Chapter 6
Quadrilaterals

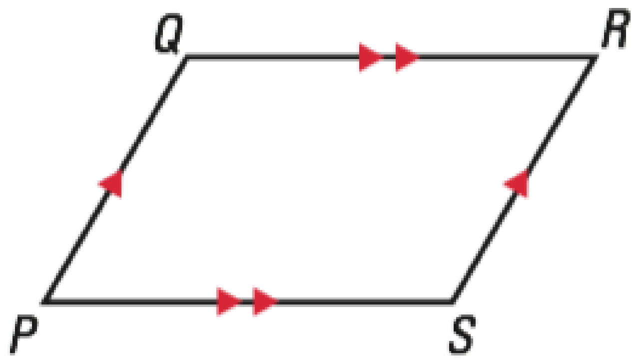
Section 2
Properties of Parallelograms

GOAL 1: Properties of Parallelograms

In this lesson and in the rest of the chapter you will study special quadrilaterals.

A ___parallelogram___ is a quadrilateral with both pairs of opposite sides parallel.

When you mark diagrams of quadrilaterals, use matching arrowheads to indicate which sides are parallel. For example, in the diagram at the right, PQ || RS and QR || SP. The symbol ▱ PQRS is read "parallelogram PQRS."

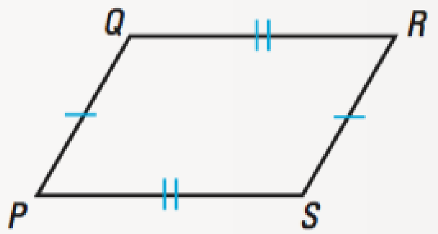


THEOREMS ABOUT PARALLELOGRAMS

THEOREM 6.2

If a quadrilateral is a parallelogram, then its opposite sides are congruent.

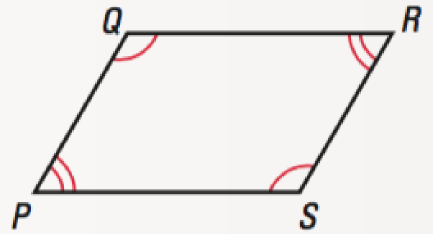
$\overline{PQ} \cong \overline{RS}$ and $\overline{SP} \cong \overline{QR}$



THEOREM 6.3

If a quadrilateral is a parallelogram, then its opposite angles are congruent.

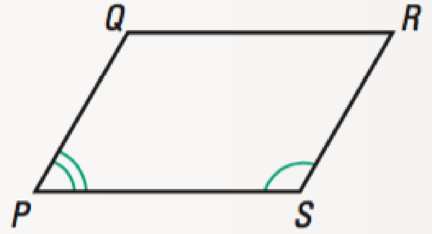
$\angle P \cong \angle R$ and $\angle Q \cong \angle S$



THEOREM 6.4

If a quadrilateral is a parallelogram, then its consecutive angles are supplementary.

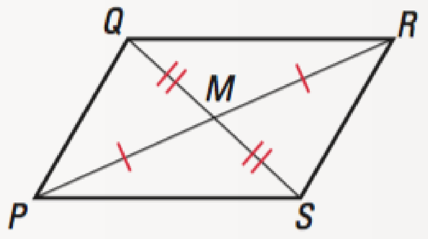
$m\angle P + m\angle Q = 180°$, $m\angle Q + m\angle R = 180°$,
$m\angle R + m\angle S = 180°$, $m\angle S + m\angle P = 180°$



THEOREM 6.5

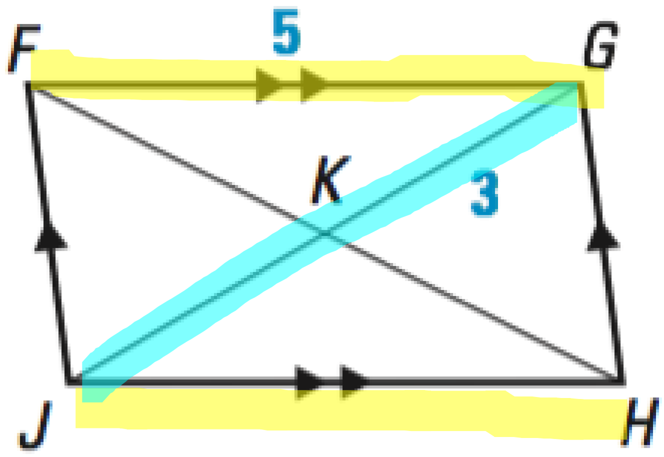
If a quadrilateral is a parallelogram, then its diagonals bisect each other.

$\overline{QM} \cong \overline{SM}$ and $\overline{PM} \cong \overline{RM}$



Example 1: Using Properties of Parallelograms

FGHJ is a parallelogram. Find the unknown lengths. Explain your reasoning.



a) JH → 5; opposite sides are congruent

b) JK → 3; diagonals bisect each other

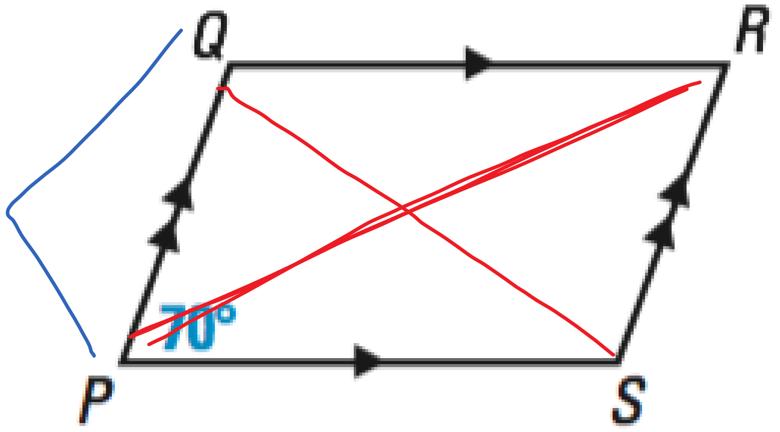
Example 2: Using Properties of Parallelograms

PQRS is a parallelogram. Find the missing angle measures.

a) m<R → 70* (same as <P)

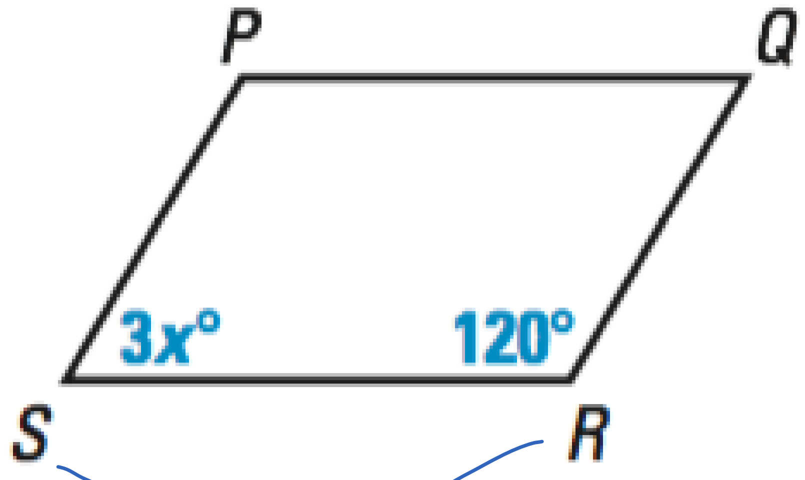
b) m<Q → 110* (180 – 70)

c) m<S → 110* (same as <Q)



Example 3: Using Algebra with Parallelogram

PQRS is a parallelogram. Find the value of x.



$\underbrace{}_{180}$

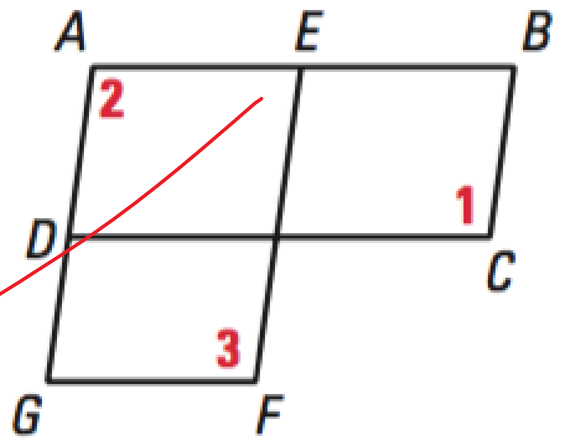
$$3x + \cancel{120} = 180$$
$$\quad -\cancel{120} \qquad -120$$

$$\frac{\cancel{3}x}{\cancel{3}} = \frac{60}{3}$$

$$x = 20$$

GOAL 2: Reasoning About Parallelograms

Example 4: Proving Facts about Parallelograms



Given: ABCD and AEFG are parallelograms.

Prove: $\angle 1 \cong \angle 3$

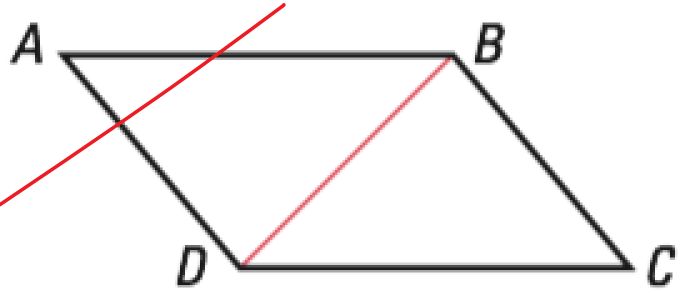
Plan: Show that both angles are congruent to $\angle 2$. Then use the transitive property.

Statements	Reasons
1)	
2)	
3)	

Example 5: Proving Theorem 6.2

Given: ABCD is a parallelogram

Prove: $\overline{AB} \cong \overline{CD}$, $\overline{AD} \cong \overline{CB}$

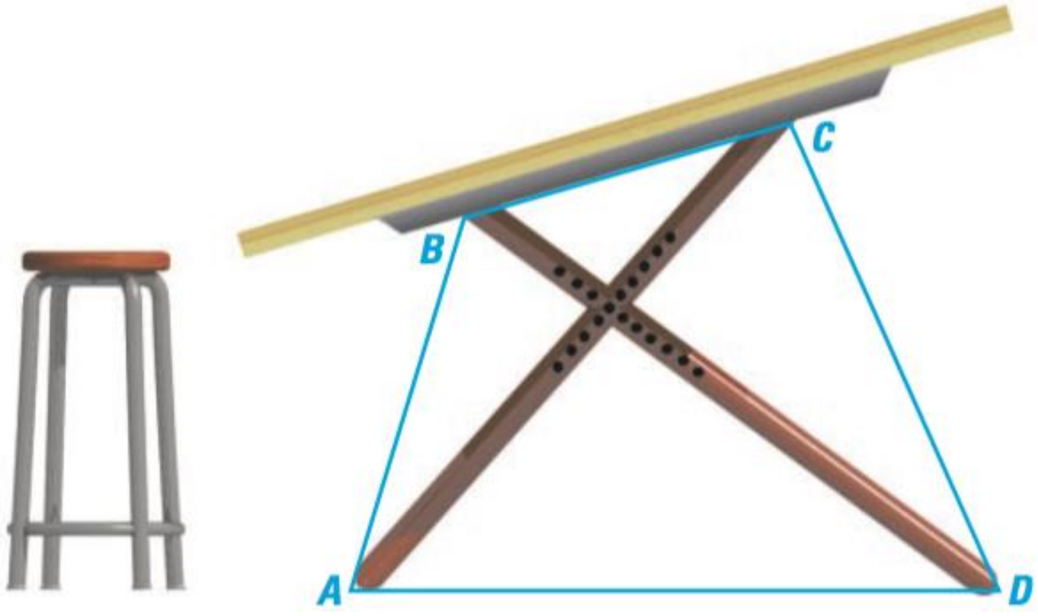


Statements	Reasons
1)	
2)	
3)	
4)	
5)	
6)	
7)	

Example 6: Using Parallelograms in Real Life

Furniture Design: A drafting table is made so that the legs can be joined in different ways to change the slope of the drawing surface. In the arrangement below, the legs AC and BD do *not* bisect each other. Is ABCD a parallelogram?

No, 6.5 states the diagonals DO need to bisect, but in this figure they don't.



EXIT SLIP