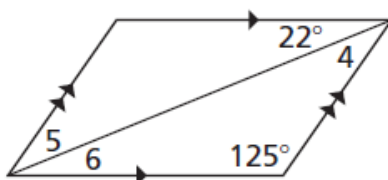
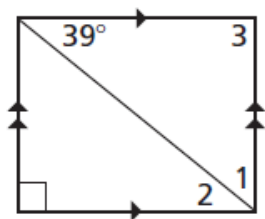


Use the diagrams to determine the measure of each angle.



1. $m\angle 1$

2. $m\angle 2$

3. $m\angle 3$

4. $m\angle 4$

5. $m\angle 5$

6. $m\angle 6$

Determine whether the statement is *always*, *sometimes*, or *never* true. Explain your reasoning.

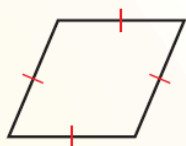
1. An isosceles triangle is a right triangle.
2. A right triangle is a scalene triangle.
3. An equilateral triangle is an equiangular triangle.
4. A right triangle is an equilateral triangle.

Essential Question

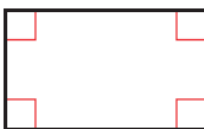
What are the properties of the diagonals of rectangles, rhombuses, and squares?

Core Concept

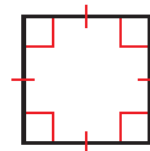
Rhombuses, Rectangles, and Squares



A **rhombus** is a parallelogram with four congruent sides.



A **rectangle** is a parallelogram with four right angles.



A **square** is a parallelogram with four congruent sides and four right angles.

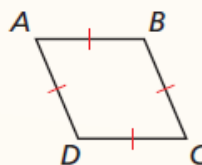
Corollaries

Corollary 7.2 Rhombus Corollary

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

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

Proof Ex. 81, p. 396

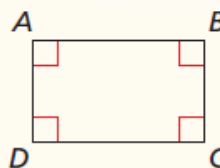


Corollary 7.3 Rectangle Corollary

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.

Proof Ex. 82, p. 396

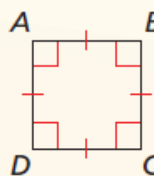


Corollary 7.4 Square Corollary

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.

Proof Ex. 83, p. 396



For any rhombus $QRST$, decide whether the statement is *always* or *sometimes* true.

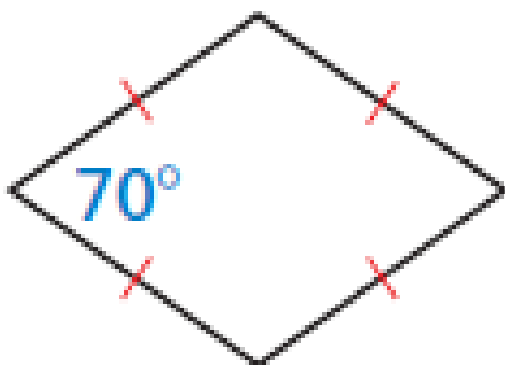
Draw a diagram and explain your reasoning.

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

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

Classify the special quadrilateral.

Explain your reasoning.



Rhombus, it
has 4 congruent
sides

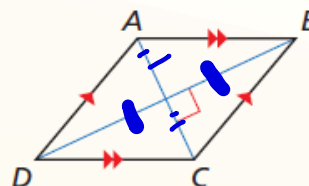
Theorems

Theorem 7.11 Rhombus Diagonals Theorem

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

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

Proof p. 390; Ex. 72, p. 395

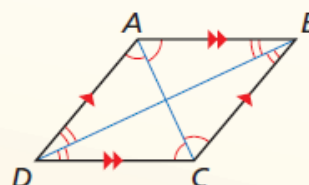


Theorem 7.12 Rhombus Opposite Angles Theorem

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 $\angle ADC$.

Proof Exs. 73 and 74, p. 395



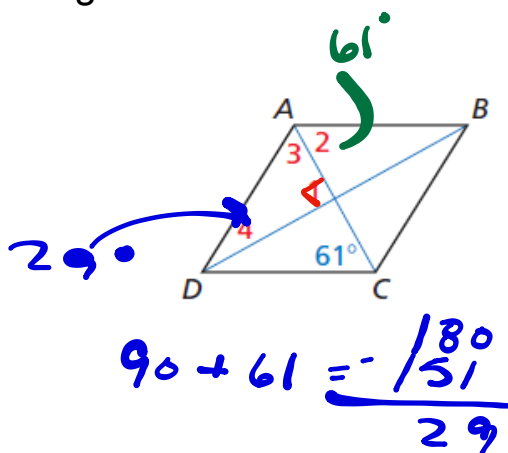
Find the measures of the numbered angles in rhombus $ABCD$.

$$m\angle 1 = 90^\circ$$

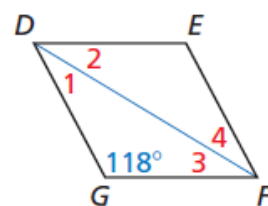
$$m\angle 2 = 61^\circ$$

$$m\angle 3 = 61^\circ$$

$$m\angle 4 = 29^\circ$$



4. In Example 3, what is $m\angle ADC$ and $m\angle BCD$?



5. Find the measures of the numbered angles in rhombus $DEFG$.

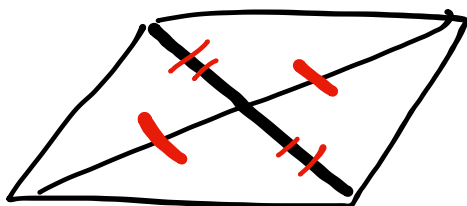
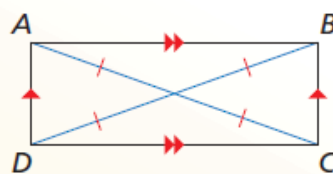
Theorem

Theorem 7.13 Rectangle Diagonals Theorem

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

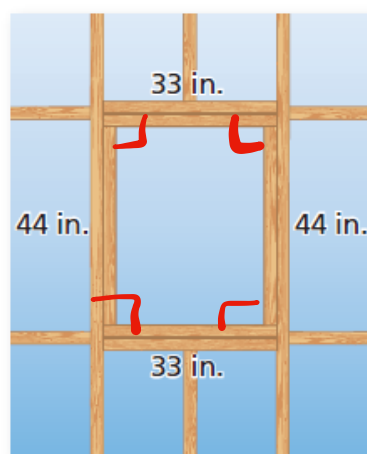
$\square ABCD$ is a rectangle if and only if $\overline{AC} \cong \overline{BD}$.

Proof Exs. 87 and 88, p. 396



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

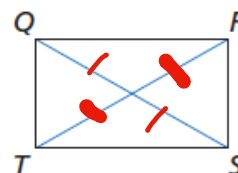
a. The opening must be a rectangle. Given the measurements in the diagram, can you assume that it is? Explain.



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?

In rectangle $QRST$, $QS = 5x - 31$ and $RT = 2x + 11$.

Find the lengths of the diagonals of $QRST$.



$$5x - 31 = 2x + 11$$

~~- 2x~~ ~~- 2x~~

$$3x - 31 = 11$$

~~+ 31~~ ~~+ 31~~

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

$$x = 14$$

Decide whether $\square ABCD$ with vertices $A(-2, 6)$, $B(6, 8)$, $C(4, 0)$, and $D(-4, -2)$ is a *rectangle*, a *rhombus*, or a *square*. Give all names that apply.

