
Whatever you do in word or deed, do all in the name of
the Lord Jesus, giving thanks to God the Father through Him
Colossians 3:17

Chapter 8 Section 4

Properties of Rhombuses, Rectangles, and Squares

Before: You used properties of parallelograms

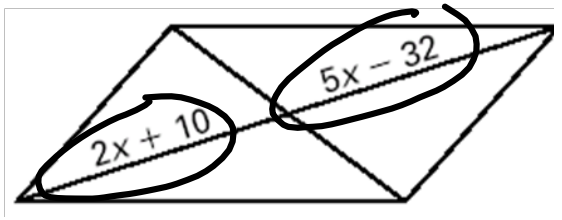
Now: You will use properties of rhombuses, rectangles, and squares

Why: So you can solve a carpentry problem

Warm Up

1. **Give five ways to prove that a quadrilateral is a parallelogram.**
2. **Find x in the parallelogram.**

2 Pairs || Sides
2 Pairs ≅ side
2 Pairs ≅ angle
1 Pair of ≅ and ||
Diagonals Bisect



$2x+10=5x-32$

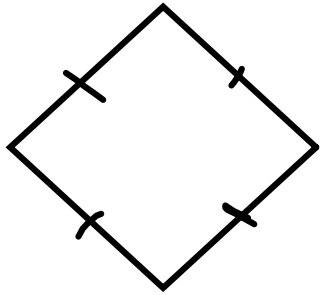
$\frac{42}{3}=\frac{3x}{3}$

$x=14$

Special types of parallelograms:

Rhombus

- 4 Sides Congruent

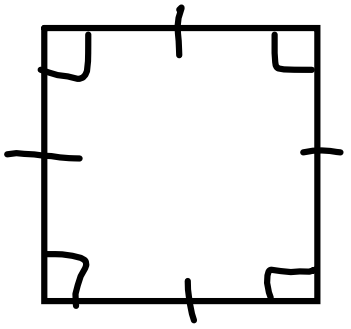


Rectangle

- 4 right angles

Square

- 4 right angles
- 4 congruent Sides



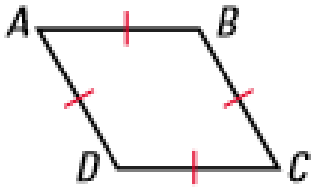
COROLLARIES

For Your Notebook

RHOMBUS COROLLARY

A quadrilateral is a rhombus if and only if it has four congruent sides.

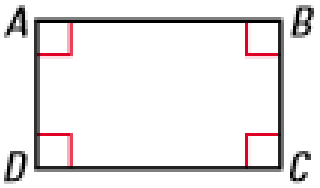
ABCD is a rhombus if and only if $\overline{AB} \cong \overline{BC} \cong \overline{CD} \cong \overline{AD}$.



RECTANGLE COROLLARY

A quadrilateral is a rectangle if and only if it has four right angles.

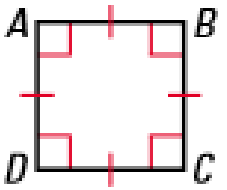
ABCD is a rectangle if and only if $\angle A$, $\angle B$, $\angle C$, and $\angle D$ are right angles.

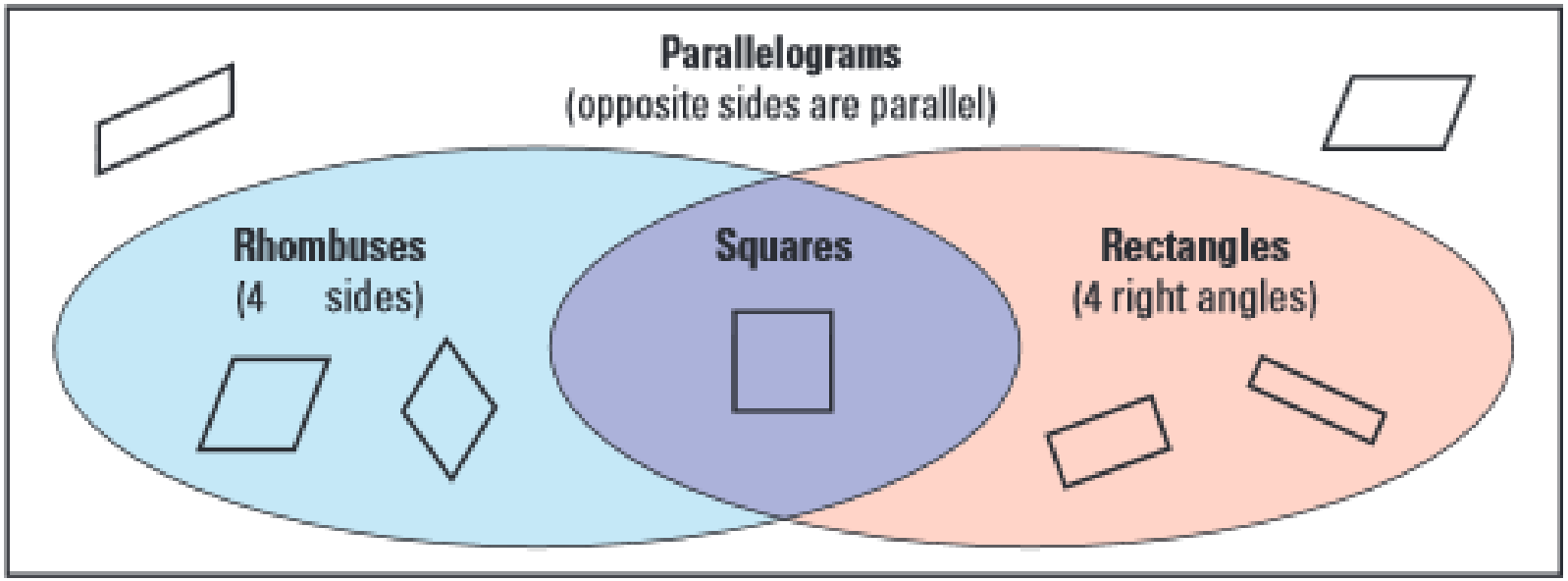


SQUARE COROLLARY

A quadrilateral is a square if and only if it is a rhombus and a rectangle.

ABCD is a square if and only if $\overline{AB} \cong \overline{BC} \cong \overline{CD} \cong \overline{AD}$ and $\angle A$, $\angle B$, $\angle C$, and $\angle D$ are right angles.

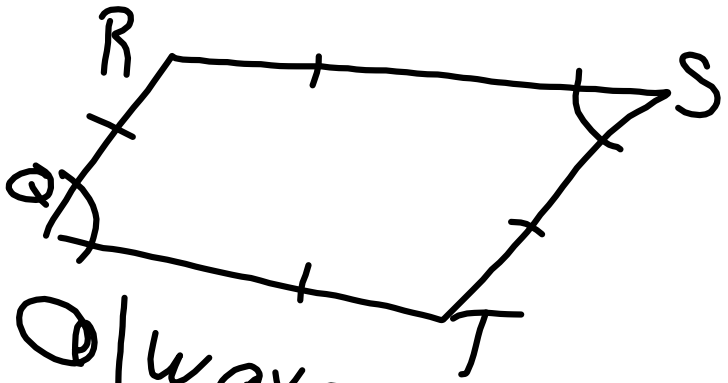



Parallelograms
(opposite sides are parallel)
Rhombuses
(4 sides)
Squares
Rectangles
(4 right angles)

Example 1

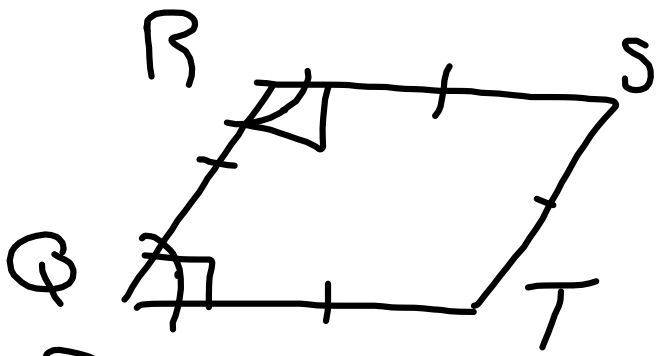
For any rhombus $QRST$, decide whether the statement is *always* or *sometimes* true. Draw a sketch and explain your reasoning.

a. $\angle Q \cong \angle S$



Always

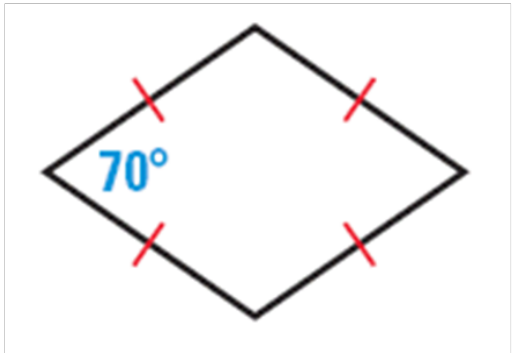
b. $\angle Q \cong \angle R$



Sometimes

Example 2

Classify the special quadrilateral. Explain your reasoning.



Rhombus

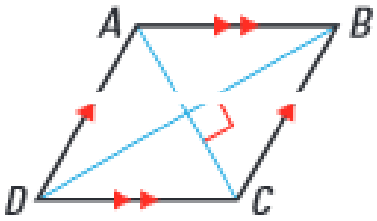
4 equal sides
no right angles

THEOREMS *For Your Notebook*

THEOREM 8.11

A parallelogram is a rhombus if and only if its diagonals are perpendicular.

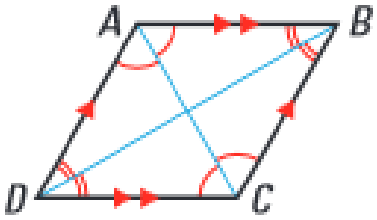
$\square ABCD$ is a rhombus if and only if $\overline{AC} \perp \overline{BD}$.



THEOREM 8.12

A parallelogram is a rhombus if and only if each diagonal bisects a pair of opposite angles.

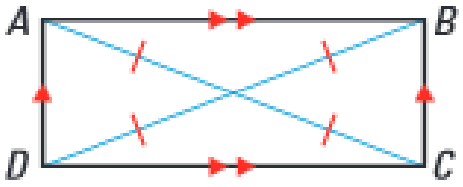
$\square ABCD$ is a rhombus if and only if $\overline{AC}$ bisects $\angle BCD$ and $\angle BAD$ and $\overline{BD}$ bisects $\angle ABC$ and $\angle ADC$.



THEOREM 8.13

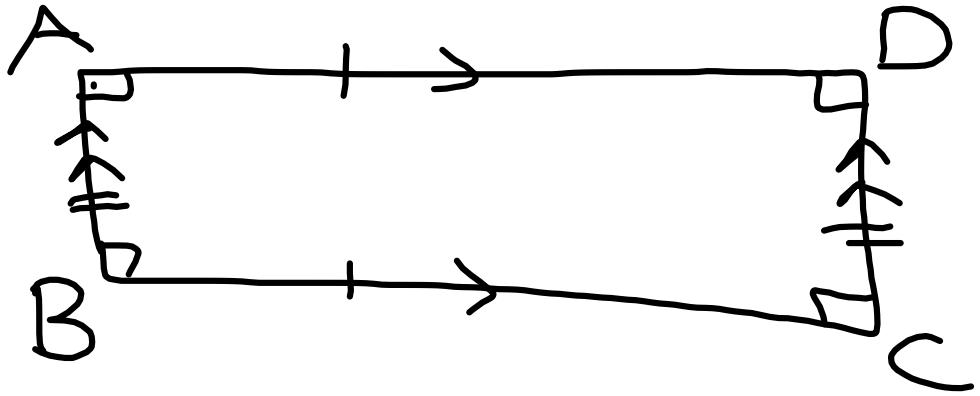
A parallelogram is a rectangle if and only if its diagonals are congruent.

$\square ABCD$ is a rectangle if and only if $\overline{AC} \cong \overline{BD}$.



Example 3

Sketch rectangle $ABCD$. List everything that you know about it.



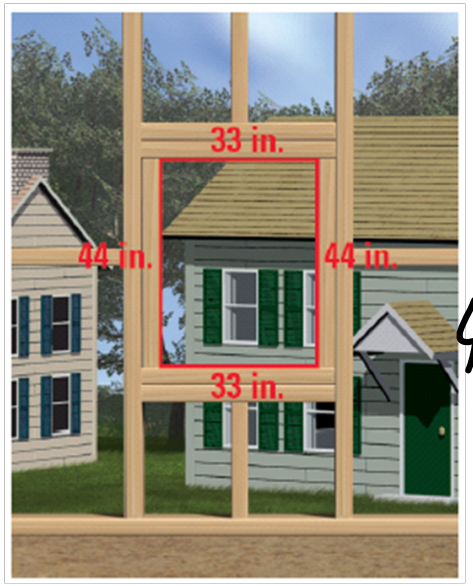
$AD \parallel BC$
$AB \parallel DC$
$AD \cong BC$
$AB \cong DC$

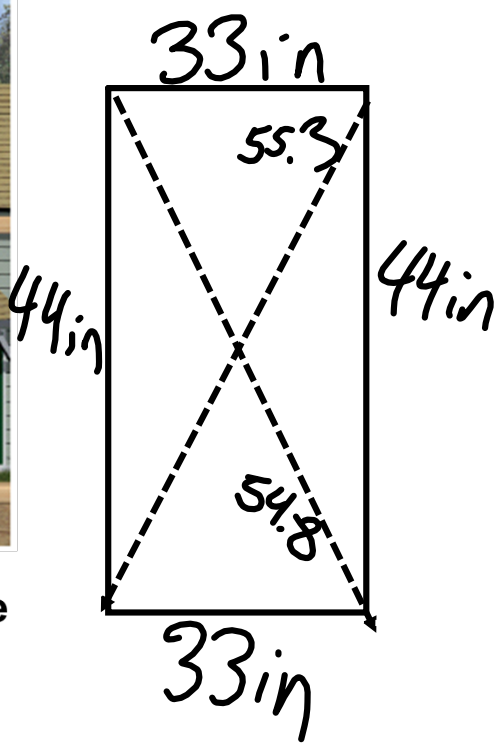
- All angles are 90°
- Opposite angles $\cong$
- adjacent angles supp
- Diagonals bisect
- Diagonals are $\cong$

Example 4

Carpentry

You are building a frame for a window. The window will be installed in the opening shown in the diagram.





a. The opening must be a rectangle. Given the measurements in the diagram, can you assume that it is? *Explain*.

no

b. You measure the diagonals of the opening. The diagonals are 54.8 inches and 55.3 inches. What can you conclude about the shape of the opening?

Parallelogram

Closing

1. For any rectangle $EFGH$, is it *always* or *sometimes* true that $\overline{FG} \cong \overline{GH}$? *Explain* your reasoning.

2. A quadrilateral has four congruent sides and four congruent angles. Sketch the quadrilateral and classify it.

3. Sketch square $PQRS$. List everything you know about the square.

4. Suppose you measure only the diagonals of a window opening. If the diagonals have the same measure, can you conclude that the opening is a rectangle? *Explain*.