IM 9–12 MATH v.1

Unit 2
Congruence

GEOMETRY

Lesson 13

Proofs about Parallelograms

Illustrative Mathematics®

Kendall Hunt

Learning Goal

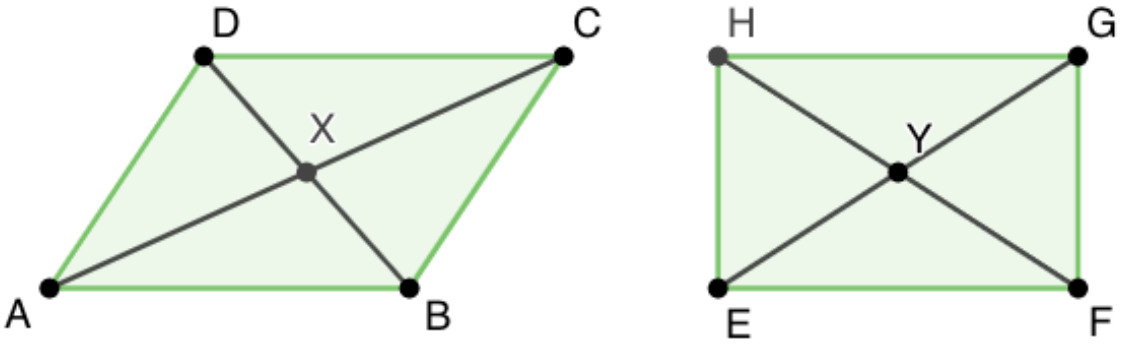
Let's prove theorems about parallelograms.

Geometry

Diagonals

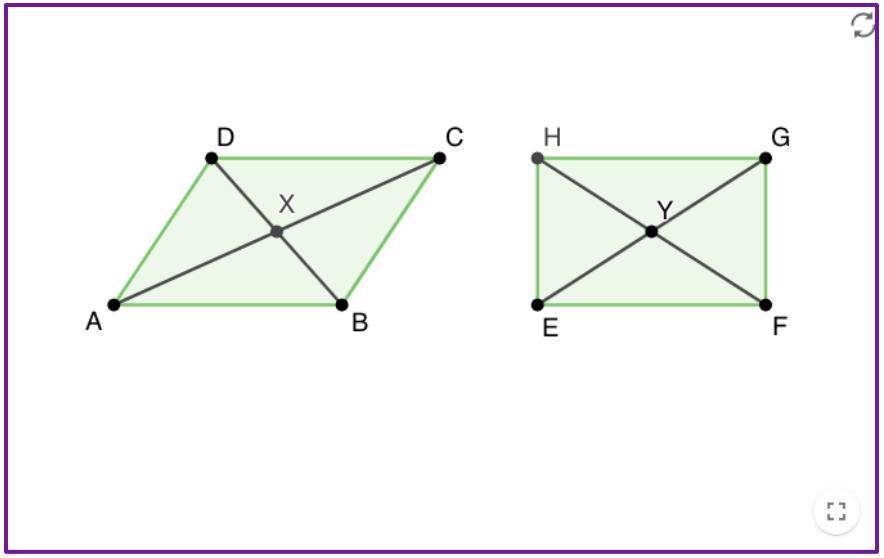
Warm-up: Notice and Wonder

Here is parallelogram *ABCD* and rectangle *EFGH*. What do you notice? What do you wonder?



Diagonals

Warm-up

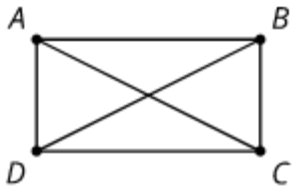


The Diagonals of a Parallelogram

Conjecture: The diagonals of a parallelogram bisect each other.

1. Use the tools available to convince yourself the conjecture is true.
2. Convince your partner that the conjecture is true for any parallelogram. Can the 2 of you think of different ways to convince each other?
3. What information is needed to prove that the diagonals of a parallelogram bisect each other?
4. Prove that segment AC bisects segment BD, and that segment BD bisects segment AC.

Work Backwards to Prove



Given: *ABCD* is a parallelogram with *AB* parallel to *CD* and *AD* parallel to *BC*. Diagonal *AC* is congruent to diagonal *BD*.

Prove: *ABCD* is a rectangle (angles *A*, B, *C*, and *D* are right angles).

With your partner, you will work backwards from the statement to the proof until you feel confident that you can prove that *ABCD* is a rectangle using only the given information.

Start with this sentence: I would know *ABCD* is a rectangle if I knew _____.

Then take turns saying this sentence: I would know [what my partner just said] if I knew _____.

Write down what you each say. If you get to a statement and get stuck, go back to an earlier statement and try to take a different path.

Proofs about Parallelograms

Lesson Synthesis

What is the converse of "If a quadrilateral is a parallelogram, then its diagonals bisect each other"?

1. A quadrilateral is a parallelogram if its diagonals bisect each other.
2. A quadrilateral is a parallelogram only if its diagonals bisect each other.

I can prove theorems about the diagonals of a parallelogram.

Learning Targets

Geometry

Backwards to Forwards

Cool-down

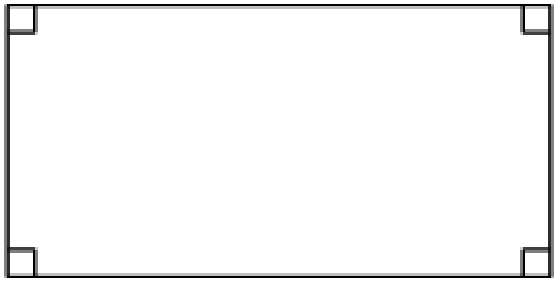
Use your notes from the Work Backwards to Prove activity to write a proof that if the diagonals of a parallelogram are congruent, that parallelogram must be a rectangle.

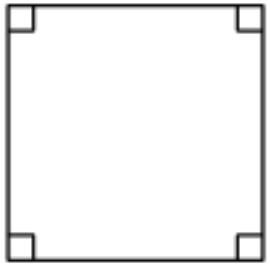
Given: $ABCD$ is a parallelogram with AB parallel to CD and AD parallel to BC. Diagonal AC is congruent to diagonal BD.

Prove: $ABCD$ is a rectangle (angles A, B, C and D are right angles).

rectangle

A quadrilateral with four right angles.





rhombus

A quadrilateral with four congruent sides.