Module 13a: Parallelograms

Math Practice(s):
   -Model with mathematics.
   -Attend to precision.

Learning Target(s):
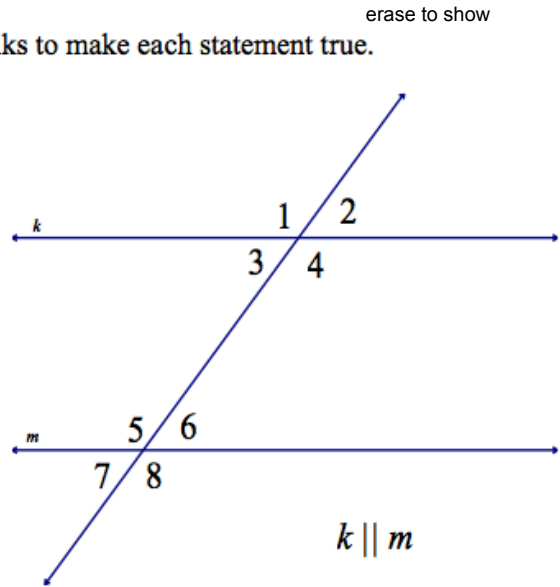   -Investigate & discover properties of parallelograms.

Homework:
   HW#14: 13a #1-4

Warm-up

erase to show

1. In the diagram shown below, $k \parallel m$. Fill in the blanks to make each statement true.

    A. $\angle 8$ and ___$\angle 4$___ are corresponding angles.

    B. $\angle 5$ and ___$\angle 1$___ are corresponding angles.

    C. $\angle 3$ and ___$\angle 6$___ are alternate-interior angles.

    D. $\angle 5$ and ___$\angle 4$___ are alternate-interior angles.

    E. $\angle 5$ and ___$\angle 3$___ are same-side interior angles.

    F. $\angle 5$ and ___$\angle 8$___ are vertical angles.

    G. $\angle 2$ and ___$\angle 3$___ are vertical angles.

    H. If $m\angle 1 = 130°$, then $m\angle 8 =$ ___$130°$___ .

k
$$\begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix}$$
m
$$\begin{matrix} 5 & 6 \\ 7 & 8 \end{matrix}$$
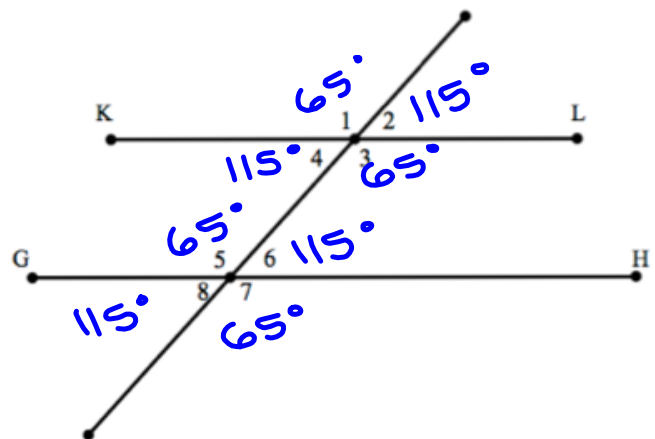
$k \parallel m$

2. In the diagram below, $\overline{KL} \parallel \overline{GH}$ and $m\angle 4 = 7x + 45$ and $m\angle 5 = 3x + 35$. Set up and solve an equation to determine the value of x. Then, in the diagram, state the measure of all 8 angles.
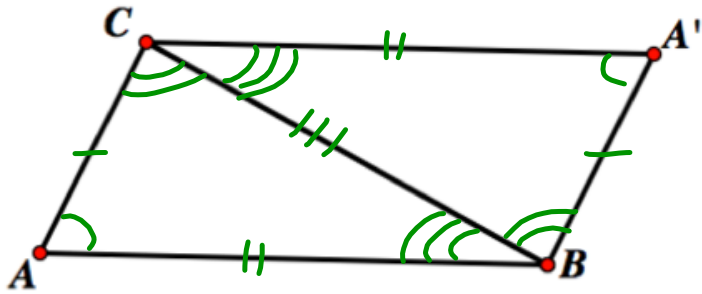
$$7x + 45 + 3x + 35 = 180$$
$$10x + 80 = 180$$
$$10x = 100$$
$$x = 10$$

K $65°$ / $115°$ L
$115°$ 4 / 3 $65°$
  1 / 2

G $65°$ / $115°$ H
$115°$ 5 / 6
  8 / 7
$115°$ $65°$

Example 1:

A. Work with a partner to analyze how the quadrilateral *ACA'B* is made up of two congruent triangles. Then, **mark all sides and angles in the quadrilateral that must be congruent.**

$$\triangle ABC \cong \triangle A'CB$$

B. Determine the following measures if $AB = 9$ cm, $AC = 5$ cm, $m\angle A = 65°$, and $m\angle ACB = 87°$.

$m\angle ABC = $ __28°__ $m\angle A' = $ __65°__

$m\angle A'BC = $ __87°__ $m\angle A'CB = $ __28°__

$CA' = $ __9 cm__ $BA' = $ __5 cm__

C. Now we are going to consider the same quadrilateral, but without showing the diagonal:

Using the information given and your answers in question B (above), label the measure of all 4 sides and all 4 angles of this quadrilateral.
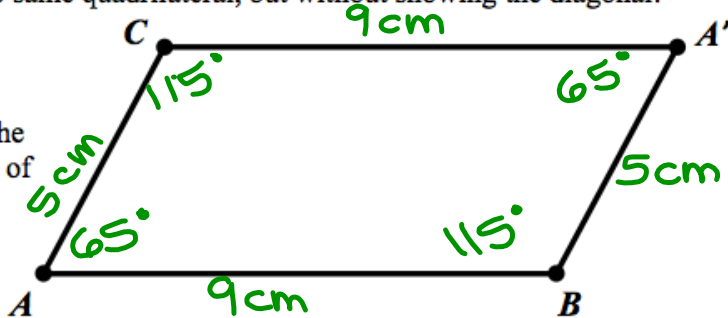
D. What appears to be true about the measures of the **opposite** angles of this quadrilateral?

Opposite ∠s appear to be ≅.

E. What appears to be true about the measures of the CONSECUTIVE angles of this quadrilateral (for example, compare $m\angle A$ with $m\angle C$, or compare $m\angle B$ with $m\angle A'$)?

Consecutive ∠s appear supplementary.

F. There are TWO conclusions we can make about the relationship between the **opposite** sides of this quadrilateral. Write two statements about the relationship between the **opposite** sides of this quadrilateral.

Opposite sides appear to be ≅
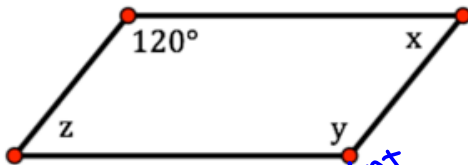Opposite sides appear to be ∥.

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Parallelogram (#VOC)

A _____quadrilateral_____ that has

_____2_____ pairs of _____||_____ sides.

Practice
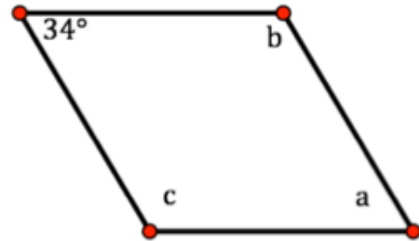
1. For each of the following parallelograms, each variable represents the measure of the angle. Determine the value of each variable.

A.

120°, x, z, y (parallelogram figure)

ss int ∠s

$z = 60°$ ($120°$ & z supp)
$x = 60°$ ($120°$ & x ss int ∠s)
$y = 120°$ (opp. ∠s ≅)

B.

34°, b, c, a (parallelogram figure)

$c = 146°$ ($34°$ & c ss int ∠s)
$b = 146°$ ($34°$ & b ss int ∠s)
$a = 34°$ (opp. ∠s ≅)

2. In parallelogram $KPLR$, $m\angle P = 7x - 75$ and $m\angle R = 3x + 45$. Set-up and solve an equation, then use your solution to determine the measure of all four angles of the parallelogram.

$m\angle P = m\angle R$ (opp.∠s ≅)

$7x - 75 = 3x + 45$
$-3x \qquad -3x$
$+75 \qquad\qquad +75$

$\dfrac{4x}{4} = \dfrac{120}{4}$

$x = 30$

$m\angle P = 7(30) - 75$
$= 210 - 75$
$= 135$

(parallelogram KPLR figure)
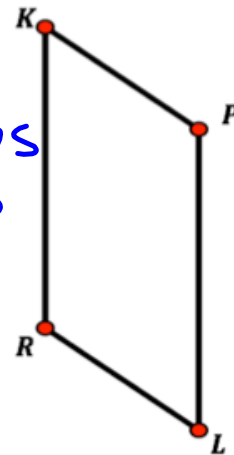
$m\angle P = 135°$ $m\angle K = 45°$
$m\angle R = 135°$ $m\angle L = 45°$

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3. In parallelogram *PCHS*, $PC = 4x + 5$, $CH = 3x + 1$ and $HS = 6x$. Set-up and solve an equation, then use your solution to determine the lengths of all four sides of the parallelogram.

$$PC = HS \quad (\text{Opp. sides} \cong)$$

$$4x + 5 = 6x$$
$$-4x \qquad -4x$$

$$\frac{5}{2} = \frac{2x}{2}$$

$$x = \frac{5}{2} = 2.5$$

$$CH = 3\left(\frac{5}{2}\right) + 1 \qquad \left(HS = \frac{6}{1}\left(\frac{5}{2}\right)\right)$$

$$= \frac{15}{2} + \frac{1}{1} \cdot \frac{2}{2} \qquad = \frac{30}{2}$$

$$\qquad\qquad\qquad\qquad = 15$$

$$= \frac{15}{2} + \frac{2}{2}$$

$$CH = \frac{17}{2} \text{ units} = 8.5 \text{ units}$$
$$PS = \frac{17}{2} \text{ units} = 8.5 \text{ units}$$
$$HS = 15 \text{ units}$$
$$PC = 15 \text{ units}$$

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