

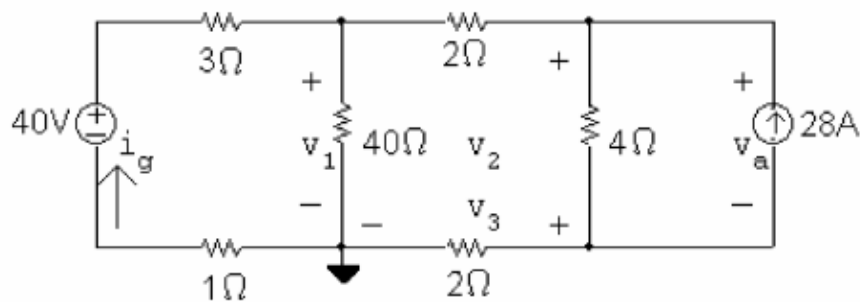
**KING FAHD UNIVERSITY OF PETROLEUM & MINERALS**  
**ELECTRICAL ENGINEERING DEPARTMENT**  
**EE-201 ELECTRIC CIRCUITS**  
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Sec: 9      Quiz # 2    Ser. #      Name:

I.D.#

For the circuit shown below, use nodal analysis to find

- a) “ $v_1$ ”, “ $v_2$ ”, and “ $v_3$ ”
- b) the power of the current source (indicating weather it is absorbed or delivered)



Solution:

The three node voltage equations are:

$$\frac{v_1 - 40}{4} + \frac{v_1}{40} + \frac{v_1 - v_2}{2} = 0$$

$$\frac{v_2 - v_1}{2} + \frac{v_2 - v_3}{4} - 28 = 0$$

$$\frac{v_3}{2} + \frac{v_3 - v_2}{4} + 28 = 0$$

Place these equations in standard form:

$$v_1 \left( \frac{1}{4} + \frac{1}{40} + \frac{1}{2} \right) + v_2 \left( -\frac{1}{2} \right) + v_3(0) = \frac{40}{4}$$

$$v_1 \left( -\frac{1}{2} \right) + v_2 \left( \frac{1}{2} + \frac{1}{4} \right) + v_3 \left( -\frac{1}{4} \right) = 28$$

$$v_1(0) + v_2 \left( -\frac{1}{4} \right) + v_3 \left( \frac{1}{2} + \frac{1}{4} \right) = -28$$

Solving,  $v_1 = 60 \text{ V}$ ;       $v_2 = 73 \text{ V}$ ;       $v_3 = -13 \text{ V}$ .

$$p_{28A} = -v_a(28 \text{ A}) = -(v_2 - v_3)(28 \text{ A}) = -(73 + 13)(28) = -2408 \text{ W}$$

The 28 A source delivers 2408 W.