

# Plinko!

6701

## Introduction

In this activity, students will simulate a popular game, find experimental probabilities, and then compare those probabilities to the corresponding theoretical probabilities.

## Grades 6-8

### NCTM Data Analysis and Probability Standards

- Understand and apply basic concepts of probability
- Compute probabilities for simple compound events, using such methods as organized lists, tree diagrams, and area models

## Files/Materials Needed

*Plinko.act*

## **PART 1** SIMULATE THE GAME OF PLINKO AND ANALYZE EXPERIMENTAL RESULTS

1

- Launch TI-Navigator™ on the computer and start the session.
- Have each student log into NavNet on their calculator.

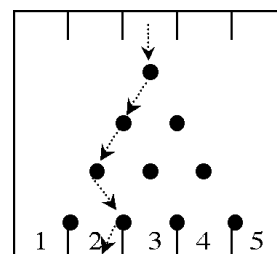
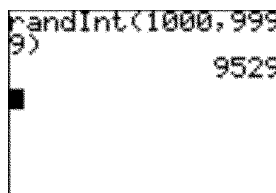
2

- Load the activity settings file *Plinko.act* into Activity Center.
- Explain to students that the game of Plinko involves dropping a disk from a slot at the top of the game. The disk makes its way down to the bottom, bouncing off pins, and going right or left as it hits each pin. Tell students that they will be simulating the game in which the disk is dropped from the middle slot as indicated by the diagram in Activity Center. There are four rows of pins and the disk has an equal chance of bouncing to the left or right at each pin.

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- Have students exit NavNet. To ensure student's have different random number generators, have each student type a different number on the home screen (phone number, student ID, etc), press **STO►** then **MATH**, arrow over to the PRB menu, and select **1: rand**.

- Instruct students to use the command `randInt(1000,9999)` to display a random four-digit integer on the home screen. Allow students to choose even and odd digits to represent left or right. For example, if even means 'right' and odd means 'left,' then the first screen shown indicates that a disk lands in Slot 2 (left, left, right, left).



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- Have students simulate the game exactly 10 times, recording the slot the disk lands in each time. At the conclusion of this activity, tell students to log back into NavNet.
- Students can then go into Activity Center and submit their results (the slot number the disk landed in each time) into L1. Click the 'List' tab so that students can see the data being submitted to Activity Center.
- Stop the activity, click on **Configure**, and click the button for **Existing activity lists**. By starting this activity, each student will receive the results from the entire class.

- d. Have students exit NavNet and create a histogram displaying the frequency that the disk landed in each slot. Use **Screen Capture** to view the student histograms. You can also create a histogram within Activity Center by clicking the **Frequency Plot** icon.
- e. Discuss the results with students. Calculate experimental probabilities, which should convince students that Slot 3 is the most likely outcome and Slots 1 and 5 are the least likely outcomes.

**PART 2** DETERMINE THE THEORETICAL PROBABILITY BY MAKING AN ORGANIZED LIST

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- a. Have students log back into NavNet. Ask students to think of all the different ways a disk can travel from Slot C to the slots at the bottom of the game. For example, LLRL is one such arrangement.
- b. Use **Quick Poll** (with *Open Response*) to collect student answers. Tell students to submit the four letters without any spaces or punctuation marks. This will aggregate results. There are 16 different arrangements:

LLLL	LRLR	RLLR	RRLR
LLLR	LRLR	RLLR	RRLR
LLRL	LRRL	RLRL	RRRL
LLRR	LRRR	RLRR	RRRR

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- a. Write all 16 arrangements on the board and have students determine the slot the ball lands in for each arrangement. Students should determine the results below.

Movement	Slot
4 lefts	1
3 lefts and 1 right	2
2 lefts and 2 rights	3
1 left and 3 rights	4
4 rights	5

- b. Instruct students to calculate the theoretical probabilities from their analysis of the organized list. Have them submit the probabilities for each slot using **Quick Poll**. Show that the theoretical results are supported by the simulation results from Part I.

**EXTENSION**

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This activity can be extended several different ways. For example, in 16 trials the disk should theoretically land in the slots, from left to right, 1, 4, 6, 4, and 1 times. This sequence of numbers can be found in the 5th row of Pascal's triangle. Using this observation, students can determine the probabilities for Plinko games with additional slots and rows of pins. A connection to the binomial theorem can also be made for advanced students.