**History & Background**

Though some believe that the idea of imaginary numbers may have been discovered some 4,000 years ago, society didn’t see its necessity until the 16th century. Until that time, history has recorded several instances where people have stumbled upon the idea of imaginary numbers but made little advancements on the idea because most people saw them as being impossible. The following list displays some of the notable discoveries that directly impacted the development of imaginary numbers (Nahin, 1988)

* 50 AD – While studying the volume of a section of a pyramid, Heron of Alexandria was led to the computation of √ (81-114). He deemed this calculation as impossible and made no more efforts towards solving the problem. (“History of Complex Numbers”)
* 665 AD – Brahmagupta, who was an Indian native from Bhinmal, authored two early works on mathematics and astronomy. In his book “Khaṇḍakhādyaka”, quadratic equations were solved and the possibility of negative solutions was allowed. (“Brahmagupta”,2015)
* 1484 – Nicolas Chuquet, a French mathematician who made significant progress in the realm of exponents and negative numbers, showed that some equations in fact lead to imaginary solutions but dismissed the idea. (Biggus, 2010).
* 1545 – Around this time, imaginary numbers began to be recognized more heavily by society. Building from advancements made by Nicolo Fontana in 1535 where he found a general method for solving all cubic equations, Girolamo Cardano extended this idea to discover what is now known as Cardan’s Formula. With this formula however, several examples were noted where one would have to take the square root of a negative number. Cardano acknowledged the existence of these imaginary numbers as solutions; nonetheless, he highly disliked the idea of working with imaginary numbers stating that such work is “as subtle as it is useless” as well as “mental torture”. (History) (Biggus, 2010) (Nahin, 1988)
* 1572 – Using a common technique known today as conjugation, Rafael Bombelli expanded upon a previous idea that one can use the square roots of negative numbers to find real solutions. While not highly accepted, Bombelli was a firm believer in what we now know as “complex numbers”. (Biggus, 2010) (History)
* 1637 – Rene Descartes, a renowned mathematician, came up with the term “imaginary” to represent expressions that require the square root of a negative number. This term was coined originally as a derogatory term since most people saw the use of these numbers as being fictitious or useless. He also created the standard form for a complex number as being a + *bi* with a being a real part and b being the imaginary part. While he made significant progress, he also disliked working with complex numbers and stated that equations with these qualities are impossible to solve. (Biggus, 2010).
* 1673 – John Wallis made improvements helping the idea of complex numbers to be accepted. He was one of the first people to come up with a way to represent complex numbers geometrically. This representation uses a graph where the X – axis represents real numbers and the Y – axis represents imaginary numbers. Wallis had some important contributions to this idea of graphing, but this representation wasn’t widely accepted until Caspar Wessel publishes the similar idea of graphing in a plane. (Biggus, 2010) (History).
* 1747 – Beginning around this time, Leonhard Euler had some notable contributions that helped society begin to accept the use of imaginary numbers. Euler developed the symbol *i* to represent √-1 which helped people better understand the difficult concept of complex numbers. (Biggus, 2010)
* 1797 – As mentioned previously, Caspar Wessel, who was a Danish Mathematician was ultimately credited for the geometrical interpretation of complex numbers. In a published paper, he was able to describe complex numbers as points in a two-dimensional complex plane which is referred to today as the “Gaussian” plane. (Biggus, 2010)
* 1831 – Carl Freidrich Gauss made some monumental advancements in the realm of complex numbers. He developed the term “complex” to represent Descarte’s notation of a+b*i* as well as constructed the algebra for this set of numbers. Augustin-Louis Cauchy also made progress with the algebra, but his work around this same time, extended mostly towards further developments in calculus. (Biggus, 2010)
* 1835 – William Hamilton is credited for the advancement of complex numbers being represented as pairs. Even though Gauss originally discovered this idea, the results were never published which led to Hamilton being credited with this discovery as well as the geometric discovery of x+*i*y being represented with coordinates (x,y). (Biggus, 2010)

While the previous list is far from comprehensive, it contains some of the pivotal times throughout history that motivated the development of imaginary numbers and extending them towards complex numbers. Apparent from the timeline, the development of complex numbers was a long process where mathematicians continued to build off of previously developed ideas. You will notice as you dive into the explanation of complex numbers that many of the same algebraic properties hold when dealing with these numbers. The discoveries of these properties and other qualities of complex numbers were determined over time since the development of complex numbers. Even in the current day, mathematicians are able to advance the concept of complex numbers to find more applications from this truly “complex” idea.

**Explanation of Mathematics**

In this section, I will provide an extensive review of the uses of imaginary numbers and how they are manipulated in mathematics. The uses of imaginary numbers are most practical when used in terms of complex numbers. A complex number is simply a number that is represented with both a real and an imaginary part such as (a + bi) for any given integers a and b. The link above will provide an overview of complex numbers through explanations, videos, and worksheets.

The base idea for understanding how to use complex numbers is understanding i. i is a symbol representing *i=*√-1. Thus, i^2 = -1. In the simplest form, i is the solution to the equation x^2=-1. As alluded to in the history and background section, before imaginary numbers were invented, this problem was unsolvable. One of the basic properties in mathematics is the idea that any number that is squared will always be positive. If this is true, and we know that it is, then, how can there be a solution to the equation x^2=-1? This dilemma was solved with the creation of the imaginary number i. While the idea can be difficult to grasp, the creation of i was essential since there are processes in our modern world that can only be modeled with equations similar to x^2=-1. Understanding the basic knowledge that *i=*√-1 is the core to everything that is used in the realm of imaginary and complex numbers. If you want an extensive introduction to imaginary numbers, watch the following video.

Introduction to i and the imaginary numbers. (2015). Retrieved November 9, 2015, from <https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/the-imaginary-numbers/v/introduction-to-i-and-imaginary-numbers>

As mentioned above, once one comprehends the variable i, complex numbers are rather simple to understand. A complex number has a real and an imaginary part. For example, in the complex number (a+bi), a is the real part, and b is the imaginary part. One key thing to remember when working with complex numbers is the need to keep the real and imaginary parts separate since it makes no sense to combine a real number with an imaginary number. Mostly for your amusement, here is a video that infers the reason for keeping both parts separate.

April Fools 2011: Complex Numbers in Math Class HD funny movies best college prank good april fools. (2012, March 31). Retrieved November 9, 2015, from <https://www.youtube.com/watch?v=OtKc9eKw3m4>

If you want to further review the concept of complex numbers, this following video from Khan Academy provides a helpful summary.

Introduction to complex numbers. (2015). Retrieved December 6,2015, from https://www.khanacademy.org/math/algebra2/introduction-to-complex-numbers-algebra-2/the-complex-numbers-algebra-2/v/complex-number-intro

To understand some of the basic mathematical properties of complex numbers, this page is split up into two sections. In the first section below labeled Complex Numbers Algebra, you will learn how complex numbers can be manipulated algebraically. The second section will give an overview of how to graph complex numbers. Both sections will include video help and links where you can learn about and practice the mathematics.

Complex Numbers Algebra

As mentioned, complex numbers are numbers represented with a real and an imaginary part such as (a + bi). Just like any other numbers in mathematics, complex numbers contain many of the same properties and can be manipulated by addition, subtraction, multiplication and division. The following section shows some examples of how complex numbers can be manipulated algebraically. The conclusion of this section will include worksheets that you can access to practice algebraically manipulating complex numbers.

Addition

When adding complex numbers, one simply combines like terms. That is, if adding (a+bi) to (c+di), one combines the real parts (a+c) and the imaginary parts (c+d)i. The following illustration demonstrates this property with an example. If you want more examples of adding complex numbers watch the video from Khan Academy.

How Do You Subtract Complex Numbers? (n.d.). Retrieved December 7, 2015, from http://www.virtualnerd.com/tutorials/?id=Alg2\_05\_01\_0004

How to add complex numbers. (2015) Retrieved December 6, 2015,from https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/adding-and-subtracting-complex-numbers/v/adding-complex-numbers

Subtraction

Subtracting complex numbers is similar to that of adding complex numbers where one simply combines the like terms, such as (a+bi) - (c+di) = (a-c) +(b-d)i. Here is an illustration and another video of this practice.

How Do You Subtract Complex Numbers? (n.d.). Retrieved December 7, 2015, from http://www.virtualnerd.com/tutorials/?id=Alg2\_05\_01\_0004

How to subtract complex numbers. (2015). Retrieved December 6, 2015, from https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/adding-and-subtracting-complex-numbers/v/subtracting-complex-numbers

Multiplication

The process of multiplying complex numbers is similar to that of expanding polynomials. Thus,(a+bi)\*(c+di) = (ac + (ad)\*i +(bc)\*i +(bd)\*i^2). The interesting aspect to this expansion is that (bd)\*i^2 is a constant since i^2=-1. Thus the result will be of the form (bd+ac)+(ad+bc)\*i. The following picture displays a problem of this type. Also available is two video links on this practice; one from Khan Academy and one personally created video.

How to multiply complex numbers (example). (2015). Retrieved November 9, 2015, from <https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/multiplying-complex-numbers/v/multiplying-complex-numbers>

Larsen, T. (2015, November 8). Complex Numbers. Retrieved November 9, 2015, from <https://www.youtube.com/watch?v=6yXljx9LbPM>

Division

When dividing complex numbers, it is most helpful to multiply both terms by the conjugate of the bottom term. A conjugate is simply the negation of the second term of the complex number. For example, the conjugate of (a+bi) is (a-bi). This action of multiplying the top and bottom terms by its conjugate is helpful because if the bottom term is (7+5i), you multiply by (7-5i) and the imaginary part disappears. (49 - 35i +35i - 25\*(-1)) = 74. This makes the division much easier since one is now only dividing by a constant. The following picture provides a demonstration of this process.

How to divide complex numbers using conjugates. (2015). Retrieved December 6, 2015, from https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/complex-conjugates-and-dividing-complex-numbers/v/dividing-complex-numbers

Worksheets

The following worksheets will give you practice with arithmetic and manipulation of complex numbers.

Palmitesso, T. (2012). Arithmetic of complex numbers. Retrieved December 4, 2015, from http://www.regentsprep.org/regents/math/algtrig/ato6/practicepageadd.htm

Roberts, D. (2012). Math B-Complex Numbers. Retrieved November 9, 2015, from <http://www.regentsprep.org/regents/math/algtrig/ato6/multprac.htm>

Graphing Complex Numbers

Complex numbers can be graphed on a two dimensional plane by graphing the imaginary part on the Y axis, and the real part on the X axis. For example, (a-bi) would correlate to the point (a,-b). With this representation, they can be represented as vectors where a+bi = <a,b>. Being able to graph these numbers helps clarify what each specific complex number means in context. The following picture shows examples of a several complex numbers graphed on the complex plane.

Complex numbers. (n.d.). Retrieved December 7, 2015, from http://www.mathwarehouse.com/algebra/complex-number/

The following applet will give a demonstration of how each complex number can be graphed as a vector. Input any complex number to see the corresponding vector. In addition, you can see what happens to graph of each complex number when it is manipulated algebraically such as by addition, subtraction, multiplication, or division.

Larsen, T. (2015, November 22). GeoGebraTube. Retrieved December 7, 2015

Below is a video that portrays how graphing with complex numbers can help solve problems that are unsolvable without the use of complex numbers. It provides a scenario that may have motivated the discovery of imaginary numbers.

An easy, alternative introduction to Imaginary Numbers. (2011, September 22). Retrieved November 9, 2015, from <https://www.youtube.com/watch?v=oxF5VQSA4Hw>

As you may be realizing there is a lot more to complex numbers than most think. Complex numbers are a unique entity in mathematics that contain many unique properties in their use and application. While it isn't expected for one to completely understand the concept of complex numbers from these explanations, the previous sections provide a clear summary of the concept of complex numbers. Below is one more helpful video in understanding imaginary numbers and some application in mathematics.

**Significance & Applications**

The addition of complex numbers into the number system has greatly enhanced the types of problems that are solvable. When society finally caught on to the idea, many of the previously impossible problems became possible. In terms of application, the field of engineering is rich with examples where complex numbers are needed and helpful in accomplishing tasks. The link above will give a brief review of some of these difficult applications.

Electrical engineering in particular has many uses with complex numbers. Imaginary numbers are used to measure amplitude and phase of an electrical oscillation such as audio signals, radio waves, or even waves used in transmitting telephone calls. Processing signals is a key component of complex numbers such as those used in large computer systems, telecommunications, radar for airplane navigation, or even in biology to analyze some of the firing events from neurons in the brain. These numbers are also used in measuring the electrical voltage and current that power different types of electrical appliances. One electrical engineer stated that "there are often more imaginary numbers than real numbers in electrical problems."

The problems that electrical engineers face use complex numbers primarily dealing with electric circuits. For example, some circuits have no real current which means that the measure of the current flow would be zero. Therefore, imaginary numbers are a necessity in these types of circuits to produce energy flow through these types of circuits. Regarding this idea, an engineer stated: "think of it like this: a coil is just a wire, so if you run electricity through it there is no real voltage drop because there is no real resistance. A capacitor is just two pieces of metal that do not touch so if you put a voltage through it no real current can flow.". Some of these examples or applications may not be intuitive for those who are not familiar with electric circuits or other subjects within the electrical engineering field. However, the following example will provide a more simple explanation regarding the subject or electricity or voltage. (Jeremiah, 2015) (Douglas, 2015)

Electrical engineers are able to measure voltage output from all different power sources. Sometimes the voltage, which is a combination of current and impedance, alternates in direction and amplitude and thus possess other dimensions such as phase shift and frequency. For this reason, engineers needed to represent multidimensional quantities in these alternating current (AC) circuits, and complex numbers provided this convenience. Thus, quantities of voltage, current, and impedance are represented in the form (a+jb). When using imaginary numbers in electricity or electronics, j is substituted for i as the imaginary number since I is a symbol for *current* in electronics.

Now, given the equation E=I\*Z where E is the voltage, I is the current, and Z is the impedance, electrical engineers are able to find the voltage, in any AC circuit. For example, consider a generator like one below that is powering a house. Suppose this electric circuit had a current of 5+4j amps and an impedance of 3-j ohms, then one can multiply the current and impedance (5+4j)\*(3-j) to find the voltage, (19+7j) volts.(Roberts)

The video below gives a more extensive introduction as to specifically how complex numbers help when working with AC circuits.

Complex Numbers: AC Circuit Application. (214, May 27). Retrieved December 7, 2015, from https://www.youtube.com/watch?v=LM2G3cunKp4

While electrical engineering has many uses for complex numbers, other fields contain applications as well. Certain engineers frequently use complex numbers in modeling fluid flow in and around objects or pipelines. Complex numbers also help to study stresses on beams and structures; follow the link below to see one simple example of how imaginary numbers are introduced in the construction of bridges. When analyzing these structures for resilience, matrices are used that contain eigenvalues and eigenvectors that often come from complex domain. (Jerry, 2015) The field of Physics also has several applications of complex numbers. In quantum mechanics for example, one can calculate a probability distribution in order to comprehend position in space; this can only be done using complex variables. (Tom, 2015)

What is an Imaginary Number? (2015). Retrieved December 7, 2015, from http://study.com/academy/lesson/what-is-an-imaginary-number.html

The following podcast gives a review of the history of imaginary numbers as well as how they can be used. With regards to applications, Melvyn Bragg and his guest discuss some of the applications that complex numbers can be used for. This audio recording is very helpful to understand why complex numbers are vital in society, specifically for engineers.

Bragg, M., Yusotoi, M., Stewart, I., & Sirius, C. (2010, November 21). Imaginary Numbers. Retrieved from In Our Times BBC Radio: [www.bbc.co.uk/programmes/b00tt6b2](http://www.bbc.co.uk/programmes/b00tt6b2)

For your amusement, follow the link below and read through a cartoon that illustrates some of the mathematical extensions that come from complex numbers.

Bower, M. (n.d.). John and Betty's Journey through Complex Numbers. Retrieved December 7, 2015, from http://mathforum.org/mbower/johnandbetty/

As mentioned earlier, some of the shared applications and examples may seem complicated for those who are unfamiliar with these engineering topics. However, I find it fascinating that complex numbers are present in so many of the conveniences that we live with. Imagine for a moment living without the luxury of electricity, listening to the radio, or even talking on a cell phone. None of these would be possible without complex numbers. Because of their necessity and usefulness, complex numbers are everywhere. It is true that complex numbers can be difficult to comprehend; nonetheless, I don't think I will ever cross a bridge over a canyon or river again without being happy that there are engineers that do understand how to analyze and use complex numbers.

**References**

The link above provides a list of APA references for all of the information, pictures, and videos used throughout this webpage. Information is parenthetically cited within the text of the History, Explanation, and Significance sections, but the full citations will be provided here if you want to access more information on a given topic.

An easy, alternative introduction to Imaginary Numbers. (2011, September 22). Retrieved November 9, 2015, from <https://www.youtube.com/watch?v=oxF5VQSA4Hw>

April Fools 2011: Complex Numbers in Math Class HD funny movies best college prank good april fools. (2012, March 31). Retrieved November 9, 2015, from <https://www.youtube.com/watch?v=OtKc9eKw3m4>

Biggus, J. (2010). Sketching the History of Hypercomplex Numbers. Retrieved November 9, 2015, from <http://history.hyperjeff.net/hypercomplex.html>

Bower, M. (n.d.). John and Betty's Journey through Complex Numbers. Retrieved December 7, 2015, from http://mathforum.org/mbower/johnandbetty/

Brahmagupta. (2015, November 3). Retrieved November 9, 2015, from <https://en.wikipedia.org/wiki/Brahmagupta>

Bragg, M., Yusotoi, M., Stewart, I., & Sirius, C. (2010, November 21). Imaginary Numbers. Retrieved from In Our Times BBC Radio: [www.bbc.co.uk/programmes/b00tt6b2](http://www.bbc.co.uk/programmes/b00tt6b2)

Complex Numbers: AC Circuit Application. (214, May 27). Retrieved December 7, 2015, from https://www.youtube.com/watch?v=LM2G3cunKp4

Complex numbers. (n.d.). Retrieved December 7, 2015, from http://www.mathwarehouse.com/algebra/complex-number/

Douglas**,** D. (2015). Using Complex Numbers. Retrieved November 10, 2015, from http://mathforum.org/library/drmath/view/53879.html

History of Complex Numbers (also known as History of Imaginary Numbers or the History of i). (n.d.). Retrieved November 9, 2015, from <http://rossroessler.tripod.com/>

How Do You Subtract Complex Numbers? (n.d.). Retrieved December 7, 2015, from http://www.virtualnerd.com/tutorials/?id=Alg2\_05\_01\_0004

How to add complex numbers. (2015) Retrieved December 6, 2015,from https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/adding-and-subtracting-complex-numbers/v/adding-complex-numbers

How to divide complex numbers using conjugates. (2015). Retrieved December 6, 2015, from https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/complex-conjugates-and-dividing-complex-numbers/v/dividing-complex-numbers

How to multiply complex numbers (example). (2015). Retrieved November 9, 2015, from <https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/multiplying-complex-numbers/v/multiplying-complex-numbers>

How to subtract complex numbers. (2015). Retrieved December 6, 2015, from https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/adding-and-subtracting-complex-numbers/v/subtracting-complex-numbers

Imaginary Numbers. (2015, May 15). Retrieved May 9, 2015, from <https://en.wikipedia.org/wiki/Imaginary_number>

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Introduction to i and the imaginary numbers. (2015). Retrieved November 9, 2015, from <https://www.khanacademy.org/math/precalculus/imaginary-and-complex-numbers/the-imaginary-numbers/v/introduction-to-i-and-imaginary-numbers>

Jeremiah**,** D. (2015). Imaginary Numbers in Electricity. Retrieved November 10, 2015, from http://mathforum.org/library/drmath/view/53851.html

Jerry**,** D. (2015). Real Life Applications of Imaginary Numbers. Retrieved November 10, 2015, from http://mathforum.org/library/drmath/view/53844.html

Larsen, T. (2015, November 8). Complex Numbers. Retrieved November 9, 2015, from <https://www.youtube.com/watch?v=6yXljx9LbPM>

Larsen, T. (2015, November 22). GeoGebraTube. Retrieved December 7, 2015

Nahin, Paul J. An Imaginary Tale: The Story of √-1. Princeton, N.J: Princeton UP, 1998. Print.

Nicolas Chuquet. (2015, May 4). Retrieved November 9, 2015, from <https://en.wikipedia.org/wiki/Nicolas_Chuquet>

Palmitesso, T. (2012). Add Complex Numbers. Retrieved December 7, 2015, from http://www.regentsprep.org/regents/math/algtrig/ato6/lessonadd.htm

Quadratic Equations and Functions. (n.d.). Retrieved December 7, 2015, from http://www.virtualnerd.com/algebra-2/quadratics

Roberts, D. (2012). Electricity and Complex Numbers. Retrieved December 7, 2015, from http://www.regentsprep.org/regents/math/algtrig/ATO6/electricalresouce.htm

Roberts, D. (2012). Math B-Complex Numbers. Retrieved November 9, 2015, from <http://www.regentsprep.org/regents/math/algtrig/ato6/multprac.htm>

That Six Thinks He's SO Perfect. (n.d.). Retrieved December 8, 2015, from http://cheezburger.com/7614190336

Tom**,** D. (2015).Applications of Imaginary Numbers. Retrieved November 10, 2015, from <http://mathforum.org/library/drmath/view/53606.html>

What is an Imaginary Number? (2015). Retrieved December 7, 2015, from http://study.com/academy/lesson/what-is-an-imaginary-number.html

**Appendix**

The theme of my webpage is complex numbers. This topic is one that has always been fascinating for me. I have never known how or why complex numbers came to be and what their importance is in society. While teachers touched on the importance of complex numbers, I was never convinced as to why society needed them. Thus, I thought this topic would be interesting not only for me to answer some of my own questions, but also for viewers to gain a clearer and deeper understanding of complex numbers and how to use them.

Since complex numbers are such a key part in the core curriculum, several of my objectives dealt with helping viewers understand properties of complex numbers as well as being able to use them.

* Viewers will learn about the key properties to imaginary and complex numbers.
* Viewers will learn how to algebraically manipulate complex numbers.
* Viewers will learn to graph complex numbers as well as discover how algebraic manipulations change the nature of the graphs.

My other objectives were focused on helping viewers gain an understanding of how complex numbers came to be and how they are used today.

* Viewers will learn about some of pivotal people and discoveries in history that led to the discovery of both imaginary and later complex numbers.
* Through learning of the history, viewers will understand why the discovery of complex numbers was necessary and helpful in society.
* Viewers will gain an appreciation of complex numbers when learning about some of their helpful applications.

Each of the resources used throughout my webpage are used to reach one of the previously stated objectives. I utilize a lot of different pictures and videos in my *Explanation of Mathematics* section. These help enhance the basic background information of imaginary and complex numbers and their uses. They provide an extra resource if viewers want to dig more deeply into each perspective topic. Additionally in the *Explanation of Mathematics*, I provide a couple links to worksheets where viewers can practice and sharpen their skills with manipulating complex numbers algebraically. The *Significance & Application* section of my webpage contains a couple videos and a podcast. These resources are made available for viewers to gain a more in-depth understanding of some applications of complex numbers.

With regards to my personally created resources, they address the objectives of helping viewers learn to manipulate and graph complex numbers. I provide a video where I demonstrate how to multiply complex numbers and encourage viewers to work through the same worksheet. This helps viewers understand one of the algebraic properties of complex numbers. I also include a Geogebra Applet where viewers have an interactive experience with graphing complex numbers. They are able to input any desired complex number and view its corresponding graph. Even more, this applet demonstrates how algebraically manipulating a given complex number will change the graph of that complex number. Both of the resources lead viewers to better learn how to work with complex numbers.

Working on this project was very rewarding. I was able to expand my knowledge of the basic properties of complex numbers and how to work with these numbers. I was also pleased to have learned about some of the stages in history that led to the discovery of imaginary numbers. Most of all, I learned about some of the basic uses and applications of imaginary numbers. It was helpful to notice how imaginary numbers show up everywhere in the real world. Even though it may be difficult to understand how engineers use them, complex numbers are at the base of many of the luxuries that society enjoys such as electricity, radio, cell phones, and bridges. I want to base my presentation around the uses of complex numbers. The applications of complex numbers are rarely mentioned or discussed; for this reason, I feel that most people would be intrigued to know truly how important complex numbers are in our real world.