16. The wheel starts turning from rest ($\omega_0 = 0$) at $t = 0$, and accelerates uniformly at $\alpha > 0$, which makes our choice for positive sense of rotation. At t_1 its angular velocity is $\omega_1 = +10$ rev/s, and at t_2 its angular velocity is $\omega_2 = +15$ rev/s. Between t_1 and t_2 it turns through $\Delta\theta = 60$ rev, where $t_2 - t_1 = \Delta t$.

(a) We find α using Eq. 11-14:

$$\omega_2^2 = \omega_1^2 + 2\alpha\Delta\theta \implies \alpha = \frac{15^2 - 10^2}{2(60)}$$

which yields $\alpha = 1.04$ rev/s^2 which we round off to 1.0 rev/s^2.

(b) We find Δt using Eq. 11-15:

$$\Delta\theta = \frac{1}{2}\left(\omega_1 + \omega_2\right)\Delta t \implies \Delta t = \frac{2(60)}{10 + 15} = 4.8 \text{ s} .$$

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

$$\omega_1 = \omega_0 + \alpha t_1 \implies t_1 = \frac{10}{1.04} = 9.6 \text{ s} .$$

(d) Any equation in Table 11-1 involving θ can be used to find θ_1 (the angular displacement during $0 \le t \le t_1$); we select Eq. 11-14.

$$\omega_1^2 = \omega_0^2 + 2\alpha\theta_1 \implies \theta_1 = \frac{10^2}{2(1.04)} = 48 \text{ rev} .$$