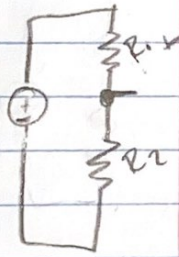
Prelab 1.2

1a. An ideal voltage meter has [infinit] internal resistance and should be in [parallel] with the circuit or device being tested.

b. An ideal current meter has [zero] internal resistant and should be in [series] with the circuit or device being tested



2. $S_{R_i}^{Req} = R_i \frac{\partial}{\partial R_i}(\ln Req)$ $\quad R_r = \frac{R_2}{R_1+R_2}$

$S_{R_i}^{Rr} = R_i \frac{\partial}{\partial R_i}(\log Rr)$

$S_{R_i}^{Rr} = \frac{R_i}{Rr} \cdot \frac{\partial Rr}{\partial R_i}$ $\quad \frac{R_1}{\frac{R_2}{R_1+R_2}} \cdot \frac{d\left(\frac{R_2}{R_1+R_2}\right)}{d R_1}$

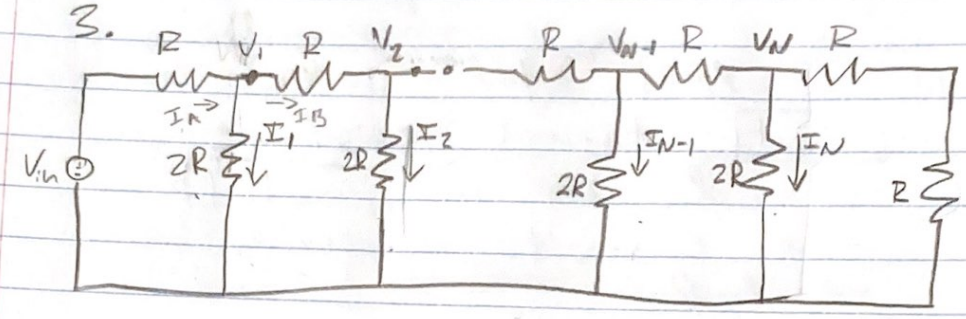
$S_{R_2}^{R} = \frac{R_2(R_1+R_2)}{R_2} \cdot \frac{R_1}{(R_2+R_1)^2}$ $\quad \frac{R_1(R_1+R_2)}{R_2} \cdot -\frac{R_2}{(R_2+R_1)^2}$

$S_{R_2}^{R} = \frac{R_1}{R_2+R_1}$ $\quad S_{R_1}^{Rr} = -\frac{R_1}{R_2+R_1}$

→ The total tolerance is the sensitivity of the voltage divider ratio compared to R_1 and the sensitivity compared to R_2 multiplied by 0.05

$$T_t = \left(S_{R_1}^{Rr} + S_{R_2}^{Rr}\right) \underbrace{0.05}_{T_i}$$

3.



$$V_1 = V_{in}\left(\frac{R}{R+R}\right) = \quad V_1 = \frac{1}{2}V_{in}$$

$$V_2 = V_1\left(\frac{R}{R+R}\right) \quad = \quad V_2 = \frac{1}{4}V_{in}$$

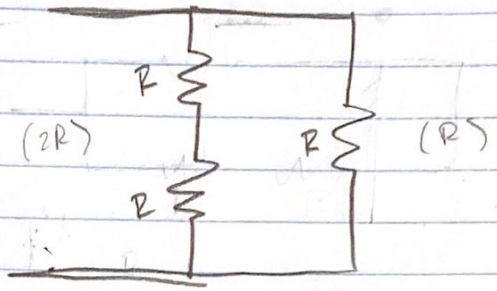
$$I_1 = V_1(2R) = \quad V_{in}R$$

$$I_2 = V_2(2R) = \quad \frac{1}{2}V_{in}R$$

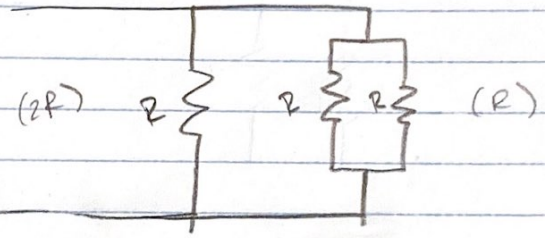
$$I_n = \frac{1}{2^n}V_{in}R$$

2:1
1:½

4.



$I_{out} = I_{in} \cdot \frac{R_{\#} \| R_{eq}}{R_{eq}}$



The second method uses one less Resistor in the resistor ladder