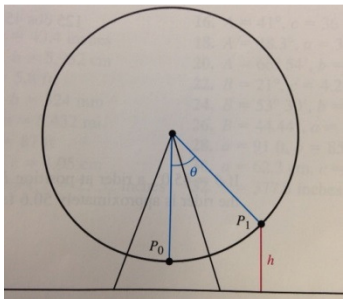
Sinusoidal Functions

Trigonometric functions can be used model the motion of a rider on a Ferris wheel. The model can then be used to provide information about the position of the rider at any time during a ride. Similarly, sinusoidal functions can be applied to everything from weather and population data to sound waves and projected sales. Throughout this unit students will investigate Ferris wheels and their motion to find the height of a rider at any point along the ride, the distance traveled by a rider, and an equation to model the movement (Activities 1 - 5). Then students will applied what they have learned and solve a similar problem.

1. Use your iPad to research the first Ferris wheel ever created. In a PowerPoint presentation fully describe the dimensions and capacity of this wheel as well as its creator and the reason it was created. Verify that your information is accurate with multiple sources because it will be used to solve our unit problem.

2. Using the diagram below as a simplified model of the Ferris wheel and the information from your research determine the rider's height, h, above the ground when Θ is 45°.



3. In 1897 a Ferris wheel was built in Vienna that still stands today. It is named the Riesenrad, which translates to the Great Wheel. The diameter of the Reisenrad is 197 feet. The top of the wheel stands 209 feet above the ground. Use the model from 2 above to determine a rider's height if a) Θ is 120°, b) Θ is 210°, and c) Θ is 315°. Provide a detailed explanation of your solving processes in a video using your iPad and an application like iMovie, ScreenChomp, or Educreations.

4. The distance a person travels while riding a Ferris wheel can be described by arc length. What is arc length and how can it be calculated? Find the distance traveled by a rider on the first Ferris wheel if a) Θ = 45°, b) Θ = 105°, c) Θ = 300°. On the original Ferris wheel a trip consisted of one revolution, during which six stops were made for loading, followed by one nine-minute, nonstop revolution. How far did the initial passengers travel on the first ride? Construct a diagram drawn to scale to represent the first Ferris wheel and use it to solve your problems. Document your solutions along with the scaled drawing.

5. Make a table of values that show a rider's height, y, above the ground for every 2.5 seconds(t) of the original Ferris wheel's first revolution. Graph the points on a rectangular coordinate system and then connect them with a smooth curve. Use the data and sinusoidal curve to find an equation in the form $y = A \sin(kt + c) + h$ or $y = A \cos(kt + c) + h$. Include a data table, graph, and any work required to show how you determined your equation.

6. Choose and complete one of the five activities in the Sinusoidal Applications packet.

Activity #1 - Temperatures in Florence
From a set of data:
1. Determine the period, amplitude, phase and vertical shifts
2. Determine sine and cosine equations from information in #2
3. Perform a sine regression using the Ti83/84

Activity #2 - Steamboat problem
From given information:
1. Create a sinusoidal wave from given information
2. Give the amplitude, period, phase and vertical shifts
3. Determine an equation to suit the graph
4. Apply the equation

Activity #3 – Fox Population Problem
From given information:
1. Create a sinusoidal wave from given information
2. Give the amplitude, period, phase and vertical shifts
3. Determine an equation to suit the graph
4. Apply the equation

Activity #4 – The Beijing Wheel
From given information:
1. Create a sinusoidal wave from given information and determine some missing information
2. Give the amplitude, period, phase and vertical shifts
3. Determine the speed of the rider
4. Determine an equation to suit the graph

Activity #5 – Hours of Sunlight in Zushi, Japan 2001
From a set of data:
1. Plot the data and create a sinusoidal curve
2. Determine a sine and cosine equation from the graph
3. Perform a sine regression using the Ti83/84 from the data given.