Ex:

```
\begin{align*}
& 18 \, \text{k}\Omega \\
& 2 \, \text{k}\Omega \\
& 66 \, \text{V} \\
& 44 \, \text{V} \\
& i_x \\
& i_1 \\
& 6 \, \text{k}\Omega \\
& 2 \, \text{mA}
\end{align*}
```

a) Use the mesh-current method to find \( i_1 \) and \( i_2 \).
b) Find the power dissipated by the dependent source.

\textbf{Soln:} a) We first write the variable \( i_x \) in the dependent source in terms of mesh currents. Since \( i_x \) is on the outside edge of the circuit, however, we may use \( i_x \) as one of our mesh currents.

Likewise, we may use \( i_1 \) as a mesh current. Unfortunately, \( i_2 \) is not a mesh current. We name the mesh current for the lower right loop \( i_2 \):
Now we look for super-meshes, (i.e. current sources between loops). We see that $i_1$ and $i_3$ form a super-mesh. Now we are ready to write our mesh current eqns for the circuit.

$i_x$ loop: $4.4V - i_x \cdot 2k\Omega - i_x \cdot 6k\Omega + i_3 \cdot 6k\Omega = 0$

$i_1, i_3$ loop: $-i_3 \cdot 6k\Omega + i_x \cdot 6k\Omega - i_1 \cdot 18k\Omega - 6V + i_3^2$

We encounter a current source, which means we shouldn't be using this voltage-loop! So we will dispense with this eqn. But we need another eqn in its place. We use $i_3 = -2mA$. That is, we have a current source on the outside edge of the circuit. This current source gives the value of the mesh current.

Our last eqn is the eqn for the current source between $i_1$ and $i_3$ loops:

$i_{1i_3}$: $i_1 - i_3 = i_x \frac{1}{12}$

We now solve the three eqns. Since $i_3 = -2mA$, we really only have 2 eqns.

$i_x$ loop: $-i_x \cdot (2k\Omega + 6k\Omega) = -4.4V - i_x \cdot 6k\Omega$

\[
\begin{align*}
\frac{i_x}{8k\Omega} &= \frac{\text{-}4.4V}{8k\Omega} + \frac{\text{-}2mA}{8k\Omega} \\
\frac{i_x}{12} &= \frac{\text{-}4mA}{12} - \frac{2mA}{12} = \frac{\text{-}6mA}{12} = \frac{1}{2}mA
\end{align*}
\]

$i_{1i_3}$: $i_1 = i_x + i_3 = \frac{1}{12} + \frac{1}{12} = \frac{1}{6}mA - 2mA = \frac{1}{3}mA - 2mA = \frac{1}{6}mA$

Finally, $i_2 = i_x - i_3 = 4 - (-2mA) = 6mA$. 
b) Power = v \cdot i. We know \( i = \frac{1}{12} \times 4 = \frac{4}{12} = \frac{1}{3} \text{mA} \).

To find \( v \), we can use a v-loop on the upper right.

\[-i_1 \cdot 18 \text{k}\Omega - 66V - v = 0V\]

where \( i_1 = -\frac{20}{12} \text{ mA} = -\frac{5}{3} \text{ mA} \)

\[v = \frac{5}{3} \cdot 18 \text{k}\Omega - 66V = -36V\]

so \( p = -36V \left( \frac{1}{3} \text{ mA} \right) = -12 \text{ mW} \)

Since \( p < 0 \), the dependent source supplies power.