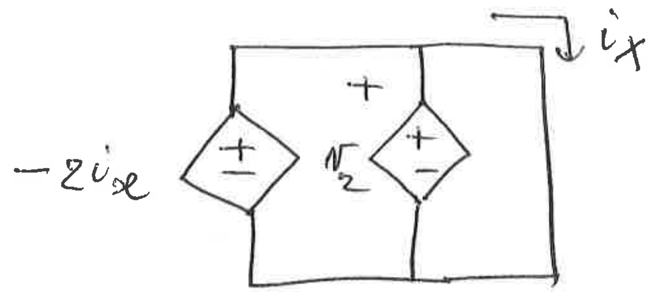
Problem 2.24

Review for Test 1

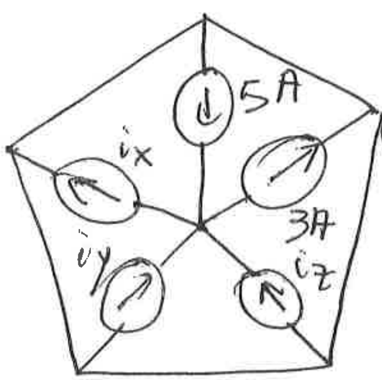
$i_x = -1\,mA$, calculate v_2



→ $v_2 = -2i_x = 2\,mV$

Problem 3.8

(a) Find i_x if $i_y = 2A$, $i_z = 0$



KCL: $3 + i_x = 5 + i_y + i_z$

→ $i_x = 2 + i_y + i_z = 4A$

(b) Find i_y if $i_x = 2A$, $i_z = 2i_y$

$i_y = 3 + i_x - 5 - i_z$

$= -2 + 2 - 2i_y$

→ $i_y = 0$

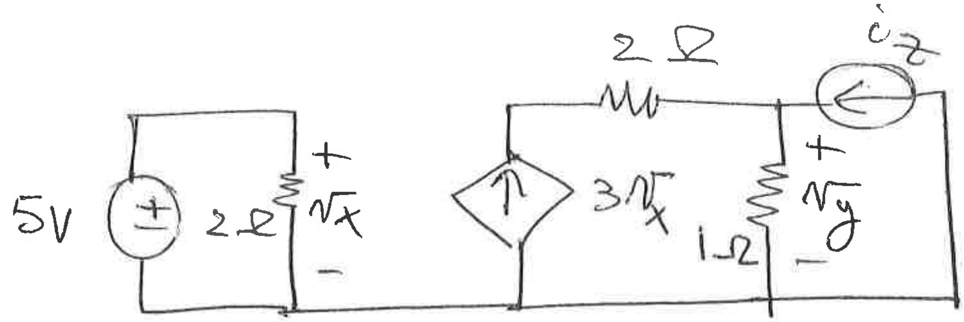
(c) Find i_z if $i_x = i_y = i_z$

$5 + i_y + i_z = 3 + i_x$

$5 + 2i_x = 3 + i_x$

→ $i_x = -2A$

Problem 3.13



(a) Calculate v_y if $i_z = -3A$.

$$v_y = 3v_x + i_z$$

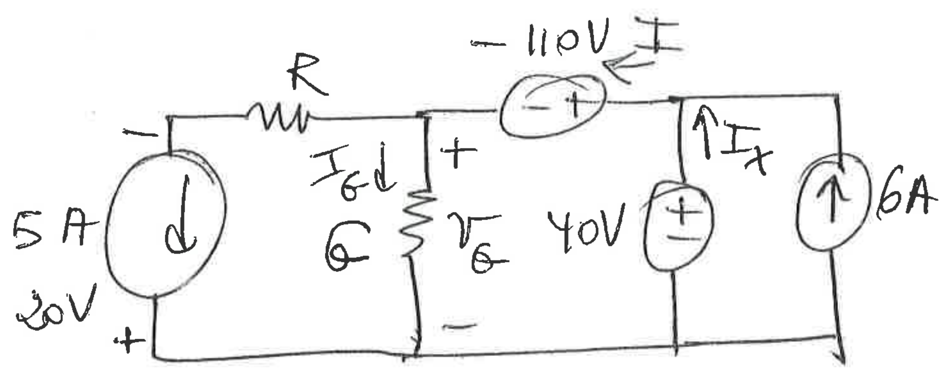
$v_x = 5$ $i_z = -3A \Rightarrow v_y = 15 - 3 = 12V$

(b) What voltage would need to replace the 5V source to obtain $v_y = -6V$ if $i_z = 0.5A$?

$$v_y = 3v_x + \underset{0.5}{i_z} = -6 \rightarrow \boxed{v_x = -2.167V}$$

Problem 3.15

Find R & G in circuit below if the 5A source is supplying 100 W and the 40 V source is supplying 500 W



5A 100W → Terminal voltage 20V

40V 500W → $I_x = 12.5A$

(1) KVL $-40 - 110 + R(5) - 20 = 0$

$\rightarrow$ $\boxed{R = 34\,\Omega}$

(2) KVL $-V_G - (-110) + 40 = 0$

$\rightarrow$ $\boxed{V_G = 150V}$

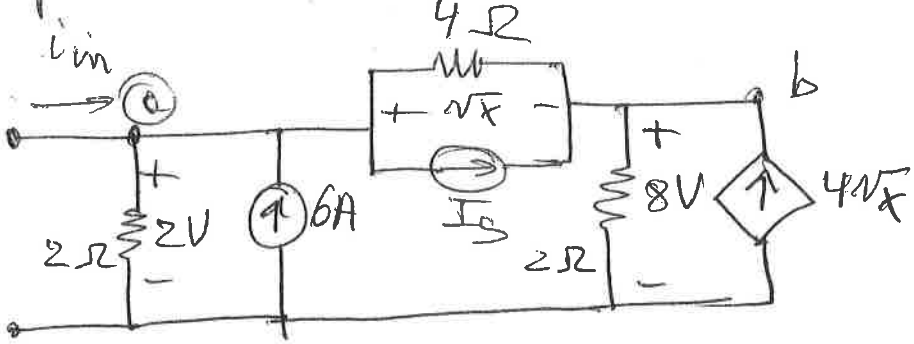
$I = I_x + 6 = 18.5A$

$\rightarrow I_G = 13.5A = G\,V_G$

$\rightarrow$ $\boxed{G = \frac{13.5}{150} = 90\,mS}$

Problem 3.20

Use ohm & Kirchhoff's law in the circuit below to find v_x, i_{in}, I_S, the power provided by the dependent source.



ⓐ KVL $-2 + v_x + 8 = 0$

$$\boxed{v_x = -6V}$$

ⓑ KCL at ⓐ $i_{in} + 6 = \frac{v_x}{4} + \overset{?}{I_S} + \frac{2}{2} \rightarrow \boxed{i_{in} = 23A}$

ⓒ KCL at ⓑ

$$I_S + 4v_x + \frac{v_x}{4} = \frac{8}{2} = 4$$

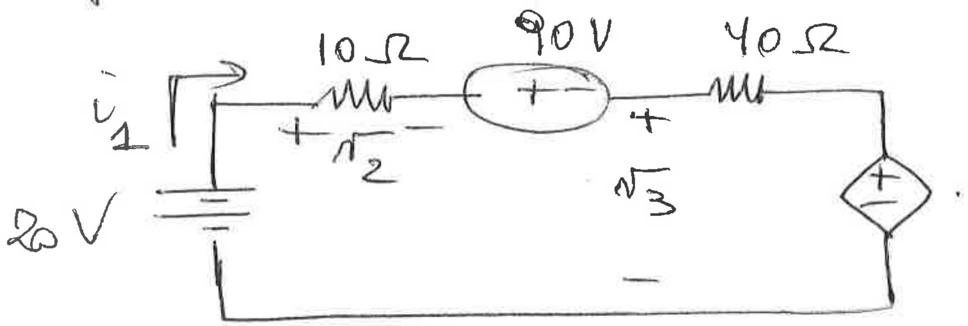
$$\rightarrow \boxed{I_S = 29.5A}$$

Power provided by dependent source

$$\boxed{8(4v_x) = -192W}$$

Problem 3.26

Find i_1 in the circuit below if the dependent voltage source is labeled (a) $2v_2$; (b) $1.5v_3$; (c) $-15i_1$



(a) KVL $-20 + 10i_1 + 90 + 40i_1 + 2v_2 = 0$

$v_2 = 10i_1$

$\rightarrow 70 + 70i_1 = 0$

$\rightarrow$ $i_1 = -1A$

(b) KVL $-20 + 10i_1 + 90 + 40i_1 + 1.5v_3 = 0$

$v_3 = 20 - 10i_1 - 90 = -70 - 10i_1$

or $v_3 = 40i_1 + 1.5v_3$

$\rightarrow v_3 = -80i_1$

$\rightarrow$ $i_1 = 1A$

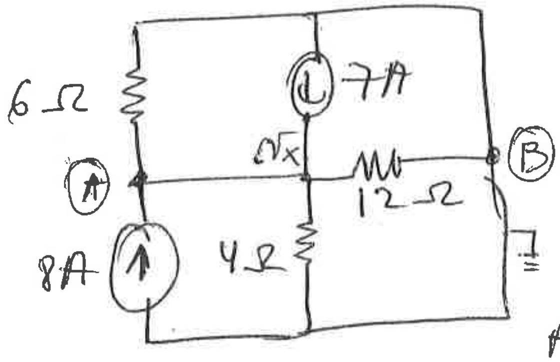
(c) KVL

$-20 + 10i_1 + 90 + 40i_1 - 15i_1 = 0$

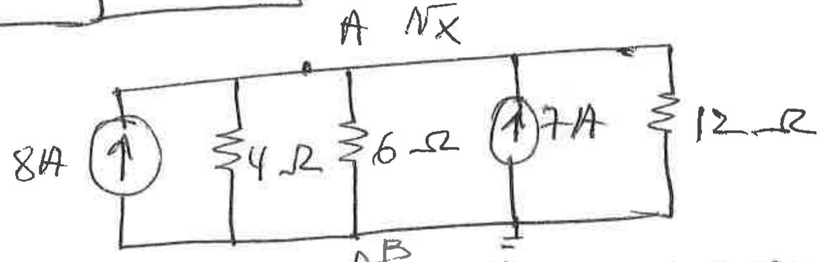
$\rightarrow$ $i_1 = -2A$

Problem 3.37

Find the power absorbed by each element in the single-node-pair circuit shown below, and show that the sum is equal to zero.



redraw circuit



This is a single-node-pair circuit.

Center node

$$8 - \frac{v_x}{6} + 7 - \frac{v_x}{12} - \frac{v_x}{4} = 0 \Rightarrow v_x = 30V$$

Power absorbed by each element

$P_{8A} = -8v_x = -240W$

$P_{6\Omega} = v_x^2/6 = 150W$

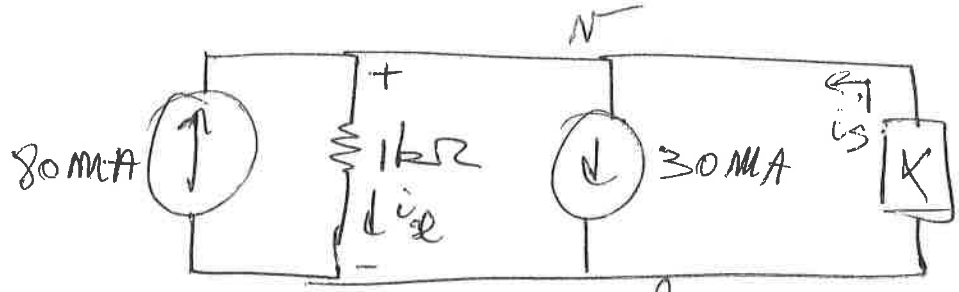
$P_{8A} = -7v_x = -210W$

$P_{12\Omega} = v_x^2/12 = 75W$

$P_{4\Omega} = v_x^2/4 = 225W$

SUM = 0

Problem 3.38



Find power absorbed by element X if it is

(a) a 4kΩ resistor

(b) 20 mA independent source, arrow pointing down

(c) dependent current source 

(d) 60V independent voltage source 

(a) $80\cdot 10^{-3} - 30\cdot 10^{-3} = \frac{v}{1000} + \frac{v}{4000} \Rightarrow v = 40V$

$P_{4k\Omega} = \frac{v^2}{10^3} = 400 mW$

(b) $80\cdot 10^{-3} - 30\cdot 10^{-3} - 20\cdot 10^{-3} = \frac{v}{10^3} \Rightarrow v = 30V \Rightarrow P_{20mA} = v\, 20\cdot 10^{-3} = 600 mW$

(c) $80\cdot 10^{-3} - 30\cdot 10^{-3} - 2i_x = v/1000$ $\quad i_x = v/1000$

$\rightarrow v = 16.67V \Rightarrow P = v\, 2i_x = 555.8 mW$

(d) $i_x = \frac{60}{1000} = 60 mA$

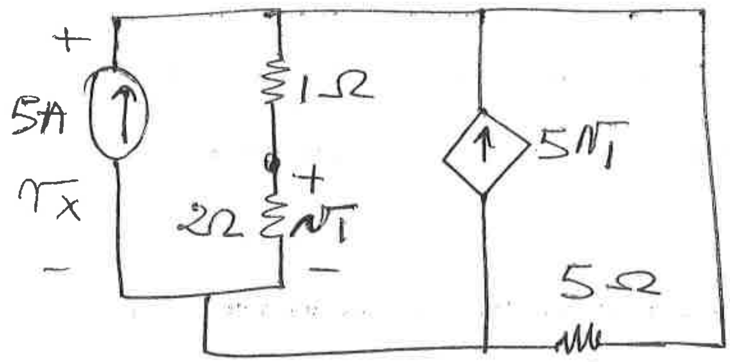
KLC $\quad 80 - 30 + i_s - i_x = 0$

$\rightarrow i_s = 10 mA$

$P_{60V} = 60(-10)\, mW = -600 mW$

Problem 2, 41

Find power absorbed by 5 Ω resistor in circuit below



KCL $\quad 5 + 5v_1 - \frac{v_x}{(1+2)} - \frac{v_x}{5} = 0$

$v_1 = \frac{2}{2+1} v_x = \frac{2v_x}{3}$

⇒ solve

$v_x = -1.786\,V$

Power absorbed by 5 Ω resistor is

$\frac{v_x^2}{5} = 638\,mW$