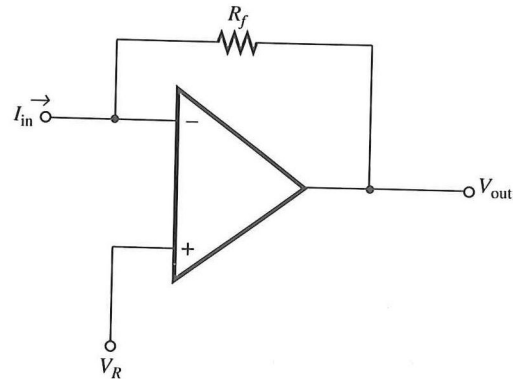Physics 313 assignment for Tuesday Oct 9:

1. In the derivation of V_{out} for the op amp integrators and differentiators, do we need to assume that V_{out} is small?

2. a) What does the circuit at right do (Assume $V_R=0$)? Explain using the golden rules of op-amps.

b) What is the maximum current that can be measured (without saturating the op amp) in the figure at right if R_f is 10 M? Assume ±15 V supplies are being used to power the op amp.

3) The slew rate of an op amp is the maximum rate at which the output voltage can change—that is, $SR= dV_{out}/dt)_{max}$. This means that for signals that change very quickly, the output may be distorted because the op amp can't "keep up." Let's see what happens when the signal is a sine wave.

a) Assume that $V_{in}=V_0\sin(\omega t)$, and that the voltage gain of the op amp circuit is A_V. Write an expression for V_{out}.

b) Now take the derivative to obtain an expression for dV_{out}/dt. Where in the cycle does the largest value of dV_{out}/dt occur, and what is this value?

c) The output will begin to be distorted when the largest value of dV_{out}/dt is equal to the slew rate (SR) of the op amp. Use your result from b) to find an expression for the frequency (in Hz) at which distortion will start to occur (your answer should depend on A_V, V_0, SR, and constants).

d) Search online for a datasheet for the LF411 op amp (or use the one in the lab) and from the datasheet find a value for the typical slew rate. Then use this and your result from c) to find the highest frequency sine wave signal with amplitude 10 V for which the output of a follower based on this op amp will be undistorted.

4) a) Design an inverting amplifier using an ideal op amp. Make the input impedance 5k and the voltage gain -25.

b) Design a non-inverting amplifier using an ideal op amp. Make the voltage gain 25. What is the input impedance?