## Answer on Question\#39929 - Physics - Mechanics | Kinametics | Dynamics

Can we move a merry go round by applying a force along the radial direction? explain in detail

## Solution:

If we apply a force directly down the radius of a merry-go-round (MGR), nothing will move if the force is less than the breaking point stress required to snap the MGR's axle or other parts. If that's the case, in which the question is, then the applied radial force $F$ will be offset by an equal but opposite reaction force $F_{R} R$. In which case we can write $\mathrm{f}=\mathrm{ma}=\mathrm{F}-\mathrm{F}_{\mathrm{R}}=0$; so the mass of the MGR m will not start to move because if $\mathrm{ma}=0$, then $\mathrm{a}=0$ since $\mathrm{m} \neq 0$.

But if any portion of the force F is normal (perpendicular) to the radius in the plane of rotation, say $\mathrm{F}_{\mathrm{n}}$, then a torque, which is a twisting moment, will be in effect. Torque $=F_{n} \cdot r$; where $r$ is the radius of the MGR. That torque will cause the MGR to accelerate (alpha) in an angular direction around the axis of rotation. And we can find that through $\mathrm{F}_{\mathrm{n}} \cdot \mathrm{r}=\mathrm{J} \cdot \alpha$; so that $\alpha=\frac{\mathrm{F}_{\mathrm{n}} \cdot \mathrm{r}}{\mathrm{J}}$ where $\mathrm{I} \sim \mathrm{mr}^{2}$ the moment of inertia. [Actually, we don't know what really is until we know the specifics of how the MGR is constructed. But $\mathrm{mr}^{2}$ is one possibility.]

Hence, if F is along the radius, the MGR won't budge because there is a reactionary force $F_{R}$ offsetting $F$. But if there is some $F_{n} \neq 0$, the MGR will begin to rotate around its axis because a torque results.

