9 CHAPTER REVIEW

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- Multi-Language Glossary
- Vocabulary practice

REVIEW KEY VOCABULARY

- distance formula, *p. 614*
- midpoint formula, *p. 615*
- focus, foci, *pp. 620, 634, 642*
- directrix, *p. 620*
- circle, *p. 626*
- center, *pp. 626, 634, 642*
- radius, *p. 626*
- ellipse, *p. 634*
- vertices, *pp. 634, 642*
- major axis, *p. 634*
- co-vertices, *p. 634*
- minor axis, *p. 634*
- hyperbola, *p. 642*
- transverse axis, *p. 642*
- conic sections, *p. 650*
- general second-degree equation, *p. 653*
- discriminant, *p. 653*
- quadratic system, *p. 658*

VOCABULARY EXERCISES

1. Copy and complete: A(n) _?_ is the set of all points in a plane equidistant from a point called the focus and a line called the directrix. **parabola**

2. Copy and complete: The line segment joining the two co-vertices of an ellipse is the _?_. **minor axis**

3. Copy and complete: The line segment joining the two vertices of a hyperbola is the _?_. **transverse axis**

4. **WRITING** *Describe* how the asymptotes of a hyperbola help you draw the hyperbola. **The asymptotes indicate how wide or narrow the hyperbola is.**

REVIEW EXAMPLES AND EXERCISES

Use the review examples and exercises below to check your understanding of the concepts you have learned in each lesson of Chapter 9.

9.1 Apply the Distance and Midpoint Formulas *pp. 614–619*

EXAMPLE

Find the distance between (−5, 3) and (1, −3). Then find the midpoint of the line segment joining the two points.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(1 - (-5))^2 + (-3 - 3)^2} = \sqrt{72} = 6\sqrt{2} \approx 8.49$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-5 + 1}{2}, \frac{3 + (-3)}{2}\right) = (-2, 0)$$

EXERCISES

EXAMPLES 1 and 3 on pp. 614–615 for Exs. 5–8

Find the distance between the two points. Then find the midpoint of the line segment joining the two points.

5. (−6, −5), (2, −3) **$2\sqrt{17}$; (−2, −4)**

6. (−2, 5), (1, 9) **5; $\left(-\frac{1}{2}, 7\right)$**

7. (−3, −4), (2, 5) **$\sqrt{106}$; $\left(-\frac{1}{2}, \frac{1}{2}\right)$**

8. **SKYDIVING** A skydiver lands 200 yards west and 40 yards north of a target. A second skydiver lands 30 yards east and 140 yards south of the same target. How far from each other do the two skydivers land? **about 292 yd**

Extra Example 9.1

Find the distance between (−4, 1) and (5, −7). Then find the midpoint of the line segment joining the two points. **distance: $\sqrt{145}$; midpoint: $\left(\frac{1}{2}, -3\right)$**

9 CHAPTER REVIEW

9.2 Graph and Write Equations of Parabolas

pp. 620–625

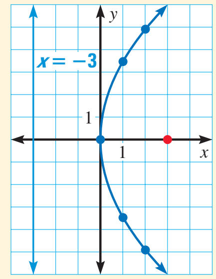
EXAMPLE

Graph $x = \frac{1}{12}y^2$. Identify the focus, directrix, and axis of symmetry.

STEP 1 **Rewrite** $x = \frac{1}{12}y^2$ in standard form as $y^2 = 12x$.

STEP 2 **Identify** the focus, directrix, and axis of symmetry. The equation has the form $y^2 = 4px$ with $4p = 12$, so $p = 3$. The focus is $(p, 0)$, or $(3, 0)$, and the directrix is $x = -p$, or $x = -3$. Because y is squared, the axis of symmetry is the x-axis.

STEP 3 **Draw** the parabola. Because $p > 0$, the parabola opens to the right. Some points on the parabola are $(0, 0)$, $(1, \pm3.46)$, and $(2, \pm4.90)$.



EXERCISES

EXAMPLES 1 and 2 on p. 621 for Exs. 9–14

Graph the equation. Identify the focus, directrix, and axis of symmetry of the parabola. **9–11. See margin for art.**

9. $x^2 = 16y$ **(0, 4), $y = -4$, $x = 0$** **10.** $y^2 = -6x$ **$\left(-\frac{3}{2}, 0\right)$, $x = \frac{3}{2}$, $y = 0$** **11.** $x^2 + 4y = 0$ **(0, −1), $y = 1$, $x = 0$**

Write the standard form of the equation of the parabola with the given focus or directrix and vertex at (0, 0).

12. Focus: $(-5, 0)$ **$y^2 = -20x$** **13.** Focus: $(0, 3)$ **$x^2 = 12y$** **14.** Directrix: $x = -6$ **$y^2 = 24x$**

9.3 Graph and Write Equations of Circles

pp. 626–632

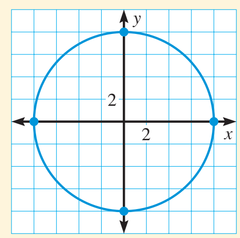
EXAMPLE

Graph $x^2 = 64 - y^2$. Identify the radius of the circle.

STEP 1 **Rewrite** $x^2 = 64 - y^2$ in standard form as $x^2 + y^2 = 64$.

STEP 2 **Identify** the radius. The graph is a circle with center at the origin and radius $r = \sqrt{64} = 8$.

STEP 3 **Draw** a circle passing through points that are 8 units from the origin, such as $(8, 0)$, $(0, 8)$, $(-8, 0)$, and $(0, -8)$.



EXERCISES

EXAMPLES 1 and 2 on pp. 626–627 for Exs. 15–20

Graph the equation. Identify the radius of the circle. **15–17. See margin for art.**

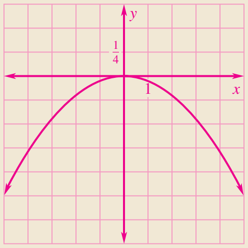
15. $x^2 + y^2 = 81$ **9** **16.** $x^2 = 40 - y^2$ **$2\sqrt{10}$** **17.** $3x^2 + 3y^2 = 147$ **7**

Write the standard form of the equation of the circle that passes through the given point and whose center is the origin.

18. $(5, 9)$ **$x^2 + y^2 = 106$** **19.** $(-8, 2)$ **$x^2 + y^2 = 68$** **20.** $(-7, -4)$ **$x^2 + y^2 = 65$**

Extra Example 9.2

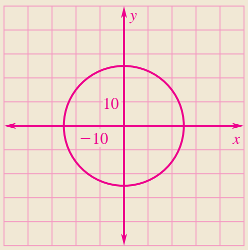
Graph $x^2 = -20y$. Identify the focus, directrix, and axis of symmetry.



focus: (0, −5), directrix: $y = 5$, axis of symmetry: $x = 0$

Extra Example 9.3

Graph $y^2 = 625 - x^2$. Identify the radius. **$r = 25$**



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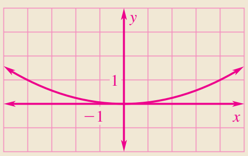

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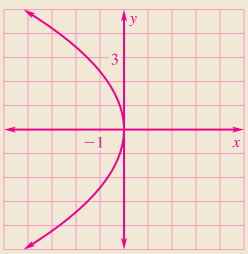

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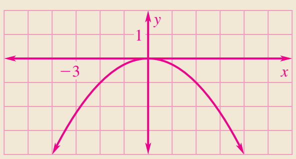

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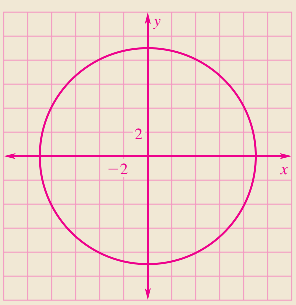

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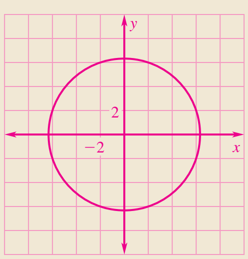

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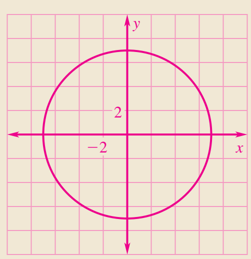
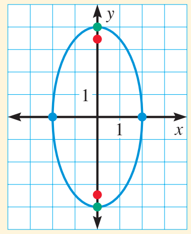


9.4 Graph and Write Equations of Ellipses *pp. 634–639*

EXAMPLE

Graph $4x^2 + y^2 = 16$. Identify the vertices, co-vertices, and foci.



STEP 1 **Rewrite** $4x^2 + y^2 = 16$ in standard form as $\frac{x^2}{4} + \frac{y^2}{16} = 1$.

STEP 2 **Identify** the vertices, co-vertices, and foci. Note that $a^2 = 16$ and $b^2 = 4$, so $a = 4$, $b = 2$, and $c^2 = a^2 - b^2 = 12$, or $c \approx 3.5$. The major axis is vertical. The vertices are at $(0, \pm 4)$. The co-vertices are at $(\pm 2, 0)$. The foci are at $(0, \pm 3.5)$.

STEP 3 **Draw** the ellipse.

EXERCISES

21–23. See margin for art.

EXAMPLES 1, 2, and 4 on pp. 635–636 for Exs. 21–25

Graph the equation. Identify the vertices, co-vertices, and foci of the ellipse.

21. $16x^2 + 25y^2 = 400$ **$(\pm 5, 0)$, $(0, \pm 4)$, $(\pm 3, 0)$**

22. $81x^2 + 9y^2 = 729$ **$(0, \pm 9)$, $(\pm 3, 0)$, $(0, \pm 6\sqrt{2})$**

23. $64x^2 + 36y^2 = 2304$ **$(0, \pm 8)$, $(\pm 6, 0)$, $(0, \pm 2\sqrt{7})$**

Write an equation of the ellipse with the given characteristics and center at (0, 0).

24. Vertex: $(-6, 0)$; co-vertex: $(0, -3)$ **$\frac{x^2}{36} + \frac{y^2}{9} = 1$**

25. Vertex: $(0, -8)$; focus: $(0, 5)$ **$\frac{y^2}{64} + \frac{x^2}{39} = 1$**

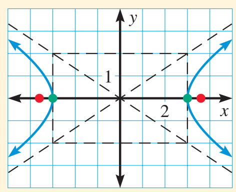
9.5 Graph and Write Equations of Hyperbolas *pp. 642–648*

EXAMPLE

Graph $4x^2 - 9y^2 = 36$. Identify the vertices, foci, and asymptotes.

STEP 1 **Rewrite** $4x^2 - 9y^2 = 36$ in standard form as $\frac{x^2}{9} - \frac{y^2}{4} = 1$.

STEP 2 **Identify** the vertices, foci, and asymptotes. Note that $a^2 = 9$ and $b^2 = 4$, so $a = 3$, $b = 2$, and $c^2 = a^2 + b^2 = 13$, or $c \approx 3.6$. The transverse axis is horizontal. The vertices are at $(\pm 3, 0)$. The foci are at $(\pm 3.6, 0)$. The asymptotes are $y = \pm\frac{b}{a}x = \pm\frac{2}{3}x$.



STEP 3 **Draw** asymptotes through opposite corners of a rectangle centered at (0, 0) that is $2a = 6$ units wide and $2b = 4$ units high. Draw the hyperbola.

EXERCISES

EXAMPLES 1 and 2 on p. 643 for Exs. 26–30

Graph the equation. Identify the vertices, foci, and asymptotes. **26–28. See margin for art.**

26. $9x^2 - y^2 = 9$ **$(\pm 1, 0)$, $(\pm\sqrt{10}, 0)$, $y = \pm 3x$**

27. $4x^2 - 16y^2 = 64$ **$(\pm 4, 0)$, $(\pm 2\sqrt{5}, 0)$, $y = \pm\frac{1}{2}x$**

28. $100y^2 - 36x^2 = 3600$ **$(0, \pm 6)$, $(0, \pm 2\sqrt{34})$, $y = \pm\frac{3}{5}x$**

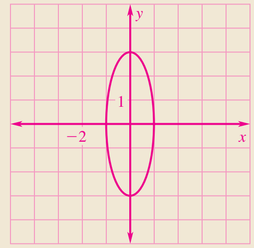
Write an equation of the hyperbola with the given foci and vertices.

29. Foci: $(0, \pm 5)$; vertices: $(0, \pm 2)$ **$\frac{y^2}{4} - \frac{x^2}{21} = 1$**

30. Foci: $(\pm 9, 0)$; vertices: $(\pm 4, 0)$ **$\frac{x^2}{16} - \frac{y^2}{65} = 1$**

Extra Example 9.4

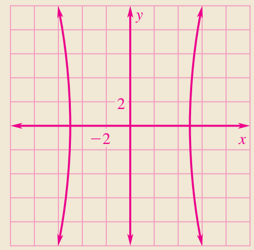
Graph $9x^2 + y^2 = 9$. Identify the vertices, co-vertices, and foci.



vertices: $(0, -3)$ and $(0, 3)$, co-vertices: $(-1, 0)$ and $(1, 0)$, foci: $(0, -2\sqrt{2})$ and $(0, 2\sqrt{2})$

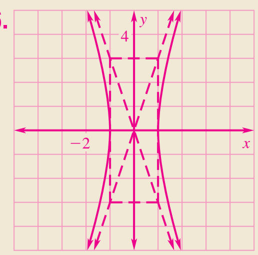
Extra Example 9.5

Graph $9x^2 - y^2 = 225$. Identify the vertices, foci, and asymptotes.



vertices: $(-5, 0)$ and $(5, 0)$; foci: $(-10, 0)$ and $(10, 0)$, asymptotes: $y = \pm 3$

26.



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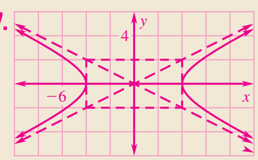

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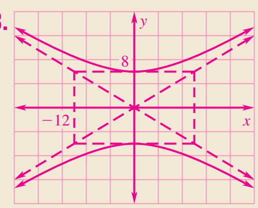

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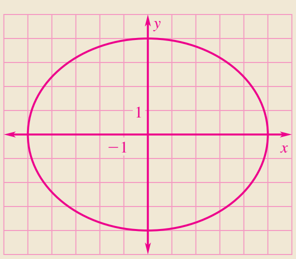

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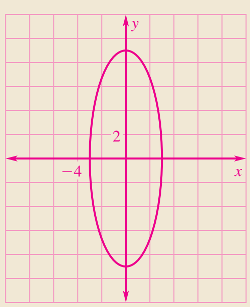

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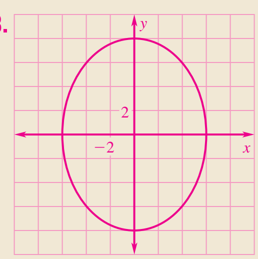
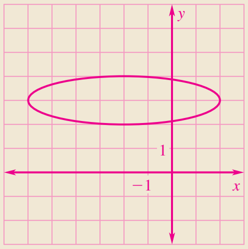


Extra Example 9.6

Classify the conic section $x^2 + 16y^2 + 4x - 96y + 132 = 0$ and write its equation in standard form. Then graph the equation.



ellipse; $\frac{(x+2)^2}{16} + (y-3)^2 = 1$

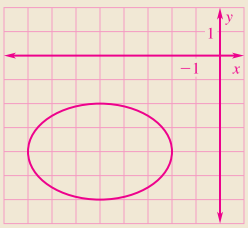
Extra Example 9.7

Solve the system.

$x^2 + y^2 = 36$

$3x^2 - y^2 - 28 = 0$ $(-4, -2\sqrt{5})$, $(-4, 2\sqrt{5})$, $(4, -2\sqrt{5})$, $(4, 2\sqrt{5})$

31. ellipse, $\frac{(x+5)^2}{9} + \frac{(y+4)^2}{4} = 1$



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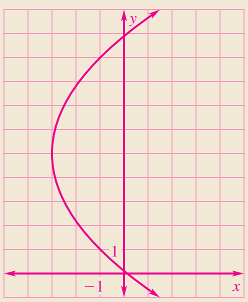

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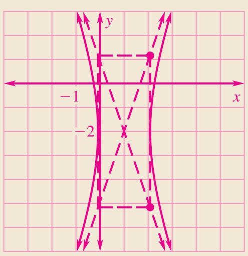

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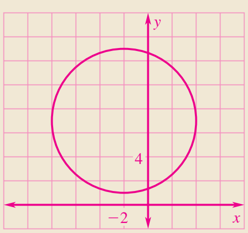


9 CHAPTER REVIEW

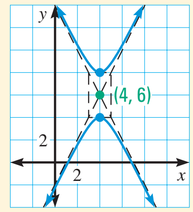
9.6 Translate and Classify Conic Sections *pp. 650–657*

EXAMPLE

Classify the conic section $-4x^2 + y^2 + 32x - 12y - 32 = 0$ and write its equation in standard form. Then graph the equation.

Because $A = -4$, $B = 0$, and $C = 1$, the discriminant is $B^2 - 4AC = 16 > 0$, so the conic is a hyperbola. Complete the square to write the equation in standard form.

$$-4x^2 + y^2 + 32x - 12y - 32 = 0$$
$$(y^2 - 12y) - 4(x^2 - 8x) = 32$$
$$(y^2 - 12y + 36) - 4(x^2 - 8x + 16) = 32 + 36 - 4(16)$$
$$(y-6)^2 - 4(x-4)^2 = 4$$
$$\frac{(y-6)^2}{4} - (x-4)^2 = 1$$



From the equation, $(h, k) = (4, 6)$, $a = \sqrt{4} = 2$, and $b = 1$. The vertices are $(4, 6 + 2) = (4, 8)$ and $(4, 6 - 2) = (4, 4)$. The graph is shown above.

EXERCISES

EXAMPLE 6 on p. 653 for Exs. 31–34

Classify the conic section and write its equation in standard form. Then graph the equation. 31–34. See margin for art.

31. $4x^2 + 9y^2 + 40x + 72y + 208 = 0$ See margin.

32. $y^2 - 10y - 8x + 1 = 0$ parabola, $(y-5)^2 = 8(x+3)$

33. $9x^2 - y^2 - 18x - 4y - 5 = 0$ hyperbola, $\frac{(x-1)^2}{\frac{10}{9}} - \frac{(y+2)^2}{10} = 1$

34. $x^2 + y^2 + 4x - 14y + 17 = 0$ circle, $(x+2)^2 + (y-7)^2 = 36$

9.7 Solve Quadratic Systems *pp. 658–664*

EXAMPLE

Solve the system. $\quad 12x^2 - 81y^2 + 16 = 0$
$\quad 2x^2 + 9y = 0$

Write the second equation as $y = -\frac{2}{9}x^2$. Then substitute in the first equation.

$12x^2 - 81\left(-\frac{2}{9}x^2\right)^2 + 16 = 0$ **Substitute for y in first equation.**

$12x^2 - 4x^4 + 16 = 0$ **Simplify.**

$x^4 - 3x^2 - 4 = 0$ **Divide each side by −4.**

$(x^2 - 4)(x^2 + 1) = 0$ **Factor.**

By the zero product property, $x = \pm 2$. The solutions are $\left(2, -\frac{8}{9}\right)$ and $\left(-2, -\frac{8}{9}\right)$.

EXERCISES

EXAMPLES 2 and 3 on pp. 659–660 for Exs. 35–37

Solve the system.

35. $y^2 = 4x$
$2x - 5y = -8$ (16, 8), (1, 2)

36. $x^2 + y^2 - 100 = 0$
$x + y - 14 = 0$ (8, 6), (6, 8)

37. $16x^2 - 4y^2 = 64$
$4x^2 + 9y^2 - 40x = -64$ (2, 0)

Chapter Test, p. 673

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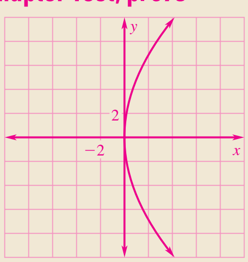

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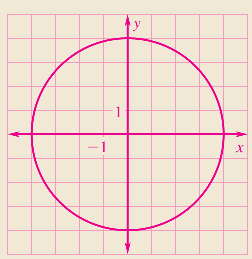

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