

2: 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)
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. Last class you learned Tic Tac Toe and were figuring out how to win by stacking and using patterns: horizontal, vertical and diagonal. You figured out how to use the winning patterns on one level or across levels! Let's look at two examples: <i>Starter Images</i> (see first two examples below). And, either on one level or across levels! It seems like diagonal was the most selected winning pattern. Drawing the game on paper is challenging, so look at the last example for Student C's drawing. Today, pay attention to how you are looking at the board and how to stop an opponent's winning pattern. 2. Divide students into their groups. Have students set up the game board and gather their pieces. 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.

	<ul 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? <p>5. At the end of the game time, encourage students to complete the reflection sheet.</p>
<p>QUESTIONS/ REFLECTIONS</p>	<p>Questions for students/prompts: Focus for Lesson 2:</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? ● Did any of your first three moves involve stacking your piece on top of another piece that had already been played? ● 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? <p>“For Next Time” Reflection Question: Which winning pattern do you think is the hardest to stop? Can you explain why?</p> <p>Other questions to consider:</p> <ul style="list-style-type: none"> ● Compare and contrast Tic Tac Toe and Tic Stac Toe (explain similarities and differences). ● 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? ● 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:

	<ul style="list-style-type: none">● In all of the games, students told us about playing on the sides or corners. Can you tell me how playing on the sides and/or corners helps in Tic Tac Toe? Use drawings and words.● This board is a few turns into the game. You're the red X player. Draw where you would put your next piece. Why is it a good move? Use words. Start with the picture above -- can you show what the board would look like if there were 3 more moves? Explain.
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Can you explain why the diagonal pattern might have more places to go?

Student A's Reasoning: Diagonal Pattern

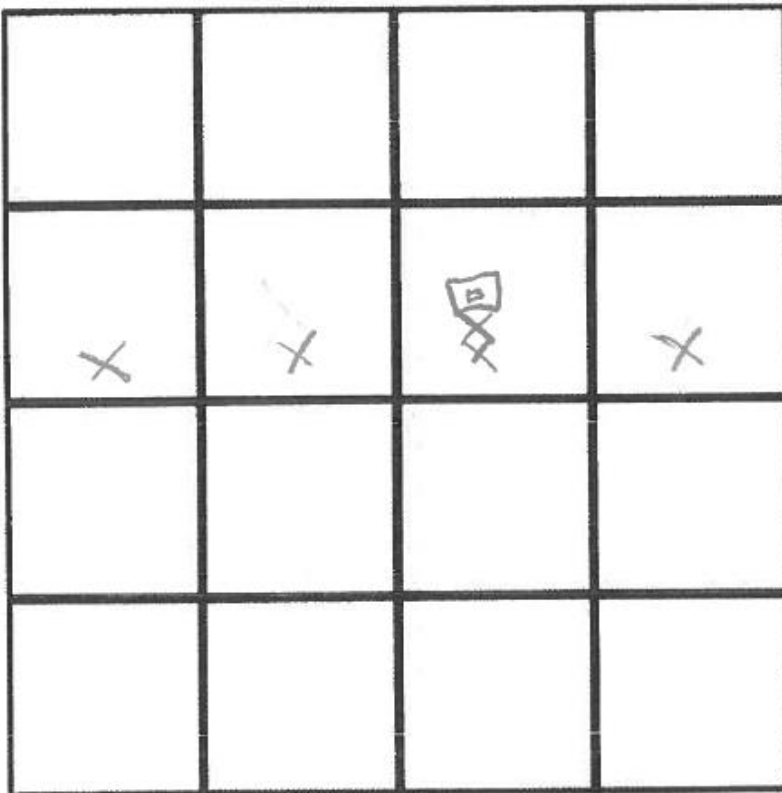
I use a diagonal because
I + feels like I can add
for more places

X			X
	X	X	
	X	X	
X			X

How can you block your opponent from using the horizontal pattern to win?

Student B's Reasoning: Horizontal Pattern

Horizontal. We had 3 in a row then stacked one on one of the X's so that they stack on top of the X then put the X beside the 3 one



Yay

How did this student represent stacking? Where is the winning pattern?

Student C's Reasoning: Corner Pattern

b) Pick one of the winning patterns from your game, how did you create that pattern? Why is it a winning pattern? Explain by drawing on the grid and using the lines below:

corner mc david skill

X O X O X	O	X O X O	X O X O
X O X O X	O	O O O	
X O X O X	O O O	X O O	X O O
X O X O X	X O X O	X X O	X X O

Reflection Sheet: Tic Tac Toe

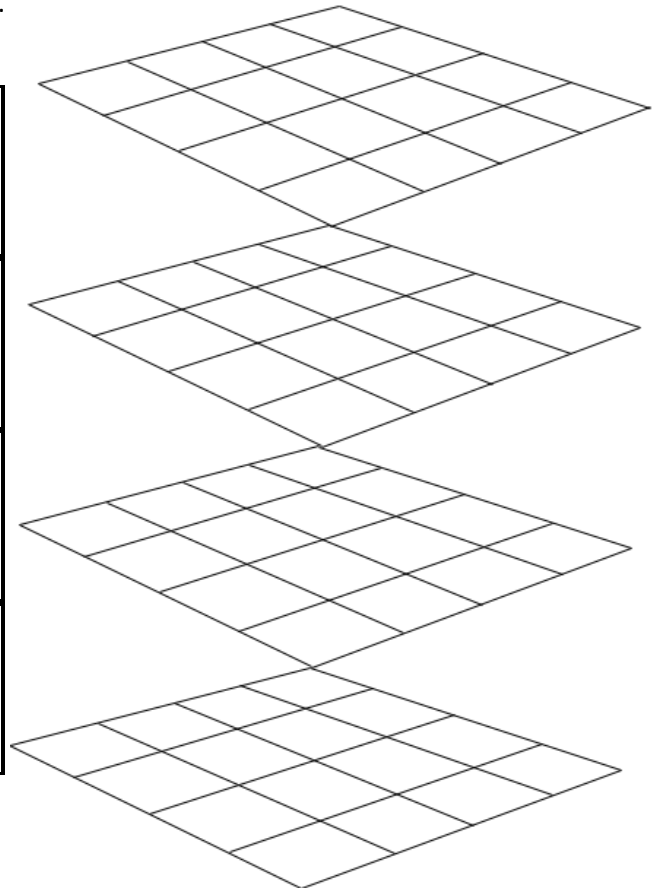
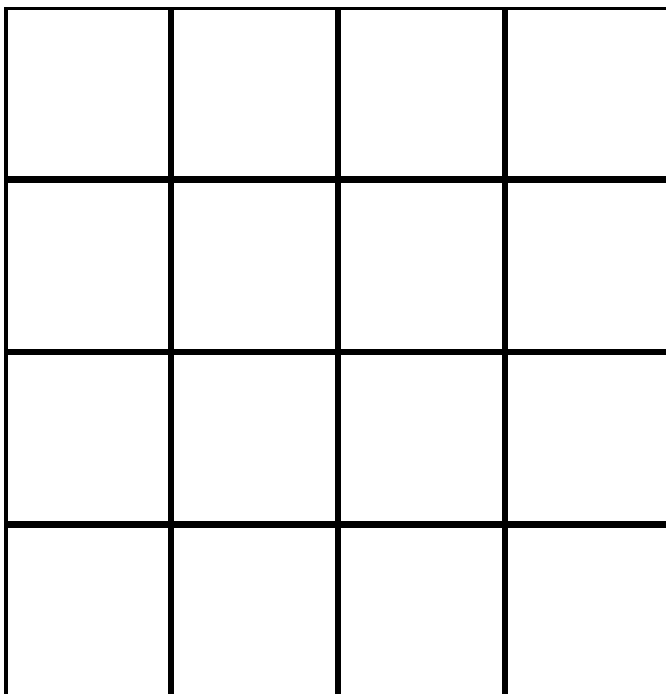
Your Name: _____ Team Members: _____

1) Wondering about How to Spot Winning Patterns:

- a) Did you rotate the game board at any point while playing? Circle One: YES / NO
- b) How did this help you see the different patterns (horizontal, vertical, diagonal)?

2) Diagramming a Winning Pattern

- a) Think about the patterns (horizontal, vertical, diagonal) that helped you or your opponents win today. Which winning pattern do you think is hardest to stop? Draw an example of it below (hint: how are you going to show stacking?).



b) What makes this a hard pattern to stop? Explain.

Think 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?