

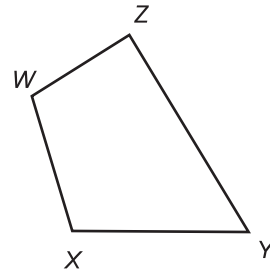
Study Guide

Quadrilaterals

A **quadrilateral** is a closed geometric figure with four sides and four vertices. Any two sides, vertices, or angles of a quadrilateral are said to be either **consecutive** or **opposite**. A segment joining any two nonconsecutive vertices in a quadrilateral is called a **diagonal**.

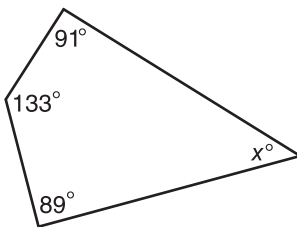
Refer to quadrilateral WXYZ for Exercises 1–5.

1. Name all pairs of opposite sides.
2. Name all pairs of consecutive angles.
3. Name the diagonals.
4. Name all pairs of consecutive vertices.
5. Name all pairs of opposite angles.

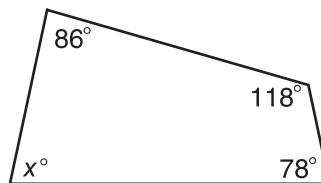


Find the missing measure(s) in each figure.

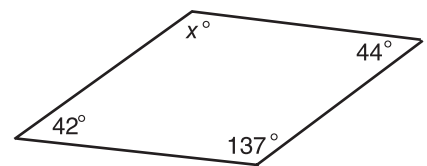
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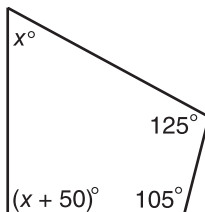
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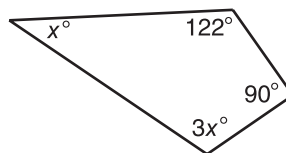
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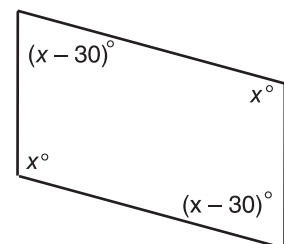
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Study Guide

Parallelograms

A special kind of quadrilateral in which both pairs of opposite sides are parallel is called a **parallelogram**.

The following theorems all concern parallelograms.

- Opposite sides of a parallelogram are congruent.
- Opposite angles of a parallelogram are congruent.
- Consecutive angles of a parallelogram are supplementary.
- The diagonals of a parallelogram bisect each other.

Example: If the quadrilateral in the figure is a parallelogram, find the values of x , y , and z .

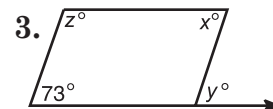
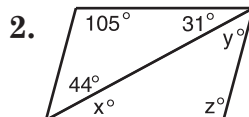
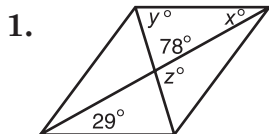
Since opposite angles of a parallelogram are congruent, $x = 72$.

Since consecutive angles of a parallelogram are supplementary, $y + 72 = 180$. Therefore, $y = 108$.

Since opposite sides of a parallelogram are congruent, $z = 8$.



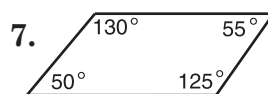
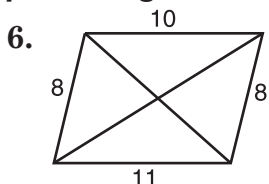
If each quadrilateral is a parallelogram, find the values of x , y , and z .



4. In parallelogram $ABCD$, $m\angle A = 3x$ and $m\angle B = 4x + 40$. Find the measure of angles A , B , C , and D .

5. In parallelogram $RSTV$, diagonals \overline{RT} and \overline{VS} intersect at Q . If $RQ = 5x + 1$ and $QT = 3x + 15$, find QT .

Explain why it is impossible for each figure to be a parallelogram.



Study Guide

Tests for Parallelograms

You can show that a quadrilateral is a parallelogram if you can show that one of the following is true.

1. Both pairs of opposite sides are parallel.
2. Both pairs of opposite sides are congruent.
3. Diagonals bisect each other.
4. Both pairs of opposite angles are congruent.
5. A pair of opposite sides is both parallel and congruent.

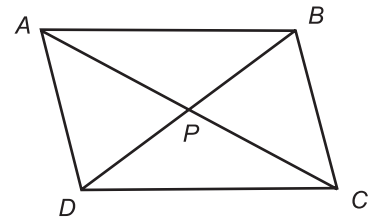
Example: $AP = 3x - 4$, $AC = 46$, $PB = 3y$, and $DP = 5y - 12$. Find the values of x and y that would make $ABCD$ a parallelogram.

For the diagonals to bisect each other, $2(3x - 4) = 46$ and $3y = 5y - 12$. Solve for each variable.

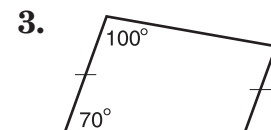
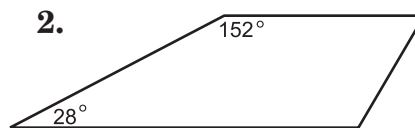
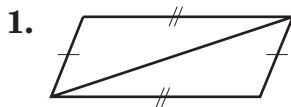
$$\begin{array}{r|l}
 2(3x - 4) = 46 & 3y = 5y - 12 \\
 6x - 8 = 46 & \text{Dist. Prop.} \quad -2y = -12 \\
 6x = 54 & \text{Add 8.} \quad y = 6 \\
 x = 9 & \text{Divide by 6.}
 \end{array}$$

*Subtract 5y.
Divide by -2.*

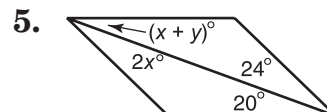
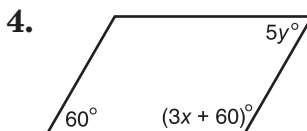
So, $x = 9$ and $y = 6$.



Determine whether each quadrilateral is a parallelogram. Write yes or no. Give a reason for your answer.



Find the values of x and y that ensure each quadrilateral is a parallelogram.



Study Guide

Rectangles, Rhombi, and Squares

A **rectangle** is a quadrilateral with four right angles. A **rhombus** is a quadrilateral with four congruent sides. A **square** is a quadrilateral with four right angles and four congruent sides. A square is both a rectangle and a rhombus. Rectangles, rhombi, and squares are all examples of parallelograms.

Rectangles	Rhombi
<ul style="list-style-type: none"> • Opposite sides are congruent. • Opposite angles are congruent. • Consecutive angles are supplementary. • Diagonals bisect each other. • All four angles are right angles. • Diagonals are congruent. 	<ul style="list-style-type: none"> • Diagonals are perpendicular. • Each diagonal bisects a pair of opposite angles.

Determine whether each statement is always, sometimes, or never true.

1. The diagonals of a rectangle are perpendicular.
2. Consecutive sides of a rhombus are congruent.
3. A rectangle has at least one right angle.
4. The diagonals of a parallelogram are congruent.
5. A diagonal of a square bisects opposite angles.

Use rhombus $DLMP$ to determine whether each statement is true or false.

6. $OM = 13$

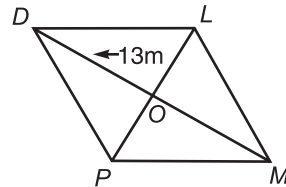
7. $PL = 26$

8. $\overline{MD} \cong \overline{PL}$

9. $m\angle DLO = m\angle LDO$

10. $\angle LDP \cong \angle LMP$

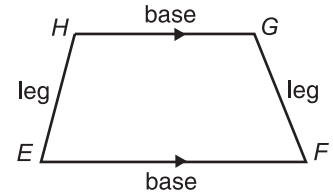
11. $m\angle DPM = m\angle PML$



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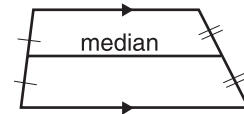
Trapezoids

A **trapezoid** is a quadrilateral with exactly one pair of parallel sides. The parallel sides are called **bases**, and the nonparallel sides are called **legs**. In trapezoid $EFGH$, $\angle E$ and $\angle F$ are called **base angles**. $\angle H$ and $\angle G$ form the other pair of base angles.



A trapezoid is an **isosceles trapezoid** if its legs are congruent.

The **median** of a trapezoid is the segment that joins the midpoints of the legs.

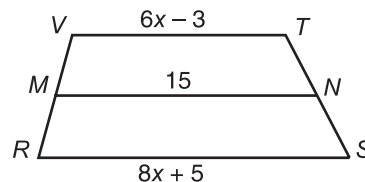


The following theorems all concern trapezoids.

- Both pairs of base angles of an isosceles trapezoid are congruent.
- The diagonals of an isosceles trapezoid are congruent.
- The median of a trapezoid is parallel to the bases, and its measure is one-half the sum of the measures of the bases.

Example: Given trapezoid $RSTV$ with median \overline{MN} , find the value of x .

$$\begin{aligned} MN &= \frac{1}{2}(VT + RS) \\ 15 &= \frac{1}{2}(6x - 3 + 8x + 5) \\ 15 &= \frac{1}{2}(14x + 2) \\ 15 &= 7x + 1 \\ 14 &= 7x \\ 2 &= x \end{aligned}$$



$HJKL$ is an isosceles trapezoid with bases \overline{HJ} and \overline{LK} , and median \overline{RS} . Use the given information to solve each problem.

1. If $LK = 30$ and $HJ = 42$, find RS .
2. If $RS = 17$ and $HJ = 14$, find LK .
3. If $RS = x + 5$ and $HJ + LK = 4x + 6$, find RS .
4. If $m\angle LRS = 66$, find $m\angle KSR$.

