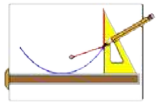

Spouting Water Project - Description and Rubric

Perhaps you have seen decorative fountains with arcs of water that appear to be standing still. In this project, you will use what you have learned to find equations that match arcs of water, and you will design a decorative fountain of your own.

1. The Perlach Shopping Center in Munich, Germany, has a fountain that uses several different arcs of water. Two of the arcs that are used in this fountain have the following specifications:

   Water arc A: parabola jet height 2.5 m, parabola horizontal jet spray distance 4.5 m
   Water arc B: parabola jet height 0.5 m, parabola horizontal jet spray distance 1 m

   Find equations that would match each of these parabolas.

2. With a photograph of a water arc or other parabola (drinking fountain, garden hose, etc.), overlay it with a coordinate grid. Find several coordinates of the arc on your grid and label them. From these coordinates, find an equation that models the water arc. Use your equation to find the maximum height the water reaches. Do this for a second photograph.

3. Now, design a fountain of your choosing using a minimum of two different water arc patterns. You need to have an illustration of your fountain and formulas that model the arcs (as in problems 1 and 2 of this project).

4. Write a short paper using the following criteria:

   - 500 words total in your assigned Google document (use the Google Docs word count tool)
   - Introduction to the project
   - Your sample problems from steps 1 and 2 with descriptions, images, and written background of the photos
   - A description of your design, image, and calculations for the formulas for the arcs in your design
   - A thorough conclusion including a reflection of your ideas on how prevalent parabolic patterns are in architecture & nature

Criterion A Knowledge and Understanding				
CATEGORY	7-8 Advanced	5-6 Proficient	3-4 Partially Proficient	1-2 Unsatisfactory
Mathematical Concepts/	Explanation shows complete understanding of the mathematical concepts used to solve the problem(s). *MYP: The student consistently makes appropriate deductions when solving challenging problems in a variety of contexts including unfamiliar situations.*	Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s). *MYP: The student generally makes appropriate deductions when solving challenging problems in a variety of familiar contexts.*	Explanation shows some understanding of the mathematical concepts needed to solve the problem(s). *MYP: The student sometimes makes appropriate deductions when solving simple problems in familiar contexts.*	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written. *MYP: The student attempts to make deductions when solving simple problems in familiar contexts.*

Criterion B Investigating Patterns				
CATEGORY	7-8 Advanced	5-6 Proficient	3-4 Partially Proficient	1-2 Unsatisfactory
Determining Properties of Quadratic Functions/ Strategy/Procedures	Always identifies and applies concepts of intercepts, vertex, axis of symmetry to parabolic patterns. Typically, uses an efficient and effective strategy to solve the problem(s). *MYP: The student selects and applies mathematical problem-solving techniques to recognize patterns, describes them as relationships or general rules, draws conclusions consistent with findings, and provides justifications or proofs.*	Typically, uses an effective strategy to solve the problem(s). Typically, uses an effective strategy to solve the problem(s). *MYP: The student selects and applies mathematical problem-solving techniques to recognize patterns, describes them as relationships or general rules, and draws conclusions consistent with findings.*	Sometimes uses an effective strategy to solve problems, but does not do it consistently. Sometimes uses an effective strategy to solve problems, but does not do it consistently. *MYP: The student selects and applies mathematical problem-solving techniques to recognize patterns, and suggests relationships or general rules.*	Rarely uses an effective strategy to solve problems. Rarely uses an effective strategy to solve problems. *MYP: The student applies, with some guidance, mathematical problem-solving techniques to recognize simple patterns.*

Criterion C Communication				
CATEGORY	5-6 Advanced/Proficient	3-4 Proficient/Partially Proficient	1-2 Unsatisfactory	0 –No Evidence
Mathematical Language/Notation	*MYP: The student shows good use of mathematical language and forms of mathematical representation. The lines of reasoning are concise, logical, and complete.* *The student moves effectively between different forms of representation.*	*MYP: The student shows sufficient use of mathematical language and forms of mathematical representation. The lines of reasoning are clear though not always logical or complete.* *The student moves between different forms of representation with some success.*	*MYP: The student shows basic use of mathematical language and/or forms of mathematical representation. The lines of reasoning are difficult to follow.*	*MYP: The student does not reach a standard described by any of the descriptions given previously.*