Important Remarks

- Homework is due on Sept. 20th, 2011 at the beginning of class
- **For all problems, keeping your work in fractions will produce easier, more accurate results.**
- Start early and get help if you need it
- Start a new page per problem
- Show all the work
- Specify all the units
- Circle your answers
- Staple pages

1. Given figure below, find I and V using circuit reduction and other techniques.

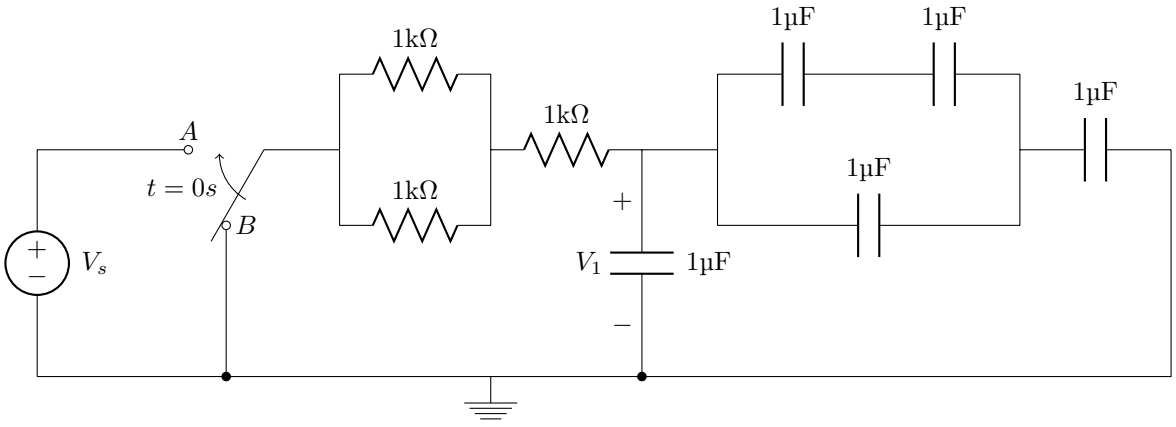

Figure 1: Circuit for problem 1

   (a) Simplify the circuit and find the time constant τ. Hint: $\tau = R_{eq}C_{eq}$.

   (b) Plot the charge and discharge curves for V_1 using the 2/3 estimation method shown in class using at least four points. Your plot should go out to at least $t = 4\tau$. To plot the charge curve, assume the switch has been in position B for a long time and switches to position A at t = 0. For the discharge curve, assume that the switch has been at A for a long time, and switches to B at $t = 0$.

   (c) Assume $V_s = 10$V. Plot the charge and discharge curves for V1 using the exponential formula used in class. Your plot should go out to at least $t = 4\tau$ using at least four points.

2. For the circuit shown in Figure 2, assume $Vs = 5$V and R is unknown. In the lab we observe the charge curve for this circuit on an oscilloscope. We measure the following:

   $V_c = 0.5$V when $t = 50$µs
   $V_c = 4.5$V when $t = 1150$µs

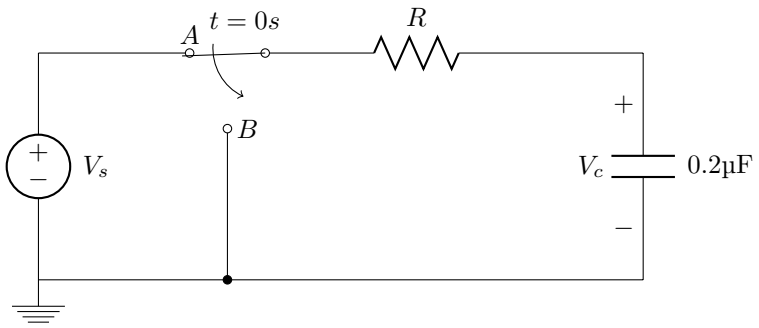

Figure 2: Circuit for problem 2

(a) Using the 10% - 90% rise time rule of thumb, calculate the time constant τ for this circuit.

(b) Using your results from part a, determine the value of R.

(c) Assume the switch has been in position A for a long time and switches to B at $t = 0$. Plot V_C for $0 < t < 4\tau$ using at least four points. Show all your work! Be sure to plot and confirm that your 10% values and 90% values match those used earlier. (Remember that the rule of thumb for the earlier calculation is an approximation).

(d) Assume the switch has been in position B for a long time and switches to A at $t = 0$. Plot V_C for $0 < t < 4\tau$ using at least four points. Show all your work! Be sure to plot and confirm that your 10% values and 90% values match those used earlier. (Remember that the rule of thumb for the earlier calculation is an approximation).

3. For the figure below: $\tau = 2$ms, $V_s = 15$V.

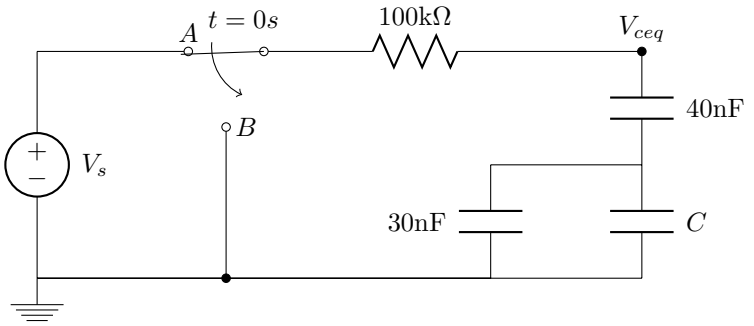

Figure 3: Circuit for problem 3

(a) Determine the value of C.

(b) Assume the switch has been in position A for a long time and switches to B at $t = 0$. Plot V_{ceq} for $0 < t < 4\tau$ using at least four points. Show all your work!

(c) Assume the switch has been in position B for a long time and switches to A at $t = 0$. Plot V_{ceq} for $0 < t < 4\tau$ using at least four points. Show all your work!