

GEOMETRY UNIT 6

PROVING QUADRILATERALS ARE PARALLELOGRAMS

PROVING THAT A QUADRILATERAL IS A PARALLELOGRAM

Content Objective: Students will be able to prove that a Quadrilateral is a Parallelogram by using special properties in theorems.

Language Objective: Students will be able to explain what properties and theorems allow a Quadrilateral to be a Parallelogram.

5 WAYS TO PROVE THAT A QUADRILATERAL IS A PARALLELOGRAM

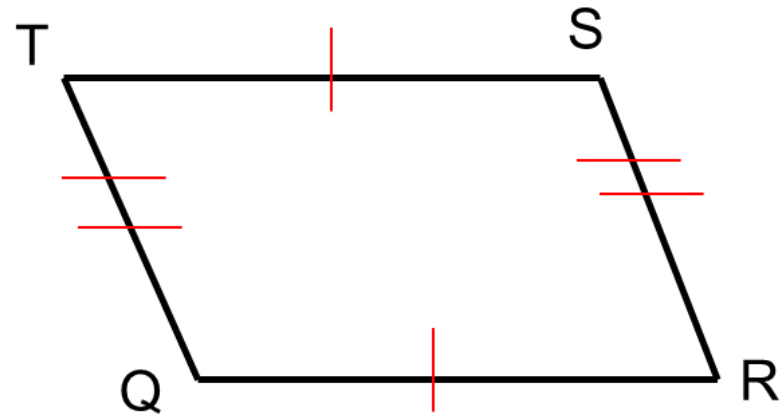
- 1.) Show that both pairs of opposite sides are parallel**
- 2.) Show that both pairs of opposite sides are congruent.**
- 3.) Show that one pair of opposite sides are both parallel and congruent.**
- 4.) Show that both pairs of opposite angles are congruent.**
- 5.) Show that the diagonals bisect each other.**

THEOREM 5-4

Theorem 5-4: If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

Given: $\overline{TS} \cong \overline{QR}$; $\overline{TQ} \cong \overline{SR}$

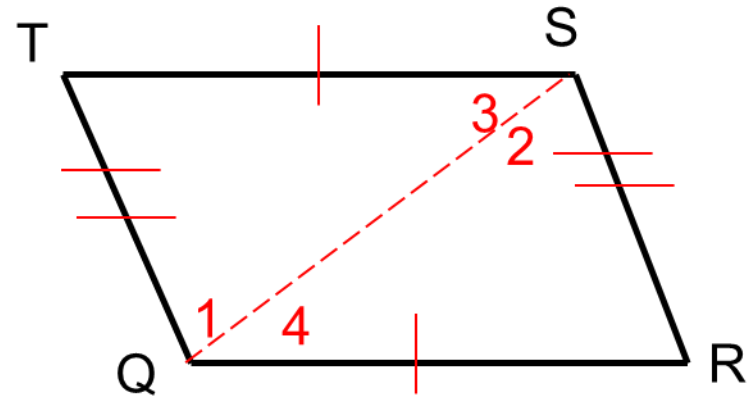
Prove: Quad. QRST is a \square .



THEOREM 5-4 – PROOF

Given: $\overline{TS} \cong \overline{QR}$; $\overline{TQ} \cong \overline{SR}$

Prove: Quad. QRST is a \square .



Statements

Reasons

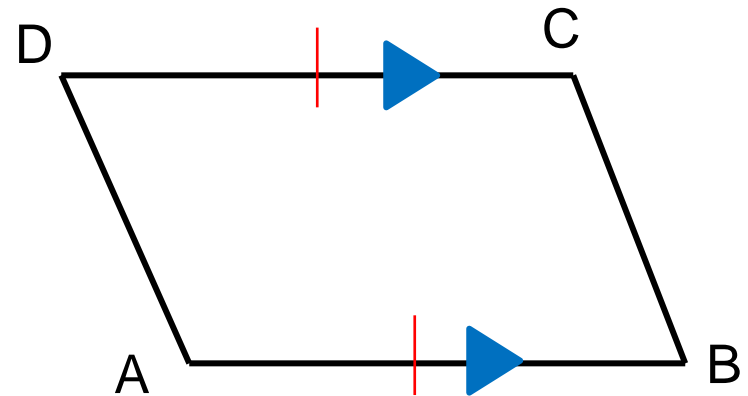
- | | |
|--|--|
| 1. $\overline{TS} \cong \overline{QR}$; $\overline{TQ} \cong \overline{SR}$ | 1. Given |
| 2. Draw \overline{QS} | 2. Between any 2 pts., there exists exactly 1 line. |
| 3. $\overline{QS} \cong \overline{QS}$ | 3. Reflexive Property |
| 4. $\triangle TSQ \cong \triangle RQS$ | 4. SSS Postulate |
| 5. $\angle 1 \cong \angle 2$; $\angle 3 \cong \angle 4$ | 5. CPCTC |
| 6. $\overline{TS} \parallel \overline{QR}$; $\overline{TQ} \parallel \overline{RS}$ | 6. If 2 lines ACBAT and alt. int. \angle 's are \cong , then the lines are \parallel . |
| 7. Quad QRST is a \square | 7. Def. of a Parallelogram |

THEOREM 5-5

Theorem 5-5: If one pair of opposite sides of a quadrilateral are both congruent and parallel, then the quadrilateral is a parallelogram.

Given: $\overline{AB} \cong \overline{CD}$; $\overline{AB} \parallel \overline{CD}$

Prove: Quad ABCD is a \square .

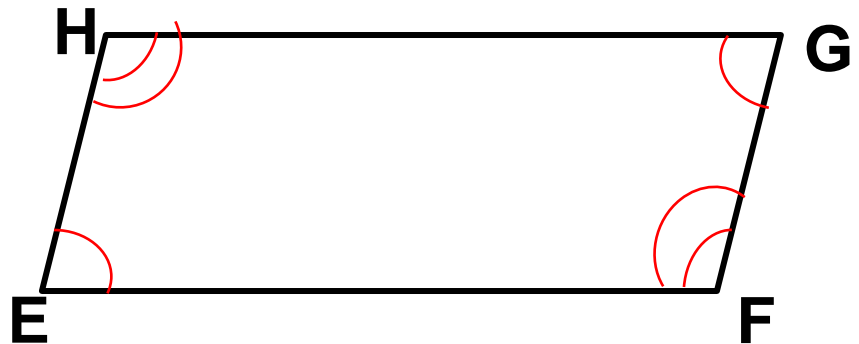


THEOREM 5-6

Theorem 5-6: If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

Given: $\angle E \cong \angle G$; $\angle H \cong \angle F$

Prove: Quad EFGH is a .

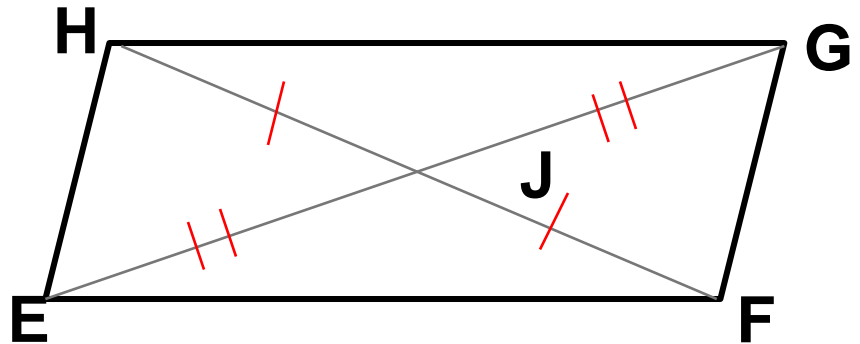


THEOREM 5-7

Theorem 5-7: If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.

Given: \overline{HF} and \overline{EG} bisect each other at point J.

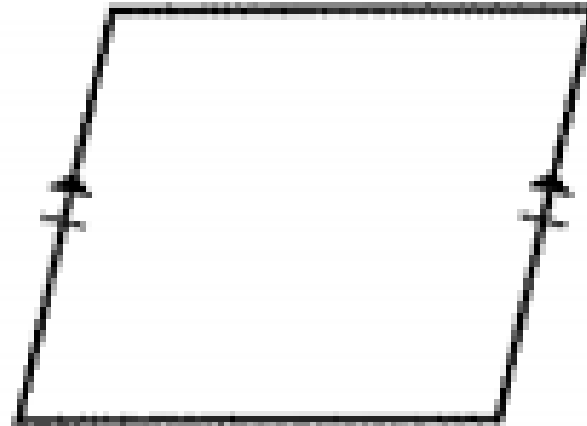
Prove: Quad EFGH is a \square .



IDENTIFYING PARALLELOGRAMS

Study the markings on each figure and decide whether the given quadrilateral is a parallelogram. If it is, state the definition or theorem that proves it.

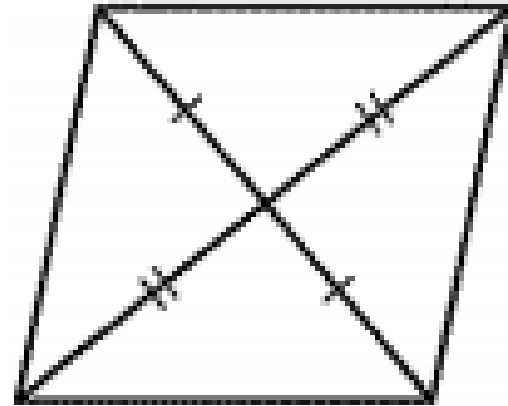
Yes; One pair of opposite sides are both parallel and congruent.



IDENTIFYING PARALLELOGRAMS

Study the markings on each figure and decide whether the given quadrilateral is a parallelogram. If it is, state the definition or theorem that proves it.

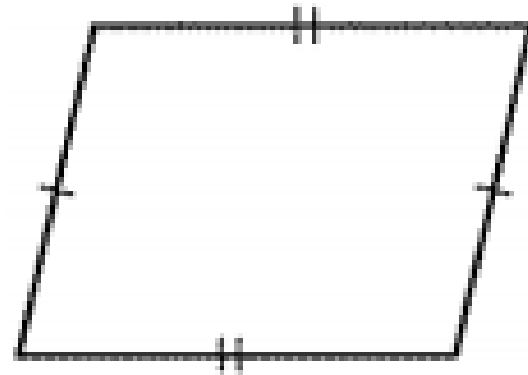
Yes; The diagonals bisect each other.



IDENTIFYING PARALLELOGRAMS

Study the markings on each figure and decide whether the given quadrilateral is a parallelogram. If it is, state the definition or theorem that proves it.

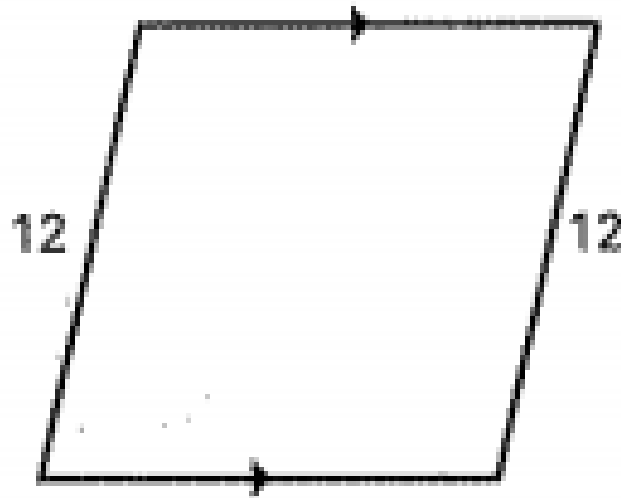
Yes; Both pairs of opposite sides are congruent.



IDENTIFYING PARALLELOGRAMS

Study the markings on each figure and decide whether the given quadrilateral is a parallelogram. If it is, state the definition or theorem that proves it.

No; The pairs of parallel and congruent sides are not the same.



IDENTIFYING PARALLELOGRAMS

Study the markings on each figure and decide whether the given quadrilateral is a parallelogram. If it is, state the definition or theorem that proves it.

Yes; Both pairs of opposite angles are congruent.

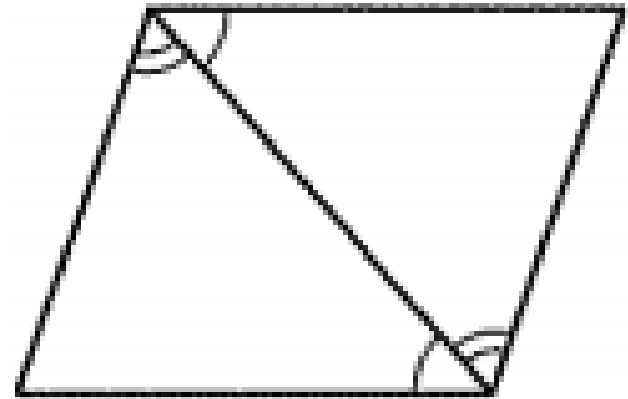


IDENTIFYING PARALLELOGRAMS

Study the markings on each figure and decide whether the given quadrilateral is a parallelogram. If it is, state the definition or theorem that proves it.

Based off the markings...NO

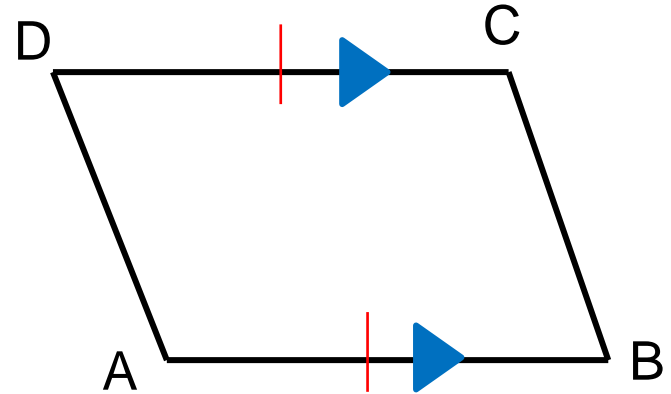
If you work some things out...YES



THEOREM 5-5 – PROOF

Given: $\overline{AB} \cong \overline{CD}$; $\overline{AB} \parallel \overline{CD}$

Prove: Quad ABCD is a \square .



Statements

Reasons

- | | |
|--|--|
| 1. $\overline{AB} \cong \overline{CD}$; $\overline{AB} \parallel \overline{CD}$ | 1. Given |
| 2. Draw \overline{AC} | 2. Between any 2 pts., there exists exactly 1 line. |
| 3. $\angle 1 \cong \angle 2$ | 3. If 2 \parallel lines ACBAT, then alt. int. \angle 's are \cong . |
| 4. $\overline{AC} \cong \overline{AC}$ | 4. Reflexive Property |
| 5. $\triangle ABC \cong \triangle CDA$ | 5. SAS Postulate |
| 6. $\angle 3 \cong \angle 4$ | 6. CPCTC |
| 7. $\overline{AD} \parallel \overline{BC}$ | 7. If 2 lines ACBAT and alt. int. \angle 's are \cong , then the lines are \parallel . |
| 8. Quad ABCD is a \square | 8. Def. of a Parallelogram |