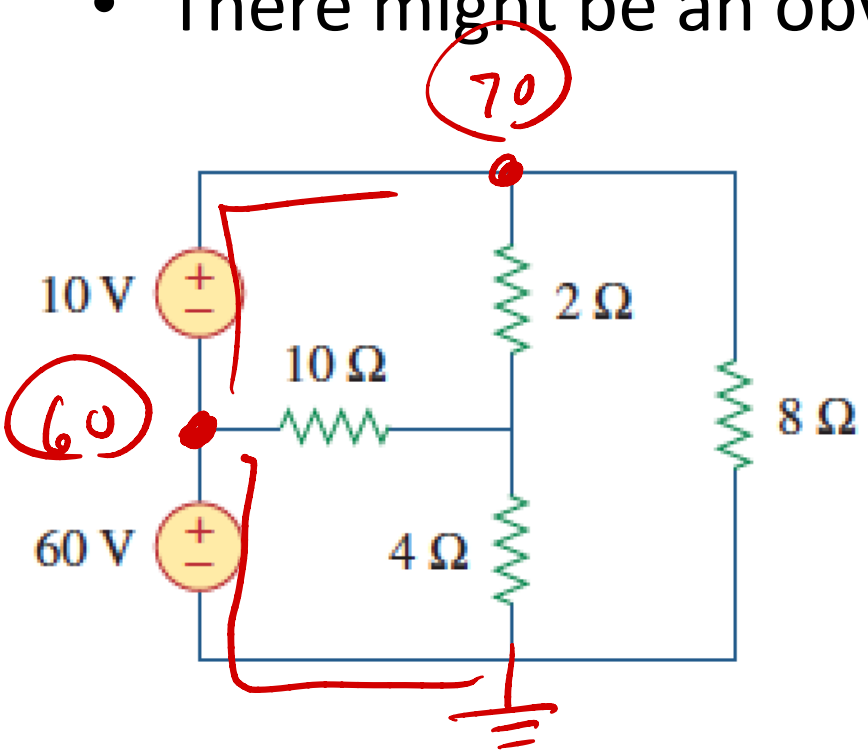
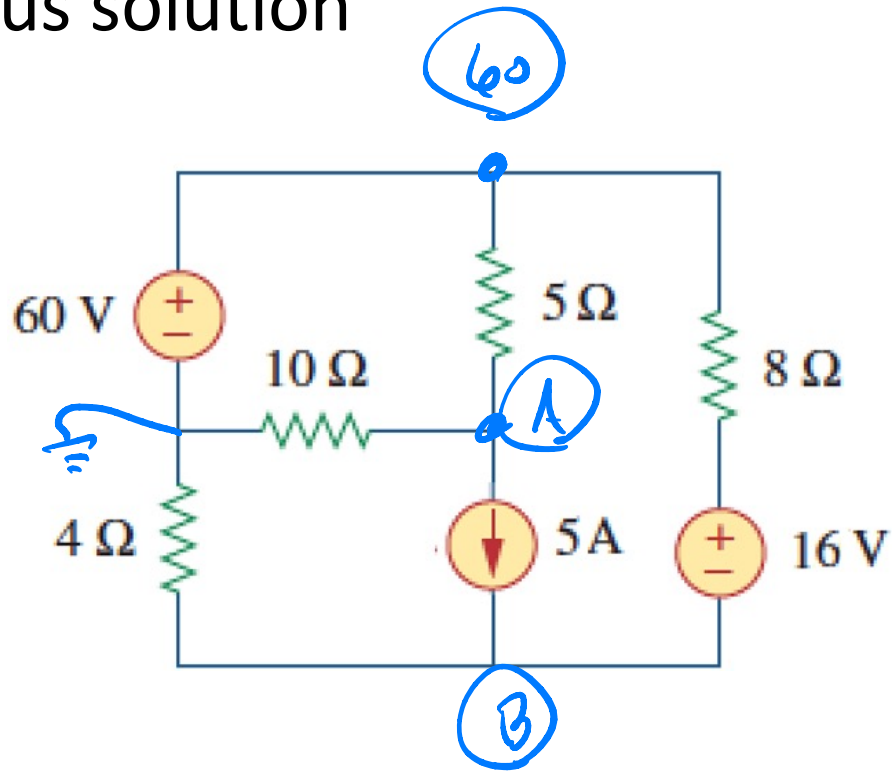
Node – 5

supernodes

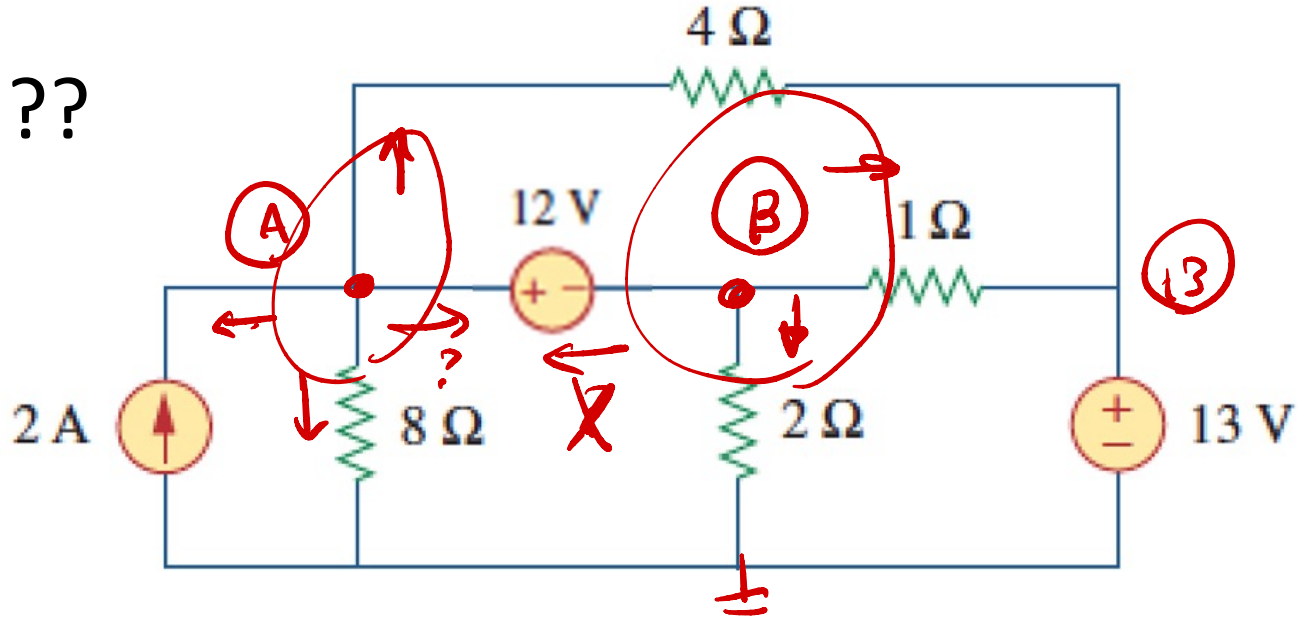
Extension #4 – multiple V-only branches

- There might be an obvious solution

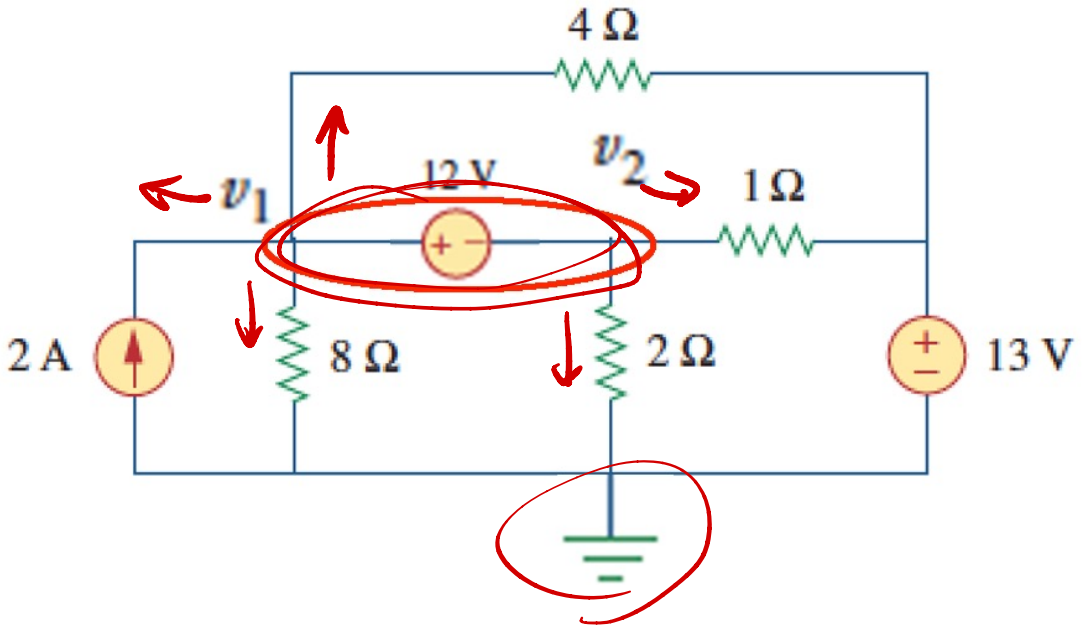




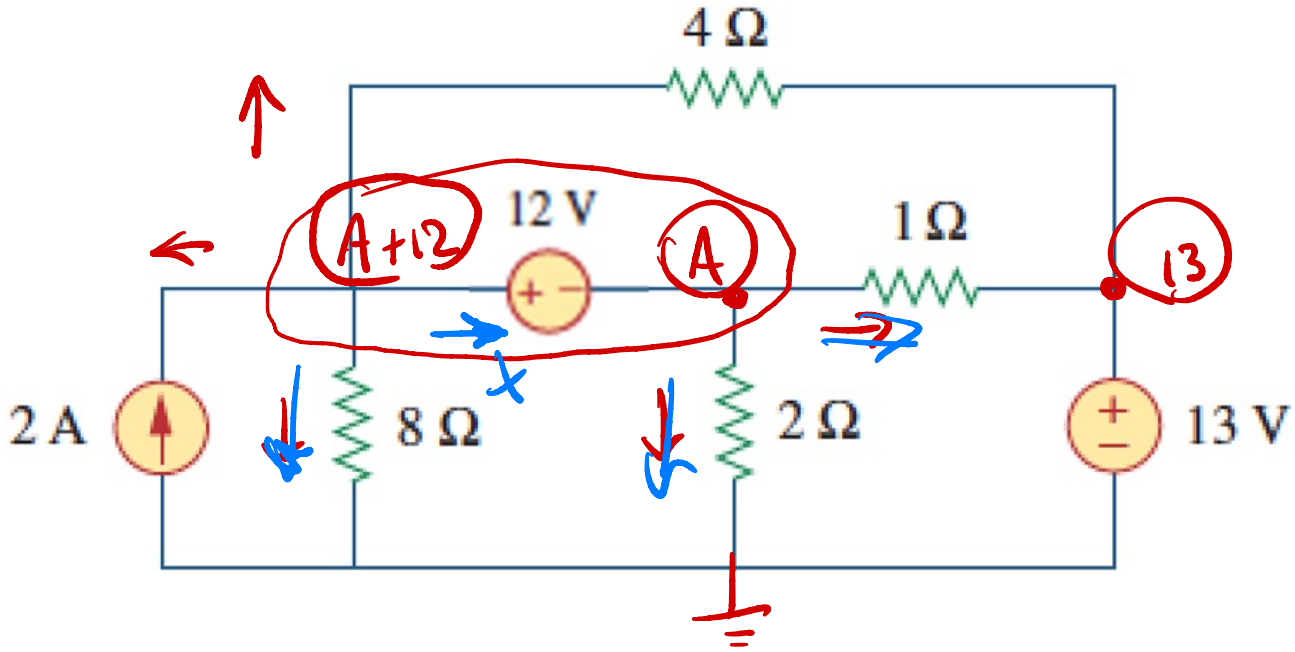
But sometimes ??



- Define a "supernode" (a cutset)
- Apply KCL on it
- Relate the voltages across it

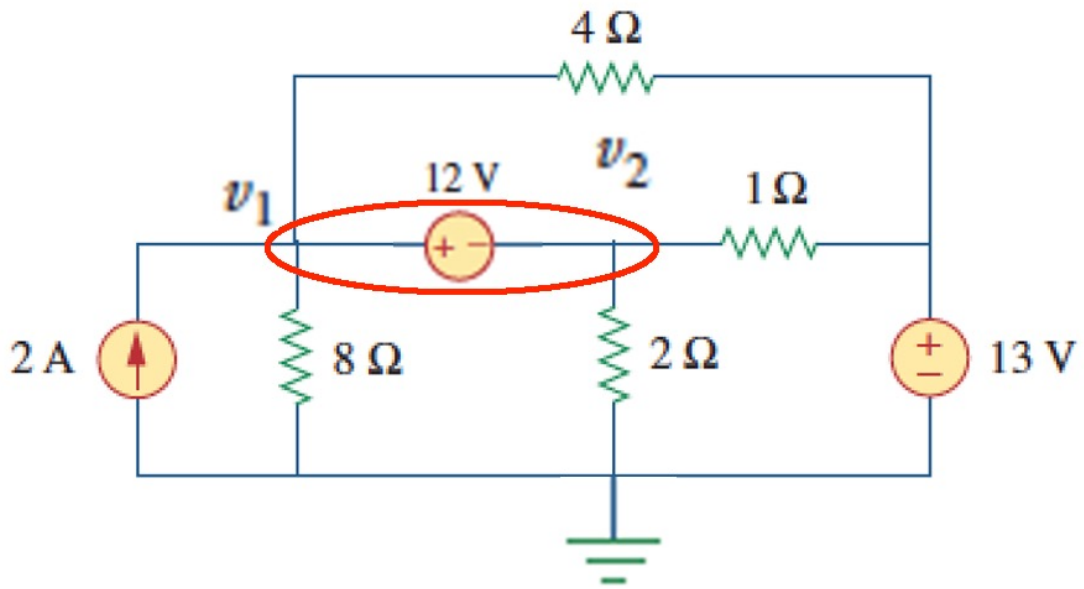


Example (details on next slide)



KCL @ supernode:

$$\frac{A}{2} + \frac{A-13}{1} + \frac{A+12}{8} - 2 + \frac{A+12-13}{4} = 0$$



Relate nodes:

$v_2 = v_1 - 12$

Node equation:

$$\frac{v_1}{8} - 2 + \frac{v_1 - 13}{4} + \frac{v_2 - 13}{1} + \frac{v_2}{2} = 0$$

$$3v_1 + 12v_2 = 146$$

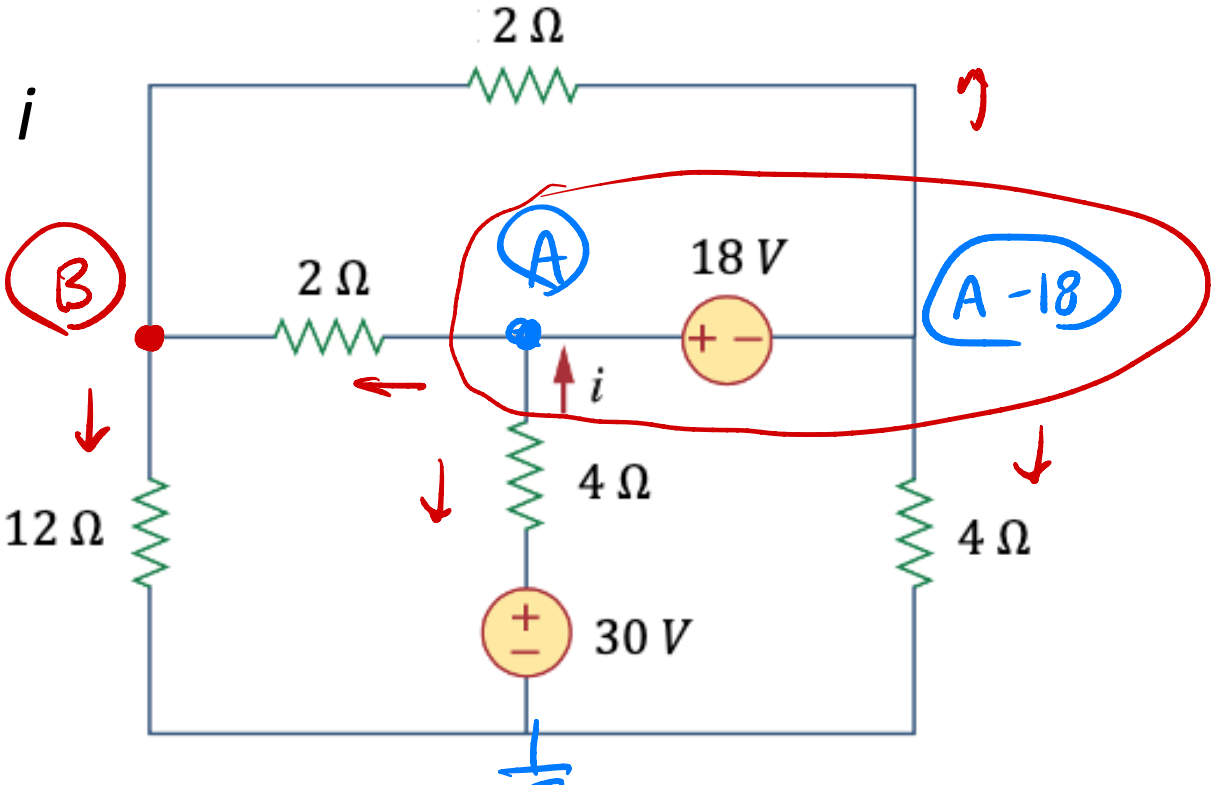
$$3v_1 + 12(v_1 - 12) = 146$$

$$15v_1 = 290$$

$$v_1 = 19\frac{1}{3}$$

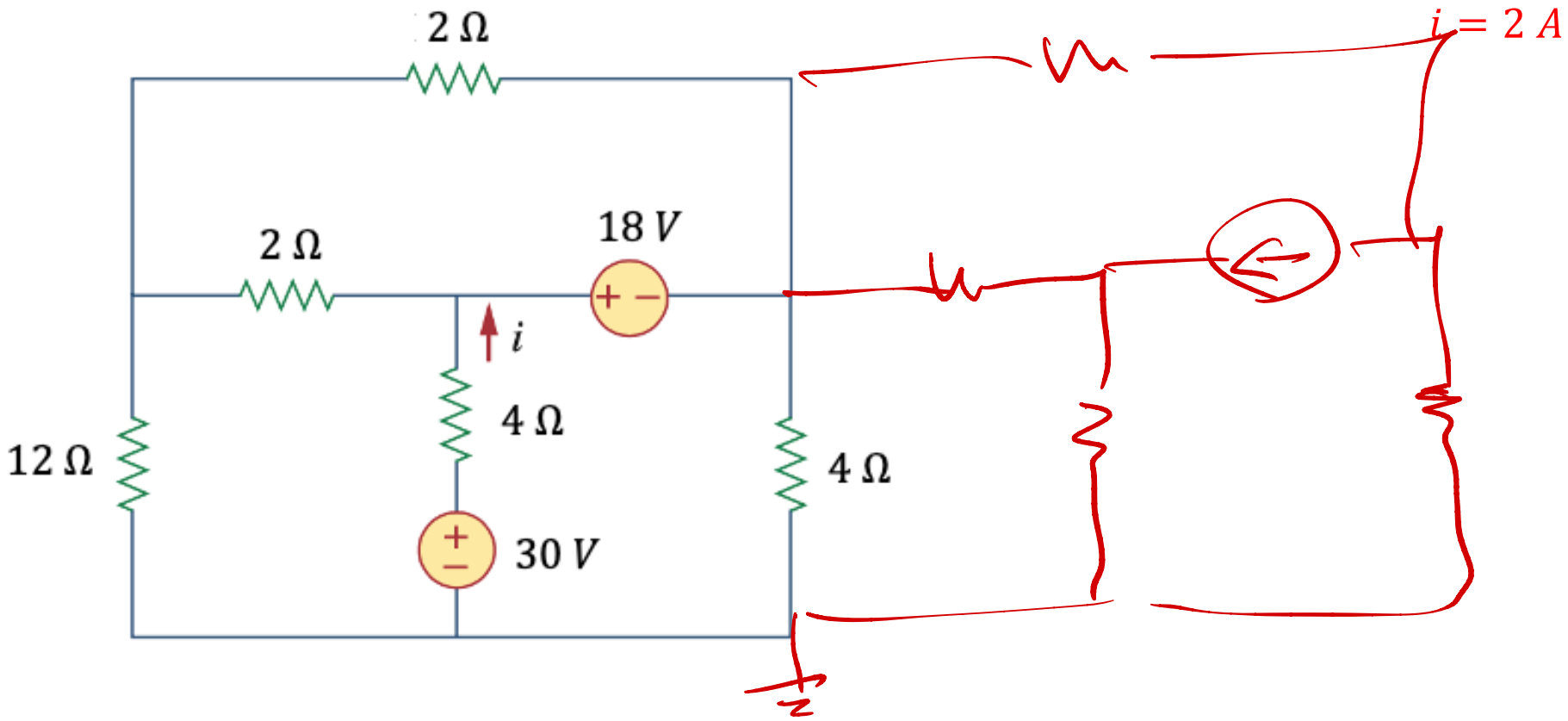
$$v_2 = 7\frac{1}{3}$$

Example: find *i*

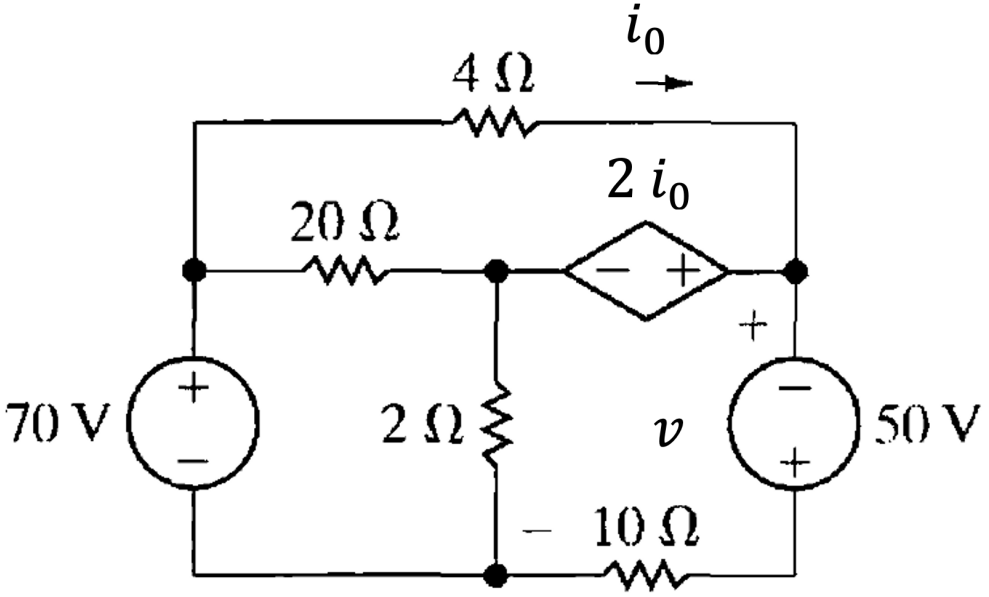


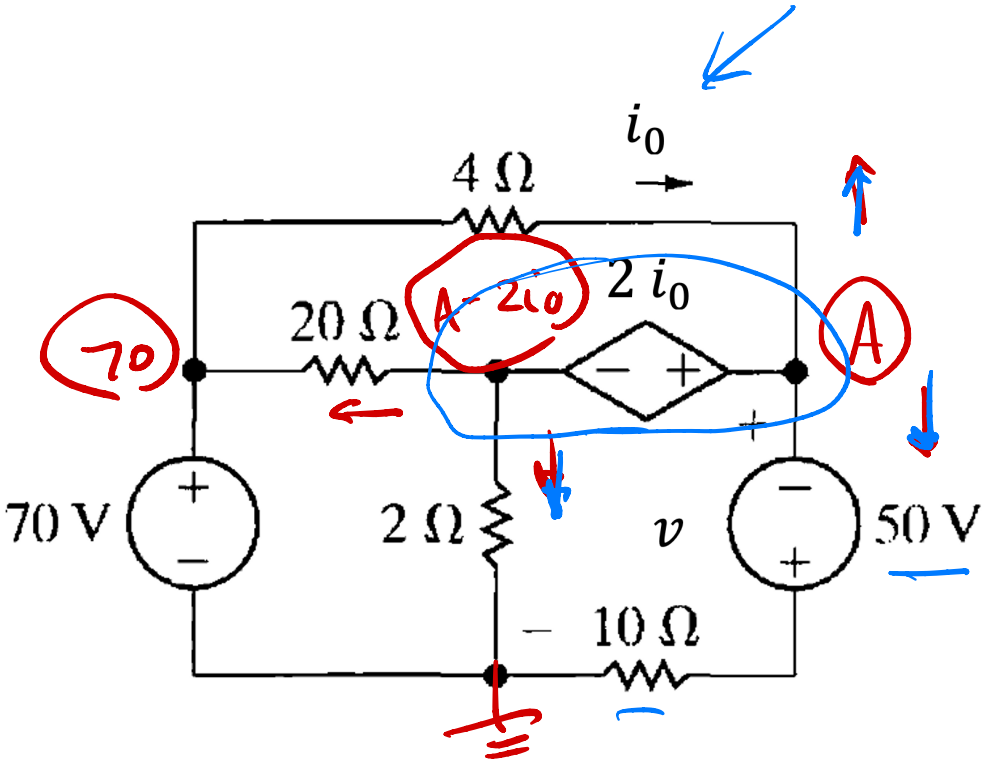
n.d. B : $\frac{B}{12} + \frac{B-A}{2} + \frac{B-(A-18)}{2} = 0$

sq. n.d. : $\frac{A-B}{2} + \frac{A-30}{4} + \frac{A-18}{4} + \frac{A-18-B}{2} = 0$


2 Ω
2 Ω
18 V
i
4 Ω
12 Ω
4 Ω
30 V
i = 2 A

Example: find v





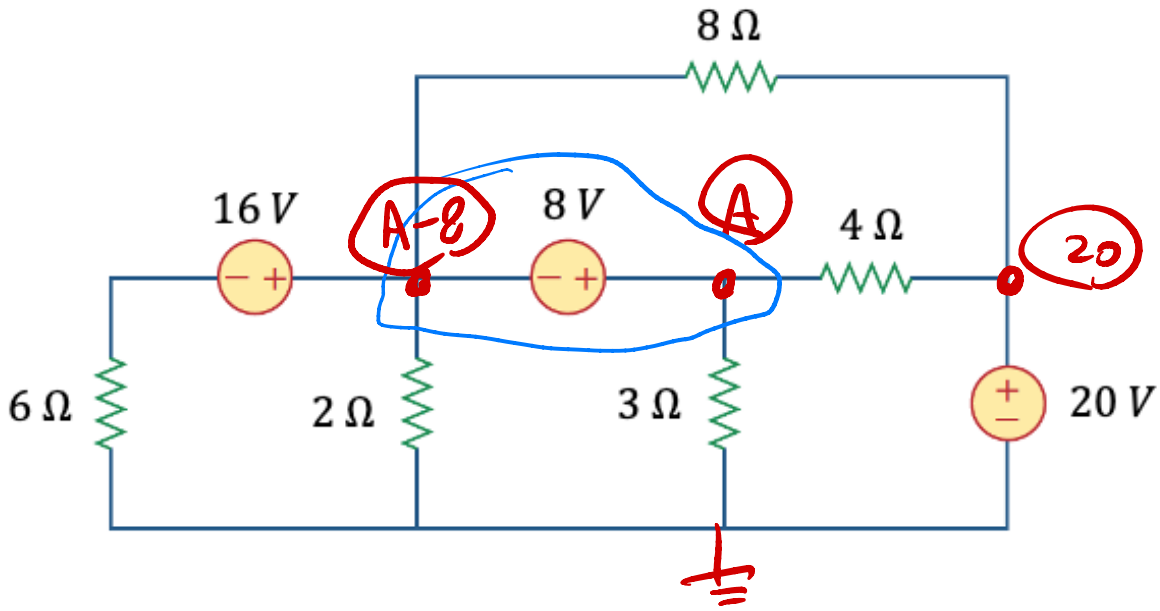
$v = 30\ V$

$$\frac{A+50}{10} + \frac{A-70}{4} + \frac{A-2i_0}{2} + \frac{A-2i_0-70}{20} = 0$$

$$i_0 = \frac{70-A}{4}$$

48 W

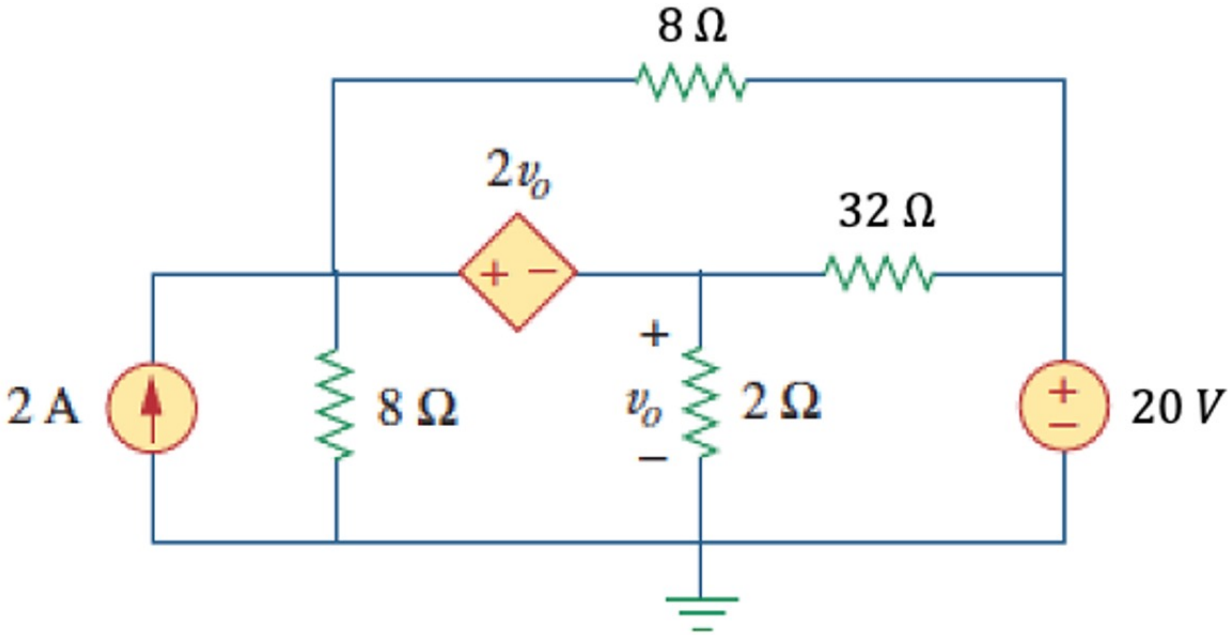
Practice problem: find the power of the 3 Ω resistor



$$\frac{A-20}{4} + \frac{A}{3} + \frac{A-8}{2} + \frac{A-8-16}{6} + \frac{A-8-20}{8} = 0$$

$v_0 =$

Practice problem: find v_o



$v_0 =$

Practice problem : find v_o