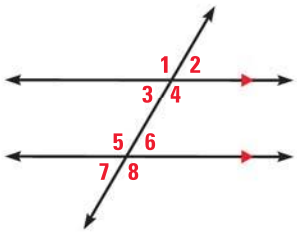
# 3 CHAPTER SUMMARY

## BIG IDEAS

*For Your Notebook*

### Big Idea 1 Using Properties of Parallel and Perpendicular Lines

When parallel lines are cut by a transversal, angle pairs are formed. Perpendicular lines form congruent right angles.

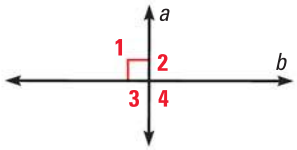



$\angle 2$ and $\angle 6$ are corresponding angles, and they are congruent.

$\angle 3$ and $\angle 6$ are alternate interior angles, and they are congruent.

$\angle 1$ and $\angle 8$ are alternate exterior angles, and they are congruent.

$\angle 3$ and $\angle 5$ are consecutive interior angles, and they are supplementary.

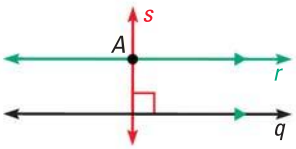



If $a \perp b$, then $\angle 1$, $\angle 2$, $\angle 3$, and $\angle 4$ are all right angles.

### Big Idea 2 Proving Relationships Using Angle Measures

You can use the angle pairs formed by lines and a transversal to show that the lines are parallel. Also, if lines intersect to form a right angle, you know that the lines are perpendicular.

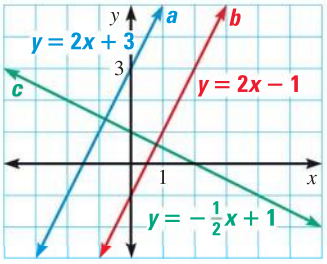
Through point $A$ not on line $q$, there is only one line $r$ parallel to $q$ and one line $s$ perpendicular to $q$.




### Big Idea 3 Making Connections to Lines in Algebra

In Algebra 1, you studied slope as a rate of change and linear equations as a way of modeling situations.

Slope and equations of lines are also a useful way to represent the lines and segments that you study in Geometry. For example, the slopes of parallel lines are the same ($a \parallel b$), and the product of the slopes of perpendicular lines is $-1$ ($a \perp c$, and $b \perp c$).



# 3 CHAPTER REVIEW

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• Multi-Language Glossary
• Vocabulary practice

## REVIEW KEY VOCABULARY

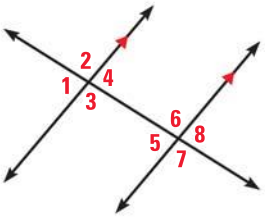
For a list of postulates and theorems, see pp. 926–931.

- parallel lines, *p. 147*
- skew lines, *p. 147*
- parallel planes, *p. 147*
- transversal, *p. 149*
- corresponding angles, *p. 149*
- alternate interior angles, *p. 149*
- alternate exterior angles, *p. 149*
- consecutive interior angles, *p. 149*
- paragraph proof, *p. 163*
- slope, *p. 171*
- slope-intercept form, *p. 180*
- standard form, *p. 182*
- distance from a point to a line, *p. 192*

### VOCABULARY EXERCISES

1. Copy and complete: Two lines that do not intersect and are not coplanar are called __?__.
2. **WRITING** *Compare* alternate interior angle pairs and consecutive interior angle pairs.

**Copy and complete the statement using the figure at the right.**




3. $\angle 1$ and __?__ are corresponding angles.
4. $\angle 3$ and __?__ are alternate interior angles.
5. $\angle 4$ and __?__ are consecutive interior angles.
6. $\angle 7$ and __?__ are alternate exterior angles.

**Identify the form of the equation as *slope-intercept form* or *standard form*.**

7. $14x - 2y = 26$
8. $y = 7x - 13$

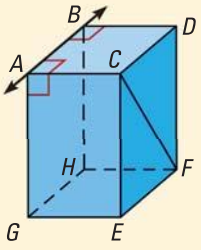
## REVIEW EXAMPLES AND EXERCISES

Use the review examples and exercises below to check your understanding of the concepts you have learned in each lesson of Chapter 3.

### 3.1 Identify Pairs of Lines and Angles *pp. 147–152*

**EXAMPLE**

**Think of each segment in the rectangular box at the right as part of a line.**




a. $\overleftrightarrow{BD}$, $\overleftrightarrow{AC}$, $\overleftrightarrow{BH}$, and $\overleftrightarrow{AG}$ appear perpendicular to $\overleftrightarrow{AB}$.

b. $\overleftrightarrow{CD}$, $\overleftrightarrow{GH}$, and $\overleftrightarrow{EF}$ appear parallel to $\overleftrightarrow{AB}$.

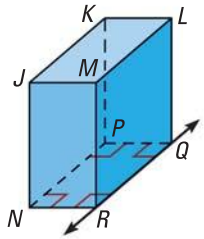
c. $\overleftrightarrow{CF}$ and $\overleftrightarrow{EG}$ appear skew to $\overleftrightarrow{AB}$.

d. Plane $EFG$ appear parallel to plane $ABC$.

**EXAMPLE 1**
on p. 147
for Exs. 9–12

## EXERCISES

**Think of each segment in the diagram of a rectangular box as part of a line. Which line(s) or plane(s) contain point *N* and appear to fit the description?**




**9.** Line(s) perpendicular to $\overleftrightarrow{QR}$

**10.** Line(s) parallel to $\overleftrightarrow{QR}$

**11.** Line(s) skew to $\overleftrightarrow{QR}$

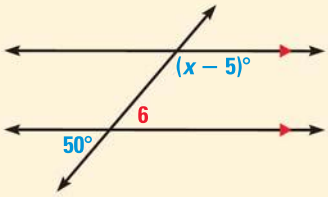
**12.** Plane(s) parallel to plane *LMQ*

# 3.2 Use Parallel Lines and Transversals

*pp. 154–160*

**EXAMPLE**

**Use properties of parallel lines to find the value of *x*.**




By the Vertical Angles Congruence Theorem, $m\angle 6 = 50°$.

$(x - 5)° + m\angle 6 = 180°$ — **Consecutive Interior Angles Theorem**

$(x - 5)° + 50° = 180°$ — **Substitute 50° for $m\angle 6$.**

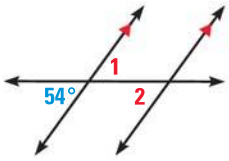
$x = 135$ — **Solve for *x*.**

**EXAMPLES 1 and 2**
on pp. 154–155
for Exs. 13–19

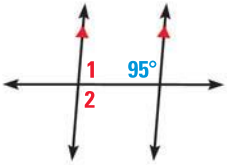
## EXERCISES

**Find $m\angle 1$ and $m\angle 2$. *Explain* your reasoning.**

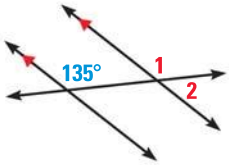
**13.**




**14.**

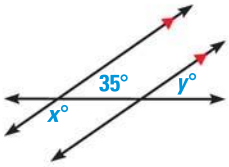



**15.**

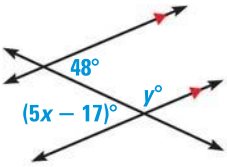



**Find the values of *x* and *y*.**

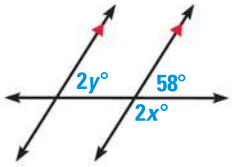
**16.**




**17.**




**18.**




**19. FLAG OF PUERTO RICO** Sketch the rectangular flag of Puerto Rico as shown at the right. Find the measure of $\angle 1$ if $m\angle 3 = 55°$. *Justify* each step in your argument.

# 3 CHAPTER REVIEW

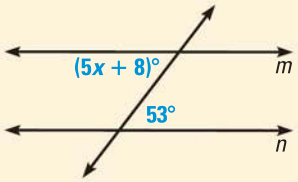
## 3.3 Prove Lines are Parallel

*pp. 161–169*

**EXAMPLE**

**Find the value of $x$ that makes $m \parallel n$.**

Lines $m$ and $n$ are parallel when the marked corresponding angles are congruent.




$(5x + 8)° = 53°$

$5x = 45$

$x = 9$

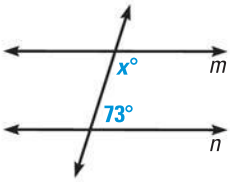
▶ The lines $m$ and $n$ are parallel when $x = 9$.

### EXERCISES

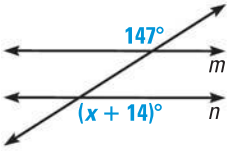
**EXAMPLE 1** on p. 161 for Exs. 20–22

**Find the value of $x$ that makes $m \parallel n$.**

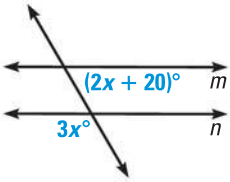
**20.**




**21.**




**22.**

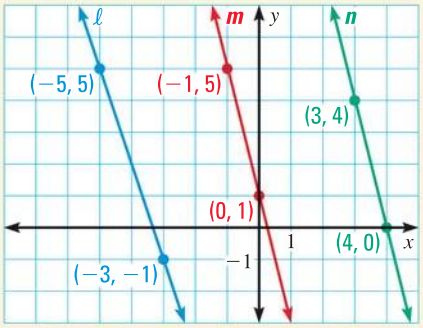



## 3.4 Find and Use Slopes of Lines

*pp. 171–178*

**EXAMPLE**

**Find the slope of each line. Which lines are parallel?**




Slope of $\ell = \frac{-1 - 5}{-3 - (-5)} = \frac{-6}{2} = -3$

Slope of $m = \frac{1 - 5}{0 - (-1)} = \frac{-4}{1} = -4$

Slope of $n = \frac{0 - 4}{4 - 3} = \frac{-4}{1} = -4$

▶ Because $m$ and $n$ have the same slope, they are parallel. The slope of $\ell$ is different, so $\ell$ is not parallel to the other lines.

### EXERCISES

**EXAMPLES 2 and 3** on pp. 172–173 for Exs. 23–24

**Tell whether the lines through the given points are *parallel*, *perpendicular*, or *neither*.**

**23.** **Line 1:** (8, 12), (7, −5)
**Line 2:** (−9, 3), (8, 2)

**24.** **Line 1:** (3, −4), (−1, 4)
**Line 2:** (2, 7), (5, 1)

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Chapter Review Practice

## 3.5 Write and Graph Equations of Lines

*pp. 180–187*

**EXAMPLE**

**Write an equation of the line $k$ passing through the point $(-4, 1)$ that is perpendicular to the line $n$ with the equation $y = 2x - 3$.**

First, find the slope of line $k$. Line $n$ has a slope of 2.

$$2 \cdot m = -1$$

$$m = -\frac{1}{2}$$

Then, use the given point and the slope in the slope-intercept form to find the $y$-intercept.

$$y = mx + b$$

$$1 = -\frac{1}{2}(-4) + b$$

$$-1 = b$$

▶ An equation of line $k$ is $y = -\frac{1}{2}x - 1$.

**EXAMPLES 2 and 3**
on pp. 180–181
for Exs. 25–26

### EXERCISES

**Write equations of the lines that pass through point $P$ and are (a) parallel and (b) perpendicular to the line with the given equation.**

**25.** $P(3, -1)$, $y = 6x - 4$

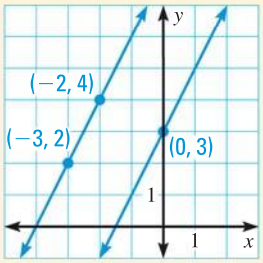
**26.** $P(-6, 5)$, $7y + 4x = 2$

## 3.6 Prove Theorems About Perpendicular Lines

*pp. 190–197*

**EXAMPLE**

**Find the distance between $y = 2x + 3$ and $y = 2x + 8$.**




Find the length of a perpendicular segment from one line to the other. Both lines have a slope of 2, so the slope of a perpendicular segment to each line is $-\frac{1}{2}$. The segment from $(0, 3)$ to $(-2, 4)$ has a slope of $\frac{4-3}{-2-0} = -\frac{1}{2}$. So, the distance between the lines is

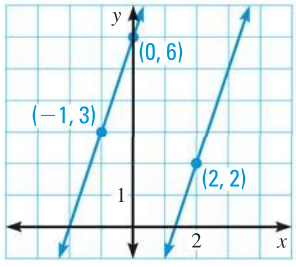
$$d = \sqrt{(-2-0)^2 + (4-3)^2} = \sqrt{5} \approx 2.2 \text{ units.}$$

**EXAMPLE 4**
on p. 193
for Exs. 27–28

### EXERCISES

**Use the Distance Formula to find the distance between the two parallel lines. Round to the nearest tenth, if necessary.**

**27.**




**28.**