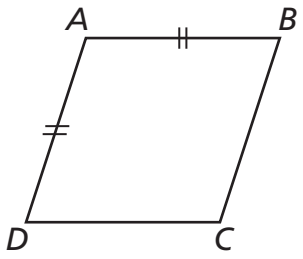
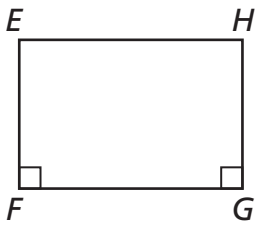
7.3 Start Thinking

Examine the diagram and determine if there appears to be enough information to conclude that the quadrilateral is a parallelogram. If there is not enough information, give an example of additional information that would allow you to prove the quadrilateral is a parallelogram.

1.



2.



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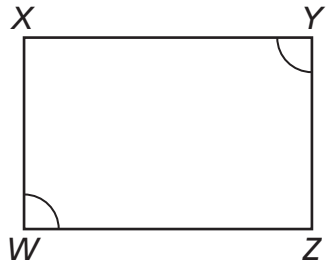


7.3 Warm Up

Use the points $A(-2, 5)$, $B(-5, 1)$, $C(3, 2)$, and $D(1, -2)$ to find the indicated slope or measure.

1. Find the slope of $\overline{AB}$.

2. Find the measure of $\overline{AC}$.

3. Find the slope of $\overline{CD}$.

4. Find the measure of $\overline{BD}$.

5. Find the slope of $\overline{AC}$.

6. Find the measure of $\overline{AB}$.

7.3 Cumulative Review Warm Up

For the conditional statement, write the converse, the inverse, and the contrapositive. Then determine if each statement is true.

1. If a triangle is right, then it contains two acute angles.

2. If two lines have the same slope, then they are parallel.

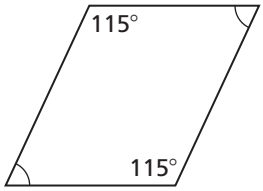
3. If there is ice on the road, then I will not go shopping.

Name _____ Date _____

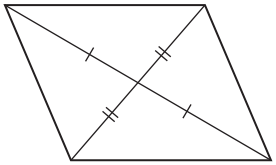
7.3 Practice A

In Exercises 1 and 2, state which theorem you can use to show that the quadrilateral is a parallelogram.

1.

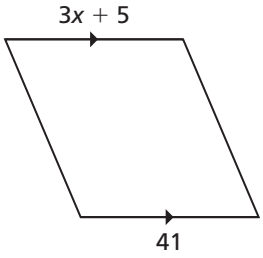


2.

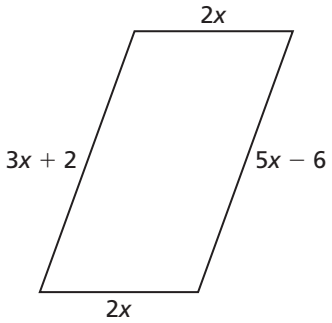


In Exercises 3 and 4, find the value of *x* that makes the quadrilateral a parallelogram.

3.



4.



In Exercises 5 and 6, graph the quadrilateral with the given vertices in a coordinate plane. Then show that the quadrilateral is a parallelogram.

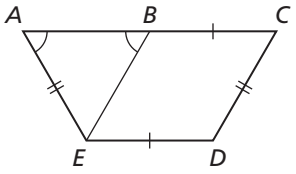
5. $A(-4, -2), B(-2, 1), C(4, 1), D(2, -2)$

6. $E(-4, 1), F(-1, 5), G(11, 0), H(8, -4)$

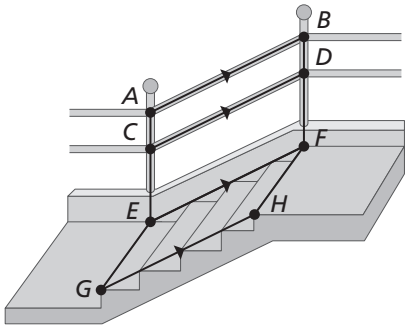
7. Use the diagram to write a two-column proof.

Given: $\angle A \cong \angle ABE$
$\overline{AE} \cong \overline{CD}, \overline{BC} \cong \overline{DE}$

Prove: $BCDE$ is a parallelogram.



8. In the diagram of the handrail for a staircase shown, $m\angle A = 145°$ and $\overline{AB} \cong \overline{CD}$.



a. Explain how to show that $ABDC$ is a parallelogram.

b. Describe how to prove that $CDFE$ is a parallelogram.

c. Can you prove that $EFHG$ is a parallelogram? Explain.

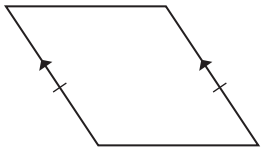
d. Find $m\angle ACD$, $m\angle DCE$, $m\angle CEF$, and $m\angle EFD$.

Name_____ Date _____

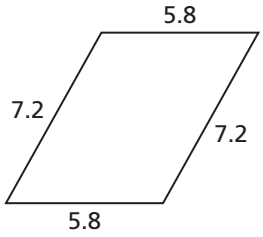
7.3 Practice B

In Exercises 1 and 2, state which theorem you can use to show that the quadrilateral is a parallelogram.

1.

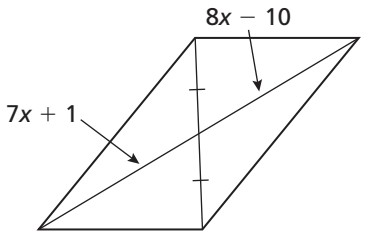


2.

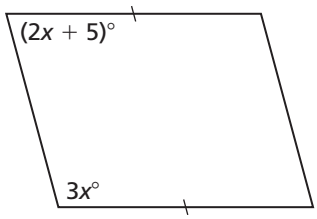


In Exercises 3 and 4, find the value of *x* that makes the quadrilateral a parallelogram.

3.



4.

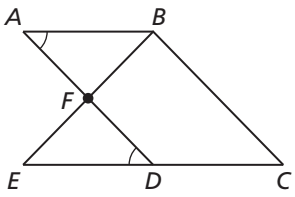


In Exercises 5 and 6, graph the quadrilateral with the given vertices in a coordinate plane. Then show that the quadrilateral is a parallelogram.

5. $W(-3, -1), X(-3, 4), Y(3, 2), Z(3, -3)$

6. $A(-4, 0), B(2, 2), C(5, -1), D(-1, -3)$

7. Use the diagram to write a two-column proof.



Given: $\angle A \cong \angle FDE$

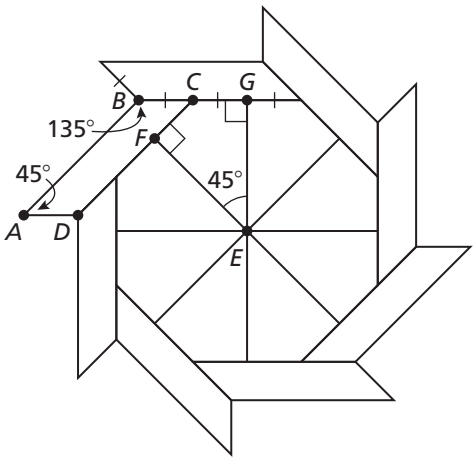
F is the midpoint of $\overline{AD}$.

D is the midpoint of $\overline{CE}$.

Prove: $ABCD$ is a parallelogram.

8. A quadrilateral has two pairs of congruent angles. Can you determine whether the quadrilateral is a parallelogram? Explain your reasoning.

9. An octagon star is shown in the figure on the right.



a. Find $m\angle FCG$, $m\angle BCF$, and $m\angle D$.

b. State which theorem you can use to show that the quadrilateral is a parallelogram.

c. The length of $\overline{AB}$ is three times the length of $\overline{AD}$. Write an expression for the perimeter of parallelogram $ABCD$ in terms of the variable x.

Name _____ Date _____

7.3 Enrichment and Extension

Proving That a Quadrilateral Is a Parallelogram

In Exercises 1–8, decide whether you are given enough information to determine that the quadrilateral is a parallelogram.

1. The opposite sides are parallel.

2. The opposite sides are congruent.

3. Two pairs of consecutive sides are congruent.

4. Two pairs of consecutive angles are congruent.

5. The diagonals are congruent.

6. The diagonals bisect each other.

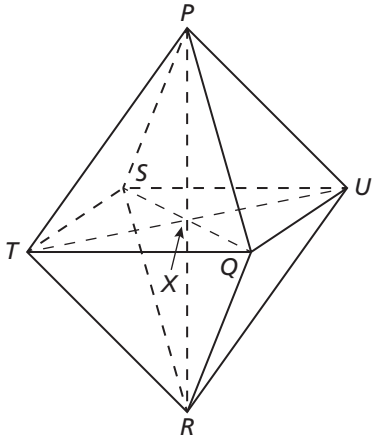
7. All four sides are congruent.

8. The consecutive angles are supplementary.

9. If two opposite angles of a quadrilateral measure $120°$ and the measures of the other angles are multiples of 10, what is the probability that the quadrilateral is a parallelogram?

10. The diagonals of quadrilateral *EFGH* intersect at $D(-1, 4)$. Two vertices of *EFGH* are $E(2, 7)$ and $F(-3, 5)$. What must be the coordinates of *G* and *H* to ensure that *EFGH* is a parallelogram?

11. In the diagram at the right, *PQRS* and *QTSU* are parallelograms. Is *PTRU* also a parallelogram? Explain why or why not.



12. Consider the supplementary angle relationships that you need to know to prove that a quadrilateral is a parallelogram. Make a conjecture using the least number of relationships that are necessary.

Name_____ Date _____

7.3 Puzzle Time

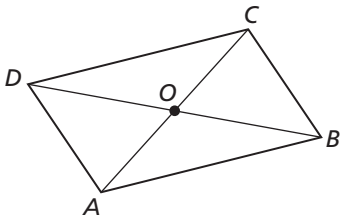
What Kind Of Ship Can Last Forever?

Circle the letter of each correct answer in the boxes below. The circled letters will spell out the answer to the riddle.

Complete the sentence.

1. If both pairs of opposite sides of a quadrilateral are _____, then the quadrilateral is a parallelogram.
2. If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a _____.
3. If one _____ of opposite sides of a quadrilateral are congruent and parallel, then the quadrilateral is a parallelogram.
4. If the diagonals of a quadrilateral _____ each other, then the quadrilateral is a parallelogram.
5. A quadrilateral is _____ a parallelogram.

Name the correct theorem number or give the correct value that would make the figure a parallelogram.



6. Given $m\angle D = 72°$, find $m\angle A$.
7. Given $m\angle A = m\angle C = 89°$, and $m\angle D = m\angle B$, indicate the theorem number that makes it a parallelogram.
8. $DO = 12$, $BO = 12$, $AO = 16$. Find CO.
9. $DC = 4x + 2$, $AB = 5x - 3$, $AD = CB$. Find x.
10. $AD = 2x + 1$, $CB = x + 8$, $DC = AB$. Find x.

F	**A**	**R**	**O**	**R**	**N**	**I**	**M**	**S**	**E**
108°	7.7	always	equal	congruent	side	sometimes	12	72°	parallelogram
I	**G**	**N**	**F**	**D**	**S**	**H**	**E**	**I**	**P**
supplementary	6	pair	intersect	16	7.8	bisect	24	7	5