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

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

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.

a + b i

Real

imaginary

Identify the real and imaginary parts of each complex number.

$4 + 5i$

R : 4
I : 5

$5 - 1i$

R : 5
I : -1

3

$3 + 0i$

R : 3
I : 0

$7i$

$0 + 7i$

R : 0
I : 7

Write each of the following as a pure imaginary number.

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

$\sqrt{-18}$ $\quad a+bi$ $\quad 9 \cdot 2$ $\quad 3 \cdot 3$ $\quad 3\sqrt{2}i$

$\sqrt{-3}$ $\quad -1 \cdot 3$ $\quad \sqrt{3}i$

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

$\sqrt{-5}$ $\quad \sqrt{5}i$

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

a+bi

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

$2-\sqrt{-25}$

$2-5i$

$3+\sqrt{-50}$

$3+5\sqrt{2}i$

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

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

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

$2-\sqrt{3}i$

$-2-\sqrt{-8}$

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

$\frac{6-\sqrt{-72}}{3}$

$\frac{6}{3}-\frac{\sqrt{-72}}{3}$

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

$2-2\sqrt{2}i$

Add:

$$(4-3i)+(-2+5i) = 2+2i$$

$$\left(4+\sqrt{-25}\right)+\left(-6-\sqrt{-16}\right) = -2+i$$

Subtract:

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

$$\left(3+\sqrt{-12}\right)+\left(+2+\sqrt{-27}\right) = 5+5\sqrt{3}\,i$$

You Try

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

$2i$ $\quad 3i$

$-3+i$

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

$6-9i$

Multiply

$4i(3-6i)$

$12i - 24i^2(-1)$

$12i + 24$

$24 + 12i$

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

$-6 + 2i + 12i - 4i^2(-1)$

$-6 + 14i + 4$

$-2 + 14i$

Remember from before:

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

$\sqrt{6} \cdot \sqrt{6} = \sqrt{36}$

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

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

$5i \cdot 2i = 10i^2(-1) = -10$

CHANGE TO IMAGINARY FIRST!!

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

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

$2 - \cancel{4i + 4i} - 8i^2(-1)$

$2 + 8 = \boxed{10}$

You Try

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

$3i \cdot 6i = 18i^2(-1) = -18$

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

$6i$ $5i$

$38+14i$

$8 - 10i + 24i - 30i^2(-1)$

$+30$

Multiply (What Happens?)

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

$16 - 12i + 12i - 9i^2(-1)$

$+9$

25

Complex Conjugate

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

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

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

$0-17i$ $\quad$ $4i$

$17i$ $\quad$ $-4i$