

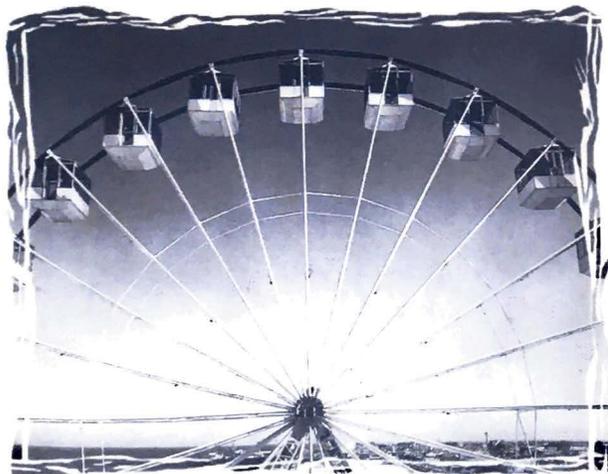
# High Noon

At the moment when the diver reaches the 12 o'clock position, his motion on the Ferris wheel is purely horizontal. So if he were released at that moment, he would not be moving up or down at all, but only to the side.

Because of this, the diver's falling time is the same as if he had fallen from a motionless Ferris wheel. But the diver will continue to move sideways throughout his fall. His sideways motion will be at the same rate as the platform was moving.

Use these facts, together with everything else you know about the Ferris wheel and the motion of falling objects, to answer these questions.

1. How long will it take for the diver to reach the water level?
2. How far to the left of center will the diver be when he is 8 feet off the ground? In other words, what is his  $x$ -coordinate when he reaches the water level?



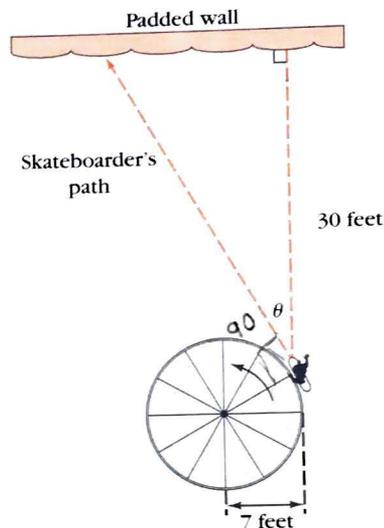
# The Ideal Skateboard

Let's consider a skateboard situation like the one you looked at in *Homework 20: Initial Motion from the Ferris Wheel*. Imagine a skateboarder holding onto a spinning platform in the middle of a skateboard park.

Here are some more details.

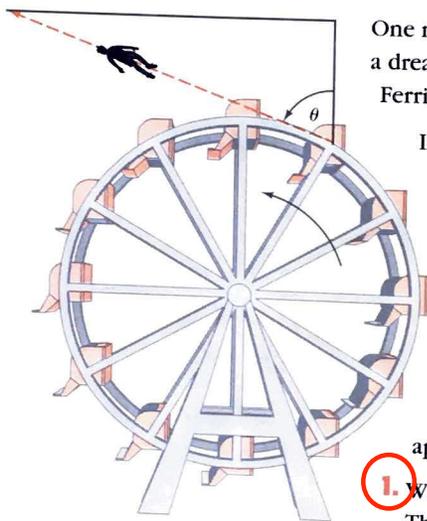
- The platform has a 7-foot radius and makes a complete turn every 6 seconds.
- The skateboarder lets go from the 2 o'clock position, as shown in the diagram.

The skateboarder will eventually crash into the padded wall. At the moment of release from the platform, the skateboarder is 30 feet from this wall.



1. How fast will the skateboarder travel? (Assume as before that there is no friction.)
2. What is the angle shown in the diagram as  $\theta$ ?
3. How much closer will the skateboarder be to the wall after each second? In other words, what is the "toward the wall" component of the skateboarder's velocity?
4. Use your answer to Question 3 to find out how long it takes for the skateboarder to reach the wall.
5. Find the actual distance the skateboarder travels, and use that information (and the answer to Question 1) as an alternate way to find out how long it takes for the skateboarder to reach the wall.

# One O'Clock Without Gravity



One night before the premiere of the show, our diver had a dream in which he was merrily spinning around on his Ferris wheel.

In this dream, the assistant decided to let go when the diver was at the 1 o'clock position. But in the diver's dream, there was no gravity, so he sailed up and to the left at a constant speed, in a direction that was tangent to the Ferris wheel's circumference at the 1 o'clock position.

Of course, his speed was the same as his speed when he was on the platform. As you know, that speed is  $2.5\pi$  feet per second, which is approximately 7.85 feet per second.

1. What was the vertical component of his velocity? That is, how much height did he gain each second? (As in other recent problems, you will need to find the angle labeled  $\theta$ .)
2. What was the horizontal component of his velocity? (Remember that movement to the left is considered negative.)

## General Velocities

As you have seen, although the speed of the Ferris wheel is constant, the vertical and horizontal components of the diver's velocity are different for different positions in the cycle.

1. What are the horizontal and vertical components of the diver's initial velocity if he is released after 8 seconds on the Ferris wheel?

(Reminder: The period for the Ferris wheel is 40 seconds. Also remember that for horizontal velocity, the positive direction is to the right.)

To generalize the situation, suppose that the diver is released after  $W$  seconds.

2. First, assume that  $W$  is less than 10, so that the diver is still in the first quadrant when he is released. Write an expression in terms of  $W$  for the vertical and horizontal components of the diver's initial velocity.

3. Now consider all values of  $W$  from 0 to 40.

- a. For which values of  $W$  is the vertical component of velocity positive? For which values is it negative? For which values is it zero?
- b. For which values of  $W$  is the horizontal component of velocity positive? For which values is it negative? For which values is it zero?

