

**4.21. Solve:** Since  $\omega = (d\theta/dt)$  we have

$$\theta_f = \theta_i + \text{area under the } \omega\text{-versus-}t \text{ graph between } t_i \text{ and } t_f$$

From  $t = 0$  s to  $t = 2$  s, the area is  $\frac{1}{2}(20 \text{ rad/s})(2 \text{ s}) = 20$  rad. From  $t = 2$  s to  $t = 4$  s, the area is  $(20 \text{ rad/s})(2 \text{ s}) = 40$  rad. Thus, the area under the  $\omega$ -versus- $t$  graph during the total time interval of 4 s is 60 rad or  $(60 \text{ rad}) \times (1 \text{ rev}/2\pi \text{ rad}) = 9.55$  revolutions.