Use the cutout X and O to play a few games of Tic-Tac-Toe. While you are playing, think about the following questions:

1. Is there a way for the first player (X) to guarantee a win or tie?
2. Is there a way for the second player (O) to guarantee a win or tie?
Torus Tic-Tac-Toe

To get use to playing Torus Tic-Tac-Toe, play on the attached numbered board. Here are the rules:
1. The first player picks a number. The player places an X on each instance where the number appears. (Example: If the first player picks 1, place an X on each 1 on the board)
2. Player two picks another number. The player places an O on each instance where the number appears.
3. Players continue picking a new number and placing their symbols (X or O) until a player gets 3 X or 3 O in a row. (Horizontal, Vertical, or Diagonal)

Play a few games of Torus Tic-Tac-Toe. While you are playing, try to answer the following questions:
3. Is there a way for the first player (X) to guarantee a win or tie?
4. Is there a way for the second player (O) to guarantee a win or tie?
5. Does it matter where the 1st player (X) places their X?

Next, try playing on the gluing diagram handouts. Do the following:
1. Try to mark four different ways to get three of a single symbol in a row on the gluing diagram board that do not work in the standard game.
2. Play a few games to get use to playing on a gluing diagram.
Torus

1 2 3
4 5 6
7 8 9

1 2 3 1 2 3 1 2 3
4 5 6 4 5 6 4 5 6
7 8 9 7 8 9 7 8 9

1 2 3
4 5 6
7 8 9
Tic-Tac-Toe on a Torus
Klein Bottle Tic-Tac-Toe

Play a few games of Klein Bottle Tic-Tac-Toe. The rules are similar to the torus version.

While you are playing, try to answer the following questions:
1. Is there a way for the first player (X) to guarantee a win or tie?
2. Is there a way for the second player (O) to guarantee a win or tie?
3. Does it matter where the 1st player (X) places their X?

Next, try playing on the gluing diagram handouts. Do the following:
1. Try to mark four different ways to get three of a single symbol in a row on the gluing diagram board that do not work in the standard and torus games.
2. Play a few games to get use to playing on a gluing diagram.
Tic-Tac-Toe on a Klein Bottle
Projective Plane Tic-Tac-Toe

Play a few games of Projective Plane Tic-Tac-Toe. The rules are similar to the torus version.

While you are playing, try to answer the following questions:
1. Is there a way for the first player (X) to guarantee a win or tie?
2. Is there a way for the second player (O) to guarantee a win or tie?
3. Does it matter where the 1st player (X) places their X?

Next, try playing on the gluing diagram handouts. Do the following:
1. Try to mark four different ways to get three of a single symbol in a row on the gluing diagram board that do not work in the previous versions of the game.
2. Play a few games to get use to playing on a gluing diagram.
**Projective Plane**

![Projective Plane Diagram]

The diagram represents a projective plane with a grid of numbers. Each row and column contains the numbers 1 through 9, with each number appearing exactly once in each row and column. The grid is structured in a way that the numbers are repeated in a pattern that is common in projective plane diagrams, ensuring that no number is repeated in any row or column across the entire grid.
Tic-Tac-Toe on a Projective Plane