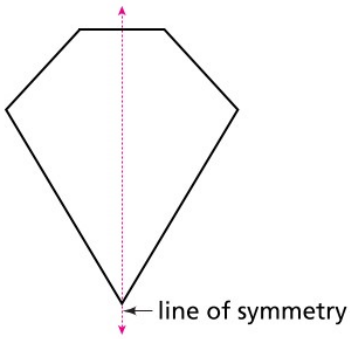
3.5 Design Challenge III The Quadrilateral Game

Special properties of triangles and quadrilaterals make them useful in the design of buildings and mechanical objects. They also play an important role in the design of craft objects.

The two common forms of **symmetry** are defined below.

Reflectional Symmetry

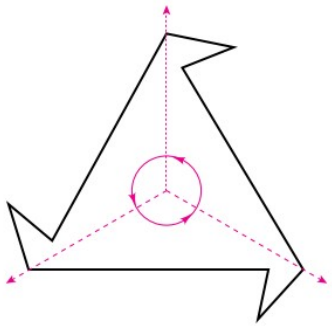
A shape with reflectional symmetry has halves that are mirror images of each other.



If you fold along the line of symmetry, the two halves of the figure match exactly. If you hold a mirror along the line of symmetry, the figure's reflection will match the half behind the mirror.

Rotational Symmetry

A shape with rotational symmetry can be turned about a center point through some angle between 0° and 360° and it will look the same.

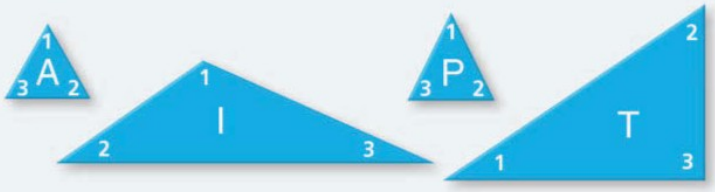


If you close your eyes as the figure above is rotated 120° or 240° and then open them, you won't notice any difference.

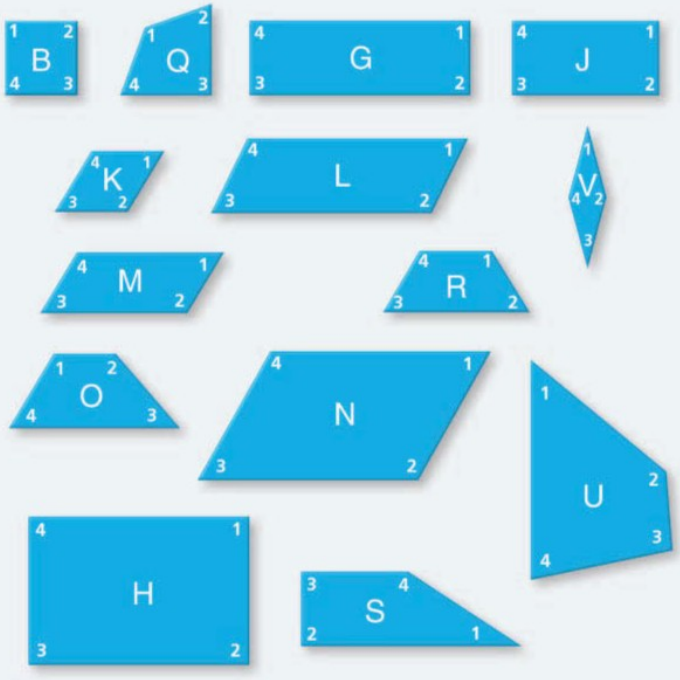
Problem 3.5

A Spotting symmetries in polygons is the first step in using those figures to make art and craft designs.

1. What kind of symmetries do the triangles in the Shapes Set have?



2. What kind of symmetries do the quadrilaterals in the Shapes Set have?

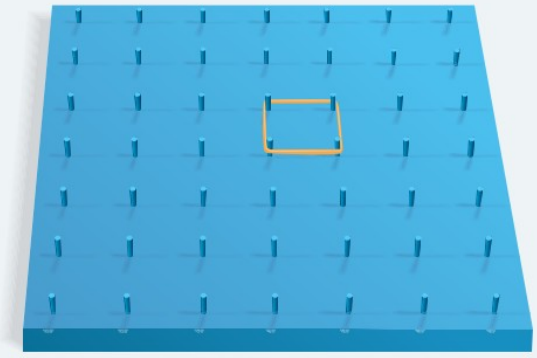


3. Look for objects in your classroom or in nature that have symmetries. What kind of symmetries do they have?

continued on the next page >

Problem 3.5 continued

The Quadrilateral Game challenges you to use all that you know about polygons, including symmetry. The game is played by two teams. To play, you need two number cubes, a game grid, a geoboard, and a rubber band.



The Quadrilateral Game

Directions

- Near the center of the geoboard, put the rubber band around a square measuring one unit on each side.
- Team A rolls the number cubes one at a time to locate an entry in the game grid on the next page. The first number locates the row and the second number locates the column.
- Team A reads the description in that location. Then they look at the quadrilateral already on the game board, and form a new quadrilateral to match the description. The challenge for Team A is to move as few corners as possible to make the new quadrilateral.
- For each corner moved, Team A receives one point.
- Next, Team B rolls the number cubes and locates the corresponding description on the grid. They make a quadrilateral matching the new description by moving as few of the corners as possible. Team B receives one point for each corner moved.
- Play continues until each team has had five turns. The team with the lowest score at the end is the winner.

Problem 3.5 continued

B Play the Quadrilateral Game. Keep a record of interesting strategies and difficult situations.

1. When did you receive 0 points during a turn? Why didn't you need to move any corners on those turns?
2. Write two new descriptions of quadrilaterals that you could use in the game grid.
3. Make your own game board with descriptions for a Triangle Game.

Quadrilateral Game Grid

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Row 6	A quadrilateral that is a square	**Add 1 point to your score and skip your turn**	A rectangle that is not a square	A quadrilateral with two obtuse angles	A quadrilateral with exactly one pair of parallel sides	A quadrilateral with one pair of opposite side lengths equal
Row 5	**Subtract 2 points from your score and skip your turn**	A quadrilateral that is not a rectangle	A quadrilateral with two pairs of consecutive angles that are equal	A quadrilateral with all four angles the same size	A quadrilateral with four lines of symmetry	A quadrilateral that is a rectangle
Row 4	A quadrilateral with no reflectional or rotational symmetry	A quadrilateral with four right angles	**Skip a turn**	A quadrilateral with exactly one pair of consecutive side lengths that are equal	A quadrilateral with exactly one right angle	A quadrilateral with two 45° angles
Row 3	A quadrilateral with no angles equal	A quadrilateral with one pair of equal opposite angles	A quadrilateral with exactly one pair of opposite angles that are equal	**Add 2 points to your score and skip your turn**	A quadrilateral with no sides parallel	A quadrilateral with exactly two right angles
Row 2	A quadrilateral with both pairs of adjacent side lengths equal	A quadrilateral with two pairs of equal opposite angles	A quadrilateral with a diagonal that divides it into two identical shapes	A quadrilateral that is a rhombus	A quadrilateral with 180° rotational symmetry	**Subtract 1 point from your score and skip your turn**
Row 1	A quadrilateral with one diagonal that is a line of symmetry	A quadrilateral with no side lengths equal	A quadrilateral with exactly one angle greater than 180°	A parallelogram that is not a rectangle	**Add 3 points to your score and skip your turn**	A quadrilateral with two pairs of opposite side lengths equal

ACE Homework starts on page 76.