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 $i^2 = -1$

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.

nonreal

Identify the real and imaginary parts of each complex number.

$4 + 5i$

Real: 4

Non Real: 5

$5 - i$

Real: 5

Imaginary: -1

3

R: 3

I: 0

$7i$

R: 0

I: 7

Write each of the following as a pure imaginary number.

$\sqrt{-16}$ $\quad -1 \cdot 16$ $\quad 4 \cdot 4$ $\quad 4i$

$\sqrt{-18}$ $\quad -1 \cdot 18$ $\quad 3 \cdot 6$ $\quad 3\sqrt{2}\,i$

$\sqrt{-3}$ $\quad \sqrt{3}\,i$

$\sqrt{-12}$ $\quad -1 \cdot 4 \cdot 3$ $\quad 2 \cdot 2$ $\quad 2\sqrt{3}\,i$

$\sqrt{-5}$ $\quad -1 \cdot 5$ $\quad \sqrt{5}\,i$

$\sqrt{-36}$ $\quad -1 \cdot 36$ $\quad 6 \cdot 6$ $\quad 6i$

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

$a+bi$

$2-\sqrt{-25}$ $\quad -1\cdot 25$ $\quad 2-5i$

$3+\sqrt{-50}$ $\quad -1\cdot 50$, $2\cdot 25$, $5\cdot 5$ $\quad 3+5\sqrt{2}i$

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

$-2-\sqrt{-8}$

$\frac{6-\sqrt{-72}}{3}$ $\quad -1\cdot 72$, $8\cdot 9$, $2\cdot 4$, $3\cdot 3$, $2\cdot 2$

$\frac{6-6\sqrt{2}i}{3}$

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

Add:

$(4-3i)+(-2+5i)$ $\quad 2+2i$

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

$(4+5i)+(-6-4i)$ $\quad -2+i$

Subtract:

$(-3+7i)+(5+4i)$ $\quad -8+11i$

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

$3\cdot 4$, $9\cdot 3$

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

$5+5\sqrt{3}i$

You Try

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

$(4-2i)-(-2+7i)$

Multiply

$i^2=-1$

$4i(3-6i)$

$12i-24i^2$

$12i+24$

$24+12i$

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

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

$-6+14i+4$

$-2+14i$

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

This means that

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

Multiply

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

$5i \cdot 2i = 10i^2 = -10$

*Simplify Radicals First

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

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

$2 - 4i + 4i - 8i^2$

$2 + 8 = 10$

You Try

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

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

*Multiply (What Happens?)

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

$16 - 12i + 12i - 9i^2$

$16 + 9$

25

Complex Conjugate

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

opposite sign on the imaginary part

$3+2i$ → $3-2i$

$4-3i$ → $4+3i$

$-16+32i$ → $-16-32i$

$-17i$ → $+17i$

$4i$ → $-4i$

$17i$