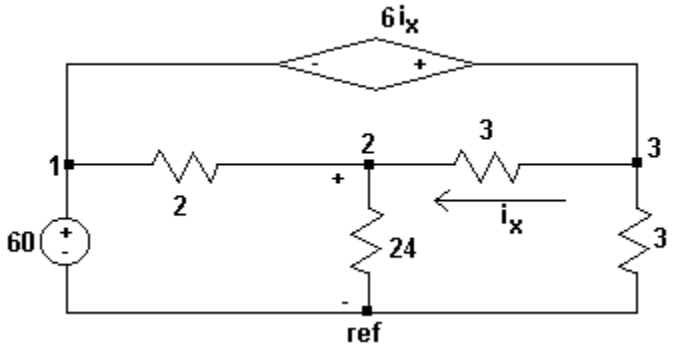
EECE499 – Homework #2
Due (F) Feb 18

SOLUTION

1. Find the voltage at node2, V_2.



As you see above, we already have all the marks for nodes and the reference.

Solution

1. KCL at node 1: Since we already know the node voltage V_1=60, we do not need equation at node 1.

2. KCL at node 2: $\{\frac{V_2-60}{2}+\frac{V_2}{24}+\frac{V_2-V_3}{3}=0\}$,

Simplification yields: $\{21V_2-8V_3=720\}$ ----------(1)

3. KCL at node 3: Since we have two variables in one equation (1), we'd better find one relationship that connects the V_2 and V_3. *In other words, in this example, we do not have to define a current through the dependent source*.

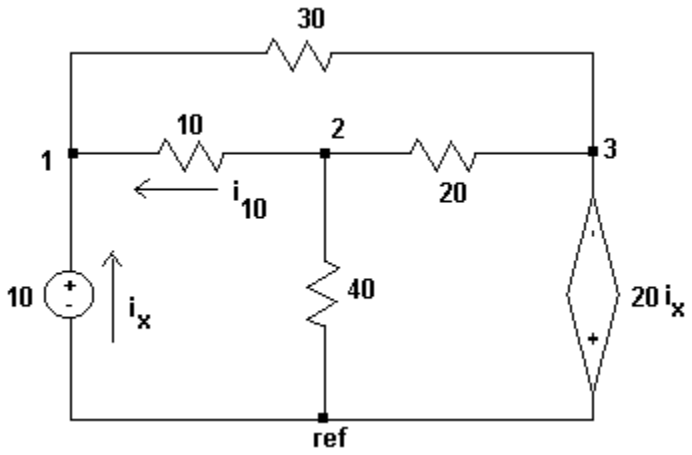
First we relate the current i_x in terms of V_2 and V_3: $\{\frac{V_3-V_2}{3}=i_x\}$

Second, we get the V_3 directly from the circuit: (hint apply KVL around the outer loop): $\{V_3=6i_x+60\}$

If we combined these two, we finally have: $\{V_3=6\frac{V_3-V_2}{3}+60 \text{ --------> } V_3=2V_2-60\}$ --(2)

4. By equation (1) and (2), we have: V_2= (48)

2. Using node-voltage method, find the current i_{10}.



SOLUTION

Step 1: Essential nodes

Step 2: Reference

Step 3: Node voltage equations.

@node 2: $\frac{V_2-10}{10}+\frac{V_2}{40}+\frac{V_2-V_3}{20}=0$ --------> $7V_2-2V_3=40$ ------(1)

@node 1: $-i_x+\frac{10-V_2}{10}+\frac{10-V_3}{30}=0$

Since $V_3=-20i_x$ or $i_x=-\frac{V_3}{20}$, the equation @node 1 becomes:

$\frac{V_3}{20}+\frac{10-V_2}{10}+\frac{10-V_3}{30}=0$ ----------> $6V_2-V_3=80$ ----------(2)

From (1) and (2): $V_2=24$ and $V_3=64$

Your answer: $i_{10}=$ _____ $i_{10}=\frac{24-10}{10}=1.4$