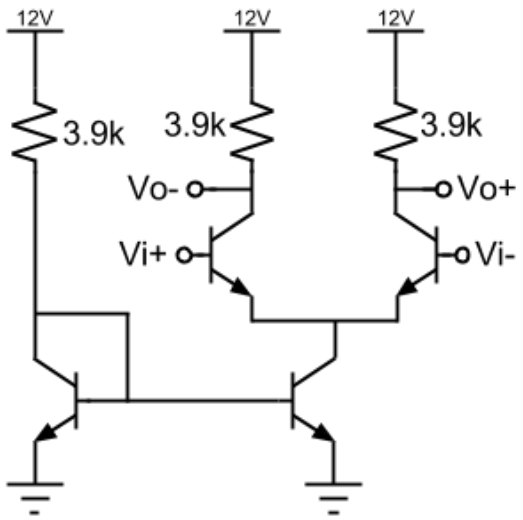

Figure 1: A sample design for a differential amplifier.

In this lab you will build and characterize a differential amplifier. The learning goals are listed below:

- Observe the use a current mirror to create a bias point.
- Become familiar with the analysis a differential amplifier.
- Familiarize yourself with the definition and measurement of differential design specifications.

IMPORTANT NOTE: This is the first stage of your operational amplifier. Please keep it on your breadboard for use in future labs.

1 Build and Measure a Differential Amplifier

1. Calculate I_{tail}, A_{dm}, A_{cm}, $CMRR$, $PSRR$, and V_{sw} for the differential amplifier pictured in Figure 1
2. Build the circuit pictured in Figure 1.
3. Measure the offset voltage of your constructed amplifier.
4. Measure I_{tail}, A_{dm}, A_{cm}, $CMRR$, $PSRR$, and V_{sw} of the circuit you built. Be sure to adjust your test inputs so that the current in each of the differential transistors is the same. Reconcile your measurements against your calculations.

One of the great nuisances of differential amplifier tests is the need to create a two tricky small signal inputs: the differential inputs v_{ip} and v_{in} and the power supply input used to find the $PSRR$.

You can make the differential inputs by using two op-amps, one configured as an inverting amplifier and the other as non-inverting. You can use these two op-amps to set the common mode bias voltage as well by adding in offset voltages. Consider using potentiometers to set the offest voltages because you will need to trim them to find your amplifiers input-referred offset voltage. If you're feeling bold, consider the poor man's balun discussed in lab.

You can add a small signal voltage ripple to the power supply by capacitively coupling from the signal generator.