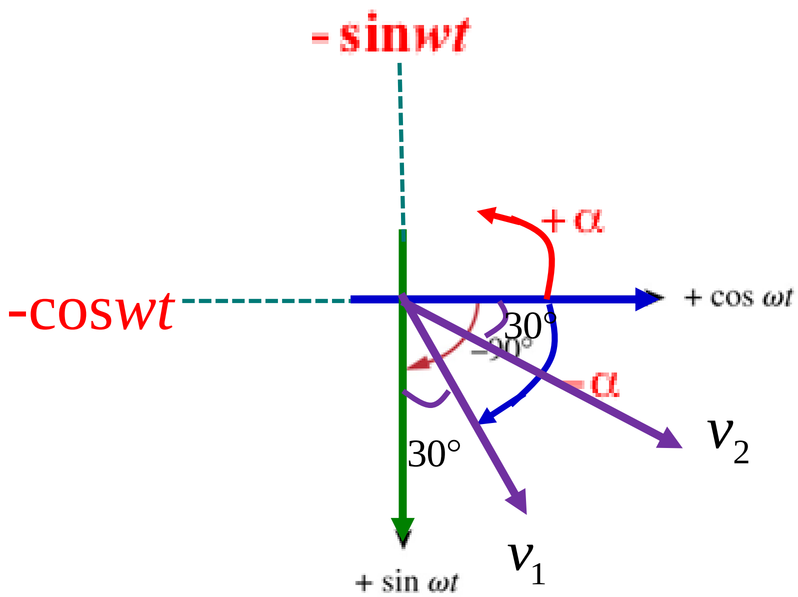
9.5 Given $v_1 = 45\sin(\omega t + 30^\circ)$ V and $v_2 = 50\cos(\omega t - 30^\circ)$ V, determine the phase angle between the two sinusoids and which one lags the other.



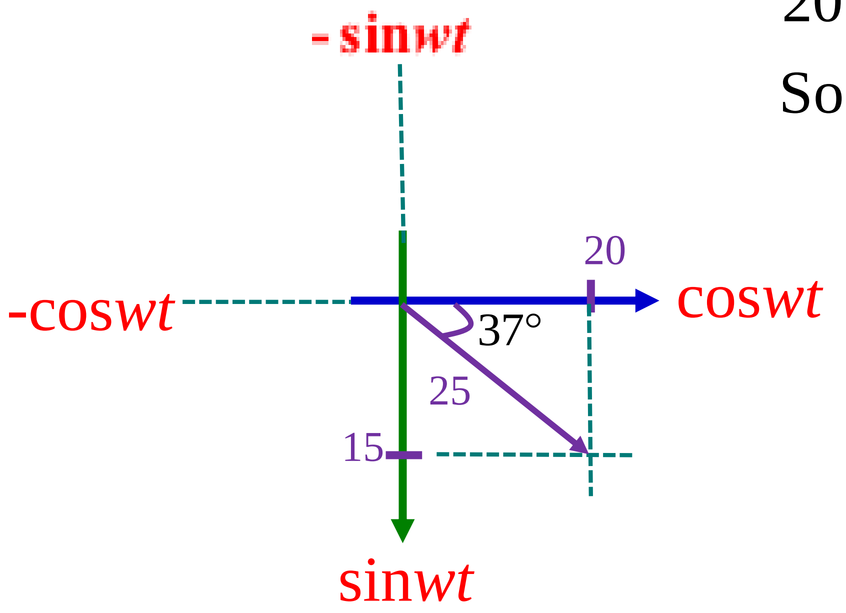
$$v_1 \text{ lags } v_2 \ 30^\circ$$

$$\cos wt = \sin(wt + 90^\circ)$$

$$\sin wt = \cos(wt - 90^\circ)$$

9.16 Transform the following sinusoids to phasors:

(c) $20\cos(2t) + 15\sin(2t)$

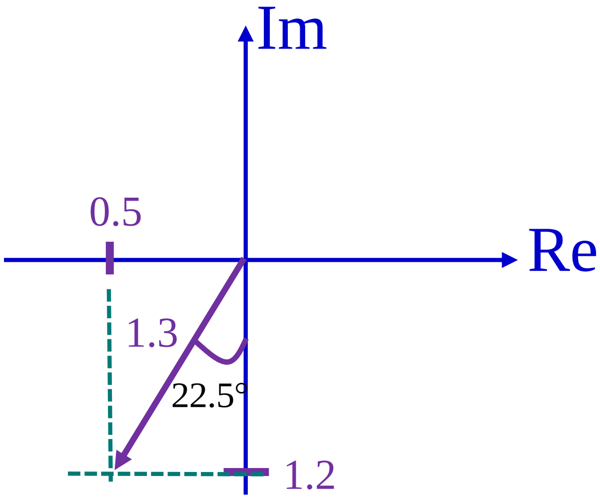


$$20\cos(2t)+15\sin(2t)=25\cos(2t-37°)$$

So:The phasor$=25\angle -37°$

9.18 Obtain the sinusoids corresponding to each of the following phasors:

(d) $\mathbf{I}_2 = -0.5 - j1.2$ A, $\omega = 10^3$



$$I_2 = 1.3\angle -112.5°$$

So:The sinusoid=$1.3\cos(10^3 t - 112.5°)$

9.27 A parallel *RLC* circuit has the node equation

$$\frac{dv}{dt} + 50v + 100\int v\,dt = 110\cos(377t - 10°)\text{ V}$$

Determine $v(t)$ using the phasor method. You may assume that the value of the integral at $t = -\infty$ is zero.

Solution:

$$jw\text{V} + 50\text{V} + \frac{100\text{V}}{jw} = 110\angle -10°$$

$$\Rightarrow \text{V} = \frac{110\angle -10°}{jw + 50 + \dfrac{100}{jw}}$$

$$= \frac{110\angle -10°}{j377 + 50 + \dfrac{100}{j377}}$$

$$= 0.289\angle -92.5°$$

So: $v(t) = 0.289\cos(377t - 92.5°)$

9.30 A voltage $v(t) = 100\cos(60t + 20°)$ V is applied to a parallel combination of a 40-kΩ resistor and a 50-μF capacitor. Find the steady-state currents through the resistor and the capacitor.

Solution:

$$\mathrm{V} = 100\angle 20°$$

$$Z_C = \frac{1}{j60\times 50\times 10^{-6}} = -\frac{j}{3}\ \mathrm{k\Omega}$$

$$\mathrm{I}_R = \frac{\mathrm{V}}{R} = \frac{100\angle 20°}{40} = 2.5\angle 20°\ \mathrm{mA}$$

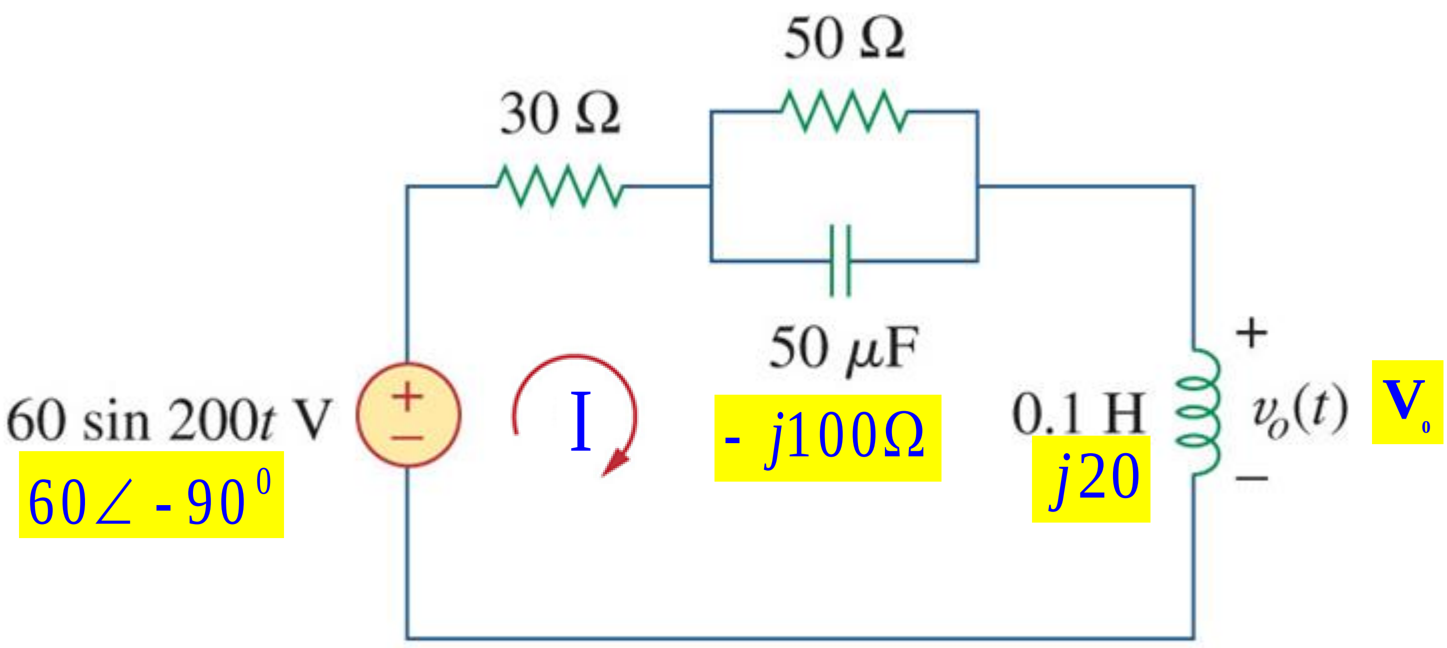
$$\mathrm{I}_C = \frac{\mathrm{V}}{Z_C} = \frac{100\angle 20°}{-\frac{j}{3}} = 300\angle 110°\ \mathrm{mA}$$

So: $i_R = 2.5\cos(60t + 20°)$ mA

$i_C = 300\cos(60t + 110°)$ mA

Problem 9.42 P406

Calculate $v_o(t)$ in the circuit of Fig. 9.49.



Solution:

$$V_0 = I \times j20$$

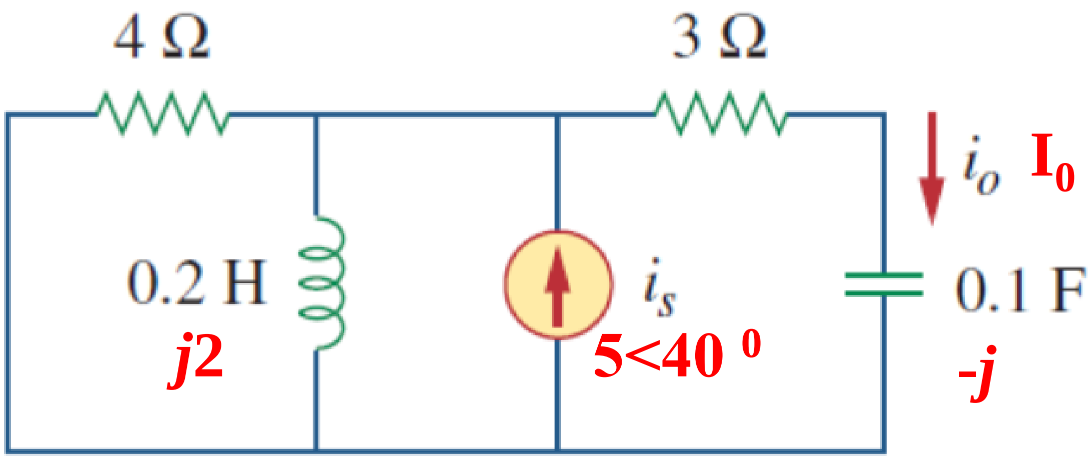
$$= \frac{60\angle -90^\circ}{30+50\parallel(-j100)+j20} \times j20$$

$$= 17.14\angle 0^\circ$$

So: $v_0(t) = 17.14\cos(200t)$ V

Problem 9.46 P407

If $i_s = 5\cos(10t + 40°)$ A in the circuit of Fig. 9.53, find i_o.



Solution:

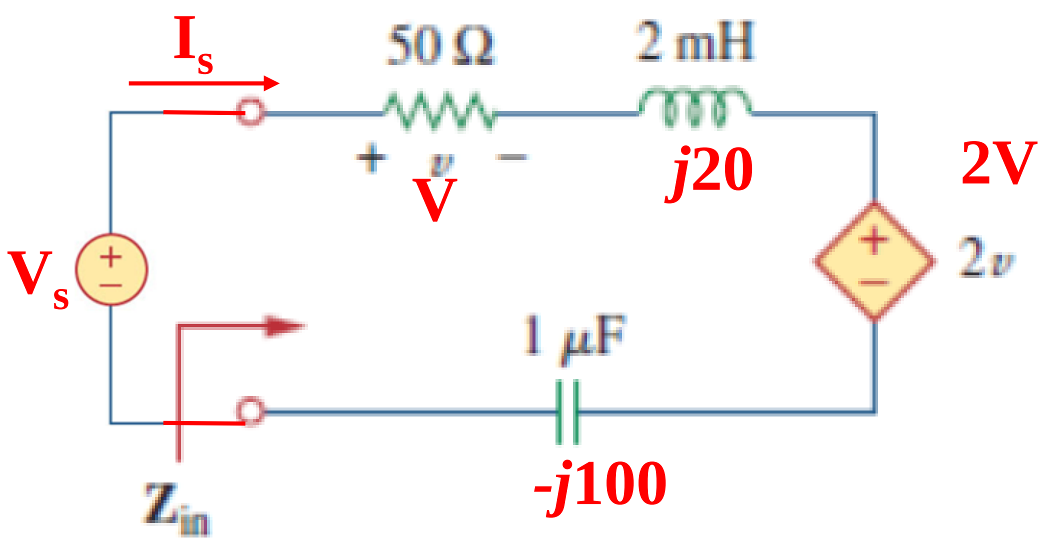
$$I_0 = \frac{4 \| j2}{4 \| j2 + 3 - j} \times 5\angle 40°$$

$$= 2.325\angle 94.5°$$

So: $i_0 = 2.325\cos(10t + 94.5°)$ A

Problem 9.62 P408

For the circuit in Fig. 9.69, find the input impedance Z_{in} at 10 krad/s.



Solution:

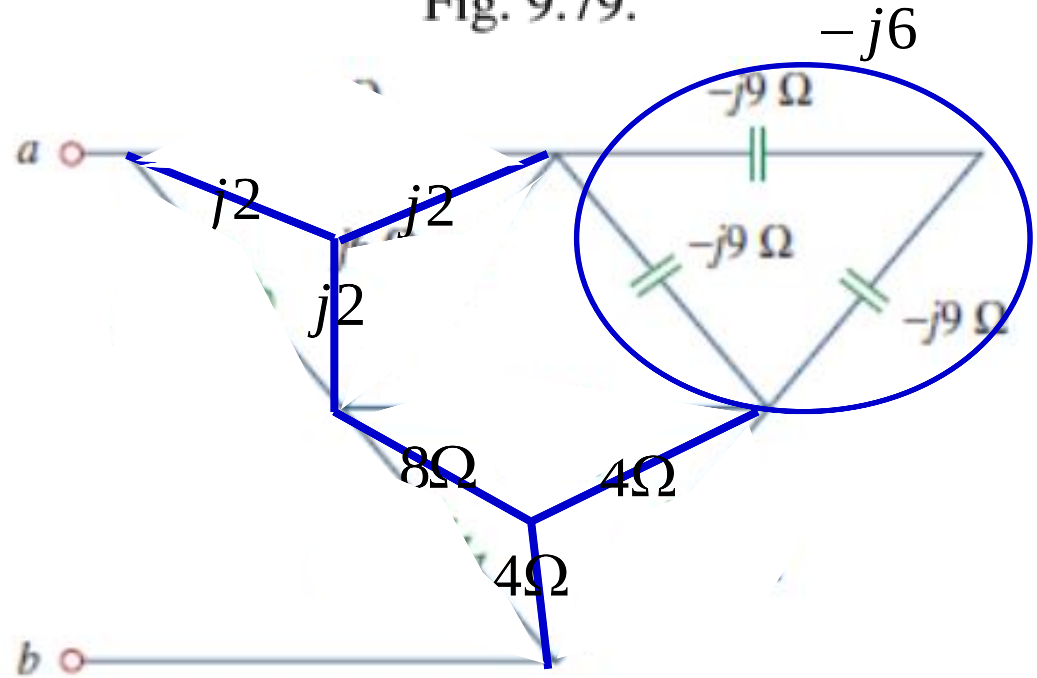
$$V_s = I_s(50 + j20 - j100) + 2V$$

$$\text{Since } V = 50 I_s$$

$$\text{So: } Z_{in} = \frac{V_s}{I_s} = 150 - j80$$

Problem 9.72 P410

Calculate the value of $\mathbf{Z}_{ab}$ in the network of Fig. 9.79.



$$Z_{ab} = 7.567 + j0.5946$$