Design a Fountain

Your mission is to design a fountain for a park or town square in your community. Include a minimum of 2 pairs of intersecting arcs in your fountain and at least six arcs total. Your fountain has a circular base with diameter of 100 ft. At most 2 of your arcs may begin at the edge of the fountain the rest of the arcs must be shifted from the edge. No arc can shoot water out of the fountain.

Each water arc should meet these requirements:

1) Starting point is ground level (at the bottom of fountain)

2) Max height of each arc is between 30 ft and 60 ft

3) Water speed is between 6 ft/s and 70 ft/s

4) Angle of the arc is between 15ºand 75º

Give a top and side view of your fountain design (This can be a rough sketch). Also include a page for calculations and graphs of each individual graph path of the water arc. Calculations should include where your arcs intersect, x-intercepts, distance(s) from the edge of the fountain, maximum height of the arc, etc… Give your calculations in the appropriate form with the required unit of measure. Graphs on graph paper or computer generated graphs are required as well as an explanation of your location/use of the fountain. Also describe the path of the water. All arcs flow at the same time, chase each other, alternate, and so on…

Additional information needed to complete the project:

The path of the water arc whose speed, v, is measured in feet per second is given by:

$$y = \frac{-16}{v^2(\cos A)^2}x^2 + (\tan A)x \qquad \text{where A is the angle of the nozzle}$$

This equation is really just our quadratic equation in standard form

$$y = ax^2 + bx + c$$

Using the factored form of the quadratic equation may also help find where your arcs are located. (let y = 0 and **a** is the same a in the first equation)

$$y = a(x-p)(x-q)$$

Scoring Rubric: Any project having major conceptual error or calculation errors in the model will not be evaluated. (50 points possible)

Score of 50

To obtain this score the project includes all requirements for 40 points plus a model of the fountain or a high quality poster display. All calculations are error free and an excellent narrative about the location/water flow is included.

Score of 40

Students use the equation for the path of the parabolic arc correctly in designing the fountain. The graph of the fountain is accurate, clear, and includes the heights and widths of all arcs. The graphs of the arcs are drawn correctly and the equations of the arcs, stream angles, and water speeds are free of error. The stream angles and water speeds are also within the given guidelines. The poster is attractively presented and shows a fountain design that is supported by mathematics. A poster display is provided, but not to scale and not of high quality.

Score of 25
Student's poster lacks some of the details regarding heights and widths of the water arcs, the measures of the stream angles, or the water speeds. The sketch of the fountain is rough and needs improvement. There are minor errors in the mathematic calculations needed to design the fountain.

Score of 12
Student's poster lacks many of the essential details necessary for the project. The sketch of the fountain is careless and demonstrates superficial work. Students do not fully understand how the use the equation for the path of the parabolic water arc to design their fountain. There are numerous mathematical and conceptual errors in the calculations.

Project Due Date: