

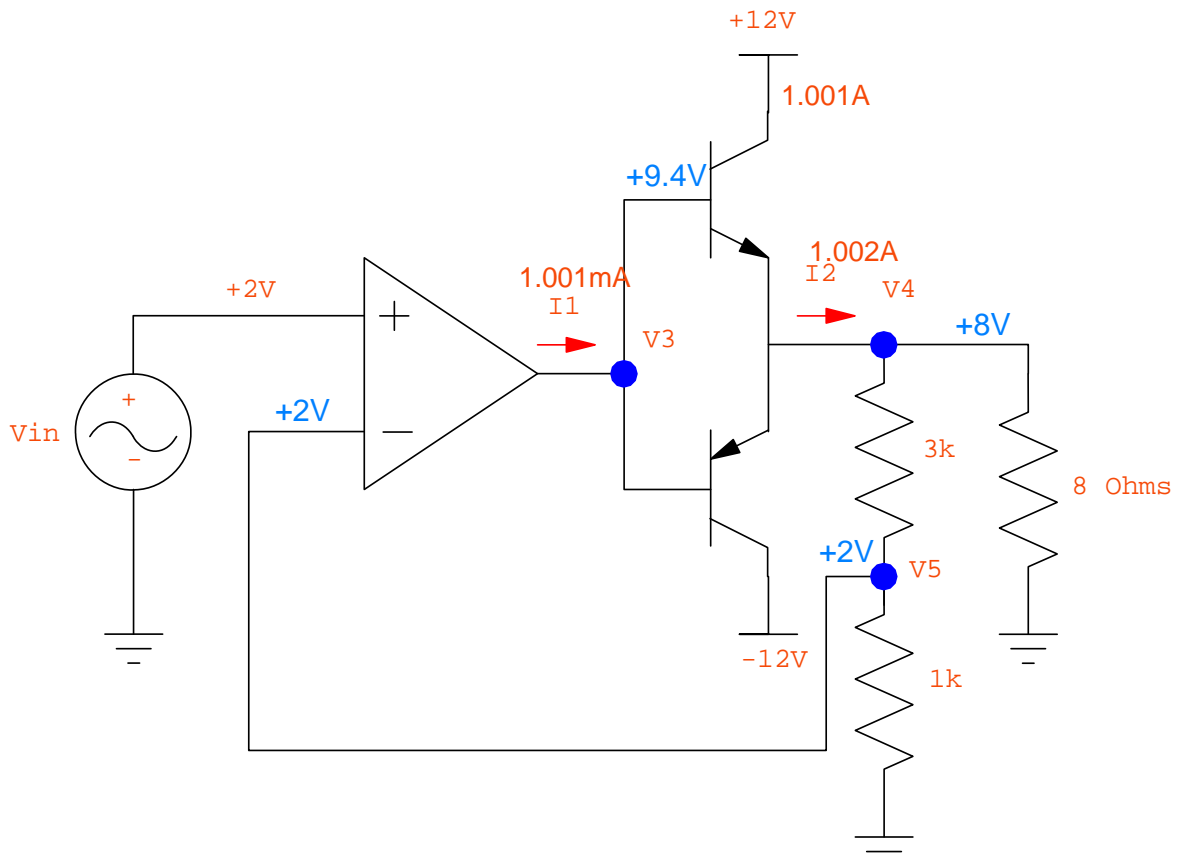
ECE 321 - Quiz #1 - Name _____

Push-Pull Amplifiers, Op-Amp Amplifiers, April 4, 2019

1) Determine the voltages and currents for the following push-pull amplifier. Assume TIP transistors:

- $\beta = 1000$
- $|V_{be}| = 1.4V$
- $\min(|V_{ce}|) = 0.9V$

I1	I2	V3	V4	V5
1.001 mA	1.002 mA	9.4 V	8 V	2 V



$$I_2 = \left(\frac{8V}{8\Omega} \right) + \left(\frac{8V}{4k\Omega} \right) = 1.002A$$

$$I_e = I_2 = (1 + \beta)I_b$$

$$I_1 = I_b = \frac{1.002A}{1001} = 1.001mA$$

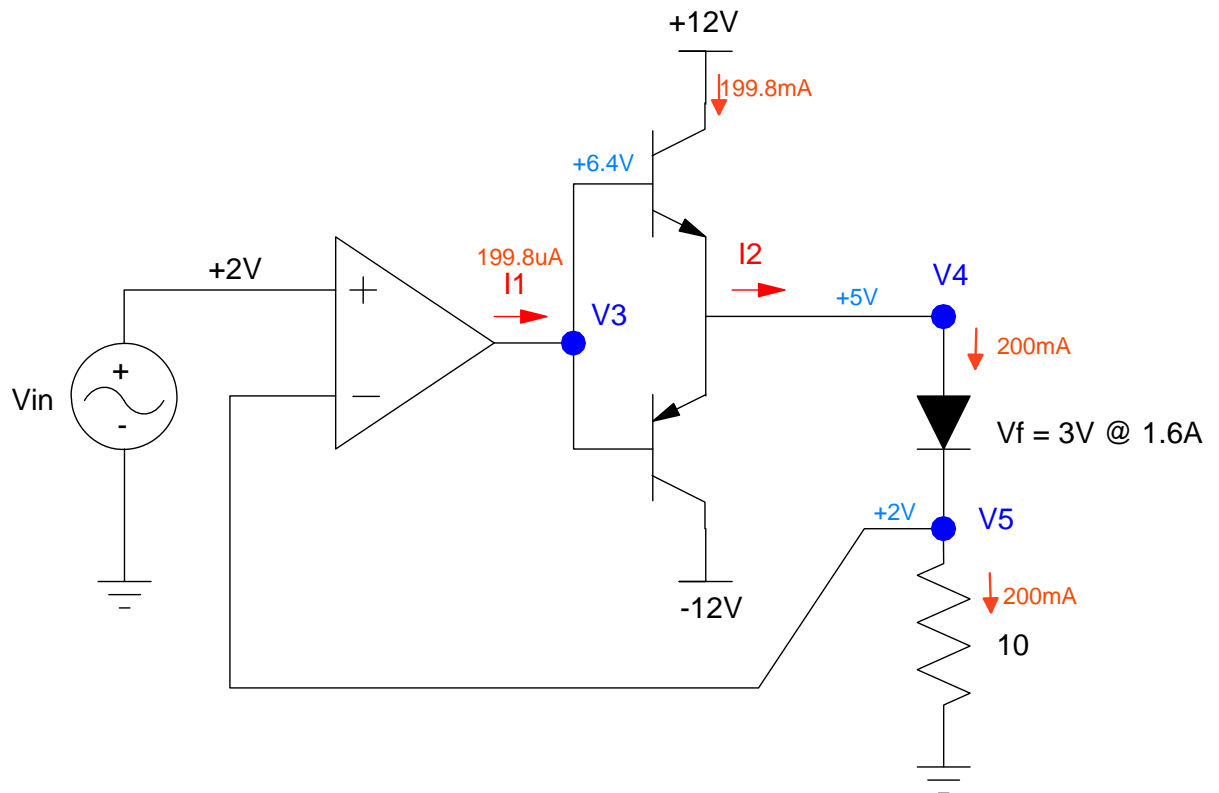
2) Determine the voltages and currents for the following current amplifier. Assume TIP112 transistors:

- $\beta = 1000$
- $V_{be} = 1.4V$
- $\min(V_{ce}) = 0.9V$

Also assume a 5W white LED

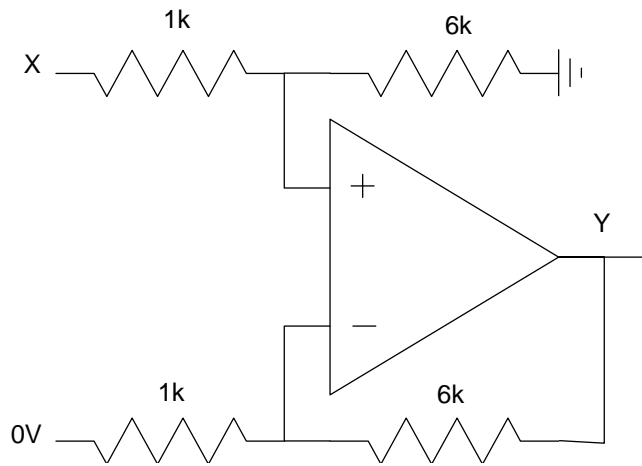
- $V_f = 3.0V @ 1.6A$

I1	I2	V3	V4	V5
200 μA	200 mA	6.4 V	5 V	2 V



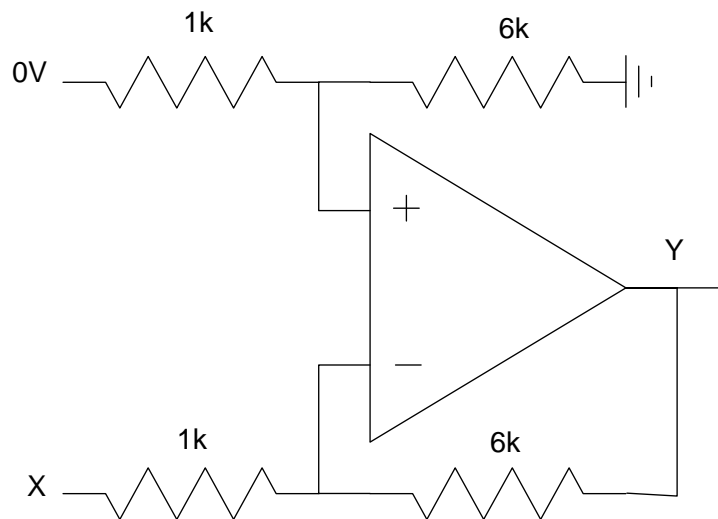
3a) Design an op-amp circuit with a gain of +6

$$Y = 6X$$



3b) Design an op-amp circuit with a gain of -6

$$Y = -6X$$

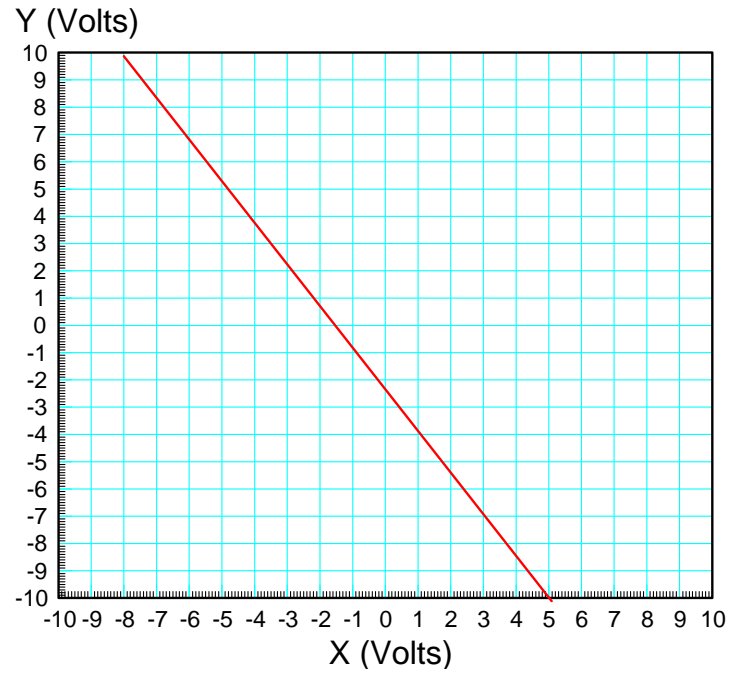


4a) Determine the relationship between X and Y from the following graph.

$$\text{Slope} = \frac{-20}{13} = -1.54$$

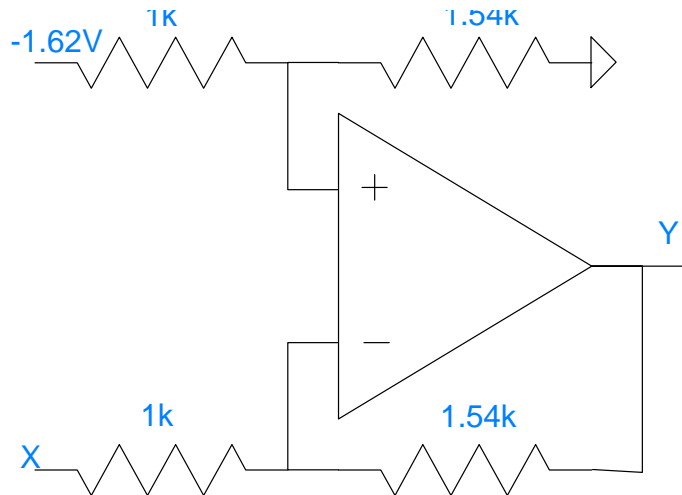
Zero intercept = -2.5

$$y = -1.54x - 2.5$$



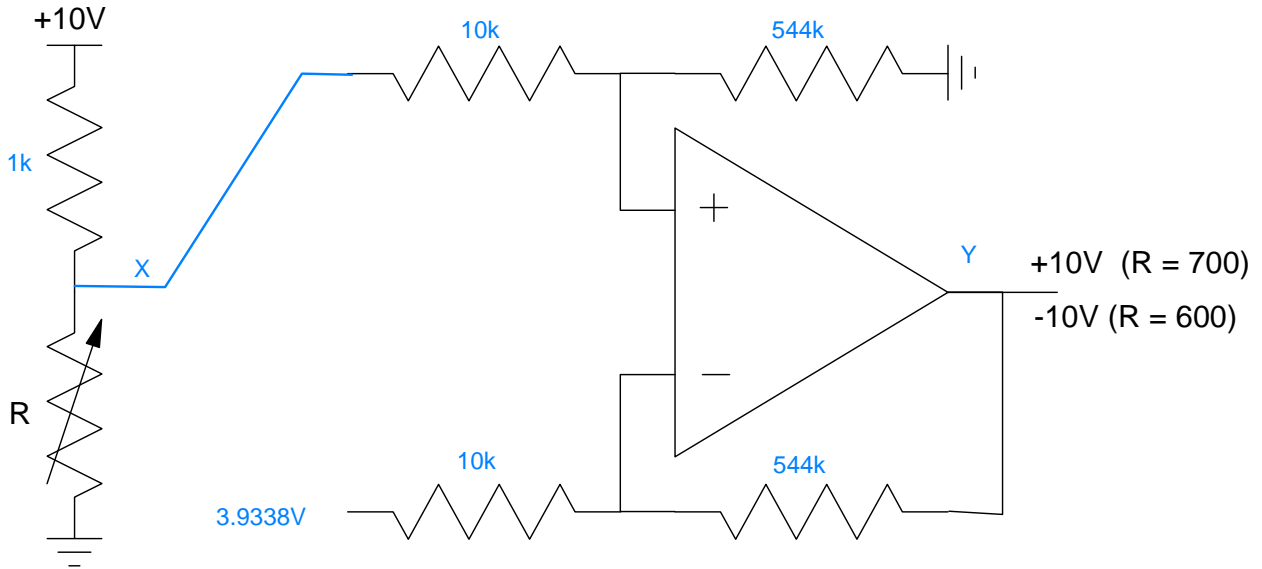
4b) Design an op-amp circuit to match the following relationship between X and Y:

$$y = 1.54(-1.62 - x)$$



5) Design a circuit which outputs

- -10V when R = 600 Ohms
- +10V when R = 700 Ohms



600 Ohms:

$$X = \left(\frac{600}{600+1000} \right) 10V = 3.75V$$

700 Ohms

$$X = \left(\frac{700}{700+1000} \right) 10V = 4.1176V$$

$$\text{gain} = \left(\frac{10V - (-10V)}{4.1176V - 3.75V} \right) = 54.40$$

The output is 0V at the midpoint

$$\text{Offset} = \left(\frac{3.75+4.1176}{2} \right) = 3.9338V$$

or.... use one of the endpoints

$$y = \left(\frac{R_2}{R_1} \right) (A - B)$$

$$10V = 54.40(4.1176 - \text{Offset})$$

$$\text{Offset} = 3.9338V$$

Single Payer Trivia!!! What is the combined annual salary of the top 65 executives of insurance companies?

\$1.6 billion. (Source: Bernie Sanders)

<https://www.nytimes.com/interactive/2018/05/25/business/ceo-pay-2017.html>