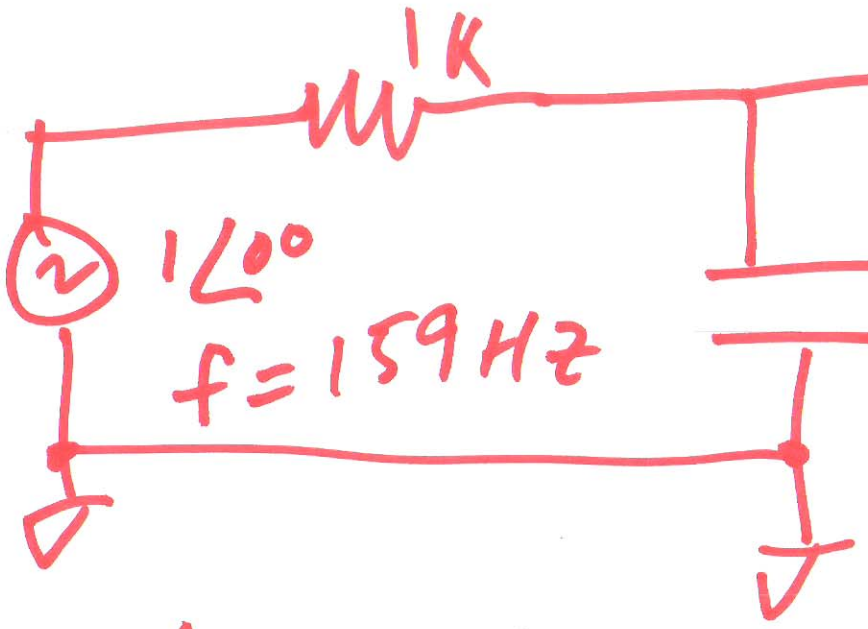
EE 320
Engineering Electronics I
Lecture 3
Jan. 26, 2015

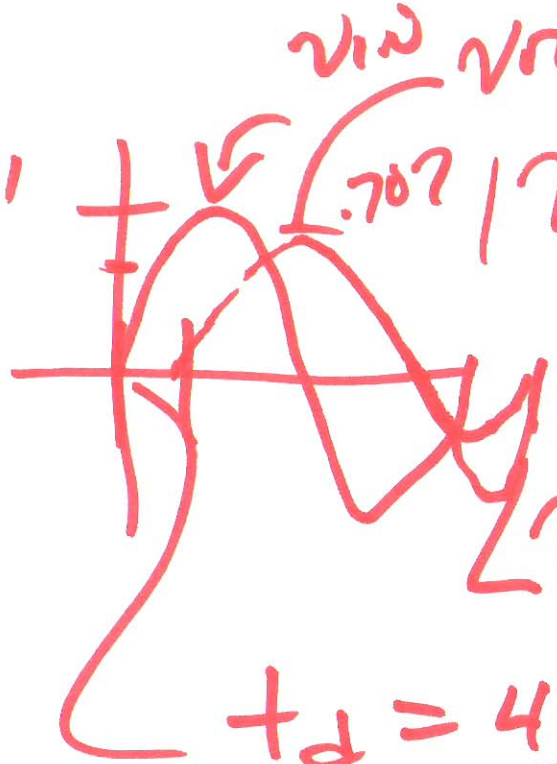


$$v_{out} = v_{in} \cdot \frac{\frac{1}{j2\pi f \cdot 159 \cdot 10^{6}}}{1K + \frac{1}{j2\pi f \cdot 159 \cdot 10^{6}}}$$

$$v_{out} = v_{in} \cdot \frac{1}{1 + j2\pi f \cdot 159 \cdot 10^{3}}$$

$$V_{OUT} = V_{in} \cdot \frac{1}{1 + \sum \frac{}{}\; j2\pi 159 \cdot 10^{-3}}$$

$$V_{OUT} = \frac{1\angle 0^\circ}{1 + j}$$

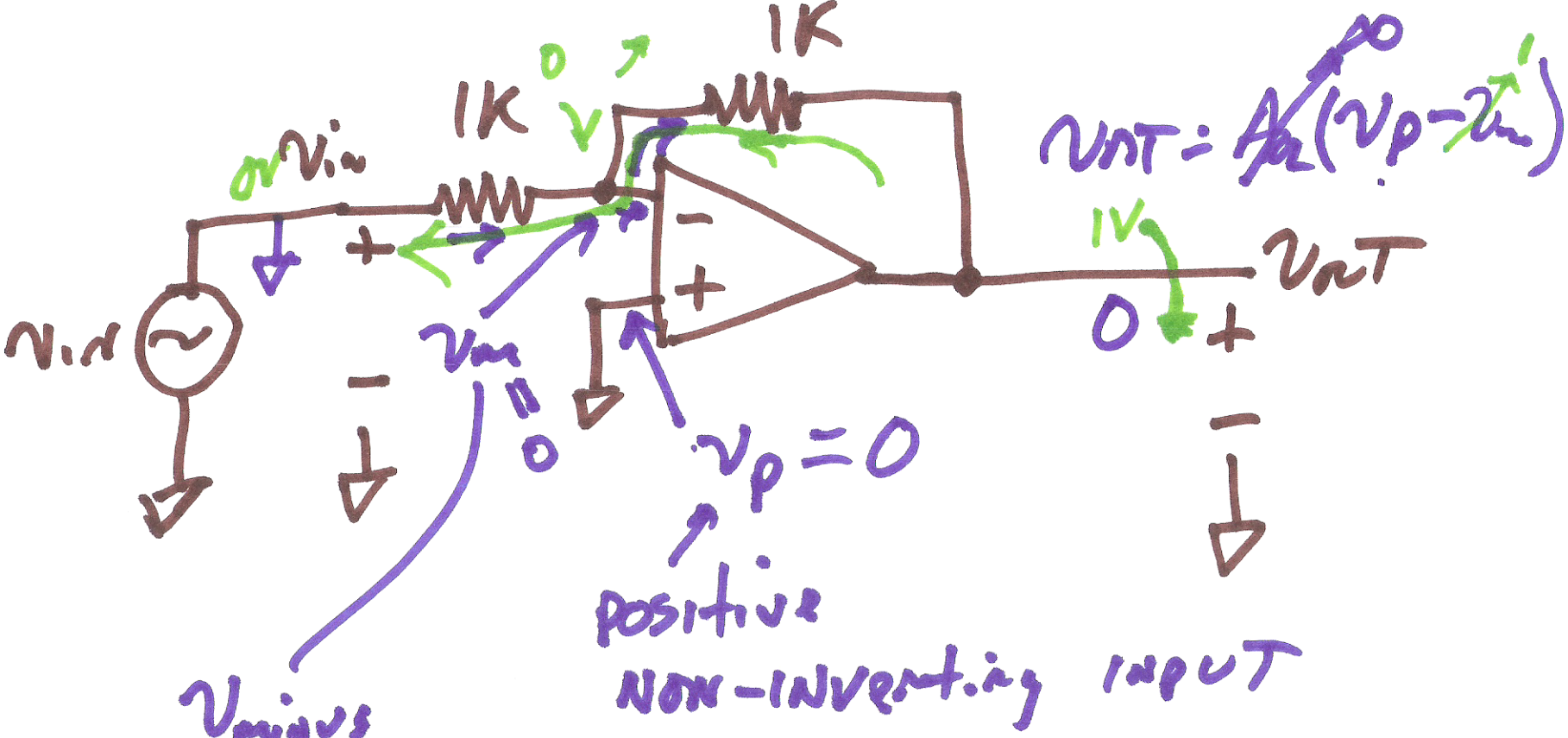


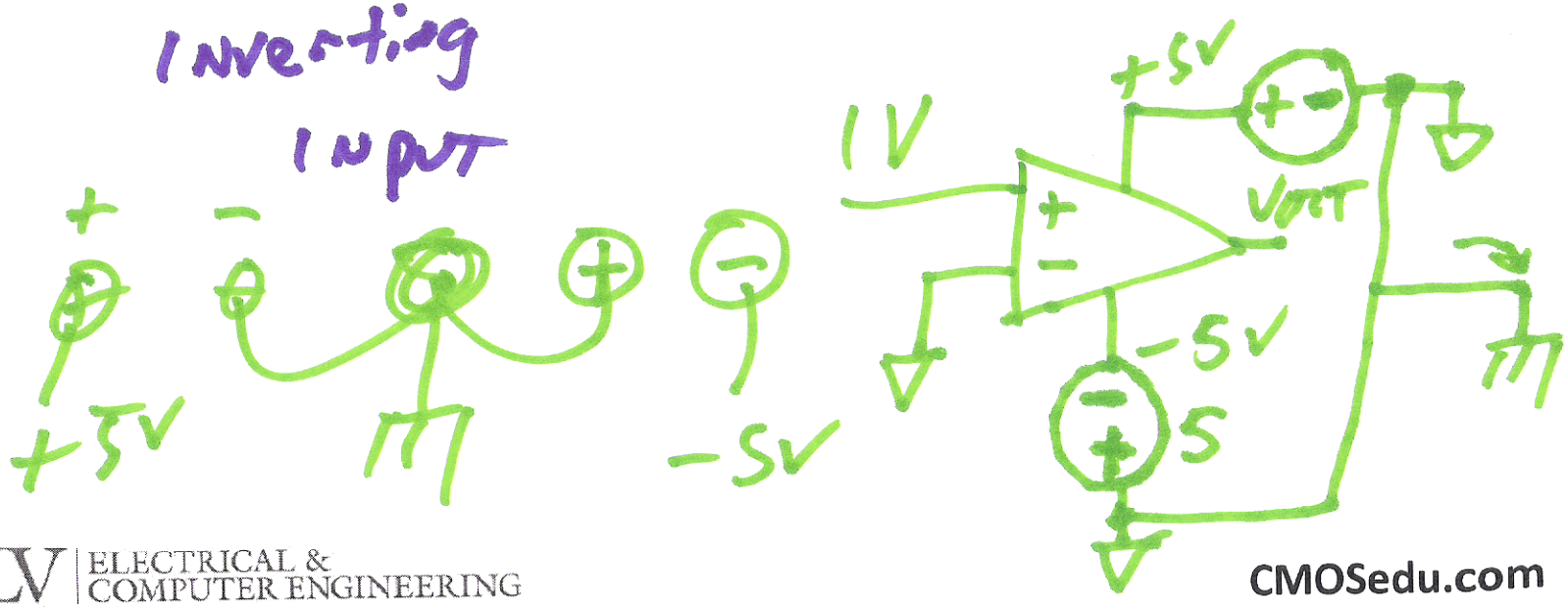
$$|V_{OUT}| = \frac{1}{\sqrt{1^2 + 1^2}} = \frac{1}{\sqrt{2}} = .707$$

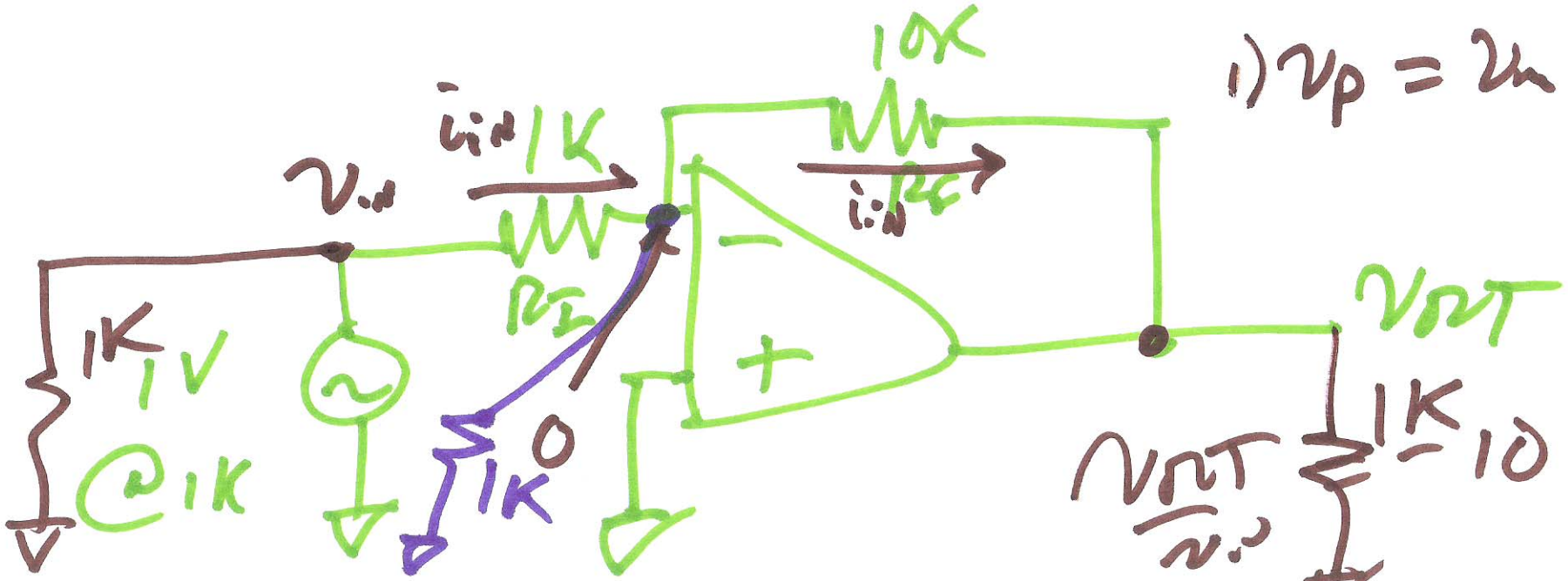
$$\angle V_{OUT} = \angle 0^\circ - \tan^{-1}\frac{1}{1} = -45^\circ$$

$\frac{1}{8}$

$$t_d = \frac{45^\circ}{360} \cdot \frac{1}{159}$$


1K
1K
0
v_{in} or V_{in}
v_{in}
v_m
$v_m = 0$
$v_p = 0$
$v_{OUT} = A_{dc}(v_p - v_m)$
1V
0
v_{OUT}
positive
NON-INVERTING INPUT
v_{minus}
INVERTING
INPUT


+5V
-5V
1V
+5V
V_{OUT}
-5V
5



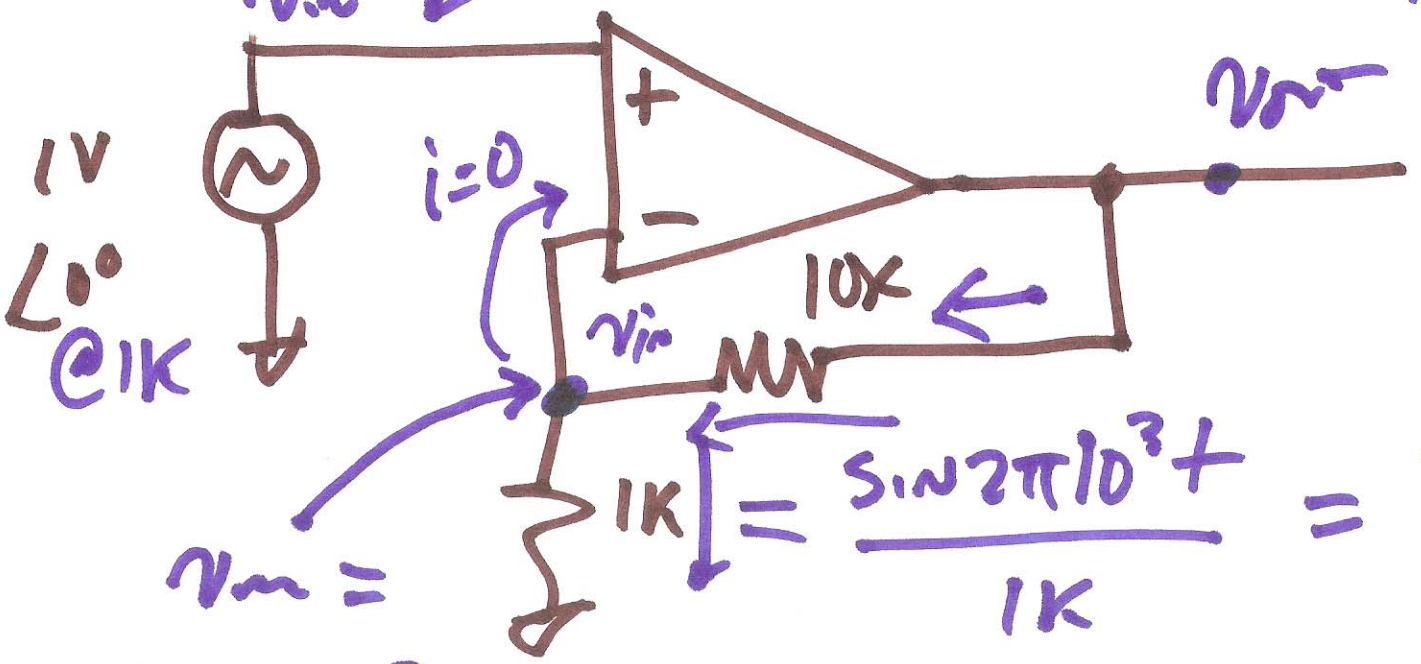
$$i_{in} = \frac{v_{in} - 0}{1K} = \frac{0 - v_{OUT}}{10K}$$

R_1 R_F

inverting Amp

inverting conf.

$$\frac{R_F}{R_1} = \frac{10K}{1K} = \frac{-v_{OUT}}{v_{in}} \quad \Rightarrow \quad \boxed{\frac{v_{OUT}}{v_{in}} = -\frac{R_F}{R_1}}$$



1) $v_p = v_m$

2) KCL @ v_m

$$\frac{v_{in}}{1K} = \frac{\sin 2\pi 10^3 t}{1K} = \frac{v_p}{1K} = \frac{v_m}{1K}$$

$$\frac{v_{out} - v_{in}}{10K} = \frac{v_{in}}{1K}$$

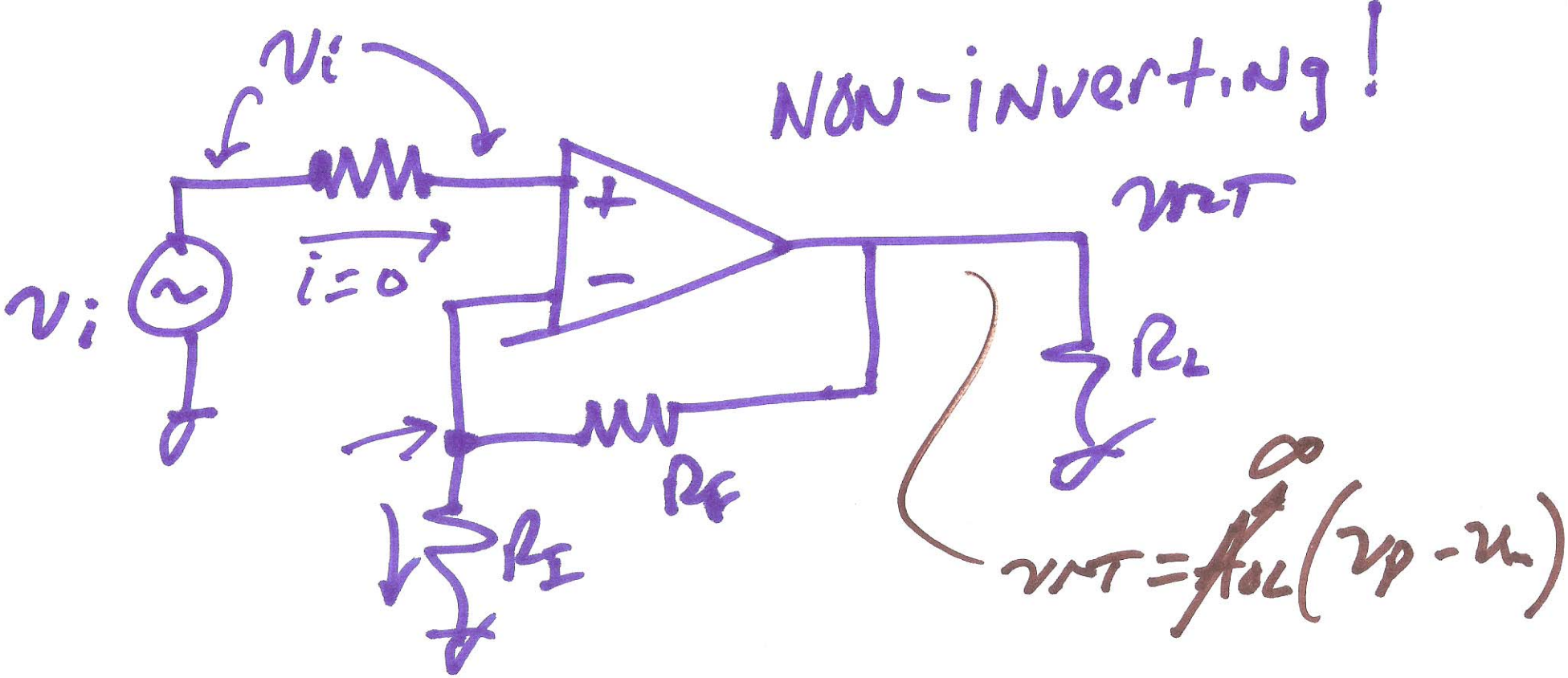
$$\frac{v_{out}}{v_{in}} = \frac{10K}{1K} + \frac{10K}{10K}$$

$$= 10 + 1 = +11$$

$$\frac{v_{out}}{10K} = \frac{v_{in}}{1K} + \frac{v_{in}}{10K}$$

$$1 + \frac{R_F}{R_1} = \frac{R_F + R_1}{R_1}$$

5)

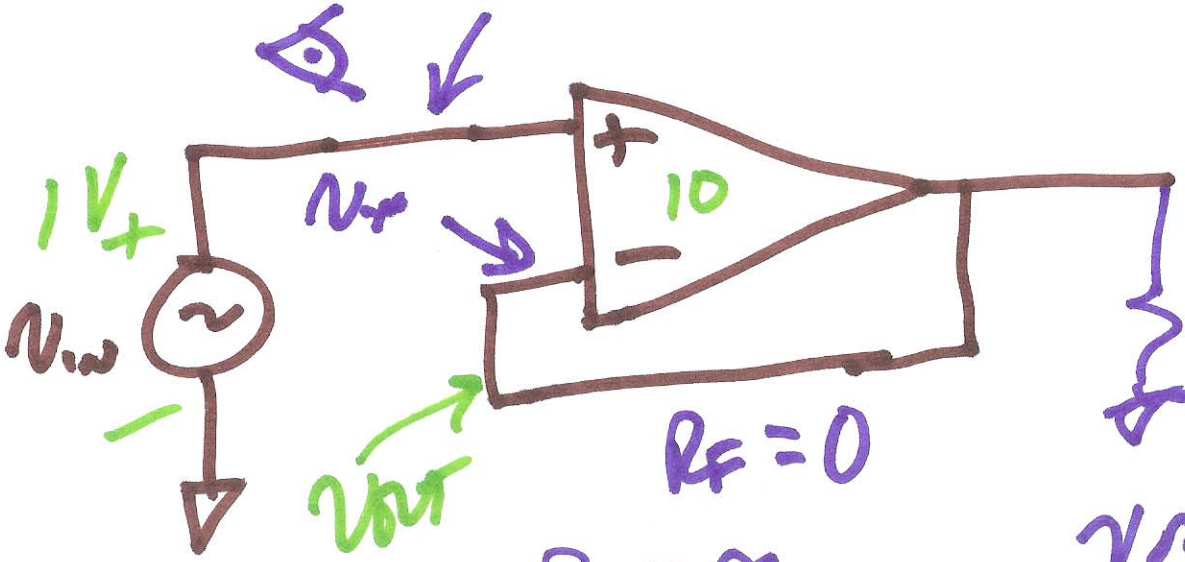


$$\frac{v_i}{R_I} = \frac{v_{OUT} - v_i}{R_F} \Rightarrow \frac{v_{OUT}}{v_i} = 1 + \frac{R_F}{R_I}$$

$$\boxed{\frac{v_{OUT}}{v_{in}} = \frac{R_I + R_F}{R_I}}$$

b)

Voltage follower



$v_{out} = v_{in}$

$$\frac{v_{out}}{v_{in}} = 1 + \frac{R_F}{R_S} = 1 \quad (R_F \to 0,\ R_S \to \infty)$$

$$v_{out} = 10 \cdot (1 - v_{out})$$

$$v_{out} = 10 - 10 v_{out} \qquad v_{out} = \frac{10}{11} \approx .9$$