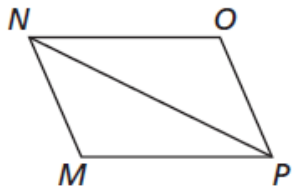
Write a two-column proof.

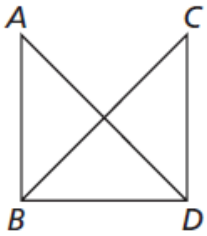
1. Given: $\overline{MN} \cong \overline{PO}, \quad NO \cong MP$

Prove: $\triangle PMN \cong \triangle NOP$



2. Given: $\overline{AB} \cong \overline{CD}, \quad \overline{AB} \perp \overline{BD}, \quad \overline{CD} \perp \overline{BD}$

Prove: $\overline{AD} \cong \overline{BC}$



Solve the equation. Justify each step.

1. $2x - 8 = 5 + 4x$

2. $\frac{1}{2}(3x + 8) = 2x - 3$

3. $\frac{11 - x}{5} = 9 - 7x$

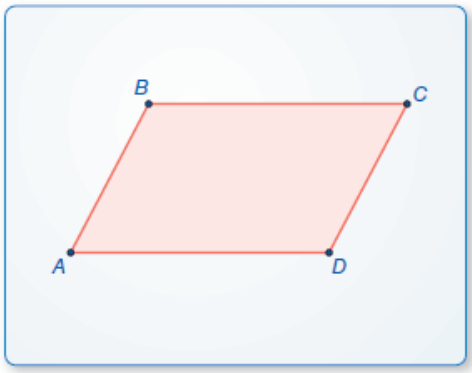
Essential Question

What are the properties of parallelograms?

Work with a partner. Use dynamic geometry software.

a. Construct any parallelogram and label it *ABCD*. Explain your process.

Sample



b. Find the angle measures of the parallelogram.
What do you observe?

c. Find the side lengths of the parallelogram. What do you observe?

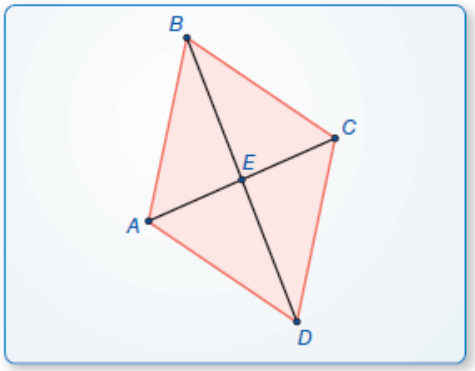
d. Repeat parts (a)–(c) for several other parallelograms. Use your results to write conjectures about the angle measures and side lengths of a parallelogram.

Work with a partner. Use dynamic geometry software.

a. Construct any parallelogram and label it *ABCD*.

b. Draw the two diagonals of the parallelogram. Label the point of intersection *E*.

Sample



c. Find the segment lengths *AE*, *BE*, *CE*, and *DE*. What do you observe?

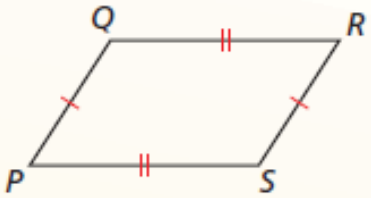
d. Repeat parts (a)–(c) for several other parallelograms. Use your results to write a conjecture about the diagonals of a parallelogram.

Theorems

Theorem 7.3 Parallelogram Opposite Sides Theorem

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

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

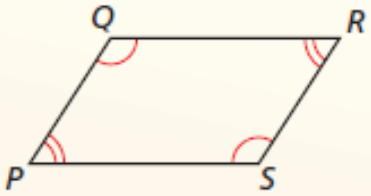


Proof p. 368

Theorem 7.4 Parallelogram Opposite Angles Theorem

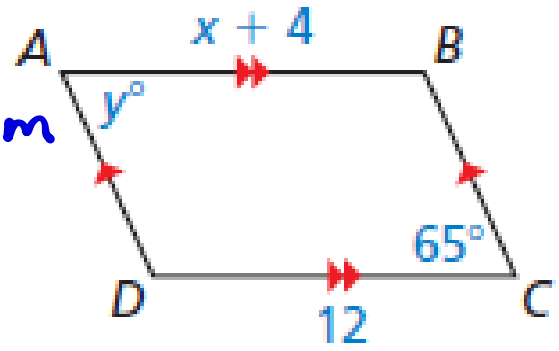
If a quadrilateral is a parallelogram, then its opposite angles are congruent.

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



Proof Ex. 37, p. 373

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



$\square ABCD$ is a llogram

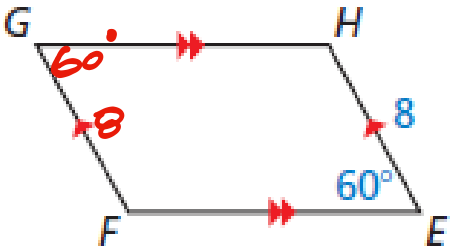
$\overline{AB} \cong \overline{DC}$

$x + 4 = 12 \quad x = 8$

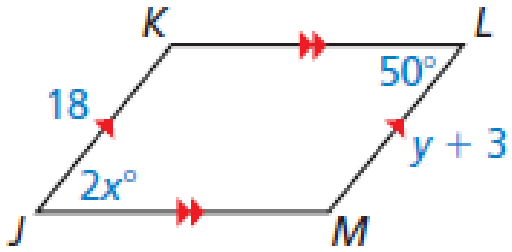
$\angle DAB \cong \angle BCD$

$y = 65^\circ$

1. Find FG and $m\angle G$.



2. Find the values of x and y.



$x = 25$

$y + 3 = 18$

$-3 \quad -3$

$y = 15$

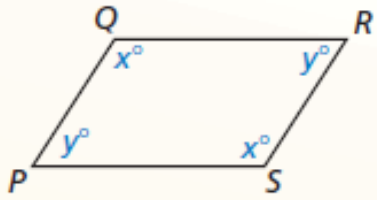
Theorems

Theorem 7.5 Parallelogram Consecutive Angles Theorem

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

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

Proof Ex. 38, p. 373

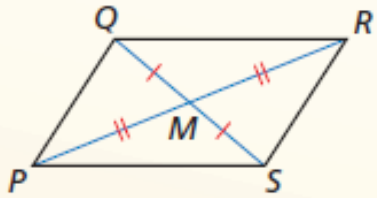


Theorem 7.6 Parallelogram Diagonals Theorem

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

If $PQRS$ is a parallelogram, then $\overline{QM} \cong \overline{SM}$ and $\overline{PM} \cong \overline{RM}$.

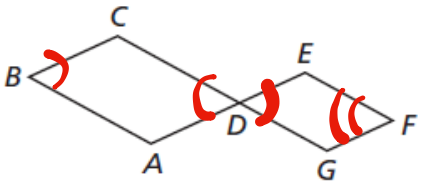
Proof p. 370



As shown, part of the extending arm of a desk lamp is a parallelogram. The angles of the parallelogram change as the lamp is raised and lowered. Find $m\angle BCD$ when $m\angle ADC = 110°$.

Write a two-column proof.

Given *ABCD* and *GDEF* are parallelograms.



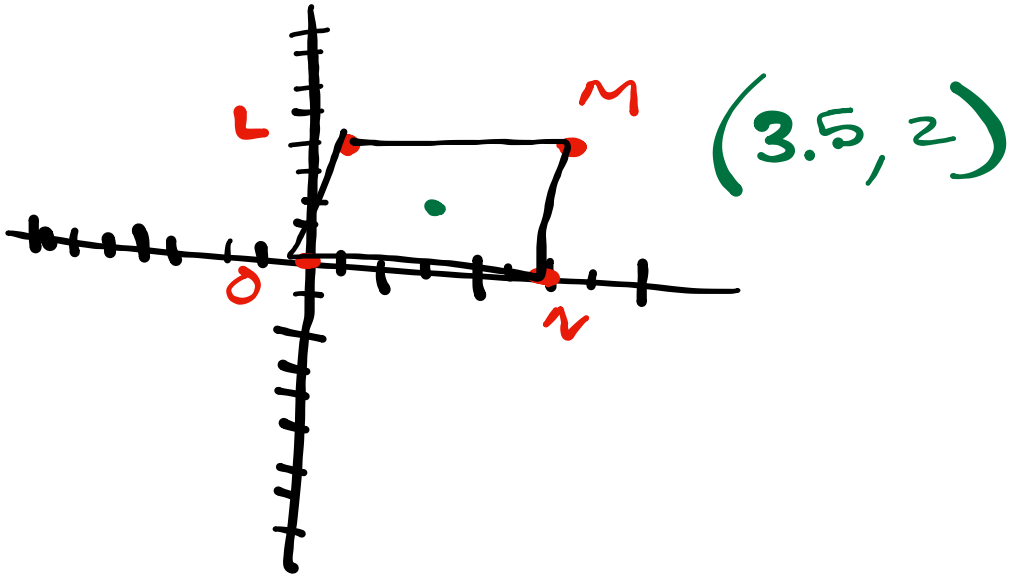
Prove $\angle B \cong \angle F$

STATEMENTS	REASONS
1. *ABCD* and *GDEF* are parallelograms.	1. Given
2. $\angle CDA \cong \angle B$, $\angle EDG \cong \angle F$	2. If a quadrilateral is a parallelogram, then its opposite angles are congruent.
3. $\angle CDA \cong \angle EDG$	3. Vertical Angles Congruence Theorem (Thm. 2.6)
4. $\angle B \cong \angle F$	4. Transitive Property of Congruence (Thm. 2.2)

3. WHAT IF? In Example 2, find $m\angle BCD$ when $m\angle ADC$ is twice the measure of $\angle BCD$.

4. Using the figure and the given statement in Example 3, prove that $\angle C$ and $\angle F$ are supplementary angles.

Find the coordinates of the intersection of the diagonals of $\square LMNO$ with vertices $L(1, 4)$, $M(7, 4)$, $N(6, 0)$, and $O(0, 0)$.



Three vertices of $\square WXYZ$ are $W(-1, -3)$, $X(-3, 2)$, and $Z(4, -4)$. Find the coordinates of vertex Y.

5. Find the coordinates of the intersection of the diagonals of $\square STUV$ with vertices $S(-2, 3)$, $T(1, 5)$, $U(6, 3)$, and $V(3, 1)$.

6. Three vertices of $\square ABCD$ are $A(2, 4)$, $B(5, 2)$, and $C(3, -1)$. Find the coordinates of vertex D.

• **Exit Ticket:** Draw parallelogram *ABCD* with $m\angle A = 72°$ and *BC* = 8.2 centimeters. Find $m\angle B$ and the length of $\overline{AD}$.