Imaginary Numbers

For many centuries, mathematicians encountered the square roots of negative numbers in their equation solving, and their conclusion was to stop there since taking the square root of a negative number was considered impossible. Until Gerolamo Cardano, an Italian mathematician of the 1500s, decided that the square root of a negative number was not going to stop him. He was looking for two numbers that would have a product of 40 and sum of 10. He found that $5+\sqrt{-15}$ and $5-\sqrt{-15}$ were the two numbers. He described this work as "mental torture," since the calculations worked, but he felt that the results did not hold any meaning. During the 1600s, René Descartes, a French philosopher and mathematician, unintentionally coined the name "imaginary numbers." He was making fun of the square roots of negative numbers being fake and not real, but the name stuck. Leonhard Euler, a Swiss mathematician, during the 1700s formalized the notation and defined $\boldsymbol{i}=\sqrt{-1}$. Interestingly enough, there are many real-life applications of these imaginary numbers.

We know that a positive times a positive is a positive and a negative times a negative is also a positive. What times itself can be a negative number? That's an impossible problem!

Fun Fact

Now you might be thinking, what is the square root of $\boldsymbol{i}$? The result is a different complex number:

$$\frac{\sqrt{2}}{2}+\left(\frac{\sqrt{2}}{2}\right)\boldsymbol{i}$$

We can conclude that **ALL** numbers are complex numbers.

Real-Life Applications

- Electromagnetism
- Fluid Dynamics
- Quantum Mechanics
- Designing Electronic Circuits
- Studying Audio Signals

Types of Numbers

Complex Numbers

$a+bi$ $3-7i$ $-2+i\sqrt{10}$

Real Numbers

e $-\sqrt{14}$ π 3 $\sqrt{6}$ $-\frac{1}{2}$

Imaginary Numbers

$3i$ $-2i$ $i\sqrt{17}$ $i=\sqrt{-1}$ $\frac{1}{2}i$

Until now, it is likely that you only have experience with real numbers: rational & irrational numbers, integers, etc. But now we see that the real numbers with the imaginary numbers make up the set of complex numbers. All numbers can be written as a complex number: **a + b*i***. For example, 7 can be written as **7 + 0*i***.