

3: LESSON PLAN - Tic Tac Toe

LEARNING AIMS	<p>Students will:</p> <ul style="list-style-type: none"> ● Engage in cooperative play (W1-5) ● Reflect on their own logical and spatial reasoning ● Gain a basic understanding of game mechanics, rules, fundamental gameplay, strategies, winning, cooperative principles ● Logical Reasoning: Exploring game mechanics and the three winning patterns (W1) ● Spatial Reasoning: Locating pieces in order to know where to place and stack (W1) ● Logical reasoning: Wondering about winning patterns – why they work and how to defend against them (W2) ● Spatial reasoning: Diagramming the final board in drawings (W2) ● Logical reasoning: Analyze winning patterns (W3) ● Spatial reasoning: Dimension-shifting between 2D drawing/photo and 3D game board (W3)
MATERIALS	<ul style="list-style-type: none"> ● Enough copies of <i>Tic Tac Toe</i> for your class ● Whiteboard and marker ● Condensed rules sheet -- Tic Tac Toe How to Play ● Students need pen/pencil
SPECIAL CONSIDERATIONS	<ul style="list-style-type: none"> ● Tic Tac Toe is a quick game; one round takes a few minutes ● Organize groups according to student needs: Play in pairs, so two on two. Encourage discussion and understanding of the game.
LESSON ACTIVITIES	<ol style="list-style-type: none"> 1. Students: grab your pencil! Then get into playing groups – games and start/reflection sheets will be handed out. <p>In the last two lessons, you focused on getting to know the different winning patterns of Tic Tac Toe (horizontal, vertical, diagonal, diagonally vertical). You made great use of the different levels you can play at and used some really creative winning strategies to trick your opponents.</p> <p>This class, you are encouraged to try and take your current understanding of the game to the next level (terrible pun) by experimenting with the three-dimensional options of play – in how you draw your board and play with the pieces!</p> <p>To begin, work with your playing group to build the final board that Student A drew in two different ways. Think about which picture you use more. Then explain your thinking on the <i>Starter Sheet</i> (see below). Then start playing!</p> 2. Divide students into their groups.

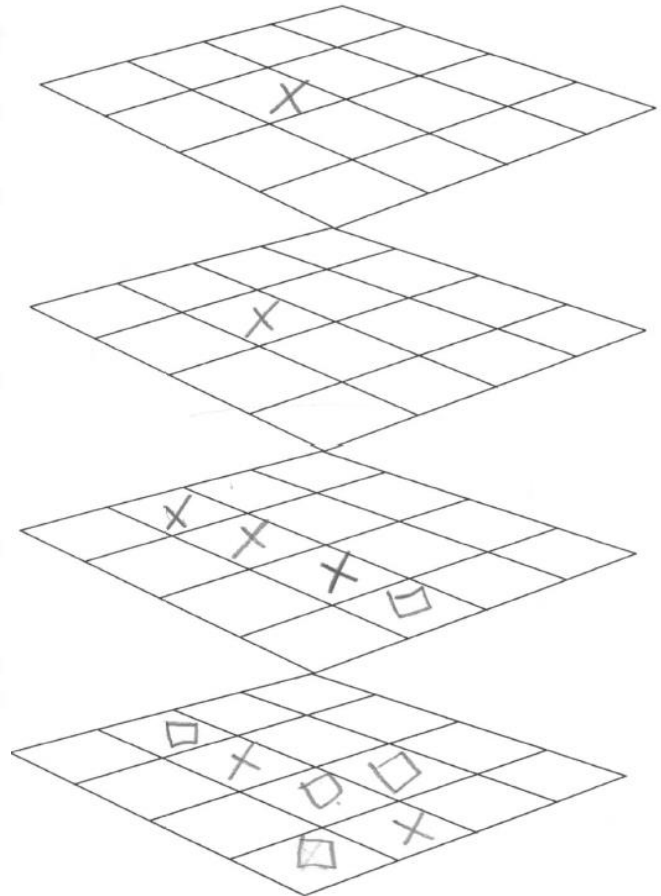
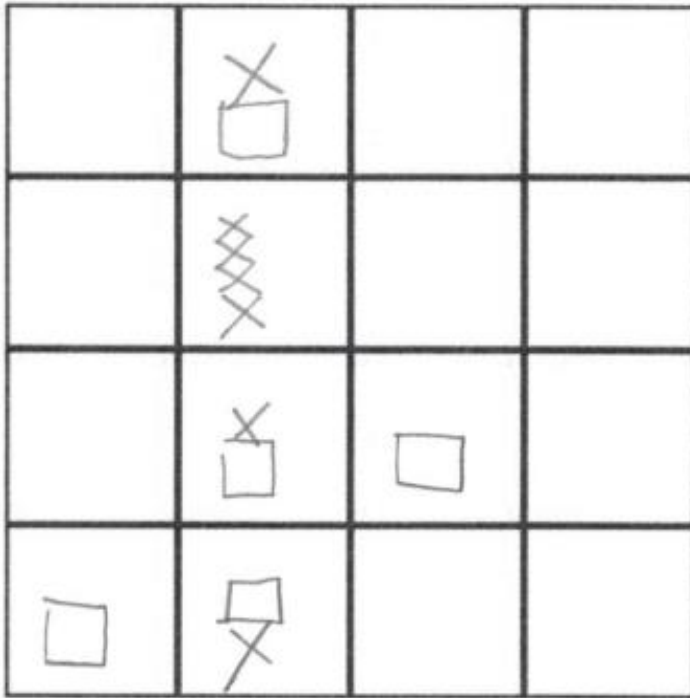
	<ol style="list-style-type: none"> 3. Hand out the reflection sheet so students know what questions to think about. Encourage them to choose one round of the game and answer the questions. 4. Teacher circulates and prompts student discussion of strategies. Encourage students to ask each other the questions listed on the “How to Play” sheet. <ol style="list-style-type: none"> a. Why did you choose to do that? b. Could you have tried a different strategy? c. What are the benefits or risks of stacking? 5. Encourage students to complete the reflection sheet. <p>Note: If some groups need an additional challenge for further analysis, provide the <i>Bonus Challenge</i> page and invite students to explore.</p>
<p>QUESTIONS/ REFLECTIONS</p>	<p>Questions for students/prompts: Focus for Lesson 3:</p> <ul style="list-style-type: none"> ● How might playing vertically help you beat your opponent? ● How might using the various levels change the way you try and win? ● Is there a ‘right’ time to start building up? How do you know when that time is? ● What is one multi-level winning idea you have found? How does it work? ● Is there a benefit to your opponent going to the next level before you? ● Does having multiple levels of play make the game harder or easier? ● What moves might help make the game hard for your opponent? <p>“For Next Time” Reflection Question: Think about it for next time: Are there any spots on the grid that are more useful than others to have your pieces in? If so, which ones?</p> <p>Other questions to consider:</p> <ul style="list-style-type: none"> ● Would rotating the board make a difference to your thinking? ● Which level is that hardest to win on (base, 2nd, 3rd, 4th, across levels)? ● Are there any places on the board where you try and put your pieces first? ● What do you do if your opponent takes a spot you wanted to put your piece? ● How many moves in advance are you planning? ● Did any of your first three moves involve stacking your piece on top of another piece that had already been played?

	<ul style="list-style-type: none">● During the middle of the game, how did you decide where to place a piece on the board? Use drawings and words.● Which types of patterns (horizontal, vertical, diagonal and multi-level versions) did you try and use to win your game?● Pick one of the patterns you used in your game, why did you choose to use that pattern?● Explain the similarities and differences you noticed between Tic Tac Toe and Tic Stac Toe.● Explain the similarities and differences you noticed between Gobblet Gobblers and Tic Stac Toe.● Mathematicians who research game theory are interested in all the different moves that can be made in a game. Can you show all the opening moves for the three related games: Tic Tac Toe, Gobblet Gobblers, and Tic Stac Toe? Draw pictures, give a count and reason for the count.● What is an important strategy you figured out while playing Tic Stac Toe. Use drawings and words.● Is it better to be the first player or the second player? Why?● Can you set up more than one way to win? 2 ways? 3 ways?● What do you do when you are thinking offensively?● What do you do when you are thinking defensively?● One group realized that with the board as pictured [include image], that the _____ team would win on their next turn. How did they know?● Imagine you've been hired to make a tips & tricks website for Tic Stac Toe. Create two important tips to help players. Use drawings to help explain. Tip 1: Tip 2:● In all of the games, students told us about playing on the sides or corners. Can you tell me how playing on the ideas and/or corners helps in Tic Stac Toe? Use drawings and words.
--	--

Starter Sheet: Tic Tac Toe

Your Name: _____ Team Member Names: _____

Using the Tic Tac Toe pieces, **build** Student A's game board shown in these pictures. Both pictures show the same game.



1. Which picture helped you the most when you were building the game board? (Circle One)

1) **Left**

2) **Right**

3) **Both together**

2. Explain why the picture you chose made it easier to build the game board:

Reflection Sheet: Tic Tac Toe

Your Name: _____ Team Members: _____

Shifting Dimensions to Analyze a Win

a) **Set the board up so it matches the photo.** The 'X' team has had seven turns, the 'O' team has had six turns. **It is the 'O' team's turn.**

b) **Circle** the team you predict will win this game:

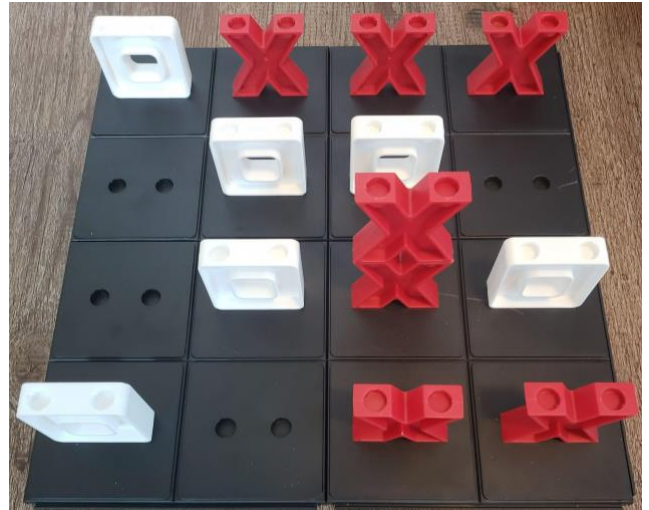
Team 'X' / Team 'O'

c) **Predict** how many turns that team will win in:

_____ turns.

d) **Play** this game to its end and circle the team that won:

Team 'X' / Team 'O'



e) **Explain** how the Team won! What pattern did they use to win (horizontal, vertical, diagonal)?

Draw the final board!

Think about it for next time: Are there any spots on the grid that are more useful than others to have your pieces in? If so, which ones?

Find more resources on <http://www.learnmathwithgames.com/>

Bonus Challenge!

How would you build a game with this winning line?
How many different boards could you make?

