

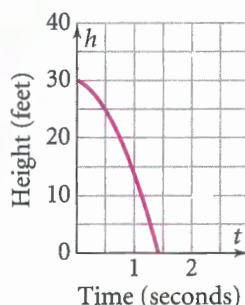
You can model the height of an object moving under the influence of gravity using a quadratic function. As an object falls, its speed continues to increase. Ignoring air resistance, you can find the approximate height of a falling object using the function $h = -16t^2 + c$. The height h is in feet, the time t is in seconds, and the initial height of the object c is in feet.

5 EXAMPLE **Real-World Problem Solving**



Nature Suppose you see an eagle flying over a canyon. The eagle is 30 ft above the level of the canyon's edge when it drops a stick from its claws. The force of gravity causes the stick to fall toward Earth. The function $h = -16t^2 + 30$ gives the height of the stick h in feet after t seconds. Graph this quadratic function.

t	$h = -16t^2 + 30$
0	30
1	14
2	-34



Height h is dependent on time t . Graph t on the x -axis and h on the y -axis. Use nonnegative values for t .

Quick Check

- 5 a.** Suppose a squirrel is in a tree 24 ft above the ground. She drops an acorn. The function $h = -16t^2 + 24$ gives the height of the acorn in feet after t seconds. Graph this function.
- b. Critical Thinking** Describe a reasonable domain and range for the function in Example 5.

EXERCISES

For more exercises, see *Extra Skill and Word Problem Practice*.

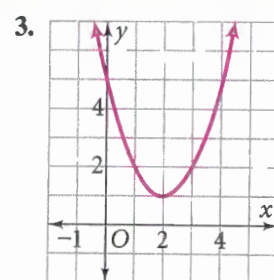
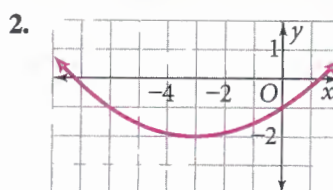
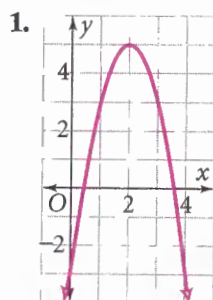
Practice and Problem Solving

A Practice by Example

Example 1
(page 551)



Identify the vertex of each graph. Tell whether it is a minimum or maximum.



Example 2
(page 551)

Graph each function.

4. $y = -4x^2$

5. $f(x) = 1.5x^2$

6. $y = \frac{2}{3}x^2$

7. $f(x) = -\frac{1}{2}x^2$

8. $y = -\frac{1}{3}x^2$

9. $f(x) = 3x^2$

Example 3
(page 552)

Order each group of quadratic functions from widest to narrowest graph.

10. $y = 3x^2, y = \frac{1}{2}x^2, y = 4x^2$

11. $f(x) = 5x^2, f(x) = \frac{1}{3}x^2, f(x) = x^2$

12. $y = -\frac{1}{2}x^2, y = 5x^2, y = -\frac{1}{4}x^2$

13. $f(x) = -2x^2, f(x) = -\frac{2}{3}x^2, f(x) = -4x^2$

Example 4
(page 552)

Graph each function.

14. $f(x) = x^2 + 2$

15. $y = x^2 - 3$

16. $y = \frac{1}{2}x^2 + 4$

17. $f(x) = -x^2 - 1$

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

19. $f(x) = 4x^2 - 7$

Example 5
(page 553)

20. A gull drops a clam shell onto some rocks from a height of 50 ft. The function $h = -16t^2 + 50$ gives the shell's approximate height h in feet after t seconds. Graph the function.

B Apply Your Skills

Match each graph with its function.

A. $f(x) = x^2 - 1$

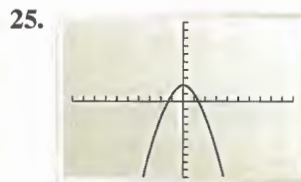
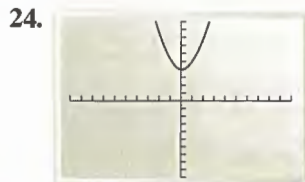
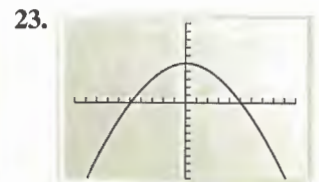
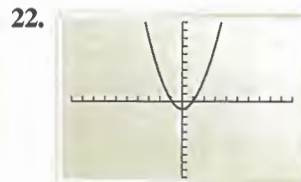
B. $f(x) = x^2 + 4$

C. $f(x) = -x^2 + 2$

D. $f(x) = 3x^2 - 5$

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

F. $f(x) = -0.2x^2 + 5$



Writing Without graphing, describe how each graph differs from the graph of $y = x^2$.

27. $y = 2x^2$

28. $y = -x^2$

29. $y = 1.5x^2$

30. $y = \frac{1}{2}x^2$

Graph each function.

31. $y = -\frac{1}{4}x^2 + 3$

32. $f(x) = -1.5x^2 + 5$

33. $y = 3x^2 - 6$

Trace each parabola on a sheet of paper and draw its axis of symmetry.

