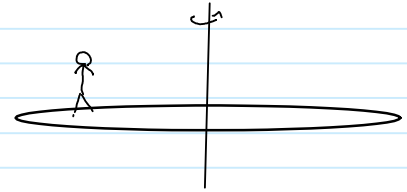


20-R-IM-PT-2(Solution)

July 28, 2020 6:59 PM

A merry-go-round is spun at a speed of 1.5 rad/s. At this speed a child, with a mass of 23kg, directly jumps on the merry go round at a distance of 0.3 m from the centre. If the merry go round has a radius of 3m, and a mass of 50kg, what is the new speed of the merry go round. Assume the merry-go-round is a flat circle with a mass of 17kg, and the child can be treated as a point mass. Also assume that the child does not slide on the merry-go-round.



$$I_1 \omega_1 = I_2 \omega_2 \quad \omega_1 = 1.5 \text{ rad/s}$$

$$I_1 = mr^2 \cdot \frac{1}{2} \quad m = 17 \text{ kg} \quad r = 3 \text{ m}$$
$$= \frac{(3)^2 \cdot 17}{2} = 76.5$$

$$I_2 = \left(\frac{1}{2} mr^2 + m_{\text{child}} d^2 \right) \quad m_{\text{child}} = 23 \text{ kg} \quad d = 1.45 \text{ m}$$
$$= \left(\frac{1}{2} \cdot 3^2 \cdot 17 + 23 \cdot 1.45^2 \right) = 124.825$$

$$\omega_2 = \frac{I_1}{I_2} \cdot \omega_1 = \frac{76.5}{124.825} \cdot 1.5 = 0.9199 \text{ rad/s}$$

The new angular speed is 0.92 rad/s