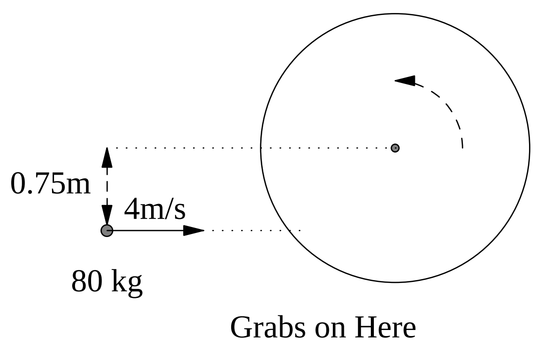
4. (30 pts.) A merry-go-round (a disk of radius 1.8 m and moment of inertia $300\,\text{kgm}^2$) is rotating freely at an angular velocity of 0.75 rad/s in the direction shown in the diagram. Daredevil Dave (whose mass is 80 kg) runs along the path shown in the figure with an initial speed of 4 m/s and jumps onto the **edge** of the merry-go-round as shown. Your ultimate goal will be to find the final angular velocity of Dave and the merry-go-round together.

a. (10 pts.) *Before doing any calculations*, what fundamental principle of physics can you use to find that final angular velocity? Justify your use of that principle carefully and clearly, but briefly.

b. (20 pts.) What is the final angular velocity of Dave and the merry-go-round together?



4. (30 pts.) A merry-go-round (a disk of radius 1.8 m and moment of inertia 300 kgm^2) is rotating freely at an angular velocity of 0.75 rad/s in the direction shown in the diagram. Daredevil Dave (whose mass is 80 kg) runs along the path shown in the figure with an initial speed of 4 m/s and jumps onto the **edge** of the merry-go-round as shown. Your ultimate goal will be to find the final angular velocity of Dave and the merry-go-round together.

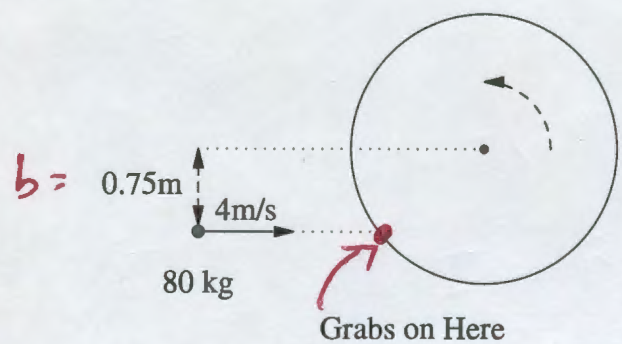
a. (10 pts.) *Before doing any calculations*, what fundamental principle of physics can you use to find that final angular velocity? Justify your use of that principle carefully and clearly, but briefly.

Conservation of Angular Momentum applies because there is no net external torque.

b. (20 pts.) What is the final angular velocity of Dave and the merry-go-round together?

$$L_i = L_f$$

$$I_i \omega_i + m v b_i = I_f \omega_f$$



$$I_f = I_i + (80)(1.8)^2$$

so

$$(300)(0.75) + (80)(4)(0.75) = \left[300 + 80(1.8)^2\right] \omega_f$$

$$\boxed{\omega_f = 0.832 \text{ rad/s}}$$