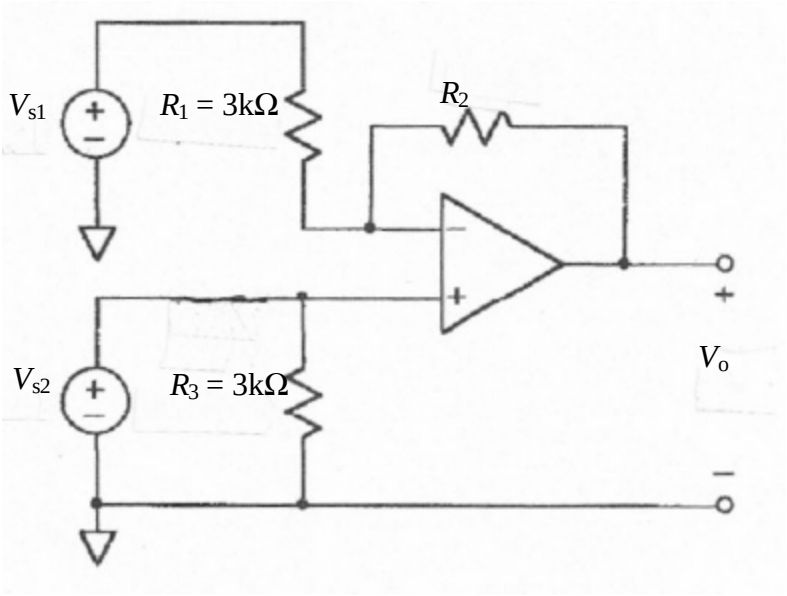
UNIVERSITY OF UTAH
ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT

ECE 1270 HOMEWORK #9 and #10 Summer 2007

1.



Rail voltages = ± 9V

a) The above circuit operates in linear mode. Derive a symbolic expression for V_o. The expression must contain not more than the parameters V_{s1}, V_{s2}, R_1, R_2, and R_3.

2. a) If V_{s2} = 0V, find the value of R_2 that will yield an output voltage of V_o=-1V when V_{s1}=10mV.

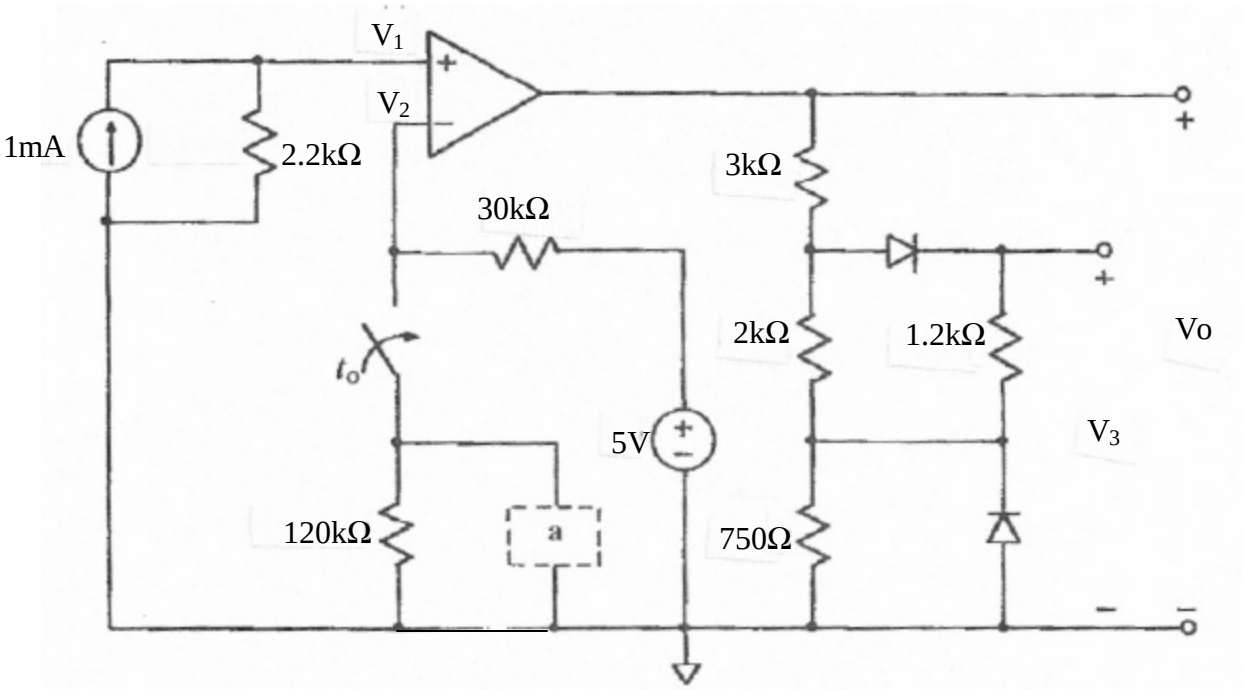
b) Derive a symbolic expression for Vo in terms of common mode and differential input voltages:

$$v_\Sigma = \frac{V_{s1} + V_{s2}}{2} \text{ and } v_\Delta = \frac{V_{s1} - V_{s2}}{2}$$

The expression must contain not more than the parameters V_2, v_Δ, R_1, R_2, and R_3. Write the expression as v_Σ times a gain term plus v_Δ times a gain term. Hint: write V_{s1} ande V_{s2} in terms of v_Σ and v_Δ.

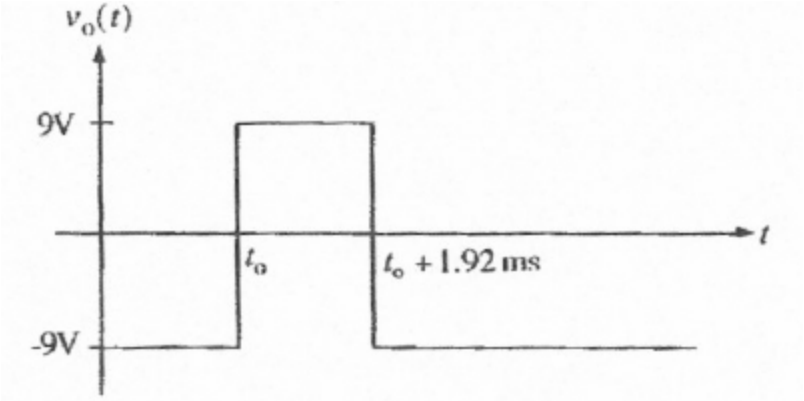
c) Using the value of R_2 from part (a), calculate the input resistance, $R_{in}=V_{s2}/i_{s2}$, seen by the V_{s2} source.

3.



Rail voltages = ±9V

After being open for a long time, the switch closes at time t = t_o.



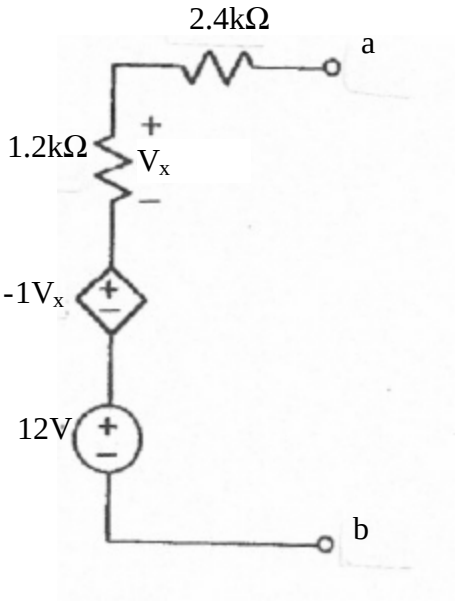
a) Choose either an L or a C to go in box a to produce the $v_o(t)$ shown above. Specify what component goes in the box and its value.

b) Sketch $V_1(t)$, showing numerical values appropriately.

4. a) Sketch $V_2(t)$, showing numerical values appropriately.

b) Sketch $V_3(t)$. Show numerical values for $t < t_o$, for $t_o < t < (t_o + 1.92ms)$, and for $t > (t_o + 1.92ms)$. Use the ideal model of the diode: when forward biased, its resistance is zero; when reverse biased, its resistance is infinite.

5.

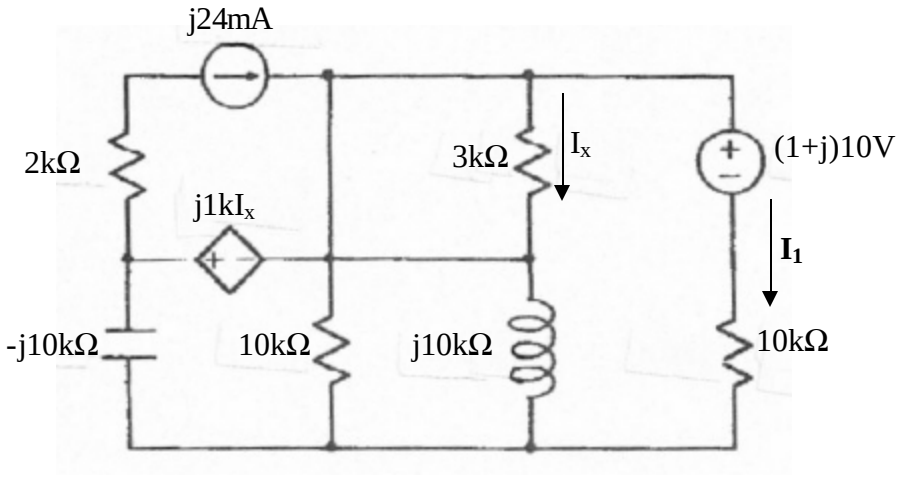


a) Find the Thevenin equivalent of the above circuit relative to terminals **a** and **b**.

b) If we attach R_L to terminals **a** and **b**, find the value of R_L that will absorb maximum power.

c) Calculate the value of that maximum power absorbed by R_L.

6.



a) A frequency-domain circuit is shown above. Write the value of phasor current $\mathbf{I_1}$ in rectangular form.

b) Given ω=20k rad/sec., write a numerical time-domain expression for $i_1(t)$, the inverse phasor of $\mathbf{I_1}$.