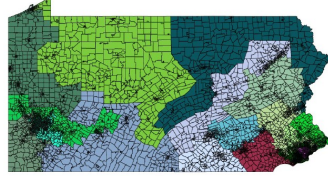


How Math Can Save Democracy

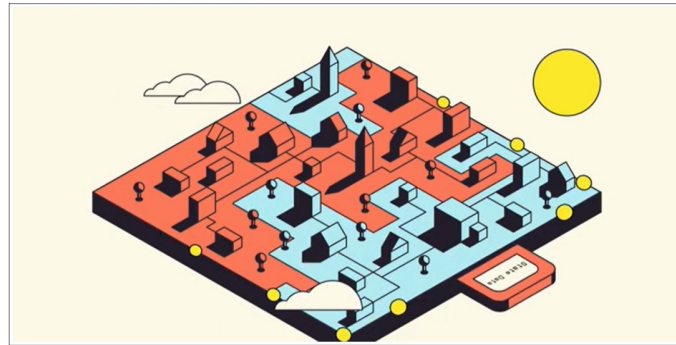


Can Math
Solve the



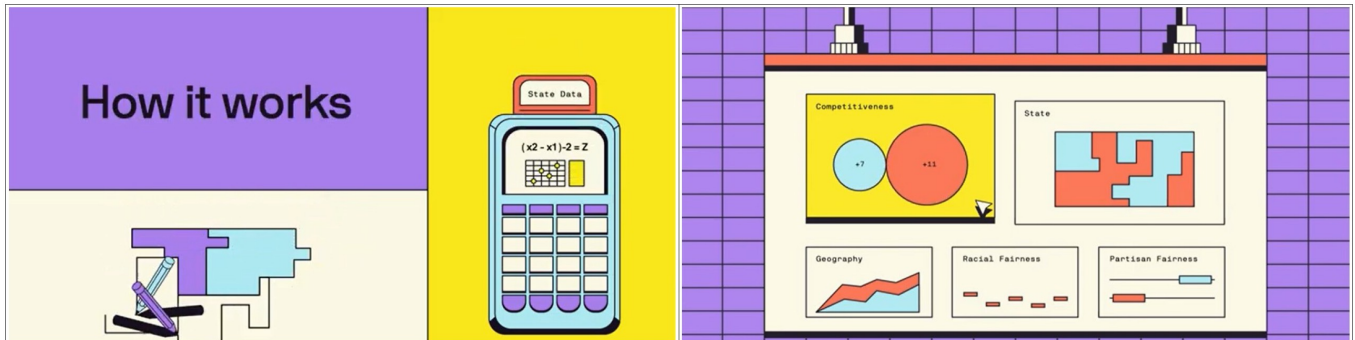
Gerrymandering
Problem?

What is Gerrymandering?



Gerrymandering is the process of drawing voting districts unfairly in favor of one's political party.

Which parameters and data can a mathematician look at to check it?



**Population equity; Compactness and contiguity; Votes;
Traditional districting principles (respecting communities)**

Explain in one sentence the use of each equation.

..... THE MATHEMATICS OF DEMOCRACY

WHAT IS *Polsby-Popper Compactness Score?*

We can try to quantify gerrymandering by measuring how "reasonably shaped" a voting district is. The **Polsby-Popper Compactness Score** of district S, $PP(S)$, measures how much "unnecessary" perimeter S has.

$$PP(S) = 4\pi \frac{\text{area enclosed by the district}}{(\text{perimeter of the district})^2}$$

If there is too much perimeter for the area, $PP(S)$ is closer to 0.

If there is a small amount of perimeter for the area, $PP(S)$ is closer to 1.

If $PP(S)$ is close to 0, this indicates that the district might have been gerrymandered.

..... THE MATHEMATICS OF DEMOCRACY

WHAT IS *the Efficiency Gap?*

Wasted votes are those that do not affect an election: either votes above the 50% majority threshold for a winning candidate or any for a losing candidate. The **efficiency gap (EG)** is one method for measuring gerrymandering by adding up the wasted votes of each party's candidates over all electoral districts.

$$EG = \frac{|(\text{one party's wasted votes}) - (\text{other party's wasted votes})|}{\text{total number of votes}}$$