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.

<u>Complex Numbers</u>

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

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

Operations with Complex Numbers

Addition and Subtraction:

Examples:

1. $(4+7\mathrm{i})+(1-6\mathrm{i})=$
2. $(1+2\mathrm{i})-(4+2\mathrm{i})=$
3. $3\mathrm{i}-(-2+3\mathrm{i})-(2+5\mathrm{i})=$
4. $(3+2\mathrm{i})+(4-\mathrm{i})-(7+\mathrm{i})=$

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

Examples (Multiplying):

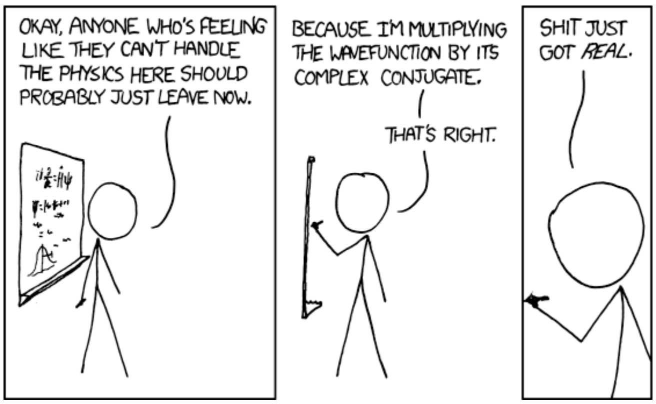
1. $4(-2+3\mathrm{i})=$

Section 2.4 – Complex Numbers

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

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

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 ($a + bi$).

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

Section 2.4 – Complex Numbers

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

Solve the following equations.

3. $x^2 + 4 = 0$

4. $3x^2 - 2x + 5 = 0$

Homework: p. 167 #3, 5, 13, 19, 22, 23, 25, 27, 30, 33, 38, 47, 59, 65