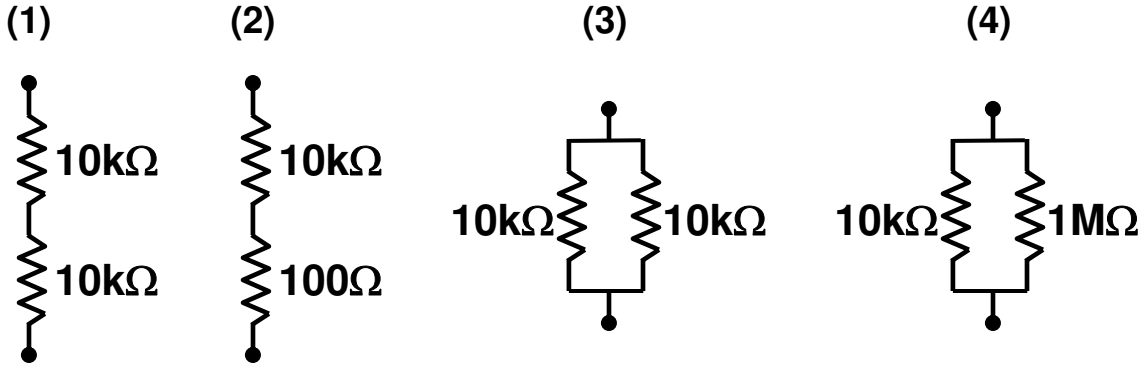
Name: _____ Perm #: _____ TA: _____

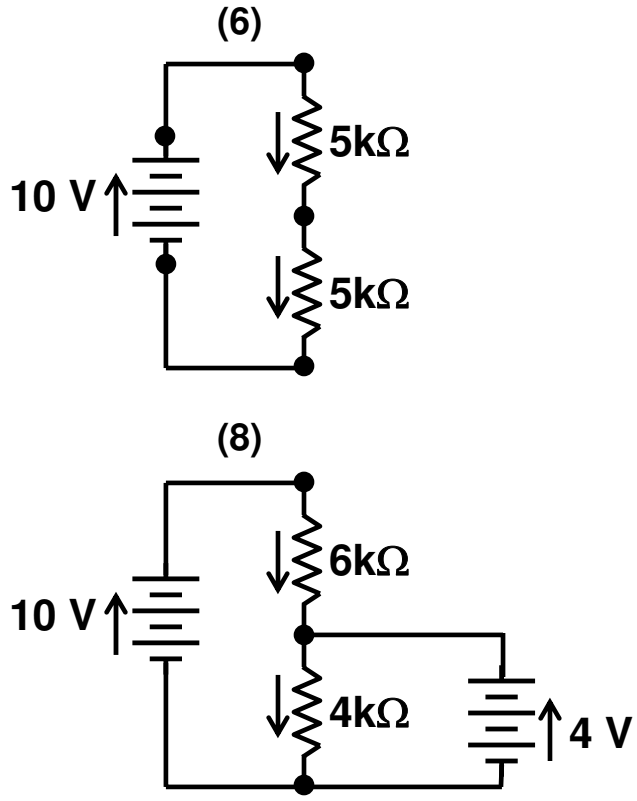
HW1, PHYSICS 127A, PART 1

1-4. Compute the effective resistance of the following series and parallel circuits.

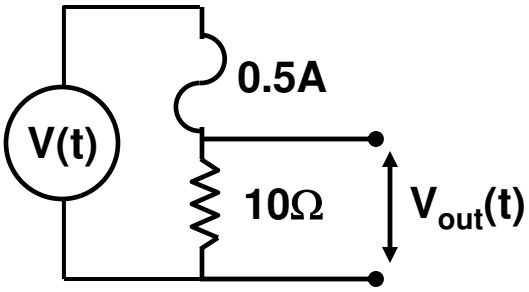


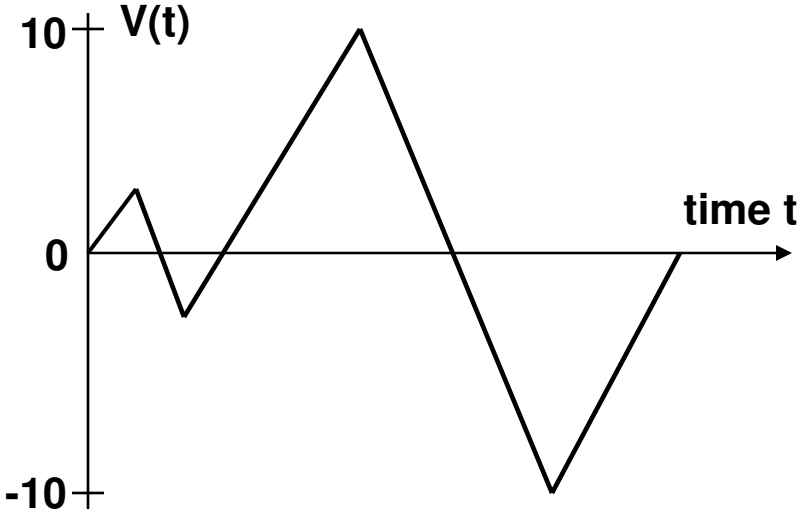
5. For problems 2 and 4, the 100Ω and 1MΩ resistors affect the circuit by a small amount. Why can these resistors, to a good approximation, be ignored? (Hint: Resistors typically are manufactured to a tolerance (inaccuracy) of +-5%).

6-8. Compute the voltage at each node (dots) and current through each component (arrows) for the following 4 circuits.



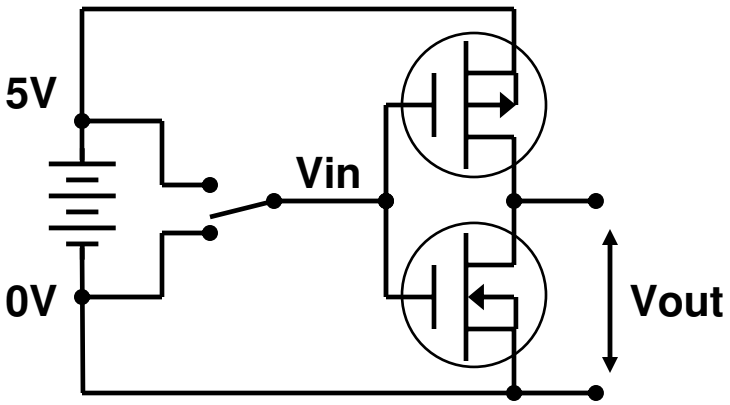
9. In the following circuit with a 0.5 Amp fuse, the battery voltage V(t) changes with time according to the plot. Sketch the expected output voltage versus time.





10. (hard) Qualitatively, what effect does the resistance of the fuse have on the output voltage? The fuse resistance can be found in its datasheet, which can be downloaded by searching at digikey.com for the part number 0312.500HXP, then selecting technical/catalog information, then datasheets.

11. (extra credit) Modern digital electronics are made from CMOS (Complementary Metal-Oxide Semiconductor) transistors, which can be thought of as electronically controlled on/off switches. These transistors have three terminals: the left hand "gate" terminal acts as the control lever, while the top and bottom wires are the switch terminals. The top (p-mos) transistor turns on (R=0) for Vin=0 and off (R=infinity) for Vin=5V. The bottom (n-mos) "complementary" transistor has the opposite on/off behavior. For the following circuit, what is the output voltage Vout for the two cases Vin=0 and Vin=5 volts.

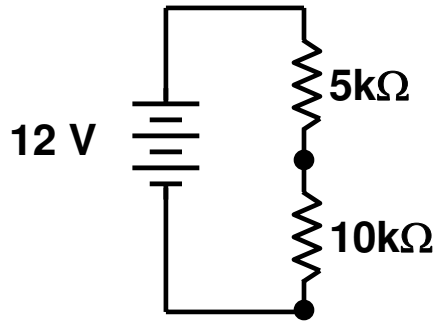


Vin	Vout
0	
5	

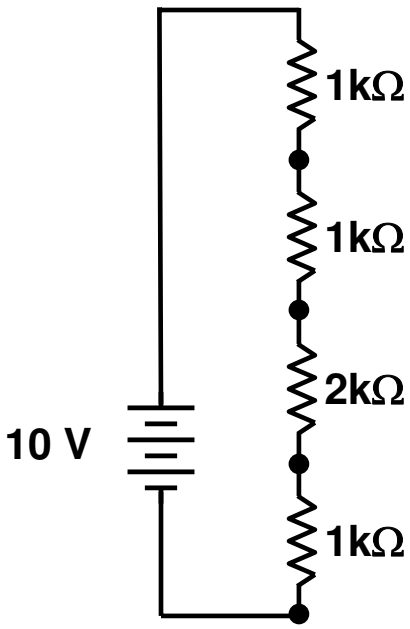
HW1, PHYSICS 127A, PART 2

1-2. Compute the output voltage at the nodes (dots) for the following voltage dividers.

(1)

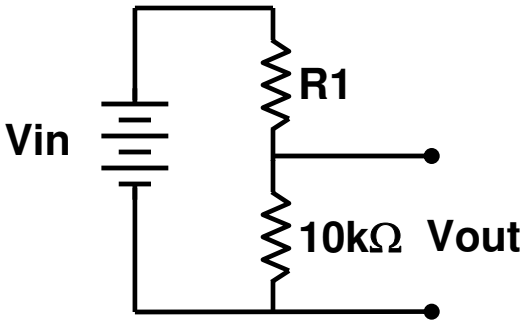


(2)

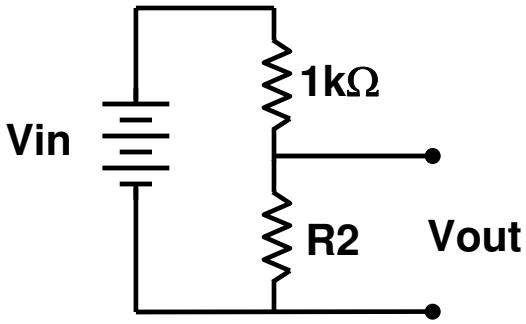


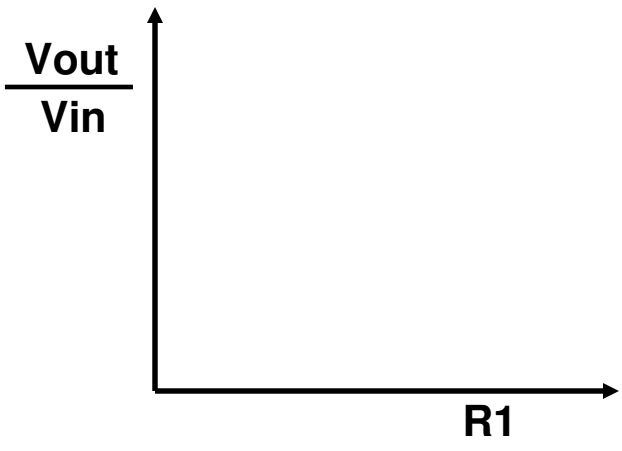
3-4. <u>Sketch</u> Vout/Vin versus R1 or R2 for the two following circuits

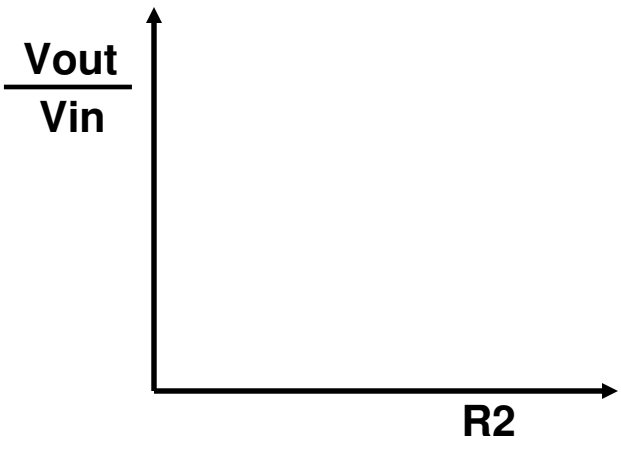
(3)



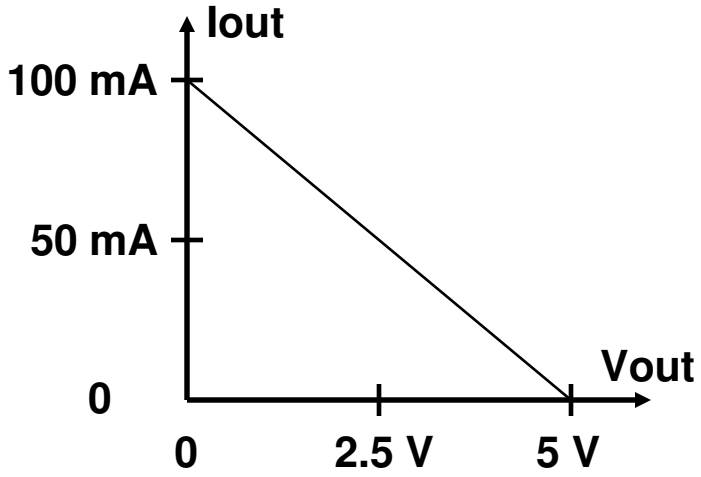
(4)



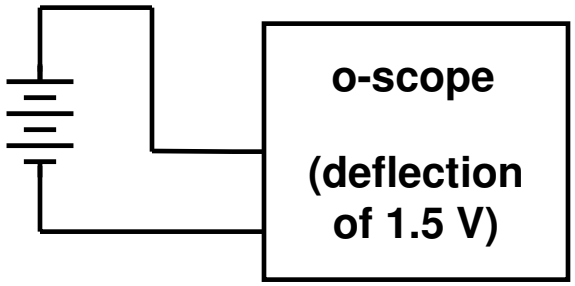


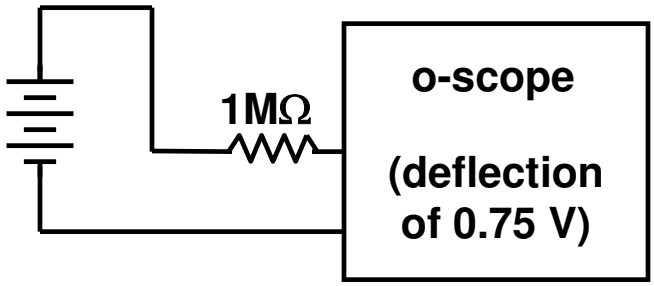


5. A "black box" circuit has been measured to give an output voltage versus output current given by the following graph. Compute the equivalent output voltage and resistance of the voltage source model in (5).



6. An oscilloscope measures a battery voltage of 1.5 V. When a series resistor of 1 MΩ is added to the circuit, the o-scope measures 0.75 V. What is the input resistance of the o-scope?





7. For the o-scope of problem 6, compute the voltage that it will measure for a 1 V source with an output impedance of 5 kΩ.