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# Homework #7

1. 9.3 : $v(t) = A \cos(\omega t + \theta)$

$$v(t) = 25 \cos(400\pi t + 60^\circ)$$

$25 \rightarrow A$, $400\pi \rightarrow \omega$, $60^\circ \rightarrow \theta$

a. Maximum amplitude :

$A = 25 \text{ V}$

1. b. $2\pi f = W$

$$f = \frac{W}{2\pi} = \frac{400\pi}{2\pi} = 200 \text{ Hz} //$$

d. $\theta = (60^\circ)\frac{\pi}{180^\circ} = \frac{\pi}{3} = 1.047 \text{ rad} //$

e. $\theta = 60^\circ \rightarrow$ Phase angle //

f. $T = \frac{1}{f} = \frac{1}{200} = 5 \cdot 10^{-3} \text{ s} = 5 \text{ ms} //$

2. 9.11:

b. $y = 90\sin(50t - 20) + 60\cos(50t - 70)$

$= 90\cos(50t - 110) + 60\cos(50t - 70)$

$Y = 90 \angle -110^\circ + 60 \angle -70^\circ$

$Y = -30.782 - 84.572j + 20.521 - 56.382j$

$= -10.261 - 140.954j$

$Y = 141.325 \angle -94.16^\circ$

$y = 141.325\cos(50t - 94.16)$ //

d. $y = 10\cos(\omega t + 30^\circ) + 10\sin(\omega t) + 10\cos(\omega t + 150^\circ)$

$= 10\cos(\omega t + 30^\circ) + 10\cos(\omega t - 90^\circ) + 10\cos(\omega t + 150^\circ)$

$Y = 10 \angle 30^\circ + 10 \angle -90^\circ + 10 \angle 150^\circ$

(cont.)

2. d. $Y = 8.66 + 5j - 10j - 8.66 + 5j = 0$

$\boxed{y = 0}$ //

3. 9.5:

a. $v = V_m \cos(\omega t + \phi)$

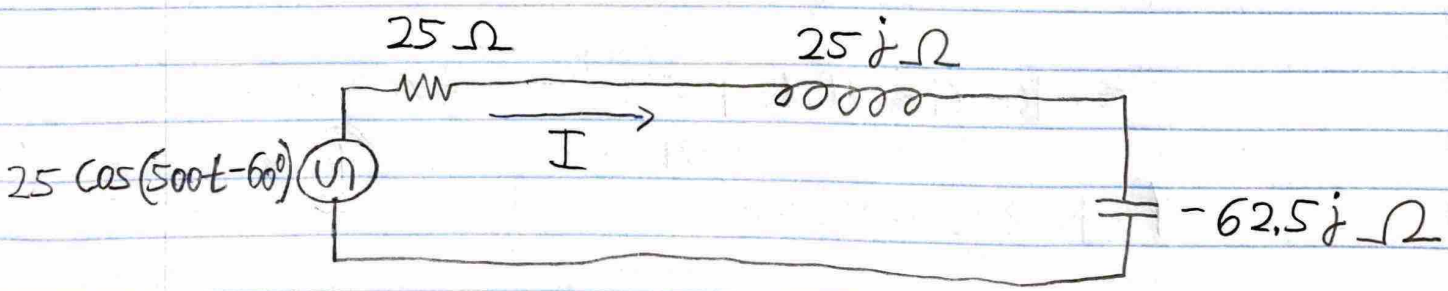
$v = 25 \cos(500t - 60°)$

$V_m \quad \omega \quad \phi$

$Z_L = j\omega L = j(500)(0.050) = 25j\ \Omega$

$Z_C = -\frac{j}{\omega C} = -\frac{j}{(500)(32 \cdot 10^{-6})}$

$= \boxed{-62.5j\ \Omega}$ //




b. $V = 25e^{j(60/180)\pi} = 25e^{j\pi/3}$

$= 25\left[\cos\left(\frac{\pi}{3}\right) + j\sin\left(\frac{\pi}{3}\right)\right]$

(Cont.)

3. b. $V = 25\cos\left(\frac{\pi}{3}\right) + 25j\cos\left(\frac{\pi}{2} - \frac{\pi}{3}\right)$

$= 25\cos\left(\frac{\pi}{3}\right) + 25j\cos\left(\frac{\pi}{6}\right)$

$= 25\cos(60^\circ) + 25j\cos(30^\circ)$

$= 25 \angle 60^\circ + j(25 \angle 30^\circ)$

$= 12.5 + 21.651j + j(21.651 + 12.5j)$

$= 12.5 + 21.651j + 21.651j - 12.5$

$= 43.302\ j$

$I = \frac{V}{Z_{total}} = \frac{43.302\ j}{25 + 25j - 62.5j}$

$= \frac{43.302\ j}{25 - 37.5j}$

$= 0.961 \angle 146.31^\circ\ A$

$= 961 \angle 146.31^\circ\ mA$ //

C. $i = I_m \cos(\omega t + \theta)$

$= 961\cos(500t + 146.31^\circ)\ mA$ //

4. 9.23: $Z_1 = 12 - j4\ \Omega$

$Z_2 = 8 + j12\ \Omega$

Equivalent admittance:

$$Y_{Parallel} = \frac{1}{Z_1} + \frac{1}{Z_2} + \frac{1}{5} - \frac{j}{10}$$

$$= \frac{1}{12-4j} + \frac{1}{8+12j} + \frac{1}{5} - \frac{j}{10}$$

$$= 0.075 + 0.025j + 0.038 - 0.058j$$

$$= 0.113 - 0.033j\ S$$

$$Z_{Parallel} = \frac{1}{Y_{Parallel}} = \frac{1}{0.113 - 0.033j}$$

$$= 8.154 + 2.381j$$

$$Z_{ab} = -j12.8 + Z_{Parallel} + 13.6$$

$$= -12.8j + 8.154 + 2.381j + 13.6$$

$$= 21.754 - 10.419j$$

$$Y_{ab} = \frac{1}{Z_{ab}} = \frac{1}{21.754 - 10.419j}$$

$$= 0.0374 + 0.0179j$$

$$= 0.041 \angle 25.576^\circ\ S = \boxed{41 \angle 25.576^\circ\ mS}$$

5. 9.28:

$\omega = 2000 \text{ rad/s}$

$$Z_{eq} = R + j\omega L - \frac{j}{\omega C}$$

$$= 3000 + j(2000)(500 \cdot 10^{-3}) - \frac{j}{2000 \cdot 100 \cdot 10^{-9}}$$

$$= 3000 + 1000j - 5000j$$

$$= 3000 - 4000j \ \Omega$$

$$= 5000 \angle -53.13^\circ$$

$V_s = 80 \text{ V} = 80 \angle 0^\circ$

$$I_o = \frac{V_s}{Z_{eq}} = \frac{80 \angle 0^\circ}{5000 \angle -53.13^\circ} = 0.016 \angle 53.13^\circ$$

$$i_o(t) = 16 \cos(2000t + 53.13^\circ) \text{ mA} \ //$$