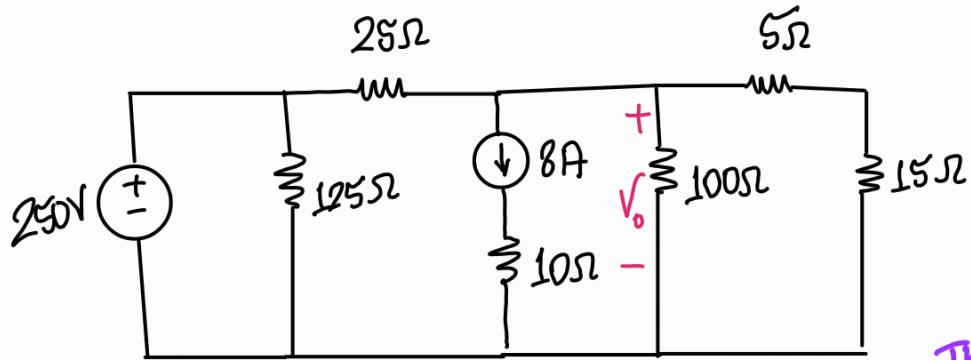
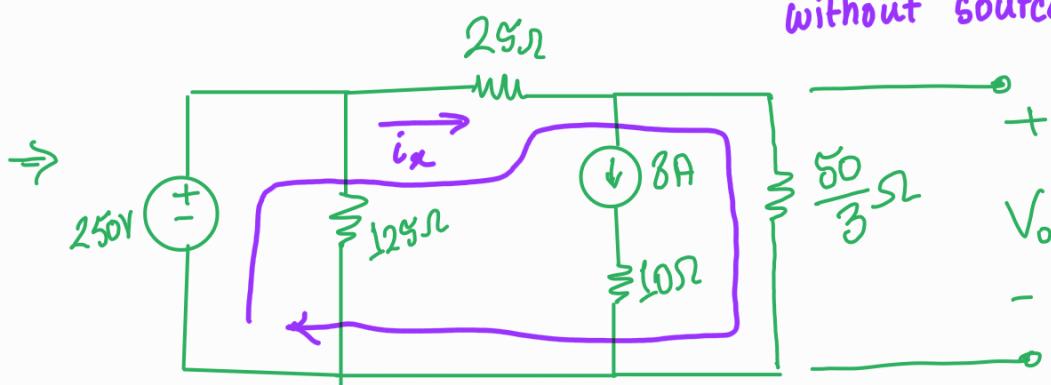


# Problem 1



Find  $V_o$  and the power of the voltage source & the current source.

This problem is best solved without source transform



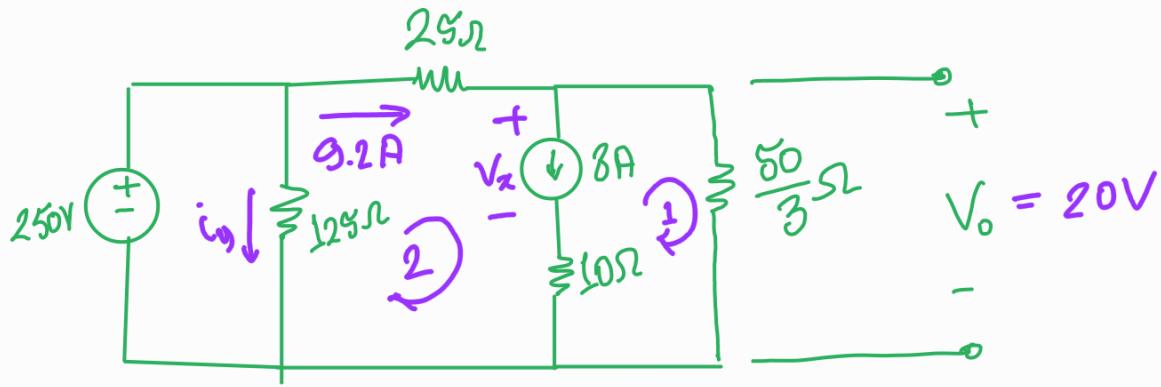
$$KVL \rightarrow -250 + 25i_x + \frac{50}{3}(i_x - 8) = 0$$

$$\Rightarrow 75i_x + 50i_x - 400 = 750$$

$$\Rightarrow 125i_x = 1150$$

$$\Rightarrow i_x = 9.2 \text{ A}$$

$$\therefore V_o = \frac{50}{3} \times (i_x - 8) = \frac{5 \times 12}{3} = 20 \text{ V}$$



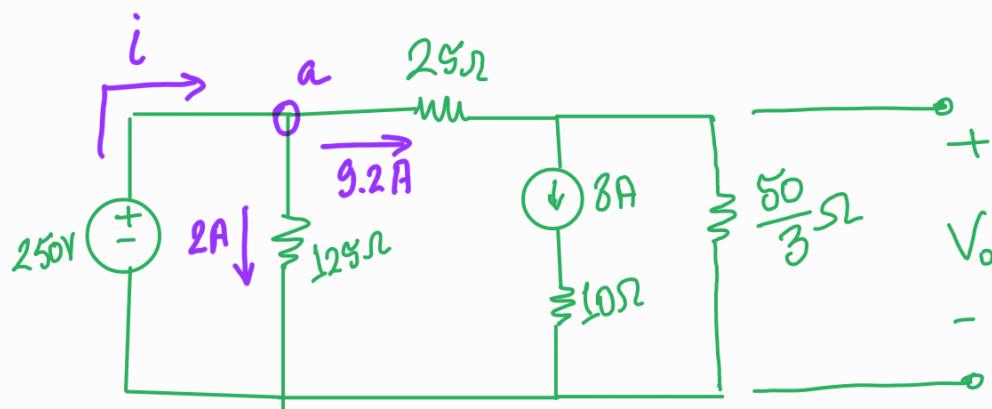
$$\text{KVL @ } 1 \rightarrow -V_x + 20 - 80 = 0$$

$$\Rightarrow V_x = -60V$$

$$\therefore P_{8A} = +V_x I = (-60) \times 8 = -480W \quad [\text{Mistake in slide}]$$

$$\text{KVL @ } 2 - -125i_y + 9.2 \times 25 + 20 = 0$$

$$\Rightarrow i_y = 2A$$

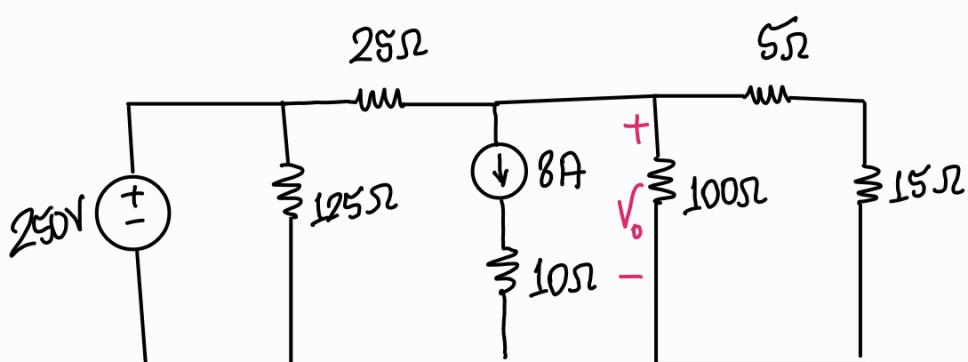


$$\text{KCL @ } a - i = 2 + 9.2 = 11.2A$$

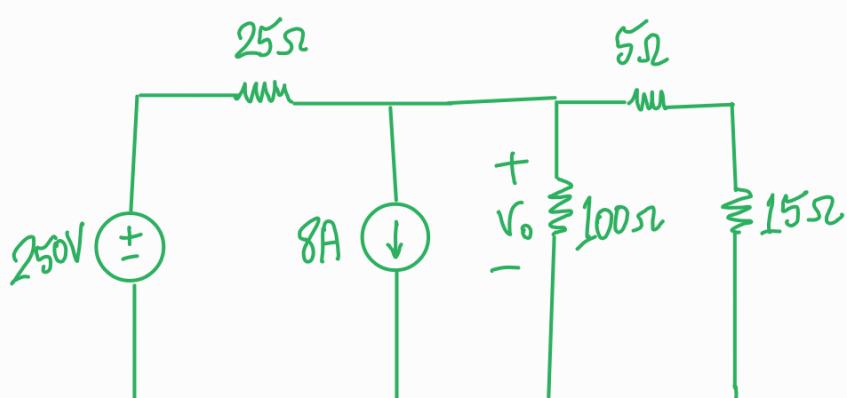
$$\therefore P_{250V} = -250 \times 11.2 W = -2.8 \text{ KW}$$

But what if you want to solve it using source transformation?

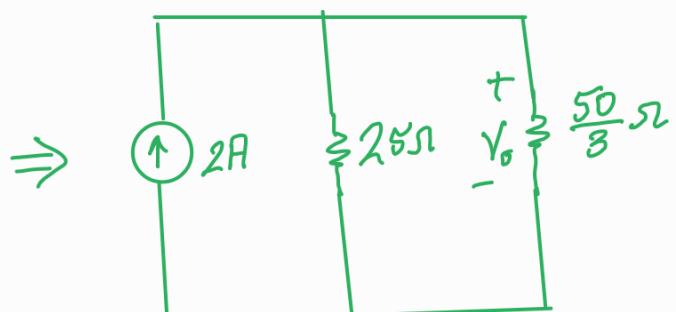
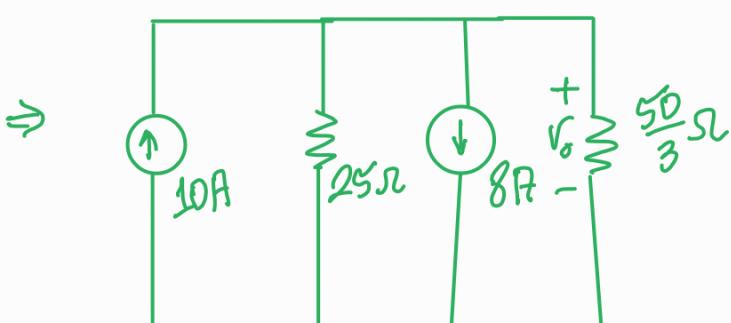
You can follow the slide based simplification. But note that you can only find  $V_o$  using the simplification. If you try finding the power in the truncated ckt, the power values will not match.



(truncation is a type of lossy compression)



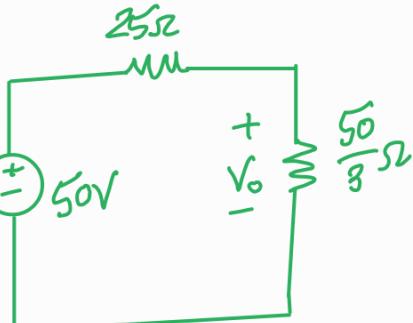
truncating following the slide's principle



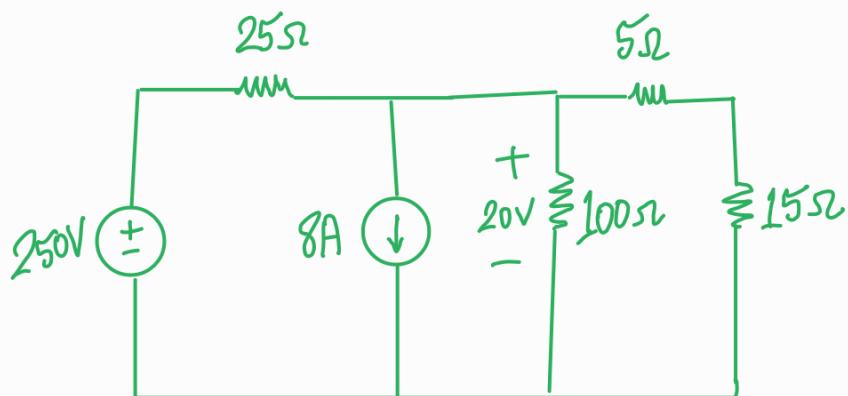
$$V_o = \frac{\frac{50}{3}}{25 + \frac{50}{3}} \times 50 \quad \checkmark$$

$$= \frac{50 \times 50}{125} \quad \checkmark$$

= 20V ← same as KVL-KCL method



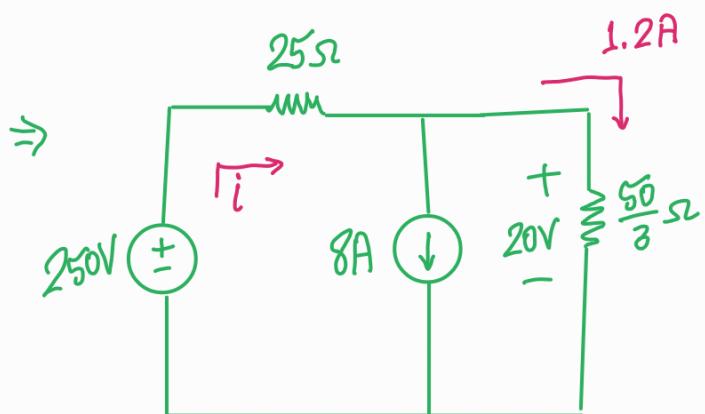
but now if you take the truncated ckt and try finding the power of the sources —



$$P_{8A} (\text{truncated}) = +20 \times 8 \text{ W}$$

$$= 160 \text{ W}$$

→ doesn't match



$$\Rightarrow i = 9.2 \text{ A}$$

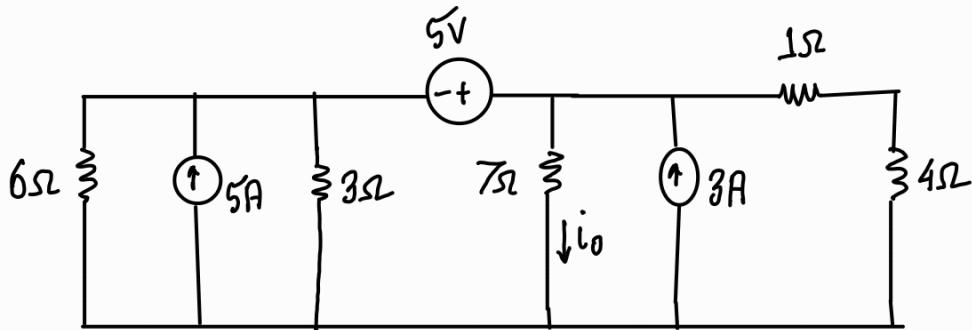
$$\therefore P_{250V} (\text{truncated}) = -250 \times 9.2 \text{ W}$$

$$= -2.3 \text{ kW}$$

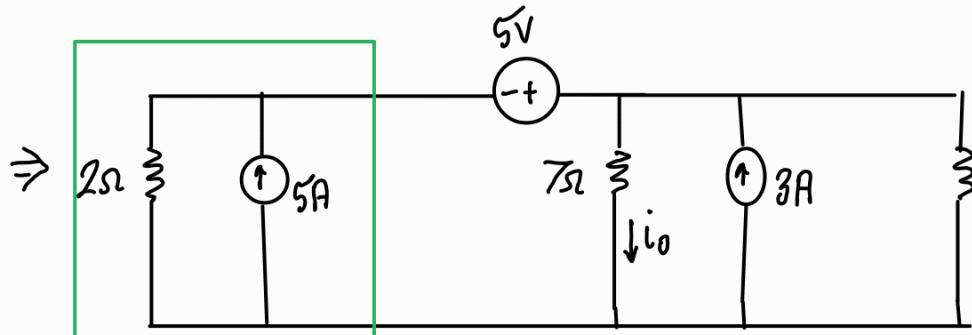
→ doesn't match

Takeaway — the chances of such a question coming in the exams is very low. Even if such a question comes you probably won't be forced to apply source transformation.

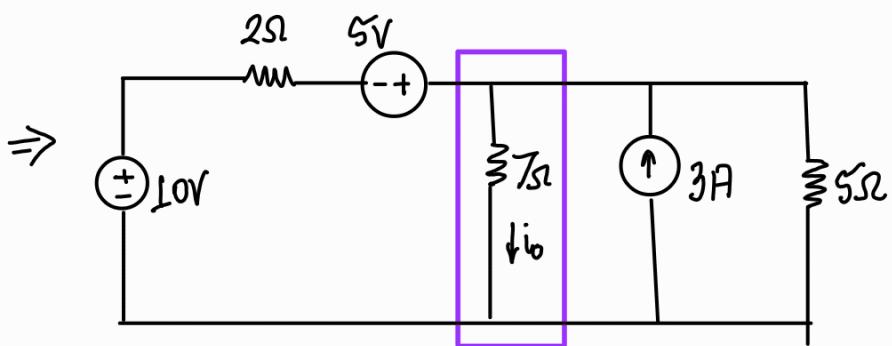
## Problem 2



Find  $i_o$  using source transformation.



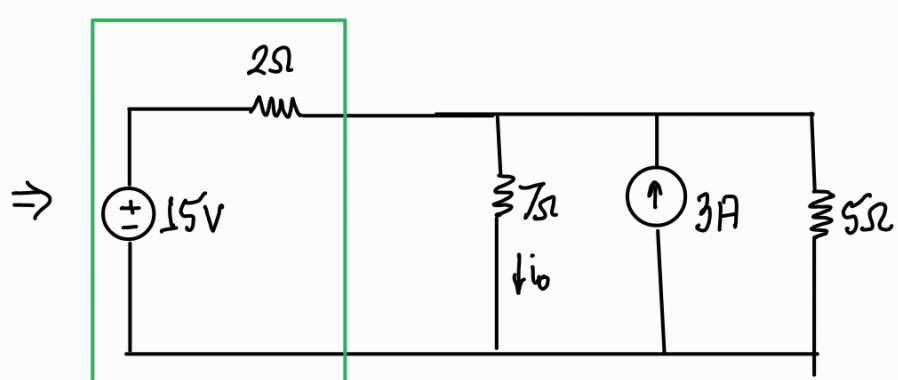
The goal of src transform is to bring the ckt in a form where you can combine resistors and sources.



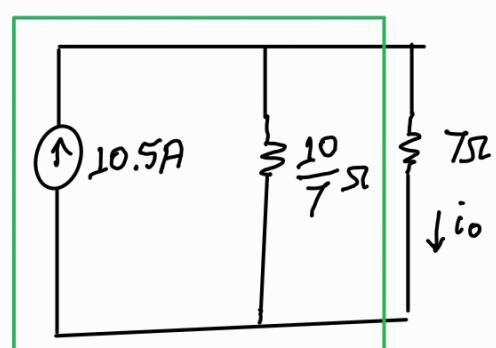
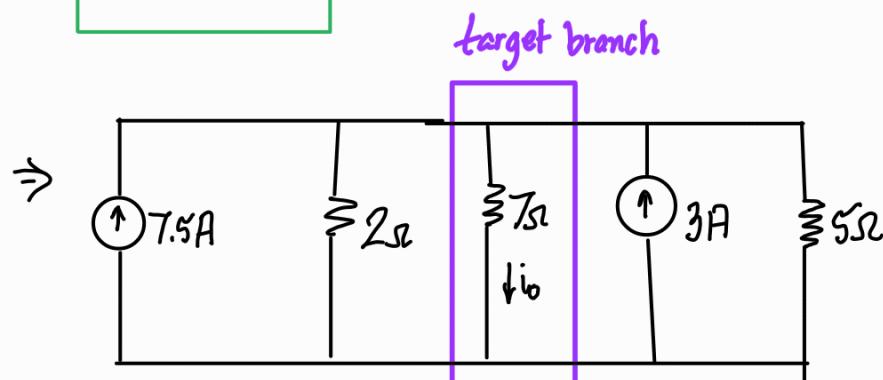
So just follow these steps —

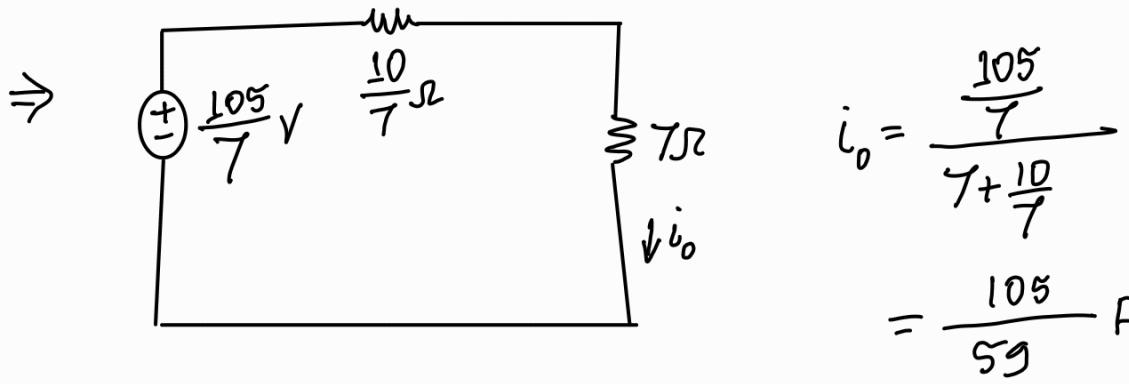
- ① simplify if possible
- ② else apply src transform & try again

DO NOT COMBINE TARGET BRANCHES

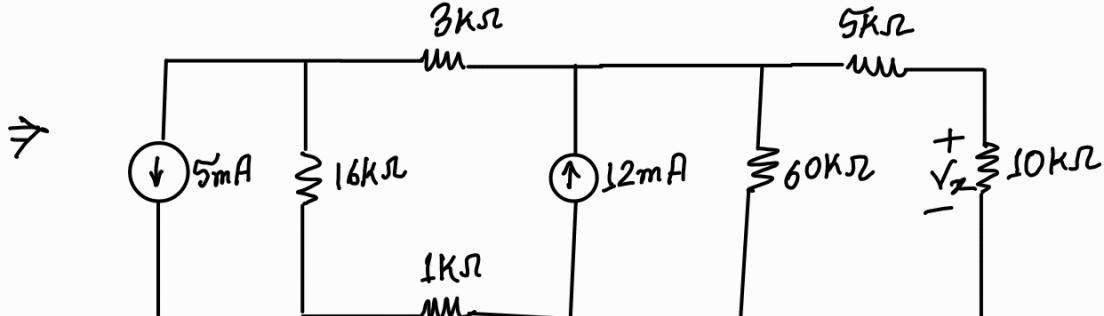
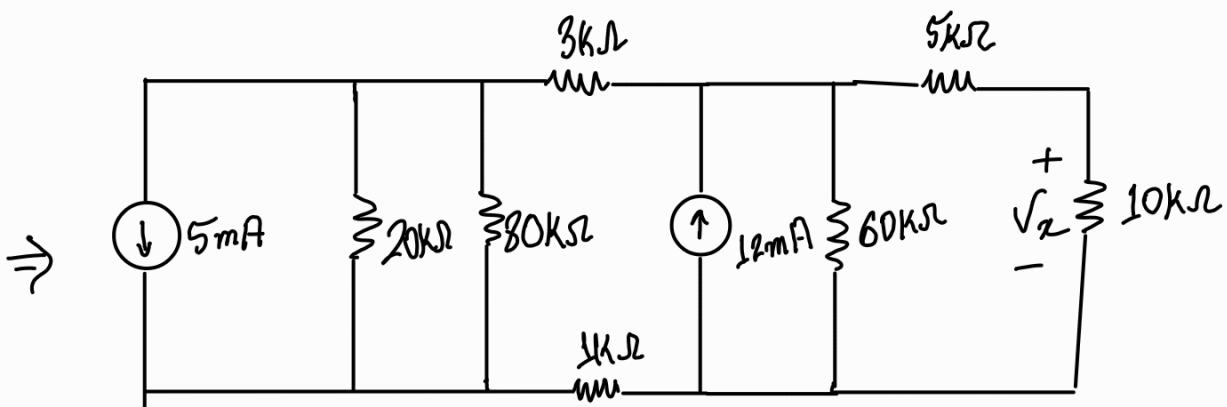
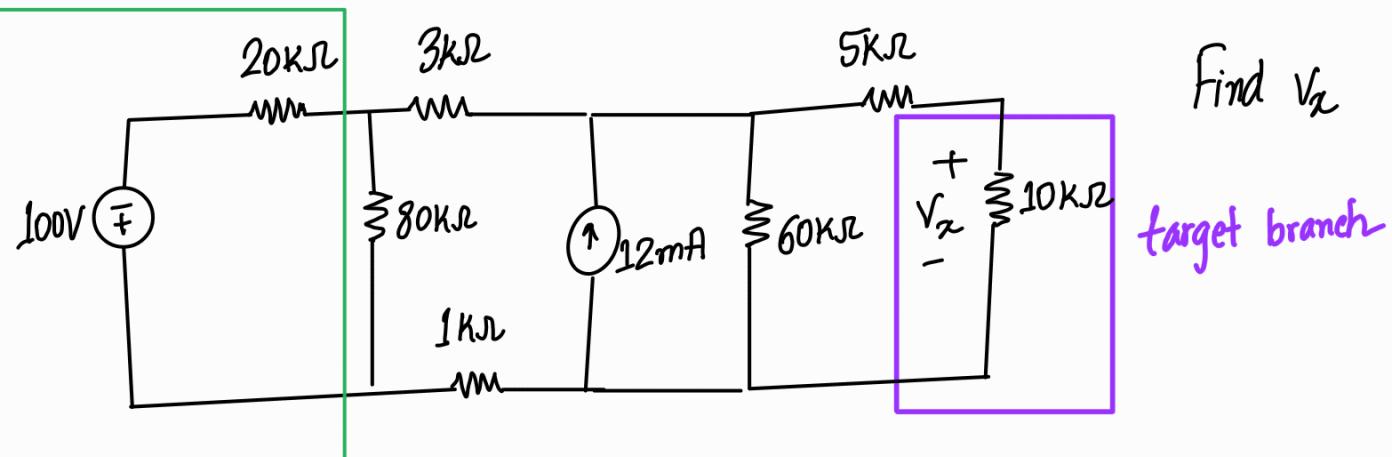


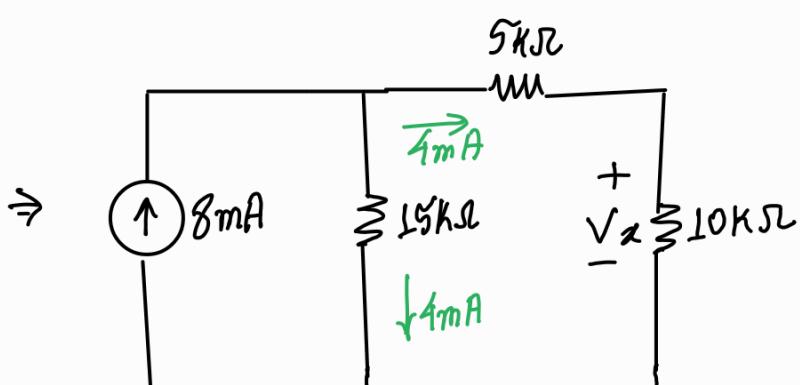
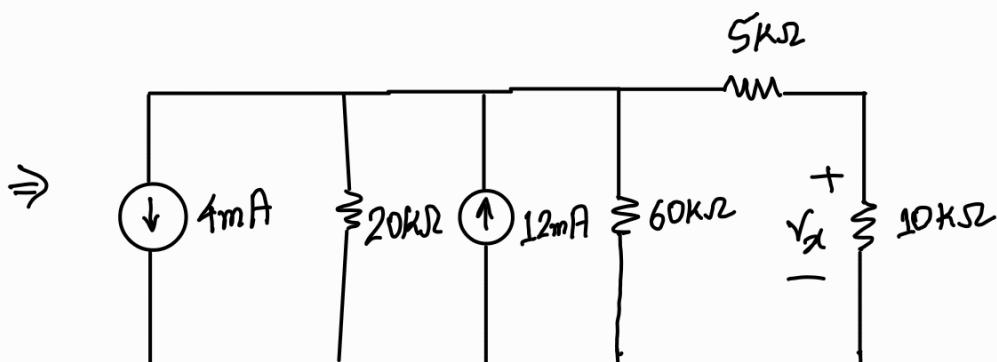
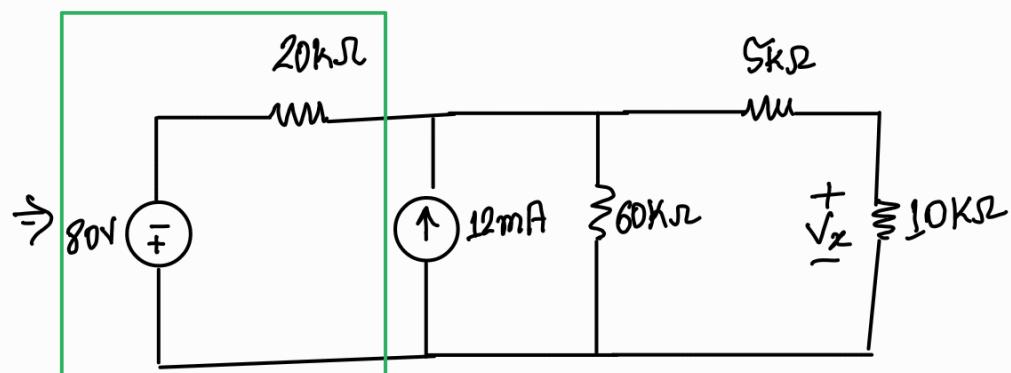
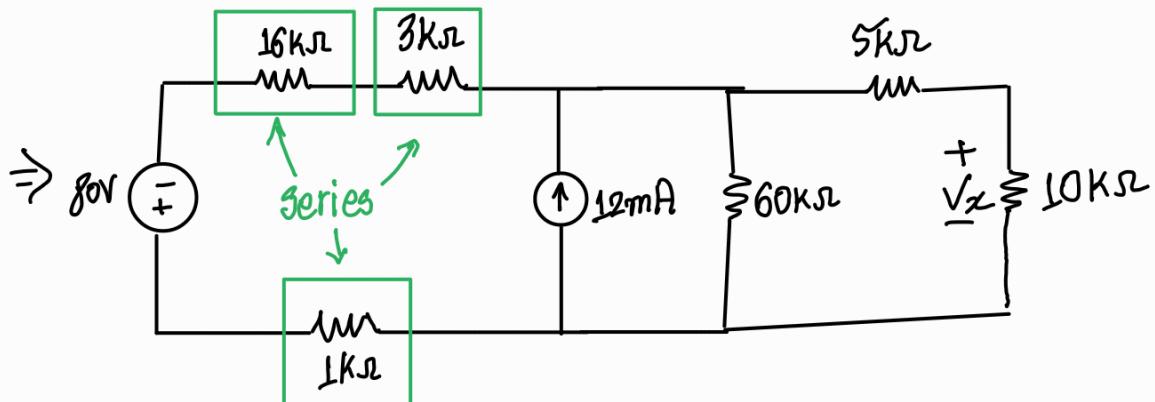
- ③ Continue till there is a single loop left





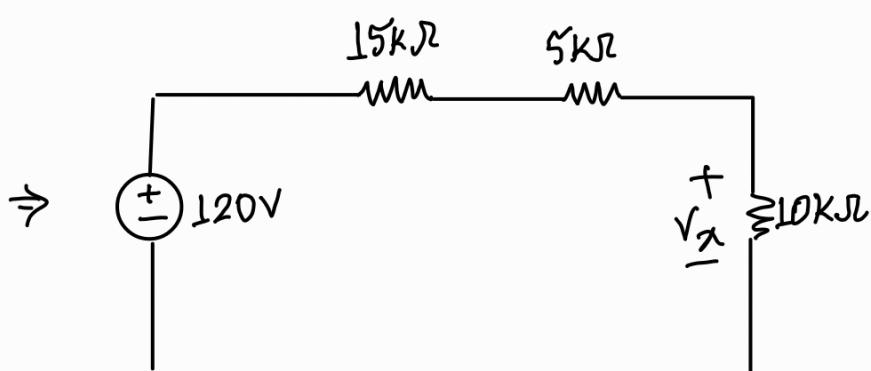
### Problem 3





if the question doesn't ask you to bring the circuit to a single loop, you can just apply current divider here.

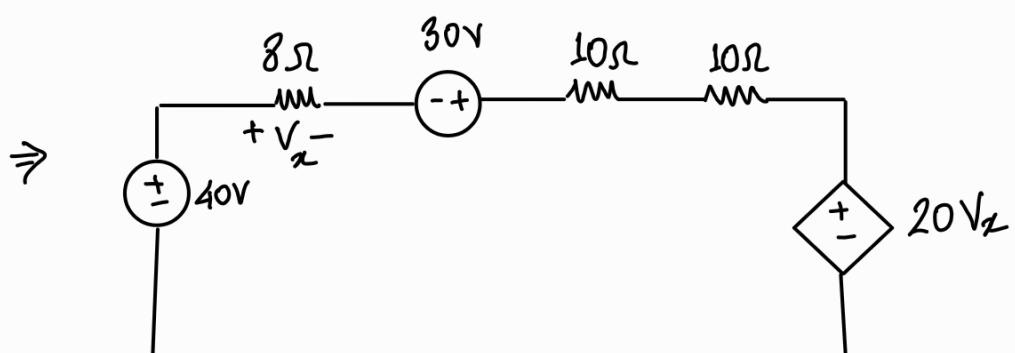
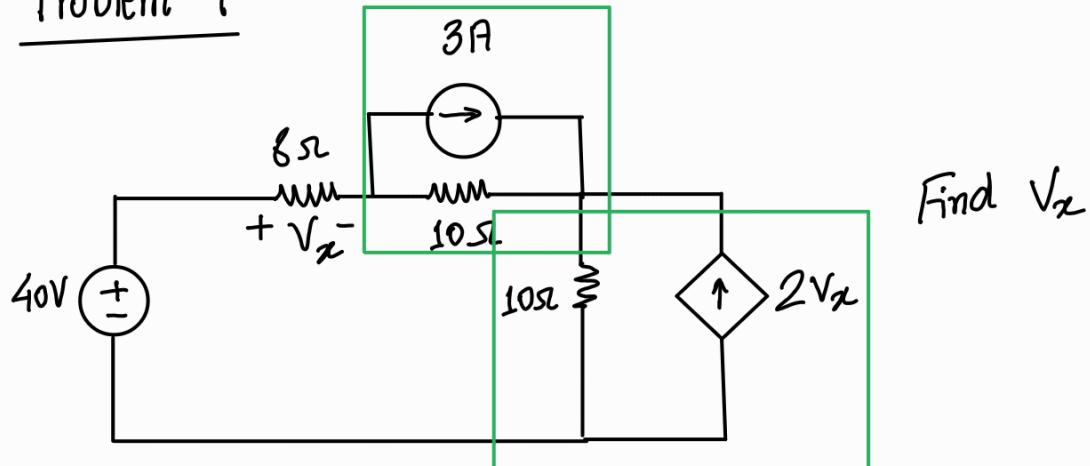
$$\therefore V_x = 4 \times 10 \text{ V} = 40 \text{ V}$$



But if the question asks you to bring the ckt to a single loop, this is the form you want.

$$V_x = \frac{10}{30} \times 120 \text{ V} = 40 \text{ V}$$

### Problem 4



$$\Rightarrow \begin{array}{c} 8\Omega \\ +V_x - \\ 70V \end{array} \xrightarrow{i} \begin{array}{c} 20\Omega \\ + \\ 20V_x \end{array}$$

$$i = \frac{70 - 20V_x}{8 + 20}$$

$$\text{but } i = \frac{V_x}{8}$$

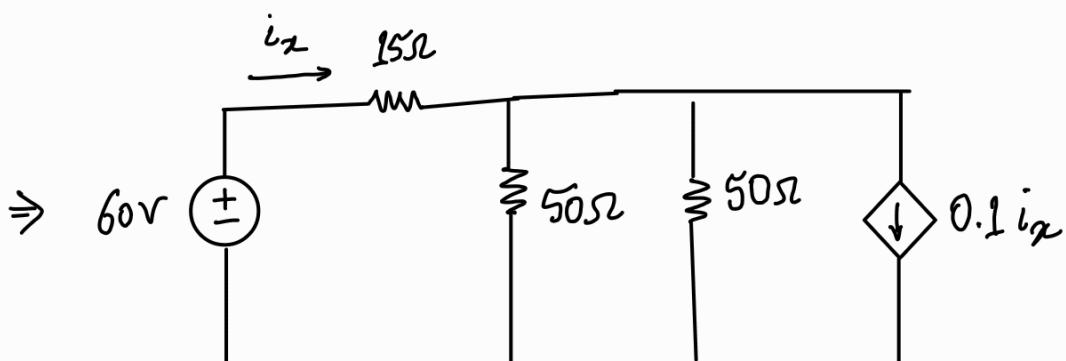
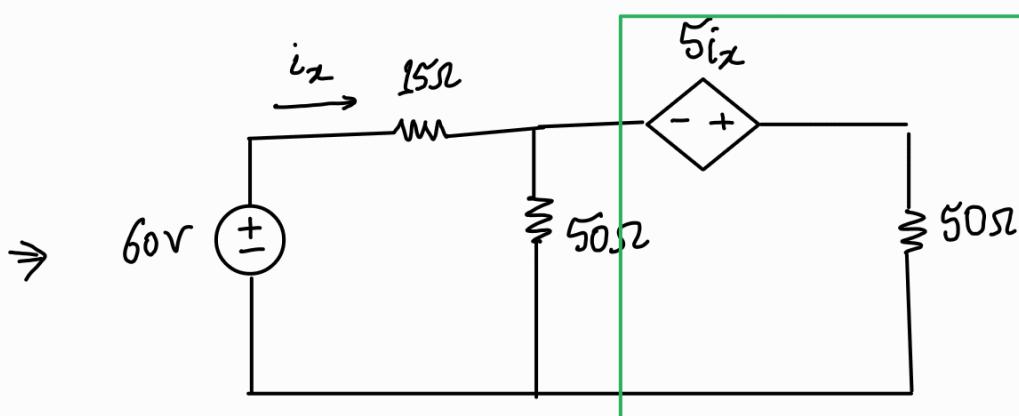
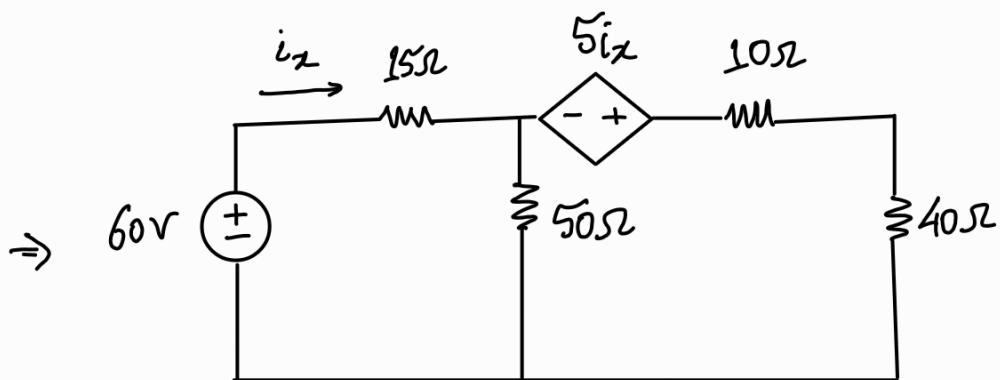
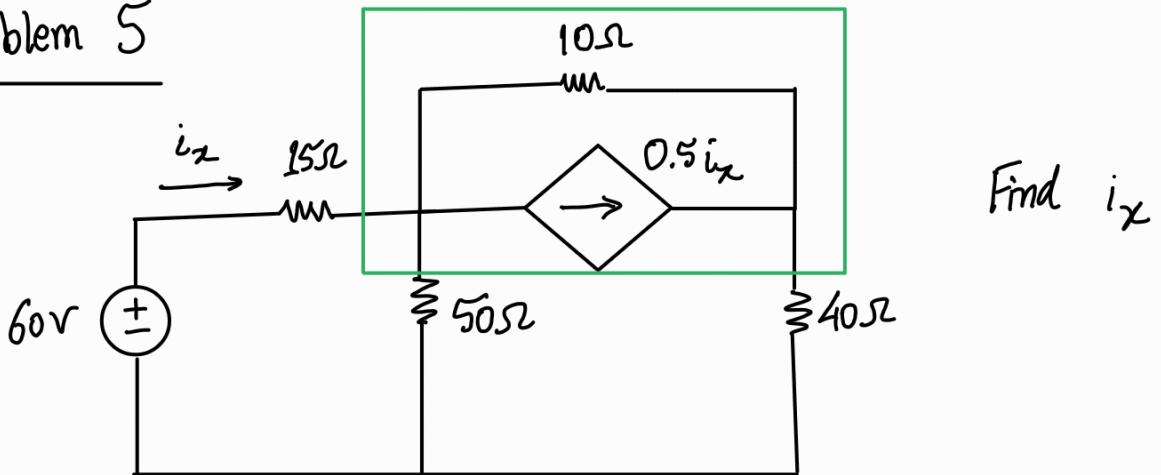
$$\therefore \frac{V_x}{8} = \frac{70 - 20V_x}{28}$$

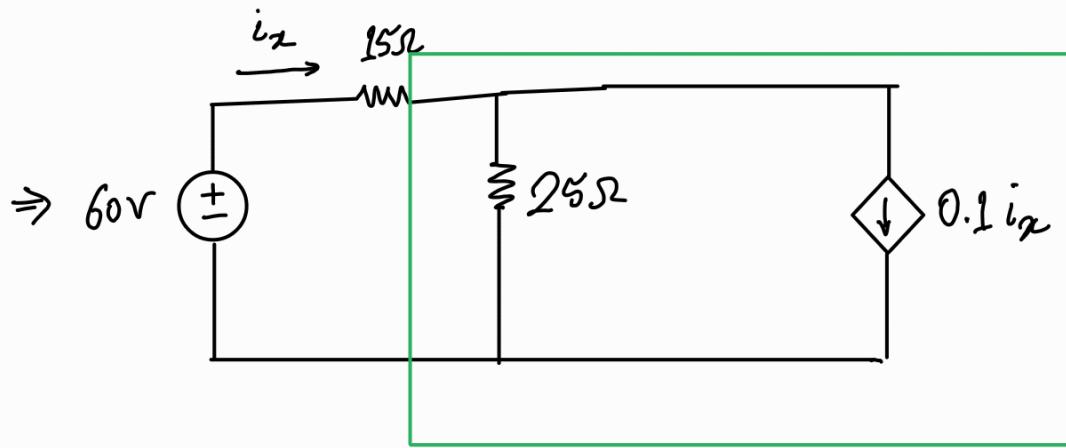
$$\Rightarrow 28V_x = 560 - 160V_x$$

$$\Rightarrow 188V_x = 560$$

$$\Rightarrow V_x = 2.98V$$

Problem 5





$$\Rightarrow$$

Diagram of the simplified circuit:

- A 60V DC voltage source is connected in series with a 15Ω resistor.
- The output of this series combination is connected to a dependent voltage source  $2.5i_x$ .
- The current through the 15Ω resistor is labeled  $i_x$ .

$$i_x = \frac{60 + 2.5i_x}{40}$$

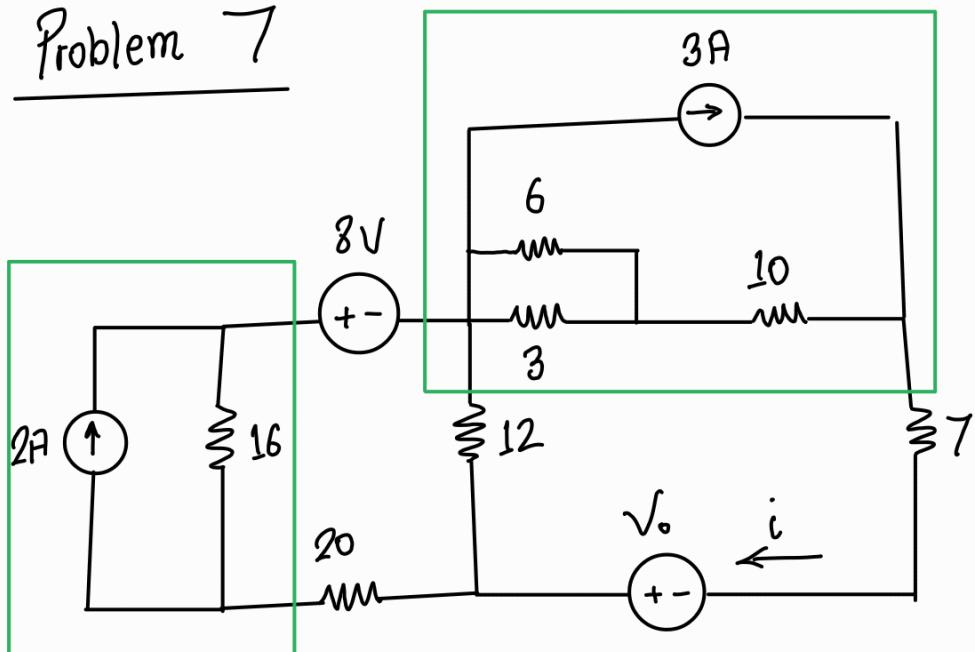
$$\Rightarrow 37.5i_x = 60$$

$$\Rightarrow i_x = 1.6A$$

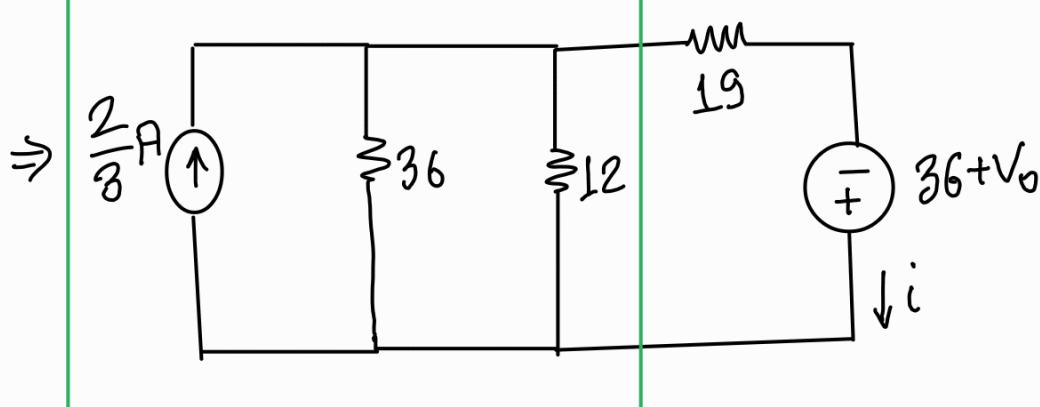
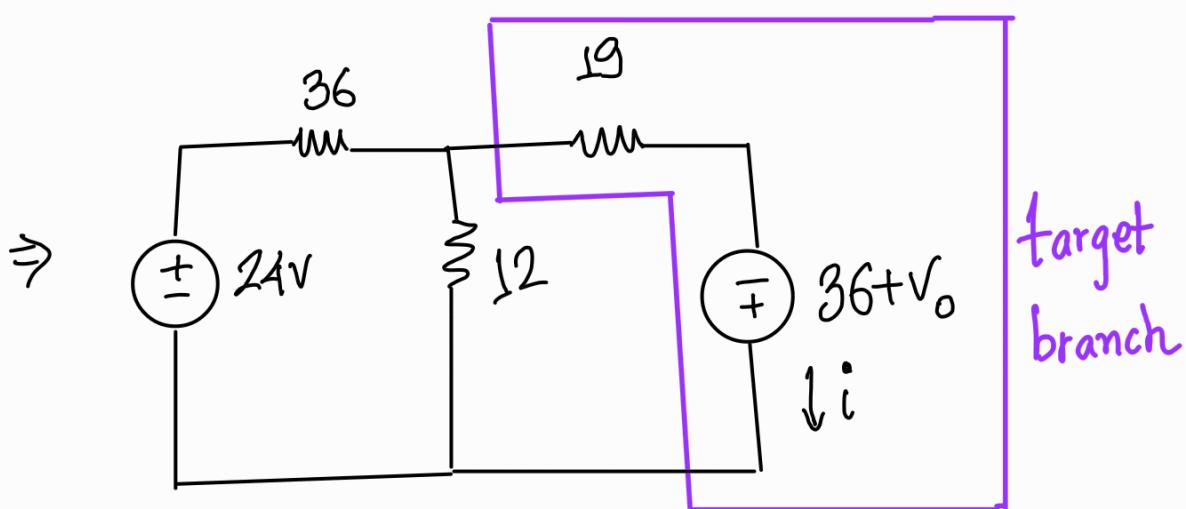
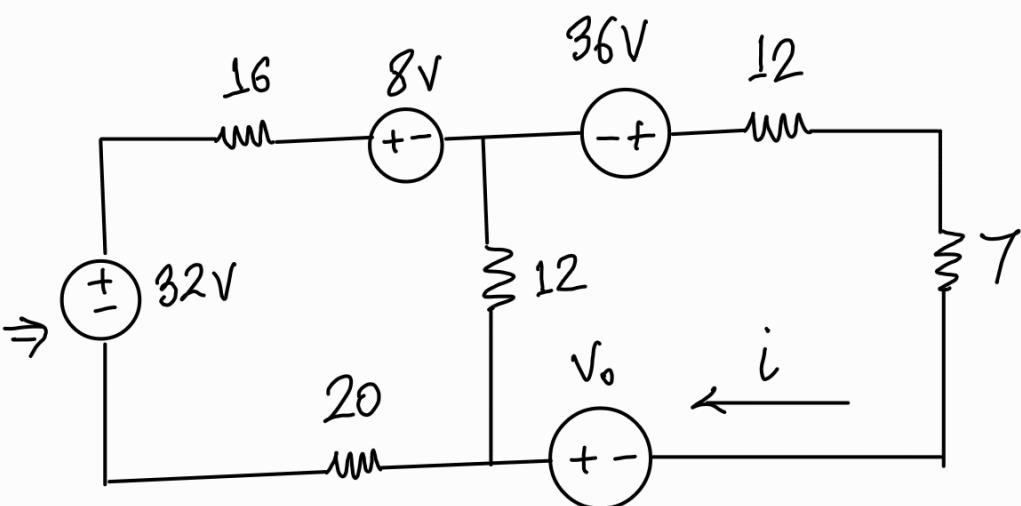
## Problem 6

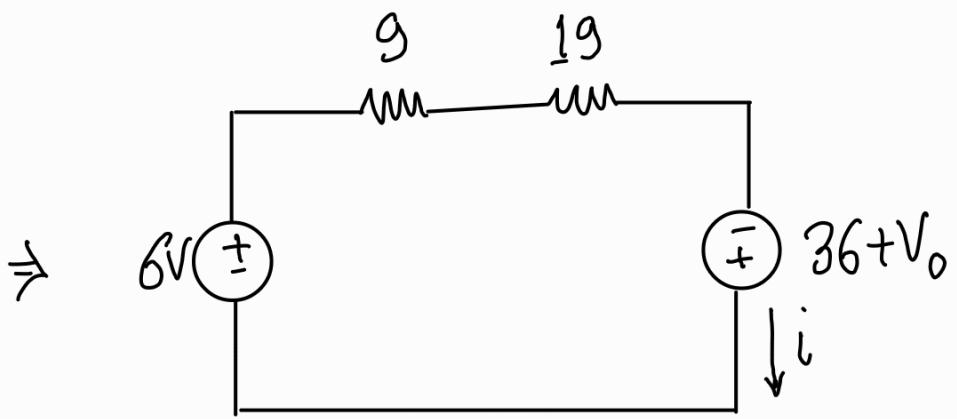
Literally the same as Problem 2.

## Problem 7



Reduce the ckt to a single loop. If  $i=2.5A$  determine  $v_o$





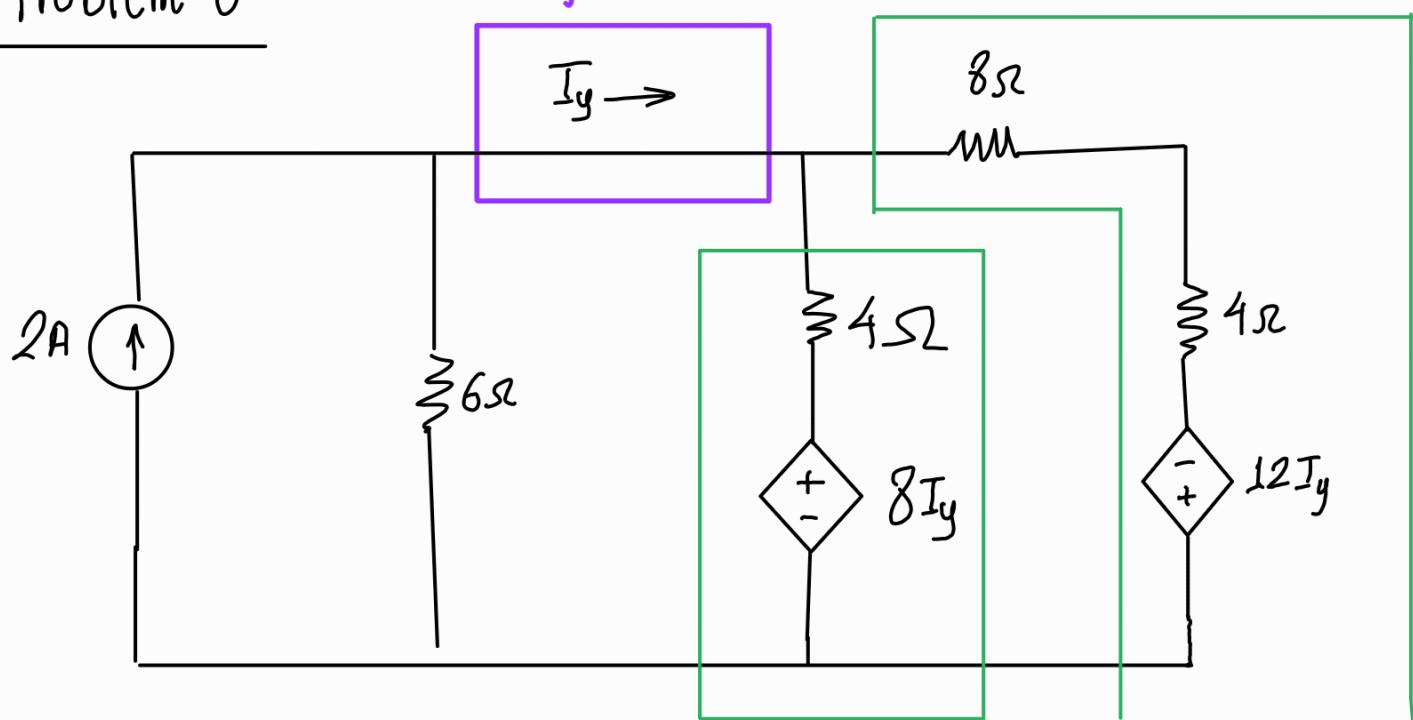
$$i = \frac{42 + V_o}{9 + 19} \Rightarrow 2.5 = \frac{42 + V_o}{28}$$

$$\Rightarrow V_o + 42 = 70$$

$$\Rightarrow V_o = 28 \text{ V}$$

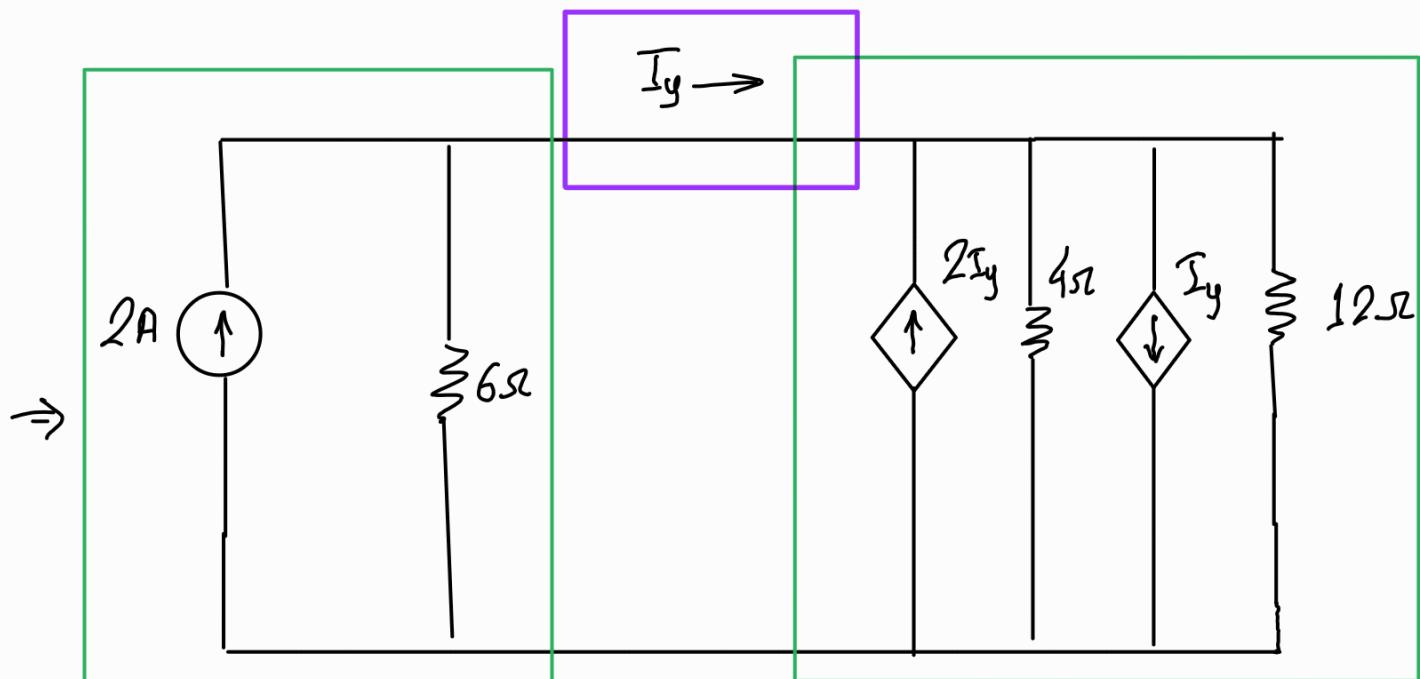
## Problem 8

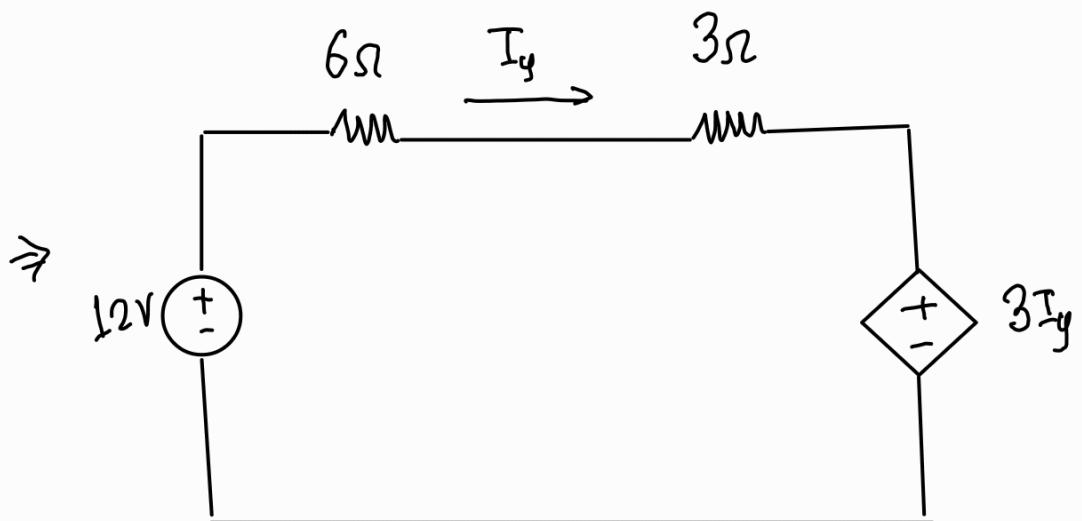
target branch



Reduce the ckt to a single loop and solve for  $I_y$

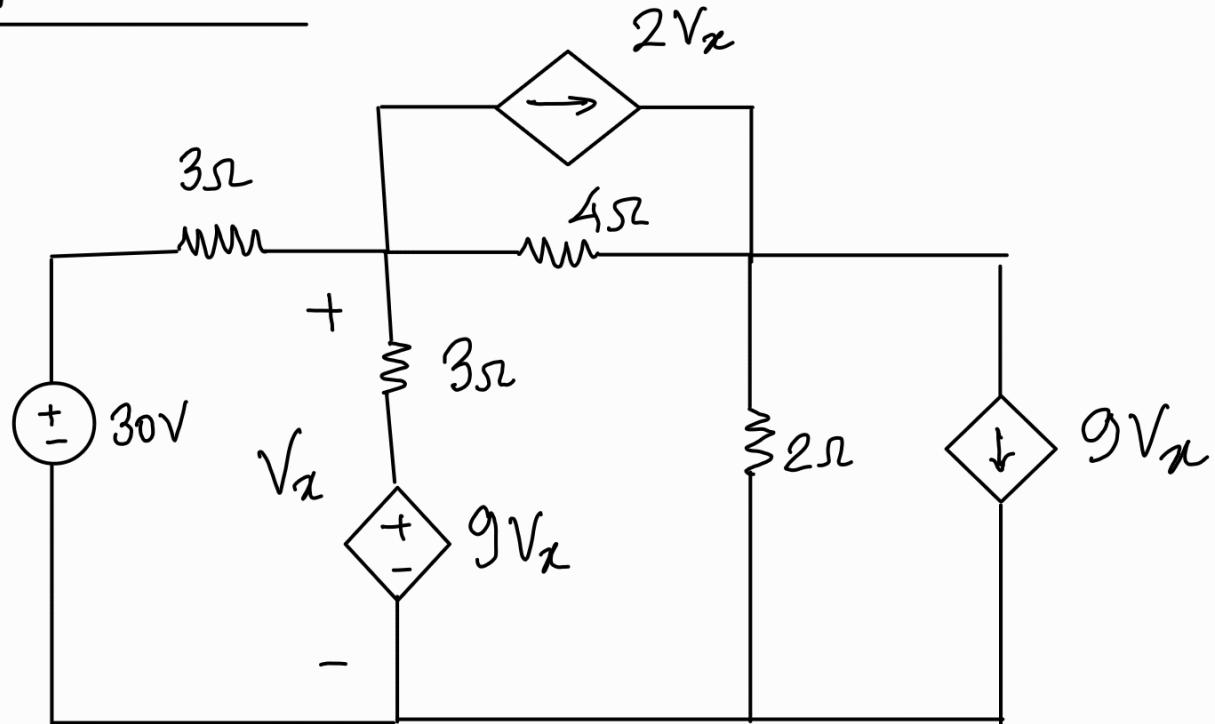
target branch



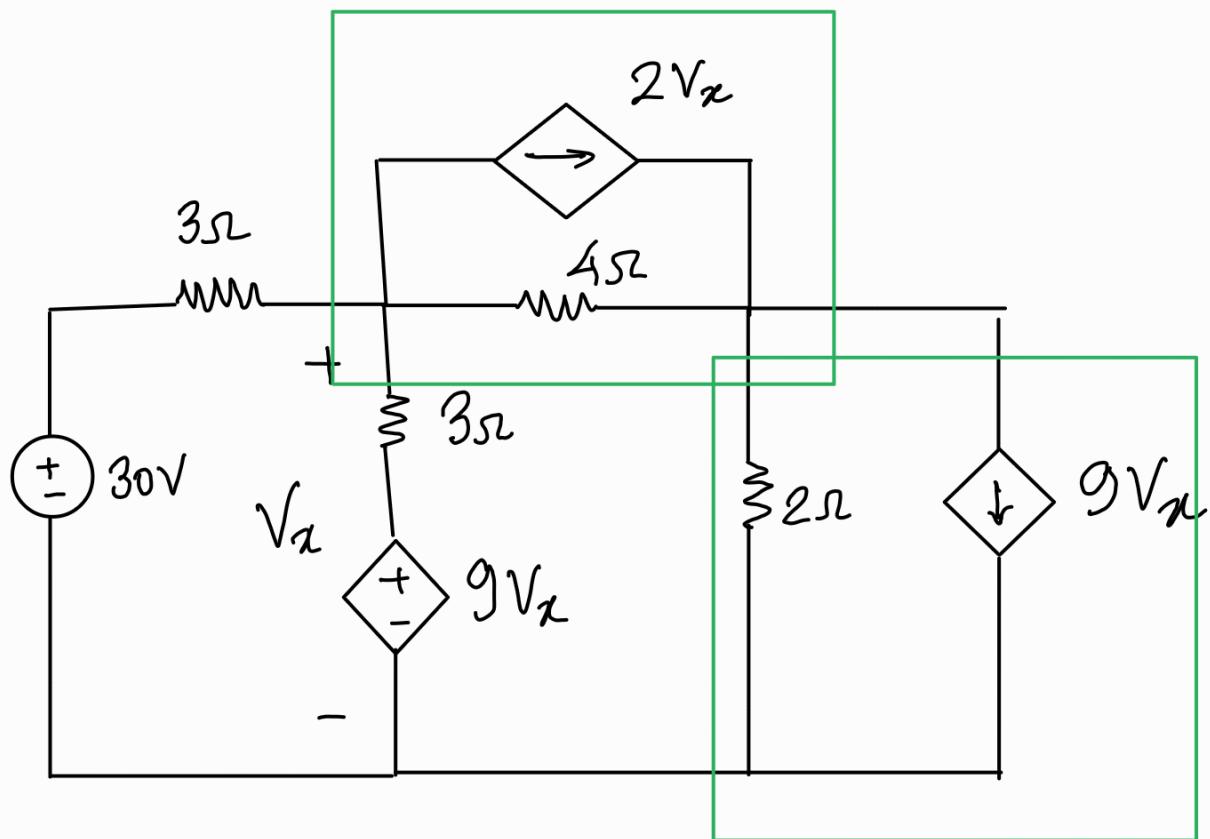


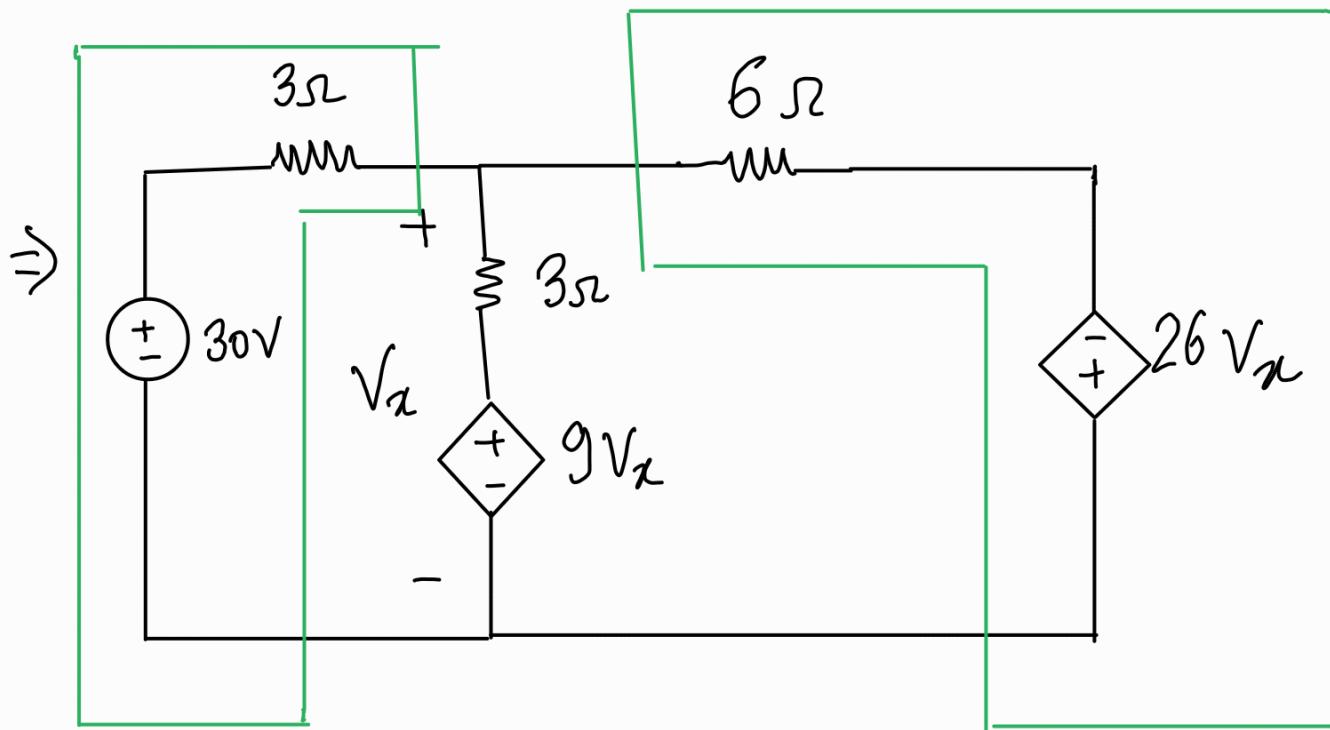
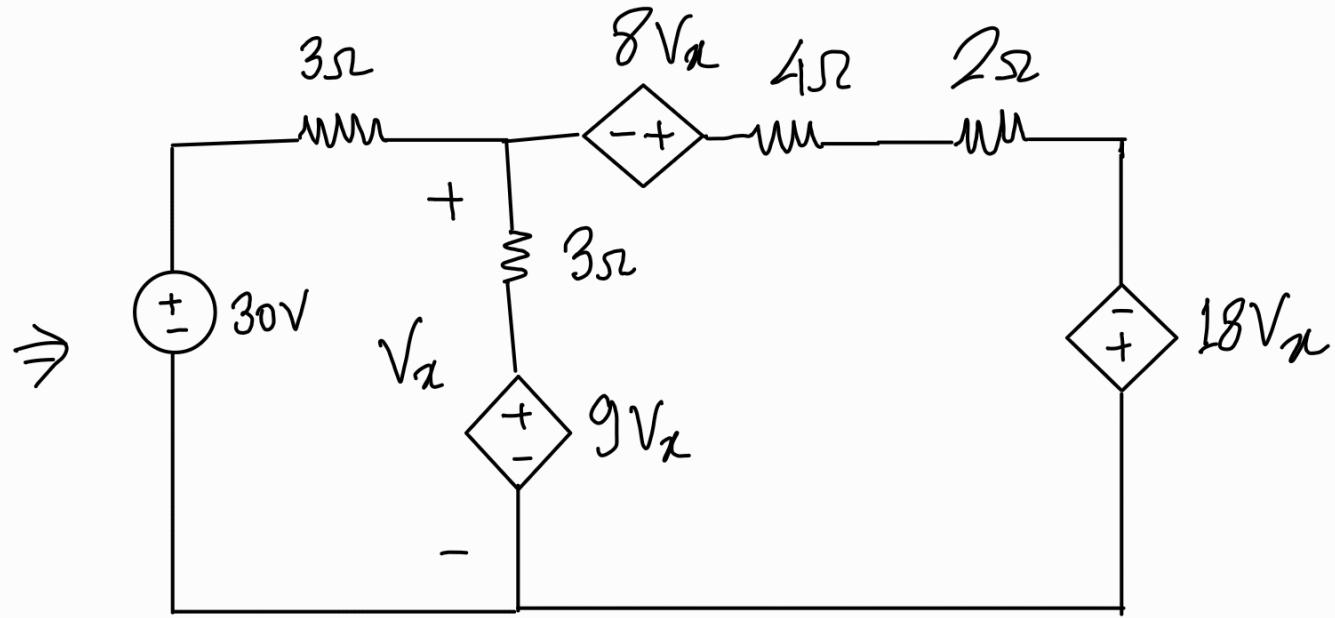
$$I_y = \frac{12 - 3I_y}{9} \Rightarrow I_y = 1A$$

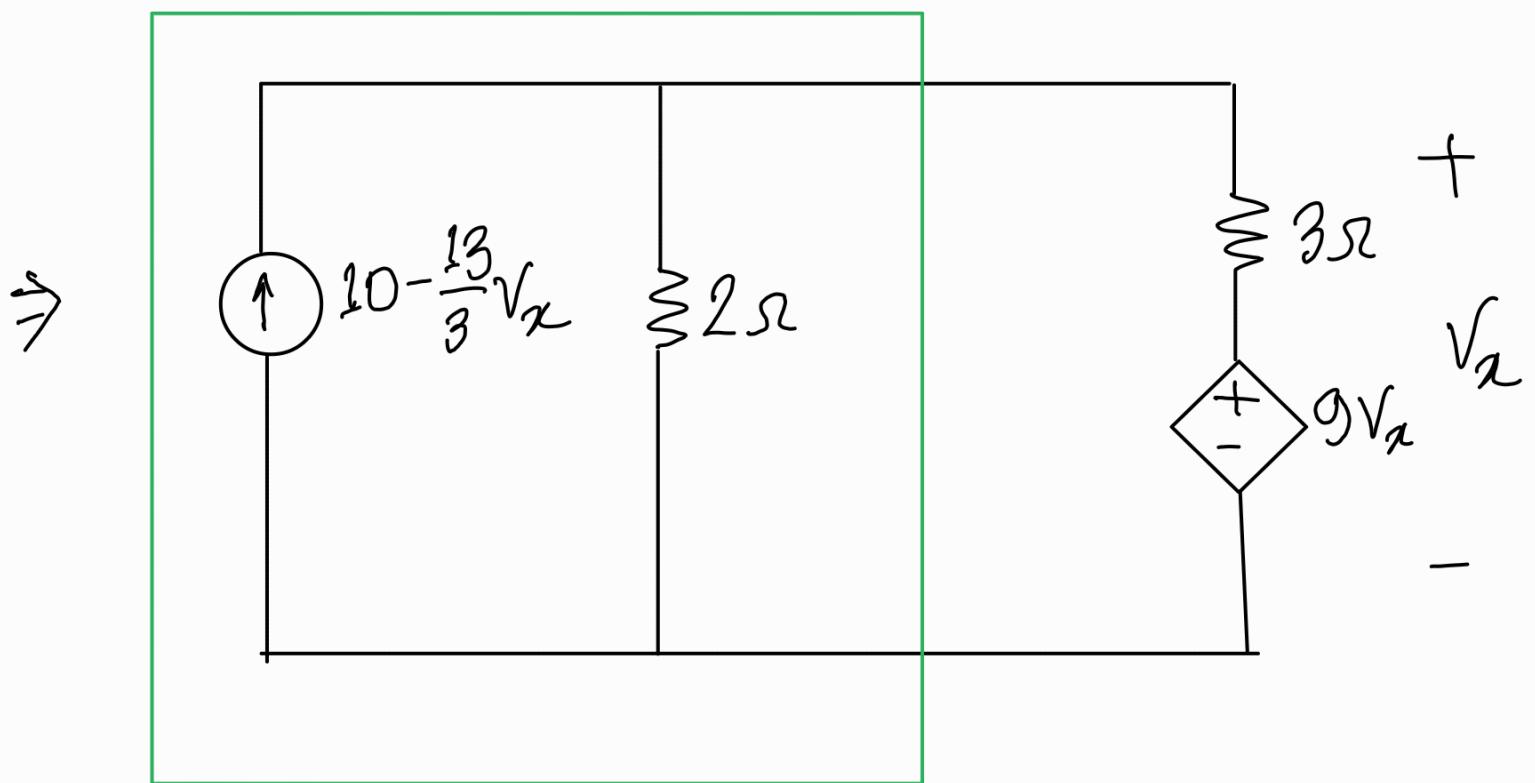
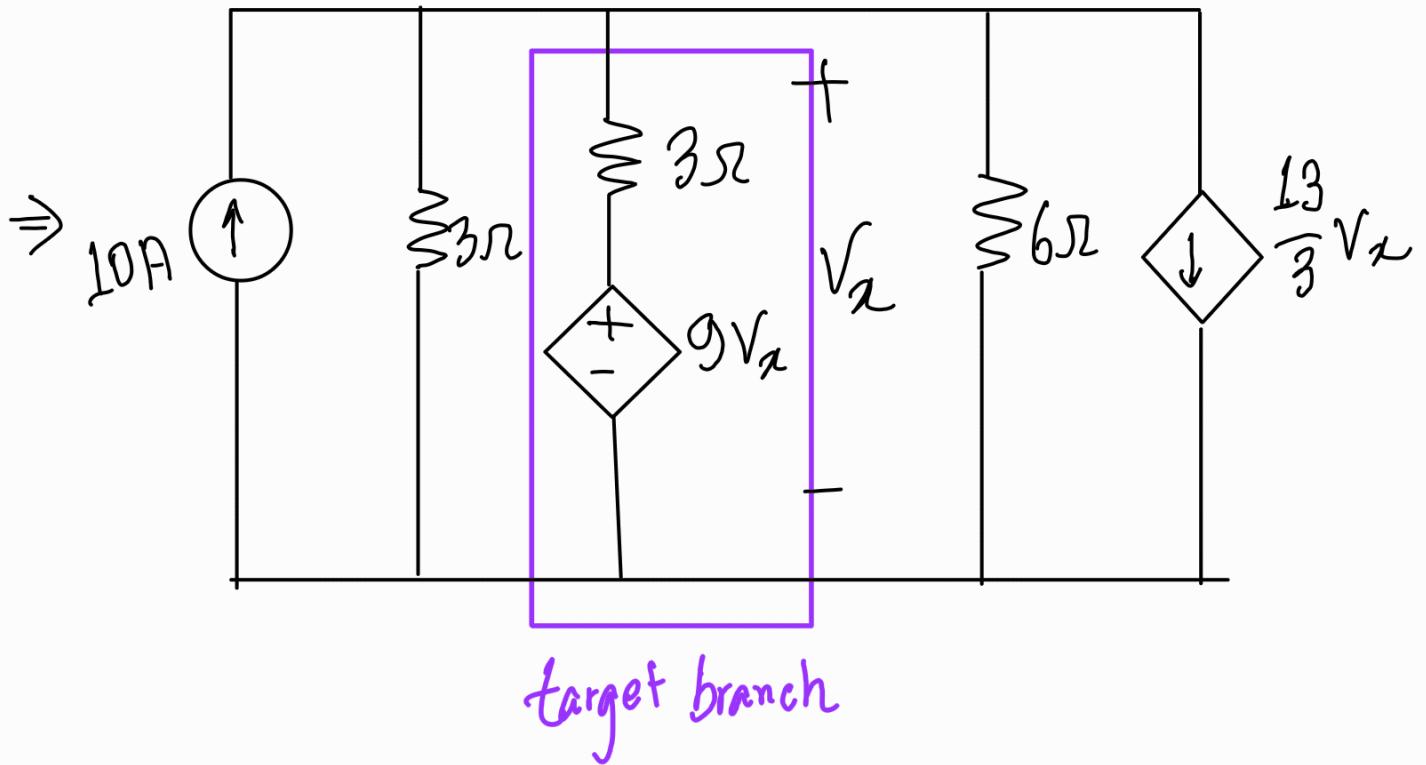
# Problem 9

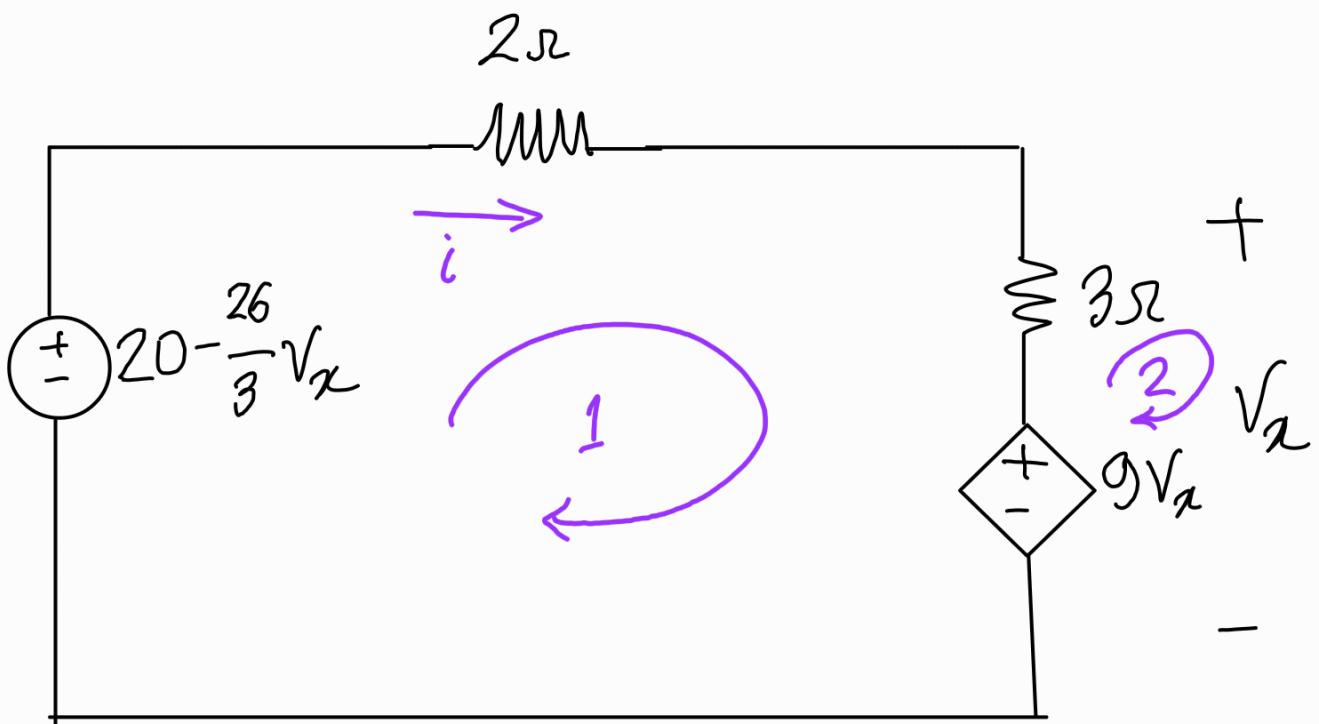


Reduce to a single loop and find  $V_x$ .









KVL @ 1 —

$$-20 + \frac{26}{3}V_x + 2i + V_x = 0$$

$$\Rightarrow 26V_x + 3V_x + 6i = 60$$

$$\Rightarrow 29V_x + 6i = 60 \quad \textcircled{i}$$

KVL @ 2 —

$$V_x - 9V_x - 3i = 0 \Rightarrow 8V_x + 3i = 0 \quad \textcircled{ii}$$

Solving ① & ② —

$$V_x = 4.615 \text{ V}$$

ANSWER

$$i = -12.31 \text{ A}$$