

7.4**Properties of Special Parallelograms**

For use with Exploration 7.4

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

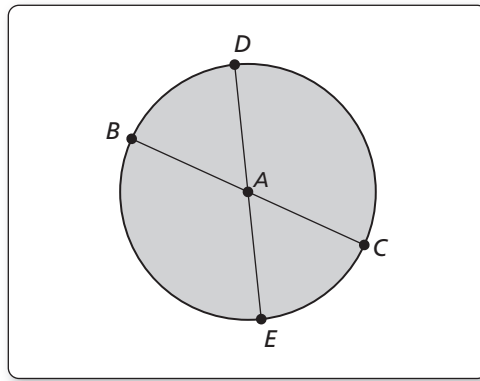
1 EXPLORATION: Identifying Special Quadrilaterals

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software.

- a. Draw a circle with center A .
- b. Draw two diameters of the circle.
Label the endpoints B , C , D , and E .
- c. Draw quadrilateral $BDCE$.

Sample



- d. Is $BDCE$ a parallelogram? rectangle? rhombus? square?
Explain your reasoning.
- e. Repeat parts (a) – (d) for several other circles. Write a conjecture based on your results.

7.4 Properties of Special Parallelograms (continued)

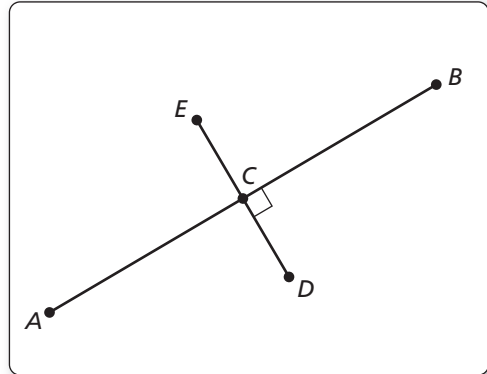
2 **EXPLORATION:** Identifying Special Quadrilaterals

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software.

- a. Construct two segments that are perpendicular bisectors of each other. Label the endpoints $A, B, D,$ and E . Label the intersection C .
- b. Draw quadrilateral $AEBD$.
- c. Is $AEBD$ a parallelogram? rectangle? rhombus? square? Explain your reasoning.

Sample

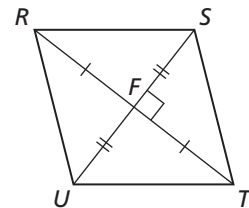


- d. Repeat parts (a) – (c) for several other segments. Write a conjecture based on your results.

Communicate Your Answer

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

- 4. Is $RSTU$ a parallelogram? rectangle? rhombus? square? Explain your reasoning.



- 5. What type of quadrilateral has congruent diagonals that bisect each other?

7.4**Notetaking with Vocabulary**

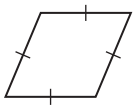
For use after Lesson 7.4

In your own words, write the meaning of each vocabulary term.

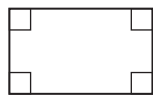
rhombus

rectangle

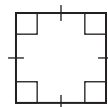
square

Core Concepts**Rhombuses, Rectangles, and Squares**

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



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

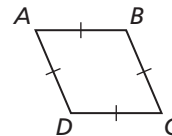


A **square** is a parallelogram with four congruent sides and four right angles.

Notes:**Corollary 7.2 Rhombus Corollary**

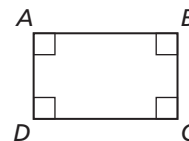
A quadrilateral is a rhombus if and only if it has four congruent sides.

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

**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.

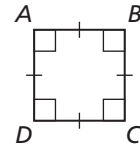


7.4 Notetaking with Vocabulary (continued)

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.

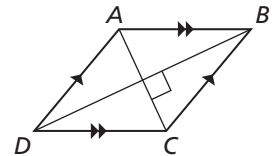


Notes:

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 $\overline{AC} \perp \overline{BD}$.

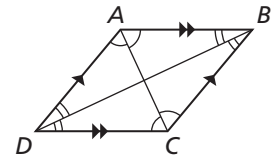


Notes:

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 $\angle ADC$.

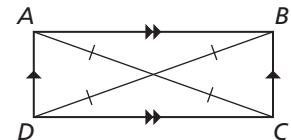


Notes:

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



Notes:

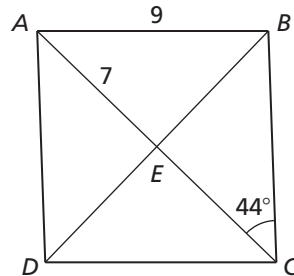
7.4 Notetaking with Vocabulary (continued)

Extra Practice

- For any rhombus $MNOP$, decide whether the statement $\overline{MO} \cong \overline{NP}$ is *always* or *sometimes* true. Draw a diagram and explain your reasoning.
- For any rectangle $PQRS$, decide whether the statement $\angle PQS \cong \angle RSQ$ is *always* or *sometimes* true. Draw a diagram and explain your reasoning.

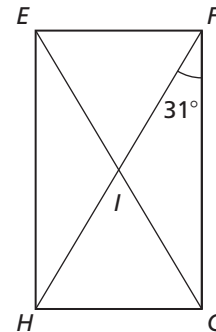
In Exercises 3–5, the diagonals of rhombus $ABCD$ intersect at E . Given that $m\angle BCA = 44^\circ$, $AB = 9$, and $AE = 7$, find the indicated measure.

3. BC 4. AC 5. $m\angle ADC$



In Exercises 6–8, the diagonals of rectangle $EFGH$ intersect at I . Given that $m\angle HFG = 31^\circ$ and $EG = 17$, find the indicated measure.

6. $m\angle FHG$ 7. HF 8. $m\angle EFH$



In Exercises 9–11, the diagonals of square $LMNP$ intersect at K . Given that $MK = \frac{1}{2}$, find the indicated measure.

9. PK 10. $m\angle PKN$ 11. $m\angle MNK$

