

# 3-IN-A-ROW

## ACTIVITY GUIDE

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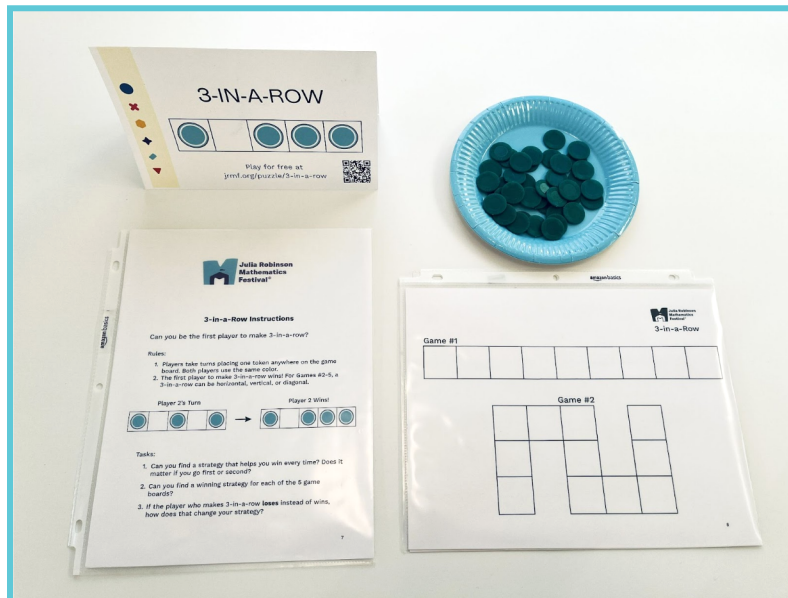
**Julia Robinson  
Mathematics  
Festival**

## Materials and Setup

Per table (assuming 5 pairs of students per table), you will need:

| Per Table                | Material Preparation                               |         |
|--------------------------|----------------------------------------------------|---------|
| 200 colored tokens       | Each station needs about 40 same-colored tokens    |         |
| 3 copies of Instructions | 1 page each                                        | p. 7    |
| 5 copies of Game Boards  | 4 pages each<br><i>can be printed double-sided</i> | p. 8-11 |
| 1 copy of Table Sign     | 1 page<br><i>print on cardstock for sturdiness</i> | p. 12   |

| Per Table                   | Purchasing Materials                       |                                            |                                                                                         |
|-----------------------------|--------------------------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------|
| 5 sets of colored tokens    | <a href="#">pack of 600</a><br>for \$13.99 |                                            |                                                                                         |
| 13 plastic sheet protectors | <a href="#">pack of 100</a><br>for \$7.67  | <a href="#">pack of 500</a><br>for \$26.99 | These are recommended in order to protect the documents that students will be handling. |





## Objective

Be the first player to make 3-in-a-row.

Rules:

1. Players take turns placing one token anywhere on the game board. Both players use the same color.
2. The first player to make 3-in-a-row wins! For Games #2-5, a 3-in-a-row can be horizontal, vertical, or diagonal.

## Materials

Each 3-in-a-Row table should be prepped for 5 stations of two students.

Each station needs:

1. 40 same-color tokens
2. 3-in-a-Row instructions.
3. 3-in-a-Row game boards.

## How to Play

**We encourage you to explore the activity yourself ahead of time.**

You can try our online version [here](#).

Introduce the activity without overexplaining it and without telling what strategies students might want to use. As much as possible, avoid giving away answers. Students should be encouraged to explore, experiment, and learn from their mistakes.

1. Model the rules using the tokens to explain.
2. Play a game with the student.
3. Have the student explore the next game boards, either on their own or with a partner.

## Standards

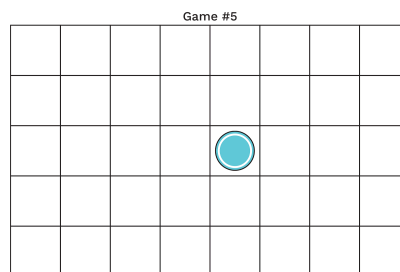
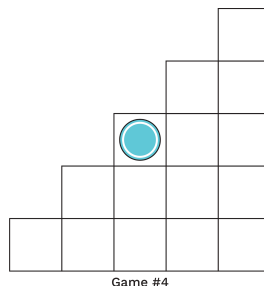
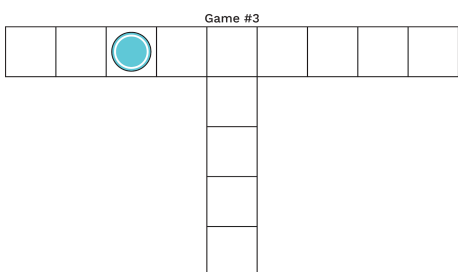
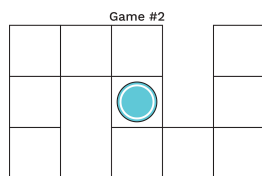
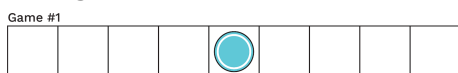
1. Make sense of problems and persevere in solving them. CCSS.MP1
2. Construct viable arguments and critique the reasoning of others. CCSS.MP3
3. Model with mathematics. CCSS.MP4
4. Attend to precision. CCSS.MP6

## Asking Good Questions

1. Ask questions about confidence.
  - a. When a student asks you “Is this right?”, instead of saying “yes” or “no” right away, ask them how confident they are in their answer. Here are some examples:
    - i. “Maybe. What do you think? How confident are you?”
    - ii. “On a scale of 1-5, how confident are you in your answer?”
  - b. If a student is not confident in their answer, follow up by asking “What would help you feel more confident in your answer?” or “Why do you not feel confident?” This helps you determine how best to help the student through their explorations.
2. Ask students about choices.
  - a. When a student is stuck or shows you a wrong answer, instead of jumping in and showing the student the correct answer, start by asking about the choices that the student made along the way. Here are some suggested steps to follow:
    - i. Start from the beginning.
    - ii. Ask students to show you what they’ve tried so far.
    - iii. When the student gets to a point where they have different choices, ask the student “What other choices can you make here?”
    - iv. Have the student make a different choice and try to solve the puzzle. This helps the student see that they have the power to make different choices during an activity, and they’ll start to do this on their own in the future.
    - v. If you’re familiar with the puzzle or a particular solution, stop the student only when a different choice will help them get to the solution. This will help them feel successful faster without you giving away too much of the answer.
3. Ask students about strategies.
  - a. If a student is getting into the activity and has been doing it for a while, ask the student if there are any strategies they’ve come up with to help them solve the puzzle or win the game.
  - b. Follow up by asking if they think their strategies will work for all puzzles and/or larger puzzles, more complex puzzles, etc. Have the student explore more complex puzzles to test out their strategies.
  - c. This is a great way to encourage a student to dive deeper into an activity and to start looking for patterns, structure, and proofs.

## Answers

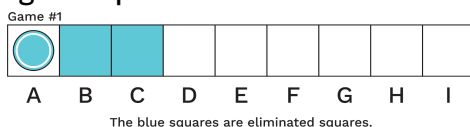
If both players are playing perfectly, Player 1 can always win in each of the five games. Below is an example of a winning first move for each game (every game has more than one winning first move).



### General Strategies:

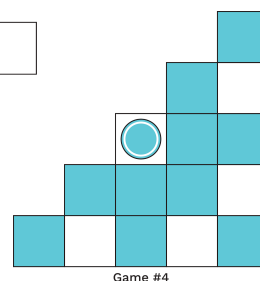
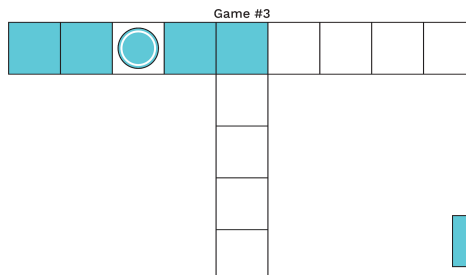
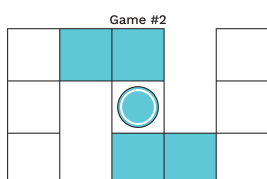
#### 1. Eliminating Squares

After the first move, players can start to eliminate squares that would allow the other player to immediately win. For example, in Game #1, if Player 1 places a token in square A, Player 2 would not want to place a token in either square B or C. Squares B and C can be eliminated as good options for the rest of the game.



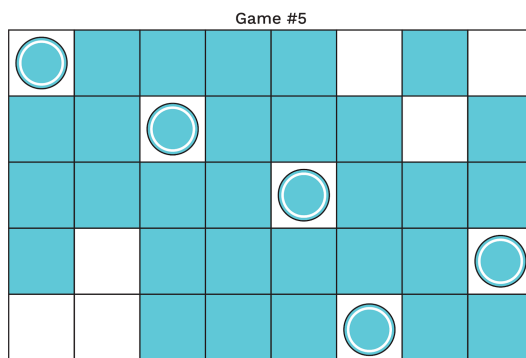
#### 2. Splitting into Two Equal Groups

When possible, an elegant strategy for this game is to split the board into two equal groups and mirror whatever your opponent does. The winning moves for Games #1-4 shown above take advantage of this strategy. Below is what each of these game boards looks like with the eliminated squares marked in blue; in each example, two identical groups of squares have been created.



### 3. Splitting into Two Similar Groups (Advanced)

A more advanced strategy is to split the board into two similar groups that behave the same way. Below is an example where Player 1 split the board into two similar groups, a left and right group. The two groups are similar, because a single token in either group will eliminate all of the squares in that group. So, if Player 2 places a token in the left group, eliminating all of the squares in the left group, Player 1 can place a token in the right group, eliminating all of the remaining squares, and vice-versa. In this example, Player 1 would win no matter what Player 2 does.



The blue squares are eliminated squares. It's Player 2's turn.



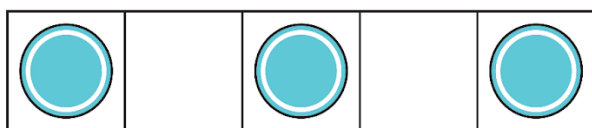
## 3-in-a-Row Instructions

Can you be the first player to make 3-in-a-row?

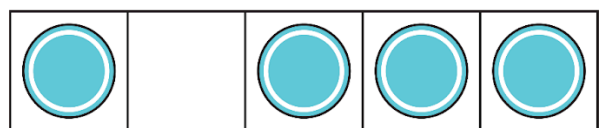
Rules:

1. Players take turns placing one token anywhere on the game board. Both players use the same color.
2. The first player to make 3-in-a-row wins! For Games #2-5, a 3-in-a-row can be horizontal, vertical, or diagonal.

Player 2's Turn



Player 2 Wins!



Tasks:

1. Can you find a strategy that helps you win every time? Does it matter if you go first or second?
2. Can you find a winning strategy for each of the 5 game boards?
3. If the player who makes 3-in-a-row **loses** instead of wins, how does that change your strategy?

## 3-in-a-Row

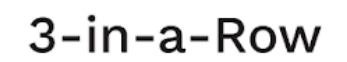
### Game #1

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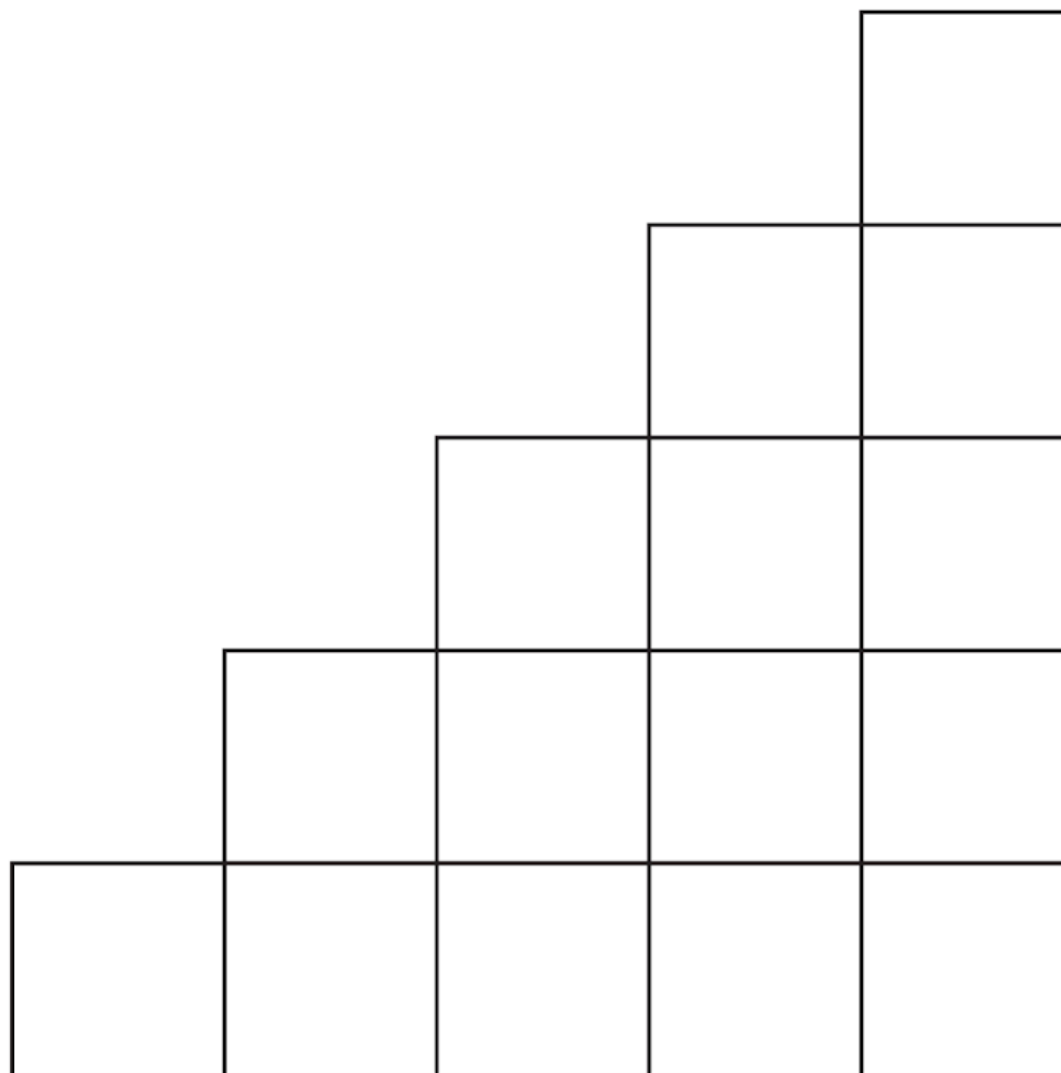
### Game #2

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|  |  |  |  |  |



[illegible]

## 3-in-a-Row



Game #4

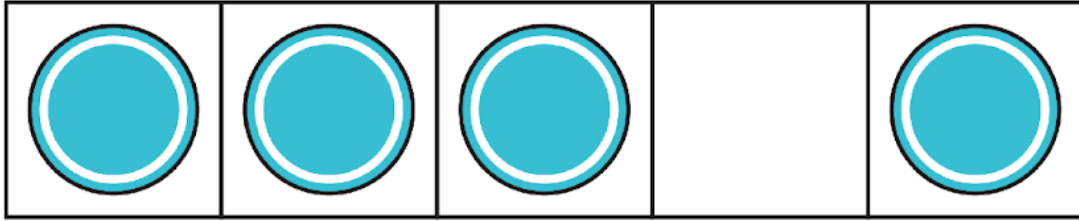
## 3-in-a-Row

### Game #5

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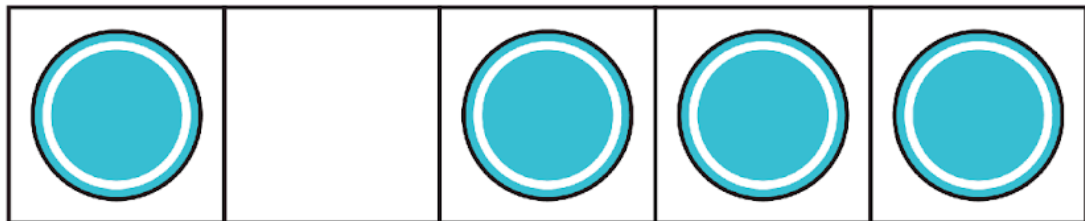
Play for free at  
[jrmf.org/puzzle/3-in-a-row](http://jrmf.org/puzzle/3-in-a-row)



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