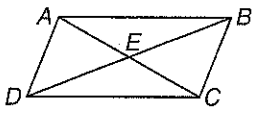
NAME _____ DATE _____ PERIOD _____

8-3 Study Guide and Intervention

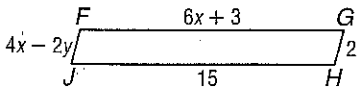
Tests for Parallelograms

Conditions for a Parallelogram There are many ways to establish that a quadrilateral is a parallelogram.



If:	If:
both pairs of opposite sides are parallel,	$\overline{AB} \parallel \overline{DC}$ and $\overline{AD} \parallel \overline{BC}$,
both pairs of opposite sides are congruent,	$\overline{AB} \cong \overline{DC}$ and $\overline{AD} \cong \overline{BC}$,
both pairs of opposite angles are congruent,	$\angle ABC \cong \angle ADC$ and $\angle DAB \cong \angle BCD$,
the diagonals bisect each other,	$\overline{AE} \cong \overline{CE}$ and $\overline{DE} \cong \overline{BE}$,
one pair of opposite sides is congruent and parallel,	$\overline{AB} \parallel \overline{CD}$ and $\overline{AB} \cong \overline{CD}$, or $\overline{AD} \parallel \overline{BC}$ and $\overline{AD} \cong \overline{BC}$,
then: the figure is a parallelogram.	**then:** *ABCD* is a parallelogram.

Example **Find x and y so that $FGHJ$ is a parallelogram.**



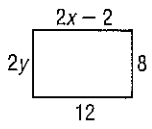
$FGHJ$ is a parallelogram if the lengths of the opposite sides are equal.

$6x + 3 = 15$ $\quad$ $4x - 2y = 2$
$6x = 12$ $\quad$ $4(2) - 2y = 2$
$x = 2$ $\quad$ $8 - 2y = 2$
$-2y = -6$
$y = 3$

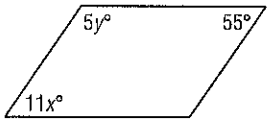
Exercises

Find x and y so that each quadrilateral is a parallelogram.

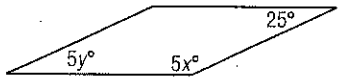
1.



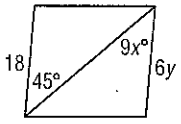
2.



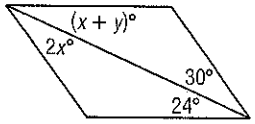
3.



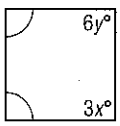
4.



5.



6.



Lesson 8-3

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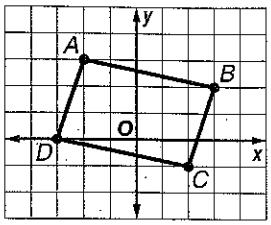
8-3 Study Guide and Intervention *(continued)*

Tests for Parallelograms

Parallelograms on the Coordinate Plane On the coordinate plane, the Distance Formula and the Slope Formula can be used to test if a quadrilateral is a parallelogram.

Example **Determine whether *ABCD* is a parallelogram.**



The vertices are $A(-2, 3)$, $B(3, 2)$, $C(2, -1)$, and $D(-3, 0)$.

Method 1: Use the Slope Formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$.

slope of $\overline{AD} = \frac{3 - 0}{-2 - (-3)} = \frac{3}{1} = 3$ slope of $\overline{BC} = \frac{2 - (-1)}{3 - 2} = \frac{3}{1} = 3$

slope of $\overline{AB} = \frac{2 - 3}{3 - (-2)} = -\frac{1}{5}$ slope of $\overline{CD} = \frac{-1 - 0}{2 - (-3)} = -\frac{1}{5}$

Opposite sides have the same slope, so $\overline{AB} \parallel \overline{CD}$ and $\overline{AD} \parallel \overline{BC}$. Both pairs of opposite sides are parallel, so *ABCD* is a parallelogram.

Method 2: Use the Distance Formula, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

$AB = \sqrt{(-2 - 3)^2 + (3 - 2)^2} = \sqrt{25 + 1}$ or $\sqrt{26}$

$CD = \sqrt{(2 - (-3))^2 + (-1 - 0)^2} = \sqrt{25 + 1}$ or $\sqrt{26}$

$AD = \sqrt{(-2 - (-3))^2 + (3 - 0)^2} = \sqrt{1 + 9}$ or $\sqrt{10}$

$BC = \sqrt{(3 - 2)^2 + (2 - (-1))^2} = \sqrt{1 + 9}$ or $\sqrt{10}$

Both pairs of opposite sides have the same length, so *ABCD* is a parallelogram.

Exercises

Determine whether a figure with the given vertices is a parallelogram. Use the method indicated.

1. $A(0, 0)$, $B(1, 3)$, $C(5, 3)$, $D(4, 0)$; Slope Formula

2. $D(-1, 1)$, $E(2, 4)$, $F(6, 4)$, $G(3, 1)$; Slope Formula

5. $S(-2, 4)$, $T(-1, -1)$, $U(3, -4)$, $V(2, 1)$; Distance and Slope Formulas

7. A parallelogram has vertices $R(-2, -1)$, $S(2, 1)$, and $T(0, -3)$. Find all possible coordinates for the fourth vertex.

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8-3 Study Guide and Intervention

Tests for Parallelograms

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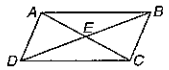

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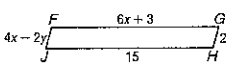

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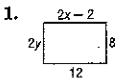
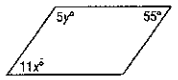
Exercises

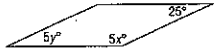
Find x and y so that each quadrilateral is a parallelogram.

1. 

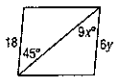
$x = 7$; $y = 4$

2. 

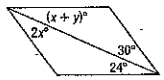
$x = 5$; $y = 25$

3. 

$x = 31$; $y = 5$

4. 

$x = 5$; $y = 3$

5. 

$x = 15$; $y = 9$

6. 

$x = 30$; $y = 15$

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8-3 Study Guide and Intervention *(continued)*

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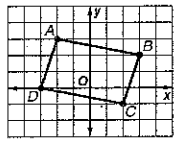

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   yes

2. $D(-1, 1)$, $E(2, 4)$, $F(6, 4)$, $G(3, 1)$; Slope Formula
   yes

3. $R(-1, 0)$, $S(3, 0)$, $T(2, -3)$, $U(-3, -2)$; Distance Formula
   no

4. $A(-3, 2)$, $B(-1, 4)$, $C(2, 1)$, $D(0, -1)$; Distance and Slope Formulas
   yes

5. $S(-2, 4)$, $T(-1, -1)$, $U(3, -4)$, $V(2, 1)$; Distance and Slope Formulas
   yes

6. $F(3, 3)$, $G(1, 2)$, $H(-3, 1)$, $I(-1, 4)$; Midpoint Formula
   no

7. A parallelogram has vertices $R(-2, -1)$, $S(2, 1)$, and $T(0, -3)$. Find all possible coordinates for the fourth vertex.
   $(4, -1)$, $(0, 3)$, or $(-4, -5)$