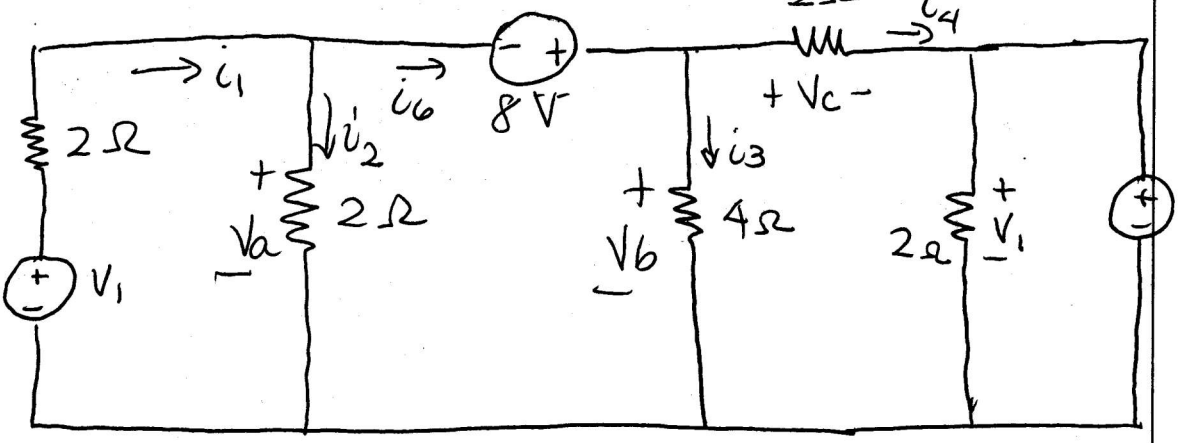
2.70 Find the value of V_1 in the circuit so that $V_a = 0$ V.



KVL $-V_1 + 2i_1 + V_a = 0$

$V_a = 0$

$V_1 = 2i_1$

KVL:

$-V_a + -8 + V_b = 0$

$V_a = 0$

$V_b = 8V$

KCL:

$i_1 = i_2 + i_6$

$i_2 = \frac{V_a}{2} = 0$

$i_2 = 0$

$i_1 = i_6$

KVL:

$-V_b + V_c + V_1 = 0$

$V_b = 8$

$-8 + V_c + V_1 = 0$

$V_c + V_1 = 8$

Ohm: $V_c = 2i_4$

$V_b = 4i_3$

$8 = 4i_3$

$i_3 = 2A$

KCL: $i_6 = i_3 + i_4$

$i_1 = 2 + i_4$

$2i_4 + V_1 = 8$

$2i_4 + 2i_1 = 8$

$2i_4 + 2(2 + i_4) = 8$

$i_4 = 1A$

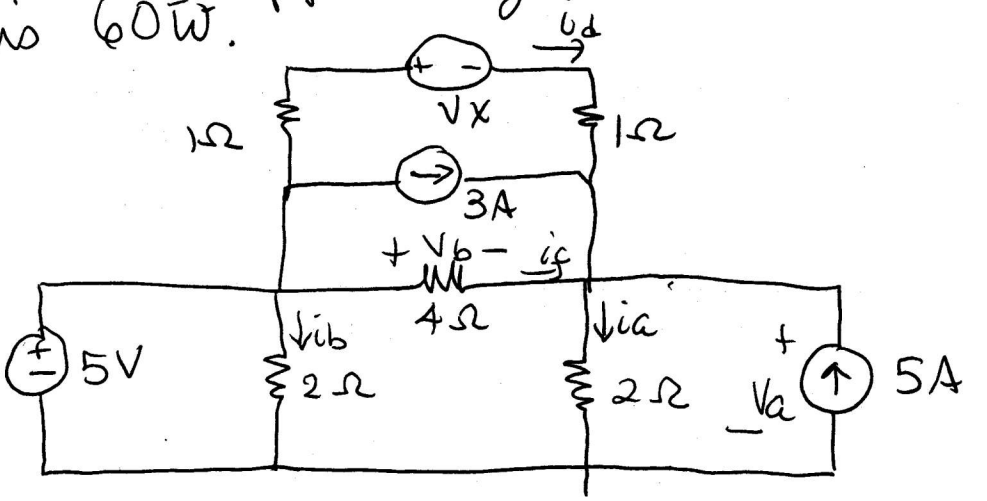
$$i_4 = 1A.$$

$$i_1 = 2 + i_4 = 2 + 1 = 3$$

$$V_1 = 2 i_1 = 2(3) = 6V$$

$$\boxed{V_1 = 6V}$$

2.71 Find the value of V_x if the power supplied by the 5-A source is 60W.



$$p = -Va(5)$$

$$-60W = -Va(5)$$

$$\boxed{Va = 12V}$$

$$ia = \frac{Va}{2}$$

$$ia = \frac{12}{2} = 6A$$

$$\boxed{ia = 6A}$$

$$ib = 5V/2\Omega$$

$$\boxed{ib = 2.5A}$$

KVL

$$-5 + Vb + Va = 0$$

$$-5 + Vb + 12 = 0$$

$$\boxed{Vb = 7V}$$

$$i_c = \frac{V_b}{4} = \frac{7}{4} = 1.75\,A$$

$$\boxed{i_c = 1.75\,A}$$

KCL:

$$i_d + 3 + i_c - i_a + 5 = 0$$

$$i_d + 3 + 1.75 - 6 + 5 = 0$$

$$\boxed{i_d = 3.75\,A}$$

KVL:

$$-V_b + i_d(1) + V_x + 1(i_d) = 0$$

$$-7 + (-3.75) + V_x + (-3.75) = 0$$

$$\boxed{V_x = 14.5\,V}$$