

## ART PROJECT

### Performance Standard 8B.J

Make a drawing using piecewise functions and relations from a specified list of equations accordingly:

- *Mathematical knowledge:* Demonstrate knowledge of the properties of the graphs of conic sections, absolute value and inverse relations and a variety of symbolic representations for piecewise functions.
- *Strategic knowledge:* Analyze the domains needed and demonstrate both the equations with appropriate domains and the final design.
- *Explanation:* Explain completely and clearly what was done and why it was done.

### Procedures

1. *In order to interpret and describe numerical relationships using tables, graphs, and symbols (8B)*, students should experience sufficient learning opportunities to develop the following:
  - Use a variety of symbolic representations for functions and relations, including piecewise functions.
  - Describe the properties and features of any non-degenerate conic section from an equation or graph.
  - Write an equation for conic sections from a graph.Note: Students should be familiar with conic sections, absolute value graphs and inverse relations in order to complete the assessment.
2. Provide each student a copy of the "Art Project" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Ask students to complete the following task:

Using graph paper, draw a picture containing only graphs of lines, conics, and absolute values. The picture must be composed of a minimum of 10 different equations. There must be at least 2 lines, 2 absolute value graphs, 2 parabolas, and 2 other kinds of conics. In addition, one of the absolute value graphs or one of the parabolas must have a horizontal line of symmetry.

Two copies need to be submitted for evaluation: one with all the parts numbered to coincide with a numbered list of the equations and the domain for each equation written next to the equation; the other copy will be a final copy with the picture outlined with black marker and colored to make an attractive picture. (Domains must be to the nearest hundredth if not integers.) A written description of the solution process and reasons for each step must be submitted with the design.

4. Evaluate each student's work using all 3 dimensions of the rubric and its guide to determine the performance level. A 4 in mathematical knowledge would require at least 10 equations, including the required equations, with appropriate domains. A strategy score of 4 would require that the first drawing show the complete graphs of the equations with an indication of the intersection points where the domains converge. An explanation score of 4 would require that the written part agree with the design and accurately describe what was done and why.

### Examples of Student Work follow

### Resources

- Copies of the "Art Project" task sheet
- Graphing calculator
- Mathematics Rubric

### Time Requirements

- Students are to complete the project outside of class and turn it in after three to five days

Name \_\_\_\_\_ Date \_\_\_\_\_

### **GRAPHING ART PROJECT**

Using graph paper, draw a picture containing only graphs of lines, conics, and absolute values. The picture must be composed of a minimum of ten different equations. There must be at least

Two lines, two absolute value graphs, two parabolas, and two other kinds of conics.

In addition, one of the absolute value graphs or one of the parabolas must have a horizontal line of symmetry.

Two copies need to be submitted for evaluation: one with all the parts numbered to coincide with a numbered list of the equations and the domain for each equation written next to the equation; the other copy will be a final copy with the picture outlined with black marker and colored to make an attractive picture. (Domains must be to the nearest hundredth if not integers.) A written description of the solution process and reasons for each step must be submitted with the design.

Adapted from "Projects: A Journey", Mary Ebert and Sandy Graham, Quincy Senior High School, presented at ICTM Preconference, October 1999.

I started out solving this project's problem by first deciding what I wanted to draw. After just sketching different designs on regular paper, I came across a mountain range design that I liked. I decided to stick with it, and added details like a lake (an ellipse) and a sun (a parabola). I then went about making sure I had the right kinds and numbers of graphs, so I added birds for more parabolas and a cloud for another conic. After drawing my picture out in sketch form to my satisfaction, I then worked on my equations. I started with the absolute values (my mountains) first, then my ellipses, and so on. For each one I spent time moving it to where I wanted it exactly, and making sure that my domains allowed them to correspond with each other. Eventually, after getting my equations down, I moved my picture to the graph paper, copying down one outline and one for coloring. I finished with coloring in my little landscape as a mountain range silhouetted against a sunset.

$$\textcircled{1} y = |x+8| \quad D = \{-8 \leq x \leq -4\}$$

$$\textcircled{2} y = |x+4| \quad D = \{-8 \leq x \leq 0\}$$

$$\textcircled{3} y = |x| \quad D = \{-4 \leq x \leq 4\}$$

$$\textcircled{4} y = |x-4| \quad D = \{0 \leq x \leq 8\}$$

$$\textcircled{5} y = |x-8| \quad D = \{4 \leq x \leq 8\}$$

$$\textcircled{6} y = |x-12| \quad D = \{8 \leq x \leq 12\}$$

$$\textcircled{7} y = |x+12| \quad D = \{-12 \leq x \leq -8\}$$

$$\textcircled{8} \frac{(x-2)^2}{49} + \frac{(y+2)^2}{4} = 1$$

$$\textcircled{9} \frac{(x+6)^2}{9} + (y-8)^2 = 1$$

$$\textcircled{10} y = -\frac{1}{8}x^2 + 5 \quad D = \{-3 \leq x \leq 3\}$$

$$\textcircled{11} y = \frac{3}{4}x + 2 \quad D = \{3 \leq x \leq 10\}$$

$$\textcircled{12} y = 3x - 1 \quad D = \{2 \leq x \leq 5\}$$

$$\textcircled{13} y = -3x - 1 \quad D = \{-5 \leq x \leq -2\}$$

$$\textcircled{14} y = -\frac{3}{4}x + 2 \quad D = \{-10 \leq x \leq -3\}$$

$$\textcircled{15} y = -(x+4)^2 + 11 \quad D = \{-5 \leq x \leq -3\}$$

$$\textcircled{16} y = -(x+2)^2 + 11 \quad D = \{-3 \leq x \leq -1\}$$

$$\textcircled{17} y = x^2 + 2 \quad D = \{-1 \leq x \leq 1\}$$

$$\textcircled{18} y = (x-4)^2 + 2 \quad D = \{3 \leq x \leq 5\}$$

$$\textcircled{19} y = (x-8)^2 + 2 \quad D = \{7 \leq x \leq 9\}$$

$$\textcircled{20} y = (x+4)^2 + 2 \quad D = \{-5 \leq x \leq -3\}$$

$$\textcircled{21} y = (x+8)^2 + 2 \quad D = \{-9 \leq x \leq -7\}$$

$$\textcircled{22} y = -2(x+\frac{1}{2})^2 + 14 \quad D = \{-1 \leq x \leq 0\}$$

$$\textcircled{23} y = -2(x-\frac{1}{2})^2 + 14 \quad D = \{0 \leq x \leq 1\}$$

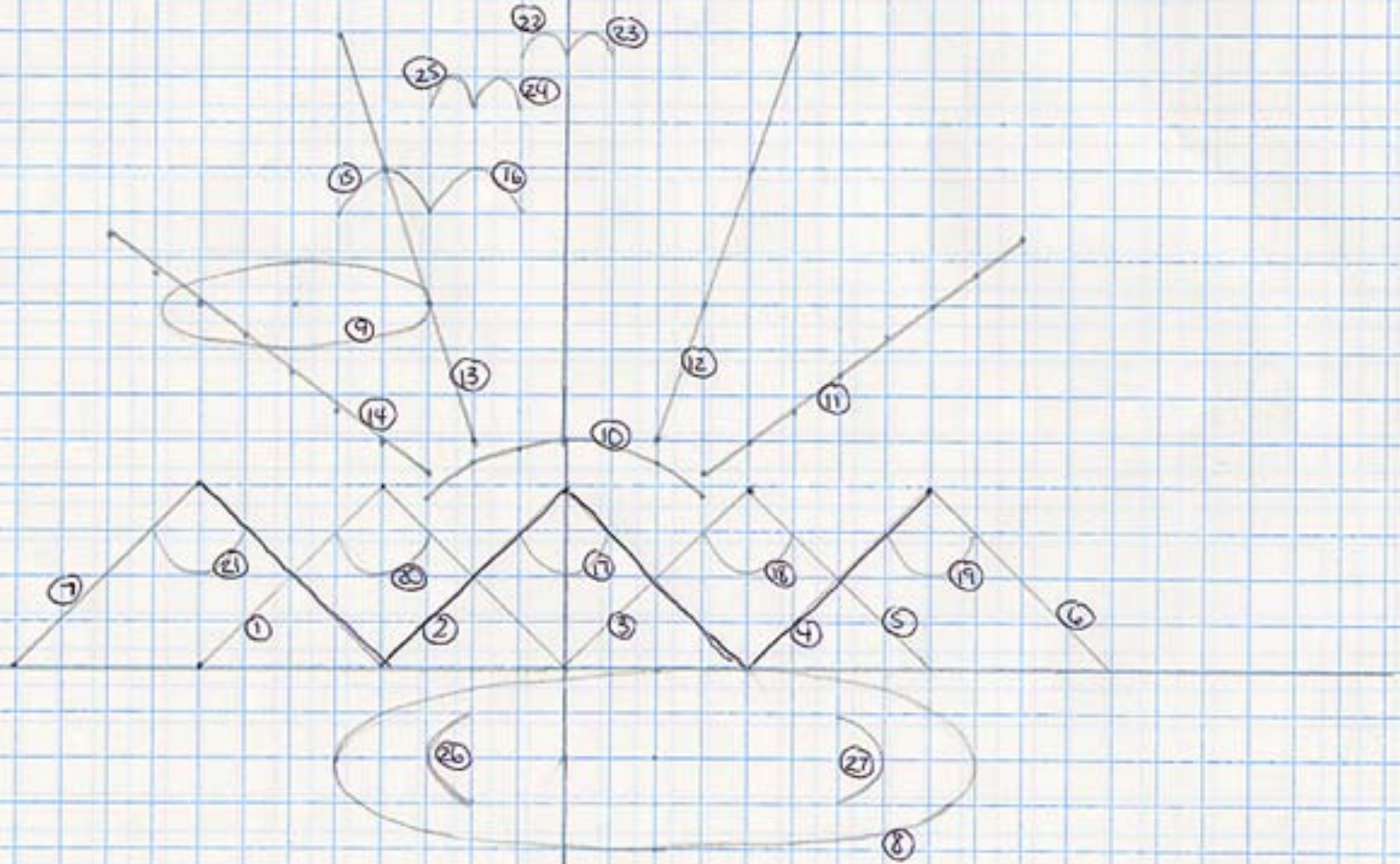
$$\textcircled{24} y = -3(x+\frac{3}{2})^2 + 13 \quad D = \{-2 \leq x \leq -1\}$$

$$\textcircled{25} y = -3(x+\frac{5}{2})^2 + 13 \quad D = \{-3 \leq x \leq -2\}$$

$$\textcircled{26} x = (y+2)^2 - 3 \quad D = \{-3 \leq y \leq -1\}$$

$$\textcircled{27} x = -(y+2)^2 + 7 \quad D = \{-3 \leq y \leq -1\}$$

8B-JM3



88-JM4

"Meets" (page 4)

