14. The wheel starts turning from rest ($\omega_0 = 0$) at $t = 0$, and accelerates uniformly at $\alpha = 2.00$ rad/s^2. Between t_1 and t_2 it turns through $\Delta\theta = 90.0$ rad, where $t_2 - t_1 = \Delta t = 3.00$ s.

(a) We use Eq. 11-13 (with a slight change in notation) to describe the motion for $t_1 \le t \le t_2$:

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

which we plug into Eq. 11-12, set up to describe the motion during $0 \le t \le t_1$:

$$\begin{aligned} \omega_1 &= \omega_0 + \alpha t_1 \\ \frac{\Delta\theta}{\Delta t} - \frac{\alpha\Delta t}{2} &= \alpha t_1 \\ \frac{90.0}{3.00} - \frac{(2.00)(3.00)}{2} &= (2.00)t_1 \end{aligned}$$

yielding $t_1 = 13.5$ s.

(b) Plugging into our expression for ω_1 (in previous part) we obtain

$$\omega_1 = \frac{\Delta\theta}{\Delta t} - \frac{\alpha\Delta t}{2} = \frac{90.0}{3.00} - \frac{(2.00)(3.00)}{2} = 27.0 \text{ rad/s} .$$