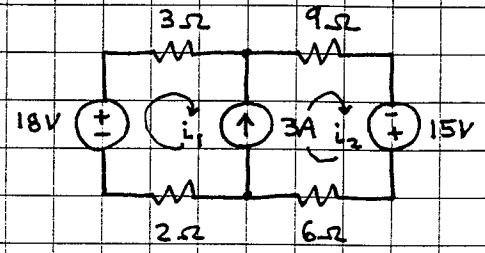
ex:



Use mesh-current method to find total pwr dissipated by circuit.

soln: Define mesh currents i_1 and i_2 as shown above on circuit diagram.

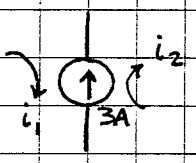
If we try to take sum of V drops = 0 around mesh loops, we have a problem with 3A source.

Use a supermesh. That is, use sum of V drops around larger outside loop = 0V, and write an equation relating i_1 and i_2 to 3A source.

Eq'n for V drops around outside loop = 0V:

$$-i_1\,2\Omega + 18V - i_1\,3\Omega - i_2\,9\Omega + 15V - i_2\,6\Omega = 0V$$

Eq'n relating i_1, i_2, and 3 A source:



$$+i_2 - i_1 = 3A$$

$+i_2$: same direction of current flow for i_2 and 3A source

$-i_1$: opposite direction of current flow for i_1 and 3A source

Now we rearrange our two eq'ns in two unknowns and solve for i_1 and i_2.

$i_2 = i_1 + 3A$ (from 2nd eq'n, substite this in 1st eq'n)

Move i_1, i_2 terms to right side in 1st eq'n and substitute for i_2:

$$18V + 15V = i_1(2\Omega + 3\Omega) + (i_1 + 3A)(9\Omega + 6\Omega)$$

$$33V - 3A \cdot 15\Omega = i_1(2\Omega + 3\Omega + 9\Omega + 6\Omega) = i_1 \cdot 20\Omega$$

$$\text{or} \quad i_1 = \frac{33V - 45V}{20\Omega} = \frac{-12V}{20\Omega} = -0.6\,A$$

$$\text{and} \quad i_2 = i_1 + 3A = -0.6A + 3A = 2.4\,A$$

The text considers the "total power dissipated by the circuit" to mean the "total power dissipated by the resistors."

This total power is $i_1^2 \cdot 2\Omega + i_1^2 \cdot 3\Omega + i_2^2 \cdot 6\Omega + i_2^2 \cdot 9\Omega$

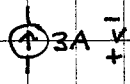
$$\text{or} \quad P_{tot} = (-0.6)^2 \cdot 5\Omega \cdot A^2 + (2.4)^2 \cdot 15\Omega A^2$$

$$\text{or} \quad P_{tot} = 88.2\,W$$

Or we can take the negative of the power for the three sources:

$$P_{tot\ src's} = 18V \cdot (-i_1) + V \cdot 3A + 15V \cdot (-i_2)$$

where V is across 3A source: $-i_1 \cdot 2\Omega + 18V - i_1 \cdot 3\Omega + V = 0V$ (Use V loop)



$$\text{or} \quad V = -0.6 \cdot 5\Omega - 18V = -21V$$

$$\therefore \quad P_{tot\ src's} = 18V \cdot 0.6A + (-21V) \cdot 3A + 15V \cdot (-2.4A)$$

$$= 10.8 - 63 - 36\,W = -88.2\,W$$

$$\therefore \quad P_{tot} = -(-88.2)\,W = 88.2\,W \quad \checkmark$$