PRACTICE & PROBLEM SOLVING

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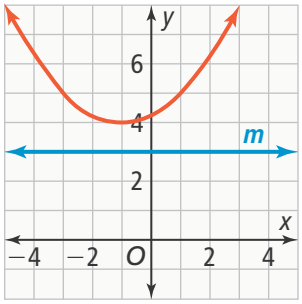
Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

19. Communicate Precisely Use the graph to answer the questions. Line m is the directrix of the parabola.



a. How would you find the vertex of the parabola? Explain.

b. How would you find the focus of the parabola? Explain.

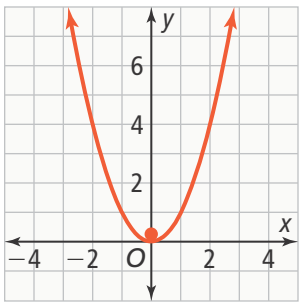
c. How would you find an equation of the parabola? Explain.

20. Communicate Precisely Define a parabola as a set of points. What is the relationship of the points to the lines and points associated with the parabola?

21. Mathematical Connections The general form of the equation of a parabola is $y = x^2 - 6x + 9$. What are the focus, vertex, and directrix of the parabola?

22. Reason How does changing the distance from the focus to the directrix change the shape of a parabola in the coordinate plane? Explain.

23. Construct Arguments The parabola has its focus at $\left(0, \frac{1}{4}\right)$ and vertex at (0, 0). How would you find the equation of the parabola?



PRACTICE

For Exercises 24–27, find the vertex of each parabola. SEE EXAMPLE 1

24. focus: (3, 7); directrix: $y = -1$

25. focus: (6, 2); directrix: $y = -4$

26. focus: (−4, 3); directrix: $y = 0$

27. focus: (−2, −1); directrix: $y = -6$

For Exercises 28–31, find the vertex, focus and directrix of each parabola. SEE EXAMPLE 2

28. $y - 7 = \frac{1}{8}(x - 3)$

29. $y + 4 = \frac{1}{36}(x - 1)$

30. $y - 3 = \frac{1}{16}(x + 6)$

31. $y + 5 = \frac{1}{2}(x - 10)$

For Exercises 32–34, write an equation of each parabola with the given focus and directrix. SEE EXAMPLE 3

32. focus: (0, 4); directrix: $y = 0$

33. focus: (5, 1); directrix: $y = -9$

34. focus: (−4, 5); directrix: $y = 2$

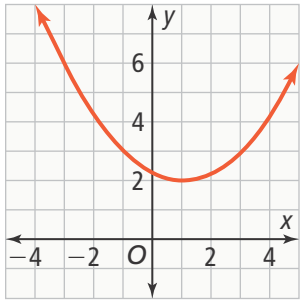
For Exercises 35–37, write an equation of each parabola with the given focus and vertex. SEE EXAMPLE 3

35. focus: (4, 5); vertex: (4, −1)

36. focus: (−4, 9); vertex: (−4, 5)

37. focus: (2, 4); vertex: (2, 0)

For Exercises 38–40, use the graph of the parabola shown to answer each question. SEE EXAMPLE 4



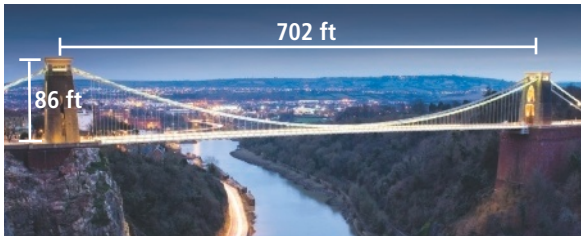
38. What is the vertex of the parabola?

39. Using a point on the parabola and the equation $y - k = \frac{1}{4p}(x - h)^2$, what is p?

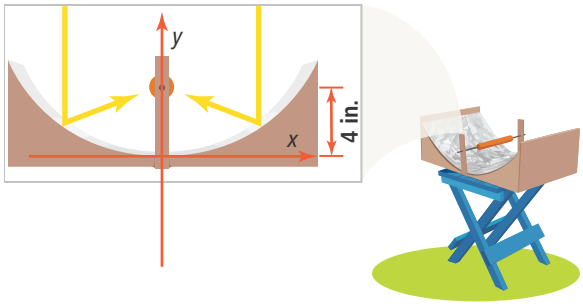
40. What is the focus of the parabola?

APPLY

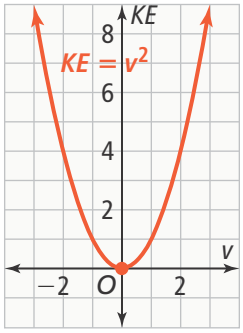
41. Reason Henry is building a model of the Clifton Suspension Bridge using a scale factor of 100 ft : 1 in. The cables between the towers are in the shape of a parabola. He writes an equation of the parabola to describe the model he is building and uses the equation to determine the distances from the cable to the deck of the bridge. Suppose the deck is the x-axis and the vertex lies on the y-axis. What is the equation that Henry writes?



42. Model With Mathematics Devin builds a solar hot dog cooker for the science fair. Suppose the base of the cooker is the x-axis and the hot dog is on the y-axis at the focus. What is the equation of the parabola that models the cooker?



43. Higher Order Thinking An engineer is making an impact analysis on a car bumper. He graphs the kinetic energy of a 2-kg steel ball as a function of the velocity of the ball. Kinetic energy is measured in joules (J) and velocity is measured in meters per second.



a. What are the vertex, focus, and directrix of the parabola?

b. The car bumper has to withstand an impact of 25 J from the 2-kg steel ball without any damage. How fast is the ball moving when it strikes the bumper with that amount of energy?

ASSESSMENT PRACTICE

44. An equation of a parabola is $y - 5 = \frac{1}{8}(x - 4)$. Select all that apply.

Ⓐ The vertex of the parabola is (5, 4).

Ⓑ $p = 2$

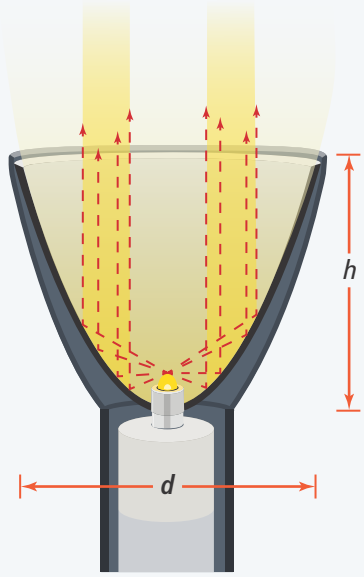
Ⓒ The focus of the parabola is (4, 7).

Ⓓ The directrix of the parabola is $y = 3$.

45. SAT/ACT Which is the vertex of the parabola represented by the equation $y + 5 = 6(x - 6)^2$?

Ⓐ (6, 5)
Ⓒ (6, −5)
Ⓑ (−6, −5)
Ⓓ (−6, 25)

46. Performance Task Some flashlights are designed so that a parabolic mirror reflects light forward from a light source.



For the flashlight to work best, the light source is placed at the focus of the parabola. Deon designs a flashlight so $d = 4$ in. and $h = 3$ in.

Part A How could Deon model the mirror on the coordinate plane? What is an equation for the mirror?

Part B At what point above the vertex would Deon place the light source?

Part C Suppose Deon wants to place the light source $\frac{1}{2}$ in. farther from the vertex with the same $h = 3$ in. Will the mirror be narrower or wider? Explain.