1. **Finding a Formula for the Amount of Material Used to Construct a Box.** A large rectangular box, open at the top, is to be constructed so that the volume is 20 cubic feet and the base has length equal to twice its width. We will seek a formula for the amount of material that will be needed to construct the box in terms of the width of the box.

(a) First draw a picture of the box and label its dimensions. Use h for the height, x for the width, and write the length in terms of x.

(b) Write an expression in terms of h and x for A, the amount of material used to construct the box. To do this, you will have to add up the areas of the bottom and the four sides of the box.

(c) Now consider the volume of the box. You are given that it is 20 ft^3. Use this fact to write an equation relating h and x and then solve for h in terms of x.

(d) Substitute the expression for h which you found in (3) into the expression for A in (2) and simplify the result. You should now have an expression ***for A as a function of x***. What do you think is a reasonable domain for this function?

(e) Use your calculator to graph the function that you found for A. Be sure to set a viewing window on your calculator that makes sense for the function which you are graphing.

(f) Based on your graph, is it possible to construct a box with the given specifications such that A is 80 ft^2? 50 ft^2? 25 ft^2? Why or why not?

(g) From your graph, determine the approximate value of x which will give the ***minimum*** value for the A and what this minimum A will be. Why do you think minimizing A might be important?

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2. **Installing Telephone Cable** Points A and B are opposite one another on shores of a straight river 3 km wide. Point C is on the same shore as B, but 2 km down the river from B. A telephone company wishes to lay a cable from A to C. Cable laid underwater costs $500 per km and cable laid on land costs $100 per km.

(a) Draw and label a sketch.

(b) How much would it cost to lay cable directly from A to C?

(c) What would be the total cost to lay cable from A to B under water, then from B to C on land?

(d) Suppose point D is located on land exactly midway between points B and C. What would be the total cost to lay the cable from A to D under water, then from D to C on land?

(e) The results so far should suggest that the cable paths described in parts (c) and (d) above are not the most cost-efficient. The path described in part (e) might be best, but perhaps there is an *optimum* location for point D, not necessarily midway between B and C.

Let point D be located on a line from B to C, and let x be the distance from B to D. Find expressions for the distance from D to C, and for the distance from A to D.

Write an equation for the total cost function.

(f) Graph the cost function on your calculator and estimate the value of x (and hence the location of point D) that minimizes the cost function. Also determine the minimum cost.

Section 2.7 HW:

2.7 (p. 163)/ #1, 3, 7, 19, 21 (Hint: Use Distance = (Rate)(Time) to find the distance traveled by each car), 23, 24