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CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

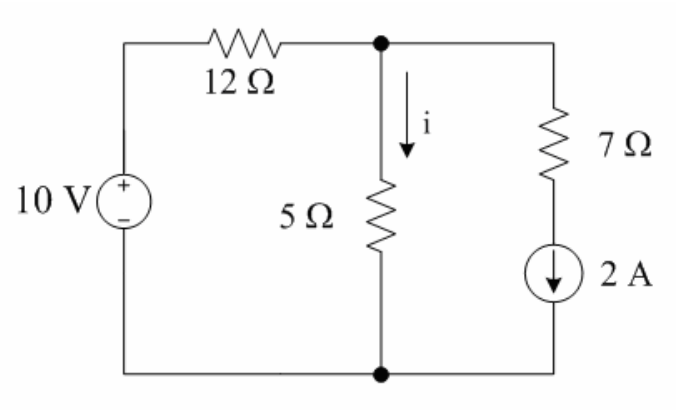
Quiz No. 5 2/20/04

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE
BE SURE TO STATE ALL ASSUMPTIONS

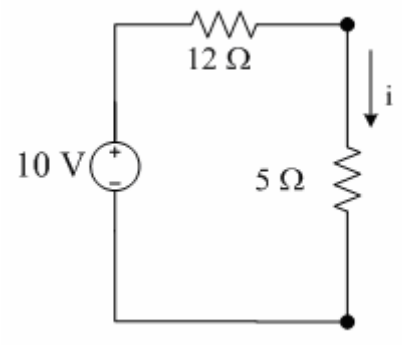
Problem 1 (10 points) Using superposition determine

(a) the current i_1 through the 5 Ω resistor (observe the direction for I given in the circuit below) from the 10 volts source. $i_1 = 0.588$ A

(b) the current i_2 through the 5 Ω resistor (observe the direction for i given in the circuit below) from the 2 ampere source. $i_2 = -1.41$ A



ANSWER:
(a) First turn off the current source and replace it with an open circuit. Then the equivalent circuit is as follows:



So we can easily calculate the current through the 5 Ω resistor:

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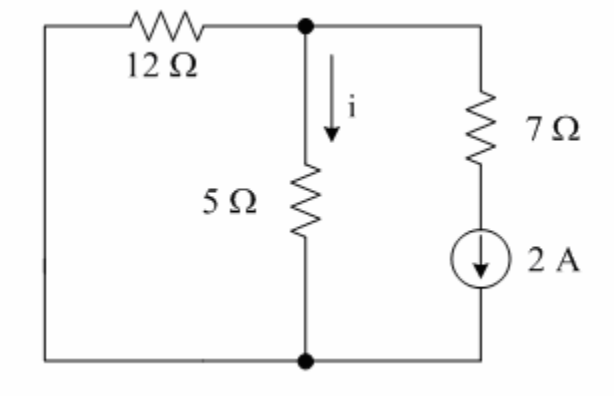
$$i_1 = \frac{10V}{12\Omega + 5\Omega} = 0.588A$$

(b) Turn off the voltage source and replace it with an short circuit. The equivalent circuit is as follows:



Then $i_2 = -2A \cdot \frac{12\Omega}{12\Omega + 5\Omega} = -1.412A$

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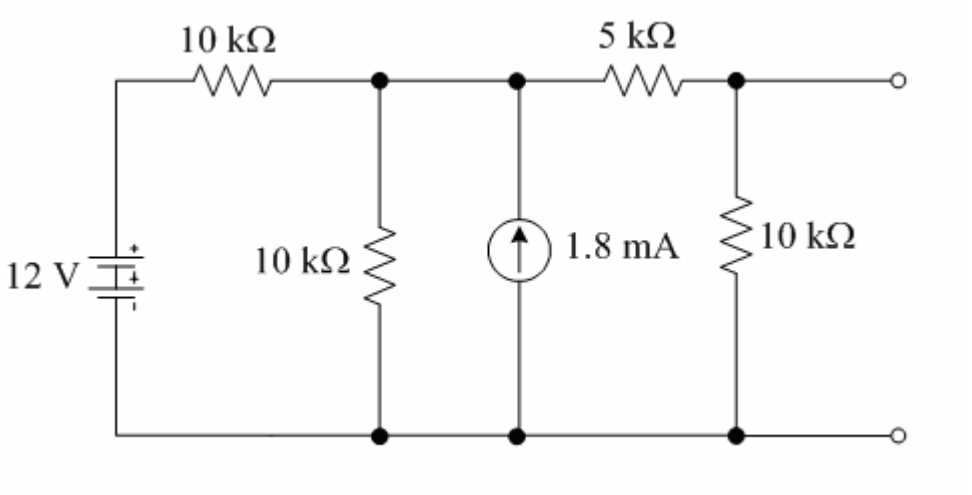
Problem 2 (10 points)

What is the Thevenin equivalent of the circuit shown below

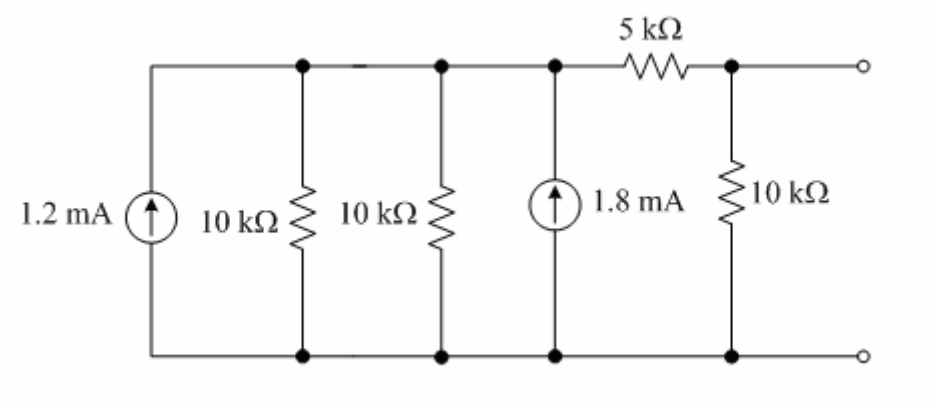
V_T= 7.5 V R_T= 5 kΩ



ANSWER:

The problem is similar to the example listed in p.106. And we could use the same method to solve it step by step.

(1) Convert 12 V in series with 10 kΩ to 1.2 mA in parallel with 10 kΩ;



(2) Combine two current sources and resistors;

1.2 mA+1.8 mA=3.0 mA; 10 kΩ//10 kΩ=5 kΩ;

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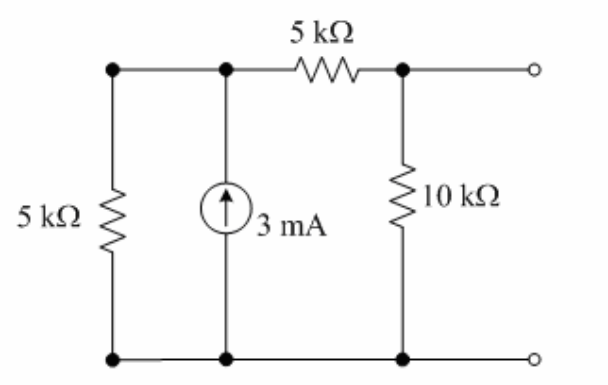
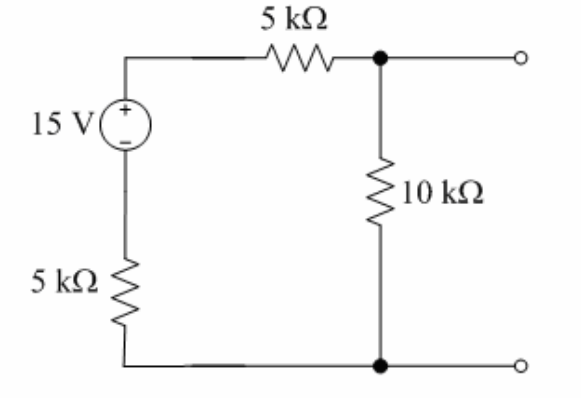
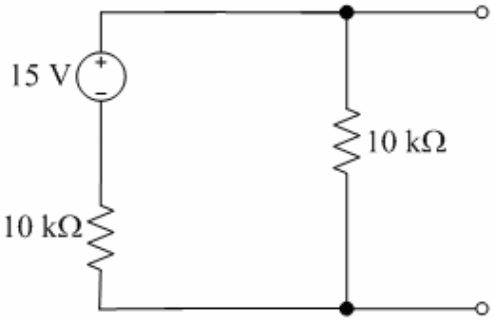


(3) Convert 3 mA in parallel with 5 kΩ to 15 V in series with 5 kΩ;



(4) Combine two resistors together;
5 kΩ+ 5 kΩ=10 kΩ;



(5) Convert 15 V in series with 10 kΩ to 1.5 mA in parallel with 10 kΩ;

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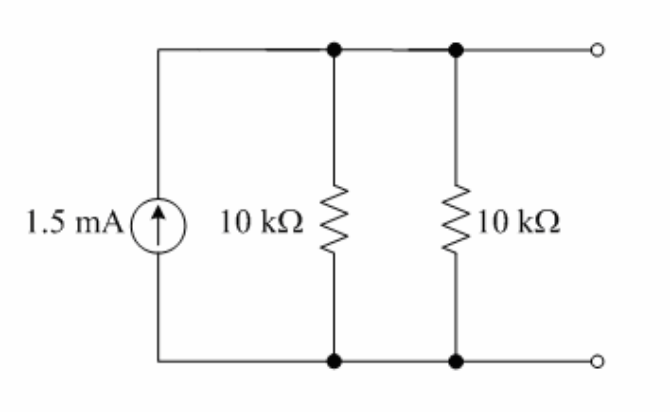
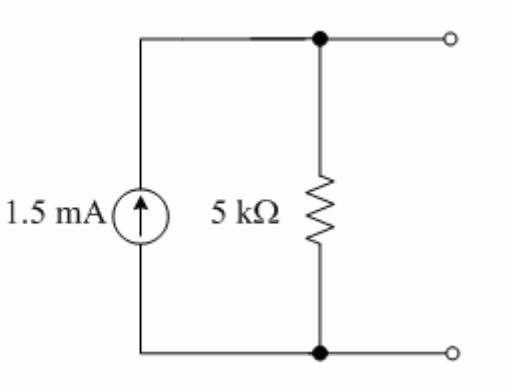


(6) Combine two resistor together;
10 kΩ//10 kΩ=5 kΩ;



(7) Convert 1.5 mA in parallel with 5 kΩ to 7.5 V in series with 5 kΩ;