Exam #1 → Tuesday Aug. 10, 2019 @ 7:00pm

Location: Chardon 124

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

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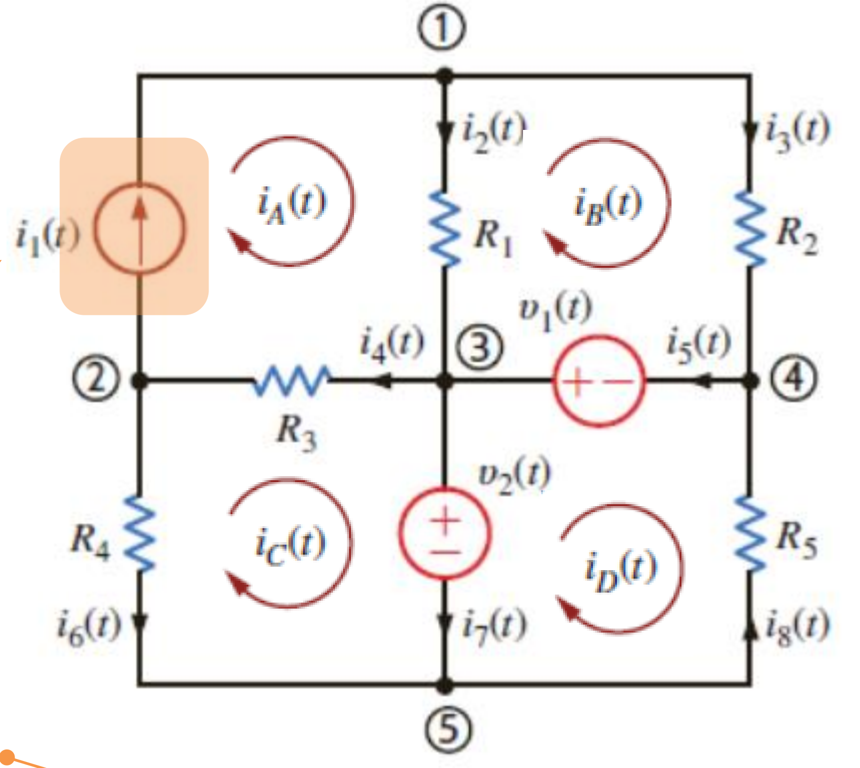
Location: Chardon 124

Concepts Chapter #3:

1) Nodal Analysis
   - Select node as reference
   - # of Eq. = # of nodes – 1
   - variables → voltages
   - KCL → equations
   - voltage source → constraint eq. (express in terms of variables)
   - voltage source between 2 non-reference nodes → supernode
2) Loop Analysis
   - # of Eq. = # of independent loops
   - variables → currents (assign a loop current to each independent loop)
   - KVL → equations
   - current source → constraint eq. (express in terms of variables)

Last Lecture → Mesh Analysis

- *M → # of independent loops in a planar circuit*
- *M → # independent simultaneous equations*



<u>**Analysis Procedure**</u>

1) Identify #of equations
2) Stablish current around loops
3) Identify voltage drops according currents
4) Identify current sources / dependent sources
5) Apply KVL to loops
6) Write constraint equation – current sources
7) Write controlling equation – dependent sources
8) Solve equation system

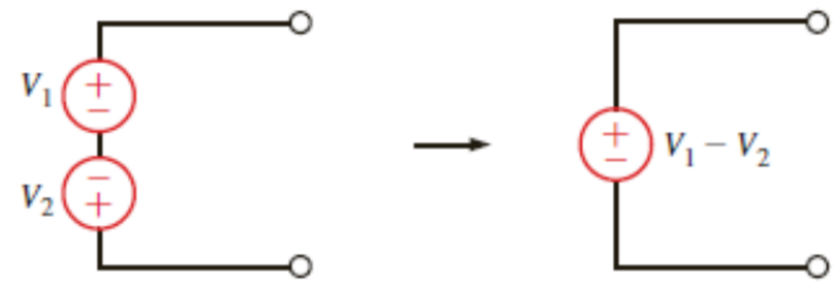
$$I_A = I_1$$

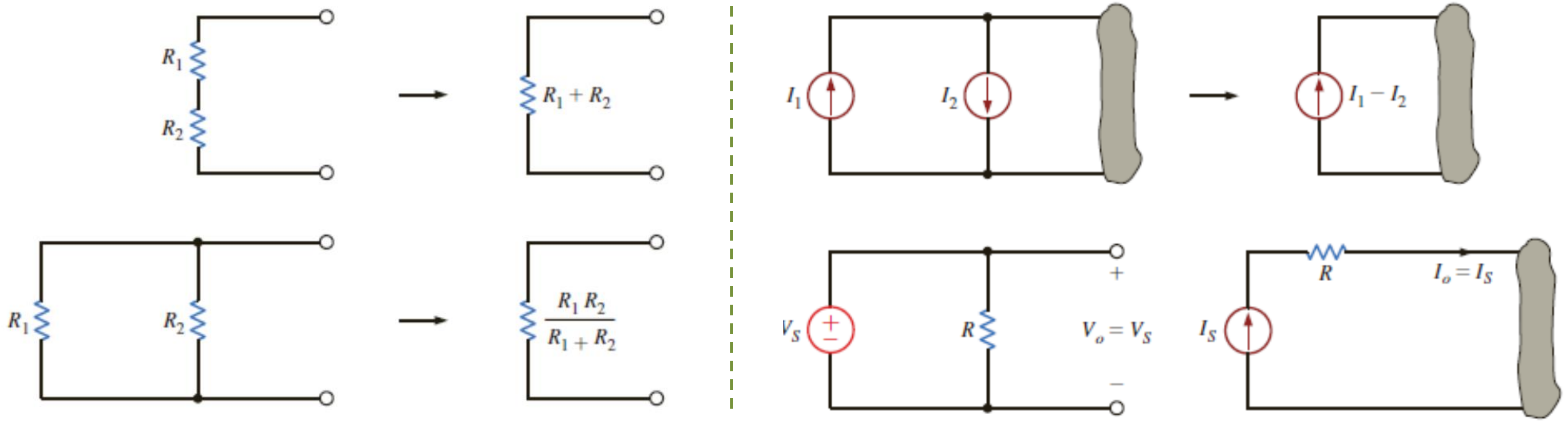
Additional Analysis Techniques → Chapter #5

- **Linearity and Equivalence**
- **Superposition**
- **Thevenin Equivalent Circuit**
- **Norton Equivalent Circuit**
- **Source Transformation**
- **Maximum Power Transfer**

Circuit Equivalence

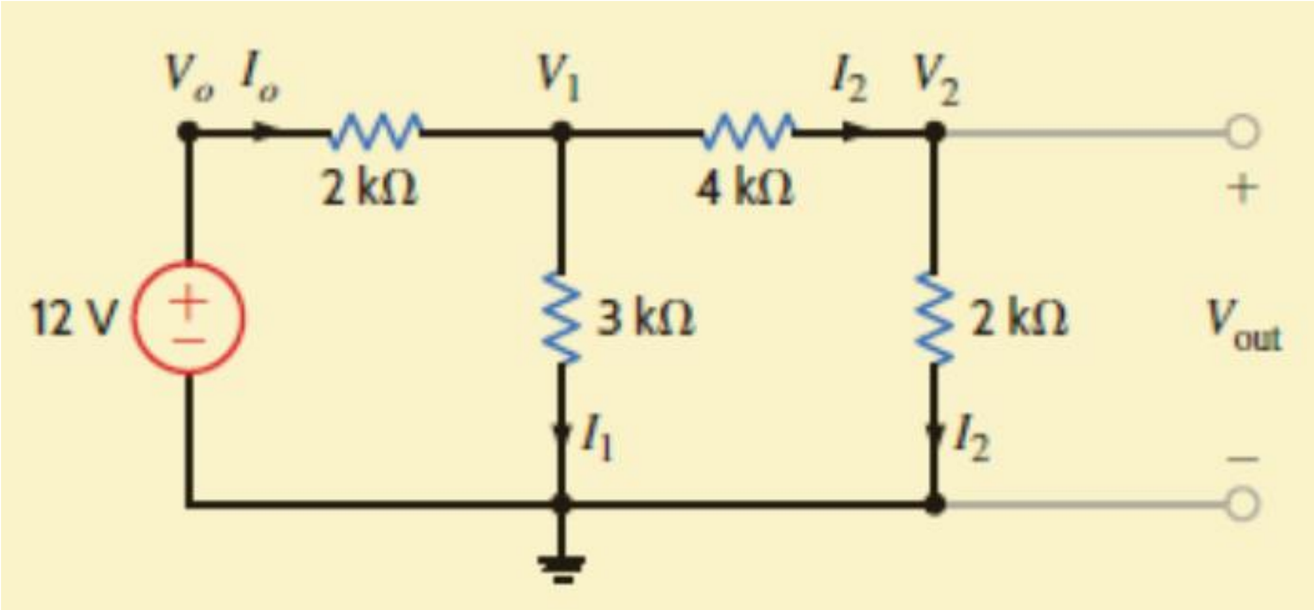
An equivalent circuit refers to a theoretical circuit that retains all of the electrical characteristics of a given circuit.





Circuit Linearity

Requires both additivity and homogeneity (scaling)



$$\frac{V_{out}}{V_0} = \frac{V_{out}'}{V_0'}$$

$$V_{out}' = 1V \rightarrow V_o' = 6V$$

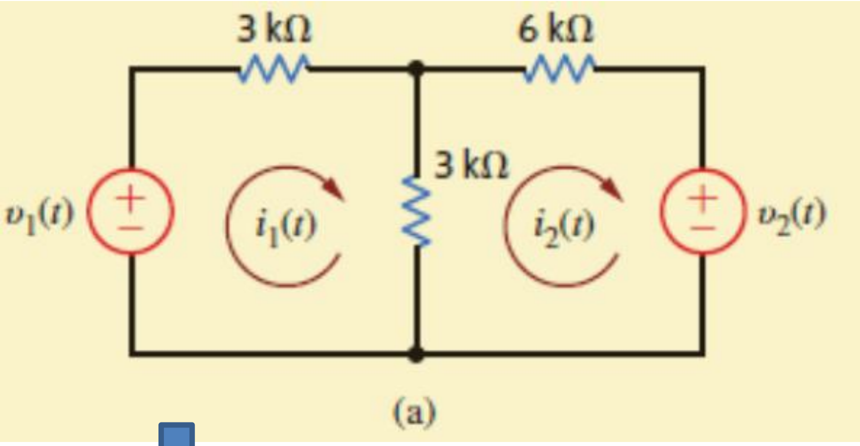
$$\therefore V_{out} = V_0 \cdot \frac{V_{out}'}{V_0'} = V_0 \cdot \frac{1}{6} = 2V$$

Example 5.1: Find V_{out}…

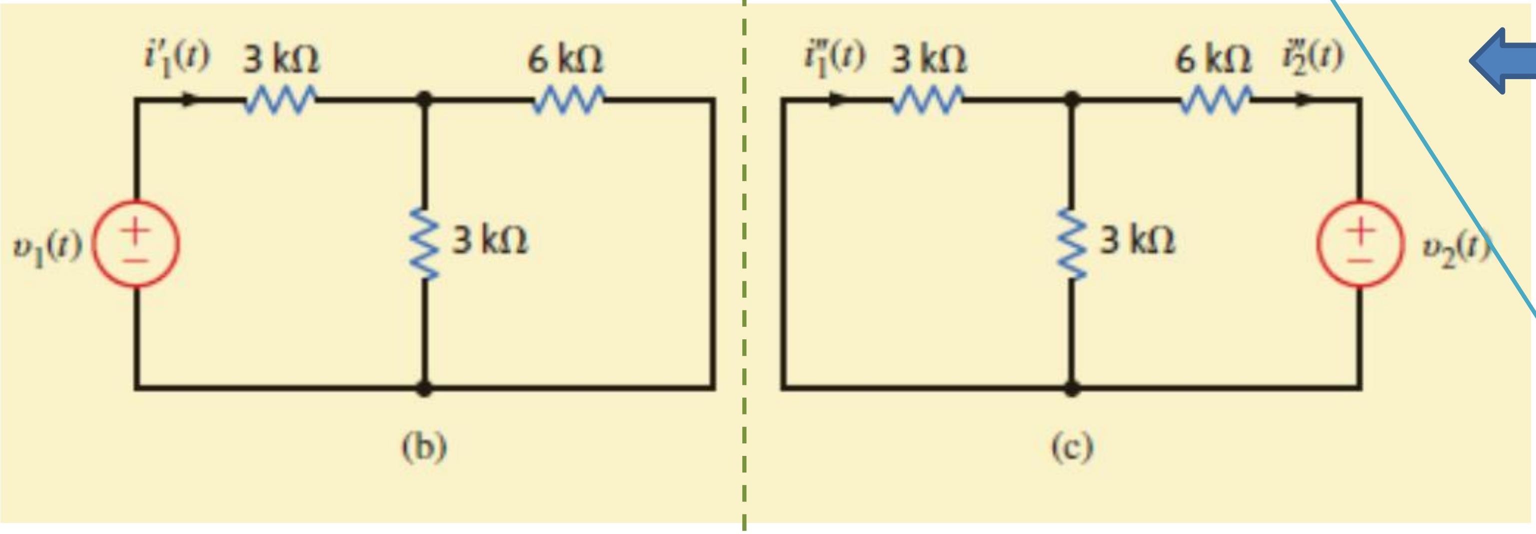
assuming V_{out} =1, find V_o and then use linearity to obtain V_{out} for V_o= 12V.

Superposition

In any linear circuit containing multiple independent sources, the current or voltage at any point in the network may be calculated as the algebraic sum of the individual contributions of each source acting alone.



$$v_2(t) = 0 \qquad\qquad v_1(t) = 0$$



$$i_1(t) = \frac{v_1(t)}{5k} - \frac{v_2(t)}{15k}$$

$$i_1'(t) = \frac{v_1(t)}{5k}$$

$$i_1''(t) = -\frac{v_2(t)}{15k}$$

$$i_1(t) = i_1'(t) + i_1''(t)$$

Superposition

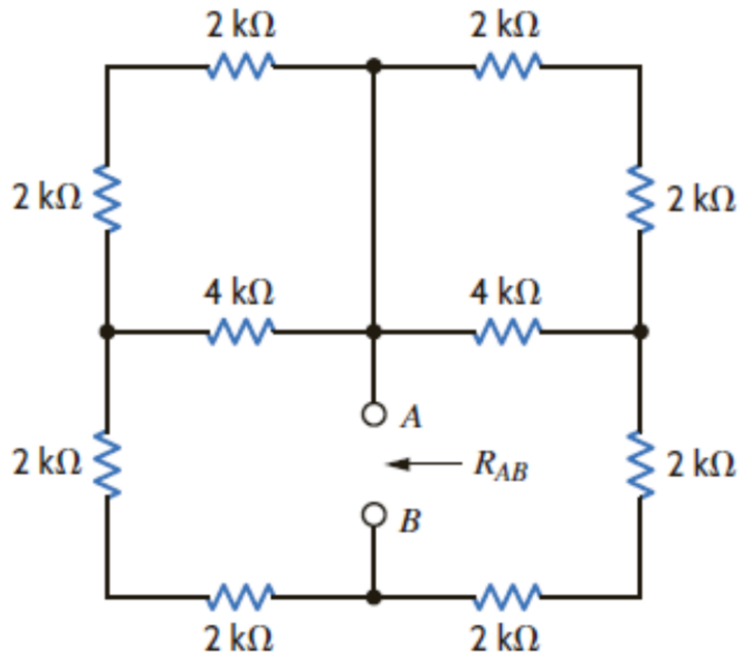
Each independent source can be applied independently with the remaining source turned off:

- ***Turn off a voltage source*** → *short circuit*
- ***Turn off a current source*** → *open circuit*

The final solution is the algebraic sum of the independent results!

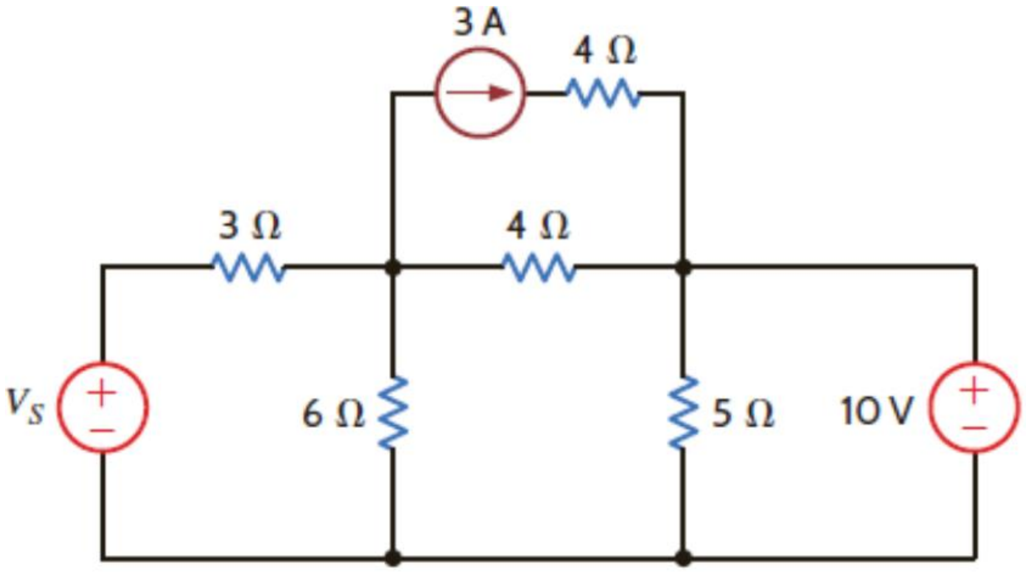
Problem 2.65

Find R_{AB} in the circuit provided.



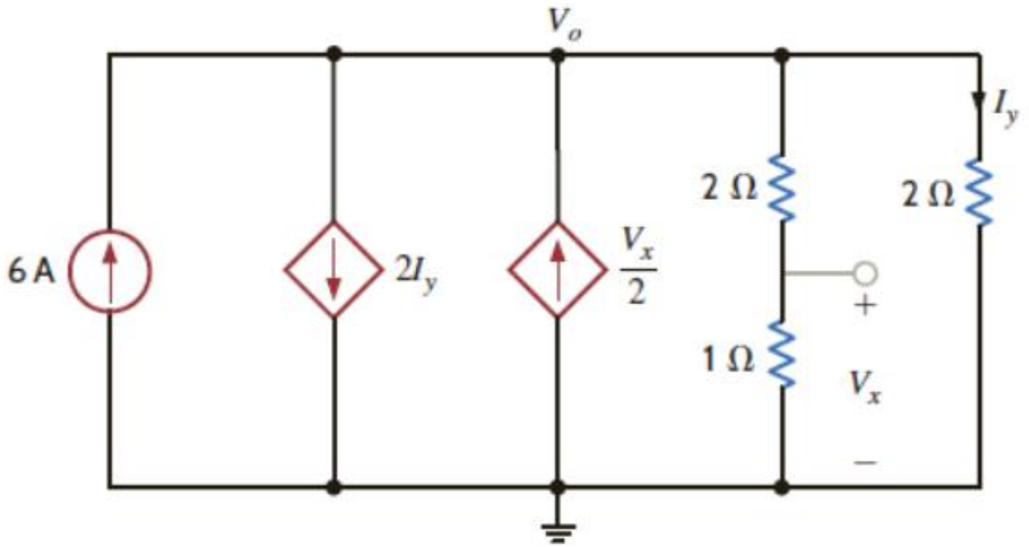
Learning Assessment E2.33

If the power supplied by the 3A current source is 12W, find V_S and the power supplied by the 10V source.



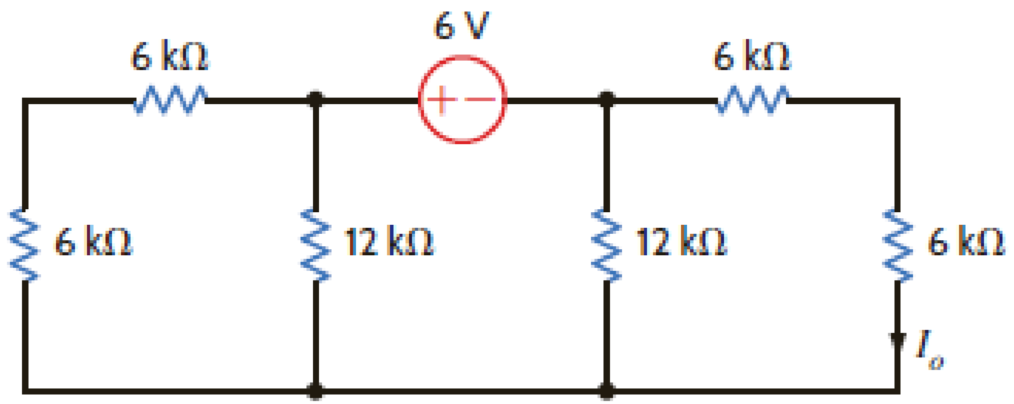
Problem 2.121

Find V_0 in the provided network.



Problem → 3.31

Find I_0 using both nodal and mesh analysis



Problem → 3.310

Find V_0 using both nodal and mesh analysis