Simulate a Coin and Die Event

Design a simulation and compare its frequency to a modeled probability

Name: _____ Date: _____

Part 1: Plan and model the event

Materials: a fair coin, a fair 6-sided number cube, and a pencil.

Event: A success happens when you flip **heads** AND roll an **even number**. One trial means one coin flip and one die roll.

1. Design your simulation. Write directions that another student could follow. Include how to flip, roll, record, and reset for the next trial.

2. List the sample space. Complete the table. Write each possible coin-and-die result, such as H1 or T6.

Coin result	1	2	3	4	5	6
H						
T						

3. Model the probability. Circle the success outcomes in your table. Then complete:

Number of equally likely outcomes: _____ Success outcomes: _____

Modeled probability of success: _____ / _____ = _____

4. Assumption: We model the coin flip and die roll as independent. In your own words, what does that mean?

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Part 2: Run, tally, and compare

5. Run 20 trials. Follow your plan from Part 1. Record the coin result, die result, and whether the event was a success. Do not redo a trial because you dislike its result.

Trial	Coin	Die	Success?
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Trial	Coin	Die	Success?
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

6. Find your experimental frequency.

Successes: _____ out of 20

Experimental frequency: _____ / 20 = _____

7. Compare. How does your experimental frequency compare with the modeled probability? Why might they not be exactly equal?

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Answer key and teaching notes

Setup and materials: Print and supply all student pages, keeping teacher-key pages separate. Give each pair one fair coin, one fair 6-sided number cube, and pencils. Students may work individually if enough materials are available. Use a flat rolling surface and ask students to keep every result. No digital randomizer is needed.

Teacher script: “Today, one trial has two actions: flip a coin and roll a number cube. Our success event is heads and an even number. Before we collect data, we will model all equally likely outcomes. Then we will see what happens in our own set of trials. Your data are observations; they do not have to match the model exactly.”

Observation method: Circulate during trials 1-5. Check that each student or pair flips and rolls once per row, records both results, and marks success only for H2, H4, or H6. Ask: “What would count as a success?” and “Did you keep results that were not successes?” Review the completed table and comparison response after collection.

1. Simulation directions - sample acceptable response: “Flip the coin once and roll the die once. Write both results in the next row. Mark success only if the result is heads with 2, 4, or 6. Repeat until 20 rows are complete.” Accept equivalent directions that use one flip and one roll per trial and preserve every outcome.

2. Sample space: H1, H2, H3, H4, H5, H6; T1, T2, T3, T4, T5, T6.

3. Modeled probability: There are 12 equally likely outcomes. The favorable outcomes are H2, H4, and H6: 3 outcomes. Probability = 3/12 = 1/4.

4. Independence: Accept: the coin result does not change the die result, and the die result does not change the coin result. This is a modeling assumption about the fair devices, not something 20 trials can prove.

5-6. Trial records and experimental frequency: Answers vary. Accept any complete, plausible 20-trial record using coin outcomes H/T and die outcomes 1-6, with success marked exactly for H2, H4, and H6. Experimental frequency must equal the student’s counted successes divided by 20. Do not expect or require 1/4.

7. Comparison rubric: Full response states the student’s fraction, compares it to 1/4, and explains that random samples can vary, especially with only 20 trials. Strong responses may note that more trials often give a frequency that is closer to the modeled probability, but no particular result is guaranteed.

Source credit: New York Next Generation Mathematics Learning Standards, NY-7.SP.8.c, “Design and use a simulation to generate frequencies for compound events.” https://www.nysed.gov/curriculum-instruction/new-york-state-next-generation-mathematics-learning-standards