PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

13. Look for Relationships Jordan wants to graph the equation $25x^2 - 9y^2 = 225$.

a. What kind of conic section could the equation represent? Explain.

b. Explain how to write the equation in standard form. Then write the equation in standard form.

c. What are the vertices?

d. What are the asymptotes?

e. What are the foci?

f. Is the transverse axis horizontal or vertical? Explain.

g. Graph the equation.

14. Use Structure Write the equation of the hyperbola that has its center at the origin, vertices on the y-axis 8 units apart, and asymptotes $y = \pm\frac{4}{3}x$. Then graph the hyperbola.

15. Error Analysis Describe and correct the error Elaine made in determining the vertices, asymptotes, and foci of a hyperbola.

hyperbola: $\frac{y^2}{144} - \frac{x^2}{256} = 1$

vertices: (-12, 0) and (12, 0)

asymptotes: $y = \pm\frac{4}{3}x$

foci: (0, -400) and (0, 400) ✗

16. Higher Order Thinking The square of the distance from the center of a hyperbola to a focus is 78. The intersections of the hyperbola with the transverse axis are $(-\sqrt{20}, 0)$ and $(\sqrt{20}, 0)$. Write the equation of the hyperbola.

17. Construct Arguments Determine whether the equation $\frac{x^2}{18} - \frac{y^2}{32} = -2$ represents a hyperbola. Explain.

PRACTICE

Write an equation for the hyperbola. SEE EXAMPLE 1

18. foci at (5, 0) and (–5, 0) and a constant difference of 8

19. foci at (0, 15) and (0, –15) and a constant difference of 18

Graph the hyperbola. SEE EXAMPLE 2

20. $\frac{y^2}{4} - \frac{x^2}{9} = 1$

21. $\frac{x^2}{1} - \frac{y^2}{25} = 1$

22. $\frac{x^2}{16} - \frac{y^2}{36} = 1$

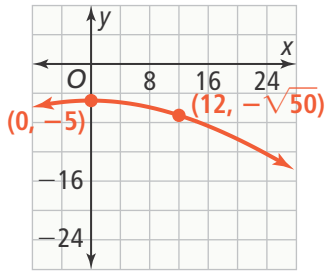
23. $\frac{y^2}{49} - \frac{x^2}{25} = 1$

Write an equation for the hyperbola with the given information. SEE EXAMPLE 3

24. vertices (0, –6) and (0, 6) and asymptotes $y = \pm\frac{2}{3}x$

25. vertices (–9, 0) and (9, 0) and asymptotes $y = \pm\frac{4}{3}x$

26. A telescope is made with a hyperbolic mirror, shown graphed on the coordinate plane. To assemble the telescope correctly, the manufacturer needs to know the distance to the focus on the same side as the reflective side of the mirror. What is this distance? What equation represents the location of the mirror? SEE EXAMPLE 4



Which conic section is represented by each equation? SEE EXAMPLE 5

27. $16x^2 + 25y^2 - 64 = 0$

28. $-49x^2 + 36y^2 - 48 = 0$

29. $4y^2 + 8y - x - 16 = 0$

30. $-x^2 - y^2 + 5x - 10y + 15 = 0$

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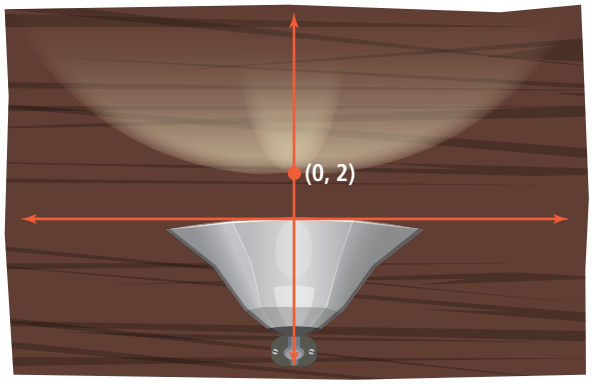
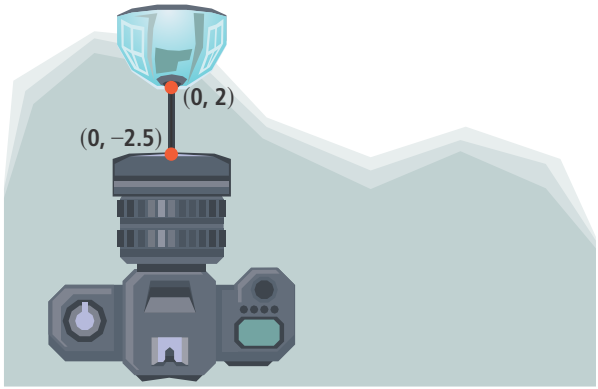
Mixed Review Available Online

APPLY

31. Model With Mathematics When the light from a lamp shines on a wall, a hyperbola is formed. What is the equation of the hyperbola with asymptotes $y = \pm\frac{2}{5}x$?



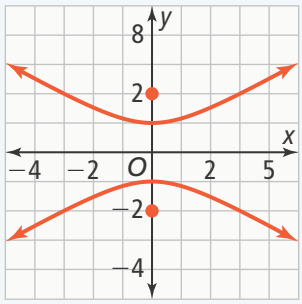
32. Model With Mathematics In order to take a panoramic photograph, a camera must have a hyperbolic mirror. The graphic shows that the camera is below the mirror. The lens is at one focus of the camera, and the mirror is at one vertex. Write an equation for the cross section of the mirror.



33. Reason Jupiter's gravity changes a spacecraft's path to a hyperbola as it approaches. The focus of the hyperbola nearest the spacecraft's path is the center of Jupiter. The diameter of the planet is 139,822 km. Suppose the path of an approaching spacecraft has an equation with $a = 80{,}000$ km and $c = 170{,}000$ km. Assuming the transverse axis is horizontal, write the equation that models the path of the spacecraft as it approaches Jupiter. What is the distance from the spacecraft to the planet at the vertex of the hyperbola?

ASSESSMENT PRACTICE

34. Write an equation of the hyperbola shown in the graph.



35. SAT/ACT Which equation represents a hyperbola?

Ⓐ $4x^2 + 81y^2 + 12 = 0$

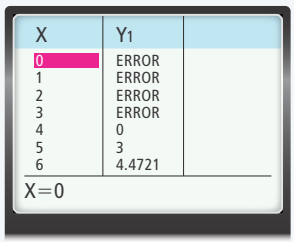
Ⓑ $9x^2 + 16y^2 - 4x - 24y + 18 = 0$

Ⓒ $49y^2 + 7y - 2x + 14 = 0$

Ⓓ $-36x^2 - 36y^2 + 6x - 13y + 20 = 0$

Ⓔ $25x^2 - 121y^2 + 64 = 0$

36. Performance Task Libby wants to graph a hyperbola with the equation $y^2 - x^2 + 16 = 0$. The function $y = \sqrt{x^2 - 16}$ represents part of the hyperbola. Libby used the TABLE feature on her graphing calculator to show several points on the graph of $y = \sqrt{x^2 - 16}$.



Part A Explain why some entries show ERROR.

Part B Using the information in the table, what can you conclude about the vertices of the equation $y^2 - x^2 + 16 = 0$?

Part C Write the equation $y^2 - x^2 + 16 = 0$ in standard form to prove you correctly found the vertices from the table.