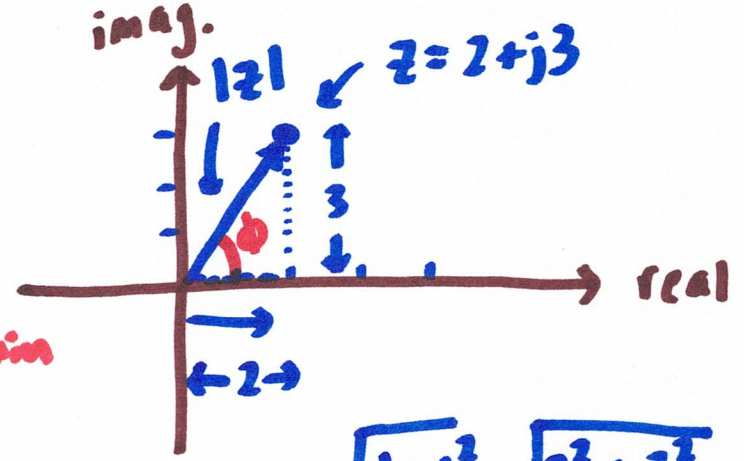
EE 220: Circuits I

$j = \sqrt{-1}$

complex numbers: $x + jy$ (real, imaginary)



rectangular → $z = 2 + j3$ ← imaginary (complex) domain

SOH-CAH-TOA → $\tan\phi = \frac{3}{2}$

$\sqrt{|z|^2} = \sqrt{2^2 + 3^2}$

$|z| = \sqrt{2^2 + 3^2}$

$\boxed{|z| = \sqrt{13}}$

$\tan^{-1}(\tan(\phi)) = \tan^{-1}\left(\frac{3}{2}\right)$

$\boxed{\phi = \tan^{-1}\left(\frac{3}{2}\right)}$

rect. → $z = 2 + j3$

polar → $z = \sqrt{13} \angle 56.3°$

$(2+j3) + (4+j1) = 6 + j4$

polar → $z = |z| \angle \phi$

$\boxed{z = \sqrt{13} \angle 56.3°}$

$x = |z|\cos\phi$
$y = |z|\sin\phi$
} $x + jy$

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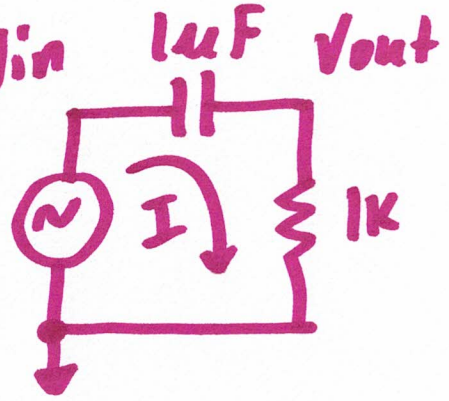


$5\cos(2\pi \cdot 1K \cdot t)$

↑ mag.

$\boxed{Vin = 5\angle 0^\circ \text{ V}}$

$$Z_C = \frac{1}{j \cdot 2\pi \cdot f \cdot C}$$

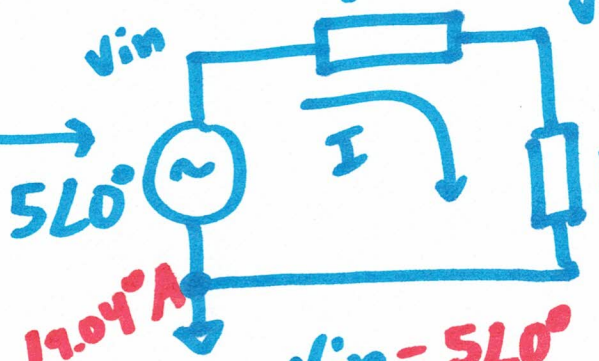
↑ 1K ↑ 1mF

$$Z_C = \frac{159.15}{j} = -j159.15\,\Omega$$

Find phasors for:

1.) Vin
2.) Vout
3.) I

$Z_R = 1K\Omega$ $\quad -j159.15\,\Omega$



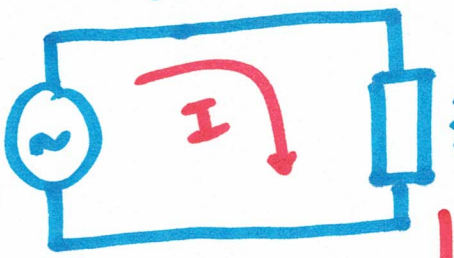
$\frac{\phi}{360^\circ} \cdot T = td$

$\frac{9.04}{360} \cdot 1ms = 25.1us$

$$I = \frac{V}{R} = \frac{V}{Z} \leftarrow \text{impedance}$$

$$I = \frac{5\angle 0^\circ}{1.013K\angle -9.04^\circ} = 4.93m\angle 9.04^\circ A$$

$\boxed{I = 4.93\angle 9.04^\circ mA}$



real ↓ $\quad$ imaginary ↓

$Z_T = 1K - j159.15$

$$|Z_T| = \sqrt{(1K)^2 + (159.15)^2}$$

$$\phi = \tan^{-1}\left(\frac{-159.15}{1000}\right)$$

$\boxed{Z_T = 1.013K\angle -9.04^\circ\,\Omega}$

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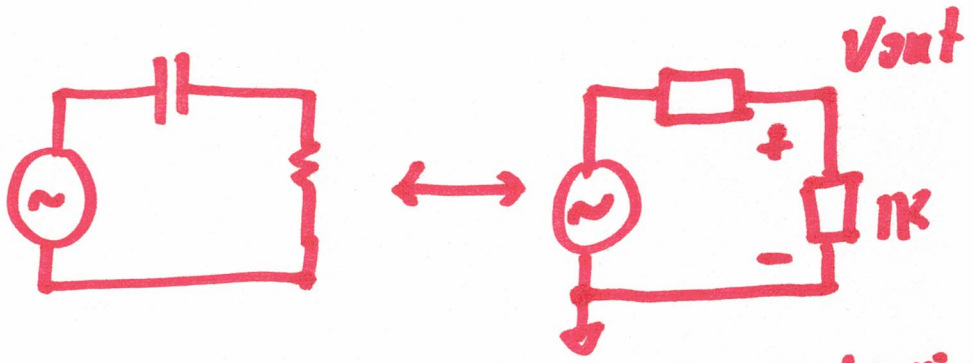
$V_{in} = 5\angle 0^\circ$

$I = 4.93\angle 9.04^\circ \text{ mA}$

$V_{out} = 4.93\angle 9.04^\circ \text{ V}$



$I = 4.93\angle 9.04^\circ \text{mA}$

$Z = 1K$

$1K + j0$

$|Z| = \sqrt{1K^2 + 0^2} = 1K$

$\phi = \tan^{-1}\left(\frac{0}{1K}\right) = 0^\circ$

$Z = 1K\angle 0^\circ\ \Omega$

$V_{out} = I \cdot Z$

$V_{out} = 4.93\angle 9.04^\circ \text{mA} \cdot 1K\angle 0^\circ \Omega$

$V_{out} = 4.93\angle 9.04^\circ \text{ V}$

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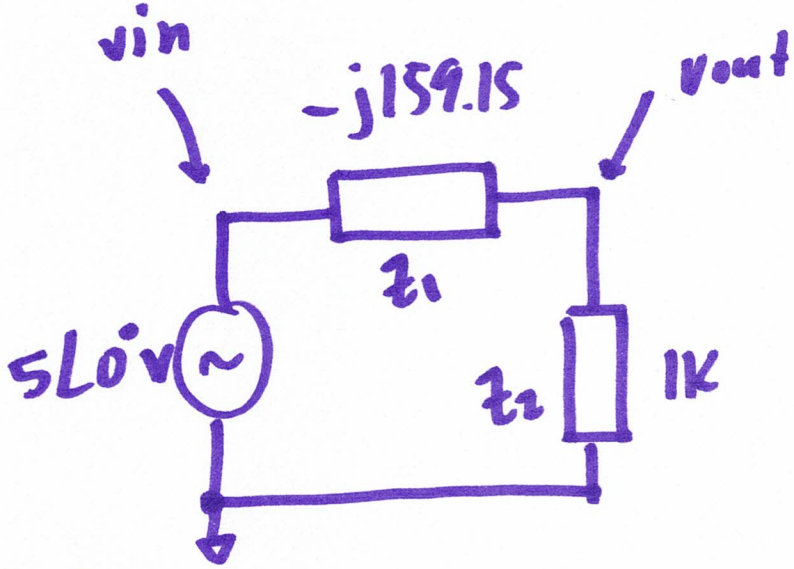

$$5\angle 0^\circ = V_{in}$$

$$V_{out} = V_{in}\left(\frac{Z_2}{Z_1 + Z_2}\right)$$

$$V_{out} = 5\angle 0^\circ\left(\frac{1k\angle 0^\circ}{1.013k\angle -9.04^\circ}\right)$$

$$V_{out} = 5\angle 0^\circ\left(0.987\angle 9.04^\circ\right)$$

$$\boxed{V_{out} = 4.93\angle 9.04^\circ\ V}$$

$Z_R = R$

$Z_C = \frac{1}{-j\omega C}$

$Z_L = j\omega L$

$\omega = 2\pi f$

Last Day to do missed quizzes: 4/27/2022