

Cardano and the Cubic Equation

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Special Thanks

Thanks to Dr. Markus Hunziker for the book recommendation, and to William Dunham, whose chapter *Cardano and the Solution of the Cubic* in the book *Journey through Genius* provided the primary source for this talk.

- 1 A Teensy Bit of (Unfortunately) Math
 - What is a cubic?
 - Luca Pacioli's *Summa de Arithmetica*
- 2 Rising Action
 - del Ferro, Fior, & Tartaglia
 - Cardano & Ferrari
- 3 Fallout
 - Tartaglia Relents
 - Tartaglia Challenges

Solving for x

Easy to solve:

Linear Equation

$$mx + b = 0 \quad (1)$$

Solved by the Babylonians ca. 2000 BCE

Quadratic Equation

$$ax^2 + bx + c = 0 \quad (2)$$

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The Cubic Equation: Unsolved as of 1494 CE

Cubic Equation

$$ax^3 + bx^2 + cx + d = 0 \quad (3)$$

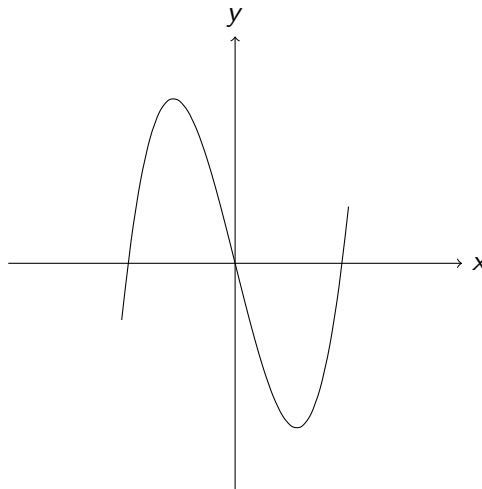
Luca Pacioli (1445-1517)

In an important contemporary mathematics textbook in 1494, Pacioli assesses solving the cubic equation as likely impossible.



Source: from *Wikipedia*, painting often attributed to Jacopo de'Barbari, 1495

- Scipione del Ferro solves the “repressed cubic:”
- del Ferro keeps the solution secret.
- On his deathbed in 1526, del Ferro tells his student, Antonio Fior
- A hothead, Fior challenges a noted scholar–Niccolo Fontana



Tartaglia

Tartaglia (1499-1557)

- Niccolo Fontana, better known as “Tartaglia” (meaning “the Stammerer”, due to a war wound).
- Fontana had boasted he could solve cubics of another form.

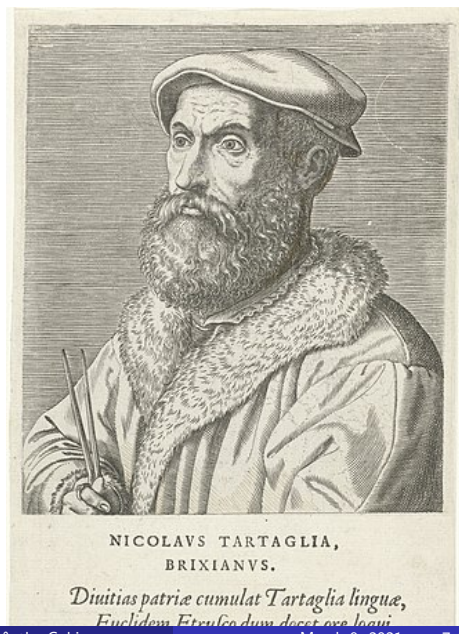


NICOLAUS TARTAGLIA,
BRIXIANVS.

*Diuitias patriæ cumulat Tartaglia linguae,
Euclidem Etrusco dum docet ore loqui*

The Challenge

- Fior gives Tartaglia 30 “repressed cubics”, Tartaglia gave Fior 30 problems of various topics.
- Working furiously, Tartaglia discovers the solution the night before the problems are due, winning 30 to 0.
- Fior fades from history.



Cardano

Now enters the strangest character of the story—Gerolamo Cardano (1501-1576). His story is a half-hour talk, so we proceed with a negligent survey.



Source: from [Wikipedia](#) 

Cardano—Ups and Downs

- A failed and successful doctor with severe psychological issues (he loved the feeling of pain *ending*)
- An avid gambler and one of the first statisticians
- Father of a murderer
- Stellar mathematician, ardent astrologer
- Author of a (dubious) autobiography
- Arrested for heresy, held a pension from the Pope



Source: from [Wikipedia](#)        

- Enter the final player in our story—Ludovico Ferrari.
- *Ars Magna* (“Great Art”)
- To include the solution of the cubic, begged Tartaglia.

Ferrari (1522-1565)

- Asked for work from Cardano—on the very day Cardano had received a good omen (the incessant squawking of a magpie)
- Quickly turned to his colleague, by the age of 20 Ferrari was a near equal

Tartaglia's Conditions

- After much begging, Tartaglia gives Cardano the solution—in the form of a poem
 - Ferrari uses the ideas to solve the “next” equation—the quartic!
- The equation must be kept encoded
- This won't do for Cardano—he wants to put it in a book!
- Suddenly, Cardano and Ferrari have an idea.

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- Remember del Ferro?
 - Cardano and Ferrari do
 - Obtaining the solution (identical to Tartaglia's) from del Ferro's notes, Cardano and Ferrari publish.
 - del Ferro is credited.

Backlash from Tartaglia

- Accusations and insults fly back and forth between Tartaglia and Ferrari (rather a hot-head)
- A contest ensues on Ferrari's home turf
 - Cardano does not even show
- Tartaglia loses—blaming the “rowdiness and partisanship of the crowd”
 - Given Ferrari's reputation, some historians believe he was lucky to escape with his life.

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The End