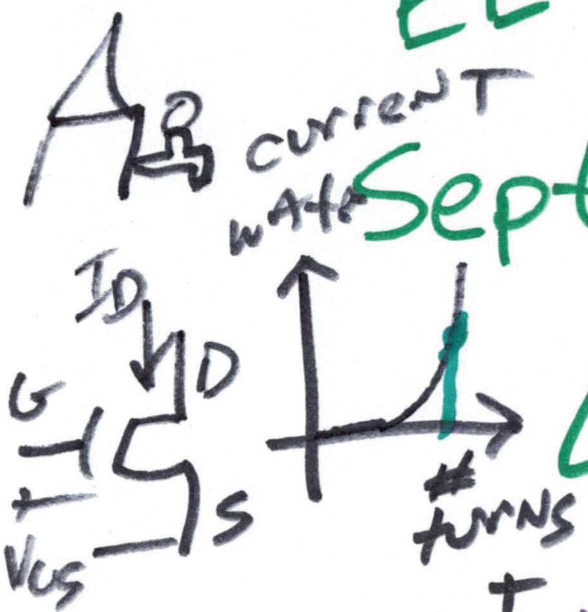
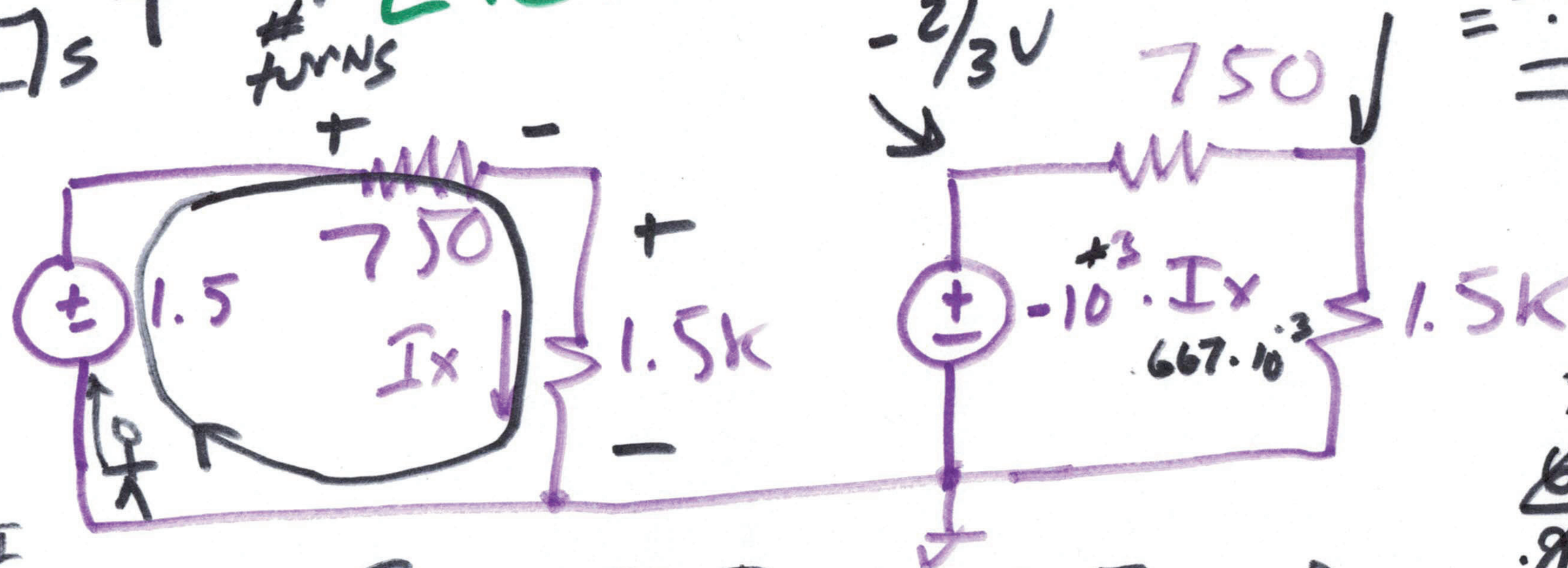
EE 220 Circuits 1

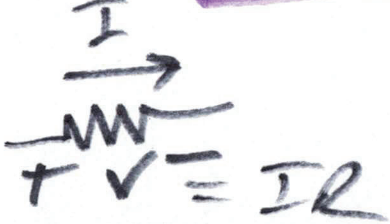
Sept. 20, 2020

Lecture 11



$$-\frac{2}{3}\cdot\frac{1.5k}{750+1.5k} = -.444V$$

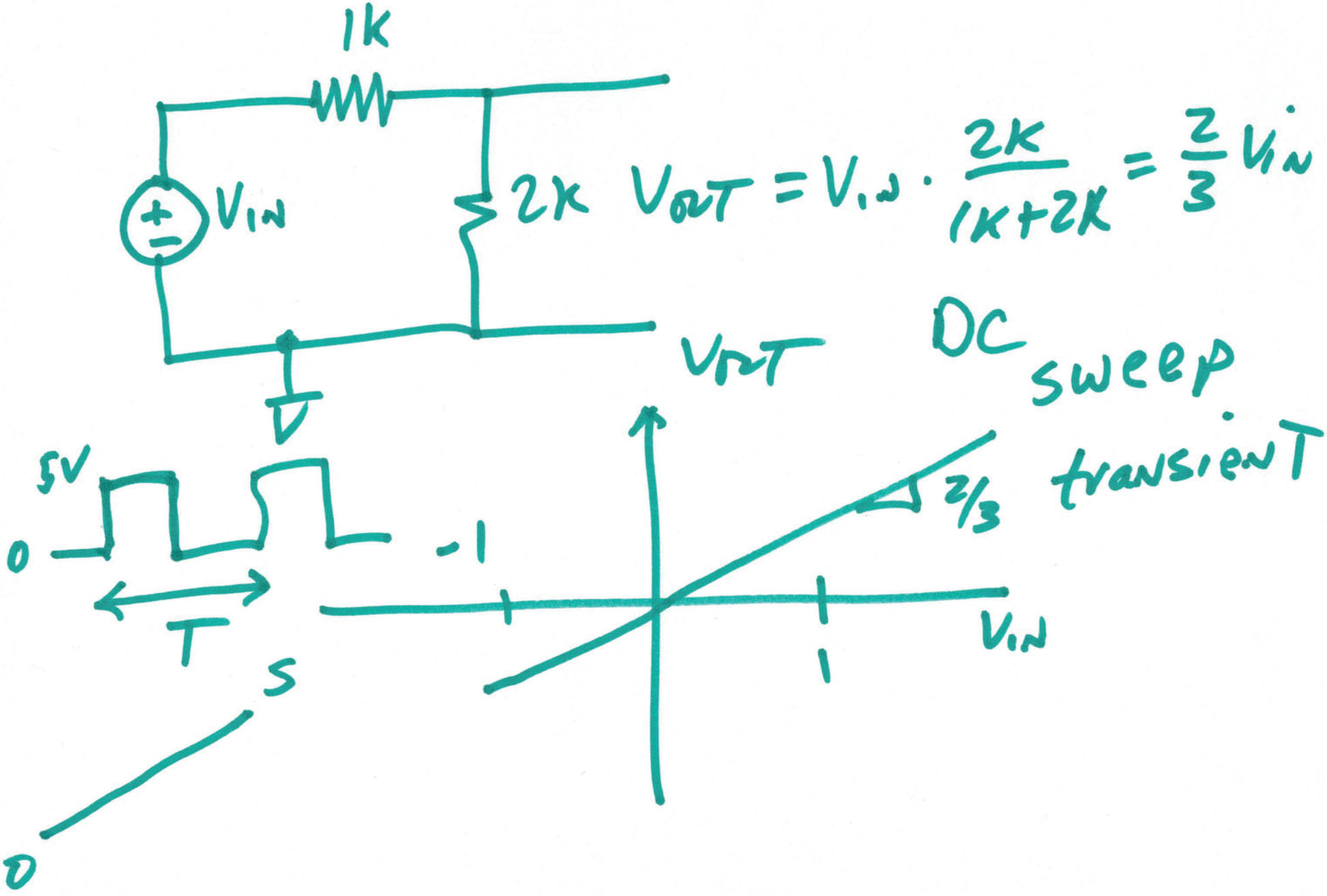




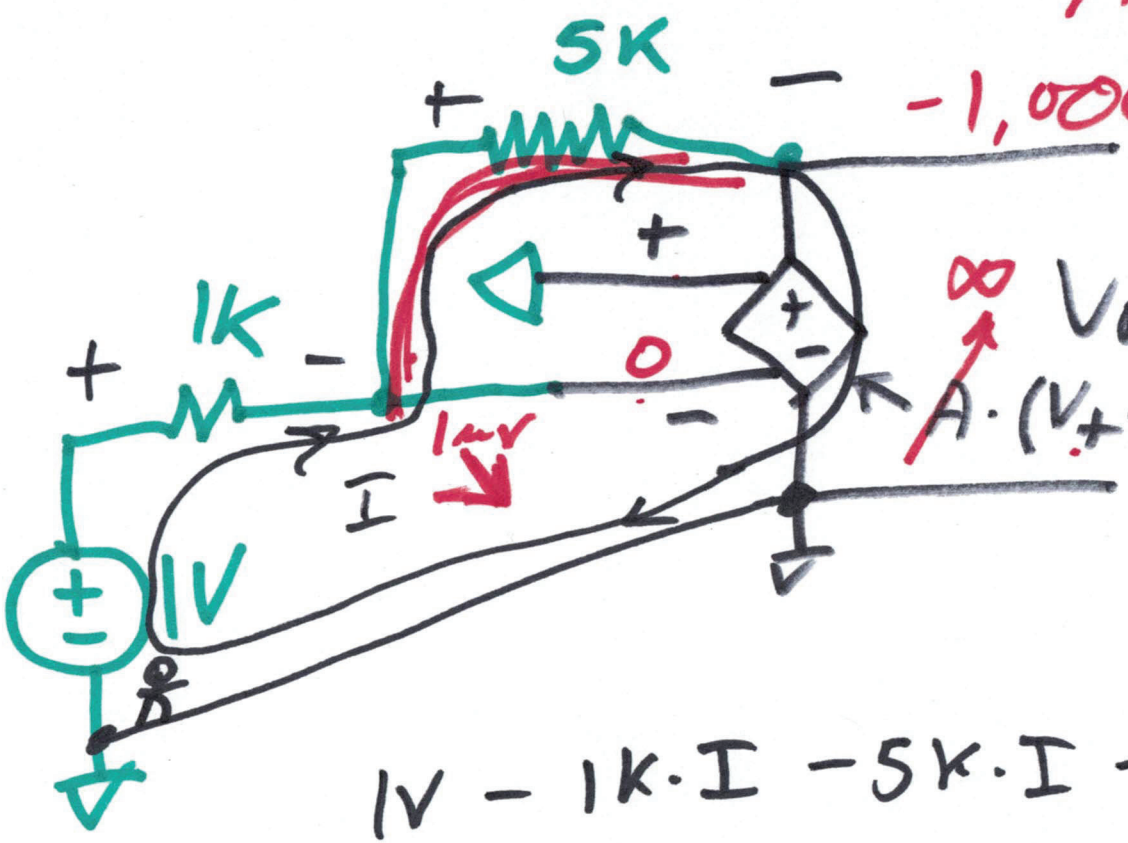
$$1.5 - 750\cdot I_x - 1.5k I_x = 0$$

$$I_x = \frac{1.5}{2.25k} = \frac{.25\cdot6}{.250\cdot900} = 6.67$$

$$I_x = .667\,mA$$


1k
2k
V_{IN}
$V_{OUT} = V_{IN} \cdot \frac{2k}{1k+2k} = \frac{2}{3} V_{IN}$
V_{OUT}
DC sweep
transient
5V
0
T
-1
1
V_{IN}
2/3
S
D

op-Amps



$A \to \infty$

$-1{,}000\ V_+ \to V_-$

∞ V_{OUT} (0-1-V).

B.S

1000

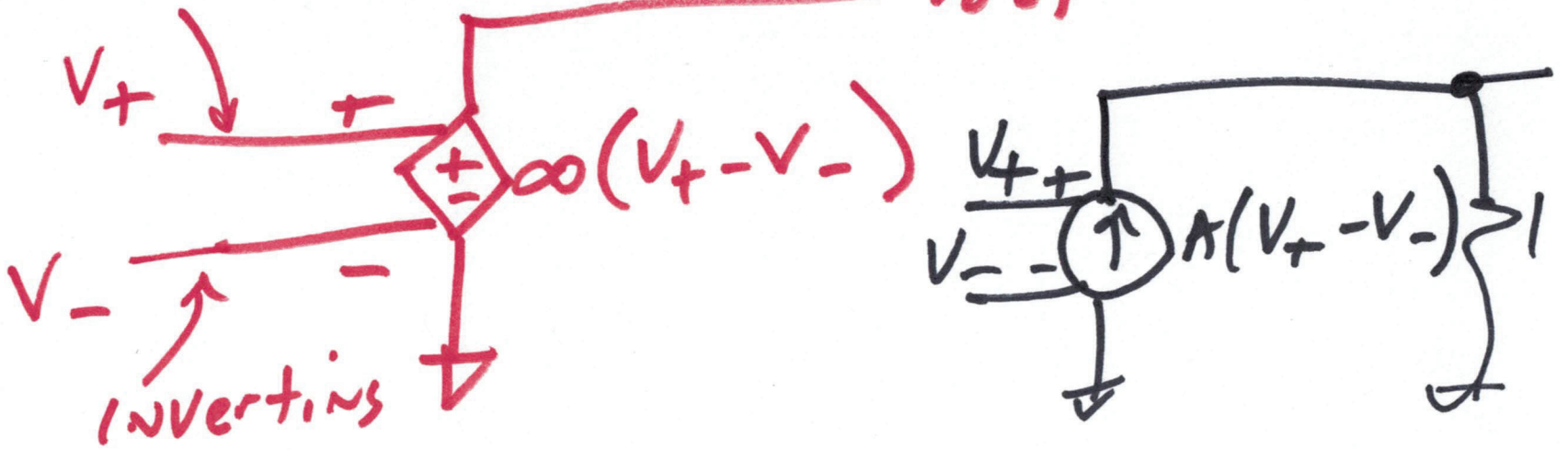
10^6

∞ 0

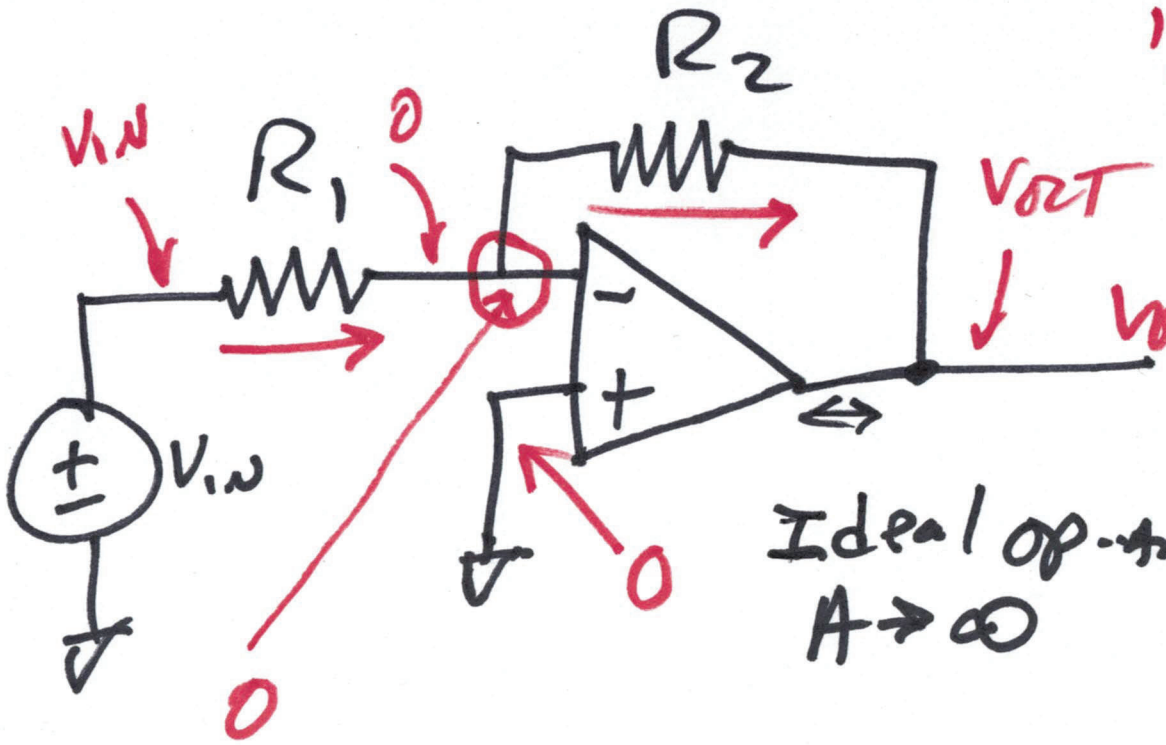
$$1V - 1K \cdot I - 5K \cdot I - \underbrace{A(V_+ - V_-)}_{V_{OUT}} = 0$$

$$1 - A \cdot V_{OUT} = I - 6K$$

Non-inverting Op-Amp



Inverting op-Amp



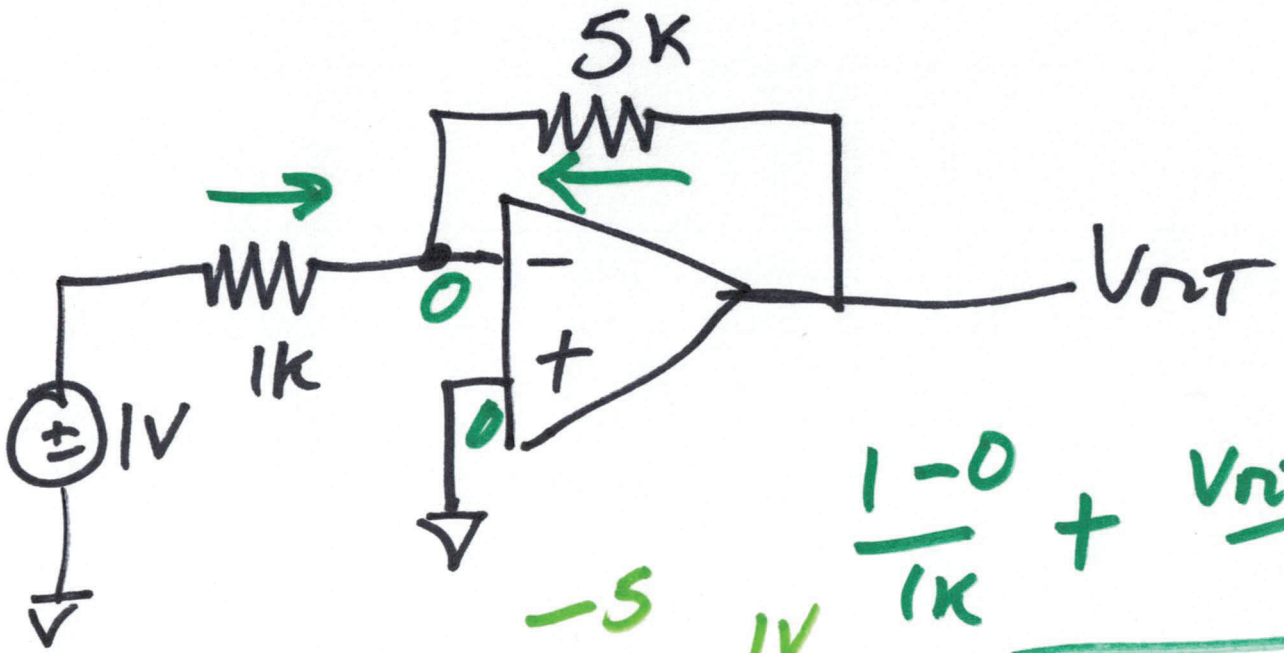
1) determine V_+ (voltage on NON-INVERTING INPUT)

2) set V_- to V_+

$$\frac{V_{IN} - 0}{R_1} = \frac{0 - V_{OUT}}{R_2}$$

3) KCL AT INVERTING (-V) INPUT

$$\frac{V_{OUT}}{V_{IN}} = -\frac{R_2}{R_1}$$



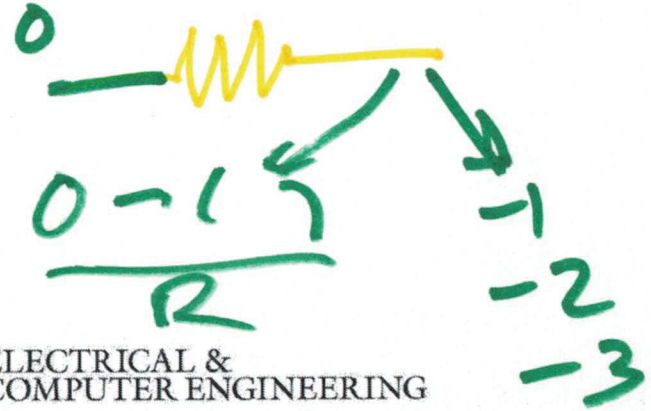
$$\frac{1-0}{1K}+\frac{V_{oT}-0}{5K}$$

$$V_{oT}=\left(-\frac{R_2}{R_1}\right).V_{in}$$

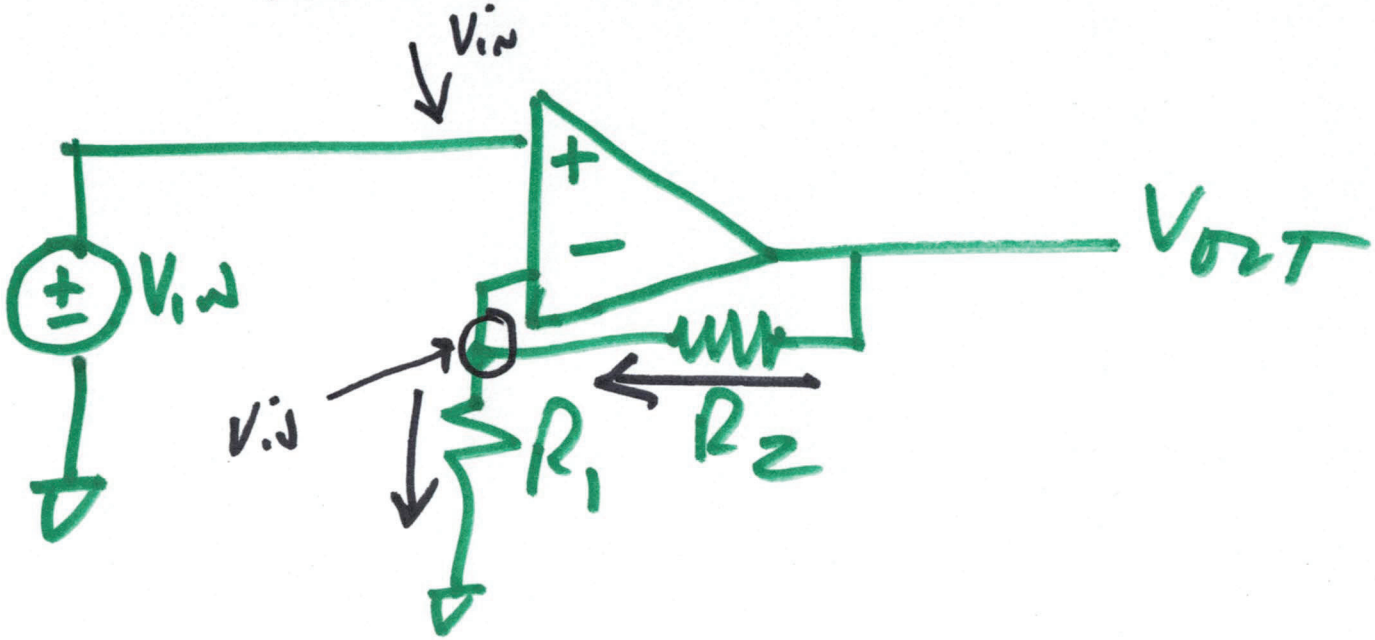
-5 1V

$$V_{oT}=-5V$$

R

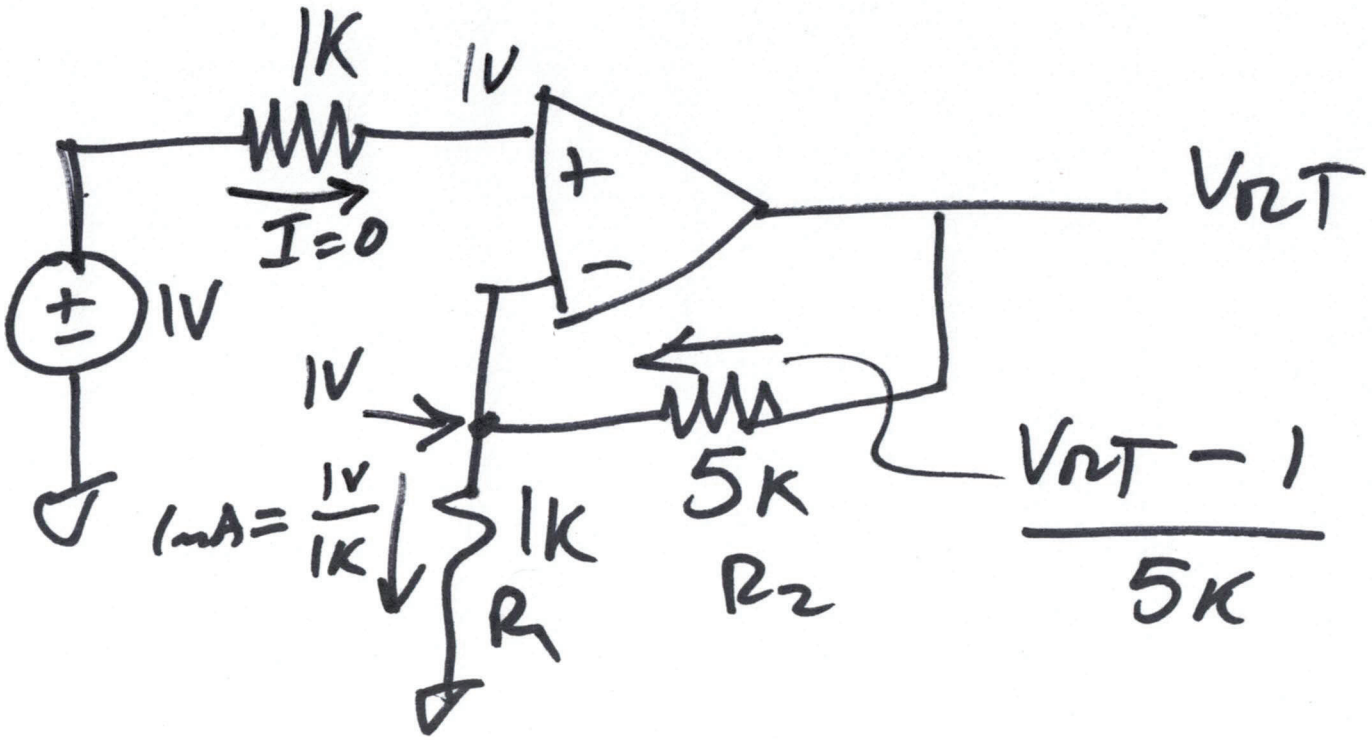


NON-INVERTING OP-AMP



$$\frac{V_{IN}}{R_1} = \frac{V_{OUT} - V_{IN}}{R_2} \rightarrow V_{IN}\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{V_{OUT}}{R_2}$$

$$\boxed{\frac{V_{OUT}}{V_{IN}} = 1 + \frac{R_2}{R_1} = \frac{R_1 + R_2}{R_1}}$$



$$\frac{1}{1K} = \frac{V_{OUT} - 1}{5K} \rightarrow 5 = V_{OUT} - 1$$

$$\boxed{V_{OUT} = 6}$$

$$1 + \frac{R_2}{R_1}$$