Math 3 6.5 Parallelograms Unit 6

*EQ: How can we prove a figure to be a parallelogram and solve for variables in a parallelogram?*

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| Properties of Parallelograms |
| Sides | A **parallelogram** is a quadrilateral with both pairs of opposite sides parallel. | http://www.mathplanet.com/Oldsite/media/44000/parallelogram_499x300.jpg |
| If a quadrilateral is a parallelogram, the 2 pairs of opposite sides are congruent. | http://www.mathplanet.com/Oldsite/media/44000/parallelogram_499x300.jpg |
| Angles | If a quadrilateral is a parallelogram, the 2 pairs of opposite angles are congruent. | http://www.mathplanet.com/Oldsite/media/44000/parallelogram_499x300.jpg |
| If a quadrilateral is a parallelogram, the consecutive angles are supplementary. | http://www.mathplanet.com/Oldsite/media/44000/parallelogram_499x300.jpg |
| If a quadrilateral is a parallelogram and one angle is a right angle, then all angles are right angles. | http://www.mathplanet.com/Oldsite/media/44000/parallelogram_499x300.jpg |
| Diagonals | If a quadrilateral is a parallelogram, the diagonals bisect each other. | http://www.mathplanet.com/Oldsite/media/44000/parallelogram_499x300.jpg |
| If a quadrilateral is a parallelogram, the diagonals form two congruent triangles. | http://www.mathplanet.com/Oldsite/media/44000/parallelogram_499x300.jpg |

**Example 1:** Given: ▭ABCD is a parallelogram.

Prove: AB $≅$ CD and BC $≅$ DA.

|  |  |
| --- | --- |
| **Statement** | **Reason** |
| 1. ABCD is a parallelogram
 | 1.  |
| 2.  | 2. Definition of a parallelogram |
| 1. ∠1 $≅$ ∠4, ∠3 $≅$ ∠2
 | 3. |
| 4. AC $≅$ AC | 4. |
| 5. ∆ABC $≅$ ∆CDA | 5. |
| 6.  | 6. CPCTC |

**Example 2:** Given: ▭ABCD is a parallelogram.

 Prove: AC and BD bisect each other at E.

|  |  |
| --- | --- |
| **Statement** | **Reason** |
| 1. ABCD is a parallelogram | 1. Given |
| 2. AB $∥$ DC | 2.  |
| 3. ∠1 $≅$ ∠4, ∠2 $≅$ ∠3 | 3. |
| 4. AB = DC | 4. |
| 5.  | 5. ASA |
| 6. AE $≅$ CE, BE $≅$ DE | 6.  |
| 7.  | 7. Definition of midpoint |
| 8.  | 8. Definition of bisector |

**Example 3:** For what values of x and y must each figure be a parallelogram?



1.
2.



1.
2.

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1.
2.

Math 3 6.5 Quadrilaterals Unit 6

*EQ: How can we use the properties of quadrilaterals to solve for unknowns?*

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| --- | --- | --- |
| Rectangle | Rhombus | Square |
| A **rectangle** is a parallelogram with four right angles. | A **rhombus** is a parallelogram with four congruent sides. | A **square** is a parallelogram with four congruent sides and four right angles. |
| A **rectangle** has all the properties of a parallelogram PLUS:* 4 right angles
* Diagonals are congruent

 | A **rhombus** has all the properties of a parallelogram PLUS:* 4 congruent sides
* Diagonals bisect angles
* Diagonals are perpendicular

 | A **square** has all the properties of a parallelogram PLUS:* All the properties of a rectangle
* All the properties of a rhombus

https://dj1hlxw0wr920.cloudfront.net/userfiles/wyzfiles/ebed6a2c-7998-4f62-b5d9-1f03b4b5baa2.gif |

**Example 1:** Solve for x and the measure of each angle if ▭DGFE is a rectangle.

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**Example 2:** ▭ABCD is a rectangle whose diagonals intersect at point E.

1. If AE = 36 and CE = 2x – 4, find x.
2. If BE = 6y + 2 and CE = 4y + 6, find y.

**Example 3:** Using the diagram to the right to answer the following if ▭ABCD is a rhombus.

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1. Find the m∠1.
2. Find the m∠2.
3. Find the m∠3.
4. Find the m∠4.

**Example 4:** Solve for each variable if the following are rhombi.

1. 
2.

|  |  |  |  |
| --- | --- | --- | --- |
| Trapezoid | A **trapezoid** is a quadrilateral with exactly one pair of parallel sides, called *bases*, and two nonparallel sides, called *legs*. | Isosceles Trapezoids | Trapezoid Midsegment |
| An **isosceles trapezoid** is a trapezoid with congruent legs. | The **median** (also called the midsegment) of a trapezoid is a segment that connects the midpoint of one leg to the midpoint of the other leg. |
| A trapezoid is isosceles if there is only:* One set of parallel sides
* Base angles are congruent
* Legs are congruent
* Diagonals are congruent
* Opposite angles are supplementary
 | **Theorem:** If a quadrilateral is a trapezoid, then a) the midsegment is parallel to the bases and b) the length of the midsegment is half the sum of the lengths of the bases |
|  |  |

**Example 5:** CDEP is an isosceles trapezoid and m<C = 65. What are m<D, m<E, and m<F?

**Example 6:** What are the values of x and y in the isosceles triangle below if DE || DC?

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**Example 7:** QR is the midsegment of trapezoid LMNP. What is x and the length of LM?

**You Try!** TU is the midsegment of trapezoid WXYZ. What is x and the length of TU?