SOLUTIONS TO EXAM #2

EE 201 **EXAM-2** **March 29, 1999**

Spring 1999, Russell

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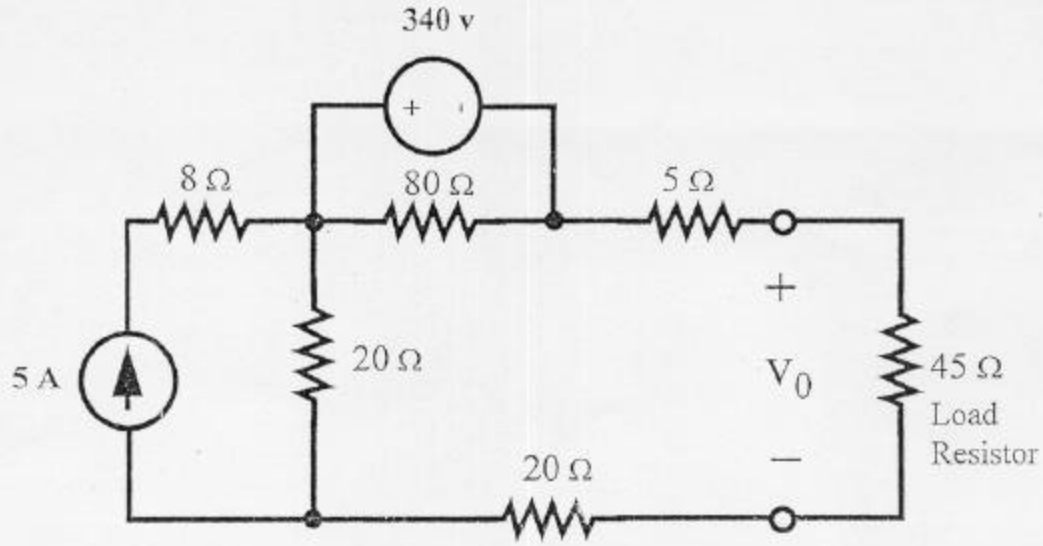
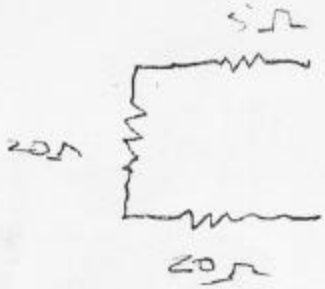
NAME:_____

1. For the circuit below: a) use superposition to find V_0, b) is the value of the load resistor such that maximum power is being delivered to it?

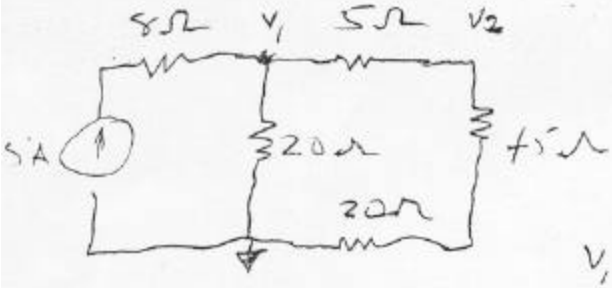
4.54





$R_{Th} = 45\Omega$ → yes max power is being delivered to it.

$$-5 + \frac{V_1}{20} + \frac{V_1}{70} = 0 \qquad V_1 = \frac{5}{\left(\frac{1}{20}+\frac{1}{70}\right)} = 77.78V$$



$$\rightarrow V_0' = \frac{77.78}{70}(45) = 50V$$

$$\frac{V_1}{20} + \frac{V_2}{70} + \frac{V_1 - V_2}{80} + \frac{V_2 - V_1}{80} = 0$$

$$V_2 = V_1 - 340$$

$$\frac{V_1}{20} + \frac{V_1 - 340}{70} = 0 \rightarrow V_1 = 75.56V$$

$$\rightarrow V_2 = -264.44V$$

$$\therefore V_0'' = \frac{V_2}{70}(45) = -170V \qquad \therefore V_0 = V_0' - V_0'' = -120V$$

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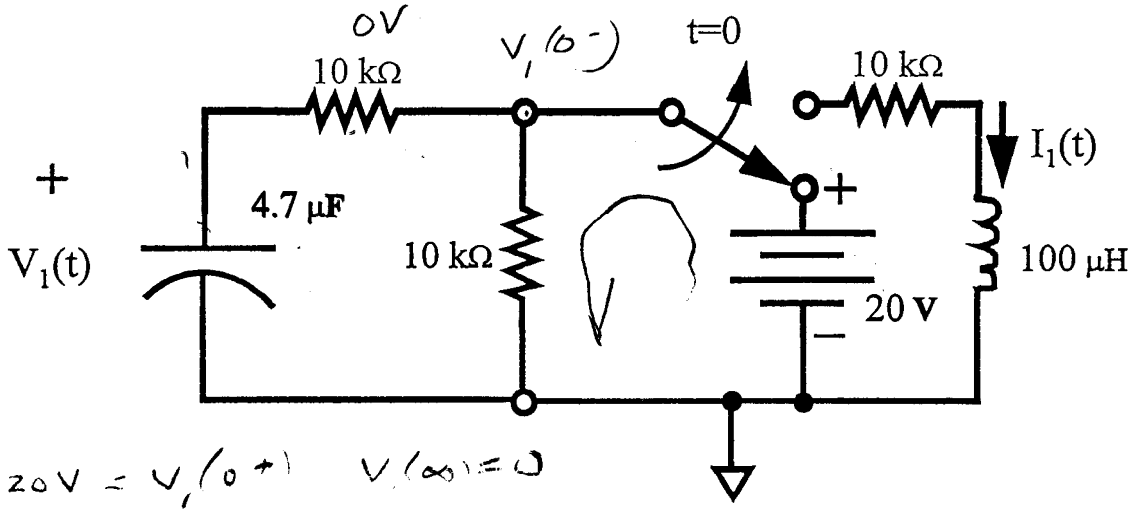
2. In the circuit below, the switch has been in the bottom position for a long time. At t=0, the switch moves up to the top position. Please answer the following questions:
What is $V_1(0^-)$? What is $V_1(0^+)$? What is $V_1(\infty)$?
What is $I_1(0^-)$? What is $I_1(0^+)$? What is $I_1(\infty)$?



$V_1(0^-) = 20V = V_1(0^+)$ $V(\infty) = 0$

$I_1(0^-) = 0$ $I_1(0^+)$ $I_1(\infty) = 0$

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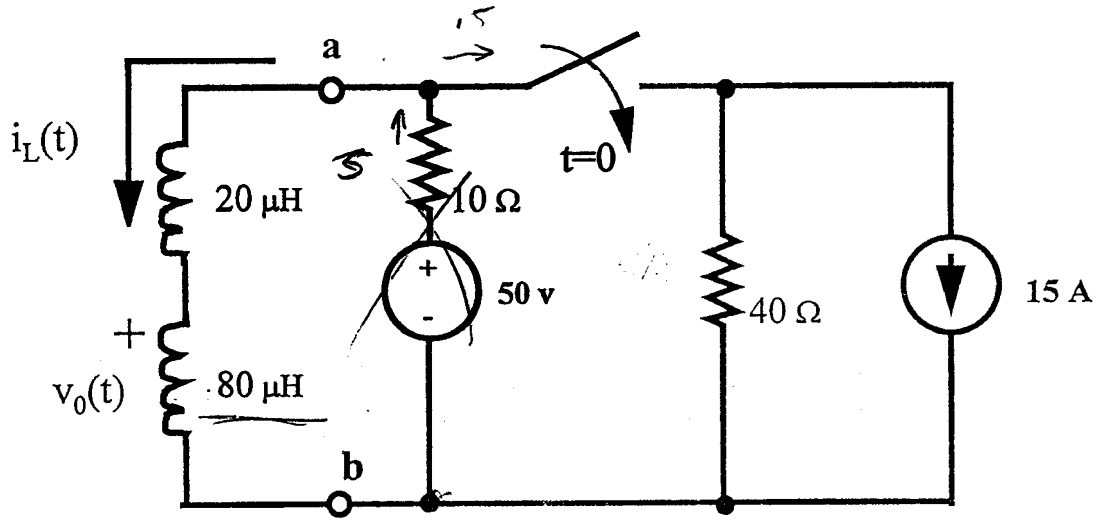
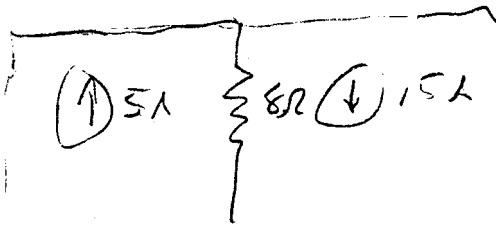
3. The switch in the circuit below has been open for a long time before closing at t=0. Find the voltage, $V_0(t)$ across the bottom inductor, for $t \geq 0+$. [HINT: source transformations will help.]

1.43



5 A i_L -10 A



$+15-5=0 \rightarrow i_L = -10A$

$\tau = \frac{L_{eq}}{R_{eq}} \quad \frac{80\,\mu H}{8\,\Omega} = (80{,}000)^{-1}$

$i_L(t) = -10 + [5-(-10)]e^{-80{,}000t}$

$-10 + 15e^{-80{,}000t}$

$\rightarrow v_0(t) = L\frac{di(t)}{dt} = 80\mu\,(15(-80{,}000))\,e^{-80{,}000t}$

$= -96e^{-80000t}\ V$

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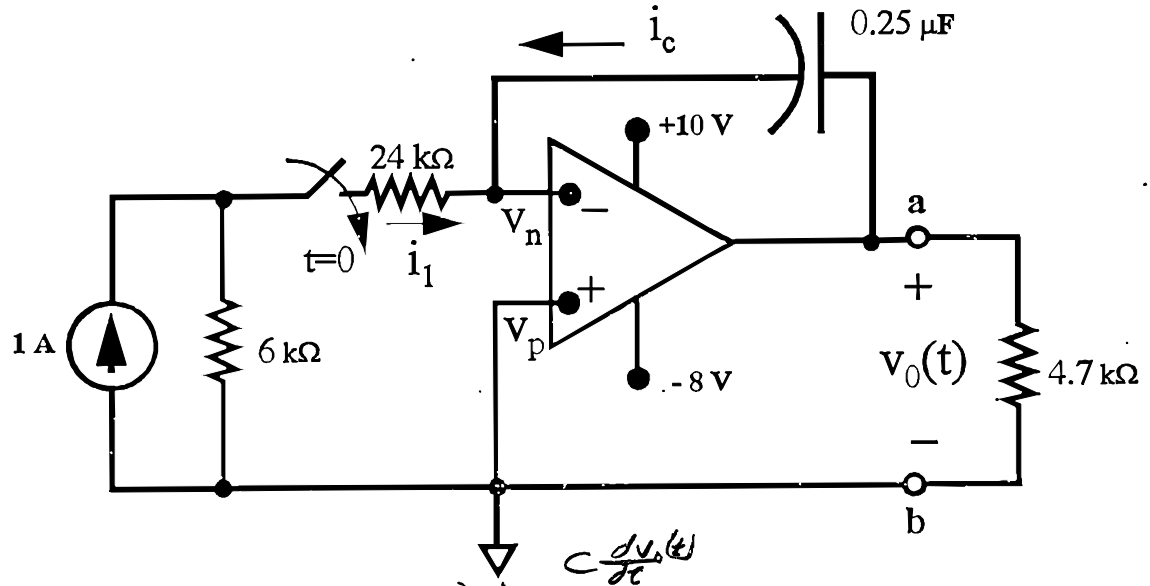
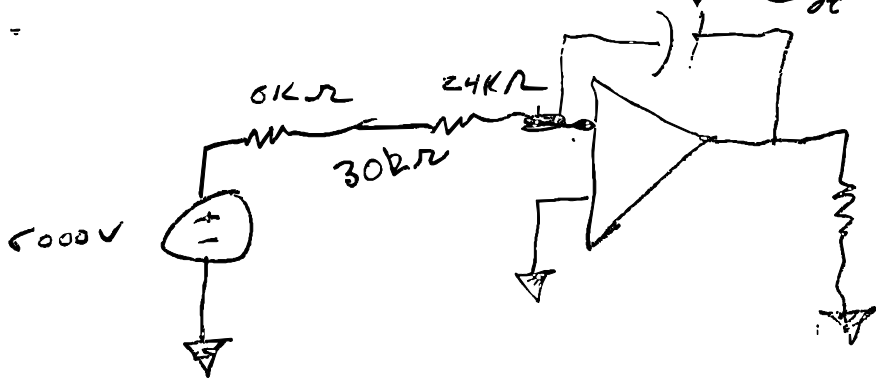
4. The energy stored in the capacitor in the circuit shown below is zero at the instant the switch is closed. a) Derive an equation for the output voltage, Vo, as a function of time. b) How many milliseconds does it take for the amplifier to reach saturation?

7.80





$$\frac{v_n^{\nearrow 0} - 6000}{30K\Omega} - C\frac{dv}{dt} = 0$$

$$C\frac{dv}{dt} = -\frac{6000}{30K} \qquad \frac{dv}{dt} = 800000 \Rightarrow v_0(t) = \int_0^t -800{,}000\,dt$$

$$= -800{,}000t$$

V

$$-800000t = -8V \rightarrow$$

$$t = \text{[illegible]}$$

10 ms