Using Recursion in Models and Decision Making: Recursion in Cyclical Models

IV.D Student Activity Sheet 7: Modeling the Singapore Flyer

On February 11, 2008, Singapore opened a new observation wheel called the Singapore Flyer. At the time of its opening, this giant Ferris wheel was the tallest in the world. The Singapore Flyer consists of an observation wheel with a diameter of 150 meters atop a boarding terminal, giving the structure an overall height of 165 meters. Twenty-eight air-conditioned capsules rotate on the outside of the wheel to provide unobstructed views of the city. The wheel rotates at a constant rate of 26 centimeters per second. This is slow enough that the wheel does not need to stop for loading and unloading unless there are special passenger needs.

1. Using graph paper, draw an accurate diagram of the wheel showing the dimensions given above. Use a compass or other tool to accurate draw the circle.

2. On the next page, fill in the table showing the height of a single capsule changing as it rotates counterclockwise from the boarding terminal around the wheel. To do this, calculate the circumference of the wheel.

a. How many minutes does it take a capsule to make one complete revolution around the wheel? (Round to the nearest minute.) Explain your process.

b. Before completing the table, explain how the angle values provided in the table are correct.

c. The first inscribed angle that models the situation after one minute is shown. Use additional diagrams and inscribed right triangles to determine more values of the total height as a given capsule continues to rotate through one complete revolution. Use trigonometry to calculate the corresponding values of a and complete the table, finding the height of the capsule at the various intervals of time.

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Time (min)	Angle of Rotation from Boarding Station	Vertical Leg of Right Triangle (*a*)	Process (If you decide to change your process, explain your decision.)	Total Height of Capsule (m)
1	12°			
30	360°			

3. Create a graph showing the height changing as a given capsule rotates through one complete revolution of the wheel. Show at least 10 well-spaced data points on your graph.

4. Use spreadsheet software or a graphing calculator to model the height of a capsule as it continues to rotate around the wheel. Show at least 90 minutes of rotation. Create a graph of the data.

5. On your graph, label the period and amplitude of the curve. How do these values on your mathematical model relate to the physical context of the Singapore Flyer?

6. **REFLECTION:** In this problem, your classmates used different methods to solve this problem. Now that you have seen the different processes, which were most useful? If you had to do this problem using a different process than the one you used, which method would you choose? What information would you need to know? What calculations would you have to do differently? How were trigonometric ratios used in the different processes??

7. **EXTENSION**

   - Research another gigantic Ferris wheel. Find the dimensions of the wheel and how long it takes for the wheel to complete one revolution. Using that information, make a rough sketch of the height of a capsule over time.

   OR

   - What other situations can you think of that repeat themselves and could possibly be modeled with a periodic function? (Some examples include volume of air in lungs over time during rest, a pendulum swinging, the bounce of a sp***rin***g, sea levels affected by tides, and sound waves.)