EE1050 Final given: Spring 00

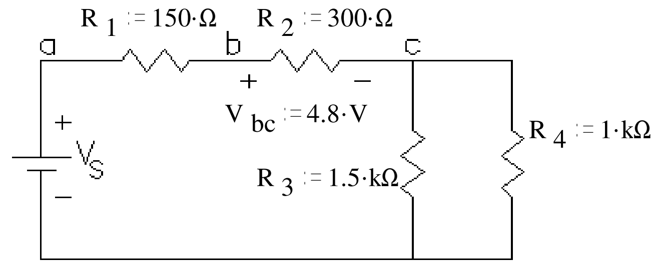
(The space between problems has been removed.)

1. (15 pts) In the circuit shown the voltage between points b and c is measured as 4.8V.

   a) What must V_S be?

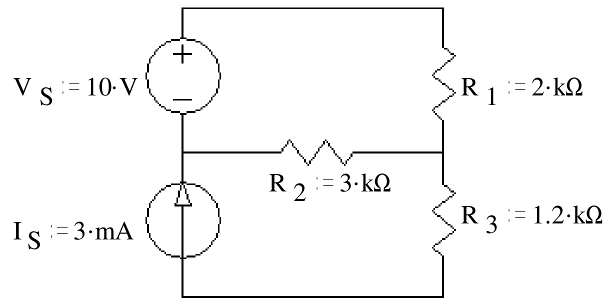
   b) How much power is dissipated in resistor R_2?

   c) How much power is contributed by V_S?



2. (14 pts) a) Use the method of superposition to find the voltage across R_2. Be sure to clearly show and **circle** your intermediate results.

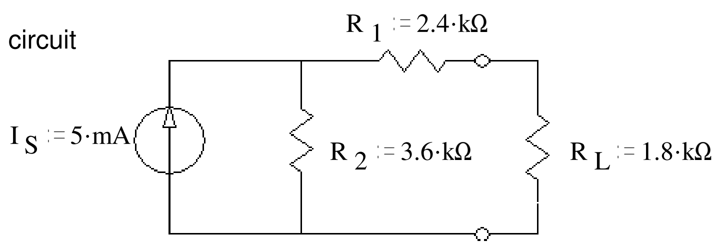
   b) Show the polarity of this voltage on the drawing.



3. a) (11 pts) Find and draw the Thévenin equivalent of the circuit shown. The load resistor is R_L.

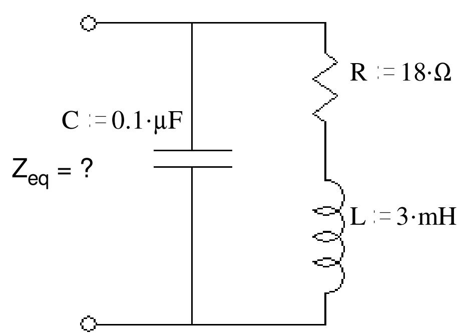
   b) (7 pts) Find and draw the Norton equivalent of the same circuit.

   c) (4 pts) Find the load voltage using your Thévenin equivalent circuit.

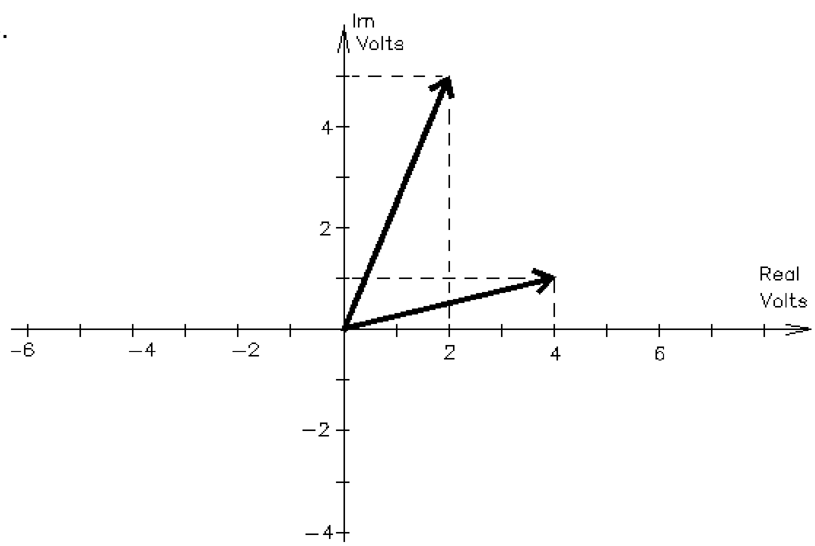


4. (24 pts) a) Find Z_{eq} for this circuit. Express in simplest polar or rectangular form. $f := 10000 \cdot \text{Hz}$

   b) Consider Z_{eq} as a load. What is the power factor of this load?



5.



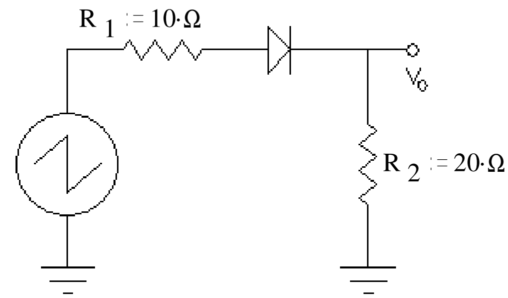
(14 pts) The two phasors shown represent two voltages, v_1 and v_2.

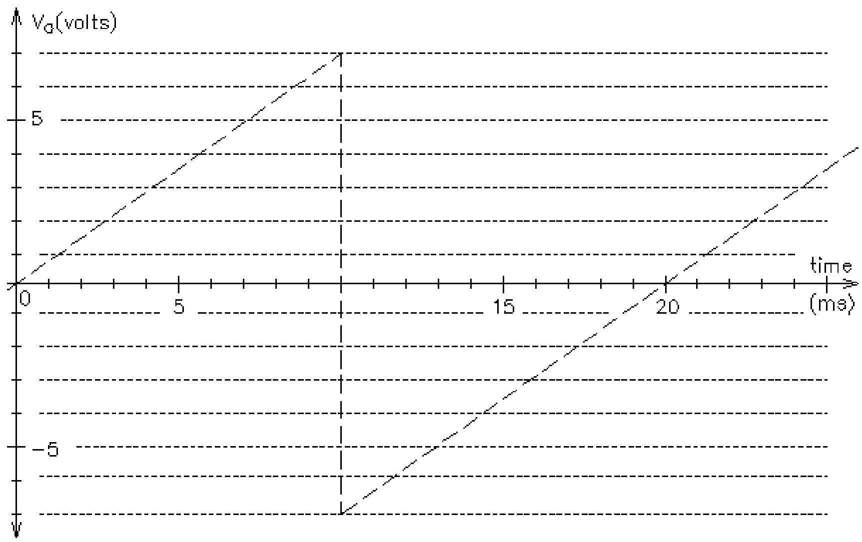
a) Draw the phasor representation for $v_3 = v_1 - v_2$

b) Find the magnitude of v_3.

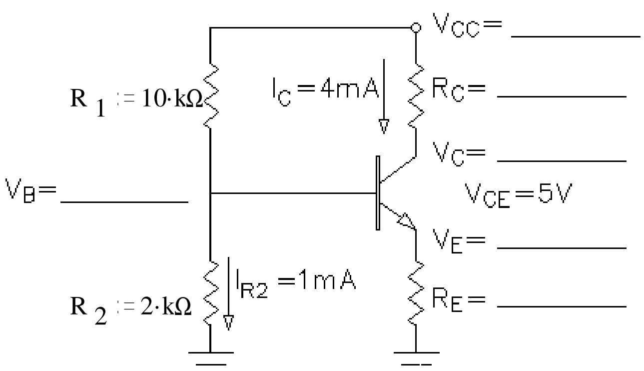
c) Find the phase angle of v_3.

6. (18 pts) The voltage waveform shown below (dotted line) is applied to the circuit shown at right. <u>Accurately</u> draw the output voltage you expect to see across the 20 Ω resistor. Draw on the same graph. Label important times and/or voltage levels.

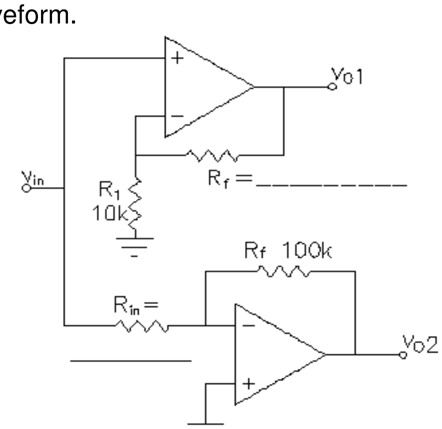


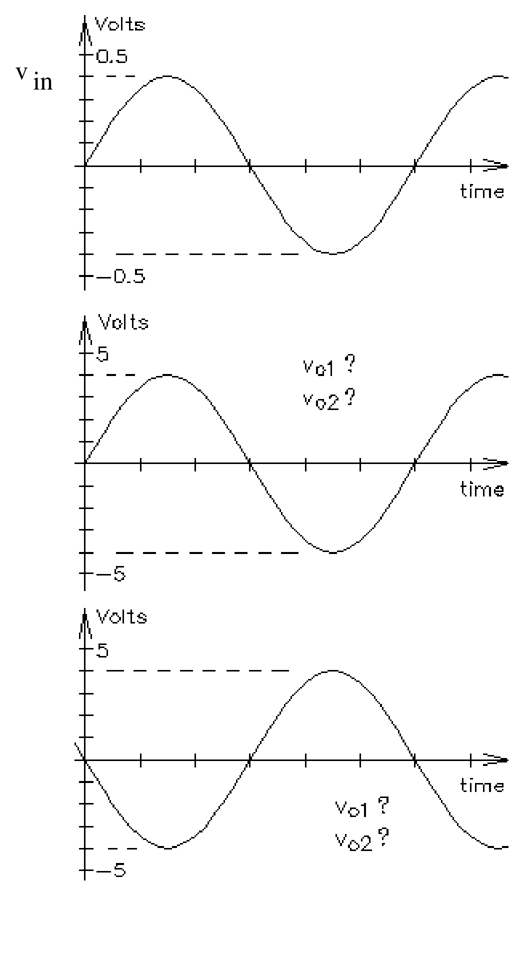


7. (18 pts) Fill in the blanks in the circuit below. You may neglect the base bias current (I_B).



8. (15 pts) The same input voltage (shown right) is connected to two different op-amp circuits.
a) The output voltages are also shown. Indicate which output voltage is v_{o1} and which is v_{o2} by circling the correct answer at each waveform.

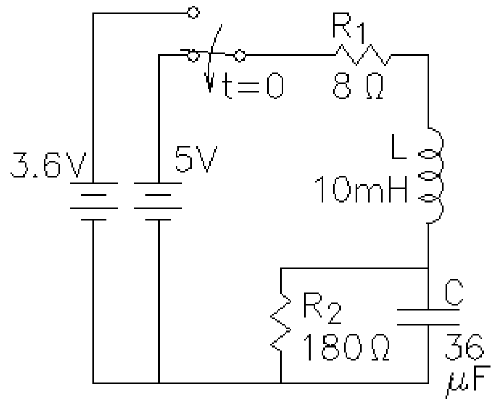




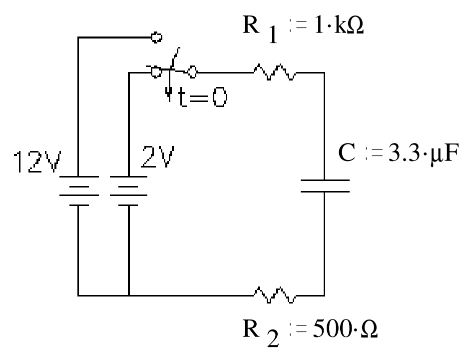
b) Find the values of the two unknown resistors.

9. (24 pts) Analysis of the circuit shown yields the solutions to the characteristic equation and the expression for $i_L(t)$ below. Find the constants A, B and D given the initial conditions shown.

$s_1 := (-477 + 1635j)\cdot\frac{1}{sec}$, $s_2 := (-477 - 1635j)\cdot\frac{1}{sec}$



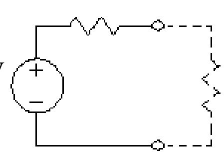
10. (16 pts) The switch has been in the upper position for a long time and is switched down at time t = 0.
At what time is v_C = 4 V?



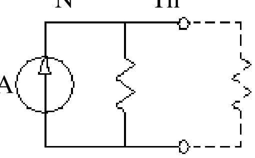
Answers

1. a) $V_S := 16.8\cdot V$ b) $P_{R2} := 76.8\cdot mW$ c) $P_S := 269\cdot mW$
2. a) $V_{R2} := 2.4\cdot V$ b) - left, + right
3. a) $R_{Th} := 6\cdot k\Omega$ b) $R_N = R_{Th} := 6\cdot k\Omega$ c) $V_L := 4.15\cdot V$

$V_{Th} := 18\cdot V$



$I_N := 3\cdot mA$



4. a) $Z_{eq} := 876\cdot\Omega\cdot e^{-j\cdot 63.9\cdot deg}$ OR $Z_{eq} = 385 - 787i\ \cdot\Omega$ b) $pf := 0.44$
5. a) phasor to (-2, 4) b) $4.47\cdot V$ c) $117\cdot deg$
6. Straight lines between the following points: (0ms,0V) (1ms, 0V) (10ms, 4.2V) (10ms, 0V) (21ms, 0V), then ramps up as between 0.7ms & 10ms
7. $V_B := 2\cdot V$ $V_{CC} := 12\cdot V$ $R_C := 1.43\cdot k\Omega$ $V_C := 6.3\cdot V$ $V_E := 1.3\cdot V$ $R_E .. 325\cdot\Omega$
8. a) v_{o1} v_{o2} b) $R_f := 90\cdot k\Omega$ $R_{in} := 10\cdot k\Omega$
9. $i_L(t) = e^{-477\cdot t}\cdot(-7.45\cdot mA\cdot\cos(1635\cdot t) + 83.26\cdot mA\cdot\sin(1635\cdot t)) + 26.60\cdot mA$
10. $t := 7.97\cdot ms$