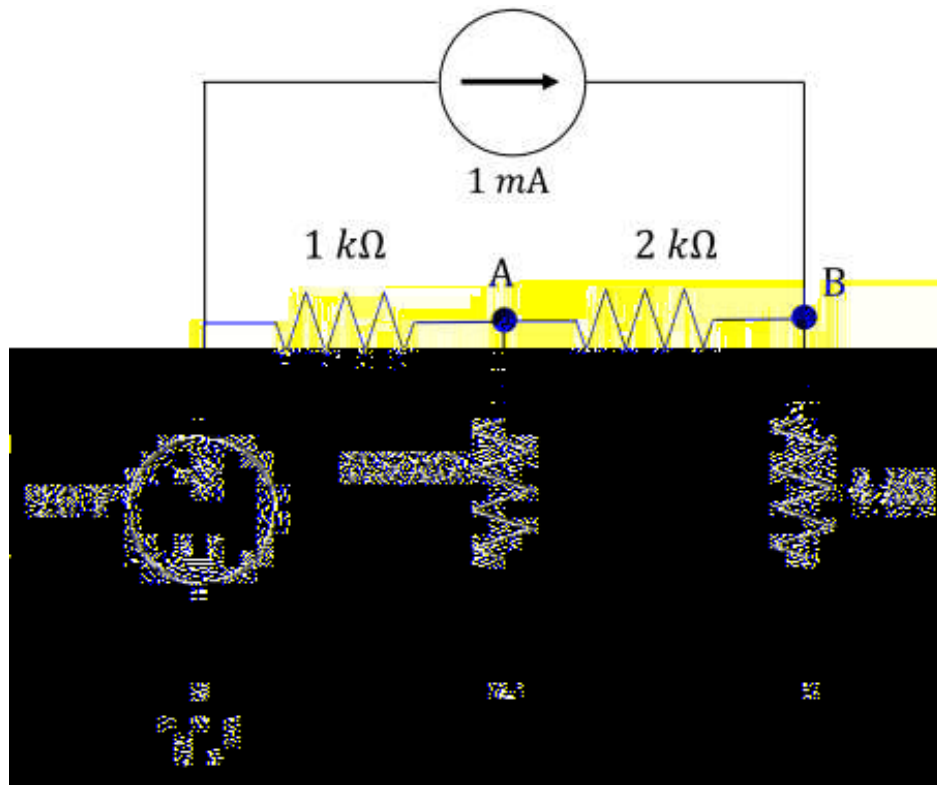# Homework 3
ECE2004 CRN:12898

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Question 1:   Solve for the voltages at node A and node B.

$$\frac{A - 10V}{1k\Omega} + \frac{A - B}{2k\Omega} + \frac{A}{0.5k\Omega} = 0$$

$$\frac{B - A}{2k\Omega} + \frac{B}{4k\Omega} - 1mA = 0$$
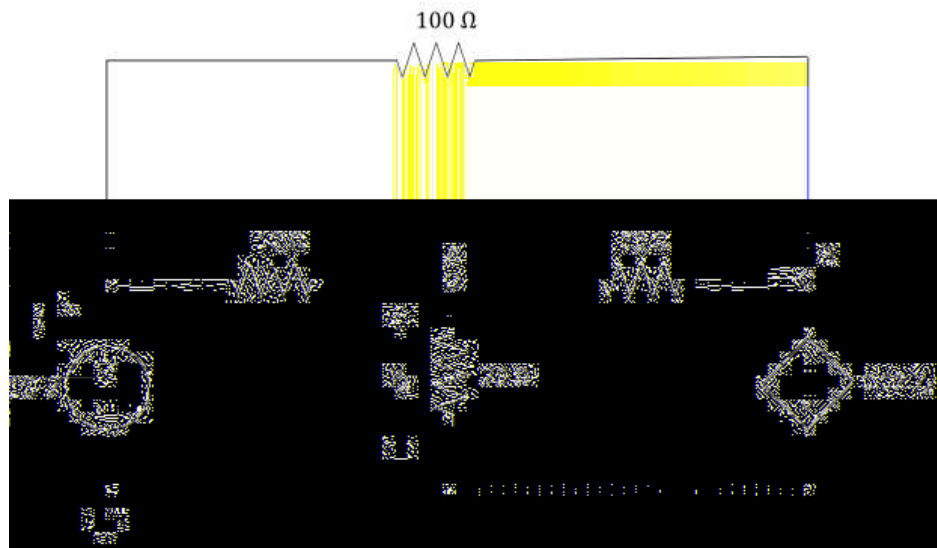
$$7A - B = 20V$$

$$3B - 2A = 4V$$

$$7A - 20V = B$$

$$A = \frac{64}{19}V \approx 3.37V$$
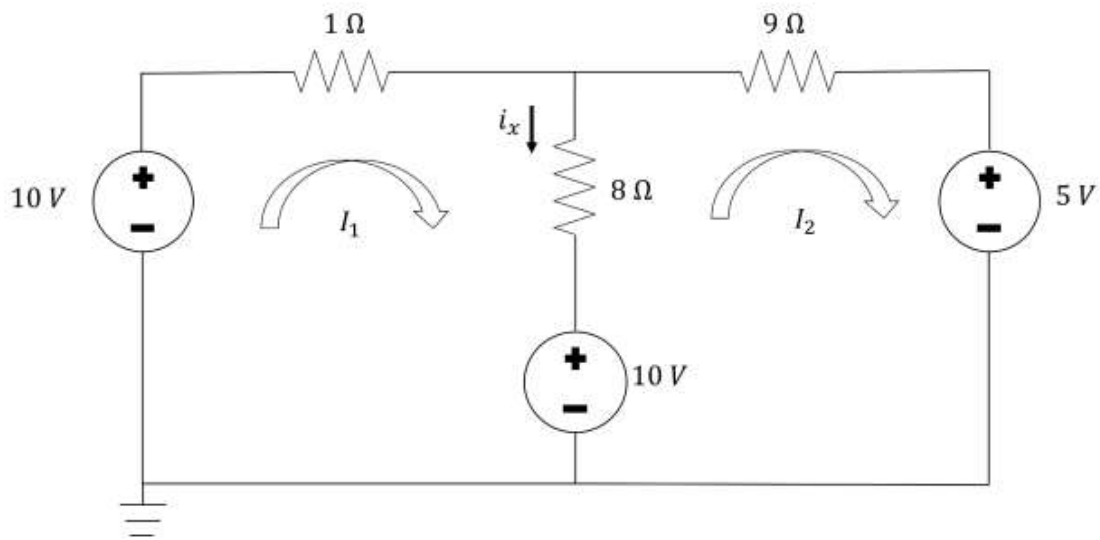
$$B = \frac{68}{19}V \approx 3.58V$$

Question 2: Solve for i.

$$\frac{10V - B}{100\Omega} + \frac{10V - A}{10\Omega} - i = 0$$

$$\frac{A - 10V}{10\Omega} + \frac{A}{20\Omega} + \frac{A - B}{30\Omega} = 0$$

$$\frac{B - 10V}{100\Omega} + \frac{B - A}{30\Omega} + 0.02A = 0$$

$$\frac{B + 10A}{100\Omega} = 1.1A - i$$

$$11A - 2B = 60V$$

$$13B - 4A = 30V$$

$$\frac{11}{2}A - 30V = B$$

$$\frac{56}{9}V = A$$

$$\frac{38}{9}V = B$$

$$\frac{299}{450}A = 1.1A - i$$

$$i = \frac{98}{255}A \approx 0.435A$$

Question 3: Solve for i_x. (Hint: Super nodes may contain more than two nodes.)

4 Ω

v3

$$v_1 + 5V = v_2$$
$$v_1 + 20V = v_3$$
$$\frac{v_1 - 10V}{4\Omega} + \frac{v_1}{8\Omega} + i_x + \frac{v_3 - 10V}{4\Omega} = 0$$
$$i_x = -\frac{5v_1}{8\Omega}$$
$$\frac{v_1 + 5V}{16\Omega} + \frac{5v_1}{8\Omega} = 0$$
$$\frac{5V + 11v_1}{16\Omega} = 0$$
$$v_1 = \frac{-5}{11}V$$
$$i_x = -\frac{5\frac{-5}{11}V}{8\Omega}$$
$$i_x = \frac{25}{88}A \approx 0.284A$$

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Question 4:

A) Use Mesh Current Analysis to solve for I_1 and I_2.

$$1\Omega(I_1) + 8\Omega(I_1 - I_2) + 10V - 10V = 0$$
$$8\Omega(I_2 - I_1) + 9\Omega(I_2) - 5V + 10V = 0$$
$$I_1(9\Omega) - 8\Omega(I_2) = 0$$
$$I_2(17\Omega) - 8\Omega(I_1) + 5V = 0$$
$$I_1 = \frac{8}{9}I_2$$
$$\frac{89\Omega}{9}I_2 + 5V = 0$$
$$I_2 = -\frac{45}{89}A \approx -0.506A$$
$$I_1 = -\frac{40}{89}A \approx -0.449A$$

B) What is the value of the current through the 8Ω resistor, i_x, and in what direction is it flowing?

$$i_x + I_2 - I_1 = 0$$
$$i_x = I_1 - I_2$$
$$i_x = -\frac{40}{89}A + \frac{45}{89}A$$
$$i_x = \frac{5}{89}A \approx 0.056A$$

i_x is flowing towards ground (aka in the same direction as the arrow on the diagram for i_x is pointing.)

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