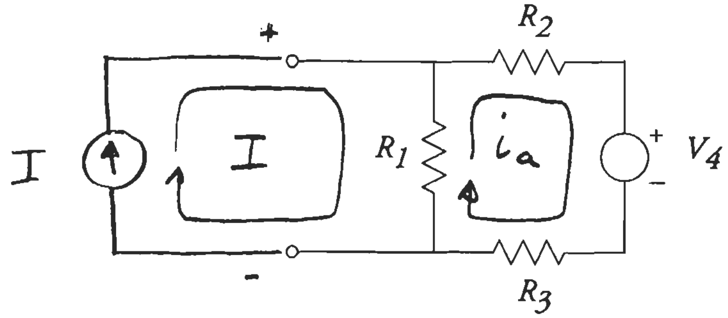
1. Add a test current to the terminals, and use the loop method to solve:



Apply KVL around the i_a loop:

$$(R_1 + R_2 + R_3)\, i_a - I R_1 + V_4 = 0$$

$$\Rightarrow \quad (R_1 + R_2 + R_3)\, i_a = I R_1 - V_4$$

Plug in numbers:

$$(3 + 4 + 2)\, i_a = 3I - 12$$

$$\Rightarrow \quad i_a = \frac{1}{3} I - \frac{4}{3}$$

Now, the voltage across the terminals is

$$v = (I - i_a) R_1$$

$$= \left[I - \left(\tfrac{1}{3} I - \tfrac{4}{3} \right) \right] 3$$

$$= 2I + 4 = V_T + R_T I$$

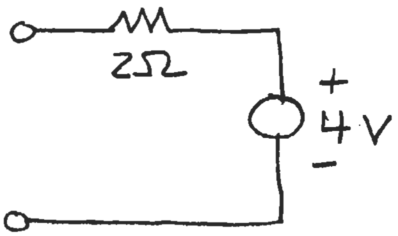
$$\Rightarrow \quad \boxed{R_T = 2\,\Omega, \quad V_T = 4\text{ V}}$$

Also, $I_N = V_T / R_T$, $R_N = R_T$. Therefore,

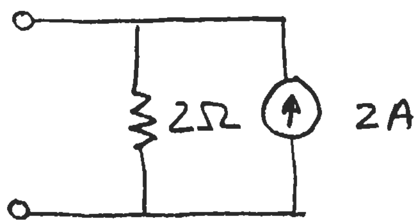
$$\boxed{I_N = 2A, \quad R_N = 2\Omega}$$

Therefore, the equivalent circuits are:

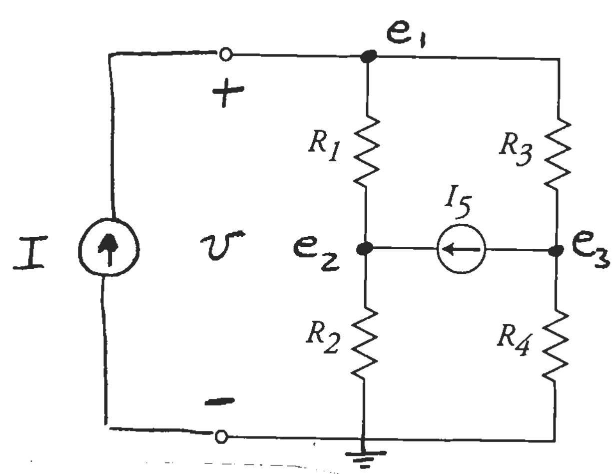
Thevenin:



Norton:



2. As above, apply a test current. This time, I'll use node method. (There are more unknown nodes with node method, but the loop method is trickier, due to current source in circuit.)



The node equations are

e_1: $(G_1 + G_3)\, e_1 \quad - G_1\, e_2 \quad - G_3\, e_3 = I$

e_2: $- G_2 e_1 + (G_1 + G_2)\, e_2 \quad + 0\, e_2 = I_5$

e_3: $- G_3 e_1 + \quad 0\, e_2 + (G_3 + G_4) e_3 = -I_5$

Plugging in numbers:

$$1.25\, e_1 - 1\, e_2 - 0.25\, e_3 = I$$
$$-1\, e_1 + 1.25\, e_2 + 0\, e_3 = 10$$
$$-0.25\, e_1 + 0\, e_2 + 1.25\, e_3 = -10$$

Solve by Cramer's rule:

$$v = e_1 = \frac{\begin{vmatrix} I & -1 & -0.25 \\ 10 & 1.25 & 0 \\ -10 & 0 & 1.25 \end{vmatrix}}{\begin{vmatrix} 1.25 & -1 & -0.25 \\ -1 & 1.25 & 0 \\ -0.25 & 0 & 1.25 \end{vmatrix}}$$

$$= \frac{1.5625\, I + 9.375}{0.625}$$

$$= 15 + 2.5\, I$$

$$\Rightarrow \boxed{\begin{array}{c} V_T = 15\text{ V}, \quad R_T = R_N = 2.5\,\Omega \\ I_N = V_T / R_T = 6\text{ A} \end{array}}$$

No. 5505 Engineer's Computation Pad

ALVIN