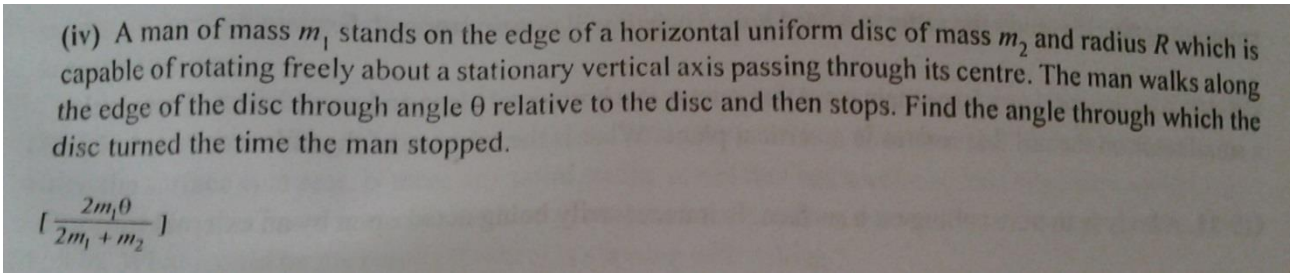
Answer on Question #56545-Physics-Mechanics-Relativity

Question 3 has not seen.


(iv) A man of mass m_1 stands on the edge of a horizontal uniform disc of mass m_2 and radius R which is capable of rotating freely about a stationary vertical axis passing through its centre. The man walks along the edge of the disc through angle θ relative to the disc and then stops. Find the angle through which the disc turned the time the man stopped.

$[\frac{2m_1\theta}{2m_1+m_2}]$

Solution

According to the conservation of momentum law:

$$m_1\omega_1 R = \frac{I_{disk}\omega_2}{R} = \frac{m_2\omega_2 R^2}{2R} = \frac{m_2\omega_2 R}{2} \to \omega_1 = \frac{m_2\omega_2}{2m_1}.$$

The angular velocity of man relative to the disk is

$$\omega = \omega_1 + \omega_2 = \frac{m_2\omega_2}{2m_1} + \omega_2 = \frac{2m_1 + m_2}{2m_1}\omega_2.$$

Thus,

$$\omega_2 = \frac{2m_1}{2m_1 + m_2}\omega.$$

The angle for disk is

$$\phi = \omega_2 t = \frac{2m_1}{2m_1 + m_2}\omega t = \frac{2m_1}{2m_1 + m_2}\theta.$$

Answer: $\boldsymbol{\frac{2m_1}{2m_1+m_2}\theta}$.