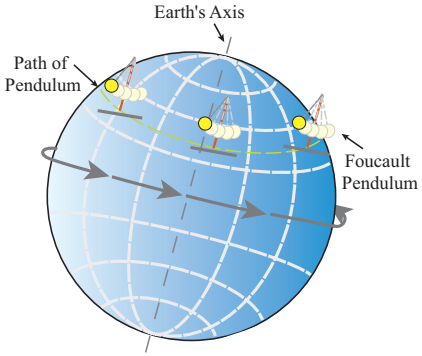
CHAPTER 7 PROJECT

Trigonometric Applications



At the Paris Observatory in 1851, Jean Foucault used a long pendulum to prove that Earth is rotating. As it swings, the pendulum appears to change its path. However, it is not the pendulum that changes path, but the room rotating underneath it. At the North Pole, Earth revolves 360° underneath the pendulum over 24 hours. The path of a pendulum at the equator does not revolve at all; instead, the pendulum travels in a huge circle while Earth spins. At points between the two, the pendulum cannot show how far it travels, but it can show how much planet Earth is revolving underneath it. To calculate how much our planet revolves in a particular location, use the following equation.

$$\text{degrees of revolution} = 360° \sin\left(\text{latitude of location}\right)$$

Location	Latitude
United Nations, NY	40°44′58″
California Academy of Sciences	37°46′12″
Smithsonian, Washington, DC	38°53′19″
St. Isaac's Cathedral, Russia	59°53′02″
Paris Observatory, France	48°48′58″

1. In a 24-hour period, how many degrees does Earth revolve at the locations specified in the table?

Your university has decided to install a 50-foot Foucault Pendulum in your science building and asked you to make sure that there is enough room.

2. If the pendulum swings a total of 16°, how long is the arc traced in the air by the tip of the pendulum during one swing?

3. The school plans to build a small wall encircling the swinging pendulum. What should the diameter of the circle be if they want the tip of the pendulum to come within 6 inches of the wall?

4. When the pendulum reaches the farthest point from the center, how much higher will the tip be compared to when it is at the center?

5. If the science center only has room for a circular wall of diameter 12 feet, how many degrees can the pendulum swing and still stay 6 inches from the wall?

6. The Foucault Pendulum in the United Nations building has a length of 75 feet and a period of 10 seconds. Assuming simple harmonic motion and that at $t = 0$ the pendulum is at its farthest distance away (6 feet from the center of the circle), what function models the motion of the pendulum? Graph this function.