HKN EE42/100 MT1 Review

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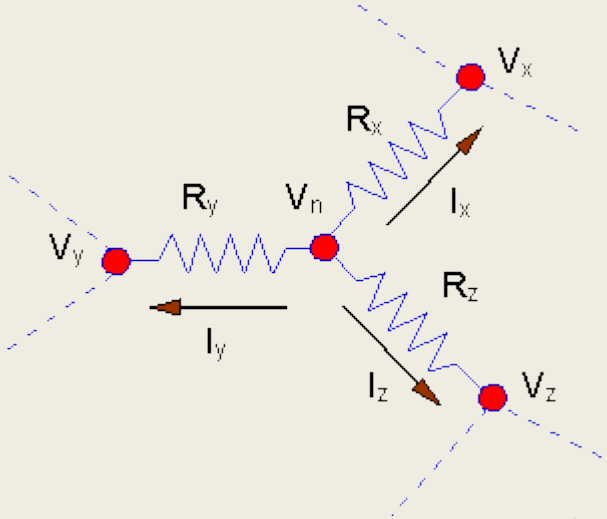
Nodal Analysis

Step 1:
a) Identify all extraordinary nodes (connection point between at least 3 branches)
b) Select one as ground
c) Assign node voltage names to others

Step 2:
a) Apply KCLs at the nodes

Step 3:
a) Solve to determine unknowns

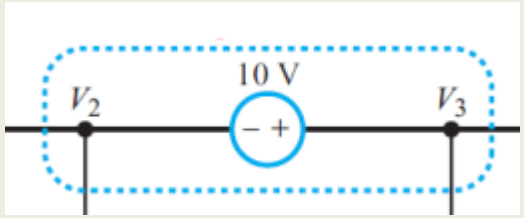


$$\frac{V_n - V_y}{R_y} + \frac{V_n - V_x}{R_x} + \frac{V_n - V_z}{R_z} = 0$$

Nodal Analysis

Supernodes!

If we have a source between two nodes, we can “combine” them into a supernode!

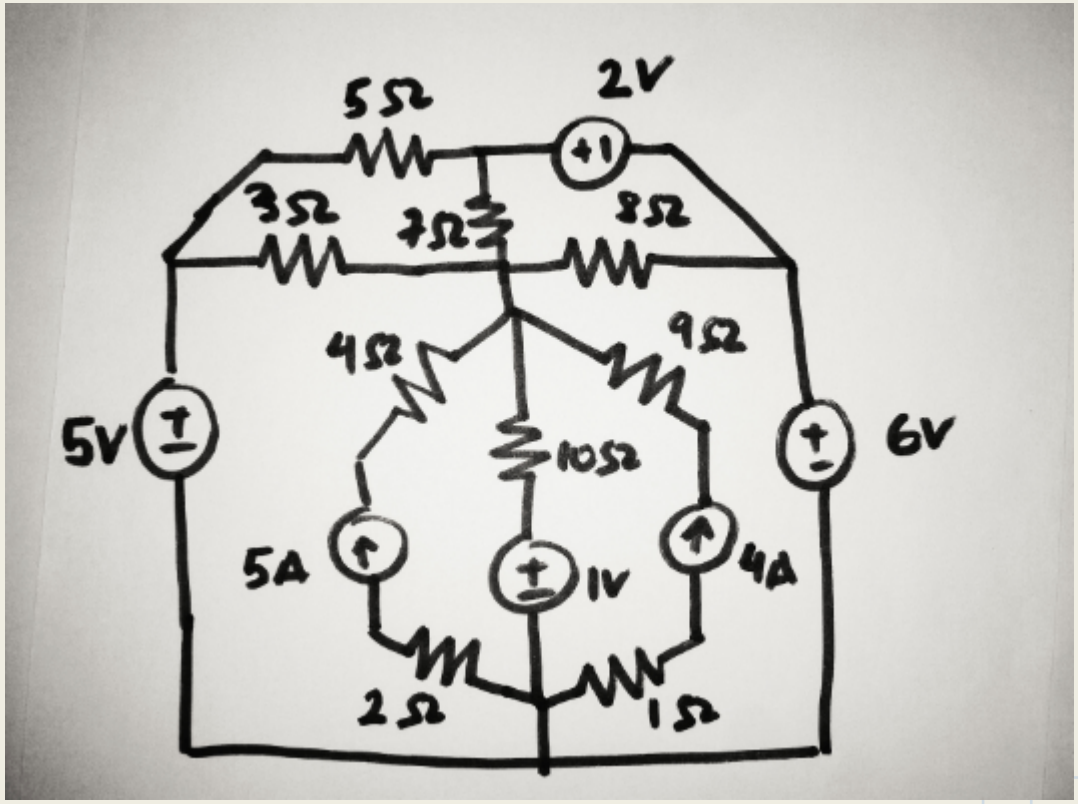


We use the voltage difference to relate V_3 and V_2:

$$V_3 - V_2 = 10\ V$$

Nodal Analysis

Let's put it all together!
Find the nodal analysis equation(s) to get voltages at each node!

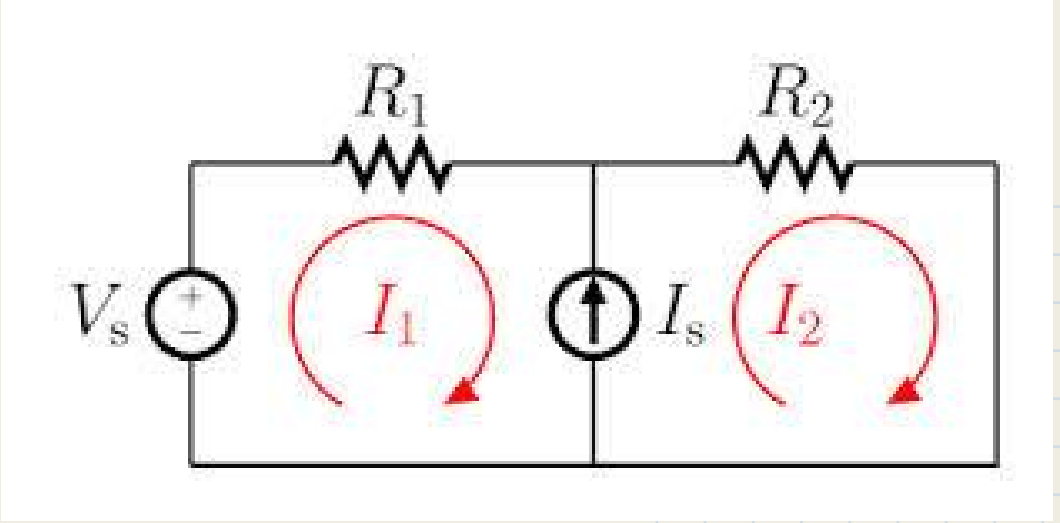


Mesh Analysis

Step 1:
a) Identify all loops (meshes)

Step 2:
a) Apply KVL on the loops

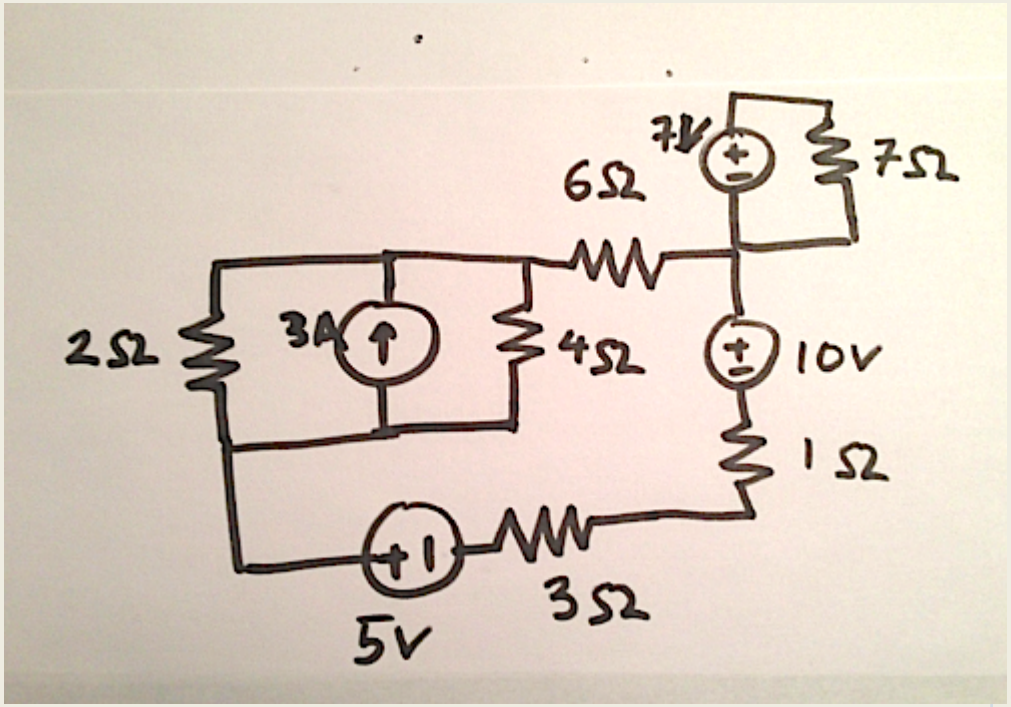
Step 3:
a) Solve to determine unknowns



We have a supermesh, where is it?

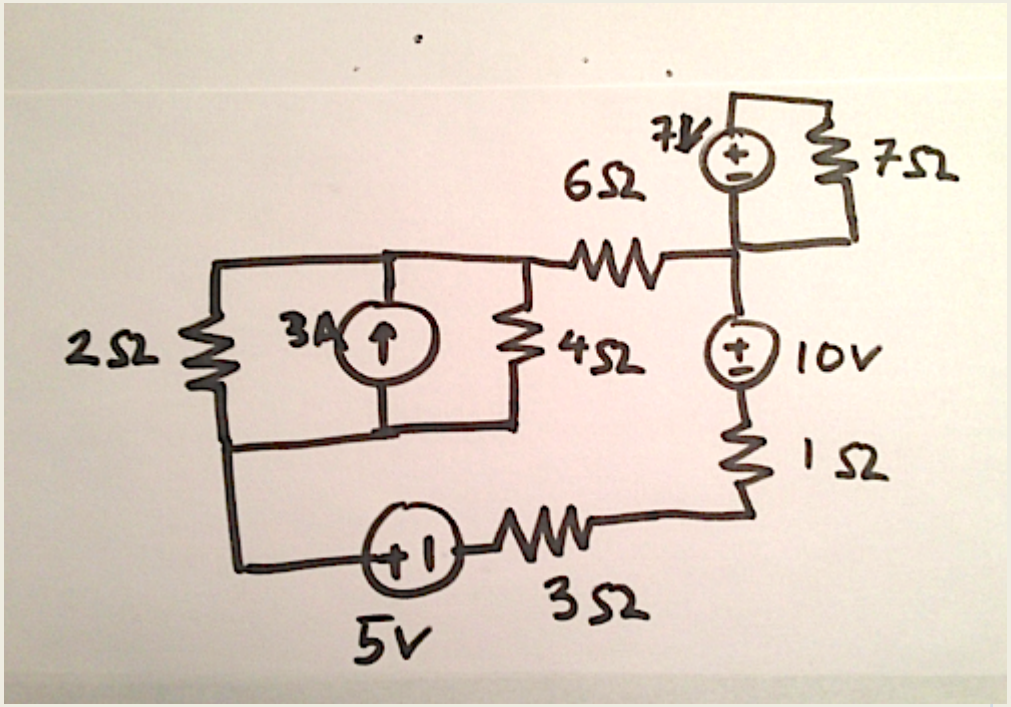
Mesh Analysis

Find the mesh equations for this circuit!



Mesh Analysis

Find the mesh equations for this circuit!

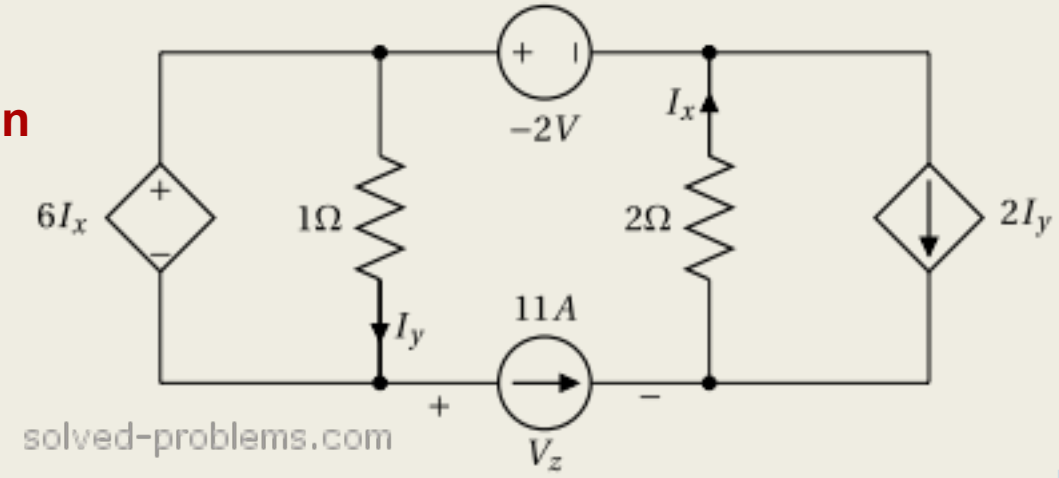


Dependent Sources

The values for the dependent source depend **on values elsewhere in the circuit!**

In this scenario: $V_{dep} = 6I_x$, $I_{dep} = 2I_y$

(could depend on voltages too)



Superposition

Analysis by superposition:

1. Select 1 independent source to keep, and turn off the rest:
    a. Short independent voltage sources
    b. Open independent current sources

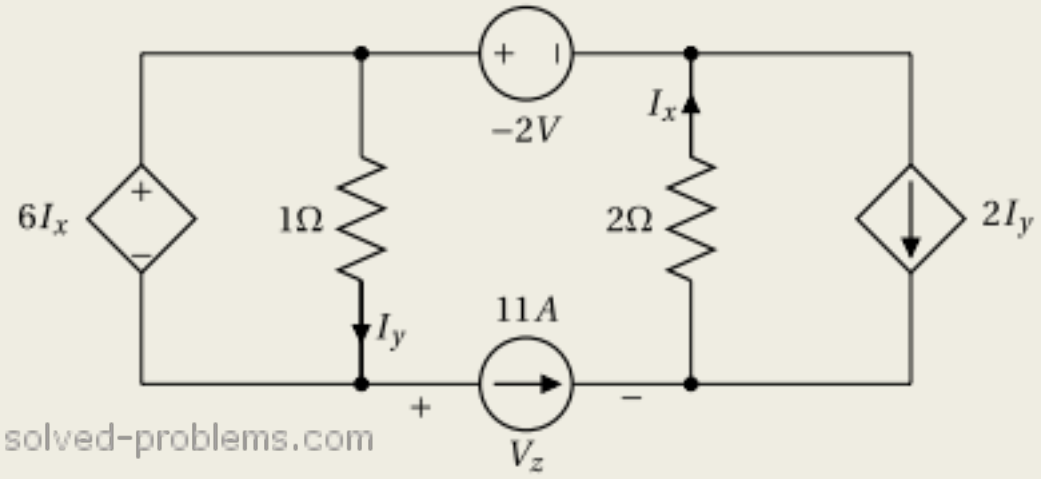
2. Solve the circuit using KVL or KCL

3. Repeat for every independent source

4. The currents and voltages of the entire circuit is equal to the sum of the currents and voltages solved in (2.) for each source

Superposition

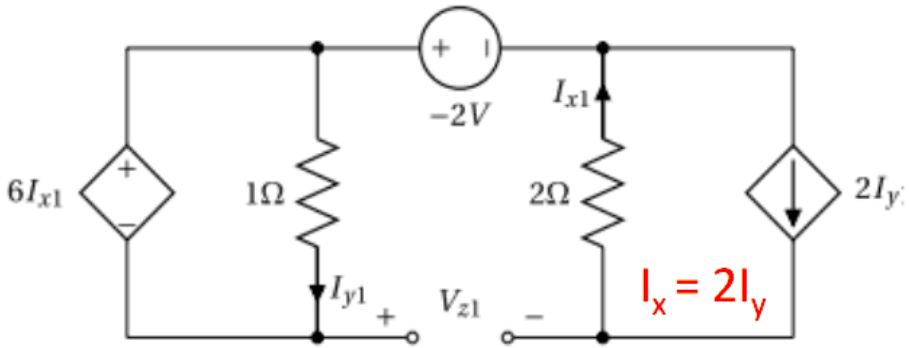
Analysis by superposition:



Superposition

Analysis by superposition:

$6 I_x = 1 * I_y$



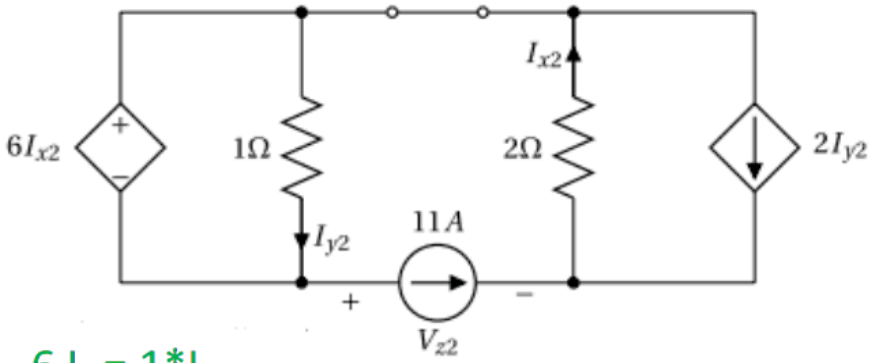
1. Turn off independent current source
2. Replace with open circuit

Since I_x and I_y are 0, there is no voltage drop across the resistors

$I_x = 0$ $I_y = 0$ $V_z = -2V$

Superposition

Analysis by superposition:



$6\ I_x = 1 * I_y$

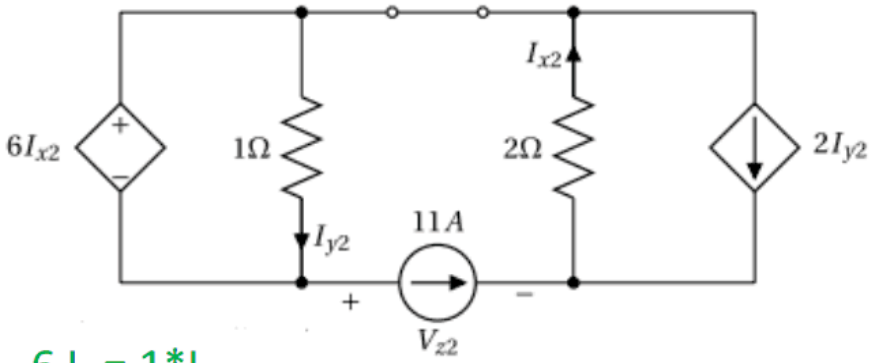
$11A + 2I_y = I_x$ $\qquad$ $2I_x + 1I_y + V_z = 0$

1. Turn off independent voltage source
2. Replace with short circuit

$I_x = -1A \quad I_y = -6A \quad Vz = 8V$

Superposition

Analysis by superposition:



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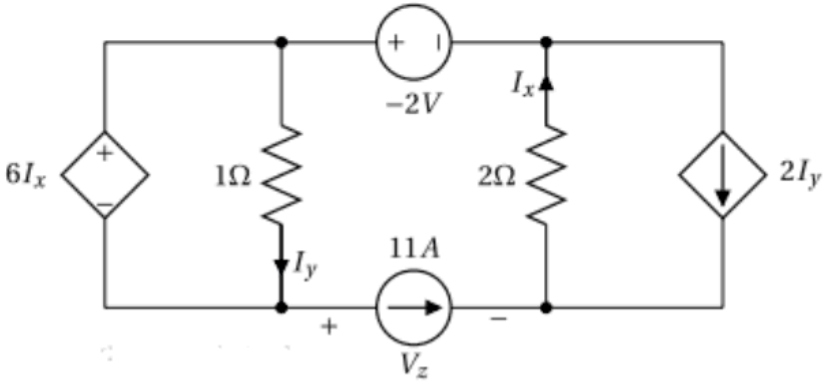
Superposition

Analysis by superposition:



$I_y = I_y + I_y = 0 + (-6A) = -6A$

$I_x = I_x + I_x = 0 + (-1A) = -1A$

$V_z = V_z + V_z = (-2V) + (8V) = 6V$