Section 2.4 – Complex Numbers

Example: Solve $x^2 + 1 = 0$.

To overcome the inability to solve this in the real number system, a COMPLEX NUMBER SYSTEM was created.

Complex Numbers

A *complex number* has both a REAL component and an IMAGINARY component.

A complex number is written in standard form as $a + bi$, where a is a *real part* and bi is the *imaginary part* (b alone is a real number).

Principal Square Roots of Negative Numbers

If a is a positive number, the principal square root of the negative number –a is defined as:

$$\sqrt{-a} = i\sqrt{a}.$$

Examples: Write the complex number in standard form.

1. $\sqrt{-3}\sqrt{-12} =$

2. $\sqrt{-48} - \sqrt{-27} =$

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Operations with Complex Numbers

Addition and Subtraction:

Examples:

1. $(4+7i)+(1-6i)=$

2. $(1+2i)-(4+2i)=$

3. $3i-(-2+3i)-(2+5i)=$

4. $(3+2i)+(4-i)-(7+i)=$

RECALL: $i^1=i$ **and** $i^2=-1$**, so** $i^3=i\bullet i^2=i\bullet(-1)=-i$ **and** $i^4=i^2\bullet i^2=(-1)(-1)=1$

Examples (Multiplying):

1. $4(-2+3i)=$

2. $(2-i)(4-3i)=$

3. $(3+2i)(3-2i)=$

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Solve the following equations.

1. $x^2+4=0$

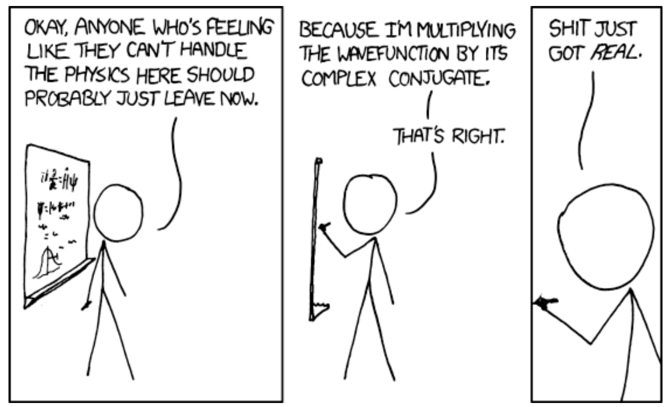
2. $3x^2-2x+5=0$

Section 2.4 – Complex Numbers

Complex Conjugates

The conjugate of a complex number of the form $a + bi$ is $a - bi$.

Example: Multiply $4 - 3i$ by its complex conjugate.



Example: Write the quotient of the following complex number in standard form (*a + bi*).

$$\frac{2+3i}{4-2i} =$$