Parallelograms

Objectives

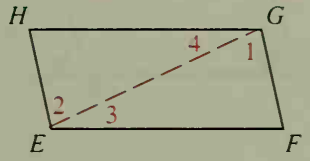
1. Apply the definition of a parallelogram and the theorems about properties of a parallelogram.
2. Prove that certain quadrilaterals are parallelograms.
3. Apply theorems about parallel lines and the segment that joins the midpoints of two sides of a triangle.

5-1 *Properties of Parallelograms*

A **parallelogram** ($\square$) is a quadrilateral with both pairs of opposite sides parallel. The following theorems state some properties common to all parallelograms. Your proofs of these theorems (Written Exercises 13–15) will be based on what you have learned about parallel lines and congruent triangles.

Theorem 5-1

Opposite sides of a parallelogram are congruent.



Given: $\square EFGH$

Prove: $\overline{EF} \cong \overline{HG}$; $\overline{FG} \cong \overline{EH}$

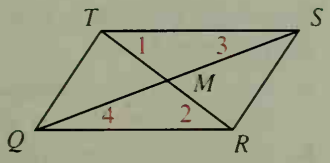
Plan for Proof: Draw $\overline{EG}$ to form triangles with corresponding sides $\overline{EF}$ and $\overline{HG}$, $\overline{FG}$ and $\overline{EH}$. Use the pairs of alternate interior angles $\angle 1$ and $\angle 2$, $\angle 3$ and $\angle 4$, to prove the triangles congruent by ASA.

Theorem 5-2

Opposite angles of a parallelogram are congruent.

Theorem 5-3

Diagonals of a parallelogram bisect each other.



Given: $\square QRST$ with diagonals $\overline{QS}$ and $\overline{TR}$

Prove: $\overline{QS}$ and $\overline{TR}$ bisect each other.

Plan for Proof: You can prove that $\overline{QM} \cong \overline{MS}$ and $\overline{RM} \cong \overline{MT}$ by showing that they are corresponding parts of congruent triangles. Since $\overline{QR} \cong \overline{TS}$ by Theorem 5-1, you can show that $\triangle QMR \cong \triangle SMT$ by ASA.