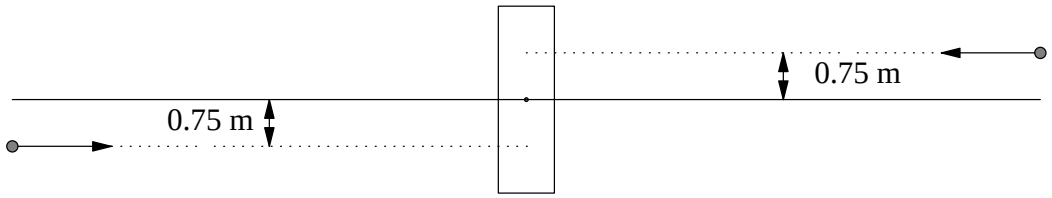
4. (30 pts.) Two 70-kg ice skaters are moving in straight lines along a frictionless pond with initial speeds of 2 m/s, as shown in the figure. They grab onto a bar of mass 100 kg and length 3 m that is mounted half-way between them on a frictionless vertical axle. The bar was initially at rest. Your ultimate goal will be to find the final angular velocity of the bar+skaters.

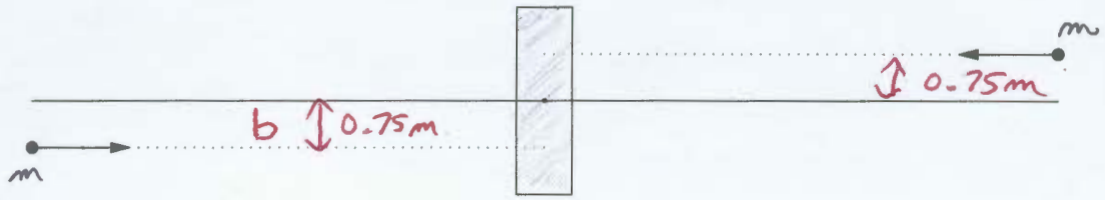


a. (5 pts.) *Before doing any calculations*, can you assume that the total angular momentum of the bar+skaters remains constant? Justify your answer briefly but clearly.

b. (5 pts.) *Before doing any calculations*, can you assume that the total mechanical energy of the bar+skaters remains constant? Justify your answer briefly but clearly.

c. (20 pts.) What is the final angular velocity of the bar+skaters?

4. (30 pts.) Two 70-kg ice skaters are moving in straight lines along a frictionless pond with initial speeds of 2 m/s, as shown in the figure. They grab onto a bar of mass 100 kg and length 3 m that is mounted half-way between them on a frictionless vertical axle. The bar was initially at rest. Your ultimate goal will be to find the final angular velocity of the bar+skaters.



a. (5 pts.) *Before doing any calculations*, can you assume that the total angular momentum of the bar+skaters remains constant? Justify your answer briefly but clearly. Yes, since there are no external torques.

b. (5 pts.) *Before doing any calculations*, can you assume that the total mechanical energy of the bar+skaters remains constant? Justify your answer briefly but clearly. NO, since you can't assume that the skater – bar forces are conservative. Though those forces are internal, they still can affect total energy.

c. (20 pts.) What is the final angular velocity of the bar+skaters?

$$L_i = L_f$$

$$2mvb = I_{bar}\omega_{f,bar} + 2mb^2\omega_f$$

$$\frac{2mvb}{I_{bar} + 2mb^2} = \omega_f, \quad \omega_f = \frac{2(70)(2)(0.75)}{\frac{1}{12}(100)(3)^2 + 2(70)(0.75)^2}$$

$$\boxed{\omega_f = 1.37 \text{ rad/s}}$$