

## **Discovering Geometry at Kennywood**

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### **Overview**

This unit enhances the ninth and tenth grade PSP geometry curriculum. This unit will provide students with the opportunity to apply geometric ideas and concepts while learning about the history of one of Pittsburgh's famous landmarks...Kennywood Park. At the beginning of the unit, students will study the background of Kennywood Park. They will learn about the history of the park, how it changed throughout the years, and how it achieved its status as a historical landmark. After learning about the park, students will complete an activity in the classroom based on Kennywood's rollercoasters. They will use graphing calculators to compare the heights and maximum speeds of the rollercoasters. The highlight of the unit is when students actually take a field trip to Kennywood to explore other geometry related problems. Kennywood Park will provide an arena for applying the problem solving skills that students have acquired throughout the year. This will include problems involving similar triangles, proportions, rates, volume, and probability. Students will also perform a scavenger hunt throughout the park to locate specific geometric shapes, such as: triangles, rectangles, squares, circles, parallelograms, pyramids, prisms, cylinders, cones, and spheres. Problems such as these show students the practical applications of geometric ideas. The unit will also serve as a review of major concepts and enable students to see and experience geometry as it comes alive in Kennywood Park.

### **Rationale**

Geometry is a second year course of high school mathematics designed for students who have successfully completed Algebra I. This course emphasizes

understanding the relationships among geometric figures and using those relationships, along with the skills acquired in Algebra I, to solve problems. In addition to learning new mathematics, students will investigate how mathematics is actually found and used in the world around them. Students will also explore potential careers that use the mathematics studied in this course.

The major thread of this course is learning through an informal, guided discovery approach. Students perform investigations, make and test conjectures, and use their conjectures to solve problems. During the first semester, students will use inductive reasoning to make conjectures, define geometric terms, discover properties of lines, angles, triangles, quadrilaterals and other polygons, and are introduced to deductive reasoning and proofs. In second semester, they will explore circles and their properties, area and volume formulas, the Pythagorean Theorem, ratio and proportion, and properties of similarity.

Beginning with the graduation class of 2003, students must demonstrate proficiency in reading, writing, and mathematics to graduate from a Pennsylvania high school. Proficiency may be demonstrated by scoring at a proficient level on either the State assessments in these areas in either grade 11 or 12, or on local assessments aligned with the academic standards and State assessments. Many of the required standards are taught in this course. Throughout the school year, students will take practice exams consisting of both multiple choice questions and open-ended problems. Students will explore how the open-ended problems are scored, and they will have the opportunity to revise their work to meet the standards.

The unit I have developed will reinforce the goals of the PSP geometry curriculum. It has been designed to be taught near the end of the course after students have completed their study of the geometric concepts it utilizes. *Discovering Geometry at Kennywood* will use one of Pittsburgh's famous landmarks to illustrate many of the concepts and ideas studied throughout the year.

Kennywood Park was designated a national historic landmark in 1987 for its significance in commemorating the history of the United States of America. That history dates all the way back to the French and Indian War. Because of its location along the Monongahela River, the site that would eventually be known as the "rollercoaster capital of the world" was a strategic point in the battle that would eventually cost General Edward Braddock his life.

Attempting to gain control of the fork of the Monongahela, Allegheny and Ohio rivers, General Braddock and his army of 1100 men were sent by the British into the region. They were joined by George Washington, a young colonel, in the

Virginia Militia who led a small detachment of Colonials. On their way to accomplish their goal, they marched right through the site that is now known as Kennywood Park. While crossing the river, the army was divided and the battle actually took place on the ground across the river from Kennywood which is now Braddock and North Braddock. Even though the French and Indians were outnumbered, they beat the larger and better equipped British Army. General Braddock was mortally wounded and carried from the field. He died a few days later. Along Kennywood Boulevard, you can see the historical marker denoting Braddock's crossing.

The land by the Monongahela River where Kennywood sits was purchased in 1818 by Charles K. Kenny. Since the time of the Civil War, families would hold picnics and family reunions on a wooded section of the property called Kenny's Grove. The Kenny farm was located on a bluff above the Monongahela River on a right of way owned by the Monongahela Street Railway Company. Rather than purchase the land outright, the railway company leased a tract of ground from Anthony Kenny. They wanted to build a trolley park to help boost its ridership in the evenings and on weekends. The trolley park originally contained a Dance Pavilion, Casino (restaurant), and a building to house a merry-go-round. The name for the park, "Kennywood," was chosen by Andrew Mellon, whose family held stock in the railway. Two of the three original buildings, the Casino and the Merry-go-round pavilion, which was converted to a refreshment stand in the 1920's, are still in use today.

Kennywood Park officially opened on Decoration Day, May 30, 1899. It was located about 12 miles from the City of Pittsburgh along the Monongahela River across from the huge Edgar Thomson Works of the Carnegie Steel Company. A major form of transportation at the time was the trolley. Trolley lines radiated from Pittsburgh and extended to the edges of the urban areas. For many years, the trolley company would not allow the railroad to open a station. The Pennsylvania Railroad, which ran along the Monongahela River, dropped passengers off at Braddock Station and from there they took a trolley to the park. The railroads provided special reduced round-trip rates, which enabled people from as far away as New Castle, Erie, Washington (Pennsylvania), Youngstown, Cleveland, Canton, Columbus, and Wheeling to come to the park. Although there were unpaved roads in the area, they were an insignificant way of getting to the park since few people owned automobiles.

With the merger of the Pittsburgh Street Railway Company (PRC) and the Monongahela Street Railway Company in 1900, Kennywood became available to many more people with a single fare cost of 5 cents per ride. With the increased accessibility of Kennywood, more attractions were added. In 1901, the Old Mill

opened as “a six minute ride on water that was cool and comfortable.” It had mirrors, music and electric lighting.

In 1902, the Pittsburgh Street Railway Company subleased the park to a group from Aspinwall, Pennsylvania. The company, The Pittsburgh Steeplechase and Amusement Company, spent \$141,500 upgrading the park. They added a steeplechase ride that lasted only two seasons. They also built a building that through the years has served as everything from a scenic railway loading station and vaudeville theater to a fun house and finally a home for a skooter ride. The vaudeville theater was built in 1904. Its stage measured 40 feet by 60 feet and could accommodate 600 spectators. A primitive “simulator” ride was added in 1905. It was a motion picture that “makes one imagine he is riding over Niagara Falls in the car.” The dance floor of the Steeplechase Building also served as a roller skating rink.

During the early 1900s, church groups wanted the railway companies to close their parks on Sundays. In response to that request, Kennywood started to offer outdoor religious services. Concert bands and guest choirs entertained with religious music and the park remained opened. Kennywood continued to fight against Pennsylvania’s Blue Laws, which restricted business on Sundays, well into the 1950s.

In 1906, the Pennsylvania Steeplechase and Amusement Company folded. Andrew S. McSwigan assumed control of the park. He updated Kennywood by painting all of the buildings a uniform color, landscaped the grounds, increased the number of electric lights and covered all of the paths with Ligonier white stone. He also reduced the price of some of the attractions, made some free, and renamed some of the rides. Specifically, he changed the name of the Old Mill to The Fairyland Floats. A former newspaper reporter, McSwigan used the newspaper to promote the new Kennywood park. Record breaking crowds soon started to fill the park.

In 1906, Kennywood’s attractions included the dance pavilion, rental boats, Electric Theater, Merry-Go-Round, miniature railroad, roller skating, and the Scenic Railway. The “Great Western Train Hold-Up” was a combination Wild West Show and live drama. Kennywood lost more than \$17,000 on this venture and did not continue it in the 1907 season.

Outside businesses also leased space in Kennywood to set up their own attractions. Some of these included a fortune teller, name plate machine, chameleon, overland wagon, Laughing Gallery, weighing machines, Circle Swing, Ferris Wheel, Irish Village, the House of Mystery, photo gallery, Pony Track, swings and a shooting gallery.

In December 1906, Andrew McSwigan and his partners Frederick Henniger and A. F. Megahan formed a partnership known as Pittsburg Kennywood Park Company. They had many years of experience in the amusement park business. Megahan withdrew from the company in 1908 selling his shares to the other two partners. Members of the McSwigan and Henniger families would operate Kennywood Park for the next 90 years.

Booking picnics became the foundation of Kennywood's success throughout the century. In addition to school picnics, they also booked annual outings for communities, nationality groups, corporations, labor unions, fraternal organizations, church groups, and family reunions.

Kennywood faced competition from a dozen or so trolley parks and amusement resorts in western Pennsylvania. They included: Calhoun, Coney Island (Neville Island), Dream City (Wilkinsburg), Luna Park (Oakland), Oakwood, Southern, and West View. The railroad companies also offered excursions to parks like Idora (Youngstown, Ohio), Woodland Beach (Ashtabula, Ohio), Cascade (New Castle), Idlewild, Aliquippa, Conneaut Lake, and Celoron on Lake Chautauqua, New York.

Despite the competition, Kennywood soon became known as the dominant coaster park with the addition of a racer rollercoaster and the speed-o-plane. A fire on August 12, 1911 destroyed the Penny Arcade, shooting gallery and theater. Despite those losses, Kennywood continued to expand for the next operating season. Portions were rebuilt and new attractions were added including a \$10,000 shooting gallery.

Although some things were in short supply during World War I, Kennywood continued to prosper. Patriotic celebrations were held and admission was free to soldiers. During the 1920s, Kennywood doubled in size. When Andrew McSwigan died unexpectedly at age 57, his son Andrew Brady McSwigan assumed his position. Following in his father's footsteps, he continued to add attractions to Kennywood. In addition to fulfilling the title of best coaster park by adding several rollercoasters, the younger McSwigan also laid out the park's first Kiddieland. A swimming pool was added in 1925 along with a grand stand. With the increase in automobile traffic to the park in the roaring 20s, Kennywood began placing yellow arrows with the park's name on them around the Pittsburgh area to point motorists in the right direction. These signs can still be seen throughout the city in strategic locations.

The Great Depression brought tough times to many people; however, Kennywood was able to survive with the help of ballroom dancing and school picnics.

Kennywood's bargain price enabled one to enjoy a day's worth of entertainment for as little as 50 cents. Often, a day at Kennywood was the only excursion enjoyed by children during the Depression. Postponed by the hard times, Noah's Ark, originally scheduled to open in 1930, opened in 1936. Ironically, Noah's Ark opened the same year that Pittsburgh experienced its largest flood.

During World War II, all production of amusement rides was halted as factories shifted to production of war-related items. With America's strict rationing system, amusement parks were at the bottom of the list for receiving items like sugar, tires, gasoline, ammunition for the shooting gallery and anything made of metal. Kennywood was unable to add anything new to the park and had a difficult time operating rides due to a shortage of replacement parts. Throughout the war, Kennywood was only able to buy one ride; a used Ferris Wheel built in 1936. They repainted it with patriotic stars and stripes.

Kennywood also faced an employee shortage during the war. With younger men being drafted, Kennywood encouraged retirees and women to fill jobs previously held by men. While rural amusement parks were forced to close temporarily during the war due to travel restrictions and rations, Kennywood's urban location allowed it to remain open. The depression was over, people had money to spend and Kennywood became the ideal stay-at-home vacation spot. The steel mills were operating at near full capacity and the workers looked to Kennywood for entertainment on the weekends. Service men and women were given free admission to the park and well known bands were booked in the dance pavilion. In 1947, Kennywood celebrated its golden anniversary of 50 continuous years in operation.

In the following years, Kennywood continued to grow and prosper. Many new rides were added, picnics continued to occur and the Fall Fantasy Parade was started. The Dance Pavilion and swimming pool were closed in 1953 partly because of the segregation that had diminished them from the attraction they had once been. The swimming pool eventually reopened in 1956, fully integrated. The 1960s and 1970s forced Kennywood to adapt to changes in society. While families used to be the primary visitors to Kennywood, the 60's brought more teenagers and unsupervised groups of young people. The park was forced to adjust its policies to accommodate this change. In 1971, Kennywood park was able to purchase the ground the park was built on from the Anthony Kenny heirs. It was now possible for the park to erect permanent rides and invest in improvements without the fear of having to leave the land someday. Several permanent rides were added to the park in the 1970s including the Thunderbolt, Turnpike, Enterprise, Monster, Super Roundup and Log Jammer. The lagoon was improved and landscaped and in 1976 a new, larger Island Stage was built. With

competition now coming from super theme parks that were being developed throughout the country, Kennywood was forced to change with the times.

The 1980s began with the construction of the Laser Loop. This steel looping coaster changed the Kennywood skyline and helped maintain Kennywood's rollercoaster capital of the world status. Other changes in the 1980s included the end of the pony rides, the creation of the midway between the Enterprise and the Laser Loop, the replacement of the row boats with paddle boats, and the addition of several games, refreshment stands and new rides. Other changes that took place in Kennywood included eliminating tickets for rides and drinks and switching to a "pay one price" policy for admission and direct cash sales for refreshments.

In the 1980's the National Park Service conducted a program to identify, designate, recognize, and protect recreational sites of national significance. Kennywood Park became one of only six National Historical Landmarks in Allegheny County. Part of the historical significance of Kennywood is that the park shows the other side to the steel mills and industries. It shows what people did for fun and recreation.

In 1964 the Pennsylvania Historical and Museum Commission erected a roadside marker commemorating Braddock's Crossing on the southern most point of Kennywood's property along Kennywood Boulevard.

In 1977, the Pittsburgh History and Landmarks Foundation presented Kennywood with a plaque recognizing the fiftieth anniversary of the park's Dentzel Carousel. On February 8, 1982 Kennywood's Casino was awarded a plaque on the basis of its architectural significance and named as a historical site.

On August 25, 1992 The Pennsylvania Historical and Museum Commission dedicated another marker near the park's entrance. It recognized the founding of Kennywood by the Monongahela Street Railroad Company in 1898.

One of the biggest attractions at any amusement park is its roller coasters. Kennywood is famous for having some of the best roller coasters in the world. Currently, there are five rollercoasters in Kennywood Park.

Kennywood's oldest coaster, the Jack Rabbit, was built in 1920. Even though sections of the rollercoaster are replaced each year, it remains pretty much the same as when it first opened. The old wooden rollercoaster is famous for its double dip that lifts riders from their seats. Designed by John Miller, the Jack Rabbit is 70 feet high and 2130 feet long. The maximum speed reached by the rollercoaster is 45 miles per hour.

The Racer was added to Kennywood Park in 1927. The original racer stood from 1910 until 1926 when it was demolished to make room for the new, better racer rollercoaster. Although it only has a 40 foot drop, which to rollercoaster enthusiasts is not much, the racer is still a thrilling ride. The ride is unique in the fact that both trains run on a continuous track, with riders starting on one side of the platform and ending on the other. The racer reaches a maximum speed of 40 miles per hour. John Miller also designed the Racer which is 76 feet tall and 2400 feet long.

The Phippen was one of Kennywood's famous coasters from 1924-1967. It was designed by John A. Miller. It was a double dip rollercoaster which ran through the ravine at the back of the park.

The Thunderbolt replaced the Phippen in 1968. Designed by John Miller and Andy Vettel, this favorite wooden rollercoaster was voted one of the top wooden rollercoasters in America by The Discovery Channel in 2002. Since there are no seat dividers, riders get the opportunity to squish their partner as the coaster reaches speeds of 53 miles per hour around the bends. Although there are no drastic drops on this rollercoaster, the single position lapbar enables riders to get plenty of air over the smaller drops throughout the ride. Originally, the Thunderbolt had a small hill on the second curve around the loading station. The hill was removed in 1969. The Thunderbolt is 3250 feet long and reaches a height of 95 feet.

The Steel Phantom was a welcome addition to Kennywood Park after the Laser Loop departed. It was designed by Arrow Dynamics and was considered by most to be a rough coaster. Many reviews written on the coaster claim that it is "hideously rough and causes too much headbanging on Arrow's unpadded horsecollars." The bottom of the second drop and the corkscrews were especially rough. With a maximum speed of 80 miles per hour it was worth the wait for the front seat of the Steel Phantom. The Steel Phantom was 160 feet high and 3000 feet long.

Phantom's Revenge, which opened in 2001 replaced the Steel Phantom. It preserved the beginning spiral drop and the second 225 foot dive through the Thunderbolt. Instead of the loop, boomerang and corkscrews, the Phantom's Revenge has more bunny hops and helices. Designed and built by Morgan Manufacturing, Phantom's Revenge is 3500 feet long. Its drop is 232 feet and it is even faster than the Steel Phantom with a maximum speed of 85 miles per hour.

Wild Mouse roller coasters at other parks are famous for their quick, steep drops and hairpin turns that seem to throw riders out of their seats. Kennywood's 1999

addition, the Exterminator, is modeled after the famous wild mouse coasters. The indoor rollercoaster was designed by R & R Creative Amusement Designs. Riders actually take the role of rats that have infested Kennywood Park. The ride simulates the rat's chase from the exterminators who were called in to get rid of them. With a total height of 40 feet and a length of 1400 feet, the excitement comes from the spinning and turning on the tight turns. The maximum speed of the Exterminator is 22 miles per hour. Most of the ride takes place in the dark.

Most people will admit that they love the food at Kennywood almost as much as the rides. The Parkside Terrace is a cafeteria-style restaurant located in the middle of the park. There are also eighteen different refreshment stands located throughout the park.

In addition to being "The Roller Coaster Capital of the World," Kennywood might also be called "The French Fry Capital of the World." The most famous food stand at the park is the Potato Patch. Each year, Kennywood uses over 450,000 pounds of potatoes to make its famous french fries.

Every trip to an amusement park leaves you with lasting memories. When I think back to my first visit to Kennywood, one thing that sticks out most in my mind was the Pitt Fall. The Pitt Fall was added to Kennywood in 1997, becoming the world's tallest and fastest free-fall ride. In the summer of 2002, I was a chaperone for "Kennywood Camp" while working at the Science Center. The campers that I was paired with wanted to ride the Pitt Fall, and since it looked like it offered a nice view of the park, I agreed to go with them. I have never considered myself afraid of heights, but I couldn't help but wonder if I was going to pass through a cloud soon. After the slow ascent to the top of the cylindrical tower, we sat at the top and admired the view to the disheartening sound of the machinery behind us. That is when I got a little nervous. What if the breaks don't work? Is this shoulder harness tight enough? Before I could get another question to race through my head, the bottom dropped out. My heart, which was already pounding loud enough for the other riders to hear, suddenly was lodged in my throat. I began kicking my legs frantically, as if that was going to help stop me. Fortunately it was over in a matter of seconds. I've never been so happy to put my feet on the ground.

No park would be complete without a Merry-Go-Round. The carousel which is currently in Kennywood was built in 1926 by the William Dentzel Company of Philadelphia. It was to be used for the Sesquicentennial Exhibition which was held in Philadelphia in 1926. Unfortunately, Dentzel did not get the Merry-Go-Round done in time. Fortunately for Kennywood, they were able to buy the carousel the following year. It cost \$25,000 for the new ride. There were 72 animals hand-carved from bass wood. The inside 3 rows included a total of 50

jumping horses with a row of 20 stationary ones along the outside row. It also included four chariots, one lion, and one tiger, a Dentzel trademark. The park advertised the Carousel as “one of the largest and most elaborate carousels ever built.” The carousel contained 1400 50 watt lamps to light up the park at night. To house the new carousel, the park built a new pavilion, installed the old band organ and the new Dentzel Carousel has operated there ever since.

## **Objectives**

*Discovering Geometry at Kennywood* seeks to achieve many objectives. The students will use Kennywood Park as an arena to showcase the geometry skills they have acquired throughout the year. As students complete this unit, they will demonstrate their ability to complete problems involving different mathematical concepts. Specifically, they will be able to:

- Calculate distances and rates of speed in transportation used to get to Kennywood during the 1890s and today. Students will compare the data and draw conclusions based on it.
- Describe the history and development of Kennywood Park throughout the last 100 years.
- Use graphing calculators to investigate relationships between the height and speed of Kennywood’s rollercoasters. They will also review coordinate geometry and be introduced to linear regressions.
- Complete a unit rate problem and make calculations using data from the Potato Patch.
- Determine the volume of various sized ice cream cones and calculate the unit price and best value when purchasing a cone.
- Estimate the height of the Pit Fall using similar triangles.
- Practice ratio problems using rpm’s of the merry-go-round and Aero360.
- Apply geometry skills while creating their own problems based on Kennywood Park.

## **Strategies**

Many strategies will be used to achieve the objectives of this unit. Students will work cooperatively to solve problems in this unit. They will also apply research skills, critical thinking skills, and communication skills. Specific math content standards are addressed throughout the unit. A list of math content standards addressed in this unit is included at the end of this unit.

## Classroom Activities

### Activity 1: Transportation

This would be an excellent opportunity for students to compare transportation in the 1890s with transportation today. Students could calculate the rate of speed of the trains and trolleys and compare it to the rate of speed of the automobile today. After learning about the mode of transportation used in the 1890s, students would be provided with the distance from Kennywood to some of the cities mentioned above and the amount of time it took to travel to Kennywood from those cities. The students would then calculate the rate of speed from each city. They will also calculate the average rate of speed for all cities. Finally, they will compare the rate of transportation then to today by calculating the rate of speed that they travel to Kennywood on the field trip.

### Activity 2: Video

Since the beginning of Kennywood as a trolley park to its classification as one of the best amusement parks in the country, this Pittsburgh landmark continues to provide endless entertainment and enjoyment for different generations. As students in my geometry classes begin *Discovering Geometry at Kennywood*, I would want them to be familiar with the history of the park that will be their focus of study. They will begin by watching Rick Sebak's award-winning documentary *Kennywood Memories*, produced in 1988 for WQED-TV. After watching the video, they will complete an activity sheet on the movie.

### Activity 3: Rollercoasters

The information on Kennywood's rollercoasters lends itself to a great math activity. After being given the information on the various roller coasters, students would examine the data to find the relationship between the height of a roller coaster and its maximum speed. To begin this activity, students would construct a scatter plot of the height and speed of Kennywood's five rollercoasters. This would give students the opportunity to review coordinate geometry, a standard covered during the first semester. The students should notice a linear relationship between the height and maximum speed. This would be a great opportunity to introduce the students to the concept of linear regression, which they will need as they move on to Algebra II. By doing a linear regression of the data, they will be able to find the slope and the y-intercept of the equation. We will discuss what the slope and y-intercept represent in general, and then specifically what it means for this problem situation. The students will use the slope to predict the maximum speed for coasters of different heights in other theme parks, then do further research to find out if their predictions are accurate.

I believe that this will be a very powerful lesson for several reasons. The students will discover that there is actually mathematics behind something fun and exciting, like rollercoasters. They will be reviewing standards for their final exam in a real-world problem situation. One of my goals for all of my students is to prepare them for the next level of mathematics that they will enter. Since Geometry is sandwiched in between Algebra I and Algebra II, many students struggle in Algebra II because they have not used those skills for over a year. This is an excellent opportunity for my students to review some Algebra concepts so that they are not forgotten before they reach Algebra II.

#### Activity 4: The Potato Patch

As students are enjoying their Potato Patch French fries, they can answer several questions based on a unit rate problem. First, I would provide them with the following statistics. Kennywood uses about 250 tons of potatoes each season. Students should already know that there are 2000 pounds in one ton. Assuming each potato weighs one pound, they could first calculate the number of pounds of potatoes used in a season. I would then tell the students that Kennywood is open 121 days during the season, and ask them to calculate how many pounds of potatoes are used per day.

#### Activity 5: Ice Cream Cones

When students are enjoying their ice-cream cones, I will have them figure out what size cone offers the best value. I will have my students answer that question by using what they have learned about volume and unit rates. Students will investigate several different sizes of ice cream cones. They will measure them to find their radii and heights, and then the students will compute the volume of each cone using the formula for finding the volume of a cone. What about the ice cream that is on top of the cone? After a little discussion, the students should discover that it is the shape of a hemisphere, and they will calculate its volume and add it to the volume of the cone. They will then inquire as to the price of each cone, and calculate the unit price of each cone. This will give the students the amount of ice cream per dollar, so they can determine which cone is the best value.

#### Activity 6: The Pitt Fall

I will never forget my exhilarating ride on Kennywood's Pit Fall. After getting my feet on the ground and getting my wits about me, I asked myself a couple of questions that I feel could be excellent problems for my students to solve. How high up in the air were we, and how fast were we going? A major concept in

geometry is that of proportionality. I will have my students find the height of the tower by using similar triangles and solving a proportion. First the students will measure the height of someone near the Pitt Fall, and then they will measure the shadow of the object person. Next they will measure the shadow of the Pitt Fall. Based on previous problems the students have completed involving similar right triangles, they know the height of the person and their shadow should be proportional to the height of the Pitt Fall and its shadow.

After solving their proportion, the students will use their solution to estimate the speed at which a rider is descending while riding the Pitt Fall. First they will subtract 70 feet from their solution, since that is the height at which the Pitt Falls magnetic breaks are activated, to find the distance of the free-fall. Then the students will use stop watches to time the descent three times and find the mean of their data. Next they will calculate the unit rate to discover how many feet per second at which they were falling. Finally they will convert their solution into miles per hour to get a better understanding of just how fast they were really moving.

#### Activity 7: Merry-Go-Round

The concept of ratios and proportions is important to the study of geometry. The Merry-Go-Round and Aero 360 present an opportunity for students to form a ratio of revolutions per minute. After calculating the revolutions per minute of each ride, they will compare the rpms of each ride and write proportions to solve problems.

#### Activity 8: Student Designed Problems

As a culminating activity students will have the opportunity to design their own geometry problems about Kennywood. They will use concepts learned throughout the course of the year to create their own problem using a different aspect of Kennywood Park. They will work with a group to complete this activity.

## **Annotated Bibliography/Resources**

### ***Books***

Jacques, Jr., Charles J. Kennywood: Roller Coaster Capital of the World. Jefferson: Amusement Park Journal, 1982.

A comprehensive resource about Kennywood Park that contains facts and pictures of the park over the years.

Jacques, Jr., Charles J. More Kennywood Memories. Jefferson: Amusement Park Journal, 1998.

A comprehensive history of Kennywood Park. Includes historical and current photographs of the park.

Kidney, Walter. Pittsburgh's Landmark Architecture, The Historic Buildings of Pittsburgh and Allegheny County. Pittsburgh: Pittsburgh History and Landmarks Foundation, 1997.

Includes specific descriptions and pictures of landmarks that have been noted for their local, state and national significance.

Lorant, Stefan. Pittsburgh The Story of an American City. Pittsburgh: Esselmont Books, LLC, 1999.

A comprehensive book about the city of Pittsburgh. The book includes a history of the city, changes that have occurred and current developments. Also highlights influential Pittsburghers and contains many photographs.

### ***Video***

Sebak, Rich. Kennywood Memories. Pittsburgh: WQED, 1990.

A documentary about the history of Kennywood Park. Also contains current information about the daily operation of the park.

### ***Websites***

[www.phlf.org](http://www.phlf.org)

Website for the Pittsburgh History and Landmarks foundation which contains lesson plans for teachers.

[www.kennywood.com](http://www.kennywood.com)

The official website of Kennywood Park.

[www.coastergallery.com](http://www.coastergallery.com)

A website that contains data on many rollercoasters, including the coasters at Kennywood Park.

[www.home.nyc.rr.com/johnmiller/kenny.html](http://www.home.nyc.rr.com/johnmiller/kenny.html)

Contains historical information on various parks.

[www.rollercoasterking.com/PhotoGallery/Kennywood/Kennywood.htm](http://www.rollercoasterking.com/PhotoGallery/Kennywood/Kennywood.htm)

A reproduction from the United States Department of the Interior, National Park Service, Register of Historic Places report.

[www.tpne.8m.com/Kennywood.html](http://www.tpne.8m.com/Kennywood.html)

An informative website that contains information on all of Kennywood's rollercoasters.

## Appendices-Standards

### Appendix A

#### *ACTIVITY #1*

### **Transportation to Kennywood Park**

In the early 1900s, people traveled from many different cities to enjoy Kennywood Park. Use the following information to complete these questions on transportation to Kennywood.

#### **Distances from Kennywood**

Erie	128 miles
New Castle	53 miles
Washington, PA	30 miles
Youngstown	66 miles
Cleveland	132 miles
Canton	93 miles
Columbus	185 miles
Wheeling	59 miles

1. Assume that in 1900 the average speed of a train was 35 miles per hour. Calculate the time it took to travel from each city to Kennywood Park.
2. Assume that in 2004 the average speed by car is 50 miles per hour. Calculate the time it would take to travel from each city to Kennywood Park today.
3. If a traveler wanted to leave home in Youngstown at 9:00 am and be home by 11:00 pm, how much more time would he/she have to enjoy the park today than in 1900?
4. How much more time would someone from Washington, PA have to spend at Kennywood Park than someone from Cleveland in 1900? 2004?
5. Do you agree or disagree with this statement? Someone from Canton would have twice as much time to enjoy Kennywood than someone from Columbus if they left and returned at the same time. Explain.

Appendix B

**ACTIVITY #2**

***Kennywood Memories***

1. What are the best things you take with you when you leave Kennywood for the night?
2. How often are the rides at Kennywood inspected?
3. Describe the prior uses of the land on which Kennywood is located.
4. Who is credited with naming the park Kennywood?
5. In 1902, what were rollercoasters sometimes called?
6. What steel coaster, added to the park in 1980 is no longer at Kennywood?
7. What is the oldest surviving ride in the park?
8. What was the original name of the Turtle?
9. Why were the hills taken out of the auto ride?
10. What is the most popular food stand in Kennywood Park?
11. Describe some of the changes that have occurred to Noah's Ark over the years.
12. Why did the pool, a park landmark, eventually close?

13. Who has been the Kennywood Mascot since 1974?
  
14. What does “Kennywood’s Open” really mean?
  
15. What nationality day is usually the biggest event of the season at Kennywood?
  
16. What is unique about the Racer?
  
17. What ride does John Jacques consider the heart of Kennywood? The soul of Kennywood?
  
18. What recognition did Kennywood receive in 1987?
  
19. Why was Kennywood named a National Historic Landmark?
  
20. Describe some changes that have occurred at Kennywood since the video was made.

Appendix C

**ACTIVITY #3**

**Kennywood's Rollercoasters**

1. Complete the table. Describe the relationship.

Rollercoaster	Height of Coaster	Maximum Speed of Coaster
Jack Rabbit		
Racer		
Thunderbolt		
Steel Phantom		
Phantom's Revenge		

- Using your TI-83+ graphing calculator, enter the info from the table into L1 and L2.
- Make a scatter plot. What relationship do you see?
- Find the Linear Regression Equation for L1 and L2.
- What is the slope? What does it mean in this situation?
- What is the y-intercept? What does it mean in this situation?
- If Kennywood plans on building a 250 foot high rollercoaster, what would you expect its maximum speed to be?



Appendix E

**ACTIVITY #5**

**Ice Cream Cones**



Small Cone \$ \_\_\_\_\_

Large Cone \$ \_\_\_\_\_

Radius = \_\_\_\_\_

Radius = \_\_\_\_\_

Height = \_\_\_\_\_

Height = \_\_\_\_\_

1. What geometric shapes form each ice cream cone?
2. Measure the height and radius of each cone.
3. Compute the volume of each cone (use 3.14 for  $\pi$ ). Show your work.
4. Which cone is the best value? That is, which cone gives the most ice cream per dollar? Show your work.

Appendix F

**ACTIVITY #6**

**The Pitt Fall**

1. Use a tape measure to measure the height of a classmate and the length of the shadow they cast.
2. Measure the shadow cast by the Pitt Fall.
3. Set up a proportion to estimate the height of the Pitt Fall. Show your work.
4. The magnetic brakes are applied when the rider on the Pitt Fall are 70 feet above the ground. Estimate the distance of the Pitt Fall's free fall.
5. Using a stop watch, time the descent of the Pitt Fall three times, and then calculate the mean.
6. Estimate the average rate of speed in feet per second of the Pitt Fall. Convert your answer to miles per hour. Show your work.

Appendix G

**ACTIVITY #7**

**The Merry-Go-Round**

Your task is to compare the number of revolutions per minute of two of Kennywood's famous rides: the Merry-Go-Round and the Aero 360.

1. To calculate the RPM's of the Merry-Go-Round

- Pick out your favorite animal.
- Using a watch, count the number of times your animal passes in one minute. This will be the RPM's of the Merry-Go-Round.

RPM's = \_\_\_\_\_

2. Now, develop a strategy to calculate the RPM's of the Aero 360. Write your strategy in the space below.

RPM's = \_\_\_\_\_

3. What is the ratio of RPM's of the Merry-Go-Round to the Aero 360?

4. If the Merry-Go-Round makes 500 revolutions, how many revolutions will the Aero 360 make in the same time?

## Appendix H

### ***ACTIVITY #8***

#### **Student Designed Problems**

After enjoying your day of fun and problem solving at Kennywood, your final assignment will be to create your own Geometry problem at Kennywood. Your problem should be centered on a concept that we have learned this year. These concepts include, but are not limited to: circles, polygons, similar figures, ratios and proportions, unit rates, surface area, volume, etc. Your problem should also include a solution, with all work shown. You may work with a partner or small group of no more than four on this project.

## Appendix I

### *Content Standards Addressed*

#### **Mathematics Standards**

1. All students use numbers, number systems, and equivalent forms (including numbers, words, objects and graphics) to represent theoretical and practical situations.
2. All students compute, measure, and estimate to solve theoretical and practical problems, using appropriate tools, including modern technology such as calculators and computers.
3. All students apply the concepts of patterns, functions and relations to solve theoretical and practical problems.
4. All students formulate and solve problems and communicate the mathematical processes used and the reasons for using them.
5. All students understand and apply basic concepts of algebra, geometry, probability and statistics to solve theoretical and practical problems.
6. All students evaluate, infer and draw appropriate conclusions from charts, tables and graphs, showing the relationships between data and real-world situations.