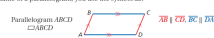


Lesson 25.1 and 25.2: Properties of Parallelograms

A quadrilateral with two pairs of parallel sides is a **parallelogram**. To write the name of a parallelogram, use the symbol \square .



Helpful Hint
Opposite sides of a quadrilateral do not have to be parallel. Opposite angles do not have to be equal.

Theorem 7-2-1 Properties of Parallelograms

THEOREM	HYPOTHESIS	CONCLUSION
If a quadrilateral is a parallelogram, then its opposite sides are congruent. (□ \rightarrow opp. sides \cong)		$\overline{AB} \cong \overline{CD}$ $\overline{AD} \cong \overline{BC}$

Theorem 7-2-2 Properties of Parallelograms

THEOREM	HYPOTHESIS	CONCLUSION
7-2-2 If a quadrilateral is a parallelogram, then its opposite angles are congruent. (□ \rightarrow opp. \angle s \cong)		$\angle A \cong \angle C$ $\angle B \cong \angle D$
7-2-3 If a quadrilateral is a parallelogram, then its consecutive angles are supplementary. (□ \rightarrow con. \angle s supp.)		$m\angle A + m\angle B = 180^\circ$ $m\angle B + m\angle C = 180^\circ$ $m\angle C + m\angle D = 180^\circ$ $m\angle D + m\angle A = 180^\circ$
7-2-4 If a quadrilateral is a parallelogram, then its diagonals bisect each other. (□ \rightarrow diag. bisect each other)		$\overline{AE} \cong \overline{CE}$ $\overline{BE} \cong \overline{DE}$

[Ex. 1] Reasoning Application

The diagram shows the parallelogram-shaped linkage that pins the frame of a race car to one wheel of the car. Find each measure.



1. PS

2. $m\angle PQR$

3. PT

YOUR TURN

In $\square CHAWL$, $m\angle A = 28$,
 $m\angle C = 50$, and $m\angle H = 74$.
Find each measure.
a. \overline{CH}
b. $m\angle NAC$
c. \overline{CH}



2]

Using Properties of Parallelograms to Find Measures

$\square ABCD$ is a parallelogram. Find each measure.

1. \overline{AD}

2. $m\angle B$

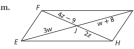


YOUR TURN $\square EFGH$ is a parallelogram.

Find each measure.

2a. \overline{FC}

2b. \overline{FH}



Theorems Conditions for Parallelograms

THEOREM	EXAMPLE
7-2-4 If one pair of opposite sides of a quadrilateral are parallel and congruent, then the quadrilateral is a parallelogram. (quad. with 1 pair of opp. sides \parallel and \cong)	
7-2-5 If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram. (quad. with opp. sides \cong)	
7-2-6 If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram. (quad. with opp. \angle s \cong)	

Remember!
In the converse of a theorem, the hypothesis and conclusion are exchanged.

The two theorems below can also be used to show that a given quadrilateral is a parallelogram.

THEOREM	EXAMPLE
7-2-4 If an angle of a quadrilateral is supplementary to both of its consecutive angles, then the quadrilateral is a parallelogram. (quad. with \angle supp. to con. \angle s \rightarrow □)	
7-2-5 If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram. (quad. with diag. bisecting each other \rightarrow □)	

[Ex. 3] Verifying Figures are Parallelograms

1. Show that $\square ABCD$ is a parallelogram for $a = 2$ and $b = 6$.



2. Show that $\square EFGH$ is a parallelogram for $z = 11$ and $w = 4.5$.



YOUR TURN

1. Show that PQRS is a parallelogram for $a = 2.4$ and $b = 9$.



Helpful Hint
To show that a quadrilateral is a parallelogram, you only have to show that 1 of the 4 conditions of the theorem.

Conditions for Parallelograms
Both pairs of opposite sides are parallel (definition).
One pair of opposite sides are parallel and congruent. (Theorem 7-2-4)
Both pairs of opposite sides are congruent. (Theorem 7-2-5)
Both pairs of opposite angles are congruent. (Theorem 7-2-6)
One angle is supplementary to both of its consecutive angles. (Theorem 7-2-4)
The diagonals bisect each other. (Theorem 7-2-5)