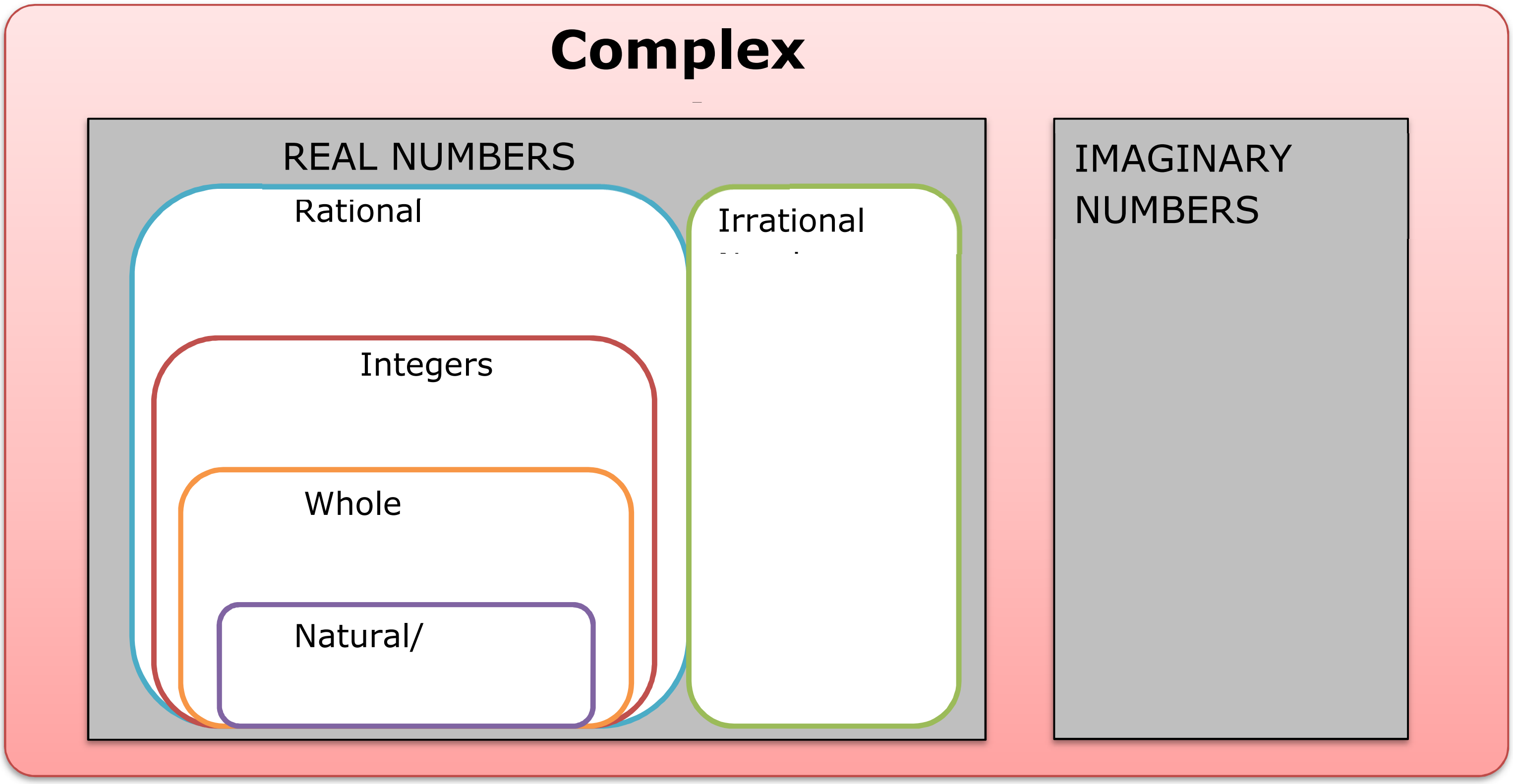
PAP Algebra 2 Name: ______________________________

Notes: Complex Numbers Period: _______ Date: ________________



Consider the equation $x^2 = -1$. Is there a real number solution to this equation?

The imaginary number $\boldsymbol{i}$ is a number such that $i^2 = -1$. Because no real number exists such that its square is equal to a negative number, the number i is not a part of the real number system.

If $i^2 = -1$, then what is the value of i?

Examples: Rewrite each expression using $\boldsymbol{i}$.

1. $\sqrt{64} - \sqrt{-63}$
2. $\sqrt{-13} + 10$
3. $\dfrac{1-\sqrt{-44}}{2}$

The **set of complex numbers** is the set of all numbers written in the form $a \pm bi$, where a and b are real numbers. The a term is called the **real part of a complex number**, and the bi term is called the **imaginary part of a complex number**.

Examples: Write the following as a complex number. Identify the $\boldsymbol{a}$ and $\boldsymbol{b}$.

4. i
5. 3
6. $\pi + 3.2i$

When operating with complex numbers involving i, combine like terms by treating i as a variable (even though it is a constant.)

Simplify each expression.

7. $(3 + 2i) - (1 - 6i)$

8. $4i + 3 - 6 + i - 1$

9. $7i + 4 - 2i - 10$

Determine each product.

10. $5i(3 - 2i)$

11. $(5 + 3i)(2 - 3i)$

12. $(1 - 3i)(1 + 3i)$

What do you notice about #12?

Complex conjugates are pairs of numbers of the form $a + bi$ and $a - bi$. The product of a pair of complex conjugates is always a real number and equal to $a^2 + b^2$. Division of complex numbers requires the use of complex conjugates because imaginary numbers are not allowed to remain in the denominator. You can rewrite the division of complex numbers by multiplying both the numerator and denominator by the conjugate of the denominator.

Examples: Rewrite each quotient without a complex number in the denominator.

13. $\frac{2-i}{3+2i}$

14. $\frac{3-4i}{2-3i}$

15. $\frac{5+2i}{1+i}$

16. $\frac{20-5i}{2-4i}$