Thevenin
Equivalent Circuit 2

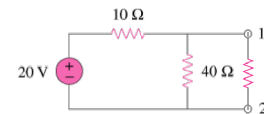EGR 220, Chapter 4
February 25, 2020

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Equivalent Resistance

• Equivalent resistance and voltage are terminal-dependent
• Ohm's Law tells us that $V = I*R$ so…
  • $R = V/I$
  • Electrical resistance is the ratio of:
    • The (open circuit) voltage across a pair of nodes **to**
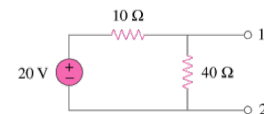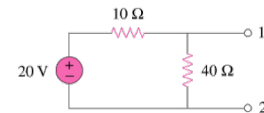   • The (short circuit) through the pair of nodes

2

2

• Equivalent circuits concept

a) Indistinguishable from each other,

b) …In terms of the $V - I - R_{eq}$ characteristics,

c) …At the specified terminals (nodes)

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Thevenin Equivalent – Process

1) **Find R_{Th}:**

2) **Find V_{Th}:**

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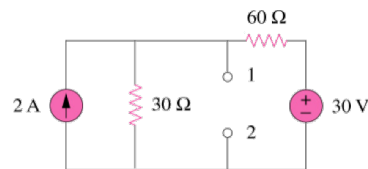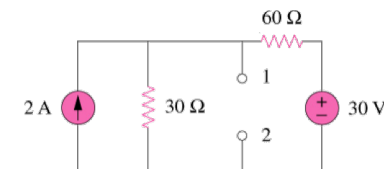
Thevenin: Find V_{Th}, R_{Th}

− Source Transformation, 2A −

2 A   30 Ω   60 Ω   30 V
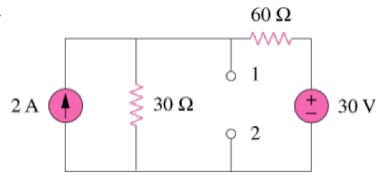
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Thevenin: Find V_{Th}, R_{Th}

− Source Transformation, 30V −

2 A   30 Ω   60 Ω   30 V
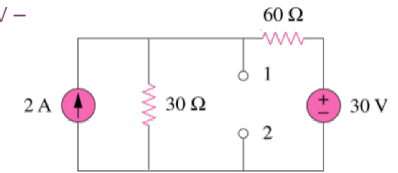
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* Maximum Power Transfer *

• **How** do we find the P_{max} the circuit can deliver to R_L?

12 V   6 Ω   3 Ω   2 Ω   12 Ω   2 A R_L
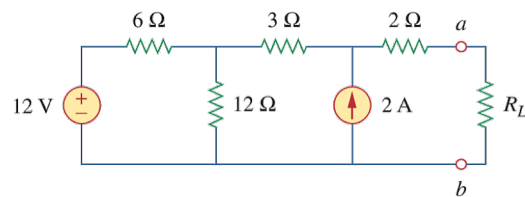
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Maximum Power Transfer

12 V   6 Ω   3 Ω   2 Ω   12 Ω   2 A R_L
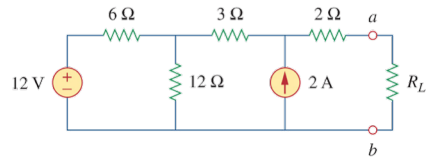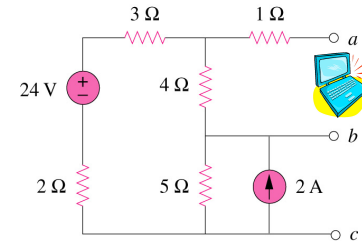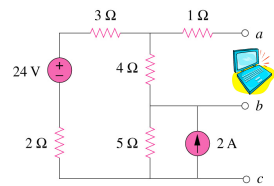
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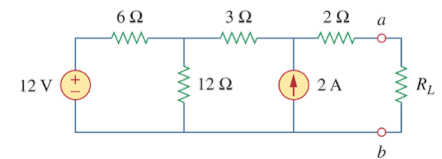
Maximum Power Transfer

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Concept Question

- Are equivalent circuits all the same?
- Discuss V_{Th}, R_{Th} at *a-b* and *b-c*
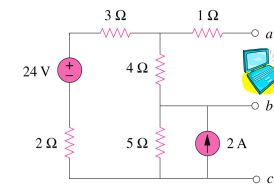- What is R_L for maximum power transfer, and how do you find the amount of power transferred?
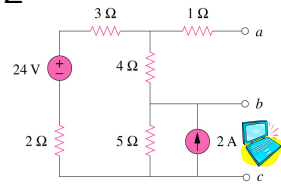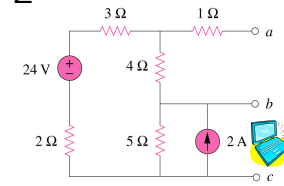
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Thevenin Equivalent

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Thevenin Equivalent

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Thevenin Equivalent 2

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Thevenin Equivalent 2

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For the next homework: *a* to *c*

(Thevenin equivalent for *b* to *c* is posted)
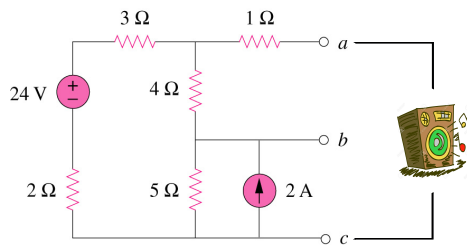
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Thevenin Self-Review

- What is a Thevenin Equivalent Circuit?
  - Draw a generic Thevenin equivalent circuit
  - Discuss and write down 3 good uses for a Thevenin equivalent circuit, or for the Thevenin theorem
- How might you find the maximum power that can be delivered to any load from any circuit?
  - Why is this an important question?

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Norton Equivalent Circuit

$$V_{Th} = v_{oc}$$

$$I_N = i_{sc}$$

$$R_{Th} = R_N = R_{in} = \frac{v_{oc}}{i_{sc}}$$

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Summary

- Source transformation
- Equivalency
  - Equivalent resistance
  - Voltage – Current – R_{eq} behavior
- Thevenin equivalent circuit
  - V-source & series resistor
  - Uses for Thevenin equivalent circuits
  - Only need to know the Norton equivalent exists. We will focus on Thevenin

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Questions?

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