Tutorial: Proving a Quadrilateral is a Parallelogram

Slide 1:

In this tutorial we will look at ways to prove that a quadrilateral is a parallelogram. We will look at properties of the sides, properties of the angles, and properties of the diagonals.

Slide 2:

We can prove that a quadrilateral is a parallelogram if we know the properties of the sides.

The definition of a parallelogram is that both pair of parallel sides are congruent. If we know this fact about a quadrilateral, we know it is a parallelogram.

Another property is that the opposite sides of a parallelogram are congruent. If we know this fact about a quadrilateral, we know it is a parallelogram.

The last way that we can show that a quadrilateral is a parallelogram is to show that one pair of opposite sides is both parallel AND congruent. If one pair of sides is parallel and congruent, it will follow that the other pair of sides is also parallel and congruent.

Warning! You can NOT prove that a figure is a parallelogram with one pair of parallel sides and the other pair of congruent sides.

Slide 3:

We can prove the quadrilateral is a parallelogram if we know the properties of the angles.

One property is that both pairs of opposite angles are congruent. If we know this about a quadrilateral, we can state that it is a parallelogram.

Another property is that each pair of consecutive angles is supplementary. There are four pairs in the quadrilateral and it is not necessary to show that all four pairs are supplementary. Only two pairs are needed if they have one angle in common. In other words, if angle A and angle B are supplementary and angle B and angle C are supplementary, we would be able to show that it is a parallelogram.

The last method we could use is if we know that one pair of opposite angles is congruent and one pair of consecutive angles is supplementary.

Warning!! You can NOT prove the figure is a parallelogram with two pair of consecutive angles if the pairs do not have one angle in common. In other words, if you know that angles A and D are supplementary and angles B and C are supplementary, this does NOT prove this quadrilateral is a parallelogram.

Slide 4:

We can prove that a quadrilateral is a parallelogram if we know properties of the diagonals.

The diagonals bisect each other. This means that they intersect at a point that is the midpoint of the diagonal. In this case, segment AM is congruent to segment CM and segment DM is congruent to segment BM.

We must know that BOTH diagonals have been bisected.

Slide 5:

Now you try.

Decide if the following quadrilaterals can be proven to be parallelograms. Click solution to reveal the answer.

1. Quadrilateral with one pair of opposite sides both measuring 6 feet and the other pair of opposite sides both measuring 3 feet.

Solution
Because both pairs of opposite sides are congruent, this is a parallelogram.

2. Quadrilateral HIJK has angles H and I that are supplementary and angles J and K that are supplementary.

Solution
This cannot be proven to be a parallelogram because the pairs of supplementary angles do not have an angle in common.

3. Quadrilateral with one diagonal that has one part labeled 3 and the other part labeled 3 and the other diagonal with on part labeled 5 and the other part labeled 5.

Solution
Because both diagonals are bisected, this is a parallelogram.

Slide 6:

Remember.

You can prove that a quadrilateral is a parallelogram if you know properties of its sides, angles, or diagonals.