

### **This problem is from**

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### **Neighborhood fences and gates: design using mathematics**

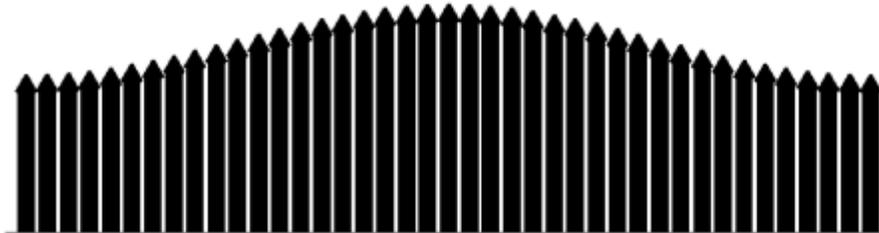
As you walk around your neighborhood, you will see lots of fences and gates in the front yards of houses. The design of the fences can be described by mathematical functions.

- 1) Walk around your neighborhood and take pictures or draw sketches of yard fences or gates of different shapes. If your house has a fence be sure to include it.
- 2) Find mathematical functions that can be used to design the fences in the pictures or sketches. Include the domain of the functions. Since the pictures don't have coordinate axes, you will need to make choices about the height and width of your functions and possibly about other parameters. Be sure to list the choices you make and your reasons for making those choices.
- 3) Fences and gates can have different purposes. Use your imagination to sketch or describe a new fence shape that you find interesting and that has a unique shape. Think of where your fence might be used and what purpose your fence might have. Then find a function that describes your fence and explain the choices you made and how those choices are connected to the purpose for your fence.
- 4) Provide a set of instructions that you can give to a picket fence builder. Your instructions should include the number of pickets and their width, the height of each picket, the separation between pickets and the order in which they should be installed.
- 5) Look for public places or private homes in your neighborhood that do not have fences. Propose a fence or a gate for one of these places based on its purpose and provide a mathematical function for it.

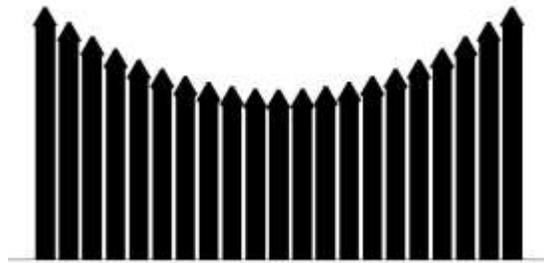
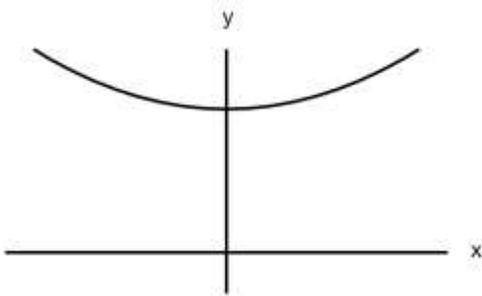
## Notes to the instructor

Traditionally, in mathematics courses we are given a function and we are asked to identify features of the function: Is it even? Is it periodic? Is it decreasing? This task does the opposite; it asks students to propose functions that have given features, which is the type of skill mathematicians use when deciding on an ansatz for data fitting, for example. Here, students are asked to propose functions that have specific qualitative features, which allows students to use creativity and prior knowledge to suggest functions. Since there are multiple acceptable possibilities, there is opportunity for students to reveal their knowledge and personal choices.

The problem also makes connections to culture and community and can promote discussions about the purpose Gates and fences (security, protection, aesthetics?). Below are sample figures that may give the instructor ideas for this problem.



Function of the form:  $y(x) = A + B \cos(x)$



Two representations of a function of the form:  $y(x) = A + B x^2$

Other unrestricted suggestions: odd and even functions

