13.B Find the Dimensions

You have 40 square feet of artificial turf and 28 feet of fencing. Is it possible to use all your materials to build a rectangular pen?

1. Find the dimensions of a rectangle having area 40 and perimeter 28. (Hint: You may use trial and error, tables, or graphs.)

Problems like this one can be solved using algebra. The first step is to write some equations.

$$\begin{cases} LW = 40 \\ 2L + 2W = 28 \end{cases}$$

2. Explain how these equations express the given conditions for the pen.

3. Divide all the terms in the second equation by two, to make it simpler.

4. Use algebra to show how the equations can be combined into one of the following equations having just one variable:
   a. $L(14 - L) = 40$, or
   b. $L + \frac{40}{L} = 14$

5. Explain the following steps to transform the equation in problem 4b:

$$L + \frac{40}{L} = 14$$
$$L^2 + 40 = 14L$$
$$L^2 - 14L + 40 = 0$$

6. a. Use algebra to transform the equation in problem 4a into the same equation.
   b. Solve the equation.

7. a. The perimeter of a rectangle is 50. Write the area in terms of the length.
   b. The area of a rectangle is 60. Write the perimeter in terms of the width.

For each problem, 8-11, find the dimensions of the rectangle. Show your work and explain your method. Include a sketch labeled with the variables you use.

8. A rectangle has area 180 and perimeter 64.

9. A rectangle has area 126. The length is 25 more than the width.

10. A rectangle has perimeter 35, and its length is 4 times its width.

11. A rectangle has area 25, and its length is 4 times its width.

12. **Report** Hyru has 40 square feet of artificial turf. Valerie has 40 feet of fencing. They decide to use all their materials to build a rectangular pen. Write them a letter explaining as many methods as possible for finding appropriate dimensions for such a pen.