

Name \_\_\_\_\_ Date \_\_\_\_\_

## Up and Down or Down and Up

### Exploring Quadratic Functions

#### Vocabulary

Write the given quadratic function in standard form. Then describe the shape of the graph and whether it has an absolute maximum or absolute minimum. Explain your reasoning.

$$2x^2 = x + 4$$

#### Problem Set

Write each quadratic function in standard form.

1.  $f(x) = x(x + 3)$

$$f(x) = x(x + 3)$$

$$f(x) = x \cdot x + x \cdot 3$$

$$f(x) = x^2 + 3x$$

2.  $f(x) = 3x(x - 8) + 5$

3.  $g(s) = (s + 4)s - 2$

4.  $d(t) = (20 + 3t)t$

5.  $f(n) = \frac{2n(3n - 6)}{3}$

6.  $m(s) = \frac{s(s + 3)}{4}$

Write a quadratic function in standard form that represents each area as a function of the width. Remember to define your variables.

7. A builder is designing a rectangular parking lot. She has 300 feet of fencing to enclose the parking lot around three sides.

Let  $x$  = the width of the parking lot

The length of the parking lot =  $300 - 2x$

Let  $A$  = the area of the parking lot

Area of a rectangle = width  $\times$  length

$$A = w \cdot l$$

$$A(x) = x \cdot (300 - 2x)$$

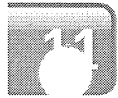
$$= x \cdot 300 - x \cdot 2x$$

$$= 300x - 2x^2$$

$$= -2x^2 + 300x$$

8. Aiko is enclosing a new rectangular flower garden with a rabbit garden fence. She has 40 feet of fencing.

9. Pedro is building a rectangular sandbox for the community park. The materials available limit the perimeter of the sandbox to at most 100 feet.



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10. Lea is designing a rectangular quilt. She has 16 feet of piping to finish the quilt around three sides.

11. Kiana is making a rectangular vegetable garden alongside her home. She has 24 feet of fencing to enclose the garden around the three open sides.

12. Nelson is building a rectangular ice rink for the community park. The materials available limit the perimeter of the ice rink to at most 250 feet.

**11**

Use your graphing calculator to determine the absolute maximum of each function. Describe what the  $x$ - and  $y$ -coordinates of this point represent in terms of the problem situation.

13. A builder is designing a rectangular parking lot. He has 400 feet of fencing to enclose the parking lot around three sides. Let  $x$  = the width of the parking lot. Let  $A$  = the area of the parking lot. The function  $A(x) = -2x^2 + 400x$  represents the area of the parking lot as a function of the width.

The absolute maximum of the function is at  $(100, 20,000)$ .

The  $x$ -coordinate of 100 represents the width in feet that produces the maximum area.

The  $y$ -coordinate of 20,000 represents the maximum area in square feet of the parking lot.

14. Joelle is enclosing a portion of her yard to make a pen for her ferrets. She has 20 feet of fencing. Let  $x$  = the width of the pen. Let  $A$  = the area of the pen. The function  $A(x) = -x^2 + 10x$  represents the area of the pen as a function of the width.
15. A baseball is thrown upward from a height of 5 feet with an initial velocity of 42 feet per second. Let  $t$  = the time in seconds after the baseball is thrown. Let  $h$  = the height of the baseball. The quadratic function  $h(t) = -16t^2 + 42t + 5$  represents the height of the baseball as a function of time.
16. Hector is standing on top of a playground set at a park. He throws a water balloon upward from a height of 12 feet with an initial velocity of 25 feet per second. Let  $t$  = the time in seconds after the balloon is thrown. Let  $h$  = the height of the balloon. The quadratic function  $h(t) = -16t^2 + 25t + 12$  represents the height of the balloon as a function of time.
17. Franco is building a rectangular roller-skating rink at the community park. The materials available limit the perimeter of the skating rink to at most 180 feet. Let  $x$  = the width of the skating rink. Let  $A$  = the area of the skating rink. The function  $A(x) = -x^2 + 90x$  represents the area of the skating rink as a function of the width.
18. A football is thrown upward from a height of 6 feet with an initial velocity of 65 feet per second. Let  $t$  = the time in seconds after the football is thrown. Let  $h$  = the height of the football. The quadratic function  $h(t) = -16t^2 + 65t + 6$  represents the height of the football as a function of time.

