

## 10.3 Exercise Set

FOR EXTRA HELP



**Concept Reinforcement** In each of Exercises 1–8, match the conic section with the equation in the column on the right that represents that type of conic section.

- (d) A hyperbola with a horizontal axis
- (f) A hyperbola with a vertical axis
- (h) An ellipse with its center not at the origin
- (a) An ellipse with its center at the origin
- (g) A circle with its center at the origin
- (b) A circle with its center not at the origin
- (c) A parabola opening upward or downward
- (e) A parabola opening to the right or to the left

- $\frac{x^2}{10} + \frac{y^2}{12} = 1$
- $(x + 1)^2 + (y - 3)^2 = 30$
- $y - x^2 = 5$
- $\frac{x^2}{9} - \frac{y^2}{10} = 1$
- $x - 2y^2 = 3$
- $\frac{y^2}{20} - \frac{x^2}{35} = 1$
- $3x^2 + 3y^2 = 75$
- $\frac{(x - 1)^2}{10} + \frac{(y - 4)^2}{8} = 1$

Graph each hyperbola. Label all vertices and sketch all asymptotes.

- $\frac{y^2}{16} - \frac{x^2}{16} = 1$
- $\frac{x^2}{9} - \frac{y^2}{9} = 1$
- $\frac{x^2}{4} - \frac{y^2}{25} = 1$
- $\frac{y^2}{16} - \frac{x^2}{9} = 1$
- $\frac{y^2}{36} - \frac{x^2}{9} = 1$
- $\frac{x^2}{25} - \frac{y^2}{36} = 1$
- $y^2 - x^2 = 25$
- $x^2 - y^2 = 4$
- $25x^2 - 16y^2 = 400$
- $4y^2 - 9x^2 = 36$

Graph.

- $xy = -6$
- $xy = 8$
- $xy = 4$
- $xy = -9$
- $xy = -2$
- $xy = -1$
- $xy = 1$
- $xy = 2$

Classify each of the following as the equation of a circle, an ellipse, a parabola, or a hyperbola.

- $x^2 + y^2 - 6x + 4y - 30 = 0$  Circle
- $y + 9 = 3x^2$  Parabola

Answers to Exercises 9–26 are on p. IA-29.

- | Ellipse   | Parabola                        |
|---|---------------------------------|
| 29. $9x^2 + 4y^2 - 36 = 0$  | 30. $x + 3y = 2y^2 - 1$         |
| 31. $4x^2 - 9y^2 - 72 = 0$  | 32. $y^2 + x^2 = 8$ Circle      |
| 33. $y^2 = 20 - x^2$ Hyperbola<br>Circle  |                                 |
| 34. $2y + 13 + x^2 = 8x - y^2$ Circle   |                                 |
| 35. $x - 10 = y^2 - 6y$ Parabola  | 36. $y = \frac{7}{x}$ Hyperbola |
| 37. $x - \frac{8}{y} = 0$ Hyperbola   | 38. $9x^2 = 9 - y^2$ Ellipse    |
| 39. $y + 6x = x^2 + 5$ Parabola   | 40. $x^2 = 16 + y^2$ Hyperbola  |
| 41. $9y^2 = 36 + 4x^2$ Hyperbola  |                                 |
| 42. $3x^2 + 5y^2 + x^2 = y^2 + 49$ Circle   |                                 |
| 43. $3x^2 + y^2 - x = 2x^2 - 9x + 10y + 40$ Circle  |                                 |
| 44. $4y^2 + 20x^2 + 1 = 8y - 5x^2$ Ellipse  |                                 |
| 45. $16x^2 + 5y^2 - 12x^2 + 8y^2 - 3x + 4y = 568$ Ellipse                                   |                                 |
| 46. $56x^2 - 17y^2 = 234 - 13x^2 - 38y^2$ Ellipse   |                                 |
| TW 47. Explain how the equation of a hyperbola differs from the equation of an ellipse.     |                                 |
| TW 48. Is it possible for a hyperbola to represent the graph of a function? Why or why not? |                                 |

## SKILL REVIEW

To prepare for Section 10.4, review solving systems of equations and solving quadratic equations (Sections 3.2 and 8.2).

Solve.

49.  $5x + 2y = -3,$   
 $2x + 3y = 12$  [3.2]  $(-3, 6)$

50.  $4x - 2y = 5,$   
 $3x + 5y = -6$  [3.2]  $(\frac{1}{2}, -\frac{3}{2})$

51.  $\frac{3}{4}x^2 + x^2 = 7$  [8.2]  $-2, 2$

52.  $3x^2 + 10x - 8 = 0$  [8.2]  $-4, \frac{2}{3}$

53.  $x^2 - 3x - 1 = 0$  [8.2]  $\frac{3}{2} \pm \frac{\sqrt{13}}{2}$

54.  $x^2 + \frac{25}{x^2} = 26$  [8.5]  $\pm 1, \pm 5$

## SYNTHESIS

**TW** 55. What is it in the equation of a hyperbola that controls how wide open the branches are? Explain your reasoning.

**TW** 56. If, in

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1,$$

$a = b$ , what are the asymptotes of the graph? Why?

Find an equation of a hyperbola satisfying the given conditions.

57. Having intercepts  $(0, 6)$  and  $(0, -6)$  and asymptotes  $y = 3x$  and  $y = -3x$

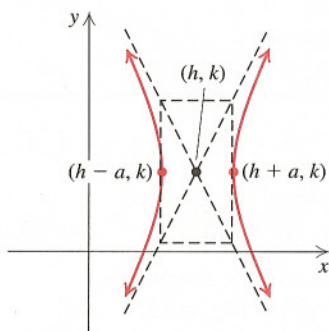
$$\frac{y^2}{36} - \frac{x^2}{4} = 1$$

58. Having intercepts  $(8, 0)$  and  $(-8, 0)$  and asymptotes  $y = 4x$  and  $y = -4x$

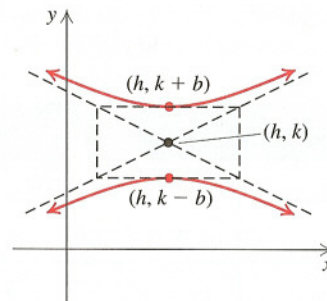
$$\frac{x^2}{64} - \frac{y^2}{1024} = 1$$

The standard equations for horizontal or vertical hyperbolas centered at  $(h, k)$  are as follows:

$$\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$$



$$\frac{(y - k)^2}{b^2} - \frac{(x - h)^2}{a^2} = 1$$



The vertices are as labeled and the asymptotes are

$$y - k = \frac{b}{a}(x - h) \quad \text{and} \quad y - k = -\frac{b}{a}(x - h).$$

For each of the following equations of hyperbolas, complete the square, if necessary, and write in standard form. Find the center, the vertices, and the asymptotes. Then graph the hyperbola.

59.  $\frac{(x - 5)^2}{36} - \frac{(y - 2)^2}{25} = 1$

60.  $\frac{(x - 2)^2}{9} - \frac{(y - 1)^2}{4} = 1$

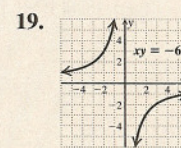
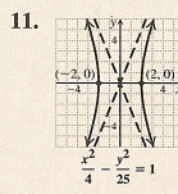
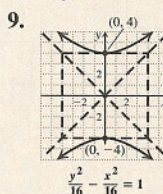
61.  $8(y + 3)^2 - 2(x - 4)^2 = 32$

62.  $25(x - 4)^2 - 4(y + 5)^2 = 100$

63.  $4x^2 - y^2 + 24x + 4y + 28 = 0$

64.  $4y^2 - 25x^2 - 8y - 100x - 196 = 0$

## Try Exercise Answers: Section 10.3



27. Circle 29. Ellipse