Geometry 1.2 Name______________________________

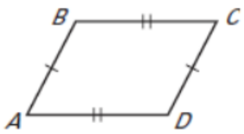
Class-Notes Date________________Period________

8.3 Show that a Quadrilateral is a Parallelogram

Goal: Use properties to identify parallelograms.

THEOREM

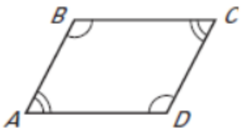
If both pairs of opposite __sides__ of a quadrilateral are congruent, then the quadrilateral is a parallelogram.



If $\overline{AB} \cong$ __$\overline{DC}$__ and $\overline{BC} \cong$ __$\overline{AD}$__, then $ABCD$ is a parallelogram.

THEOREM

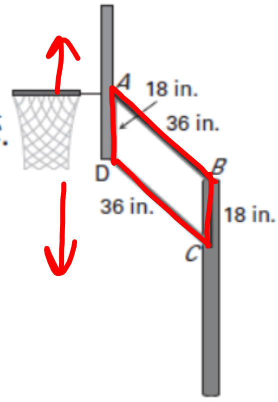
If both pairs of opposite __angles__ of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

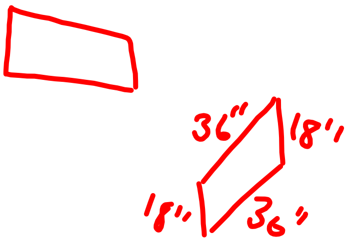


If $\angle A \cong$ __$\angle C$__ and $\angle B \cong$ __$\angle D$__, then $ABCD$ is a parallelogram.

Example 1 ***Solve a real-world problem***

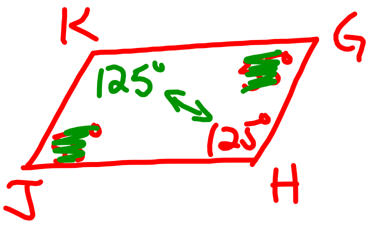
Basketball In the diagram at the right, $\overline{AB}$ and $\overline{DC}$ represent adjustable supports of a basketball hoop. *Explain* why $\overline{AD}$ is always parallel to $\overline{BC}$.



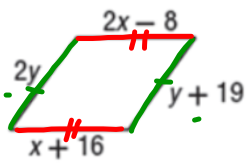


Example 2 **Draw the parallelogram and label the information.**

In quadrilateral *GHJK*, $m\angle G = 55°$, $m\angle H = 125°$, and $m\angle J = 55°$. Find $m\angle K$. What theorem can you use to show that *GHJK* is a parallelogram?



You try: Solve for x and y so that the quadrilateral is a parallelogram.



$2y = y + 19$ AND $2x - 8 = x + 16$

$y = 19$

$x - 8 = 16$

$x = 24$

Which theorem did you use to solve for x and y?

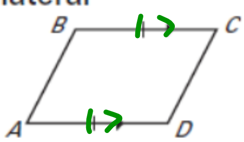
BOTH PAIR OF OPPOSITE SIDES ≅

NEW

THEOREM

If one pair of opposite sides of a quadrilateral are parallel and congruent, then the quadrilateral is a parallelogram.

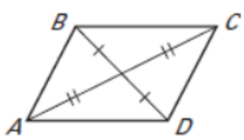
If $\overline{BC}$ // $\overline{AD}$ and $\overline{BC}$ ____ $\overline{AD}$, then *ABCD* is a parallelogram.



THEOREM

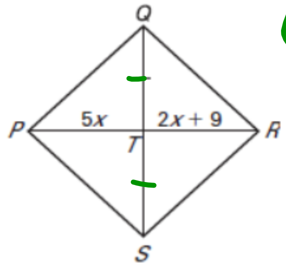
If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.

If $\overline{BD}$ and $\overline{AC}$ bisect each other, then *ABCD* is a parallelogram.



Example 3 *Use algebra with parallelograms*

For what value of x is quadrilateral *PQRS* a parallelogram?



GIVEN: $\overline{QT} \cong \overline{TS}$

$\overline{PT} \cong \overline{RT}$

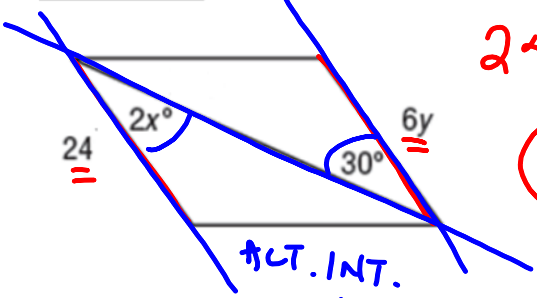
$5x = 2x + 9$

$3x = 9$

$x = 3$

Which theorem is demonstrated in example 3?

Example 4 **For what values of x and y is the quadrilateral a parallelogram?**



ALT. INT. ∡s

$24 = 6y$

$4 = y$

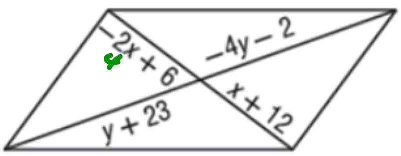
$2x = 30$

$x = 15$

Which theorem is demonstrated in example 4?

OPP. SIDES ≅ AND //

Example 5 **For what values of x and y is the quadrilateral a parallelogram?**



$-2x + 6 = x + 12$

$-6 = 3x$

$-2 = x$

$-4y - 2 = y + 23$

$-25 = 5y$

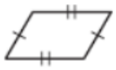
$-5 = y$

Which theorem is demonstrated in example 5?

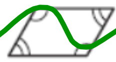
CONCEPT SUMMARY: WAYS TO PROVE A QUADRILATERAL IS A PARALLELOGRAM

1. Show both pairs of opposite sides are parallel. **(Definition)**

2. Show both pairs of opposite sides are congruent.

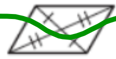


3. ~~Show both pairs of opposite angles are congruent.~~



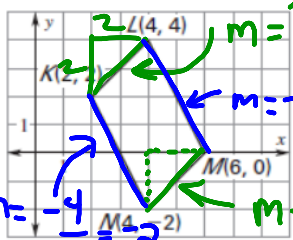
4. Show one pair of opposite sides are congruent and parallel.

5. ~~Show the diagonals bisect each other.~~



Example 6 *Use coordinate geometry*

Show that quadrilateral *KLMN* is a parallelogram.



PARALLEL LINES → SAME SLOPE

$\frac{\text{rise}}{\text{run}}$

$m = \frac{2}{2} = 1$ PARALLEL SIDES

$m = -\frac{4}{2} = 2$ ≅ SIDES

$m = \frac{-4}{2} = -2$

$m = \frac{2}{2} = 1$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Homework: WS 8.3 - Tests for Parallelograms