Find the vertex.

13. $y = -5x^2 + 10x + 3$

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

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

16. $y = -x^2 + 6x + 1$

17.

$y = x^2 + 4x - 5$
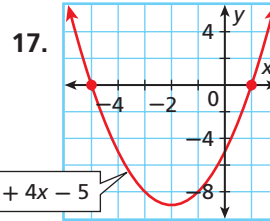
18. Archery The height in feet above the ground of an arrow after it is shot can be modeled by $y = -16t^2 + 63t + 4$. Can the arrow pass over a tree that is 68 feet tall? Explain.

PRACTICE AND PROBLEM SOLVING

Independent Practice

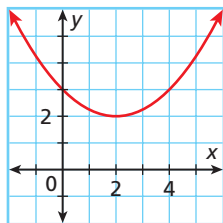| For Exercises	See Example
19–21	1
22–24	2
25–28	3
29–33	4
34	5

Extra Practice
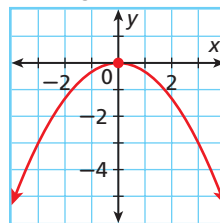
Skills Practice p. S20

Application Practice p. S36

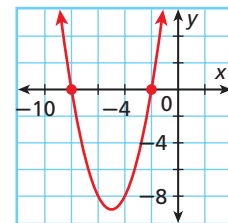**Find the zeros of each quadratic function from its graph. Check your answer.**
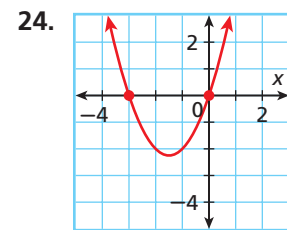
19. $y = \frac{1}{4}x^2 - x + 3$
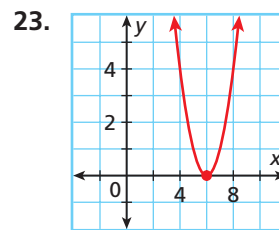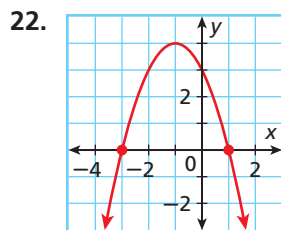

20. $y = -\frac{1}{3}x^2$

21. $y = x^2 + 10x + 16$

Find the axis of symmetry of each parabola.

22.

23.

24.

For each quadratic function, find the axis of symmetry of its graph.

25. $y = x^2 + x + 2$

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

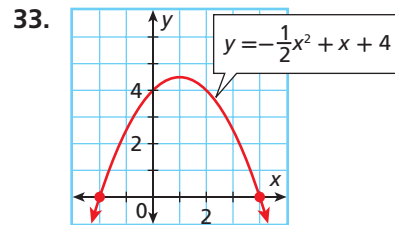**27.** $y = \frac{1}{2}x^2 - 5x + 4$

28. $y = -2x^2 + \frac{1}{3}x - \frac{3}{4}$
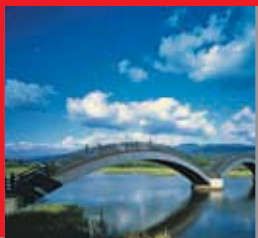
Find the vertex.

29. $y = x^2 + 7x$

30. $y = -x^2 + 8x + 16$

31. $y = -2x^2 - 8x - 3$

32. $y = -x^2 + \frac{1}{2}x + 2$

33.

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

Engineering

This arched bridge spans a river near the city of Yokote in northwestern Japan.

34. Engineering The height in feet of the curved arch support for a bridge over a creek can be modeled by $f(x) = -0.628x^2 + 4.5x$, where x is the horizontal distance in feet from where the arch support enters the water. If there is a flood that raises the level of the creek by 5.5 feet, will the top of the arch support be above the water? Explain.

35. Critical Thinking What conclusion can be drawn about the axis of symmetry of any quadratic function for which $b = 0$?