

Iron Chef Week 3-Table 4

The Class:

Algebra II

The Game:

Three unusual dice are sitting on a table. Your opponent (student representative) chooses one of the three dice. Notice these dice are not normal dice as the numbers on the faces are a bit funny. You (the teacher) then choose one of the remaining dice. You both then roll your respective dice. Whoever rolls a higher number scores one point. The first player to score a total of 5 points wins the game.

The Catch:

The three dice have been created in such a way that, regardless of which dice your opponent chooses, you will have a better chance of winning by choosing one of the other dice.

In other words:

Pink colored die beats Yellow colored die.

Yellow colored die beats Green colored die.

Green colored die beats Pink colored die.

The Goal:

To understand that transitivity, a property of real numbers does not always hold.

The Purpose:

Using the dice challenge students will explore a non-transitive mathematical system. Concept of probability, counting, and data collecting will also be explored.

The Activity

1. Play the dice challenge with an individual student
2. Allow students to work in small groups to determine “the best” die. (See possible student responses below)
3. Have the class vote on the best die then play the game a second time versus the class
4. In small groups, collect data on each game (pink vs. green, pink vs. yellow, yellow vs. green)
5. As a class, compile and analyze group data
6. Confirm this data by determining the probability of winning each game ((pink vs. green, pink vs. yellow, yellow vs. green)
7. Create a set of 4 dice that exhibit this same non-transitivity

Possible Student Responses

1. The total sum of the green die is the largest
2. The green die has the most 6's
3. The pink die seems to be better than the yellow die and the yellow die seems to be better than the green die so the green die is the worst and the pink is the best
4. The yellow die is the most "in the middle" (all 3's)
5. The pink die, because pink is the prettiest

Extensions:

- Create new dice that will maximize your probability of winning regardless of the dice your opponent chooses
- Create a set of 5 dice that exhibit this same non-transitivity
- As the number of dice increases, what happens to the probability
- How many rounds are needed in the original game to ensure a 95% chance of winning
- Create a different set of non-transitive dice, with a different number of sides
- Consider applying this idea to election runoff outcomes