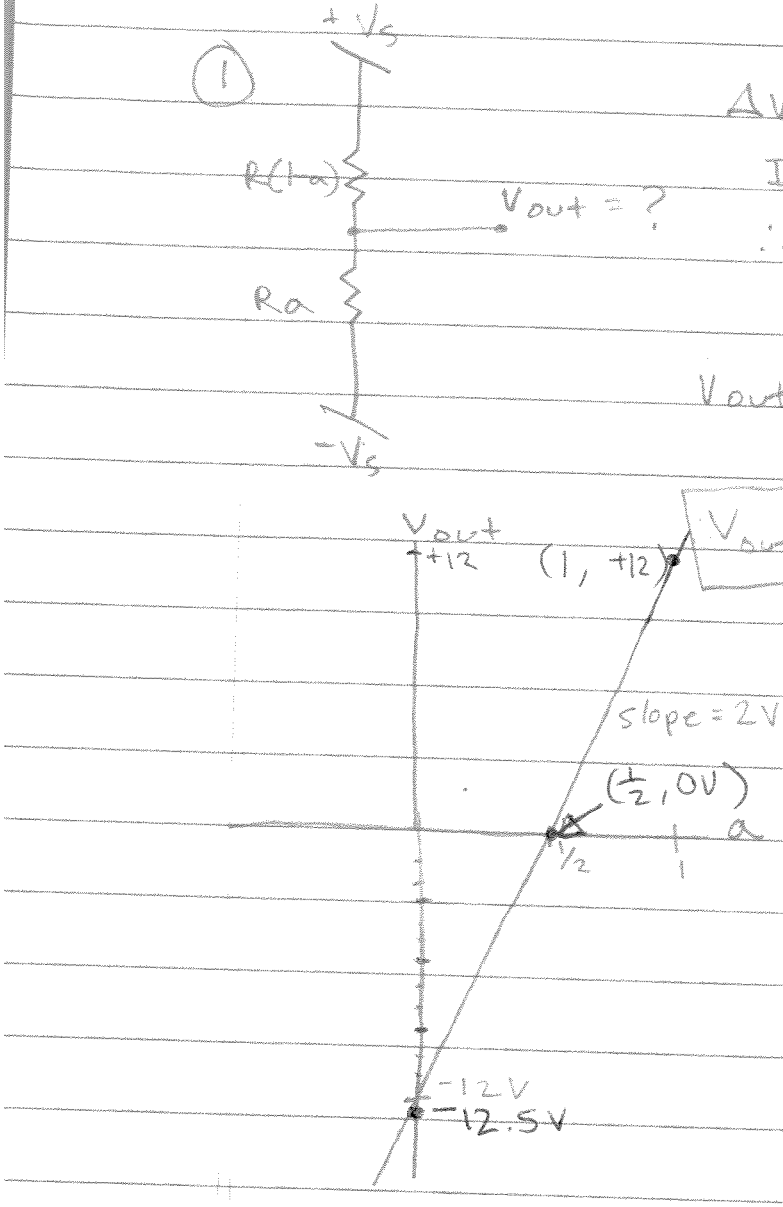
Ruby Spring

Intro to circuits prelab + lab



① $\Delta V = IR(1-a)$

$I = \frac{2V_s}{R}$

$\therefore \Delta V = \frac{2V_s}{R}(1-a)R = 2V_s(1-a)$

$V_{out} = V_s - 2V_s(1-a) = V_s(1-2(1-a))$

$= V_s(1-2+2a)$

$\boxed{V_{out} = V_s(2a-1)}$

graph:

$V_{out} = 12(2a-1) = 24a - 12$

② $i_{total} = i_1 + i_2$ $\quad i_1 = \frac{V}{R_1}$ $\quad i_2 = \frac{V}{R_2}$ $\quad i = \frac{V}{R_{eq}}$

$i_1 = \frac{V}{R_1} + \frac{V}{R_2} = \frac{R_2 V}{R_1 R_2} + \frac{R_1 V}{R_1 R_2} = \frac{R_2 V + R_1 V}{R_1 R_2} = \frac{V(R_2 + R_1)}{R_1 R_2}$

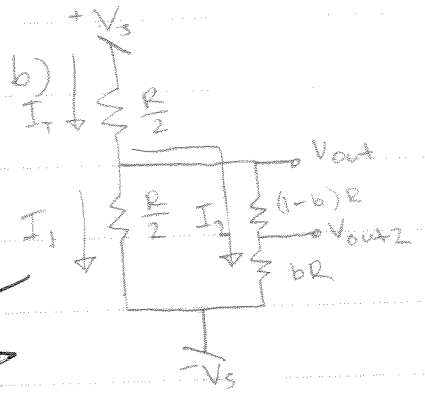
$i_1 = V \Big/ \frac{R_1 R_2}{R_1 + R_2}$

R_{eq}

$\therefore R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$

(3) a) $V_{out} = 12(2a-1) = 12(2\frac{1}{2}-1) = 12(0) = 0$ $\boxed{V_{out} = 0V}$

b)



$R_{eq} = \frac{R}{2} + \left[\frac{\frac{R}{2}\,R}{\frac{R}{2}+R}\right] = \frac{R}{2} + \left[\frac{R^2/2}{\frac{3R}{2}}\right] = \frac{R}{2} + \frac{2R^2}{6R}$

$R_{eq} = \frac{3R}{6} + \frac{2R}{6} = \frac{5R}{6}$

$I_{total} = \frac{V_{total}}{R_{eq}} = \frac{2V_S}{5R/6} = \frac{12V_S}{5R}$

lab results

~~what~~ fluctuates b/w -2.45 and -12

$V_{out} = V_S - I_T\frac{R}{2} = V_S - \frac{6}{5R}V_S \cdot \frac{R}{2} = V_S - \frac{6}{5}V_S = \boxed{-2.4V}$

* because R_{eq} has changed!

c) $\boxed{V_{out2} = V_{out} - I_2 R(1-b)}$ or $V_{out2} = V_{out} - \left[\frac{12V_S}{5R} - \frac{(V_{out}+V_S)2}{R}\right]$

$I_2 = I_T - I_1 = \frac{12V_S}{5R} - \frac{(V_{out}+V_S)}{R/2} = \frac{12V_S}{5R} - \frac{9.6\cdot 2}{R}$

$I_2 = .00288 - .00192 = 9.6\times10^{-4}\,A$

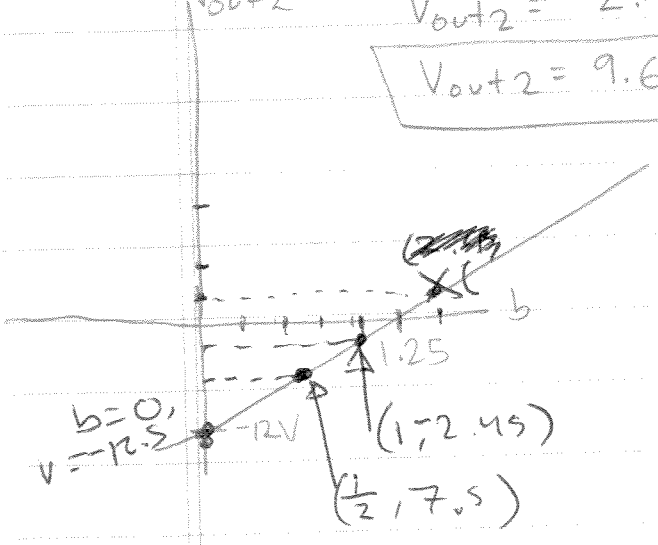
graph: $V_{out2} = -2.4V - \left[9.6\times10^{-4}A \cdot 10{,}000\Omega\right](1-b)$

V_{out2} $V_{out2} = -2.4V - 9.6(1-b) = -2.4V - 9.6 + 9.6b$

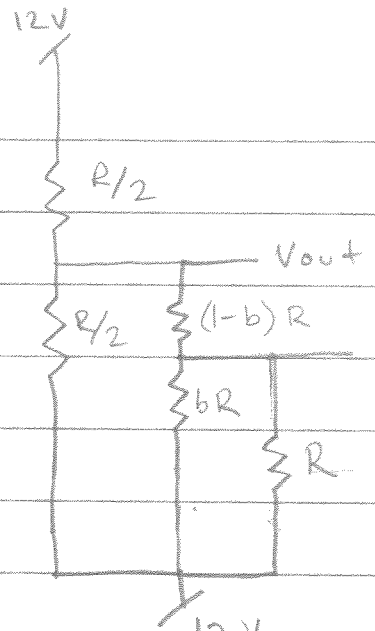
$\boxed{V_{out2} = 9.6b - 12}$

$\begin{array}{r} 0\,1\,1\,0 \\ \times\ 1\ 0\ 0\ 1 \\ \hline 9.6 \\ 2.4 \end{array}$

$\frac{9.6}{2} = 4.5 + .3$



a) find V_{out} when $b = 0, 1$



$b = 0$:

$$R_{eq} = \frac{R}{2} + \frac{R/2 \cdot R}{R/2 + R} = 8,333.3\overline{3}$$

$$V_{out,0} = 12V - I_T R/2$$

$$= -2.4V$$

$$I_{T,0} = \frac{24V}{8,333.3\Omega} = .00288A$$

$$\frac{R^2}{2R} = \frac{R}{2}$$

$b = 1$:

$$R_{eq} = \frac{R}{2} + \frac{R/2 \cdot R/2}{R} = \frac{R}{2} + \frac{R^2/4}{R} = \frac{R}{2} + \frac{R}{4} = \frac{3R}{4}$$

$$I_{T,1} = \frac{24V \cdot 4}{2R} = \frac{32}{R} = .0032A$$

$$V_{out,1} = 12V - .0032 \cdot \frac{10,000}{2} = -4V$$

before resistance

b	Vout
0	-2.45
1	-2.45
1/2	-2.45

after resistance is added

b	vout
0	-2.35
1	-2.73
1/2	-3.88