Chapter 5 Project

Gateway to the West

An activity to demonstrate the use of quadratic equations in real life.

The Gateway Arch on the St. Louis riverfront in Missouri serves as an iconic monument symbolizing the westward expansion of American pioneers, such as Lewis and Clark. A nationwide competition was held to choose an architect to design the monument and the winner was Eero Saarinen, a Finnish American who immigrated to the United States with his parents when he was 13 years old. Construction began in 1962 and the monument was completed in 1965. The Gateway Arch is the tallest monument in the United States. It is constructed of stainless steel and weighs more than 43,000 tons. Although the arch is heavy, it was built to sway with the wind to prevent it from being damaged. In a 20 mph wind, the arch can move up to 1 inch. In a 150 mph wind, the arch can move up to 18 inches.

1. If you were to place the Gateway Arch on a coordinate plane centered around the y-axis, then the equation $y = -0.00635x^2 + 630$ could be used to model the height of the arch in feet.

a. The general form for a quadratic function is $y = ax^2 + bx + c$. Identify the values for a, b, and c from the Gateway Arch equation.

b. Find the vertex of the Gateway Arch equation.

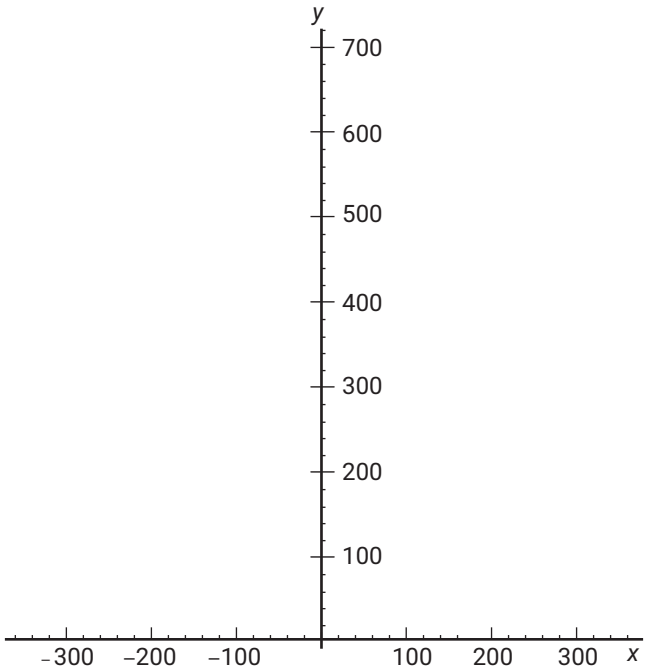
c. Does the vertex represent a maximum or a minimum? Explain your answer based on the coefficients of the Gateway Arch equation.

d. What is the height of the Gateway Arch at its peak?

e. Write the equation for the axis of symmetry of the Gateway Arch equation.

f. Find the x-intercepts of the Gateway Arch equation. Round to the nearest integer.

2. Using the coordinate plane below and the information from Problem 1, graph the Gateway Arch equation.



3. How far apart are the legs of the Gateway Arch at its base?

4. The Gateway Arch equation is a mathematical model. Look up the actual values for the height of the Gateway Arch and the distance between the legs of the arch at its base on the internet and describe how they compare to the values calculated using the equation.