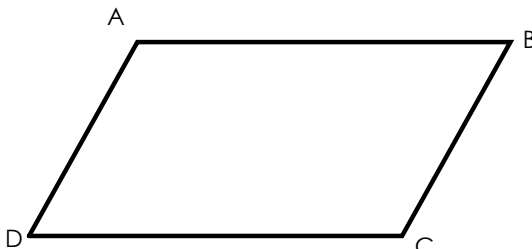


5.1 Properties of Parallelograms

Objective: Students will use the properties of parallelograms to solve problems

Parallelogram

A _____ where both pairs of opposite sides are _____



If we know

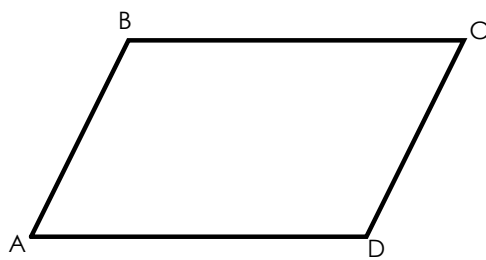
_____ || _____

_____ || _____

ABCD is a parallelogram

Four more properties we know are true for EVERY parallelogram

A quadrilateral is a parallelogram if opposite sides are congruent



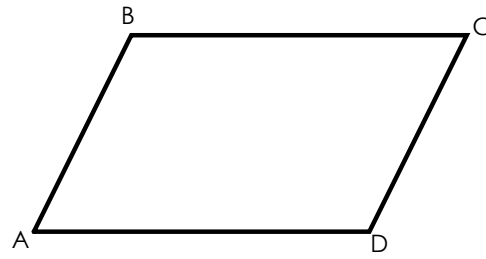
If we know

$BC \cong \underline{\hspace{1cm}}$

$BA \cong \underline{\hspace{1cm}}$

Then ABCD is a parallelogram

A quadrilateral is a parallelogram if opposite angles are congruent



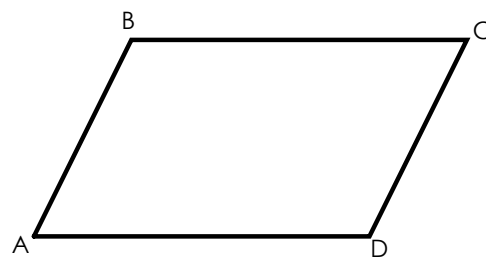
If we know

$\angle B \cong \angle \underline{\hspace{1cm}}$

$\angle A \cong \angle \underline{\hspace{1cm}}$

Then ABCD is a parallelogram

A quadrilateral is a parallelogram if consecutive angles are supplementary



If we know

$\angle B + \angle \underline{\hspace{1cm}} = 180^\circ$

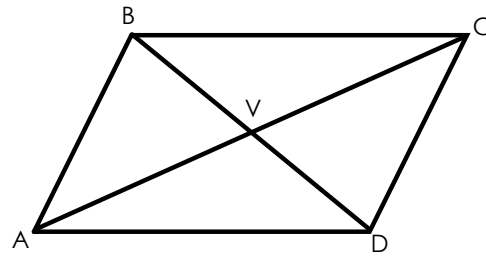
$\angle A + \angle \underline{\hspace{1cm}} = 180^\circ$

$\angle D + \angle \underline{\hspace{1cm}} = 180^\circ$

$\angle C + \angle \underline{\hspace{1cm}} = 180^\circ$

Then ABCD is a parallelogram

A quadrilateral is a parallelogram if diagonals bisect each other



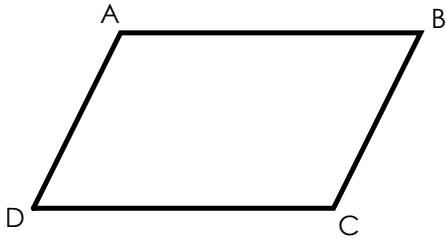
If we know

$BV \cong \underline{\hspace{1cm}}$

$AV \cong \underline{\hspace{1cm}}$

Then ABCD is a parallelogram

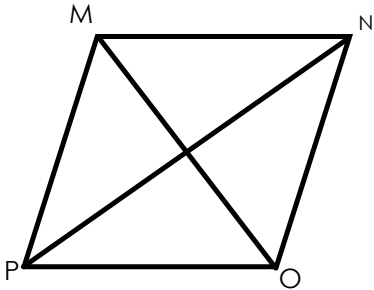
Given: In quadrilateral ABCD, $\angle B \cong \angle D$ and $\angle A \cong \angle C$. Prove that ABCD is a parallelogram.



Proof

Quadrilateral ABCD is a parallelogram because

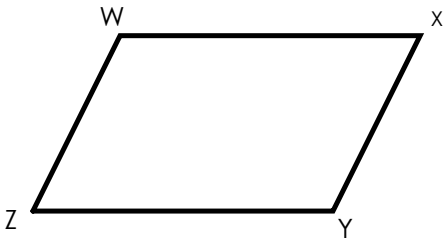
Given: In quadrilateral MNOP, diagonals \overline{MO} and \overline{NP} intersect at point T and $\overline{MT} \cong \overline{OT}$ and $\overline{NT} \cong \overline{TP}$. Prove that MNOP is a parallelogram.



Proof

Quadrilateral MNOP is a parallelogram because

Given: In quadrilateral WXYZ, $\overline{WX} \parallel \overline{ZY}$ and $\overline{WZ} \parallel \overline{XY}$. Prove that WXYZ is a parallelogram.



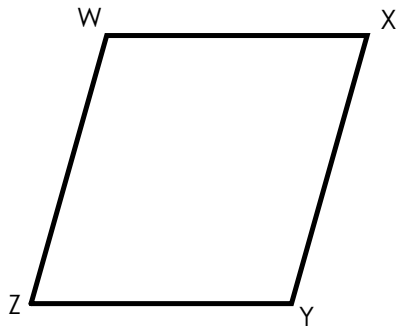
Proof

Given: In quadrilateral ABCD, $\overline{AB} \cong \overline{DC}$. What additional information is needed to prove that ABCD is a parallelogram.

Additional Information

Quadrilateral ABCD is a parallelogram because

In parallelogram WXYZ, $\angle Z = 68^\circ$. Find the $m\angle W$ and justify your answer.



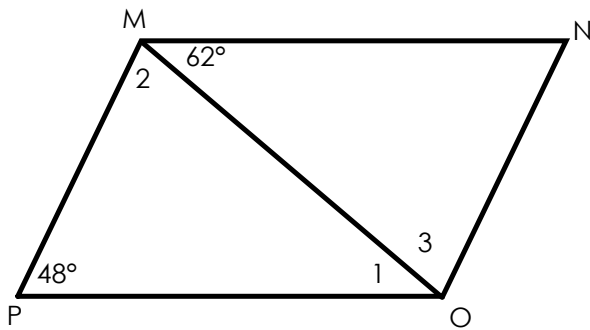
The $m\angle W = \underline{\hspace{2cm}}$, because $\underline{\hspace{2cm}}$

In parallelogram ABCD, $\angle A = 75^\circ$. Find the $m\angle C$ and justify your answer.



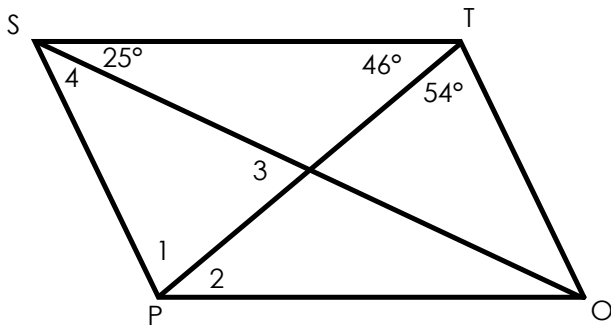
The $m\angle C = \underline{\hspace{2cm}}$, because $\underline{\hspace{2cm}}$

In parallelogram MNOP, $\angle NMO = 62^\circ$ and $\angle P = 48^\circ$. Find the $m\angle 1$, $m\angle 2$ and $m\angle 3$. Justify your answer.



Angle	Measure	Reason
$\angle 1$		
$\angle 2$		
$\angle 3$		

In parallelogram STOP, $\angle TSO = 25^\circ$, $\angle PTO = 54^\circ$ and $\angle STP = 46^\circ$. Find the $m\angle 1$, $m\angle 2$, $m\angle 3$ and $m\angle 4$. Justify your answer.



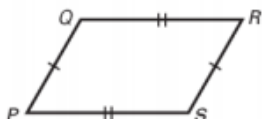
Angle	Measure	Reason
$\angle 1$		
$\angle 2$		
$\angle 3$		
$\angle 4$		

Independent Practice

Fill in the missing information about the parallelograms below

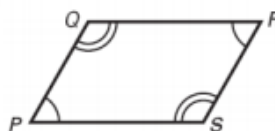
If a quadrilateral is a parallelogram, then its **opposite sides** are congruent.

$$\underline{\hspace{2cm}} \cong \overline{RS} \text{ and } \overline{SP} \cong \underline{\hspace{2cm}}$$



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

$$\angle P \cong \angle \underline{\hspace{1cm}} \text{ and } \angle \underline{\hspace{1cm}} \cong \angle S$$



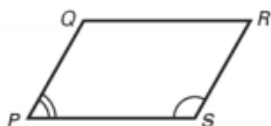
If a quadrilateral is a parallelogram, then its **consecutive angles** are supplementary.

$$m\angle P + m\angle Q = \underline{\hspace{2cm}}^\circ,$$

$$m\angle Q + m\angle R = \underline{\hspace{2cm}}^\circ,$$

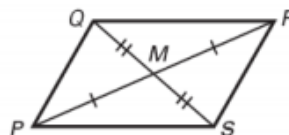
$$m\angle R + m\angle S = \underline{\hspace{2cm}}^\circ,$$

$$m\angle S + m\angle P = \underline{\hspace{2cm}}^\circ$$

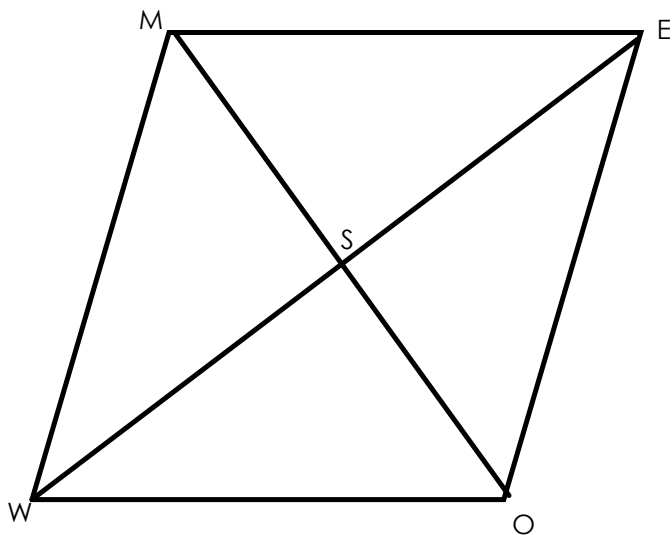


If a quadrilateral is a parallelogram, then its diagonals **bisect** each other.

$$\overline{QM} \cong \underline{\hspace{1cm}} \text{ and } \underline{\hspace{1cm}} \cong \overline{RM}$$



Parallelogram MEOW is pictured below. Fill in the missing information and state the property that you used to answer the question

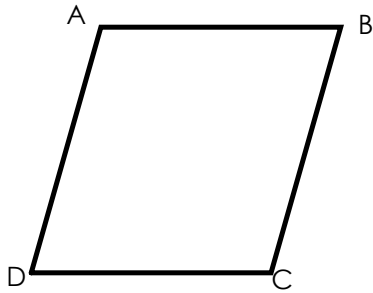


$$ME \cong \underline{\hspace{1cm}}, \text{ because } \underline{\hspace{2cm}}$$

$$MW \parallel \underline{\hspace{1cm}}, \text{ because } \underline{\hspace{2cm}}$$

$$WS \cong \underline{\hspace{1cm}}, \text{ because } \underline{\hspace{2cm}}$$

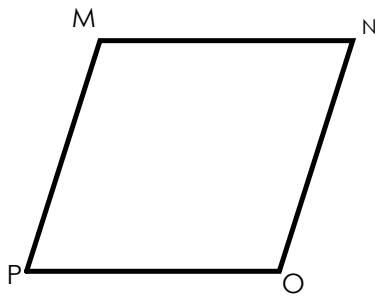
Given: In quadrilateral ABCD, $\angle B + \angle C = 180$ and $\angle A$ is supplementary to $\angle B$.
Prove that ABCD is a parallelogram.



Proof

Quadrilateral ABCD is a
parallelogram because

Given: In quadrilateral MNOP, $\overline{MP} \parallel \overline{NO}$ and $\overline{MN} \parallel \overline{PO}$.
Prove that MNOP is a parallelogram.



Proof

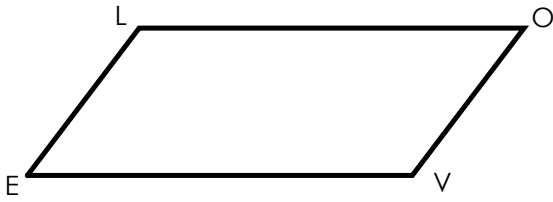


Given: In quadrilateral WXYZ, $\overline{WX} \cong \overline{ZY}$ and $\overline{WZ} \cong \overline{XY}$.
Prove that WXYZ is a parallelogram.

Proof



In parallelogram LOVE, $\angle L = 141^\circ$. Find the $m\angle V$ and justify your answer.

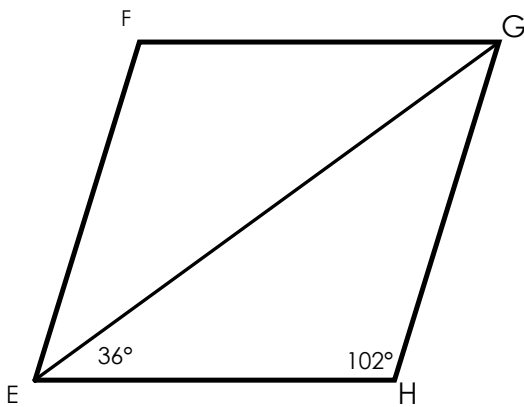


The $m\angle V = \underline{\hspace{2cm}}$, because $\underline{\hspace{2cm}}$
 $\underline{\hspace{2cm}}$

In parallelogram CATS, $\angle A = 27^\circ$. Find the $m\angle T$ and justify your answer.

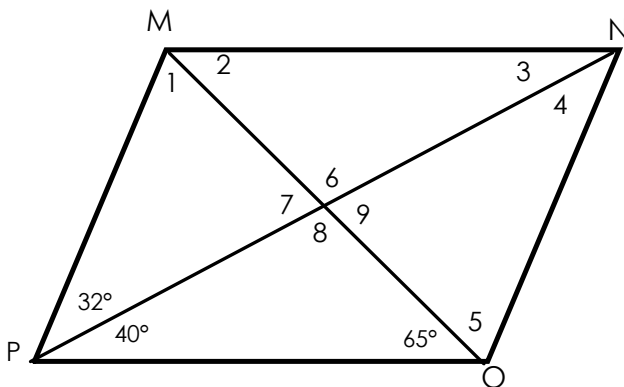
The $m\angle T = \underline{\hspace{2cm}}$, because $\underline{\hspace{2cm}}$
 $\underline{\hspace{2cm}}$

In parallelogram FEHG, $\angle GEH = 36^\circ$ and $\angle EHG = 102^\circ$. Find the measures of the angles in the chart below. Justify your answer.



Angle	Measure	Reason
$\angle EFG$		
$\angle FGE$		
$\angle FEG$		
$\angle EGH$		

In parallelogram MNOP, $\angle MOP = 65^\circ$, $\angle NPO = 40^\circ$ and $\angle MPN = 32^\circ$. Find the measures of the angles in the chart below. Justify your answer.



Angle	Measure	Reason
$\angle 1$		
$\angle 2$		
$\angle 3$		
$\angle 7$		
$\angle 8$		
$\angle 9$		
$\angle 10$		
$\angle 11$		
$\angle 12$		