NC Math 2
Unit 3- Complex Numbers

Key

Pg #: __________

Complex Numbers- Combination of ___real___ and ___imaginary___ numbers

$a + bi$

Real Part — Imaginary Part — $\sqrt{-1}$

Note: Either part can be **0**, so all Real Numbers and Imaginary Numbers are also Complex Numbers:

Complex Number	Real Part	Imaginary Part
3 + 2i	3	2
5	5	**0**
−6i	**0**	−6

Think back to Unit 1. If the discriminant of a quadratic is negative, there are no real solutions, but there are imaginary solutions.

Imaginary numbers happen when you try to take the square root of a negative number.

$\sqrt{-1} = i$

Which means $i^2 =$ -1

Example: Can you simplify $\sqrt{-9}$?

Let's split the radical into 2 parts and try: $\sqrt{-9} = \sqrt{-1} * \sqrt{9} = i * 3 = 3i$

Rewrite the Following numbers using the imaginary numbers "i":

1. $\sqrt{-25}$ $5i$
2. $\sqrt{-81}$ $9i$
3. $\sqrt{-144}$ $12i$
4. 12 - $\sqrt{-225}$ $12 - 15i$
5. $-48 + \sqrt{-256}$ $-48 + 16i$
6. Use what you know about complex numbers to find the imaginary solutions of $y = 5x^2 - 8x + 4$.

$$\frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{8 \pm \sqrt{(-8)^2-4(5)(4)}}{2(5)} = \frac{8 \pm \sqrt{64-80}}{10} = \frac{8 \pm \sqrt{-16}}{10} = \frac{8 \pm 4i}{10} = \frac{4 \pm 2i}{5}$$

Now, lets combine what we know about Simplifying Radicals and Complex Numbers:

1. $\sqrt{-20}$ $\quad 2i\sqrt{5}$
2. $-\sqrt{-28}$ $\quad -2i\sqrt{7}$
3. $2\sqrt{-75}$ $\quad 2\cdot 5i\sqrt{3} = 10i\sqrt{3}$
4. $5\sqrt{-8}$ $\quad 5\cdot 2i\sqrt{2} = 10i\sqrt{2}$
5. $\sqrt{-147}$ $\quad 7i\sqrt{3}$
6. $\sqrt{-72}$ $\quad 2\cdot 3i\sqrt{2} = 6i\sqrt{2}$
7. $\sqrt{-128}$ $\quad 4\cdot 2i\sqrt{2} = 8i\sqrt{2}$
8. $\frac{3}{4}\sqrt{-144}$ $\quad \frac{3}{4}\cdot 12i$ $\quad 9i$
9. $\sqrt{-512}$ $\quad 4\cdot 4i\sqrt{2} = 16i\sqrt{2}$

1). 20
4 5
2 2

2). 28
14 2
7 2

3). 75
3 25
5 5

4). 8
2 4
2 2

5). 147
3 49
7 7

6). 72
9 8
3 3 4 2
2 2

7). 128
8 16
4 2 4 4
2 2

8). Perfect square

9). 512
16 32
4 4 16 2
4 4

10. For i^x where x is an even number greater than zero, develop a rule to determine if i^x simplified is 1 or -1

If $x/2$ is an even number, then $i^x = 1$.

If $x/2$ is an odd number, then $i^x = -1$

Odd exponents (not divisible by 2) would be either i or $-i$

$\sqrt{-1} = i$

$-1 = i^2$

$-i = i^3$
$(-1\cdot i)$

$1 = i^4$
$(-1\cdot -1)$

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