

MARBLE CHALLENGE

Everything You Need to Play

MATERIALS

Marble Challenge Game Board

- 1 game board per pair of students. These instructions will assume students are playing one-on-one, but students can also play in two teams.
- Or you can use physical marbles or any other small items—paper clips, scraps of paper, etc. Give each pair of students the required number of marbles or other items based on the instructions.
- Or you can use the MATHCOUNTS Club App to mimic the physical game.

Writing Utensils and Scratch paper

- 1 writing utensil per student. If you use the game board, students will need to cross out the illustrated marbles as they are eliminated. If you use physical marbles or the app, students may want pencil and paper to keep a running total of the number of marbles remaining.



RULES

The Marble Challenge is a subtraction game. Players will start with a certain number of marbles (or objects or a written number) and take turns subtracting 1, 2, 3 or 4 marbles. The player who subtracts the last marble (or object or number) loses the game.

- Determine the starting number of marbles. If players are using the game board, then the greatest number they can choose is 56. In other games, they can start with other numbers.
- When a player removes a number, it must be the next lower number after the previous removals. For example, if Player A removes 56 through 53 and Player B then decides to remove 2 marbles, Player B must remove 52 and 51. That would show that 50 marbles remain.
- Decide who will be Player A and who will be Player B—use rock paper scissors, flip a coin, etc.
- To start, Player A will subtract 1, 2, 3 or 4 marbles. If players are using physical marbles or other objects, then Player A should remove the number of objects. If they are using the game board, they should cross out the number of marbles they are removing. (Figure 1)
- Next, Player B has the option to subtract 1, 2, 3 or 4 marbles from the remaining marbles and similarly mark the game board.
- Players will continue this pattern, alternating turns and removing 1, 2, 3 or 4 marbles. Players must remove at least 1 marble (no skipping a turn).
- The goal is to not be the player to remove the last marble. The player who removes marble 1 is the loser, or, in other words, the player who removes marble 2 is the winner.



Figure 1: Player A's First Move






Figure 2: Completed Game

DIFFERENTIATION, SCALING AND EXTENSIONS



Change the Rules

Rule variations for this game are easy ways to change the difficulty level or alter it enough to keep the game interesting. Depending on your club's needs, some of the following suggested rule changes could be helpful. Feel free to come up with your own as well!

-  Adjust the total number of marbles in play. The given game board allows up to 56, but try any number more or less (use the game board or a piece of paper with a total to subtract from)!
-  Change the numbers of marbles that players are allowed to remove. Try 1, 2, 3 or 2, 3, 4, 5 or any other combination. This will change the modulus for the calculation. (*Hint: Google "Survivor 21 Flags" to find videos of a version of this game being played on the show!*)
-  Add more players! Playing with three or more will change the strategy and calculations.

Extend Concepts to Similar Games

A couple of games address concepts similar to those in Marble Challenge. If you want to extend student's understanding of this game and modular arithmetic, look up the following!

-  Nim—The rules to this game are similar to those of Marble Challenge. However, in Nim, there are three piles to draw from instead of one.
-  The Count to 21 game—Using the reverse of the rules of Marble Challenge, players start with zero and take turns adding to the total, with the loser being the first to reach 21.

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