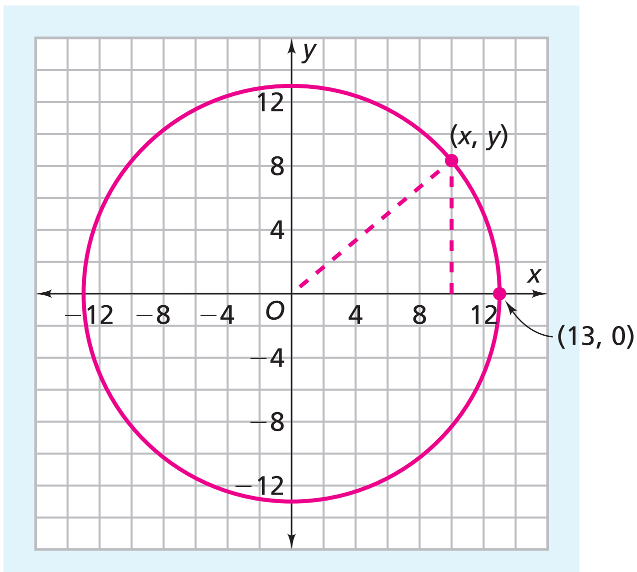
Applications Connections Extensions ACE

Applications

1. a. Write an equation that relates the coordinates x and y for points on the circle.



b. Find the missing coordinates for each of these points on the circle. If there is more than one possible point, give the missing coordinate for each possibility. Show that each ordered pair satisfies the equation.

(0, ■) (5, ■) (−4, ■) (−8, ■)

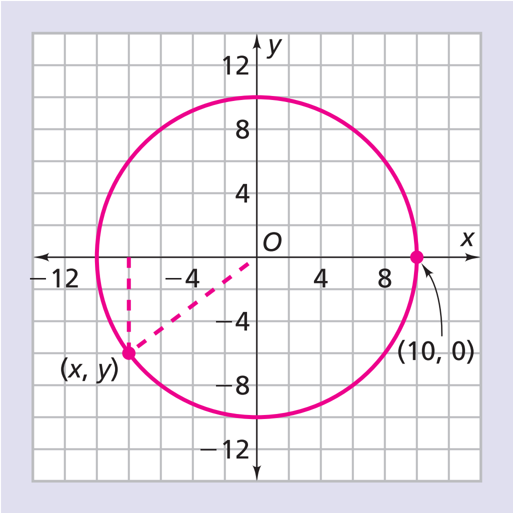
(■, 10) (■, −6) (■, 0) (■, −2)

c. Write an inequality that relates the coordinates x and y for points inside the circle.

d. Choose any point in the interior of the circle and confirm that this point is a solution for the inequality you wrote in part (c).

e. Choose any point outside the circle and check that it is not a solution for the inequality you wrote in part (c).

2. a. Write an equation that relates the coordinates x and y for points on the circle.



b. Find the missing coordinates for each of these points on the circle. If there is more than one possible point, give the missing coordinate for each possibility. Show that each ordered pair satisfies the equation.

(8, ■) (3, ■) (−4, ■) (0, ■)

(■, −4) (■, −6) (■, 0) (■, 2)

c. Write an inequality that describes the points in the interior of the circle.

d. Write an inequality that describes the points outside the circle.

e. Choose one point in the interior of the circle and one point outside the circle and confirm these are solutions for the appropriate inequalities.

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Applications

3. On a copy of this diagram, draw quadrilaterals meeting the conditions in parts (a)–(d). Your figures should fit entirely on the grid and should not overlap.

   a. Rectangle $ABCD$ lies entirely in the second quadrant.

   b. Rectangle $EFGH$ lies entirely in the first quadrant.

   c. Rectangle $PQRS$ is not a square. It lies entirely in the third quadrant except for vertex Q.

   d. Square $TUVW$ lies entirely in the fourth quadrant.

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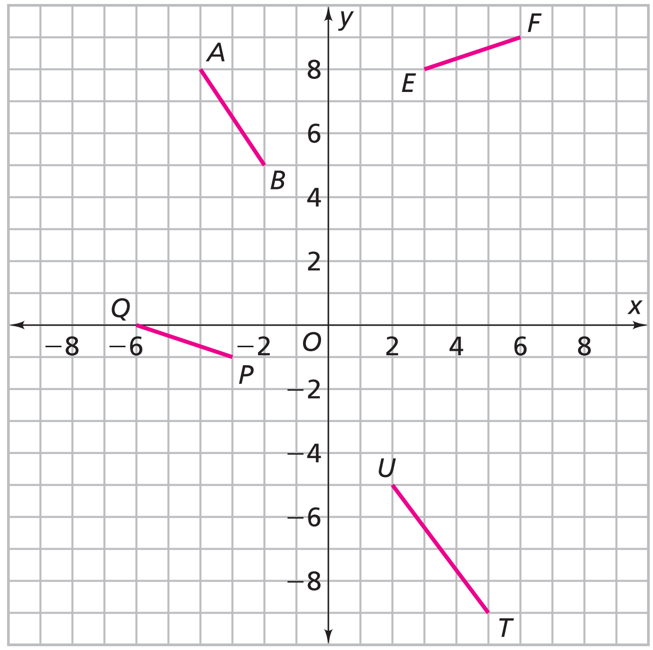


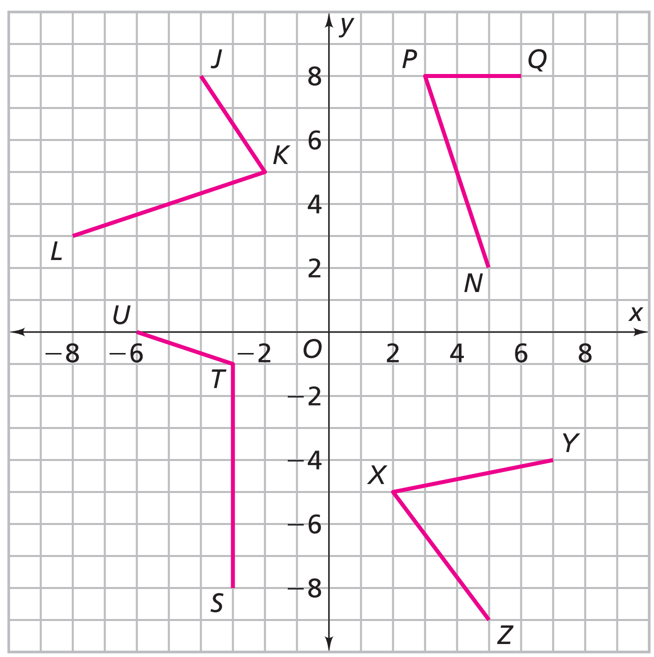
4. The quadrilaterals named in parts (a)–(d) are parallelograms formed on the diagram at the right. Give the coordinates for the fourth vertex. Then, calculate the slopes of the sides to show that the opposite sides are parallel.

   a. $JKLM$

   b. $NPQR$

   c. $STUV$

   d. $WYXZ$



Applications

Find the equation of a line parallel to the given line.

5. $y = 2x + 3$

6. $y = -4x + 7$

7. $y = -3x + 5$

8. $y = \frac{1}{2}x - 12$

9. $y = -\frac{2}{3}x - 4$

10. $y = 6x - 9$

For Exercises 11–16, find the equation of a line perpendicular to the given line.

11. $y = 3x + 2$

12. $y = -\frac{3}{4}x - 2$

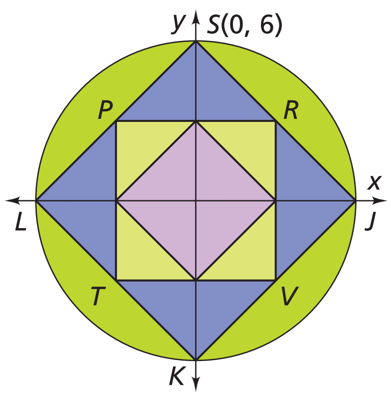
13. $y = -2x + 7$

14. $y = 5x - 1$

15. $y = \frac{1}{2}x + 3$

16. $y = -4x - 5$

17. a. The circle in this design is centered at the origin. Find coordinates for points *J, K,* and *L.*



b. Points *P, R, V,* and *T* are the midpoints of the segments on which they lie. Find coordinates for each of these points.

c. Find coordinates of the vertices of the innermost quadrilateral. Is this quadrilateral a square? Explain.

Find the midpoint of the segment with the given endpoints.

18. $(0, 0)$ and $(4, 6)$

19. $(3, 2)$ and $(7, -4)$

20. $(1, 2)$ and $(8, 5)$

21. $(1, 2)$ and $(-5, 6)$

22. $(0, 0)$ and $(-4, -7)$

23. $(-1, -5)$ and $(-6, 2)$

Connections

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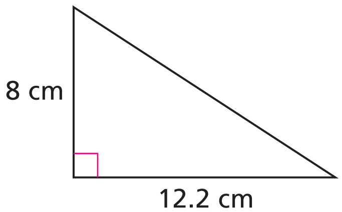
Use the Pythagorean Theorem to find the unknown side length.

24.



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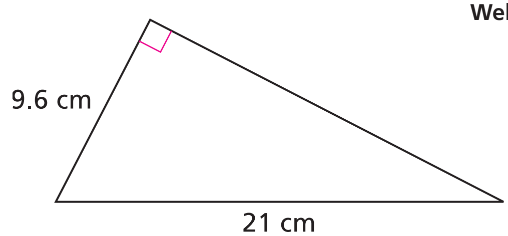
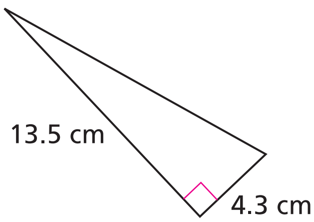
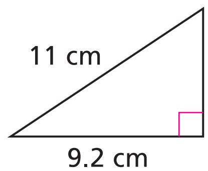


26.



27.



Write an equation for the line with the given slope and *y*-intercept.

28. slope $\frac{1}{2}$, y-intercept (0, 3)

29. slope $-\frac{1}{3}$, y-intercept (0, 5)

30. slope 6, y-intercept $(0, \frac{1}{2})$

Write an equation for the line with the given slope and that passes through the given point.

31. slope 2, point (3, 1)

32. slope -4, point $(-1, 7)$

33. slope $-\frac{5}{6}$, point (0, 5)

34. For each type of quadrilateral in the first column, identify all the properties from the second column that apply to that type of quadrilateral.

Quadrilateral Types	Properties
a. square	**i.** Two pairs of parallel sides
b. rectangle	**ii.** Four right angles
c. rhombus	**iii.** Two pairs of congruent sides
d. parallelogram	**iv.** Interior angle measures with a sum of 360°
	v. Opposite angle measures with a sum of 180°
	vi. Perpendicular diagonals

Connections

For Exercises 35–46, find the value of each expression.

35. $12 + (-18)$ **36.** $-9 + (-19)$ **37.** $-32 - 73$

38. $-23 - (-12)$ **39.** $90 - (-24)$ **40.** $34 - 76$

41. $-22 \times (-3)$ **42.** $5 \times (-13)$ **43.** -12×20

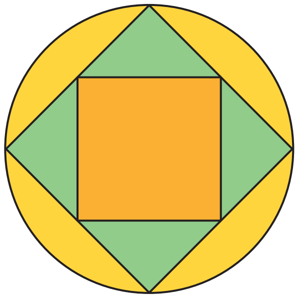
44. $-24 \div 6$ **45.** $-42 \div (-2)$ **46.** $84 \div (-4)$

47. Suppose you've drawn a design on a coordinate grid. Tell whether each coordinate rule will produce a similar design.

a. $(x, y) \rightarrow (x + 2, y + 3)$ **b.** $(x, y) \rightarrow (2x, 3y)$

c. $(x, y) \rightarrow (2.5x, 2.5y)$ **d.** $(x, y) \rightarrow (-2x, -2y)$

48. The radius of this crop design is 6 meters.



a. What is the area of the smaller square?

b. What is the area of the region between the smaller and larger squares?

c. What is the area of the region between the larger square and the circle?

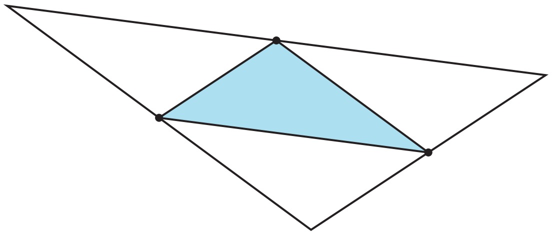
d. Describe all the symmetries in the design.

49. **a.** Consider the points $A(-2, 2)$, $B(-1, -1)$, $C(-1, 2)$, $D(0, -3)$, $E(0, 2)$, $F(1, 0)$, $G(2, 0)$, $H(4, -1)$, $J(5, -1)$, $K(6, -1.5)$. Without plotting points or drawing lines, find the slope of these lines.

line AB line CD line EF line GH line JK

b. Order the slopes in part (a) from least to greatest.

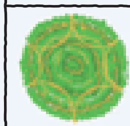
50. **a.** Suppose you connect the midpoints of the sides of a triangle as shown below to form a smaller triangle. How does the perimeter of the blue triangle compare to that of the original triangle?



b. How does the area of the blue triangle compare to that of the original triangle?

51. Two students became intrigued by crop designs. They did a project comparing the occurrences of different shapes in three countries, A, B and C.

CROP CIRCLE OCCURRENCES

Boundary Type	Country A	Country B	Country C
 Circle	12	12	6
 Square	8	3	9

a. Make a circle graph to compare the total number of circular crop designs in three countries with the total number of square crop designs.

b. Make a bar graph to compare the crop designs from countries A, B, and C.

c. Make three statements summarizing the students' findings on crop designs in the three countries.

Find the equation of the line through the points.

52. $(2, 3)$ and $(0, 1)$

53. $(-1, 3)$ and $(2, -9)$

54. $(-1, -1)$ and $(3, 7)$

55. Kara started to find the midpoints of some segments, but she didn't finish. Her work is shown in parts (a)–(c). Finish her calculations to find the midpoint. Then give the coordinates of the segment's endpoints.

a. $\left(\frac{-3 + 9}{2}, \frac{-1 + 1}{2}\right)$

b. $\left(\frac{-3 - 4}{2}, \frac{-7 + 1}{2}\right)$

c. $\left(\frac{-3 + (-9)}{2}, \frac{-1 + (-1)}{2}\right)$

For Exercises 56–58, tell whether the lines intersect. If they do, find their intersection point both algebraically *and* graphically. If they don't intersect, explain how you know.

56. $y = x - 11$ and $y = 3x + 23$

57. $y = 2x + 10$ and $y = x + 20$

58. $y = 3x + 9$ and $y = 3(x + 10)$

59. **Multiple Choice** Which expression is equivalent to $3x + 10$?

A. $3(x + 10)$

B. $3x + 7x$

C. $5(x + 2) - 2x$

D. $2x - 5x + 10$

Extensions

60. This circle has radius 5 and center (1, 2). Find or estimate the missing coordinates for these points on the circle. In each case, use the Pythagorean Theorem to check that the point is 5 units from the center.

a. (■, 6)

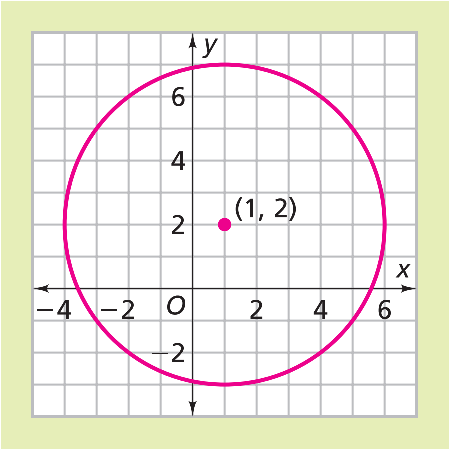
b. (5, ■)

c. (−3, ■)

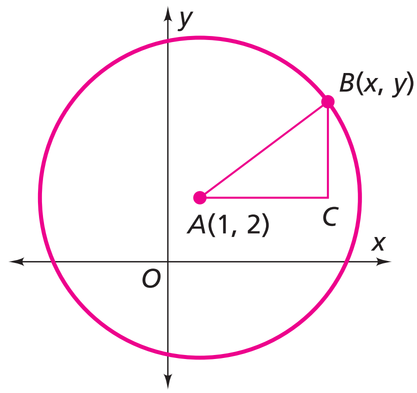
d. (1, ■)

e. (■, 2)

f. (4, ■)



61. **a.** This circle has radius 5 and center (1, 2). $\overline{AC}$ is parallel to the x-axis. $\overline{BC}$ is parallel to the y-axis. What are the lengths of $\overline{AC}$, $\overline{BC}$, $\overline{AB}$ in terms of x and y?

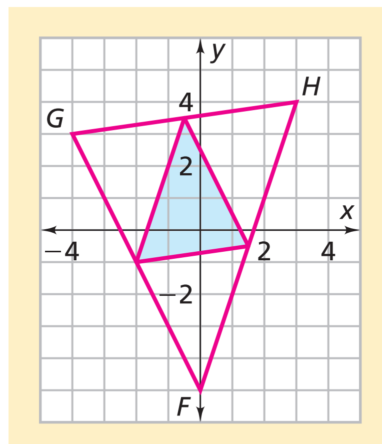


b. What equation shows how these side lengths are related?

c. Suppose you redraw the figure with $B(x, y)$ in a different position, but still on the circle. Would the coordinates of B still fit the equation you wrote in part (b)?

d. Based on this example, what do you think is the general equation for points on a circle with center (m, n) and radius r?

62. **a.** The vertices of the blue triangle are the midpoints of the sides of $\triangle FGH$. How are the sides of the blue triangle related to those of $\triangle FGH$? Use coordinates to check your ideas.



b. Draw several more triangles and connect their midpoints to form a smaller triangle. Record your observations.

63. Consider the points $O(0, 0)$, $X(4, 5)$, $L(2, 3)$, and $M(6, 8)$.

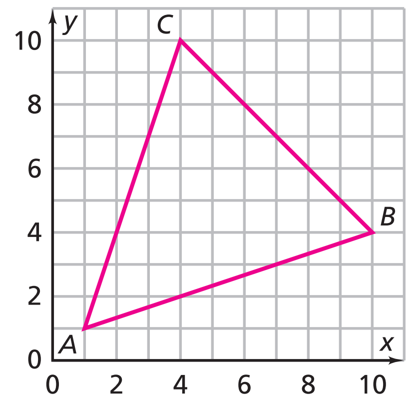
a. Points U and V divide $\overline{OX}$ into three equal-length segments. Find the coordinates of points U and V.

b. Points W and Z divide $\overline{LM}$ into three equal-length segments. Find the coordinates of points W and Z.

c. $\overline{OX}$ can be translated to correspond with $\overline{LM}$. Describe the rule for this translation.

d. Check your coordinates for points W and Z by applying your translation rule to points U and V.

64. Use the diagram below. Record your answers to parts (a)–(c) in a copy of the table at the bottom of the page.



a. Find the coordinates of points X and Y that divide $\overline{AC}$ into three equal-length segments.

b. Find the coordinates of points M and N that divide $\overline{BC}$ into three equal-length segments.

c. Find the coordinates of points P and Q that divide $\overline{AB}$ into three equal-length segments.

d. Describe the pattern relating the coordinates of the endpoints to the coordinates of the two points that divide the segment into thirds.

e. How can you find the coordinates of the two points R and S that divide the segment joining points $G(x_1, y_1)$ and $H(x_2, y_2)$ into three equal-length segments?

Segment	Endpoint	Dividing Point	Dividing Point	Endpoint
$\overline{AC}$	A(■, ■)	X(■, ■)	Y(■, ■)	C(■, ■)
$\overline{BC}$	B(■, ■)	M(■, ■)	N(■, ■)	C(■, ■)
$\overline{AB}$	A(■, ■)	P(■, ■)	Q(■, ■)	B(■, ■)

65. **Multiple Choice** In triangle ABC, point D is on $\overline{AB}$ and point E is on $\overline{AC}$, such that $2AD = DB$ and $2AE = EC$. $2AD$ means twice the length of AD and $2AE$ means twice the length of AE. Which of the following statements is *not* true?

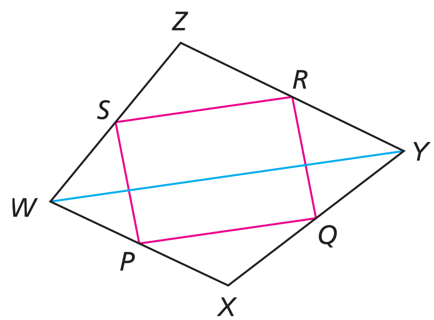
A. $\triangle ADE$ is similar to $\triangle ABC$

B. $BC = 3DE$

C. $\overline{DE}$ is parallel to $\overline{BC}$

D. area of $\triangle ABC$ = 3(area of $\triangle ADE$)

66. In this diagram, the vertices of $PQRS$ are the midpoints of the sides of quadrilateral $WXYZ$. $\overline{WY}$ is twice as long as $\overline{SR}$.



a. Explain why $\triangle WZY$ is similar to $\triangle SZR$.

b. How does the similarity of $\triangle WZY$ and $\triangle SZR$ imply that $\overline{SR}$ is parallel to $\overline{WY}$?

c. How could you show that $\overline{PQ}$ is parallel to $\overline{WY}$?

d. Why do the results of parts (b) and (c) imply that $\overline{SR}$ is parallel to $\overline{PQ}$?

e. How could you repeat the reasoning from parts (a)–(d) to show that $\overline{SP}$ is parallel to $\overline{RQ}$?

f. How does the reasoning from parts (a)–(e) show that $PQRS$ is a parallelogram?