

6-3

Proving That a Quadrilateral Is a Parallelogram



Vocabulary

Review

1. Does a pentagon have *opposite sides*?

Yes / No

2. Does an n -gon have *opposite sides* if n is an odd number?

Yes / No

Draw a line from each side in Column A to the *opposite side* in Column B.

Column A

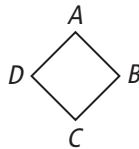
3. \overline{AB}

4. \overline{AD}

Column B

\overline{BC}

\overline{DC}



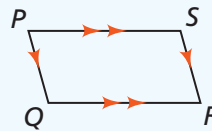
Vocabulary Builder

parallelogram (noun) pa ruh LEL uh gram

Definition: A **parallelogram** is a quadrilateral with two pairs of opposite sides parallel. Opposite sides may include arrows to show the sides are parallel.

Related Words: square, rectangle, rhombus

parallelogram



Use Your Vocabulary

Write P if the statement describes a *parallelogram* or NP if it does not.

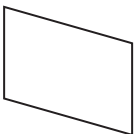
5. octagon

6. five congruent sides

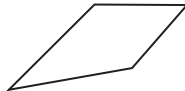
7. regular quadrilateral

Write P if the figure appears to be a *parallelogram* or NP if it does not.

8.



9.



10.



Theorems 6-8 through 6-12

Theorem 6-8 If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

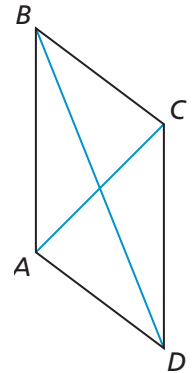
Theorem 6-9 If an angle of a quadrilateral is supplementary to both of its consecutive angles, then the quadrilateral is a parallelogram.

Theorem 6-10 If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

Theorem 6-11 If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.

Theorem 6-12 If one pair of opposite sides of a quadrilateral is both congruent and parallel, then the quadrilateral is a parallelogram.

Use the diagram at the right and Theorems 6-8 through 6-12 for Exercises 11–16.

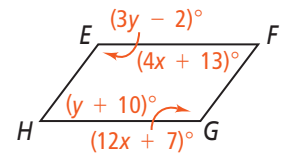


11. If $\overline{AB} \cong \square$, and $\overline{BC} \cong \square$, then $ABCD$ is a \square .
12. If $m\angle A + m\angle B = \square$ and $m\angle \square + m\angle D = 180$, then $ABCD$ is a \square .
13. If $\angle A \cong \angle \square$ and $\angle \square \cong \angle D$, then $ABCD$ is a \square .
14. If $\overline{AE} \cong \square$ and $\overline{BE} \cong \square$, then $ABCD$ is a \square .
15. If $\overline{BC} \cong \square$ and $\overline{BC} \parallel \square$, then $ABCD$ is a \square .
16. If $\overline{CD} \cong \square$ and $\overline{CD} \parallel \square$, then $ABCD$ is a \square .



Problem 1 Finding Values for Parallelograms

Got It? Use the diagram at the right. For what values of x and y must $EFGH$ be a parallelogram?



17. Circle the equation you can use to find the value of y . Underline the equation you can use to find the value of x .

$y + 10 = 3y - 2$ $y + 10 = 4x + 13$ $(y + 10) + (3y - 2) = 180$

18. Find y .

19. Find x .

20. What equation could you use to find the value of x first?

21. $EFGH$ must be a parallelogram for $x = \square$ and $y = \square$.

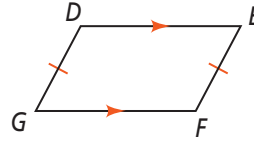


Problem 2 Deciding Whether a Quadrilateral Is a Parallelogram

Got It? Can you prove that the quadrilateral is a parallelogram based on the given information? Explain.

Given: $\overline{EF} \cong \overline{GD}$, $\overline{DE} \parallel \overline{FG}$

Prove: $DEFG$ is a parallelogram.



22. Circle the angles that are consecutive with $\angle G$.

$\angle D$ $\angle E$ $\angle F$

23. Underline the correct word to complete the sentence.

Same-side interior angles formed by parallel lines cut by a transversal are complementary / congruent / supplementary.

24. Circle the interior angles on the same side of transversal \overline{DG} . Underline the interior angles on the same side of transversal \overline{EF} .

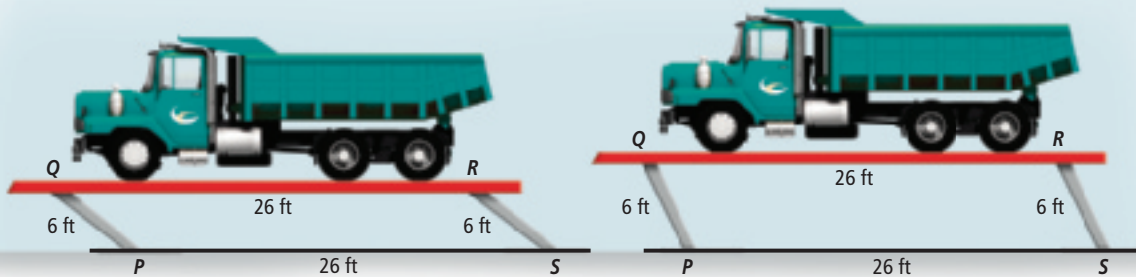
$\angle D$ $\angle E$ $\angle F$ $\angle G$

25. Can you prove $DEFG$ is a parallelogram? Explain.



Problem 3 Identifying Parallelograms

Got It? Reasoning A truck sits on the platform of a vehicle lift. Two moving arms raise the platform. What is the maximum height that the vehicle lift can elevate the truck? Explain.



26. Do the lengths of the opposite sides change as the truck is lifted?

27. The least and greatest possible angle measures for $\angle P$ and $\angle Q$ are and .

28. The greatest possible height is when $m\angle P$ and $m\angle Q$ are .

29. What is the maximum height that the vehicle lift can elevate the truck? Explain.



Lesson Check • Do you UNDERSTAND?

Compare and Contrast How is Theorem 6-11 in this lesson different from Theorem 6-6 in the previous lesson? In what situations should you use each theorem? Explain.

For each theorem, circle the hypothesis and underline the conclusion.

30. Theorem 6-6

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

31. Theorem 6-11

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

Draw a line from each statement in Column A to the corresponding diagram in Column B.

Column A

32. A quadrilateral is a parallelogram.

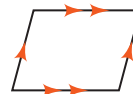
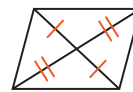
33. The diagonals of a quadrilateral bisect each other.

34. Circle the word that describes how Theorem 6-6 and Theorem 6-11 are related.

contrapositive converse inverse

35. In which situations should you use each theorem? Explain.

Column B



Math Success

Check off the vocabulary words that you understand.

diagonal

parallelogram

quadrilateral

Rate how well you can prove that a quadrilateral is a parallelogram.

