SOLUTION: EXAM #1

1) (a) 
\[ H\{s\} = \frac{2 + 2/s}{4 + 2/s}, \quad Y\{s\} = \frac{s+1}{2s(s+1/2)} = \frac{1}{s} - \frac{1/2}{s+1/2}, \quad y(t) = u(t)[1-.5e^{-t/2}] \] 

(b) \( n=[1 1]; d=[2 1]; \text{step}(n,d), \text{freqs}(n,d), \)

2) \( V_{th} = 20j, \quad Z_{th} = 4 - 2j, \quad \hat{Z}_L = 4 + 2j, \quad \hat{P}_L = 12.5 \)

3) (a) \( H_1\{s\} = \frac{2}{s+2} + \frac{1}{s-1}, \quad h_1(t) = u(t)(2e^{-2t} + e^t) \)

(b) \( H_2\{s\} = \frac{-4 + 2+2j}{s+1+2j} + \frac{2-2j}{s+1-2j}, \quad h_2(t) = u(t)(-4+4\sqrt{2}e^{-t}\cos(2t-\pi/4)) \)

4) (a) Let \( x(t) \) be the node voltage ai the input of each op amp; let \( y(t) \) be the node voltage at the output of the lower op amp. After taking the phasor representation of the signals and the impedances of the circuit elements and setting the input phasor to unity, one finds the set of node voltage equations at the input nodes are:

\[
\begin{align*}
1/2 &= (1/2+sc+1/R)X - (sc+1/R)Y \\
0 &= (2+sc)X - 2Y - scB \\
0 &= 2X - B
\end{align*}
\]

(b) \( \text{syms} \ R \ sc \)

\[
H = [0 0 1]^*\{.5+sc+1/R -sc-1/R 0;2+sc -2 -sc;2 0 -1\}^*(-1)^*[.5;0;0]
\]

answer

\[ H = 2/(R+sc^2+sc)*R \]