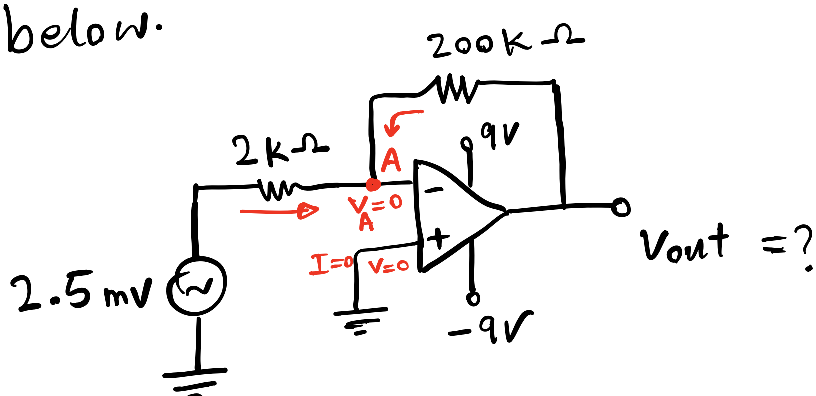
Op-Amp Examples

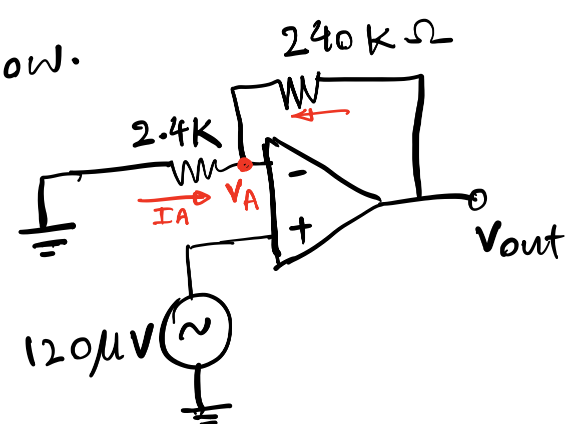
1- Find V_{out} in the op Amp circuit below.



$$\frac{V_{out}}{200\,k\Omega} = -\frac{2.5\,mV}{2\,k\Omega}$$

$$V_{out} = -\frac{200\,k\Omega}{2\,k\Omega}\, 2.5\,mV = -250\ mV$$

2- Find V_{out} in the op-Amp circuit below.

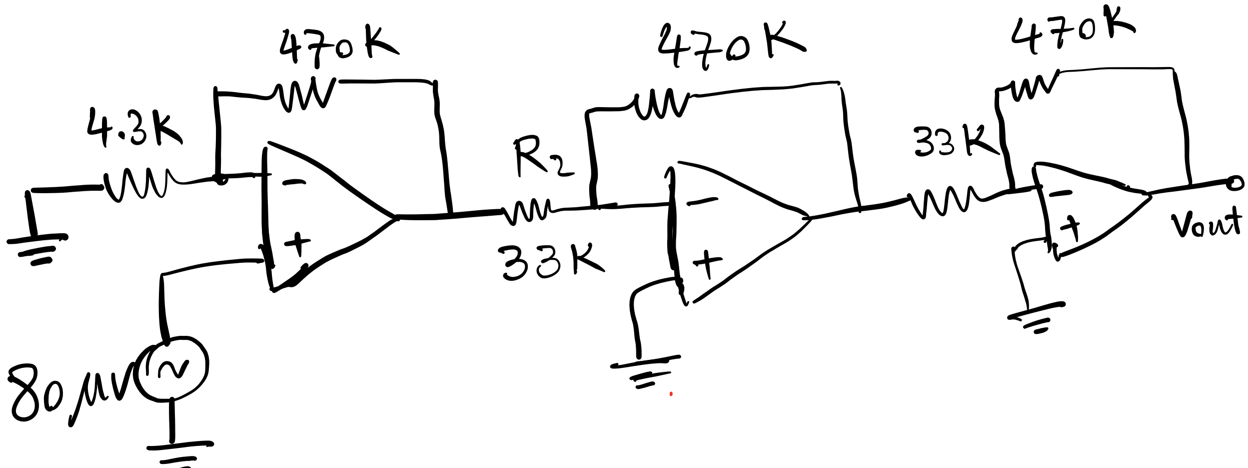


$$1 + \frac{240k\Omega}{2.4k\Omega} = 1 + 100 = 101$$

$$V_{out} = (101)(120\,\mu V) = \frac{101 \times 120}{1000}\,mV$$

$$V_{out} = 12.12\,mV$$

3- Find V_{out} in the Op-Amp circuit below.

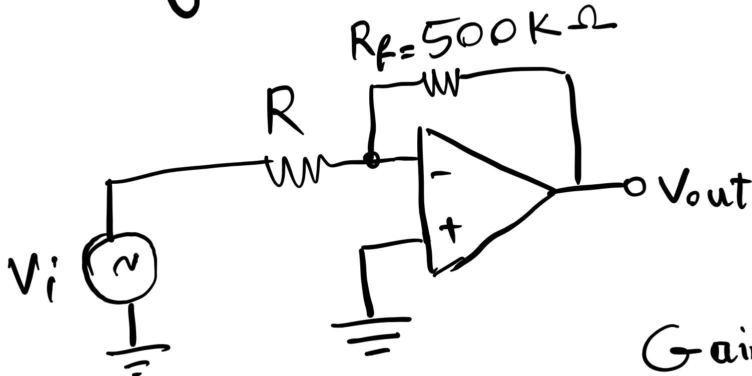


$$V_{out} = \left(1 + \frac{470}{4.3}\right)\left(-\frac{470}{33}\right)\left(-\frac{470}{33}\right) 80\,\mu V$$

$$V_{out} = (110)(-14.2)(-14.2)\ 80\,\mu V$$

$$V_{out} = 22.2 \times 10^{3} \times 80\,\mu V = 1.78\ V$$

4- Find the resistor value R for a gain of -10, -20, and -50.



$$Gain = \frac{V_{out}}{V_{in}}$$

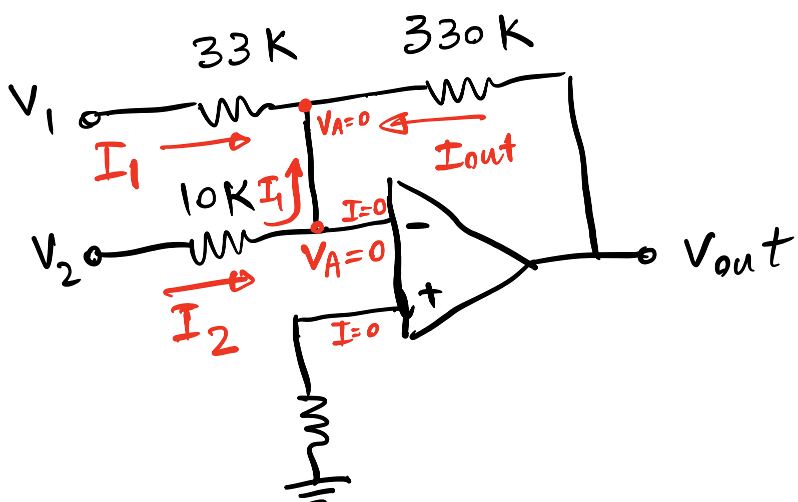
$$\frac{V_{out}}{R_f} = -\frac{V_i}{R} \Rightarrow Gain = -\frac{R_f}{R}$$

$$-10 = -\frac{500}{R} \Rightarrow R = 50\ K\Omega$$

$$-20 = -\frac{500}{R} \Rightarrow R = 25\ K\Omega$$

$$-50 = -\frac{500}{R} \Rightarrow R = 10\ K\Omega$$

5- Find V_{out} in the summing op-Amp in the circuit below.

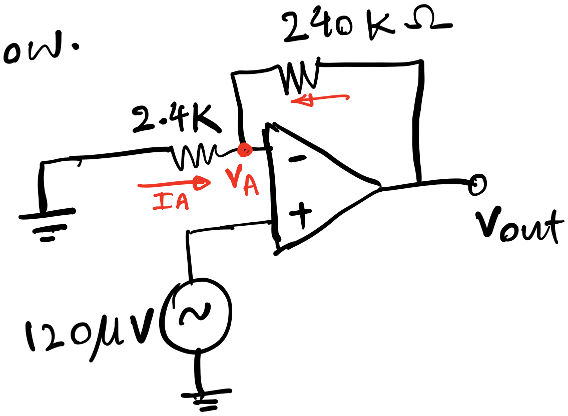


$$I_1 + I_2 = -I_{out}$$

$$\frac{V_1}{33K} + \frac{V_2}{10K} = -\frac{V_{out}}{330K}$$

$$V_{out} = -330\left(\frac{V_1}{33} + \frac{V_2}{10}\right)$$

- Find V_{out} in the op-Amp circuit below.



$V_A = 120\mu V$

$$\frac{120\,\mu V}{2.4\,K\Omega} = -\frac{120\mu V - V_{out}}{240\,K\Omega}$$

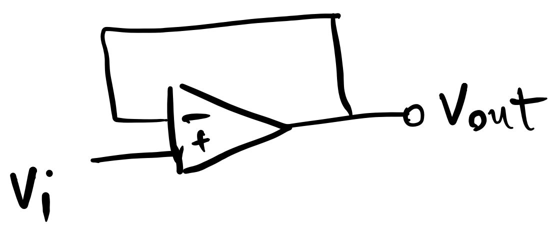
$$V_{out} = 240\,K\left(\frac{120\,\mu V}{2.4\,K} + \frac{120\,\mu V}{240\,K\Omega}\right)$$

$$V_{out} = 240\,K\left(\frac{100}{2K}\,\mu V + \frac{1}{2k}\,\mu V\right)$$

$$V_{out} = 120\;(100 + 1)\,\mu V = 120(101)\,\mu V$$

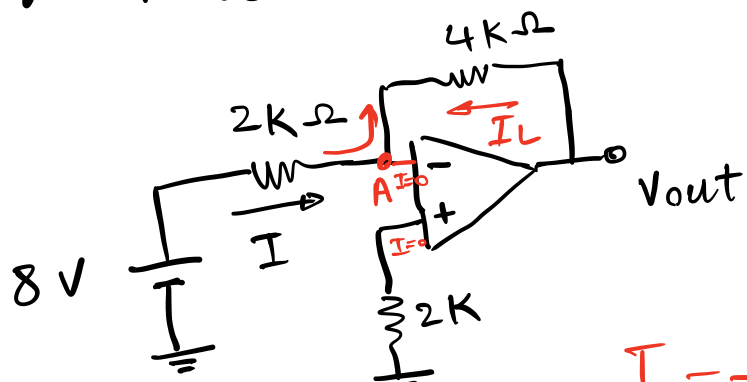
$$= 12.12\ mV$$

6- Find Vout in the Voltage Follower below.



$$V_{out} = V_i$$

7- Find I and Vout.

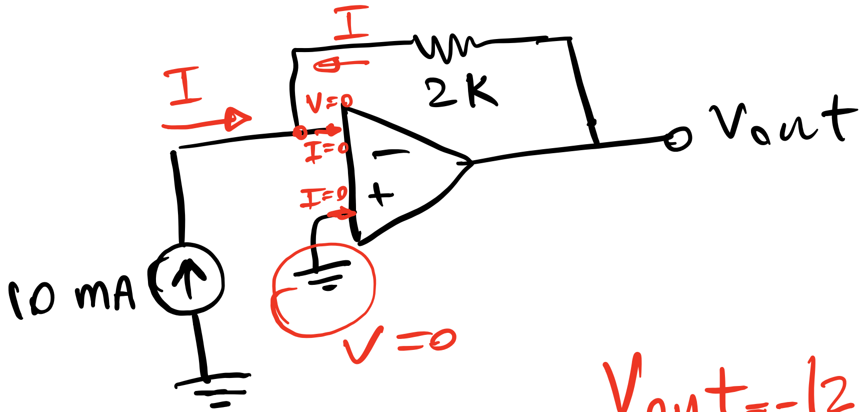


$I = -I_L$

$V_A = 0$

$$\frac{8\,V}{2\,K\Omega} = -\frac{V_{out}}{4\,K\Omega} \Rightarrow V_{out} = -16\,V$$

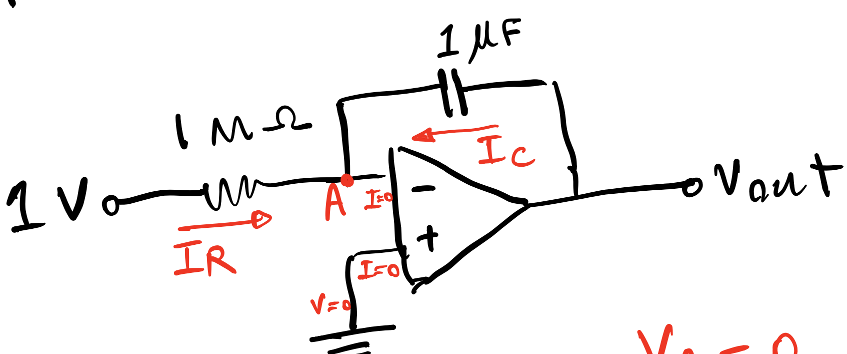
8- Find Vout.



$$V_{out} = -(2K)(10mA)$$

$$V_{out} = -20\ V$$

9- Find Vout.



$$V_A = 0$$

$$I_c = -I_R$$

$$I_c = C\frac{dV_{out}}{dt} \qquad I_R = \frac{V_{in}}{R} = \frac{1V}{1M\Omega}$$

$$C\frac{dV_{out}}{dt} = -\frac{V_{in}}{R}$$

$$V_{out} = -\frac{1}{RC}\int V_{in}\,dt$$

$$V_{out} = \frac{-1}{(1\,M\Omega)(1\,\mu F)}\int 1\,dt$$

$$V_{out} = -1\,(10^{-6})(10^{6})\int dt$$

$$V_{out} = -t$$