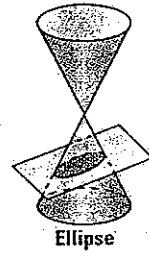
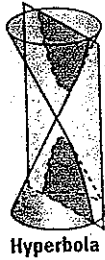


**CIRCLE**

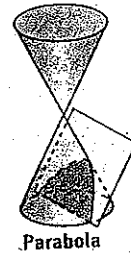


**ELLIPSE**

**CONIC SECTIONS**  
 $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$



**HYPERBOLA**



**PARABOLA**

## Chapter 10 - Classifying Conics

| <b>General Form of Equation<br/>Of Conics</b><br>$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ | <b>Type of Conic</b> | <b>Reason</b> |
|--|----------------------|---------------|
| 1. $6x^2 + 6y^2 - 162 = 0$   |                      |               |
| 2. $x^2 - 8y = 0$  |                      |               |
| 3. $4x^2 + 2y^2 - 8 = 0$   |                      |               |
| 4. $4y^2 - x^2 + 4 = 0$  |                      |               |
| 5. $x^2 + y^2 + 6y - 27 = 0$   |                      |               |
| 6. $x^2 - y^2 + 8x - 16 = 0$   |                      |               |
| 7. $3x^2 + 4y^2 + 8y - 8 = 0$  |                      |               |
| 8. $x^2 + y^2 - 8y + 11 = 0$   |                      |               |
| 9. $9x^2 + 25y^2 - 54x - 50y - 119 = 0$  |                      |               |
| 10. $25x^2 - 9y^2 - 18y + 219 = 0$   |                      |               |
| 11. $x^2 + 8x + y + 23 = 0$  |                      |               |

## 7.3 – Circles

Write an equation for each circle if the coordinates of the center and the length of the radius are given.

1. center  $(-1, -5)$ ,  $r = 2$  units

2. center  $(-8, 7)$ ,  $r = \frac{1}{2}$  units

3. center  $(0.5, 0.7)$ ,  $r = 13.5$  units

4. center  $(3, -3)$ ,  $r = \sqrt{5}$  units

Find the coordinates of the center and the radius of each circle. Then draw the graph on a separate sheet of graph paper. Be sure to label the center and the radius.

5.  $x^2 + (y+2)^2 = 4$

6.  $(x-3)^2 + (y-1)^2 = 25$

7.  $x^2 + y^2 + 8x - 6y = 0$

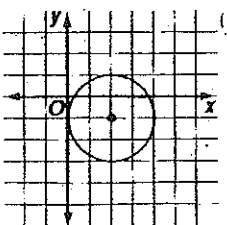
8.  $x^2 + y^2 - 6y - 16 = 0$

9.  $x^2 + y^2 - 6x - 12y + 36 = 0$

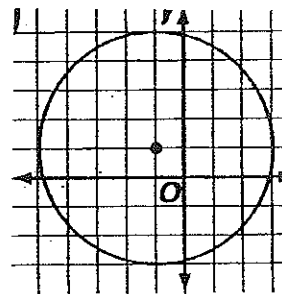
10.  $x^2 + y^2 = 14x - 24$

Write an equation for each graph.

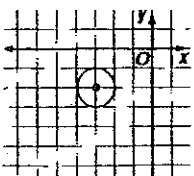
11.



12.



13.



## Study Guide

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## Circles

A **circle** is the set of all points in a plane that are equidistant from a given point, called the **center**. The distance from the center to any point on the circle is called the **radius**.

Equation of Circle with Center at  $(h, k)$ , radius  $r$ 

$$(x - h)^2 + (y - k)^2 = r^2$$

**Example:** Find the center and radius of the circle whose equation is  $x^2 + 2x + y^2 + 4y = 11$ . Then graph the circle.

Complete the square for each variable.

$$x^2 + 2x + y^2 + 4y = 11$$

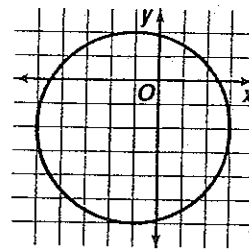
$$x^2 + 2x + \blacksquare + y^2 + 4y + \square = 11 + \blacksquare + \square$$

Write the equation in the form

$$x^2 + 2x + 1 + y^2 + 4y + 4 = 11 + 1 + 4$$

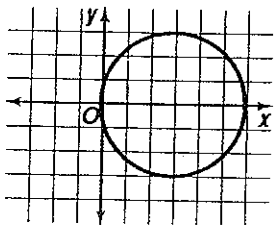
 $(x - h)^2 + (y - k)^2 = r^2$ 

$$(x + 1)^2 + (y + 2)^2 = 16$$

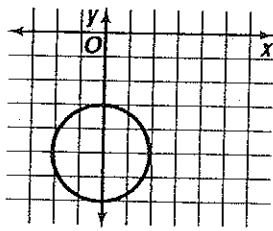
The circle has its center at  $(-1, -2)$  and a radius of 4.

Write an equation for each circle.

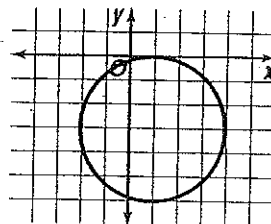
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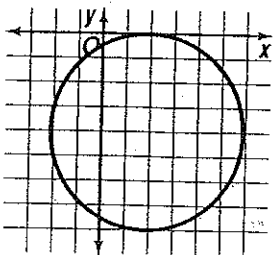
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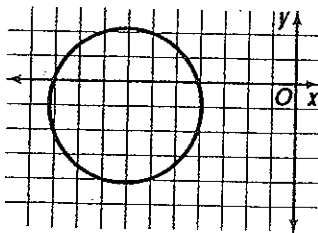
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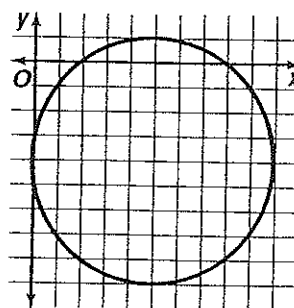
4.



5.



6.



Write an equation for each circle if the coordinates of the center and length of the radius are given.

7  $(-3, 5)$ , 7 units8  $(-4, -6)$ , 5 units

# — Ellipses

Find the coordinates of the center and the lengths of the major and minor axes. Then draw the graph of each ellipse on a separate sheet of graph paper. Be sure to label your graphs.

1.  $\frac{x^2}{25} + \frac{y^2}{9} = 1$

2.  $\frac{(x+6)^2}{49} + \frac{(y-2)^2}{81} = 1$

3.  $16x^2 + 9y^2 = 144$

4.  $x^2 + 4y^2 + 24y = -32$

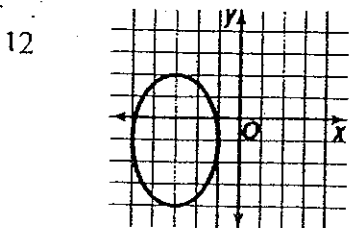
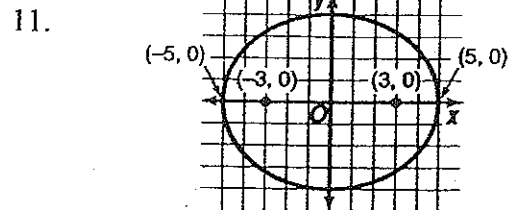
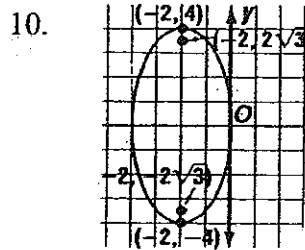
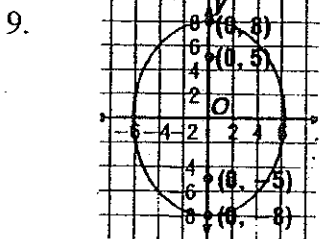
5.  $x^2 + 25y^2 - 8x + 100y + 91 = 0$

6.  $9x^2 + 16y^2 + 18x + 64y - 71 = 0$

7.  $16x^2 + 25y^2 + 32x - 150y = 159$

8.  $9x^2 + 4y^2 - 11 = 18x - 16y$

Write an equation for each graph.



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## Ellipses

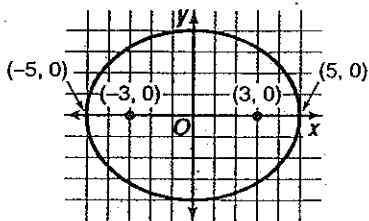
~~An ellipse is the set of all points in a plane such that the sum of the distances from two given points in the plane, called the **foci**, is constant. An ellipse has two axes of symmetry. The intersection of the two axes is the **center of the ellipse**. The ellipse intersects the axes to define two segments whose endpoints lie on the ellipse. The longer segment is called the **major axis**, and the shorter segment is called the **minor axis**.~~

Standard Equations for Ellipses with Center at  $(h, k)$ 

Horizontal Major Axis:  $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1 \quad (a^2 > b^2)$

Vertical Major Axis:  $\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1 \quad (a^2 > b^2)$

## Example:



Write the equation of the ellipse.

First find the length of the major axis. The distance between  $(-5, 0)$  and  $(5, 0)$  is 10 units.

$$2a = 10$$

$$a = 5 \text{ so } a^2 = 25$$

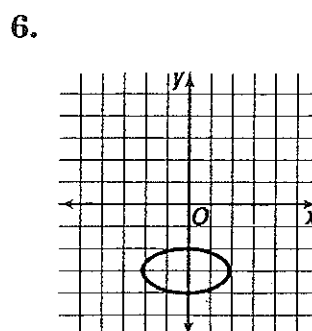
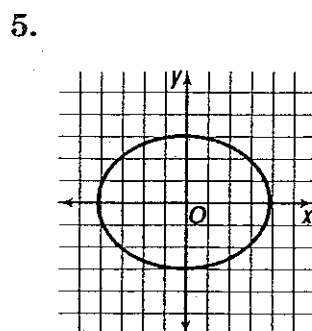
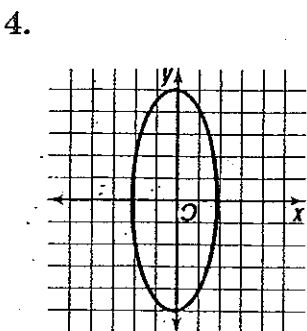
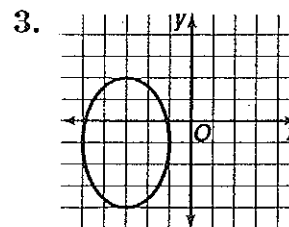
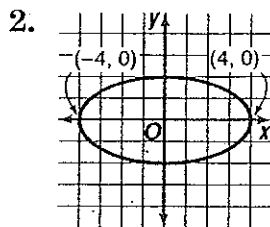
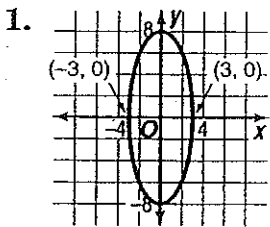
Since the foci are at  $(-3, 0)$  and  $(3, 0)$ ,  $c = 3$ .

$$b^2 = a^2 - c^2$$

$$b^2 = 5^2 - 3^2 \text{ so } b^2 = 16$$

The equation is  $\frac{x^2}{25} + \frac{y^2}{16} = 1$ .

Write an equation for each ellipse.



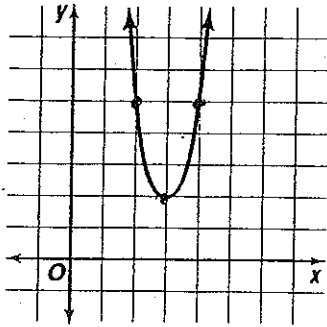
## Practice

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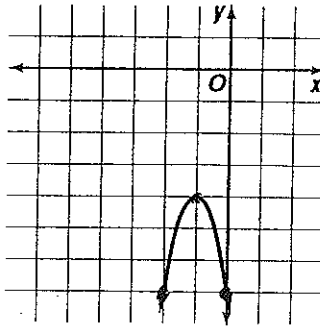
## Parabolas

Write an equation for each parabola.

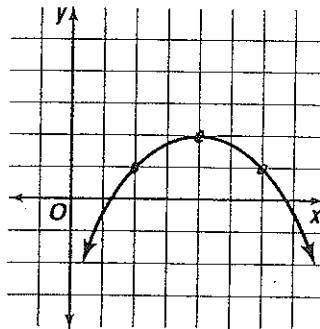
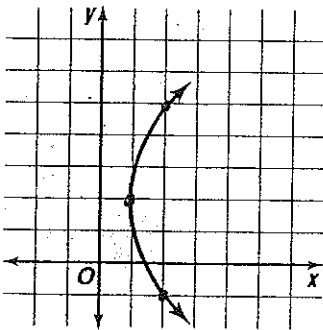
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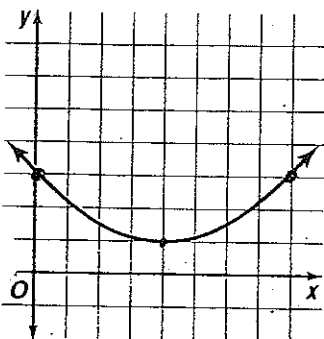
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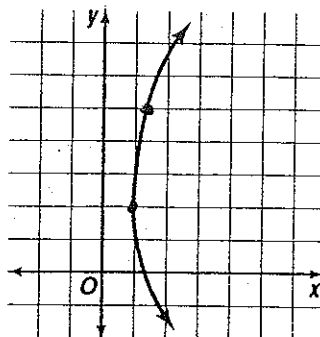
4.



5.



6.



# Parabolas

## 7-2

Change each equation to the form  $y = a(x - h)^2 + k$ .

11.  $x^2 = 10y$

13.  $y = x^2 - 6x + 33$

15.  $y = 3x^2 - 24x + 50$

12.  $x^2 = -2y$

14.  $y = x^2 + 4x + 1$

16.  $y = \frac{1}{2}x^2 - 3x + \frac{19}{2}$

Change each equation to the form  $x = a(y - k)^2 + h$ .

17.  $6x = y^2$

19.  $x = y^2 + 8y + 20$

21.  $x = \frac{1}{4}y^2 - \frac{1}{2}y - 3$

18.  $y^2 = -12x$

20.  $x = y^2 - 14y + 25$

22.  $x = 5y^2 - 25y + 60$

Graph each parabola

1.  $x^2 = 6y$

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

7.  $x^2 = (y - 1)$

10.  $(y - 8)^2 = -4(x - 4)$

13.  $x = y^2 - 14y + 25$

16.  $y = x^2 + 4x + 1$

2.  $y^2 = -8x$

5.  $(x - 8)^2 = \frac{1}{2}(y + 1)$

8.  $(x + 2)^2 = 6y$

11.  $y = x^2 - 6x + 33$

14.  $y = \frac{1}{2}x^2 - 3x + \frac{19}{2}$

17.  $y = 3x^2 - 24x + 50$

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

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

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

12.  $x = y^2 + 8y + 20$

15.  $x = \frac{1}{4}y^2 - \frac{1}{2}y - 3$

18.  $x = 5y^2 - 25y + 60$



# 7.5 – Hyperbolas

For each hyperbola find the coordinates of the center and state whether the transverse axis is horizontal or vertical. Then draw the graph on a separate sheet of graph paper. Be sure to label your graphs.

1.  $\frac{x^2}{9} - \frac{y^2}{25} = 1$

2.  $\frac{(y-4)^2}{16} - \frac{(x+2)^2}{9} = 1$

3.  $\frac{(x+6)^2}{36} - \frac{(y+3)^2}{49} = 1$

4.  $x^2 - y^2 + 8x - 2y - 21 = 0$

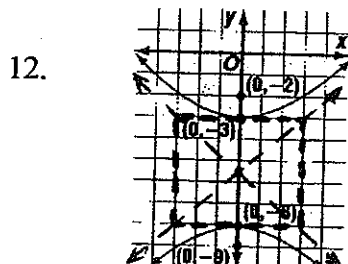
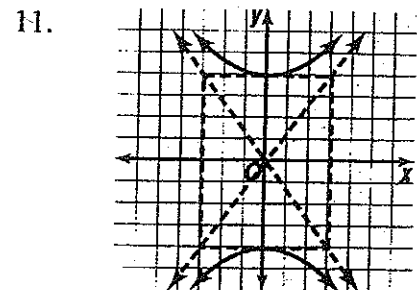
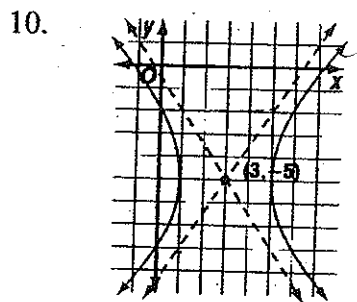
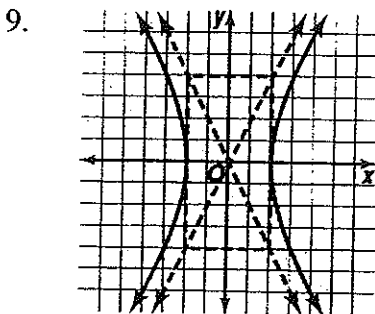
5.  $4x^2 - y^2 - 8x - 12 = 0$

6.  $4x^2 - 25y^2 - 8x - 96 = 0$

7.  $4y^2 - 9x^2 + 16y + 18x = 29$

8.  $16x^2 - y^2 + 96x + 8y + 112 = 0$

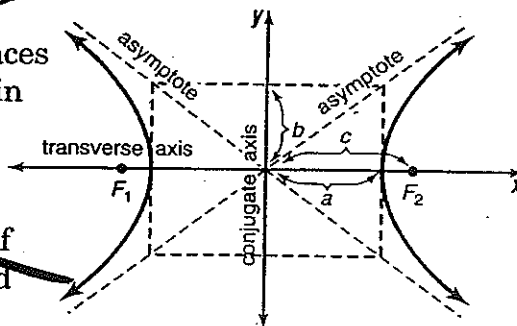
Write an equation for each graph.



# Study Guide

## Hyperbolas

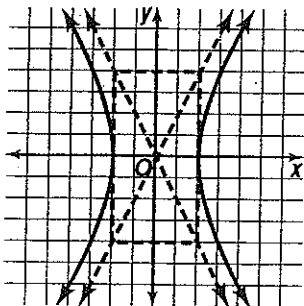
A hyperbola is the set of all points in a plane such that the absolute value of the difference of the distances from any point on the hyperbola to two given points in the plane, called the foci, is constant. Key features of a hyperbola are the foci, vertex, asymptotes, transverse axis, and conjugate axis, shown in the figure. The center of a hyperbola is the midpoint of the segment connecting the foci. The lengths  $a$ ,  $b$ , and  $c$  are related by the formula  $c^2 = a^2 + b^2$ .



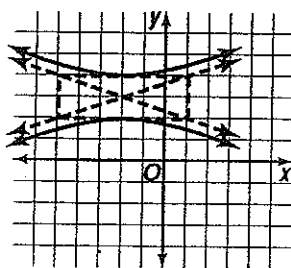
|                           |   |   |
|---------------------------|---|---|
| Equation of the Hyperbola | $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ | $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$ |
| Slopes of the Asymptotes  | $\pm \frac{b}{a}$                               | $\pm \frac{a}{b}$                               |
| Transverse Axis           | Horizontal                                      | Vertical  |
| Foci                      | $(h-c, k), (h+c, k)$                            | $(h, k-a), (h, k+a)$                            |
| Vertices                  | $(h-a, k), (h+a, k)$                            | $(h, k-a), (h, k+a)$                            |

Write an equation for each hyperbola.

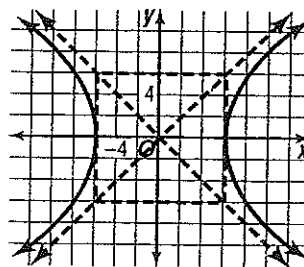
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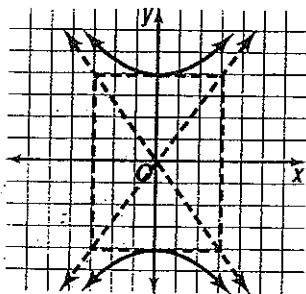
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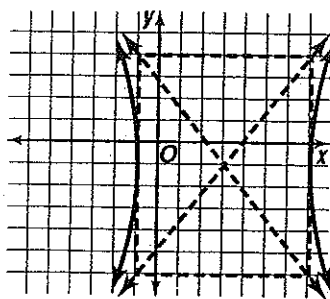
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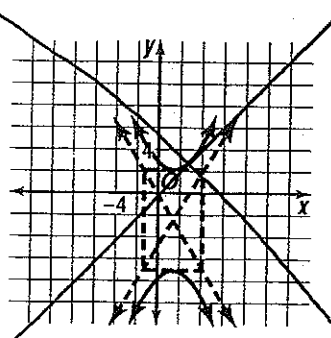
4.



5.



6.



## Conic Section

## 7-6

**Exploratory** State whether the graph of each of the following equations is a parabola, a circle, an ellipse, or a hyperbola.

1.  $x^2 + y^2 = 9$

2.  $\frac{y^2}{8} - \frac{x^2}{10} = 1$

3.  $\frac{x^2}{4} + \frac{y^2}{6} = 1$

4.  $x^2 + y^2 = 4$

5.  $y = (x - 3)^2 + 25$

6.  $x = \left(y + \frac{1}{2}\right)^2$

7.  $\frac{(x+3)^2}{1} - \frac{(y-4)^2}{9} = 1$

8.  $\frac{(y-7)^2}{3} + \frac{(x+2)^2}{2} = 1$

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

1.  $x^2 = 8y$

2.  $4x^2 + 2y^2 = 8$

3.  $3x^2 + 3y^2 = 81$

4.  $9x^2 - 4y^2 = 4$

5.  $3x^2 + 4y^2 + 8y = 8$

6.  $13x^2 - 49 = -13y^2$

7.  $y^2 - 2x^2 - 16 = 0$

8.  $y = x^2 + 3x + 1$

9.  $x^2 - 8y + y^2 = -11$

10.  $\frac{(y-5)^2}{4} - (x+1)^2 = 4$

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

12.  $x^2 - 4y^2 + 10x - 16y = -5$

13.  $9x^2 + 25y^2 - 54x - 50y = 119$

14.  $(y-4)^2 = 9(x-4)$

15.  $3y^2 + 24y - x^2 - 2x = -41$

16.  $x^2 + y^2 + 6y - 8x = -24$

page 9

### Conic Sections.

For exercises 1 – 14, classify the conic equation. Use C for circle, E for ellipse, H for hyperbola, P for parabola.

1.  $9x^2 + 4y^2 + 36x - 24y + 36 = 0$

2.  $x^2 - 9y^2 + 2x - 54y - 80 = 0$

3.  $x^2 - 9y^2 + 36y - 72 = 0$

4.  $x^2 + y^2 - 10x - 2y + 10 = 0$

5.  $16x^2 + 25y^2 = 36x + 50y - 61$

6.  $x^2 + y^2 - 16x + 4y + 67 = 0$

7.  $9x^2 + 25y^2 - 36x - 50y = -61$

8.  $x^2 - 2x + 8y + 9 = 0$

9.  $y^2 - 4y - 4x = 0$

10.  $12x^2 + 20y^2 - 12x + 40y - 37 = 0$

11.  $9y^2 - x^2 + 10x + 54y + 55 = 0$

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

13.  $9y^2 + 36x^2 + 48x - 36y + 43 = 0$

14.  $x^2 - 2x + 8y + 17 = 0$

For exercises 15-22, solve each equation by completing the square. Match the equation with its graph.

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

16.  $y^2 - x^2 + 12y + 4x = -31$

17.  $x^2 + 6x + 5 = -2y$

18.  $x^2 + y^2 - 4x - 6y - 3 = 0$

19.  $x^2 + y^2 + 2x - 2y = 7$

20.  $y^2 - 2y + 9 = 4x$

21.  $4x^2 - 9y^2 - 16x - 20 = 0$

22.  $25x^2 + 4y^2 + 100x + 16y = -16$

