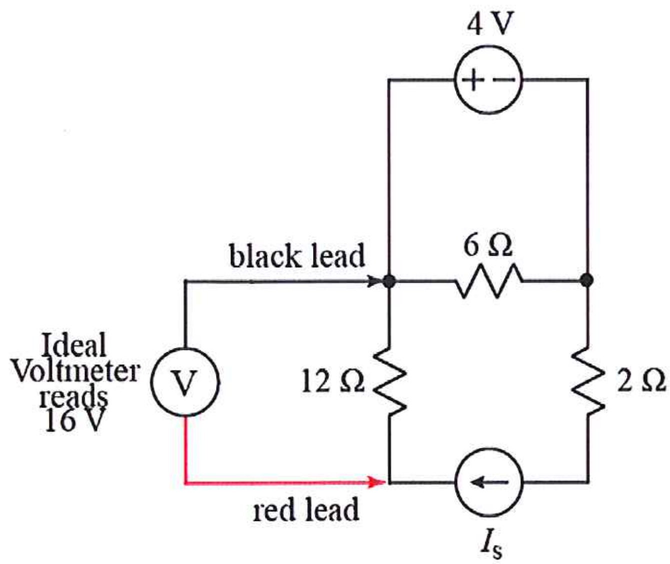
EXAM #1 prob 1 solution

Ex:



a) Find the numerical value of I_s.

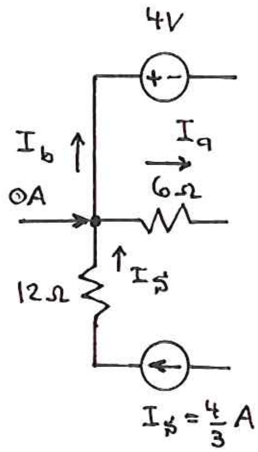
b) Find current flowing into the + input of the 4 V source.

soln: a) An ideal voltmeter draws no current, so I_s must flow thru the 12 Ω resistor (and thru the 2 Ω resistor, of course).

We can solve for I_s by using Ohm's law for the 12 Ω resistor. Note that the red lead is the + side of the voltage measurement, so we should measure the current in the 12 Ω resistor with an arrow pointing up. This is in the same direction as the arrow for I_s, so the sign of our I_s from Ohm's law will be correct.

$$I_s = \frac{16V}{12\Omega} = \frac{4}{3} A \approx 1.333 A$$

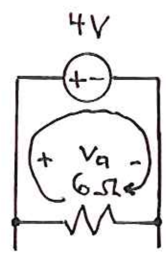
b) We use a current summation to find the current flowing into the + input of the 4V source.



The voltmeter draws no current, and we have $I_s = \frac{4}{3}$ A flowing into the node thru the 12Ω resistor. We have the following current summation eq'n with unknown I_a and I_b.

$$I_s = I_a + I_b \quad \text{(what flows in must flow out)}$$

To find I_a, we use a voltage loop on the top half of the circuit.



Using a clockwise loop, and using the sign where we exit a component as the sign of the term in the sum, we have the following:

$$-4V + V_a = 0V$$

So $V_a = 4V$. Now we use Ohm's law to find I_a.

$$I_a = \frac{4V}{6\Omega} = \frac{2}{3} A \approx 0.667 A$$

Combining results, we have enough information to determine I_b.

$$I_s = I_a + I_b$$

or

$$\frac{4}{3} A = \frac{2}{3} A + I_b$$

or

$$I_b = \frac{2}{3} A \approx 0.667 A$$