

Answer on Question #48378, Physics, Mechanics | Kinematics | Dynamics

You are driving at 40mph which for your tire size equates to 50 rad/s. You accelerate uniformly to a speed of 48mph in 5 seconds. How many revolutions did your tire make?

Solution:

Linear speed = radius \times angular speed

$$v = r\omega$$

Thus, the radius of tire is

$$r = \frac{v}{\omega} = \frac{(40 * 0.44704) \text{ m/s}}{50 \text{ rad/s}} = 0.358 \text{ m}$$

The acceleration is

$$a = \frac{v - v_0}{t} = \frac{(48 - 40) * 0.44704}{5} = 0.715 \text{ m/s}^2$$

Kinematics equation

$$S = v_0 t + \frac{at^2}{2}$$

where a is acceleration, S is distance, v_0 is initial velocity and v is final velocity.

$$S = 40 * 0.44704 * 5 + \frac{0.715 * 5^2}{2} = 98.36 \text{ m}$$

The number of revolutions is

$$N = \frac{S}{2\pi r} = \frac{98.36}{2\pi * 0.358} = 43.7 \approx 44 \text{ rev}$$

Answer: $N = 44 \text{ rev}$