

## Secondary Mathematics Topics in which Redistricting Concepts Could Connect Ideas

It is a complaint heard around the country: “When will I ever use this?” Redistricting is rich with mathematical concepts, which have real-world applications. The main requirements of mathematical courses are fixed, but teachers can squeeze in meaningful lessons related to history and computer science. These carefully crafted lessons can connect mathematics to current events and affect our students on a higher level. I view this personally as a global approach to teaching mathematics, rather than a local approach.

### Statistics Units:

- **Probability:**
  - Examining Random Walks and the probabilities involved.
    - An activity could include a simple random walk and students flip coins for a set number of runs. (Heads: go right; Tails: go left) Discuss the change in the probability for a grid or in 3d. Encourage students to discuss outcomes when probabilities change (use a random number generator that gives integer results from 1-100 and only move right on numbers divisible by 3).
- **Expected Value:**
  - (At risk of oversimplification) Use polling percentages to determine the expected results.
- **Combinations and Permutations:**
  - Examining the number of ways there are to “redistrict” a 3 by 3 grid into 3 districts. Increase values and discuss the outcomes. Discuss symmetry.
- **Creating Visuals such as histograms or boxplots.**
- **Regression Analysis**
  - Using curves of best fit with data from Districtr
- **T-tests:**
  - Use Districtr for data
- **ANOVA:**
  - Use Districtr for data

### Algebra:

- **Matrices**
  - Markov Chains with MGGG’s work
- **Systems of Equations**
  - Creating Regions under boundary restrictions.
- **Functions**

### Geometry

- **Measures for Compactness**
  - Discuss “compact” districts.

- Students can use Geogebra or grid paper to compute the Polsby-Popper or Reock test for districts. Compare the perimeters of various districts. There are several tests for compactness and this can lead to valuable conversation on whether or not these are appropriate for recognizing gerrymandering.

**Reasoning and Problem Solving:**

- Use the redistricting “game” after introducing redistricting guidelines.
- Gridlandia website
- Districtr
  - Propose a few districting goals for students which relates to current events. MGGG has already created some helpful materials for this.

**Programming:**

- Students familiar with Python can find MGGG’s open source code online. Assign alterations to particular code.

**Debates:**

- Debate whether partisan gerrymandering should or should not be determined at the federal level.
- Debate whether particular regions could be classified as gerrymandered.