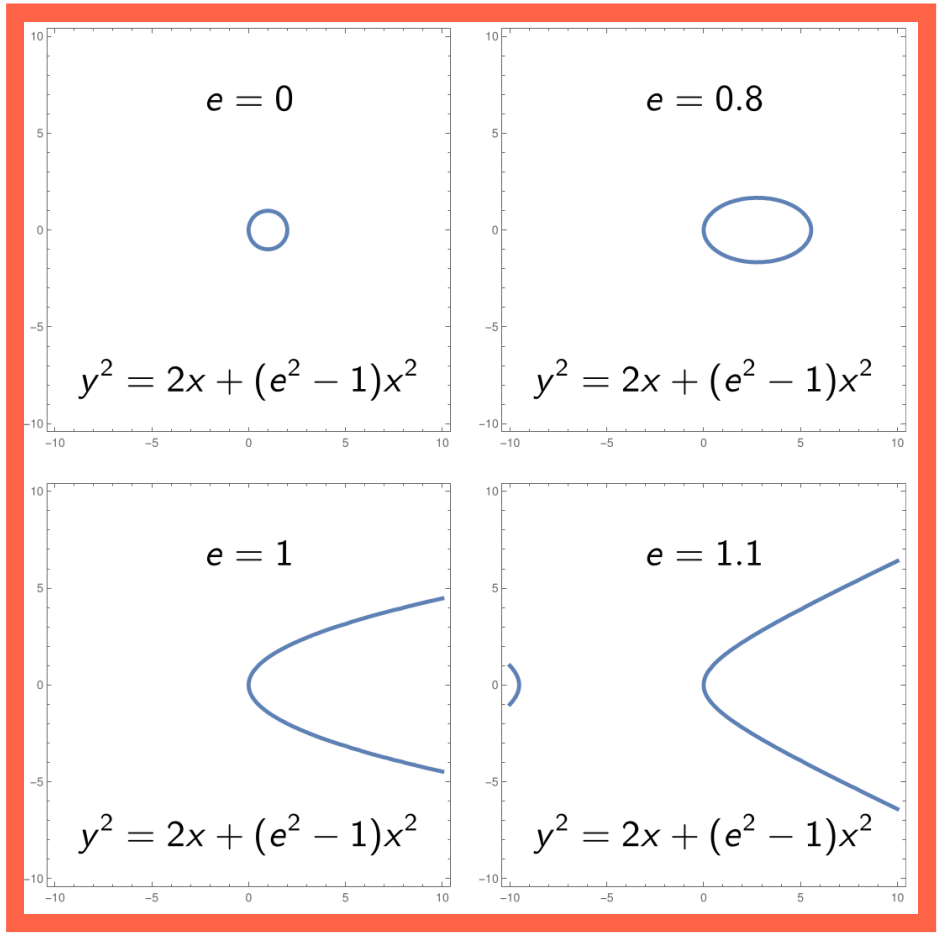
What is...tropical geometry - part 1?

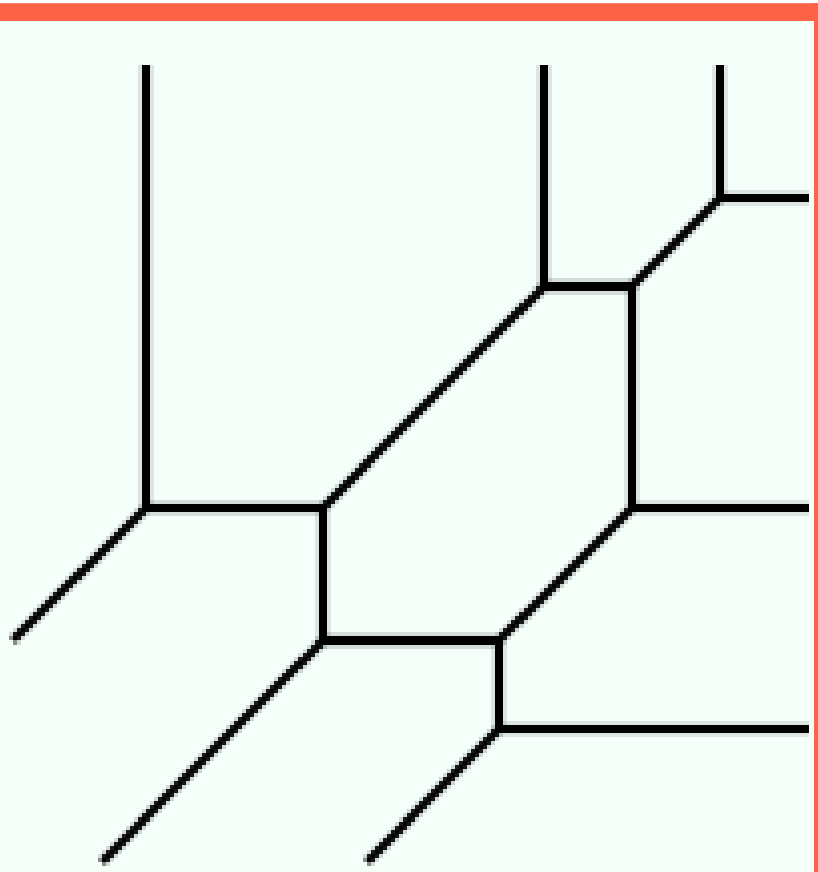
Or: Introduction

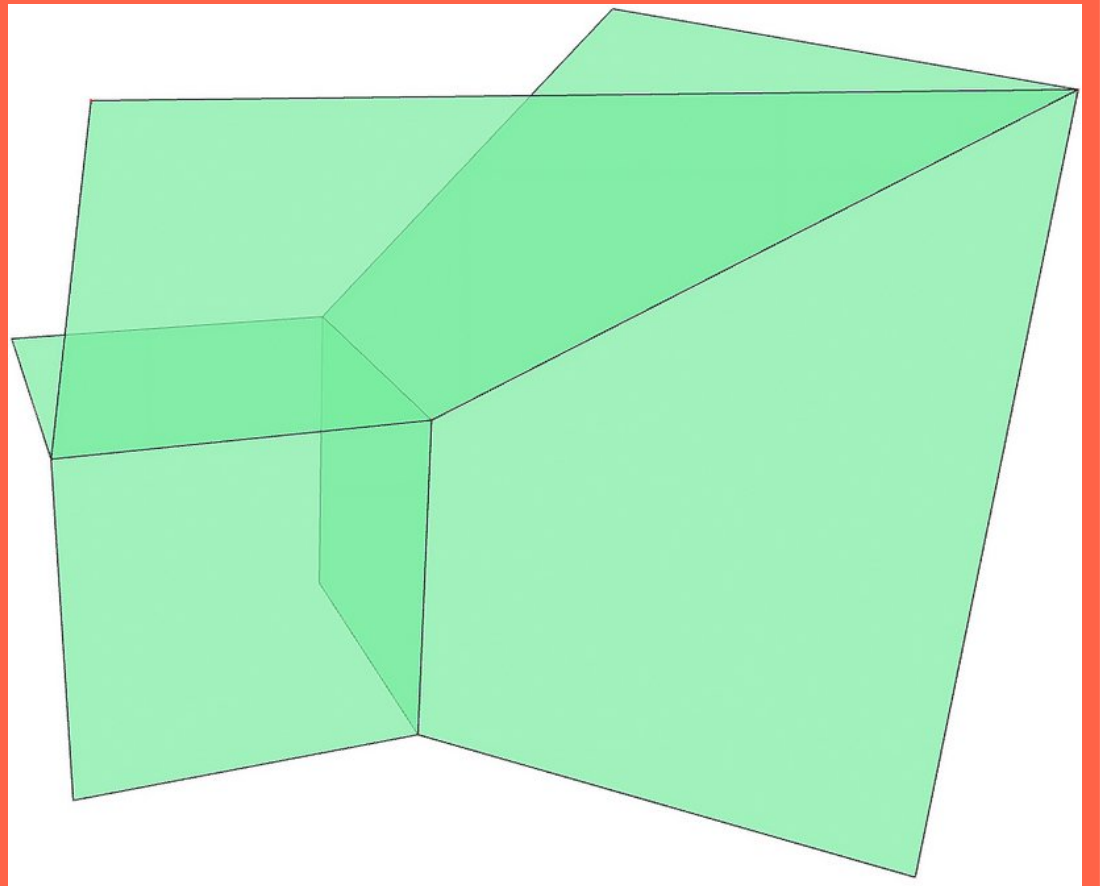
What is algebraic geometry (AG)? Algebra!



- AG explores questions about the roots of polynomials, often in multiple variables
- Example The conic sections (circle, ellipse, parabola, hyperbola)
- Problem AG objects are inherently complex and difficult to analyze

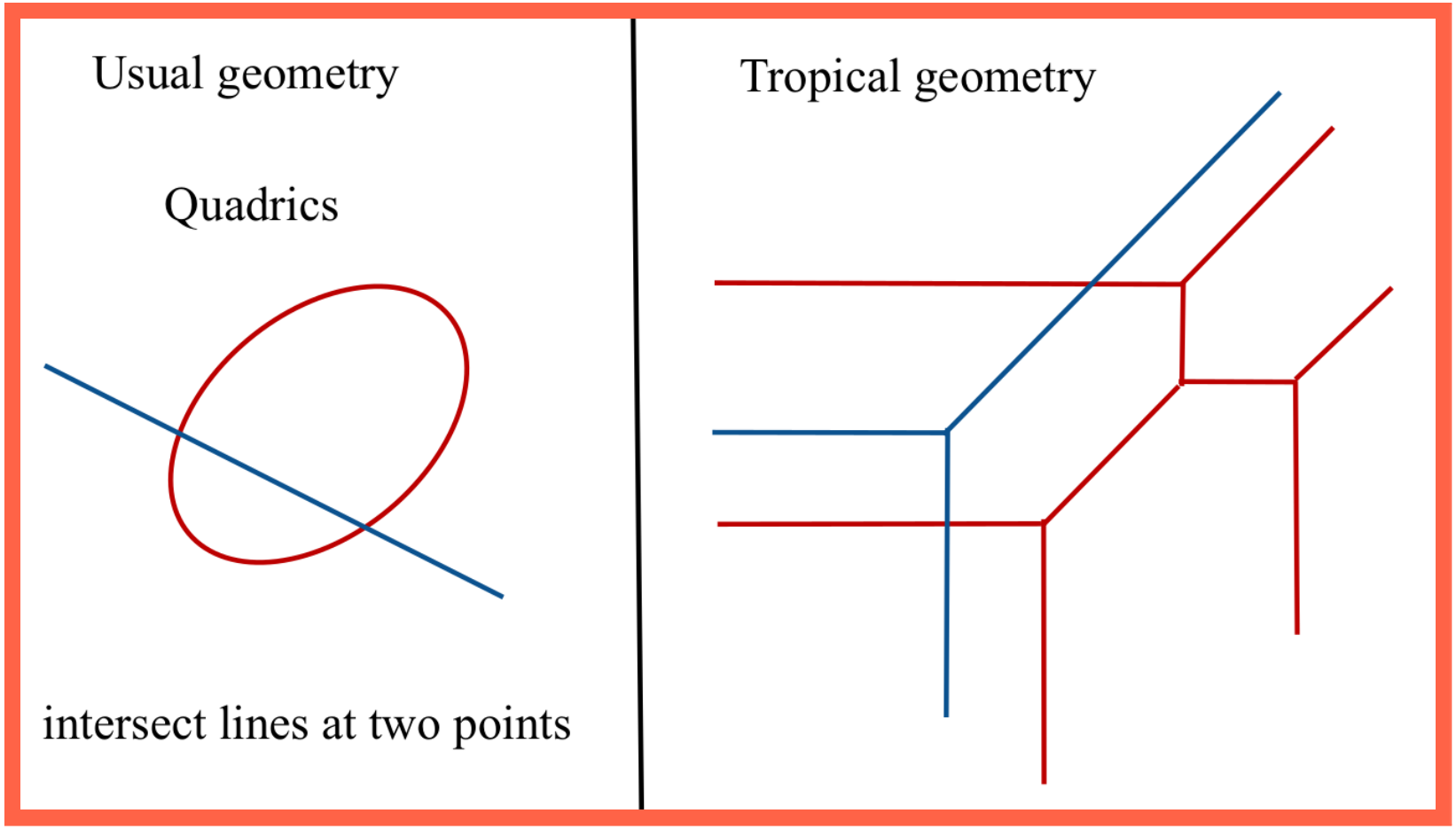
What is tropical geometry (TG)? Combinatorics!





- TG is a piecewise-linear version of AG
- Crucial Tropical zero sets have an inherent combinatorial structure
- One upshot TG offers a simplification for studying AG

Algebra = combinatorics?

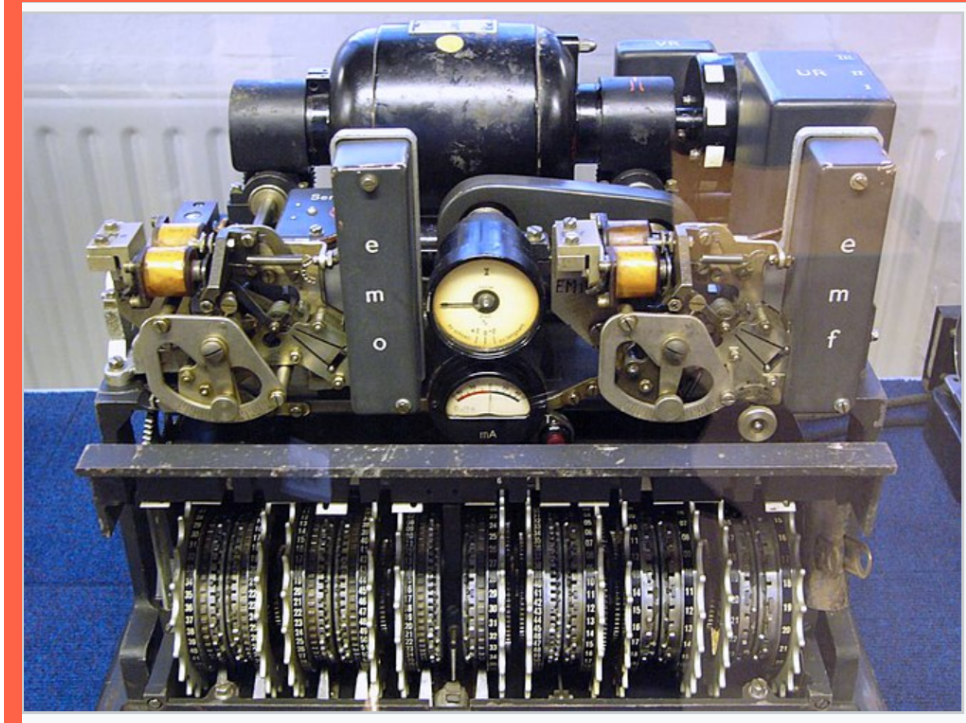


- Fascinating Many AG theorems have tropical analogs in TG
- Example above Bézout's theorem and its tropical counterpart
- Indeed (De)tropicalization is an operation that connects AG and TG

What it can do for you

- Above The dutch railway network
- Observation The network appears to be quite piecewise-linear
- Fun fact TG is used in optimization and has been proposed for improving the Dutch railway network

What it can't do for you



Lorenz cipher machine, used in World War II to encrypt communications of the German High Command.

- Solving tropical equations is very difficult
- Cryptography = we value complexity and challenge
- Tropical cryptography offers a promising approach to cybersecurity

Thank you for your attention!

I hope that was of some help.