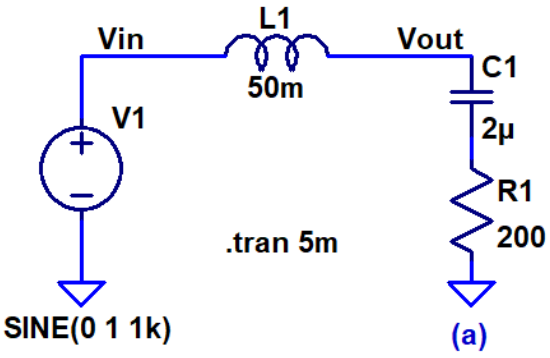
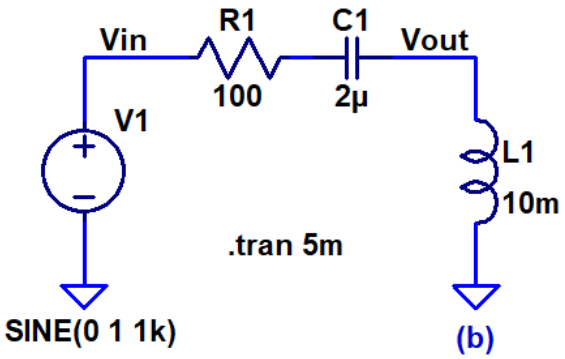
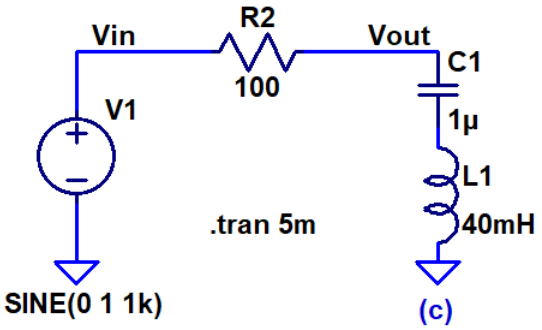
H.W. #24 EE 220 Fall 2019

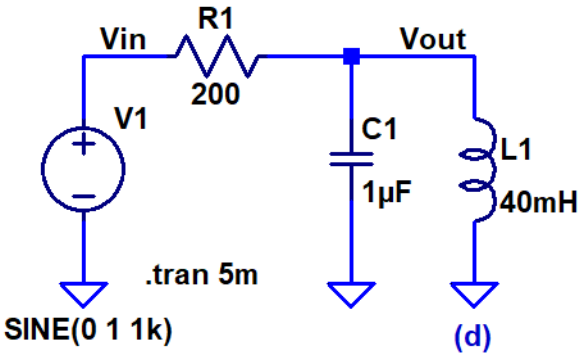
Show your work for credit!

1. Determine Vout in each of the following circuits using phasor analysis in steady-state (not the start-up transient). Sketch Vout and Vin in the time domain on the same plot showing the phase shift. Verify your hand calculations and sketches using LTspice. (8 points)









2. For the circuit in 1(c) determine the input frequency when Vout goes to 0. This is called series resonance. The energy stored in the capacitor is equal to the energy stored in the inductor. The energy is transferred back and forth between the two components during each oscillation cycle. A series resonant LC circuit behaves like a short so Vout is shorted to ground through LC and this is why Vout is zero. Also show that the current flowing in the circuit is 1V(peak)/100Ω or 10 mA peak when the input is at the resonant frequency and Vout is 0. Verify your hand calculations using LTspice. (2 points)
3. For the circuit in 1(d) determine the input frequency when Vout is equal to Vin (parallel resonance, the LC behaves like an open). Show that no current flows in input source and R1 at this resonant frequency. Verify your hand calculations using LTspice. (2 points)