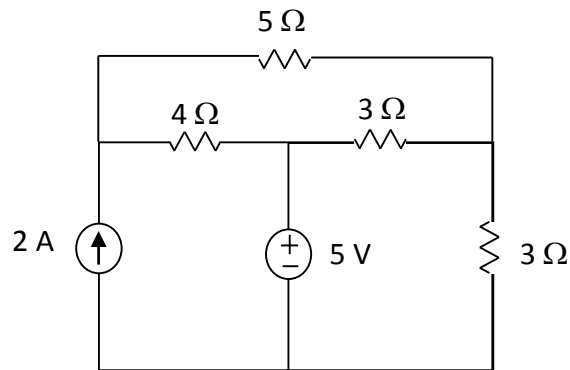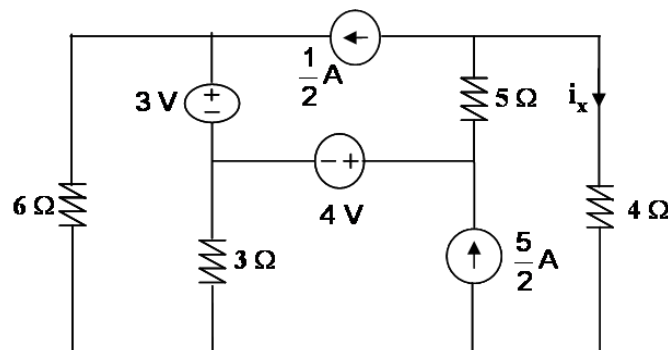# HOMEWORK II

Question 1 Consider the circuit below.

a) Obtain the node equation in matrix form.
b) Solve the node equation, and determine the branch voltages and currents.
c) Obtain the mesh equation in matrix form.
d) Solve the mesh equation, and determine the branch currents and voltages.
e) Determine the powers delivered to/supplied by the branches. Verify that the power is conserved.
f) Suppose that only the current through the 5 V battery is required. Transform the upper Δ connected resistors to the equivalent Y connected resistors, solve the simple circuit (just one node equation), and determine the required current.

Answer   Part (f) 2/3 A.

Question 2 Consider the circuit below.

a) Obtain the node equation in matrix form.
b) Solve the node equation, and determine the branch voltages and currents.
c) Obtain the mesh equation in matrix form.

d) Solve the mesh equation, and determine the branch currents and voltages.

e) Determine the powers delivered to/supplied by the branches.
   Verify that the power is conserved.

f) Find the current i_x by superposition.

Question 3 For the following circuit, find the powers delivered to/supplied by the elements. Is the 3-T two-port passive or active? Explain.
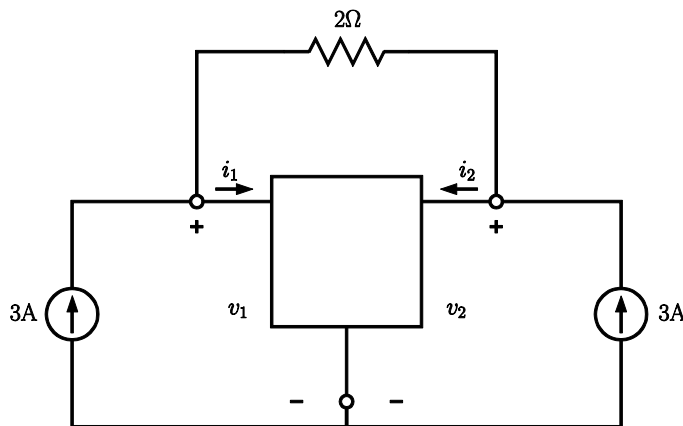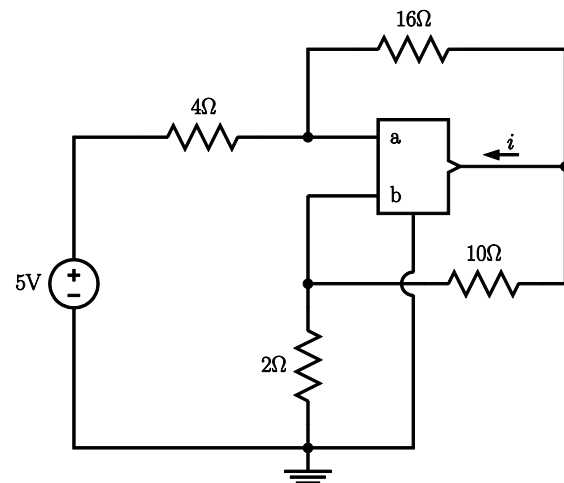

$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 2 & 4 \\ -4 & 0 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$$

Question 4 The circuit element AVG is introduced in Figure 1. For the circuit given in Figure 2, find the node voltages, the current i, and the powers delivered to/supplied by the elements.

$$i_a = 0, \quad i_b = 0$$
$$v_c = 10(v_a + v_b)$$
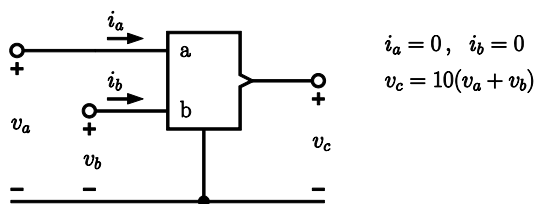
Figure 1 The circuit element AVG.

Figure 2 The circuit for Question 4.