Bellwork

Simplify each of the following:

1. $(7 - 5x) + (-3 + 8x)$

2. $(-9 + x) - (-6 + 7x)$

3. $(-1 + 3x)(11 - 9x)$

The Imaginary Unit

Complex Numbers:

Any number that consists of a real part and an imaginary part.

Standard form of an imaginary number:

$$a + bi$$

Where: a is the real part of the number

b is the imaginary part of the number

What is i?

i = the imaginary unit

$i = \sqrt{-1}$

More important information to keep in mind about i:

$i^2 = -1$

$i^3 = -i$

$i^4 = 1$

$i^5 = i$

Adding Complex Numbers

In general: (a + bi) + (c + di)

Consider i to be a variable like x or y.

Procedure:

1. Eliminate the parentheses
2. Combine the real parts
3. Combine the imaginary parts
4. Put the result in standard form a + bi

Example

1. (23 - 14i) + (-3 + 11i)

Subtracting Complex Numbers

In general: (a + bi) - (c + di)

Procedure:

1. Rewrite the expression eliminating the parentheses. This will require changing the sign in all the terms in the second set of parentheses.
2. Combine the real parts.
3. Combine the imaginary parts.
4. Write the expression in standard form a + bi

Example

1. (2 - 7i) - (4 - 9i)

Multiplying Complex Numbers

In general: $(a + bi)(c + di)$

Procedure:

1. Distribute the expression.
2. Combine any like terms.
3. Replace the i^2 with (-1) and simplify.
4. Combine like terms again.
5. Write the expression in standard form.

Example

1. (5 - 7i)(-12 + 5i)

Dividing Complex Numbers

In general: $\frac{a + bi}{c + di}$

Conjugates:

Given (a + bi), the conjugate is (a - bi).

[Change the sign on the i term.]

Procedure:

1. Multiply the top and the bottom of the fraction by the conjugate of the bottom.
2. On the top repeat all multiplication steps.
3. On the bottom repeat all multiplications steps.
4. Write the expression in standard form.

Example

1. $\frac{6 - i}{2 + 3i}$

2. $\frac{-3 + 7i}{5i}$