

Geometry, Combinatorics, Patterns and Fun

March, 23rd, 2016

Abstract

The talk is about some easy to state puzzles, their elegant proofs and impactful consequences. One such puzzle, posed by Sylvester (1893), is to show that for any set S of finitely many points in \mathbb{R}^2 if a line passing through any two points of S contains at least an additional (third) point from S then all points of S are collinear. The problem was independently solved by Melchior and Gallai. Gallai solved the problem in response to a question from Paul Erdős. The problem later became known as Sylvester-Gallai problem. In (2012), Ben Green and Terence Tao used Sylvester-Gallai's result to prove a crucial lemma that they used for "prime gap" problem. We will also explore some generalization and related problems to Sylvester-Gallai's problem. Another famous problem in Combinatorial geometry is "happy ending problem". The problem resulted in Erdős rediscovering Ramsey Theory.

The other part of the talk will focus on patterns in number sequences, permutations and partitions. There are many beautiful puzzles in this area. If time permits, we will play with few, consider their generalizations and their huge impact.