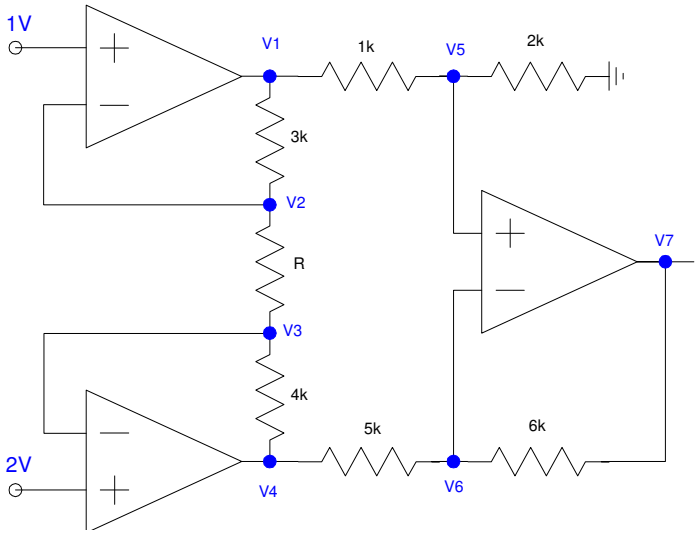
ECE 321 - Quiz #1 - Name _____

Op-Amp Amplifiers & mixers., Push-Pull Amplifiers

1) Give 7 equations which allow you to solve for the 7 unknown voltages. You do not need to solve.

- Assume ideal op-amps.
- Assume R = 900 + 100*(your birth month) + (your birth day).



Vp = Vm

$$V_2 = 1V$$

$$V_3 = 2V$$

$$V_5 = V_6$$

Conservation of current

$$\left(\frac{V_2 - V_1}{3k}\right) + \left(\frac{V_2 - V_3}{R}\right) = 0$$

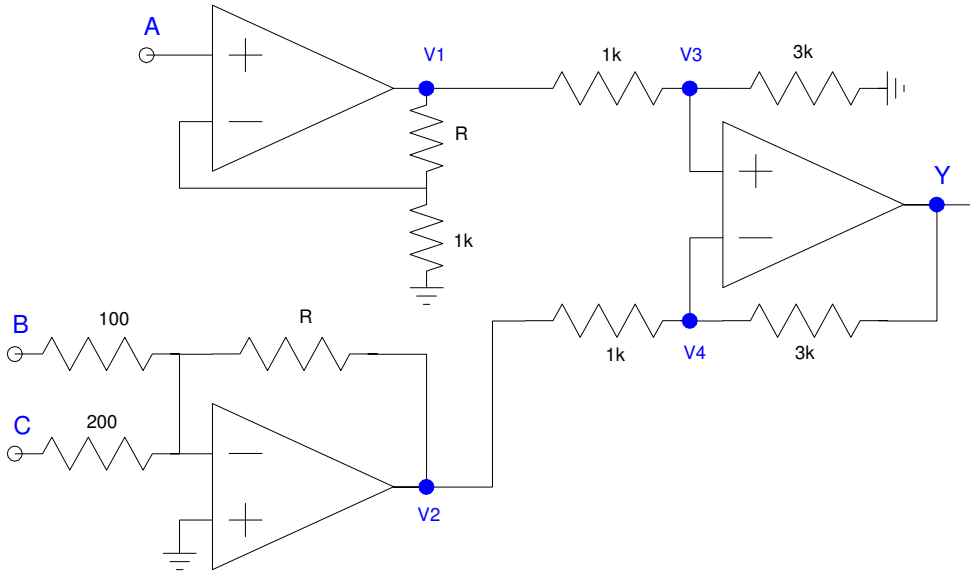
$$\left(\frac{V_3 - V_2}{R}\right) + \left(\frac{V_3 - V_4}{4k}\right) = 0$$

$$\left(\frac{V_5 - V_1}{1k}\right) + \left(\frac{V_5}{2k}\right) = 0$$

$$\left(\frac{V_6 - V_4}{5k}\right) + \left(\frac{V_6 - V_7}{6k}\right) = 0$$

2) Determine Y as a funciton of A, B, and C.

- Assume ideal op-amps
- Assume R = 900 + 100*(your birth month) + (your birth day).



$$V_1 = \left(1 + \frac{R}{1k}\right)A$$

$$V_2 = -\left(\frac{R}{100}\right)B - \left(\frac{R}{200}\right)C$$

$$Y = 3(V_1 - V_2)$$

$$Y = 3\left(1 + \frac{R}{1k}\right)A + \left(\frac{3R}{100}\right)B + \left(\frac{3R}{200}\right)C$$

3) Design a circuit which outputs

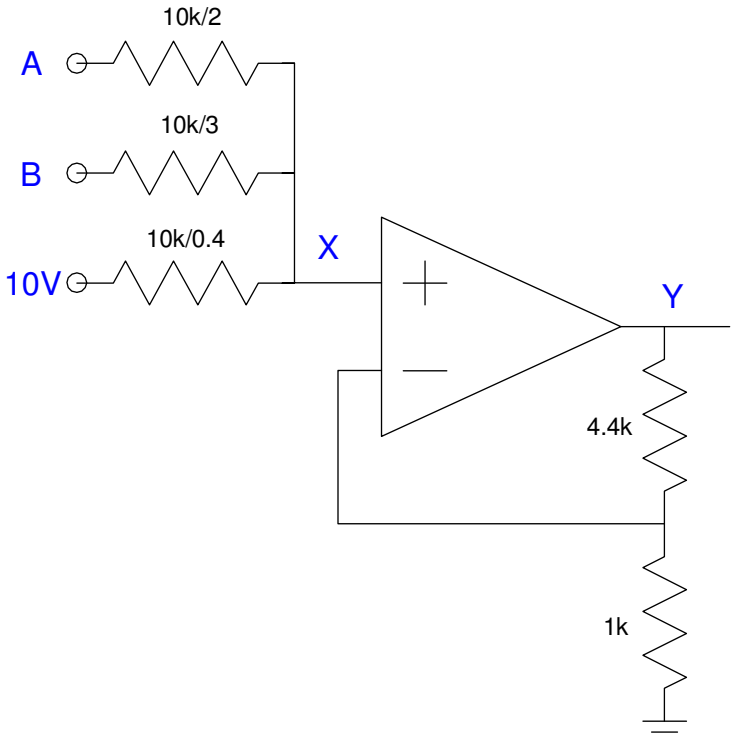
Y = 4 + 2A + 3B

note: the gain on A and B are positive

Assume a 10V source is available

$$X = \left(\frac{0.4 \cdot 10V + 2A + 3B}{5.4} \right)$$

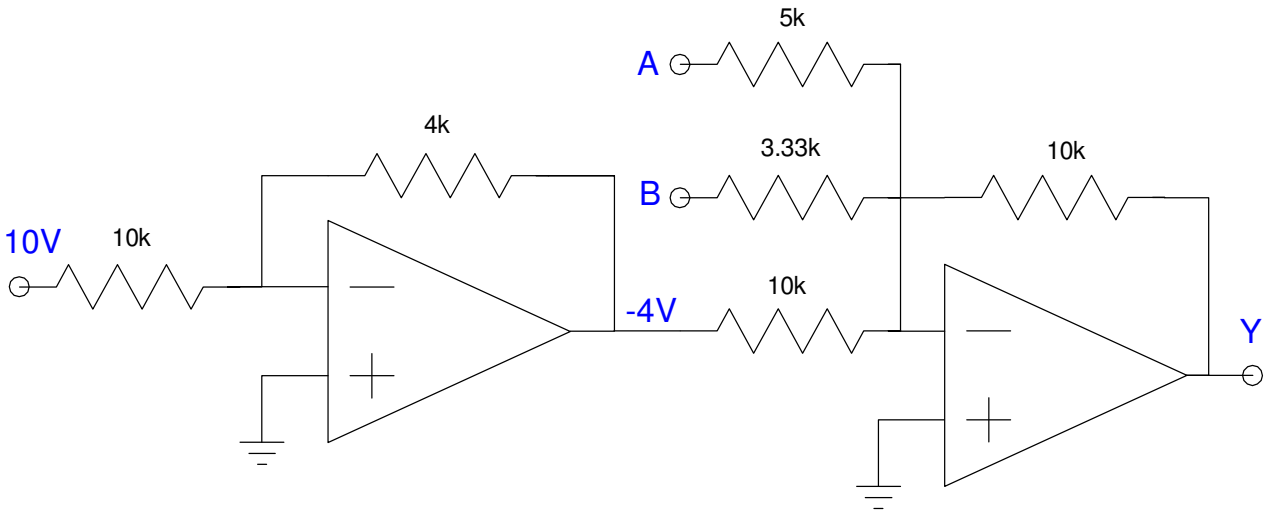
$$Y = 5.4X$$



4) Design a circuit which outputs

Y = 4 - 2A - 3B

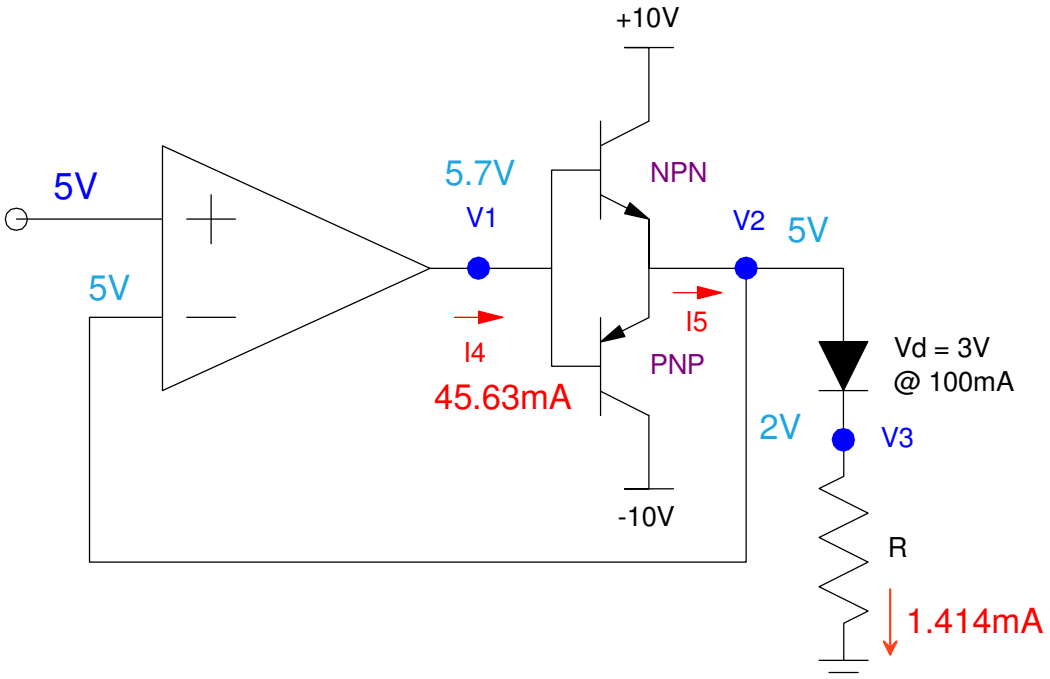
note: the gain on A and B are negative



5) Determine the voltages and currents for the following push-pull amlifier. Assume

- Ideal op-amps
- R = 900 + 100*(your birth month) + (your birth day)
- Transistors with:
  - $\beta = 30$
  - $|V_{be}| = 0.7V$

R 900 + 100*mo + day	V1	V2	V3	I4	I5
1414	**5.7V**	**5.0V**	**2.0V**	**45.63uA** I5 / 31	**1.414mA** 2V / R



6) Determine the voltages and currents for the following push-pull amlifier. Assume

- Ideal op-amps
- R = 900 + 100*(your birth month) + (your birth day)
- Transistors with
  - $\beta = 30$
  - $|V_{be}| = 0.7V$

R 900 + 100*mo + day	V1	V2	V3	I4	I5
1414	**8.70 V**	**8.00 V**	**5.00 V**	**114.1uA** I5 / 31	**3.536mA** 5V / R