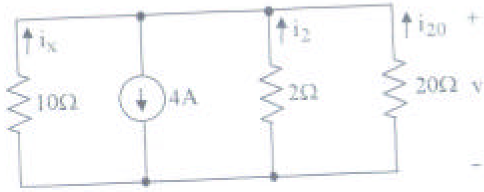
1.



(a) Calculate i_x, i_2, and v.
(b) Find the power dissipated for every component including the current source.

a. First we name all voltages and currents. Make sure you indicate the direction of each current and + and − ends of each voltage.

- We equate all voltages in parallel

$$v_x = V_2 = V$$

using Ohm's Law

$$v_x = 10\Omega \cdot -i_x$$

$$v = 20\Omega \cdot -i_{20}$$

$$v_2 = 2\Omega \cdot -i_2$$

since $v_x = v \Rightarrow i_{20} = \frac{10\Omega \cdot i_x}{20\Omega} = \frac{1}{2} i_x \rightarrow (1)$

since $v_2 = V \Rightarrow i_2 = \frac{10\Omega \cdot i_x}{2} = 5 i_x \rightarrow (2)$

using Currents sum at the upper left node

$4A - i_x - i_2 - i_{20} = 0$ (if current is going in the node it's (-), out of the node is (+)

substituting for i_2 and i_{20} from (1) and (2), we get

$$4A - i_x - 5i_x - \frac{1}{2} i_x = 0$$

$$4A = \frac{13}{2} i_x$$

$$i_x = \frac{8}{13} A$$

From eq. (1)

$$i_2 = 5 i_x = 5 \times \frac{8}{13} A = \frac{40}{13} A$$

$$V = 10\Omega \cdot -i_x = 10\Omega \cdot \frac{-8}{13} A = \frac{-80}{13} V$$

(b) Power Dissipation:

$$P_{(10\Omega)} = -i_x v_x = \frac{8}{13} \times \frac{-80}{13} = \frac{640}{169} W$$

(The negative sign is because i_x goes from - to +)

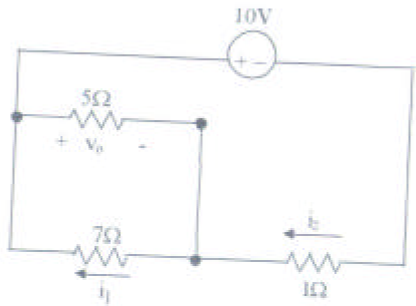
$$P_{(20\Omega)} = -i_{20} V = \frac{-1}{2} i_x V = \frac{-8}{2 \times 13} \times \frac{-80}{13} = \frac{320}{169} W$$

$$P_{(2\Omega)} = -i_2 v = \frac{-40}{13} \times \frac{-80}{13} = \frac{3200}{169} W$$

$$P_{(4A)} = v \times 4A = \frac{-80}{13} \times 4 = \frac{-320}{13} W$$

The power is negative which means it is a source. It is generating (or supplying) power.

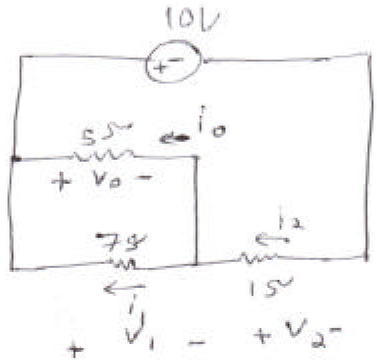
2



Calculate i_1, i_2, and v_o.

3.

First we name all voltages and currents



Voltage Loops:-

-inner Loop:- $V_o - V_1 = 0$

$V_o = V_1$

we can also notice that the resistors are in parallel and the voltages accross are equal.

using Ohm's Law:- $-5\Omega \cdot i_0 = -7\Omega \cdot i_1 \Rightarrow i_0 = \frac{7}{5} i_1$ --(1)

-Outter loop:- $10V - V_1 - V_2 = 0$

Substituting for V_1 and V_2 using Ohm's Law

$10V = V_1 + V_2$

$= -7\Omega \cdot i_1 - 1\Omega \cdot i_2$ -(2) (The negative sign is because i goes from - to +)

- Current Sum

summing the current at the center bottom node:-

$i_2 - i_1 - i_0 = 0$

$i_2 = i_0 + i_1$

using ①

$i_2 = \frac{7}{5} i_1 + i_1 = \frac{12}{5} i_1$

substituting for i_1 in ②

$10\,V = -7\Omega \cdot i_1 - 1\Omega \cdot i_2$

$= -7\Omega \cdot i_1 - 1\Omega \cdot \frac{12}{5} i_1$

$10 = \frac{-35 - 12}{5} i_1$

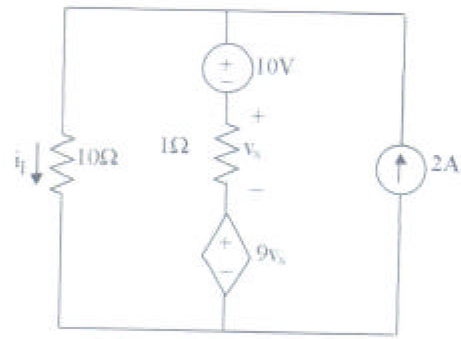
$i_1 = \frac{-50}{47} A$

$i_2 = \frac{12}{5} i_1 = \frac{12}{5} \times \frac{-50}{47} A = \frac{-120}{47} A$

$v_0 = v_1 = -7\Omega \cdot i_1 = -7 \times \frac{-50}{47} = \frac{350}{47} V$

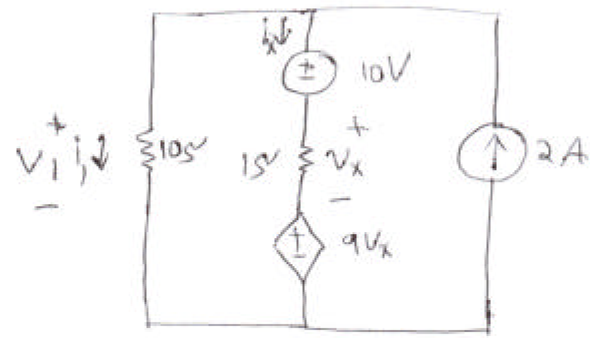
—

3.



Find v_x, i_1, and the power dissipated by the dependent source.

- Name all voltages and currents



- Voltage Loops:

The left loop:
$$10V - V_1 + 9V_x + V_x = 0$$
$$10V - V_1 + 10V_x = 0$$

using Ohm's Law:
$$10V = V_1 - 10V_x$$
$$10V = 10\Omega \cdot i_1 - 10 \cdot 1\Omega \cdot i_x \quad \rightarrow (1)$$

- Currents Sum:
$$2A - i_x - i_1 = 0$$
$$2A = i_x + i_1$$
$$i_1 = 2A - i_x \quad \rightarrow (2)$$

Substituting for i_1 in (I)

$$10V = 10\Omega \cdot (2A - i_x) - 10 \cdot 1\Omega \cdot i_x$$

$$10V = 20A\Omega - 10\Omega \cdot i_x - 10\Omega \cdot i_x$$

$$10V = 20A\Omega - 20\Omega i_x$$

$$20 i_x = 20 - 10$$

$$i_x = \frac{10}{20} = \frac{1}{2} A$$

$$v_x = i_x \cdot 1\Omega = \frac{1}{2} V$$

$$i_1 = 2A - i_x = 2 - \frac{1}{2} = \frac{3}{2} A$$

- Power Dissipation by the depandant source

$$P = iV = i_x (9 v_x) = \frac{1}{2} \times 9 \times \frac{1}{2} = \frac{9}{4} W$$