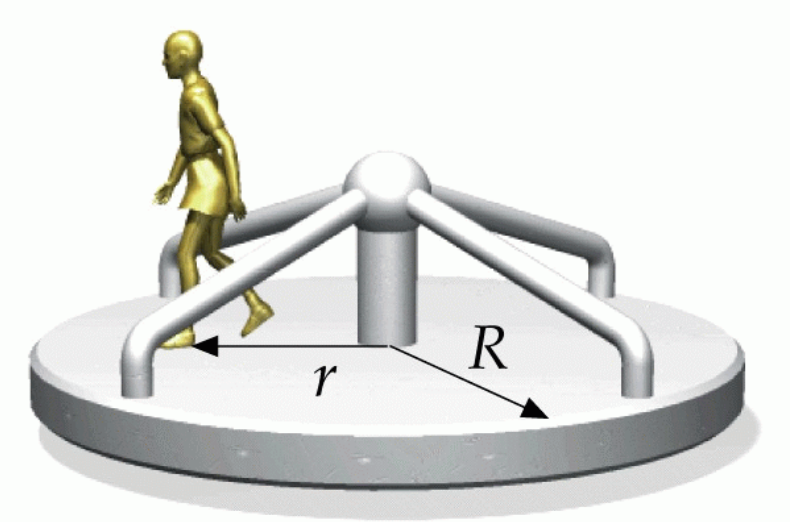
Ex : A merry-go-round of radius R=2 m and moment of inertia I_{mgr}=500 kg·m^2 is rotating about a frictionless pivot, making one revolution every 5 s. A child of mass m=25 kg originally standing at the pivot point, walks out to the rim. Find the new angular speed of the merry-go-round.



∘ Note: ω_f of the system is related to ω_i as angular momentum is conserved.

$$\vec{L}_i = \vec{L}_f \qquad \Rightarrow \qquad I_i\omega_i = I_f\omega_f$$

∘ Determine the I_i and I_f of the system.

$$I_i = I_{mgr} \qquad I_f = I_{mgr} + I_{cf}$$

∘ Solving for ω_f gives:

$$\omega_f = \frac{I_{mgr}\omega_i}{I_{mgr} + mR^2}$$

Using $\omega = 2\pi/T$,

$$\omega_f = \frac{(500\ \text{kg}\cdot\text{m}^2)\ \cdot\ (1\ \text{rev}/5\ \text{s})}{(500\ \text{kg}\cdot\text{m}^2) + 25\ \text{kg}(2\ \text{m})^2} = \frac{1\ \text{rev}}{6\ \text{s}}$$