Name_____

Course_____

Materials: TI-Nspire

Rectangles_Parabolas.TNS

In this activity, you will explore:

- relationships between length and area for a rectangle with a fixed perimeter
- equations, graphs, and spreadsheets to predict maximum area.

The Problem

Sixty feet of fencing is purchased for the grounds crew to fence off a rectangular portion of property for a garden. The owner has made it perfectly clear that he would like the plot of land with the greatest area. Help the grounds crew decide on the dimensions for the maximum area.

Open the file *Rectangles_Parabolas.TNS* on your handheld and follow along with your teacher to work through the activity.

Instructions for exploring the file:

- Press ctrl ▸ to advance to the next page in the TNS file
- Move the cursor to the vertex with the open circle then ctrl ⬚ to drag the point to a different location.

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1. Read through the TNS file beginning at page 1.1 through page 1.4. Move the lower right vertex point of the rectangle on page 1.4 and describe what changes as you move the vertex.

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2. Continue on and read page 2.1. As you move the vertex on page 2.3, you will capture data points into a spreadsheet. To capture the measurements of the rectangle into the spreadsheet press ctrl . after each movement. To view the measurements move to page 2.3. Examine the data values in the spreadsheet and describe relationships between the length and the width and the length and the area.

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3. For the measurements that you collected in the spreadsheet on page 2.3, what would you say the maximum area and dimensions are?_____

4. Continue to page 2.4 and examine the scatter plot of the data. What do the x and y axis represent in the context of the problem? How would you describe the pattern that you see?

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5. How can you use the graph to find the maximum area?_____

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6. Move to page 2.5. The scatter plot is in view, as well as the graph of the function $f1(x) = x^2$.

   a. Using two different transformation tools move the graph of f1 so that is summarizes the points that are plotted. Using the Navpad, move the cursor over the graph of f1, but not on the vertex until you see the ⁒ cursor . Press ctrl (click) to grab the parabola and move it until it has a shape like the scatter plot, then press enter.

   b. Now move the cursor to the vertex of f1 until you get the translation tool ✣. Press ctrl (click) to grab the parabola and move it until it fits over the scatter plot.

   c. Now, that you have a function that summarizes the data, how could you find the maximum area and the dimensions?

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7. Draw the rectangle that represents this situation and label the length l and the width in terms of the length (l).Write an equation for the area, A, in terms of l.

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8. Change your equation by replacing l with x. A is represented as f2(x). Enter your equation in f2 and press enter. You can add the entry line back ctrl G to graph your equation. Based on your model, what would be the maximum area and dimensions of the rectangle?

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