



Weird & Wireless: What is the coolest and most practical math equation?

Welcome again to the wonderful but sometimes weird world of wireless comms, written by Joel Young, [CTO of Digi International](#).

I know that many of you will look at the topic of the blog and give a big "ick" or some other guttural sound that I don't know how to spell. To you, I offer my sympathy. Of course, for the rest of you that choose to read on, you may be wondering what in the world this topic has to do with a wireless blog.

For you, I confess that my mind has been rejuvenated by what I will term cool math thoughts and the direct tie to wireless will need to be made clear in a future blog due to the length limitations placed upon me by the curators of the blog. For you, I request your patience.

Recently the eldest of my four sons went off to college. As a freshman at Arizona State, he has declared a major in math and psychology.

I discovered that one of the coolest things about having a kid in college is that I get the most amazing flow of text messages. These messages offer up opinions, pose questions and also include the occasional challenge.

They cover topics ranging from social justice, to ancient philosophy, to integration using trigonometric substitution, intertwined with the proverbial need for more snack food. During one of these text conversations, I learned that my son's favourite number is e (not the letter, but the root of the natural log) and that his professor had promised to prove that

$$i^i = e^{-\pi/2}$$

where i is the imaginary number representing the square root of -1.

I didn't remember having a favourite number or a favourite equation for that matter, but after hearing my son's explanation as to why e is his favourite number, I thought I should probably find favourites of my own.

Then it hit me and I realized that I had a favourite equation, it had just been forgotten, lost in the sea of power point slides and ROI calculations over 25 years; embedded in that equation is my favourite number. My favourite equation is Euler's Formula:

$$e^{ix} = \cos x + i \sin x$$

Most of math, electrical engineers and physicists would agree that Euler's formula is a work of art, defining a relationship between and exponential function and trigonometric functions using complex numbers, enabling us to do such cool things as high speed modulation of digital signals. Of course, by some manipulation and plugging in $\pi/2$ for x , and raising both sides to the i^{th} power, you also get...

$$i^i = e^{-\pi/2}$$

How cool is that, if you raise the imaginary number i , to the imaginary power of i , you get a real number, Hence, metaphorically letting your imagination go can result in something real, no matter how irrational it may be. My favourite number is i . Let your imagination run wild!



Joel Young, VP of Research and Development and CTO at [Digi International](#), has more than 22 years of experience in developing and managing data and voice communications. He joined Digi International in June 2000 and in his current role he is responsible for research and development of all of Digi's core products.

Prior to joining Digi, Joel was VP of Sales & Marketing at Transcript International where he was responsible for sales, marketing, and product development for all information security products. During his tenure at Transcript, he also served as VP of Product Development and VP of Engineering where he was responsible for engineering, research and product development for wireless communications products, cellular telephony, wireline telephony and land mobile radio, data security and specialized digital radio products.

He also served as District Manager for AT&T Business Communications Services where he was responsible for the creation and implementation of voice processing and network database strategies, including deploying new voice processing platforms into the AT&T switched network for private network and other outbound calling services.