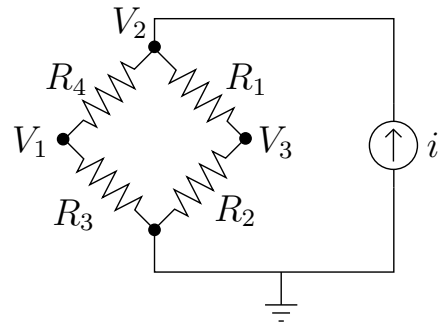


Physics 261 Final Exam

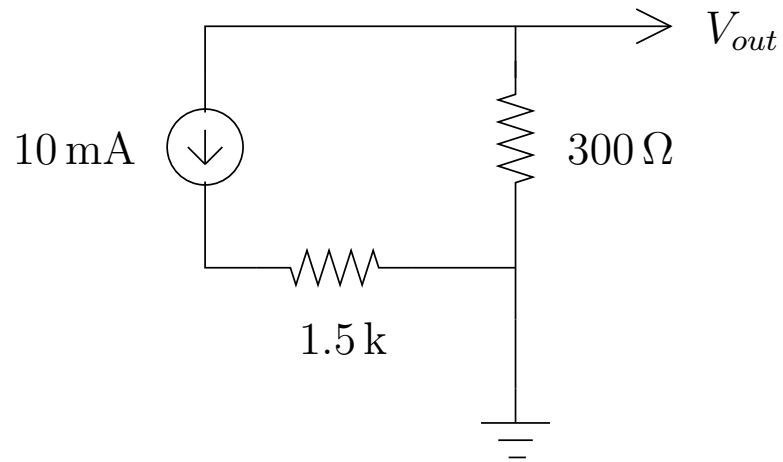
Remember to show your work.

Name:

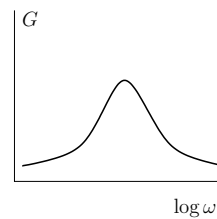
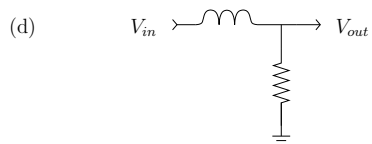
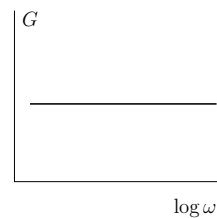
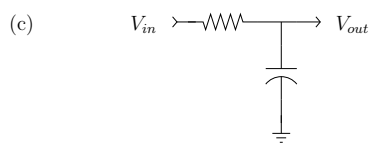
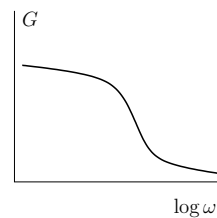
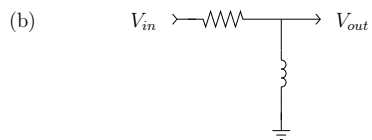
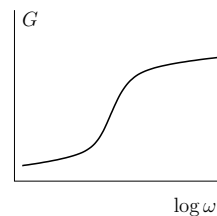
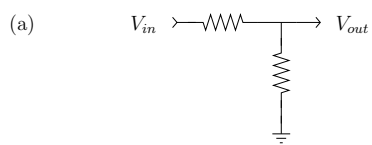


1. (7 points) Set up (but do not solve) the equations of node voltage analysis for V_1, V_2, V_3 in the above circuit.

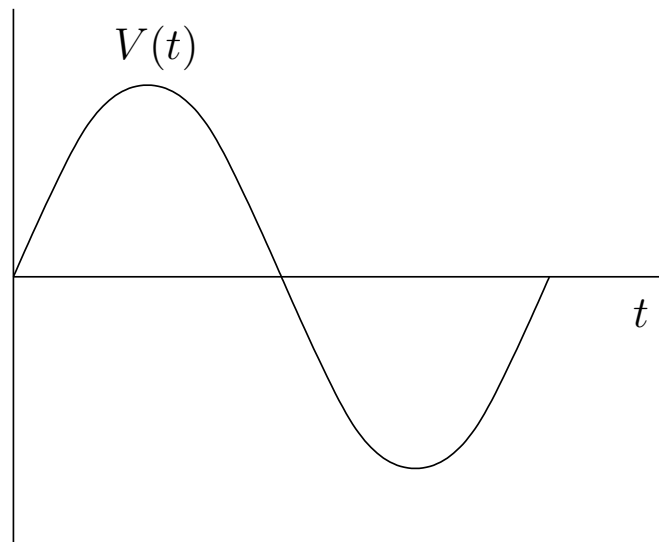
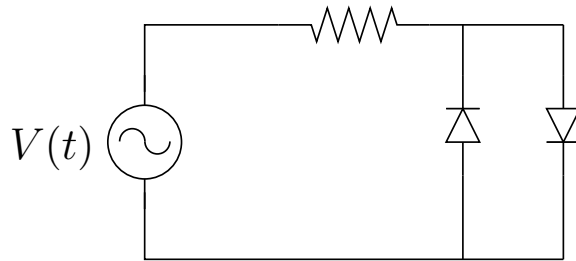
2. (8 points) Find and draw the Thévenin and Norton equivalents for this circuit.

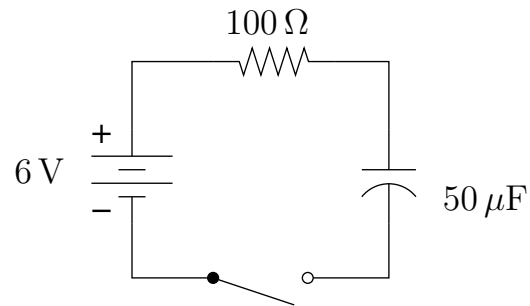


3. (12 points) Choose the correct gain function for each circuit. There may be duplicates.

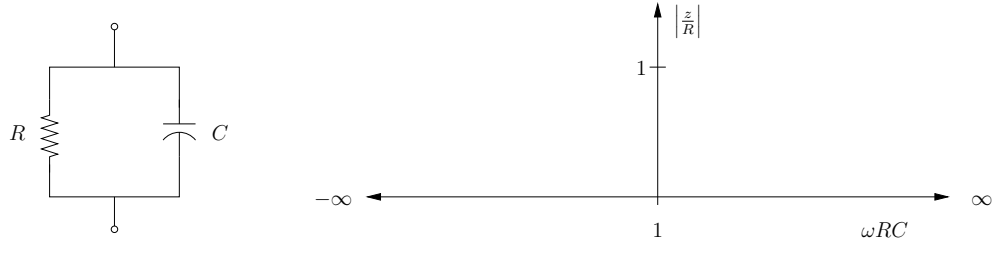


4. (7 points) Sketch the voltage across the resistor on the same axes as $V(t)$ below.





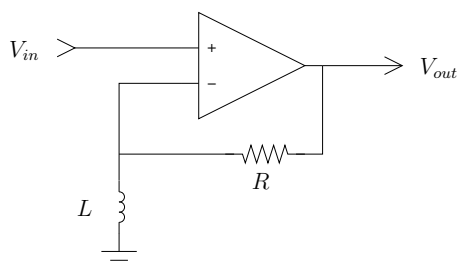
5. (18 points) Assume that the capacitor is initially uncharged. The switch is closed at time $t = 0$. Find and sketch as a function of time:
- (a) the voltage across the resistor, V_R .
 - (b) the current.
 - (c) the charge on the capacitor.



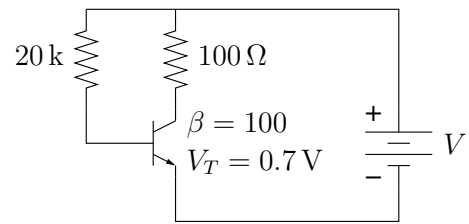
6. (15 points) Find the *magnitude of the dimensionless impedance*, $|z/R|$, as a function of ωRC . Sketch on the axes provided.¹

¹Note that the horizontal axis is logarithmic.

7. (18 points) Don't panic! Analyze as you would any op amp circuit with negative feedback, and assume the input voltage signal has some frequency ω .



- Find V_{out} as a function of V_{in} and ω .
- Find the magnitude of the gain.
- Find the phase. Does the output voltage lead or lag the input?



8. (15 points) For what range of V , if any, will the transistor be in
- (a) cutoff mode?
 - (b) saturated mode?
 - (c) active mode?