Big Ideas Math: Geometry
Chapter Summary

Chapter 7: Quadrilaterals and Other Polygons

Core Vocabulary

A *diagonal* of a polygon is a segment that joins two nonconsecutive vertices.

A polygon in which all sides are congruent is called an *equilateral polygon*.

A polygon in which all angles are congruent is called an *equiangular polygon*.

A *regular polygon* is a convex polygon that is both equilateral and equiangular.

A *parallelogram* is a quadrilateral in which both pairs of opposite sides are parallel.

A *rhombus* is a parallelogram with four congruent sides.

A *rectangle* is a parallelogram with four right angles.

A *square* is a parallelogram with four congruent sides and four right angles.

A *trapezoid* is a quadrilateral with exactly one pair of parallel sides.

The parallel sides of a trapezoid are the *bases of a trapezoid*.

Base angles of a trapezoid are two consecutive angles whose common side is a base.

The nonparallel sides of a trapezoid are the *legs of a trapezoid*.

A trapezoid with congruent legs is an *isosceles trapezoid*.

The *midsegment of a trapezoid* is the segment that connects the midpoints of its legs.

A *kite* is a quadrilateral that has two pairs of consecutive congruent sides, but opposite sides are not congruent.

Games

- What Makes Me a Parallelogram?
- It's All About the Details
- Race for Distance

This is available online in the *Game Closet* at www.bigideasmath.com.

Learning Goals

Use the interior angle measures of polygons.

Use the exterior angle measures of polygons.

Use properties to find side lengths and angles of parallelograms.

Use parallelograms in the coordinate plane.

Identify and verify parallelograms.

Show that a quadrilateral is a parallelogram in the coordinate plane.

Use properties of special parallelograms.

Use properties of diagonals of special parallelograms.

Use coordinate geometry to identify special types of parallelograms.

Use properties of trapezoids.

Use the Trapezoid Midsegment Theorem to find distances.

Use properties of kites.

Identify quadrilaterals.

Standards

Common Core:
HSG-CO.C.11, HSG-SRT.B.5, HSG-MG.A.1, HSG-MG.A.3

Corollaries

Corollary 7.1 Corollary to the Polygon Interior Angles Theorem
The sum of the measures of the interior angles of a quadrilateral is 360°.

Corollary 7.2 Rhombus Corollary
A quadrilateral is a rhombus if and only if it has four congruent sides.

Corollary 7.3 Rectangle Corollary
A quadrilateral is a rectangle if and only if it has four right angles.

Corollary 7.4 Square Corollary
A quadrilateral is a square if and only if it is a rhombus and a rectangle.

Essential Questions

What is the sum of the measures of the interior angles of a polygon?

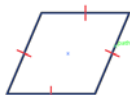What are the properties of parallelograms?

How can you prove that a quadrilateral is a parallelogram?

What are the properties of the diagonals of rectangles, rhombuses, and squares?

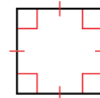What are some properties of trapezoids and kites?

Core Concept

Rhombuses, Rectangles, and Squares

A **rhombus** is a parallelogram with four congruent sides.

A **rectangle** is a parallelogram with four right angles.

A **square** is a parallelogram with four congruent sides and four right angles.

🌀 Theorems

7.1 Polygon Interior Angles Theorem
The sum of the measures of the interior angles of a convex n-gon is $(n-2) \cdot 180°$.

7.2 Polygon Exterior Angles Theorem
The sum of the measures of the exterior angles of a convex polygon, one angle at each vertex, is 360°.

7.3 Parallelogram Opposite Sides Theorem
If a quadrilateral is a parallelogram, then its opposite sides are congruent.

7.4 Parallelogram Opposite Angles Theorem
If a quadrilateral is a parallelogram, then its opposite angles are congruent.

7.5 Parallelogram Consecutive Angles Theorem
If a quadrilateral is a parallelogram, then its consecutive angles are supplementary.

7.6 Parallelogram Diagonals Theorem
If a quadrilateral is a parallelogram, then its diagonals bisect each other.

7.7 Parallelogram Opposite Sides Converse
If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

7.8 Parallelogram Opposite Angles Converse
If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

7.9 Opposite Sides Parallel and Congruent Theorem
If one pair of opposite sides of a quadrilateral are congruent and parallel, then the quadrilateral is a parallelogram.

7.10 Parallelogram Diagonals Converse
If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.

7.11 Rhombus Diagonals Theorem
A parallelogram is a rhombus if and only if its diagonals are perpendicular.

7.12 Rhombus Opposite Angles Theorem
A parallelogram is a rhombus if and only if each diagonal bisects a pair of opposite angles.

7.13 Rectangle Diagonals Theorem
A parallelogram is a rectangle if and only if its diagonals are congruent.

7.14 Isosceles Trapezoid Base Angles Theorem
If a trapezoid is isosceles, then each pair of base angles is congruent.

7.15 Isosceles Trapezoid Base Angles Converse
If a trapezoid has a pair of congruent base angles, then it is an isosceles trapezoid.

7.16 Isosceles Trapezoid Diagonals Theorem
A trapezoid is isosceles if and only if its diagonals are congruent.

7.17 Trapezoid Midsegment Theorem
The midsegment of a trapezoid is parallel to each base, and its length is one-half the sum of the lengths of the bases.
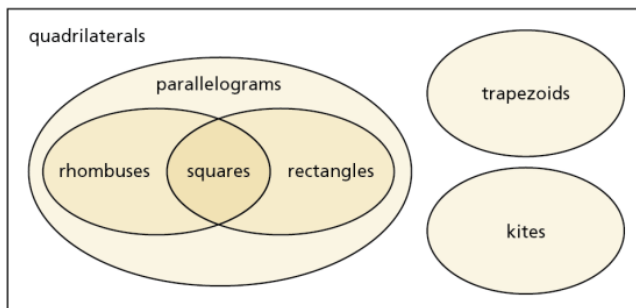
7.18 Kite Diagonals Theorem
If a quadrilateral is a kite, then its diagonals are perpendicular.

7.19 Kite Opposite Angles Theorem
If a quadrilateral is a kite, then exactly one pair of opposite angles are congruent.

🌀 Core Concept

Classifications of Quadrilaterals

Ways to Prove a Quadrilateral is a Parallelogram

1. Show that both pairs of opposite sides are parallel. *(Definition)*	
2. Show that both pairs of opposite sides are congruent. *(Parallelogram Opposite Sides Converse)*	
3. Show that both pairs of opposite angles are congruent. *(Parallelogram Opposite Angles Converse)*	
4. Show that one pair of opposite sides are congruent and parallel. *(Opposite Sides Parallel and Congruent Theorem)*	
5. Show that the diagonals bisect each other. *(Parallelogram Diagonals Converse)*	

What's the Point?

The STEM Videos available online show ways to use mathematics in real-life situations.

The Chapter 7: Diamonds STEM Video is available online at www.bigideasmath.com.

Additional Review

- Using Parallelograms in the Coordinate Plane, *p. 371*
- Showing That a Quadrilateral Is a Parallelogram in the Coordinate Plane, *p. 380*
- Relationships between Special Parallelograms, *p. 389*
- Identifying Special Parallelograms in the Coordinate Plane, *p. 392*
- Showing That a Quadrilateral Is a Trapezoid in the Coordinate Plane, *p. 398*
- Identifying Special Quadrilaterals, *p. 402*