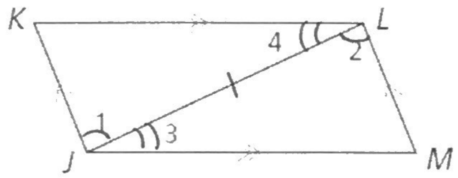
Proving and Justifying with Parallelograms

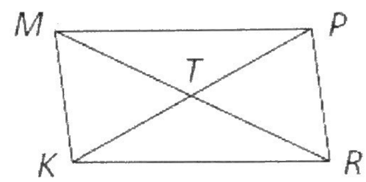
Yesterday, you explored 4 out of the 5 theorems associated with parallelograms. You learned that opposite sides are congruent, opposite angles are congruent, consecutive angles are supplementary, and diagonals bisect each other. It was mentioned that, in a parallelogram, diagonals form two congruent triangles, but you never really explored it. In the problem below, you are going to prove that a parallelogram forms two congruent triangles.

Given: JKLM is a parallelogram
Prove: $\Delta JKL \cong \Delta LMJ$



Statements	Reasons
1. JKLM is a parallelogram	1. given
2. $\overline{KJ} \parallel \overline{LM}$, $\overline{KL} \parallel \overline{JM}$	2. Def. of Parallelogram
3. $\angle 1 \cong \angle 2$	3. Alternate Interior $\angle$'s ~~are $\cong$~~ Postutate
4. $\angle 3 \cong \angle 4$	4. Alt. Int. $\angle$'s Post.
5. $\overline{JL} \cong \overline{JL}$	5. Reflexive Prop.
6. $\Delta JKL \cong \Delta LMJ$	6. ASA

Using the picture at the right, answer the following questions about parallelogram MPRK. Justify your answer (using properties of parallelograms) for each question.



a. $\angle MPR \cong \angle MKR$ Why? opposite $\angle$'s are $\cong$

b. $\angle PRK \cong \angle KMP$ Why? opposite $\angle$'s are $\cong$

c. $\overline{MT} \cong \overline{TR}$ Why? Diagonals bisect each other

d. $\overline{PR} \cong \overline{MK}$ Why? opposite sides are $\cong$

e. $\overline{MP} \parallel \overline{KR}$ Why? Def. of Parallelogram

f. $\overline{MK} \parallel \overline{PR}$ Why? Def. of Parallelogram

g. $\angle MPK \cong \angle PKR$ Why? alt. int. $\angle$'s Postulate

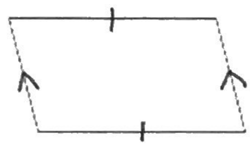
h. $\angle MTK \cong \angle PTR$ Why? Vertical $\angle$'s are $\cong$

i. $m\angle MKR + m\angle PRK = 180^\circ$ Why? Consecutive $\angle$'s are Supplementary

Justifying with Properties of Parallelograms

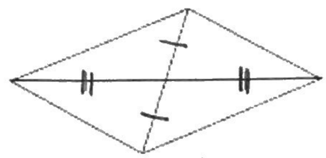
Determine if each quadrilateral must be a parallelogram. Explain why or why not.

a.



not enough info.
- 2 sides of opposite sides are parallel
- opposite sides are ≅

b.



Parallelogram
- Diagonals bisect each other

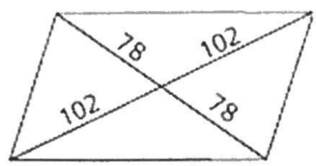
c.

Parallelogram
- opposite ∠'s are ≅.

d.

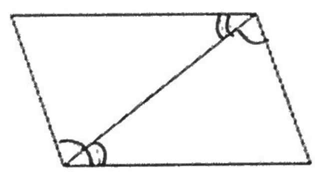
117° + 63° = 180°
Parallelogram
- Consecutive ∠'s are Supplementary

e.



Parallelogram
- Diagonals Bisect each other

f.



- Alt. interior ∠'s are ≅

Parallelogram

g. If the diagonals are perpendicular, which type of quadrilateral could it be?

RHOMBUS

h. If all four sides are the same length, which type of quadrilateral could it be?

RHOMBUS

i. If the diagonals are congruent, which type of quadrilateral could it be?

Rectangle

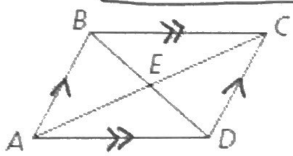
j. A parallelogram has one right angle. What is a more specific name for the parallelogram? Justify your answer using properties of parallelograms and specific quadrilaterals.

If all 4 sides are ≅ and all 4 angles are ≅.

Square

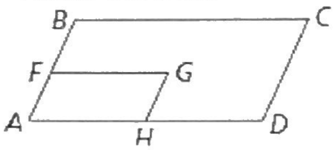
Proofs with Parallelograms

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



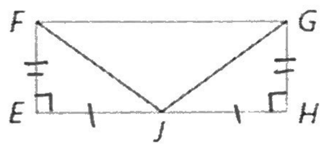
Statements	Reasons
1. ABCD is a parallelogram	1. Given
2. $\overline{AB} \cong \overline{CD}$	2. opposite sides of ∥ are ≅
3. $\overline{DA} \cong \overline{BC}$	3. opposite sides of ∥ are ≅
4. $\overline{DB} \cong \overline{DB}$	4. Reflexive Prop.
5. $\triangle ABD \cong \triangle CDB$	5. SSS
6. $\angle BAD \cong \angle DCB$	6. CPCTC

b. **Given:** ABCD and AFGH are parallelograms
Prove: $\angle C \cong \angle G$



Statements	Reasons
1. ABCD is a parallelogram	1. Given
2. AFGH is a parallelogram	2. Given
3. $\angle C \cong \angle A$	3. Opp. ∠'s of a Parall. are ≅
4. $\angle A \cong \angle G$	4. opposite ∠'s of a ∥ are ≅
5. $\angle C \cong \angle G$	5. Trans. Prop.

c. **Given:** EFGH is a rectangle, J is the midpoint of $\overline{EH}$.
Prove: $\triangle FJG$ is isosceles.



Statements	Reasons
1. EFGH is a rectangle.	1. Given
2. $\angle E$ & $\angle H$ are right angles.	2. Rectangles have 4 Rt. ∠'s
3. $\angle E \cong \angle H$	3. Def. of Right ∠'s
4. J is the midpoint of $\overline{EH}$.	4. Given
5. $\overline{EJ} \cong \overline{JH}$	5. Def. of Midpoint
6. EFGH is also a parallelogram	6. all rect. are parallelograms
7. $\overline{FE} \cong \overline{GH}$	7. opp. sides of ∥ are ≅.
8. $\triangle FJE \cong \triangle GJH$	8. SAS
9. $\overline{FJ} \cong \overline{JG}$	9. CPCTC
10. $\triangle FJG$ is isosceles	10. Def. of Isosceles