6-3 Proving That a Quadrilateral Is a Parallelogram

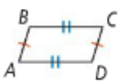
Content Standards
G.CO.11 Prove theorems about parallelograms . . . the diagonals of a parallelogram bisect each other and its converse . . .
Also G.SRT.5

Objective To determine whether a quadrilateral is a parallelogram

take note — Theorem 6-8

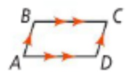
Theorem
If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

If . . .



$\overline{AB} \cong \overline{CD}$
$\overline{BC} \cong \overline{DA}$

Then . . .
$ABCD$ is a ▱



take note — Theorem 6-9

Theorem
If an angle of a quadrilateral is supplementary to both of its consecutive angles, then the quadrilateral is a parallelogram.

If . . .

$m\angle A + m\angle B = 180$
$m\angle A + m\angle D = 180$

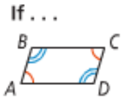
Then . . .
$ABCD$ is a ▱

You will prove Theorem 6-9 in Exercise 21.

Theorem 6-10

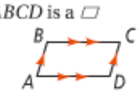
Theorem
If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

If . . .

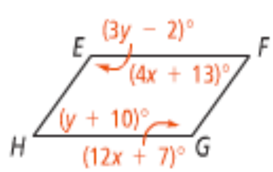


$\angle A \cong \angle C$
$\angle B \cong \angle D$

Then . . .
$ABCD$ is a ▱



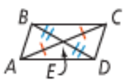
Got It? **1.** Use the diagram at the right. For what values of x and y must $EFGH$ be a parallelogram?



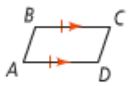
$3y - 2 + y + 10 = 180$
$4y + 8 = 180$
$4y = 172$
$y = 43$

$4x + 13 + 12x + 7 = 180$
$16x + 20 = 180$
$16x = 160$
$x = 10$

take note — Theorem 6-11

Theorem	If . . .	Then . . .
If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.	 $\overline{AE} \cong \overline{CE}$ $\overline{BE} \cong \overline{DE}$	$ABCD$ is a ▱ 

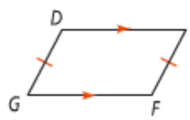
take note — Theorem 6-12

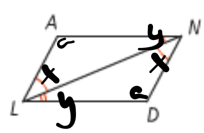
Theorem	If . . .	Then . . .
If one pair of opposite sides of a quadrilateral is both congruent and parallel, then the quadrilateral is a parallelogram.	 $\overline{BC} \cong \overline{DA}$ $\overline{BC} \parallel \overline{DA}$	$ABCD$ is a ▱ 

Got It? **2.** Can you prove that the quadrilateral is a parallelogram based on the given information? Explain.

a. Given: $\overline{EF} \cong \overline{GD}$, $\overline{DE} \parallel \overline{FG}$
Prove: $DEFG$ is a parallelogram.

b. Given: $\angle ALN \cong \angle DNL$, $\angle ANL \cong \angle DLN$
Prove: $LAND$ is a parallelogram.



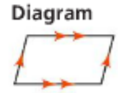
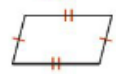
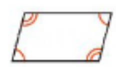
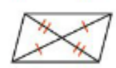
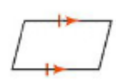


$x + y = m\angle L$
$x + y = m\angle N$
$\angle L \cong \angle N$
$\angle A \cong \angle D$

DEFG is not a ▱ because ~~one pair~~ of opp. sides is not ~~both~~ ~~|| and ≅~~

LAND is a ▱ because both pairs of opp. ∠s are ≅

Concept Summary — Proving That a Quadrilateral Is a Parallelogram

Method	Source	Diagram
Prove that both pairs of opposite sides are parallel.	Definition of parallelogram	
Prove that both pairs of opposite sides are congruent.	Theorem 6-8	
Prove that an angle is supplementary to both of its consecutive angles.	Theorem 6-9	
Prove that both pairs of opposite angles are congruent.	Theorem 6-10	
Prove that the diagonals bisect each other.	Theorem 6-11	
Prove that one pair of opposite sides is congruent and parallel.	Theorem 6-12	

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