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Maths duels and how they influenced modern day mathematics

Maths duels and how they influenced modern day mathematicsThis essay will cover how mathematical duels from the renaissance in Italy over 400 years ago lead to the explanation of many modern day mathematical and physics problems. These duels were a way to decide which mathematician would get a job. Any mathematician would have the ability to challenge a fellow mathematician for their job. They would do this by each giving each other a list of questions they could solve, then after a certain time period they would see who answered the most questions correctly and that person would get the job.

The beginning of the path to imaginary numbers all started with the search for the general solution of a cubic formula denoted as, $ax^3+bx^2+cx+d=0$. In 1494 Luca Pacioli, Leonardo da Vinci's maths teacher, released Summa de Arithmatica. Which was a well regarded maths paper that covered most of known mathematics, and in this paper he claimed that the general formula for solving cubics was 'impossible to find'. Greeks, Chinese, Persians and many more cultures attempted to solve it with limited success until Scipione Del Ferro managed to find the general solution to depressed cubics. Which are cubics without bx^2 or 0 of them. Once Del Ferro had this solution he told no one and hid it away. This was his secret weapon for any maths duel as he could give them a list of depressed cubics and wait for them to get 0. Del Ferro continued this till his deathbed.

Then on his deathbed Del Ferro told his student Antonio Fior, who was arguably a less brilliant mathematician than Del Ferro. Unlike Ferro, Fior went around boasting his ability to solve depressed cubics. Then a mathematician from Venice challenged Fior called Niccolo Tartaglia who was mainly a self taught mathematician. Tartaglia then travelled to Bologna to challenge the rather arrogant Fior. Going into this duel, Fior was confident as he had the secret to solving the depressed cubics, however Tartaglia managed to solve the solution to the depressed cubics on his own. Then Fior set him a list of 30 questions to answer in 40 days and Tartaglia managed to answer them all correctly in two hours. Then Fior didn't manage to solve any in the 40 days.

Then as Del Ferro did he kept his solution a secret to use for job security. However later on in his life he got pestered by Gerolamo Cardono, a well regarded scholar. Then finally Tartaglia broke and told Cardono the secret to solving the depressed cubic. However Cardono had a condition on being told the secret he mustn't tell anyone and not publish it anywhere. This was bad for Cardono seeing as he was a successful man and didn't need job security, as he would gain more from having papers published.

Cardono worked on finding the general solution of cubic equations until he found it one day. The way he managed to do it was by substituting in $x=x-b/3a$. With this substitution it would cancel out the squared x terms and turn the cubic depressed. This was great news for Cardono except he couldn't publish the full paper seeing as it used Tartaglia's solution to the depressed cubics. This was a great pain for him seeing as he couldn't get the publicity that he wanted. This all changed when the son in law of Del Ferro, the original solver, contacted him. Cardonon went to visit him and on his visit he was given Del Ferro old textbooks which had the solutions to the depressed cubics. Cardono saw this as a way round his promise to Tartaglia so he was finally able to publish his paper. Tartaglia saw this as a betrayal however this decision influenced modern day mathematics and physics for the best.

Before I cover how it led to the discovery of imaginary and complex numbers. I will briefly mention how they would solve these cubics. They would do it in a way similar to completing the square but with cubes. This geometric proof ignored the negative roots seeing as you can't get a negative volume, area or side length.

The way imaginary and complex numbers came into existence was when sum cubics would lead to the root of a negative number. For example x^3=15+4, even though this has a solution of x=4, using Del Ferro's and cardono's algorithm it causes you to root a negative number which is deemed impossible. The two roots you get are 2+ or - root negative one. It's only when you add the two roots together that you get 4. Seeing as the two roots of negative one cancel each other out. And finally in the sixteenth century Francois Viete introduced modern day algebra, and they no longer use geometry as a predominant way of solving maths problems. This allowed imaginary numbers to develop as they no longer needed to worry about having a negative volume, area or side length.

From here on out I will be covering a brief history of imaginary and complex numbers in mathematics and going over some of its most prominent appearances in equations. Rene Descartes was remembered for using the root of a negative number a lot especially in his book La Geometrie. He also came up with the name imaginary numbers which stuck till the current day. Next Leonhard Euler comes up with the notation for imaginary numbers of i, which I will be using from here on out. Euler used it in his famous identity of e^(i*pi)+1=0. The next notable use of i was by Erwin Schrodinger in his equation of,

$$i\hbar \frac{\partial}{\partial t}\Psi = \hat{H}\Psi$$

This equation is used to find the energy level of quantum systems.

In conclusion I think without maths duels we would still have imaginary numbers, this is because the human desire to solve the unsolvable would've led to the solution of cubics and them i. However I certainly think that the duels sped up the process. Given that it also would have slown it down seeing as Del Ferro told no one until he died. Considering how the duels could've slowed down mathematics I can say they definitely have influenced modern day mathematicians. Seeing as i is used in equations, being taught in universities and at school and that I'm writing this essay on it.

References

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