

Example

Write KVL for the loops identified in the circuit below

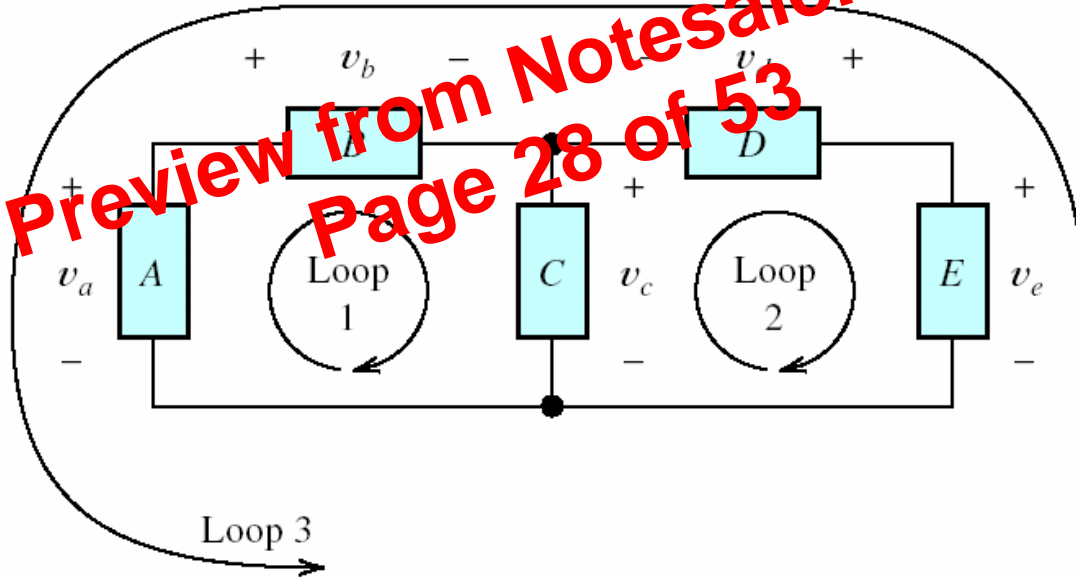


Figure 1.24 Circuit used for illustration of Kirchhoff's voltage law.

$$\text{Loop 1: } -v_a + v_b + v_c = 0$$

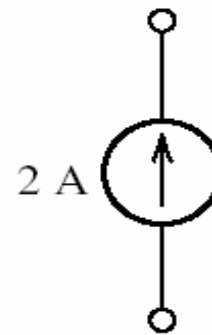
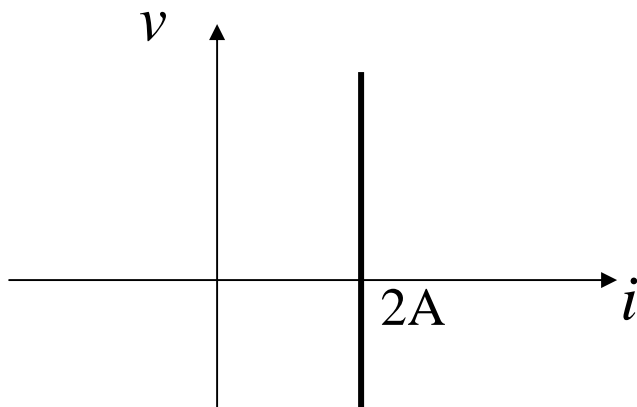
$$\text{Loop 2: } -v_c - v_d + v_e = 0$$

$$\text{Loop 3: } v_a - v_e + v_d - v_b = 0$$

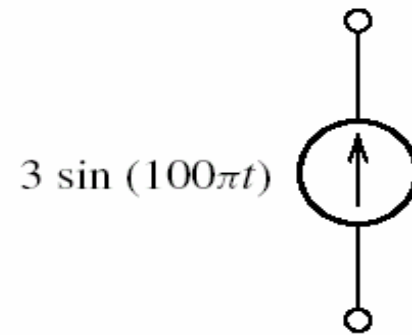
Independent Current Sources

- Forces a specific current to flow through itself independent of the elements connected to it and of the voltage across it

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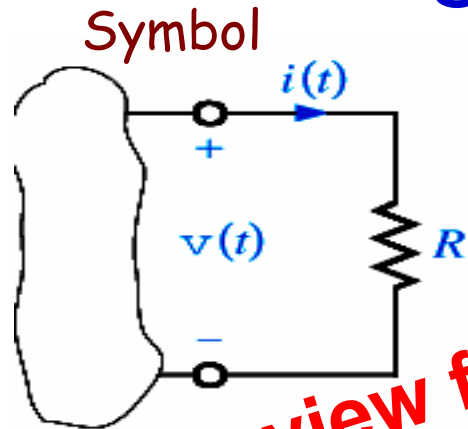


(a) Dc current source

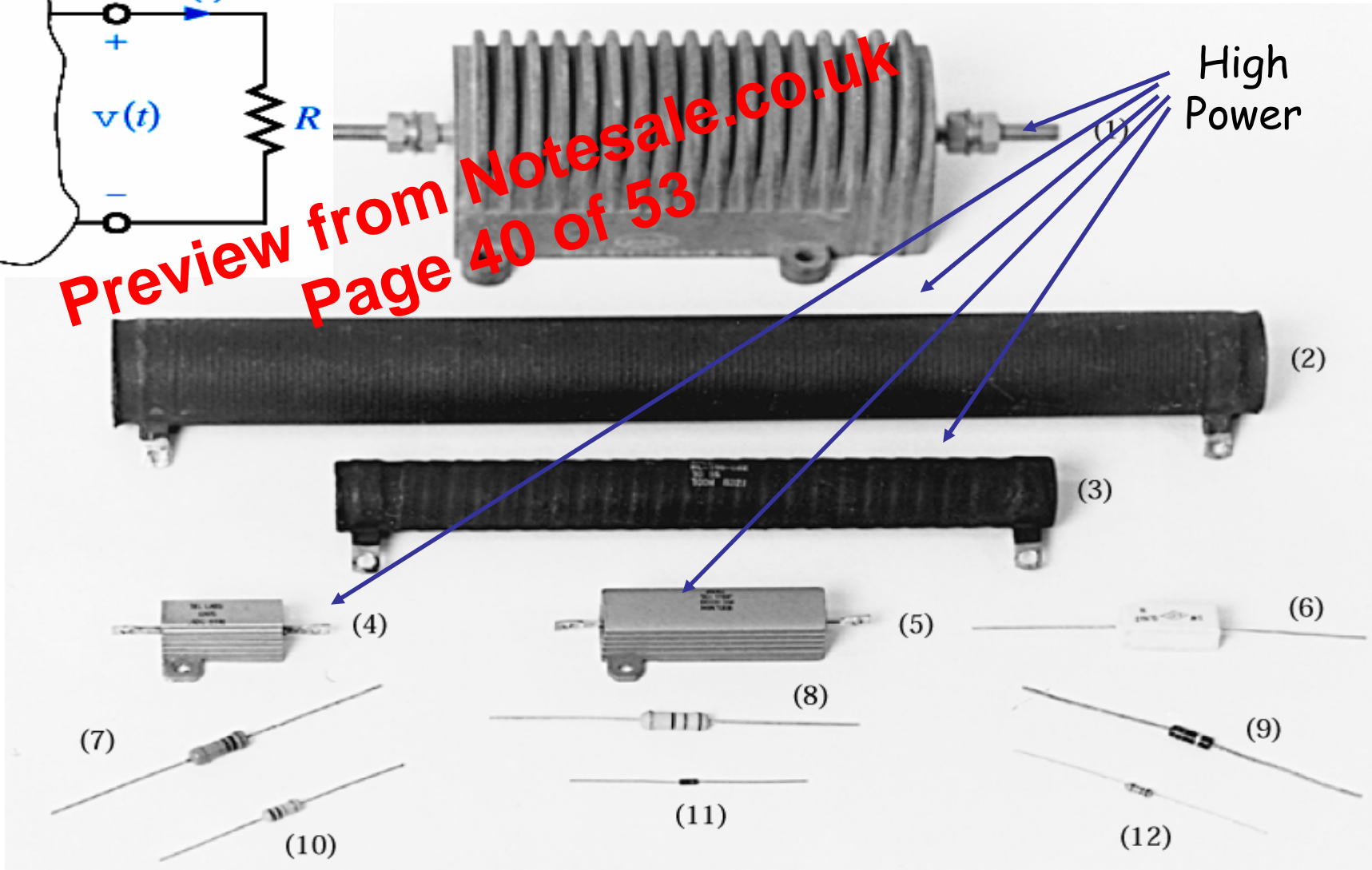


(b) Ac current source

Some Practical Resistors



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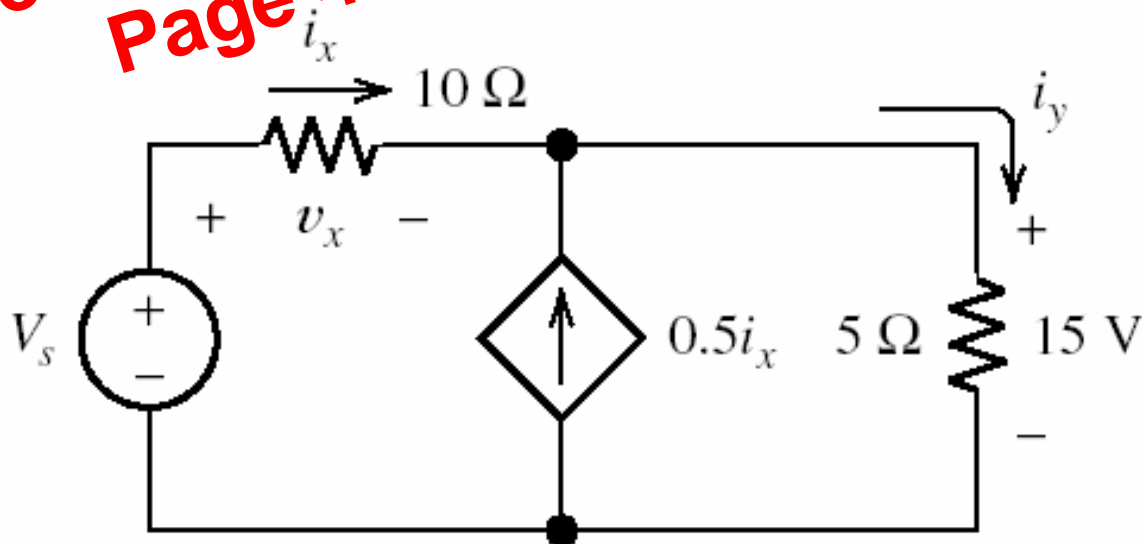


Using KVL, KCL, and Ohm's Law to Solve a Circuit Problem

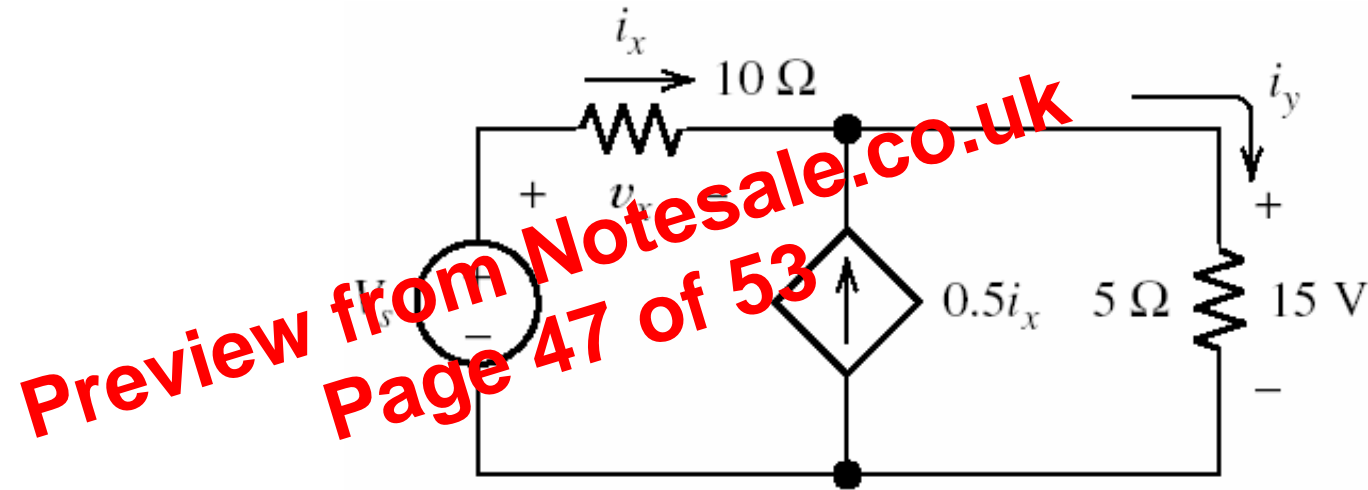
Example:

Find the source voltage in the following circuit

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Example (cont.)



$$i_y = \frac{15 \text{ V}}{5 \Omega} = 3 \text{ A}$$

$$i_x + 0.5i_x = i_y$$

$$i_x = 2 \text{ A}$$

$$v_x = 10i_x = 20 \text{ V}$$

$$V_s = v_x + 15$$

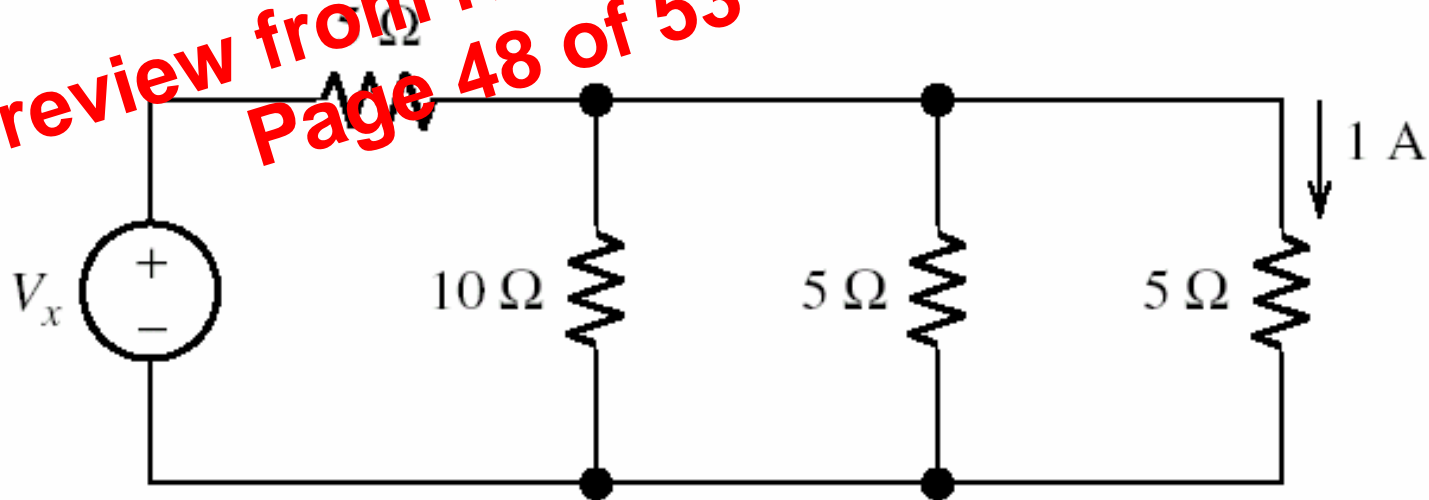
$$V_s = 35 \text{ V}$$



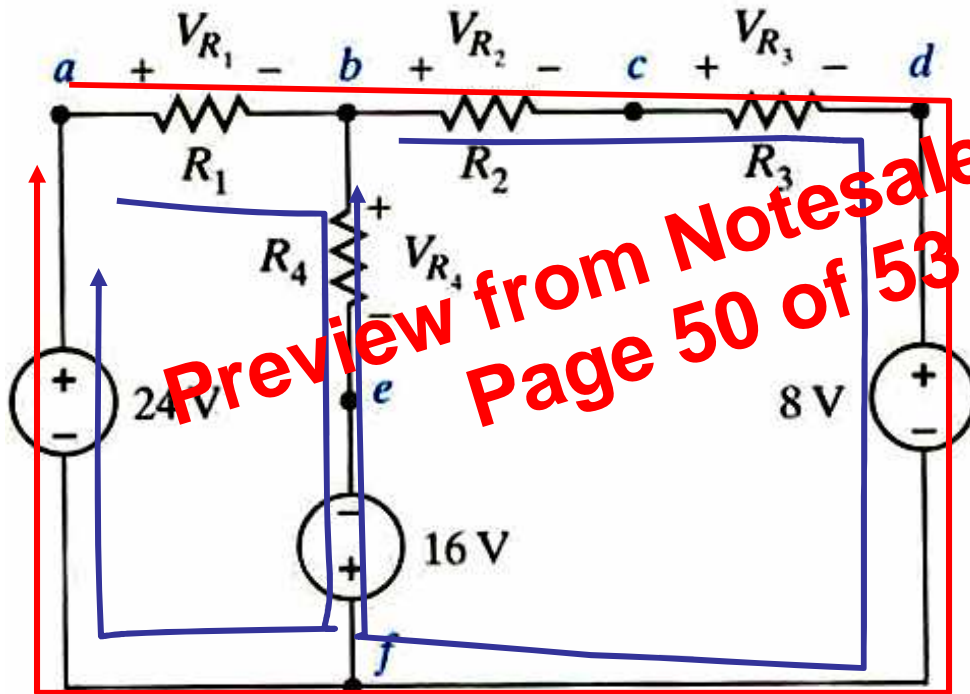
Another Example

Find V_x

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How Many KCL or KVL Equations are Needed?



In the circuit define

N Number of nodes
 B Number of branches

$N-1$ Linearly Independent KCL Equations
 $B-(N-1)$ Linearly Independent KVL Equations

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$$V_{R_1} + V_{R_4} - 16 - 24 = 0$$

$$V_{R_2} + V_{R_3} + 8 + 16 - V_{R_4} = 0$$

$$V_{R_1} + V_{R_2} + V_{R_3} + 8 - 24 = 0$$

EXAMPLE:

For the circuit shown we have $N = 6$, $B = 7$. Hence there are only two independent kvl equations

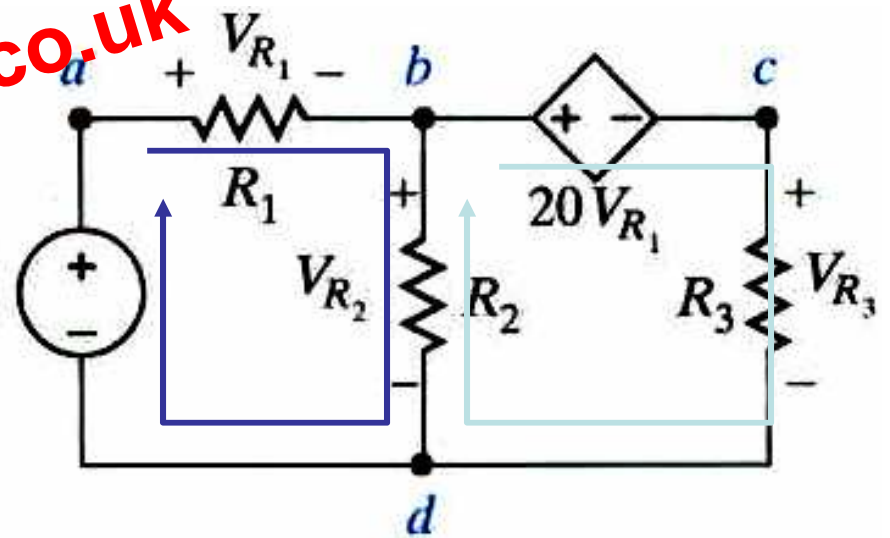
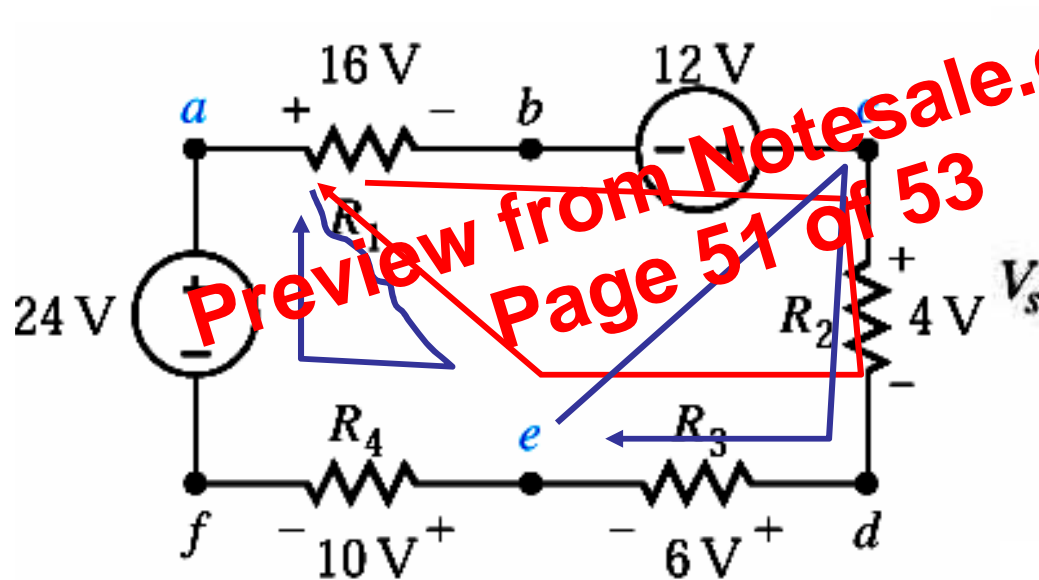
The third equation is the sum of the other two!!



Another Example

Find the voltages V_{ae} & V_{ec}

Dependent sources are handled with the same ease



$$V_{ae} + 10 - 24 = 0$$

$$16 - 12 + 4 + 6 - V_{ae} = 0$$

Given the choice use the simplest loop

$$4 + 6 + V_{ec} = 0$$

$$V_{R_1} + V_{R_2} - V_S = 0$$

$$20V_{R_1} + V_{R_3} - V_{R_2} = 0$$