Lecture 6
Basics – 6 of 7

circuit analysis; dependent sources

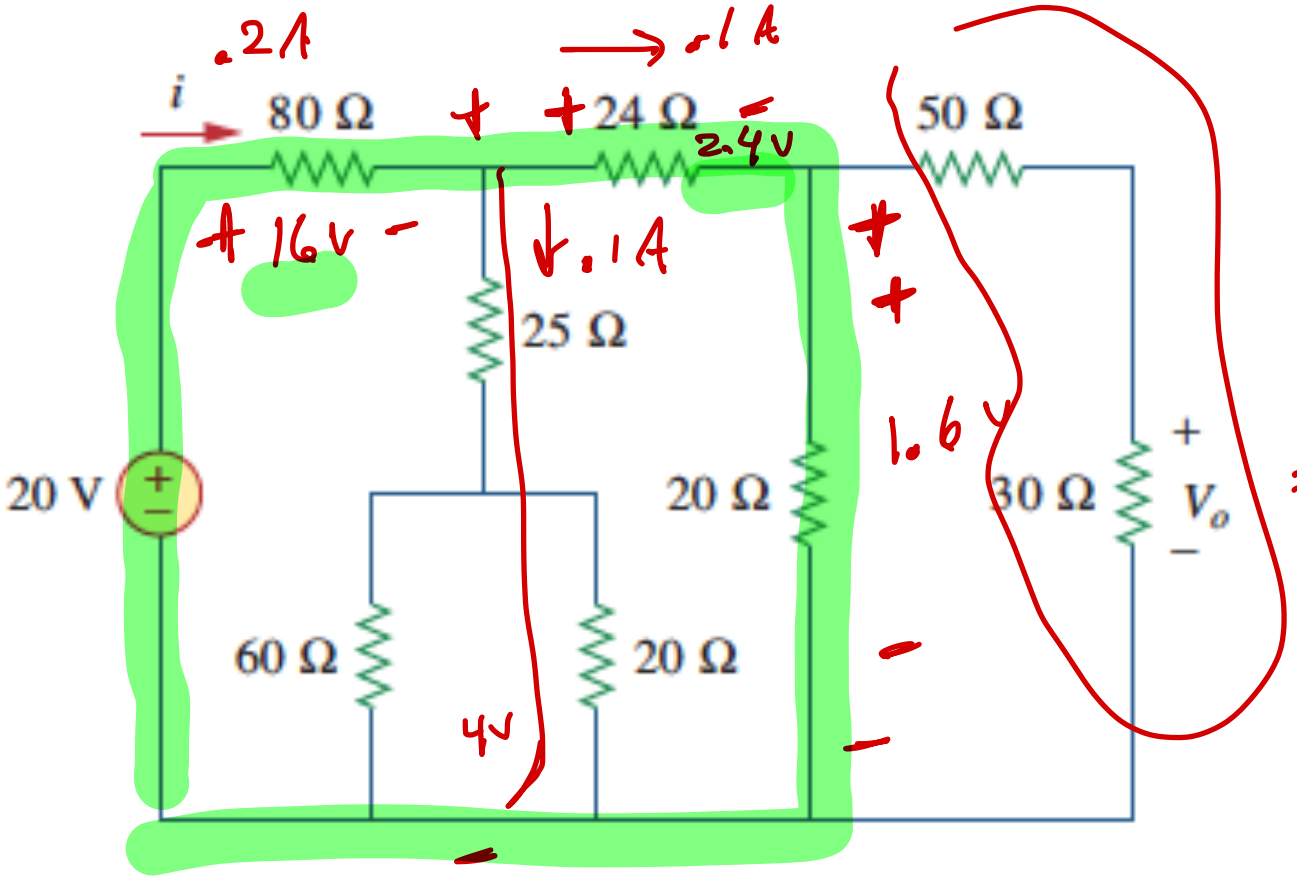
Circuit Analysis

- 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

0.2 A, 0.6 V

Example: find I and V_o



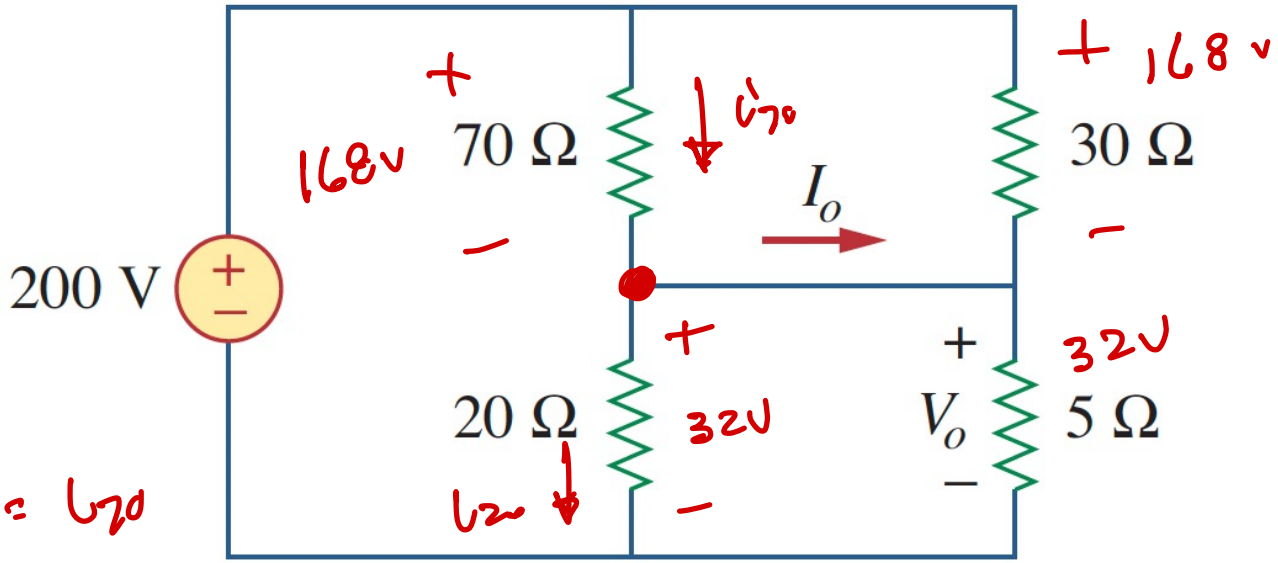
$= \frac{30}{50+30} \cdot 1.6$

$= 0.6\,V$

$i_{20} = \frac{168}{70}$ A $\quad i_{20} = \frac{32}{20}$ A

32 V, 0.6 A

Example: find V_o and I_o

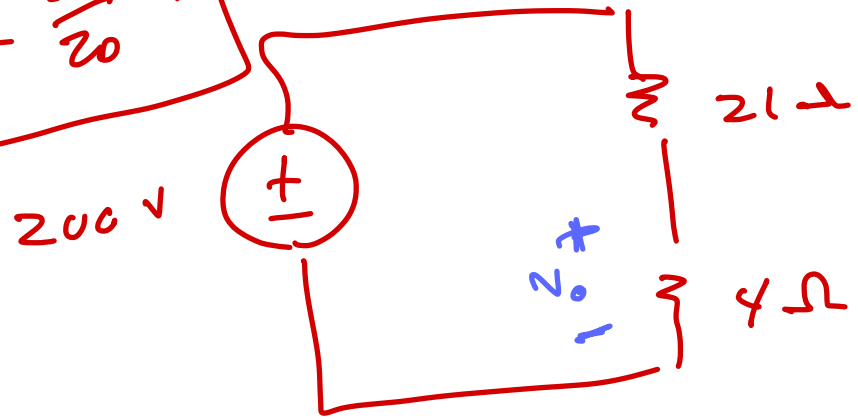


$\frac{30 \cdot 70}{100} = 21\ \Omega$

$\frac{20 \cdot 5}{25} = 4\ \Omega$

$I_o = i_{20}$

$= \frac{168}{20} - \frac{32}{20}$ A

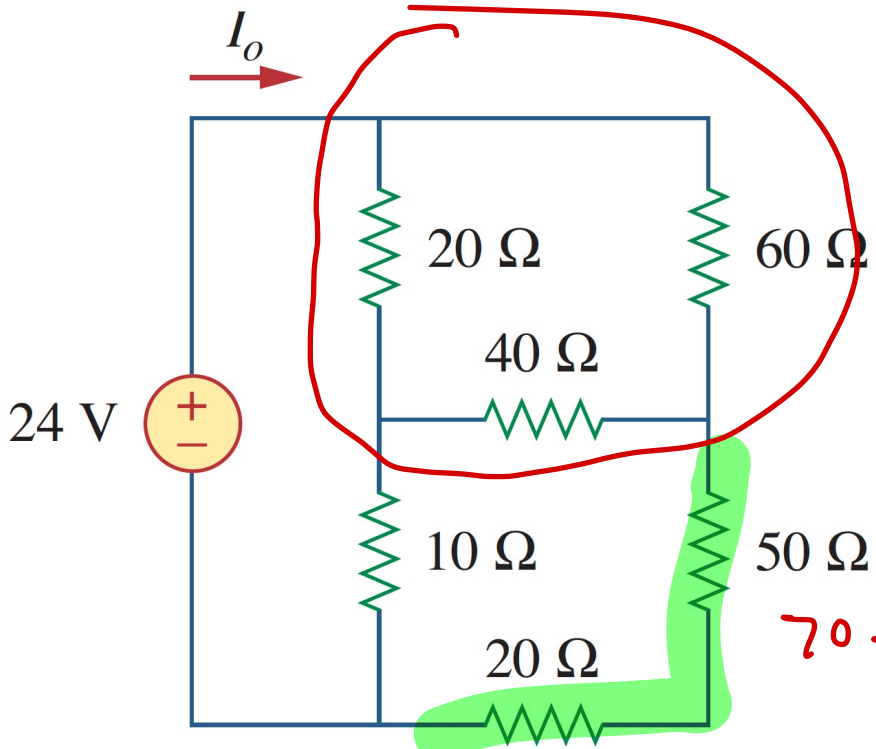


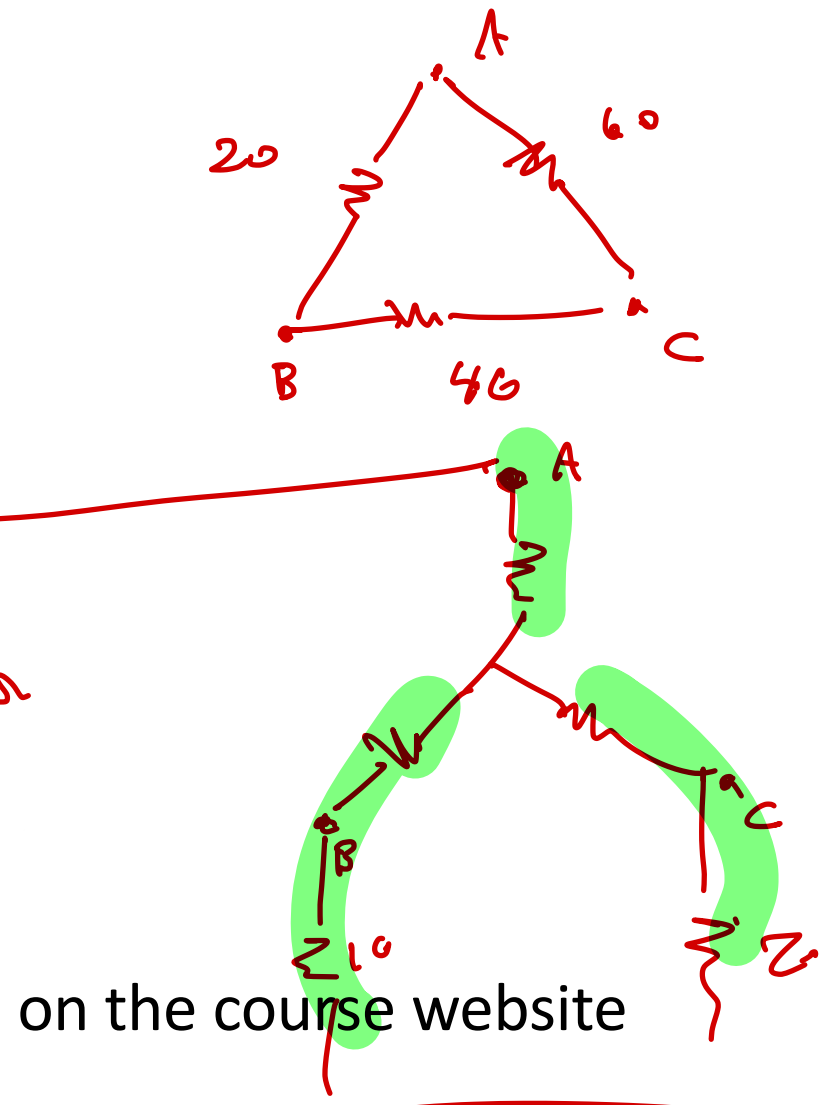
voltage div

$V_o = \frac{4}{21+4} \cdot 200$

$= 32$ V

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

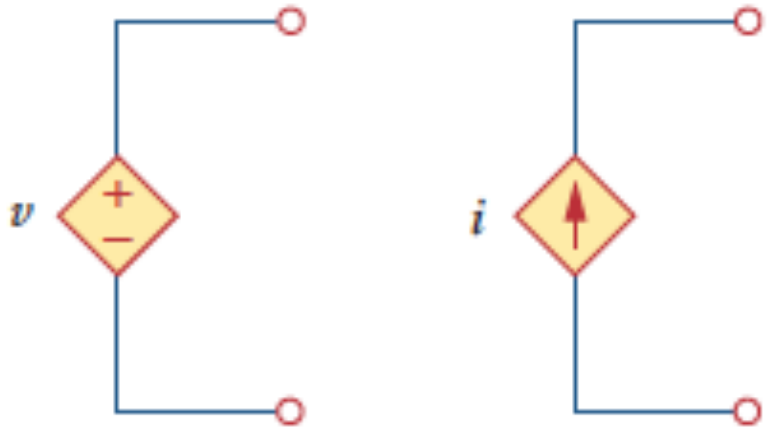




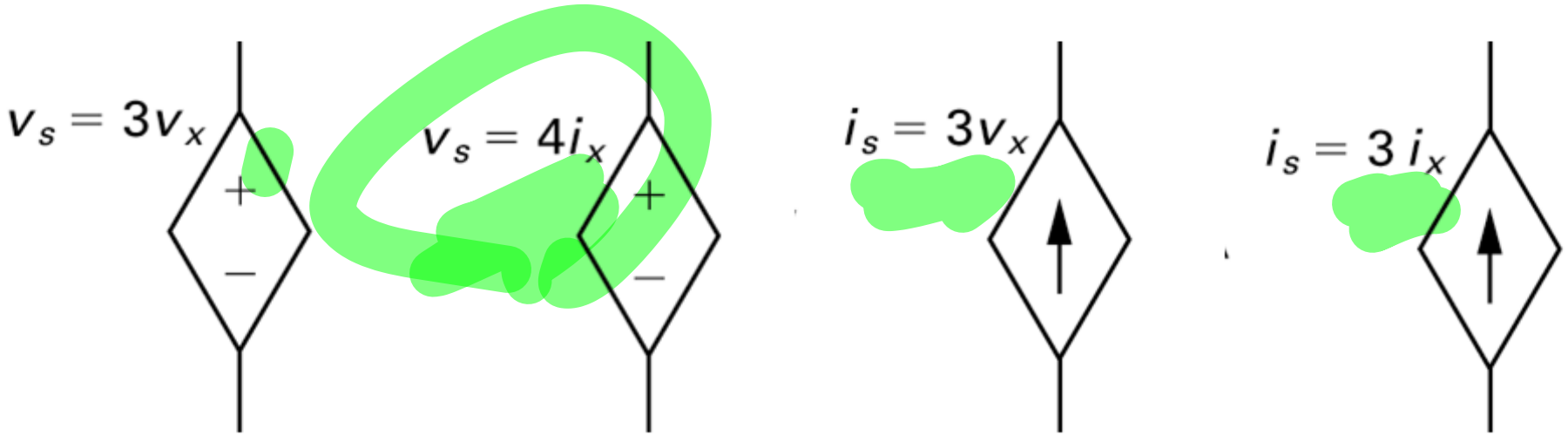
Watch/read materials on Delta-Wye on the course website

Dependent Sources

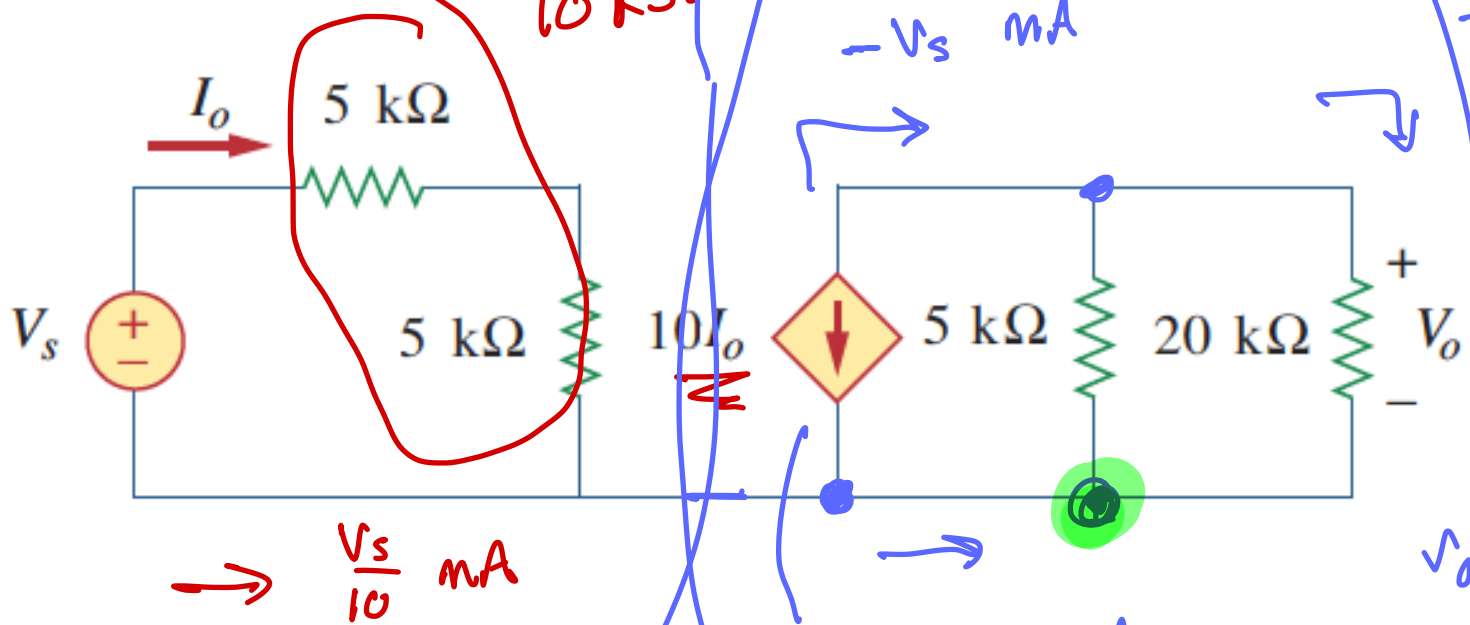
- The voltage or current is dependent upon some other circuit variable
- Drawn as a diamond or rhombus



- 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:



$I_o = \frac{V_s}{10}$ mA

10 KΩ

$-V_s$ mA

$= V_s$ mA

$\frac{V_s}{10}$ mA

10 KΩ

V_s

$-V_s \frac{5K}{5K+20K}$ mA

$= -\frac{V_s}{5}$ mA

$V_o = \left(-\frac{V_s}{5}\text{ mA}\right)(20\text{ K}\Omega)$

$-4V_s$ Volts

Example:

2.21 Find V_x in the circuit of Fig. 2.85.

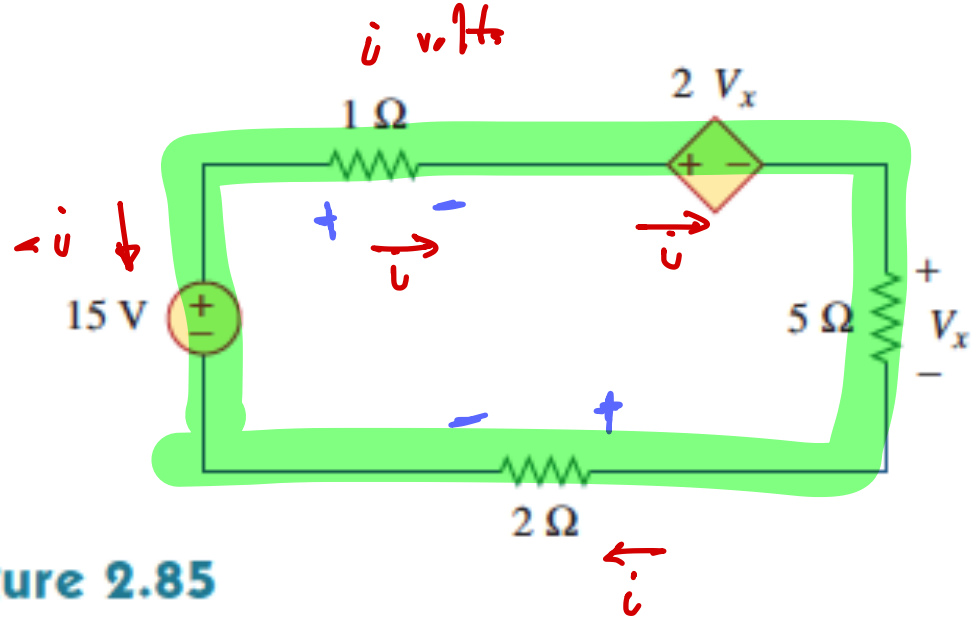


Figure 2.85

$15 - i - 2V_x - 5i - 2i = 0$

$-10i$

i volts

$-i$

$+i$

$5i$ volts $= V_x$

$15 - i(1+10+5+2) = 0$

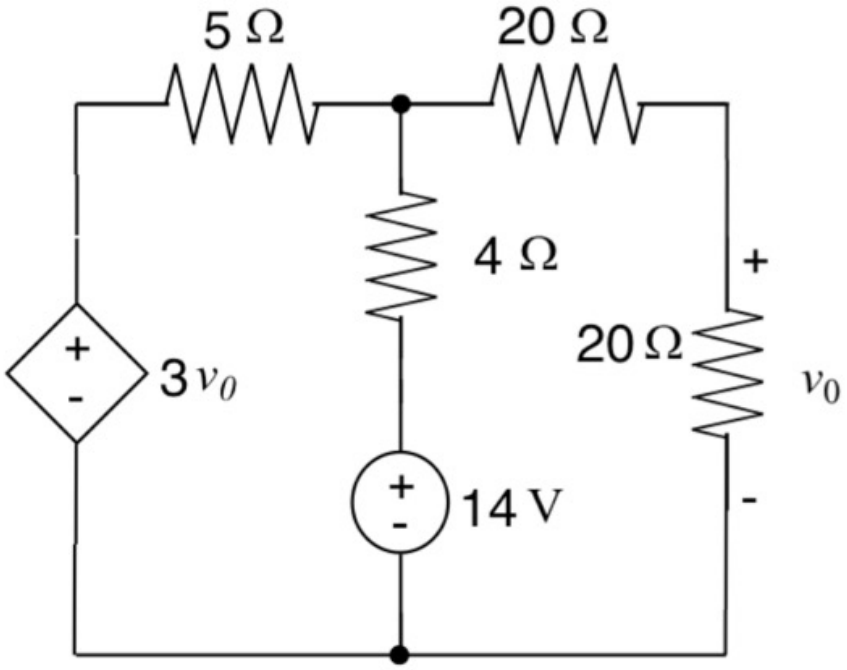
$i = \frac{15}{18}$

$V_x = 5 \cdot \frac{15}{18} =$ ——

$2i$ volts

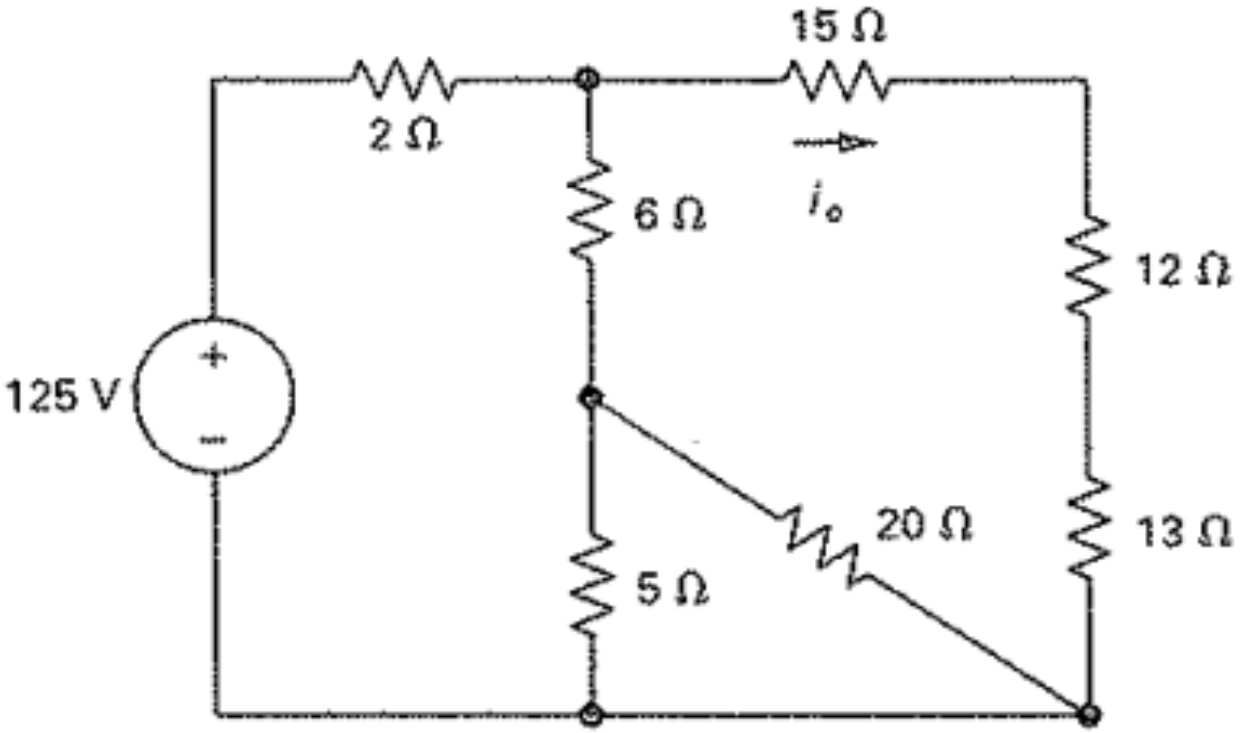
– 2 A, – 60 W

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



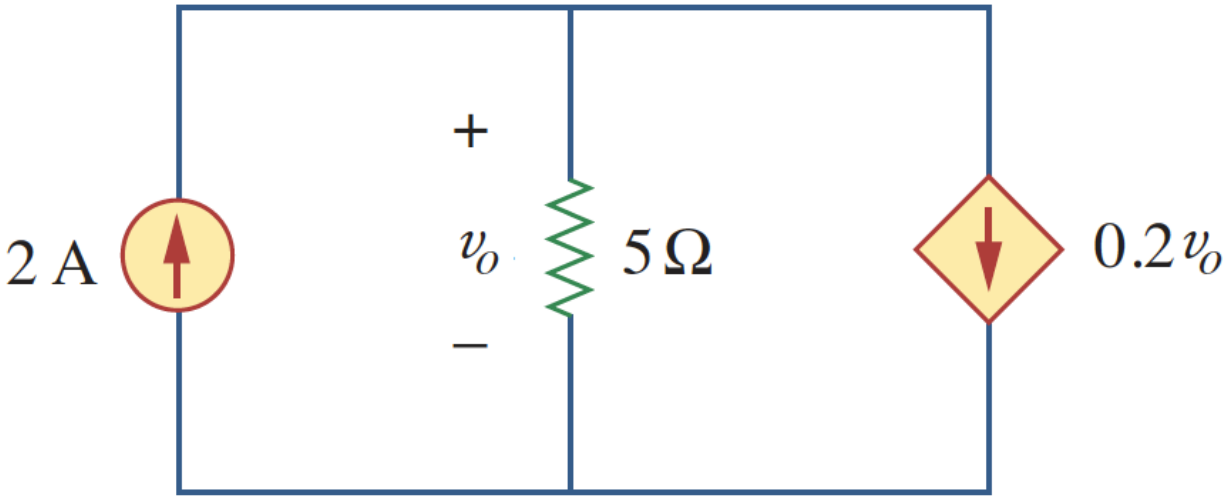
2.5 A

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