Unit 7 Lesson 5: Rectangles (section 6-4)

OBJ: To recognize and apply properties of rectangles.

To Determine whether parallelograms are rectangles.

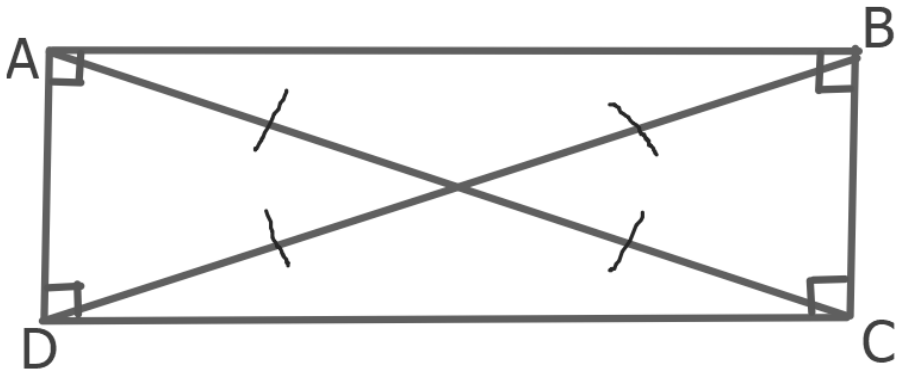
Definition: rectangle is a parallelogram with four right angles.

↓

so all properties of parallelograms also apply to rectangles.

Theorem

If a parallelogram is a rectangle, then the diagonals are congruent.



$\overline{AC} \cong \overline{BD}$

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If a quadrilateral is a rectangle, then the following properties are true. (7 properties)

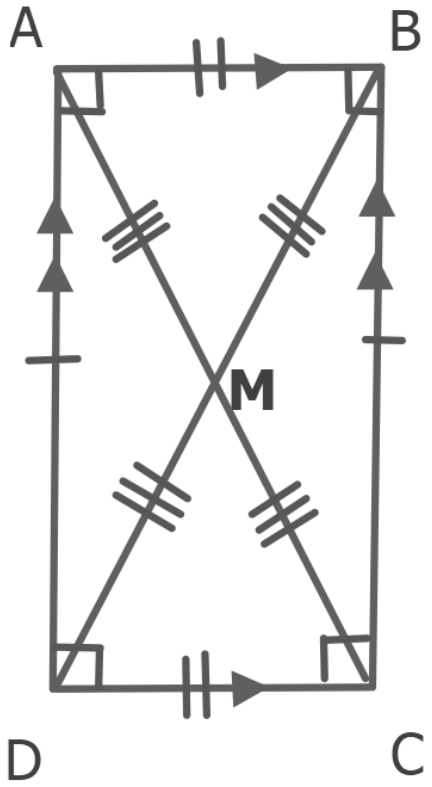
1. Opposite sides are congruent and parallel. (2)

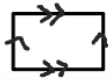
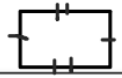
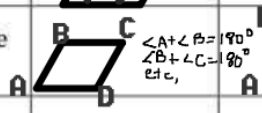
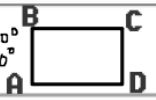
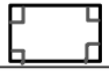
2. Opposite angles are congruent.

3. Consecutive angles are supplementary.

4. Diagonals are congruent and bisect each other. (2)

5. All four angles are right angles.



Shape →	Parallelogram	Rectangle	Rhombus	Square	Trapezoid	Isosceles Trapezoid	Kite
Opposite sides are parallel							
Opposite sides are congruent							
Opposite angles are congruent							
Consecutive interior angles are supplementary	 						
Diagonals bisect each other							
All angles are right angles							
Diagonals are congruent							
All sides are congruent							
Diagonals bisect each angle							
Diagonals are perpendicular							
Base angles are congruent							
Exactly one pair of opposite angles congruent							
Exactly two pair of consecutive congruent sides							

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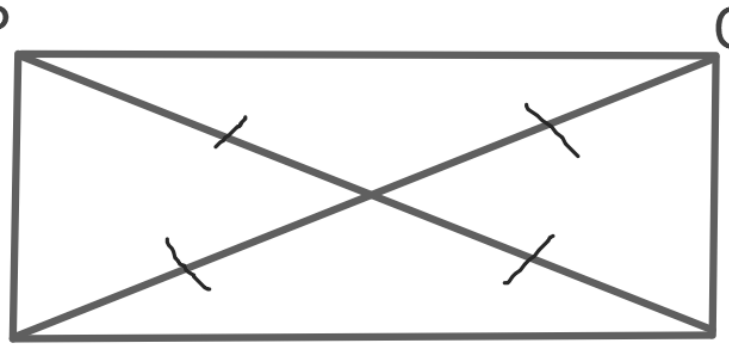
Example 1:

Quad MNOP is a rectangle. If MO = 6x +14 and PN = 9x + 5, find x.

diag diag



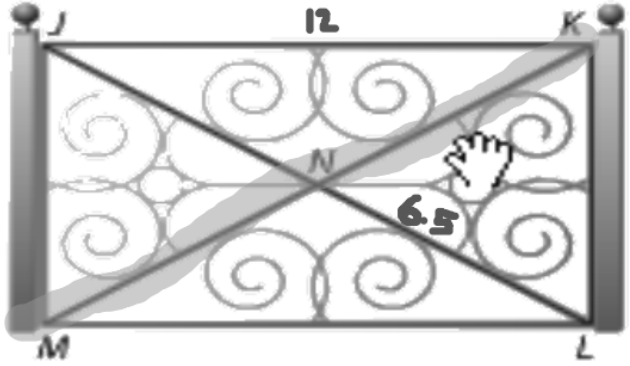
SINCE the segments are diagonals and MNOP is a rectangle, the diagonals are congruent.

6x+14 = 9x +5

9 = 3x

3 = x

Example 2: CONSTRUCTION: A rectangular garden gate is reinforced with diagonal braces to prevent it from sagging. If JK = 12 feet, and LN = 6.5 feet, find KM.



Since JKLM is a rectangle, it is also a parallelogram. There fore the diagonals bisect each other. So JN = 6.5 and JL = 13.

Since JKLM is a rectangle the diagonals are also congruent so KM = JL = 13 feet

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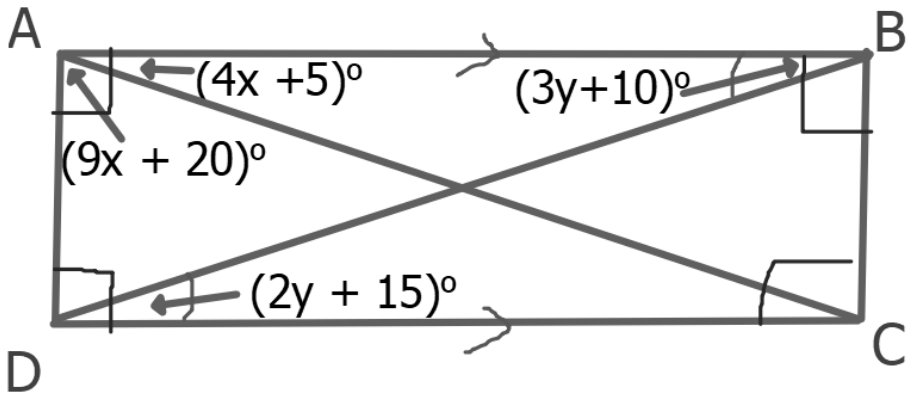
Example 3: Quadrilateral ABCD is a rectangle. Find x and y.



Angle DAB must = 90 for ABCE to be a rectangle. So

$$9x + 20 + 4x + 5 = 90$$
$$13x + 25 = 90$$
$$13x = 65$$
$$\boxed{x = 5}$$

Since ABCD is a rectangle it is also a parallelgram so Alternate Interior angles ABC and BDC are congruent

$$3y + 10 = 2y + 15$$
$$\boxed{y = 5}$$

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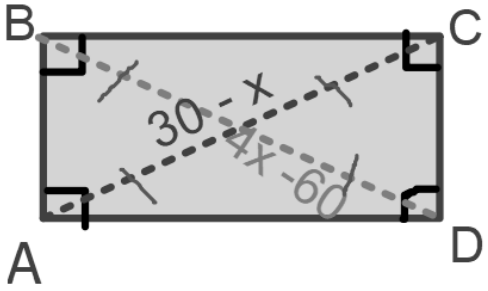
Example 4: ABCD is a rectangle. If AC = 30 - x and BD = 4x - 60, find x.

Draw and label a diagram



Since segments AC and BD are both diagonals and ABCD is a rectangle, then the diagonals are congruent.

$$30 - x = 4x - 60$$
$$-5x = -90$$
$$x = 18$$

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Example 5:

Quadrilateral FGHJ has vertices F(-4,-1), G(-2,-5), H(4,-2), and J(2,2). Determine whether FGHJ is a rectangle using slope formula.

We need to show FGHJ is a parallelogram with 4 right angles, This will make it a rectangle. To do this we ~~much~~ must find and compare the slopes of all 4 sides.

$$m \text{ of } \overline{FG} = \frac{-5+1}{-2+4} = \frac{-4}{2} = -2$$

$$m \text{ of } \overline{GH} = \frac{1}{2}$$

$$m \text{ of } \overline{HJ} = -2$$

$$m \text{ of } \overline{JF} = \frac{1}{2}$$

Since segments FG and JG have the same slope they are parallel. SInce segments GH and HJ have the same slope they are parallel. That means FGHJ is a parallelogram.

Notice the segments FG and GH have slopes that are opposite reciprocals. That means the segments are perpendicular. Therefore and FGH is a right angle. Remember if a parallelogram has one right angle it has 4 right angles. A parallelogram with 4 right angles is a rectangle so we just proved that FGHJ is a rectangle.