EE 220 Circuits I

Oct. 9, 2023

Lecture 12

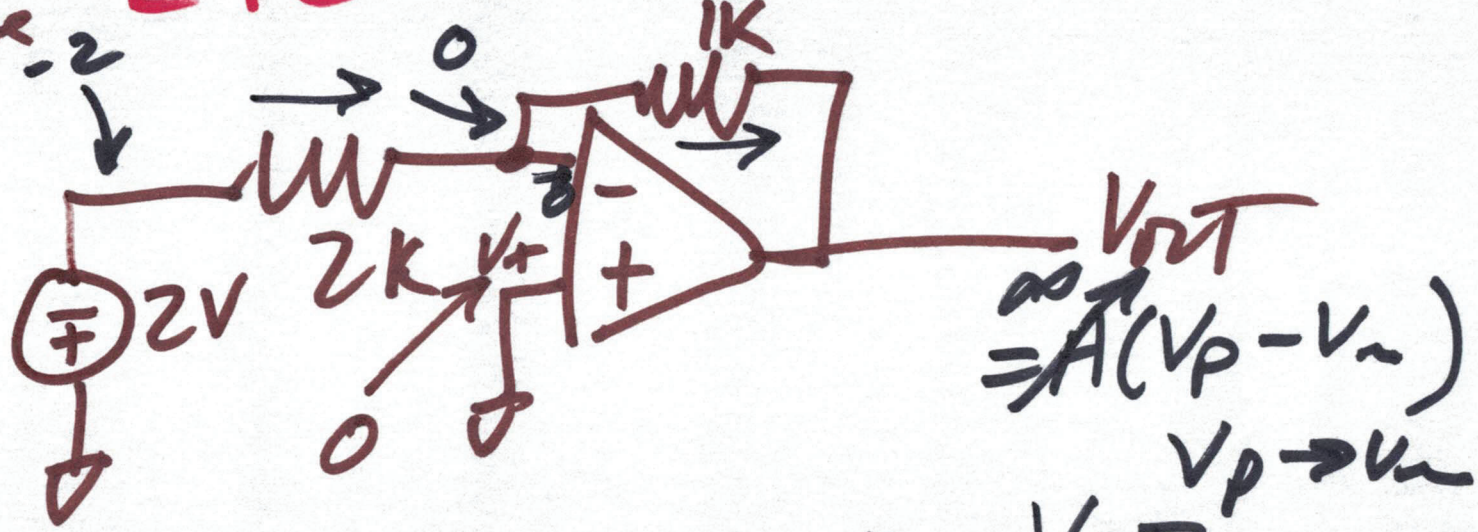
1) determine NON-INVERTING input voltage

1) (determine V_+)

2) $V_+ = V_-$

$V_p = V_-$

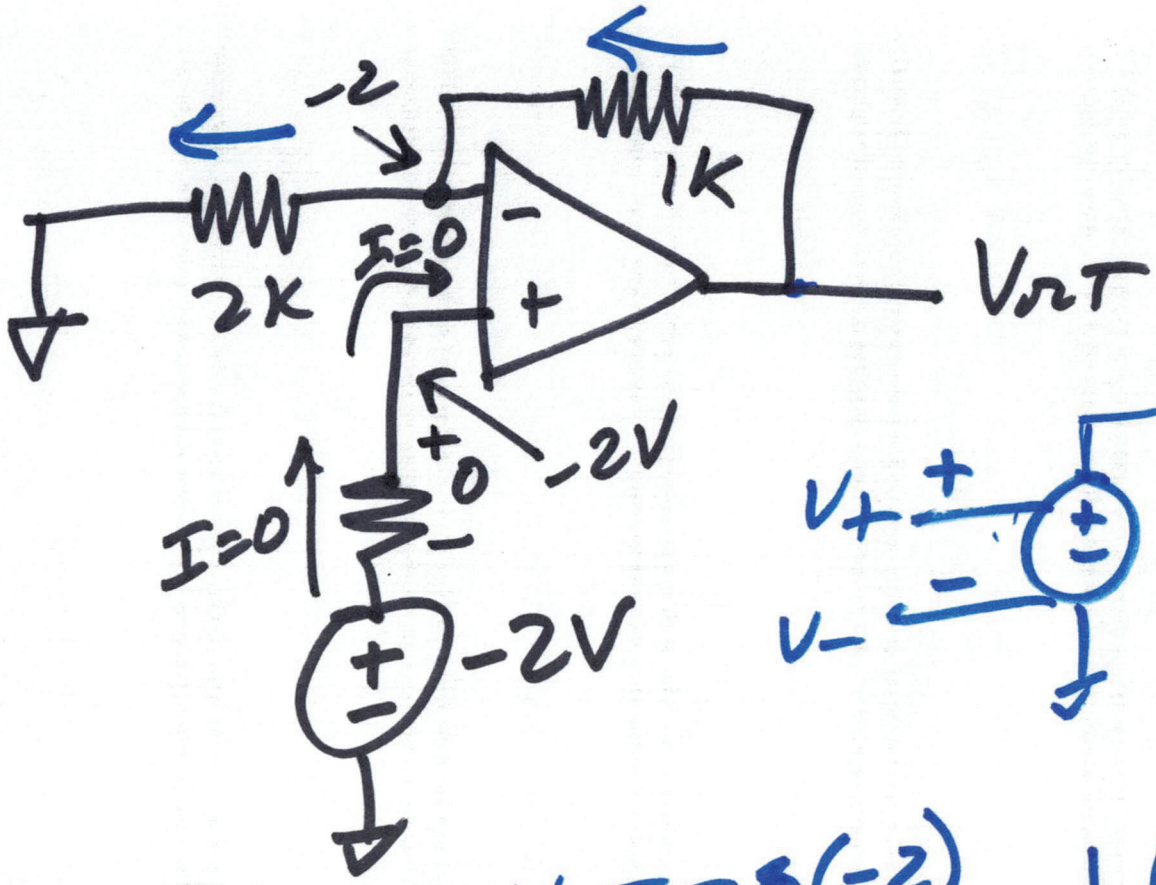
3) KCL @ V_-

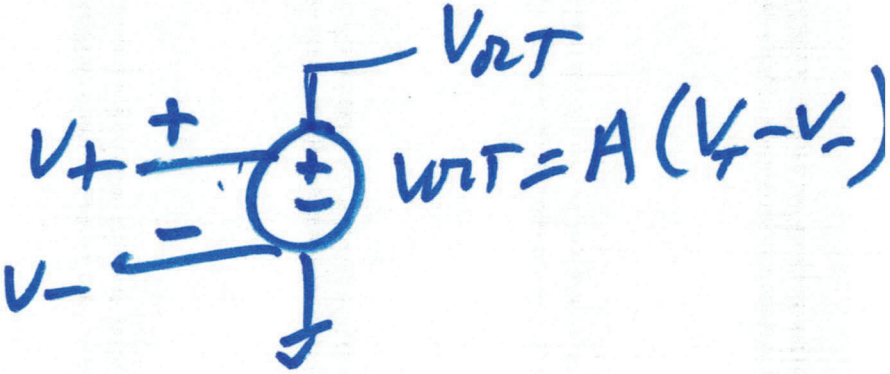


$$\frac{-2-0}{2K} = \frac{0-V_{OUT}}{1K}$$

$$\frac{1K}{2K}(+2) = +V_{OUT}$$

$$\boxed{V_{OUT} = 1V}$$



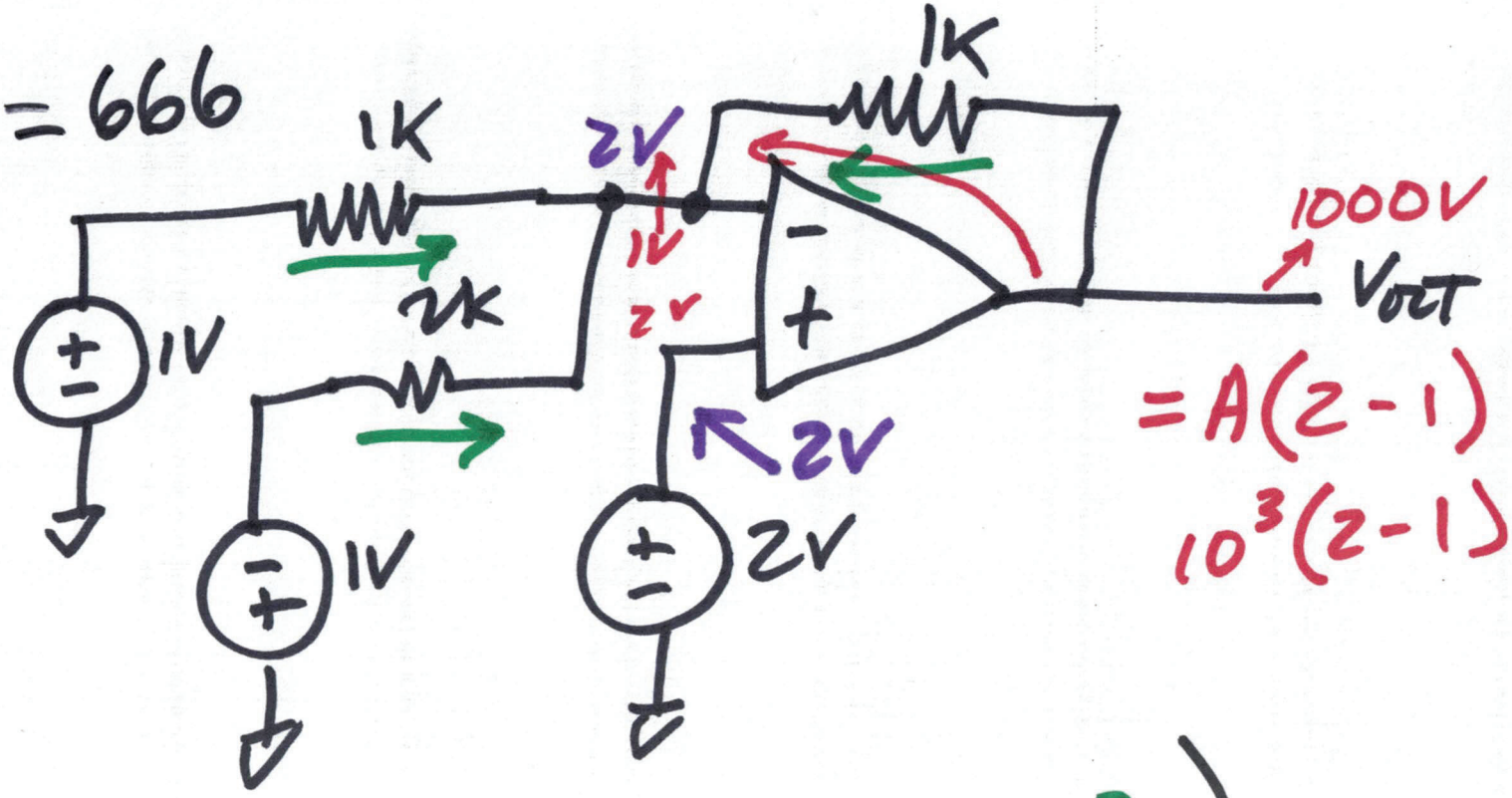


$$\frac{-2-0}{2K} = \frac{V_{oT} - \frac{1}{2}(-2)}{1K}, \quad \frac{1}{2}(-2) = V_{oT} + 2$$

$$-1 = V_{oT} + 2$$

$$\boxed{V_{oT} = -3V}$$

$1k \| 2k = 666$



$$2K\left(\frac{1-2}{1K} + \frac{-1-2}{2K} + \frac{V_{OUT}-2}{1K}\right) = 0$$

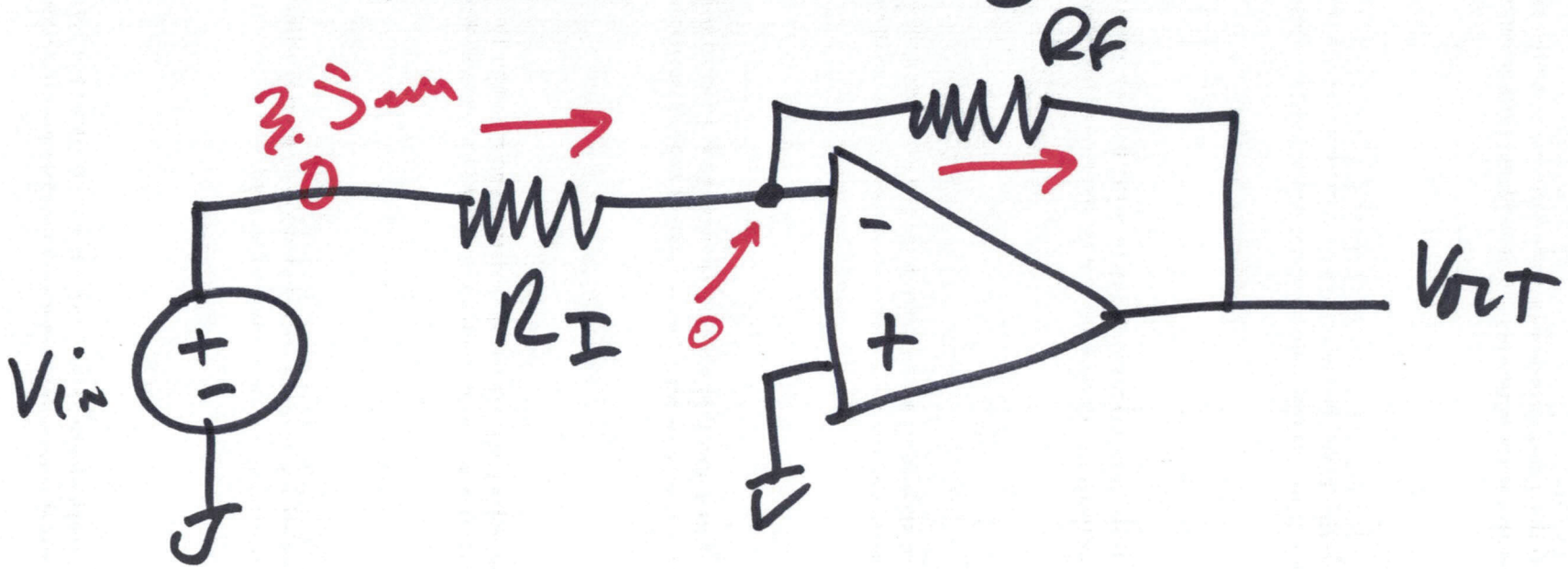
$$2(-1) + (-3) + 2V_{OUT} - 4 = 0$$

$$2V_{OUT} = 9$$

$$\boxed{V_{OUT} = 4.5V}$$

3)

Inverting topology

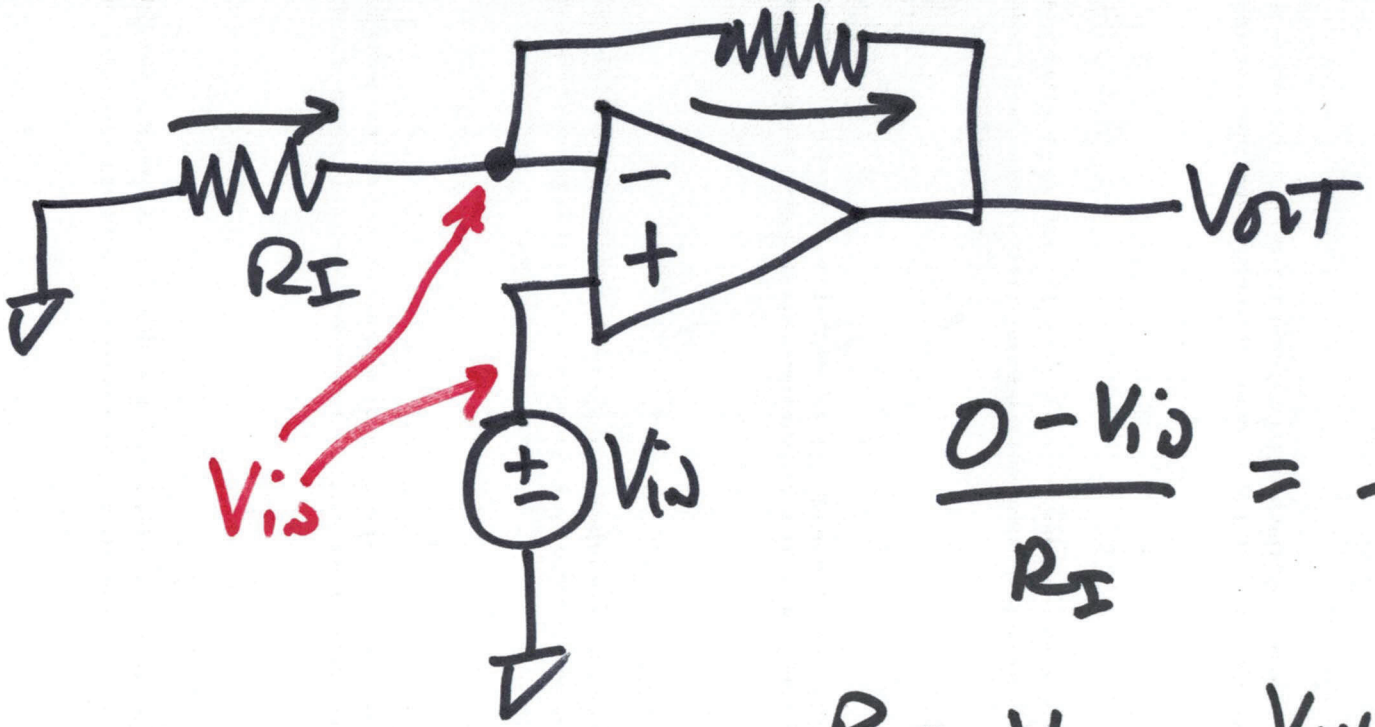


$$\text{GAIN} = \frac{V_{OUT}}{V_{IN}} = \frac{-R_F}{R_I}$$

$$\frac{V_{IN}-0}{R_I} = \frac{0-V_{OUT}}{R_F}$$

$$V_{OUT} = -V_{IN} \cdot \frac{R_F}{R_I}$$

NON-INVERTING R_F

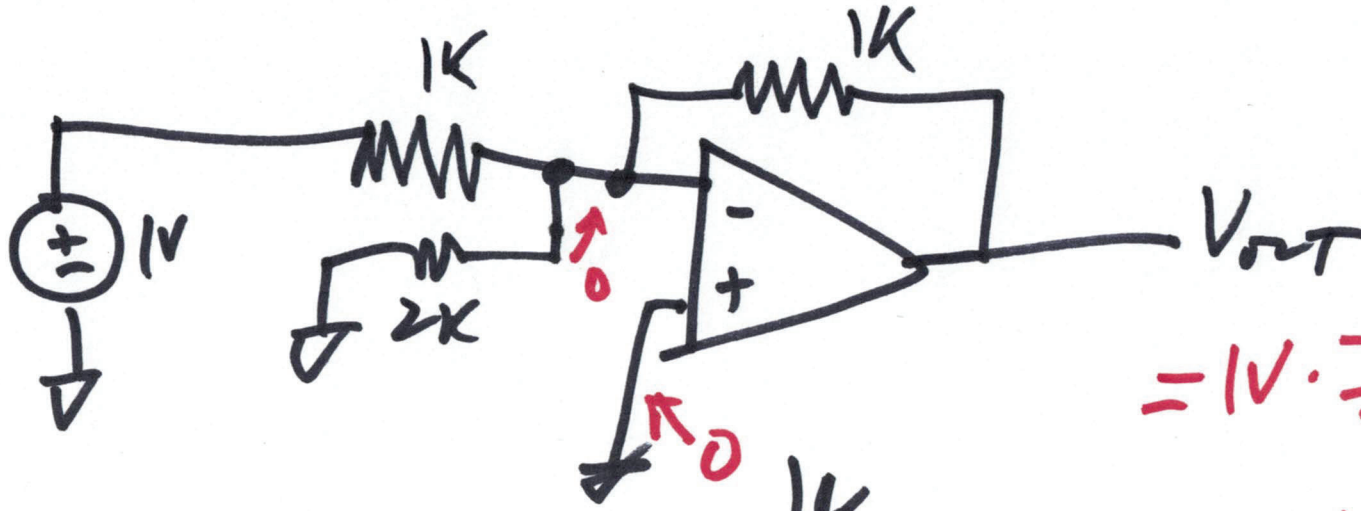


$$\frac{0 - V_{in}}{R_I} = \frac{V_{IN} - V_{OUT}}{R_F}$$

$$-\frac{R_F}{R_I} \cdot V_{in} = V_{IN} - V_{OUT}$$

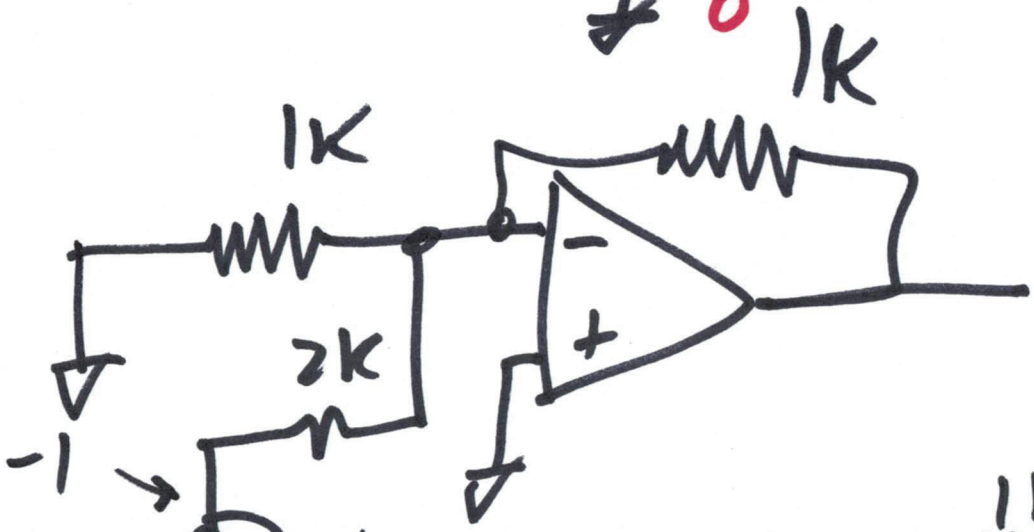
$$V_{OUT} = \left(1 + \frac{R_F}{R_I}\right) V_{in}$$

$$\frac{R_I + R_F}{R_I} = \frac{V_{OUT}}{V_{IN}} = \left(1 + \frac{R_F}{R_I}\right)$$

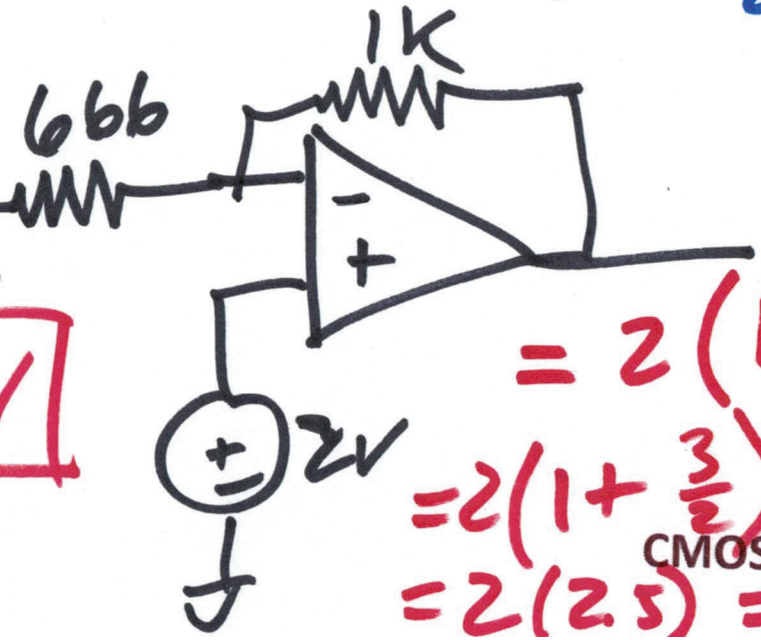


$= 1V \cdot \frac{-1K}{1K}$

$= -1V$



$= -1V \cdot \frac{-1K}{2K} = +\frac{1}{2}V$



$V_{OUT} = -1 + \frac{1}{2} + 5$

$= 4.5V$

$= 2\left(1 + \frac{1K}{666}\right)$

$= 2\left(1 + \frac{3}{2}\right)$ $\frac{2}{3}K$

$= 2(2.5) = 5V$