7–1

NAME _______________ DATE _______________

# Study Guide

Student Edition
Pages 338–345

## *Integration: Algebra*
## *Using Proportions*

A **ratio** is a comparison of two quantities. The ratio of $a$ to $b$ can be expressed as $\frac{a}{b}$, where $b$ is not 0. The ratio can also be written $a{:}b$.

An equation stating that two ratios are equal is a **proportion**. Therefore, $\frac{a}{b} = \frac{c}{d}$ is a proportion for any numbers $a$ and $c$ and any nonzero numbers $b$ and $d$. In any true proportion, the cross products are equal. So, $\frac{a}{b} = \frac{c}{d}$ if and only if $ad = bc$.

***Example:*** Solve $\frac{11}{16} = \frac{44}{x}$ by using cross products.

$$\frac{11}{16} = \frac{44}{x}$$
$$11x = 16 \cdot 44$$
$$11x = 704$$
$$x = 64$$

***For Exercises 1–4, use the table to find the ratios. Express each ratio as a decimal rounded to three places.***

| Teams | Wins | Losses |
|---|---|---|
| Hawks | 16 | 13 |
| Tigers | 15 | 14 |
| Mustangs | 12 | 16 |

**1.** games won to games lost for Hawks

**2.** games won by the Hawks to games won by Tigers

**3.** games won to games played for Tigers

**4.** games won to games played for Mustangs

***Solve each proportion by using cross products.***

**5.** $\frac{9}{28} = \frac{x}{84}$

**6.** $\frac{3}{18} = \frac{4x}{7}$

**7.** $\frac{x+5}{7} = \frac{x+3}{5}$

***Use a proportion to solve each problem.***

**8.** If two cassettes cost \$14.50, how much will 15 cassettes cost?

**9.** If a 6-foot post casts a shadow that is 8 feet long, how tall is an antenna that casts a 60-foot shadow at the same time?

7–1

NAME ______________________ DATE ____________

# Practice

Student Edition
Pages 338–345

## Integration: Algebra
## Using Proportions

***Solve each proportion using cross products.***

**1.** $\frac{3}{5} = \frac{x}{15}$

**2.** $\frac{20 - x}{x} = \frac{6}{4}$

**3.** $\frac{x+1}{5} = \frac{x-1}{2}$

**4.** $\frac{x}{x-3} = \frac{x+4}{x}$

**5.** $\frac{x+1}{6} = \frac{x-1}{x}$

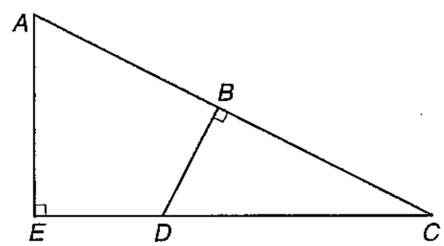
**6.** $\frac{1}{x} = \frac{6}{x+9}$

**7.** $\frac{x}{x+8} = \frac{2}{3}$

**8.** $\frac{4}{12} = \frac{x+2}{2x+5}$

***In the figure at the right, $\frac{AC}{CD} = \frac{CE}{CB}$. Use proportions to complete the table.***

| | AC | BC | AB | CE | ED | DC |
|---|---|---|---|---|---|---|
| **9.** | 10 | 4 | | 8 | | |
| **10.** | 12 | | | 10 | | 9 |




***Use a proportion to solve each problem.***

**11.** The ratio of seniors to juniors in the Math Club is 2:3. If there are 21 juniors, how many seniors are in the club?

**12.** A 15-foot building casts a 9-foot shadow. How tall is a building that casts a 30-foot shadow at the same time?

**13.** A photo that is 3 inches wide and 5 inches high was enlarged so that it is 12 inches wide. How high is the enlargement?

**14.** Philip has been eating 2 hamburgers every 5 days. At that rate, how many hamburgers will he eat in 30 days?

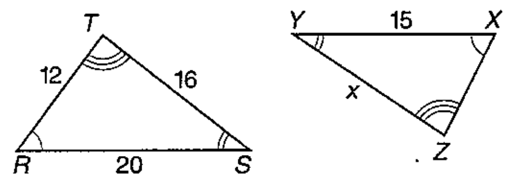
## *Exploring Similar Polygons*

Two polygons are **similar** if and only if their corresponding angles are congruent and the measures of their corresponding sides are proportional.

The symbol $\sim$ means *is similar to.*

The ratio of the lengths of two corresponding sides of two similar polygons is called the **scale factor**.

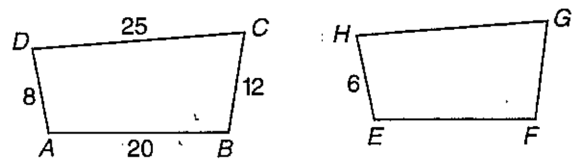
***Example:*** Find $x$ if $\triangle RST \sim \triangle XYZ$.




The corresponding sides are proportional, so we can write a proportion to find the value of $x$.

$$\frac{16}{x} = \frac{20}{15}$$
$$20x = 240$$
$$x = 12$$

***If quadrilateral ABCD is similar to quadrilateral EFGH, find each of the following.***




**1.** scale factor of $ABCD$ to $EFGH$

**2.** $EF$

**3.** $FG$

**4.** $GH$

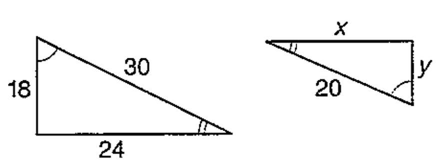
**5.** perimeter of $ABCD$

**6.** perimeter of $EFGH$

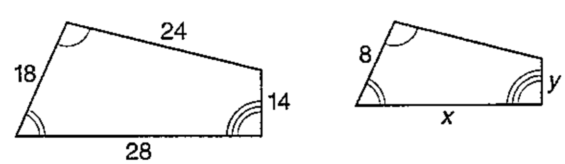
**7.** ratio of perimeter of $ABCD$ to perimeter of $EFGH$

***Each pair of polygons is similar. Find the values of x and y.***

**8.**




**9.**



7–2

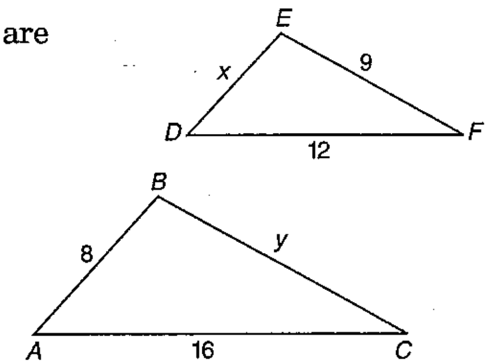
NAME________________________ DATE ____________

# Practice

Student Edition
Pages 346–353

## Exploring Similar Polygons

***In the figure at the right, △ABC is similar to △DEF.***



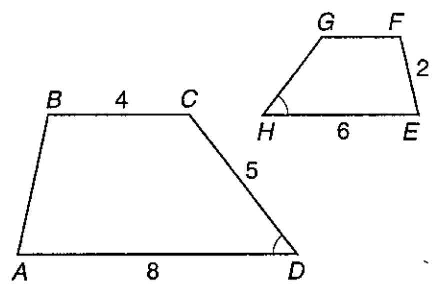

**1.** Write three equal ratios to show corresponding sides are proportional.

**2.** Find the value of $x$.

**3.** Find the value of $y$.

**4.** Find the ratio $\frac{m\angle A}{m\angle D}$.

***In the figure at the right, quadrilateral ABCD is similar to quadrilateral EFGH.***




**5.** Write four equal ratios to show corresponding sides are proportional.

**6.** Find $AB$.

**7.** Find $HG$.

**8.** Find $FG$.

**9.** The sum of the measures of $\angle A$ and $\angle C$ equals the sum of the measures of which two angles of quadrilateral $EFGH$?

7–3

NAME________________________ DATE ____________

# Study Guide

Student Edition
Pages 354–361

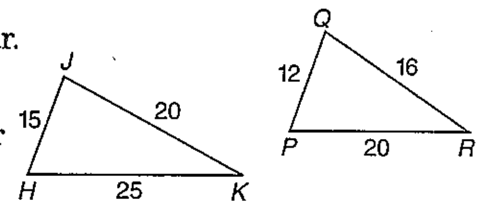
## *Identifying Similar Triangles*

There are three ways to determine whether two triangles are similar.

- Show that two angles of one triangle are congruent to two angles of the other triangle. (AA Similarity)
- Show that the measures of the corresponding sides of the triangles are proportional. (SSS Similarity)
- Show that the measure of two sides of a triangle are proportional to the measures of the corresponding sides of the other triangle and that the included angles are congruent. (SAS Similarity)

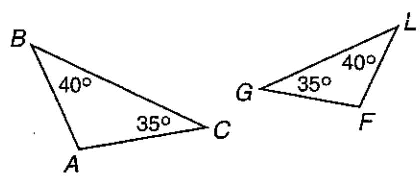
***Example:*** Determine whether the triangles are similar. Explain your answer.

Since $\frac{15}{12} = \frac{25}{20} = \frac{20}{16}$, the triangles are similar by SSS Similarity.

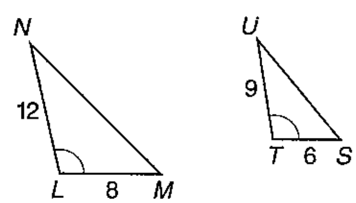



***Determine whether each pair of triangles is similar. Give a reason for your answer.***

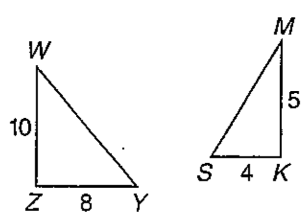
**1.**



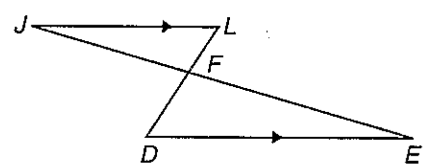

**2.**




**3.**

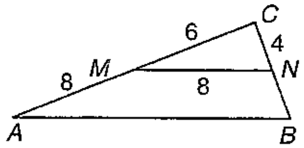



**4.**

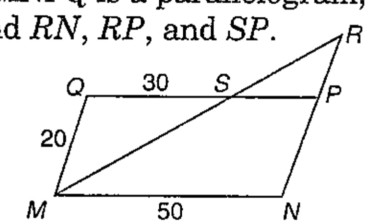



***Identify the similar triangles in each figure. Explain why they are similar and find the missing measures.***

**5.** If $\overline{MN} \parallel \overline{AB}$, find $AB$, $BC$, and $BN$.




**6.** If $MNPQ$ is a parallelogram, find $RN$, $RP$, and $SP$.

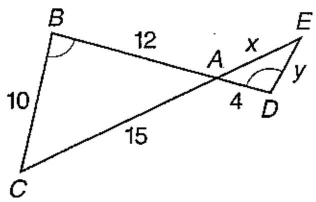


# Practice

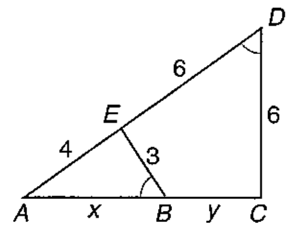
## *Identifying Similar Triangles*

***Identify the similar triangles in each figure. Explain why they are similar and use the given information to find x and y.***

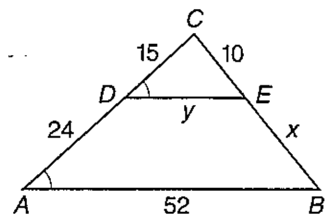
**1.**




**2.**



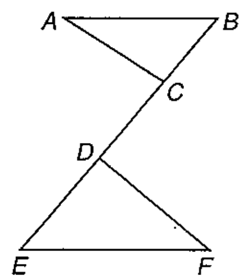

**3.**




***Write a two-column proof.***

**4. Given:** $\overline{AB} \parallel \overline{EF}$
$\overline{AC} \parallel \overline{DF}$

**Prove:** $\triangle ABC \sim \triangle FED$

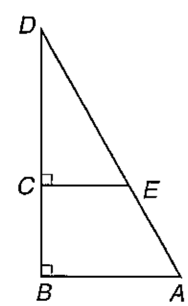



**Proof:**

| Statements | Reasons |
| --- | --- |

**5. Given:** $\overline{AB} \perp \overline{BD}$
$\overline{EC} \perp \overline{BD}$

**Prove:** $\triangle BDA \sim \triangle CDE$




**Proof:**

| Statements | Reasons |
| --- | --- |

NAME ______________________ DATE ____________

# Study Guide



## *Parallel Lines and Proportional Parts*

The following theorems involve proportional parts of triangles.

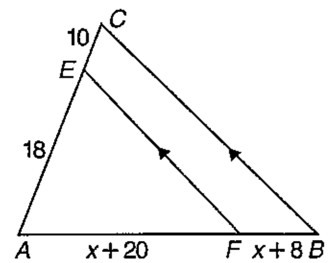
- If a line is parallel to one side of a triangle and intersects the other two sides, then it separates these sides into segments of proportional lengths.
- If a line intersects two sides of a triangle and separates the sides into corresponding segments of proportional lengths, then the line is parallel to the third side.
- A segment whose endpoints are the midpoints of two sides of a triangle is parallel to the third side of the triangle and its length is one-half the length of the third side.

***Example:*** In $\triangle ABC$, $\overline{EF} \parallel \overline{CB}$, find the value of $x$.

$\overline{EF} \parallel \overline{CB}$ implies that $\frac{AF}{FB} = \frac{AE}{EC}$.

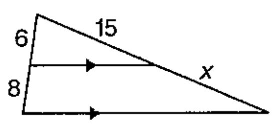
Rewrite the proportion and solve.

$$\frac{x+20}{x+8} = \frac{18}{10}$$
$$10x + 200 = 18x + 144$$
$$56 = 8x$$
$$7 = x$$

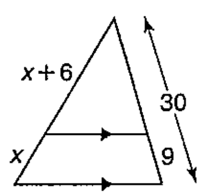



***Find the value of x.***

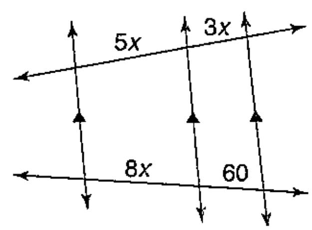
**1.**




**2.**



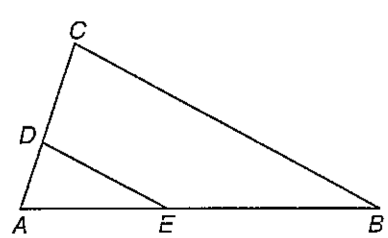

**3.**




***In $\triangle ABC$, find x so that $\overline{DE} \parallel \overline{CB}$.***

**4.** $DC = 18$, $AD = 6$, $AE = 12$, $EB = x - 3$

**5.** $AC = 30$, $AD = 10$, $AE = 22$, $EB = x + 4$




**6.** In $\triangle RST$, $M$ is the midpoint of $\overline{RS}$, $N$ is the midpoint of $\overline{ST}$, and $P$ is the midpoint of $\overline{RT}$. Find the perimeter of $\triangle MNP$ if $RS = 28$, $ST = 34$, and $RT = 30$.

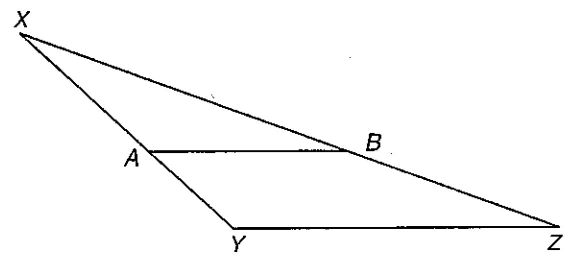
NAME ______________________ DATE ____________

# Practice

Student Edition
Pages 362–369

## Parallel Lines and Proportional Parts

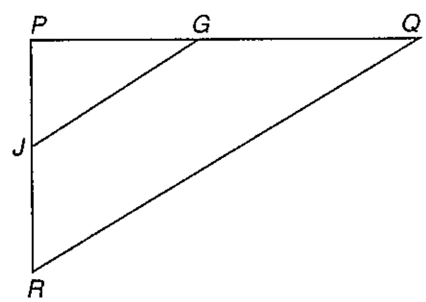
***Refer to the figure at the right for Exercises 1–2. Determine whether it is always true that $\overline{AB} \parallel \overline{YZ}$ under the given conditions.***




1. $XA = 6$
   $AY = 4$
   $XB = 8$
   $BZ = 5$

2. $XB = 3$
   $BZ = 2$
   $AX = 6$
   $AY = 10$

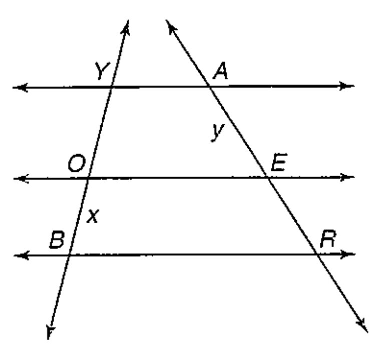
***In $\triangle PQR$, find x and y so that $\overline{JG} \parallel \overline{RQ}$.***




3. $PJ = 6$
   $JG = 5$
   $PG = 4$
   $GQ = x$
   $RQ = x + 6$
   $JR = y$

4. $RQ = 10$
   $JG = 8$
   $PJ = 8x - 5$
   $JR = x$
   $PG = 3y + 2$
   $QG = y$

5. In the figure at the right, $\overleftrightarrow{YA} \parallel \overleftrightarrow{OE} \parallel \overleftrightarrow{BR}$. Find the values of $x$ and $y$ if $YO = 4$, $ER = 16$, and $AR = 24$.



7–5

NAME ______________________ DATE ______________

# Study Guide

Student Edition
Pages 370–377

## *Parts of Similar Triangles*

Each mathematical word in the following list has a different meaning in everyday usage than when it is used in a mathematical context. When you read mathematics, you must be sure that you are using each word in the correct context.

| | | | |
|---|---|---|---|
| altitude | right | mean | scale |
| extreme | product | segment | ruler |
| plane | obtuse | acute | |
| meter | yard | median | |

***Each definition below describes an everyday usage of one of the words in the list above. For each definition, write the correct word from the list above in the blanks at the right.***

1. an instrument for measuring ______________
2. a tool for smoothing a wood surface ______________
3. the opposite of left ______________
4. differing widely from the ordinary ______________
5. keen in perception ______________
6. dull ______________
7. contemptible ______________
8. fragment ______________
9. the dividing strip down the middle of a highway ______________
10. height above sea level ______________
11. a person in charge of a country ______________
12. the grounds of a building ______________
13. an item that is manufactured ______________
14. a small plate forming part of the external covering of a fish ______________
15. Choose five words from the list above. Compare their mathematical definition and their everyday usage. Describe how the definitions are similar and how they are different.

7–5

NAME ______________________________ DATE ____________

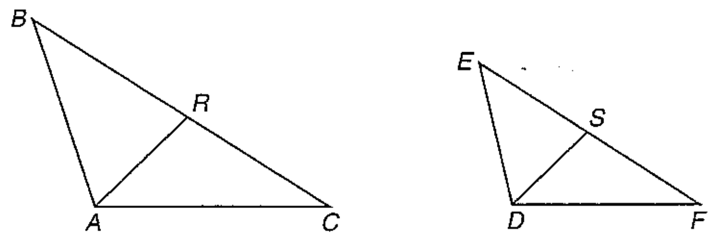
# Practice

Student Edition
Pages 370–377

## Parts of Similar Triangles

***In the figure at the right, $\triangle ABC \sim \triangle DEF$, $\overline{BR} \cong \overline{RC}$, and $\overline{ES} \cong \overline{SF}$. Find the value of x.***

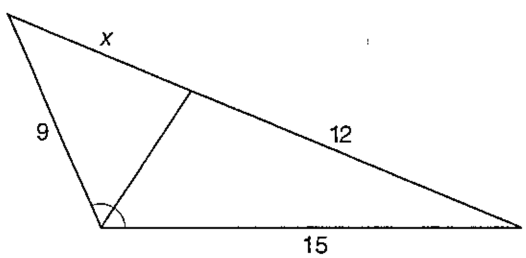
**1.** $BC = 24$
$EF = 15$
$AR = x$
$DS = x - 6$



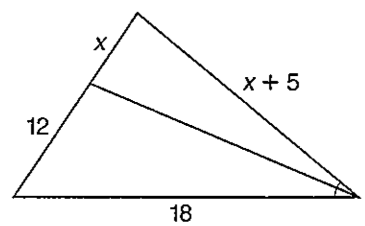

**2.** $AB = 2x + 5$
$DE = x + 7$
$AR = 24$
$DS = 18$

***Find the value of x.***

**3.**

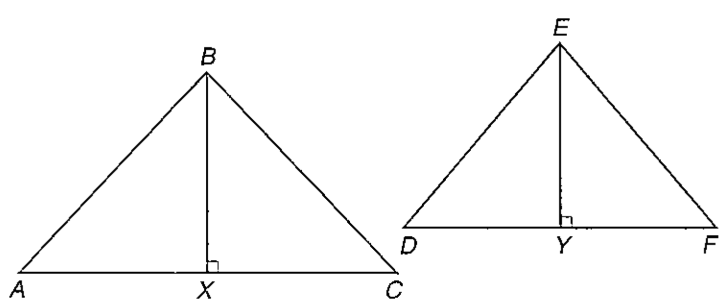



**4.**




***In the figure at the right, $\triangle ABC \sim \triangle DEF$, and $\overline{BX}$ and $\overline{EY}$ are altitudes. Find the value of x.***

**5.** $AB = 25$
$DE = 16$
$BX = 18$
$EY = x$




**6.** $AB = 30$
$DE = 25$
$BX = 2x + 5$
$EY = x + 10$

NAME______________________________ DATE ____________

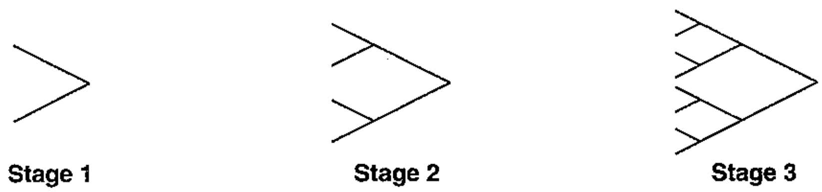
# Study Guide

Student Edition
Pages 378–383

## *Fractals and Self-Similarity*

Fractal geometry is the geometry of things in nature that are irregular in shape. A **fractal** is a geometric shape created using a process called **iteration**. Iteration is a process of repeating the same procedure over and over again. **Self-similarity** is a characteristic of fractals. The smaller and smaller details of a shape have the same geometrical characteristics as the original, larger form.

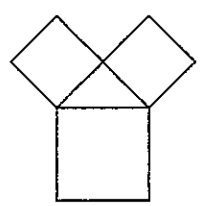
***Example:***




**1.** Follow the iteration process to produce a figure.

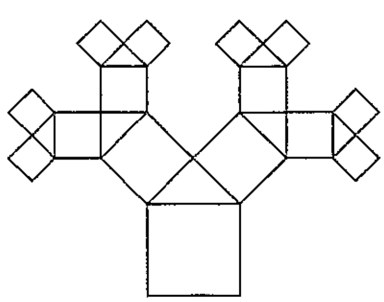
- Draw a square.
- Attach the hypotenuse of an isosceles right triangle to one side of the square. The hypotenuse should be the same length as the side of the square.
- Attach a square to each leg of the triangle. The sides of the squares should be the same length as the legs of the triangle.

This is Stage 1.



**2.** Describe the next step in the iteration process.

**3.** Draw Stage 3 of the figure in Exercise 1.



**4.** Is the figure produced in Exercise 3 self-similar?

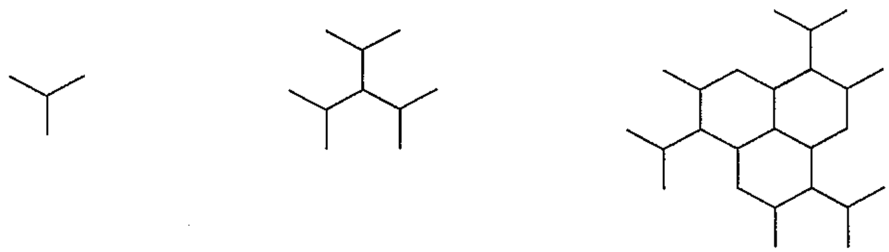
NAME ____________________ DATE __________

# Practice

Student Edition
Pages 378–383

## *Fractals and Self-Similarity*

***Use the drawings below of three stages of a variation on the Koch curve to complete Exercises 1 and 2.***



Stage 1 Stage 2 Stage 3

1. Draw Stage 4.

2. Describe the iterative process used in this variation.

3. Draw an equilateral triangle. Divide each side into fourths, and connect the points to form three lines parallel to each side of the triangle.

4. Find the number of similar triangles within the figure in Exercise 3.

5. Create a figure and draw stages 1–3 of iteration.

6. Describe the iterative process used in Exercise 5.

7. **Solve a Simpler Problem** How many diagonals can be drawn for a polygon with 15 sides?