4-1 Review of Complex Numbers

Objective: Students will be able to:

- Know the parts of a complex number
- Know how to add, subtract, and multiply 2 complex numbers
- Know what a conjugate is and how to find one

$i = \sqrt{-1}$ AND $i^2 = -1$

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

Definition

Complex numbers are numbers of the form $a + bi$ where a and b are real numbers. The real number a is called the real part and the number b is called the imaginary part.

Real — Imaginary (attached to i)

Identify the real and imaginary parts of each complex number.

$4 + 5i$ (non real)
Real: 4
Imaginary: 5

$5 - i$
Real: 5
Imaginary: -1

3
Real: 3
Imaginary: 0

$7i$
Real: 0
Imaginary: 7

Write each of the following as a pure imaginary number.

$\sqrt{-16}$ — $-1 \cdot 16$, $16 = 4 \cdot 4$ — $\boxed{4i}$

$\sqrt{-18}$ — $-1 \cdot 18$, $18 = 2 \cdot 9$, $9 = 3 \cdot 3$ — $\boxed{3\sqrt{2}i}$

$\sqrt{-3}$ — $\boxed{\sqrt{3}i}$

$\sqrt{-12}$ — $12 = 2 \cdot 6$, $6 = 2 \cdot 3$ — $\boxed{2\sqrt{3}i}$

$\sqrt{-5}$ — $-1 \cdot 5$ — $\boxed{\sqrt{5}i}$

$\sqrt{-36}$ — $36 = 6 \cdot 6$ — $\boxed{6i}$

Write each in Standard Form. State the real and imaginary parts.

$a+bi$

$2-\sqrt{-25}$ $5i$

$\boxed{2-5i}$

Real   Imaginary

$3+\sqrt{-50}$ $\boxed{2}$ 25, 5 5

$3 + 5\sqrt{2}i$

Real   Imaginary

$\dfrac{4-\sqrt{-12}}{2}$

$-2-\sqrt{-8}$

$\dfrac{6-\sqrt{-72}}{3}$ 72: 9 (3, 3), 8 (2, 4 (2, 2))

$\dfrac{6-6\sqrt{2}i}{3} = \dfrac{6}{3} - \dfrac{6\sqrt{2}i}{3}$

Real $2 - 2\sqrt{2}i$ imaginary

Add:

$(4-3i)+(-2+5i) = \boxed{2+2i}$

$\left(4+\sqrt{-25}\right)+\left(-6-\sqrt{-16}\right)$

$(4+5i)+(-6-4i)$

$\boxed{-2+i}$

Subtract:

$(-3+7i)-(5+4i)$

$-8+11i$

$\left(3+\sqrt{-12}\right)-\left(-2-\sqrt{-27}\right)$

12: 4, 3 (2 2)   27: 9, 3 (3 3)

$(3+2\sqrt{3}i)+(+2+3\sqrt{3}i)$

$\boxed{5+5\sqrt{3}i}$

You Try

$$\left(4-\sqrt{-4}\right)+\left(-7+\sqrt{-9}\right)$$

$$(4-2i)+(+2\,\cancel{+}\,7i)$$

Multiply

$i^2=-1$ $a+bi$

$4i(3-6i)$

$12i-24i^2$

$12i-24(-1)$

$12i+24$

$24+12i$

$(-2+4i)(3-i)$

$-6+2i+12i-4i^2$

$-6+14i+4$

$-2+14i$

Remember from before:

$$\sqrt[n]{a}\sqrt[n]{b}=\sqrt[n]{ab}$$

only works when $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers

* Simplify Radicals, then multiply

This means that

$$\sqrt{a}\sqrt{b}\neq\sqrt{ab} \text{ if } a<0 \text{ or } b<0$$

Multiply

$$\sqrt{-25}\sqrt{-4} = \cancel{\sqrt{100} = 10}$$

$(5i)(2i) = 10i^2 = -10$

Simplify 1st, then multiply

$$\left(2+\sqrt{-16}\right)\left(1-\sqrt{-4}\right)$$

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

$2 \cancel{-4i+4i} - 8i^2$

$2+8 = \boxed{10}$

You Try

$$\sqrt{-9}\sqrt{-36} = -18$$

$$\left(2+\sqrt{-36}\right)\left(4-\sqrt{-25}\right)$$

Multiply (What Happens?)

* $(4+3i)(4-3i)$

$16 \cancel{-12i+12i} - 9i^2$

$16+9 = 25$

Complex Conjugate

If $a+bi$ is a complex number, then its conjugate is defined as $a-bi$

change sign on the imaginary part

$3+2i$	$4-3i$	$-16+32i$
$3-2i$	$4+3i$	$-16-32i$

$-17i$	$4i$
$+17i$	$-4i$