

8.3 Show that a Quadrilateral is a Parallelogram

Lesson 8.2 showed us characteristics of parallelograms.

The theorems told us if the figure was a parallelogram, then we knew:



In this lesson, we will know the characteristic,
then we can prove it is a parallelogram.

So, we are dealing with the _____ of the theorems from 8.2.

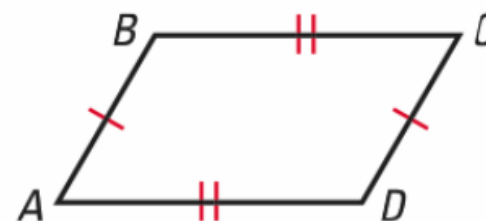
THEOREMS

For Your Notebook

THEOREM 8.7

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

If $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{AD}$, then $ABCD$ is a parallelogram.

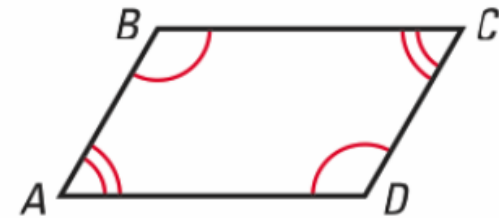


THEOREM 8.8

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

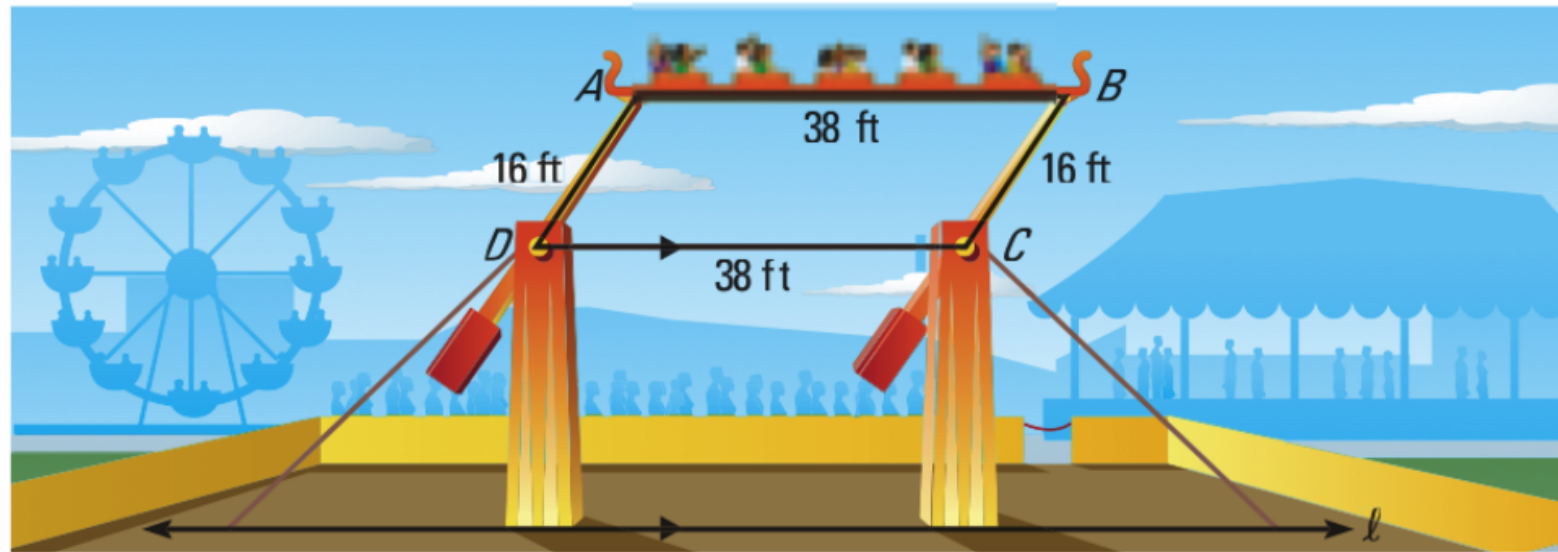
If $\angle A \cong \angle C$ and $\angle B \cong \angle D$, then $ABCD$ is a parallelogram.

Proof: Ex. 38, p. 529



EXAMPLE 1 Solve a real-world problem

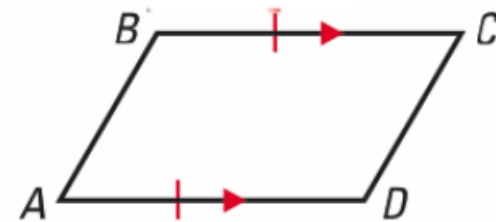
RIDE An amusement park ride has a moving platform attached to four swinging arms. The platform swings back and forth, higher and higher, until it goes over the top and around in a circular motion. In the diagram below, \overline{AD} and \overline{BC} represent two of the swinging arms, and \overline{DC} is parallel to the ground (line ℓ). Explain why the moving platform \overline{AB} is always parallel to the ground.



THEOREMS*For Your Notebook***THEOREM 8.9**

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

If $\overline{BC} \parallel \overline{AD}$ and $\overline{BC} \cong \overline{AD}$, then $ABCD$ is a parallelogram.

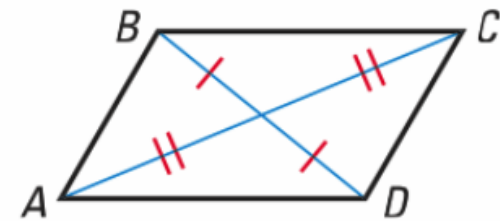


THEOREM 8.10

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

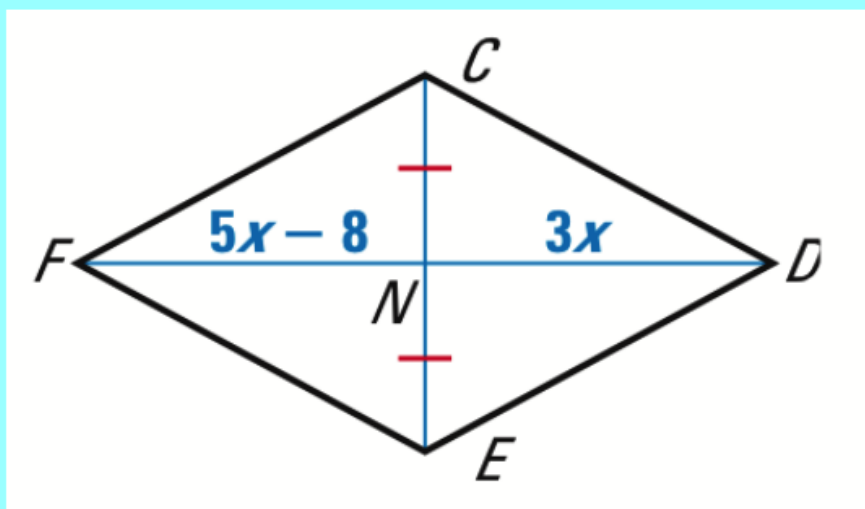
If \overline{BD} and \overline{AC} bisect each other, then $ABCD$ is a parallelogram.

Proof: Ex. 39, p. 529

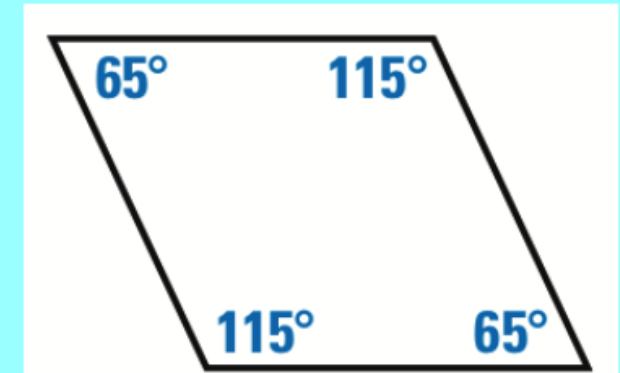
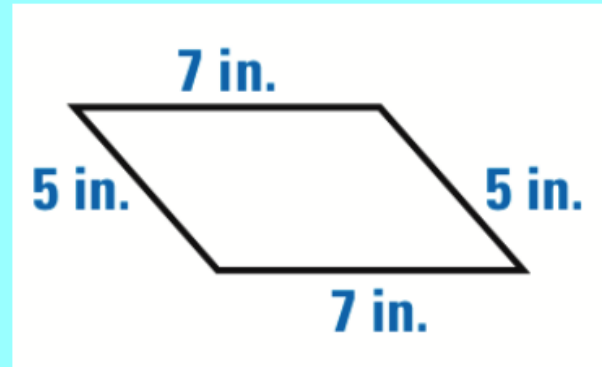
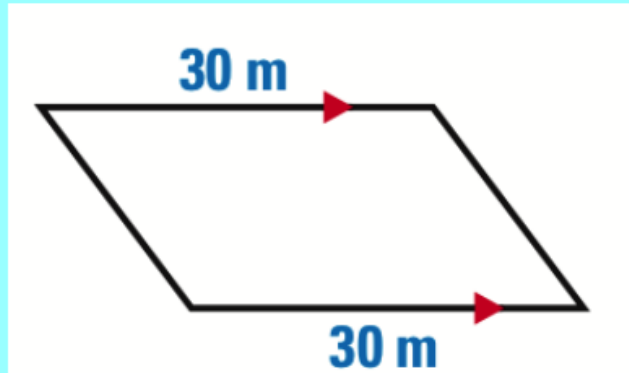


EXAMPLE 3 Use algebra with parallelograms

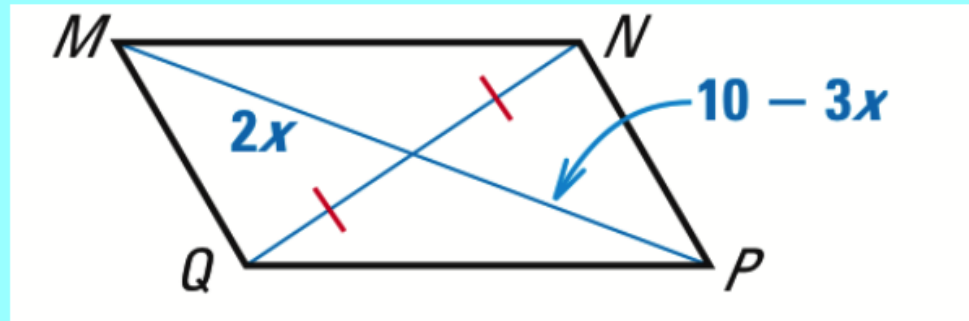
xy ALGEBRA For what value of x is quadrilateral $CDEF$ a parallelogram?



What theorem can you use to show that the quadrilateral is a parallelogram?

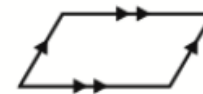


For what value of x is quadrilateral $MNPQ$ a parallelogram? *Explain*

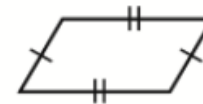


CONCEPT SUMMARY*For Your Notebook***Ways to Prove a Quadrilateral is a Parallelogram**

1. Show both pairs of opposite sides are parallel.
(*DEFINITION*)



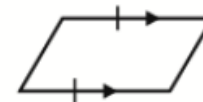
2. Show both pairs of opposite sides are congruent.
(*THEOREM 8.7*)



3. Show both pairs of opposite angles are congruent.
(*THEOREM 8.8*)



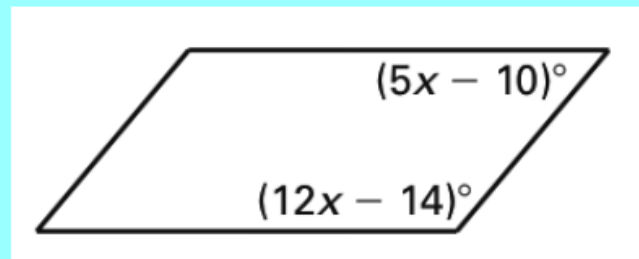
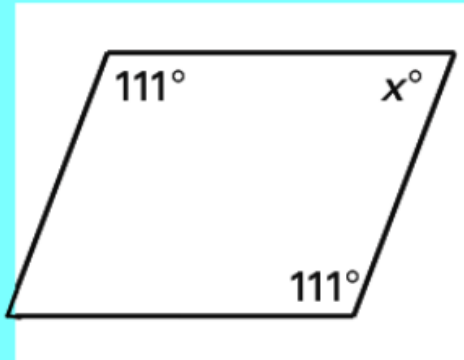
4. Show one pair of opposite sides are congruent and parallel.
(*THEOREM 8.9*)



5. Show the diagonals bisect each other.
(*THEOREM 8.10*)

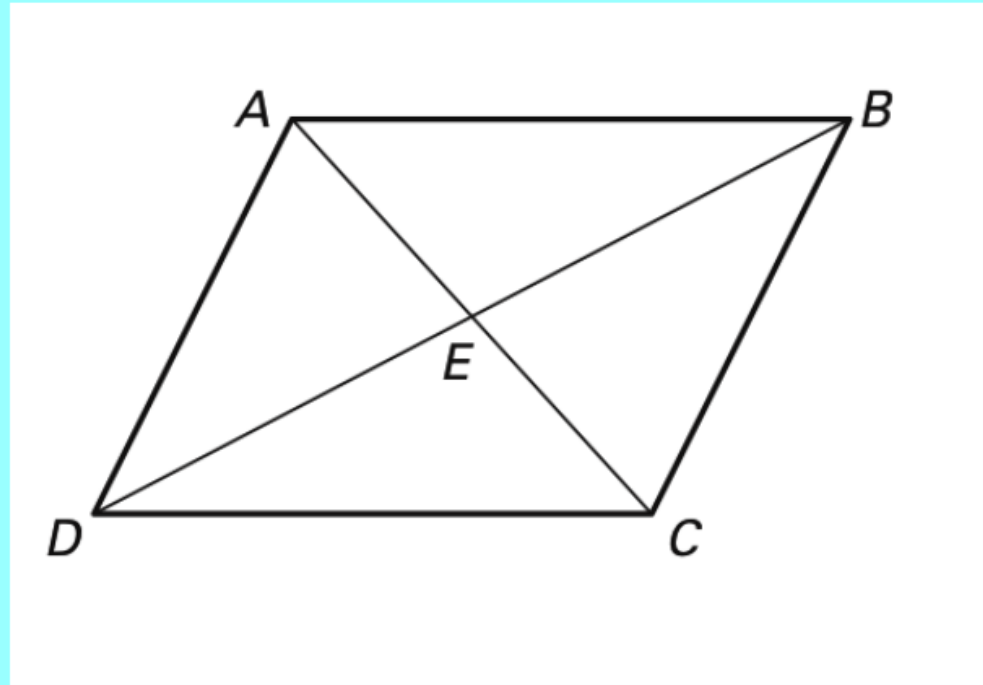


For what value of x is the quadrilateral a parallelogram?



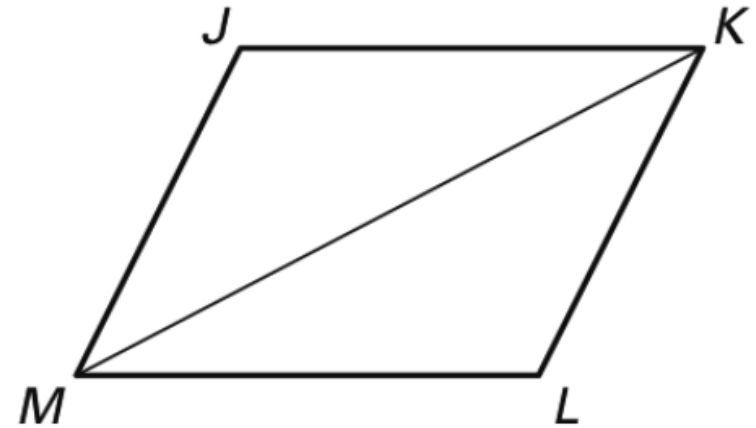
What additional information is needed in order to prove that quadrilateral $ABCD$ is a parallelogram?

15. $\overline{AB} \parallel \overline{DC}$
16. $\overline{AB} \cong \overline{DC}$
17. $\angle DCB \cong \angle DAB$
18. $\overline{DE} \cong \overline{EB}$
19. $m\angle CDA + m\angle DAB = 180^\circ$
20. $\angle DCA \cong \angle BAC$



GIVEN: $\triangle MJK \cong \triangle KLM$

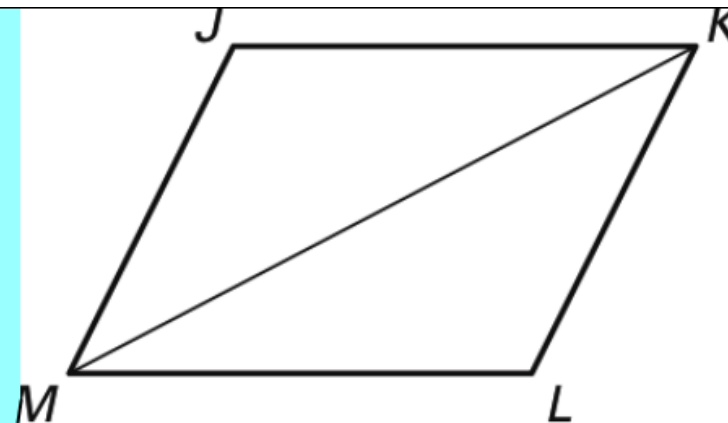
PROVE: $MJKL$ is a parallelogram.



Statements	Reasons
1. <u> ?</u>	1. Given
2. $\overline{JK} \cong \overline{LM}$ $\overline{JM} \cong \overline{LK}$	2. <u> ?</u>
3. $MJKL$ is a \square .	3. <u> ?</u>

GIVEN: $\triangle MJK \cong \triangle KLM$

PROVE: $MJKL$ is a parallelogram.



Statements

Reasons

1. ?

1. Given

2. $\overline{JK} \cong \overline{LM}$
 $\angle JKM \cong \angle KML$

2. ?

3. ?

3. Alternate Interior
 \angle 's Converse

4. $MJKL$ is a \square .

4. ?

Assignment:

p. 526 (4-6, 8-11, 15-21, 32)