Assignment

Write

Describe how you can model the motion of points on a circle by using transformations of a trigonometric function.

Remember

Transformations of periodic functions can be used to map function behavior to the behavior of periodic phenomena, such as amplitude, period, frequency, phase shift, and midline.

Practice

1. Angela rode the Ferris wheel at Navy Pier in Chicago. The Ferris wheel has a diameter of 140 feet. She was curious about how long it would take her to get from the lowest point to the highest point of the ride. She began timing her ride while she was at the bottom of the wheel and noticed that it took her 3 minutes and 45 seconds to get to the top. At the highest point, Angela was 150 feet off the ground. The vertical height, h, of a person riding the Ferris Wheel can be modeled as a trigonometric function of time, t, in seconds. The Ferris wheel moves in a clockwise direction.
   a. Determine Angela's vertical height when she is at the lowest point of the ride.
   b. Determine the amount of time it takes for Angela to complete one revolution on the Ferris wheel. Write your answer in seconds.
   c. Sketch a graph of Angela's height in feet on the Ferris wheel as a function of time in seconds.
   d. Determine the amplitude of the function. Explain your reasoning.
   e. Calculate the period and value of B of the function. Explain your reasoning.
   f. Determine the values of C and D of the function if a cosine function is used to model the problem situation. Explain how you determined your answers.
   g. Write a cosine function to model Angela's height on the Ferris wheel as a function of time.
   h. Explain how Angela could write a sine function to model the height of the Ferris wheel as a function of time.

Stretch

The hour hand of a large clock on a wall of a train station measures 18 inches in length. At noon, the tip of the hour hand is 40 inches from the ceiling. Let y equal the distance from the tip of the hour hand to the ceiling x hours after noon. Determine a trigonometric equation that best models the motion of the hour hand and sketch the graph.

Review

1. The tide at a pier can be modeled by the equation $h(t) = 2\cos\left(\frac{\pi}{6}t\right) + 7$, where t represents the number of hours past noon and $h(t)$ represents the height of the tide in feet.
   a. Determine the amplitude of the function. What does it represent in terms of this problem situation?
   b. Determine the period of the function. What does it represent in terms of this problem situation?
   c. Determine the vertical shift of the function. What does it represent in terms of this problem situation?
2. A satellite in a medium Earth orbit completes one orbit every 12 hours. The satellite follows a circular path with its center at the center of the earth. The satellite is at an altitude of 12,552 miles. The radius of the earth is 3959 miles.
   a. Determine the angle of rotation, in radians, that corresponds to a 5-hour time period.
   b. Determine the distance traveled by the satellite in a 5-hour time period.
3. Multiply the rational expressions.
   a. $\frac{x^2 + 6x + 9}{x - 3} \cdot \frac{x^2 + 3x - 18}{x^2 - 9}$
   b. $\frac{x^3 - 8}{x^4 - 9x^2} \cdot \frac{x^5 - 6x^4 + 9x^3}{x^2 - 4x + 4}$