PRACTICE B

Centripetal Force

1. A 2.10 m rope attaches a tire to an overhanging tree limb. A girl swinging on the tire has a tangential speed of 2.50 m/s. If the magnitude of the centripetal force is 88.0 N, what is the girl's mass?
2. A bicyclist is riding at a tangential speed of 13.2 m/s around a circular track. The magnitude of the centripetal force is 377 N, and the combined mass of the bicycle and rider is 86.5 kg. What is the track's radius?
3. A dog sits 1.50 m from the center of a merry-go-round and revolves at a tangential speed of 1.80 m/s. If the dog's mass is 18.5 kg, what is the magnitude of the centripetal force on the dog?
4. A 905 kg car travels around a circular track with a circumference of 3.25 km. If the magnitude of the centripetal force is 2140 N, what is the car's tangential speed?

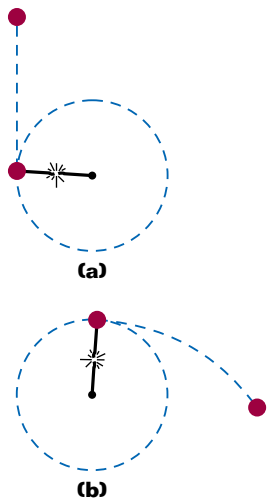

Figure 5
A ball that is on the end of a string is whirled in a vertical circular path. If the string breaks at the position shown in **(a),** the ball will move vertically upward in free fall. **(b)** If the string breaks at the top of the ball's path, the ball will move along a parabolic path.

Centripetal force is necessary for circular motion

Because centripetal force acts at right angles to an object's circular motion, the force changes the direction of the object's velocity. If this force vanishes, the object stops moving in a circular path. Instead, the object moves along a straight path that is tangent to the circle.

For example, consider a ball that is attached to a string and that is whirled in a vertical circle, as shown in **Figure 5.** If the string breaks when the ball is at the position shown in **Figure 5(a),** the centripetal force will vanish. Thus, the ball will move vertically upward, as if it has been thrown straight up in the air. If the string breaks when the ball is at the top of its circular path, as shown in **Figure 5(b),** the ball will fly off horizontally in a direction tangent to the path. The ball will then move in the parabolic path of a projectile.

DESCRIBING A ROTATING SYSTEM

To better understand the motion of a rotating system, consider a car traveling at high speed and approaching an exit ramp that curves to the left. As the driver makes the sharp left turn, the passenger slides to the right and hits the door. At that point, the force of the door keeps the passenger from being ejected from the car. What causes the passenger to move toward the door? A popular explanation is that a force must push the passenger outward. This force is sometimes called the *centrifugal force,* but that term often creates confusion, so it is not used in this textbook.