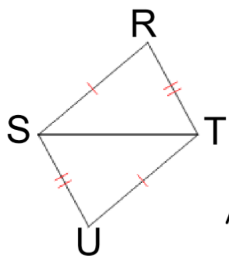
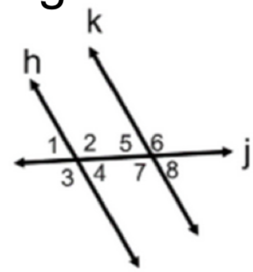
Mind Activator

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



Statement	Reason
$\overline{RS} \cong \overline{UT}$	Given
$\overline{RT} \cong \overline{US}$	Given
$\overline{ST} \cong \overline{TS}$	Reflexive Prop.
$\triangle RST \cong \triangle UTS$	SSS
$\angle R \cong \angle U$	CPCTC

2. Name 2 congruent and 2 supplementary angles to angle 1 in the image.



Congruent

$\angle 1 \cong \angle 5$ corresponding

$\angle 1 \cong \angle 8$ Alt. Ext.

Supplementary

$\angle 1$ and $\angle 6$ supp.
Same side ext.

$\angle 1$ and $\angle 3$
linear pairs.

Mind Activator

What does CPCTC stand for?

Corresponding Parts of Congruent Triangles are Congruent

What needs to be proven before CPCTC can be used?

Triangle Congruent

SSS
SAS
ASA
AAS
HL

Official Definition

Parallelogram - A quadrilateral with two pairs of parallel sides.

Parallelogram $ABCD$
$\square ABCD$

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

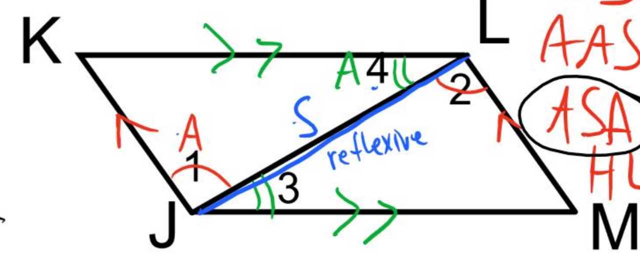
1. ▱ ⟶ opp. sides are ||

Hint: Before you start make a list of what you already know.

SAS
SSS
AAS
ASA
HL

Given: JKLM is a parallelogram

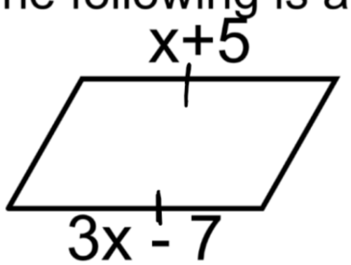
Prove: $\overline{JK} \cong \overline{LM}$, $\overline{KL} \cong \overline{MJ}$



statement	Reason
JKLM is a parallelogram	Given
$\overline{KJ} \parallel \overline{LM}$ & $\overline{KL} \parallel \overline{JM}$	Def. of Parallelogram
$\angle 1 \cong \angle 2$	Alt. Int $\angle$'s
$\angle 3 \cong \angle 4$	Alt. Int. $\angle$'s
$\overline{JL} \cong \overline{LJ}$	Reflexive Prop.
$\triangle KLJ \cong \triangle MJL$	ASA ← Triangle congruence
$\overline{JK} \cong \overline{LM}$ & $\overline{KL} \cong \overline{MJ}$	CPCTC ← parts of a triangle

Application

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



$3x-7 = x+5$

$-x \qquad -x$

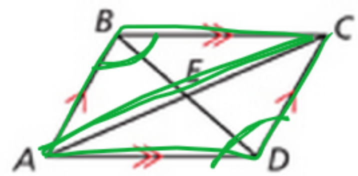
$2x-7 = 5$

$+7 \qquad +7$

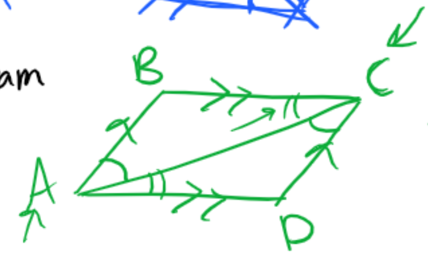
$2x = 12$

$\frac{2x}{2} = \frac{12}{2}$

$x = 6$



Given: *ABCD* is a parallelogram.
Prove: $\boxed{\angle BAD \cong \angle DCB}$ $\boxed{\angle ABC \cong \angle CDA}$
Proof:



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

<u>Theorem:</u>

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

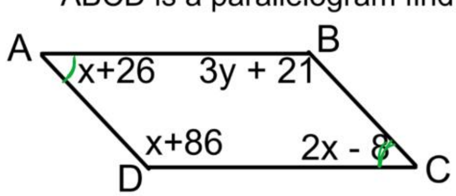
3. ▱ ⟶ opp. ∠'s ≅

<u>Conclusion</u>

∠A =∠C and ∠B =∠D

Apply this theorem

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



$2x - 8 = x + 26$
$-x \quad -x$
$1x - 8 = 26$
$+8 \quad +8$
$1x = 34$
$x = 34$

$3y + 21 = x + 86$
$3y + 21 = 34 + 86$
$3y + 21 = 120$
$-21 \quad -21$
$3y = 99$
$\frac{3y}{3} = \frac{99}{3}$
$y = 33$

Prove consecutive angles are supplementary

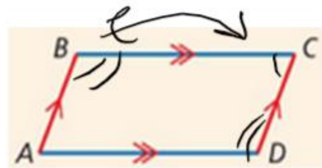
Given that ABCD is a parallelogram.

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
$\overline{AB} \parallel \overline{DC}$ + $\overline{BC} \parallel \overline{AD}$	Def. of Parallelogram
∠A and ∠B are supp.	Same side int. ∠'s
∠B and ∠C "	"
∠C and ∠D "	"
∠D and ∠A "	"

" → Same as above

Theorem:



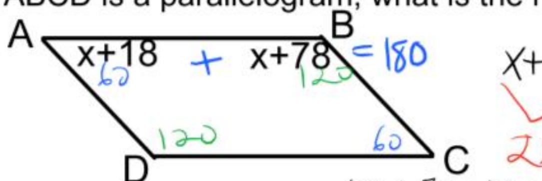
If a quadrilateral is a parallelogram then its consecutive angles are supplementary

4. ▱ → consecutive ∠'s supp.

Application

Unit

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



$42+78=120$

$\boxed{\angle B = 120}$

$$x+18 + x+78 = 180$$

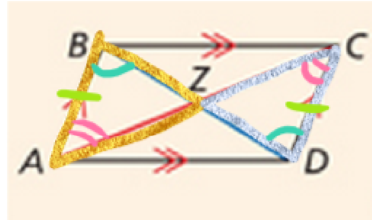
$$2x+96=180$$

$$-96 \quad -96$$

$$\frac{2x}{2} = \frac{84}{2}$$

$$x = 42$$

Given ABCD is a parallelogram,
Prove diagonals bisect each other



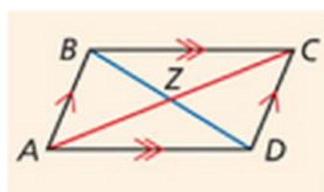
Alt. Int. ∠'s
Alt. Int ∠'s
▱ → opp. sides ≅

What are we really trying to prove?

Statement	Reason
ABCD is a parallelogram	Given
$\overline{AB} \parallel \overline{DC}$ + $\overline{BC} \parallel \overline{AD}$	Def. of parallelogram.
$\angle ZBA \cong \angle ZDC$	Alt. Int. ∠'s
$\angle ZAB \cong \angle ZCD$	Alt. Int. ∠'s
$\overline{AB} \cong \overline{CD}$	▱ → opp. sides ≅
$\triangle ABZ \cong \triangle CDZ$	ASA
$\overline{BZ} \cong \overline{DZ}$	CPCTC
$\overline{AZ} \cong \overline{CZ}$	CPCTC
$\overline{AC}$ bisects $\overline{BD}$ +	Def. of bisect
$\overline{BD}$ bisects $\overline{AC}$	Def. of bisect

Theorem:

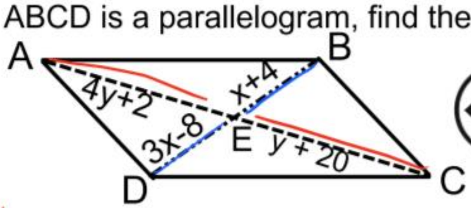
If a quadrilateral is a parallelogram then its diagonals bisect each other.



5. ▱ → diagonals bisect each other.

Application

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



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

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

What have we learned about parallelograms?

1. ▱ → opp. sides ∥
2. ▱ → opp. sides ≅
3. ▱ → opp. ∠'s ≅
4. ▱ → consecutive ∠'s supp.
5. ▱ → Diagonals bisect each other.

Review of what we learned

Fill in the blanks to complete each definition or theorem.

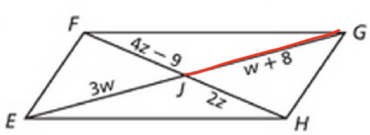
1. If a quadrilateral is a parallelogram, then its consecutive angles are __Supplementary__
2. If a quadrilateral is a parallelogram, then its opposite sides are __congruent__.
3. A parallelogram is a quadrilateral with two pairs of __opp. parallel__ sides.
4. If a quadrilateral is a parallelogram, then 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. Diagonals bisect each other

$3w = w + 8$ $\qquad m\overline{JG} = (4) + 8$

$-w \quad -w$ $\qquad m\overline{JG} = 12$

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

$w = 4$

2b. Diagonals bisect each other

$4z - 9 = 2z$ $\qquad m\overline{FH} = 4z - 9 + 2z$

$-4z \quad -4z$ $\qquad m\overline{FH} = 4(4.5) - 9 + 2(4.5)$

$\frac{-9}{-2} = \frac{-2z}{-2}$ $\qquad m\overline{FH} = 18 - 9 + 9$

$4.5 = z$ $\qquad m\overline{FH} = 18$