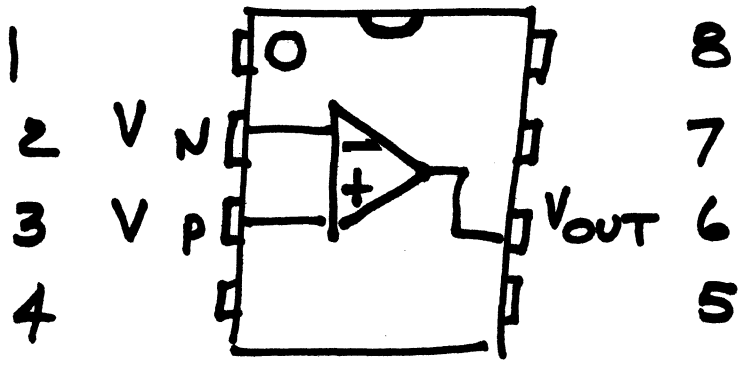
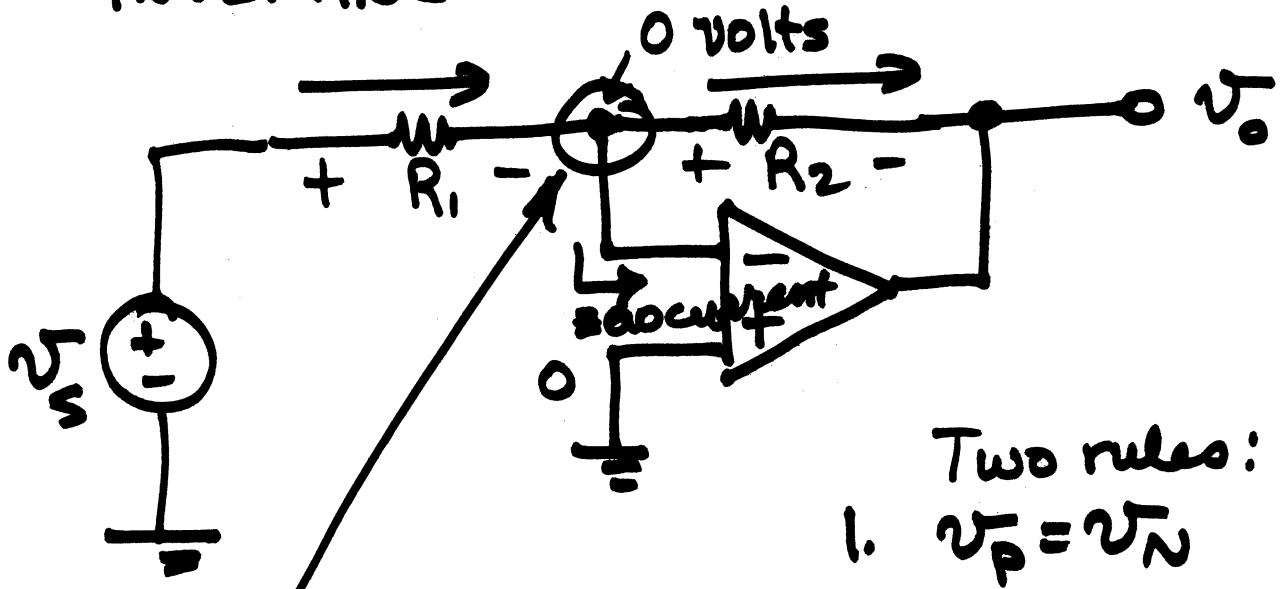
INTEGRATED CIRCUIT



OP AMP (TOP VIEW)

INVERTING AMPLIFIER



Two rules:

1. $v_p = v_N$

$\Rightarrow v_N = 0$

2. $i_p = i_N = 0$

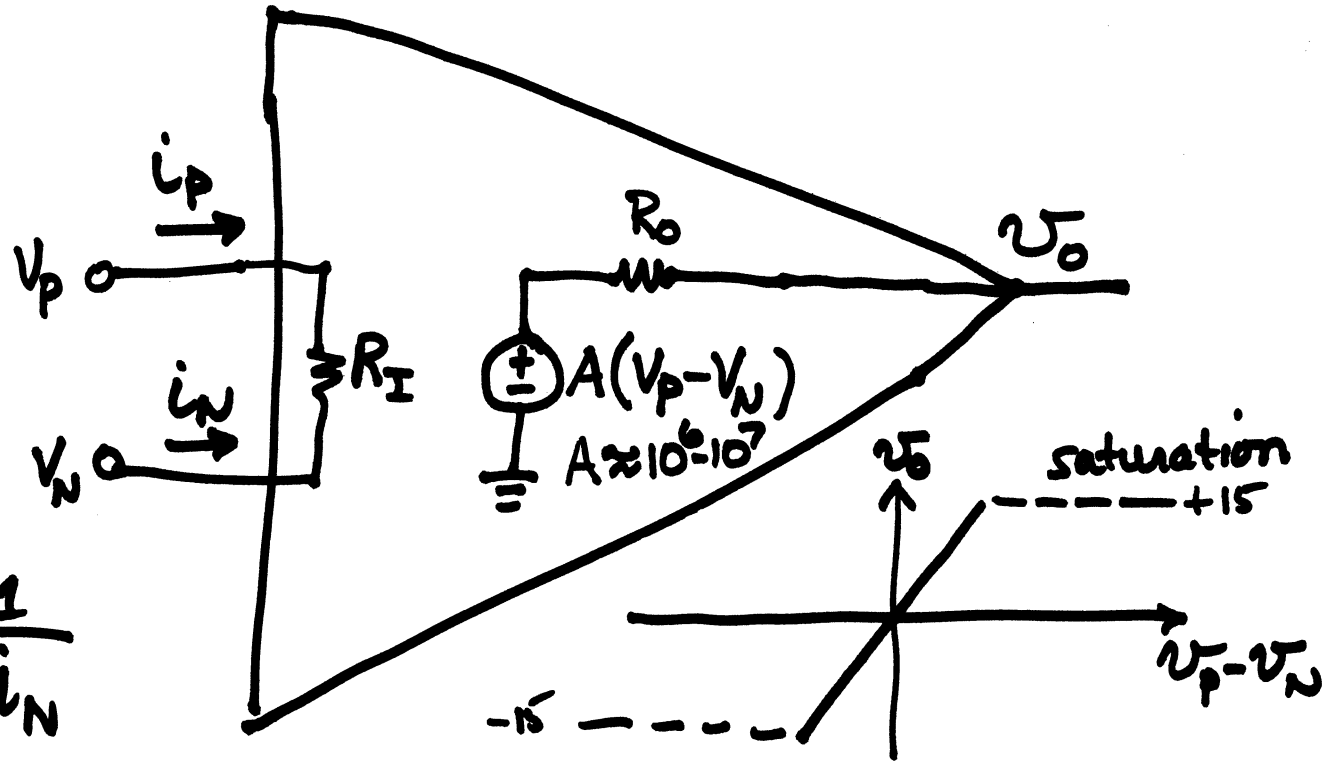
KCL @ $\sum_{\text{+in}} i = 0$

$$+\frac{v_s - 0}{R_1} + 0 \quad -\frac{0 - v_o}{R_2} = 0$$

$$\frac{v_s}{R_1} + \frac{v_o}{R_2} = 0$$

$$\frac{v_s}{R_1} = -\frac{v_o}{R_2}$$

$$\text{gain } \frac{v_o}{v_s} = -\frac{R_2}{R_1}$$



RULE 1

$i_P = i_N$

$$-V_{cc} \leq v_o \leq +V_{cc}$$

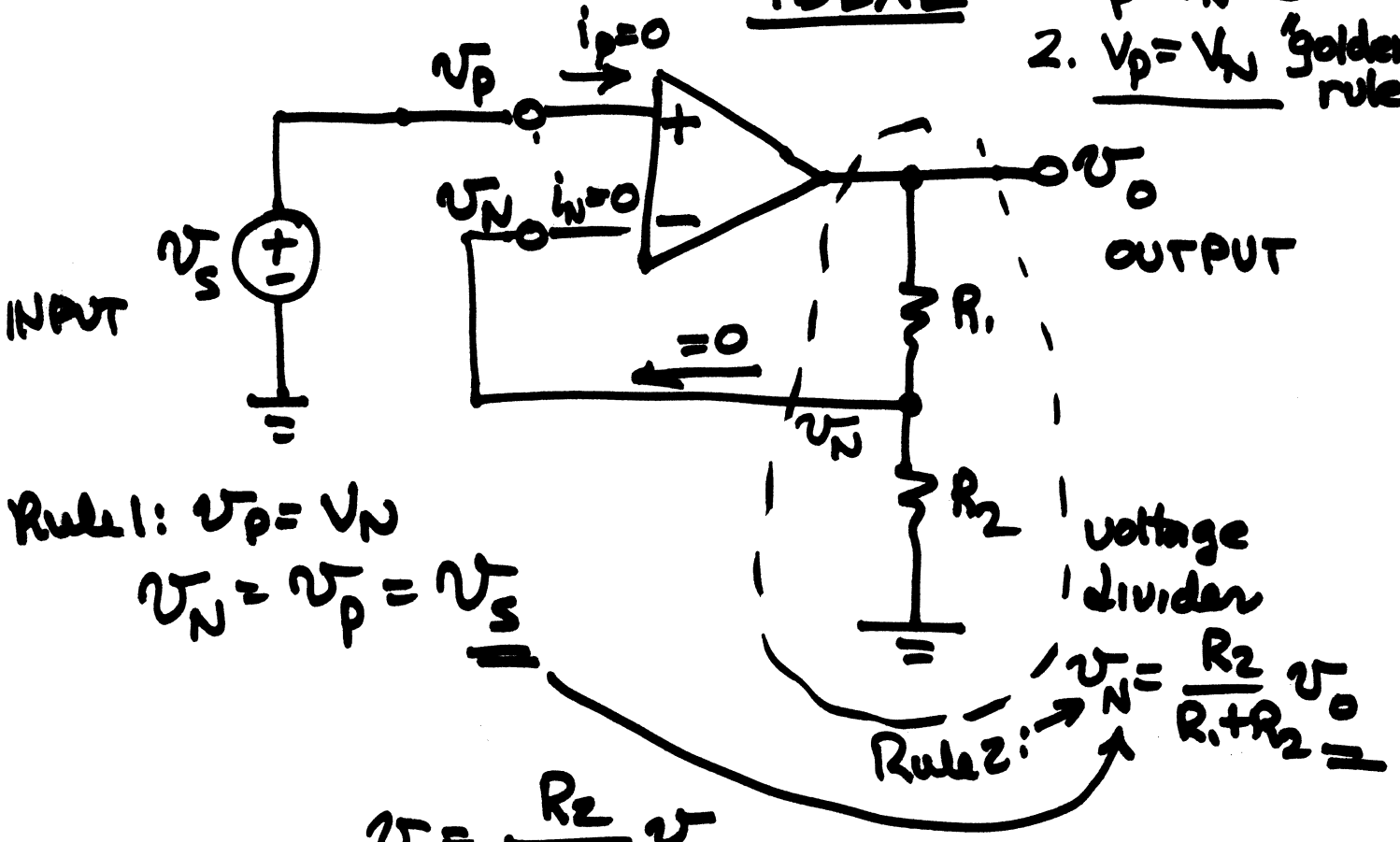
$$-V_{cc} \leq A(v_P - v_N) \leq +V_{cc}$$

$$-\frac{V_{cc}}{A} \leq v_P - v_N \leq +\frac{V_{cc}}{A}$$

RULE 2: $v_P = v_N$

IDEAL

1. $i_p = i_N = 0$
2. $v_p = v_N$ "golden rule"



Rule 1: $v_p = v_N$

$v_N = v_p = v_s$

$$v_s = \frac{R_2}{R_1+R_2} v_o$$

GAIN $$\frac{v_o}{v_s} = + \frac{R_1+R_2}{R_2}$$

NON-INUERTING AMPLIFIER