

WORKSHEET TO ACCOMPANY SECTION 3.1

APPLICATIONS OF QUADRATIC FUNCTIONS MAXIMUM AND MINIMUM VALUES

Recall: If a function f is a quadratic function of the form $f(x) = ax^2 + bx + c$, then we know:

- Its graph is a parabola
- If $a > 0$, the parabola opens upward and the function has a *minimum* value, and
- if $a < 0$, the parabola opens downward and the function has a *maximum* value.
- The vertex of the parabola is the point whose coordinates are: $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$.
- The maximum or minimum value of the function is the *y-coordinate of the vertex*.
- The maximum or minimum value occurs when $x = \frac{-b}{2a}$.

When doing application problems involving quadratic equations, read carefully. If you are asked to find a maximum or minimum value of a function (the maximum area, maximum profit, minimum cost), you will want to find the *y-coordinate* of the vertex. If you are asked how the maximum value is achieved (the dimensions that will yield maximum area, the number of units needed to be sold in order to get maximum profit), you will need to find the *x-coordinate* of the vertex.

Exercises:

1. The perimeter of a rectangle is 600 feet. Let x represent the width of the rectangle and let y represent the length. (a) Write a quadratic function that represents the area of the rectangle in terms of its width. (b) Find the dimensions of the rectangle whose perimeter is 600 feet and whose area is the maximum that is possible.
2. Steve has 920 feet of fencing available. He wants to fence in a corral as pictured in the diagram. (a) Write a quadratic equation that represents the area of the corral in terms of its width, x . (b) Find the dimensions of the corral that will yield the maximum possible area.



3. A manufacturing company has daily production costs of $C(x) = 900 - 30x + 0.3x^2$ where C is the cost in dollars and x is the number of units produced. (a) How many units should be produced each day in order to keep the daily cost at a minimum? (b) What is the minimum possible daily cost?
4. The profit for a company is given by: $P(x) = -0.0003x^2 + 120x - 180,000$ where x represents the number of units produced. (a) How many units should be produced in order to achieve the maximum possible profit? (b) What is the maximum profit?