***P14.74.** Sketch the output voltage of the circuit shown in Figure P14.74 to scale versus time. Sometimes, an integrator circuit is used as a (approximate) pulse counter. Suppose that the output voltage is −10 V. How many input pulses have been applied (assuming that the pulses have an amplitude of 5 V and a duration of 2 ms, as shown in the figure)?

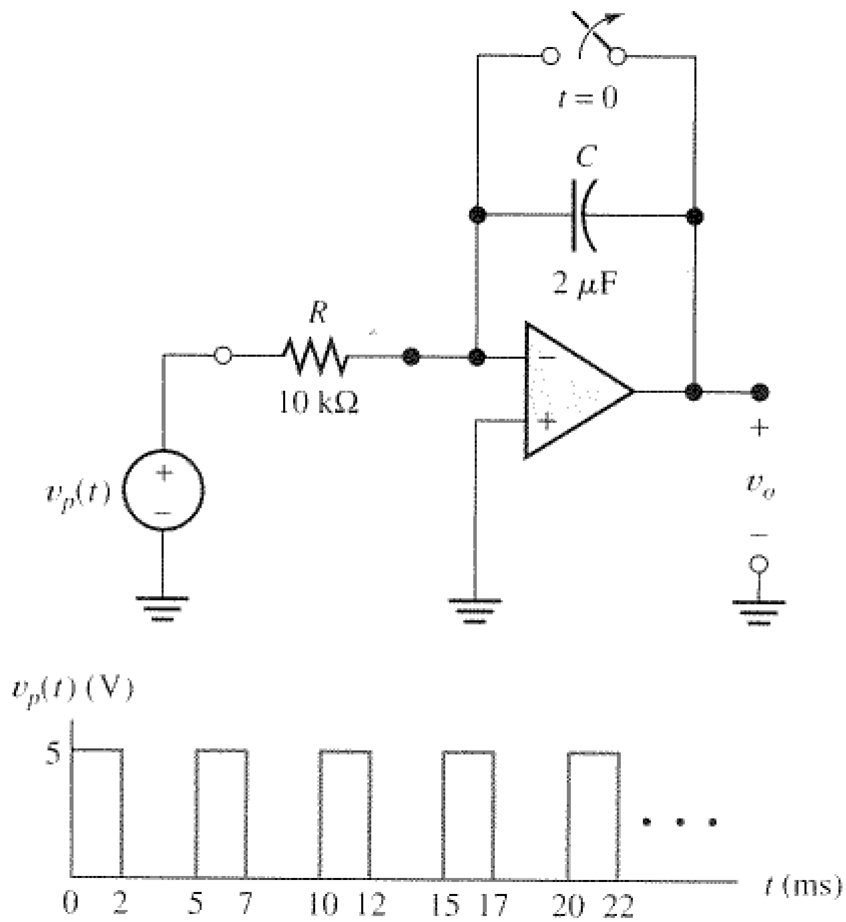
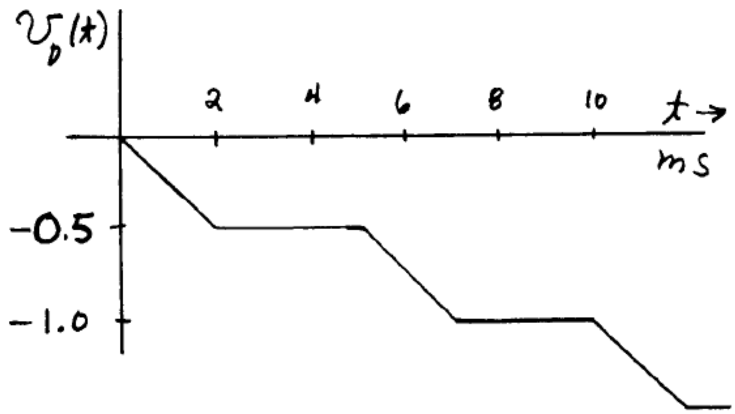



Figure P14.74

**P14.74*** This is an integrator circuit, and the output voltage is given by:

$$v_o(t) = -\frac{1}{RC}\int_0^t v_{in}(t)dt$$

$$v_o(t) = -50\int_0^t v_{in}(t)dt$$




Each pulse reduces $v_o$ by 0.5 V. Thus, 20 pulses are required to produce $v_o$ = -10V.

**P14.75.** Sketch the output voltage of the ideal op-amp circuit shown in Figure P14.75 to scale versus time.

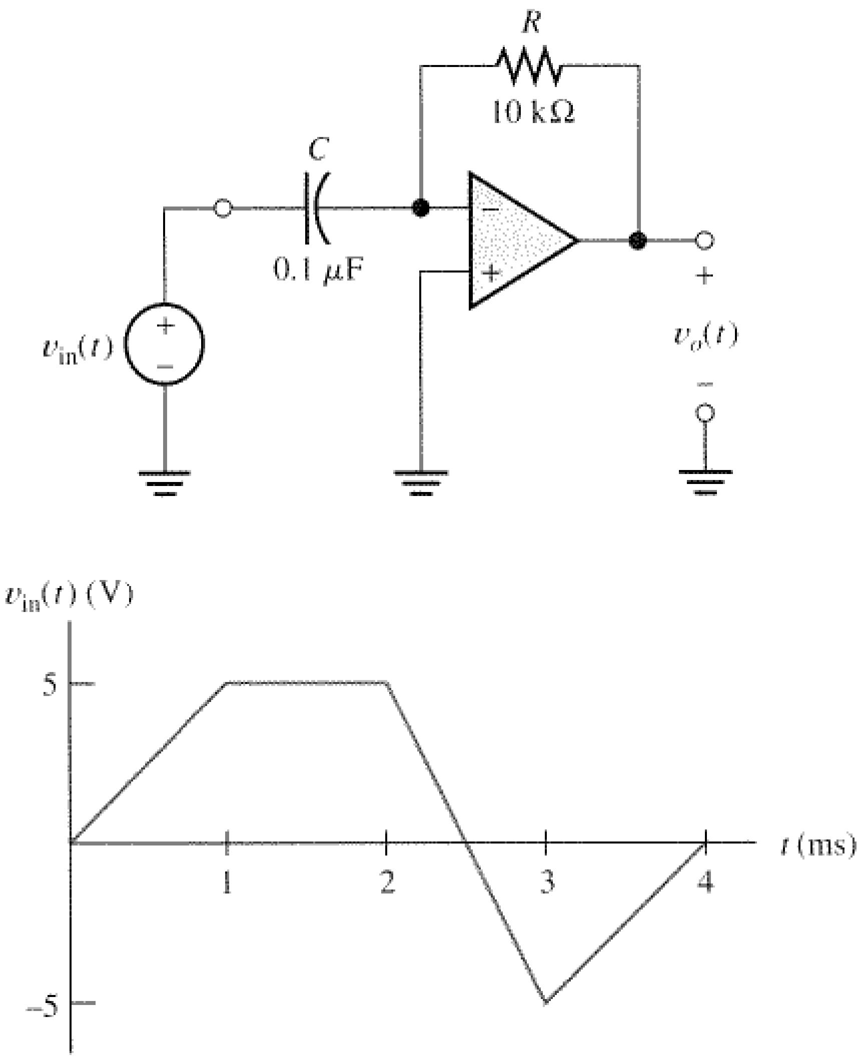



Figure P14.75

**P14.75** This is a differentiator circuit, and the output is given by:

$$v_o(t) = -RC\frac{dv_{in}(t)}{dt}$$

$$= -10^{-3}\frac{dv_{in}(t)}{dt}$$

A sketch of $v_o(t)$ versus is: