ECEN 214 Spring 2022 – Review Problems for Exam 1

The voltage and current at the terminals of a circuit element are given by

$$v = 50e^{-1600t} - 50e^{-400t} \text{ V}$$
$$i = 5e^{-1600t} - 5e^{-400t} \text{ A}$$

1. What is the power at $t = 625\mu s$?

2. How much energy is delivered to the circuit element between 0 and $625\mu s$?

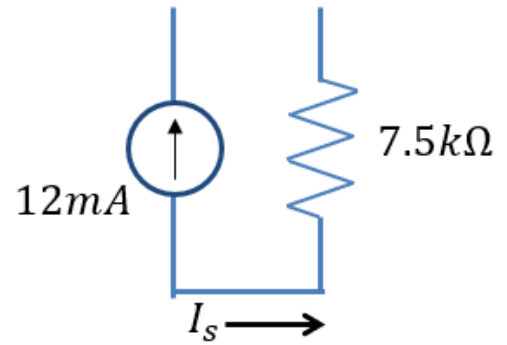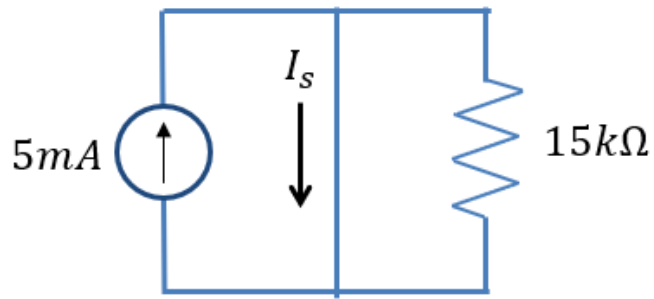In the circuit below, the following voltages and powers are given.

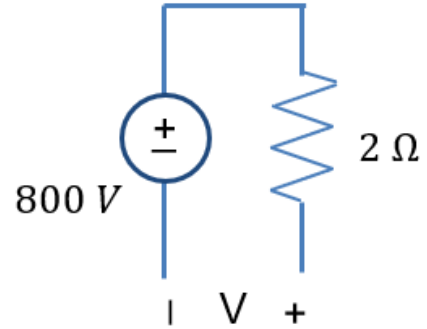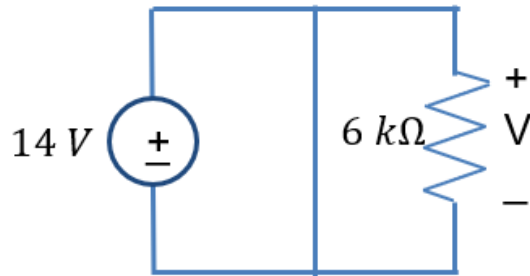| Element	Power (kW)	Voltage (V)
b	0.05 supplied	-100
c	0.4 absorbed	200
d	0.6 supplied	300
e	0.1 absorbed	-200
f	2.0 absorbed	500
g	1.25 supplied	-500
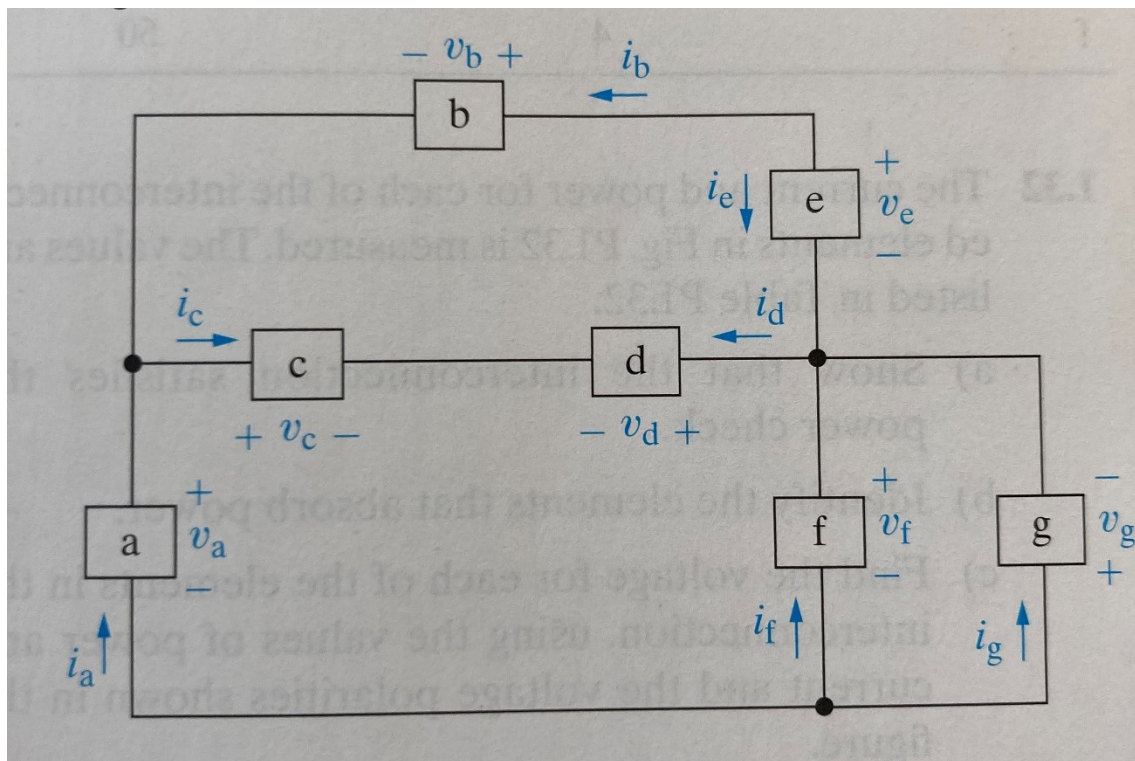
3. How much power is being absorbed by element a? (Use negative for supplied.)
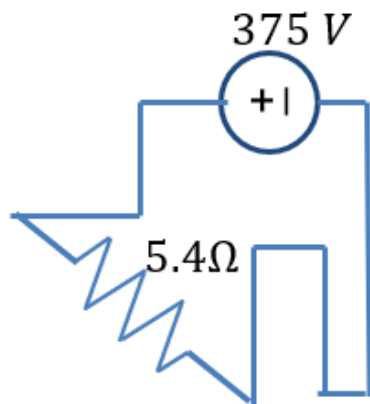
4. What is the current i_a?

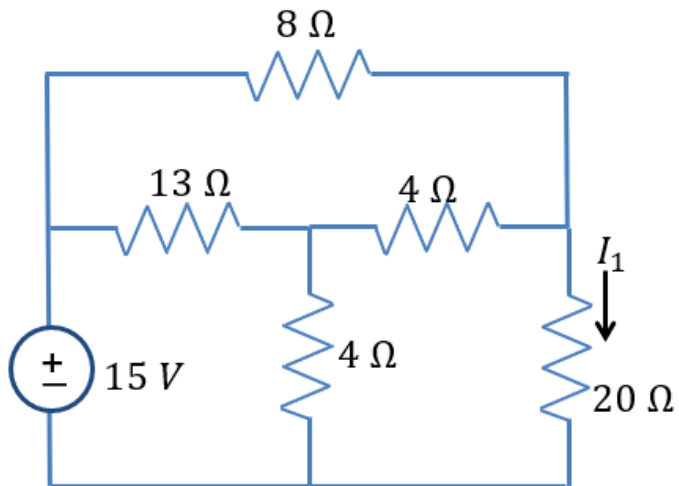5. Give the current for whichever circuit is valid.


6. Give the voltage for whichever circuit is valid.

7. If this circuit runs for 3 hours and 18 minutes, how much energy is consumed by the resistor?

8 Ω

13 Ω   4 Ω

I_1

15 V   4 Ω

20 Ω

8. If the middle Tee configuration in this circuit is replaced by an equivalent Delta, what will be the resistance of the new resistor in the delta, that is in parallel with the existing 20Ω resistor?

9. What's the current in the 20 Ω resistor?
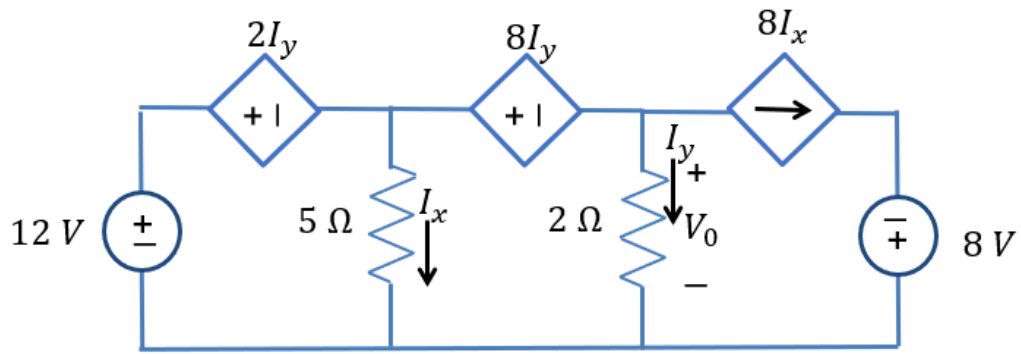
10. How much power is being delivered by the source?
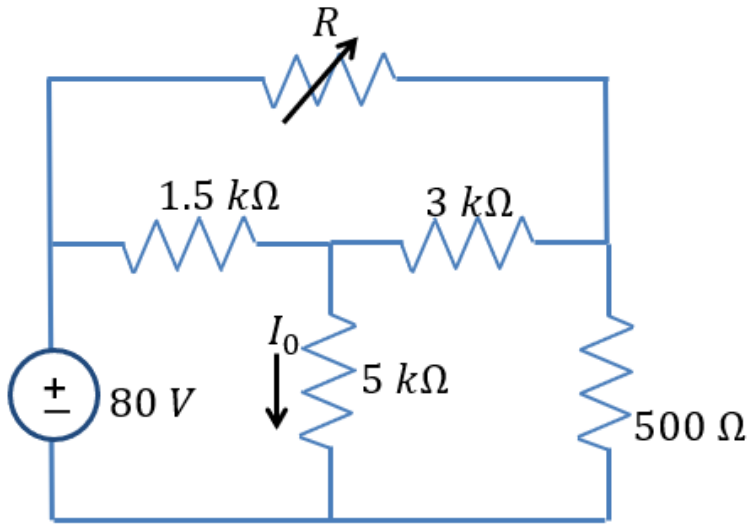
11. The variable resistor R is adjusted until the current I_0 is 10mA. What is the value of R?

12. How much power is being absorbed by the variable resistor R?

$+\ V_0\ \mathbf{|}$

$2\ \Omega$

$45\ A \uparrow$

$6\ \Omega$

I_x

$+\ -$

$2I_x$
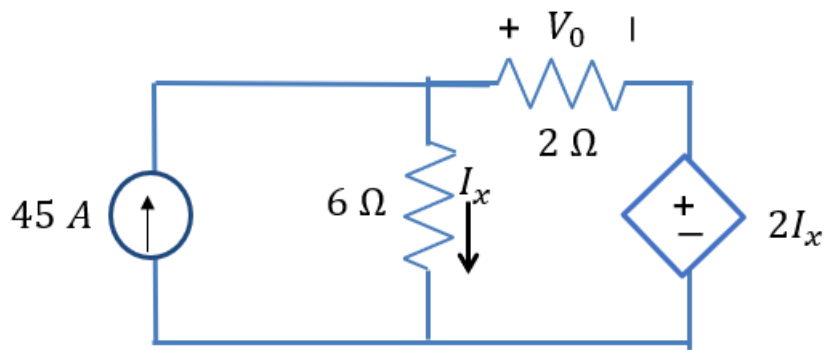
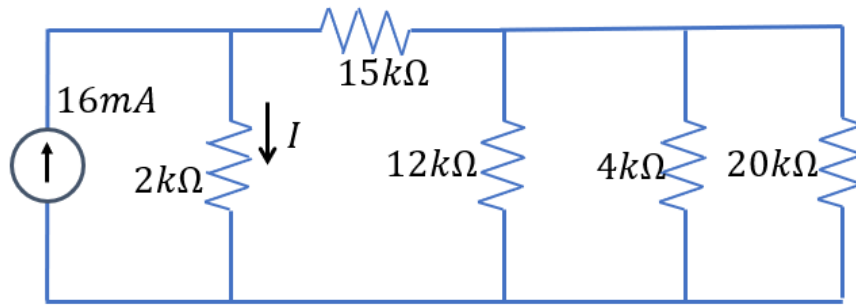13. What is the value of V_0?

14. What is the total power supplied by the two sources?
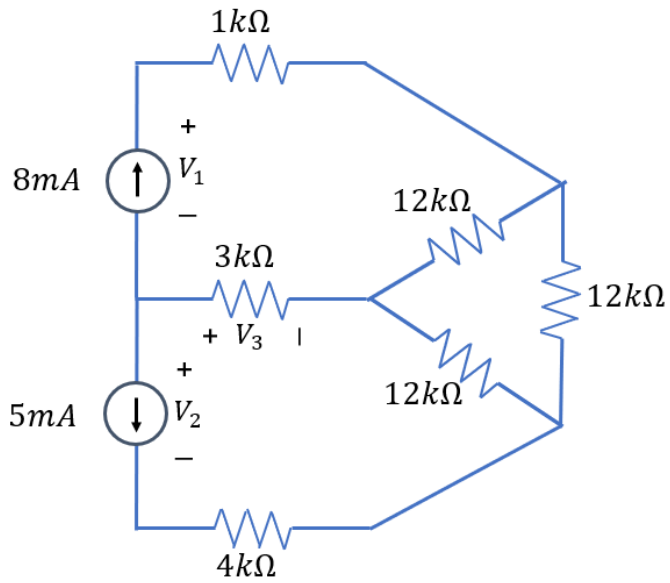
15. What is the value of I_x?

16. What is the value of I_y?
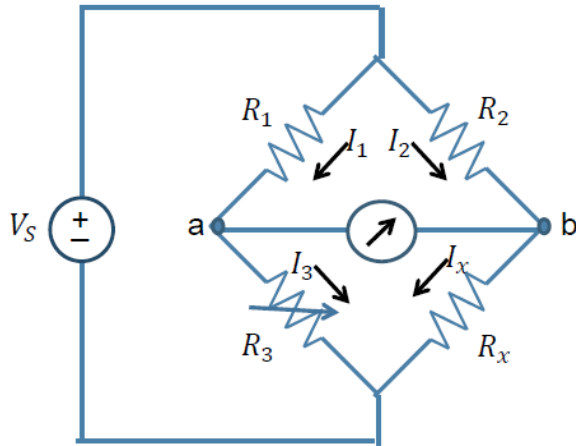
17. What is the value of V_0?

18. What is the equivalent resistance that combines all 5 resistors in this circuit?

19. What is the current I?

20. What is the power absorbed by the 20 $k\Omega$ resistor?

21. What is the voltage V_1?

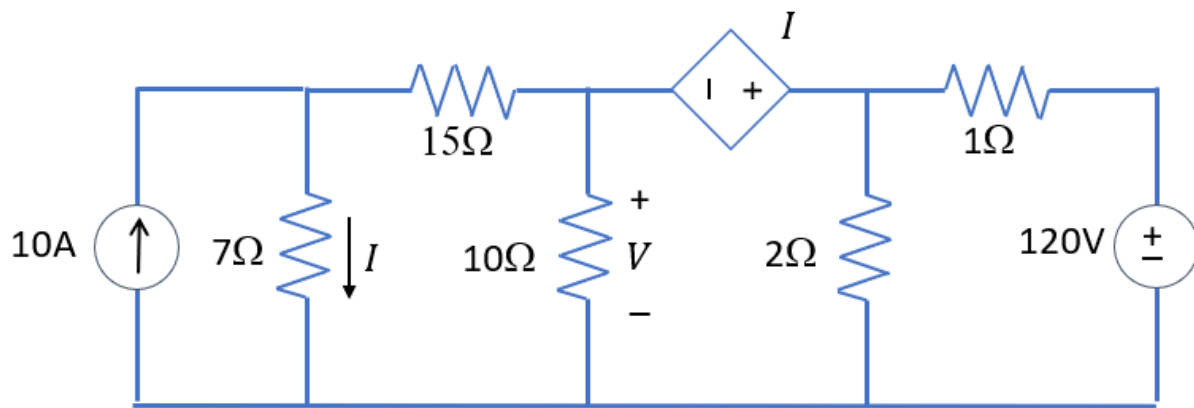22. What is the voltage V_2?

23. What is the voltage V_3?

For the Wheatstone bridge circuit above, we have $R_1 = 5\Omega$, $R_2 = 20k\Omega$. R_3 is a variable resistor between 0 and 100 Ω that we adjust until the Ammeter shows 0 A.

24. If R_3 is adjusted to 5.7 Ω, what is the resistance of R_x?

25. What's the largest value of R_x that we could measure with this circuit?

26. If you solve this circuit with the Node-Voltage method, what will be the sum of all the currents entering the supernode, according to KCL?

27. What is the current I?

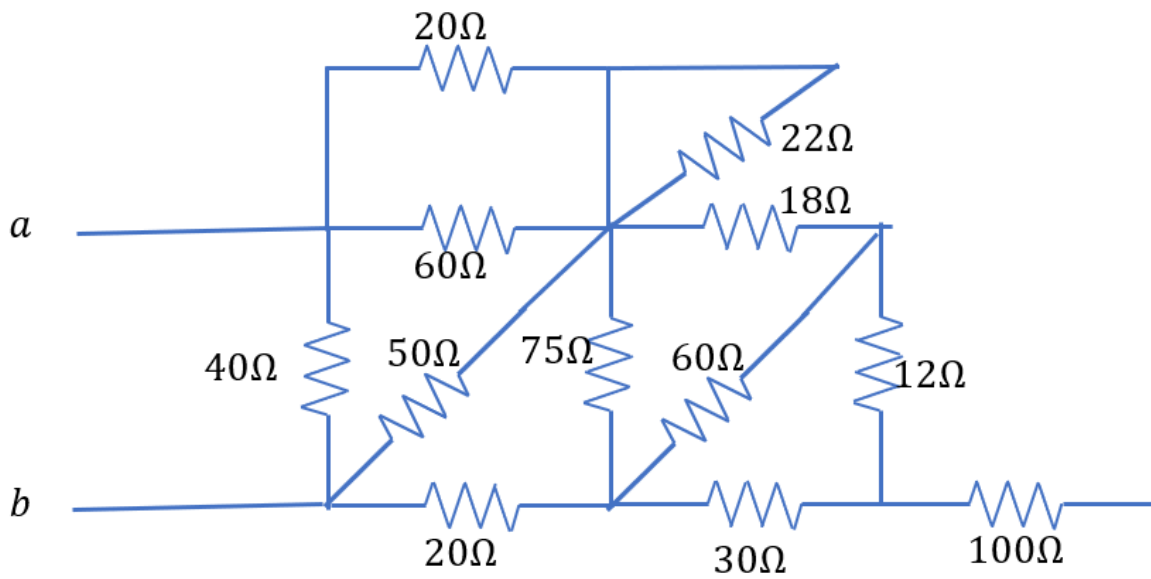28. What is the voltage V?
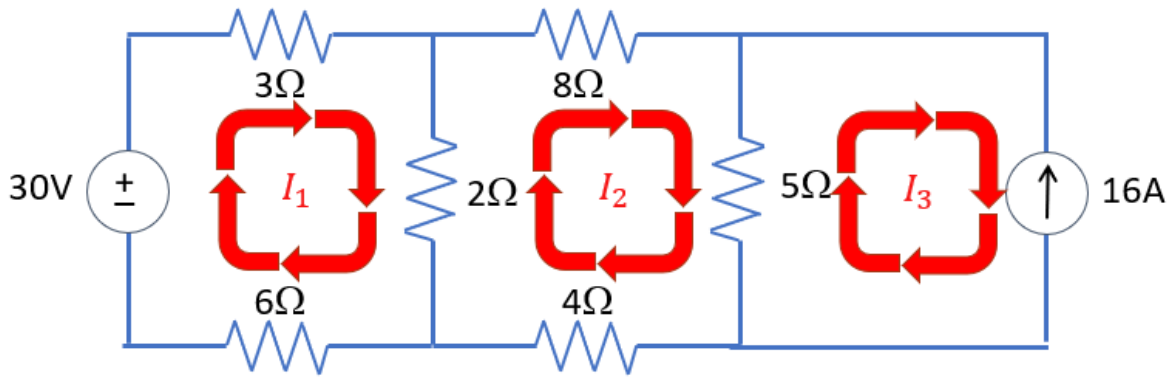
29. If you use the Mesh-Current method to solve the above circuit with the meshes defined as shown, what is the value of I_1?

30. What is the value of I_3?

31. How much power is being absorbed in the 3Ω resistor?

32. What is the equivalent resistance between a and b in the below circuit?
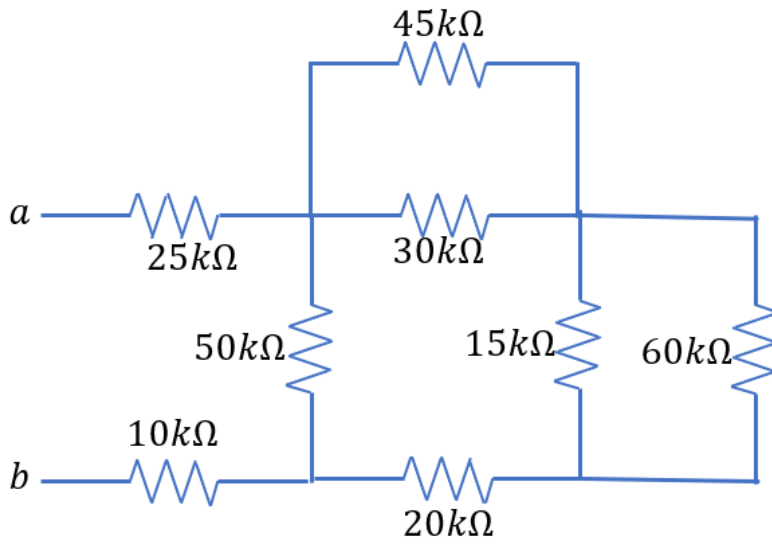
33. What is the equivalent resistance between a and b in the below circuit?
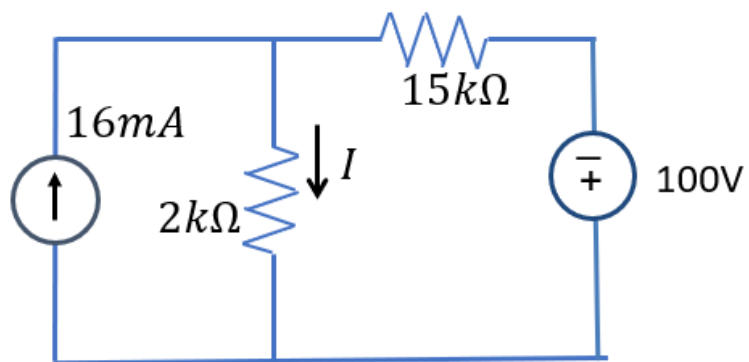
Applying the principal of superposition,

34. What is I using only the voltage source?

35. What is I using only the current source?

Convert the above circuit to its Thevenin and Norton equivalents, shown below.

36. What is V_{th}?
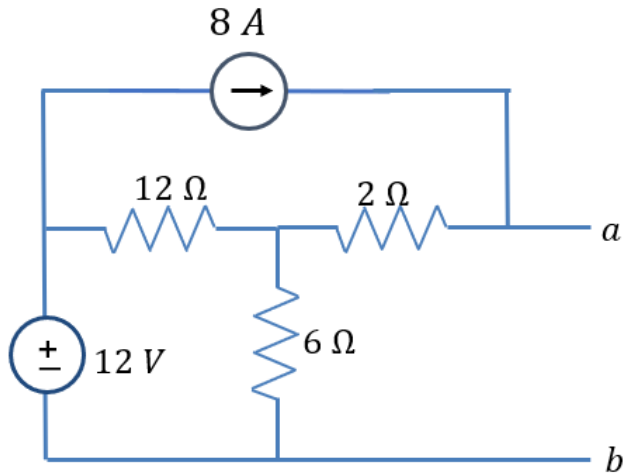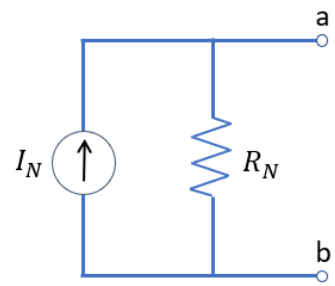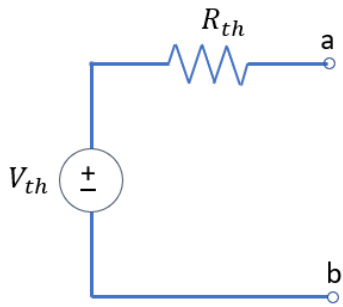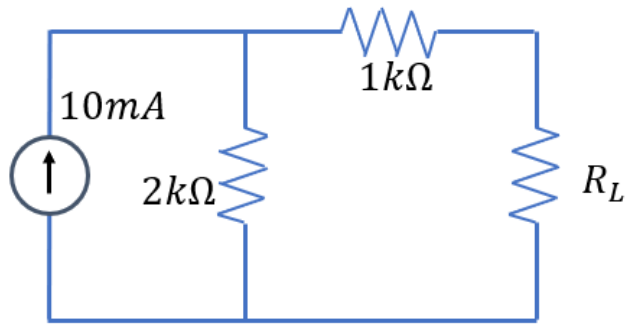
37. What is R_{th}?

38. What is I_n?

39. What is R_n?

10mA

1kΩ

2kΩ

R_L

40. What's the maximum power that can be delivered to the load resistor R_L?

Additional Questions

1. According to my slides from the first day of class, what are my three goals for this class?
    a. Become good friends with electric circuits, get pumped about becoming Aggie electrical engineers, and learn to communicate well as engineers.
2. Current is the rate of flow of what?
    a. Electric charge
3. Name three sources of energy.
    a. Answers vary: Wind, coal, natural gas, solar, hydro, battery
4. According to my slides, what are the two main things engineers do?
    a. Analyze and design
5. According to my slides, what are the two main things electricity is useful for?
    a. Transmitting energy and transmitting information
6. What is the Aggie Honor Code?
    a. An Aggie does not lie, cheat, or steal, or tolerate those who do
7. What three laws can you use to solve almost any circuit problem?
    a. Ohm's law, KCL, KVL
8. If a delta has three equal resistors with resistance = R, and you convert it to wye, what will be the resistance of the three resistors in the wye configuration?
    a. R/3
9. How do you connect an Ammeter in order to measure current?
    a. In series
10. What is the purpose of a Wheatstone bridge?
    a. To measure resistance
11. Another name for the delta-wye transformation is what?
    a. Pi-Tee transformation
12. What is the reference node in a high-voltage power grid?
    b. The earth or ground
13. If you need to make a supernode, what method are you using?
    c. Node-Voltage method
14. According to the slides, what makes superposition so powerful?
    a. Circuit design problems
15. What two measurements are sufficient to find a Thevenin or Norton equivalent?
    a. Open circuit voltage, short circuit current, equivalent resistance
16. If you have a circuit, what value of load resistance will give you the maximum power transfer?
    a. Thevenin or Norton equivalent resistance
17. What are the 6 Aggie Core Values?
    a. Respect, Excellence, Loyalty, Leadership, Integrity, and Selfless Service