# The skunk game

Students will use the skunk game to review sample space and complementary events. The skunk game allows students to move from single-stage events into multistage events, with multiple outcomes.

## Visible learning

### Learning intentions

* To be able to display the outcomes for multi-step events in a table.
* To be able to use a sample space to make predictions.

### Success criteria

* I can list sample spaces for single-stage events.
* I can list sample spaces for multistage events.
* I can calculate probabilities using sample spaces.
* I can make predictions based on calculated probabilities.

### Syllabus outcomes

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly **MAO-WM-01**
* solves problems involving probabilities in multistage chance experiments and simulations **MA5-PRO-C-01**

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## Activity structure

Please use the associated PowerPoint The skunk game to display images in this lesson.

### Launch

#### The skunk game

The skunk game can be played on the Transum website using the link [bit.ly/skunkgame](https://bit.ly/skunkgame). Instructions on how to play are included on the site. It is best played as a class using 2 physical dice or 2 virtual dice ([mathigon.org/polypad#random](https://mathigon.org/polypad#random)). The game is titled ‘skunk’ as each letter of the word represents a round of the game.

##### Equipment

* One copy of Appendix A ‘Scorecard’ per student
* 2 dice (physical or virtual)

##### Rules

1. Distribute a copy of Appendix A ‘Scorecard’ to each student.
2. To start a round, every student stands up.
3. 2 dice are rolled and the 2 numbers on the dice are added together to make a score.
4. The score is recorded in the first column, under the letter S.
5. The dice continues to be rolled until a number 1 is rolled. If the number 1 is rolled, on one or both of the dice, the score is zero and the round ends. Anyone still standing at this point will lose all their points.
6. After each roll of the dice, the students have 2 options. The students can:
* Add the total from the roll to their total and remain standing. If the student chooses this option, they wait for the next roll. If the next roll includes a 1, the student loses all the points for the round contained in the column. If the next roll does not include a 1, the student once again has the same 2 options.
* Add the total of the 2 dice to their total and sit down. If the student chooses this option, their score for the round in the column, is locked in and no further points can be added.
1. The game consists of 5 rounds, one for each of the letters in the word skunk.
2. After 5 rounds, the students add the scores from each round in each column, to find their total score. The winner is the person with the highest score after 5 rounds.

#### Post game discussion

1. Conduct a class discussion on when it is better to sit down or continue playing.

### Explore

1. Ask students to consider the sample space for rolling one die.
2. Have students calculate the probability of rolling a one and the complementary event.
3. Pose the following questions for students to Think-Pair-Share ([bit.ly/thinkpairsharestrategy](https://bit.ly/thinkpairsharestrategy)):
* Do the probabilities affect your strategy to sit or stand in the game? Why or why not?
* Does the likelihood of getting a 1 increase the longer the game goes on? Why or why not?
1. Select non-volunteer students to share some of their discussion with the whole class.
2. Ask students to consider the game where you have 2 dice. By working in visibly random groups of 3 ([bit.ly/visiblegroups](https://bit.ly/visiblegroups)) on vertical non-permanent surfaces ([bit.ly/VNPSstrategy](https://bit.ly/VNPSstrategy)), give the students a few minutes to think about and list the sample space.
3. Students do a gallery walk ([bit.ly/DLSgallerywalk](https://bit.ly/DLSgallerywalk)) looking at the different ways chosen to determine the sample space. Ask students to note their preferred method and think about why?

By participating in the group work and gallery walk activity, students may develop a table that shows the sample space.

1. Display slide 2 of The skunk game PowerPoint and conduct a class discussion around the student’s observations. Discussion points could include:
* If an outcome occurs more than once, is it important to list it more than once?
* Does the order of the outcomes matter? For example, is rolling a 3 and 2 different from rolling a 2 and a 3?

The aim of the discussion is to help students realise that they need a logical and systematic approach to listing sample space for multistage events.

### Summarise

1. Have students draw a table where 2 dice are rolled and the sum of the visible sides are calculated. This could be done in the cover of their books or on a poster for students to refer to later.
2. Students use the table to calculate the probability of rolling 2 ones and the complementary event.

The solutions for the table where 2 dice are rolled and the sum of the visible sides are calculated can be found on slide 3 of The skunk game PowerPoint.

1. Students discuss in a Think-Pair-Share:
* Why is the probability of rolling 2 ones $\frac{1}{36}?$
* Why is the probability of rolling 2 ones not $\frac{1}{6}+\frac{1}{6}$ ?
1. Select non-volunteer students to share some of their discussion with the whole class.

It’s important that students can reason why addition of probabilities does not make sense given the context of rolling 2 dice. This is an opportunity to establish with students that for concurrent or sequential events, we multiply the probabilities. The table can be used to visually verify the probability of rolling 2 ones. In the context of the game, it should be clear that rolling 2 ones is less likely than rolling a single one, so the probability should be smaller, not $\frac{1}{6}+\frac{1}{6}=\frac{1}{3}$.

### Apply

#### Equipment

* Paper
* Scissors
* Sticky tape or glue

#### Method

1. In their groups of 3 at vertical non-permanent surfaces, students are to create 2 custom dice. For each set of dice, they are to write out the sample space using a table.
2. Students’ dice can have any number of sides which meet the below criteria, based on playing skunk with 2 standard 6-sided dice:
* More likely to roll a 1 and have the game stop.
* More likely to gain a high score.
1. Encourage groups to test their custom dice by playing skunk within their group.
2. Have 2 groups combine and choose one dice from each group to play a game of skunk.
3. Facilitate a class discussion selecting one student from each group to share the dice they used and how their game of skunk played out.

## Assessment and differentiation

### Suggested opportunities for differentiation

**Launch**

* Variations to the skunk game include reducing the number of dice to 1 or increasing to 3 and/or changing the game from adding the dice to multiplying.

**Explore**

* Sample space, simple probability and complementary events are all part of the Stage 4 syllabus. Students may benefit from revising these concepts.
* More dice could be added to the multistage event**.** Students could determine how to display this data. Students could progress from 3 dice to 4 and then think about *n* dice.

**Summarise**

* Students may need a table provided.
* The game, sample space and probabilities could be explored using multiplication of 2 dice instead of addition. Slide 4 of *The skunk game* PowerPoint can be displayed to share the table of results with students.

### Suggested opportunities for assessment

**Summarise**

* The teacher could monitor student’s tables and check strategies to determine probability to clarify understanding.
* Students will demonstrate their working mathematically skills in discussions and justifications.

**Apply**

* Students will demonstrate their working mathematically skills in discussions and justifications**.**

## Appendix A

### Scorecard

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | S | K | U | N | K | Total  |
| Game 1 |  |  |  |  |  |  |
| Game 2 |  |  |  |  |  |  |
| Game 3 |  |  |  |  |  |  |
| Game 4 |  |  |  |  |  |  |
| Game 5 |  |  |  |  |  |  |

## References

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