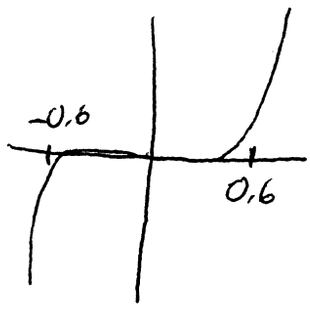
EECS 245

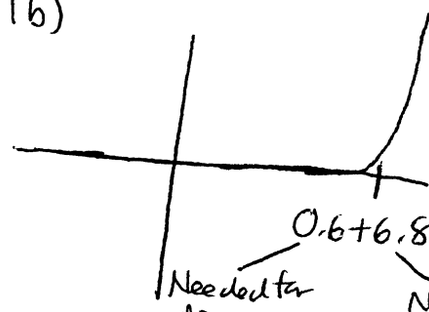
Hmwk #1 solution

3.5 Note, these are <u>not</u> ideal, but typical diodes. Thus, they have ~0.6 V drop when conducting, and slight curve

(a)

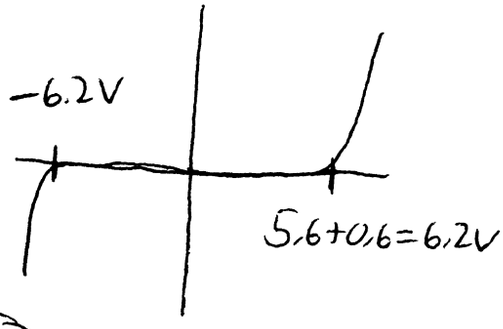


(b)



<u>Note</u>: The Zener will conduct at -0.6V and lower, but the other diode won't until it breaks

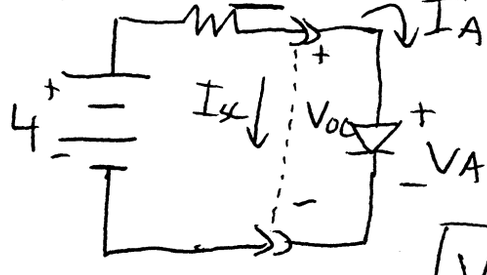
(c)



In both directions, we need 0.6 volts to turn on the forward diode, and 5.6 more to push the reverse diode into breakdown

3.9 The key to load-line is to find the open-circuit voltage and short-circuit current, plot them, draw a line, and then find the operating point. BE CAREFUL in drawing your graphs; if the scale is off, your answer will be too.

(a) 1.5kΩ ← book mistake



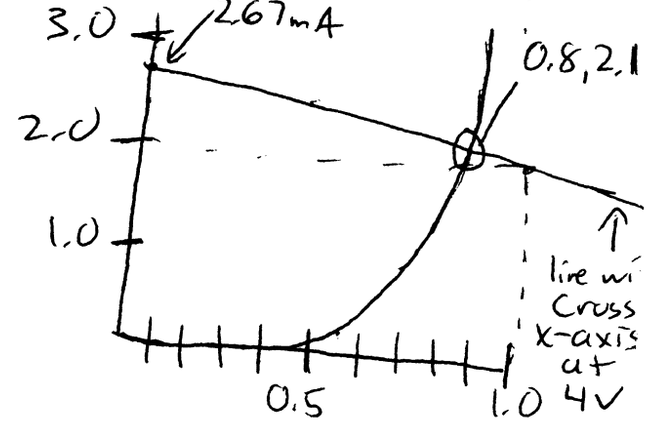
$V_{OC} = 4V$

$I_{SC} = \frac{4}{1.5k\Omega}$

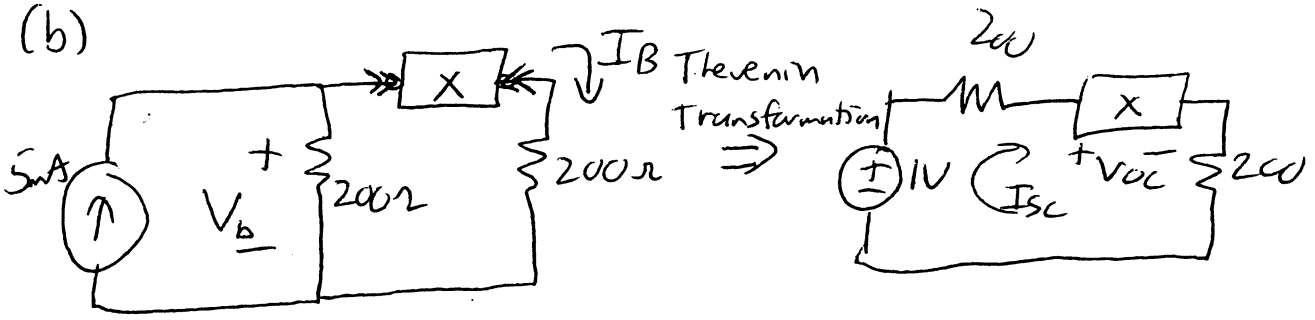
$= 2.67mA$

$V_A \approx 0.8V$

$I_A \approx 2.1mA$



(b)



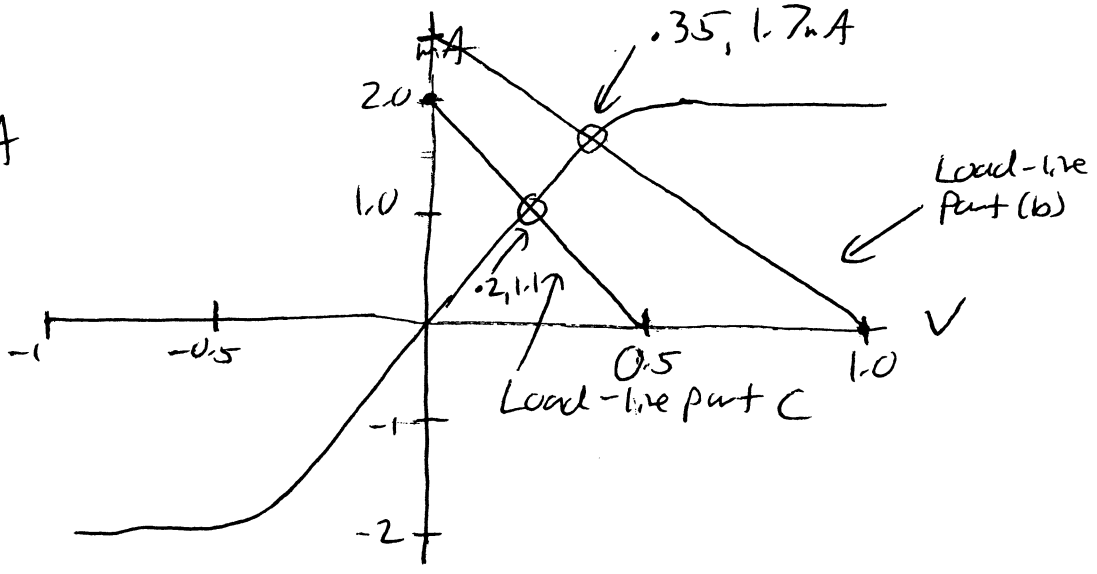
$V_{OC} = 1V$

$I_{SC} = \frac{1V}{400\Omega} = 2.5mA$

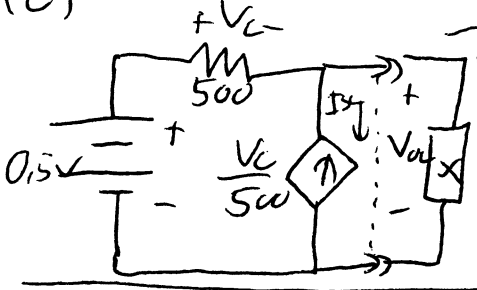
$I_b = i_x = \boxed{1.7mA}$

$V_b = V_x + 200 i_x$

$\boxed{V_b \approx 0.69V}$



(c)



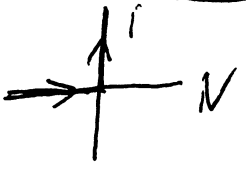
$V_{OC} = 0.5V$

$I_{SC} = \frac{V_C}{500} + \frac{V_C}{500} = \frac{V_C}{250}$

When shorted, $V_C = 0.5V \therefore \underline{I_{SC} = 2mA}$

$\boxed{I_C = i_x \approx 1.1mA \quad V_C = 0.5 - V_x \approx 0.3V}$

(3.15) Note that these are ideal diodes; they have the following transfer:



Thus, when on, Vd=0, not 0.6

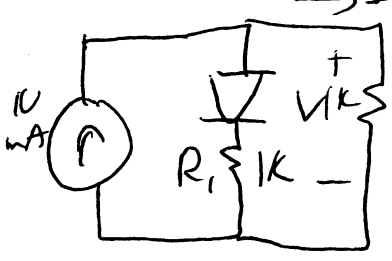
A good way to analyze is to assume the diodes are off, then turn them on when forward biased and re-analyze circuit until everything fits.

(a) +10V at the anode, 0 at the cathode → diode will turn on. Thus, $\boxed{V=0}$ and $\boxed{I = \frac{10V}{2.7K\Omega} = 3.7mA}$

(b) 0 at the anode, 10V at the cathode → diode remains off. $\boxed{V=10,\ I=0}$ (diode acts like open circuit)

(c) 5V at anode, 0 at cathode → diode turns on. Since $R_{on} = 0$ ~~for~~ for diode, all current will flow through it. Thus, $\boxed{I=0,\ V=0}$ (diode acts like a wire)

(d) Initially, diode is off. All current flows through R_2, causing V to rise to $(10mA)(1K) = 10V$. Diode R_2 turns on, and we have a current divider.



$\boxed{I = 5mA,\ V = 5V}$