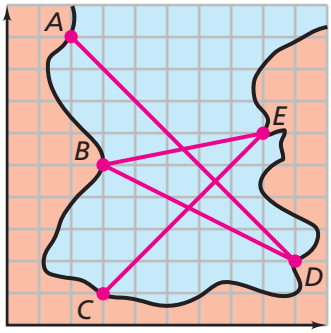
Applications

1. The diagram shows ferry routes between points surrounding a harbor. The distance between grid lines is 500 feet.



a. Call the bottom left corner on the grid the origin. Match each route with the equation that describes it.

Route	Equation
A to D	$y = 0.2x + 2{,}200$
B to D	$y = x - 1{,}000$
B to E	$y = -x + 5{,}500$
C to E	$y = -0.5x + 3{,}250$

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b. Find the coordinates of the intersection points of the four routes.

Solve each system.

2. $\begin{cases} y = 6x + 4 \\ y = 4x - 2 \end{cases}$ **3.** $\begin{cases} y = 3x + 7 \\ y = 5x - 7 \end{cases}$ **4.** $\begin{cases} y = -2x - 9 \\ y = 12x + 19 \end{cases}$

5. $\begin{cases} y = -x + 16 \\ y = -7x - 8 \end{cases}$ **6.** $\begin{cases} y = 17x - 6 \\ y = 12x + 44 \end{cases}$ **7.** $\begin{cases} y = -20x + 14 \\ y = -8x - 44 \end{cases}$

For Exercises 8–13, write the equation in $y = mx + b$ form.

8. $4x + 6y + 12 = 0$ **9.** $-7x + 9y + 4 = 0$

10. $-4x - 2y - 6 = 0$ **11.** $-x + 4y = 0$

12. $2x - 2y + 2 = 0$ **13.** $25x + 5y - 15 = 0$

14. Write the equations in Exercises 8–13 in $x = ny + c$ form.

Solve the system by using substitution.

15. $\begin{cases} 3x + 4y = 9 \\ y = x - 3 \end{cases}$ **16.** $\begin{cases} 8x - 14y = 5 \\ x = 3y \end{cases}$ **17.** $\begin{cases} 12x + 4 = 8y \\ y = x - 7 \end{cases}$

18. $\begin{cases} y = 2x - 1 \\ 4x + 6y = 10 \end{cases}$ **19.** $\begin{cases} x = 7y - 10 \\ 3x - 2y = 8 \end{cases}$ **20.** $\begin{cases} 7x - 2y = 5 \\ x = y \end{cases}$

Solve the system by using the combination method.

21. $\begin{cases} 3x - 2y = 12 \\ -3x + 8y = -6 \end{cases}$ **22.** $\begin{cases} 4x + 9y = 7 \\ 4x - 9y = 9 \end{cases}$ **23.** $\begin{cases} 12x - 14y = -8 \\ -8x - 14y = 52 \end{cases}$

24. $\begin{cases} 5x + 15y = 10 \\ 5x - 10y = -40 \end{cases}$ **25.** $\begin{cases} -6x - 4y = 21 \\ -6x + 3y = 0 \end{cases}$ **26.** $\begin{cases} 2x - 3y = 14 \\ -x + 3y = -6 \end{cases}$

Connections

For Exercises 27–32, solve the equation. Check the solution.

27. $3x + 12 = 24$ **28.** $-7x - 13 = 15$ **29.** $8 - 2x = 30$

30. $-7 + 9x = 38$ **31.** $-4 - 6x = -22$ **32.** $8x + 17 = -15$

33. In parts (a)–(f), find the value of y when $x = -2$.

a. $y = 3x - 7$ **b.** $3x - 2y = 10$ **c.** $7x - 4y = 12$

d. $x = 4y - 2$ **e.** $3 = 2x - y$ **f.** $12 = -3x - 4y$

Write an equation for the line satisfying the given conditions.

34. slope $= -4$, y-intercept $= 3$

35. slope $= \frac{2}{3}$, passing through the point $(3, 4)$

36. slope $= -\frac{3}{4}$, y-intercept $= 2$

37. passes through the points $(5, 4)$ and $(1, 7)$

For Exercises 38–43, identify the slope and y-intercept of the line.

38. $3x + 2y = 4$ **39.** $4x - 8y = 12$ **40.** $x - y = 7$

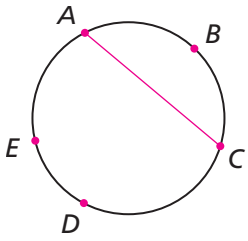
41. $y = 4x - 8$ **42.** $2y = 4x + 6$ **43.** $y = 9$

44. Two lines can intersect at 0 points (if they are parallel), 1 point, or an infinite number of points (if they are the same). In parts (a)–(d), give all the possible numbers of intersection points for the two figures. Make sketches to illustrate the possibilities.

a. a circle and a straight line **b.** two circles

c. a circle and a triangle **d.** a circle and a rectangle

45. A **chord** is a line segment joining two points on a circle. Segment AC in the diagram at the right is a chord.



a. How many chords can be drawn by joining the labeled points on this circle?

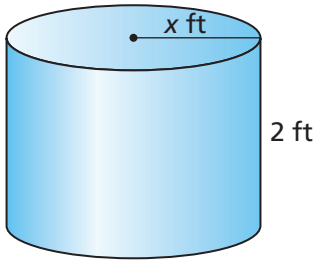
b. How many points inside the circle are intersection points of two or more of the chords from part (a)?

c. The chords cut the circle into several non-overlapping regions. How many regions are formed?

46. Multiple Choice Which point is *not* on the graph of $2x - 5y = 13$?

A. $(9, 1)$ **B.** $(4, -1)$ **C.** $(0, 3.2)$ **D.** $(6.5, 0)$

47. The cylinder at the right represents an air conditioner unit with a radius of x feet and a height of 2 feet.



a. Draw a net for a cover for the air conditioner. (The top and sides need to be covered, but not the bottom.)

b. Which equation below represents the area of the cover? Which represents the volume? Justify your choices.

$y = 2\pi x^2$ $y = \pi x^2 + 4\pi x$

$y = 2x^3$ $y = \pi x(x + 4)$

48. Multiple Choice Kaya wants to fence off part of her yard for a garden. She has 150 feet of fencing. She wants a rectangular garden with a length 1.5 times its width. Which system represents these conditions?

F. $\begin{cases} 1.5w = \ell \\ w + \ell = 150 \end{cases}$ **G.** $\begin{cases} w = 1.5\ell \\ w + \ell = 150 \end{cases}$

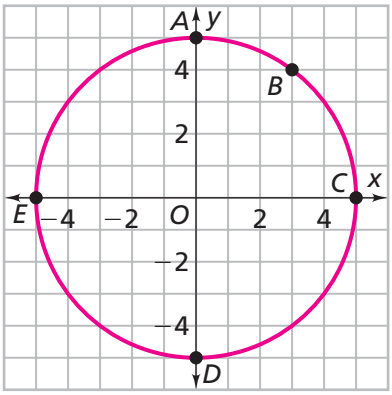
H. $\begin{cases} 2w = 3\ell \\ w + \ell = 75 \end{cases}$ **J.** $\begin{cases} 3w = 2\ell \\ 2(w + \ell) = 150 \end{cases}$

49. Multiple Choice Which equation shows how to find one dimension of the garden described in Exercise 48?

A. $2.5w = 150$ **B.** $2.5\ell = 150$

C. $2w = 3(75 - w)$ **D.** $5w = 150$

50. This circle has a radius of 5 meters.



a. Copy and complete this table for the points on the circle.

	A	B	C	D	E
x	0	■	■	■	■
y	5	■	■	■	■

b. On grid paper, sketch the image of the circle after the rule $(x, y) \rightarrow (2x, 2y)$ is applied. Copy and complete this table for the images of points A, B, C, D, and E.

	A′	B′	C′	D′	E′
2x	0	■	■	■	■
2y	10	■	■	■	■

c. Sketch the image of the original circle after the rule $(x, y) \rightarrow (x + 2, y + 2)$ is applied. Copy and complete this table for the images of points *A, B, C, D,* and *E.*

	A'	B'	C'	D'	E'
$x + 2$	2	■	■	■	■
$y + 2$	7	■	■	■	■

d. Is the image in part (b) similar to or congruent to the original circle? What about the image in part (c)?

51. Without graphing, decide whether the graph of the equation is a line, a parabola, an exponential curve, an inverse variation curve, or a circle.

a. $2x - 3y = 10$

b. $x^2 + y^2 = 100$

c. $x^2 + x^2 = 100 - y$

d. $\frac{250}{x} = y$

e. $y = 2^x$

f. $y = x^2 - x^2 + x + 100$

g. $xy = 100$

h. $3x + 10 = y$

Tell whether the table represents a linear, quadratic, exponential, or inverse-variation relationship, and write an equation for the relationship.

52.

x	0	1	2	3	4	5	6	7
y	0	−3	−4	−3	0	5	12	21

53.

x	−1	0	1	2	3	4	5	6
y	$\frac{1}{3}$	1	3	9	27	81	243	729

54.

x	1	3	4	6	9	10	12	18
y	2	8	11	17	26	29	35	53

55.

x	1	2	3	4	6	8	10	12
y	12	6	4	3	2	1.5	1.2	1

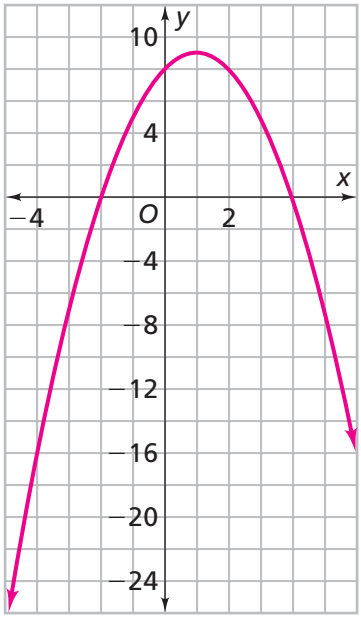
Connections

56. Tell which graph matches the equation.

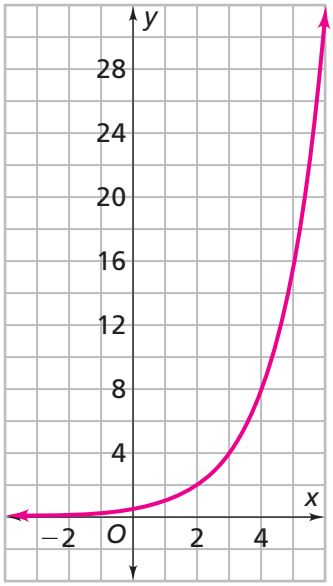
a. $y = 2^{x-1}$ **b.** $y = -x^2 + 2x + 8$ **c.** $y = (x + 2)(x - 4)$

d. $y = 2^x$ **e.** $y = 2x^2$ **f.** $25 = x^2 + y^2$

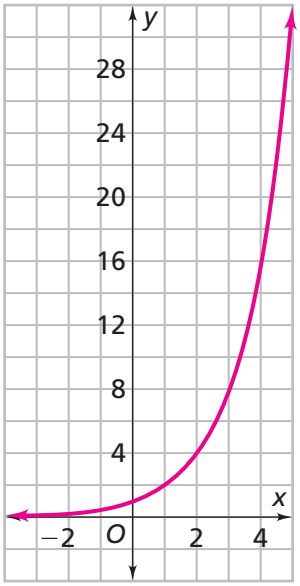
Graph 1



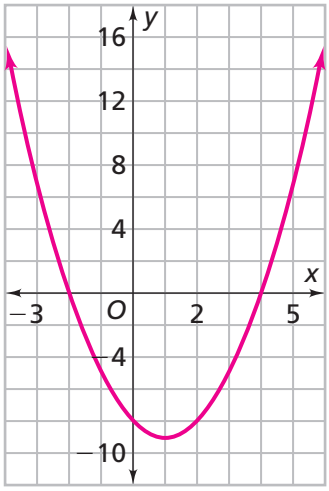
Graph 2



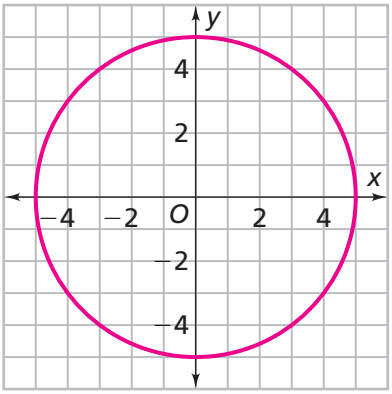
Graph 3



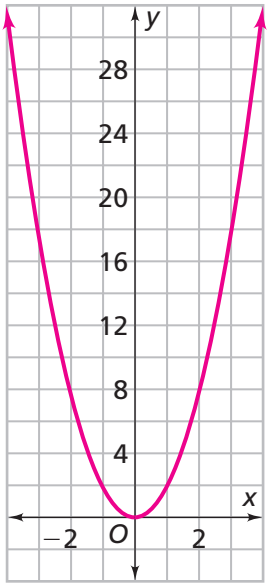
Graph 4



Graph 5



Graph 6



Solve each equation for x.

57. $5(x + 4) - 2x = 5 + 6x + 2x$

58. $2(x + 2) - 6x = 6x + 8 - 2x$

59. $x^2 - 7x + 12 = 0$

60. $x^2 + 5x - 6 = 0$

Extensions

61. Yolanda and Marissa both babysit. Yolanda charges $5.50 an hour. Marissa charges a base rate of $20, plus $0.50 an hour.

a. For each girl, write an equation showing how the charge depends on babysitting time.

b. For what times are Marissa's charges less than Yolanda's?

c. Is there a time for which Yolanda and Marissa charge the same amount?

62. Raj's age is 1 year less than twice Sarah's age. Toni's age is 2 years less than three times Sarah's age.

a. Suppose Sarah's age is s years. What is Raj's age in terms of s?

b. How old is Toni in terms of s?

c. How old are Raj, Sarah, and Toni if the sum of their ages is 21?

63. Melissa and Trevor sell candy bars to raise money for a class field trip. Trevor sells 1 more than five times as many as Melissa sells. Together they sell 49 candy bars.

a. Let m be the number of candy bars Melissa sells. Let t be the number of candy bars Trevor sells. Write a linear system to represent this situation.

b. Solve your system to find the number of candy bars each student sells.

64. Solve each system by using substitution or the combination method. You may get some strange results. In each case, graph the equations and explain what the puzzling results indicate about the solution.

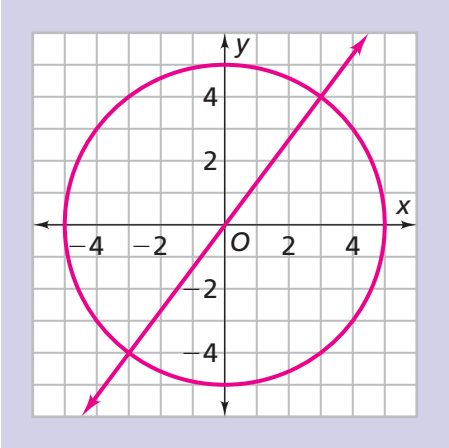
a. $\begin{cases} x - 2y = 3 \\ -3x + 6y = -6 \end{cases}$

b. $\begin{cases} x - y = 4 \\ -x + y = -4 \end{cases}$

c. $\begin{cases} 2x - 3y = 4 \\ 4x - 6y = 7 \end{cases}$

d. $\begin{cases} 4x - 6y = 4 \\ -6x + 9y = -6 \end{cases}$

65. The equation of the line is $y = \frac{4}{3}x$. The equation of the circle is $x^2 + y^2 = 25$.



You can find the intersection points by solving the system below. Modify the substitution method to solve the system.

$\begin{cases} y = \frac{4}{3}x \\ x^2 + y^2 = 25 \end{cases}$

66. Write a system of the form $\begin{cases} ax + by = c \\ dx + ey = f \end{cases}$ that has the given solution.

a. (3, 7)

b. (−2, 3)

c. no solutions

67. Consider these equivalent systems.

$\begin{cases} 2y - 3x = 0 \\ y + x = 75 \end{cases}$ and $\begin{cases} 2y - 3x = 0 \\ 3y + 3x = 225 \end{cases}$

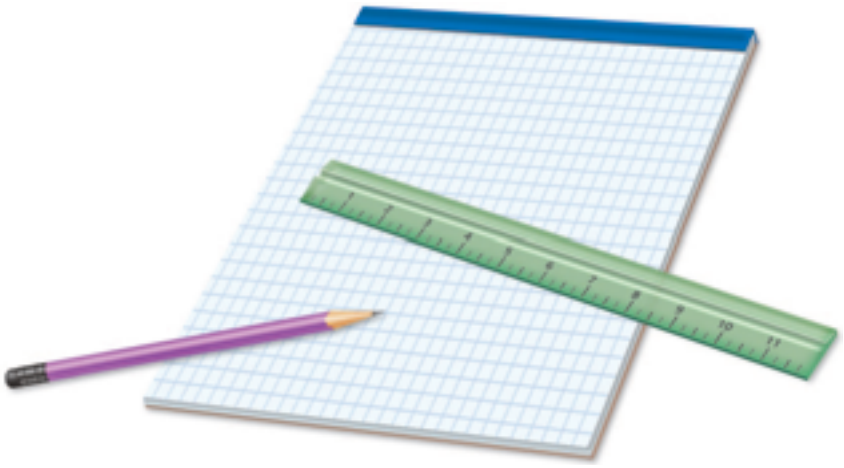
a. Do the four equations in these two systems represent four different lines? Explain.

b. Adding the two equations in the second system gives $5y = 225$, or $y = 45$. Does $y = 45$ represent the same line as either equation in the system? Does it have anything in common with the lines in the system?

c. If you add the two equations in the first system, you get $3y - 2x = 75$. Does this equation represent the same line as either equation in the system? Does it have anything in common with the lines in the system?

d. What conjectures can you make about the results of adding any two linear equations? Consider the following questions:

- Will the result be a linear equation?
- Will the graph of the new equation have anything in common with the graphs of the original equation?



Extensions