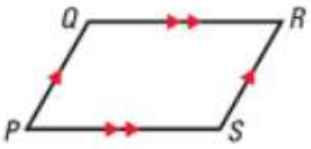
8.2 Use Properties of Parallelograms

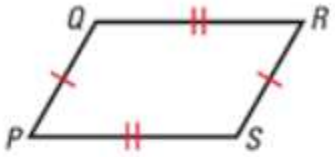
A **parallelogram** is a quadrilateral with both pairs of opposite sides parallel. The term "parallelogram $PQRS$" can be written as $\square PQRS$. In $\square PQRS$, $\overline{PQ} \parallel \overline{RS}$ and $\overline{QR} \parallel \overline{PS}$ by definition. The theorems below describe other properties of parallelograms.



THEOREM 8.3

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

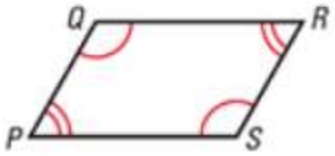
If $PQRS$ is a parallelogram, then $\overline{PQ} \cong \overline{RS}$ and $\overline{QR} \cong \overline{PS}$.



THEOREM 8.4

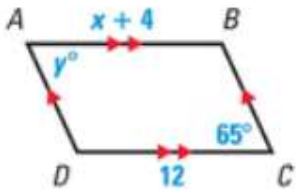
If a quadrilateral is a parallelogram, then its opposite angles are congruent.

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



EXAMPLE 1 Use properties of parallelograms

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



$ABCD$ is a parallelogram by the definition of a parallelogram. Use Theorem 8.3 to find the value of x.

$AB = CD$	Opposite sides of a $\square$ are $\cong$.
$x + 4 = 12$	Substitute $x + 4$ for AB and 12 for CD.
$x = 8$	Subtract 4 from each side.

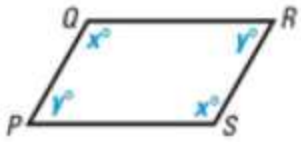
By Theorem 8.4, $\angle A \cong \angle C$, or $m\angle A = m\angle C$. So, $y^\circ = 65^\circ$.

▸ In $\square ABCD$, $x = 8$ and $y = 65$.

THEOREM 8.5

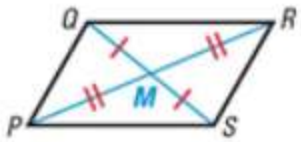
If a quadrilateral is a parallelogram, then its consecutive angles are supplementary.

If $PQRS$ is a parallelogram, then $x^\circ + y^\circ = 180^\circ$.



THEOREM 8.6

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



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