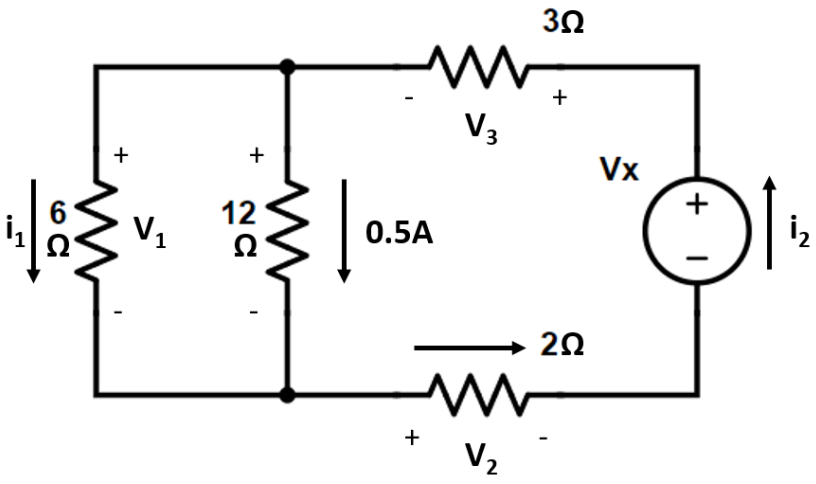
ECE100: Homework 1, Part 1 Solutions

Q1 (P1.27 from the textbook):

(a) $P = 60\text{W}$ delivered to element A
(b) $P = 60\text{W}$ taken from element A
(c) $P = 60\text{W}$ delivered to element A

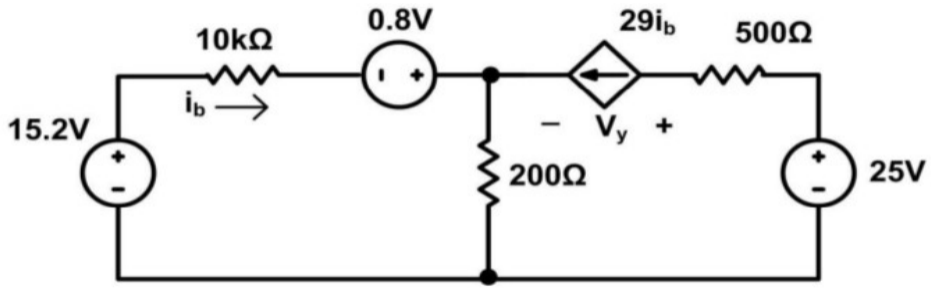
Q2 (P1.66 from the textbook):

(a) The 3-Ω resistance, the 2-Ω resistance, and the voltage source V_x are in series.
(b) The 6-Ω resistance and the 12-Ω resistance are in parallel.
(c) Refer to the sketch of the circuit. Applying Ohm's Law to the 12-Ω resistance, we determine that $v_1 = 6\text{V}$. Then, applying Ohm's Law to the 6-Ω resistance, we have $i_1 = 1\text{A}$. Next, KVL yields $i_2 = 1.5\text{A}$. Continuing, we use Ohm's Law to find that $v_2 = 3\text{V}$ and $v_3 = 4.5\text{V}$. Finally, applying KVL, we have $V_x = v_3 + v_1 + v_2 = 13.5\text{V}$.



Q3:

Find the voltage V_y in the following circuit:



The circuit contains two loops (3 if you count the outer loop), so we can write the following equations:

$$15.2 + 0.8 = 10{,}000i_b + 200i_{200\Omega}$$

$$200i_{200\Omega} + V_y + 500(29i_b) = 25$$

We can also write the following KCL equation for the central node:

$$i_{200\Omega} = i_b + 29i_b = 30i_b$$

We can plug this into the first KVL equation above:

$$10{,}000i_b + 200(30i_b) = 16$$

Solving for i_b:

$$16{,}000i_b = 16$$

$$i_b = 1\text{mA}$$

Now we can plug everything into the second equation to get V_y:

$$V_y = 25 - 200(30i_b) - 500(29i_b) = 25 - 20{,}500i_b = 25 - 20.5 = 4.5\text{V}$$