

As you drive down the road at 17 m/s you press the gas pedal and speed up with a uniform acceleration of 1.2 m/s^2 for 0.65 s . If the tires on your car have a radius of 33 cm what is their angular displacement during the acceleration?

$$v_i = 17 \text{ m/s}$$

$$v = ?$$

$$\Delta t = 0.65 \text{ s}$$

$$a = 1.2 \text{ m/s}^2$$

$$v = v_i + a \Delta t$$

$$= 17 \text{ m/s} + (1.2 \text{ m/s}^2) 0.65 \text{ s}$$

$$= 17.78 \text{ m/s}$$

$$v = r \omega$$

$$\omega_i = \frac{17 \text{ m/s}}{0.33 \text{ m}} = 51.52 \frac{\text{rad}}{\text{s}}$$

$$\omega = \frac{17.78 \text{ m/s}}{0.33 \text{ m}} = 53.88 \frac{\text{rad}}{\text{s}}$$

$$\omega = \omega_i + \alpha \Delta t$$

$$\alpha = \frac{\omega - \omega_i}{\Delta t}$$

$$\omega^2 = \omega_i^2 + 2\alpha \Delta \theta$$

$$\Delta \theta = \frac{\omega^2 - \omega_i^2}{2\alpha} = \frac{\omega^2 - \omega_i^2}{2 \left(\frac{\omega - \omega_i}{\Delta t} \right)}$$

$$= \frac{\left(53.88 \text{ rad/s} \right)^2 - \left(51.52 \text{ rad/s} \right)^2}{2 \left(\frac{53.88 \text{ rad/s} - 51.52 \text{ rad/s}}{0.65 \text{ s}} \right)}$$

$$= 34.26 \text{ rad}$$

$$\boxed{34 \text{ rad}}$$