

Warm-Up

Find the number of sides of a regular polygon if each interior angle measures 168 degrees.

LESSON 5.3 Kite and Trapezoid Properties

Learning Targets

- A. I can identify and apply the properties of a kite
- B. I can identify and apply the properties of a trapezoid

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Lesson 5.3 Kite and Trapezoid Properties

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Vocabulary

- kite
- vertex angles
- nonvertex angles
- trapezoid
- isosceles trapezoid
- bases
- base angles

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Lesson 5.3 Kite and Trapezoid Properties

LESSON 5.3 Kite and Trapezoid Properties

Recall that a **kite** is a quadrilateral with exactly two distinct pairs of congruent consecutive sides.

If you construct two different isosceles triangles on opposite sides of a common base and then remove the base, you have constructed a kite. In an isosceles triangle, the vertex angle is the angle between the two congruent sides. Therefore, let's call the two angles between each pair of congruent sides of a kite the **vertex angles** of the kite. Let's call the other pair the **nonvertex angles**.

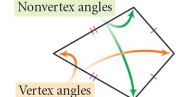
A kite also has one line of reflectional symmetry, just like an isosceles triangle. You can use this property to discover other properties of kites. Let's investigate.

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Lesson 5.3 Kite and Trapezoid Properties



Nonvertex angles



Vertex angles

**INVESTIGATION 1**

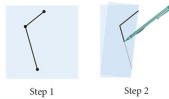
**What Are Some Properties of Kites?**

**YOU WILL NEED:**  
patty paper,  
straightedge

In this investigation you will look at angles and diagonals in a kite to see what special properties they have.

**Step 1** On patty paper, draw two connected segments of different lengths, as shown. Fold through the endpoints and trace the two segments on the back of the patty paper.

**Step 2** Compare the size of each pair of opposite angles in your kite by folding an angle onto the opposite angle. Are the vertex angles congruent? Are the nonvertex angles congruent? Share your observations with others near you and complete the conjecture.



**Kite Angle Sum Conjecture** C-34  
The \_\_\_\_\_ angles of a kite are \_\_\_\_\_.

**Step 3** Draw the diagonals. How are the diagonals related? Share your observations with others in your group and complete the conjecture.



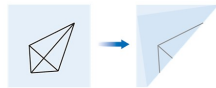
**Kite Diagonals Conjecture** C-35  
The diagonals of a kite are \_\_\_\_\_.

What else seems to be true about the diagonals of kites?

**Step 4** Compare the lengths of the segments on both diagonals. Does either diagonal bisect the other? Share your observations with others near you. Copy and complete the conjecture.

**Kite Diagonal Bisector Conjecture** C-36  
The diagonal connecting the vertex angles of a kite is the \_\_\_\_\_ of the other diagonal.

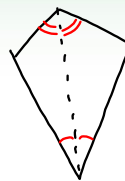
**Step 5** Fold along both diagonals. Does either diagonal bisect any angles? Share your observations with others and complete the conjecture.



**Kite Angle Bisector Conjecture** C-37  
The \_\_\_\_\_ angles of a kite are \_\_\_\_\_ by a diagonal.

*vertex*                      *bisected*

**INVESTIGATION 1 SOLUTION**



**Kite Angle Sum Conjecture** C-34  
The nonvertex angles of a kite are congruent.

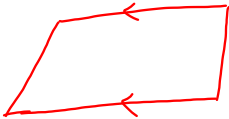
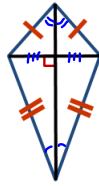
**Kite Diagonals Conjecture** C-35  
The diagonals of a kite are perpendicular.

**Kite Diagonal Bisector Conjecture** C-36  
The diagonal connecting the vertex angles of a kite is the perpendicular bisector of the other diagonal.

**Kite Angle Bisector Conjecture** C-37  
The vertex angles of a kite are bisected by a diagonal.

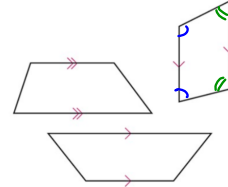
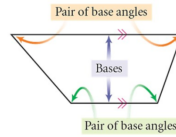
**Kite**

A quadrilateral with two distinct pairs of congruent consecutive sides.

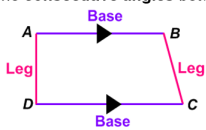


**Recall:**

**Trapezoid** A quadrilateral with exactly one pair of parallel sides. The parallel sides are called **bases** and the non-parallel sides are called **legs**. The angles formed along each base are called the **base angles**.



The **consecutive angles** between the bases of a trapezoid are **supplementary**.



$$m\angle A + m\angle D = 180$$

$$m\angle B + m\angle C = 180$$

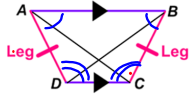
Fill in the missing angle measures for each trapezoid.

1. 
  
 $m\angle C = 62^\circ$   
 $m\angle B = 118^\circ$   
 Isosceles Trapezoid

2. 
  
 $m\angle C = 90^\circ$   
 $m\angle B = 30^\circ$

3. 
  
 $m\angle E = 95^\circ$   
 $m\angle O = 69^\circ$

**ISOSCELES TRAPEZOID:** A trapezoid where the legs are congruent.

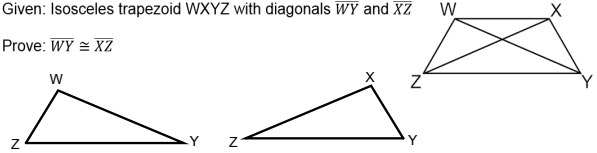


Property 1:  
Base angles of an isosceles trapezoid are congruent.  
 $\angle BAD \cong \angle ABC$     $\angle ADC \cong \angle BCD$

Property 2:  
Opposite angles of an isosceles trapezoid are supplementary.  
 $m\angle BAD + m\angle BCD = 180$   
 $m\angle ADC + m\angle ABC = 180$

Given: Isosceles trapezoid WXYZ with diagonals  $\overline{WY}$  and  $\overline{XZ}$

Prove:  $\overline{WY} \cong \overline{XZ}$



Four horizontal blue bars for writing the proof steps.

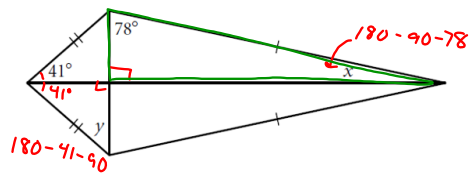
Property 3: The diagonals of an isosceles trapezoid are congruent

Kite  
4 properties

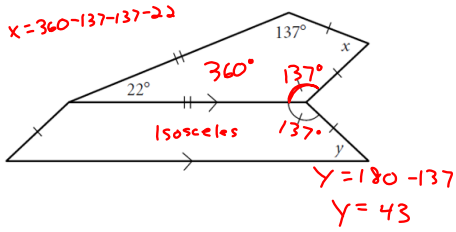
Trapezoid  
2 properties

Isos. Trap.  
3 properties

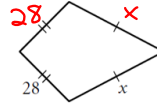
4.  $x = 12^\circ$ ,  $y = 49^\circ$



5.  $x = 64^\circ, y = 43^\circ$



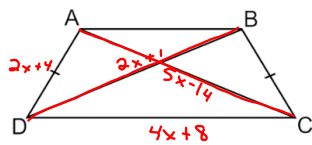
6. Perimeter = 116.  $x = 30$



$2x + 56 = 116$   
 $2x = 60$   
 $x = 30$

7. Find  $x$  if  $AD = 2x + 4$ ,  $BD = 2x + 1$ ,  $DC = 4x + 8$ , and  $AC = 5x - 14$ .

~~$360^\circ$~~   
 $AC = BD$   
 $5x - 14 = 2x + 1$   
 $3x - 14 = 1$   
 $3x = 15$   
 $x = 5$

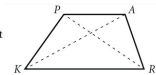


LESSON 5.3  
**Kite and Trapezoid Properties**

**Closing Question**

Which of the following might not be true about trapezoid  $PARK$ ? Why?

- a.  $\overline{PA} \parallel \overline{KR}$
- b.  $\overline{PK} \cong \overline{AR}$
- c.  $\overline{PR} \perp \overline{KA}$
- d.  $\angle K \cong \angle R$
- e.  $\angle K$  supplementary to  $\angle P$

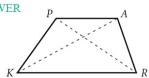




### Kite and Trapezoid Properties

#### Closing Question

ANSWER



Statements a and e are true for all trapezoids, but statements b, c, and d are only true for isosceles trapezoids. There is no evidence that trapezoid  $PARK$  is isosceles.

Assignment: 5.3 - p. 278, #s 1-8 in the TEXTBOOK

**You will turn this in today.**

Also work on the 5.1-5.2 review you just got. We will use this as part of the review for the quiz later today.