Chapter 5, Solution 10.

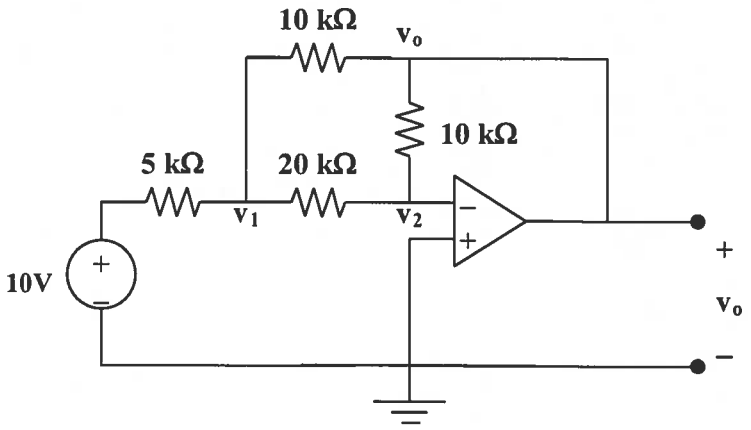
Since no current enters the op amp, the voltage at the input of the op amp is v_s. Hence

$$v_s = v_o \left(\frac{10}{10+10} \right) = \frac{v_o}{2} \longrightarrow \frac{v_o}{v_s} = \mathbf{2}$$

Chapter 5, Solution 14.

Transform the current source as shown below. At node 1,

$$\frac{10 - v_1}{5} = \frac{v_1 - v_2}{20} + \frac{v_1 - v_o}{10}$$

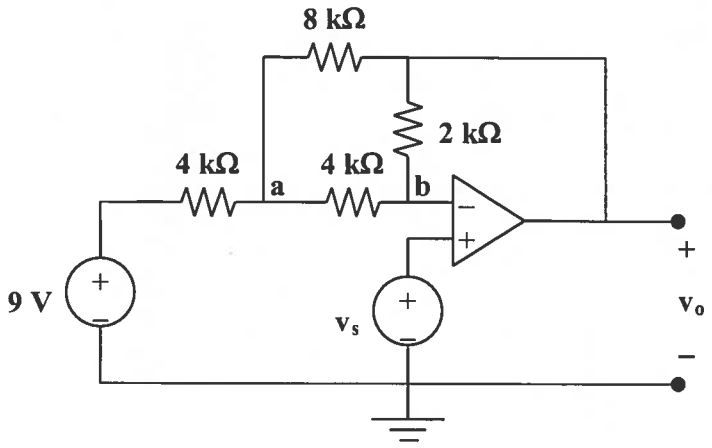


But $v_2 = 0$. Hence $40 - 4v_1 = v_1 + 2v_1 - 2v_o \longrightarrow$ $40 = 7v_1 - 2v_o$ (1)

At node 2, $\frac{v_1 - v_2}{20} = \frac{v_2 - v_o}{10}$, $v_2 = 0$ or $v_1 = -2v_o$ (2)

From (1) and (2), $40 = -14v_o - 2v_o \longrightarrow$ $v_o = \mathbf{-2.5V}$

Chapter 5, Solution 20.



At node a,

$$\frac{9-v_a}{4}=\frac{v_a-v_o}{8}+\frac{v_a-v_b}{4} \longrightarrow 18=5v_a-v_o-2v_b \qquad (1)$$

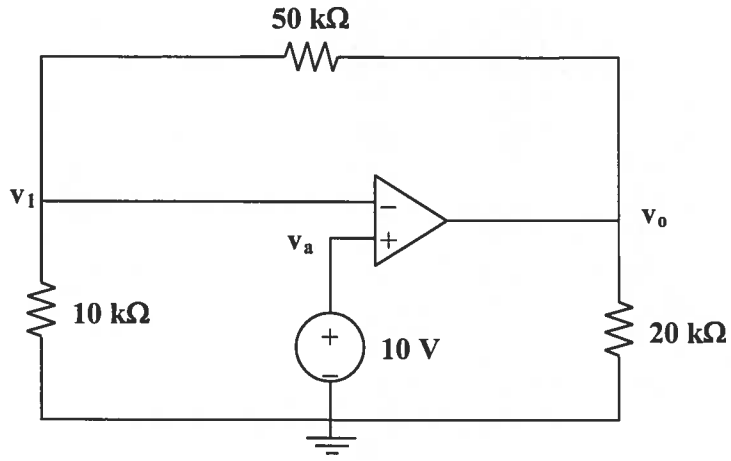
At node b,

$$\frac{v_a-v_b}{4}=\frac{v_b-v_o}{2} \longrightarrow v_a=3v_b-2v_o \qquad (2)$$

But $v_b = v_s = 2$ V; (2) becomes $v_a = 6 - 2v_o$ and (1) becomes

$$-18 = 30 - 10v_o - v_o - 4 \qquad v_o = -44/(-11) = \mathbf{4\ V}.$$

Chapter 5, Solution 28.



At node 1, $\frac{0 - v_1}{10k} = \frac{v_1 - v_o}{50k}$

But $v_1 = 10V$,

$-5v_1 = v_1 - v_o$, leads to $v_o = 6v_1 = \mathbf{60V}$

Alternatively, viewed as a noninverting amplifier,

$v_o = (1 + (50/10))\ (10V) = \mathbf{60V}$

$i_o = v_o/(20k) = 60/(20k) = \mathbf{3\ mA}$.

Chapter 5, Solution 30.

The output of the voltage becomes

$$v_o = v_i = 1.2\ \text{V}$$
$$(30\text{k} \| 20\text{k}) = 12\text{k}\Omega$$

By voltage division,

$$v_x = \frac{12}{12+60}(1.2) = 0.2\text{V}$$

$$i_x = \frac{v_x}{20\text{k}} = \frac{0.2}{20\text{k}} = \frac{20}{2\text{x}10^6} = \mathbf{10\mu A}$$

$$p = \frac{v_x^2}{R} = \frac{0.04}{20\text{k}} = \mathbf{2\mu W}.$$