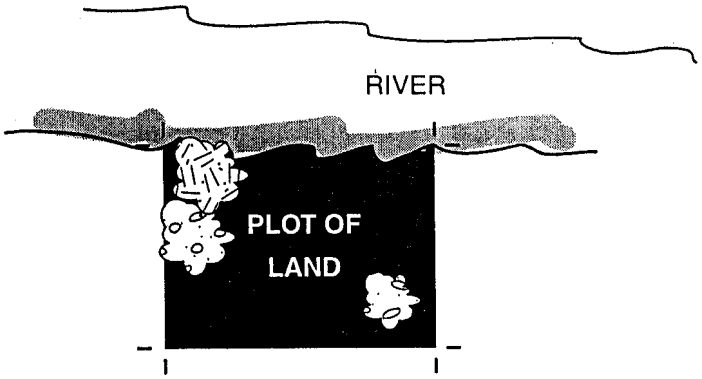
ACTIVITY A
Permission Granted

A RECTANGULAR PLOT

Suppose that you want to enclose a 650 sq m rectangular plot of land along a river. What can the dimensions of the plot be if you have only 110 m of fencing and you do not fence the river side? Provide a labeled diagram and show the method you used to arrive at your answer. If a graphing utility is used, indicate how it was used, and if applicable, sketch and label curves and any significant points. (Round answers to the nearest tenth.)



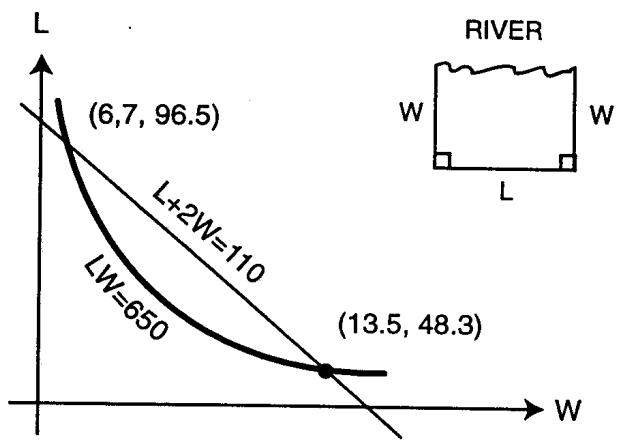
[Source: A Collection of Performance Tasks and Rubrics: High School Mathematics, Eye on Education, Larchmont, NY]

MATHEMATICAL CONCEPTS

In order to complete this task, most students will probably model the problem with a system of equations and then decide which method they will use to solve the system. They should realize that there are 2 sets of dimensions that will satisfy the given conditions. Those students who try to complete the task by using the *Solve* function on their calculators will soon realize the limits of technology.

SOLUTIONS

Method 1: Graph L vs W, and find the intersection of the line and the hyperbola. Since L and W are positive, we need only look at the branch of the hyperbola in the first quadrant. Note: Axes may be interchanged.



System is:
L + 2W = 110 or y = 110 – 2x
LW = 650 or y = 650 / x

Dimensions are:
48.3m x 13.5 m
or
6.7m x 96.5m

Source: A Collection of Performance Tasks and Rubrics: High School Mathematics, Eye on Education, Larchmont, NY]

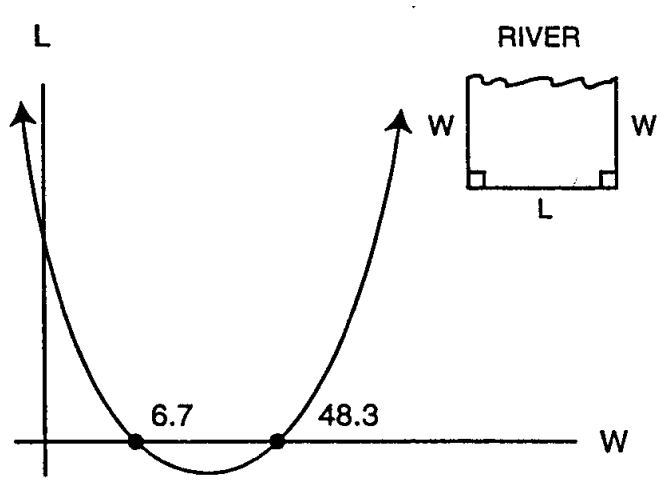
Method 2: Using substitution, get an equation in W which models the problem:

$W^2 - 55W + 325 = 0$. Then find the roots of this equation to find the widths.

Use these widths to find the lengths.

(Note: Students may prefer to model the problem in terms of L:

$L^2 - 110L + 1300 = 0$)



$LW = 650$
$(110 - 2W)W = 650$
$2W^2 - 110W + 650 = 0$
$W^2 - 55W + 325 = 0$

Dimensions are:
48.3m x 135.m
or
6.7m x 96.5m

Method 3: Use substitution and the quadratic formula to find the solutions for one dimension, and then solve for the other dimension.

Method 4: Guess and check, possibly making a table and exploring possibilities, to arrive at the solutions.

Note: The solve function on graphics calculators will give only one solution.

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RUBRIC

Level 4: This response offers clear and convincing evidence of a deep knowledge of the mathematics related to this task.

Characteristics:
Student correctly solves the problem by one of the methods given. Both solutions are given. Work may have minor flaws – e.g., intersection not labeled, or one of the answers may not be correctly rounded.

Level 3: This response offers evidence of substantial knowledge of the mathematics related to this task.

Characteristics:
Student attempts to solve the problem by one of the given methods and both solutions are correct except for one incorrect or omitted dimension.

Level 2: This response offers limited or inconsistent evidence of knowledge of the mathematics related to this task.

Characteristics:
Student attempts to solve the problem by one of the methods given but states only one set of correct dimensions; or states only the widths and not the lengths of both sets of dimensions or vice versa; or the student states both lengths or both widths as one set of dimensions.

Level 1: This response offers little or no evidence of knowledge of the mathematics related to this task.
Characteristics:
Student attempts to solve the problem by one of the methods given but cannot correctly state any part of either set of dimensions, or only one dimension of one set is correct.

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