3-10) a) A: $(2k\Omega + 2k\Omega + 2k\Omega)\, i_A - 2k\Omega\, i_B = 5V - 15V$

$$6k\Omega\, i_A - 2k\Omega\, i_B = -10V$$

B: $(2k\Omega + 4k\Omega + 4k\Omega)\, i_B - 2k\Omega\, i_A = 15V$

$$-2k\Omega\, i_A + 10k\Omega\, i_B = 15V$$

b) from A: $i_B = 5mA + 3i_A$

into B: $-2k\Omega\, i_A + 10k\Omega(5mA + 3i_A) = 15V$

$$-2k\Omega\, i_A + 50V + 30k\Omega\, i_A = 15V$$

$$28k\Omega\, i_A = -35V$$

$$i_A = -\frac{5}{4}mA = -1.25mA$$

$$i_B = 5mA + 3\left(-\frac{5}{4}mA\right)$$

$$= 5mA - \frac{15}{4}mA$$

$$= \frac{5}{4}mA = 1.25mA$$

$V_x = 4k\Omega \cdot i_B$

$= 4k\Omega \cdot 1.25mA$

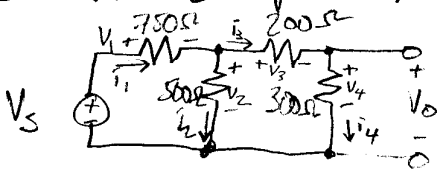
$\boxed{V_x = 5V}$

$i_x = i_B - i_A$

$= 1.25mA - (-1.25mA)$

$\boxed{i_x = 2.5mA}$

21) 3-27) use unit output method: let $V_o = 1V$



KVL $V_{1,1} = V_o = 1V$

Ohm's $i_4 = \frac{1V}{300\Omega}$
$= 3.33mA$

KCL $i_3 = i_4 = 3.33mA$

Ohm's $V_3 = i_3 \cdot 200\Omega$
$= 667mV$

KVL $V_2 = V_3 + V_4$
$= 1.67V$

Ohm's $i_2 = \frac{V_2}{500\Omega}$
$= 3.33mA$

KCL $i_1 = i_2 + i_3$
$= 6.67mA$

Ohm's $V_1 = i_1 \cdot 750\Omega$
$= 5V$

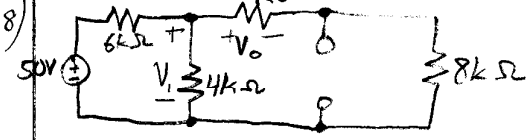
KVL $V_s = V_1 + V_2$
$= 6.67V$

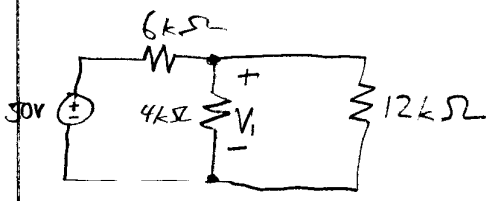
$K = \frac{V_o}{V_s}$

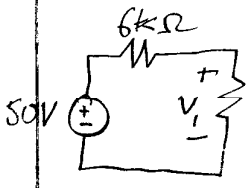
$\boxed{K = .15}$

3) 3-28)

due to 4kΩ voltage source:







$\frac{4k\Omega \cdot 12k\Omega}{4k\Omega + 12k\Omega} = 3k\Omega$

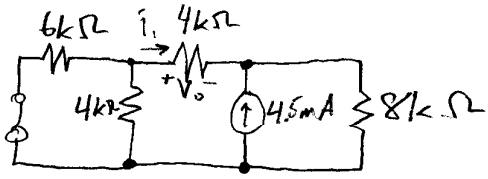
Voltage Division: $V_1 = 50V \cdot \frac{3k\Omega}{3k\Omega + 6k\Omega}$

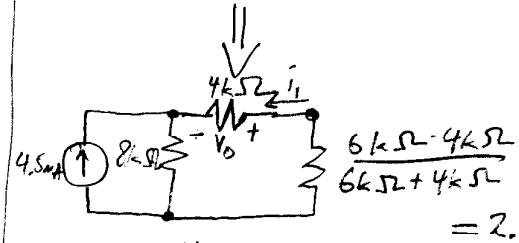
$= 16.67V$

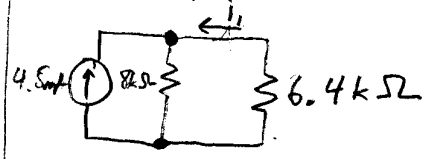
Voltage Division: $V_o = 16.67V \cdot \frac{4k\Omega}{4k\Omega + 12k\Omega}$

$= 5.56V$

due to current source:







current division: $-i_1 = 4.5mA \cdot \frac{8k\Omega}{8k\Omega + 4k\Omega}$

$i_1 = -2.5mA$

$V_o = -2.5mA \cdot 4k\Omega$

$= -10V$

$V_o = 5.56V - 10V$

$\boxed{V_o = -4.44V}$

4) 3-22) Answer is not 4.25W because superposition applies to currents + voltages, not power

$P_1 = i_1^2 \cdot R$

$250\,mW = i_1^2 \cdot 100\,\Omega$

$2500\,(mA)^2 = i_1^2$

$i_1 = 50\,mA$

$P_2 = i_2^2 R$

$i_2^2 \cdot 100\,\Omega = 4\,W$

$i_2^2 = .04\,(A)^2$

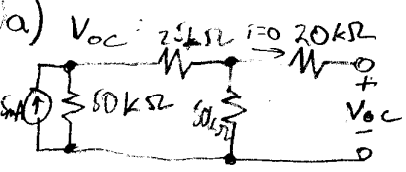
$i_2 = .2\,A$

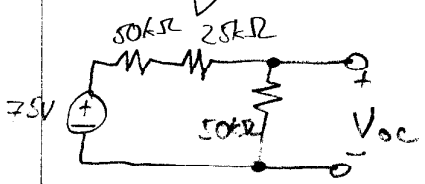
$i = i_1 + i_2 = 250\,mA$

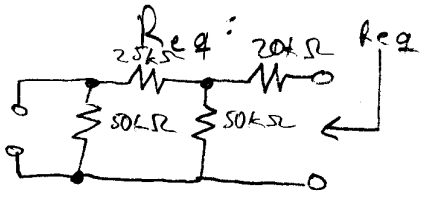
$P = i^2 R$

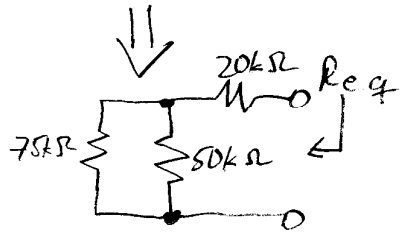
$\boxed{P = 6.25\,V}$

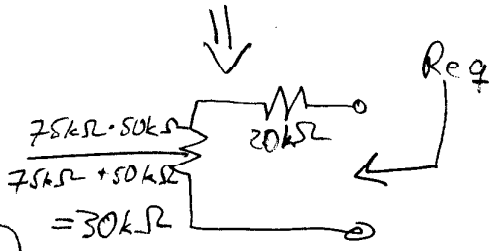
5) 3-28) a)









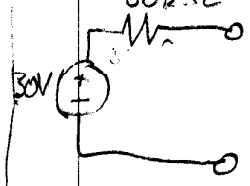


Voltage division: $V_{oc} = 75V \cdot \frac{50k\Omega}{50k\Omega + 25k\Omega + 50k\Omega}$

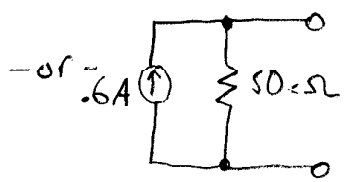
$= 30V = V_T$

$R_{eq} = 50k\Omega$

Thévenin:



Norton:



5
3-38 cont.

b) by voltage division: $V_L = V_T \frac{R_L}{R_T + R_L}$

$= 30V \cdot \frac{R_L}{50k\Omega + R_L}$

$10k\Omega$:	$V_L = 5V$
$25k\Omega$:	$V_L = 10V$
$50k\Omega$:	$V_L = 15V$
$100k\Omega$:	$V_L = 20V$

6
3-43

knowing $v = V_T - iR_T$

$iR_L = V_T - iR_T$

$9V = V_T - .03A \cdot R_T$ and $10V = V_T - .02A \cdot R_T$

$-9V = -V_T + .03A \cdot R_T$

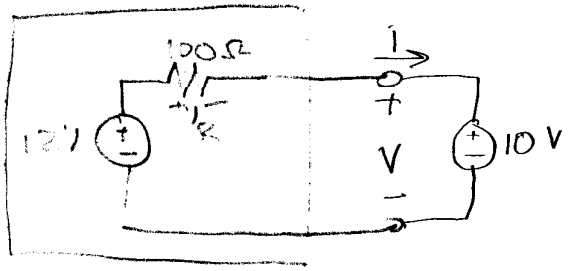
$1V = .01A \cdot R_T$

$100\Omega = R_T$

$10V = V_T - .02A \cdot 100\Omega$

$= V_T - 2V$

$V_T = 12V$



KVL: $12V = V_R + 10V$

$V_R = 2V$

Ohm's: $i = \frac{V_R}{100\Omega}$

$i = 20mA$