PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

9. Look for Relationships When would an equation of an ellipse, with center at the origin, be in the shape of a circle? Explain how you know.

10. Use Appropriate Tools The equation of an ellipse is $\frac{x^2}{36} + \frac{y^2}{4} = 1$. Write two equations you can type in *Y*1 and *Y*2 on your graphing calculator to graph the ellipse.

11. Error Analysis Kendall wants to find the key features of an ellipse. Describe and correct the error Kendall made in finding the vertices, co-vertices, and foci of the ellipse.

original equation: $\frac{(x-4)^2}{9} + \frac{(y-6)^2}{25} = 1$

vertices: (0, –5) and (0, 5)

co-vertices: (–3, 0) and (3, 0)

foci: (0, –4) and (0, 4) ✗

12. Reason The equation of an ellipse is $\frac{x^2}{25} + \frac{y^2}{49} = 1$.

Is the major axis of this ellipse vertical or horizontal?

What are the *x*-intercepts of the ellipse?

What are the *y*-intercepts of the ellipse?

13. Higher Order Thinking The area of a circle is given by the formula $A = \pi r^2$, where r is the radius. The area of an ellipse is given by the formula $A = \pi ab$, where a is half the length of the horizontal axis and b is half the length of the vertical axis. Explain the connection between the two formulas.

14. Construct Arguments Nora claims that an ellipse has vertices at (–3, 0) and (3, 0) and co-vertices at (–7, 0) and (7, 0). Is this possible? Explain.

PRACTICE

15. What is the equation in the form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ of the ellipse which has foci at (–3, 0) and (3, 0) and for which the sum of the distances from the foci to any point on the ellipse is 12?
SEE EXAMPLE 1

Graph the ellipse represented by each equation.
SEE EXAMPLE 2

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

17. $\frac{(x-1)^2}{9} + \frac{(y+2)^2}{36} = 1$

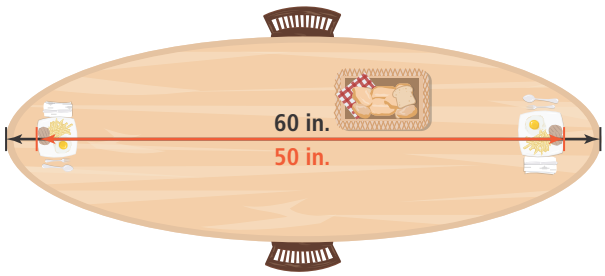
18. $\frac{x^2}{25} + \frac{y^2}{16} = 1$

19. $\frac{(x+3)^2}{49} + \frac{(y-1)^2}{16} = 1$

20. What is the equation of an ellipse centered at the origin that has a horizontal axis 12 units long and a vertical axis 22 units long?
SEE EXAMPLE 3

21. What is the equation of an ellipse with foci at (–8, 0) and (8, 0) that passes through the points (0, –3) and (0, 3)? SEE EXAMPLE 3

22. An elliptical dining table is 60 in. on its longer axis, with foci 50 in. apart. Two chairs are located at the co-vertices. Find the equation of the ellipse representing the shape of the table. To the nearest inch, how far apart are the chairs? SEE EXAMPLE 4



23. Graph each ellipse. Label the coordinates of the center, vertices, co-vertices, and foci.
SEE EXAMPLE 5

$2x^2 + 4x + 3y^2 - 6y - 7 = 0$

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

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APPLY

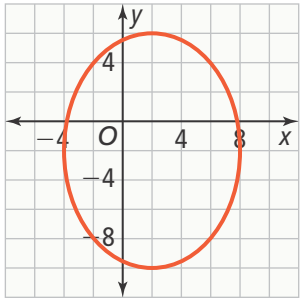
24. Model With Mathematics The wind tunnel at Langley Research Center in Hampton, Virginia is 30 ft tall and 60 ft wide. The entrance to the tunnel is in the shape of an ellipse that can be modeled by the equation $\frac{x^2}{a^2} + \frac{y}{b^2} = 1$.

a. Find the value of a. Explain.

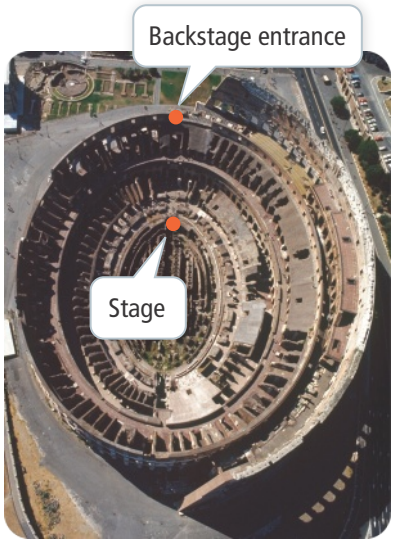
b. Find the value of b. Explain.

c. Write an equation of the ellipse that represents the entrance to the tunnel, assuming the center of the ellipse is at the origin.

25. Reason A scale drawing of an elliptical hot tub is shown. Write an equation to represent the scale drawing of the hot tub.



26. Make Sense and Persevere The Colosseum which is 188 m long and 156 m wide is an elliptical amphitheater located at the center of Rome, Italy. A backstage entrance is located at one vertex. A stage is erected at a location that corresponds to the focus that is closest to the backstage entrance. How far from the entrance is the stage?



ASSESSMENT PRACTICE

27. Which equation of an ellipse has a vertical major axis? Select all that apply.

Ⓐ $\frac{x^2}{12} + \frac{y^2}{55} = 1$

Ⓑ $\frac{x^2}{53} + \frac{y^2}{25} = 1$

Ⓒ $\frac{(x-9)^2}{82} + \frac{(y-10)^2}{120} = 1$

Ⓓ $\frac{(x+7)^2}{92} + \frac{(y+16)^2}{88} = 1$

Ⓔ $\frac{(x-6)^2}{35} + \frac{(y+11)^2}{53} = 1$

28. SAT/ACT What is the length of the minor axis of an ellipse with equation $\frac{(x-5)^2}{64} + \frac{(y+8)^2}{16} = 1$?

Ⓐ 4 Ⓑ 8 Ⓒ 16 Ⓓ 32 Ⓔ 64

29. Performance Task The Oval Office in the White House in Washington, DC, is actually elliptical. Its major axis is 35 ft 10 in. long, and its minor axis is 29 ft long.

Part A Suppose that the president's desk chair is placed at one focus of the ellipse. How far is the chair from the wall behind it?

Part B If the president were to throw a tennis ball and bounce it off a wall in the Oval Office to the vice president, seated in a chair at the other focus of the ellipse, how far would the ball travel? (Assume that the path of the ball is level.)