General Physics I - Quiz #5 Name _____

A wheel is initially rotating at 35π rad/s. The wheel comes to a stop after rotating through an angle of 280π rad. The moment of inertia of the wheel is 1.25 kg m^2. (10 pts)

a) What is the angular acceleration of the wheel?

The provided information is
$\omega_0 = 35\pi\ rad/s$
$\omega_f = 0\ rad/s$
$\theta = 280\pi\ rad$

Using the rotational form of the fourth kinematic equation

$$\omega_f^2 - \omega_0^2 = 2\alpha\ \Delta\theta$$

We solve for angular acceleration

$$\alpha = \frac{\omega_f^2 - \omega_0^2}{2\ \Delta\theta} = \frac{(0\ rad/s)^2\ - (35\pi\ rad/s)^2}{2\ (280\pi\ \text{rad})} = 6.87\ rad/s^2$$

b) What is the torque exerted on the wheel to generate this acceleration?

Torque is related to angular acceleration through the formula

$$\tau = I\alpha$$

Since the moment of inertia is 1.25 kg m^2, the torque is

$$\tau = (1.25\ kg\ m^2)\left(6.87\frac{rad}{s^2}\right) = 8.59\ N \cdot m$$