# Chapter 4

# Quadrilaterals

## 4.1 Properties of a Parallelogram

Definitions

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

23. An **altitude** of a parallelogram is the line segment from one vertex that is perpendicular to a nonadjacent side (or to an extension of that side).

## Theorems, Corollaries and Lemmas

4.1.1 A diagonal of a parallelogram separates it into two congruent triangles.

4.1.2 The opposite angles of a parallelogram are congruent.

4.1.3 The opposite sides of a parallelogram are congruent.

4.1.4 The diagonals of a parallelogram bisect each other.

4.1.5 Two consecutive angles of a parallelogram are supplementary.

4.1.6 Two parallel lines are everywhere equidistant.

4.1.7 If two sides of one triangle are congruent to two sides of a second triangle and the included angle of the first triangle is greater than the included angle of the second, then the length of the side opposite the included angle of the first triangle is greater than the length of the side opposite the included angle of the second.

4.1.8 In a parallelogram with unequal pairs of consecutive angles, the longer diagonal lies opposite the obtuse angle.

# 4.2 The Parallelogram and Kite

## Definitions

24. A **kite** is a quadrilateral with two distinct pairs of congruent adjacent sides.

## Theorems, Corollaries and Lemmas

4.2.1 If two sides of a quadrilateral are both congruent and parallel, then the quadrilateral is a parallelogram.

4.2.2 If both pairs of opposite sides of a quadrilateral are congruent, then it is a parallelogram.

4.2.3 If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.

4.2.4 In a kite, one pair of opposite angles are congruent.

4.2.5 The segment that joins the midpoints of two sides of a triangle is parallel to the third side and has length equal to one-half the length of the third side.

# 4.3 The Rectangle, Square, and Rhombus

## Definitions

25. A **rectangle** is a parallelogram with one right angle.

26. A **square** is a rectangle with two congruent adjacent sides.

27. A **rhombus** is a parallelogram with two congruent adjacent sides.

## Theorems, Corollaries and Lemmas

4.3.1 All angles of a rectangle are right angles.

4.3.2 The diagonals of a rectangle are congruent.

4.3.3 All sides of a square are congruent.

4.3.4 All sides of a rhombus are congruent.

4.3.5 The diagonals of a rhombus are perpendicular.

# 4.4 The Trapezoid

## Definitions

28. A **trapezoid** is a quadrilateral with exactly two parallel sides.

29. An **altitude** of a trapezoid is a line segment from one vertex of one base of the trapezoid, perpendicular to the opposite base (or an extension of that base).

## Theorems, Corollaries and Lemmas

4.4.1 The base angles of an isosceles trapezoid are congruent.

4.4.2 The diagonals of an isosceles trapezoid are congruent.

4.4.3 The length of the median of a trapezoid equals one-half the sum of the lengths of the two bases.

4.4.4 The median of a trapezoid is parallel to each base.

4.4.5 If two base angles of a trapezoid are congruent, the trapezoid is isosceles.

4.4.6 If the diagonals of a trapezoid are congruent, the trapezoid is isosceles.

4.4.7 If three (or more) parallel lines intercept congruent line segments on one transversal, then they intercept congruent line segments on any transversal.