NAME ______________________ DATE __________ PERIOD _____

10-1 Skills Practice

Midpoint and Distance Formulas

Find the midpoint of each line segment with endpoints at the given coordinates.

1. $(4, -1), (-4, 1)$ **$(0, 0)$**
2. $(-1, 4), (5, 2)$ **$(2, 3)$**
3. $(3, 4), (5, 4)$ **$(4, 4)$**
4. $(6, 2), (2, -1)$ **$\left(4, \frac{1}{2}\right)$**
5. $(3, 9), (-2, -3)$ **$\left(\frac{1}{2}, 3\right)$**
6. $(-3, 5), (-3, -8)$ **$\left(-3, -\frac{3}{2}\right)$**
7. $(3, 2), (-5, 0)$ **$(-1, 1)$**
8. $(3, -4), (5, 2)$ **$(4, -1)$**
9. $(-5, -9), (5, 4)$ **$\left(0, -\frac{5}{2}\right)$**
10. $(-11, 14), (0, 4)$ **$\left(-\frac{11}{2}, 9\right)$**
11. $(3, -6), (-8, -3)$ **$\left(-\frac{5}{2}, -\frac{9}{2}\right)$**
12. $(0, 10), (-2, -5)$ **$\left(-1, \frac{5}{2}\right)$**

Find the distance between each pair of points with the given coordinates.

13. $(4, 12), (-1, 0)$ **13 units**
14. $(7, 7), (-5, -2)$ **15 units**
15. $(-1, 4), (1, 4)$ **2 units**
16. $(11, 11), (8, 15)$ **5 units**
17. $(1, -6), (7, 2)$ **10 units**
18. $(3, -5), (3, 4)$ **9 units**
19. $(2, 3), (3, 5)$ **$\sqrt{5}$ units**
20. $(-4, 3), (-1, 7)$ **5 units**
21. $(-5, -5), (3, 10)$ **17 units**
22. $(3, 9), (-2, -3)$ **13 units**
23. $(6, -2), (-1, 3)$ **$\sqrt{74}$ units**
24. $(-4, 1), (2, -4)$ **$\sqrt{61}$ units**
25. $(0, -3), (4, 1)$ **$4\sqrt{2}$ units**
26. $(-5, -6), (2, 0)$ **$\sqrt{85}$ units**

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10-1 Practice

Midpoint and Distance Formulas

Find the midpoint of each line segment with endpoints at the given coordinates.

1. $(8, -3), (-6, -11)$ **$(1, -7)$**
2. $(-14, 5), (10, 6)$ **$\left(-2, \frac{11}{2}\right)$**
3. $(-7, -6), (1, -2)$ **$(-3, -4)$**
4. $(8, -2), (8, -8)$ **$(8, -5)$**
5. $(9, -4), (1, -1)$ **$\left(5, -\frac{5}{2}\right)$**
6. $(3, 3), (4, 9)$ **$\left(\frac{7}{2}, 6\right)$**
7. $(4, -2), (3, -7)$ **$\left(\frac{7}{2}, -\frac{9}{2}\right)$**
8. $(6, 7), (4, 4)$ **$\left(5, \frac{11}{2}\right)$**
9. $(-4, -2), (-8, 2)$ **$(-6, 0)$**
10. $(5, -2), (3, 7)$ **$\left(4, \frac{5}{2}\right)$**
11. $(-6, 3), (-5, -7)$ **$\left(-\frac{11}{2}, -2\right)$**
12. $(-9, -8), (8, 3)$ **$\left(-\frac{1}{2}, -\frac{5}{2}\right)$**
13. $(2.6, -4.7), (8.4, 2.5)$ **$(5.5, -1.1)$**
14. $\left(-\frac{1}{3}, 6\right), \left(\frac{2}{3}, 4\right)$ **$\left(\frac{1}{6}, 5\right)$**
15. $(-2.5, -4.2), (8.1, 4.2)$ **$(2.8, 0)$**
16. $\left(\frac{1}{8}, \frac{1}{2}\right), \left(-\frac{5}{8}, -\frac{1}{2}\right)$ **$\left(-\frac{1}{4}, 0\right)$**

Find the distance between each pair of points with the given coordinates.

17. $(5, 2), (2, -2)$ **5 units**
18. $(-2, -4), (4, 4)$ **10 units**
19. $(-3, 8), (-1, -5)$ **$\sqrt{173}$ units**
20. $(0, 1), (9, -6)$ **$\sqrt{130}$ units**
21. $(-5, 6), (-6, 6)$ **1 unit**
22. $(-3, 5), (12, -3)$ **17 units**
23. $(-2, -3), (9, 3)$ **$\sqrt{157}$ units**
24. $(-9, -8), (-7, 8)$ **$2\sqrt{65}$ units**
25. $(9, 3), (9, -2)$ **5 units**
26. $(-1, -7), (0, 6)$ **$\sqrt{170}$ units**
27. $(10, -3), (-2, -8)$ **13 units**
28. $(-0.5, -6), (1.5, 0)$ **$2\sqrt{10}$ units**
29. $\left(\frac{2}{5}, \frac{3}{5}\right), \left(1, \frac{7}{5}\right)$ **1 unit**
30. $(-4\sqrt{2}, -\sqrt{5}), (-5\sqrt{2}, 4\sqrt{5})$ **$\sqrt{127}$ units**
31. **GEOMETRY** Circle O has a diameter $\overline{AB}$. If A is at $(-6, -2)$ and B is at $(-3, 4)$, find the center of the circle and the length of its diameter. **$\left(-\frac{9}{2}, 1\right)$; $3\sqrt{5}$ units**
32. **GEOMETRY** Find the perimeter of a triangle with vertices at $(1, -3)$, $(-4, 9)$, and $(-2, 1)$. **$18 + 2\sqrt{17}$ units**

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10-2 Practice

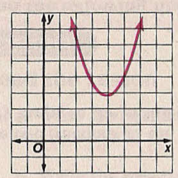
Parabolas

Write each equation in standard form.

1. $y = 2x^2 - 12x + 19$
   $y = 2(x - 3)^2 + 1$
2. $y = \frac{1}{2}x^2 + 3x + \frac{1}{2}$
   $y = \frac{1}{2}[x - (-3)]^2 + (-4)$
3. $y = -3x^2 - 12x - 7$
   $y = -3[x - (-2)]^2 + 5$

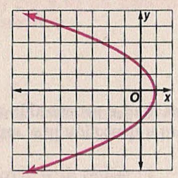
Identify the coordinates of the vertex and focus, the equations of the axis of symmetry and directrix, and the direction of opening of the parabola with the given equation. Then find the length of the latus rectum and graph the parabola.

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



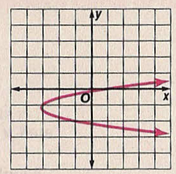
vertex: (4, 3);
focus: $\left(4, 3\frac{1}{4}\right)$;
axis: $x = 4$;
directrix: $y = 2\frac{3}{4}$;
opens up;
latus rectum: 1 unit

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



vertex: (1, 0);
focus: $\left(\frac{1}{4}, 0\right)$;
axis: $y = 0$;
directrix: $x = 1\frac{3}{4}$;
opens left;
latus rectum: 3 units

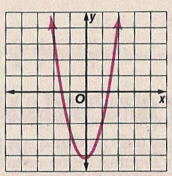
6. $x = 3(y + 1)^2 - 3$



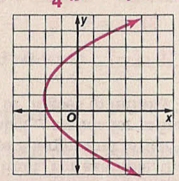
vertex: (−3, −1);
focus: $\left(-2\frac{11}{12}, -1\right)$;
axis: $y = -1$;
directrix: $x = -3\frac{1}{12}$;
opens right;
latus rectum: $\frac{1}{3}$ unit

Write an equation for each parabola described below. Then draw the graph.

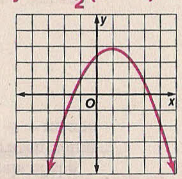
7. vertex (0, −4), focus $\left(0, -3\frac{7}{8}\right)$
   $y = 2x^2 - 4$



8. vertex (−2, 1), directrix $x = -3$
   $x = \frac{1}{4}(y - 1)^2 - 2$



9. vertex (1, 3), axis of symmetry $x = 1$, latus rectum: 2 units, $a < 0$
   $y = -\frac{1}{2}(x - 1)^2 + 3$



10. **TELEVISION** Write the equation in the form $y = ax^2$ for a satellite dish. Assume that the bottom of the upward-facing dish passes through (0, 0) and that the distance from the bottom to the focus point is 8 inches. **$y = \frac{1}{32}x^2$**

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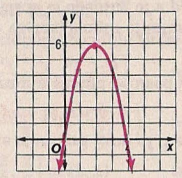
10-2 Word Problem Practice

Parabolas

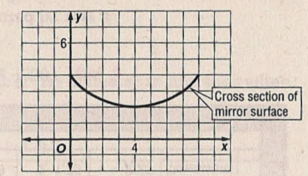
1. **PROJECTILE** A projectile follows the graph of the parabola $y = -\frac{3}{2}x^2 + 6x$. Sketch the path of the projectile by graphing the parabola.



2. **COMMUNICATION** David has just made a large parabolic dish whose cross section is based on the graph of the parabola $y = 0.25x^2$. Each unit represents one foot and the diameter of his dish is 4 feet. He wants to make a listening device by placing a microphone at the focus of the parabola. Where should the microphone be placed?
   1 foot away from the vertex along the axis (at the point (0, 1) with respect to the graph)

3. **BRIDGES** A bridge is in the shape of a parabola that opens downward. The equation of the parabola to model the arch of the bridge is given by $y = -\frac{x^2}{24} + \frac{5}{6}x + \frac{11}{6}$, where each unit is equivalent to 1 yard. The x-axis is the ground level. What is the maximum height of the bridge above the ground?
   6 yd

4. **TELESCOPES** An astronomer is working with a large reflecting telescope. The reflecting mirror in the telescope has the parabolic cross section shown in the graph whose equation is given by $y = \frac{1}{8}(x - 4)^2 + 2$. Each unit represents 1 meter. The astronomer is standing at the origin. How far from the focus of the parabola is the point on the mirror directly over the astronomer's head?



4 m

BRIDGES For Exercises 5 and 6, use the following information.
Part of the Sydney Harbor Bridge in Sydney, Australia, can be modeled by a parabolic arch. If each unit corresponds to 10 meters, the arch would pass through the points at (−25, 5), (0, 10), and (25, 5).

5. Write the equation of the parabola to model the arch.
   $y = -\frac{1}{125}x^2 + 10$

6. Identify the coordinates of the focus of this parabola.
   (0, −21.25)

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10-3 Practice

Circles

Write an equation for the circle that satisfies each set of conditions.

1. center (−4, 2), radius 8 units
$(x + 4)^2 + (y - 2)^2 = 64$

2. center (0, 0), radius 4 units
$x^2 + y^2 = 16$

3. center $\left(-\frac{1}{4}, -\sqrt{3}\right)$, radius $5\sqrt{2}$ units
$\left(x + \frac{1}{4}\right)^2 + (y + \sqrt{3})^2 = 50$

4. center (2.5, 4.2), radius 0.9 unit
$(x - 2.5)^2 + (y - 4.2)^2 = 0.81$

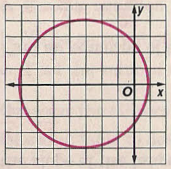
5. endpoints of a diameter at (−2, −9) and (0, −5) $(x + 1)^2 + (y + 7)^2 = 5$

6. center at (−9, −12), passes through (−4, −5) $(x + 9)^2 + (y + 12)^2 = 74$

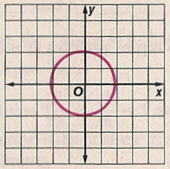
7. center at (−6, 5), tangent to x-axis $(x + 6)^2 + (y - 5)^2 = 25$

Find the center and radius of the circle with the given equation. Then graph the circle.

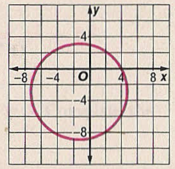
8. $(x + 3)^2 + y^2 = 16$
(−3, 0), 4 units



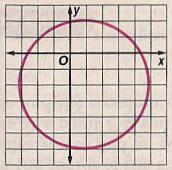
9. $3x^2 + 3y^2 = 12$
(0, 0), 2 units



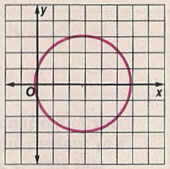
10. $x^2 + y^2 + 2x + 6y = 26$
(−1, −3), 6 units



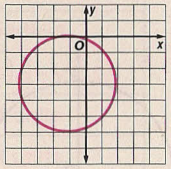
11. $(x - 1)^2 + y^2 + 4y = 12$
(1, −2), 4 units



12. $x^2 - 6x + y^2 = 0$
(3, 0), 3 units



13. $x^2 + y^2 + 2x + 6y = -1$
(−1, −3), 3 units



WEATHER For Exercises 14 and 15, use the following information.

On average, the circular eye of a hurricane is about 15 miles in diameter. Gale winds can affect an area up to 300 miles from the storm's center. In 2005, Hurricane Katrina devastated southern Louisiana. A satellite photo of Katrina's landfall showed the center of its eye on one coordinate system could be approximated by the point (80, 26).

14. Write an equation to represent a possible boundary of Katrina's eye.
$(x - 80)^2 + (y - 26)^2 = 56.25$

15. Write an equation to represent a possible boundary of the area affected by gale winds.
$(x - 80)^2 + (y - 26)^2 = 90{,}000$

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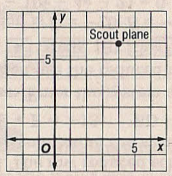
10-3 Word Problem Practice

Circles

1. **RADAR** A scout plane is equipped with radar. The boundary of the radar's range is given by the circle $(x - 4)^2 + (y - 6)^2 = 4900$. Each unit corresponds to one mile. What is the maximum distance that an object can be from the plane and still be detected by its radar?



70 mi

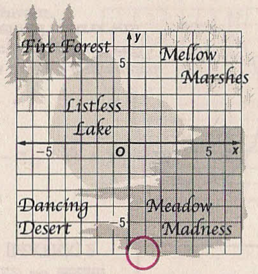
2. **STORAGE** An engineer uses a coordinate plane to show the layout of a side view of a storage building. The y-axis represents a wall and the x-axis represents the floor. A 10-meter diameter cylinder rests on its side flush against the wall. On the side view, the cylinder is represented by a circle in the first quadrant that is tangent to both axes. Each unit represents 1 meter. What is the equation of this circle?
$(x - 5)^2 + (y - 5)^2 = 25$

3. **FERRIS WHEEL** The Texas Star, the largest Ferris wheel in North America, is located in Dallas, Texas. It weighs 678,554 pounds and can hold 264 riders in its 44 gondolas. The Texas Star has a diameter of 212 feet. Use the rectangular coordinate system with the origin on the ground directly below the center of the wheel and write the equation of the circle that models the Texas Star.
$x^2 + (y - 106)^2 = 11{,}236$

4. **POOLS** The pool on an architectural floor plan is given by the equation $x^2 + 6x + y^2 + 8y = 0$. What point on the edge of the pool is farthest from the origin?
(−6, −8)

TREASURE For Exercises 5 and 6, use the following information.

A mathematically inclined pirate decided to hide the location of a treasure by marking it as the center of a circle given by an equation in non-standard form.



The secret circle can be represented by:

$$x^2 + y^2 - 2x + 14y + 49 = 0.$$

5. Rewrite the equation of the circle in standard form.
$(x - 1)^2 + (y + 7)^2 = 1$

6. Draw the circle on the map. Where is the treasure?
See circle on map at (1, −7); the southwest corner of Meadow Madness.

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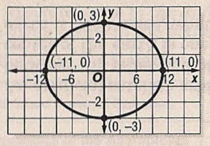
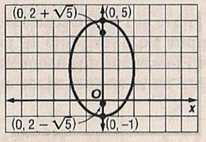
10-4 Practice

Ellipses

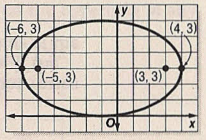
Write an equation for each ellipse.

1. 

$\frac{x^2}{121} + \frac{y^2}{9} = 1$

2. 

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

3. 

$\frac{(x+1)^2}{25} + \frac{(y-3)^2}{9} = 1$

Write an equation for the ellipse that satisfies each set of conditions.

4. endpoints of major axis at $(-9, 0)$ and $(9, 0)$, endpoints of minor axis at $(0, 3)$ and $(0, -3)$
$\frac{x^2}{81} + \frac{y^2}{9} = 1$

5. endpoints of major axis at $(4, 2)$ and $(4, -8)$, endpoints of minor axis at $(1, -3)$ and $(7, -3)$
$\frac{(y+3)^2}{25} + \frac{(x-4)^2}{9} = 1$

6. major axis 20 units long and parallel to x-axis, minor axis 10 units long, center at $(2, 1)$
$\frac{(x-2)^2}{100} + \frac{(y-1)^2}{25} = 1$

7. major axis 10 units long, minor axis 6 units long and parallel to x-axis, center at $(2, -4)$
$\frac{(y+4)^2}{25} + \frac{(x-2)^2}{9} = 1$

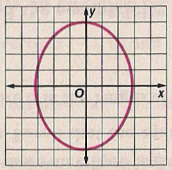
8. major axis 16 units long, center at $(0, 0)$, foci at $(0, 2\sqrt{15})$ and $(0, -2\sqrt{15})$
$\frac{y^2}{64} + \frac{x^2}{4} = 1$

9. endpoints of minor axis at $(0, 2)$ and $(0, -2)$, foci at $(-4, 0)$ and $(4, 0)$
$\frac{x^2}{20} + \frac{y^2}{4} = 1$

Find the coordinates of the center and foci and the lengths of the major and minor axes for the ellipse with the given equation. Then graph the ellipse.

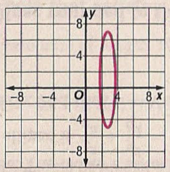
10. $\frac{y^2}{16} + \frac{x^2}{9} = 1$

$(0, 0)$; $(0, \pm\sqrt{7})$; 8; 6



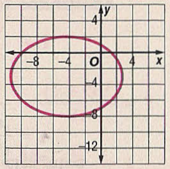
11. $\frac{(y-1)^2}{36} + \frac{(x-3)^2}{1} = 1$

$(3, 1)$; $(3, 1 \pm \sqrt{35})$; 12; 2



12. $\frac{(x+4)^2}{49} + \frac{(y+3)^2}{25} = 1$

$(-4, -3)$; $(-4 \pm 2\sqrt{6}, -3)$; 14; 10



13. **SPORTS** An ice skater traces two congruent ellipses to form a figure eight. Assume that the center of the first loop is at the origin, with the second loop to its right. Write an equation to model the first loop if its major axis (along the x-axis) is 12 feet long and its minor axis is 6 feet long. Write another equation to model the second loop.
$\frac{x^2}{36} + \frac{y^2}{9} = 1$; $\frac{(x-12)^2}{36} + \frac{y^2}{9} = 1$

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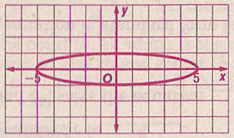
10-4 Word Problem Practice

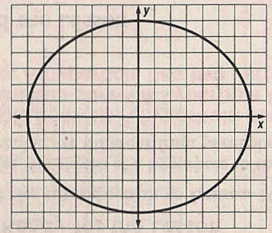
Ellipses

1. **PERSPECTIVE** A graphic designer uses an ellipse to draw a circle from the horizontal perspective. The equation used is $\frac{x^2}{25} + y^2 = 1$. Graph this ellipse.



2. **ECHOES** The walls of an elliptical room are given by the equation $\frac{x^2}{25} + \frac{y^2}{16} = 1$. Two people want to stand at the foci of the ellipse so that they can whisper to each other without anybody else hearing. What are the coordinates of the foci?
$(3, 0)$ and $(-3, 0)$

3. **FLASHLIGHTS** Daniella ended up doing her math homework late at night. To avoid disturbing others, she worked in bed with a pen light. One problem asked her to draw an ellipse. She noticed that her pen light created an elliptical patch of light on her paper, so she simply traced the outline of the patch of light. The outline of the ellipse is shown below. What is the equation of this ellipse in standard form?



$\frac{x^2}{49} + \frac{y^2}{36} = 1$

4. **ASTRONOMY** The orbit of an asteroid is given by the equation $\frac{x^2}{400} + \frac{y^2}{441} = 1$, where each unit represents one astronomical unit (i.e. the distance from Sun to Earth). What are the lengths of the major and minor axes of the orbit?
Major axis: 42 astronomical units, Minor axis: 40 astronomical units

MODELING For Exercises 5 and 6, use the following information.

James wants to try to make an ellipse using a piece of string 26 inches long. He tacks the two ends down 10 inches apart. He then takes a pen and pulls the string taut. He keeps the string taut and pulls the pen around the tacks. By doing this, he creates an ellipse.

5. Determine the lengths of the major and minor axes of the ellipse that James drew.
Major axis has length 26, minor axis has length 24.

6. If a coordinate grid is overlaid on the ellipse so that the tacks are located at $(5, 0)$ and $(-5, 0)$, what is the equation of the ellipse in standard form?
$\frac{x^2}{169} + \frac{y^2}{144} = 1$

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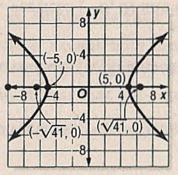
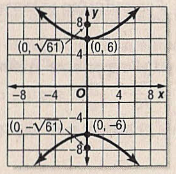
10-5 Skills Practice

Hyperbolas

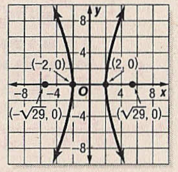
Write an equation for each hyperbola.

1.


$\frac{x^2}{25} - \frac{y^2}{16} = 1$

2.


$\frac{y^2}{36} - \frac{x^2}{25} = 1$

3.


$\frac{x^2}{4} - \frac{y^2}{25} = 1$

Write an equation for the hyperbola that satisfies each set of conditions.

4. vertices (−4, 0) and (4, 0), conjugate axis of length 8 $\frac{x^2}{16} - \frac{y^2}{16} = 1$

5. vertices (0, 6) and (0, −6), conjugate axis of length 14 $\frac{y^2}{36} - \frac{x^2}{49} = 1$

6. vertices (0, 3) and (0, −3), conjugate axis of length 10 $\frac{y^2}{9} - \frac{x^2}{25} = 1$

7. vertices (−2, 0) and (2, 0), conjugate axis of length 4 $\frac{x^2}{4} - \frac{y^2}{4} = 1$

8. vertices (−3, 0) and (3, 0), foci (±5, 0) $\frac{x^2}{9} - \frac{y^2}{16} = 1$

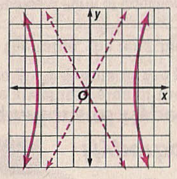
9. vertices (0, 2) and (0, −2), foci (0, ±3) $\frac{y^2}{4} - \frac{x^2}{5} = 1$

10. vertices (0, −2) and (6, −2), foci $(3 \pm \sqrt{13}, -2)$ $\frac{(x-3)^2}{9} - \frac{(y+2)^2}{4} = 1$

Find the coordinates of the vertices and foci and the equations of the asymptotes for the hyperbola with the given equation. Then graph the hyperbola.

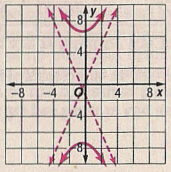
11. $\frac{x^2}{9} - \frac{y^2}{36} = 1$

$(\pm 3, 0)$; $(\pm 3\sqrt{5}, 0)$;
$y = \pm 2x$



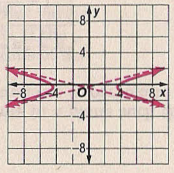
12. $\frac{y^2}{49} - \frac{x^2}{9} = 1$

$(0, \pm 7)$; $(0, \pm\sqrt{58})$;
$y = \pm\frac{7}{3}x$



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

$(\pm 4, 0)$; $(\pm\sqrt{17}, 0)$;
$y = \pm\frac{1}{4}x$

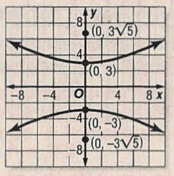


NAME ______________________ DATE __________ PERIOD ____

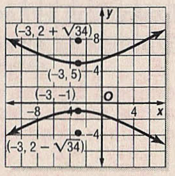
10-5 Practice

Hyperbolas

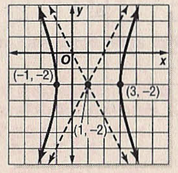
Write an equation for each hyperbola.

1.


$\frac{y^2}{9} - \frac{x^2}{36} = 1$

2.


$\frac{(y-2)^2}{9} - \frac{(x+3)^2}{25} = 1$

3.


$\frac{(x-1)^2}{4} - \frac{(y+2)^2}{16} = 1$

Write an equation for the hyperbola that satisfies each set of conditions.

4. vertices (0, 7) and (0, −7), conjugate axis of length 18 units $\frac{y^2}{49} - \frac{x^2}{81} = 1$

5. vertices (1, −1) and (1, −9), conjugate axis of length 6 units $\frac{(y+5)^2}{16} - \frac{(x-1)^2}{9} = 1$

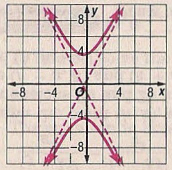
6. vertices (−5, 0) and (5, 0), foci $(\pm\sqrt{26}, 0)$ $\frac{x^2}{25} - \frac{y^2}{1} = 1$

7. vertices (1, 1) and (1, −3), foci $(1, -1 \pm \sqrt{5})$ $\frac{(y+1)^2}{4} - \frac{(x-1)^2}{1} = 1$

Find the coordinates of the vertices and foci and the equations of the asymptotes for the hyperbola with the given equation. Then graph the hyperbola.

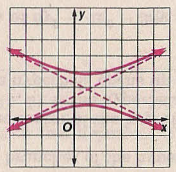
8. $\frac{y^2}{16} - \frac{x^2}{4} = 1$

$(0, \pm 4)$; $(0, \pm 2\sqrt{5})$;
$y = \pm 2x$



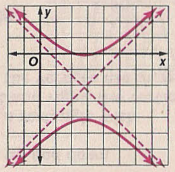
9. $\frac{(y-2)^2}{1} - \frac{(x-1)^2}{4} = 1$

(1, 3), (1, 1);
$(1, 2 \pm \sqrt{5})$;
$y - 2 = \pm\frac{1}{2}(x - 1)$



10. $\frac{(y+2)^2}{4} - \frac{(x-3)^2}{4} = 1$

(3, 0), (3, −4);
$(3, -2 \pm 2\sqrt{2})$;
$y + 2 = \pm(x - 3)$



11. **ASTRONOMY** Astronomers use special X-ray telescopes to observe the sources of celestial X rays. Some X-ray telescopes are fitted with a metal mirror in the shape of a hyperbola, which reflects the X rays to a focus. Suppose the vertices of such a mirror are located at (−3, 0) and (3, 0), and one focus is located at (5, 0). Write an equation that models the hyperbola formed by the mirror. $\frac{x^2}{9} - \frac{y^2}{16} = 1$

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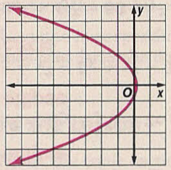
10-6 Practice

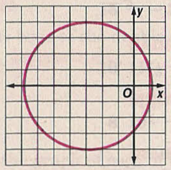
Conic Sections

Write each equation in standard form. State whether the graph of the equation is a *parabola, circle, ellipse,* or *hyperbola.* Then graph the equation.

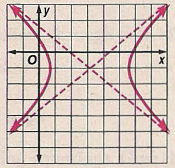
1. $y^2 = -3x$
parabola
$x = -\frac{1}{3}y^2$



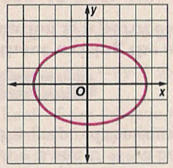
2. $x^2 + y^2 + 6x = 7$
circle
$(x + 3)^2 + y^2 = 16$



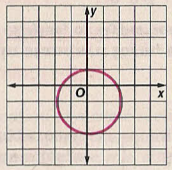
3. $5x^2 - 6y^2 - 30x - 12y = -9$
hyperbola
$\frac{(x - 3)^2}{6} - \frac{(y + 1)^2}{5} = 1$



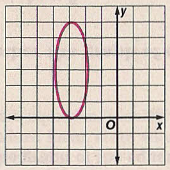
4. $196y^2 = 1225 - 100x^2$
ellipse
$\frac{x^2}{12.25} + \frac{y^2}{6.25} = 1$



5. $3x^2 = 9 - 3y^2 - 6y$
circle
$x^2 + (y + 1)^2 = 4$



6. $9x^2 + y^2 + 54x - 6y = -81$
ellipse
$\frac{(x + 3)^2}{1} + \frac{(y - 3)^2}{9} = 1$



Without writing the equation in standard form, state whether the graph of each equation is a *parabola, circle, ellipse,* or *hyperbola.*

7. $6x^2 + 6y^2 = 36$
circle

8. $4x^2 - y^2 = 16$
hyperbola

9. $9x^2 + 16y^2 - 64y - 80 = 0$
ellipse

10. $5x^2 + 5y^2 - 45 = 0$
circle

11. $x^2 + 2x = y$
parabola

12. $4y^2 - 36x^2 + 4x - 144 = 0$
hyperbola

13. ASTRONOMY A satellite travels in an hyperbolic orbit. It reaches the vertex of its orbit at (5, 0) and then travels along a path that gets closer and closer to the line $y = \frac{2}{5}x$. Write an equation that describes the path of the satellite if the center of its hyperbolic orbit is at (0, 0).

$\frac{x^2}{25} - \frac{y^2}{4} = 1$

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10-6 Word Problem Practice

Conic Sections

1. MISSING INFORMATION Rick began reading a book on conic sections. He came to this passage and discovered an inkblot covering part of an equation.

> For example, although it may not be obvious, the equation below describes a circle.
>
> 7x2 − 12x + ■y2 − 16y − 94 = 0
>
> To see that it is a circle, observe that the

Based on the information in the passage and your own knowledge of conic sections, what number is being covered by the inkblot?
7

2. HEADLIGHTS The light from the headlight of a car is in the shape of a cone. The axis of the cone is parallel to the ground. What shape does the edge of the lit region form on the road, assuming that the road is flat and level?
hyperbola

3. REASONING Jason has been struggling with conic sections. He decides he needs more practice, but he needs to have a way of making practice equations. He decides to use an equation of the form

$$Ax^2 + By^2 = 1,$$

where A and B are determined by rolling a pair of dice. After several rolls, he begins to realize that this system is not good enough because some conic sections never appear. Which types of conic section cannot occur using his method?
parabolas and hyperbolas are not possible

4. MIRROR A painter used a can of spray paint to make an image. The boundary of the image is described by the equation

$$4x^2 - 16x + y^2 - 6y + 21 = 0.$$

Put this equation into standard form and describe whether the curve is a circle, ellipse, parabola, or hyperbola.
$(x - 2)^2 + \frac{(y - 3)^2}{4} = 1$, ellipse

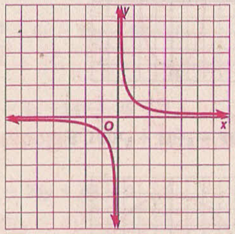
NONSTANDARD EQUATIONS

For Exercises 5–7, use the following information.

Consider the equation $xy = 1$.

5. Are there any solutions of this equation that lie on the x- or y-axis?
no

6. Sketch a graph of the solutions of the equation.



7. Assuming that the equation represents a conic section, based on the graph, which type of conic section is it?
a hyperbola

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10-7 Skills Practice

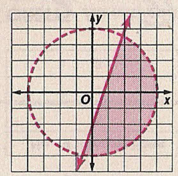
Solving Quadratic Systems

Find the exact solution(s) of each system of equations.

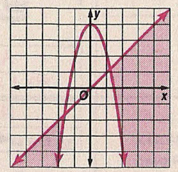
1. $y = x - 2$, $y = x^2 - 2$ **(0, −2), (1, −1)**
2. $y = x + 3$, $y = 2x^2$ **(−1, 2), (1.5, 4.5)**
3. $y = 3x$, $x = y^2$ **$(0, 0), \left(\frac{1}{9}, \frac{1}{3}\right)$**
4. $y = x$, $x^2 + y^2 = 4$ **$(\sqrt{2}, \sqrt{2}), (-\sqrt{2}, -\sqrt{2})$**
5. $x = -5$, $x^2 + y^2 = 25$ **(−5, 0)**
6. $y = 7$, $x^2 + y^2 = 9$ **no solution**
7. $y = -2x + 2$, $y^2 = 2x$ **$(2, -2), \left(\frac{1}{2}, 1\right)$**
8. $x - y + 1 = 0$, $y^2 = 4x$ **(1, 2)**
9. $y = 2 - x$, $y = x^2 - 4x + 2$ **(0, 2), (3, −1)**
10. $y = x - 1$, $y = x^2$ **no solution**
11. $y = 3x^2$, $y = -3x^2$ **(0, 0)**
12. $y = x^2 + 1$, $y = -x^2 + 3$ **(−1, 2), (1, 2)**
13. $y = 4x$, $4x^2 + y^2 = 20$ **(−1, −4), (1, 4)**
14. $y = -1$, $4x^2 + y^2 = 1$ **(0, −1)**
15. $4x^2 + 9y^2 = 36$, $x^2 - 9y^2 = 9$ **(−3, 0), (3, 0)**
16. $3(y + 2)^2 - 4(x - 3)^2 = 12$, $y = -2x + 2$ **(0, 2), (3, −4)**
17. $x^2 - 4y^2 = 4$, $x^2 + y^2 = 4$ **(−2, 0), (2, 0)**
18. $y^2 - 4x^2 = 4$, $y = 2x$ **no solution**

Solve each system of inequalities by graphing.

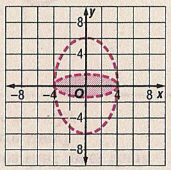
19. $y \le 3x - 2$, $x^2 + y^2 < 16$



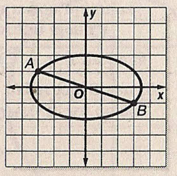
20. $y \le x$, $y \ge -2x^2 + 4$



21. $4y^2 + 9x^2 < 144$, $x^2 + 8y^2 < 16$



22. **GARDENING** An elliptical garden bed has a path from point A to point B. If the bed can be modeled by the equation $x^2 + 3y^2 = 12$ and the path can be modeled by the line $y = -\frac{1}{3}x$, what are the coordinates of points A and B? **(−3, 1) and (3, −1)**



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10-7 Practice

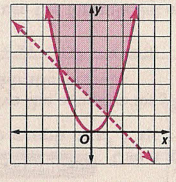
Solving Quadratic Systems

Find the exact solution(s) of each system of equations.

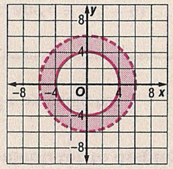
1. $(x - 2)^2 + y^2 = 5$, $x - y = 1$ **(0, −1), (3, 2)**
2. $x = 2(y + 1)^2 - 6$, $x + y = 3$ **(2, 1), (6.5, −3.5)**
3. $y^2 - 3x^2 = 6$, $y = 2x - 1$ **(−1, −3), (5, 9)**
4. $x^2 + 2y^2 = 1$, $y = -x + 1$ **$(1, 0), \left(\frac{1}{3}, \frac{2}{3}\right)$**
5. $4y^2 - 9x^2 = 36$, $4x^2 - 9y^2 = 36$ **no solution**
6. $y = x^2 - 3$, $x^2 + y^2 = 9$ **$(0, -3), (\pm\sqrt{5}, 2)$**
7. $x^2 + y^2 = 25$, $4y = 3x$ **(4, 3), (−4, −3)**
8. $y^2 = 10 - 6x^2$, $4y^2 = 40 - 2x^2$ **$(0, \pm\sqrt{10})$**
9. $x^2 + y^2 = 25$, $x = 3y - 5$ **(−5, 0), (4, 3)**
10. $4x^2 + 9y^2 = 36$, $2x^2 - 9y^2 = 18$ **(±3, 0)**
11. $x = -(y - 3)^2 + 2$, $x = (y - 3)^2 + 3$ **no solution**
12. $\frac{x^2}{9} - \frac{y^2}{16} = 1$, $x^2 + y^2 = 9$ **(±3, 0)**
13. $25x^2 + 4y^2 = 100$, $x = -\frac{5}{2}$ **no solution**
14. $x^2 + y^2 = 4$, $\frac{x^2}{4} + \frac{y^2}{8} = 1$ **(±2, 0)**
15. $x^2 - y^2 = 3$, $y^2 - x^2 = 3$ **no solution**
16. $\frac{x^2}{7} + \frac{y^2}{7} = 1$, $3x^2 - y^2 = 9$ **$(\pm 2, \pm\sqrt{3})$**
17. $x + 2y = 3$, $x^2 + y^2 = 9$ **$(3, 0), \left(-\frac{9}{5}, \frac{12}{5}\right)$**
18. $x^2 + y^2 = 64$, $x^2 - y^2 = 8$ **$(\pm 6, \pm 2\sqrt{7})$**

Solve each system of inequalities by graphing.

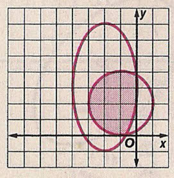
19. $y \ge x^2$, $y > -x + 2$



20. $x^2 + y^2 < 36$, $x^2 + y^2 \ge 16$



21. $\frac{(y - 3)^2}{16} + \frac{(x + 2)^2}{4} \le 1$, $(x + 1)^2 + (y - 2)^2 \le 4$



22. **GEOMETRY** The top of an iron gate is shaped like half an ellipse with two congruent segments from the center of the ellipse to the ellipse as shown. Assume that the center of the ellipse is at (0, 0). If the ellipse can be modeled by the equation $x^2 + 4y^2 = 4$ for $y \ge 0$ and the two congruent segments can be modeled by $y = \frac{\sqrt{3}}{2}x$ and $y = -\frac{\sqrt{3}}{2}x$, what are the coordinates of points A and B? **$\left(-1, \frac{\sqrt{3}}{2}\right)$ and $\left(1, \frac{\sqrt{3}}{2}\right)$**