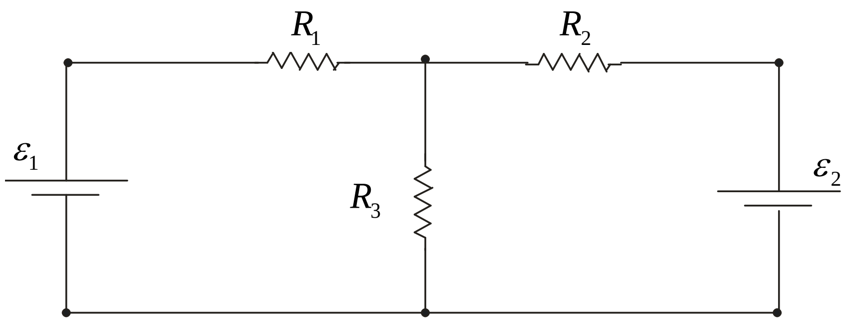
Physics 112
Preliminary Laboratory Questions Exp.4
network analysis II : Thevenin and Norton techniques

For the circuit shown:



ε_1= 8 volt, ε_2 =4 volt, R_1=1 KΩ, R_2=2 KΩ, R_3=4 KΩ.

a) Use Thevenin's equivalent circuit techniques to find the current passing through R_3.

$$R_L = R_3$$

$$R_{eq} = \frac{R_1 + R_2}{R_1 R_2} = \frac{1 \times 10^3 \times 2 \times 10^3}{(1+2) \times 10^3} = \frac{2}{3}\Omega$$

$$\varepsilon_{eq} = \varepsilon_1 - \frac{(\varepsilon_1 - \varepsilon_2)R_1}{R_1 + R_2} = 8 - \frac{(8-4) \times 1 \times 10^3}{(1+2) \times 10^3} = \frac{20}{3} volt$$

$$I_{R_L} = I_{R_3} = \frac{\varepsilon_{eq}}{R_{eq} + R_L} = \frac{\varepsilon_{eq}}{R_{eq} + R_3} = \frac{20/3}{2/3 + (4 \times 10^3)} = 1.67\ mA$$

b) Use Norton's equivalent circuit techniques to find the current passing through R_3 .

$$\varepsilon_{eq} = \frac{\varepsilon_1}{R_1} + \frac{\varepsilon_2}{R_2} = \frac{8}{1 \times 10^3} + \frac{4}{2 \times 10^3} = 10\ mA$$

$$I_{R_L} = \frac{I_{eq} R_{eq}}{R_{eq} + R_L}$$

$$I_3 = \frac{I_{eq} R_{eq}}{R_{eq} + R_3} = \frac{10 \times 10^{-3} \times 2/3}{2/3 + (4 \times 10^3)} = 1.67\mu A$$