Physics 116A Fall 2004 Solutions, Problem Set 1.
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1.18  (a) \( v_1 = 30 \text{ V} \Rightarrow i_1 = \frac{v_1}{3} = \frac{30}{3} = 6 \text{ A} \)
(b) \( v_3 = -9 \text{ V} \Rightarrow i_3 = -\frac{v_3}{3} = -\frac{-9}{3} = 3 \text{ A} \)

1.17  By Ohm's Law, \( i_3 = 3 \text{ A} \)
By KCL, \( i = 0 \rightarrow i_3 = 0 \)
(a) \( v_3 = 14 \text{ V} \): \( i = 6 - 3i = 3 \text{ A} \)

1.18  By Ohm's Law, \( i_4 = \frac{v_4}{2} = \frac{3}{2} \text{ A} \)
By KCL, \( i_4 = i_2 + 2 = 3 + 2 = 5 \text{ A} \)
(b) \( i_4 = 3 - 5 = -2 \text{ A} \)
By Ohm's Law, \( v_5 = 4i_4 = 4(-2) = -8 \text{ V} \)
(a) \( v_5 = 2 \text{ V} \): \( i_1 = \frac{v_5}{4} = \frac{2}{4} = 2 \text{ A} \), \( i_2 = \frac{v_5}{2} = \frac{2}{2} = 1 \text{ A} \), \( i_4 = 2 \text{ A} \)

1.19  By Ohm's Law, \( i_2 = \frac{v_2}{2} = \frac{6}{2} = 3 \text{ A} \)
By KVL, \( v_2 = v_1 = 12 - 6 = 6 \text{ V} \)
By Ohm's Law, \( i_3 = \frac{v_3}{2} = \frac{3}{2} = \frac{3}{2} \text{ A} \)
By KCL, \( i_3 = i_4 = 3 - \frac{3}{2} = \frac{3}{2} \text{ A} \)
By KVL, \( v_3 = 2i_3 + v_1 = 2(\frac{3}{2}) + 6 = 9 \text{ V} \)
By Ohm's Law, \( i_4 = \frac{v_4}{4} = \frac{3}{4} = \frac{3}{4} \text{ A} \)
By KCL, \( i = i_1 + i_4 = \frac{1}{2} + \frac{3}{4} = \frac{5}{4} \text{ A} \)
By KCL, \( i = i_1 + i_3 = \frac{1}{2} + \frac{3}{2} = \frac{5}{2} \text{ A} \)

1.12  By Ohm's Law, \( i = \frac{v_2}{2} = \frac{12}{2} = 2 \text{ A} \)
By KCL, \( i_1 = \frac{v_1}{6} = \frac{6}{2} = 3 \text{ A} \)
By KCL, \( i_1 = i - K_i + i_2 = (-K) + i_2 \)

(b) \( K = 3 \Rightarrow i_1 = 1(3)2 + 4 = 10 \text{ A} \)
(a) \( V_1 = 75 \times 10^3 \times (50 \times i_b) = 75 \times 10^3 \times (10 \times 10^{-3}) = 750 \text{ V} \)

(b) \( V_2 = 1.5 \times 10^3 \times (50 \times i_b) = 75 \times 10^3 \times (10 \times 10^{-3}) = 750 \text{ V} \)

(c) \( V_3 = -50 \times (0.1 \cos (120 \pi t)) = -5 \cos (120 \pi t) \text{ V} \)

\[ i = 24 \text{ A} \]

The power absorbed by the 2-V voltage source is \( P_2 = 2 \times i = 2 \times (24) = -48 \text{ W} \)

The power absorbed by the 3-V resistor is \( P_3 = (\frac{3}{2}) \times i^2 = (\frac{3}{2}) \times (24^2) = 192 \text{ W} \)

The power absorbed by the dependent voltage source is \( P_0 = (0.5 \times i)^2 = (0.5 \times 24)^2 = 288 \text{ W} \)

The power absorbed by the 4-V resistor is \( P_4 = (\frac{4}{2}) \times i^2 = (\frac{4}{2}) \times (24^2) = 144 \text{ W} \)

\[ D = \begin{bmatrix} 5 & -3 & 0 \\ 1 & 2 & 1 \\ 0 & 2 & -3 \end{bmatrix} \]

\[ D = \begin{bmatrix} 6 & -3 & 0 \\ 1 & 2 & -1 \\ 4 & 2 & 3 \end{bmatrix} \]

\[ D = \begin{bmatrix} 5 & 6 & 0 \\ 1 & 4 & 1 \\ 0 & 4 & -3 \end{bmatrix} \]

\[ D = \begin{bmatrix} 5 & -3 & 4 \\ 1 & -2 & -6 \\ 0 & 2 & 4 \end{bmatrix} \]

(b) \( i_i = \frac{v_i - v_b}{2} = \frac{-8}{2} = -4 \text{ A} \)

\[ i = \frac{v_i - v_b}{2} = \frac{-8}{2} = -4 \text{ A} \]

\[ i_s = \frac{v_u - v_d}{4} = -1 \text{ A} \]

\[ i = \frac{v_u - v_d}{2} = \frac{8 - 4}{2} = 2 \text{ A} \]