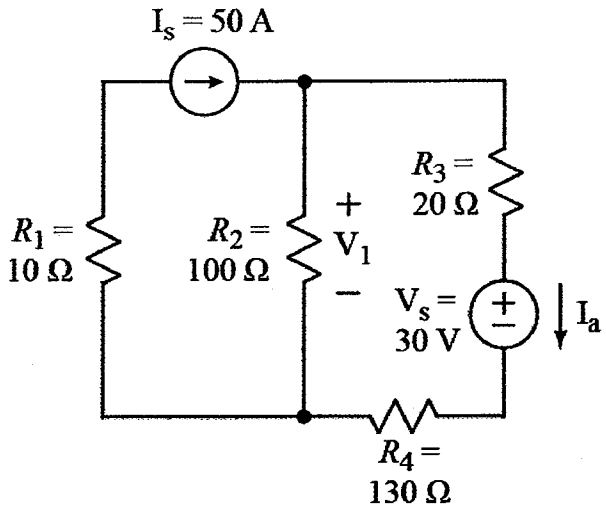
2. (20 points)

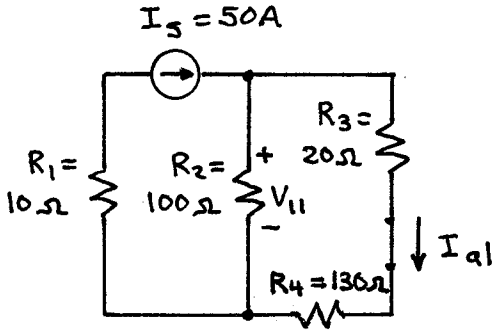


Use the method of superposition to find the values of the following:

10 pts a) V_1

10 pts b) I_a

sol'n: a), b) case I: I_s on, V_s off = wire



We have current divider.

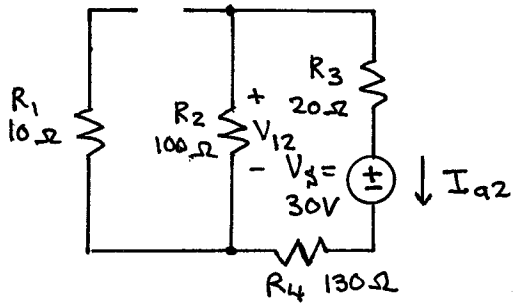
$$I_{a1} = 50A \cdot \frac{R_2}{R_2+R_3+R_4} = 50A \frac{100}{100+10+130} = 50A \cdot \left(\frac{2}{5}\right)$$

$$I_{a1} = \frac{100}{5} A = 20A$$

$$V_{11} = 50A \cdot \frac{(R_3+R_4)R_2}{R_2+R_3+R_4} = 50A \cdot 150 \| 100$$

$$V_{11} = 50A \cdot 50 \cdot 3 \| 2\Omega = \frac{15k}{5} V = 3kV$$

case II: I_s off = open, $V_s = 30V$



We have a V-divider for V_{12}.

$$V_{12} = V_s \cdot \frac{R_2}{R_2+R_3+R_4} = 30V \cdot \frac{100\Omega}{250\Omega}$$

$$V_{12} = 12\,V$$

We use Ohm's law to find I_{a2}.

$$I_{a2} = \frac{-V_s}{R_2+R_3+R_4} = \frac{-30V}{250\Omega} = -0.12\,A$$

Now we'll sum results for final answer.

$$V_1 = V_{11} + V_{12} = 3000V + 12\,V = 3012\,V$$

$$I_a = I_{a1} + I_{a2} = 20\,A + -0.12\,A = 19.88A$$

$$\boxed{V_1 = 3012\,V}$$

$$\boxed{I_a = 19.88A}$$