Warm - Up

Do Not Need to Copy The Pictures

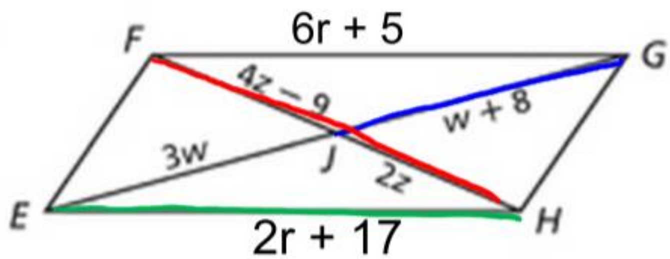
Parallelogram Properties

EFGH is a parallelogram. Find each measure.

1a. $\overline{JG} = 12$

1b. $\overline{FH} = 18$

1c. $\overline{HE}$



1a. $3w = w + 8$
$2w = 8$
$w = 4$
$\overline{JG} = (4) + 8 = 12$

1b. $4z - 9 = 2z$
$-9 = -2z$
$4.5 = z$
$\overline{FH} = 4(4.5) - 9 + 2(4.5) = 18$

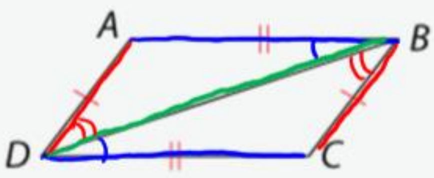
1c. $2r + 17 = 6r + 5$
$2r + 12 = 6r$
$12 = 4r$
$3 = r$
$\overline{HE} = 2(3) + 17 = 23$

Today we will learn

Converse of Parallelogram Properties

Special Type of Parallelogram

Prove: *ABCD* is a parallelogram.



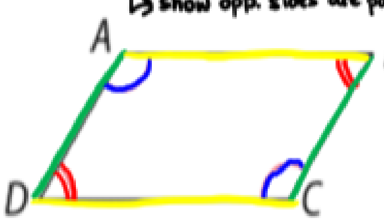
Statement	Reason
$\overline{AB} \cong \overline{CD}$, $\overline{AD} \cong \overline{CB}$	Given
$\overline{DB} \cong \overline{BD}$	Reflexive Property
$\triangle ABD \cong \triangle CDB$	SSS
$\angle DBA \cong \angle CDB$	CPCTC
$\angle BDA \cong \angle DBC$	CPCTC
$\overline{AB} \parallel \overline{CD}$ + $\overline{DA} \parallel \overline{BC}$	Converse of Alt. Int. ∠'s Thm.
ABCD is a ▱	Def. of a ▱

Prove that a quadrilateral is a parallelogram if its opposite angles are congruent.

Given: $\angle A \cong \angle C$ and $\angle B \cong \angle D$

Prove: *ABCD* is a parallelogram.

↳ show opp. sides are parallel



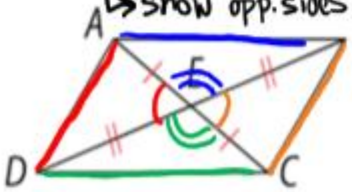
	Statement	Reason
	$\angle A \cong \angle C$ + $\angle D \cong \angle B$	Given
	$m\angle A = m\angle C$ + $m\angle D = m\angle B$	Def. of congruence
	$m\angle A + m\angle C + m\angle B + m\angle D = 360$	Polygon ∠'s sum Theorem
	$m\angle A + m\angle A + m\angle B + m\angle B = 360$	Substitution
	$2m\angle A + 2m\angle B = 360$	Addition
	$m\angle A + m\angle B = 180$	Inverse Property of Multiplication
	$\angle A$ + $\angle B$ are supp.	Definition of supplementary
First pair of ∥ lines →	$AD \parallel BC$	Inverse Prop. of Same side Int. ∠'s Thm.
	$m\angle C + m\angle C + m\angle D + m\angle D = 360$	Substitution
	$2m\angle C + 2m\angle D = 360$	Addition
	$m\angle C + m\angle D = 180$	Inverse prop. of multiplication
	$\angle C$ + $\angle D$ are supp.	Def. of Supp.
Second pair of ∥ lines →	$\overline{AB} \parallel \overline{DC}$	Inverse Prop. Same Side Int. ∠'s Thm.
	ABCD is a ▱	Def. of ▱

Prove that a quadrilateral whose diagonals bisect each other is a parallelogram.

Given: $\overline{AE} \cong \overline{CE}$ and $\overline{DE} \cong \overline{BE}$

Prove: *ABCD* is a parallelogram.

↳ show opp. sides congruent



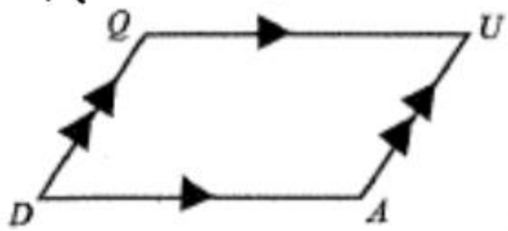
Statement	Reason
$\overline{AE} \cong \overline{CE}$ & $\overline{BE} \cong \overline{DE}$	Given
$\angle AED \cong \angle BEC$ and $\angle AEB \cong \angle DEC$	Vertical ∠'s Thm.
$\triangle AEB \cong \triangle DEC$ and $\triangle AED \cong \triangle BEC$	SAS
$\overline{AD} \cong \overline{CB}$ and $\overline{AB} \cong \overline{CD}$	CPCTC
ABCD is a ▱	If opp. sides ≅ → ▱

Converse of Parallelogram Properties

1. If opp. sides ≅ → ▱
2. If opp. ∠'s ≅ → ▱
3. If one ∠ is supp. to its consecutive ∠s → ▱
4. If one pair of opp. sides is ∥ and ≅ → ▱
5. If diagonals bisect each other → ▱

Practice with Converse Properties of Parallelograms
What is expected?

1) Will this always form a parallelogram?
X Yes ☐ No (provide a counterexample)

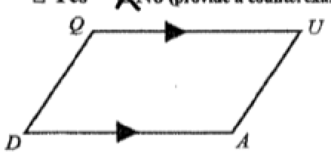


If opp. sides are parallel then its a parallelogram.

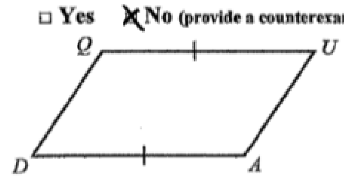
Complete problems 2-6

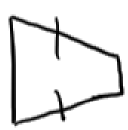
Review the answers

2) Will this always form a parallelogram?
☐ Yes X No (provide a counterexample)

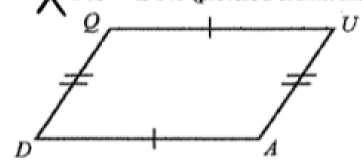


3) Will this always form a parallelogram?
☐ Yes X No (provide a counterexample)



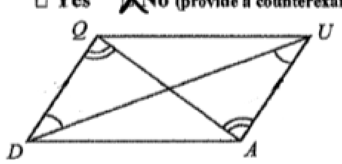


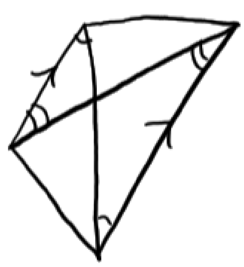
4) Will this always form a parallelogram?
X Yes ☐ No (provide a counterexample)



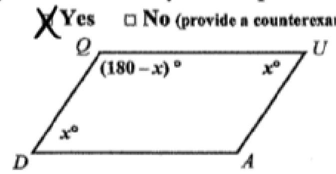
If opp. sides are ≅ then its a ▱

5) Will this always form a parallelogram?
☐ Yes X No (provide a counterexample)





6) Will this always form a parallelogram?
X Yes ☐ No (provide a counterexample)



If one ∠ is supp. to its two consecutive ∠'s then its a ▱

Converse Properties of Parallelograms

We can use the converse of each property to prove a quadrilateral is a parallelogram

If both pairs of opp. sides of a quadrilateral are Congruent then it is a parallelogram.

If both pairs of opp. ∠'s of a quadrilateral are congruent, then it is a parallelogram.

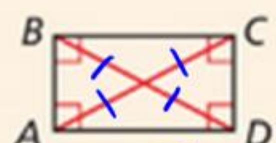
If 1 angle of a quadrilateral is supplementary to both of its consecutive angles, then it is a parallelogram.

If one pair of opposite sides are Congruent and parallel, then it is a parallelogram.

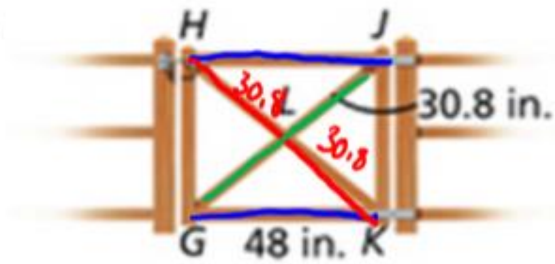
If diagonals of a quadrilateral bisect each other, then it is a parallelogram.

Now that we have SOOOO much information about parallelograms, we need to look at a special parallelogram.

A type of special quadrilateral is a rectangle. A rectangle is a quadrilateral with four right angles.

THEOREM	HYPOTHESIS
If a quadrilateral is a rectangle, then it is a parallelogram. (rect. → ▱)	
If a parallelogram is a rectangle, then its diagonals are congruent. (rect. → diags. ≅)	 $\overline{BD} \cong \overline{AC}$

Carpentry The rectangular gate has diagonal braces. Find each length.



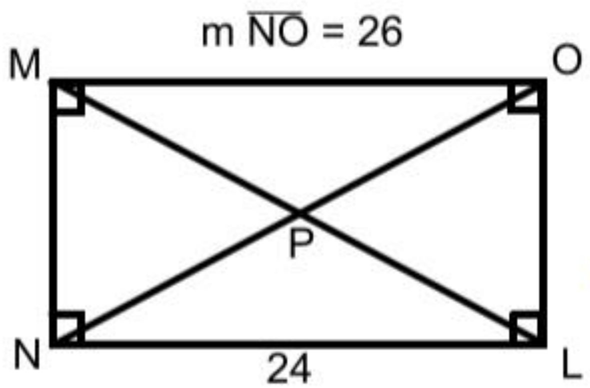
1a. $HJ = 48$in

1b. HK

$= 30.8 + 30.8$

$= 61.6$in

What are the lengths of $\overline{ML}$ and $\overline{MP}$?



$\overline{ML} \cong \overline{NO}$

$m\overline{ML} = 26$

$m\overline{MP} = 13$ ← half of ML