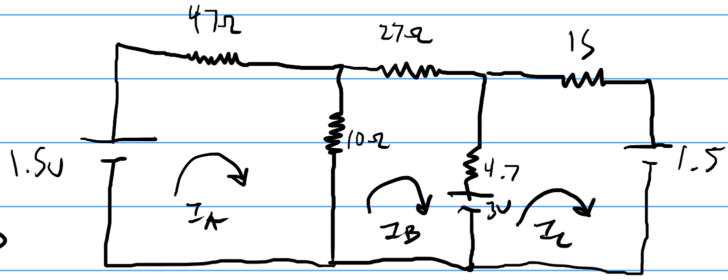
$$-1.5+47+10(I_A-I_B)=0$$

$$27I_B+4.7(I_B-I_C)+3+10=0$$

$$15I_C+1.5-3+4.7(I_C-I_B)=0$$




$$57I_A-10I_B+0\cdot I_C=1.5$$

$$-10I_A+41.7I_B-4.7I_C=-3$$

$$0\cdot I_A-4.7I_B+19.7I_C=1.5$$

$$\begin{bmatrix} 57 & -10 & 0 \\ -10 & 41.7 & -4.7 \\ 0 & -4.7 & 19.7 \end{bmatrix}\begin{bmatrix} I_A \\ I_B \\ I_C \end{bmatrix}=\begin{bmatrix} 1.5 \\ -3 \\ 1.5 \end{bmatrix}$$

a = [57 -10 0; -10 41.7 -4.7; 0 -4.7 19.7]

b = [1.5 -3 1.5]

a/b

$I_A = 30.5$ mA

$I_B = 23.7$ mA

$I_C = 3.18$ mA

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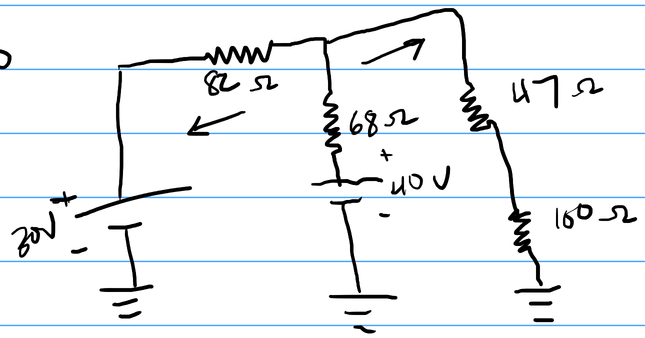


$$\frac{VA-30}{82} + \frac{VA-40}{68} + \frac{VA}{47+100} = 0$$

$$\frac{VA}{82} - \frac{30}{82} + \frac{VA}{68} - \frac{40}{68} + \frac{VA}{147} = 0$$

$$VA\left\{\frac{1}{82} + \frac{1}{68} + \frac{1}{147}\right\} = \frac{30}{82} + \frac{40}{68}$$

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## Maximum Power transfer


A load will recieve maximum Power from a linear network when its total resistance value is exactly equal to the Thevenine resistance of the network

$$R_L = R_{Th}$$

$$\text{Power} = \frac{V_{R_L}^2}{R_L}$$

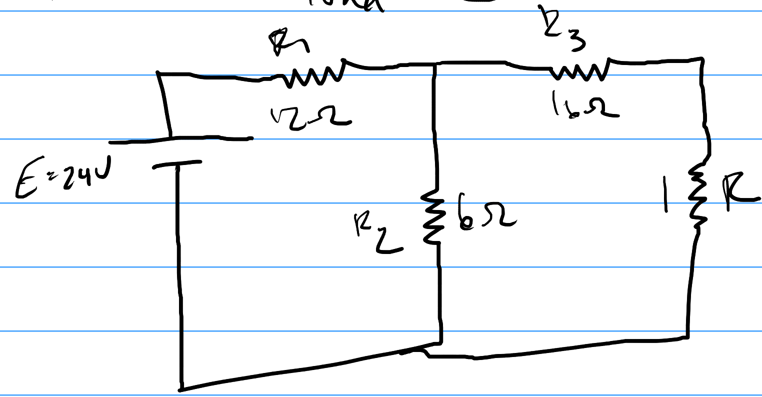
$$V_{R_L} = \frac{R_L}{R_L + R_{Th}} V_{th}$$

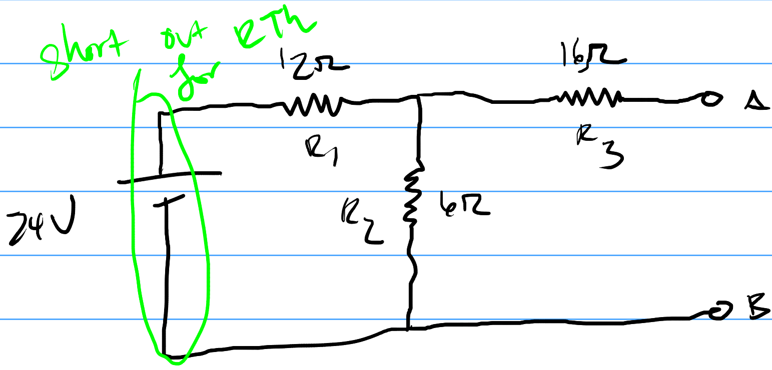
$$P_{R_L} = \frac{V_{R_L}^2}{R_L} = \frac{\left(\frac{R_L}{R_L + R_{Th}} V_{Th}\right)^2}{(R_L + R_{Th})^2 R_L}$$

$$\frac{dP_{R_L}}{R_L} = 0 \qquad P_x = \frac{x^2 V_{Th}^2}{(x+R_{Th})^2 x}$$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'g - g'f}{g^2} \qquad \frac{dP_x}{dx} =$$

Example: Determine R for maximum Power transfer to the load R




No current to $R_3$

$V_{R_3} = I \cdot R_3 = 0$

$V_{AB} = V_{R_2}$

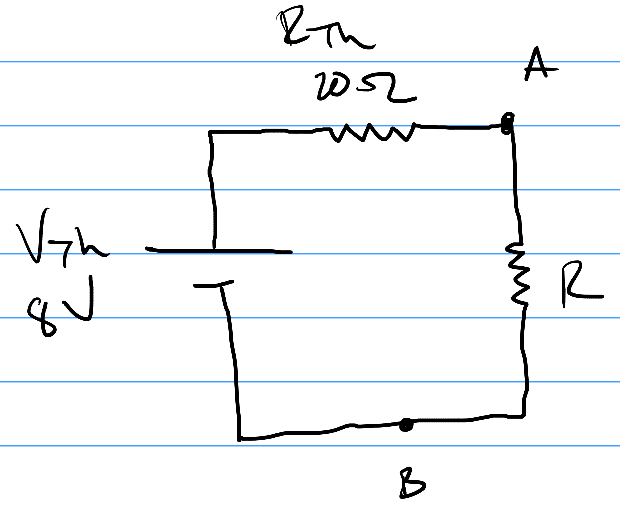
$$V_{AB} = V_{R_2} = \frac{6}{6+12}(24) = 8V$$

$V_{Th} = 8V$

$$R_{Th} = R_{AB} = R_1 \parallel R_2 + R_3$$

$$= 12\Omega \parallel 6\Omega + 16\Omega =$$

$$\frac{(12)(6)}{12+6} + 16 = 20\,\Omega$$




$$R = R_{Th} = 20\,\Omega$$

$$V_R = \frac{V_{Th}}{2}$$

$$I_R = \frac{V_{Th}}{R_{Th}+R} = \frac{V_{Th}}{2R}$$

$$P_R = \frac{V_{Th}^2}{4R}$$

$$P_R = I_R^2 R$$

$$= \left(\frac{V_{Th}}{2R}\right)^2 R = \frac{V_{Th}^2}{4R^2}$$