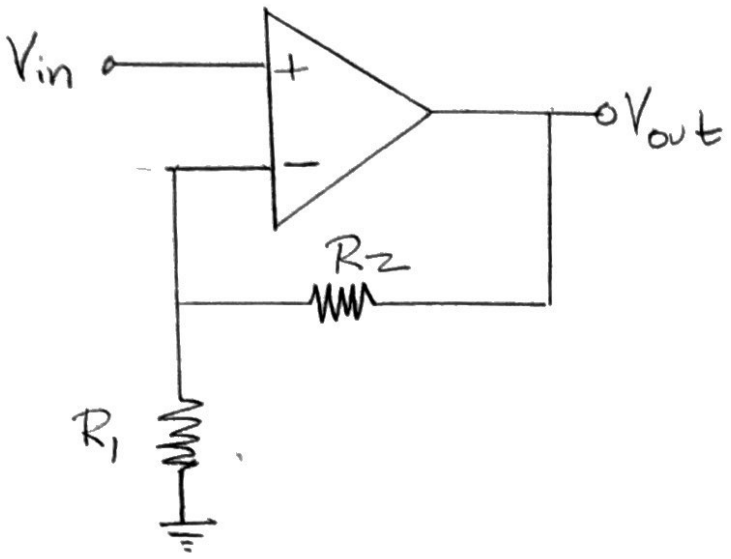
Op-Amp in Non-Inverting Configuration



The voltage on the − input is

$$V_- = V_{out}\frac{R_1}{R_1+R_2}$$

We also know (B ← a big number)

$$(V_{in}-V_-)B = V_{out}$$

We want to know V_{out} in terms of V_{in}.

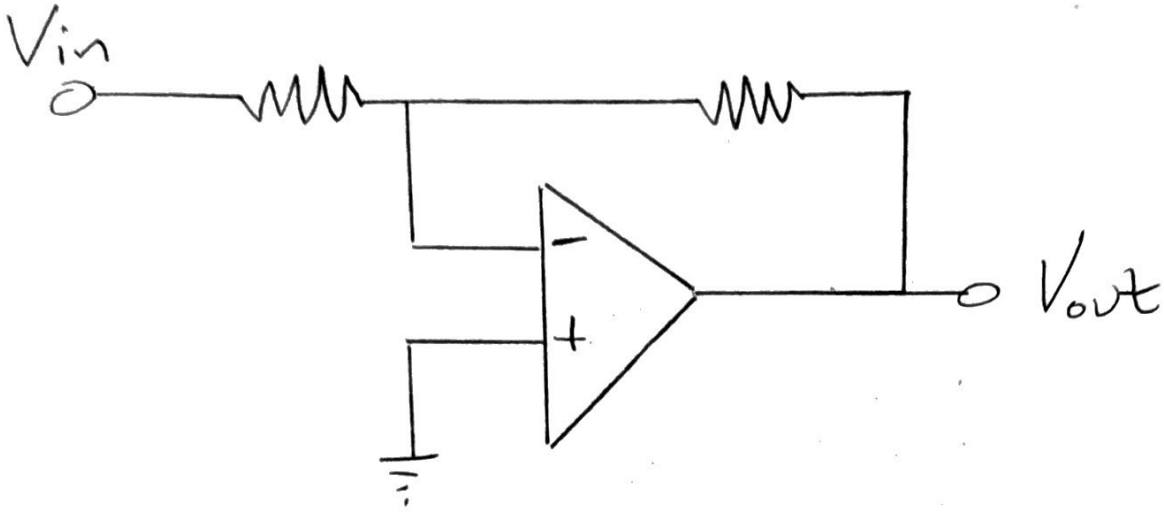
$$\left(V_{in} - V_{out}\frac{R_1}{R_1+R_2}\right)B = V_{out}$$

Gain just as claimed by Mims on p. 72 ↓

or $$V_{out}\left(1+B\frac{R_1}{R_1+R_2}\right) = BV_{in}$$

or $$V_{out} = \frac{BV_{in}}{1+B\frac{R_1}{R_1+R_2}} \approx \frac{R_1+R_2}{R_1}V_{in} = \left(1+\frac{R_2}{R_1}\right)V_{in}$$

Op-Amp in Inverting Configuration



$$V_- = V_{in} + \frac{R_1}{R_1+R_2}(V_{out} - V_{in}) = \frac{R_2}{R_1+R_2}V_{in} + \frac{R_1}{R_1+R_2}V_{out}$$

also (grounded!)

$$V_{out} = (V_+ - V_-)\,B$$

(V_+ is grounded!)

(V_{out} is negligible compared to anything multiplied by B!)

$$\Rightarrow V_- = 0$$

$$\Rightarrow R_2 V_{in} + R_1 V_{out} = 0$$

$$\Rightarrow V_{out} = -\frac{R_2}{R_1}V_{in}$$