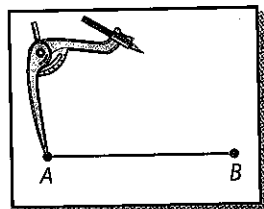
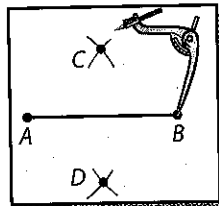


Construction Bisect a Segment

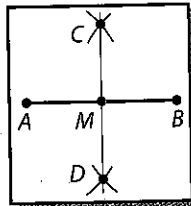
Step 1 Draw a segment and name it \overline{AB} . Place the compass at point A . Adjust the compass so that its width is greater than $\frac{1}{2}\overline{AB}$. Draw arcs above and below \overline{AB} .



Step 2 Using the same compass setting, place the compass at point B and draw arcs above and below \overline{AB} so that they intersect the two arcs previously drawn. Label the points of the intersection of the arcs as C and D .



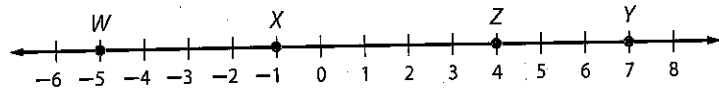
Step 3 Use a straightedge to draw \overline{CD} . Label the point where it intersects \overline{AB} as M . Point M is the midpoint of \overline{AB} , and \overline{CD} is a bisector of \overline{AB} .



Check Your Understanding

Step-by-Step Solutions begin on page R14.

Example 1 Use the number line to find each measure.



1. XY

2. WZ

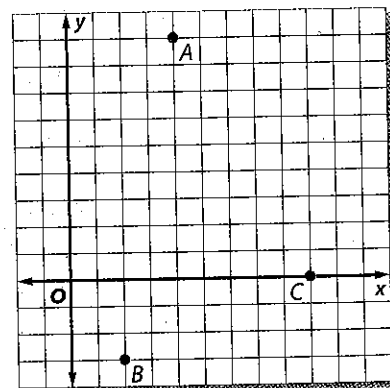
Example 2 **TIME CAPSULE** Graduating classes have buried time capsules on the campus of East Side High School for over twenty years. The points on the diagram show the position of three time capsules. Find the distance between each pair of time capsules.

3. $A(4, 9), B(2, -3)$

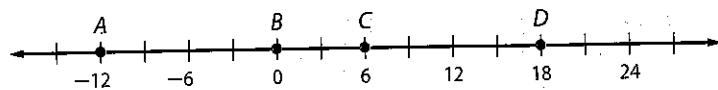
4. $A(4, 9), C(9, 0)$

5. $B(2, -3), C(9, 0)$

6. **CS REASONING** Which two time capsules are the closest to each other? Which are farthest apart?



Example 3 Use the number line to find the coordinate of the midpoint of each segment.



7. \overline{AC}

8. \overline{BD}

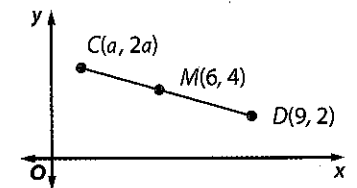
Example 4 Find the coordinates of the midpoint of a segment with the given endpoints.

9. $J(5, -3), K(3, -8)$

10. $M(7, 1), N(4, -1)$

Example 5 Find the coordinates of G if $F(1, 3.5)$ is the midpoint of \overline{GJ} and J has coordinates $(6, -2)$.

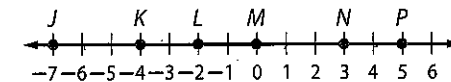
Example 6 12. **ALGEBRA** Point M is the midpoint of \overline{CD} . What is the value of a in the figure?



Practice and Problem Solving

Extra Practice is on page R1.

Example 1 Use the number line to find each measure.



13. JL

14. JK

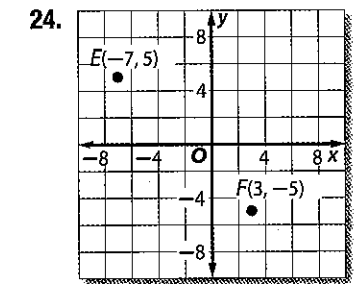
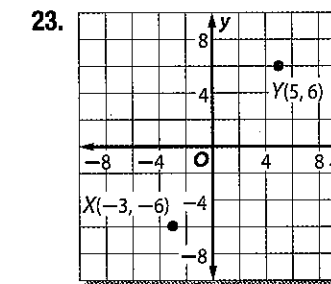
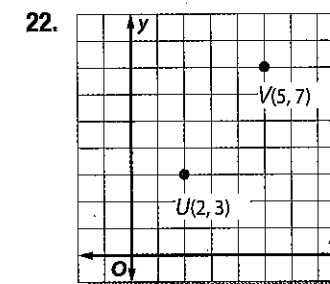
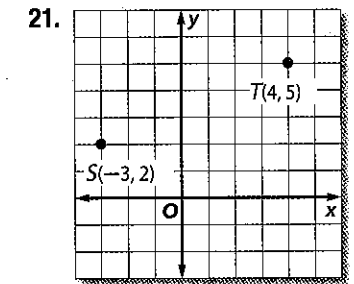
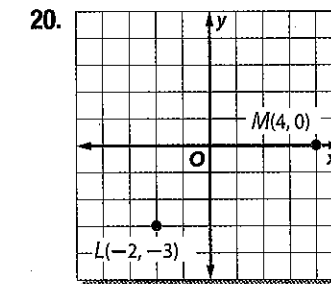
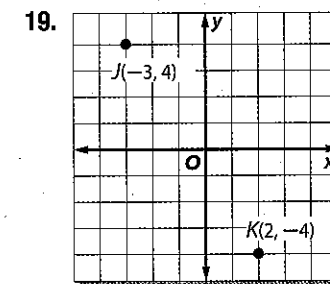
15. KP

16. NP

17. JP

18. LN

Example 2 Find the distance between each pair of points.



25. $X(1, 2), Y(5, 9)$

26. $P(3, 4), Q(7, 2)$

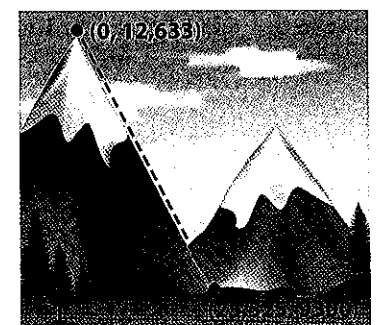
27. $M(-3, 8), N(-5, 1)$

28. $Y(-4, 9), Z(-5, 3)$

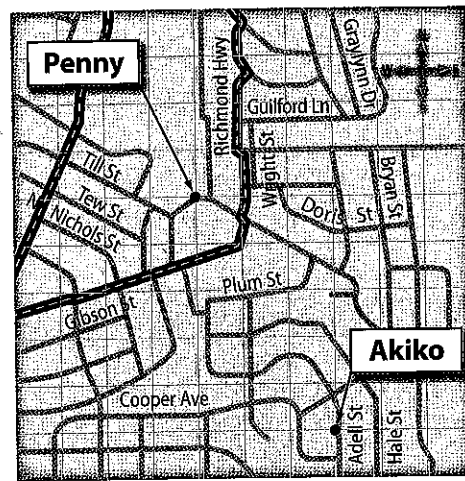
29. $A(2, 4), B(5, 7)$

30. $C(5, 1), D(3, 6)$

31. **CS REASONING** Vivian is planning to hike to the top of Humphreys Peak on her family vacation. The coordinates of the peak of the mountain and of the base of the trail are shown in feet. If the trail can be approximated by a straight line, estimate the length of the trail. (Hint: 1 mi = 5280 ft)

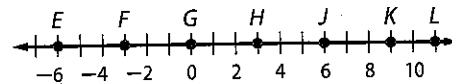


32. **CCSS MODELING** Penny and Akiko live in the locations shown on the map below.



- If each square on the grid represents one block and the bottom left corner of the grid is the location of the origin, what is the straight-line distance from Penny's house to Akiko's?
- If Penny moves three blocks to the north and Akiko moves 5 blocks to the west, how far apart will they be?

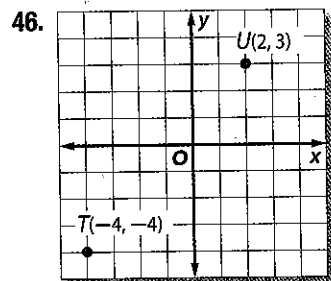
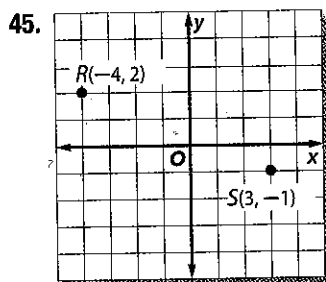
Example 3 Use the number line to find the coordinate of the midpoint of each segment.



- \overline{HK}
- \overline{FG}
- \overline{JL}
- \overline{FK}
- \overline{EF}
- \overline{EL}

Example 4 Find the coordinates of the midpoint of a segment with the given endpoints.

- $C(22, 4), B(15, 7)$
- $D(-15, 4), E(2, -10)$
- $X(-2.4, -14), Y(-6, -6.8)$
- $W(12, 2), X(7, 9)$
- $V(-2, 5), Z(3, -17)$
- $J(-11.2, -3.4), K(-5.6, -7.8)$



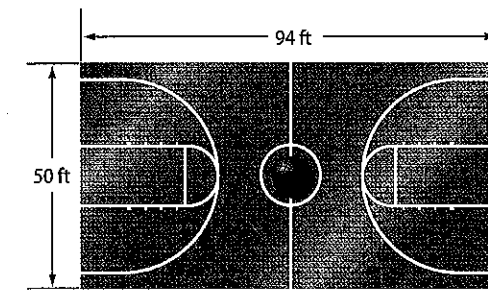
Example 5 Find the coordinates of the missing endpoint if B is the midpoint of \overline{AC} .

- $C(-5, 4), B(-2, 5)$
- $A(1, 7), B(-3, 1)$
- $A(-4, 2), B(6, -1)$
- $C(-6, -2), B(-3, -5)$
- $A(4, -0.25), B(-4, 6.5)$
- $C(\frac{5}{3}, -6), B(\frac{8}{3}, 4)$

Example 6 **ALGEBRA** Suppose M is the midpoint of \overline{FG} . Use the given information to find the missing measure or value.

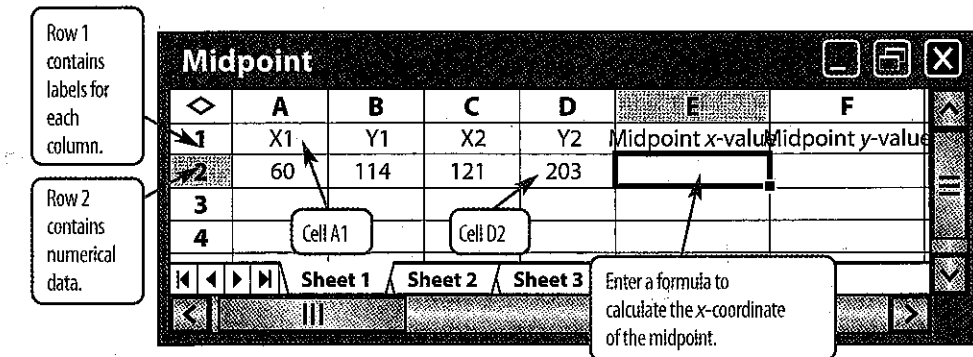
- $FM = 3x - 4, MG = 5x - 26, FG = ?$
- $FM = 5y + 13, MG = 5 - 3y, FG = ?$
- $MG = 7x - 15, FG = 33, x = ?$
- $FM = 8a + 1, FG = 42, a = ?$

- BASKETBALL** The dimensions of a basketball court are shown below. Suppose a player throws the ball from a corner to a teammate standing at the center of the court.



- If center court is located at the origin, find the ordered pair that represents the location of the player in the bottom right corner.
- Find the distance that the ball travels.

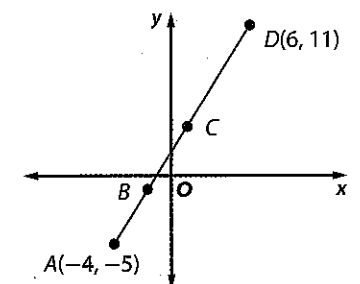
CCSS TOOLS Spreadsheets can be used to perform calculations quickly. The spreadsheet below can be used to calculate the distance between two points. Values are used in formulas by using a specific cell name. The value of x_1 is used in a formula using its cell name, A2.



Write a formula for the indicated cell that could be used to calculate the indicated value using the coordinates (x_1, y_1) and (x_2, y_2) as the endpoint of a segment.

- E2; the x-value of the midpoint of the segment
 - F2; the y-value of the midpoint of the segment
 - G2; the length of the segment
- Name the point(s) that satisfy the given condition.
- two points on the x-axis that are 10 units from $(1, 8)$
 - two points on the y-axis that are 25 units from $(-24, 3)$

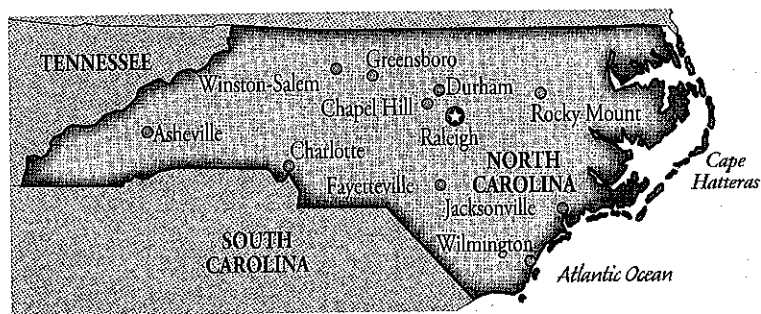
COORDINATE GEOMETRY Find the coordinates of B if B is the midpoint of \overline{AC} and C is the midpoint of \overline{AD} .



ALGEBRA Determine the value(s) of n.

- $J(n, n + 2), K(3n, n - 1), JK = 5$
- $P(3n, n - 7), Q(4n, n + 5), PQ = 13$

66. **CCSS PERSEVERANCE** Wilmington, North Carolina, is located at $(34.3^\circ, 77.9^\circ)$, which represents north latitude and west longitude. Winston-Salem is in the northern part of the state at $(36.1^\circ, 80.2^\circ)$.



- Find the latitude and longitude of the midpoint of the segment between Wilmington and Winston-Salem.
- Use an atlas or the Internet to find a city near the location of the midpoint.
- If Winston-Salem is the midpoint of the segment with one endpoint at Wilmington, find the latitude and longitude of the other endpoint.
- Use an atlas or the Internet to find a city near the location of the other endpoint.

- MULTIPLE REPRESENTATIONS** In this problem, you will explore the relationship between a midpoint of a segment and the midpoint between the endpoint and the midpoint.

- Geometric** Use a straightedge to draw three different line segments. Label the endpoints A and B .
- Geometric** On each line segment, find the midpoint of \overline{AB} and label it C . Then find the midpoint of \overline{AC} and label it D .
- Tabular** Measure and record AB , AC , and AD for each line segment. Organize your results into a table.
- Algebraic** If $AB = x$, write an expression for the measures AC and AD .
- Verbal** Make a conjecture about the relationship between AB and each segment if you were to continue to find the midpoints of a segment and a midpoint you previously found.

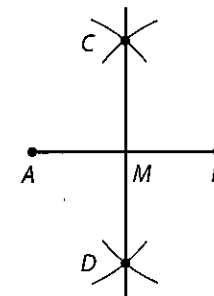
H.O.T. Problems Use Higher-Order Thinking Skills

- WRITING IN MATH** Explain how the Pythagorean Theorem and the Distance Formula are related.
- REASONING** Is the point one third of the way from (x_1, y_1) to (x_2, y_2) *sometimes, always, or never* the point $(\frac{x_1 + x_2}{3}, \frac{y_1 + y_2}{3})$? Explain.
- CHALLENGE** Point P is located on the segment between point $A(1, 4)$ and point $D(7, 13)$. The distance from A to P is twice the distance from P to D . What are the coordinates of point P ?
- OPEN ENDED** Draw a segment and name it \overline{AB} . Using only a compass and a straightedge, construct a segment \overline{CD} such that $CD = 5\frac{1}{4}AB$. Explain and then justify your construction.
- WRITING IN MATH** Describe a method of finding the midpoint of a segment that has one endpoint at $(0, 0)$. Give an example using your method, and explain why your method works.

Standardized Test Practice

73. Which of the following best describes the first step in bisecting \overline{AB} ?

- From point A , draw equal arcs on \overline{CD} using the same compass width.
- From point A , draw equal arcs above and below \overline{AB} using a compass width of $\frac{1}{3}\overline{AB}$.
- From point A , draw equal arcs above and below \overline{AB} using a compass width greater than $\frac{1}{2}\overline{AB}$.
- From point A , draw equal arcs above and below \overline{AB} using a compass width less than $\frac{1}{2}\overline{AB}$.



74. **ALGEBRA** Beth paid \$74.88 for 3 pairs of jeans. All 3 pairs of jeans were the same price. How much did each pair of jeans cost?

- F \$24.96 H \$74.88
G \$37.44 J \$224.64

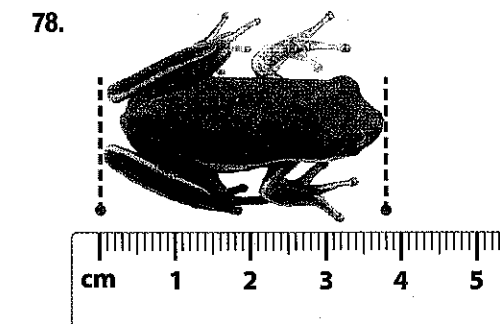
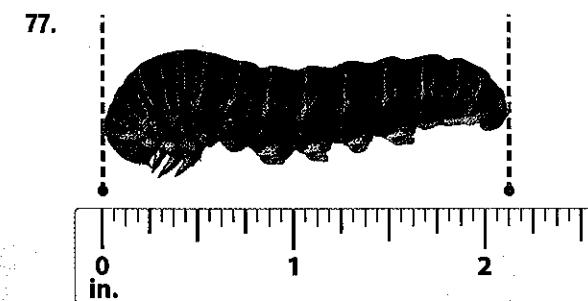
75. **SAT/ACT** If $5^{2x-3} = 1$, then $x =$

- A 0.4 D 1.6
B 0.6 E 2
C 1.5

76. **GRIDDED RESPONSE** One endpoint of \overline{AB} has coordinates $(-3, 5)$. If the coordinates of the midpoint of \overline{AB} are $(2, -6)$, what is the approximate length of \overline{AB} ?

Spiral Review

Find the length of each object. (Lesson 1-2)



Draw and label a figure for each relationship. (Lesson 1-1)

- \overline{FG} lies in plane M and contains point H .
- Lines r and s intersect at point W .
- TRUCKS** A sport-utility vehicle has a maximum load limit of 75 pounds for its roof. You want to place a 38-pound cargo carrier and 4 pieces of luggage on top of the roof. Write and solve an inequality to find the average allowable weight for each piece of luggage. (Lesson 0-6)

Skills Review

Solve each equation.

82. $8x - 15 = 5x$ 83. $5y - 3 + y = 90$ 84. $16a + 21 = 20a - 9$
85. $9k - 7 = 21 - 3k$ 86. $11z - 13 = 3z + 17$ 87. $15 + 6n = 4n + 23$