Basics – 6

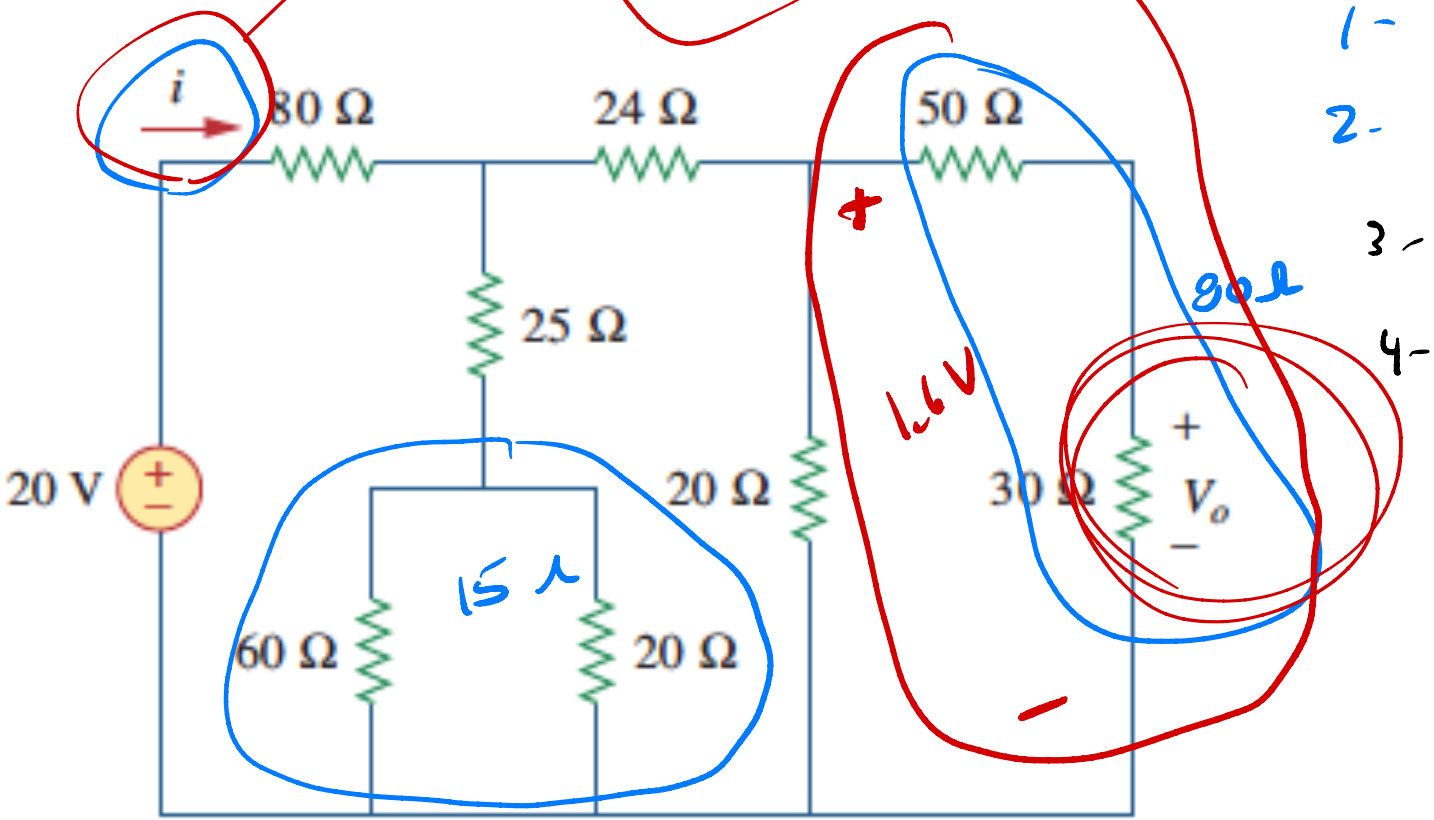
circuit analysis; dependent sources

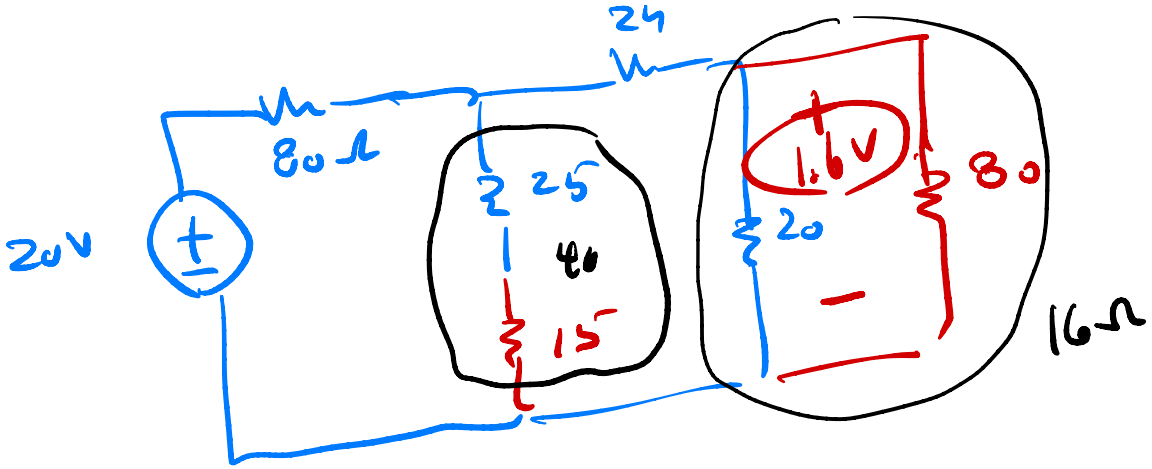
Circuit Analysis

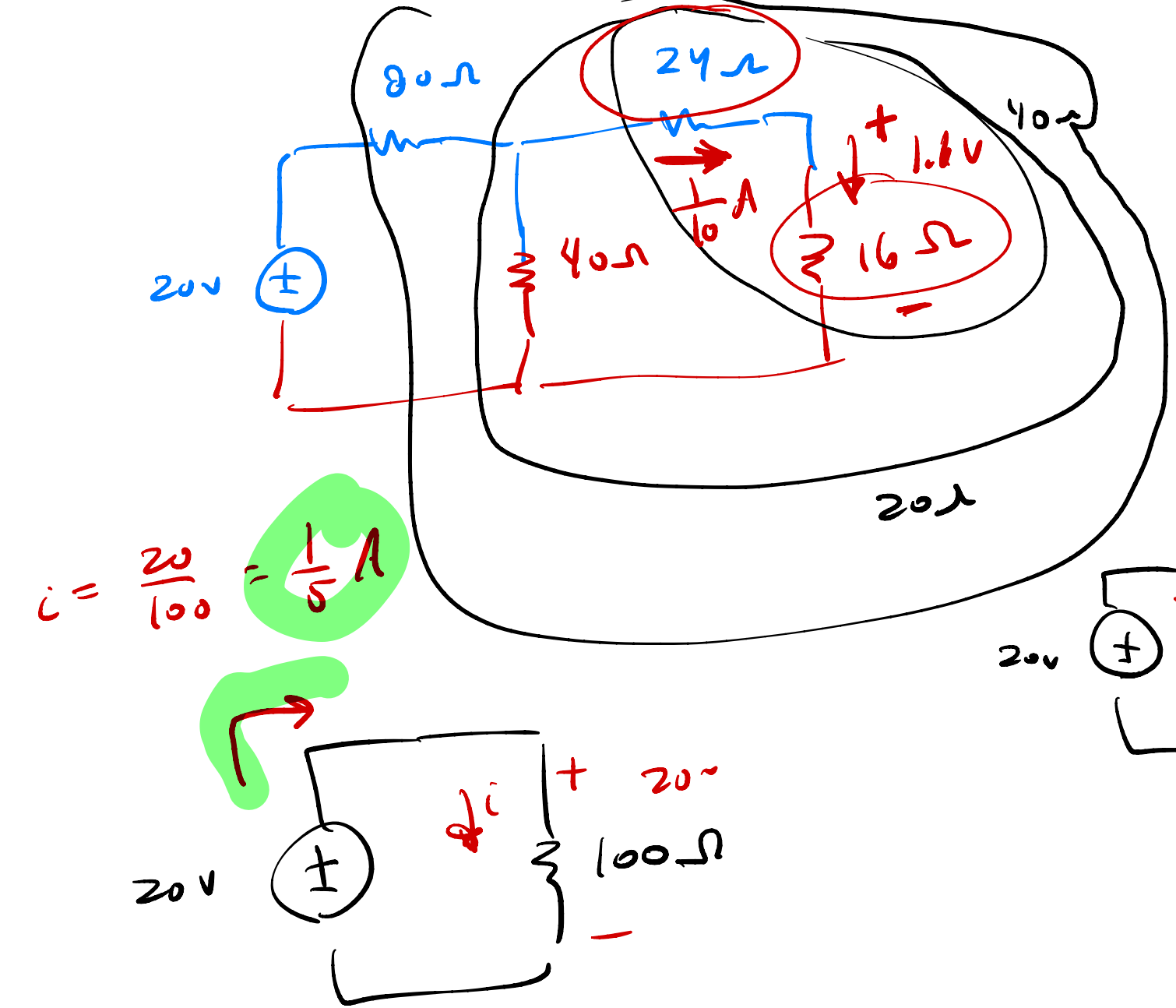
- Noted in the last class that sometimes we can do a full analysis using series/parallel combining, voltage/current division

- Let's do another example or two

Example: find I and V_o





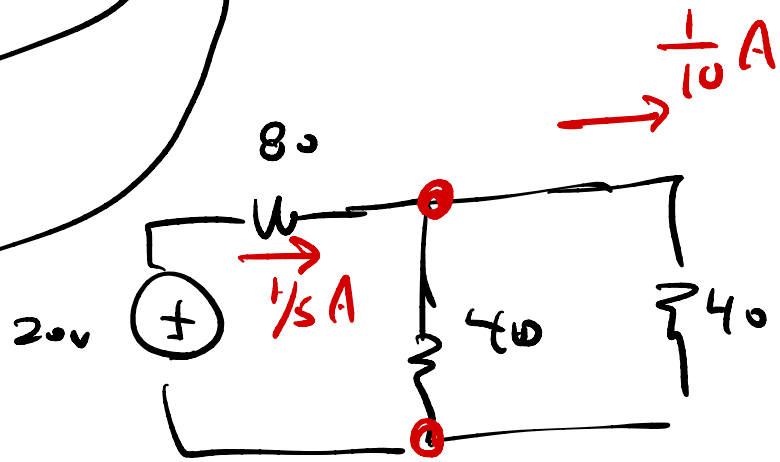


5- serie 24, 16

4- par. 40, 40

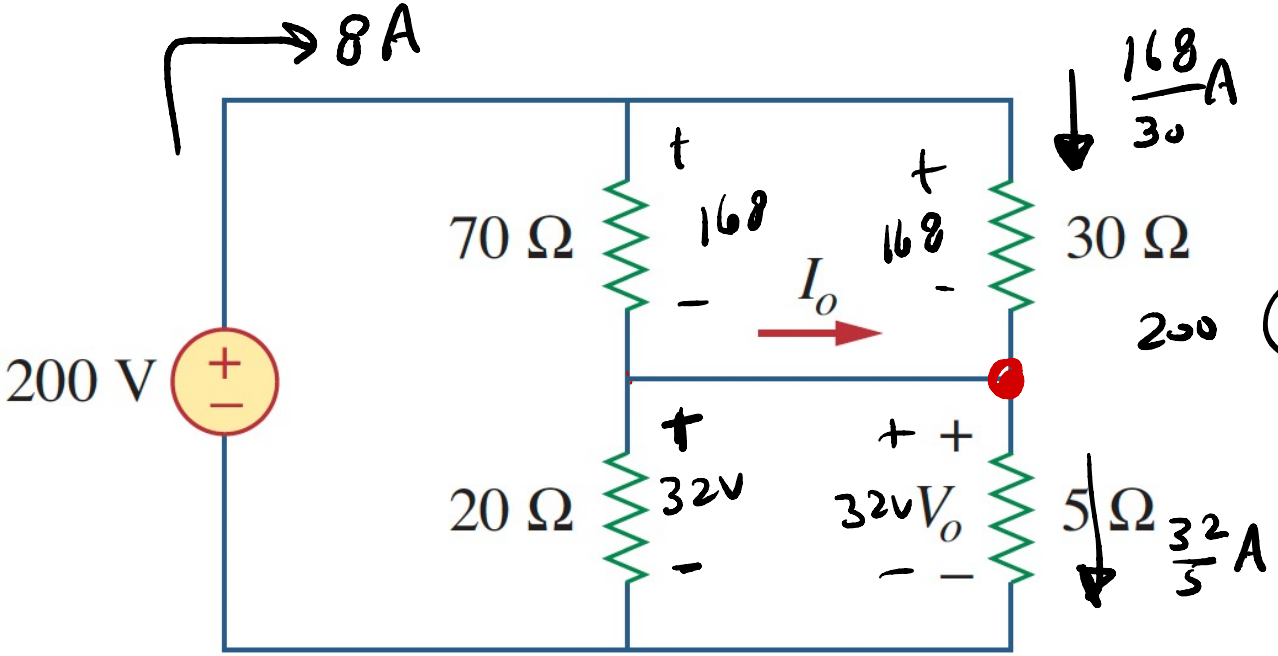
7- serie 24, 80

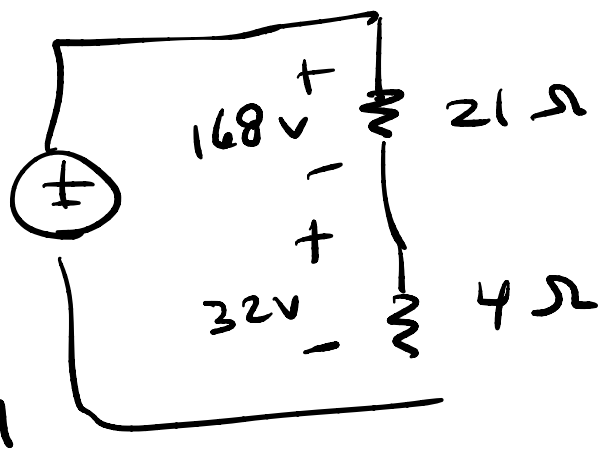
$i = \frac{20}{100} = \frac{1}{5}\,A$



24

Example: find V_o and I_o





32

~~64~~, 0.6 A

1- parallel twice

2- volt. div

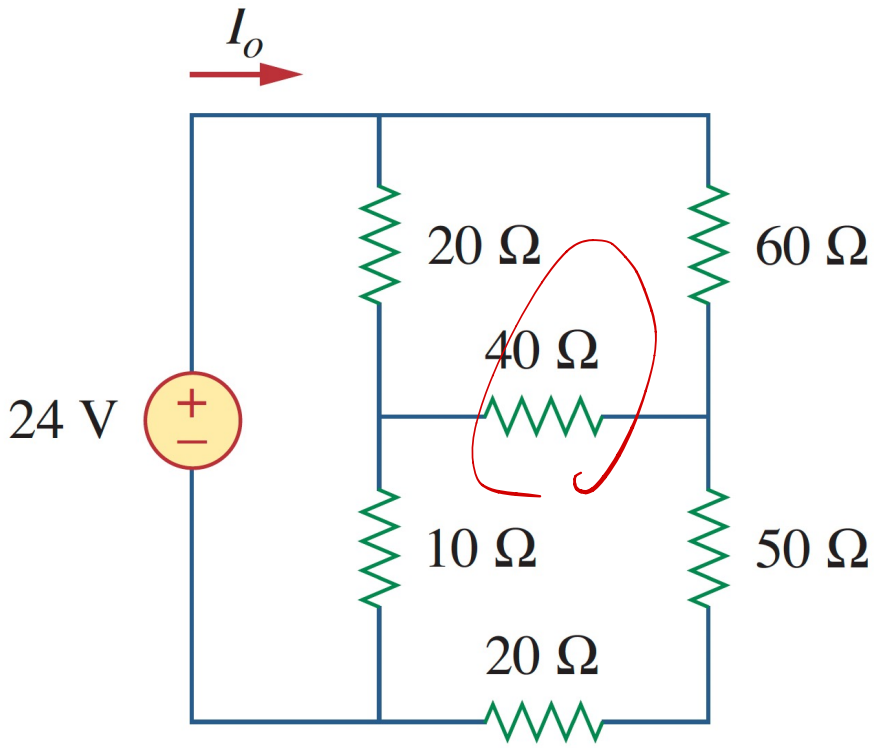
3- Ohm's law twice

4- KCL at node

$$I + \frac{168}{30} = \frac{32}{5}$$

$$I = \frac{32}{5} - \frac{168}{30} = 6\frac{2}{10} - 5\frac{9}{15} = 6\frac{4}{30} - 5\frac{18}{30} = .25\ A$$

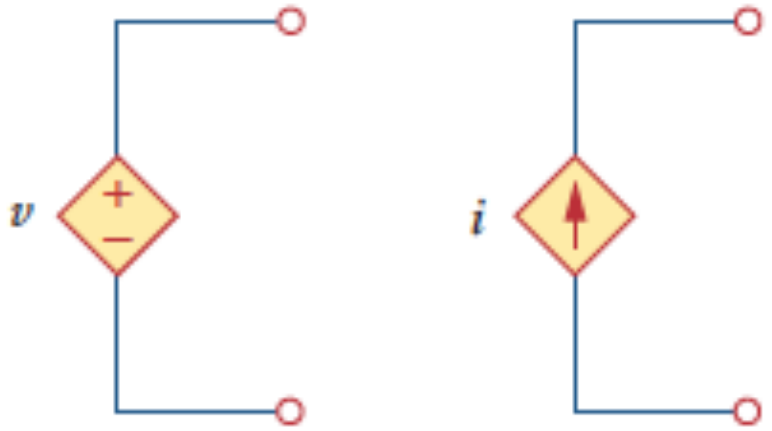
But sometimes you cannot: how do you find the current I_o now?



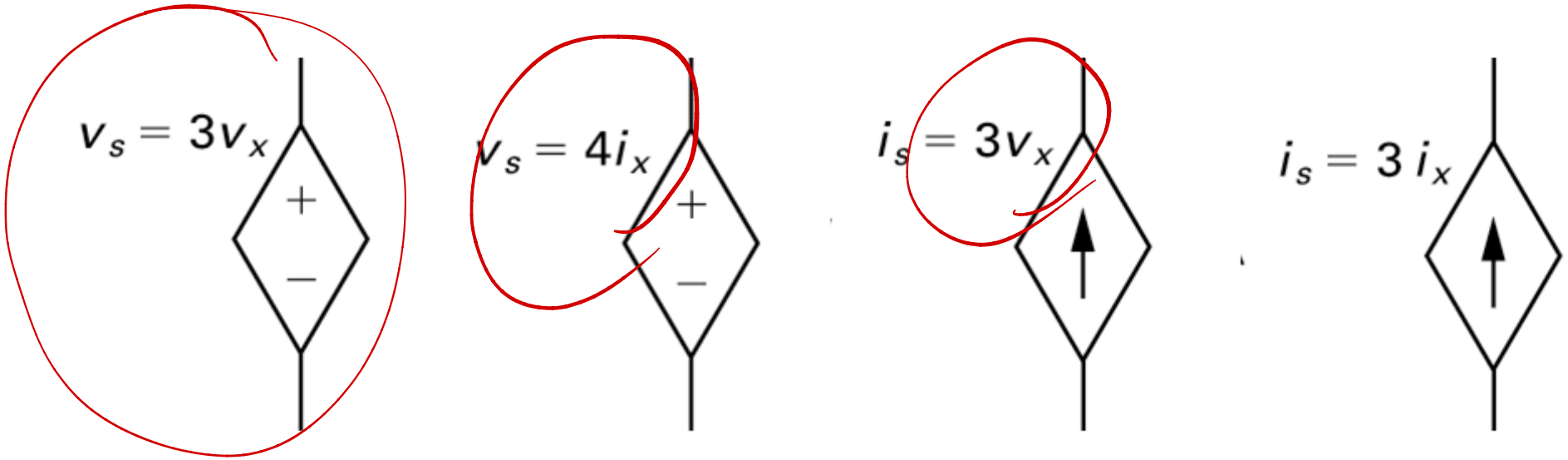
Watch/read materials on Delta-Wye on the course website

Dependent Sources

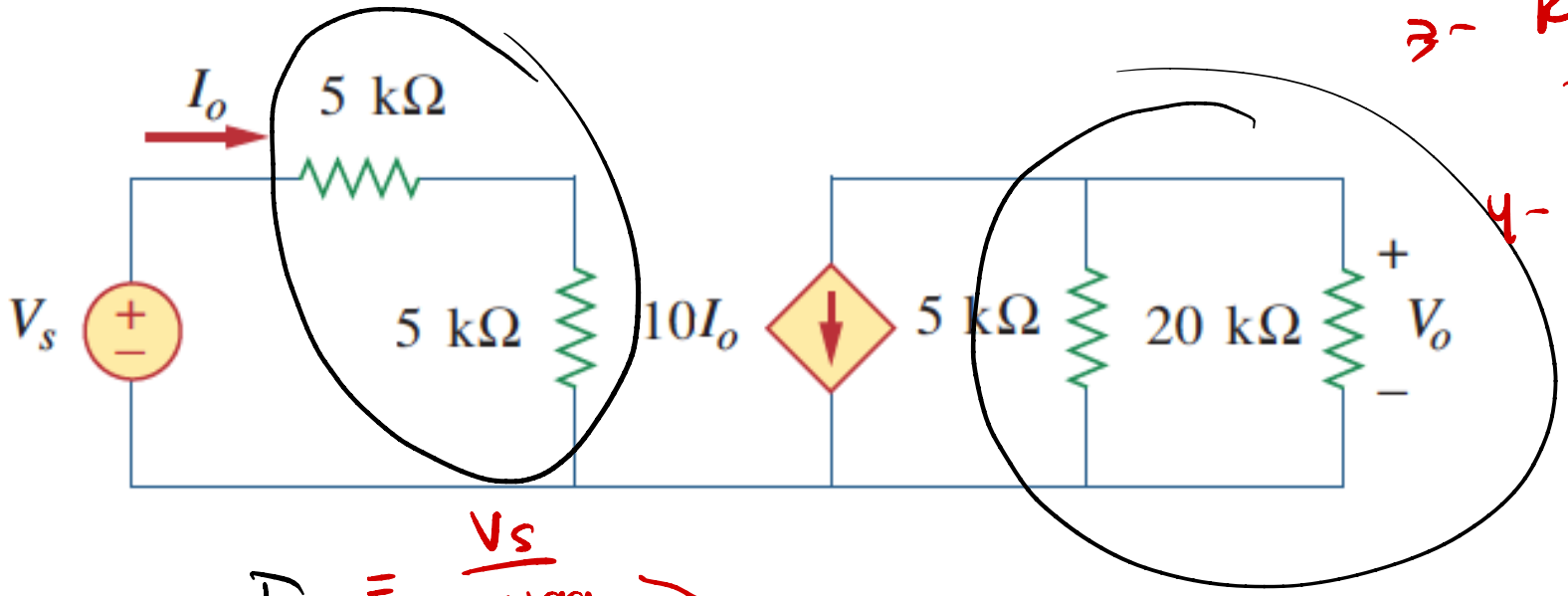
- The voltage or current is dependent upon some other circuit variable
- Drawn as a diamond or rhombus



- A <u>linear</u> relationship to some other circuit variable is common
  - What units does the entire label have?
  - What units does the multiplier have?



Example:



1- series 5.5

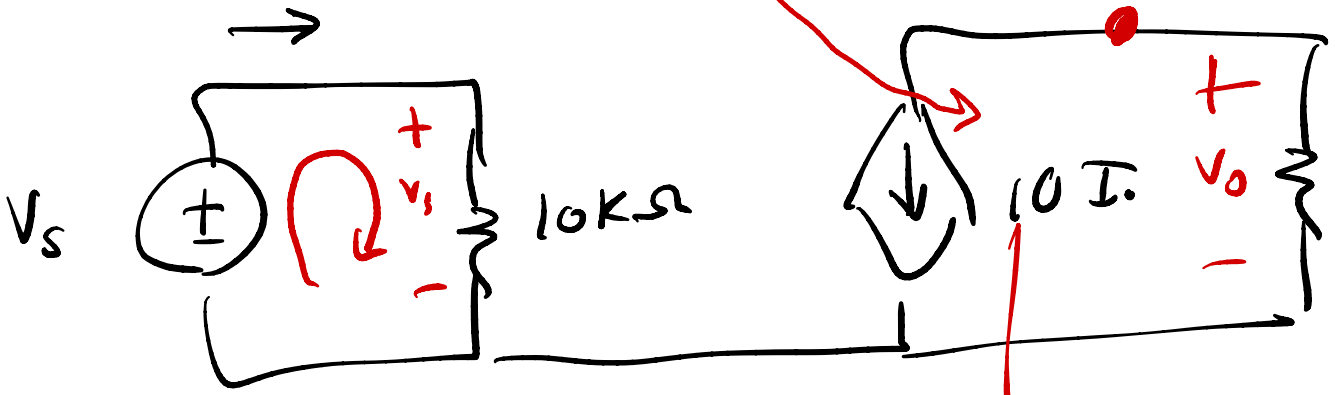
2- parallel 5.20

3- KVL left to find I_o

4- KCL on right to get I_4

$I_o = \frac{V_s}{10000}$

$I_4 = -\frac{V_s}{1000}$



5- Ohm's Law

$V_o = 4000 \cdot \frac{-V_s}{1000}$

$= -4V_s$

$= \frac{V_s}{1000}$

Example:

2.21 Find V_x in the circuit of Fig. 2.85.

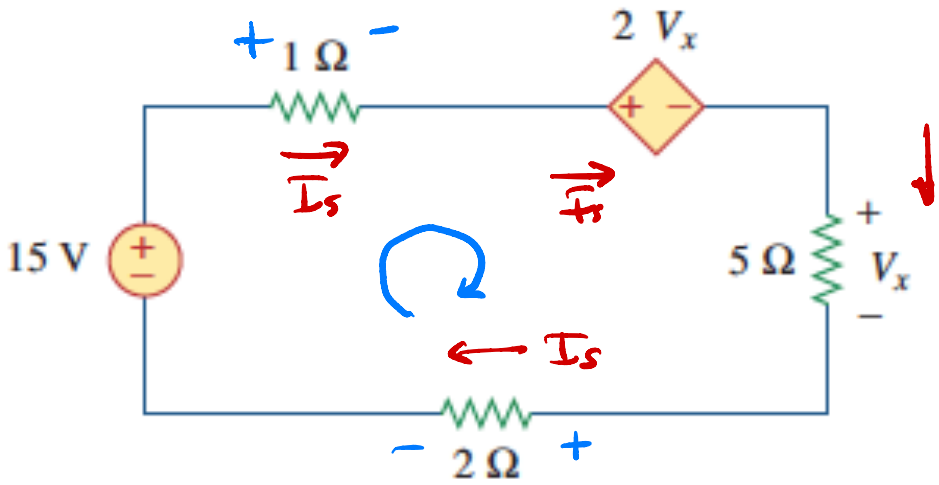


Figure 2.85

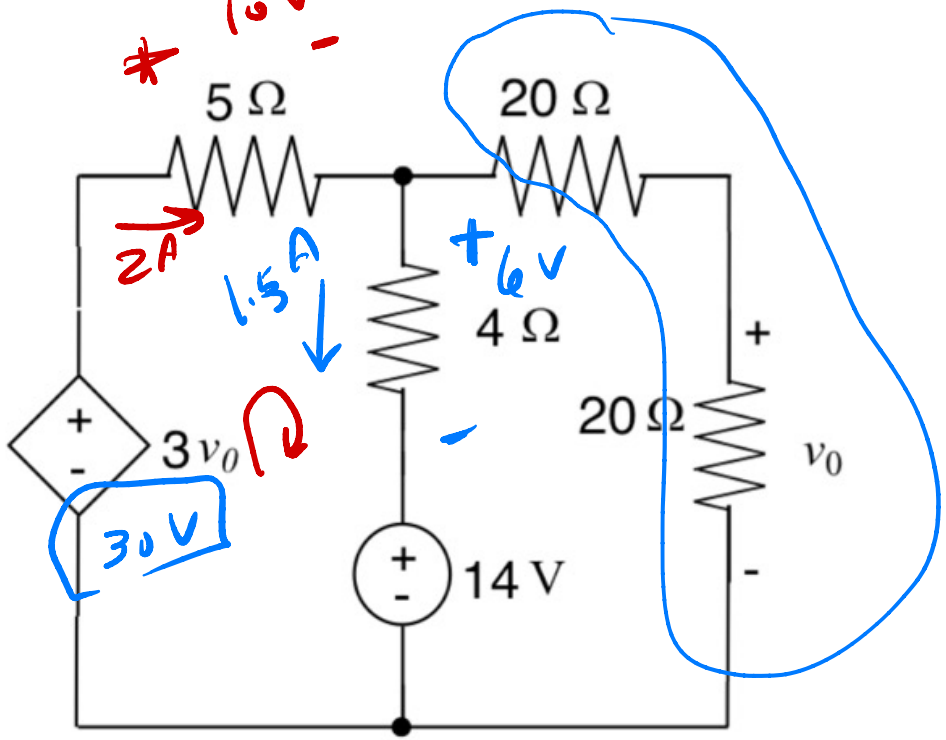
1- define I_s
2- use KCL
3- use KVL
4- ohm
$V_x = 5 I_s$
5- ohm
$V_x = 5 \cdot I_s = \frac{75}{18}$ V

KVL: $15 - 1 \cdot I_s - 2V_x - V_x - 2 I_s = 0$

$15 = 3 I_s + 3 V_x \Rightarrow 15 = 18 I_s$

$5 I_s$ $\quad I_s = \frac{15}{18}$ A.

Example: given that the current in the 4 ohm resistor is 1.5 A going down, find the current and power of the dependent source



1- Ohm law on 4 Ω

2- KVL on right

3- Use volt div

$V_0 = 10$ V

4- $3V_0 = 30$ V

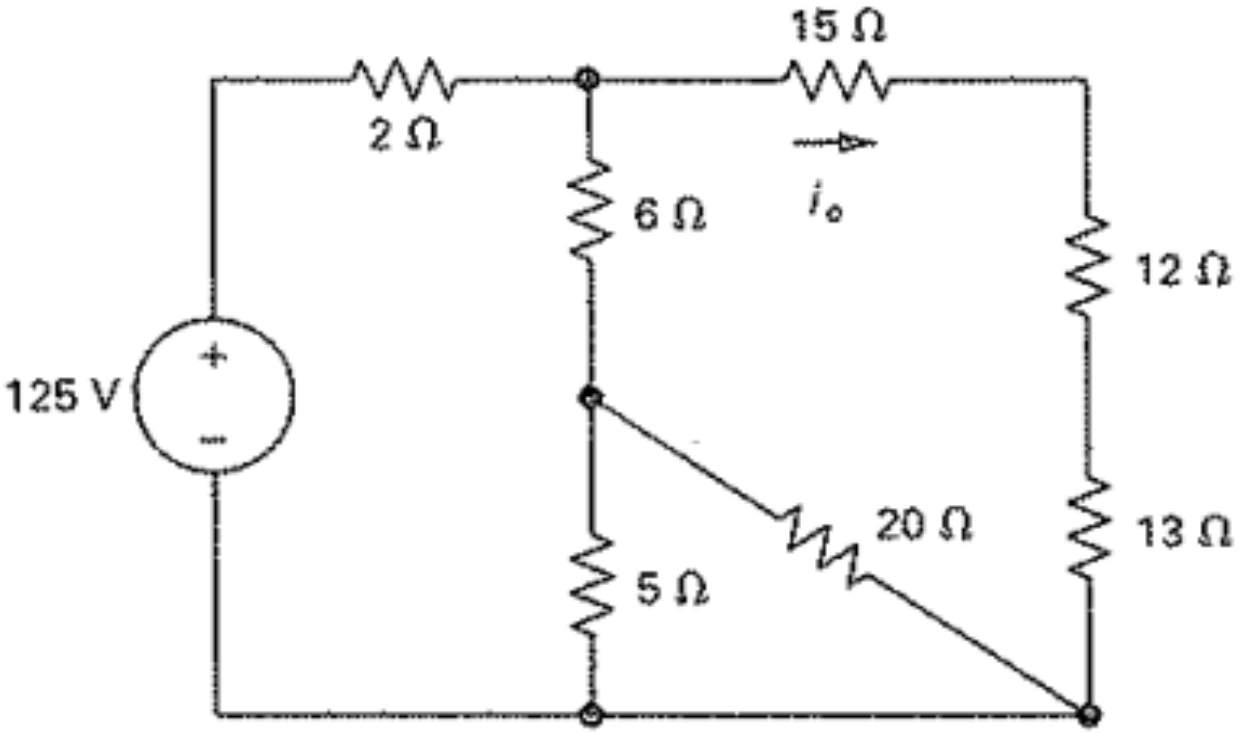
5- KVL on left hand loop

$V_{5A} = 10$ V

6- Ohm's Law

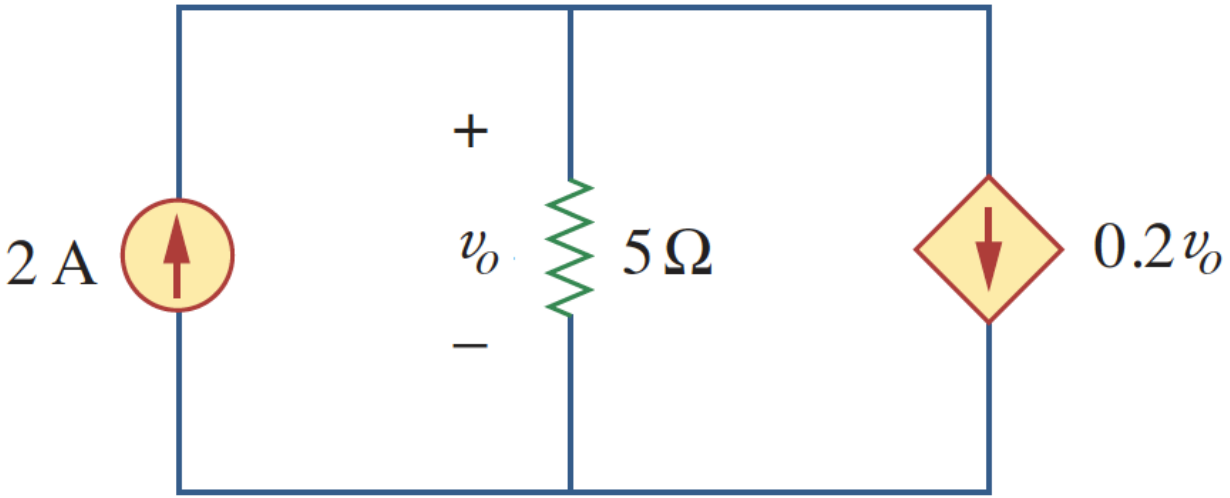
2.5 A

Practice problem: find i_o



$5\,V, 5\,W$

Practice problem: Find v_o and the power of the dependent source



$57\ V$

Practice problem: find v_o