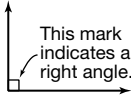
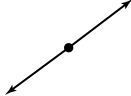
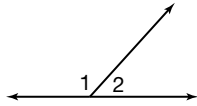





Angles (pages 362–365)


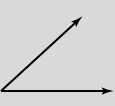
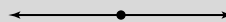


An **angle** is made up of two rays, or sides, with a common endpoint, or **vertex**. You measure angles in units called **degrees**. Angles are classified according to their measure.

Types of Angles	Right Angle  exactly 90°	Straight Angle  exactly 180°	Supplementary Angles  $m\angle 1 + m\angle 2 = 180^\circ$
	Acute Angle  less than 90°	Obtuse Angle  between 90° and 180°	Complementary Angles  $m\angle 3 + m\angle 4 = 90^\circ$

Try These Together

Classify each angle as acute, obtuse, right, or straight.

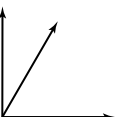
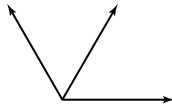
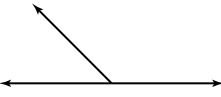
1.  2.  3. 

PRACTICE

Classify each angle as acute, obtuse, right, or straight.

4. 5° 5. 135° 6. 90° 7. 28°

Classify each pair of angles as supplementary, complementary, or neither.

8.  9.  10. 

11. **Decorating** Darma is making a poster for a school dance. She is using angles to create a decorative border. She has made several 35° angles and now wants to draw supplementary angles. Will the supplementary angles be acute, right, obtuse, or straight?



12. **Standardized Test Practice** Angles r and s are supplementary. Find $m\angle r$ if $m\angle s = 138^\circ$.

- A** 38° **B** 42° **C** 48° **D** 35°

Answers: 1. obtuse 2. acute 3. straight 4. acute 5. obtuse 6. right 7. acute 8. complementary 9. neither 10. supplementary 11. obtuse 12. B

Polygons (pages 370–373)

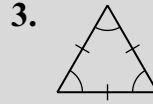


A **polygon** is a simple closed figure formed by three or more line segments. *Simple* means that the line segments do not cross each other, and *closed* means that when you draw the polygon, your pencil ends up where it started.

Naming Polygons	A polygon is named by the number of its sides or by the number of its angles. A polygon has the same number of sides and angles.		
	Common Polygons		
	triangle 3 sides	quadrilateral 4 sides	pentagon 5 sides
	hexagon 6 sides	heptagon 7 sides	octagon 8 sides
	nonagon 9 sides	decagon 10 sides	
Regular Polygons	When two or more line segments or angles have the same measure, they are congruent . When a polygon has all sides congruent and all angles congruent, it is a regular polygon .		
	<ul style="list-style-type: none"> • Slash marks through the segments that make up the sides of a polygon mean that the sides are congruent. • Arcs drawn on the angles of a polygon mean the angles are congruent. 		

Try These Together

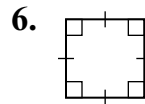
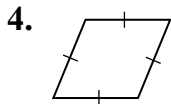
Determine which figures are polygons. If the figure is a polygon, name it and tell whether it is a regular polygon. If the figure is not a polygon, explain why.



HINT: Are the figures simple, without crossing lines, and closed?

PRACTICE

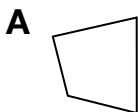
Determine which figures are polygons. If the figure is a polygon, name it and tell whether it is a regular polygon. If the figure is not a polygon, explain why.



7. **Architecture** A new office building was built in the shape of a six-sided regular polygon. Name the polygon and draw it.

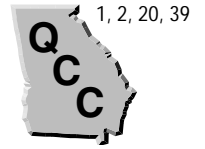


8. **Standardized Test Practice** Which of the following is a polygon?



Answers: 1. regular pentagon 2. not a polygon; segments cross 3. regular triangle 4. quadrilateral, not regular 5. quadrilateral, not regular 6. regular quadrilateral 7. See Answer Key. 8. A

Similar Polygons (pages 376–379)



Two polygons are **similar** if their corresponding angles are congruent and their corresponding sides are in proportion.

EXAMPLE

$\triangle ABC$ is similar to $\triangle DEF$. What is the missing segment length?

Since the triangles are similar, use a proportion to find the missing segment length.

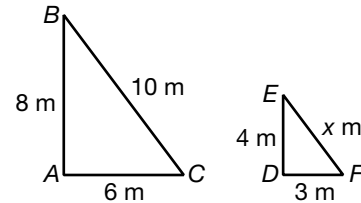
$$\frac{AC}{DF} = \frac{BC}{EF} \rightarrow \frac{6}{3} = \frac{10}{x} \quad \text{Substitute lengths.}$$

$$6x = 3(10) \quad \text{Find the cross products.}$$

$$\frac{6x}{6} = \frac{30}{6} \quad \text{Divide each side by 6.}$$

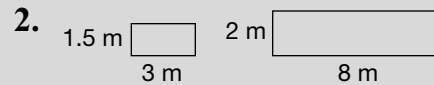
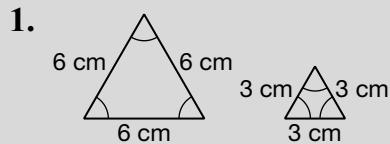
$$x = 5$$

$$EF = 5 \text{ m}$$



Try These Together

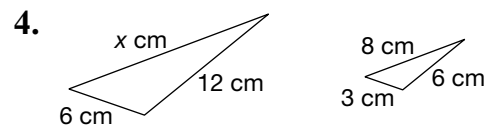
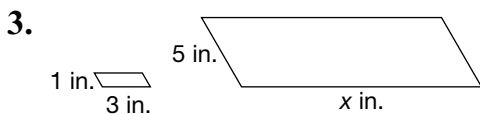
Tell whether each pair of polygons is similar. Justify your answer.



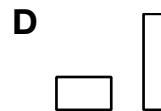
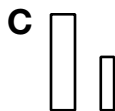
HINT: Are the angles congruent and the corresponding sides in proportion?

PRACTICE

Find the value of x in each pair of similar polygons.



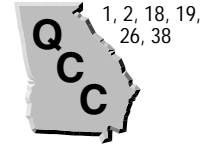
5. **Standardized Test Practice** Which best represents a pair of similar figures?



Answers: 1. Yes; their angles are congruent and their sides are proportional. 2. No; their sides are not proportional. 3. 15 in. 4. 16 cm 5. C

Triangles and Quadrilaterals

(pages 382–385)





You can classify polygons by their angles and sides.

Types of Triangles	acute all angles acute obtuse 1 obtuse angle isosceles exactly two congruent sides	right 1 right angle scalene no congruent sides equilateral 3 congruent sides
Types of Quadrilaterals	parallelogram opposite sides parallel and opposite sides congruent rectangle parallelogram with 4 right angles rhombus parallelogram with 4 congruent sides square parallelogram with 4 right angles and 4 congruent sides trapezoid exactly one pair of sides parallel	

EXAMPLES


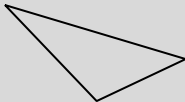
Classify each polygon by its angles and by its sides.

A  This is a triangle with one right angle, so it is a right triangle. No two sides are congruent, so the triangle is scalene.

B  This is a quadrilateral with exactly one pair of sides parallel, so it is a trapezoid.

Try These Together



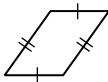
Classify each triangle by its angles and by its sides.

- 
- 
- 

HINT: Refer to the above table to help you classify the triangles.

PRACTICE

Name every quadrilateral that describes each figure. Then underline the name that best describes the figure.

- 
- 
- 

7. Advertising Molly is working on a new advertisement for a shoe company. The shoes come in an odd-shaped box. It is a quadrilateral with exactly one pair of opposite sides that are parallel. What name can she use to best describe the box.

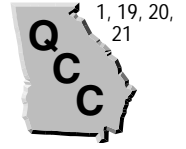


8. Standardized Test Practice A triangle has sides that measure 5 cm, 5 cm, and 8 cm. Classify the triangle by its sides.

- A** isosceles **B** acute **C** scalene **D** equilateral

Answers: 1. obtuse, isosceles 2. obtuse, scalene 3. acute, equilateral 4. quadrilateral, trapezoid 5. quadrilateral, rectangle 6. quadrilateral, parallelogram 7. trapezoid 8. A
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Tessellations (pages 388–391)



A **tessellation** is a repetitive pattern of regular polygons that fit together with no overlaps or gaps. In a tessellation, the sum of the measures of the angles where the vertices of the polygons meet is 360° .

EXAMPLE

The sum of the measures of the angles of an equilateral triangle is 180° . Can an equilateral triangle make a tessellation?

Each angle of an equilateral triangle has a measure of $180 \div 3$ or 60° . To find out if an equilateral triangle tessellates, solve $60n = 360$, where n is the number of angles at a vertex.

$$\frac{60n}{60} = \frac{360}{60} \quad \text{Divide each side by 60.}$$

$$n = 6$$

The solution is a whole number, so an equilateral triangle will make a tessellation.

Try These Together

Determine whether each polygon can be used by itself to make a tessellation. The sum of the measures of the angles of each polygon is given.

1. octagon; $1,080^\circ$

2. hexagon; 720°

PRACTICE

Determine whether each polygon can be used by itself to make a tessellation. The sum of the measures of the angles of each polygon is given.

3. triangle; 180°

4. pentagon; 540°

Sketch the following tessellations.

5. triangles

6. octagons and squares

7. **Computers** Seth wants to make a tessellation to use for a background on a Web page. He would like to use two regular hexagons and one square to form each vertex. Will this work? Why or why not?



8. **Standardized Test Practice** Which one of the following cannot be used by itself to make a tessellation?

A a triangle

B a square

C a hexagon

D a nonagon

Answers: 1. no 2. yes 3. yes 4. no 5–6. See Answer Key. 7. No, the sum of the angles of two regular hexagons and one square is 360° , not 360° . 8. D

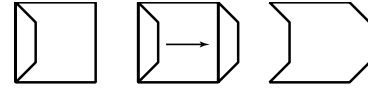
Translations (pages 392–394)



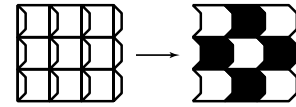
A **translation** is sliding part of a drawing to another place without turning it.

EXAMPLE

The square to the right has had the left side changed. To make sure the pieces, or pattern units, will tessellate, slide the change to the opposite side and copy it.

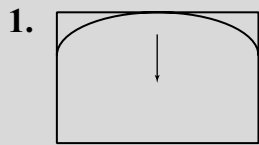


Now change all of the squares in a tessellation the same way. The tessellation takes on qualities like paintings by M. C. Escher when you add different colors or designs.



Try This Together

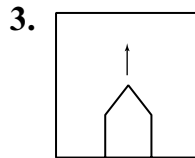
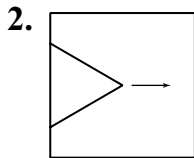
Complete the pattern unit for the translation. Then draw the tessellation.



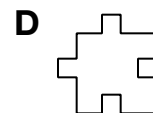
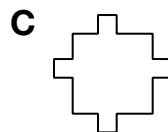
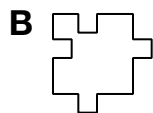
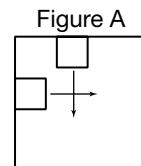
HINT: In the tessellation, all of the pieces must fit together.

PRACTICE

Complete the pattern unit for each translation. Then draw the tessellation.



4. **Standardized Test Practice** Which shows the completed pattern unit for Figure A?



Answers: 1–3. See Answer Key. 4. B

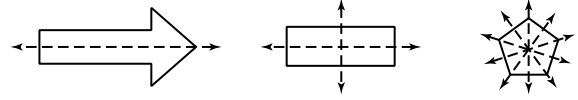
Reflections (pages 395–397)



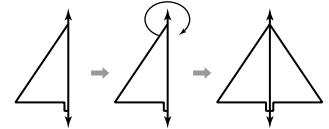
Figures that match exactly when folded in half have **line symmetry**.

EXAMPLES

A The figures to the right have line symmetry. Some figures can be folded in more than one way to show symmetry. Each fold line is called a **line of symmetry**.



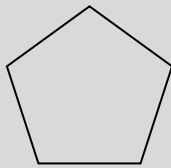
B You can create figures that have line symmetry by using a **reflection**. A reflection is a mirror image of a figure across a line of symmetry.



Try These Together

Draw all lines of symmetry for each figure.

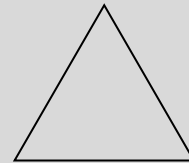
1.



2.



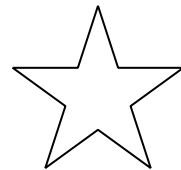
3.



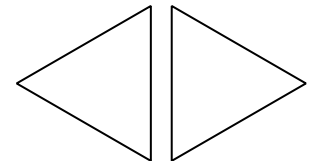
HINT: Think about all of the ways the figures can be folded in half.

PRACTICE

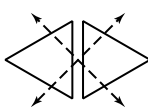
- How many lines of symmetry does a regular hexagon have?
- Life Science** Many flowers have lines of symmetry. How many lines of symmetry does a star-shaped flower have?



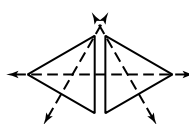
6. **Standardized Test Practice** Which of the following shows the lines of symmetry in the figure at the right?



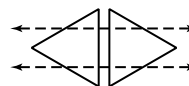
A



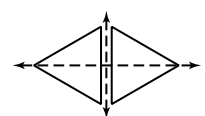
B



C



D

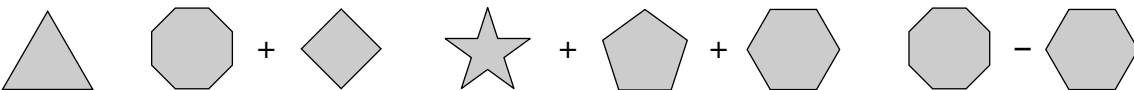
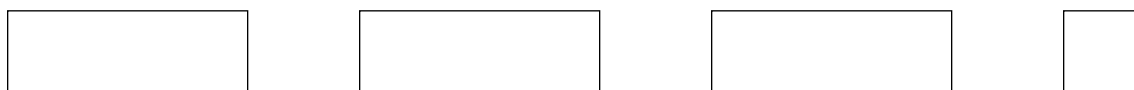
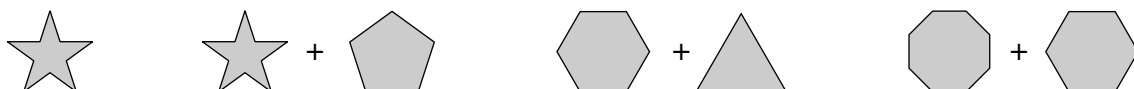
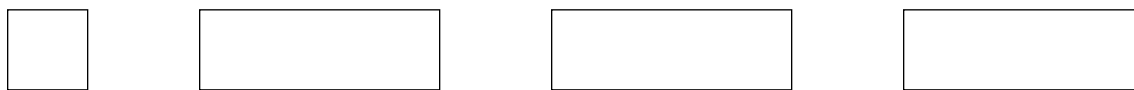


Answers: 1–3. See Answer Key. 4. 6 5. 5 6. D

Chapter 9 Review

Polygon Code

The students in the math club have come up with a secret code for sending messages. The code is based on the number of sides of different polygons, along with addition and subtraction symbols. Use the table below to help you decode the message. Each box is a letter represented by the shaded polygons below it.



Number	Letter	Number	Letter	Number	Letter	Number	Letter
1	A	8	H	15	O	21	U
2	B	9	I	16	P	22	V
3	C	10	J	17	Q	23	W
4	D	11	K	18	R	24	X
5	E	12	L	19	S	25	Y
6	F	13	M	20	T	26	Z
7	G	14	N				

Answers are located on page 115.