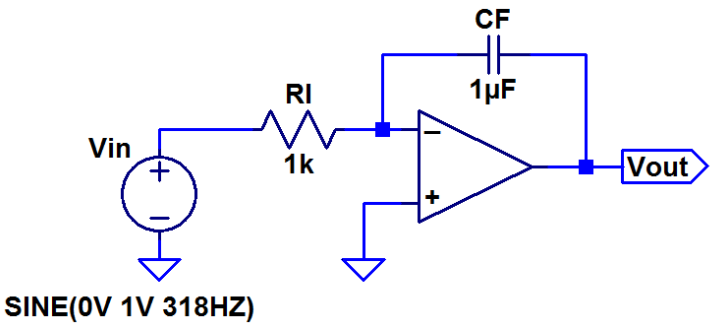
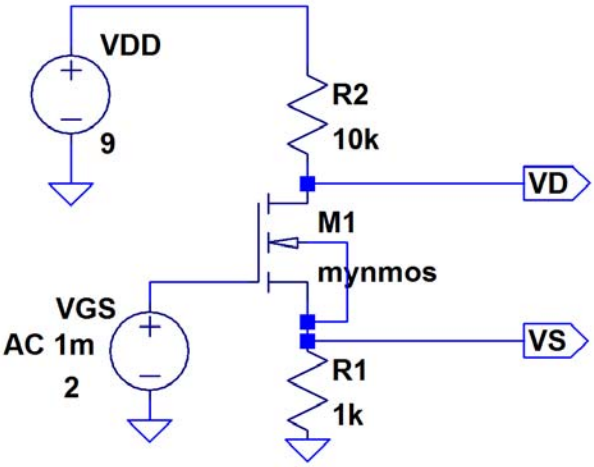
Midterm2 EE 320 Electronics, Spring 2014 Name: _____

- Closed notes, open book, **show your work** (hand calculations, including algebra) for credit.
- No scratch paper is allowed.
- Unless otherwise indicated use KP_N = 120 $\mu A/V^2$, KP_P = 40 $\mu A/V^2$, V_{THN} = 800 mV, V_{THP} = 900 mV, W = 10 μm, L = 1 μm, and a C'_{ox} = 1.75 $fF/\mu m^2$.

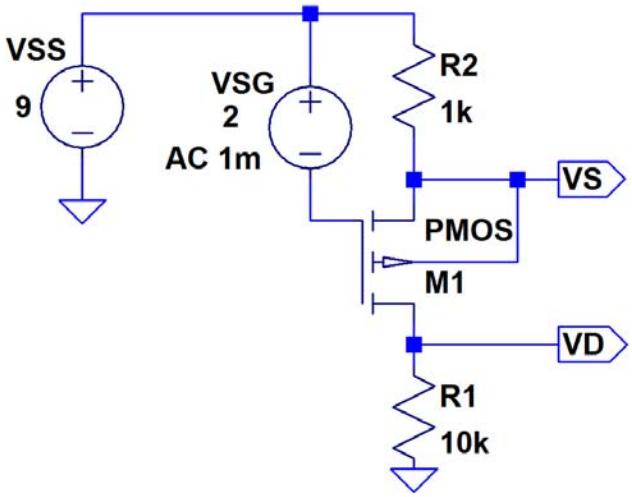
1. The input to the integrator seen below is a sinusoid having a peak amplitude of 1 V and a frequency of 318 Hz. Calculate the amplitude and phase shift of the output voltage assuming an ideal op-amp is used. Sketch the circuits' input and output voltage on the same plot in the time domain. (20 points)



2. Calculate the AC and DC voltages on the gate, drain, and source of the NMOS transistor in the following circuit. Show your work for credit. (20 points)



3. Calculate the AC and DC voltages on the gate, drain, and source of the PMOS transistor in the following circuit. Show your work for credit. (20 points)



4. Show, using both figures and equations, how to derive the small-signal transconductance of an NMOS transistor. (20 points)

5. Sketch Vin and Vout versus time on the same plot for the following circuit. Note that Vin is a pulse transitioning at 10 ns from 2 to 3 V in 10 ps. (20 points)