

# Great SET Marty!

## Big Concepts:

- Game Theory  
Students are exploring the game Set and what mathematical questions can be asked about it.

## Materials and set up:

- 6 Games of set (for 24 people)
- Paper and pencils
- Doc Cam and projector

## Prep Before Lesson:

- [https://www.setgame.com/sites/default/files/instructions/SET\(percentsign\)20INSTRUCTIONS\(percentsign\)20-\(percentsign\)20ENGLISH.pdf](https://www.setgame.com/sites/default/files/instructions/SET(percentsign)20INSTRUCTIONS(percentsign)20-(percentsign)20ENGLISH.pdf) pulled up on the doc cam (everywhere you see a percent sign, replace it)
- 3 get to know questions on the board
- Table groups of 4

## Lesson Plan:

:00–:15 *Introduction and Instructions*

- Students will enter the room and pick their seats, guided toward making teams of 4-5
- Greet students and show them the questions on the board, name, favorite number and why, what's the strangest thing you've ever eaten?
- Have each of the teams discuss the answers and after everyone is ready, each person will introduce a different person on their team.
- Once all the students have introduced each other, <https://www.youtube.com/watch?v=L0cHPWi3X2I> play the video for the students. After the video, pull up the rules and ask what questions students have about the game and the rules? Write down the game questions on the board to discuss later.

:15–:35 *Game Time!* Students will work through a round of Set. Volunteers/instructors will walk around asking what questions the game is making students wonder about. These questions will be added to the board.

:35–1:20 *Exploration* Add these questions to the list on the board. Have each group pick a question (no two groups will have the same question) which they will work through and present their work to the other teams at the end of the session. If they finish early, they will pick another question from the bank to answer with their team. If we run out of questions, groups will work to pose additional questions. (Answers can be found here: [https://www.setgame.com/sites/default/files/teacherscorner/DEVELOPING\(percentsign\)20MATHEMATICAL\(percentsign\)20REASONING.pdf](https://www.setgame.com/sites/default/files/teacherscorner/DEVELOPING(percentsign)20MATHEMATICAL(percentsign)20REASONING.pdf))

1. Find as many SETs as possible in Figure 2.
2. How many cards must be in the deck? (without counting them) Why are there this many?
3. How many SETs (including overlapping ones) are possible in the deck?
4. What is the best strategy when searching for SETs? Which type are you most likely to find?
5. What is the average number of SETs among 12 randomly selected cards?
6. If one attribute is fixed, how many cards could there be that contain no SETs?
7. Find as many cards as possible that contain no SETs.

8. Can only three cards be left at the end of the game?

- Additional, Harder Questions

1. Prove that 5 cards that have two common attribute values must include a SET. (For example, consider only the 9 red-open cards, and prove that every group of 5 cards must contain a SET.)
2. Prove that 10 cards that have one common attribute value must include a SET. (For example, prove that 10 red cards must contain a SET.)
3. If 12 randomly selected cards don't contain a SET and 3 additional cards are added, what is the probability of a SET being present?
4. What is the probability that the game will end with 0, 3, 6, 9, and 12 cards?
5. What is the probability of having 2 disjoint SETs among 12 randomly selected cards?
6. Find the maximum number of cards that contain no SETs. Prove that you have a maximum.
7. How does the game change, and how do the answers to some of these questions change if you combine 2 or 3 decks of cards together?
8. Prove that among 7 cards there cannot be exactly 4 SETs.

- Have students round up all the cards and put them back in the middle of the table. Round up the games of any tables not using them for their presentation and prep for presentations

1:20–1:45 *Presentations* Each team will present their findings on their favorite question for the rest of the group. Students will be limited to 3-4 minutes with 1 minute for questions at the end.

- If time allows, students will be allowed to present their other findings
- Ask students how this connects with math.
- Thank the students for their time and as they leave, hand out a game of Set per student!