

## Scientific Method Game:

This activity is designed both to show your students that our brains have ingrained biases that can lead to incorrect and even conflicting conclusions, even when everyone has the same data, and to demonstrate how the scientific method can overcome these biases to learn about the world. Depending on how advanced your class is, it can also demonstrate why scientists often invoke the concept of ‘Occam’s Razor’ (a preference for the simplest explanation for a phenomenon, that requires the least new theory).

### Before you begin!!!

1. You must choose the number rule you wish to be the correct answer. We typically use “numbers must be ascending”
2. **Write in a “first guess” for your students *BEFORE* making classroom copies.** If you are doing ascending numbers, start with something like “2, 4, 6”; “3, 6, 9” or “1, 3, 5”. You want to have a starting set that can suggest several different rules to different students.
3. Make sure your students understand what you mean by “number rule” and that you will be marking whether their **Number guess** fits the rule each time, **NOT** their hypothesis
4. During the game, walk around and mark a “Y” or “N” in each students “Fits rule?” column as they guess. This is remarkably easy to do, as most students will think for a few seconds between guesses, so they are not all waiting for you at once, AND because the overwhelming majority will just continue to guess numbers in the same format as your starter guess, and you’ll just be writing “Y”s. It generally takes no more than 10 minutes for all the students to convince themselves they’ve found the rule
5. Once all the students are sure that they are right about the number rule, you can do one of several things, depending on the distribution of answers. In my classrooms, if I started them with “2, 4, 6”, I usually get about half the class sure that the rule is “Even numbers” and about half sure that it’s “Evenly spaced numbers”, with one or two who have something else like “all numbers” or “any set of numbers with a 2 in it”. People who are sure about “Even numbers” will have a chart that looks something like this:

Guess of 3 numbers	Fits rule?	Hypothesis	How sure are you about your hypothesis? (%)
2, 4, 6	Yes	Even numbers	50
10, 12, 14	yes	even numbers	80
20, 22, 24	yes	even numbers	100

Specifically, they will have only made guesses that **MATCH** their original hypothesis, without ever trying to **DISPROVE** it by guessing something that they are ‘sure’ would get a “no”. In my classes, there is usually no more than one student that attempts to disprove their hypothesis, but they always get the right answer. Their chart will look something like:

Guess of 3 numbers	Fits rule?	Hypothesis	How sure are you about your hypothesis? (%)
2, 4, 6	Yes	even numbers	50
1, 3, 5	yes	evenly spaced numbers	30
1, 5, 27	yes	positive numbers	30
-1, 3, 30	yes	whole numbers	30
.25, .75, 1	yes	numbers going up	30
0, -2, -4	no	numbers going up	70

6. Since you are marking each sheet, you should have a good idea how many students settled on each hypothesis. If there’s a lot of different ideas, I like to ask for all the answers (avoiding the student that got the right answer, if there was one), make a list of them on the board, and talk for a minute about how everyone got different answers with the same data. Then I have the students pair up with someone that got a different answer and compare their hypothesis, and if there’s time, let them do a second round of guesses. Usually, this time everyone will come up with the right answer. Once everyone has the right answer, we either have a group discussion of how they changed their guessing strategy, or if any students got it right the first time, I have them explain their strategy to the group and WHY they thought of doing it that way. Further discussion relates trying to disprove your hypothesis to how the scientific method works. Science doesn’t look for “proof”, rather it tries to disprove ideas, to see which ideas withstand all attempts to disprove them. If your class is advanced enough, this is also a good time to discuss Occam’s Razor.

**Read these rules to your class before beginning (they also appear on the student sheet):**

You can do up to 10 experiments

**I will only tell you whether or not your number choices fit our number rule**

Use the chart to help you record your experiments and their results.

The first line is partially filled out for you, everyone's first guess is the same, and it **does** fit my number choosing rule.

You should make a hypothesis about what my number rule is, and how sure you are.

**Then, choose three new numbers** to test your hypothesis.

Once you've made a new guess, raise your hand, and I'll come mark whether your guess fits the rule or not

Once you reach either 10 guesses, or 100% sure, you can stop guessing.

**Work independently!!!**