17. The wheel has angular velocity $\omega_0 = +1.5$ rad/s $= +0.239$ rev/s^2 at $t = 0$, and has constant value of angular acceleration $\alpha < 0$, which indicates our choice for positive sense of rotation. At t_1 its angular displacement (relative to its orientation at $t = 0$) is $\theta_1 = +20$ rev, and at t_2 its angular displacement is $\theta_2 = +40$ rev and its angular velocity is $\omega_2 = 0$.

(a) We obtain t_2 using Eq. 11-15:

$$\theta_2 = \frac{1}{2}\left(\omega_0 + \omega_2\right)t_2 \implies t_2 = \frac{2(40)}{0.239}$$

which yields $t_2 = 335$ s which we round off to $t_2 \approx 340$ s.

(b) Any equation in Table 11-1 involving α can be used to find the angular acceleration; we select Eq. 11-16.

$$\theta_2 = \omega_2 t_2 - \frac{1}{2}\alpha t_2^2 \implies \alpha = -\frac{2(40)}{335^2}$$

which yields $\alpha = -7.12 \times 10^{-4}$ rev/s^2 which we convert to $\alpha = -4.5 \times 10^{-3}$ rad/s^2.

(c) Using $\theta_1 = \omega_0 t_1 + \frac{1}{2}\alpha t_1^2$ (Eq. 11-13) and the quadratic formula, we have

$$t_1 = \frac{-\omega_0 \pm \sqrt{\omega_0^2 + 2\theta_1\alpha}}{\alpha} = \frac{-0.239 \pm \sqrt{0.239^2 + 2(20)\left(-7.12 \times 10^{-4}\right)}}{-7.12 \times 10^{-4}}$$

which yields two positive roots: 98 s and 572 s. Since the question makes sense only if $t_1 < t_2$ we conclude the correct result is $t_1 = 98$ s.