18. The wheel starts turning from rest ($\omega_0 = 0$) at $t = 0$, and accelerates uniformly at $\alpha = +4.0$ rad/s$^2$, which makes our choice for positive sense of rotation. At $t_1$ its angular displacement (relative to its orientation at $t = 0$) is $\theta_1$, and at $t_2$ its angular velocity is $\theta_2$, where $\theta_2 - \theta_1 = \Delta\theta = 80$ rad. Also, $t_2 - t_1 = \Delta t = 4.0$ s.

(a) We find the angular velocity at $t_1$ using Eq. 11-13 (set up to describe the interval $t_1 \leq t \leq t_2$).

$$\Delta\theta = \omega_1 \Delta t + \frac{1}{2}\alpha\,(\Delta t)^2 \quad \Longrightarrow \quad \omega_1 = \frac{80 - \frac{1}{2}(4.0)(4.0)^2}{4.0}$$

which yields $\omega_1 = 12$ rad/s.

(b) We obtain $t_1$ using Eq. 11-12:

$$\omega_1 = \omega_0 + \alpha t_1 \quad \Longrightarrow \quad t_1 = \frac{12}{4.0} = 3.0 \text{ s} \ .$$