EE100 Summer 2004 Midterm Review Problems

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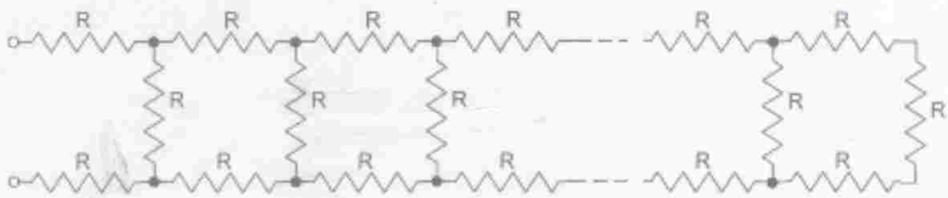
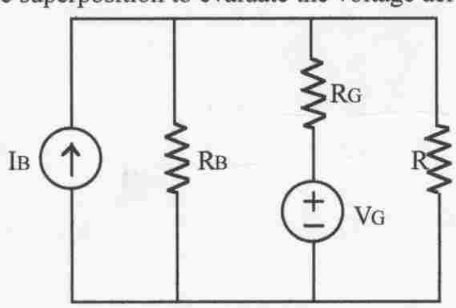
Notes:

1. The problems in this packet range in difficulty – most of them are pretty difficult. If you can understand and solve these problems, you should do very well on the midterm.
2. Justin will have a review session on Wednesday, 07/14/04 from 12:00 – 2:00 in 101 Morgan. This is NOT a lecture – Justin has volunteered to answer questions you may have. you can turn in **INDIVIDUAL SOLUTIONS** to these review problems for 5% EXTRA CREDIT. PLEASE TURN IN THE SOLUTIONS TO JUSTIN BY 12:00 PM IN 101 MORGAN ON 07/14/04. NO LATE SOLUTIONS WILL BE ACCEPTED – NO EXCEPTIONS!

1.) Find the equivalent resistance of the semi-infinite ladder of resistors:

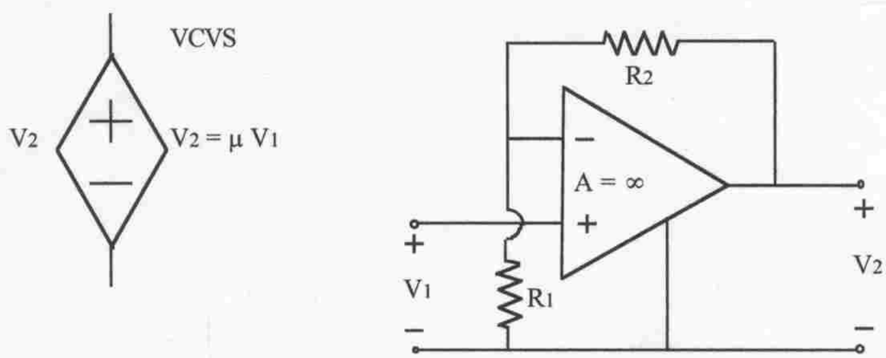


2.) Use superposition to evaluate the voltage across resistor R. Do not use source transforms.



$I_B = 12A$
$V_G = 12V$
$R = 0.23\ \Omega$
$R_B = 1\ \Omega$
$R_G = 0.3\ \Omega$

3.) The controlled source on the left can be designed using the op-amp circuit on the right.

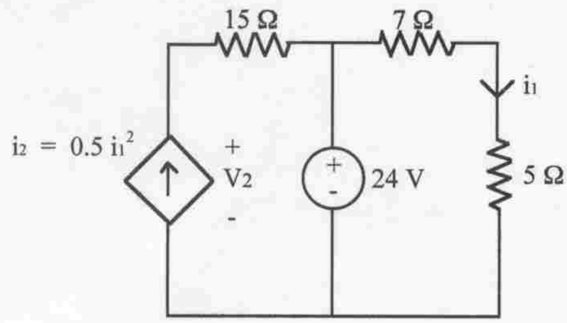


a.) Using the op-amp circuit, evaluate μ.

b.) Also the output, V_2, is unsaturated when the amplifier operates in the linear region, $-E_{sat} \le V_2 \le E_{sat}$. Specify the range of V_1 that avoids amplifier saturation.

(Hint: Use part a.)

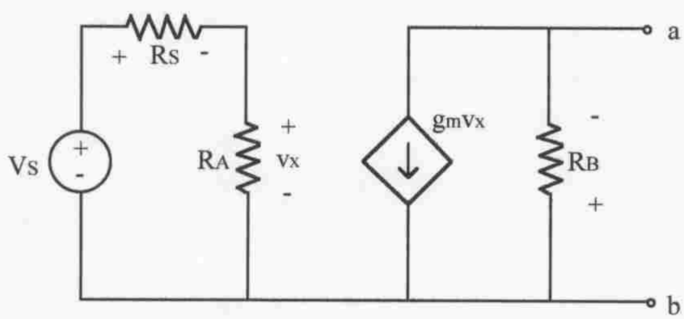
4.) See the circuit below.



a.) Is power being absorbed or dissipated by the controlled source?

b.) How much?

5.) See the circuit below:



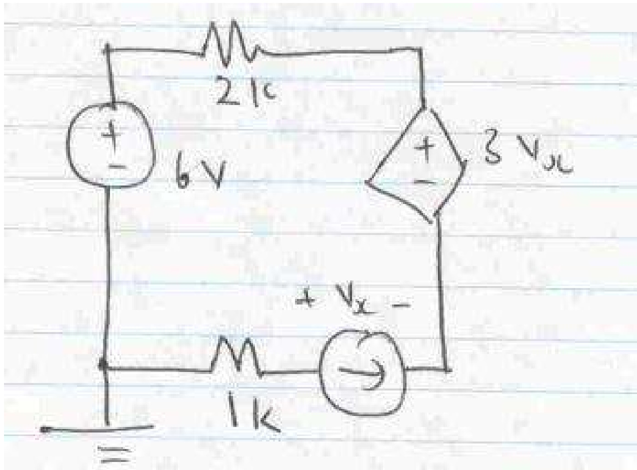
a.) Find the open circuit voltage, the short circuit current, and the equivalent resistance from the a-b terminal.

b.) Let $V_S = 24$ V and $R_A = 10$ kΩ. If the power delivered by the voltage source is 12 mW and the power delivered by the current source is 170 mW, find a value for:

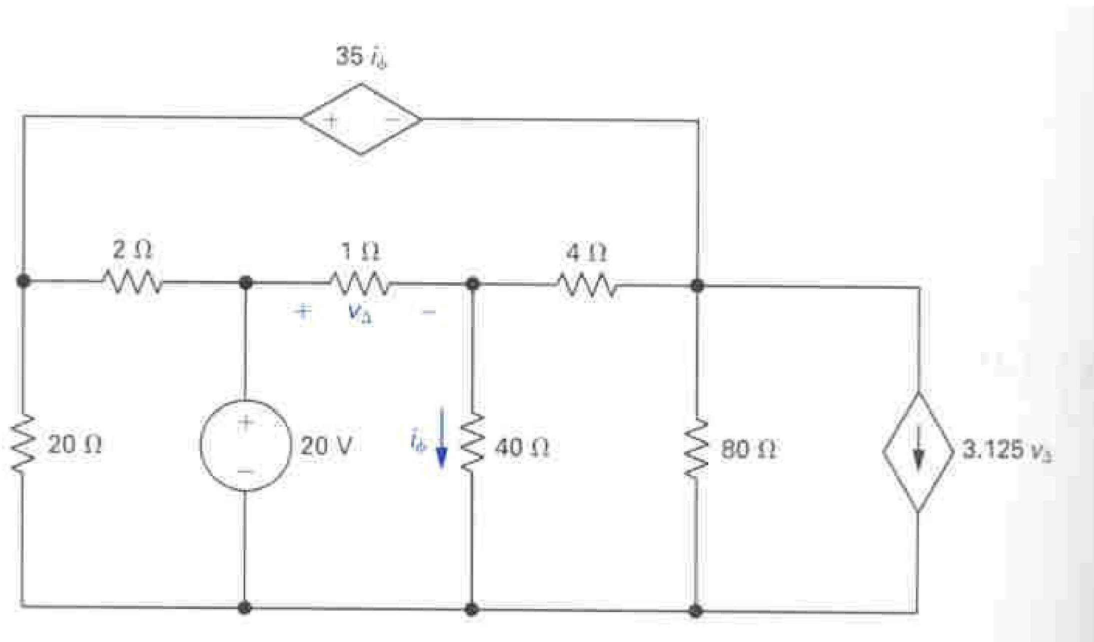
i.) R_S; ii.) g_m; iii.) R_B

c.) From a and b, draw the Thévenin and Norton equivalent circuits, using the proper numerical values.

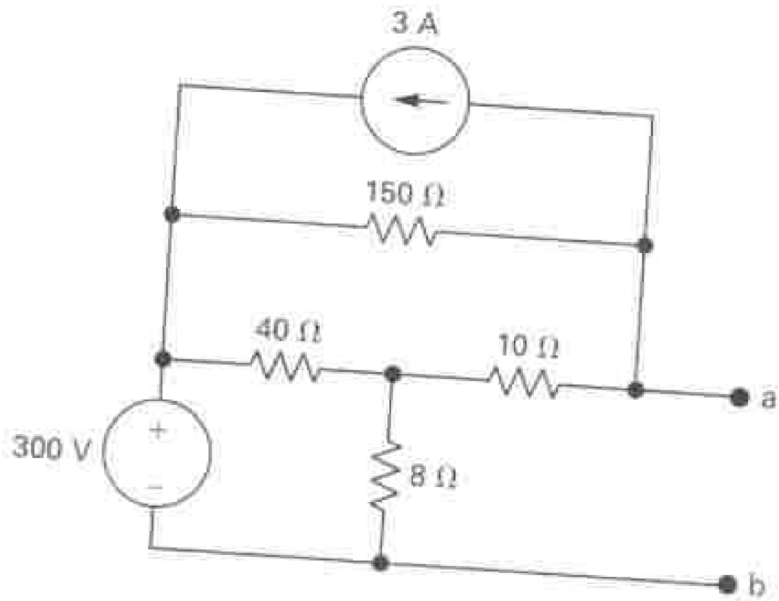
6. In the circuit below, find v_x.



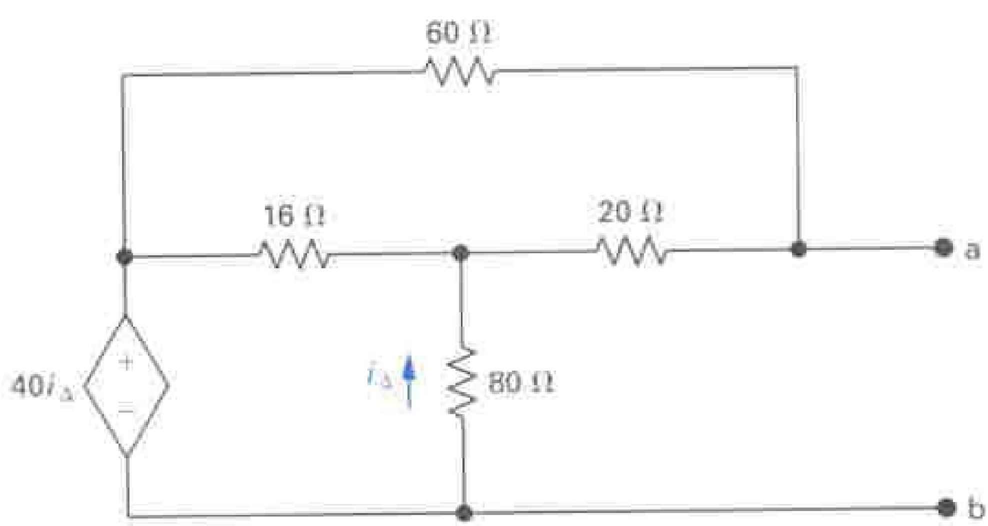
7. Use nodal analysis to write sufficient nodal equation(s) for the circuit below. DO NOT SOLVE THE EQUATIONS.



8. Find the thevenin equivalent with respect to terminals ab in the circuit below.



9. In the circuit below, find the thevenin equivalent with respect to terminals ab.



10.This is problem 5.16 from your textbook.

5.16 The circuit inside the shaded area in Fig. P5.16 is a constant current source for a limited range of values of R_L.

a) Find the value of i_L for $R_L = 2.5\ \text{k}\Omega$.

b) Find the maximum value for R_L for which i_L will have the value in (a).

c) Assume that $R_L = 6.5\ \text{k}\Omega$. Explain the operation of the circuit. You can assume that $i_n = i_p \approx 0$ under all operating conditions.

d) Sketch i_L versus R_L for $0 \le R_L \le 6.5\ \text{k}\Omega$.

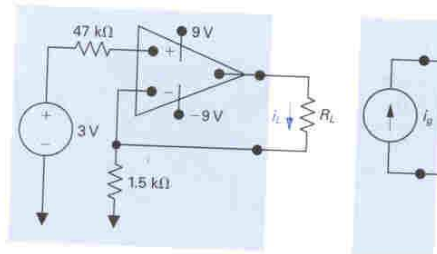
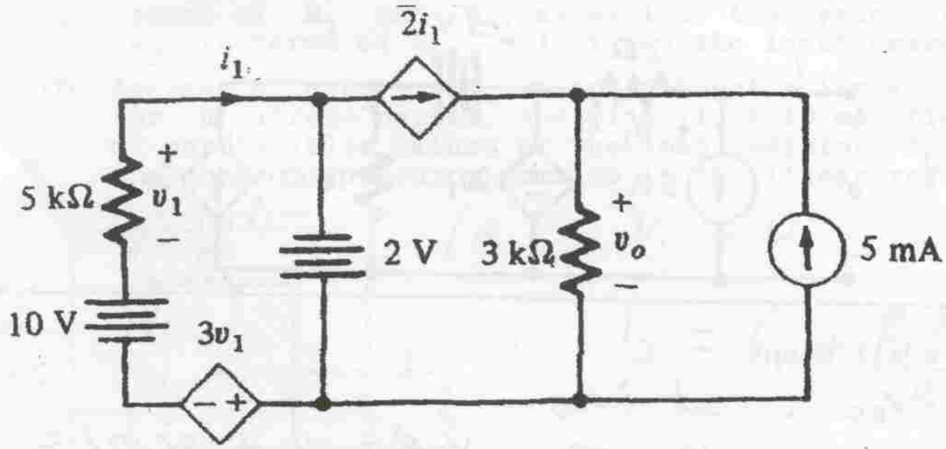


Figure P5.16

11.

Use Superposition Theorem to solve for the voltage v_o indicated in the following circuit.



12. In the circuit below, find and plot i(t) for t >= 0. Assume inductor has no initial current.