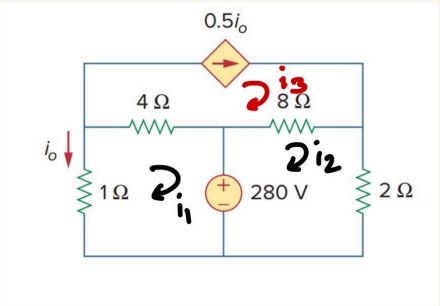
Common Mistakes in CSE250

■ Mistake 1: *Including Current Source in KVL equation in Mesh Analysis*



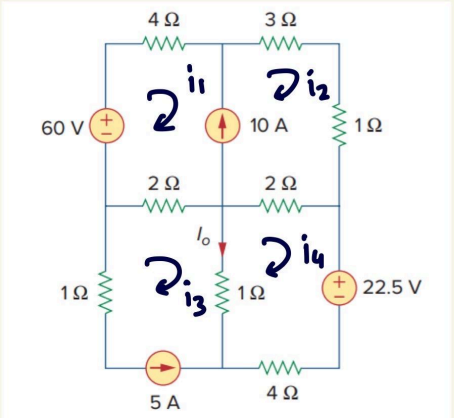
* Sometimes we include current sources in mesh equations. (which is wrong !!!)

Example for mesh 3

wrong approach ✗ $0.5i_o + 8(i_3 - i_2) + 4(i_3 - i_1) = 0$

correct approach ✓ $i_3 = 0.5i_o$ (where $i_o = -i_1$)

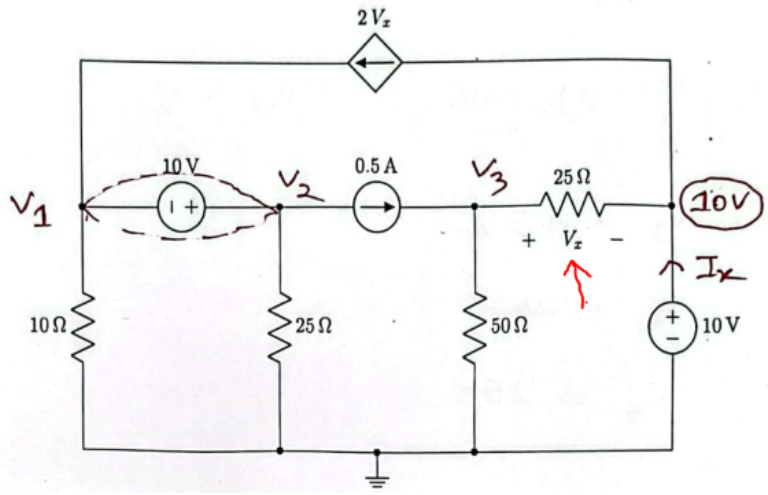
Tips: After identifying the mesh currents, determine the mesh currents which are known.



Example:

* In this circuit, $i_3 = -5A$. So we do not need to write mesh / KVL equation for this particular loop.
* This is applicable for super meshes too

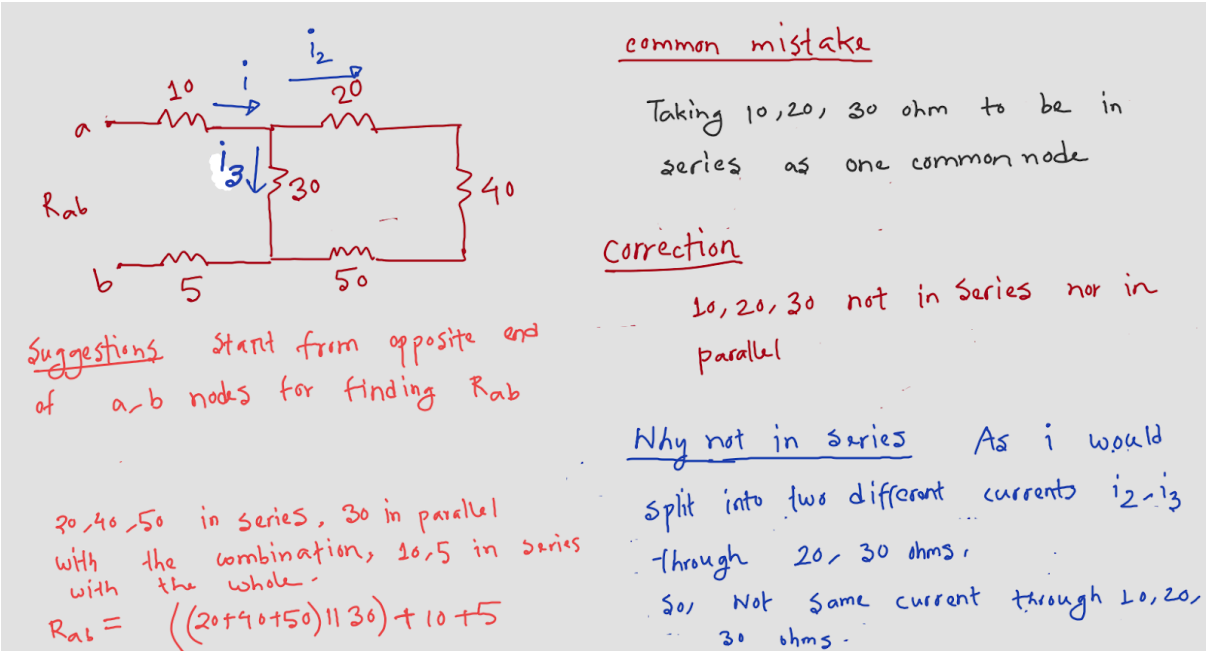
■ Mistake 2: *"Voltage Diff = Current" in KVL at Supernode:* $V_a - V_b = V_x/R$

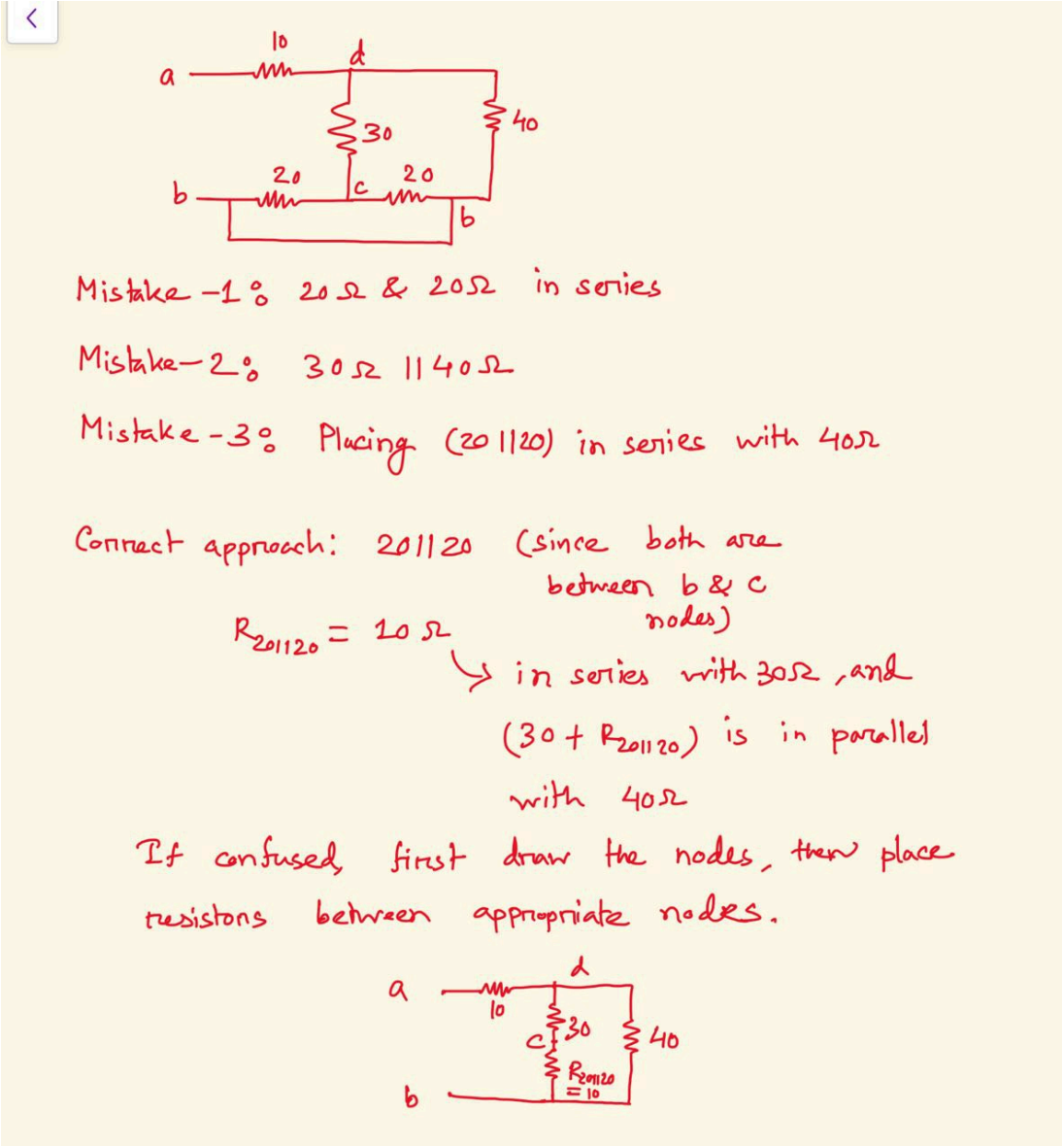


✗ $V_x = \dfrac{V_3 - 10}{25}$

✓ $V_x = V_3 - 10$

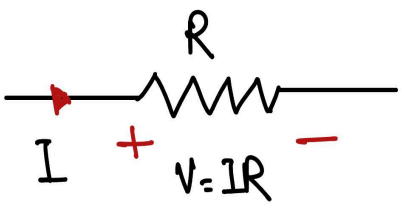
■ Mistake 3: *Messing Up Series-Parallel Resistors*



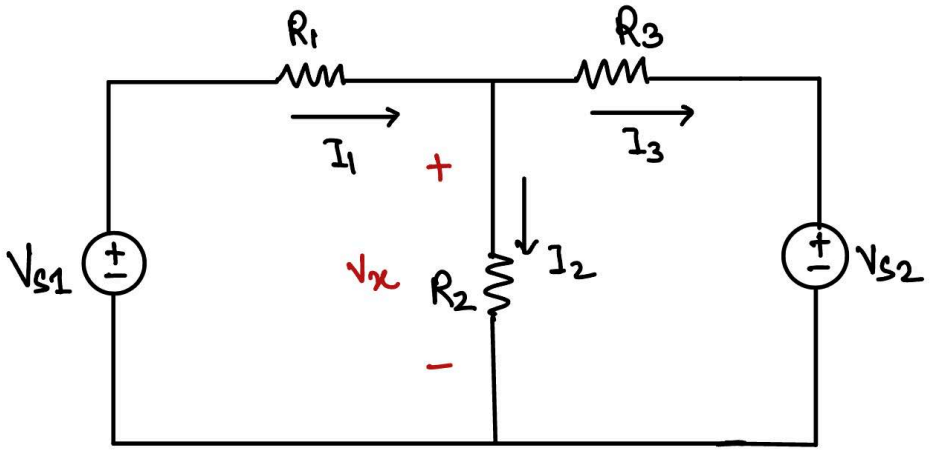


■ **Mistake 4:** *Mistaking polarity of voltage in Ohm's law*

The + sign of the voltage is always located at the terminal through which current enters through a resistor. Not to mention, Ohm's law is only applicable **to resistors only,** not current or voltage sources.



■ Mistake 5: *Applying voltage division to find voltage across resistors not connected in series*

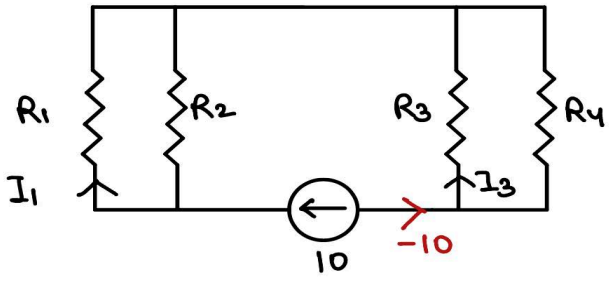


$$V_x \neq \frac{R_2}{R_1+R_2} \times V_{s1}$$

R_1, R_2, and R_3 share a common node but they are not connected in series as $I_1 \neq I_2 \neq I_3$. The voltage division rule can only be applied for resistors in series.

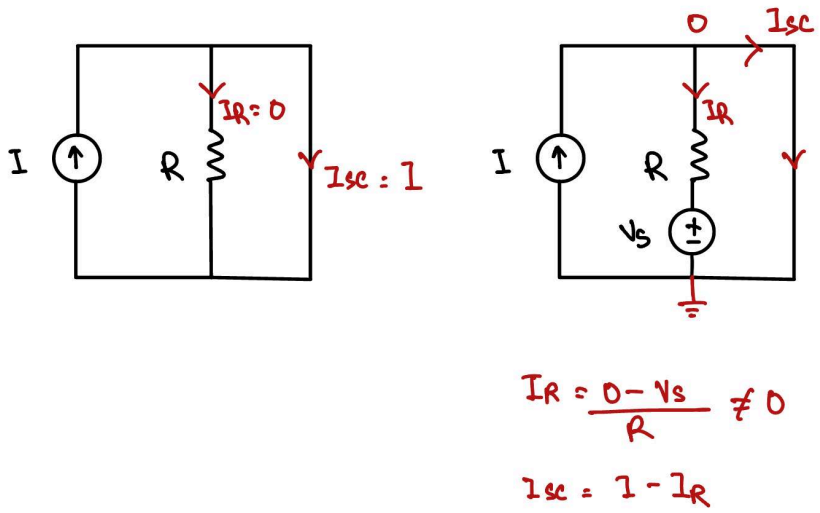
■ Mistake 6: *Applying current division using the wrong direction of total current.*

If the current found using the current division rule is exiting a particular node, then the total current used in the equation is the current entering that node.



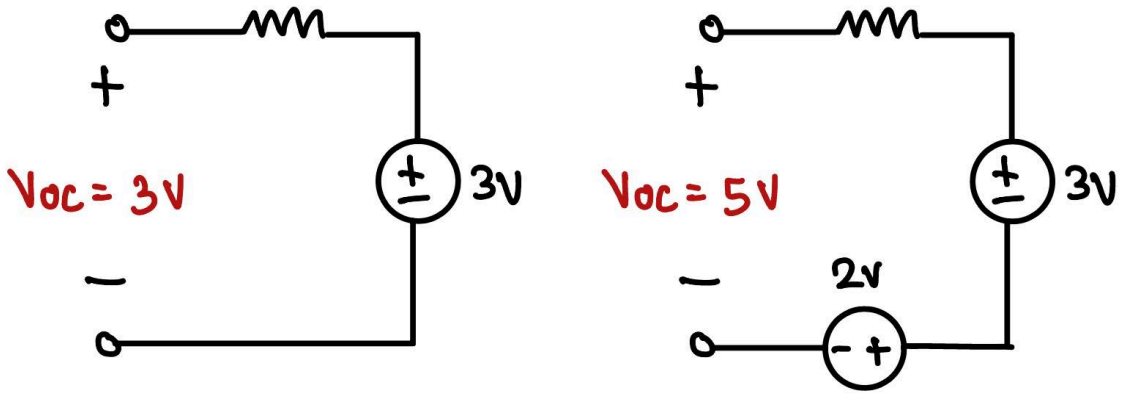
$$I_1 = \frac{R_1 \parallel R_2}{R_1} \times 10 \qquad I_3 = \frac{R_3 \parallel R_4}{R_3} \times -10$$

■ Mistake 7: *Shorting sources!*



When a resistor is shorted, the current through it becomes 0 and since V=IR, the voltage across it also becomes 0. Therefore, we can disconnect the resistor from the circuit and still obtain the same result (in most cases). However, as demonstrated above, this isn't applicable when it is in series with a voltage or a current source.

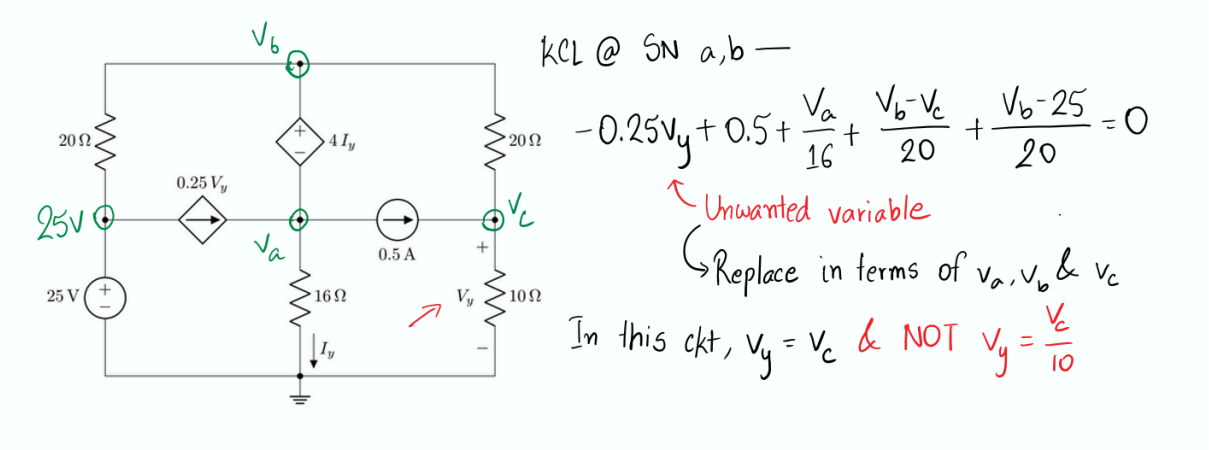
■ Mistake 8: *Finding open circuit voltage.*



Open circuit voltages are unaffected by any resistor connected in series with the open terminals. This is because the current flowing through this resistor is 0 as the loop is open and therefore the voltage drop across the resistor is also 0.

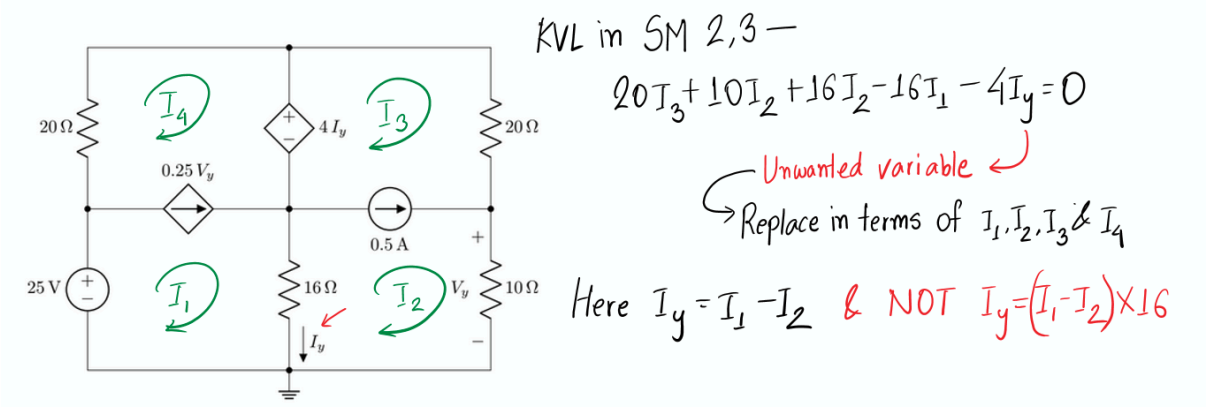
■ Mistake 9: *Replacing unwanted voltage variables in the form* $V_x = (V_a - V_b)/R$ *of nodal analysis.*

In nodal analysis, oftentimes, you have to replace unwanted voltage variables originating from dependent sources. However, when replacing such voltage variables in terms of nodal voltages, you may be tempted to write the replacement expression in the form $V_x = \frac{V_+ - V_-}{R}$, following the form of branch current. But do remember that you are replacing a voltage variable in terms of other voltage variables. No need to divide by R.

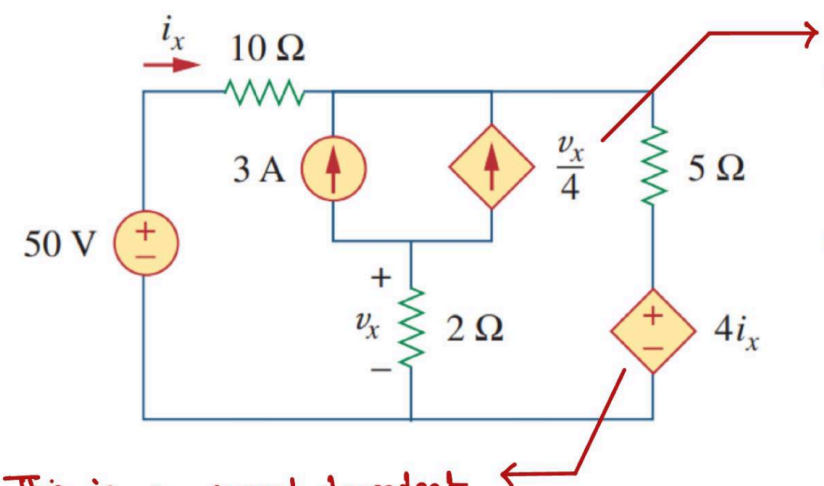


■ Mistake 10: *Replacing unwanted current variables in the form* $I_x = (I_1 - I_2) * R$ *for mesh analysis.*

Just like Mistake 11 in nodal analysis, a common mistake is to replace the current variable in mesh analysis in the form $I_x = (I_1 - I_2) * R$. Remember that you are replacing a current variable with other current variables. No need to multiply with R.



■ Mistake 11: *Mixing up dependent voltage and dependent current sources.*



it is a voltage-dependent current source; NOT a voltage source with voltage $\frac{v_x}{4}$ or a current source with voltage $\frac{v_x}{4}$

v_x can be a voltage but $\frac{v_x}{4}$ is a current

i_x can be a current but $4i_x$ is a voltage

This is a current dependent voltage source; NOT a current source with current $4i_x$ or a voltage source with current $4i_x$

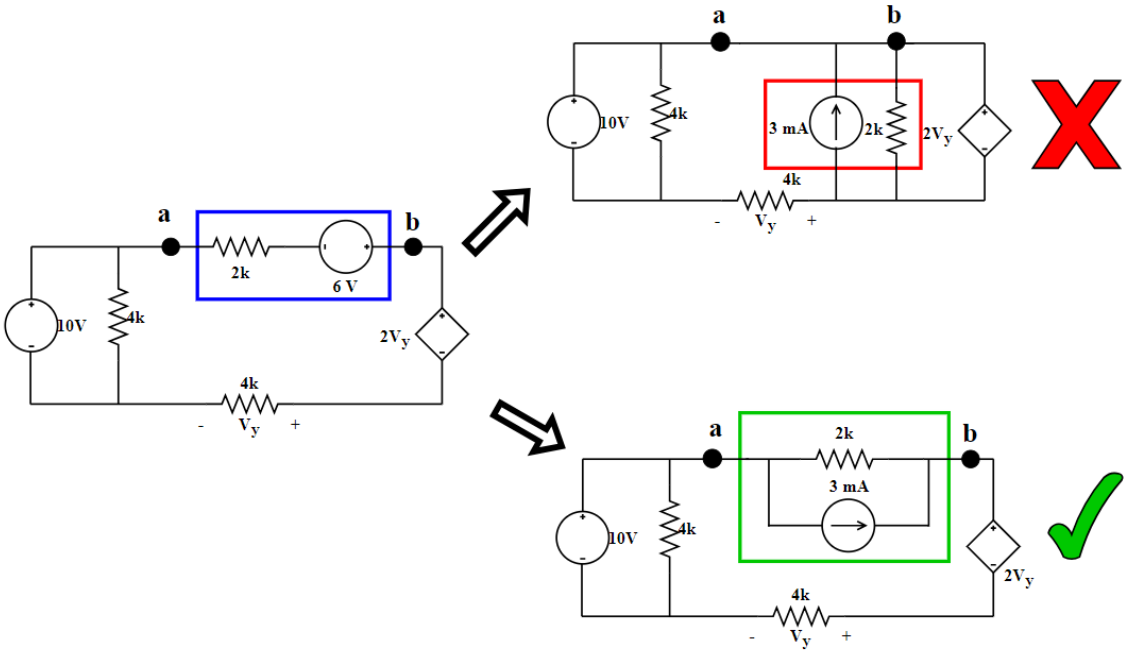
Although it is still beyond our knowledge how a current source's value can depend on a voltage and vice versa, it is possible.

- The values written beside a dependent voltage source (detected by the +- symbol) is always its voltage NOT its current. The current of a voltage source (dependent or independent) is never written directly beside it.
- The values written beside a dependent current source (detected by the ↑ symbol) is always its current NOT its voltage. The voltage of a current source (dependent or independent) is never written directly beside it.

■ Mistake 12: *Losing Nodes in Source Transformation*

One of the common mistakes that we make while doing source transformation is '***Losing Nodes in Source Transformation***'. For example, we want to apply source transformation between nodes a-b in the above circuit. We can apply source transformation between nodes a-b because there is a voltage source with a series resistor connected between node a and node b. We can transform this configuration into a current source parallel with the same resistor. However, we have to keep in mind that, the transformed configuration should be positioned between the same nodes (a and b). If you see the transformation that has been enclosed by the red box, in this case, we lose nodes (a and b) and because of the wrong connection, these two nodes become shorted.

A good practice is to label the node in between where you want to apply source transformation and then reconfigure the change in between the same nodes. For a better understanding, see the above circuit with its correct transformation of source along with the resistor.



■ Mistake 13: *Mislocating Indicated Voltage/Currents* (I_x, V_x, I_o, V_o, *etc.*) *After Source Transformation*

(Need illustration, explanation of the mistake, suggestions to avoid, and the correct way)