

25. (a) In the time light takes to go from the wheel to the mirror and back again, the wheel turns through an angle of $\theta = 2\pi/500 = 1.26 \times 10^{-2}$ rad. That time is

$$t = \frac{2\ell}{c} = \frac{2(500 \text{ m})}{2.998 \times 10^8 \text{ m/s}} = 3.34 \times 10^{-6} \text{ s}$$

so the angular velocity of the wheel is

$$\omega = \frac{\theta}{t} = \frac{1.26 \times 10^{-2} \text{ rad}}{3.34 \times 10^{-6} \text{ s}} = 3.8 \times 10^3 \text{ rad/s} .$$

- (b) If r is the radius of the wheel, the linear speed of a point on its rim is

$$v = \omega r = (3.8 \times 10^3 \text{ rad/s}) (0.05 \text{ m}) = 190 \text{ m/s} .$$