ENGR965: HW#4

3; $V_{out} \simeq \frac{\Delta R}{4R} V$

$* V_3 = \frac{R}{R+R} \cdot V = \frac{V}{2}$

$* V_x = \frac{R_x}{R+R_x} \cdot V$

$* V_{out} = V_x - V_3$

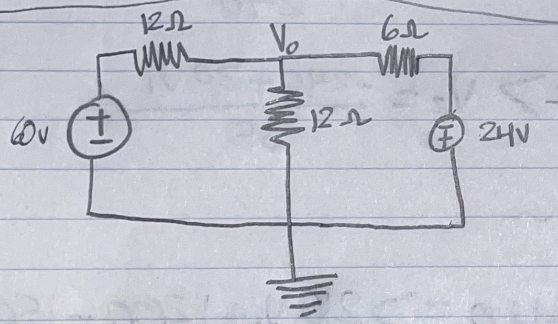
$\Rightarrow \frac{R_x}{R+R_x} V - \frac{V}{2} \Rightarrow \left(\frac{R_x}{R+R_x} - \frac{1}{2}\right) V$

$\Rightarrow \left(\frac{2R_x - (R+R_x)}{2(R+R_x)}\right) V \Rightarrow \left(\frac{2R_x - R - R_x}{2(R+R_x)}\right) V$

$\Rightarrow \left(\frac{R_x - R}{2(R_x+R)}\right) V \Rightarrow \left(\frac{R+\Delta R - R}{2(R+\Delta R+R)}\right) V$

$\Rightarrow \left(\frac{\Delta R}{2(\Delta R+2R)}\right) V \Rightarrow \frac{\Delta R}{2(2R)} V = \boxed{\frac{\Delta R}{4R} V}$

4;



$\boxed{V_o = 3}$

a) Use node-voltage method to compute V_o

$$\frac{V_o - 60}{12} + \frac{V_o}{12} + \frac{V_o + 24}{6} = 0$$

$$\Rightarrow V_o - 60 + V_o + 2V_o + 48 = 0$$

$$\Rightarrow 4V_o - 12 = 0 \Rightarrow \frac{4}{4} V_o = \frac{12}{4} = 3$$

b) Compute power dissipated in all powers.

$I_1 = \frac{60 - V_o}{12} = \frac{60-3}{12} = \frac{57}{12}$; $P_1 = I_1^2 R = \left(\frac{57}{12}\right)^2 (12) = \frac{57 \cdot 57}{12}$

$\boxed{P_1 = 270.75w}$

$I_2 = \frac{V_o}{12} = 3/12 = 1/4 \Rightarrow P_2 = I_2^2 R = (1/4)^2 (12) = 12/16 \Rightarrow 3/4 \Rightarrow \boxed{P_2 = 0.75w}$

$I_3 = I_1 - I_2 = 4.75 - 0.25 = 4.5 \Rightarrow P_3 = I_3^2 R = (4.5)^2 (6) \Rightarrow \boxed{P_3 = 121.5w}$