

## Finding the Maximum Area of a Rectangular Region

A farmer has 120 ft of fencing. He wants to put a fence around a rectangular field next to a building. (See Figure 14.) Find the maximum area he can enclose, and the dimensions of the field when the area is maximized.



FIGURE 14

Let  $x$  = the width of the field. Then

$$x + x + \text{length} = 120 \quad \text{Sum of the sides is 120 ft.}$$

$$2x + \text{length} = 120 \quad \text{Combine terms.}$$

$$\text{length} = 120 - 2x. \quad \text{Subtract } 2x.$$

The area is given by the product of the width and length, so

$$\begin{aligned} A(x) &= x(120 - 2x) \\ &= 120x - 2x^2. \end{aligned}$$

To determine the maximum area, find the vertex of the parabola given by  $A(x) = 120x - 2x^2$  using the vertex formula.