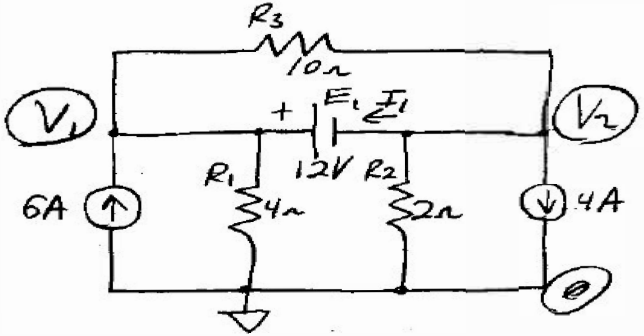
IF A VOLTAGE SOURCE IS PRESENT:

1 - CONVERT IT & SERIES "R" TO A PRACTICAL CURRENT SOURCE
2 - CHOOSE ONE END OF THE VOLTAGE SOURCE AS THE REF. NODE

3 - SUPERNODE APPROACH

(EXAMPLE 8.22)

Example 8.24 in 13th ed



(FIND THE NODE VOLTAGES)

"MODIFIED" SUPERNODE APPROACH

V_1: $6 + I_1 = \dfrac{V_1 - V_2}{R_3} + \dfrac{V_1}{R_1}$

$6 + I_1 = \dfrac{V_1}{10} - \dfrac{V_2}{10} + \dfrac{V_1}{4} \Rightarrow 6 = 0.35V_1 - 0.1V_2 - I_1$ (1)

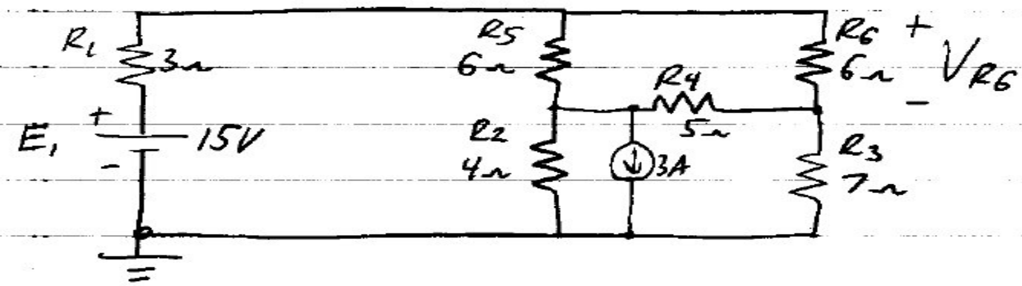
V_2: $0 = \dfrac{V_2 - V_1}{R_3} + I_1 + \dfrac{V_2}{R_2} + 4 \Rightarrow 0 = \dfrac{V_2}{10} - \dfrac{V_1}{10} + I_1 + \dfrac{V_2}{2} + 4$

$-4 = {}^{-}0.1V_1 + 0.6V_2 + I_1$ (2)

TWO EQUATIONS, THREE UNKNOWNS! WE NEED ANOTHER INDEPENDENT EQUATION:

ANOTHER NODAL ANALYSIS PROBLEM
(ICP).

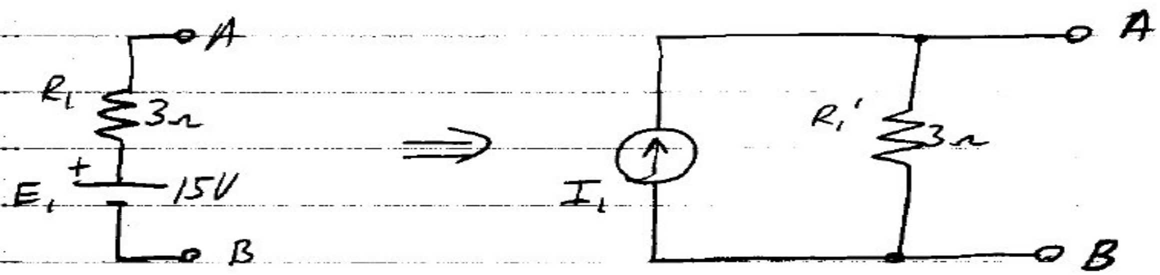
(EXAMPLE)



USE NODAL ANALYSIS TO FIND ALL NODE VOLTAGES & V_{R6}.

(1) CONVERT E_1, R_1 TO I_1, R_1' (SOURCE TRANSFORMATION)

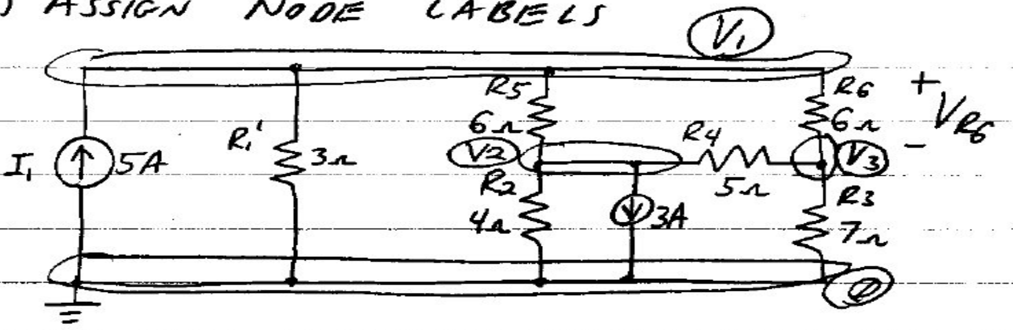
ONE APPROACH



$$I_1 = E_1/R_1 = \frac{15V}{3\Omega} = \underline{\underline{5A}}$$

REDRAW THE CIRCUIT:

(2) ASSIGN NODE LABELS



(3) KCL AT EACH NODE

$\sum I_{\text{ENTERING}} = \sum I_{\text{LEAVING}}$

FOR V_1 :

FOR V_2 :

For V3:

SOLVE (1) → (3)