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EECS 215 HW9

6a. $v(t) = 10\cos(4t - 60)$

$i(t) = 4\sin(4t + 50)$

$i(t) = 4\cos(4t + 50 - 90) = 4\cos(4t - 40)$

$v(t)$ lags $i(t)$ by $20°$

b. $v_1(t) = 4\cos(377t + 10)$

$v_2(t) = -20\cos(377t) = 20\cos(377t + 180)$

$v_2(t)$ leads $v_1(t)$ by $170°$

c. $x(t) = 13\cos 2t + 5\sin 2t = 13\cos 2t + 5\cos(2t - 90)$

$y(t) = 15\cos(2t - 11.8°)$

$x(t) = 13\angle 360° + 5\angle -90° = 13(1 + j0) + 5(0 - j1) = 13 - j5 = 13.928\angle -21.037$

$= 13.928\cos(2t - 21.037)$

$x(t)$ lags $y(t)$ by $9.24°$

18. a. $V_1 = 60\angle 15°$, $\omega = 1$

$v_1(t) = 60\cos(t + 15)$

b. $V_2 = 6 + j8$, $\omega = 40$

$V = 10\angle 53.13$, $\omega = 40$

$v_2(t) = 10\cos(40t + 53.13)$

c. $I_t = 2.8e^{-j\pi/3}$, $\omega = 377$

$I_t = 2.8\angle -\pi/3 = 2.8\angle -60$

$I(t) = 2.8\cos(377t - 60)$

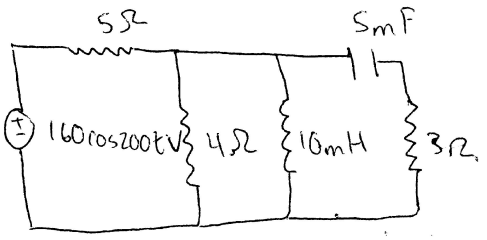
d. $Z_2 = -0.5 - j1.2,\ \omega = 10^3$

$Z_2 = 1.3 \angle -112.62$

$= 1.3 \angle 247.38$

$I_2(t) = 1.3\cos(10^3 t + 247.38)$

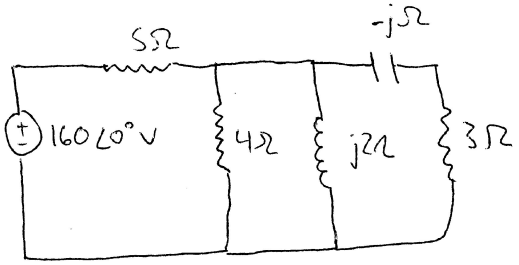
44.



$\omega = 200$

$j\omega L = j2\Omega$

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



$j2\Omega \| 3 - j\Omega = 1.2 + j1.6$

$4\Omega \| 1.2 + j1.6\ \Omega = 1.1892 + j0.8649)\ \Omega$

$Z = 5 + 1.1892 + j0.8649 = 6.1892 + j0.8649\ \Omega$

$i = \frac{160\angle 0°}{6.1892 + j0.8649} = \frac{160\angle 0}{6.1892\angle 7.955} = 25.85\angle -7.955$

$i = 25.85\cos(200t - 7.955)$

50. $\omega = 100$

$Z_1 = 20 + j10$

$Z_{eq} = \frac{(20 + j10)\ \frac{1}{j\omega C}}{20 + j10 + \frac{1}{j\omega C}} = 5 - j10$

$V = I_s Z = 5\angle 40\ (11.18\angle -63.43) = 55.9\angle -23.43$

$V_x = \frac{20}{20 + j\omega C} V = \frac{20}{20 + j10}(55.9\angle -23.43) = 49.75\angle -119.99$

$V_x = 49.75\cos(100t - 49.99)$

68. $V_{eq} = \frac{1}{5-j2} + \frac{1}{3+j} + \frac{1}{-j4} = 0.4724 + j0.2195$

79. a. $z_1 = j30 \,||\, 30 + j60 = 3 + j21$

$z_2 = j10 \,||\, 40 + z_1 = 1.535 + j8.896$

let $V_1 = 1\angle 0°$

$V_2 = \frac{z_2}{z_2 + 70} V_1 = \frac{(9.028 \angle 80.21)(1\angle 0)}{21.535 + j8.896} = 0.3875 \angle 57.77$

$V_1 = \frac{z_1}{z_1 + 40} = \frac{(21.213 \angle 81.87)(0.3875 \angle 57.77)}{47.85 \angle 26.03} = 0.1718 \angle 113.61$

$V_0 = \frac{j60}{30 + j60} V_1 = (0.8944 \angle 26.56)(0.1718 \angle 113.6) = 0.1536 \angle 140.2$

phase shift is 140.2°

b. leading

c. $V_0 = 120 (0.1536 \angle 140.2) = 18.43 \angle 140.2$

18.43V