Chapter 6, Solution 68.

A 10–V dc voltage is applied to an integrator with $\boldsymbol{R}$ = 50 kΩ, $\boldsymbol{C}$ = 100 μF at $\boldsymbol{t}$ = 0. How long will it take for the op amp to saturate if the saturation voltages are +12 V and –12 V? Assume that the initial capacitor voltage was zero.

Solution

$$v_o = -\frac{1}{RC}\int vi\, dt + v(0), \quad RC = 50 \times 10^3 \times 100 \times 10^{-6} = 5$$

$$v_o = -\frac{1}{5}\int_0^t 10dt + 0 = -2t$$

The op amp will saturate at $v_o = \pm 12$

$$-12 = -2t \longrightarrow \mathbf{t = 6s}$$