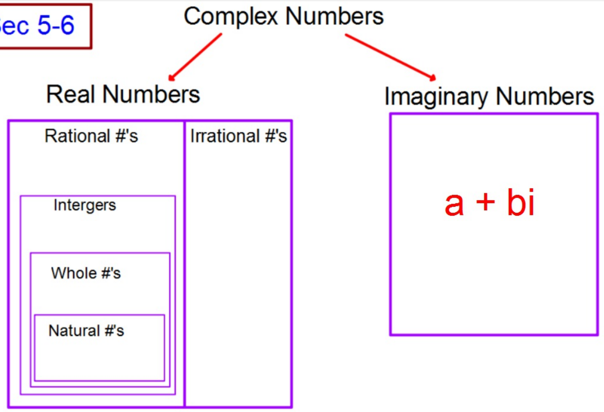
Sec 5-6



Imaginary Numbers:

$$\sqrt{-1} = i$$

i is called the imaginary unit.

Complex Numbers:

any number that can be written in the form: a + bi (a and b can be any real #)

Standard Form of a Complex Number

Real Part

Imaginary Part

Real Number: when b=0

Imaginary Number: when b≠0 (a may or may not be zero)

Examples of Imaginary #'s: 10 - 7i or 13i

The terms Complex Number and Imaginary Number are quite often used interchangeably.

Even though they are NOT the same thing!

Simplify each.

a. $\sqrt{-196}$

$= \sqrt{196 \cdot -1}$

$= \sqrt{196} \cdot \sqrt{-1}$

$= \boxed{14i}$

b. $\sqrt{-288}$

$\sqrt{144 \cdot 2 \cdot -1}$

$= \sqrt{144} \cdot \sqrt{-1} \cdot \sqrt{2}$

$= \boxed{12i\sqrt{2}}$

Write each as a Complex Number in Standard Form

a. $-9 + \sqrt{-24}$

$\sqrt{24}$

$\sqrt{4 \cdot 6}$

$\boxed{-9 + 2i\sqrt{6}}$

b. $-\sqrt{-100} + 11$

$\boxed{11 - 10i}$

Simplify each expression. Write complex numbers in Standard Form.

a. $(7 + \sqrt{-1}) - (-2 + \sqrt{-81})$

$(7 + i) - (-2 + 9i)$

$\boxed{9 - 8i}$

b. $(4 - \sqrt{25}) + (-12 - \sqrt{-64})$

$(4 - 5) + (-12 - 8i)$

$(-1) + (-12 - 8i)$

$\boxed{-13 - 8i}$

$i = \sqrt{-1}$

$i^2 = \sqrt{-1} \cdot \sqrt{-1}$ or $(\sqrt{-1})^2 = \boxed{-1}$

Simplify each:

1. $4i(3 + 6i)$

$12i + 24i^2$

$12i + 24(-1)$

$12i - 24$

$\boxed{-24 + 12i}$

2. $(2 + 3i)(1 - 5i)$

	2	$+3i$
1	2	$+3i$
$-5i$	$-10i$	$-15i^2 = 15$

$\boxed{17 - 7i}$

Simplify:

a. $(1 + 5i)^2$

$1 + 10i + \underbrace{25i^2}_{-25}$

$\boxed{-24 + 10i}$

b. $(4 + 2i)(4 - 2i)$

$16 \underbrace{- 4i^2}_{}$

$16 + 4$

$= \boxed{20}$

$(x + 5)^2$ is never just 2 terms!!!

$(a + b)^2 = a^2 + 2ab + b^2$

$(x + 5)^2 = (x)^2 + 2(1)(5)x + (5)^2$

$= x^2 + 10x + 25$

However.......

$(1 + 5i)^2 = (1)^2 + 2(1)(5i) + (5i)^2$

$= -24 + 10i$

When you square a complex number you get another complex number.

$(3 - 4i)^2 =$

$9 - 24i + \underbrace{16i^2}_{-16}$

$\boxed{-7 - 24i}$

When dealing with Real Numbers only:

$(x + 5)(3x + 2)$ is a Trinomial

When dealing with Imaginary Numbers only:

$(5 + i)(2 + 3i)$ is a Binomial

(another imaginary number)

$(2x - 3)(2x + 3) =$

$(2x)^2 - (3)^2$

$\boxed{4x^2 - 9}$

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

$(2)^2 - (3i)^2$

$4 \underbrace{- 9i^2}$

$4 + 9 = \boxed{13}$

When a and b are REAL #'s

$(a + b)(a - b) = a^2 - b^2$

$(4 + 2i)(4 - 2i)$

With Imaginary Numbers:

$(a + bi)(a - bi) = a^2 + b^2$

Factors such as $(a + b)$ and $(a - b)$ are called CONJUGATES

Conjugate

The conjugate is where we **change the sign in the middle** of two terms like this:

$3x + 1$

Conjugate: $3x - 1$

Complex Conjugates: a + bi and a - bi

$(7 + 4i)(7 - 4i) =$

$49 + 16 = 65$

The product of complex conjugates is always
a constant

Simplify each.

1. $(9 - 5i)^2$

$81 - 90i + \underbrace{25i^2}_{-25}$

$56 - 90i$

2. $(6 - 3i)(6 + 3i)$

$36 + 9 = 45$

Hwk #22: Sec 5-6

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Due tomorrow

Problems 3-5, 13, 14, 34-36, 40, 57, 59