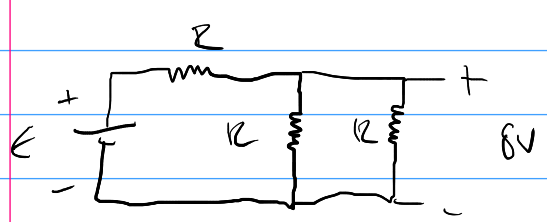
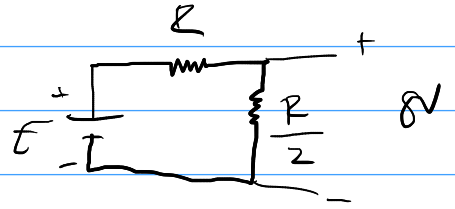
Lab 10

Evaluate:

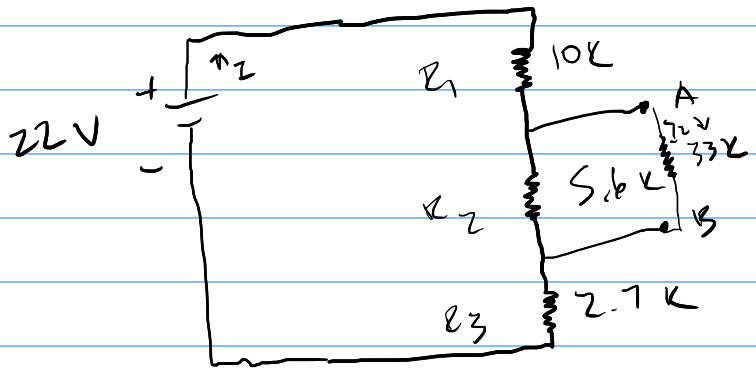
S





$$8 = \frac{\left(\frac{R}{2}\right)}{\left(R+\frac{R}{2}\right)} E = \frac{\frac{R}{2}}{\frac{2R+R}{2}} E = \frac{R}{3R} = 8$$

$$\frac{1}{3} E = 8 \qquad \epsilon = 24V$$



$$V_{AB} = \frac{5.6K + 2.7K}{10K + 5.6K + 2.7K}(22V)$$

$$I = \frac{22V}{10K + 5.6K + 2.7K}$$

$$V_{AB} = I(5.6K + 2.7K)$$

$$R_{23} = (5.6K + 2.7K) \,||\, 33K$$

$$V_{AB} = \frac{R_{23}}{R_{23} + 10K}(22V)$$

$$I_L = \frac{V_{AB}}{33K}$$

$$I_{23} = \frac{V_{AB}}{5.6K + 2.7K}$$

$$R_T = R_1 + R_2 + R_3$$

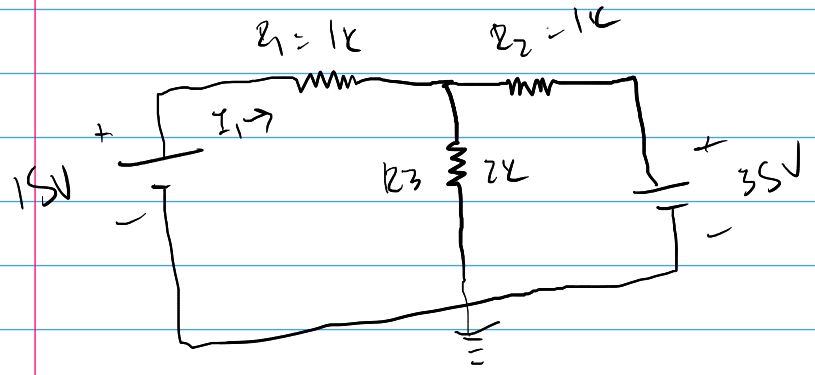
$$I_T = \frac{22}{R_T}$$

$$R_T' = R_1 + R_{23}$$

$$I_T' = \frac{22}{R_T'}$$

Chapter 9

Branch method



$$-15 + 1k\,I_1 + 2k\,I_3 = 0$$

$$-35 + 1k\,I_1 + 2k\,I_3 = 0$$

$$I_1 + I_2 = I_3$$

$$1k\,I_1 + 2k\,I_3 = 15$$

$$1k\,I_2 + 2k\,I_3 = 35$$

$$3I_1 + 2I_2 = 15$$

$$2I_1 + 3I_2 = 35$$

Cramer's Rule

$$\begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 15 \\ 35 \end{bmatrix}$$

I_1 I_2

$$AX = B$$

$$X = A^{-1}B$$

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - bc$$

$$I_1 = \frac{\begin{bmatrix} 15 & 2 \\ 35 & 3 \end{bmatrix}}{\begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}} = \frac{(15)(3) - (2)(35)}{(3)(3) - (2)(2)}$$

$$= -5mA$$

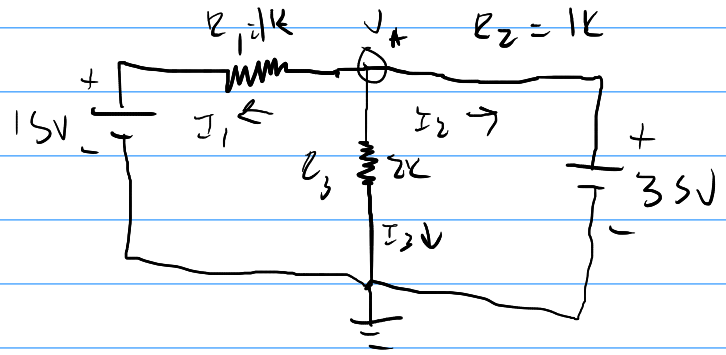
$$I_2 = \frac{\begin{vmatrix} 3 & 15 \\ 2 & 35 \end{vmatrix}}{\begin{vmatrix} 3 & 2 \\ 2 & 3 \end{vmatrix}} = \frac{(3)(35) - (2)(15)}{\cdots} = 15mA$$

$$V_{R_1} = I_1 R_1 = (-5mA)(1K) = -5V$$

$$P_{R_1} = I_1^2 R_1 = V_{R_1} I_1 = \frac{V_{R_1}^2}{R_1}$$

Method 2

Nodal Voltage method



$I_1 + I_2 + I_3 = 0$

$I_1 = \frac{V_{R1}}{R_1}$

$V_A = V_{R_1} + 15$

$V_{R_1} = V_A - 15$

$I_2 = \frac{V_{R_2}}{R_2}$

$V_A = V_{R_2} + 35$

$\frac{V_{R_3}}{R_3} = I_3 \qquad \frac{V_A}{R_3} = I_3$

$$2K\left(\frac{V_A - 15}{1K} + \frac{V_A - 35}{1K} + \frac{V_A}{2K}\right) = 0$$

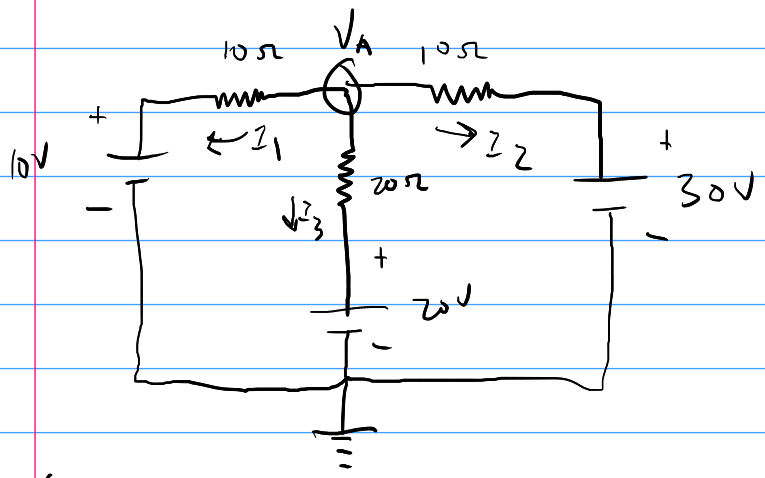
$$2(V_A - 15) + 2(V_A - 35) + V_A = 0$$

$$2V_A - 30 + 2V_A - 70 + V_A = 0$$

$$5V_A = 100$$

$$I_3 = \frac{20}{2K} = 10mA$$

Example:



$$20\left(\frac{V_A - 10}{10} + \frac{V_A - 30}{10} + \frac{V_A - 20}{20}\right) = 0$$

$$2(V_A - 10) + 2(V_A - 30) + (V_A - 20) = 0$$

$$2V_A - 20 + 2V_A - 60 + V_A - 20 = 0$$

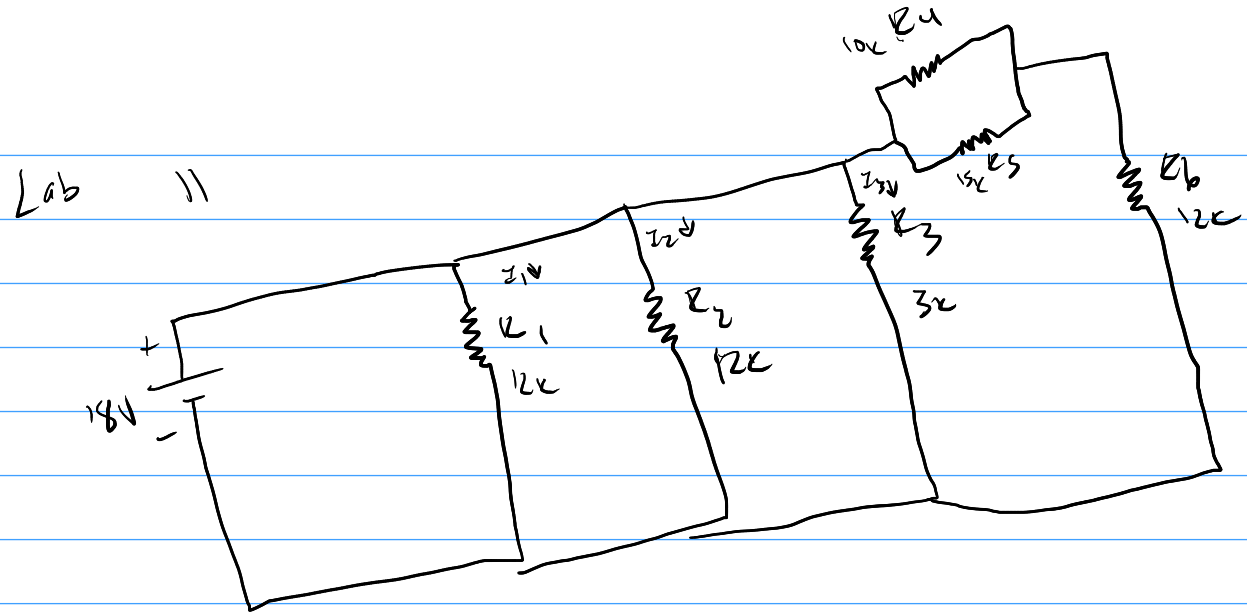
$$5V_A = 100 \qquad V_A = 20V$$

$$I_1 = \frac{20 - 10}{10\Omega} = 1A$$

$$I_2 = \frac{20 - 30}{10\Omega} = -1A$$

$$I_3 = \frac{20 - 20}{20\Omega} = 0A$$

Lab 11



$V_{R_1} = V_{R_2} = V_{R_3} = 18V$

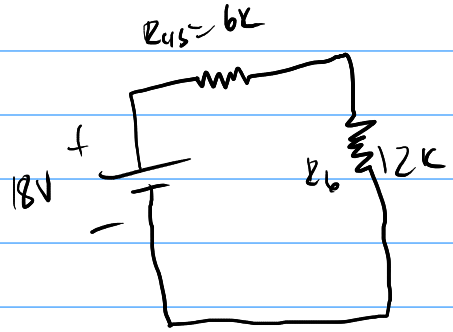
$I_1 = \frac{18}{12k} = 1.5mA$

$I_2 = \frac{18}{12k} = 1.5mA$

$I_3 = \frac{18}{3k} = 6mA$

$(10k) \| 15k = \frac{(10)(15)}{(10)+(15)} = \frac{150}{25}$

$= 6k$



$I_1 = \frac{18V}{6k+12k} = 1mA$

$I_4 = \frac{R5}{R5+R4} I = \frac{15k}{15k+10k}(1mA)$