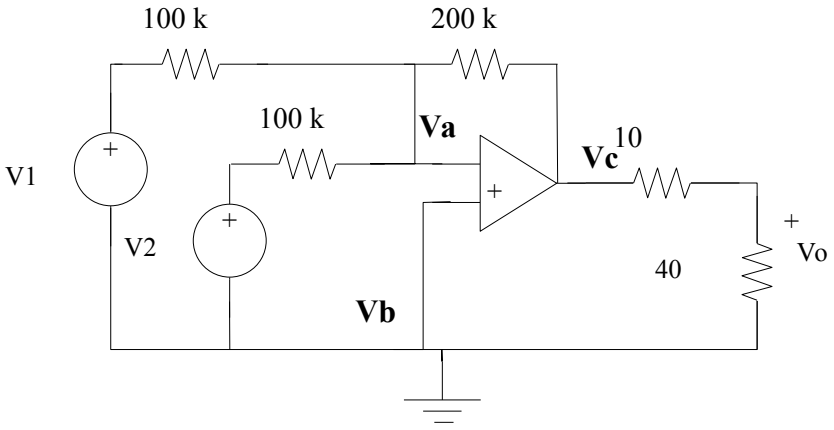
Chapter 5, Solution 40

Determine V_o in terms of V_1 and V_2.



Step 1. Label the reference and node voltages in the circuit, see above. Note we now can consider nodes a and b, we cannot write a node equation at c without introducing another unknown. The node equation at a is $[(V_a–V_1)/10^5] + [(V_a–V_2)/10^5] + 0 + [(V_a–V_c)/2x10^5] = 0$. At b it is clear that $V_b = 0$. Since we have two equations and three unknowns, we need another equation. We do get that from the constraint equation, $V_a = V_b$. After we find V_c in terms of V_1 and V_2, we then can determine V_o which is equal to $[(V_c–0)/50]$ times 40.

Step 2. Letting $V_a = V_b = 0$, the first equation can be simplified to,

$$[–V_1/10^5] + [–V_2/10^5] + [–V_c/2x10^5] = 0$$

Taking V_c to the other side of the equation and multiplying everything by $2x10^5$, we get,

$$V_c = –2V_1 – 2V_2$$

Now we can find V_o which is equal to $(40/50)V_c = 0.8[–2V_1–2V_2]$

$$V_o = \mathbf{–1.6V_1–1.6V_2}.$$