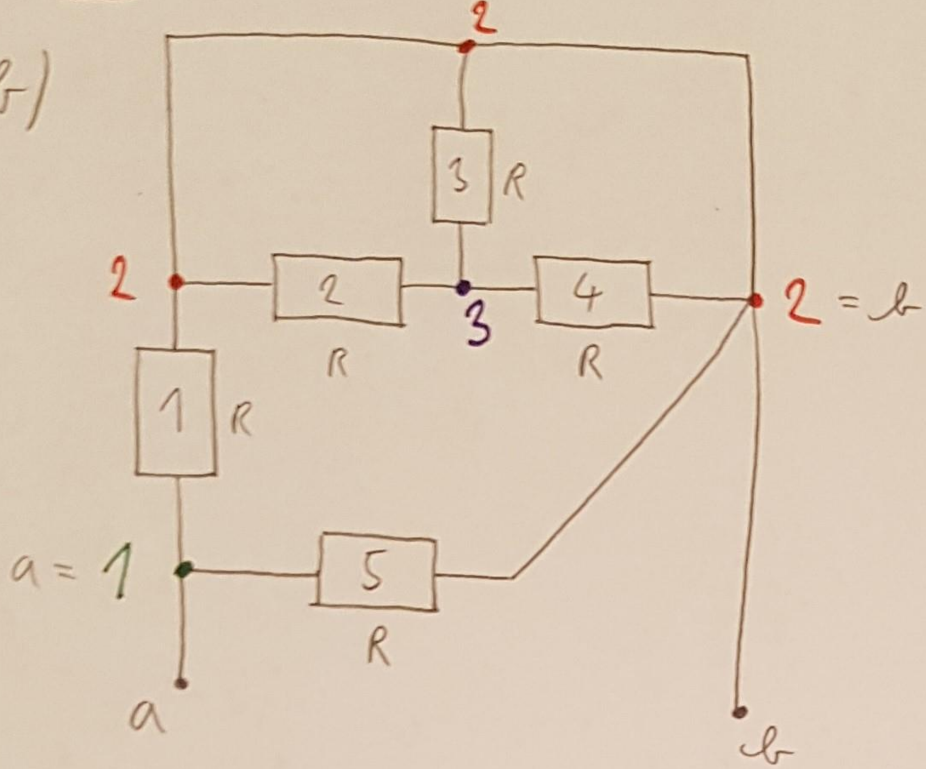



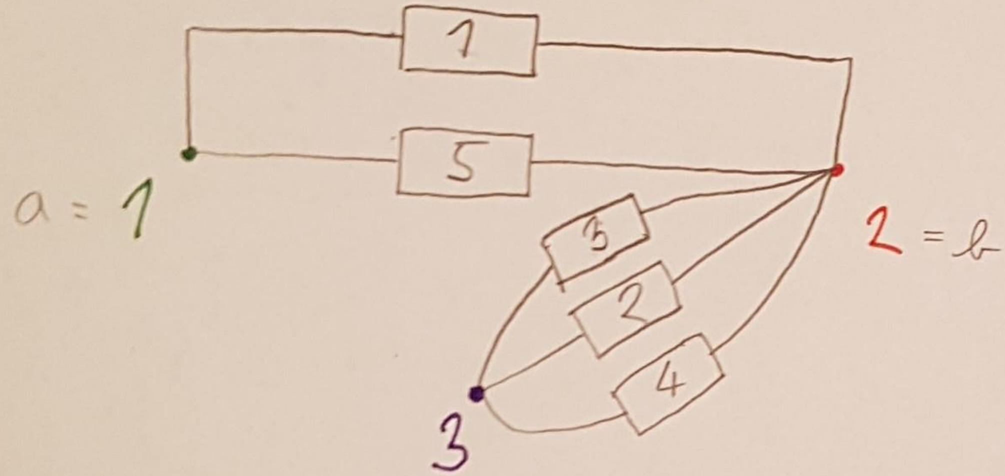

$$\frac{1}{R_{uk}} = \frac{1}{R_p} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R} \Rightarrow 3R_{uk} = R \Rightarrow R_{uk} = \frac{R}{3} = \boxed{\frac{10}{3}\,\Omega}$$

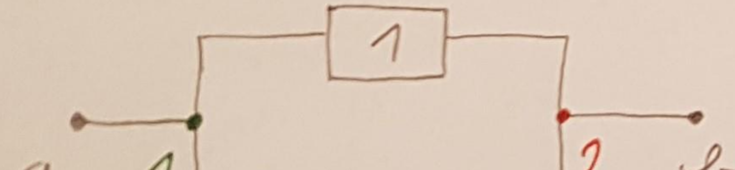
11.2-9

$R = 10\,\Omega$

b)



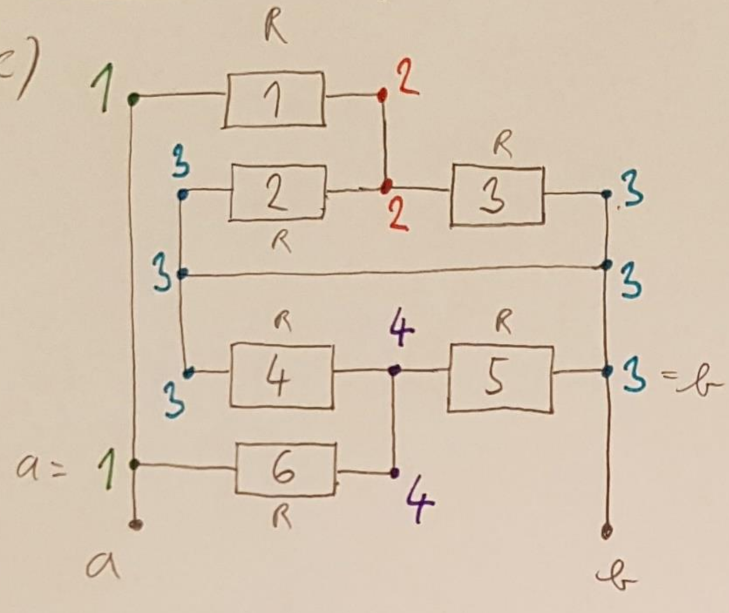



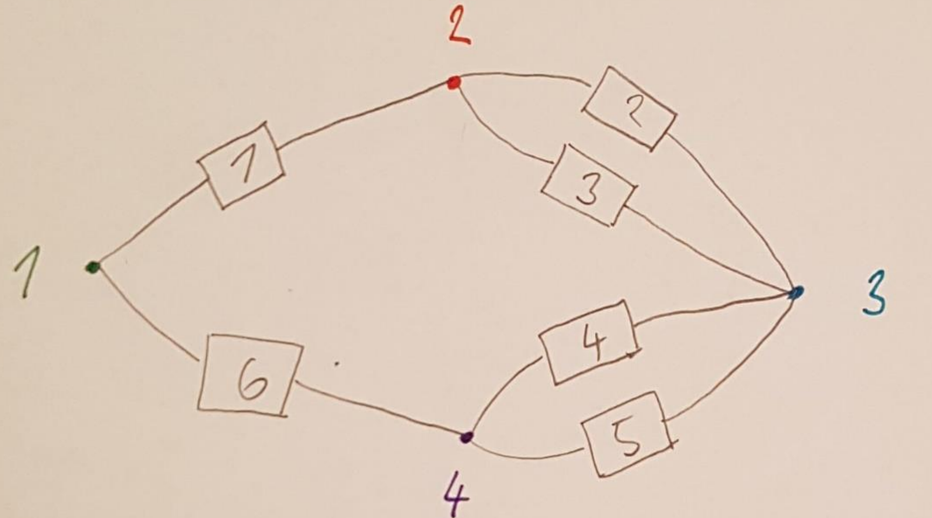

$$R_{uk} = \frac{R \cdot R}{R + R} = \frac{R}{2} = \boxed{5\,\Omega}$$

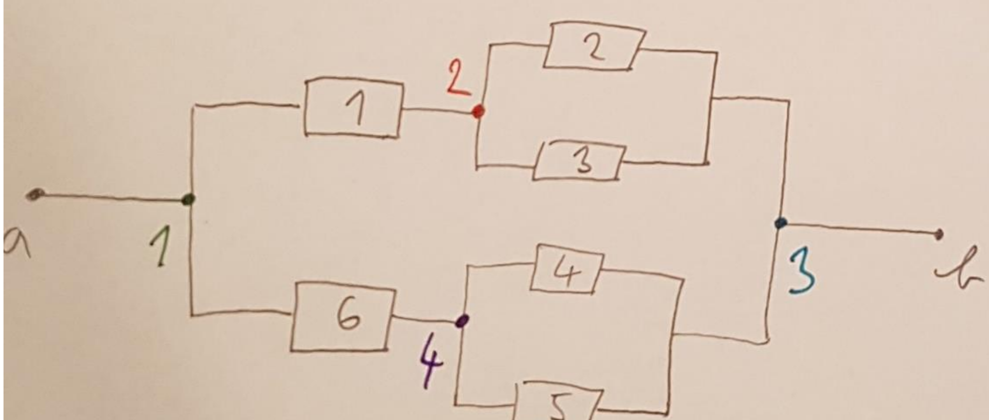
11. 2-9

$R = 10\,\Omega$

c)



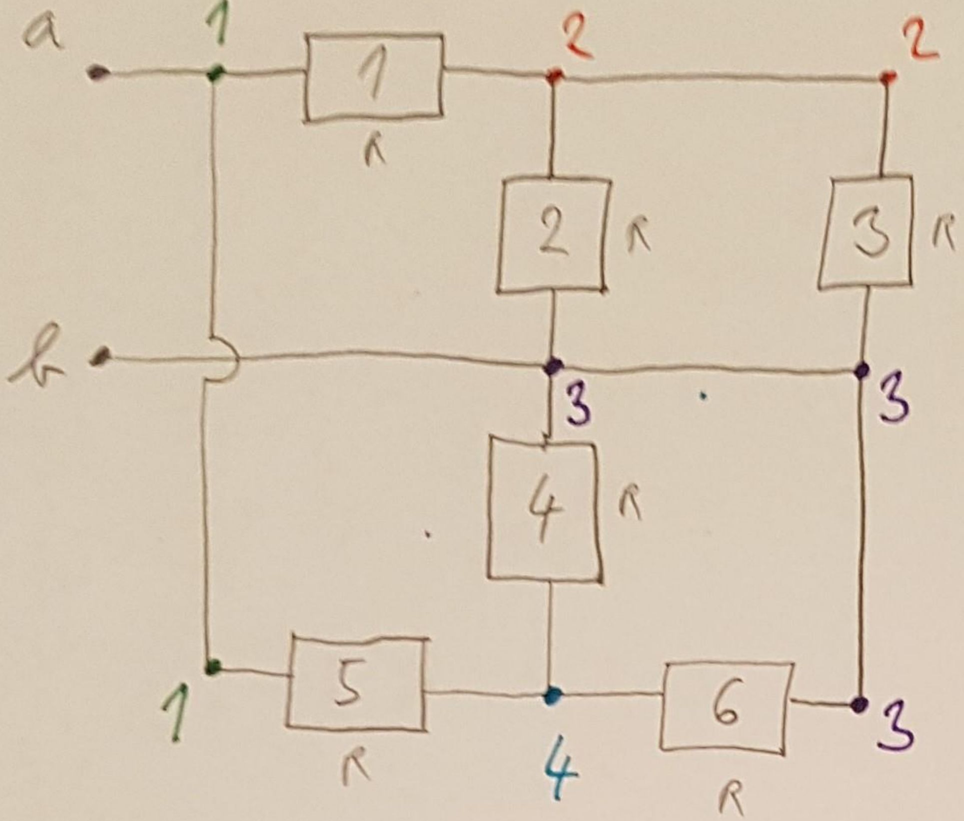

$$R_{JG} = R + (R \| R) = R + \frac{R}{2} = \frac{3}{2} R$$

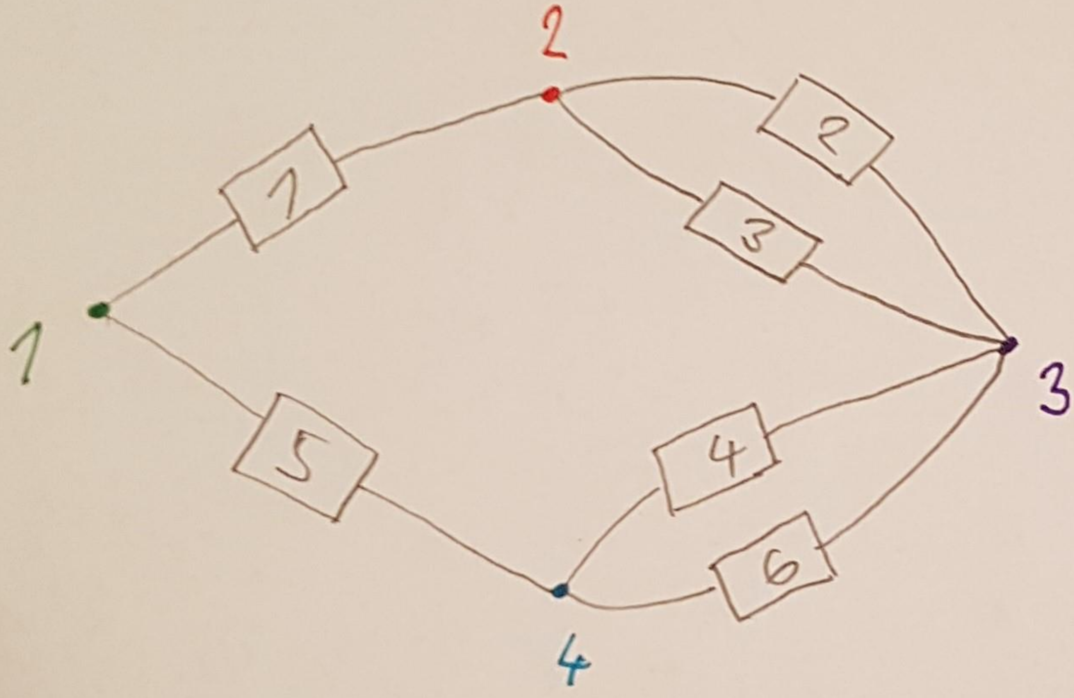
$$R_{uk} = R_{JG} \| R_{JG} = \frac{\frac{3}{2} R}{2} = \frac{3}{4} R = \frac{3}{4} \cdot 10\,\Omega = \boxed{7{,}5\,\Omega}$$

11. 2'-9

$\boxed{R = 10\,\Omega}$

d)



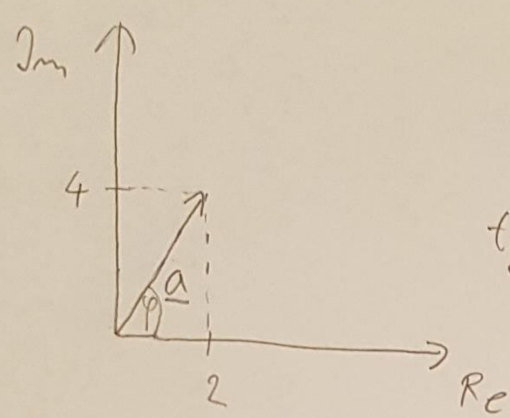




ISTO KAO U PRETHODNOM PRIMJERU:

$$\boxed{R_{uk} = 7{,}5\,\Omega}$$

# RAČUNANJE S KOMPLEKSNIM BROJEVIMA

$$\left.\begin{array}{|l|}\hline \underline{a} = 2 + 4j \\ \hline \underline{b} = 3 + 10j \\ \hline \end{array}\right\}$$ ALGEBARSKI OBLIK KOMPLEKSNOG BROJA




$$|\underline{a}| = \sqrt{Re^2 + Im^2} = \sqrt{2^2 + 4^2} = 2\sqrt{5}$$

$$tg\,\varphi = \frac{Im}{Re} = \frac{4}{2} = 2 \Rightarrow \varphi = 63{,}43^\circ$$

$$\boxed{\underline{a} = 2\sqrt{5}\,\angle 63{,}43^\circ}$$

POLARNI OBLIK KOMPLEKSNOG BROJA

$$|\underline{b}| = \sqrt{10^2 + 3^2} = \sqrt{109}$$

$$tg\,\varphi = \frac{Im}{Re} = \frac{10}{3} \Rightarrow \varphi = 73{,}3^\circ$$

$$\boxed{\underline{b} = \sqrt{109}\,\angle 73{,}3^\circ}$$

$$\underline{a} = 2 + 4j = 2\sqrt{5}\,\angle 63{,}43^\circ$$

$$\underline{b} = 3 + 10j = \sqrt{109}\,\angle 73{,}3^\circ$$

$$\underline{a} + \underline{b} = 2 + 4j + 3 + 10j = 5 + 14j$$

$$\underline{a} - \underline{b} = 2 + 4j - (3 + 10j) = -1 - 6j$$

MOŽEMO LI SE IZ POLARNOG OBLIKA VRATITI U ALGEBARSKI OBLIK?

IZ GORNJE JE SLIKE JASNO:

$$\cos\varphi = \frac{Re}{|\underline{a}|} \Rightarrow Re = |\underline{a}|\cos\varphi$$

$$\sin\varphi \quad \frac{Im}{|\underline{a}|} \Rightarrow Im = |\underline{a}|\sin\varphi$$

DAKLE:

$$\underline{a} = |\underline{a}|\cos\varphi + j|\underline{a}|\sin\varphi$$

$$\underline{a} = 2\sqrt{5}\cos(63{,}43^\circ) + j\cdot 2\sqrt{5}\sin(63{,}43^\circ)$$

$$\underline{a} = 2 + 4j$$

$$\frac{\underline{a}}{\underline{b}} = \frac{2\sqrt{5}\,\angle 63{,}43^\circ}{\sqrt{109}\,\angle 73{,}3^\circ} = \frac{2\sqrt{5}}{\sqrt{109}}\,\angle 63{,}43^\circ - 73{,}3^\circ = 0{,}43\,\angle -9{,}87^\circ$$

$$\underline{a}\cdot\underline{b} = 2\sqrt{5}\,\angle 63{,}43^\circ \cdot \sqrt{109}\,\angle 73{,}3^\circ = 2\sqrt{5}\cdot\sqrt{109}\,\angle 63{,}43^\circ + 73{,}3^\circ = 46{,}7\,\angle 136{,}73^\circ$$

1.11 -1

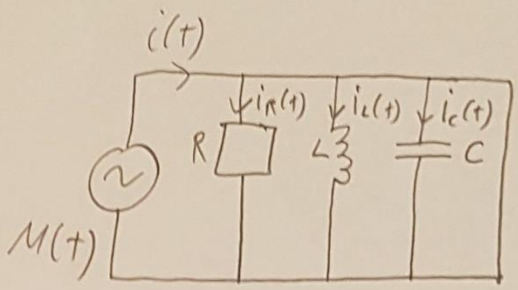
$u(t) = 100 \sin(wt + \frac{\pi}{3})\,V$

$w = 100 \frac{1}{s}$

$R = 10\,\Omega = \boxed{10\angle 0^\circ\,\Omega}$

$L = 10^{-1}\,H$

$C = 2 \cdot 10^{-4}\,F$

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$i, i_R, i_C, i_L = ?$

$$\dot{U} = \frac{100}{\sqrt{2}} \angle 60^\circ\,V = \boxed{70{,}71\angle 60^\circ\,V}$$

$$\underline{X_L} = jW \cdot L = j100\,\frac{1}{s} \cdot 10^{-1}\,H = \boxed{10\angle 90^\circ\,\Omega}$$

$$\underline{X_C} = \frac{-j}{wC} = \frac{-j}{100 \cdot 2 \cdot 10^{-4}} = \frac{-100j}{2} = \boxed{50\angle -90^\circ\,\Omega}$$

$$\frac{1}{\underline{Z_{uk}}} = \frac{1}{\underline{R}} + \frac{1}{\underline{X_L}} + \frac{1}{\underline{X_C}} = \frac{1}{10\angle 0^\circ} + \frac{1}{10\angle 90^\circ} + \frac{1}{50\angle -90^\circ} = 0{,}128\angle -38{,}66^\circ\,\frac{1}{\Omega}$$

$$\dot{I} = \frac{\dot{U}}{\underline{Z_{uk}}} = \dot{U} \cdot \frac{1}{\underline{Z_{uk}}} = \frac{100}{\sqrt{2}} \angle 60^\circ\,V \cdot 0{,}128\angle -38{,}66^\circ\,\frac{1}{\Omega} = 9{,}05\angle 21{,}34^\circ\,A$$

$$\boxed{\dot{I} = 9{,}06\angle 21{,}34^\circ\,A}$$

$i(t) = 12{,}81 \sin(100t + 21{,}34^\circ)\,A$

$i(t) = 12{,}81 \sin(100t + \underbrace{0{,}119\pi}_{=0{,}37})\,A = \boxed{12{,}81 \sin(100t + 0{,}37)\,A}$

1.11 - 2

$$\dot{I}_R = \frac{\dot{U}}{\underline{R}} = \frac{70{,}71\angle 60^\circ}{10\angle 0^\circ} = \boxed{7{,}071\angle 60^\circ\ A}$$

$$i_R(t) = 7{,}071\sqrt{2}\ \sin(100t + 60^\circ)\ A$$

$$\boxed{i_R(t) = 10\ \sin\left(100t + \frac{\pi}{3}\right) A}$$

$$\dot{I}_L = \frac{\dot{U}}{\underline{X_L}} = \frac{70{,}71\angle 60^\circ}{10\angle 90^\circ} = \boxed{7{,}071\angle -30^\circ\ A}$$

$$\boxed{i_L(t) = 10\ \sin\left(100t - \frac{\pi}{6}\right) A}$$

$$\dot{I}_C = \frac{\dot{U}}{\underline{X_C}} = \frac{70{,}71\angle 60^\circ}{50\angle -90^\circ} = \boxed{\sqrt{2}\ \angle 150^\circ\ A}$$

$$i_C(t) = \sqrt{2}\cdot\sqrt{2}\ \sin(100t + 150^\circ)\ A$$

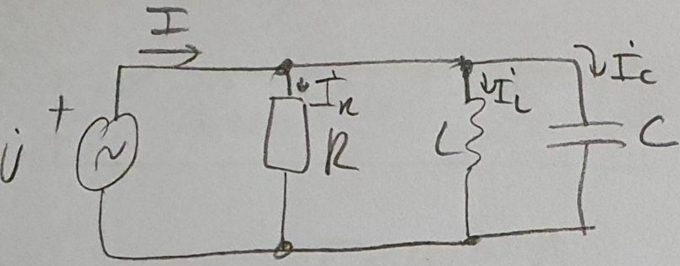
$$\boxed{i_C(t) = 2\ \sin\left(100t + \frac{5}{6}\pi\right) A}$$

PROVJERA:

$$\dot{I} = \dot{I}_R + \dot{I}_C + \dot{I}_L = 7{,}071\angle 60^\circ A + 7{,}071\angle -30^\circ A + \sqrt{2}\ \angle 150^\circ A = \boxed{9{,}06\angle 21{,}3^\circ\ A}$$

✓

1.3.




$R = 12.5\,\Omega$

$L = 100\,mH$

$C = 200\,\mu F$

$\dot{U} = 25\angle 0^\circ$

$\omega = 100\,s^{-1}$

$\dot{I} = \dfrac{\dot{U}}{\underline{Z}}$ ili bolje $\dot{I} = \dot{U} \cdot \underline{Y}$

$$\underline{Y} = \frac{1}{R} + \frac{1}{+jX_L} + \frac{1}{-jX_C}$$

$$\underline{Y} = \frac{1}{R} + \frac{1}{+j\omega L} + \frac{1}{-j\frac{1}{\omega C}}$$

$$\underline{Y} = \frac{1}{R} - j\frac{1}{\omega L} + j\omega C$$

$$\underline{Y} = \frac{1}{12.5} - j\frac{1}{\frac{100}{1000}\cdot 100} + j\,100\cdot\frac{200}{1000000}$$

$$\underline{Y} = \frac{1}{12.5} - j\frac{1}{10} + j\frac{2}{100}\,\frac{1}{50}$$

$$\underline{Y} = \frac{1}{12.5} - j\frac{1}{10} + j\frac{1}{50}$$

$$\underline{Y} = \frac{1}{12.5} + j\left(\frac{1-5}{50}\right)$$

$$\underline{Y} = \frac{1}{12.5} - j\frac{4}{50} = \frac{1}{12.5} - j\frac{1}{12.5}$$

$$\underline{Y} = 0.08 - j0.08\ S$$

$$\underline{Y} = 0.08\sqrt{2}\angle -45^\circ\ S$$

$$\dot{I} = \dot{U}\cdot\underline{Y}$$

$$\dot{I} = 25\cdot 0.08\cdot\sqrt{2}\angle -45^\circ\ A$$

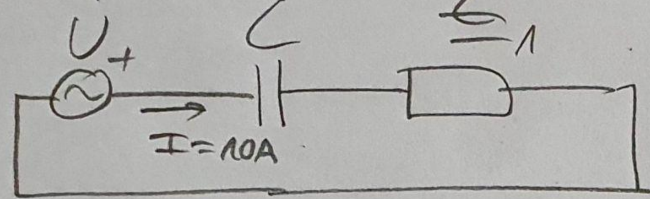
$$\dot{I} = 2\sqrt{2}\angle -45^\circ\ A$$

$$\dot{I} = 2\sqrt{2}\cdot(\cos(-45^\circ) + j\sin(-45^\circ))$$

$$\dot{I} = 2\sqrt{2}\cdot\left(\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right)$$

$$\dot{I} = 2 - j2\ A$$

1.4.



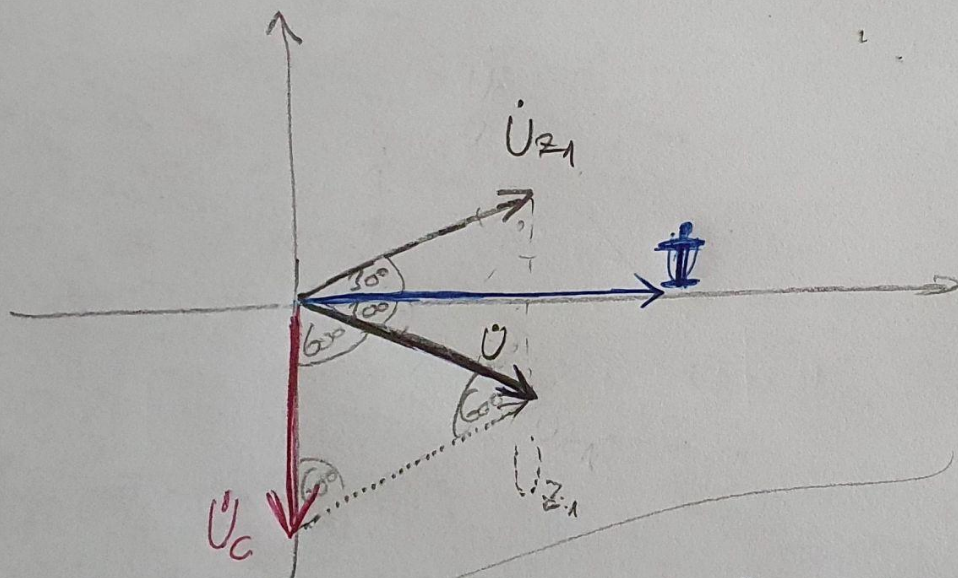

$\underline{Z}_C = \underline{Z}_1$

$U_C = U_{Z_1} = U = 100\,V$

$Z = \frac{U}{I} \rightarrow Z = \frac{100}{10} = 10\,\Omega$

$\dot{I} = 10\angle 0°\ A$

$\underline{Z} = \underline{Z}_C + \underline{Z}_1$



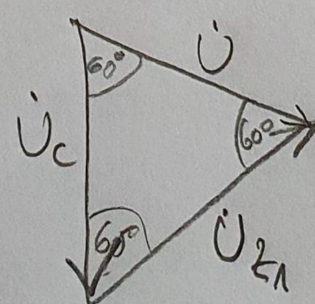

$\dot{U} = \dot{U}_C + \dot{U}_{Z_1}$

ISTOSTRANIČNI TROKUT

3 JEDNAKE STRANICE!

$\dot{U}_{Z_1} = 100\angle 30°\ V$

$\dot{U} = 100\angle -30°\ V$




$\underline{Z}_1 = \frac{\dot{U}_{Z_1}}{\dot{I}} = \frac{100\angle 30°}{10\angle 0°} = 10\angle 30°\ \Omega$

$\underline{Z}_1 = 10(\cos(30°) + j\sin(30°)) = 10 \cdot \left(\frac{\sqrt{3}}{2} + j\frac{1}{2}\right) = 5\sqrt{3} + j5\ \Omega$