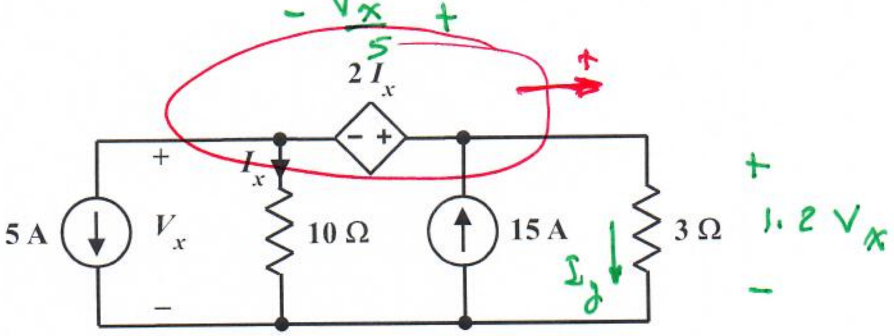
EE/EET 2240

Homework Problem #031



Determine the value of V_x.

$$I_x = \frac{V_x}{10\Omega} \qquad I_y = \frac{1.2V_x}{3\Omega} = 0.4V_x$$

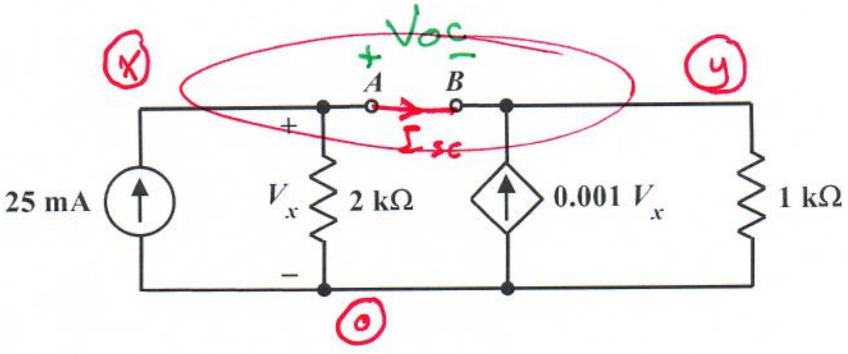
$$5A + \frac{V_x}{10\Omega} - 15A + \frac{4}{10}V_x = 0$$

$$\frac{1}{2}V_x = 10$$

$$V_x = 20V$$

EE/EET 2240

Homework Problem #033



(a) Find the Thévenin equivalent circuit with respect to terminals *A* and *B*.

$$-25mA + \frac{V_x}{2k\Omega} = 0 \Rightarrow V_x = 50V$$

$$\frac{V_y}{1k\Omega} - \frac{V_x}{1000} = 0 \Rightarrow V_y = V_x = 50V$$

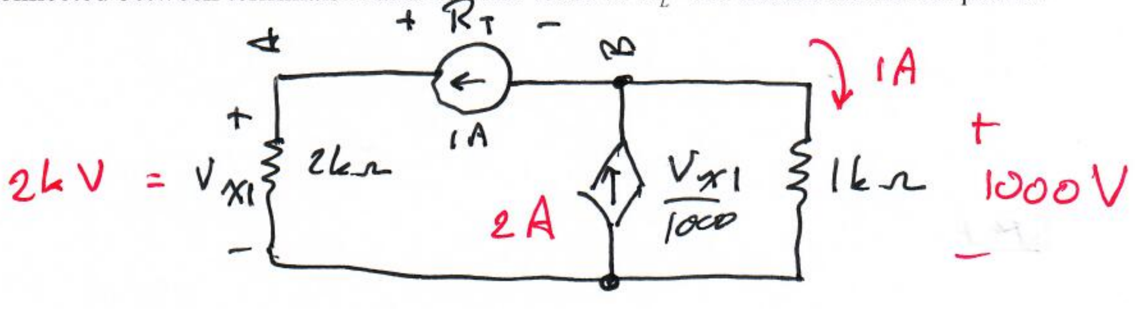
$$V_{oc} = V_x - V_y = \boxed{0 \equiv V_T}$$

$$-25mA + \frac{V_x}{2k\Omega} - \frac{V_x}{1000} + \frac{V_x}{1000} = 0$$

$$\Rightarrow V_x = 50V$$

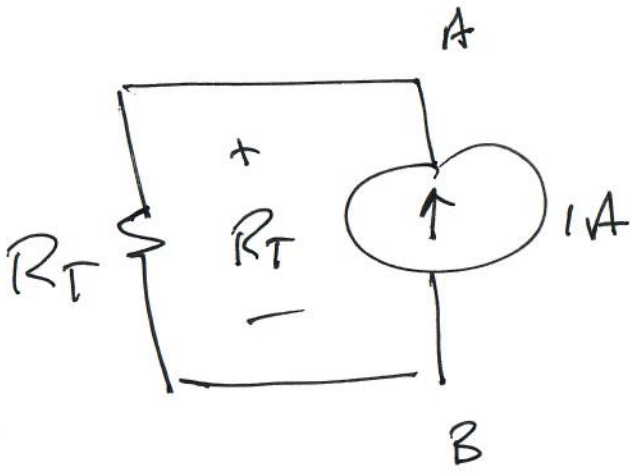
$$I_{sc} = 0\ A \qquad \Rightarrow R_T = \frac{0V}{0A}$$

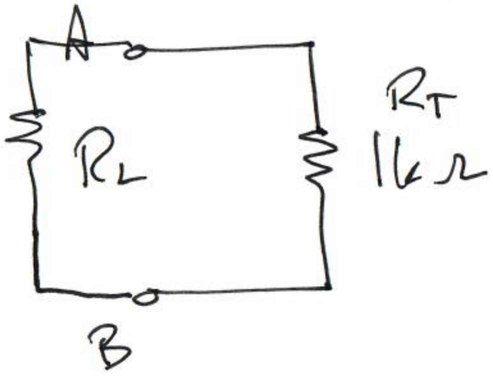
(b) If connected between terminals *A* and *B*, what value of R_L will absorb maximum power?



$$R_T + 1000 - 2000V = 0$$

$$R_T = \boxed{1000\Omega}$$

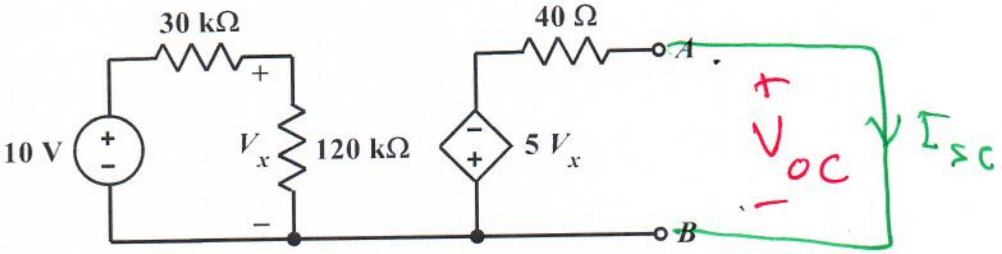

A
+
R_T
R_T
—
1A
B



R_L will not absorb power or deliver power.

EE/EET 2240

Homework Problem #032



Find the Norton equivalent circuit with respect to terminals *A* and *B*.

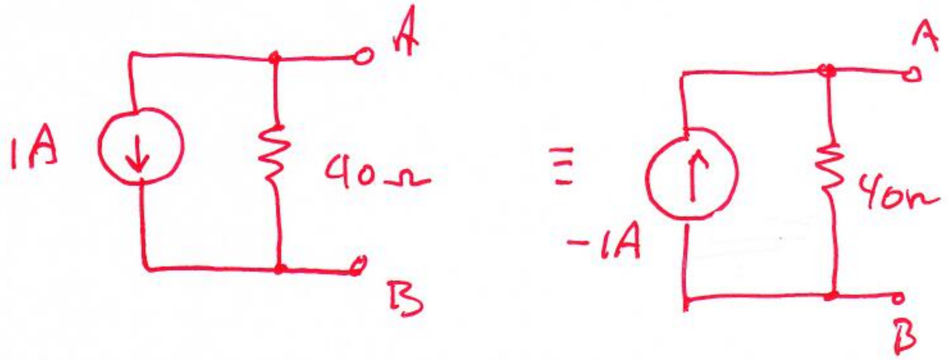
$$V_x = \frac{120k\Omega}{150k\Omega} \cdot 10V = 8V$$

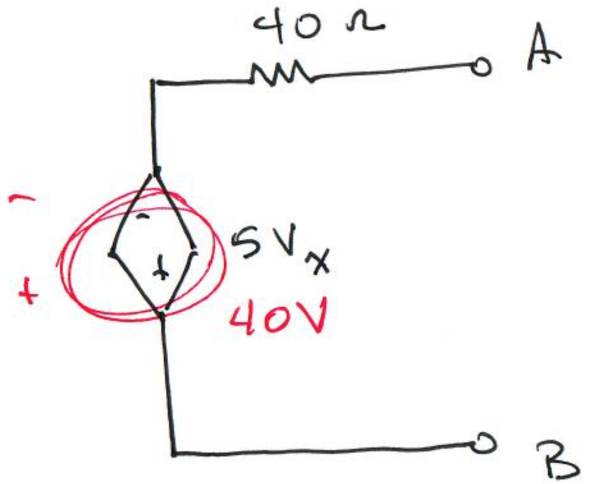
$$V_{oc} = -5V_x = -40V$$

$$I_{sc} = -\frac{40V}{40\Omega} = \boxed{-1A}$$

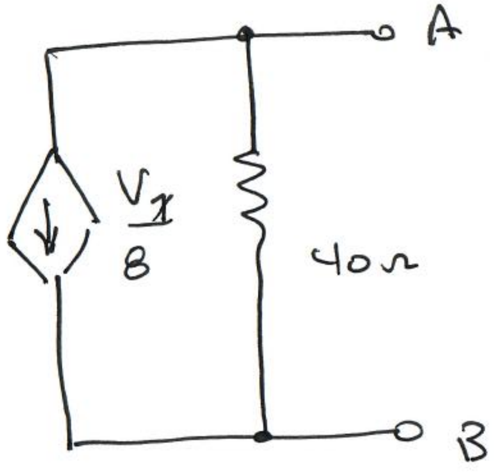
$$I_N = \boxed{-1A}$$

$$R_N = \frac{V_{oc}}{I_{sc}} = \frac{-40V}{-1A} = 40\Omega$$

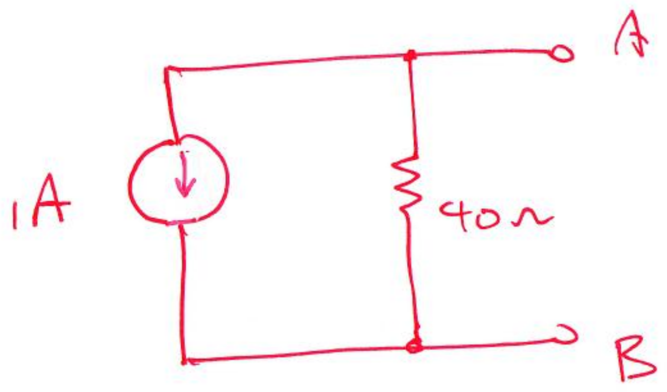



40 Ω
A
-
+
5V_x
40V
B

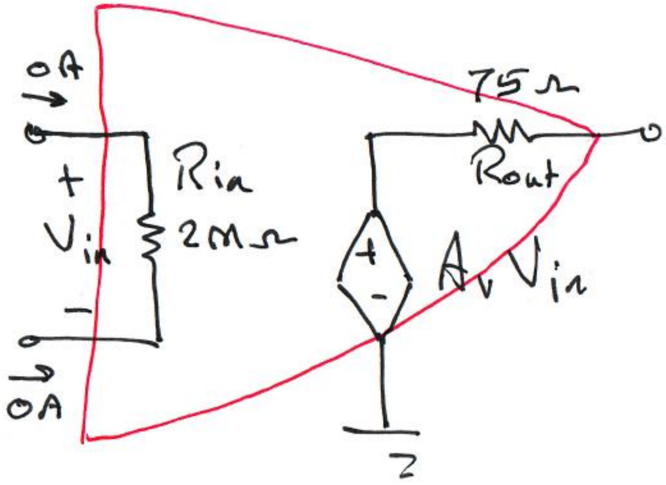
=>


A
V_x / 8
40Ω
B

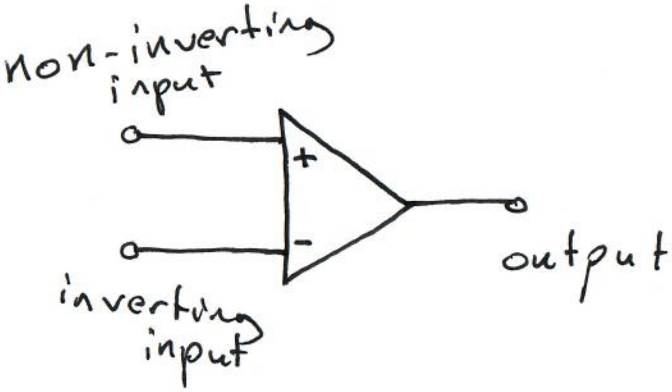
|||


A
1A
40Ω
B

Operational Amplifier (opAmp)



$$A_v \approx 100{,}000$$



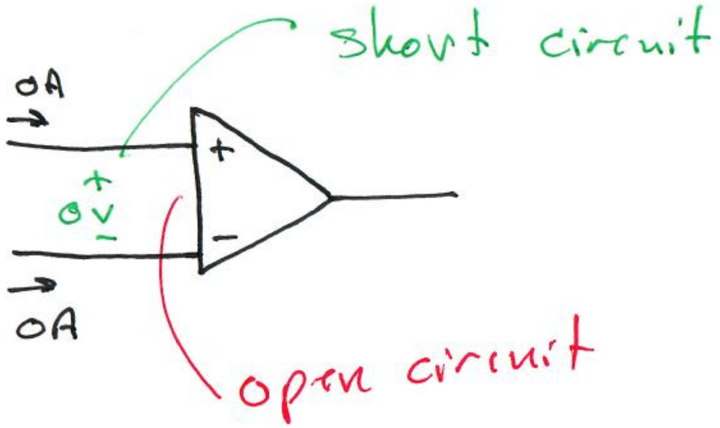
For an ideal OpAmp

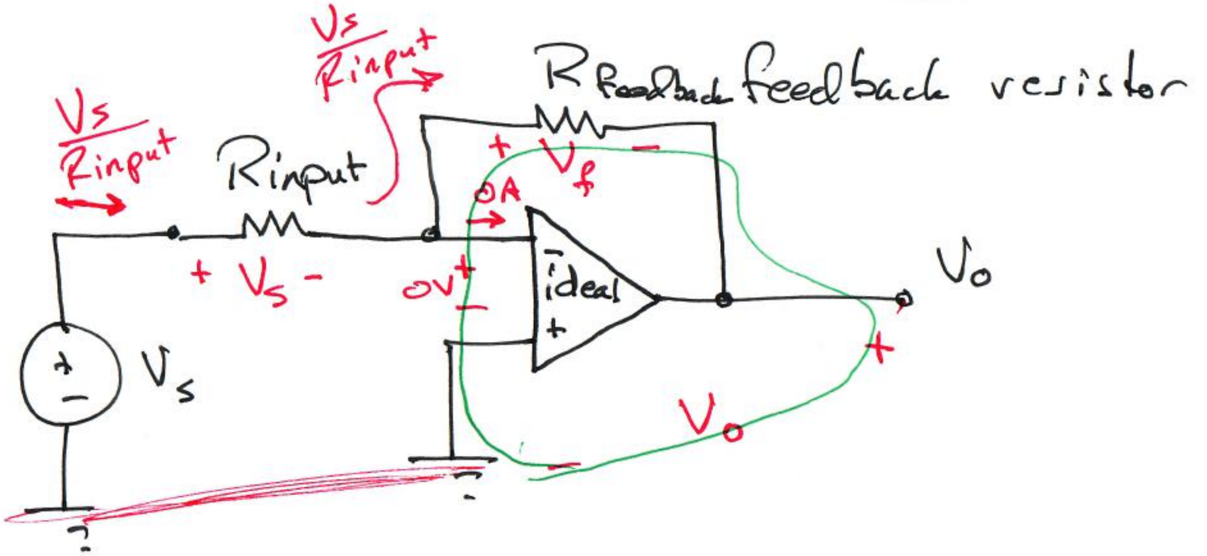
$R_{in} \approx \infty\ \Omega$

$R_{out} \approx 0\ \Omega$

$V_{in} \approx 0\ V$

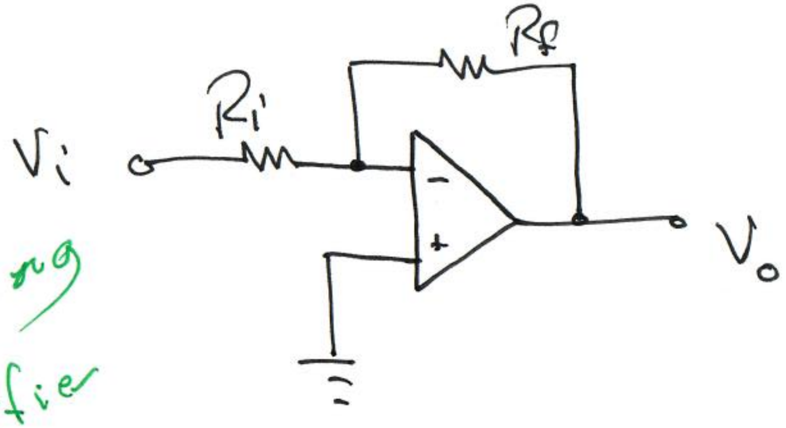
$A_v \approx \infty\ V/V$





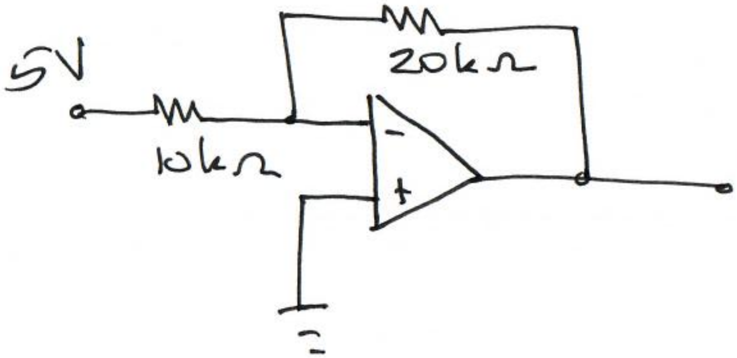
$$V_f = R_{feedback} \times \frac{V_s}{R_{input}}$$

$$V_o = -V_f = -\frac{R_f}{R_i} V_s$$



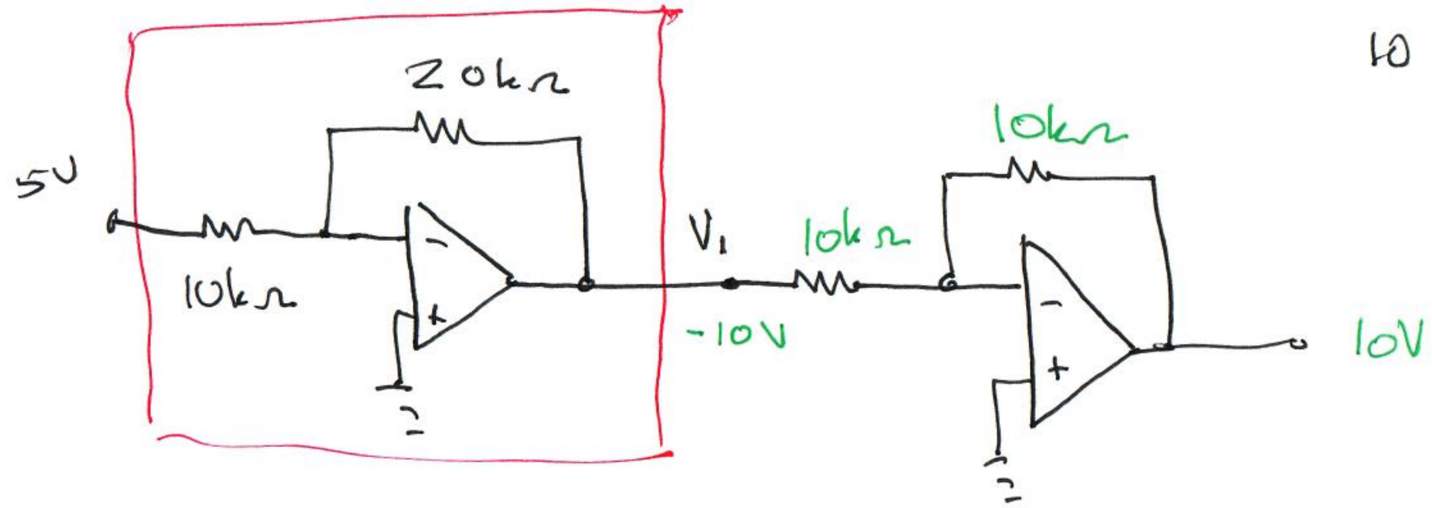
Inverting Amplifier

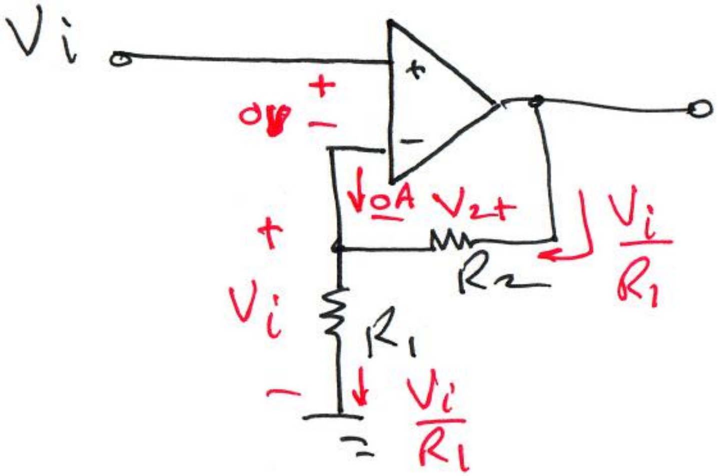
$$V_o = \underset{\uparrow\ \text{inverting}}{-} \underbrace{\frac{R_f}{R_i}}_{\text{amplifier}} V_i$$



$$V_o = -\frac{20k\Omega}{10k\Omega} \cdot 5V$$

$$= -10V$$





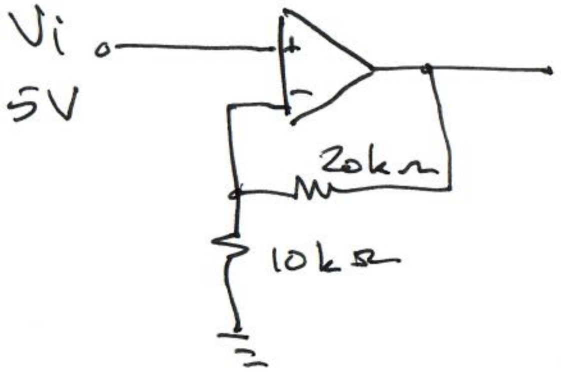
$$V_2 = R_2 \frac{V_i}{R_1}$$

$$= \frac{R_2}{R_1} V_i$$

$$V_o = V_2 + V_i$$

Amplifier

$$= \left(1 + \frac{R_2}{R_1}\right) V_i$$



$$V_o = \left(1 + \frac{20k\Omega}{10k\Omega}\right)5V$$

$$= 15V$$