

## 1 Op-Amp Golden Rules

Most op-amp circuits are designed to use feedback, where the output of the circuit is coupled with the input. In negative feedback, the output diminishes the gain of the amplifier (as opposed to positive feedback, where the gain increases).

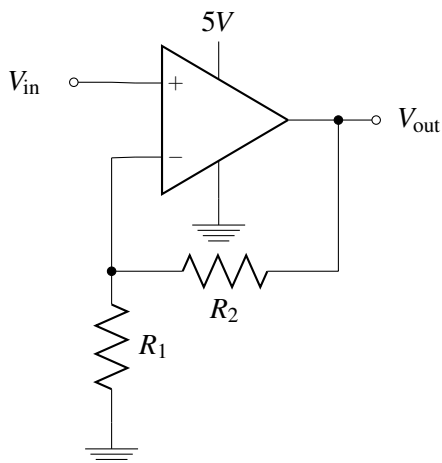
In negative feedback, an ideal op-amp has the follows these two rules:

- The two input terminals, do not draw any current.
- The input voltages  $v_+$  and  $v_-$  are equal. The first rule holds since we assume that the input resistance for an op-amp is infinite. The second rule holds because in feedback, the input and output voltage have to be the same.

### 1. Second Golden Rule

We know that the output of an op-amp cannot be higher than the supply voltage. Assuming the voltage is 15V and the gain is  $10^5$ , what does  $v_+ - v_-$  need to be?

**2. Non-Inverting Amplifier** For the circuit below, use the golden rules to find the gain of the circuit ( $\frac{V_{out}}{V_{in}}$ ).



**3. Inverting Amplifier** Find the gain for the circuit below.

