

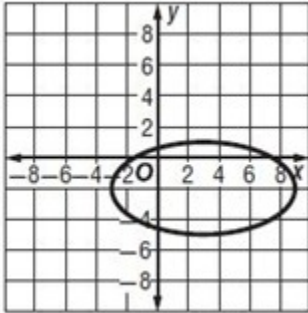
9-6 Identifying Conic Sections

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. $x^2 + 4y^2 - 6x + 16y - 11 = 0$

ANSWER:

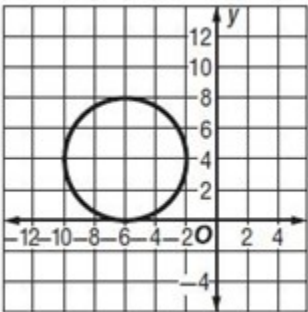
$$\frac{(x-3)^2}{36} + \frac{(y+2)^2}{9} = 1; \text{ ellipse}$$



2. $x^2 + y^2 + 12x - 8y + 36 = 0$

ANSWER:

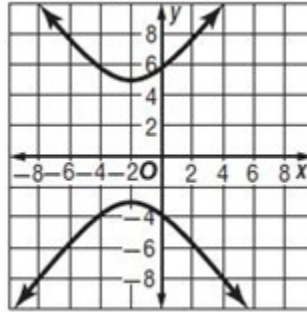
$$(x+6)^2 + (y-4)^2 = 16; \text{ circle}$$



3. $9y^2 - 16x^2 - 18y - 64x - 199 = 0$

ANSWER:

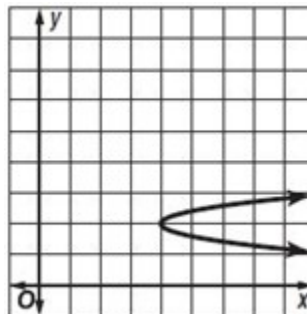
$$\frac{(y-1)^2}{16} - \frac{(x+2)^2}{9}; \text{ hyperbola}$$



4. $6y^2 - 24y + 28 - x = 0$

ANSWER:

$$x = 6(y-2)^2 + 4; \text{ parabola}$$



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

5. $4x^2 + 6y^2 - 3x - 2y = 12$

ANSWER:

ellipse

6. $5y^2 = 2x + 6y - 8 + 3x^2$

ANSWER:

hyperbola

7. $8x^2 + 8y^2 + 16x + 24 = 0$

ANSWER:

circle

9-6 Identifying Conic Sections

8. $4x^2 - 6y = 8x + 2$

ANSWER:

parabola

9. $4x^2 - 3y^2 + 8xy - 12 = 2x + 4y$

ANSWER:

hyperbola

10. $5xy - 3x^2 + 6y^2 + 12y = 18$

ANSWER:

hyperbola

11. $8x^2 + 12xy + 16y^2 + 4y - 3x = 12$

ANSWER:

ellipse

12. $16xy + 8x^2 + 8y^2 - 18x + 8y = 13$

ANSWER:

parabola

13. **CCSS MODELING** A military jet performs for an air show. The path of the plane during one trick can be modeled by a conic section with equation

$24x^2 + 1000y - 31,680x - 45,600 = 0$, where distances are represented in feet.

a. Identify the shape of the curved path of the jet. Write the equation in standard form.

b. If the jet begins its path upward or ascent at $x = 0$, what is the horizontal distance traveled by the jet from the beginning of the ascent to the end of the descent?

c. What is the maximum height of the jet?

ANSWER:

a. Parabola; $y = -0.024(x - 660)^2 + 10,500$

b. about 1320 ft

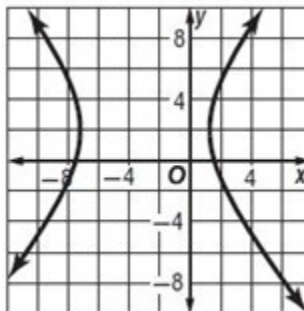
c. 10,500 ft

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

14. $3x^2 - 2y^2 + 18x + 8y - 35 = 0$

ANSWER:

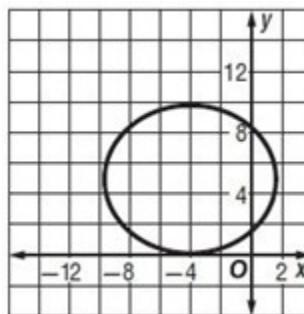
$$\frac{(x+3)^2}{18} - \frac{(y-2)^2}{27} = 1; \text{ hyperbola}$$



15. $3x^2 + 24x + 4y^2 - 40y + 52 = 0$

ANSWER:

$$\frac{(x+4)^2}{32} + \frac{(y-5)^2}{24} = 1; \text{ ellipse}$$

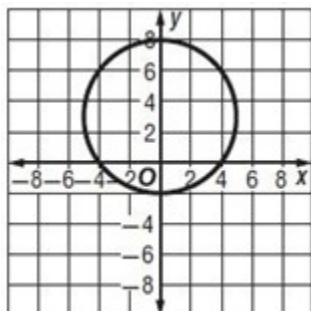


9-6 Identifying Conic Sections

16. $x^2 + y^2 = 16 + 6y$

ANSWER:

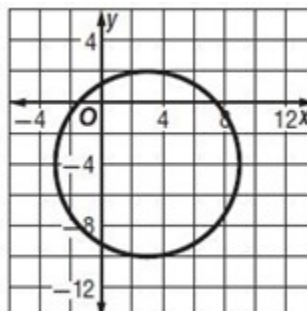
$$x^2 + (y - 3)^2 = 25; \text{ circle}$$



19. $x^2 + 8y = 11 + 6x - y^2$

ANSWER:

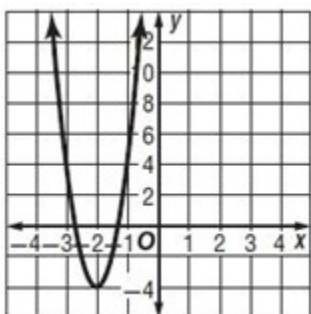
$$(x - 3)^2 + (y + 4)^2 = 36; \text{ circle}$$



17. $32x + 28 = y - 8x^2$

ANSWER:

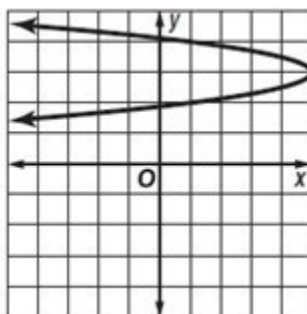
$$y = 8(x + 2)^2 - 4, \text{ parabola}$$



20. $4y^2 = 24y - x - 31$

ANSWER:

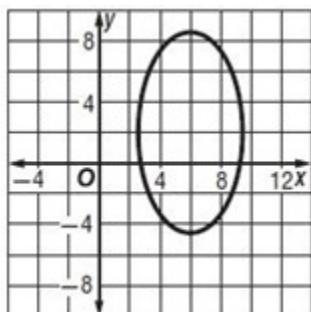
$$x = -4(y - 3)^2 + 5; \text{ parabola}$$



18. $7x^2 - 8y = 84x - 2y^2 - 176$

ANSWER:

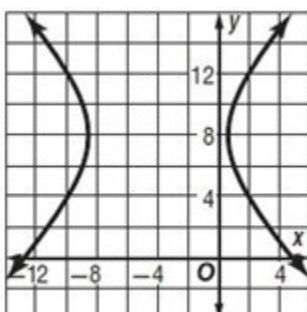
$$\frac{(y - 2)^2}{42} + \frac{(x - 6)^2}{12} = 1; \text{ ellipse}$$



21. $112y + 64x = 488 + 7y^2 - 8x^2$

ANSWER:

$$\frac{(x + 4)^2}{21} - \frac{(y - 8)^2}{24} = 1; \text{ hyperbola}$$

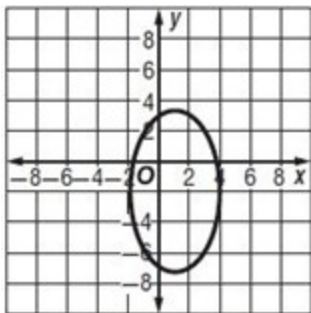


9-6 Identifying Conic Sections

22. $28x^2 + 9y^2 - 188 = 56x - 36y$

ANSWER:

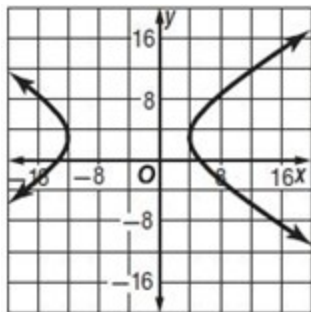
$$\frac{(y+2)^2}{28} + \frac{(x-1)^2}{9} = 1; \text{ ellipse}$$



23. $25x^2 + 384y - 64y^2 + 200x = 1776$

ANSWER:

$$\frac{(x+4)^2}{64} - \frac{(y-3)^2}{25} = 1; \text{ hyperbola}$$



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

24. $4x^2 - 5y = 9x - 12$

ANSWER:

parabola

25. $4x^2 - 12x = 18y - 4y^2$

ANSWER:

circle

26. $9x^2 + 12y = 9y^2 + 18y - 16$

ANSWER:

hyperbola

27. $18x^2 - 16y = 12x - 4y^2 + 19$

ANSWER:

ellipse

28. $12y^2 - 4xy + 9x^2 = 18x - 124$

ANSWER:

ellipse

29. $5xy + 12x^2 - 16x = 5y + 3y^2 + 18$

ANSWER:

hyperbola

30. $19x^2 + 14y = 6x - 19y^2 - 88$

ANSWER:

circle

31. $8x^2 + 20xy + 18 = 4y^2 - 12 + 9x$

ANSWER:

hyperbola

32. $5x - 12xy + 6x^2 = 8y^2 - 24y - 9$

ANSWER:

hyperbola

33. $18x - 24y + 324xy = 27x^2 + 3y^2 - 5$

ANSWER:

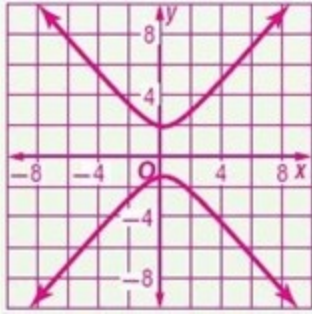
hyperbola

9-6 Identifying Conic Sections

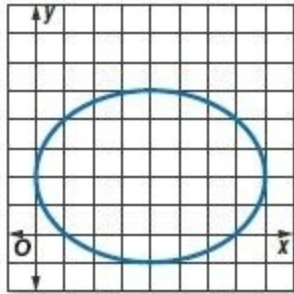
34. **LIGHT** A lamp standing near a wall throws an arc of light in the shape of a conic section. Suppose the edge of the light can be represented by the equation $3y^2 - 2y - 4x^2 + 2x - 8 = 0$. Identify the shape of the edge of the light and graph the equation.

ANSWER:

hyperbola



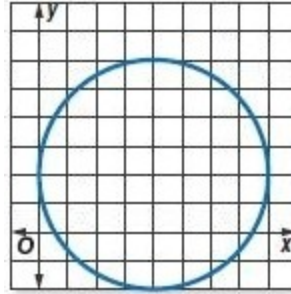
Match each graph with its corresponding equation.



- 35.
- $x^2 + y^2 - 8x - 4y = -4$
 - $9x^2 - 16y^2 - 72x + 64y = 64$
 - $9x^2 + 16y^2 = 72x + 64y - 64$

ANSWER:

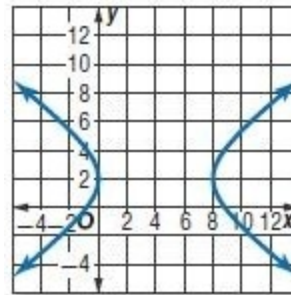
c



- 36.
- $x^2 + y^2 - 8x - 4y = -4$
 - $9x^2 - 16y^2 - 72x + 64y = 64$
 - $9x^2 + 16y^2 = 72x + 64y - 64$

ANSWER:

a



- 37.
- $x^2 + y^2 - 8x - 4y = -4$
 - $9x^2 - 16y^2 - 72x + 64y = 64$
 - $9x^2 + 16y^2 = 72x + 64y - 64$

ANSWER:

b

For Exercises 38–41, match each situation with an equation that could be used to represent it.

- $47.25x^2 - 9y^2 + 18y + 33.525 = 0$
- $25x^2 + 100y^2 - 1900x - 2200y + 45,700 = 0$
- $16x^2 - 90x + y - 0.25 = 0$
- $x^2 + y^2 - 18x - 30y - 14,094 = 0$

38. **COMPUTERS** the boundary of a wireless network with a range of 120 feet

ANSWER:

d

9-6 Identifying Conic Sections

39. **FITNESS** the oval path of your foot on an exercise machine

ANSWER:

b

40. **COMMUNICATIONS** the position of a cell phone between two cell towers

ANSWER:

a

41. **SPORTS** the height of a football above the ground after being kicked

ANSWER:

c

42. **CCSS SENSE-MAKING** The shape of the cables in a suspension bridge is approximately parabolic. If the towers for a planned bridge are 1000 meters apart and the lowest point of the suspension cables is 200 meters below the tops of the towers, write the equation in standard form with the origin at the vertex.

ANSWER:

$$y = 0.0008x^2$$

43. **MULTIPLE REPRESENTATIONS** Consider an ellipse with center $(3, -2)$, vertex $M(-1, -2)$, and co-vertex $N(3, -4)$.

$N(3, -4)$.

a. ANALYTICAL Determine the standard form of the equation of the ellipse.

b. ALGEBRAIC Convert part **a** to

$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ form.

c. GRAPHICAL Graph the ellipse.

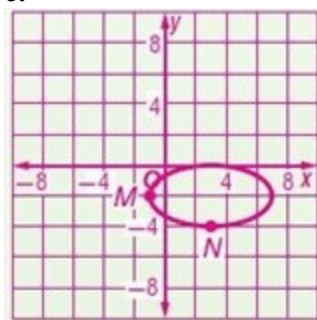
d. ANALYTICAL If the ellipse is rotated such that M is moved to $(3, -6)$, determine the location of N and the angle of rotation.

ANSWER:

a.
$$\frac{(x-3)^2}{16} + \frac{(y+2)^2}{4} = 1$$

b.
$$x^2 + 4y^2 - 6x + 16y + 9 = 0$$

c.



d. $N(5, -2)$; 90° counterclockwise

9-6 Identifying Conic Sections

44. **CHALLENGE** When a plane passes through the vertex of a cone, a degenerate conic is formed.

a. Determine the type of conic represented by

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

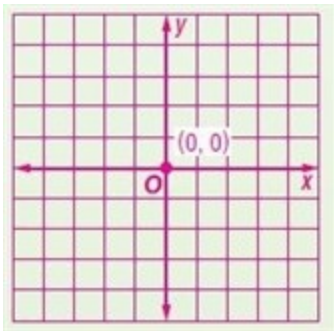
b. Graph the conic.

c. Describe the difference between this degenerate conic and a standard conic.

ANSWER:

a. ellipse

b.



c. The graph of the standard conic is an ellipse, and the graph of the degenerate conic is a single point.

45. **REASONING** Determine whether the following statement is *sometimes*, *always*, or *never* true. Explain your reasoning.

When a conic is vertical and $A = C$, it is a circle.

ANSWER:

Sample answer: Always; when a conic is vertical, $B = 0$. When this is true and $A = C$, the conic is a circle.

46. **OPEN ENDED** Write an equation of the form

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0,$$

where $A = 9C$, that represents a parabola.

ANSWER:

Sample answer: $9x^2 + 6xy + y^2 + 2x + 2y + 8 = 0$

47. **WRITING IN MATH** Compare and contrast the graphs of the four types of conics and their corresponding equations.

ANSWER:

Sample answer: An ellipse is a flattened circle. Both circles and ellipses are enclosed regions while hyperbolas and parabolas are not. A parabola has one branch, which is a smooth curve that never ends, and a hyperbola has two such branches that are reflections of each other. In standard form and when there is no xy -term: an equation for a parabola consists of only one squared term, an equation for a circle has values for A and C that are equal, an equation for an ellipse has values for A and C that are the same sign but not equal, and an equation for a hyperbola has values of A and C that have opposite signs.

48. **SAT/ACT** A class of 25 students took a science test. Ten students had a mean score of 80. The other students had an average score of 60. What is the average score of the whole class?

A 66

B 68

C 70

D 72

E 78

ANSWER:

B

49. Six times a number minus 11 is 43. What is the number?

F 12

G 11

H 10

J 9

ANSWER:

J

9-6 Identifying Conic Sections

50. **EXTENDED RESPONSE** The amount of water remaining in a storage tank as it is drained can be represented by the equation $L = -4t^2 - 10t + 130$, where L represents the number of liters of water remaining and t represents the number of minutes since the drain was opened. How many liters of water were in the tank initially? Determine to the nearest tenth of a minute how long it will take for the tank to drain completely.

ANSWER:

130 L; 4.6 min

51. Ruben has a square piece of paper with sides 4 inches long. He rolled up the paper to form a cylinder. What is the volume of the cylinder?

- A. $\frac{4}{\pi}$
 B. $\frac{16}{\pi}$
 C. 4π
 D. 16π

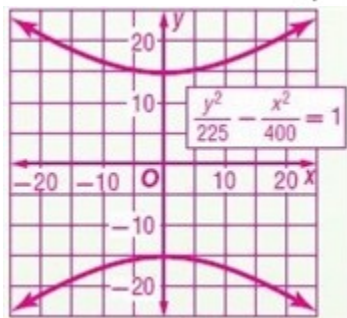
ANSWER:

B

52. **ASTRONOMY** Suppose a comet's path can be modeled by a branch of the hyperbola with equation $\frac{y^2}{225} - \frac{x^2}{400} = 1$. Find the coordinates of the vertices and foci and the equations of the asymptotes for the hyperbola. Then graph the hyperbola.

ANSWER:

$(0, \pm 15)$; $(0, \pm 25)$; $y = \pm \frac{3}{4}x$

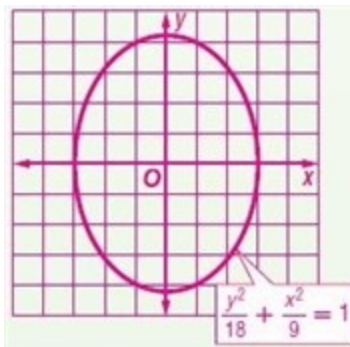


Find the coordinates of the center and foci and the lengths of the major and minor axes for the ellipse with the given equation. Then graph the ellipse.

53. $\frac{y^2}{18} + \frac{x^2}{9} = 1$

ANSWER:

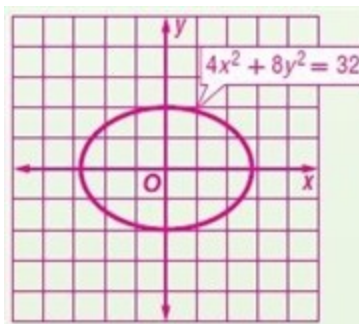
$(0, 0)$; $(0, \pm 3)$; $6\sqrt{2}$; 6



54. $4x^2 + 8y^2 = 32$

ANSWER:

$(0, 0)$; $(\pm 2, 0)$; $4\sqrt{2}$; 4

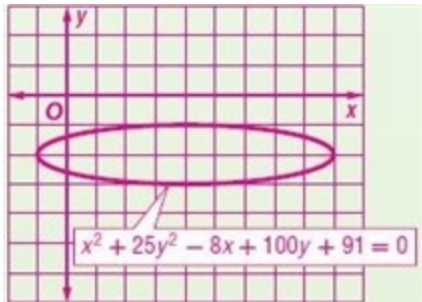


9-6 Identifying Conic Sections

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

ANSWER:

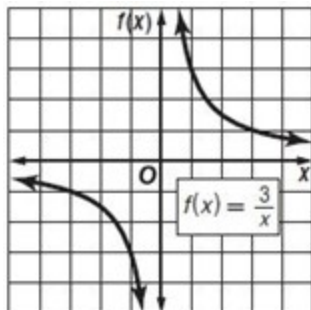
$(4, -2); (4 \pm 2\sqrt{6}, -2); 10; 2$



Graph each function.

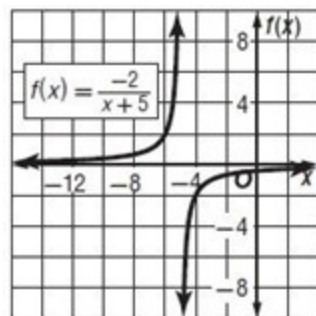
56. $f(x) = \frac{3}{x}$

ANSWER:



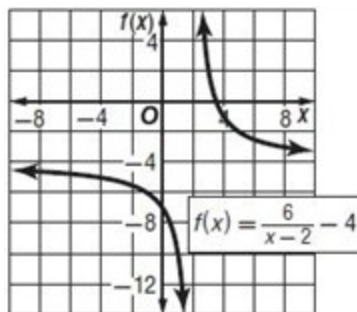
57. $f(x) = \frac{-2}{x+5}$

ANSWER:



58. $f(x) = \frac{6}{x-2} - 4$

ANSWER:



59. **SPACE** A radioisotope is used as a power source for a satellite. The power output P (in watts) is given

by $P = 50e^{-\frac{t}{250}}$, where t is the time in days.

a. Is the formula for power output an example of exponential growth or decay? Explain your reasoning.

b. Find the power available after 100 days.

c. Ten watts of power are required to operate the equipment in the satellite. How long can the satellite continue to operate?

ANSWER:

a. Decay; the exponent is negative.

b. about 33.5 watts

c. about 402 days

Solve each system of equations.

60. $6g - 8h = 50$

$6h = 22 - 4g$

ANSWER:

$(7, -1)$

61. $3u + 5v = 6$

$2u - 4v = -7$

ANSWER:

$\left(-\frac{1}{2}, \frac{3}{2}\right)$

62. $10m - 9n = 15$

$5m - 4n = 10$

ANSWER:

$(6, 5)$