

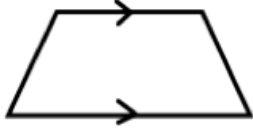
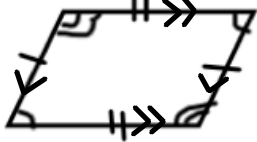
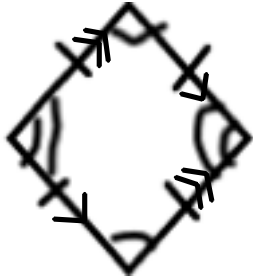

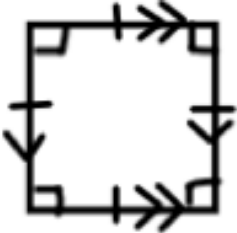
Do Now

- 1) Write a definition for the following quadrilaterals
- 2) Draw and label the quadrilaterals and indicate what you know about the sides and angles.
- 3) List the properties of the the sides and the angles in the appropriate box

	Definition	Sketch	Properties
Trapezoid			
Parallelogram			
Rhombus			
Rectangle			
Square			

Do Now

- 1) Write a definition for the following quadrilaterals
- 2) Draw and label the quadrilaterals and indicate what you know about the sides and angles.
- 3) List the properties of the the sides and the angles in the appropriate box

	Definitio n	Sketch	Properties
Trapezoid	a quadrilateral with only one pair of parallel sides.		- 1 set of opposite sides are parallel
Parallelogram	a four-sided plane rectilinear figure with opposite sides parallel		- Opposite sides are parallel - Opposite sides have equal lengths - Opposite angles are congruent - diagonals bisect each other
Rhombus	any parallelogram with equal sides, including a square		- Opposite sides are parallel - All side have equal lengths - Opposite angles are congruent -Diagonals are perpendicular bisectors of each other
Rectangle	a plane figure with four straight sides and four right angles, especially one with unequal adjacent sides, in contrast to a square		- Opposite sides are parallel - Opposite sides have equal lengths - All angles are right -Diagonals bisect each other
Square	a plane figure with four equal straight sides and four right angles		- Opposite sides are parallel - All side have equal lengths - All angles are right -Diagonals are perpendicular bisectors of each other

6.5 Symmetries of Quadrilaterals

A Develop Understanding Task

A line that reflects a figure onto itself is called a **line of symmetry**. A figure that can be carried onto itself by a rotation is said to have **rotational symmetry**.

Every four-sided polygon is a **quadrilateral**. Some quadrilaterals have additional properties and are given special names like squares, parallelograms and rhombuses. A **diagonal** of a quadrilateral is formed when opposite vertices are connected by a line segment. In this task you will use rigid-motion transformations to explore line symmetry and rotational symmetry in various types of quadrilaterals.

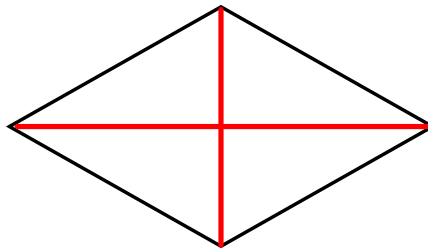
6.5 Symmetries of Quadrilaterals

A Develop Understanding Task

A line that reflects a figure onto itself is called a **line of symmetry**. A figure that can be carried onto itself by a rotation is said to have **rotational symmetry**.

rotational symmetry = more than one 360° turn

Every four-sided polygon is a **quadrilateral**. Some quadrilaterals have additional properties and are given special names like squares, parallelograms and rhombuses. A **diagonal** of a quadrilateral is formed when opposite vertices are connected by a line segment. In this task you will use rigid-motion transformations to explore line symmetry and rotational symmetry in various types of quadrilaterals.

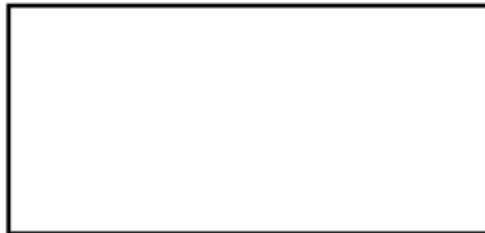


1. A **rectangle** is a quadrilateral that contains four right angles. Is it possible to reflect or rotate a rectangle onto itself?

For the rectangle shown below, find

- any lines of reflection, or
- any centers and angles of rotation

that will carry the rectangle onto itself.



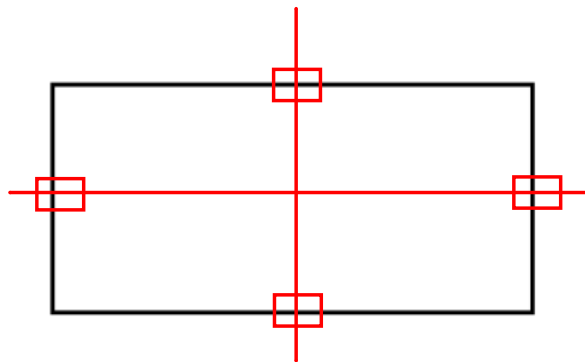
Describe the rotations and/or reflections that carry a rectangle onto itself. (Be as specific as possible in your descriptions.)

1. A **rectangle** is a quadrilateral that contains four right angles. Is it possible to reflect or rotate a rectangle onto itself?

For the rectangle shown below, find

- any lines of reflection, or → **measure \perp bisectors of each side**
- any centers and angles of rotation → **intersection of \perp bisectors**

that will carry the rectangle onto itself.



Describe the rotations and/or reflections that carry a rectangle onto itself. (Be as specific as possible in your descriptions.)

Rotations

- two-fold rotational symmetry
- two 180° rotations maps the original back onto itself

Reflections

- two different directions over the \perp bisectors

2. A **parallelogram** is a quadrilateral in which opposite sides are parallel. Is it possible to reflect or rotate a parallelogram onto itself?

For the parallelogram shown below, find

- any lines of reflection, or
- any centers and angles of rotation

that will carry the parallelogram onto itself.



Describe the rotations and/or reflections that carry a parallelogram onto itself. (Be as specific as possible in your descriptions.)

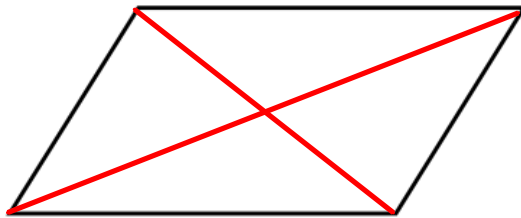
What is the same about rectangles and parallelograms?

2. A **parallelogram** is a quadrilateral in which opposite sides are parallel. Is it possible to reflect or rotate a parallelogram onto itself?

For the parallelogram shown below, find

- any lines of reflection, or
- any centers and angles of rotation

that will carry the parallelogram onto itself.



Describe the rotations and/or reflections that carry a parallelogram onto itself. (Be as specific as possible in your descriptions.)

Rotations

- two-fold rotational symmetry
- two 180° rotations maps the original back onto itself

Reflections

- No reflection symmetry
- not "reflection symmetric"

What is the same about rectangles and parallelograms?

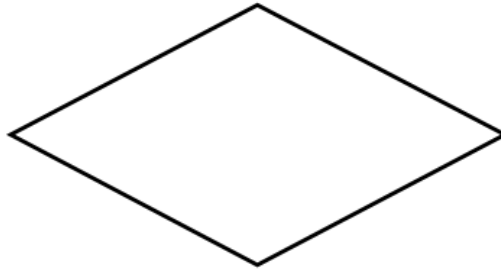
- opposite sides are \cong
 - opposite sides are $//$
- ← **Criteria** for two-fold rotational symmetry!!

3. A **rhombus** is a quadrilateral in which all sides are congruent. Is it possible to reflect or rotate a rhombus onto itself?

For the rhombus shown below, find

- any lines of reflection, or
- any centers and angles of rotation

that will carry the rhombus onto itself.



Describe the rotations and/or reflections that carry a rhombus onto itself. (Be as specific as possible in your descriptions.)

What is the most important criteria for two-fold rotational symmetry?

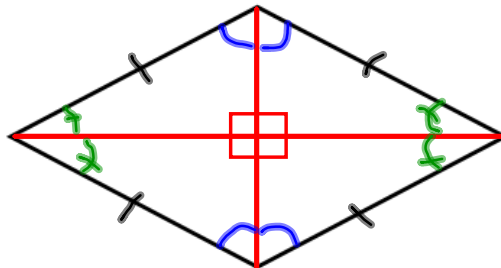
Predict: What will happen with a square?

3. A **rhombus** is a quadrilateral in which all sides are congruent. Is it possible to reflect or rotate a rhombus onto itself?

For the rhombus shown below, find

- any lines of reflection, or
- any centers and angles of rotation

that will carry the rhombus onto itself.



Describe the rotations and/or reflections that carry a rhombus onto itself. (Be as specific as possible in your descriptions.)

Rotations

- two-fold rotational symmetry
- two 180° rotations maps the original back onto itself

Reflections

- 2 distinct lines of reflection that bisect each angle

What is the most important criteria for two-fold rotational symmetry?

- opposite sides are \cong
- opposite sides are $//$

Predict: What will happen with a square?

4. A **square** is both a rectangle and a rhombus. Is it possible to reflect or rotate a square onto itself?

For the square shown below, find

- any lines of reflection, or
- any centers and angles of rotation

that will carry the square onto itself.



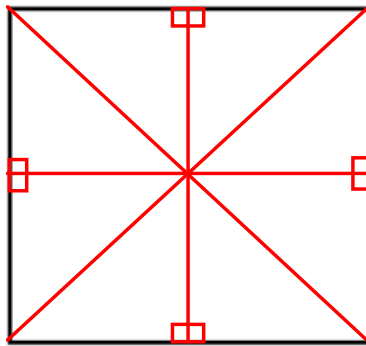
Describe the rotations and/or reflections that carry a square onto itself. (Be as specific as possible in your descriptions.)

4. A **square** is both a rectangle and a rhombus. Is it possible to reflect or rotate a square onto itself?

For the square shown below, find

- any lines of reflection, or
- any centers and angles of rotation

that will carry the square onto itself.



Describe the rotations and/or reflections that carry a square onto itself. (Be as specific as possible in your descriptions.)

Rotations

- four-fold rotational symmetry
- four 90° rotations maps the original back onto itself
- (90° , 180° , 270° , 360°)

Reflections

- 4 distinct lines of reflection that bisect each angle or side
- b/c of 2 consecutive \cong sides, we can reflect over the diagonals

5. A **trapezoid** is a quadrilateral with one pair of opposite sides parallel. Is it possible to reflect or rotate a trapezoid onto itself?

Draw a trapezoid based on this definition. Then see if you can find

- any lines of symmetry, or
- any centers of rotational symmetry

that will carry the trapezoid you drew onto itself.

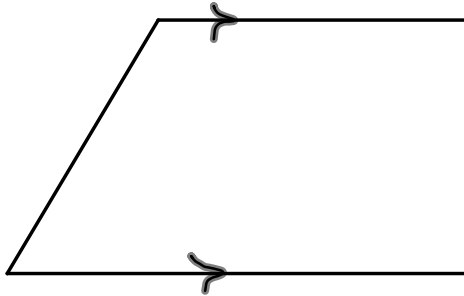
If you were unable to find a line of symmetry or a center of rotational symmetry for your trapezoid, see if you can sketch a different trapezoid that might possess some type of symmetry.

5. A **trapezoid** is a quadrilateral with one pair of opposite sides parallel. Is it possible to reflect or rotate a trapezoid onto itself?

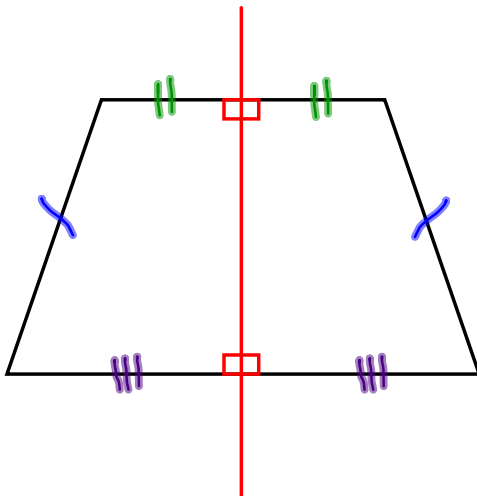
Draw a trapezoid based on this definition. Then see if you can find

- any lines of symmetry, or
- any centers of rotational symmetry

that will carry the trapezoid you drew onto itself. **Not possible**



If you were unable to find a line of symmetry or a center of rotational symmetry for your trapezoid, see if you can sketch a different trapezoid that might possess some type of symmetry.



Isosceles Trapezoid

- 1 set of // sides
- 2 \cong legs

- 1 set of // sides is not enough for rotational symmetry
- 2 sets are necessary for rotational symmetry