8.2 Use Properties of Parallelograms

Goal • Find angle and side measures in parallelograms.

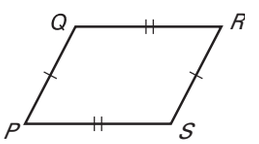
Your Notes

VOCABULARY

Parallelogram A parallelogram is a quadrilateral with both pairs of opposite sides parallel.

THEOREM 8.3

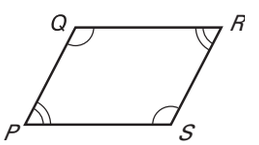
If a quadrilateral is a parallelogram, then its opposite sides are congruent.



If *PQRS* is a parallelogram, then $\overline{PQ} \cong \overline{RS}$ and $\overline{QR} \cong \overline{PS}$.

THEOREM 8.4

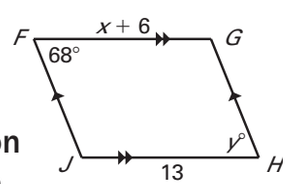
If a quadrilateral is a parallelogram, then its opposite angles are congruent.



If *PQRS* is a parallelogram, then $\angle P \cong \angle R$ and $\angle Q \cong \angle S$.

Example 1 *Use properties of parallelograms*

Find the values of *x* and *y*.



Solution

FGHJ is a parallelogram by the definition of a parallelogram. Use Theorem 8.3 to find the value of *x*.

$FG = HJ$ **Opposite sides of a ▱ are ≅.**

$x + 6 = 13$ **Substitute $x + 6$ for *FG* and 13 for *HJ*.**

$x = 7$ **Subtract 6 from each side.**

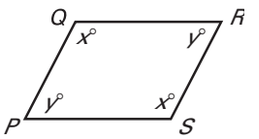
By Theorem 8.4, $\angle F \cong \angle H$, or $m\angle F = m\angle H$. So, $y° = 68°$.

In ▱*FGHJ*, $x = 7$ and $y = 68$.

Your Notes

THEOREM 8.5

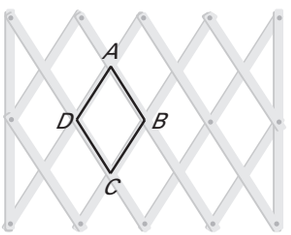
If a quadrilateral is a parallelogram, then its consecutive angles are supplementary .



If *PQRS* is a parallelogram, then $x° + y° =$ 180° .

Example 2 ***Use properties of a parallelogram***

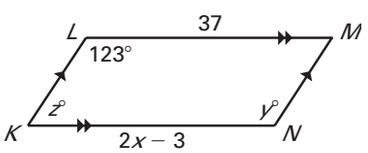
Gates As shown, a gate contains several parallelograms. Find $m\angle ADC$ when $m\angle DAB = 65°$.



Solution

By Theorem 8.5, the consecutive angle pairs in $\square ABCD$ are supplementary . So, $m\angle ADC + m\angle DAB =$ 180° . Because $m\angle DAB = 65°$, $m\angle ADC =$ 180° − 65° = 115° .

✔ ***Checkpoint*** **Find the indicated measure in $\square KLMN$ shown at the right.**



1. x

$x = 20$

2. y

$y = 123$

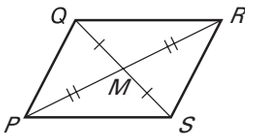
3. z

$z = 57$

Your Notes

THEOREM 8.6

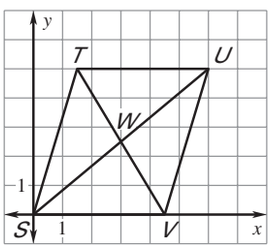
If a quadrilateral is a parallelogram, then its diagonals bisect each other.



$\overline{QM} \cong \overline{SM}$ and $\overline{PM} \cong \overline{RM}$

Example 3 ***Use properties of a parallelogram***

The diagonals of $\square STUV$ intersect at point W. Find the coordinates of W.



Solution

By Theorem 8.6, the diagonals of a parallelogram bisect each other. So, W is the midpoint of the diagonals $\overline{TV}$ and $\overline{SU}$. Use the Midpoint Formula.

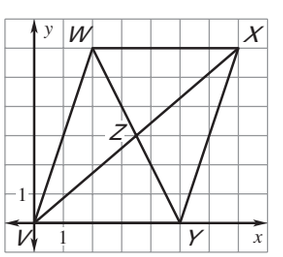
Coordinates of midpoint W of $\overline{SU}$ = $\left(\frac{6+0}{2}, \frac{5+0}{2}\right) = \left(3, \frac{5}{2}\right)$

In Example 3, you can use either diagonal to find the coordinates of W. Using $\overline{SU}$ simplifies calculations because one endpoint is (0, 0).

✔ ***Checkpoint*** **Complete the following exercises.**

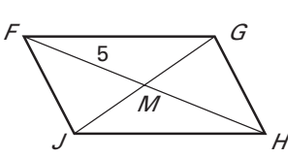
4. The diagonals of $\square VWXY$ intersect at point Z. Find the coordinates of Z.

$Z\left(\frac{7}{2}, 3\right)$



5. Given that $\square FGHJ$ is a parallelogram, find MH and FH.

$MH = 5$, $FH = 10$



Homework