The Quadratic River Problem

Part One: 1. How is area and perimeter calculated for rectangles? When might it be helpful to maximize or minimize area in real-life? Perimeter?

Find the area and perimeter rectangles with the given widths and lengths to fill out the table below.

Width	Length	Perimeter	Area
100 ft	200 ft		
50 ft	250 ft		
125 ft	175 ft		

What do you notice about the perimeters? Areas?

2. Let's explore more with this online geogebra tool. Use the perimeter of _____ units.

Width	Length	Perimeter	Area

3. What do you notice from your explorations?

4. Continue to work with the geogebra tool. Given the perimeter of _____ units , what width and length maximizes the area? What width and length minimizes the area?

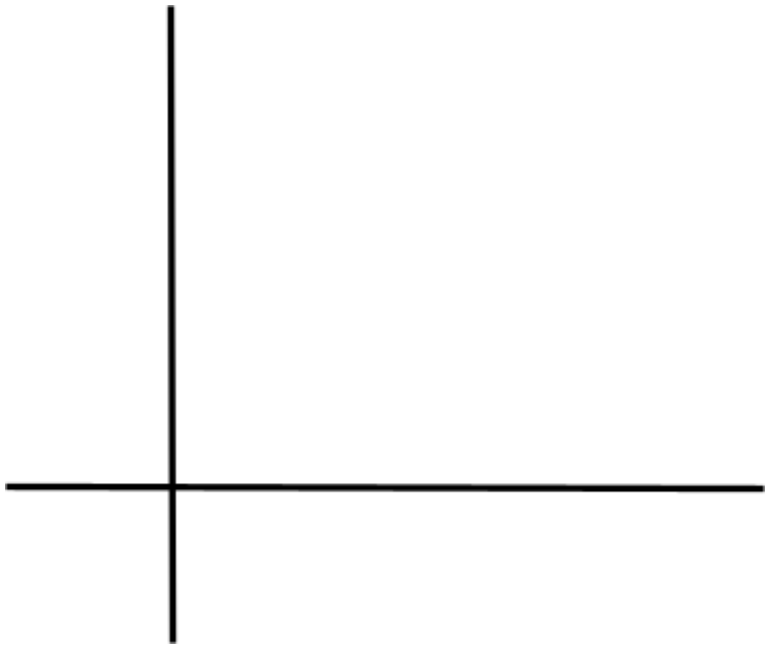
Width	Length	Perimeter	Area

5. Suppose you have 600 feet of fencing to enclose a rectangular plot that borders on a river. In this rectangular plot, you are building a garden.

a. Draw a picture to match the scenario. Pick the two congruent sides to be x and label the other side(s) accordingly. Describe what x is represented in your picture.

b. Using what you know about calculating the area of a rectangle along with the picture from part a, write an equation for Area, $A(x)$ of the rectangular plot.

c. Graph $A(x)$ on your graphing calculator. Sketch a graph labeling your axes appropriately, including units.



d. Using your graphing calculator to complete the following table. Make sure to include appropriate units. Remember that the graph in part c is a graph of the area function $A(x)$ for the rectangular plot.

Width x	Length	Perimeter	Area
			11200 ft^2
			25000 ft^2
			44200 ft^2
			45000 ft^2

e. What do you notice from the graph and the table? Include information about perimeter, width, and length. Are there any area values that have multiple options for width and length? Explain.

f. Since we are fencing in a garden, we want to maximize the area. Find the width, length, and area associated with maximizing area using the graph. Describe the point that corresponds to these values. Redraw your original picture with labels for the found width, length, and area measurements.

g. If you computed $A(150)$, what value would you expect to get? (Do not compute the value).

h. What point does the ordered pair $(\frac{-b}{2a}, A(\frac{-b}{2a}))$ represent on the graph?

i. Find the vertex of the graph of $A(x)$ (using $x = \frac{-b}{2a}$ to find the x-coordinate). Compare this with your answer in part f.

Part Two: Suppose you have 400 feet of fencing to enclose a rectangular plot. In this rectangular plot, you are building a playground.

a. Draw a picture to match the scenario. Pick the two congruent sides to be x and label the other sides accordingly.

b. Using what you know about calculating the area of a rectangle along with the picture from part a, write an equation for Area, $A(x)$.

c. Complete the following table. Make sure to include appropriate units.

Width x	Length	Perimeter	Area
30 ft		400 ft	
50 ft		400 ft	
80 ft		400 ft	
100 ft		400 ft	

d. Since we are fencing in a playground, we want to maximize the area. Find the width, length, and area associated with maximizing area using $(\frac{-b}{2a}, A(\frac{-b}{2a}))$.

e. Based on the information from the table and your answers from part d, what shape would give us the maximum area?