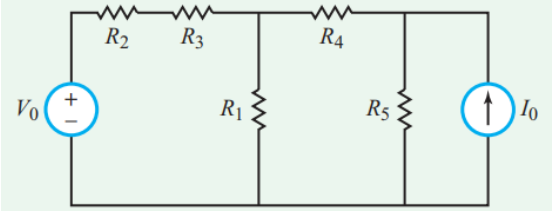
ECEN203 Tutorial 3: Analysis Techniques (with answers)

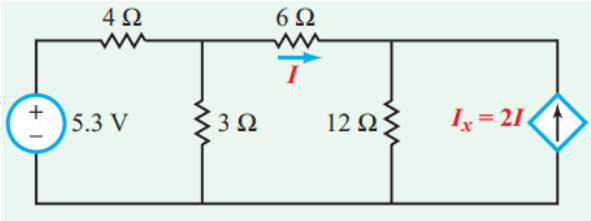
Answer all 16 questions. Answers provided for your self-checking.

Q1. For the circuit shown below, (a) identify all extraordinary nodes and select one of them as the ground node, (b) develop node-voltage equations at the remaining extraordinary nodes, (c) solve for the node voltages, and then (d) calculate the power consumed by R_5. The element values are V_0 = 10 V, I_0 = 0.8 A, R_1 = 5 Ω, R_2 = 2 Ω, R_3 = 3 Ω, R_4 = 10 Ω and R_5 = 2.5 Ω.



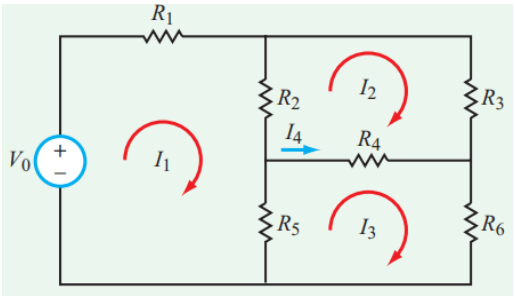
(Answer: (a) 3 extraordinary nodes, (b) - , (c) V_1 = 4.5 V and V_2 = 2.5 V, (d) P @ R_5 = 2.5 W)

Q2. The circuit below contains a current-controlled current source (CCCS) whose magnitude I_x, is governed by the current flowing through the 6 Ω resistor in the direction shown. Determine I_x.



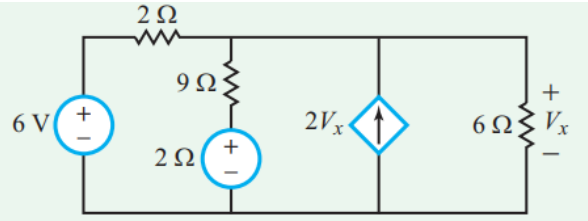
(Answer: I_x = 0.1 A.)

Q3. Use mesh analysis to (a) obtain mesh-current equations for the circuit below and then (b) determine the current in R_4, given that V_o = 18 V, R_1 = 6 Ω, R_2 = R_3 = 2 Ω, and R_4 = R_5 = R_6 = 4 Ω.



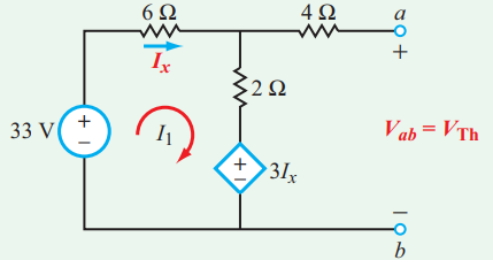
(Answer: I @ R_4 = 0 A; I_1 = 2 A, I_2 = 1 A, I_3 = 1 A.)

Q4. Apply the superposition principle to the circuit shown below to determine V_x.



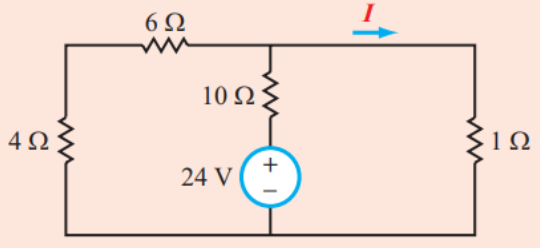
(Answer: V_x = -2.63 V.)

Q5. Find the Thevenin equivalent circuit at terminals (a, b) for the circuit below by applying the combination of open-circuit-voltage and external-source methods.



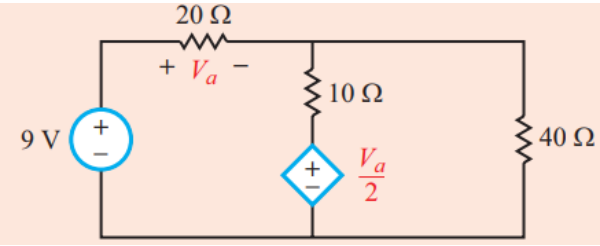
(Answer: V_{Th} = 15 V, R_{Th} = 56/11 Ω.)

Q6. Apply nodal analysis to determine the current I in the circuit below.



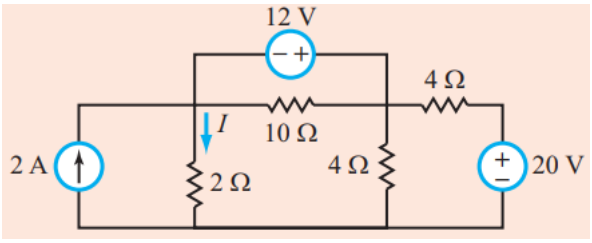
(Answer: I = 2 A.)

Q7. Apply nodal analysis to find V_a in the circuit below.



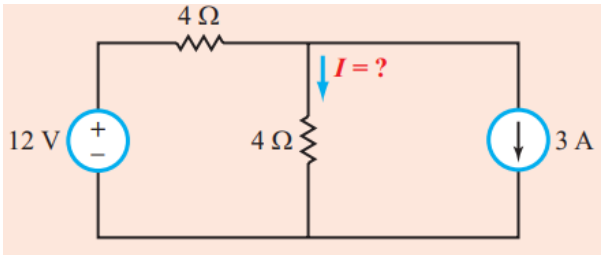
(Answer: V_a = 5 V.)

Q8. Apply the supernode concept to determine I in the circuit below.



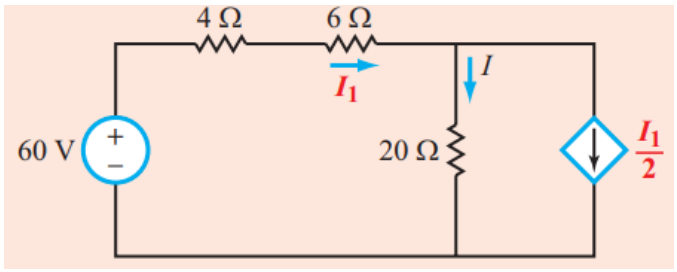
(Answer: I = 0.5 A.)

Q9. Apply mesh analysis to determine I in the circuit below.



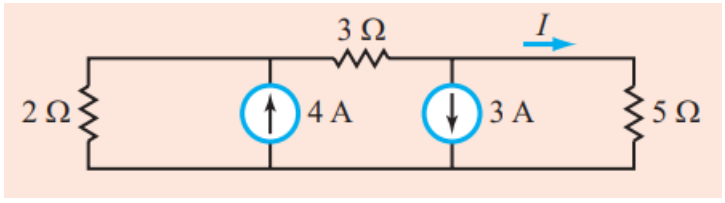
(Answer: I = 0.)

Q10. Determine the current I in the circuit below.



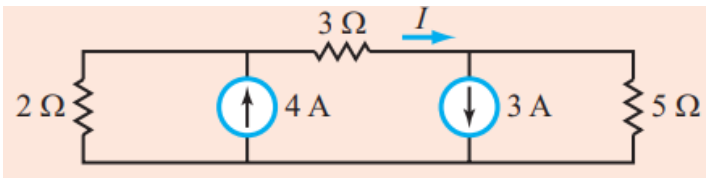
(Answer: I = 1.5 A.)

Q11. Apply mesh analysis to determine I in the circuit below.



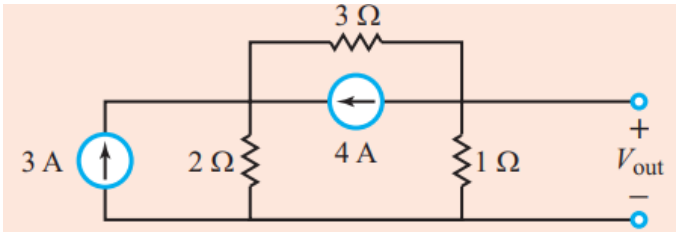
(Answer: I = -0.7 A.)

Q12. Apply the source-superposition method to determine the current I in the circuit below.



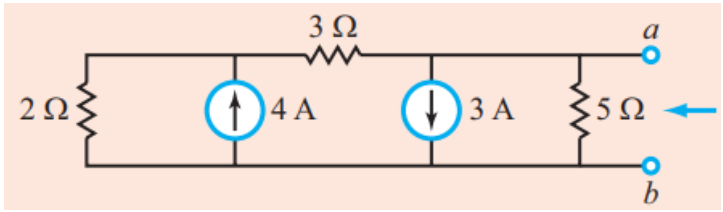
(Answer: I = 2.3 A.)

Q13. Apply source superposition to determine V_{out} in the circuit below.



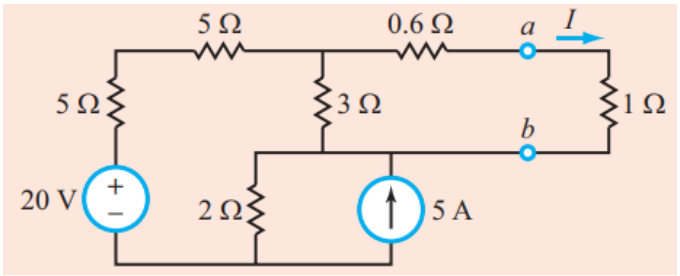
(Answer: V_{out} = -1 V.)

Q14. Determine the Thevenin-equivalent circuit at terminals (a, b) in the circuit below.

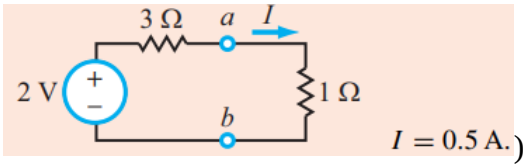


(Answer: V_{Th} = -3.5 V, I_{sc} = -1.4 A, R_{Th} = 2.5 Ω.)

Q15. Find the Thevenin equivalent of the circuit to the left of terminals (a, b) in the circuit below, and then determine the current I.



(Answer:



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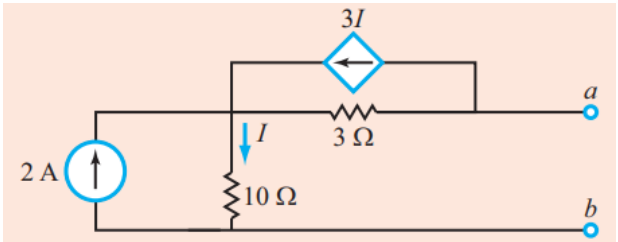
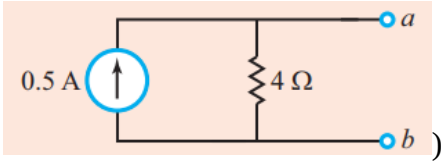
Q16. Find the Norton equivalent at terminals (a, b) of the circuit below.



(Answer: 

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