


Properties of Quadrilaterals

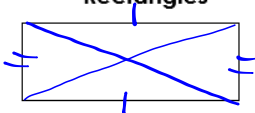
A **parallelogram** is a type of quadrilateral that has **two pairs of opposite sides**  **parallel**. Parallelograms are denoted by the symbol \square . If a quadrilateral has two pairs of parallel, opposite sides, then it can be classified as a parallelogram.

There are 5 theorems associated with PARALLELOGRAMS: 4 sides

- Opposite sides are congruent
 $\overline{KL} \cong \overline{NM}$
 $\overline{KN} \cong \overline{LM}$
- Opposite angles are congruent
 $\angle K = \angle M$
 $\angle L = \angle N$
- Consecutive angles are supplementary
 $\angle K + \angle L = 180^\circ$
 $\angle L + \angle M = 180^\circ$ $\angle M + \angle N = 180^\circ$
 $\angle N + \angle K = 180^\circ$
- Diagonals bisect each other
 $\overline{NO} \cong \overline{OL}$
 $\overline{KO} \cong \overline{OM}$
- Diagonals form two congruent triangles
 $\triangle KMN \cong \triangle MKL$

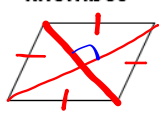
Parallelograms can be broken down into three more specific types of quadrilaterals with the same properties as parallelograms. The three specific types also have some of their own properties.

Rectangles



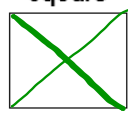
- All properties of parallelograms
- Diagonals are congruent
- Four right angles

Rhombus



- All properties of parallelograms
- Diagonals are perpendicular
- Diagonals bisect each other
- Four sides are congruent

Square

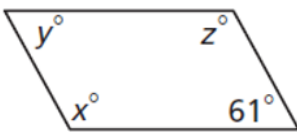


- All properties of parallelograms
- Four right angles
- Four congruent sides
- Diagonals are congruent, perpendicular, and bisect each other

Applying Properties of Quadrilaterals

1. Solve for x, y, and z.

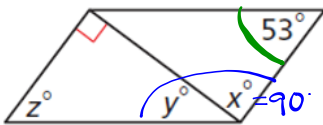
Relationship: _____



$y = 61$
 $x = 119$ $z = 119$
 opposite angles \cong
 consec. angles = 180

2. Solve for x, y, and z.

Relationship: _____



$x = 90^\circ$
 $53 + 90 + y = 180$ $y = 37$
 $z = 53$
 Alternate Int. Angles
 consecutive
 Oppo. Angles \cong

3. In parallelogram ABCD, $AB = 17.5$, $DE = 18$, and $m\angle BCD = 110^\circ$. Point E represents the intersection of the diagonals. Draw a picture of parallelogram ABCD and answer the following questions:

a. $BD = 18 + 18 = 36$

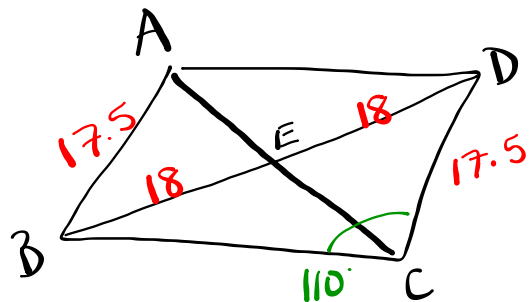
b. $CD = 17.5$

c. $BE = 18$

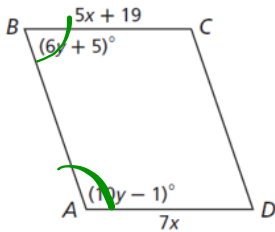
d. $m\angle ABC = 70^\circ$

e. $m\angle ADC = 70^\circ$

f. $m\angle DAB = 110$



4. Find the value of x . Then find the length of BC .



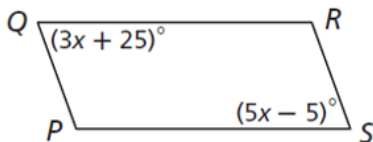
$$\begin{aligned} \overline{BC} &= \overline{AD} \\ 5x + 19 &= 7x \\ 19 &= 2x \\ x &= 9.5 \end{aligned}$$

$$\overline{BC} = 66.5$$

Relationship: opposite sides / oppo. angles

$$\begin{aligned} \angle B + \angle A &= 180 \\ 6y + 5 + 10y - 1 &= 180 \\ 16y + 4 &= 180 \\ 16y &= 176 \\ y &= 11 \end{aligned}$$

5. Find the value of x . Then find Angle Q .



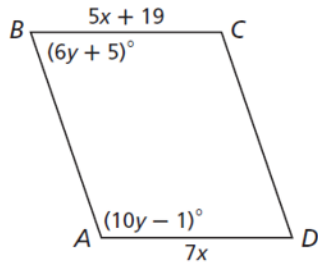
$$\begin{aligned} \angle Q &= \angle S \\ 3x + 25 &= 5x - 5 \\ 30 &= 2x \\ x &= 15 \end{aligned}$$

$$\angle Q = 70^\circ$$

Relationship: opposite angles

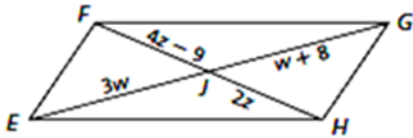
6. Find the value of y . Then find the measure of Angle C and D.

Relationship: _____



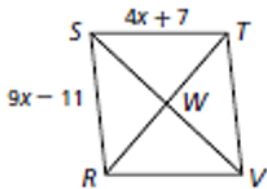
7. EFGH is a parallelogram. Find w and z .

Relationship: _____



8. RSTV is a rhombus. Find the length of TV.

Relationship: _____



9. In rectangle TUVW below, it is know that $TV = 19 - 2x$ and $WU = 10 + x$. Find the value of x .

Relationship: _____

