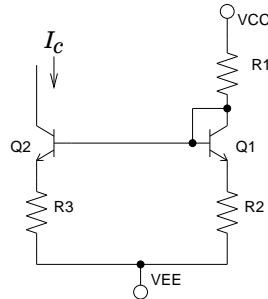# Physics 536 - Assignment #7

1. Consider the current mirror circuit shown below:

Determine appropriate values for R_1, R_2 and R_3 that will produce $V_b = -5$ V and give $I_c = 10$ mA when $V_{CC} = +10$ V and $V_{EE} = -10$ V. A reasonable choice for the current that will flow through Q_1 is 1 mA. Assume that $V_{be} = 0.7$ V.

2. Suppose the current mirror described in question 1 was used as a current source in the differential pair amplifier shown below:
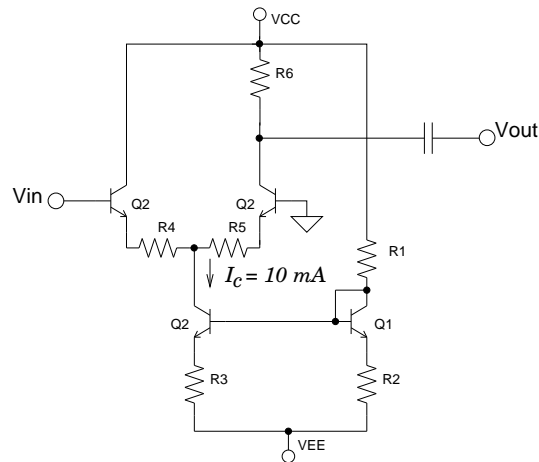
Suppose the component values were $R_4 = R_5 = 50$ Ω and $R_6 = 500$ Ω and that the capacitor is large enough that it does not change the shape of the output waveform.

(a) Show that the small signal gain of this circuit is $G = +5$.

(b) What is the output impedance of this circuit?

(c) If the circuit were connected to a resistive load, $R_L = 5$ kΩ, what would be the amplitude of the voltage, v_L, measured across the load, in terms of v_{in}?

3. Suppose the output of the previous circuit was connected to an emittor follower using a transistor with $\beta = 100$ as shown below, in which $R_7 = 100$ kΩ and $R_8 = 1$ kΩ. The purpose of R_7 is to keep the base of Q_3 at a well defined DC voltage.
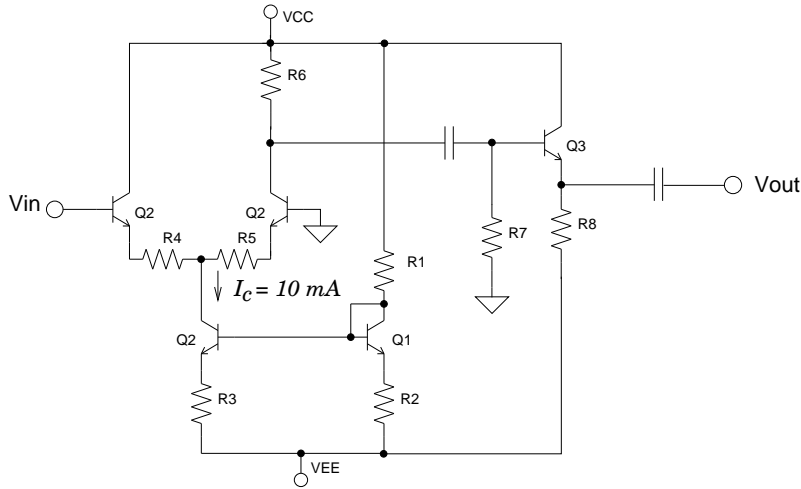
(a) What is the output impedance of this amplifier circuit?

(b) If a resistive load of $R_L = 500$ Ω, what would be the amplitude of the voltage, v_L, measured across the load?