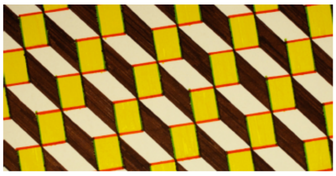
# 5.7 Parallelogram Conjectures and Proof

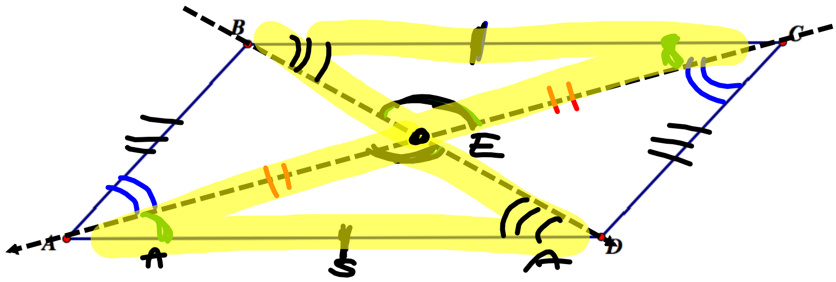
*A Solidify Understanding Task*



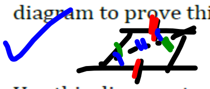


In Mathematics I you made conjectures about properties of parallelograms based on identifying lines of symmetry and rotational symmetry for various types of parallelograms. Now that we have additional knowledge about the angles formed when parallel lines are cut by a transversal, and we have criteria for convincing ourselves that two triangles are congruent, we can more formally prove some of the things we have noticed about parallelograms.

1. Explain how you would locate the center of rotation for the following parallelogram. What convinces you that the point you have located is the center of rotation?




2. If you haven't already, draw one or both of the diagonals in the above parallelogram. Use this diagram to prove this statement: *opposite sides of a parallelogram are congruent*

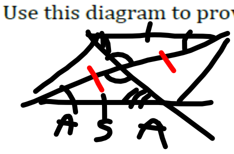


by ASA $\triangle ABC \cong \triangle CDA$, so all corresponding sides are congruent. So opposite sides of parallelograms are $\cong$.

3. Use this diagram to prove this statement: *opposite angles of a parallelogram are congruent*

by ASA ∥, so opposite angles in parallelograms are $\cong$.

4. Use this diagram to prove this statement: *the diagonals of a parallelogram bisect each other*



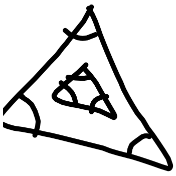

by ASA, $\triangle AED \cong \triangle CEB$
so the diagonals bisect each other.

The statements we have proved above extend our knowledge of properties of all parallelograms: not only are the opposites sides parallel, they are also congruent; opposite angles are congruent; and the diagonals of a parallelogram bisect each other. A parallelogram has 180° rotational symmetry around the point of intersection of the diagonals—the center of rotation for the parallelogram.

If we have a quadrilateral that has some of these properties, can we convince ourselves that the quadrilateral is a parallelogram? How many of these properties do we need to know before we can conclude that a quadrilateral is a parallelogram?

AH. Inter
corresponding → parallel
A H. Exter

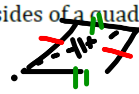
5. Consider the following statements. If you think the statement is true, create a diagram and write a convincing argument to prove the statement.



a. If opposite sides and opposite angles of a quadrilateral are congruent, the quadrilateral is a parallelogram.

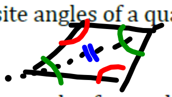
by SSS Δs are ≅.
so we have correspond <'s → parallel

b. If opposite sides of a quadrilateral are congruent, the quadrilateral is a parallelogram.



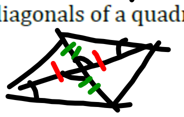
by SSS, ↑ same as above

c. If opposite angles of a quadrilateral are congruent, the quadrilateral is a parallelogram.



AAA, makes similar Δ's
so you could make bigger or smaller parallelogram

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



by SAS, Δ's are congruent,
then corresponding <'s are ≅,
→ parallel

READY, SET, GO! Name Period Date

## READY

Topic: Sketching quadrilaterals based on specific features

**Sketch the quadrilateral by connecting the points in alphabetical order. Close the figure.**

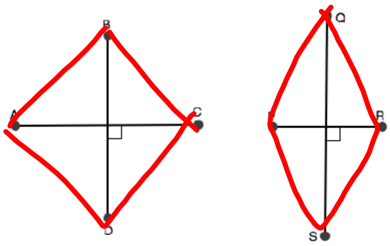
1. In both figures, the lines are perpendicular bisectors of each other.

a. Are the quadrilaterals you sketched congruent?

NO

b. What additional requirement(s) is/are needed to make the figures congruent?

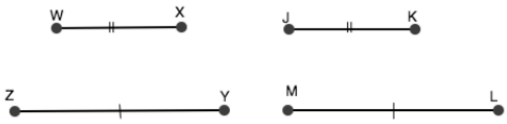
$\overline{PR}$ would need to be = to $\overline{AC}$




2. In both figures one set of opposite sides are parallel and congruent.

a. Are the quadrilaterals you sketched congruent?

b. What additional requirement(s) is/are needed to make the figures congruent?

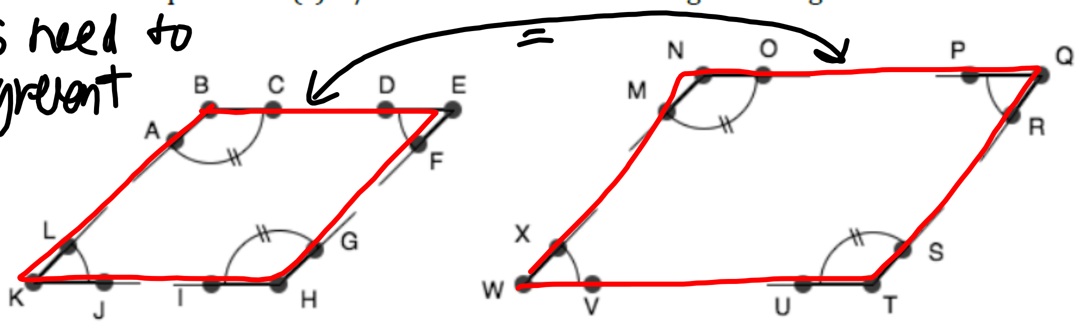


3. In both figures corresponding angles are congruent.

a. Are the quadrilaterals you sketched congruent? No

b. What additional requirement(s) is/are needed to make the figures congruent?

sides need to be congruent

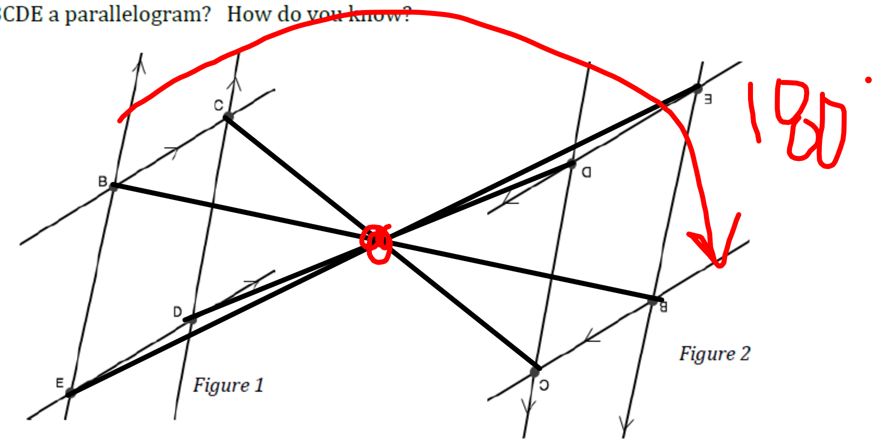


**SET**

Topic: Properties of parallelograms

4. Quadrilateral BCDE below was formed by 2 sets of intersecting parallel lines. Figure 2 is the image of figure 1. It has been rotated 180º. Find the center of rotation for figure 1. Make a list of everything that has been preserved in the rotation. Then make a list of anything that has changed.

Is quadrilateral BCDE a parallelogram? How do you know?




The following theorems all concern parallelograms:

- Opposite sides of a parallelogram are congruent.
- Opposite angles of a parallelogram are congruent.
- Consecutive angles of a parallelogram are supplementary.
- The diagonals of a parallelogram bisect each other.

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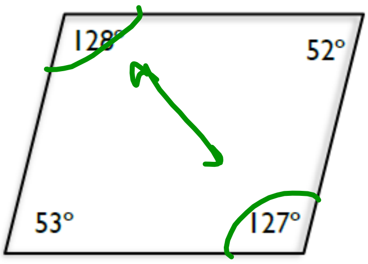
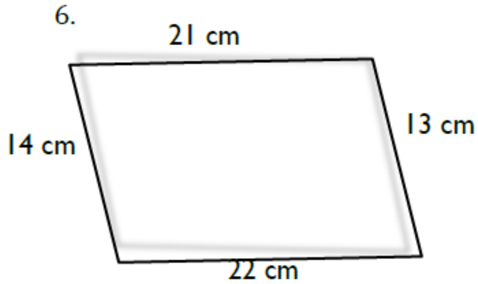
**Give a reason from the list above that explains why it is NOT possible for each figure below to be a parallelogram. List ALL that apply.**

5.




opposite angles are not congruent.

6.



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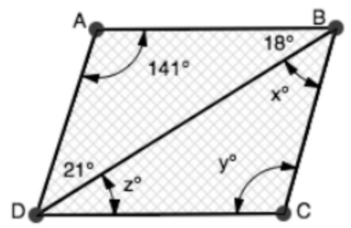


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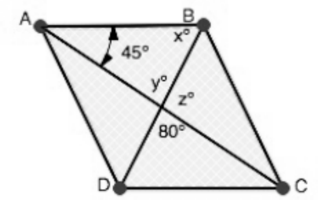


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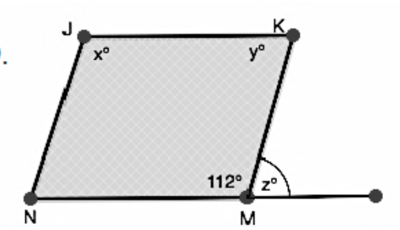
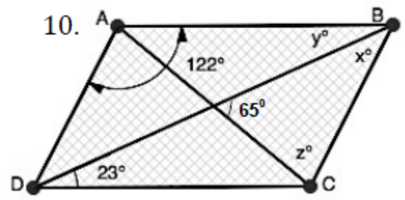



10.



Start 'go' section of 5.7

## GO

Topic: Using correct mathematical symbols

**Rewrite the phrases below using correct mathematical symbols.**

*Example: Eleven plus eight is nineteen.* *11 + 8 = 19*

11. Triangle ABC is congruent to triangle GHJ. ____________
12. Segment BV is congruent to segment PR. ____________
13. Three feet are equal to one yard. ____________
14. Line TR is parallel to line segment WQ. ____________
15. Ray VP is perpendicular to segment GH. ____________
16. Angle 3 is congruent to angle 5. ____________
17. The distance between W and X is 7 feet. WX = 7
18. The length of segment AB is equal to the length of TR. AB = TR

(no line on top)

19. The measure of angle SRT is equal to the measure of angle CDE. $m\angle SRT = m\angle CDE$

$m\angle SRT$

20. Explain when it is proper to use an equal sign and when it is proper to use the congruent symbol.

$D = 4$ $\triangle \cong \triangle$

$AB = AB$ shapes

amounts $\overline{AB} \cong \overline{CD}$