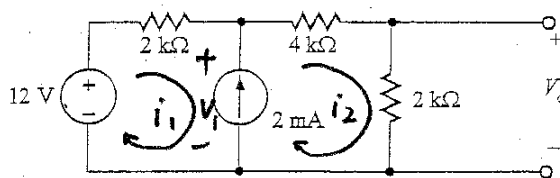EE 112 Electric Circuit Analysis I

EXAM 2   WINTER 2005

Name:_____   Last 4 digits of Student ID:_____
Section #:_____

PROBLEM #1
Use **mesh analysis** to find V_0 in the network below. Find the power associated with the current source. Indicate whether the power is supplied or absorbed.

KVL for supermesh:

$$-12 + 2i_1 + (4+2)i_2 = 0 \qquad (1) \qquad ②$$

$$i_1 + 3i_2 = 6 \qquad (2)$$

$$i_2 - i_1 = 2 \qquad (3) \qquad ②$$

$$(2) + (3) \rightsquigarrow \quad 4i_2 = 8$$

$$i_2 = 2\,mA \qquad ①$$

$$i_1 = 0$$

$$V_0 = 2i_2 = \underline{4V} \qquad ①$$

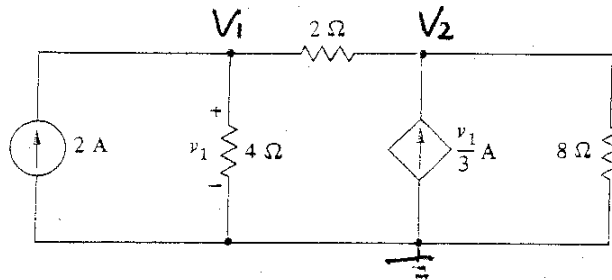Apply KVL to mesh 1:

$$-12 + 2i_1 + V_1 = 0$$

$$V_1 = 12 - 2i_1 = 12V \qquad ①$$

$$P = -2 \times 10^{-3} V_1 = \underline{-24\,mW} \qquad ②$$

the power is supplied

PROBLEM #2

Find the power delivered to the 2Ω resistor using **nodal analysis**.

KCL @ node 1:

$$2 - \frac{V_1}{4} + \frac{V_2 - V_1}{2} = 0 \qquad (1)$$

$$8 - 2V_1 + 2V_2 - 2V_1 = 0$$

$$3V_1 - 2V_2 = 8 \qquad (3)$$

KCL @ node 2:

$$\frac{V_1 - V_2}{2} + \frac{V_1}{3} - \frac{V_2}{8} = 0 \qquad (2)$$

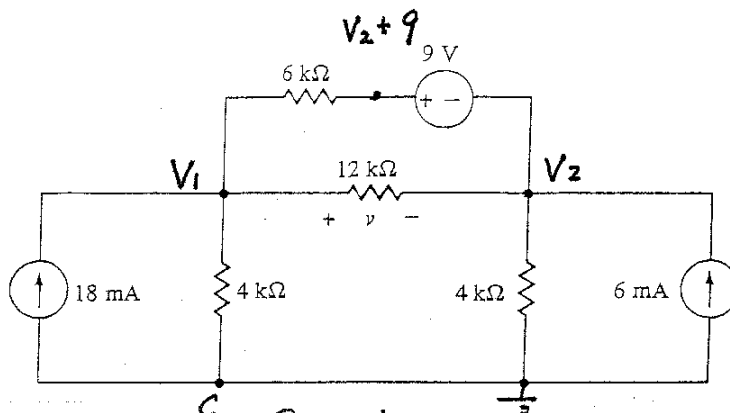$$12V_1 - 12V_2 + 8V_1 - 3V_2 = 0$$

$$4V_1 = 3V_2$$

$$V_1 = \frac{3}{4} V_2 \qquad \text{Substitute in } (3)$$

$$\begin{cases} V_2 = 32 \ V \\ V_1 = 24 \ V \end{cases}$$

$$P_{2\Omega} = \frac{V^2}{R} = \frac{(V_1 - V_2)^2}{R} = \frac{64}{2} = 32 \ W$$

PROBLEM #3
Using nodal analysis, find v.

$V_2 + 9$

9 V

$6\text{ k}\Omega$

V_1 $12\text{ k}\Omega$ V_2

$+\ v\ -$

18 mA $4\text{ k}\Omega$ $4\text{ k}\Omega$ 6 mA

Apply KCL @ node 1:

$$18 - \frac{V_1}{4} + \frac{V_2 - V_1}{12} + \frac{V_2 - V_1 + 9}{6} = 0 \qquad (1)$$

⟲ (2)

$$18 \times 12 - 3V_1 + V_2 - V_1 + 2V_2 - 2V_1 + 18 = 0$$

$$2V_1 - V_2 = 78 \qquad (3)$$

Apply KCL @ node 2:

$$\frac{V_2 - V_1 + 9}{6} + \frac{V_2 - V_1}{12} + \frac{V_2}{4} = 6 \qquad (2)$$

④²

$$2V_2 - 2V_1 + 18 + V_2 - V_1 + 3V_2 = 72$$

$$-2V_1 + 4V_2 = 36 \qquad (4)$$

$$(3) + (4): \quad 3V_2 = 114$$

$$\underline{V_2 = 38\text{ V}} \quad \text{substitute in (3)}$$

(2)

$$\underline{V_1 = 58\text{ V}}$$

$$V = V_1 - V_2 = 58 - 38 = \underline{20\text{ V}}$$

(2)

1 (9)	2 (8)	3 (8)	Total (25)