HOMEWORK #2

1)

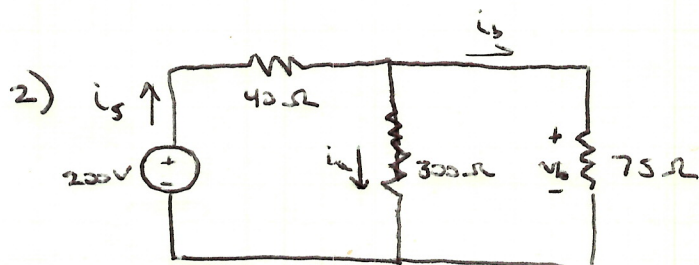| i (mA)	v(V)
-10	-120
-5	-60
5	60
10	120
15	180
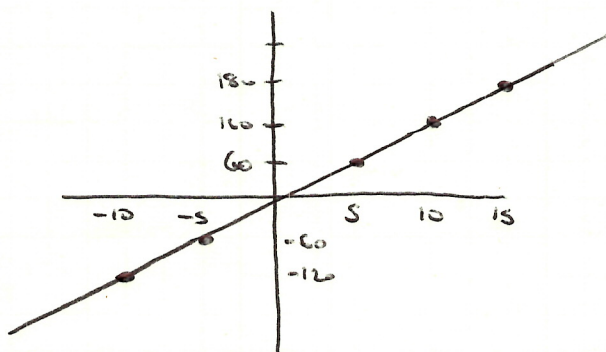
$$v = iR$$

$$R = \frac{v}{i}$$

$$= \frac{60}{0.005}$$

$$\boxed{R = 12\,k\Omega}$$

2)

a) KVL: $v_a = v_b$

OHMS LAW: $v_a = 300\,i_a$
$v_b = 75\,i_b$

$\bullet \quad i_b = 4\,i_a$

KCL: $i_s = i_a + i_b = 5\,i_a$

KVL: $200 - 40\,i_s - 300\,i_a = 0$
$200 - 40(5\,i_a) - 300\,i_a = 0$

$500\,i_a = 200 \Rightarrow \boxed{i_a = \frac{200}{500} = 0.4\,A}$

b) $i_b = 4\,i_a = 4(0.4A) = \boxed{1.6A}$

c) $v_a = (300\,\Omega)\,i_a = (300\,\Omega)(0.4A) = \boxed{120V}$

d) $P_a = (300)(0.4)^2 = \boxed{48W}$

$P_b = (75)(1.6)^2 = \boxed{192W}$

$P_{40} = (40)\left[5(0.4)\right]^2 = \boxed{160W}$

e) $P_s = (200)(2) = \boxed{400W}$

CHECK

3)

a) Given $i_0 = 2A$
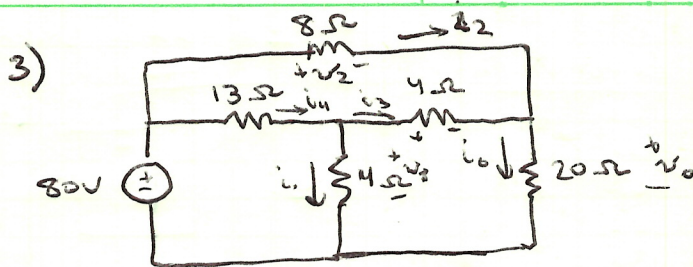
$$V_0 = (2A)(20\Omega) = 40V$$

$$V_2 = 80V - 40V = 40V$$

$$i_2 = \frac{40V}{8\Omega} = 5A$$

~~$i_3 = i_2 = i_0$~~

$$i_3 + i_2 = i_0 \implies i_3 = 2A - 5A = -3A$$

$$V_3 = (-3A)(4\Omega) = -12V$$

KVL: $V_1 + V_3 - V_0 = 0$

$$V_1 = (-12V) + (40V)$$

$$= 28V$$

$$\boxed{i_1 = \frac{28V}{4\Omega} = 7A}$$

b) Need $i_4 = i_1 + i_3 = (7A) + (-3A) = 4A$

$P = i^2 R$:

$P_0 = (2A)^2 \, 20\Omega = 80W$	$P_3 = (-3A)^2 \, 4\Omega = 36W$
$P_1 = (7A)^2 \, 4\Omega = 196W$	$P_4 = (4A)^2 \, 13\Omega = 208W$
$P_2 = (5A)^2 \, 8\Omega = 200W$	

c) $\Sum P = 720W$ ← ✓

$$i_{source} = i_2 + i_4 = 9A$$

$$\Sum P_{source} = VI = (80V)(9A) = 720W$$

4)
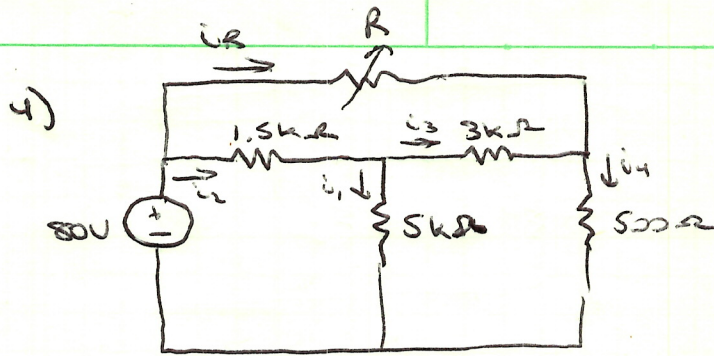
GIVEN: $i_1 = 10mA$, find R

$v_1 = (10mA)(5k\Omega) = 50V$

KVL: $80V - v_2 - 50V = 0 \Rightarrow v_2 = 30V$

$i_2 = \frac{30V}{1.5k\Omega} = 20mA$

KCL: $i_2 = i_3 + 0.01A$

$i_3 = 10mA$

$v_3 = (10mA)(3k\Omega) = 30V$

KVL: $v_1 - v_3 - v_4 = 0 \Rightarrow v_4 = 20V$

$i_4 = \frac{20V}{500\Omega} = 40mA$

KCL: $i_3 + i_R = i_4$

$i_R = 30mA$

KVL: $80V - v_R - v_4 = 0$

$v_R = 60V$

$$\boxed{R = \frac{60V}{30mA} = 2k\Omega}$$
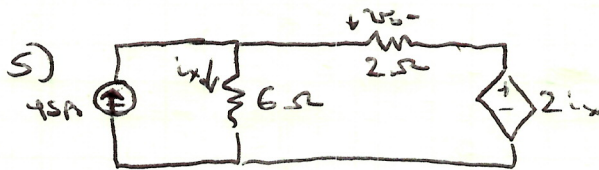
5)

KVL: $v_x - v_0 - 2i_x = 0 \Big\} \quad v_0 = 4i_x$

and $v_v = 6i_x$

$i_1 = \frac{v_0}{2}$

KCL: $45A = i_x + i_1 = \frac{v_0}{4} + \frac{v_0}{2} = \frac{3}{4}v_0 \Rightarrow v_0 = \frac{45A}{\left(\frac{3}{4}\right)} = 60V$

And $v_v = (i_0)(6\Omega) = 6\frac{v_0}{4} = 90V$

So: $P_{45A} = (45A)(v_x) = 4050W$

$P_{2i_x} = (2i_x)(-i_1) = 2\frac{v_0}{4}\left(-\frac{v_0}{2}\right) = -900W$

The only independent voltage source is $45\bigoplus$, so the total power supplied is $\boxed{4050W}$