Name ______________________________ Date ______________

LESSON 8.3

Study Guide

For use with pages 522–529

GOAL **Use properties to identify parallelograms.**

Vocabulary

Theorem 8.7: If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

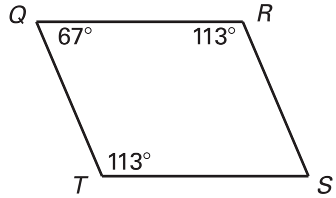
Theorem 8.8: If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

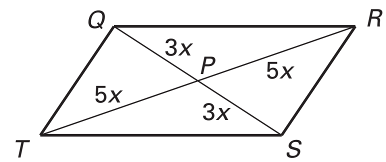
Theorem 8.9: If one pair of opposite sides of a quadrilateral are congruent and parallel, then the quadrilateral is a parallelogram.

Theorem 8.10: If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.

EXAMPLE 1 Identify parallelograms

Explain how you know that quadrilateral *QRST* is a parallelogram.

a. 

b. 

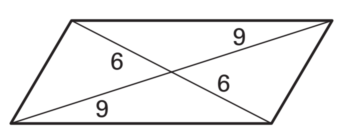
Solution

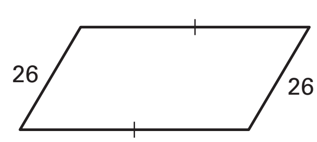
a. By the Corollary to Theorem 8.1 you know that $m\angle Q + m\angle R + m\angle S + m\angle T = 360°$, so $m\angle Q = 67°$. Because both pairs of opposite angles are congruent, then *QRST* is a parallelogram by Theorem 8.8.

b. In the diagram, $QP = PS$ and $RP = PT$. So, the diagonals bisect each other, and *QRST* is a parallelogram by Theorem 8.10.

Exercises for Example 1

Which theorem can be used to show that the quadrilateral is a parallelogram?

1. 

2. 

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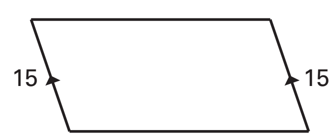
4. 

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Study Guide *continued*

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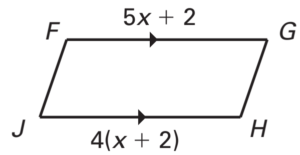
EXAMPLE 2 Use algebra with parallelograms

For what value of *x* is quadrilateral *FGHJ* a parallelogram?



Solution

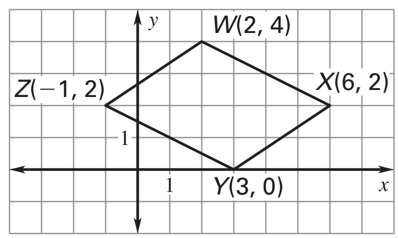
By Theorem 8.9, if one pair of opposite sides of a quadrilateral are congruent and parallel, then the quadrilateral is a parallelogram. From the diagram, $\overline{FG} \parallel \overline{JH}$. Find x so that $\overline{FG} \cong \overline{JH}$.

$FG = JH$	Set the segment lengths equal.
$5x + 2 = 4(x + 2)$	Substitute.
$5x + 2 = 4x + 8$	Distributive Property
$x = 6$	Solve for x.

When $x = 6$, $FG = 5(6) + 2 = 32$ and $JH = 4(6 + 2) = 32$. So, $FGHJ$ is a parallelogram when $x = 6$.

EXAMPLE 3 Use coordinate geometry

Show that quadrilateral *WXYZ* is a parallelogram.



Solution

STEP 1 Use the Distance Formula to show that $\overline{WX}$ and $\overline{YZ}$ are congruent.

$WX = \sqrt{(6 - 2)^2 + (2 - 4)^2} = 2\sqrt{5}$ $\quad YZ = \sqrt{(-1 - 3)^2 + (2 - 0)^2} = 2\sqrt{5}$

Because $WX = YZ = 2\sqrt{5}$, $\overline{WX} \cong \overline{YZ}$.

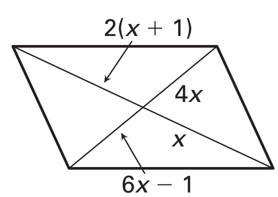
STEP 2 Use the slope formula to show that $\overline{WX} \parallel \overline{YZ}$.

Slope of $\overline{WX} = \frac{2 - 4}{6 - 2} = -\frac{1}{2}$ $\quad$ Slope of $\overline{YZ} = \frac{2 - 0}{-1 - 3} = -\frac{1}{2}$

Because $\overline{WX}$ and $\overline{YZ}$ have the same slope, they are parallel.

$\overline{WX}$ and $\overline{YZ}$ are congruent and parallel. So, $WXYZ$ is a parallelogram by Theorem 8.9.

Exercises for Examples 2 and 3



5. In the diagram at the right, what value of x makes the quadrilateral a parallelogram?

6. The vertices of $LMNO$ are $L(-4, 2)$, $M(-5, -2)$, $N(-1, -4)$, and $O(0, 0)$. Show that $LMNO$ is a parallelogram.

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