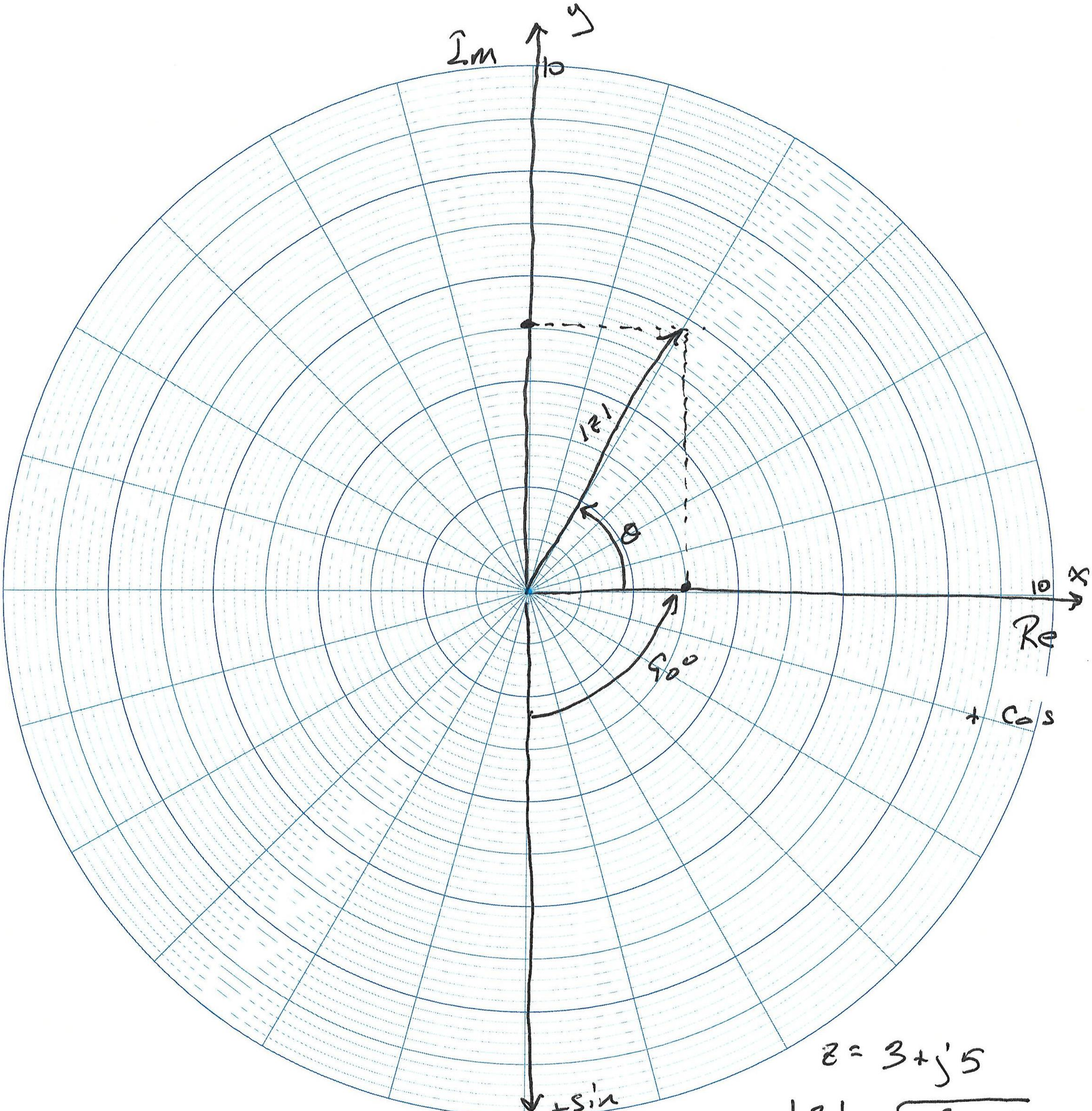
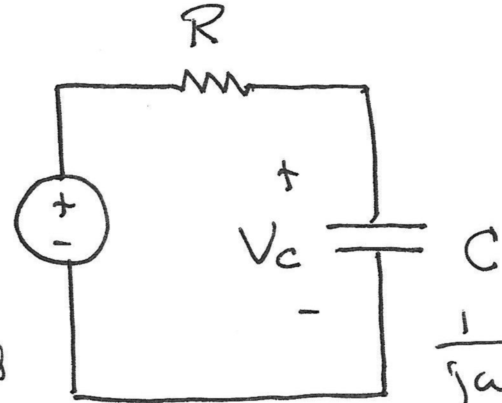


$z = 3 + j5$

$|z| = \sqrt{3^2 + 5^2}$

$\theta = \angle z = \tan^{-1}\frac{5}{3}$



$2\cos 3t$ V

$2\angle 0°$ V

$\omega = 3\ \frac{\text{rad}}{\text{s}}$

$$\frac{1}{j\omega C}\,\Omega = -j\frac{1}{\omega C}\,\Omega$$

What is the steady-state AC voltage across the capacitor. (V_c)

$$V_c = \frac{\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}} \cdot 2\angle 0°$$

$$= \frac{\frac{2}{j\omega C}}{R + \frac{1}{j\omega C}} = \frac{2}{1 + j\omega RC} = \frac{2}{1 + j3RC}$$

Choose $R = 1\,\Omega$, $C = \frac{1}{3}$ F

$$V_c = \frac{2}{1+j(3)(1)(\frac{1}{3})} = \frac{2}{1+j}$$

$$z = 1+j = \sqrt{2}\angle 45^\circ$$

$$|z| = \sqrt{1^2 + 1^2} = \sqrt{2}$$

$$\angle z = \tan^{-1}\frac{1}{1} = 45^\circ$$

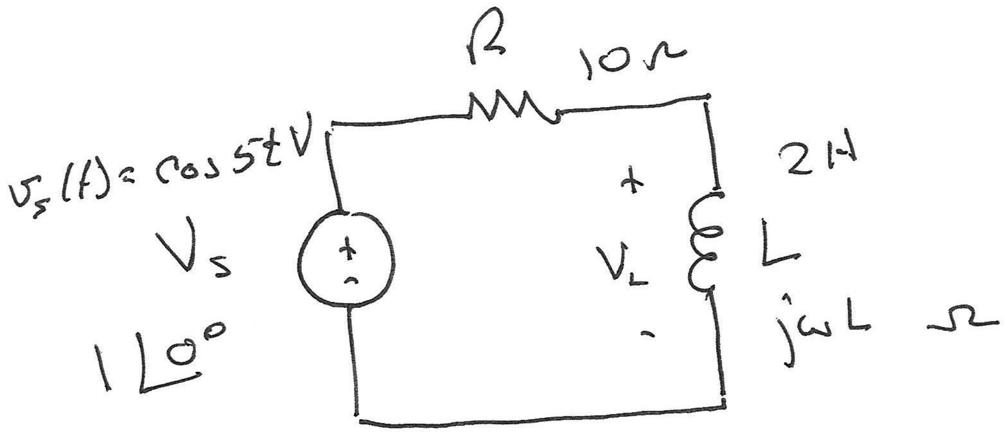
$$V_c = \frac{2}{\sqrt{2}\angle 45^\circ} = \sqrt{2}\angle -45^\circ \text{ V}$$

$$v_{c_{ss}}(t) = \sqrt{2}\cos(3t - 45^\circ) \text{ V}$$

$$\frac{A\angle\theta_1}{B\angle\theta_2} = \frac{A}{B}\angle\theta_1-\theta_2$$

$$\frac{A\,e^{j\theta_1}}{B\,e^{j\theta_2}} = \frac{A}{B}e^{j(\theta_1-\theta_2)}$$

$$= \frac{A}{B}\angle\theta_1-\theta_2$$



$\omega = 5$

$R = 10$

$j = 2$

$j\omega L = j10$

$$V_L = \frac{j\omega L}{R + j\omega L} \cdot V_s$$

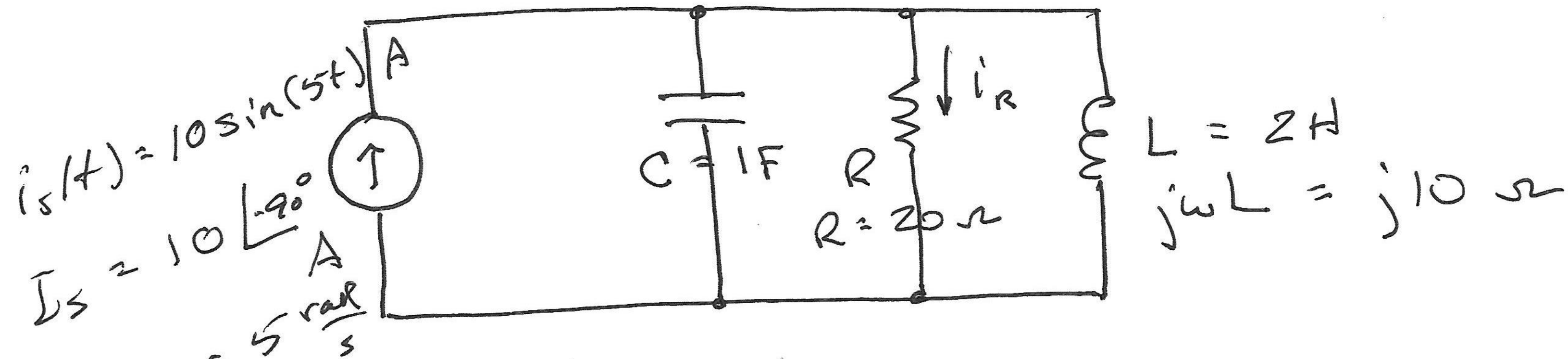
$$V_L = \frac{j\omega L}{R + j\omega L} \cdot V_s = \frac{j10}{10 + j10} \cdot 1\angle 0°$$

$90 + 0 - 45$

$$= \frac{10\angle 90°}{\sqrt{200}\ \angle 45°} \cdot 1\angle 0° = \frac{1}{\sqrt{2}} \angle 45° \text{ V}$$

or $$V_L = \frac{j}{1+j} = \frac{1\angle 90°}{\sqrt{2}\angle 45°} = \frac{1}{\sqrt{2}} \angle 45° \text{ V}$$

$$v_{L_{ss}}(t) = \frac{1}{\sqrt{2}} \cos(5t + 45°) \text{ V}$$



$$\frac{1}{j\omega C} = \frac{1}{j5} = -j0.2$$

Find $i_R(t)$

$$I_R = \frac{\frac{1}{R}}{j\omega C + \frac{1}{R} + \frac{1}{j\omega L}} \cdot I_s$$

$$= \frac{\frac{1}{20}}{j5 + \frac{1}{20} - j\frac{1}{10}} \cdot 10\angle -90^\circ$$

$$= \frac{1}{j100 + 1 - j2} \cdot 10\angle -90^\circ$$

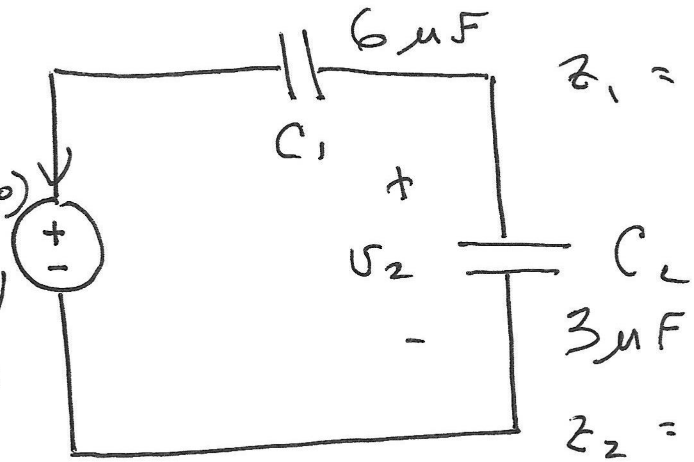
$$I_R = \frac{1}{1 + j98} \cdot 10\angle -90^\circ$$

$$\approx \frac{1}{j100} \cdot 10\angle -90^\circ$$

$$= .01\angle -90^\circ \cdot 10\angle -90^\circ$$

$$= .1\angle -180^\circ$$

$$i_R(t) \approx .1 \cos(5t - 180^\circ) \text{ A}$$



$v_s(t) = 10\cos(3t + 30°)$

$V_s = 10 \angle 30°$ V

$\omega = 3$ rad/s

$$Z_1 = \frac{1}{j\omega C_1} = \frac{1}{j\,18\times10^{-6}} = -j\,\frac{10^6}{18}\ \Omega$$

$$Z_2 = \frac{1}{j\omega C_2} = \frac{1}{j\,9\times10^{-6}} = -j\,\frac{10^6}{9}\ \Omega$$

What if $v_s(t) = 10\sin(3t + 30°)$?
What is the proper phasor notation?

$10 \angle -60°$ w.r.t. cos

$\omega = 3$ rad/s

$$V_2 = \frac{Z_2}{Z_1 + Z_2}\cdot V_s = \frac{-j\,\frac{10^6}{9}}{-j\,\frac{10^6}{18} - j\,\frac{10^6}{9}}\cdot 10\angle 30° \cdot \frac{\left(\frac{18}{10^6}\right)}{\left(\frac{18}{10^6}\right)}$$

$$= \frac{-j2}{-j - j2}\cdot 10\angle 30° = \frac{2}{1+2}\cdot 10\angle 30°$$

$$= \frac{20}{3}\angle 30°$$

$$v_2(t) = \frac{20}{3} \cos(3t + 30^\circ) \text{ V}$$