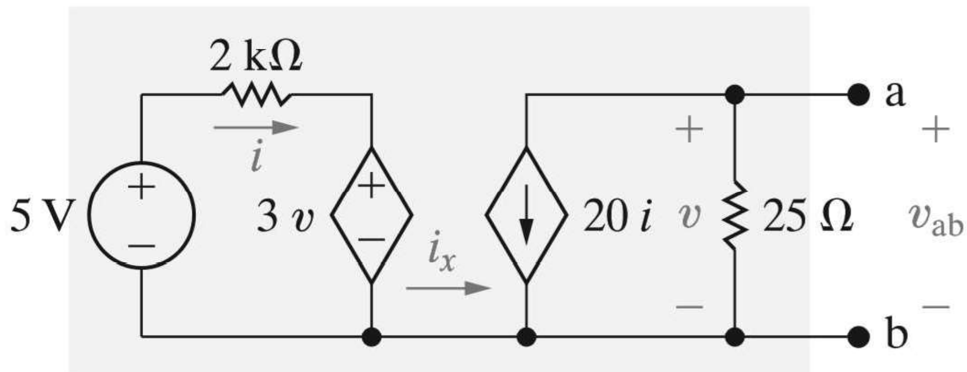
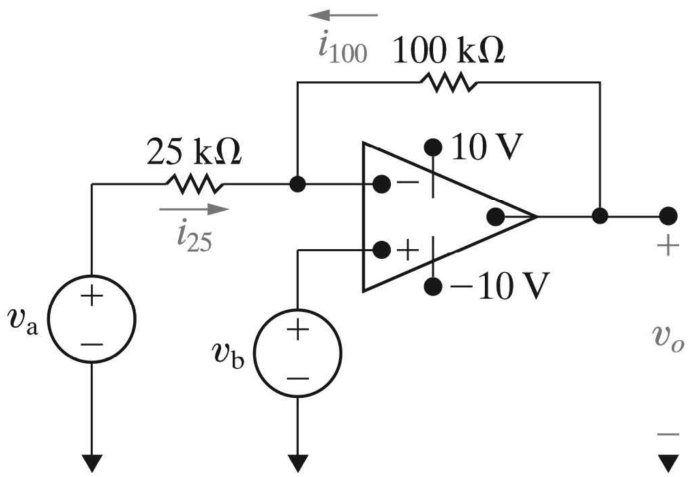
Problem 1

Find the Thévenin equivalent for the circuit containing dependent sources shown below:



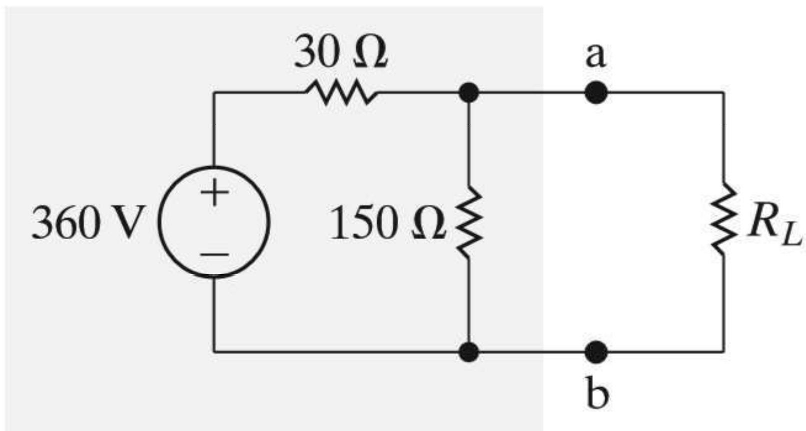
Problem 3

The op amp shown is ideal. Calculate v_0 if $v_a = 1V$ and $v_b = 0V$. Repeat for $v_a = 1V$ and $v_b = 2V$. If $v_a = 1.5V$, specify the range of v_b that avoids amplifier saturation.



Problem 4

For the circuit shown below, find the value of R_L that results in maximum power being transferred to R_L. Calculate the maximum power that can be delivered to R_L. When R_L is adjusted for maximum power transfer, what percentage of the power delivered by the 360V source reaches R_L?



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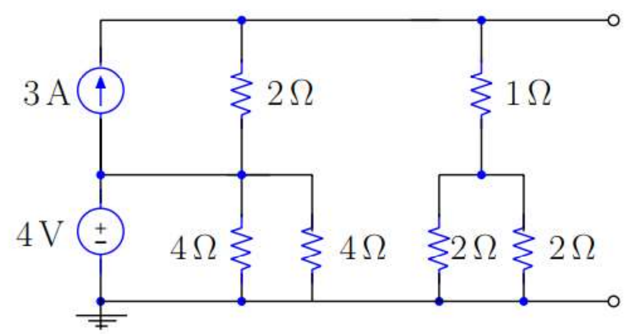
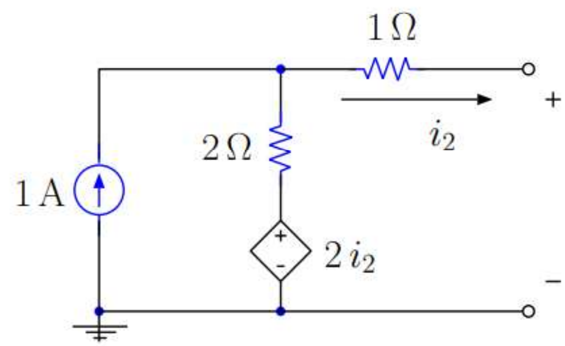
1(d)

(d) (10 pt) Reduce the following circuit to its Thevenin Equivalent, that is find V_T , R_T .



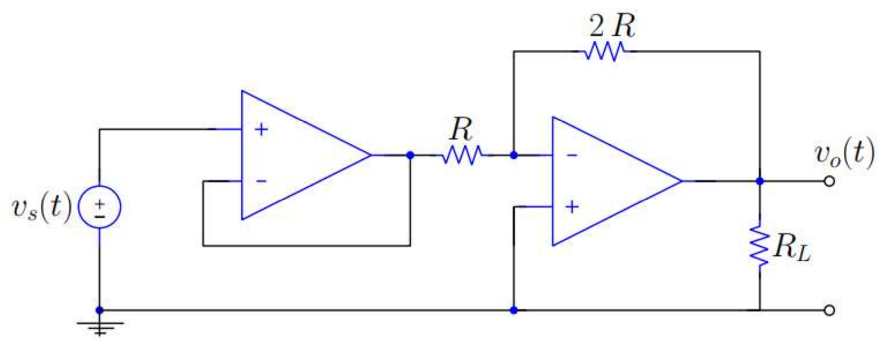
2(b)

(b) (15pt) Find the Thevenin Equivalent Circuit.



3. Problem 3 (25 points)

(a) (19 pt) Analyze the following circuit and find v_0/v_s . Use the ideal op-amp approximations.



(b) Find the power absorbed/supplied in R_L if

i. (2pt) $R_L = 3\,\Omega$

$p =$

ii. (2pt) $R_L = 0\,\Omega$

$p =$

iii. (2pt) $R_L = \infty\,\Omega$

$p =$

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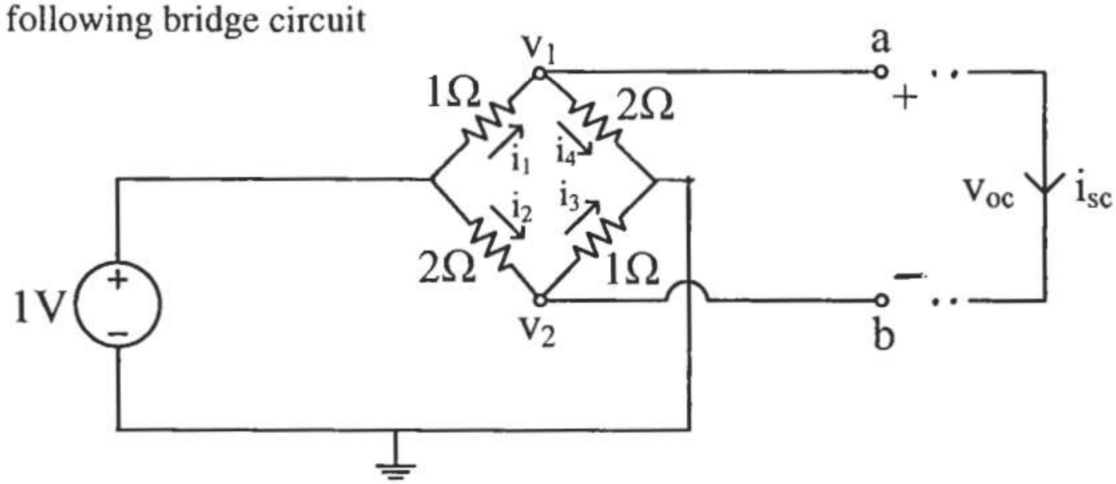
2

Analyze the following bridge circuit



(a) The terminal v_1 and v_2 are open. Calculate v_1, v_2, and v_{oc}.

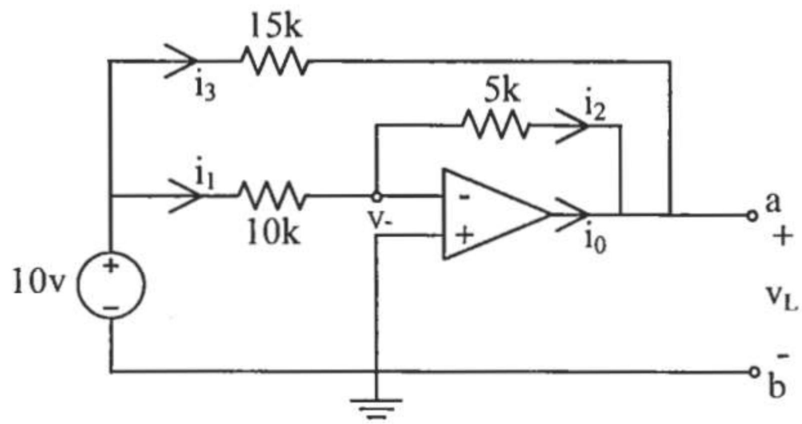
(b) The terminals v_1 and v_2 are shorted together calculate i_1, i_2, i_3, i_4, and i_{sc}.

(c) Compute the Thevenin resistance of the circuit between a and b.

(d) Draw and label Thevenin and Norton equivalent circuits between a and b.

3

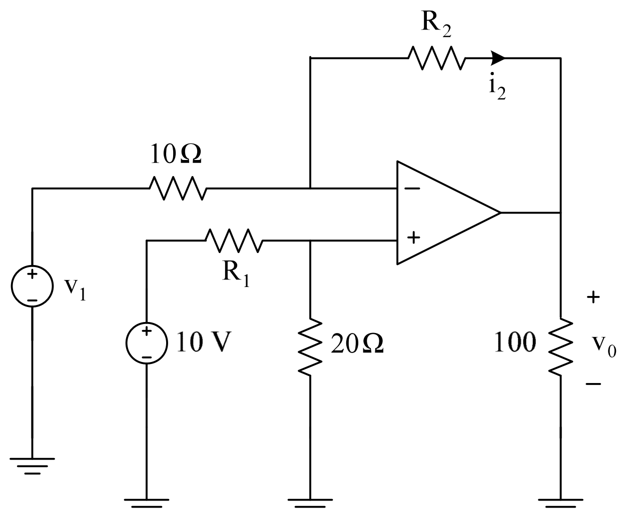
Consider the following op-amp circuit.



(a) Find v_-, i_1, i_2, i_3, i_0, and v_L.

(b) If you connect $R_L = 5k\Omega$ between a and b, what is v_L and i_0?

Problem 3 (25 points)



All parts of this problem refer to the circuit shown above, but **all parts are independent**. Your answer to each part should **not depend** on your answer to any other part. In all parts, assume that the op amp **is an ideal op amp**.

a) (10 points) **Goal of Part (a):** you want the current i_2 to have the value $i_2 = (0.1v_1 - 0.8)$ amperes. Find a value of R_1 that will achieve this goal.

R_1 =__________________________________

b) (10 points) **Goal of Part (b):** you want the output voltage, v_0, to depend on the input voltage, v_1, according to some relationship whose slope is $\frac{dv_0}{dv_1} = -b$ for some constant b. Find R_2 in terms of b.

R_2 =__________________________________

Problem 3 (cont.)

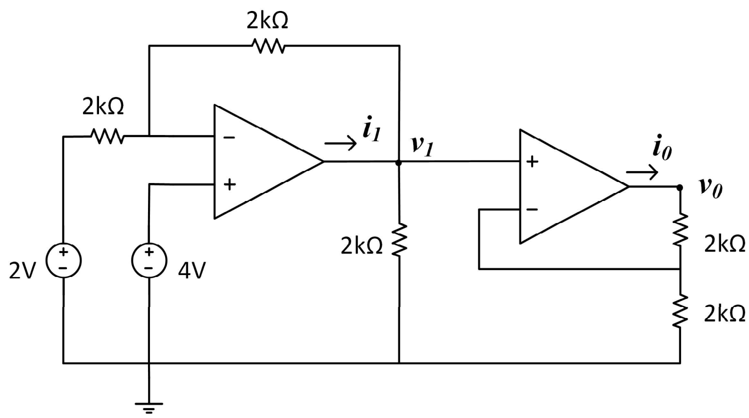
c) (5 points) **Goal of Part (c):** now suppose that the 100Ω resistor is changed to a 1Ω resistor.

Because the op-amp is ideal, changing the 100Ω resistor has no effect on the current i_2. Which one of the ideal op amp properties guarantees that i_2 is independent of the value 100Ω? State the property.

Changing the 100Ω resistor to 1Ω has no effect on the value of i_2 because:

(Problem 3 cont'd)

(b) In the following circuit, assuming linear operation and ideal op-amp approximation, determine the node voltages v_0, v_1, and the currents i_0, i_1.



$v_0 =$ ______________________

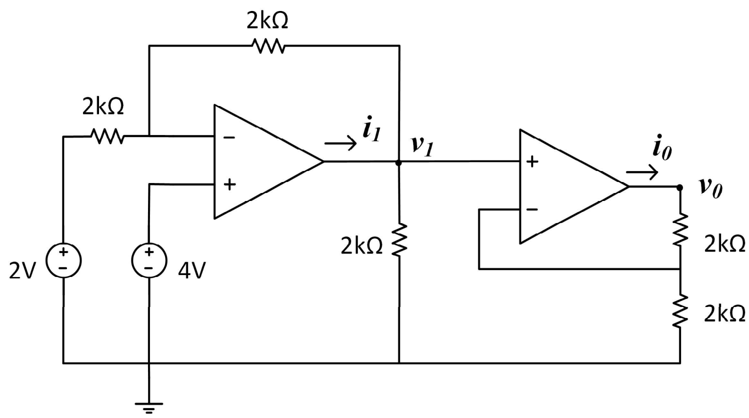
$v_1 =$ ______________________

$i_0 =$ ______________________

$i_1 =$ ______________________

(Problem 3 cont'd)

(b) In the following circuit, assuming linear operation and ideal op-amp approximation, determine the node voltages v_0, v_1, and the currents i_0, i_1.



$v_0 =$ ____________________

$v_1 =$ ____________________

$i_0 =$ ____________________

$i_1 =$ ____________________