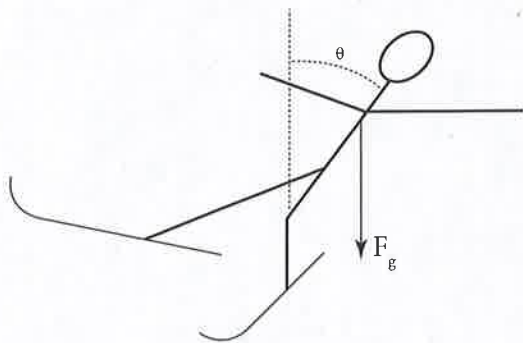


## CHAPTER 4 FREESTANDING PRACTICE QUESTIONS

1. A 100 kg skier's knee can withstand a lateral torque of 500 N·m before dislocating. As the skier loses control going around a corner, one ski comes up off the snow and the other boot and lower leg remain vertical, such that the knee starts to bend laterally. If the distance from the skier's knee to his center of mass is 1 m, at what angle  $\theta$  from vertical will the knee dislocate due to the torque of gravity alone?



- A) 30  
B) 45  
C) 60  
D) 90
2. When rapidly turning a corner on a flat road, a cyclist leans into the center of the turn. The frame of the bike is nearly parallel to which vector?
- A) The force of gravity on the bicycle and rider  
B) The normal force on the pair  
C) The centripetal force  
D) The sum of the normal and friction forces
3. A 1000 kg gondola is operated on a cable between two towers 340 m apart. When the gondola is exactly between the towers, it is 100 m below their height. What is the tension in the cable at this midpoint?
- A) 5 kN  
B) 8 kN  
C) 10 kN  
D) 20 kN
4. Which of the following concerning uniform circular motion is true?
- A) The centrifugal force is the action-reaction pair of the centripetal force.  
B) Unlike the centrifugal force, the centripetal force is a type of force akin to that of friction, gravity and tension forces.  
C) The velocity of the object in motion changes whereas the acceleration of the object is constant.  
D) A satellite undergoing uniform circular motion is falling towards the center in a circular path.
5. When spinning a coin on a flat surface, two equal forces with opposite directions are applied to the opposite sides of a coin. Which of the following is true about the coin after it leaves the hand? (Assume ideal frictionless motion.)
- A) The coin does not rotate because equal but opposite forces cancel each other out.  
B) The coin does not rotate because equal but opposite torques cancel each other out.  
C) The coin rotates and the rotational acceleration is zero.  
D) The coin rotates and the rotational acceleration is equal to the net torque divided by the moment of inertia.
6. In the human leg, there is 20% of the body's mass in the upper leg (acting at 20 cm from the hip), 10% in the lower leg (acting at 90 cm) and 3% in the foot (acting at 120 cm). Find the center of mass of an outstretched leg for a person who is 70 kg.
- A) 30 cm from the hip  
B) 40 cm from the hip  
C) 50 cm from the hip  
D) 60 cm from the hip
7. A fully unraveled yo-yo is being walked swung around in a vertical circle (a trick known as "around the world"). The yo-yo is 100 g on a string that is 90 cm long. A yo-yo guru manages to make his yo-yo travel three complete circles in 1 second. Determine the centripetal acceleration on the yo-yo.
- A) 28 m/s<sup>2</sup>  
B) 32 m/s<sup>2</sup>  
C) 284 m/s<sup>2</sup>  
D) 320 m/s<sup>2</sup>