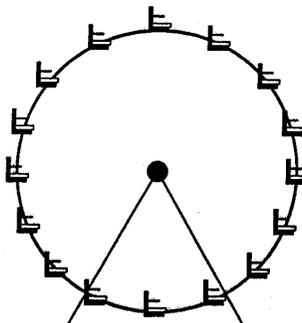


THE FERRIS WHEEL

The Ferris Wheel, a classic amusement park ride, was invented by George Ferris. Mr. Ferris was an American engineer who debuted his wheel at the 1893 World's Fair in Chicago.

Suppose that you are 4 feet off the ground in the bottom car of a Ferris Wheel and ready to ride. If the radius of the wheel is 25 feet and it makes 2 revolutions per minute,

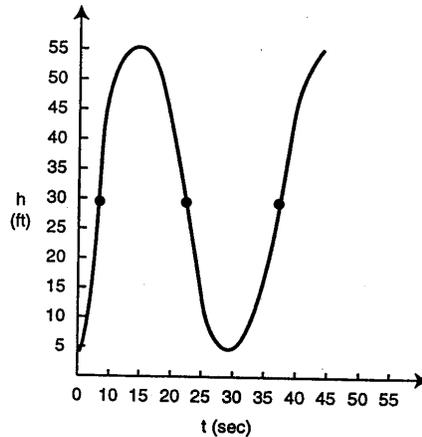
- Sketch a graph that shows your height h (in ft) and above the ground at time t (in sec) during the first 45 seconds of your ride.
- Why is your curve periodic? Explain in terms of the problem.
- What is the period of your curve? Explain this number in terms of the problem.
- Give a possible equation for your curve.
- At what speed are you traveling on the Ferris Wheel? (ft/sec) Explain.
- Suppose that the radius of the Wheel were decreased and that the Wheel still make two revolutions per minute, would the
 - period change? Explain.
 - amplitude change? Explain.
 - speed change? Explain.



[Source: A Collection of Performance Tasks and Rubrics: High School Mathematics, Eye on Education, Larchmont, NY]

SOLUTION

- a. Graph should look like:



- b. The car covers every height from 4' to 54' on the way up and then again on the way down, and this is the case with each revolution.
- c. The period is 30 seconds since this is the time for one complete revolution.
- d. Using the cosine function, the most likely answers are $y = -25\cos[(\pi/15)x] + 29$ or $y = 25\cos[(\pi/15)(x-15)] + 4$. However, there are an infinite number of possible answers which can be generated by replacing x with $(x-h)$ where $h=30n$ (n is any integer) in the former case, or by replacing x with $(x-h)$ where $h=15 + 30n$ (n is any integer) in the latter case.

Using the sine function, the most likely answer will be $y=25\sin[(\pi/15)(x-7.5)] + 29$. Again, there are an infinite number of possible answers which can be generated by replacing x with $(x-h)$ where $h=15 + 30n$ (n is any integer).

- e. The Ferris wheel makes 2 revolutions per minute, each revolution covers 50π feet, therefore, the speed is 100π ft / min ≈ 314 ft/60 sec or about 5'/sec.

Source: A Collection of Performance Tasks and Rubrics: High School Mathematics, Eye on Education, Larchmont, NY]

- f. (1) No, because it would still take 30 seconds to complete a revolution.
(2) Yes, the amplitude would decrease because the height of the wheel would decrease.
(3) Yes, speed would decrease since the circumference would decrease and so, less distance would be covered per minute or second.

RUBRIC

Level 4: This response offers clear and convincing evidence of a deep knowledge of the mathematics related to this task.

Characteristics:

The graph is correct, and all questions are answered correctly with appropriate explanations. A computational flaw may occur.

Level 3: This response offers evidence of substantial knowledge of the mathematics related to this task.

Characteristics:

The graph is correct, and all questions are answered correctly but one explanation may be weak or missing.

Or

The graph is correct, and one question is incorrectly answered or missing but all else is correct with appropriate explanations.

Or

The graph is flawed but shows a periodic function, and all other questions are correctly answered with appropriate explanations.

Source: [A Collection of Performance Tasks and Rubrics: High School Mathematics](#), Eye on Education, Larchmont, NY]

A.40

Level 2: This response offers limited or inconsistent evidence of knowledge of the mathematics related to this task.

Characteristics:

The graph is correct or flawed but periodic, and most but not all of the questions are answered correctly with appropriate explanations. Explanations may be weak. (More than one question must be incorrect.)

Level 1: This response offers little or no evidence of knowledge of the mathematics related to this task.

Characteristics:

Most of the questions are answered incorrectly or are missing.

Or

Most of the explanations are missing or weak.

Source: A Collection of Performance Tasks and Rubrics: High School Mathematics, Eye on Education, Larchmont, NY]

A.41