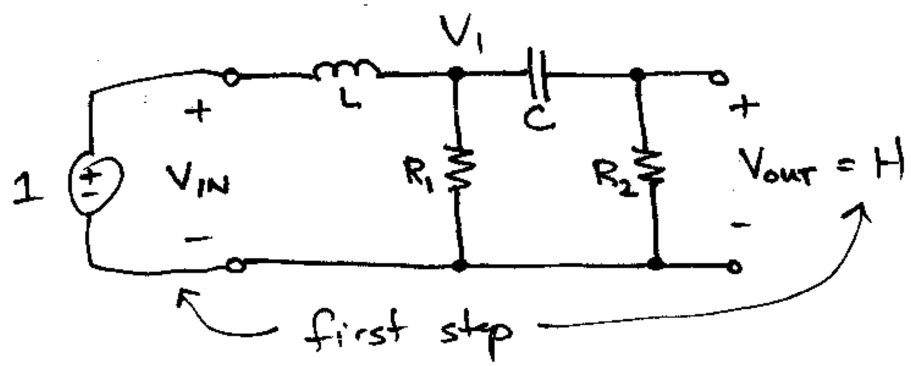
EC200 M.E. #8 NAME:
CM:

(1) Find the voltage transfer function $H(s) = \frac{V_{out}}{V_{IN}}$. (see below)
Express your result as a ratio of two polynomials in s, with a unity coefficient on the highest order denominator term.



Nodal analysis (can use other techniques, too):

$$\left.\begin{aligned} \frac{V_1 - 1}{Ls} + \frac{V_1}{R_1} + \frac{V_1 - H}{1/Cs} &= 0 \\ \frac{H - V_1}{1/Cs} + \frac{H}{R_2} &= 0 \end{aligned}\right\} \xrightarrow{\text{SOLVE}}$$

$$\Rightarrow H(s) = \frac{R_1 C s R_2}{R_1 C s R_2 + R_1 + L s^2 C R_2 + L s + C s^2 L R_1}$$

combine

$$= \frac{R_1 R_2 C s}{s^2(LCR_2 + LCR_1) + s(R_1 R_2 C + L) + R_1}$$

$$H(s) = \frac{\frac{R_1 R_2 C}{LCR_2 + LCR_1} s}{s^2 + \frac{R_1 R_2 C + L}{LCR_2 + LCR_1} s + \frac{R_1}{LCR_1 + LCR_2}}$$

$$= \frac{\frac{R_1 \| R_2}{L} s}{s^2 + \left(\frac{R_1 \| R_2}{L} + \frac{1}{(R_1 + R_2)C}\right) s + \frac{1}{LC}\left(\frac{R_1}{R_1 + R_2}\right)}$$

② Plot the pole-zero diagram for the impedance function $Z(s)$:

$$\frac{16s^3 + 64s^2 + 128s}{s^4 + 10s^3 + 29s^2 + 40s + 100} = Z(s)$$

→ Factor the numerator: $16(s+2+j2)(s+2-j2)s$

→ Factor the denominator: $(s+5)^2\,(s+j2)(s-j2)$