Exam #1 → Tuesday February 5, 2018 @ 3:30pm

Concepts Chapter #1:

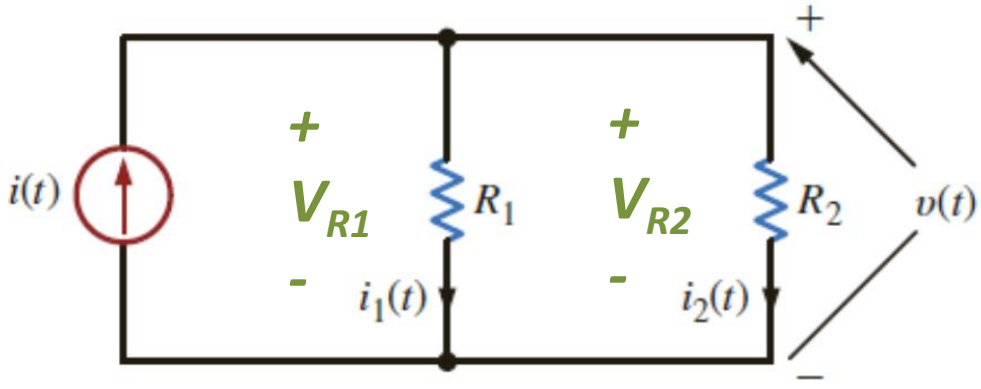
- **Current/Charge Relationship**
- **Power/Energy/Current/Voltage Relationships**
- **Conservation of Energy**

Concepts Chapter #2:

- **Ohm's Law (passive sign convention)**
- **Kirchhoff's Current Law (KCL)**
- **Kirchhoff's Voltage Law (KVL)**
- **Voltage/Current Divider**
- **Equivalent Resistance**
- **Wye/Delta Transformations**
- **Solving Circuits**

***** "Bate": bring your own set of equations (no problems, photocopies, solutions, etc)… subject to approval by the professor**

Last Lecture → Current / Voltage Division

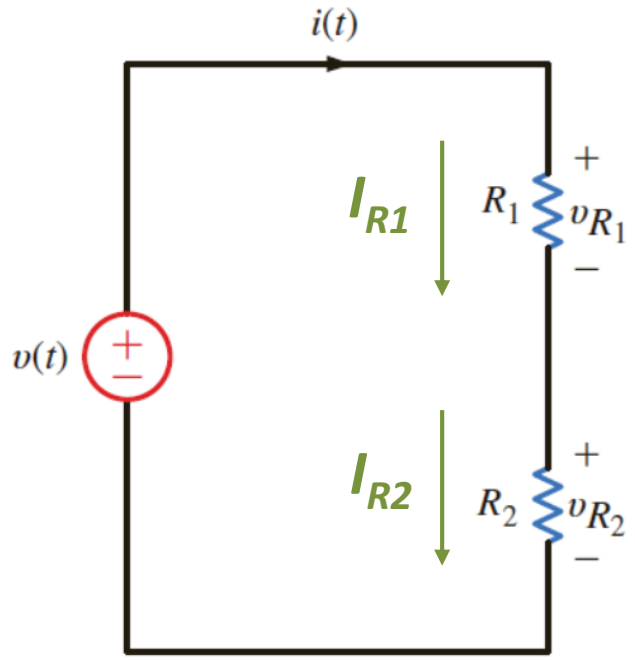


* $V_{R1}=V_{R2}=v(t)$

∴ R_1 and R_2 are in <u>parallel</u>

$$\therefore i_1(t) = \frac{R_2}{R_1 + R_2} \cdot i(t)$$

$$i_2(t) = \frac{R_1}{R_1 + R_2} \cdot i(t)$$



* $I_{R1} = I_{R2} = i(t)$

∴ R_1 and R_2 are in <u>series</u>

$$\therefore v_{R1} = \frac{R_1}{R_1 + R_2} \cdot v(t)$$

$$v_{R2} = \frac{R_2}{R_1 + R_2} \cdot v(t)$$

Last Lecture → Multiple Source/Resistor Networks

- **Series**

  The sum of several voltage source in series can be replaced by one source whose value is the algebraic sum of the individual source

  The equivalent resistance of N resistors in series is simply the sum of the individual resistances.

$$R_s = R_1 + R_2 + \cdots + R_N$$

- **Parallel**

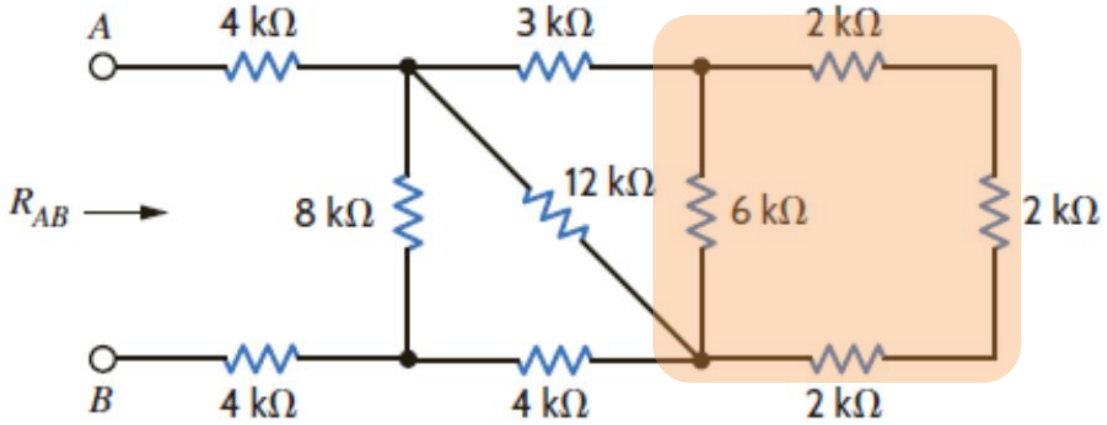
  The sum of several current source in series can be replaced by one source whose value is the algebraic sum of the individual source

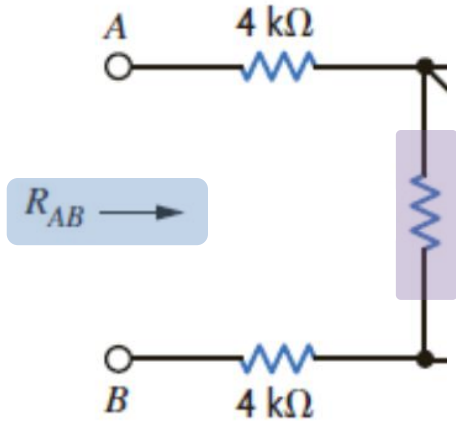
  The reciprocal of the equivalent resistance of N resistors in parallel is equal to the sum of the reciprocal of the individual resistances.

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_N}$$

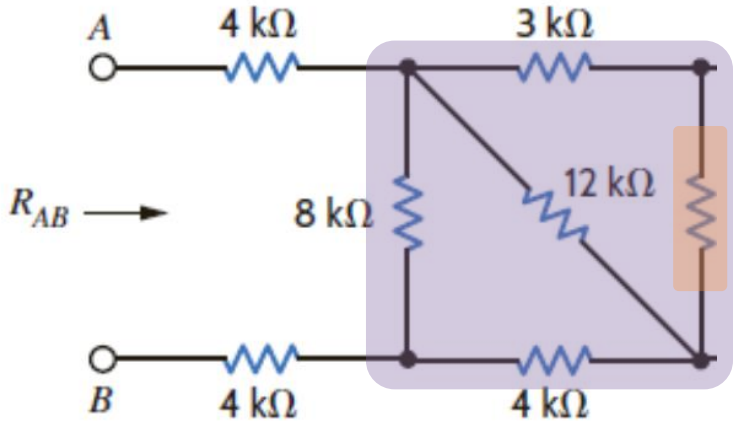
Series/Parallel Resistor Combinations

E2.16: Find R_{AB} in the provided network.





$$8k \| (12k \| (3k + 3k) + 4k) = 4k$$

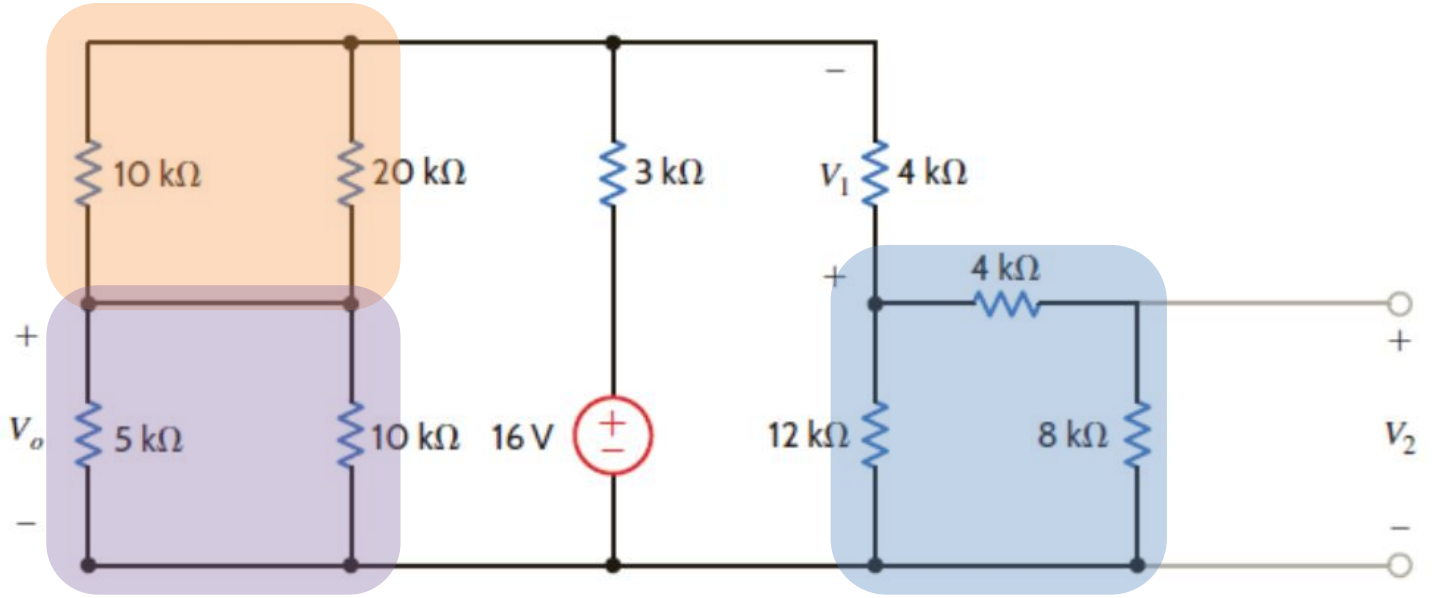


$$6k \| (2k + 2k + 2k) = 3k$$

$$\therefore R_{AB} = 4k + 4k + 4k$$

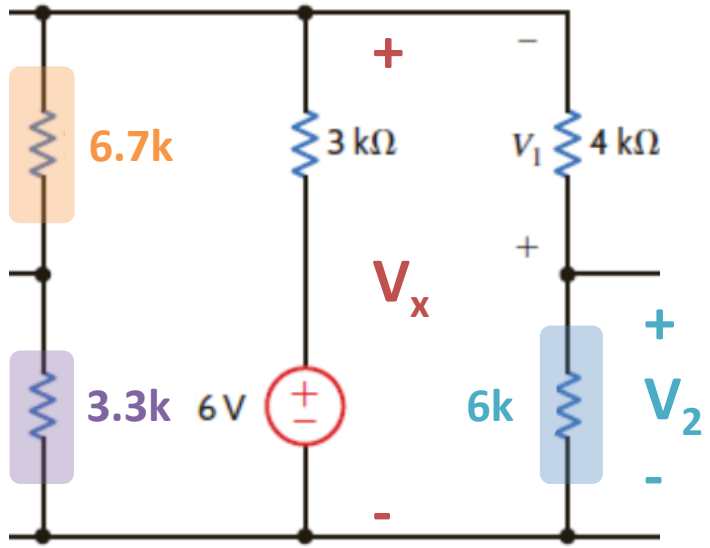
Learning Assessment E2.22

Find V_0, V_1, and V_2 in the network provided.



$$V_0 = V_x\left[\frac{3.3k}{6.7k + 3.3k}\right] = 1.24V$$

$$V_0 = 4.5\left[\frac{8k}{4k + 8k}\right] = 3V$$



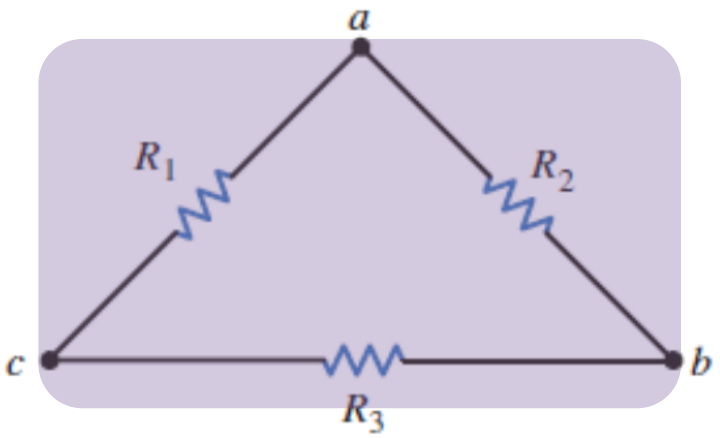
$$V_x = 6\left[\frac{10k \| 10k}{3k + 10k \| 10k}\right] = 3.75V$$

$$V_1 = -V_x\left[\frac{4k}{6k + 4k}\right] = -1.5V$$

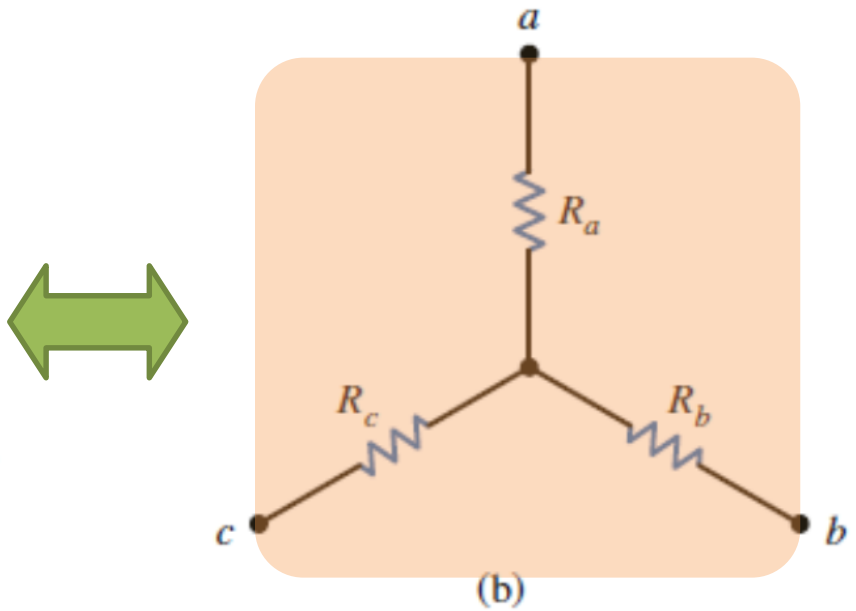
$$V_2 = 6 + V_1 = 4.5V$$

Wye ⇆ Delta Transformations

For the two networks to be equivalent at each corresponding pair of terminals, it is necessary that the resistance at the corresponding terminals be equal (e.g., the resistance at terminals a and b with c open-circuited must be the same for both networks.



(a)



(b)

$$\Delta \leftarrow Y \begin{cases} R_1 = \dfrac{R_aR_b + R_bR_c + R_aR_c}{R_b} \\ R_2 = \dfrac{R_aR_b + R_bR_c + R_aR_c}{R_c} \\ R_3 = \dfrac{R_aR_b + R_bR_c + R_aR_c}{R_a} \end{cases}$$

$$Y \leftarrow \Delta \begin{cases} R_a = \dfrac{R_1R_2}{R_1 + R_2 + R_3} \\ R_b = \dfrac{R_2R_3}{R_1 + R_2 + R_3} \\ R_c = \dfrac{R_1R_3}{R_1 + R_2 + R_3} \end{cases}$$

Wye ⇆ Delta Transformations

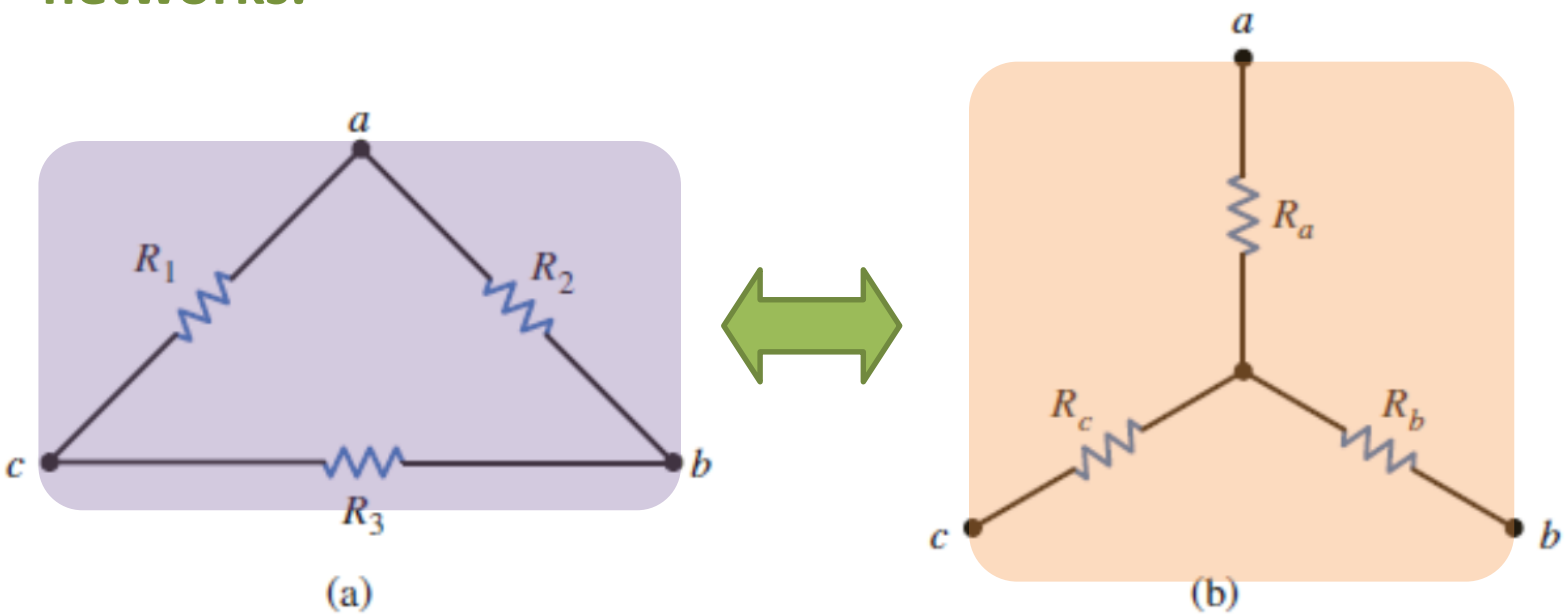
For the two networks to be equivalent at each corresponding pair of terminals, it is necessary that the resistance at the corresponding terminals be equal (e.g., the resistance at terminals a and b with c open-circuited must be the same for both networks.

… for $R_a = R_b = R_c = R_Y$

$R_1 = R_2 = R_3 = R_\Delta$

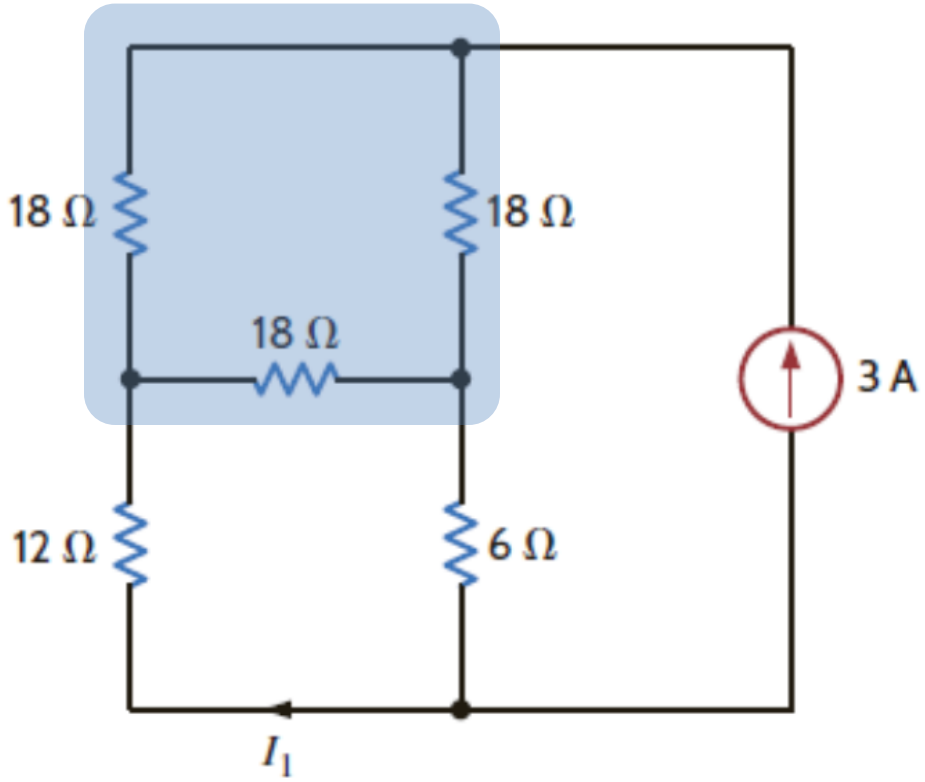
$\Delta \leftarrow Y$ $\quad R_\Delta = 3R_Y$

$Y \leftarrow \Delta$ $\quad R_Y = \frac{1}{3}R_\Delta$



Learning Assessment E2.26

Find I_1 in the network provided.



Circuits with Dependent Sources

1) **Write KVL and/or KCL equations for the network**

   → treat the dependent CS as an independent CS

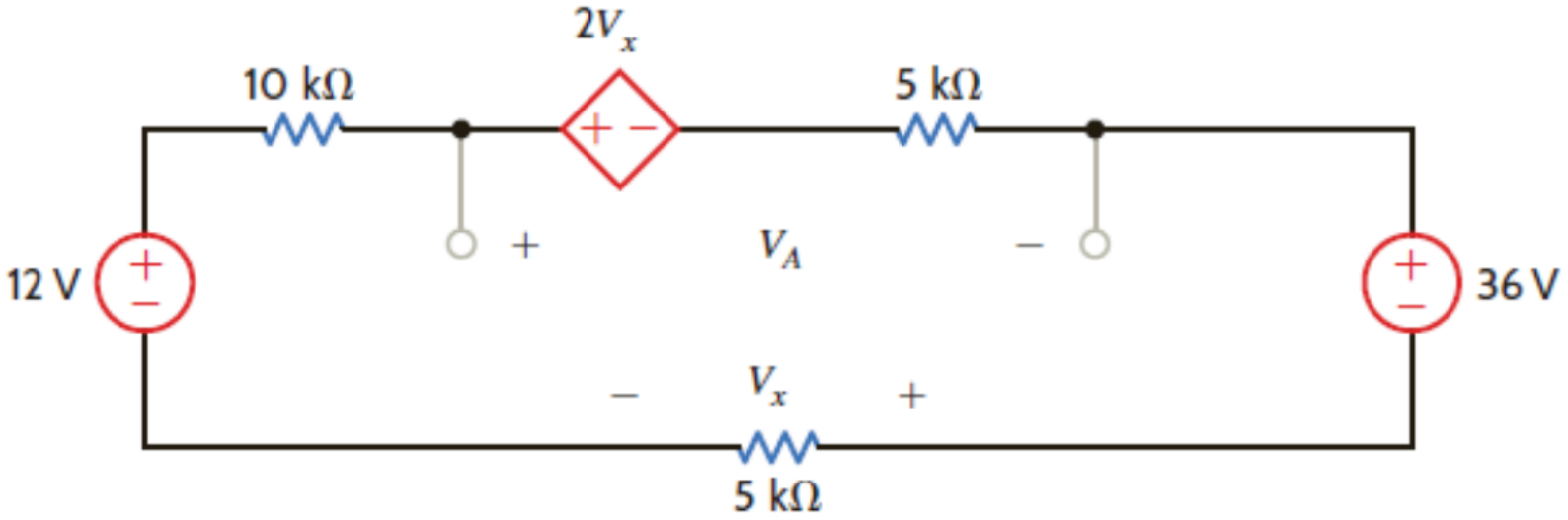
2) **Write the equation that specifies the relationship of the dependent source to the controlling parameter.**

3) **Solve the equations for the unknowns.**

   → Be sure the number of linearly independent equations matches the number of unknowns.

Learning Assessment E2.29

Find V_A in the network provided.



Problem 2.35

Find the power absorbed by the dependent source in the circuit provided.