



7.2 Properties of Parallelograms

Essential Question

What are the properties of parallelograms?

Parallelogram Exploration

Begin by clicking through the steps below to make and explore a parallelogram

1. Construct Angle BAC
 2.3. Construct parallel lines
 4. Make Parallelogram
 5.7. Finish Parallelogram
 Hide Measurements

C1. Construct Diagonals
 C2. Midpoint and Measure

$m\angle ABD = 44.6^\circ$ $m\angle BDC = 135.4^\circ$
 $m\angle CAB = 135.4^\circ$ $m\angle DCA = 44.6^\circ$

$AC = 3.8 \text{ cm}$
 $CD = 9.0 \text{ cm}$
 $BD = 3.8 \text{ cm}$
 $AB = 9.0 \text{ cm}$

Exploration 1

Parallelogram sides and angles.

- Construct a parallelogram and measure all of its angles and sides.
- With a partner, complete the conjectures below:

In a parallelogram, opposite angles are _____

In a parallelogram, opposite sides are _____

In a parallelogram, angles that are next to each other are _____

- Change the parallelogram several times to see if these appear to be always true.

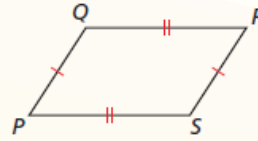
Theorems

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

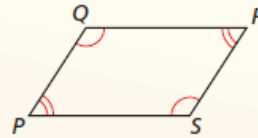


Theorem 7.4 Parallelogram Opposite Angles Theorem

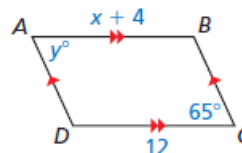
If a quadrilateral is a parallelogram, then its opposite angles are congruent.

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

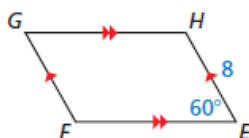
Proof Ex. 37, p. 373



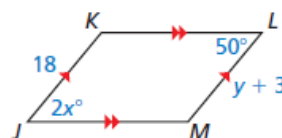
Find the values of x and y .



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



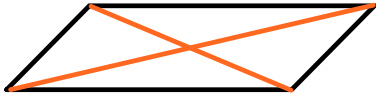
2. Find the values of x and y .



Exploration 2

Parallelogram Diagonals

1. Construct the diagonals in your parallelogram.
2. Measure the lengths of the diagonal parts.
3. Write down a conjecture about the parts of the diagonals.



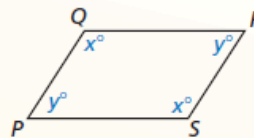
Theorems

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 $x^\circ + y^\circ = 180^\circ$.

Proof Ex. 38, p. 373

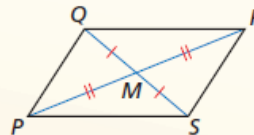


Theorem 7.6 Parallelogram Diagonals Theorem

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

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

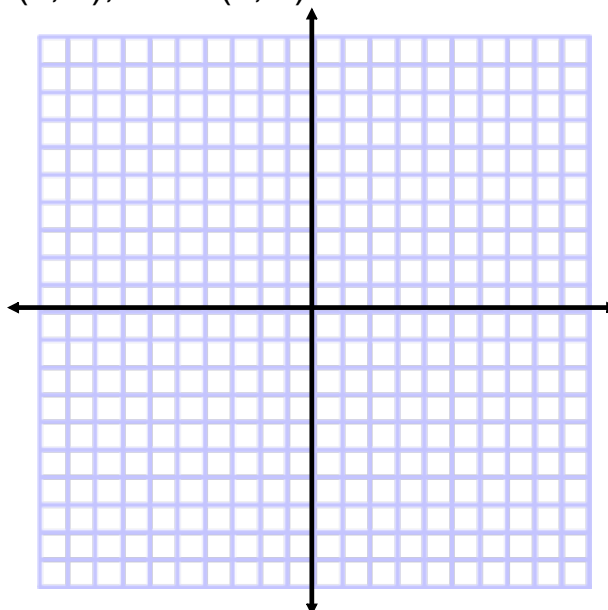
Proof p. 370



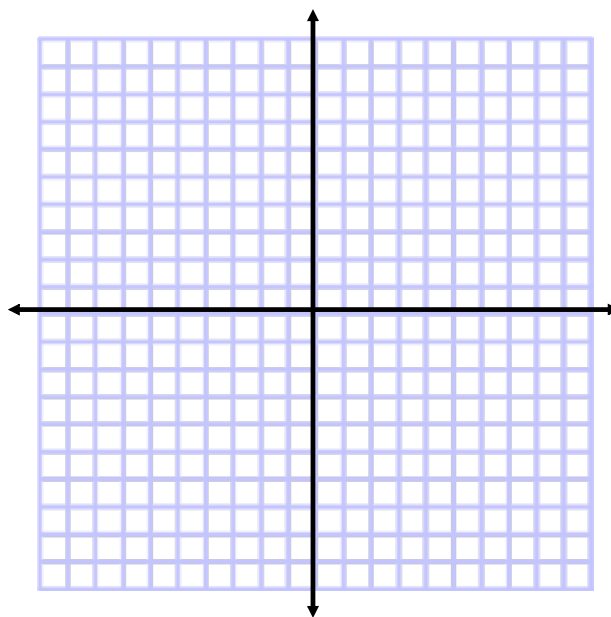
As shown, part of the extending arm of a desk lamp is a parallelogram. The angles of the parallelogram change as the lamp is raised and lowered. Find $m\angle BCD$ when $m\angle ADC = 110^\circ$.



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 $V(3, 1)$.

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