# 1.3 EXERCISES

## SKILL PRACTICE

**A**

1. **VOCABULARY** Copy and complete: To find the length of $\overline{AB}$, with endpoints $A(-7, 5)$ and $B(4, -6)$, you can use the __?__. **Distance Formula**

2. ★ **WRITING** *Explain* what it means to bisect a segment. Why is it impossible to bisect a line? **Divide a segment into two congruent segments; a line has infinite length.**
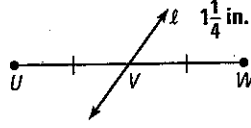
**EXAMPLE 1**
on p. 15
for Exs. 3–10

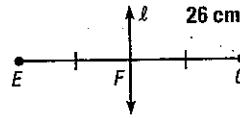**FINDING LENGTHS** Line $\ell$ bisects the segment. Find the indicated length.
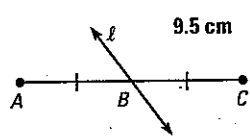
3. Find $RT$ if $RS = 5\frac{1}{8}$ in.
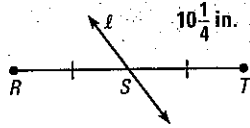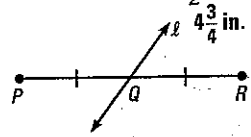
4. Find $UW$ if $VW = \frac{5}{8}$ in.
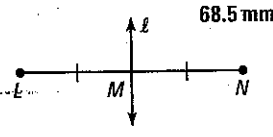
5. Find $EG$ if $EF = 13$ cm.



6. Find $BC$ if $AC = 19$ cm.

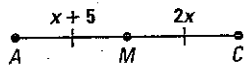7. Find $QR$ if $PR = 9\frac{1}{2}$ in.

8. Find $LM$ if $LN = 137$ mm.



9. **SEGMENT BISECTOR** Line $RS$ bisects $\overline{PQ}$ at point $R$. Find $RQ$ if $PQ = 4\frac{3}{4}$ inches. $2\frac{3}{8}$ in.
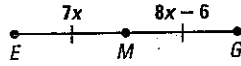
10. **SEGMENT BISECTOR** Point $T$ bisects $\overline{UV}$. Find $UV$ if $UT = 2\frac{7}{8}$ inches. $5\frac{3}{4}$ in.

**EXAMPLE 2**
on p. 16
for Exs. 11–16

**xy ALGEBRA** In each diagram, $M$ is the midpoint of the segment. Find the indicated length.

11. Find $AM$. **10**

12. Find $EM$. **42**

13. Find $JM$. **1**
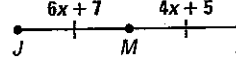


14. Find $PR$. **98**
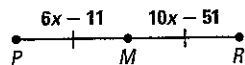
⑮ Find $SU$. **70**

16. Find $XZ$. **146**



**EXAMPLE 3**
on p. 17
for Exs. 17–30

**FINDING MIDPOINTS** Find the coordinates of the midpoint of the segment with the given endpoints.

17. $C(3, 5)$ and $D(7, 5)$ **(5, 5)**

18. $E(0, 4)$ and $F(4, 3)$ $\left(2, 3\frac{1}{2}\right)$

19. $G(-4, 4)$ and $H(6, 4)$ **(1, 4)**

20. $J(-7, -5)$ and $K(-3, 7)$ **(-5, 1)**

21. $P(-8, -7)$ and $Q(11, 5)$ $\left(1\frac{1}{2}, -1\right)$

22. $S(-3, 3)$ and $T(-8, 6)$ $\left(-5\frac{1}{2}, 4\frac{1}{2}\right)$

23. ★ **WRITING** Develop a formula for finding the midpoint of a segment with endpoints $A(0, 0)$ and $B(m, n)$. *Explain* your thinking.
$\left(\frac{m}{2}, \frac{n}{2}\right)$; when $x_2$ and $y_2$ are replaced by zero in the Midpoint Formula and $x_1$ and $y_1$ are replaced by $m$ and $n$ the result is $\left(\frac{m}{2}, \frac{n}{2}\right)$.

1.3 Use Midpoint and Distance Formulas    **19**

## Study Strategy

**Exercises 25–30** Point out that in each exercise, the letter *M* is used for the midpoint of the segment. Discuss how students can check their answers by using the midpoint formula with the coordinates of the point they find and the coordinates of the given endpoint to verify that they get the given coordinates of *M*.

## Avoiding Common Errors

**Exercises 31–33** To minimize substitution errors, suggest that students write the distance formula in full before they make any substitutions. Then have them write $(x_1, y_1)$ and $(x_2, y_2)$ below the specific pairs of numbers that they plan to use for the substitutions.

## 🖩 Graphing Calculator

**Exercise 41** Suggest that students do paper and pencil calculations to find that $LF = \sqrt{26}$ and $JR = \sqrt{5}$. They can then use the calculator to find the approximate value of $\sqrt{26} - \sqrt{5}$.

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**24.** 8 should be added to 2 and 3 should be added to −1; $\left(\dfrac{8+2}{2}, \dfrac{3+(-1)}{2}\right)$, (5, 1).

**24. ERROR ANALYSIS** *Describe* the error made in finding the coordinates of the midpoint of a segment with endpoints $S(8, 3)$ and $T(2, -1)$.

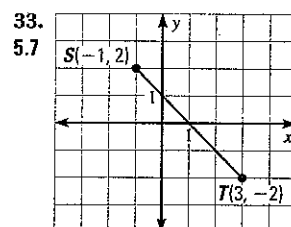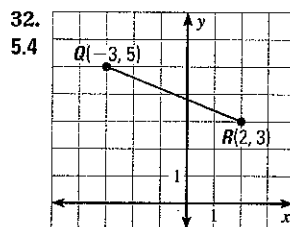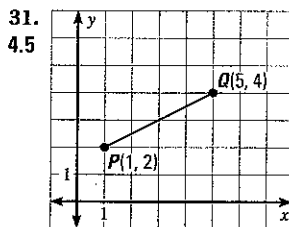$$\left(\dfrac{8-2}{2}, \dfrac{3-(-1)}{2}\right) = (3, 2) \quad \times$$

**FINDING ENDPOINTS** Use the given endpoint *R* and midpoint *M* of $\overline{RS}$ to find the coordinates of the other endpoint *S*.

**25.** $R(3, 0)$, $M(0, 5)$ **(−3, 10)**   **26.** $R(5, 1)$, $M(1, 4)$ **(−3, 7)**   **27.** $R(6, -2)$, $M(5, 3)$ **(4, 8)**

**28.** $R(-7, 11)$, $M(2, 1)$ **(11, −9)**   **29.** $R(4, -6)$, $M(-7, 8)$ **(−18, 22)**   **30.** $R(-4, -6)$, $M(3, -4)$ **(10, −2)**
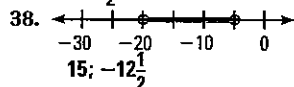
**DISTANCE FORMULA** Find the length of the segment. Round to the nearest tenth of a unit.

**31.** 4.5   **32.** 5.4   **33.** 5.7



**B 34. ★ MULTIPLE CHOICE** The endpoints of $\overline{MN}$ are $M(-3, -9)$ and $N(4, 8)$. What is the approximate length of $\overline{MN}$? **D**

Ⓐ 1.4 units   Ⓑ 7.2 units   Ⓒ 13 units   Ⓓ 18.4 units

**NUMBER LINE** Find the length of the segment. Then find the coordinate of the midpoint of the segment.

**㉟** 7; $-\dfrac{1}{2}$   **36.** 8; −2   **37.** 40; 5

**38.** 15; $-12\dfrac{1}{2}$   **39.** 9; $-3\dfrac{1}{2}$   **40.** 5; $-4\dfrac{1}{2}$
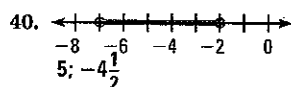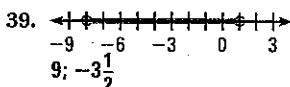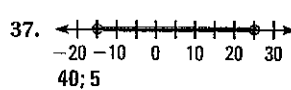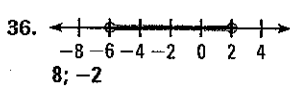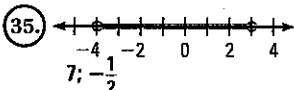


**41. ★ MULTIPLE CHOICE** The endpoints of $\overline{LF}$ are $L(-2, 2)$ and $F(3, 1)$. The endpoints of $\overline{JR}$ are $J(1, -1)$ and $R(2, -3)$. What is the approximate difference in the lengths of the two segments? **B**

Ⓐ 2.24   Ⓑ 2.86   Ⓒ 5.10   Ⓓ 7.96

**42.** *Sample answer:* Use the Distance Formula to find *PM*, then multiply *PM* by 2 to find *PQ* (*PM* = 5, *PQ* = 10).

**42. ★ SHORT RESPONSE** One endpoint of $\overline{PQ}$ is $P(-2, 4)$. The midpoint of $\overline{PQ}$ is $M(1, 0)$. *Explain* how to find *PQ*.

**COMPARING LENGTHS** The endpoints of two segments are given. Find each segment length. Tell whether the segments are congruent.

**43.** $AB = 3\sqrt{5}$, $CD = 2\sqrt{10}$; not congruent

**44.** $EF = 5$, $GH = \sqrt{41}$; not congruent

**45.** $JK = 8\sqrt{2}$, $LM = \sqrt{130}$; not congruent

**43.** $\overline{AB}$: $A(0, 2)$, $B(-3, 8)$
   $\overline{CD}$: $C(-2, 2)$, $D(0, -4)$

**44.** $\overline{EF}$: $E(1, 4)$, $F(5, 1)$
   $\overline{GH}$: $G(-3, 1)$, $H(1, 6)$

**45.** $\overline{JK}$: $J(-4, 0)$, $K(4, 8)$
   $\overline{LM}$: $L(-4, 2)$, $M(3, -7)$

**46. ⓧⓨ ALGEBRA** Points *S*, *T*, and *P* lie on a number line. Their coordinates are 0, 1, and *x*, respectively. Given $SP = PT$, what is the value of *x*? $\dfrac{1}{2}$

**C 47. CHALLENGE** *M* is the midpoint of $\overline{JK}$, $JM = \dfrac{x}{8}$, and $JK = \dfrac{3x}{4} - 6$. Find *MK*. $1\dfrac{1}{2}$

◯ = **WORKED-OUT SOLUTIONS** on p. WS1   ★ = **STANDARDIZED TEST PRACTICE**

**48. WINDMILL** In the photograph of a windmill, $\overline{ST}$ bisects $\overline{QR}$ at point $M$. The length of $\overline{QM}$ is $18\frac{1}{2}$ feet. Find $QR$ and $MR$.  **$QR = 37$ ft, $MR = 18\frac{1}{2}$ ft**

(*@HomeTutor*) for problem solving help at classzone.com
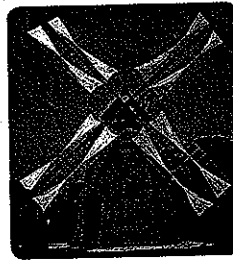
**(49.) DISTANCES** A house and a school are 5.7 kilometers apart on the same straight road. The library is on the same road, halfway between the house and the school. Draw a sketch to represent this situation. Mark the locations of the house, school, and library. How far is the library from the house?
**See margin for art; 2.85 km**

(*@HomeTutor*) for problem solving help at classzone.com

**ARCHAEOLOGY** The points on the diagram show the positions of objects at an underwater archaeological site. Use the diagram for Exercises 50 and 51.
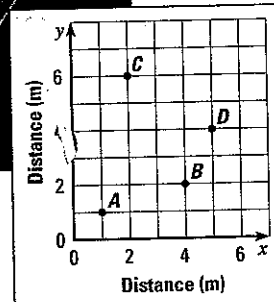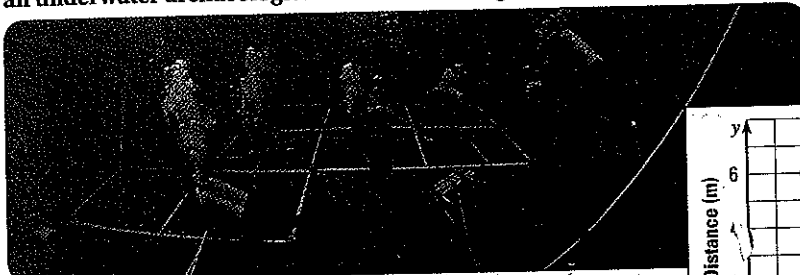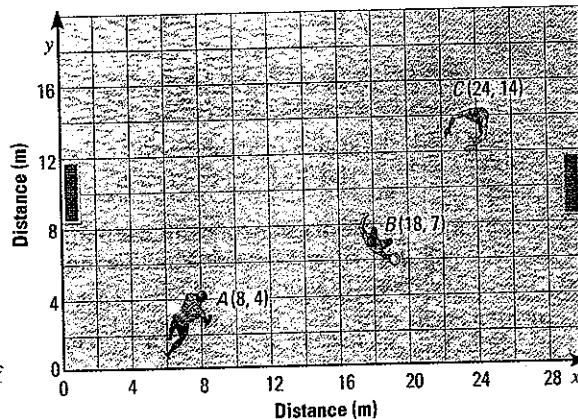
**50.** Find the distance between each pair of objects. Round to the nearest tenth of a meter if necessary.

**a.** $A$ and $B$ **3.2 m**   **b.** $B$ and $C$ **4.5 m**   **c.** $C$ and $D$ **3.6 m**

**d.** $A$ and $D$ **5 m**   **e.** $B$ and $D$ **2.2 m**   **f.** $A$ and $C$ **5.1 m**

**51. objects
B and D;
objects A and C**

**51.** Which two objects are closest to each other? Which two are farthest apart?

(*Animated* Geometry) at classzone.com

[B] **52. WATER POLO** The diagram shows the positions of three players during part of a water polo match. Player $A$ throws the ball to Player $B$, who then throws it to Player $C$. How far did Player $A$ throw the ball? How far did Player $B$ throw the ball? How far would Player $A$ have thrown the ball if he had thrown it directly to Player $C$? Round all answers to the nearest tenth of a meter.   **10.4 m; 9.2 m; 18.9 m**

1.3   Use Midpoint and Distance Formulas   **21**

49. House    Library    School
5.7 km
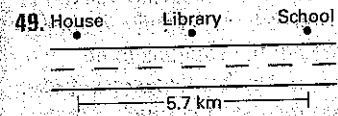
**Daily Homework Quiz**

📑 Transparency Available

1. $\overline{AB}$ bisects $\overline{CD}$ at $E$. If $CE = 2\frac{1}{4}$ in., find $CD$. **$4\frac{1}{2}$ in.**

2. Point $M$ is the midpoint of $\overline{XY}$. Find $XM$. **17**

X •————2x + 7————M————8x − 23————• Y

3. Point $M$ is the midpoint of $\overline{PQ}$ with endpoints $P(2, -6)$ and $Q(-8, 0)$. Find the coordinates of $M$. **(−3, −3)**

4. The midpoint of $\overline{GH}$ is $M(4, -1)$. One endpoint is $G(5, 3)$. Find the coordinates of $H$. **(3, −5)**

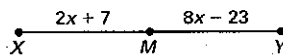5. To find the distance between the swing and the sandbox in his backyard, Darren made a graph and found the coordinates of the swing to be (7, 2) and the coordinates of the sandbox to be (−3, 8). Find the distance between the swing and the sandbox to the nearest tenth of a unit. **11.7**

🌐 **Online Quiz**

Available at **classzone.com**

**Diagnosis/Remediation**
- Practice A, B, C in Chapter Resource Book
- Study Guide in Chapter Resource Book
- Practice Workbook
- @HomeTutor

**Challenge**
Additional challenge is available in the Chapter Resource Book.

**Quiz**
An easily-readable reduced copy of the quiz (with answers) on Lessons 1.1–1.3 from the Assessment Book can be found on p. 1G.

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a. Find the distance around the park to the nearest yard. **191 yd**

b. A new path and a bridge are constructed from point $Q$ to the midpoint $M$ of $\overline{PR}$. Find $QM$ to the nearest yard. **40 yd**

c. A man jogs from $P$ to $Q$ to $M$ to $R$ to $Q$ and back to $P$ at an average speed of 150 yards per minute. About how many minutes does it take? *Explain.* **About 1.5 min; find the total distance, about 230 yards, and divide by 150 yards per minute.**


Distance (yd) vs Distance (yd) graph with points P, Q, R
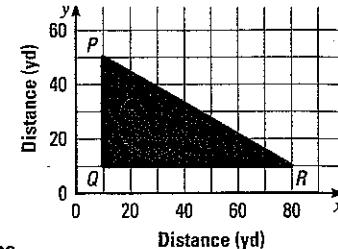
[C] 54. **CHALLENGE** $\overline{AB}$ bisects $\overline{CD}$ at point $M$, $\overline{CD}$ bisects $\overline{AB}$ at point $M$, and $AB = 4 \cdot CM$. Describe the relationship between $AM$ and $CD$. **They are equal lengths.**

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**MIXED REVIEW**

The graph shows data about the number of children in the families of students in a math class. *(p. 888)*

55. What percent of the students in the class belong to families with two or more children? **72%**

56. If there are 25 students in the class, how many students belong to families with two children? **14 students**


- 1 child 28%
- 2 children 56%
- 3 or more children 16%
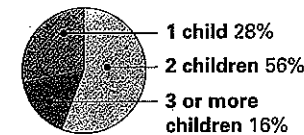
Solve the equation. *(p. 875)*

57. $3x + 12 + x = 20$ **2**    58. $9x + 2x + 6 - x = 10$ **$\frac{2}{5}$**    59. $5x - 22 - 7x + 2 = 40$ **−30**

In Exercises 60–64, use the diagram at the right. *(p. 2)*

60. Name all rays with endpoint $B$. **$\vec{BA}$, $\vec{BC}$ (or $\vec{BE}$)**

61. Name all the rays that contain point $C$. **$\vec{CD}$, $\vec{CB}$, $\vec{CE}$, $\vec{DC}$, $\vec{BC}$ (or $\vec{BE}$), $\vec{EC}$ (or $\vec{EB}$)**

62. Name a pair of opposite rays. **$\vec{CB}$ and $\vec{CE}$**

63. Name the intersection of $\overleftrightarrow{AB}$ and $\overleftrightarrow{BC}$. **point $B$**

64. Name the intersection of $\overleftrightarrow{BC}$ and plane $P$. **point $B$**



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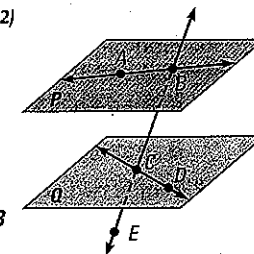
**QUIZ for Lessons 1.1–1.3**

1. Sketch two lines that intersect the same plane at two different points. The lines intersect each other at a point not in the plane. *(p. 2)* **See margin.**

In the diagram of collinear points, $AE = 26$, $AD = 15$, and $AB = BC = CD$. Find the indicated length. *(p. 9)*

A •———B •———C •———D •————————• E

2. $DE$ **11**       3. $AB$ **5**       4. $AC$ **10**

5. $BD$ **10**       6. $CE$ **16**       7. $BE$ **21**
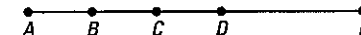
8. The endpoints of $\overline{RS}$ are $R(-2, -1)$ and $S(2, 3)$. Find the coordinates of the midpoint of $\overline{RS}$. Then find the distance between $R$ and $S$. *(p. 15)* **(0, 1); about 5.7**