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

Solu: 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.

Equation for $V$ drops around outside loop $= 0V$:

$-i_1 \cdot 2\pi + 18V - i_1 \cdot 3\pi - i_2 \cdot 7\pi + 15V - i_2 \cdot 6\pi = 0V$

Equation relating $i_1$, $i_2$, and $3A$ source:

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

\[ i_2 = i_1 + 3A \quad \text{(from 2}^{\text{nd}} \text{ eqn, substitute this in 1}^{\text{st}} \text{ eqn)} \]

Move \( i_1, i_2 \) terms to right side in 1\(^{\text{st}}\) eqn and substitute for \( i_2 \):

\[
18V + 15V = i_1 (2\Omega + 3\Omega) + (i_1 + 3A)(9\Omega + 6\Omega)
\]
\[
33V - 3A \cdot 15\Omega = i_1 (2\Omega + 3\Omega + 9\Omega + 6\Omega) = i_1 \cdot 20\Omega
\]

or \[
i_1 = \frac{33V - 45V}{20\Omega} = \frac{-12V}{20\Omega} = -0.6A
\]

and \[
i_2 = i_1 + 3A = -0.6A + 3A = 2.4A
\]

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

This total power is \[i_1^2 \cdot 2\Omega + i_1^2 \cdot 3\Omega + i_2^2 \cdot 6\Omega + i_2^2 \cdot 9\Omega\]
or \[
P_{\text{tot}} = (-0.6)^2 \cdot 5\Omega + (2.4)^2 \cdot 15\Omega
\]
or \[
P_{\text{tot}} = 88.2\, \text{W}
\]

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

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

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

(Use \( V \) loop) \[
\bigoplus 3A \, \bigoplus
\]

or \( V = -0.6 \cdot 5\Omega - 18V = -21V\)

\[
P_{\text{tot src's}} = 18V \cdot 0.6A + (-21V) \cdot 3A + 15V \cdot (-2.4A)
\]

\[
= 10.8 - 63 - 36\, \text{W} = -88.2\, \text{W}
\]

\[
\therefore P_{\text{tot}} = -(-88.2)\, \text{W} = 88.2\, \text{W}
\]