IM 9–12 MATH v.1

Unit 2
Congruence

GEOMETRY

Lesson 12

Proofs about Quadrilaterals

Illustrative Mathematics®

Kendall Hunt

Learning Goal

Geometry

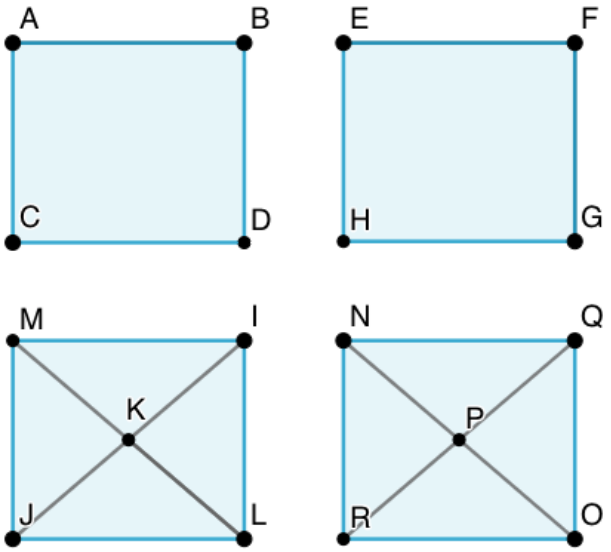
Let's prove theorems about quadrilaterals and their diagonals.

Play with Parallelograms

Warm-up

Which statement(s) do you agree with?

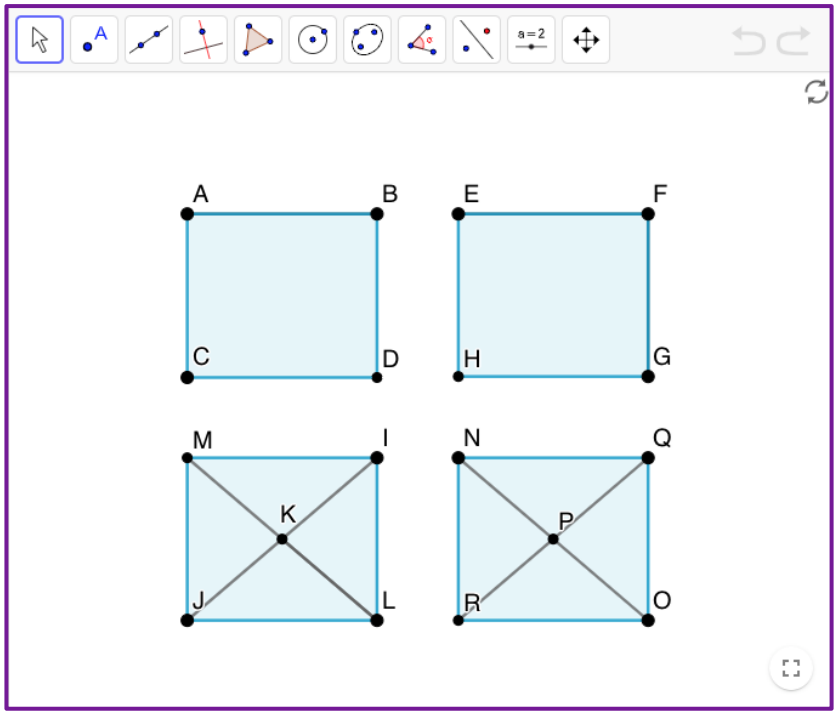
- All rectangles are parallelograms.
- All parallelograms are rectangles.



1. Which figures (if any) are always rectangles? Which figures can be dragged to make a rectangle?
2. Which figures (if any) are always parallelograms? Which figures can be dragged to make a parallelogram?

Play with Parallelograms

Warm-up



From Conjecture to Proof

Here are some conjectures:

- All rectangles are parallelograms.
- If a parallelogram has (at least) one right angle, then it is a rectangle.
- If a quadrilateral has 2 pairs of opposite sides that are congruent, then it is a parallelogram.
- If the diagonals of a quadrilateral both bisect each other, then the quadrilateral is a parallelogram.
- If the diagonals of a quadrilateral both bisect each other and they are perpendicular, then the quadrilateral is a **rhombus**.

1. Pick one conjecture and use technology to convince yourself it is true.
2. Rewrite the conjecture to identify the given information and the statement to prove.
3. Draw a diagram of the situation. Mark the given information and any information you can figure out for sure.
4. Write a rough draft of how you might prove your conjecture is true.

Checking a Proof

Exchange proofs with your partner. Read the rough draft of their proof. If it convinces you, write a detailed proof together following their plan. If it does not convince you, suggest changes that will make the proof convincing.

Proofs about Quadrilaterals

Lesson Synthesis

Conjecture: All rhombuses are parallelograms.

- Andre: If $ABCD$ is a rhombus, then it is a parallelogram.
- Clare: If $ABCD$ has four congruent sides, then the opposite sides are congruent, so it must be a parallelogram.
- Diego: If $AB \cong BC \cong CD \cong DA$ then $AB \parallel CD$.

- I can critique a proof about quadrilaterals.
- I can prove theorems about quadrilaterals.
- I can rewrite a conjecture so it is specific enough to prove.

Learning Targets

Geometry

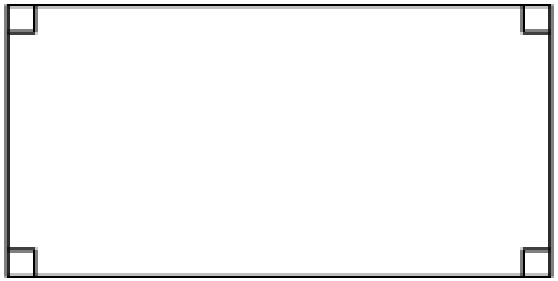
A Proof In Time Saves Nine

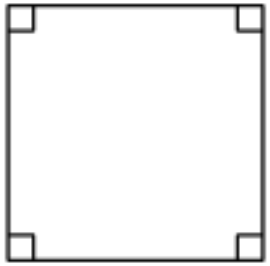
Cool-down

Elena wants to prove that a quadrilateral with 4 right angles must have congruent opposite sides. Explain to Elena how she can use the fact that all rectangles are parallelograms in her proof.

rectangle

A quadrilateral with four right angles.





rhombus

A quadrilateral with four congruent sides.