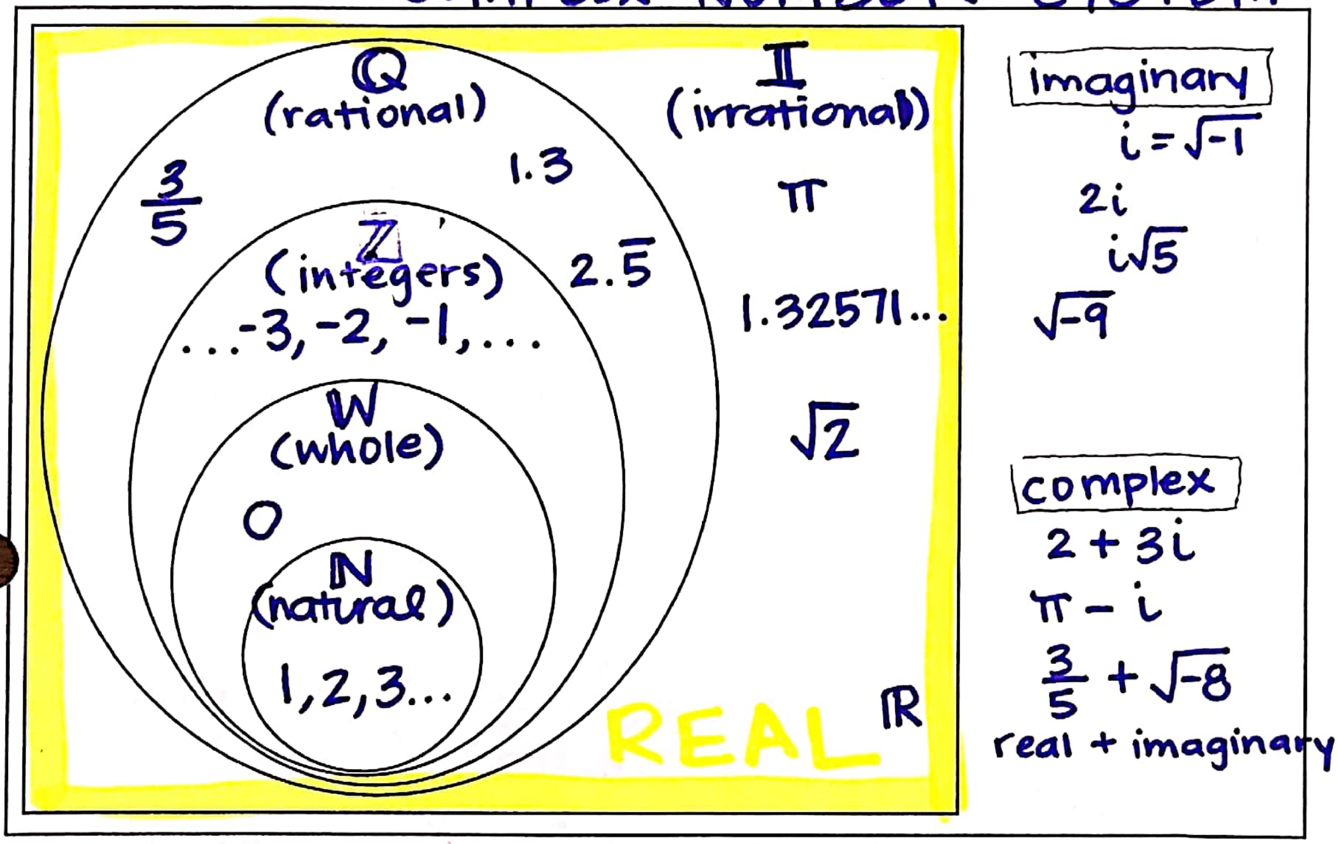
Name: ______________________ Date: ______________ Period: __________

1.5 Real and Imaginary Numbers Notes

You have been told in the past that you are not allowed to have a <u>negative</u> number under a radical.

This isn't always true. There is another system of numbers that are called the <u>imaginary</u> numbers. This system includes all radicals with a negative number in it.

COMPLEX NUMBER SYSTEM



This system uses the lowercase letter i to represent the negative under a radical.

$i = \sqrt{-1}$ <u>Note</u>: $i^2 = -1$

These radicals are rewritten by ~~making the number positive,~~ simplifying the radical if possible, and putting the i **in front** of the radical. The i goes after the number if it is a perfect square.

Ex.

1. $\sqrt{-4} =$
   $\sqrt{-1} \cdot \sqrt{4}$
   $i \cdot 2$
   $\boxed{2i}$

2. $\sqrt{-36} =$
   $\sqrt{-1} \cdot \sqrt{36}$
   $i \cdot 6$
   $\boxed{6i}$

3. $\sqrt{-3} =$
   $\sqrt{-1} \cdot \sqrt{3}$
   $\boxed{i\sqrt{3}}$

4. $\sqrt{-11} =$
   $\sqrt{-1} \cdot \sqrt{11}$
   $\boxed{i\sqrt{11}}$

Algebra 2 Notes
U1.5 Complex Number Notes

Name: ____________________
Date: ______________ Per: ________

Definitions

1. Imaginary Number: $i^2 = -1$; If a is a positive real number, then the principal square root of negative a is the imaginary number $i\sqrt{a}$; that is, $\sqrt{-a} = i\sqrt{a}$. (Extends the existing number system by giving a solution to problems that look like: $x^2 = -1$.)
2. Complex Number – is a number in the form $a+bi$, where a and b are real numbers and $i=\sqrt{-1}$. The number a is the real part of $a+bi$ and bi is the imaginary part. Any solution should be written in this form. (It is customary to put i in front of a radical if it is part of the solution.)
3. Patterns of i - To determine the value of i to any power just find the largest multiple of 4 and i to that multiple of 4 =1 then the remainder is the exponent of i that is evaluated and multiplied by 1. Example: $i^{347} = i^{344}i^3 = (1)(-i) = -i$.

$$i^1 = i$$
$$i^2 = -1$$
$$i^3 = -i$$
$$i^4 = 1$$

Guided Practice Part I: Complete all problems and show ALL work. Box answers.

1. $\sqrt{-16}$ $\boxed{4i}$

2. $\sqrt{-28}$ $i\sqrt{28}$ $\boxed{2i\sqrt{7}}$ 28 → 4, 7; 4 → 2, 2

3. $\sqrt{-5}$ $\boxed{i\sqrt{5}}$

4. $\sqrt{-10} \bullet \sqrt{-2}$ $\sqrt{20}$ $\boxed{2\sqrt{5}}$ 20 → 10, 2; 10 → 5, 2

5. $\dfrac{\sqrt{-50}}{\sqrt{-10}} = \sqrt{\dfrac{-50}{-10}} = \boxed{\sqrt{5}}$

6. $\dfrac{21\sqrt{-6}}{7\sqrt{2}} = 3\sqrt{\dfrac{-6}{2}} = 3\sqrt{-3} = \boxed{3i\sqrt{3}}$

7. $(3\sqrt{-5})^2$ $3\sqrt{-5} \cdot 3\sqrt{-5}$ $9\sqrt{25} = 9 \cdot 5 = \boxed{45}$

8. $(6\sqrt{-8})^2$ $6\sqrt{-8} \cdot 6\sqrt{-8}$ $36\sqrt{64} = 36 \cdot 8 = \boxed{288}$

9. $\sqrt[3]{-27}$ $\sqrt[3]{-1} \cdot \sqrt[3]{27}$ $-1 \cdot 3$ -3

$\sqrt[3]{-1} = -1$ because $(-1)^3 = -1$
$\sqrt[3]{27} = 3$ because $3^3 = 27$

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