PROBLEMS YOU SHOULD BE ABLE TO DO BEFORE YOU TAKE ECE 209

FALL 1995 **A.P. FELZER**

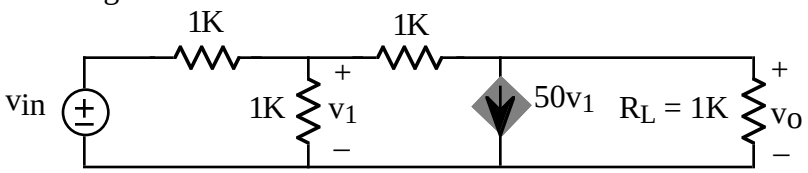
1. Sketch each of the following for $x \geq 0$

   a. $y = \dfrac{20}{\sqrt{x^2 + 100}}$

   b. $y = \dfrac{2x}{\sqrt{x^2 + 100}}$

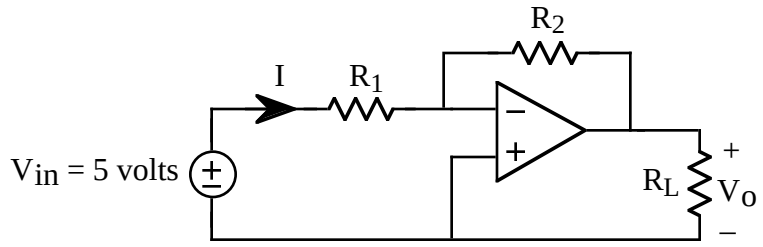
   c. $y = \tan^{-1}(x)$

2. Given the following circuit



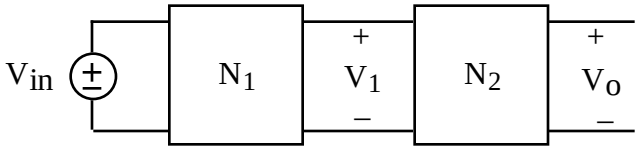
   a. Write and put in matrix the node equations
   b. Solve your equations in part (a) for the node voltages if $v_{in} = 5$ mv
   c. Find the power being supplied by the source v_{in} and the power being received by the load R_L if $v_{in} = 5$ mv
   d. Find R_{eq} as seen by the source v_{in}
   e. Find the transfer function $G = v_o/v_{in}$. Then make use of your result to find v_o if $v_{in} = 5$ volts. Make sure you get the same result as in part (b)
   f. Find and draw the Thevenin Equivalent as seen by R_L if $v_{in} = 5$ mv
   g. Make use of your Thevenin Equivalent circuit in part (f) to find v_o. Make sure you get the same results as in parts (b) and (e)
   h. Make use of SPICE to check your result for v_o when $v_{in} = 5$ mv

3. Given the following circuit with an ideal op amp



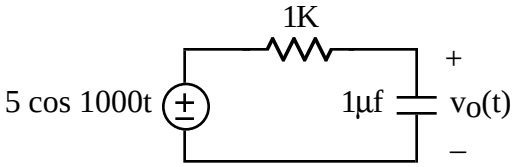
   with $R_1 = 1K$, $R_2 = 2K$ and $V_{CC} = 15$ volts
   a. Find V_o if $V_{in} = 5$ volts
   b Find the input resistance $R_{in} = V_{in}/I$
   c. Sketch $v_o(t)$ if $v_{in}(t) = 10 \cos 100t$
   d. Find V_- if $V_{in} = 10$ volts

4. Under what circumstances does the overall voltage gain $G = V_o/V_{in}$ of the following cascade circuit



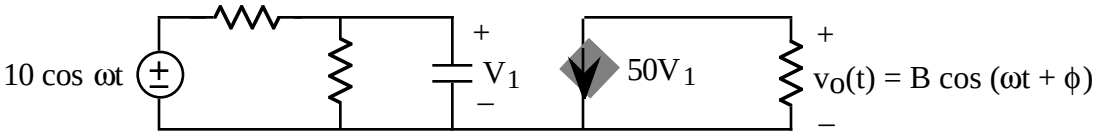
equal the product of the open circuit voltage gains of the individual sections. Explain why

5. Given the following circuit



   a. Find and then sketch the sinusoidal steady state response of $v_o(t)$ by writing and solving the differential equation for the forced response
   b. Use a SPICE transient analysis to check your results in part (a). Explain how you were able to determine the phase of the steady state response from the graph
   c. How will increasing the frequency of the input affect the magnitude of the sinusoidal steady state $v_o(t)$. Explain why

6. Given the following circuit in the sinusoidal steady state



Sketch a graph of the magnitude B of the sinusoidal steady state response as a function of frequency ω. Describe your curve. Explain why it looks the way it does

7. Repeat Problem (5) for i(t) in the following RL circuit