ECE 321 - Quiz #1 - Name _____

Op-Amp Amplifiers, Push-Pull amplifiers.

Calculators, internet, Matlab permitted.

1) Determine the voltages V1..V4

V1	V2	V3	V4
0.99995V	**0.999935V**	**4.999875V**	**2.99905V**
1.000V	**1.000V**	**5.000V**	**3.000V**

$$\left(\frac{V_1-1}{100}\right)+\left(\frac{V_1}{2{,}000{,}000}\right)=0$$

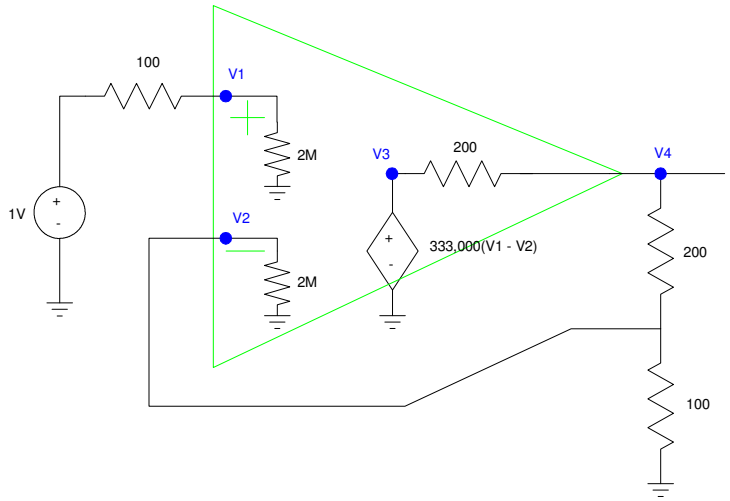
$$\left(\frac{V_2-V_4}{200}\right)+\left(\frac{V_2}{100}\right)+\left(\frac{V_2}{2{,}000{,}000}\right)=0$$

$$V_3=333333(V_1-V_2)$$

$$\left(\frac{V_4-V_3}{200}\right)+\left(\frac{V_4-V_2}{200}\right)=0$$

Solving in Matlab

```
-->A = [1/100+1/2e6, 0, 0, 0 ;
-->0,1/200+1/100+1/2e6,0,-1/200;
-->333333,-333333,-1,0;
-->0,-1/200,-1/200,1/200+1/200]
 A  =

    0.0100005    0.           0.        0.
    0.           0.0150005    0.      - 0.005
    333333.    - 333333.    - 1.        0.
    0.         - 0.005      - 0.005     0.01

-->B = [1/100;0;0;0]
 B  =

    0.01
    0.
    0.
    0.

-->V = inv(A)*B
 V  =

    0.99995
    0.999935
    4.999875
    2.999905
```



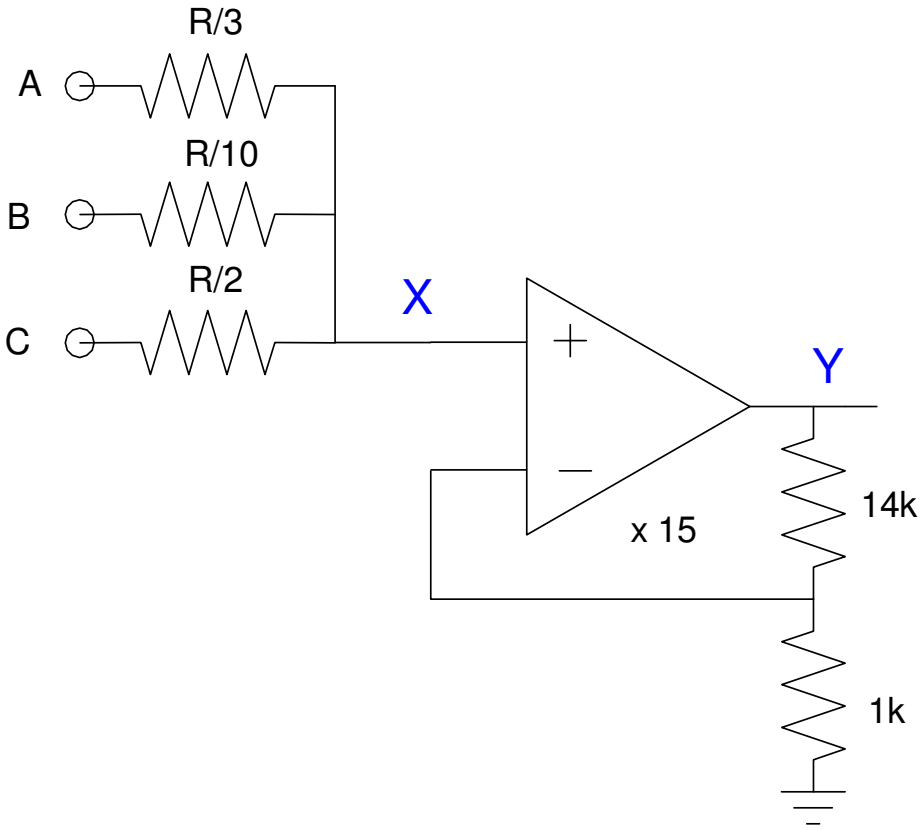
2) Assume signals A, B, C are 1Vpp signals in the range of 20-1000 Hz, capable of driving 1mA. Design an amlifier so that the output is

$$Y = 3A + 10B + 2C$$

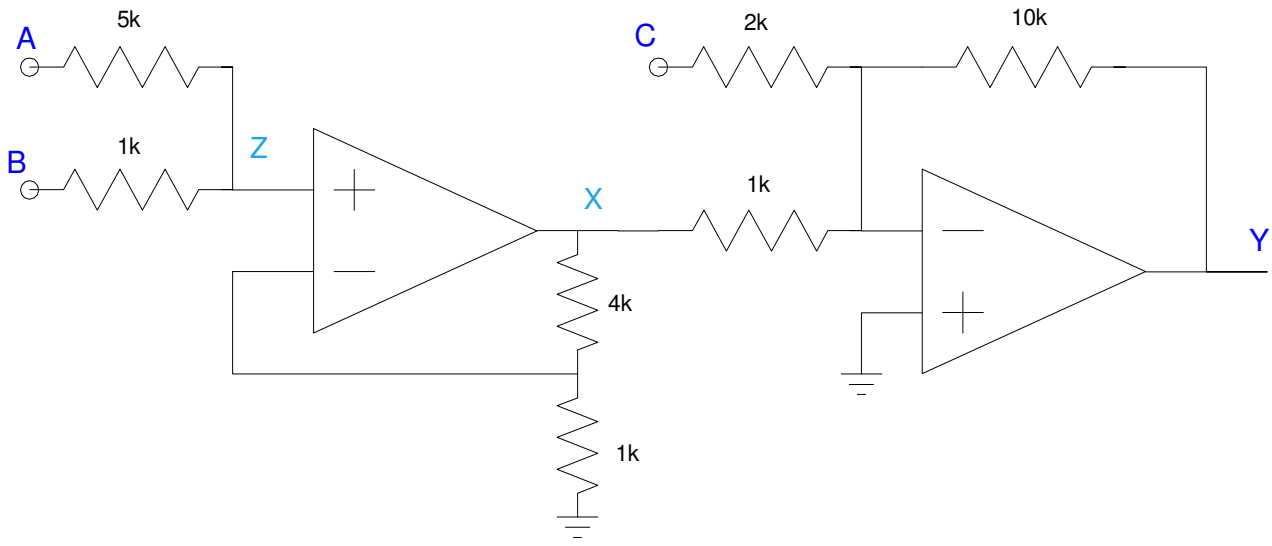
There are many solutions. This is one

$$X = \left(\frac{3A+10B+2C}{15}\right)$$

$$Y = 15X$$



3) Determine Y as a funciton of A, B, and C. Assume ideal op-amps



$$Z = \left(\frac{A+5B}{6}\right)$$

$$X = 5Z = \left(\frac{5}{6}\right)A + \left(\frac{25}{6}\right)B$$

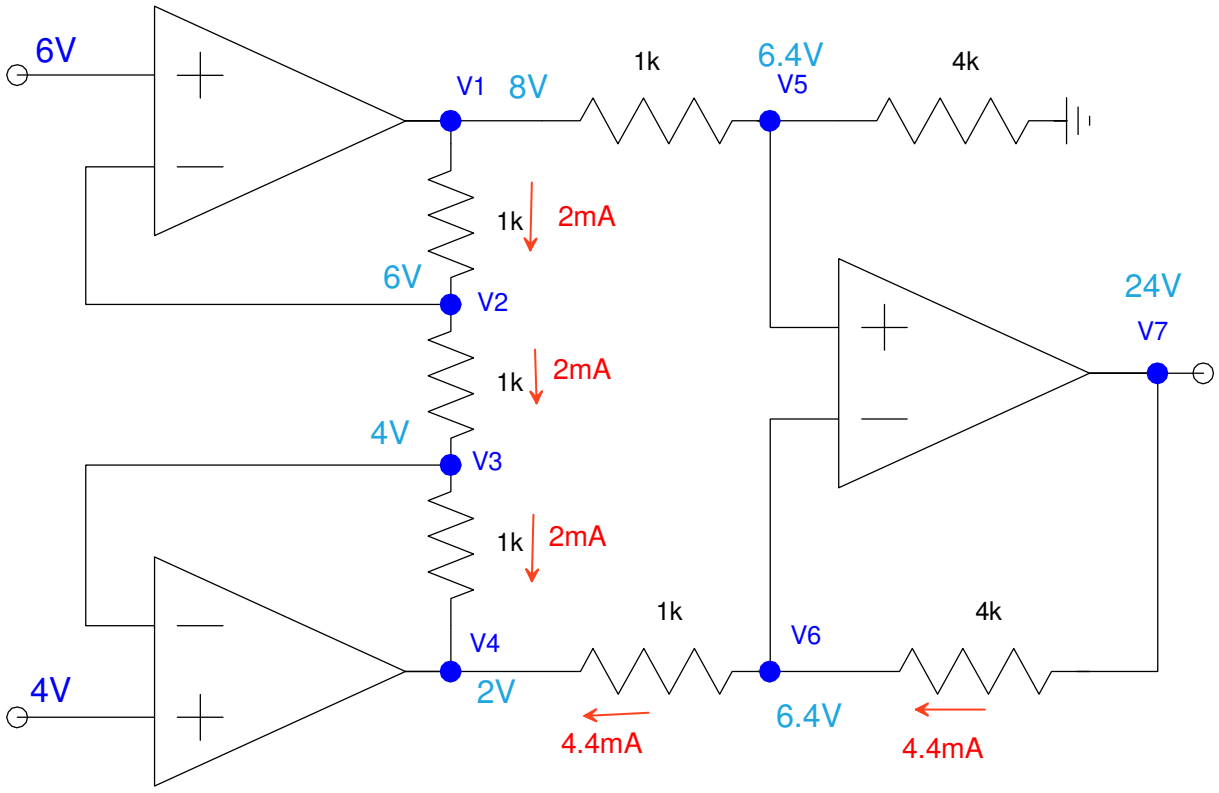
$$Y = -\left(\frac{10k}{1k}\right)X - \left(\frac{10k}{2k}\right)C$$

$$Y = -\left(\frac{50}{6}\right)A - \left(\frac{250}{6}\right)B - 5C$$

$$\boxed{Y = -8.333A - 41.667B - 5.00C}$$

4) Determine the voltges for the following op-amp circuit. Assume ideal op-amps

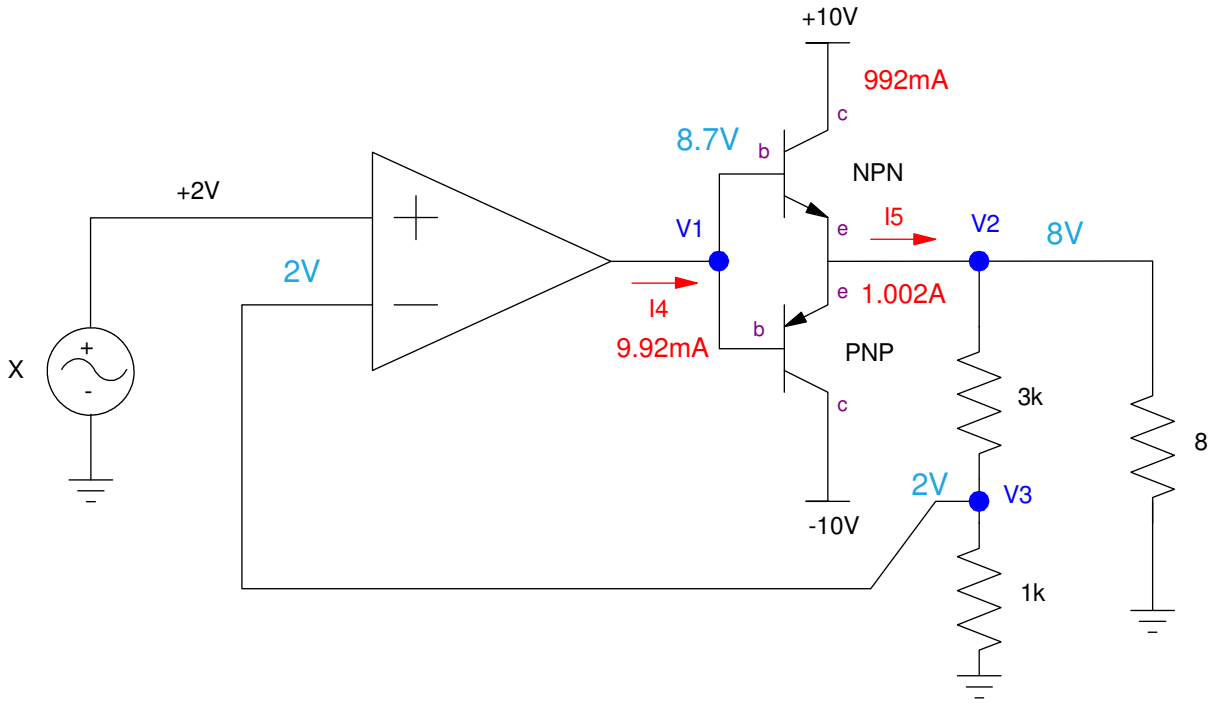
V1	V2	V3	V4	V5	V6	V7
8V	**6V**	**4V**	**2V**	**6.4V**	**6.4V**	**24V**



5) Determine the voltages for the following push-pull amplifier. Assume

- | Vbe | = 0.7V
- beta = 100

V1	V2	V3	I4	I5
8.7V	**8.00V**	**2.00V**	**9.92mA**	**1.002A**



6) Determine the voltages for the following push-pull amplifier. Assume

- | Vbe | = 0.7V
- beta = 100

V1	V2	V3	I4	I5
5.70V	**5.00V**	**2.00V**	**1.98mA**	**200mA**