

Chapter 6: Torques and Center of Mass

1. The Achilles tendon inserts on the calcaneus at a distance of 8cm from the axis of the ankle joint. If the force generated by the muscles attached to the Achilles tendon is 3000 N and the moment arm of this force about the ankle joint axis is 5 cm, what torque is created by these muscles about the ankle joint?
2. An athlete is doing a knee extension exercise using a 100-N dumbbell strapped to her ankle 40 cm from her knee joint. She holds her leg so that the horizontal distance from her knee joint to the dumbbell is 30 cm.
 - a. For this position, what torque is created by the dumbbell about the axis through her knee joint.
 - b. If the moment arm of the knee extensor muscles is 4 cm about the knee joint axis, what amount of force must these muscles produce to hold the leg in the position described? Ignore the weight of the leg.
3. What can a hurdler do to minimize the amount of vertical effort in clearing a hurdle?
4. A hurdler's knee is 0.97 m above ground level. The ankle is 0.91 m above ground level. What is the height of the center of mass of the shank (lower leg)? The length percent for the shank is 47.5%.
5. What could a gymnast do to increase her stability when she is landing on the balance beam from a flip.