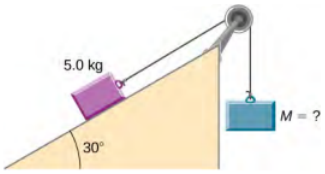
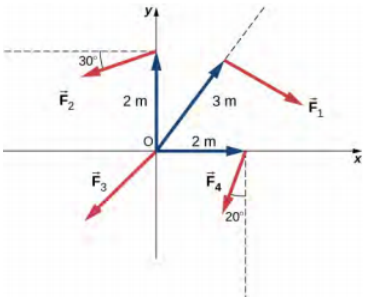
8.E: Fixed-Axis Rotation Introduction (Exercises)

8.E.0.1 10.2 Rotation with Constant Angular Acceleration

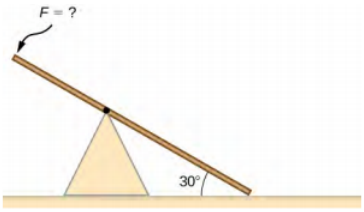
1. What hanging mass must be placed on the cord to keep the pulley from rotating (see the following figure)? The mass on the frictionless plane is 5.0 kg. The inner radius of the pulley is 20 cm and the outer radius is 30 cm.



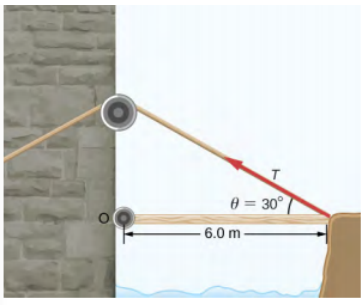
2. Calculate the torque about the z-axis that is out of the page at the origin in the following figure, given that $F_1 = 3$ N, $F_2 = 2$ N, $F_3 = 3$ N, $F_4 = 1.8$ N.



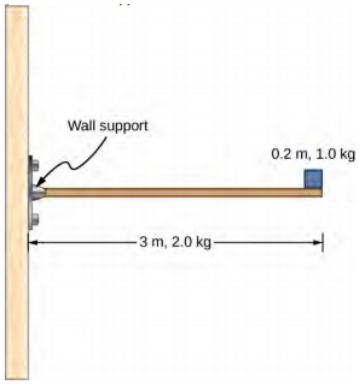
3. A seesaw has length 10.0 m and uniform mass 10.0 kg and is resting at an angle of 30° with respect to the ground (see the following figure). The pivot is located at 6.0 m. What magnitude of force needs to be applied perpendicular to the seesaw at the raised end so as to allow the seesaw to barely start to rotate?



4. A torque of 5.00×10^3 N • m is required to raise a drawbridge (see the following figure). What is the tension necessary to produce this torque? Would it be easier to raise the drawbridge if the angle θ were larger or smaller?



5. A horizontal beam of length 3 m and mass 2.0 kg has a mass of 1.0 kg and width 0.2 m sitting at the end of the beam (see the following figure). What is the torque of the system about the support at the wall?



6. What force must be applied to end of a rod along the x-axis of length 2.0 m in order to produce a torque on the rod about the origin of $8.0\hat{k}$ N • m?
7. What is the torque about the origin of the force (5.0 $\hat{i}$ − 2.0 $\hat{j}$ + 1.0$\hat{k}$) N if it is applied at the point whose position is: $\vec{r}$ = (−2.0 $\hat{i}$ + 4.0$\hat{j}$) m?

A uniform rod of length L and mass M is held vertically with one end resting on the floor as shown below. When the rod is released, it rotates around its lower end until it hits the floor. Assuming the lower end of the rod does not slip, what is the linear velocity of the upper end when it hits the floor?

8.E.1 Contributors and Attributions

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