

## Math Enrichment Week 7: SKUNK Game Overview

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Write the following questions on the chalkboard or overhead:

- I might make more money if I was in business for myself; should I quit my job?
- An earthquake might destroy my house; should I buy insurance?
- My mathematics teacher might collect homework today; should I do it?

Ask students to share their responses to each of these scenarios. Ask students why their responses may be different from their classmates. Ideally the class discussion will mirror some of the concepts which follow.

Every day each of us must make choices like those described above. The choices we make are based on the chance that certain events might occur. We informally estimate the probabilities for events by using a variety of methods: looking at statistical information, using past experiences, asking other people's opinions, performing experiments, and using mathematical theories. Once the probability for an event has been estimated, we can examine the consequences of the event and make an informed decision about what to do.

Making the connection between choice and chance is basic to understanding the significance and usefulness of mathematical probability. We can help middle school students make this connection by giving them experiences wherein choice and change come into play followed by tasks that cause them to think about, and learn from, those experiences.

The game of SKUNK presents middle-grade students with an experience that clearly involves both choice and chance. SKUNK is a variation on a dice game also known as "pig" or "hold'em." The object of SKUNK is to accumulate points by rolling dice. Points are accumulated by making several "good" rolls in a row but choosing to stop before a "bad" roll comes and wipes out all the points. SKUNK can be played by groups, by the whole class at once, or by individuals. The whole-class version is described following an explanation of the rules.

### *The Game of SKUNK*

To start the game each player makes a score sheet like this:

	S	K	U	N	K	

Each letter of SKUNK represents a different round of the game; play begins with the "S" column and continue through the "K" column. The object of SKUNK is to accumulate the greatest possible point total over five rounds. The rules for play are the same for each of the five rounds.

- At the beginning of each round, every player stands. Then, a pair of dice is rolled. (Everyone playing uses that roll of the dice; unlike other games, players do not roll the dice for just themselves.)
- A player gets the total of the dice and records it in his or her column, unless a "one" comes up.
- If a "one" comes up, play is over for that round and all the player's points in that column are wiped out.
- If "double ones" come up, all points accumulated in prior columns are wiped out as well.
- If a "one" doesn't occur, the player may choose either to try for more points on the next roll (by continuing to stand) or to stop and keep what he or she has accumulated (by sitting down).

**Note:** If a "one" or "double ones" occur on the very first roll of a round, then that round is over and each player must take the consequences.

### Playing SKUNK with the Whole Class

The best way to teach SKUNK to the class is to play a practice game.

Draw a SKUNK score sheet on the chalkboard or overhead transparency on which to record dice throws. Have all students make their own score sheets on their own scrap paper. Have all students stand up next to their chairs. Either you or a student rolls the dice. Suppose a "four" and a "six" come up, total 10. Record the outcome of the roll in the "S" column on the chalkboard:

Score Record				
S	K	U	N	K
10				

On the first roll, all the players get a total of the dice or a zero if any "ones" come up. Kerry and Lisa are standing up, so they also write "10" in their score sheets.

Kerry				
S	K	U	N	K
10				

Lisa				
S	K	U	N	K
10				

After each roll, players may choose either to remain standing or to sit down. Those who are standing get the results of the next dice roll; those who sit down keep the score they have accumulated for that round regardless of future dice rolls. Once someone sits down, that person may not stand up again until the beginning of the next round.

Instead of focusing on a single class winner, more students will be drawn into thinking about a strategy for doing well in this game by emphasizing personal goals. When playing the game for the second and third time, ask students to focus on trying to better their own previous score. After each game ask for a show of hands of those who did better than last time.

#### Thinking about SKUNK

Although playing SKUNK is fun, thinking about SKUNK is essential for student understanding of the underlying concepts. In groups of two or three, students should complete the questions on the handout.

Groups of students could organize whole-class experiments to find answers to problems 4, 5, 6. As a class, share results and solutions to the questions posed.

#### Suggested solutions and discussion points

For question 1, the chance part of SKUNK is the dice roll and choice part is the decision to sit down or remain standing. Many games can be listed for question 2. Games of pure chance include Candy Land and bingo. Games involving almost pure choice, disregarding who goes first and your opponent's ability, include chess and tic-tac-toe. Most games, such as hearts, basketball, or Monopoly, involve both choice and chance. The game of Uno is mostly chance no matter what choices are made. But poker can be either mostly chance or mostly choice depending how it is played. Strategies are useful only in games that allow for choices. But even games that have choices can be mostly chance for a player who makes choices without any strategy.

Question 3 can lead to class discussions that involve interesting probabilities and decisions from students' lives. Some events that a thirteen-year-old would ascribe mostly to chance include these: you find a \$20 bill, your calculator is stolen, having a bad acne outbreak, your cousin becomes a famous musician, your best friend has to go to a different high school than you, and the like. Some typical events resulting from a thirteen-year-old's choices might include these: a girl dances with you because you asked her, you flunk a quiz because you didn't study, you get paid your allowance because you do your chores, and so on.

Questions 4, 5, and 6 can be done either by experimenting or making theoretical arguments. For example, for question 5, dice could be rolled many times and the points noted. Then the points could be totaled and the average value per time calculated. One theoretical approach is to list the equally likely outcomes for rolling a pair of dice where SKUNK points are accumulated. Twenty-five equally likely outcomes yield points. Such a list of outcomes is shown in **table 1**. Rolls including a "one" are not shown because no points are accumulated on the rolls.

**Table 1**

		Second Die				
		2	3	4	5	6
First Die	2	4	5	6	7	8
	3	5	6	7	8	9
	4	6	7	8	9	10
	5	7	8	9	10	11
	6	8	9	10	11	12

The average of all the equally likely values is 8. This value can be either calculated or observed from the symmetry of the table.