

5.8 Exercises

Concept Check

Fill-in-the-Blank. Complete the sentences using information found in this chapter.

- When a linear function is written in the form $f(x) = mx + b$, m is the _____ and b is the _____.
- The turning point of a parabola is called the _____.
- A parabola is a mirror image of itself on either side of the axis of _____.
- For a quadratic function $y = ax^2 + bx + c$, if $a < 0$, then the parabola opens _____.
- If a parabola opens upward, and (h, k) is the lowest point, the value k is called the _____ value of the function.
- If a parabola opens downward, and (h, k) is the highest point, the value k is called the _____ value of the function.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

- The vertex of a vertical parabola is the lowest point on the parabola.
- The maximum or minimum value of a quadratic function written in general form can be found by letting $x = -\frac{b}{2a}$ and solving for y .
- Quadratic functions of the form $y = ax^2 + bx + c$, have a line of symmetry at $x = \frac{b}{2a}$.

Practice

For each quadratic function, **a.** find its vertex, **b.** find its line of symmetry, **c.** locate (or estimate) its x -intercepts, and **d.** graph the function. (**Note:** If solving the quadratic equation results in nonreal solutions, then the graph does not cross the x -axis.) See Examples 1 through 3.

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|-----------------------|--------------------------|
| 1. $y = x^2 + 4$ | 8. $y = x^2 - 4x$ |
| 2. $y = x^2 - 6$ | 9. $y = -x^2 - 4x + 2$ |
| 3. $y = 8 - x^2$ | 10. $y = -x^2 - 5x + 4$ |
| 4. $y = -2 - x^2$ | 11. $y = 2x^2 - 10x + 3$ |
| 5. $y = x^2 - 2x - 3$ | 12. $y = 2x^2 - 12x - 5$ |
| 6. $y = x^2 - 4x + 5$ | 13. $y = x^2 + 7x - 4$ |
| 7. $y = x^2 + 6x$ | 14. $y = x^2 + 5x + 4$ |

15. $y = -x^2 + x - 3$

18. $y = 2x^2 - x - 3$

16. $y = -x^2 - 7x + 3$

19. $y = 3x^2 + 5x + 2$

17. $y = 2x^2 + 7x - 4$

20. $y = 3x^2 - 9x + 5$

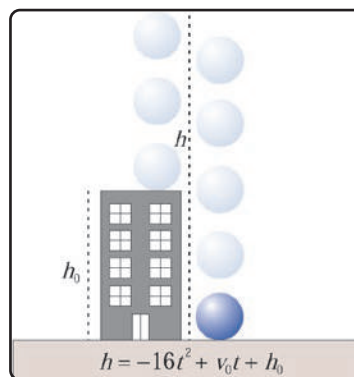
Applications

Solve the following word problems. See Example 4.

21. The perimeter of a rectangle is 60 yd. What are the dimensions of the rectangle with maximum area?
22. The perimeter of a rectangle is 56 ft. What are the dimensions of the rectangle with maximum area?

In the following exercises use the formula $h = at^2 + v_0t + h_0$, where h is the height (in feet) of a projectile after time, t (in seconds). The initial velocity is v_0 and the initial height is h_0 .

23. A ball is thrown vertically upward from the ground with an initial velocity of 112 ft per sec.
- When will the ball reach its maximum height?
 - What will be the maximum height?
24. A ball is thrown vertically upward from the ground with an initial velocity of 104 ft per sec.
- When will the ball reach its maximum height?
 - What will be the maximum height?
25. A stone is projected vertically upward from a platform that is 32 ft high at a rate of 128 ft per sec.
- When will the stone reach its maximum height?
 - What will be the maximum height?



26. A stone is projected vertically upward from a platform that is 20 ft high at a rate of 160 ft per sec.
- When will the stone reach its maximum height?
 - What will be the maximum height?

In business, the term revenue represents income. The revenue (income) is found by multiplying the number of units sold times the price per unit.

$$[\text{Revenue} = (\text{price}) \cdot (\text{units sold})]$$

27. A store owner estimates that by charging x dollars each for a certain lamp, he can sell $40 - x$ lamps each week. What price will yield maximum revenue?
- What is the revenue function $R(x)$?
 - What price will yield a maximum revenue?
28. When fishing reels are priced at x dollars each, local consumers will buy $36 - x$ fishing reels.
- What is the revenue function $R(x)$?
 - What price will yield a maximum revenue?
29. A manufacturer produces calculators. She estimates that by selling them for x dollars each, she will be able to sell $80 - 2x$ calculators each week.
- What is the revenue function $R(x)$?
 - What price will yield a maximum revenue?
 - What will be the maximum revenue?
30. A manufacturer produces radios. He estimates that by selling them for x dollars each, he will be able to sell $100 - x$ radios each month.
- What is the revenue function $R(x)$?
 - What price will yield a maximum revenue?
 - What will be the maximum revenue?

Writing & Thinking

31. Use your graphing calculator to graph each of the following quadratic functions.
- Graph each equation one at a time.
 - Graph all three parabolas at the same time (all three curves should appear on the display).
 - $y = x^2 + 1$
 - $y = x^2 + 3$
 - $y = x^2 - 4$
32. In your own words, state the effect on the graph of $y = x^2$ by changing the constant term k in the function $y = x^2 + k$.

- 33.** Use your graphing calculator to graph each of the following quadratic functions
- Graph each equation one at a time.
 - Graph all three parabolas at the same time (all three curves should appear on the display).
 - $y = (x - 3)^2$
 - $y = (x - 5)^2$
 - $y = (x + 2)^2$
- 34.** In your own words, state the effect on the graph of $y = x^2$ by changing the constant term h in the function $y = (x - h)^2$.
- 35.** Discuss the general relationship of the graph of a function of the form $y = (x - h)^2 + k$ to the graph of the function $y = x^2$.