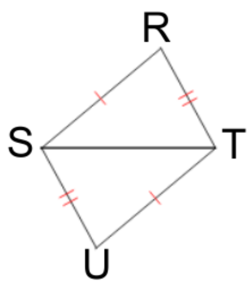
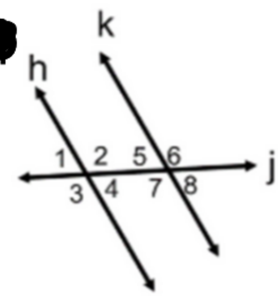
Mind Activator

1. Given $\overline{RS} = \overline{UT}$ and $\overline{RT} \cong \overline{US}$. Prove $\angle R \cong \angle U$.



S	R
$\overline{RS} \cong \overline{UT}$	Given
$\overline{RT} \cong \overline{US}$	Given
$\overline{ST} \cong \overline{TS}$	Reflexive Property
$\triangle SRT \cong \triangle TUS$	SSS
$\angle R \cong \angle U$	CPCTC

2. Name 2 [redacted] congruent and 2 [redacted] supplementary angles to $\angle 1$.



$\angle 1 \cong \angle 5$
Corresponding

$\angle 1 \cong \angle 8$
Alt. Int. $\angle$'s

$\angle 1$ and $\angle 6$ are supplementary.
Same side exterior

$\angle 1$ and $\angle 2$ are supplementary
Linear pairs

Official Definition

Parallelogram - A quadrilateral with two pairs of parallel sides.

Parallelogram *ABCD*
▱*ABCD*

$\overline{AB} \parallel \overline{CD}$, $\overline{BC} \parallel \overline{DA}$

Hint: Before you start make a list of what you already know.
opp. sides parallel, Alt. Int. ∠'s, reflexive prop., CPCTC

Given: JKLM is a parallelogram

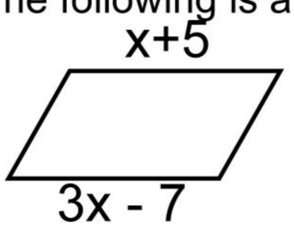
Prove: $\overline{JK} \cong \overline{LM}$, $\overline{KL} \cong \overline{MJ}$

Statement	Reason
JKLM is a parallelogram	Given
$\overline{KL} \parallel \overline{JM}$ + $\overline{KJ} \parallel \overline{LM}$	Def. of parallelogram
$\angle 4 \cong \angle 3$	Alt. Int. ∠'s theorem
$\angle 1 \cong 2$	Alt. Int. ∠'s Theorem
$\overline{JL} \cong \overline{LJ}$	Reflexive Property
$\triangle JKL \cong \triangle LMJ$	ASA
$\overline{KL} \cong \overline{MJ}$	CPCTC
$\overline{JK} \cong \overline{LM}$	CPCTC

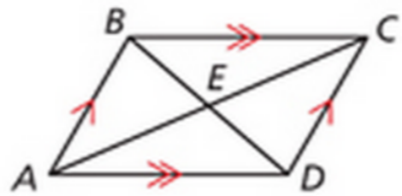
THEOREM	HYPOTHESIS	CONCLUSION
2. If a quadrilateral is a parallelogram, then its opposite sides are congruent. (▱ → opp. sides ≅)		$\overline{AB} \cong \overline{CD}$ $\overline{BC} \cong \overline{DA}$

Application

The following is a parallelogram, what is the value of x?



$x+5 = 3x-7$
$-x \quad\quad -x$
$5 = 2x - 7$
$+7 \quad\quad +7$
$\frac{12}{2} = \frac{2x}{2}$
$x = 6$

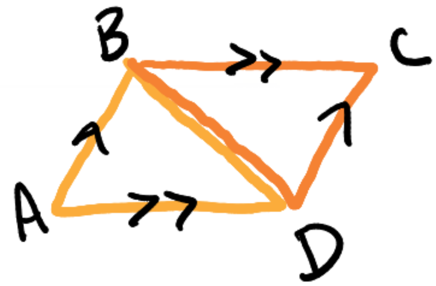


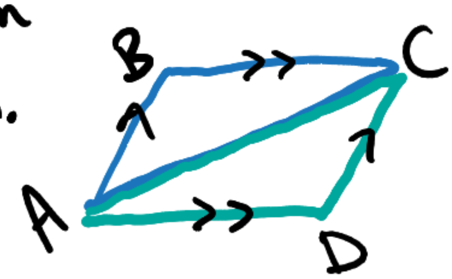
Given: *ABCD* is a parallelogram.

Prove: $\angle BAD \cong \angle DCB$, $\angle ABC \cong \angle CDA$

Proof:

Statement	Reason
ABCD is a parallelogram	Given
$\overline{BC} \parallel \overline{AD}$ + $\overline{AB} \parallel \overline{DC}$	Def. of Parallelogram
$\angle CBD \cong \angle ADB$	Alt. Int. $\angle$'s Thm.
$\angle CDB \cong \angle ABD$	Alt. Int. $\angle$'s Thm.
$\overline{BD} \cong \overline{DB}$	Reflexive Property
$\triangle BCD \cong \triangle DAB$	ASA
$\angle BAD \cong \angle DCB$	CPCTC
$\angle BCA \cong \angle DAC$	Alt. Int. $\angle$'s Thm.
$\angle CAB \cong \angle ACD$	Alt. Int. $\angle$'s Thm.
$\overline{CA} \cong \overline{AC}$	Reflexive Property
$\triangle ABC \cong \triangle CDA$	ASA
$\angle ABC \cong \angle CDA$	CPCTC





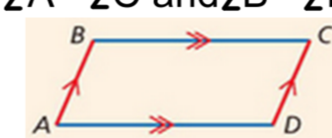
Theorem:

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

3. ▱ ⟶ opp. $\angle$'s $\cong$

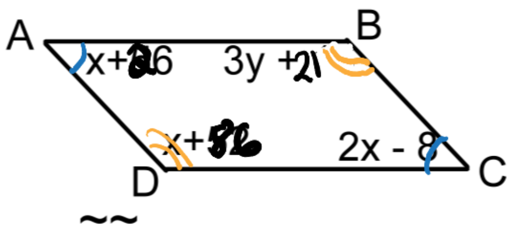
Conclusion

$\angle A = \angle C$ and $\angle B = \angle D$



Apply this theorem

ABCD is a parallelogram find the value of x and y.



$2x - 8 = x + 26$

$-x \quad -x$

$x - 8 = 26$

$+8 \quad +8$

$x = 34$

$120 + 3y + 21 = 180$

$3y + 141 = 180$

$3y = 39$

$y = 13$

Prove consecutive angles are supplementary

Given that ABCD is a parallelogram.

Prove: ∠A and ∠B are supplementary.
∠B and ∠C are supplementary.
∠C and ∠D are supplementary.
∠D and ∠A are supplementary.

Statement	Reason
ABCD is a parallelogram	Given
$\overline{AD} \parallel \overline{BC}$ + $\overline{AB} \parallel \overline{DC}$	Definition of parallelogram.
∠A and ∠B are supp.	Same side Int. Thm.
∠B and ∠C are supp.	Same side Int. Thm.
∠C and ∠D are supp.	Same side Int. Thm.
∠D and ∠A are supp.	Same side Int. Thm.

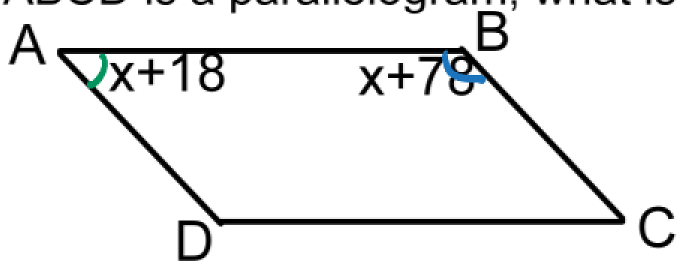
Theorem:

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

4. ▱ → consecutive ∠'s supp.

Application

ABCD is a parallelogram, what is the measure of angle B?



$x+18+x+78=180$

$2x+96=180$

$-96 \quad -96$

$2x=84$

$x=42$

What have we learned so far?

Parallelogram Properties

1. Opp sides are $\parallel$
2. Opp sides are $\cong$
3. Opp $\angle$'s are $\cong$
4. Consecutive $\angle$'s are supp.

Your turn to try some application problems

In ▱*KLMN*, *LM* = 28 in., *MO* = 14 in, *LN* = 26 in., and m∠*LKN* = 74°. Find each measure.

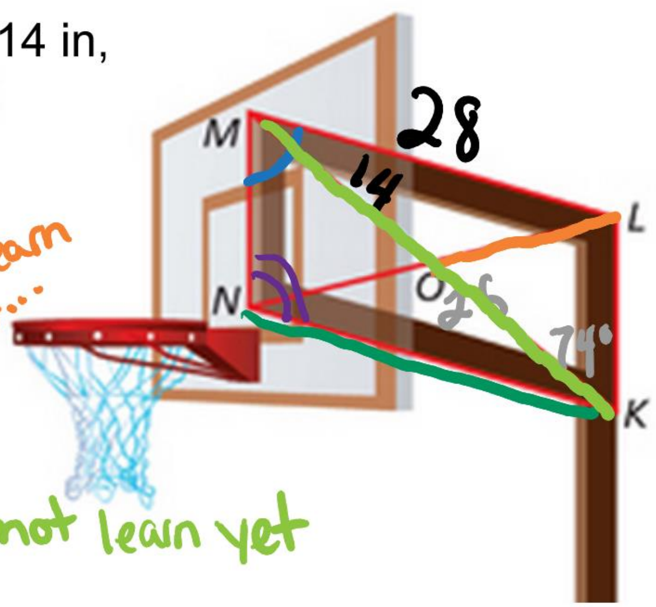
1a. $\overline{KN}$ = 28 in

1b. m∠*NML* = 74°

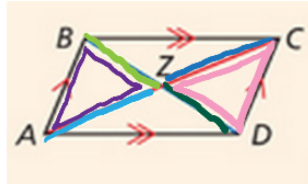
1c. $\overline{LO}$ = 26/2 = 13 ← Did not learn yet...

1d. m∠KNM = 180 − 74 = 106°

1e. $\overline{MK}$ = 14 · 2 = 28 ← Did not learn yet



Given ABCD is a parallelogram,
Prove diagonals bisect each other



BD bisects CA
and
CA bisects BD

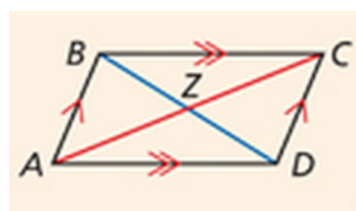
What are we really trying to prove?

$\overline{BZ} \cong \overline{DZ}$ + $\overline{AZ} \cong \overline{CZ}$

Statement	Reason
ABCD is a parallelogram	Given
$\overline{AB} \parallel \overline{DC}$ + $\overline{BC} \parallel \overline{AD}$	Def. of parallelogram
$\angle DBA \cong \angle BDC$	Alt. Int. ∠'s Thm
$\angle CAB \cong \angle ACD$	Alt. Int. ∠'s Thm
$\overline{BA} \cong \overline{DC}$	opp. sides of ▱ are ≅
$\triangle BZA \cong \triangle DZC$	ASA
$\overline{BZ} \cong \overline{DZ}$	CPCTC
$\overline{AZ} \cong \overline{CZ}$	CPCTC
$m\overline{BZ} = m\overline{DZ}$	Def. of ≅
$m\overline{AZ} = m\overline{CZ}$	Def. of ≅
BD bisects AC	Def of bisects
AC bisects BD	Def. of bisects

Theorem:

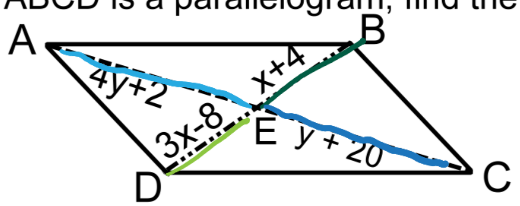
If a quadrilateral is a parallelogram then its diagonals bisect each other.



5. ▱ ⟶ diagonals bisect each other.

Application

ABCD is a parallelogram, find the value of x and y.



$3x - 8 = x + 4$
$-x \quad -x$
$2x - 8 = 4$
$+8 \quad +8$
$\frac{2x}{2} = \frac{12}{2}$
$x = 6$

$4y + 2 = y + 20$
$-y \quad -y$
$3y + 2 = 20$
$-2 \quad -2$
$\frac{3y}{3} = \frac{18}{3}$
$y = 6$

What have we learned about parallelograms?

Parallelogram Properties

1. Opp sides are ||
2. Opp sides are $\cong$
3. Opp ∠'s are $\cong$
4. Consecutive ∠'s are supp.
5. Diagnols bisect Each other.

Review of what we learned

Fill in the blanks to complete each definition or theorem.

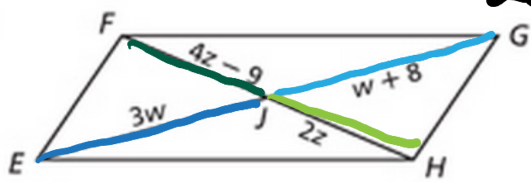
1. If a quadrilateral is a parallelogram, then its consecutive angles are __Supplementary__.
2. If a quadrilateral is a parallelogram, then its opposite sides are __congruent__
3. A parallelogram is a quadrilateral with two pairs of __parallel__ sides.
4. If a quadrilateral is a parallelogram, then its diagonals __bisect__ each other.
5. If a quadrilateral is a parallelogram, then its opposite angles are __congruent__

Extra Practice

EFGH is a parallelogram. Find each measure.

2a. *JG*

2b. *FH*



2a. JG

$3w = \cancel{w}+8$
$-w \quad -\cancel{w}$

$\frac{\cancel{2}w}{\cancel{2}} = \frac{8}{2}$

$w=4$

$JG = (4)+8 = 12$

2b. FH

$4z - 9 = \cancel{2z}$
$-2z \quad -\cancel{2z}$

$2z - \cancel{9} = 0$
$\quad +9 \quad +9$

$\frac{\cancel{2}z}{\cancel{2}} = \frac{9}{2}$

$z = 4.5$

$FH = 4(4.5) - 9 + 2(4.5)$

$= 18 - 9 + 9$

$= 9 + 9$

$FH = 18$