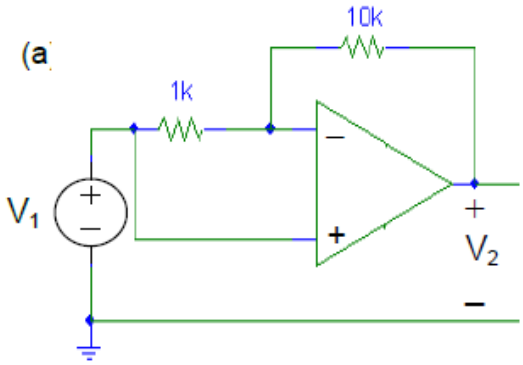
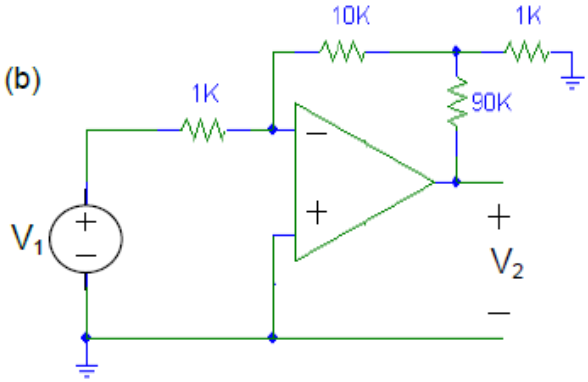
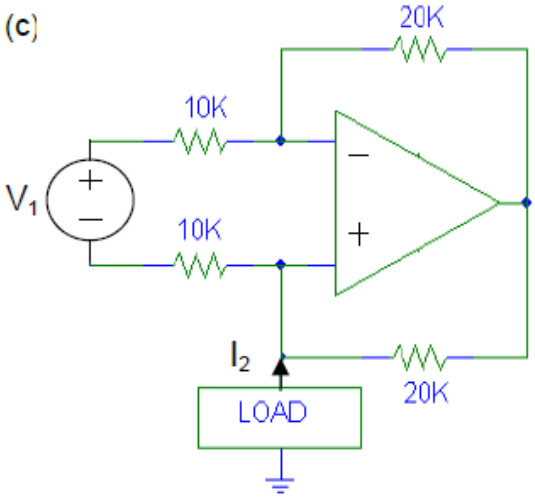
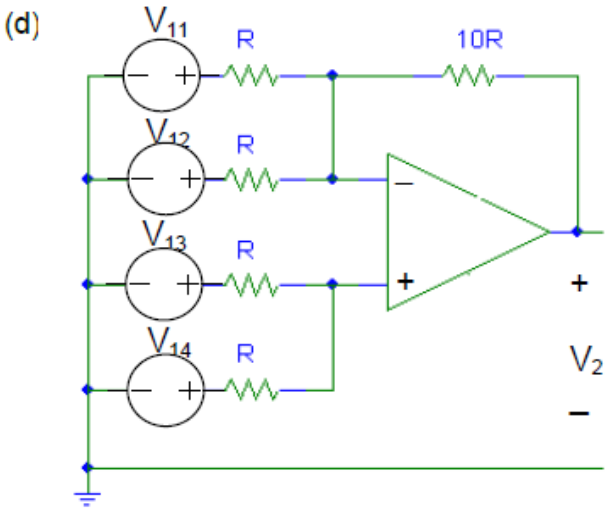
1. The Thevenin equivalent of a microphone for a particular sound level consists of a voltage source $V_s$ = 20mV peak-to-peak in series with a resistance $R_s$ = 100kΩ.
   - **(a)** Find the power delivered to a loudspeaker having resistance $R_L$ = 8Ω if it is directly connected across the output terminals of the microphone.
   - **(b)** If an amplifier having input resistance $R_i$ = 100kΩ is used to amplify the signal from the microphone, find the required Voltage Gain of the amplifier so that the power delivered by the amplifier to the same loudspeaker is 4W.
   - **(c)** How would the required Voltage Gain change if (i) $R_i$ = 10kΩ and (ii) $R_i$ = 1MΩ?
   - **(d)** Calculate the values of the Power Gain of the amplifier in the three cases.
   - **(e)** Comment on how the Voltage and Power gains change as $R_i$ changes.

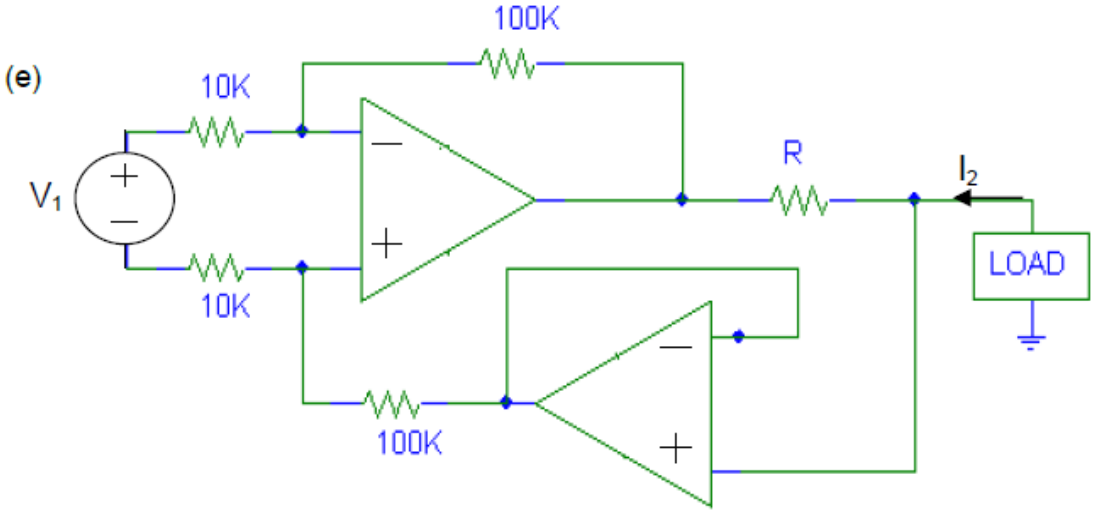
2. Assuming the opamp(s) to be ideal, obtain the input-output relationships of the given circuits.



3.

Three pressure-sensitive sensors are used to double-check the weight readings obtained from the suspension systems of a long-range jet airplane. Each sensor is calibrated such that 10 μV corresponds to 1 kg.

(a) Design a circuit which adds the three voltage signals to produce an output voltage calibrated such that 10 V corresponds to 400,000 kg, the maximum take-off weight of the aircraft.

(b) Verify your design by analyzing the final circuit.