Ch 22 Problems

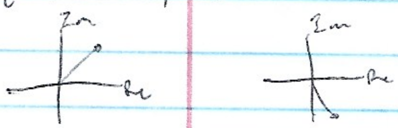
1) a) $r_1 = \sqrt{3^2+4^2} = 5$ $r_2 = \sqrt{2^2+5^2} = 5.4$

b) $\theta_1 = \tan^{-1}\left(\frac{4}{3}\right) = 0.93$ $\theta_2 = \tan^{-1}\left(\frac{-5}{2}\right) = -1.12$

$z_1 = 5\angle 0.93$ $z_2 = 5.4 \angle -1.12$

c) $z = re^{i\theta}$ $z_1 = 5e^{0.93i}$ $z_2 = 5.4e^{-1.12i}$

d)



5) a) $(1-i)^4 = (1-2i+i^2)^2$

$= (-2i)^2 = 4i^2 = \boxed{-4}$

b) $\sqrt{2} - i - i + i^2\sqrt{2} = \boxed{-2i}$

c) $\frac{5}{(1-i)(2-i)(3-i)} = \frac{5}{-i^3+6i^2-11i+6}$

$= \frac{5}{i-6+6-11i} = -\frac{1}{2i}\left(\frac{i}{i}\right)$

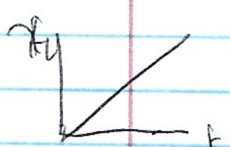
$= \frac{-i}{2\cdot(-1)} = \boxed{\frac{i}{2}}$

9) a) complex variables - have a Real component & an Im component; Similar to vectors in an x-y plane.

13) $Z_L = iX_L = i\omega L$

$X_L = \omega L = \left[\frac{1}{s}\right][H] = \Omega$

17) $X_L = \omega L = 2\pi f L$



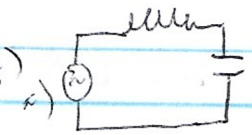
21) $X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$

$f = \frac{1}{2\pi C X_C}$

if $X_C = 10\Omega$, $f = \frac{1}{2\pi\cdot(50\times10^{-6}F)(10\Omega)}$

$= 318\ Hz$

25) a)



$i\omega L + \frac{1}{i\omega C} = 0$

$i\omega L - \frac{i}{\omega C} = 0$

$i\omega L = \frac{i}{\omega C}$

$\omega^2 = \frac{1}{LC}$ $\omega = \sqrt{\frac{1}{LC}}$

b) $\left(\frac{1}{i\omega L} + \frac{1}{i\omega C}\right)^{-1} = 0$

$= i\left(-\frac{1}{\omega L} + \omega C\right)^{-1} = 0$

$= i\left(\frac{-1+\omega^2 LC}{\omega L}\right)^{-1} = 0$

$\frac{i\omega L}{\omega^2 LC - 1} = 0$

$\frac{iL}{\omega LC - 1} = 0$ no possible zero impedance found

Ch 21) 33) I_{dc} R

I_0 R } Same P

$I_{dc} = \frac{V}{R}$ $P_{dc} = I_{dc}^2 R$

$\langle P \rangle = \frac{V_0}{\sqrt{2}} \frac{I_0}{\sqrt{2}}$ $I_{dc} = \sqrt{\frac{P}{R}}$

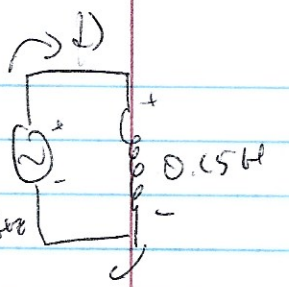
$V = IZ = IR$

$\langle P \rangle = \frac{I_0^2 R}{2}$

$I_{dc} = \sqrt{\frac{I_0^2 R}{2R}}$

$= \boxed{\frac{I_0}{\sqrt{2}}}$ $(= I_{Rms})$

37)



a) $\omega = 377$ $\quad f = \frac{\omega}{2\pi} = \frac{377\ rad/s}{2\pi\ rad} = 60\ Hz$

b) $Z_L = i\omega L = 56.6i\ \Omega$

c) $V(t) = 170\ V \cdot e^{i(377t)}$

$= 170 \angle (377t)$

d) $V(t) = i\omega L I(t)$

$I(t) = \frac{V(t)}{i\omega L} = \frac{170\ V \cdot e^{i(377t)}}{i(377\ \Omega)(0.15\ H)}$