Name missing

39/40

HW P1

1. a. $(-4+5j)(2-4j) = -8+10j+16j+20 = 12+26j$

$\sqrt{12^2+26^2} = 28.6356$ $\quad \sqrt{4^2+5^2}\cdot\sqrt{2^2+4^2} = 28.6356$

equal

b. $\frac{-4+5j}{2-4j}\frac{(2+4j)}{(2+4j)} = \frac{(-4+5j)(2+4j)}{4+16} = \frac{-8-16j+10j-20}{20}$

$= \left|\frac{-28-6j}{20}\right| = \sqrt{\left(\frac{28}{20}\right)^2+\left(\frac{6}{20}\right)^2} = 1.43$

$\frac{|z_1|}{|z_2|} = \frac{6.403}{4.47} = 1.43$

equal

c. $|z_1+z_2| = |-4+5j+2+4j| = |2+9j| = 9.2195$

$|z_1|+|z_2| = 6.403+4.47 = 10.873$

Not equal

2. a. $9\Omega = 8.4\angle 90^\circ = 8.4j = 8.4e^{j90^\circ}$

b. $I = (5+12j)\mu A \quad f = 600Hz \quad \omega = 600\cdot 2\pi \doteq 3769.9$

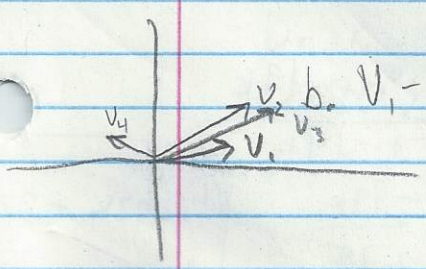
$|I| = 13 \quad \tan^{-1}\left(\frac{12}{5}\right) = 67.38^\circ$

$i(t) = 13\mu A\cos(3769.9t+67.38^\circ)$

3. a. $V_1+V_2 = 1.5V\cos(\omega t+10^\circ)+3.2V\cos(\omega t+25^\circ)$

$1.477+.26j+2.9+1.35j = 4.377+1.61j$

$= 4.66\cos(\omega t+20.195^\circ)$



b. $V_1-V_2 = 1.477+.26j-2.9-1.35j = -1.423-1.09j$

$= 1.792\cos(\omega t+142.5-48^\circ)$

4. $\omega = 60 \cdot 2\pi \quad L = 5.2\text{mH} \quad z = j\omega L = 1.96j = \boxed{1.96\angle 90^\circ}$

5. a. $z = \frac{1}{j\omega C} \quad 240\,\Omega = \frac{1}{j(1.8k \cdot 2\pi)C} \quad 240\,j(1.8k \cdot 2\pi)C = 1$

$C = 3.68 \times 10^{-7} = \boxed{.3684\,\mu F}$

b. $240 = j(1.8 \cdot 2\pi k)(L) = \boxed{21.2\,\text{mH}}$

c. Linear. Due to L: 2x frequency = 2x impedance, = 240Ω
Due to C: 1/2 impedance, = −120Ω ($\frac{1}{j} = -j$)

d. $j(2.7 \cdot 2\pi k)\,21.2\text{mH} + \frac{-j}{2\pi f \cdot .364\mu} = 359.68 - 160 = \boxed{199.65\,\Omega}$

6. a. $Z_{eq} = 330\Omega + j(1k\,2\pi)\,100m = \boxed{330\Omega + 200\pi\Omega j}$

b. $330 + \frac{-j}{.22\mu \cdot 4\pi k} = \boxed{330\,\Omega + -361j\,\Omega}$

c. No values? $= R + j\omega L - \frac{j}{\omega C} \qquad \omega = 8\pi k H_z$

d. $j(1.5 \cdot 2\pi k) \cdot 160m + 4k \,||\, \frac{1}{j(1.5 \cdot 2\pi) \cdot 03\mu}$

$= 15.08k + 4k \,||\, -3.5kj$

$= 15.08k\Omega + \left(\frac{1}{4k} \frac{-1}{3.5kj}\right)^{-1}$

$= 15.08k\Omega + \frac{14kj}{3.5kj - 4k}\left(\frac{-4k - 3.5kj}{-4k - 3.5kj}\right)$

$= 15.08k\Omega + \frac{-56kj + 49k}{12.25k + -14k}$

$= 15.08k\Omega + \frac{-56kj}{-1.75}^{32} + \frac{-49k}{1.75}^{28} = \boxed{(-12.92k + 32kj)\,\Omega}$

7. a. currents $\frac{10}{\sqrt{330^2 + 200\pi^2}} \angle -\tan\left(\frac{200\pi}{330}\right) = 14.1\text{mA} \angle 62.29°$

b. $\frac{10}{\sqrt{330^2 + 361^2}} \angle -\tan\frac{-361}{330} = 20.4\text{mA} \angle 47.63°$

c. $I = \frac{V}{R} \Rightarrow \boxed{I = \frac{10}{R + j\omega L - \frac{j}{\omega C}}}$

d. $\frac{10}{\sqrt{12.92^2 + 32^2}} \angle -\tan\frac{32}{-12.92} = .29\text{mA} \angle 68°$

8. a. $V = \frac{I}{R} \quad R = \frac{V}{I} = \frac{14\angle 16°}{30\text{m}\angle 36°} = \frac{14\cos 16 + 14\sin 16j}{30\text{m}\cos 36 + 30\text{m}\sin 36j}$

$= \frac{13.458 + 3.86j}{24.27 + 17.63j} \cdot \frac{(24.27\text{m} - 17.63j)}{(24.27 - 17.63j)}$

$= \frac{13.458 \cdot 24.27 + 13.458 \cdot (-17.63j) + 3.86j(24.27) + 3.86j(-17.63j)}{24.27^2 + 17.63}$

626.24

$= \frac{326.62 + 68 + 237.26j + 93.68j}{626.24}$

$= \frac{394.62}{626.24} \quad \frac{-143.58}{626.24} = .63 - .229$

$\frac{14\angle 16}{30\text{m}\angle 36} = 466 = 438.5 - 159.6j \quad -180$

$\boxed{Z = 258.5 - 159.6j}$

b. current (by 20°)

c. 20°

9. a. $20.336 + -45.677j$ $\boxed{R = 20.336\ \Omega}$

$\omega = 6\pi$ $\quad \omega C\ 45.677 = 1 \quad C = \frac{1}{6\pi \cdot 45.677}$ $\boxed{C = 1.161\ \mu F}$

b. $20.336 + -45.677j$ ~~$20.336 + 45.677j$~~ $20.336 + 45.677j$

$= \frac{413.5 + 2086.39}{20.336 + 45.677}$

$\frac{1}{Z_{eq}} = .02\angle 66^\circ = \frac{1}{R} + j\omega C$

$.008 + .01827j$

$\boxed{R = 122.93\ \Omega}$ $\quad \boxed{C = .9693\ \mu F}$

10. a. $\left|\frac{V}{I}\right| = \frac{\sqrt{60^2 + 28^2}}{3.4} = \boxed{19.47}$

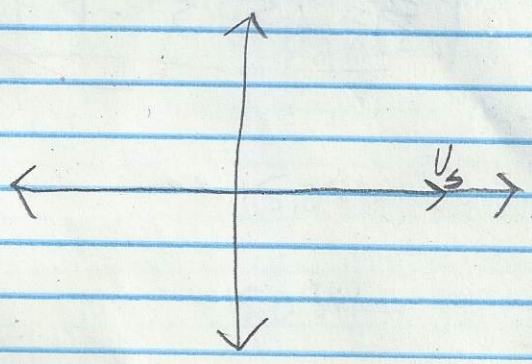
b. $19.47 \cos 55^\circ = \boxed{11.167\ \Omega}$

c. V ahead of current, $\boxed{\text{Inductor}}$

$19.47 \sin 55^\circ = 15.949$

$\frac{15.949}{2\pi 60} = \boxed{42.3\ mH}$

11.



$R = \frac{-j}{1k\pi\ 12\mu} + 40$

$R = 83.3j + 40 = 92.436\angle -64.36^\circ$

11. $V_s = 12\angle 0°$ $f = 500\,Hz$ $C = 12\,\mu F$ $R = 40\,\Omega$

$Z_a = -26.52j + 40 = 48\angle -33.55$

$I = \frac{V}{R} = \frac{12\angle 0}{48\angle -33.55} = .25\angle 33.55°$

$I = .25\angle 33.55°$

$V_R = I R = 10\angle 33.55°$

$V_L = I R_L = 26.52\angle -90 \cdot .25\angle 33.55$

$= 6.63\angle -56.45°$