Name: KEY!

Hour: ________

CHAPTER 6

IMAGINARY & COMPLEX NUMBERS

Lesson 6-8: Imaginary Numbers

Vocabulary

Imaginary Numbers: allow us to take the square root of a negative #

$i = \sqrt{-1}$

Practice

when solving - must have 2 answers!

1. Evaluate $\sqrt{-9}$

$\sqrt{9} \cdot \sqrt{-1}$

$3 \cdot i = \boxed{3i}$

2. Solve $\sqrt{x^2} = \sqrt{-100}$

$x = \sqrt{100} \cdot \sqrt{-1}$

$x = 10$ or -10 → i

So, $\boxed{x = 10i \text{ or } x = -10}$

3. i^2

$i \cdot i$

$\sqrt{-1} \cdot \sqrt{-1} = \boxed{-1}$

4. Show that $i\sqrt{7}$ is $\sqrt{-7}$.

$(i\sqrt{7})^2 = i^2 \cdot \sqrt{7}^2$

$= i^2 \cdot 7$

$= -1 \cdot 7 = \boxed{-7}$

Simplify.

5. $\sqrt{-4} - \sqrt{-49}$

$2i - 7i = \boxed{-5i}$

6. $(6i)(4i)$

$24i^2 = 24 \cdot -1$

$= \boxed{-24}$

7. $\sqrt{-36} + 3\sqrt{-4}$

$6i + 3 \cdot 2i$

$6i + 6i = \boxed{12i}$

8. $\frac{\sqrt{-25}}{\sqrt{-81}} = \frac{5\cancel{i}}{9\cancel{i}} = \boxed{\frac{5}{9}}$

9. $\sqrt{-36}\sqrt{-64}$

$6i \cdot 8i = 48i^2$

$= 48 \cdot -1 = \boxed{-48}$

10. $\sqrt{-12} = \sqrt{3 \cdot -4} = \sqrt{3} \cdot \sqrt{-4}$

$\sqrt{3} \cdot 2i$

$\boxed{2i\sqrt{3}}$

11. Solve $2b^2 - \cancel{5} = -55$

$\cancel{+5} \quad +5$

$\frac{\cancel{2}b^2}{\cancel{2}} = \frac{-50}{2}$

$\sqrt{b^2} = \sqrt{-25}$

$\boxed{b = -5i \text{ or } 5i}$

* Note: do NOT combine radicals w/ negatives inside!

$\sqrt{-36} \cdot \sqrt{-64} \neq \sqrt{2304} = 48$

Lesson 6-9: Complex Numbers

Vocabulary

Complex Numbers: have 2 parts - a real part & an imaginary part.

real $a + bi$ imaginary } ex: $2+3i$

Complex Conjugate: the complex conjugate of $a+bi$ is $a-bi$.

*When working with complex numbers, treat "i" like a variable - you can combine your "like terms"!

Practice

Simplify.

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

   $\boxed{13 + 5i}$

2. $3i(5 + 6i)$

   $15i + 18i^2$

   $15i + 18 \cdot -1$

   $15i - 18 = \boxed{-18 + 15i}$

3. $(4 - 3i)(2 + 5i)$ FOIL!

   $8 + 20i - 6i - 15i^2$

   $8 + 14i - 15(-1)$

   $8 + 14i + 15 = \boxed{23 + 14i}$

Find the complex conjugate of each:

4. a. $7 + 4i$ — $7 - 4i$

   b. $13 - 6i$ — $13 + 6i$

   c. $242 + 74i$ — $242 - 74i$

What happens when you multiply a complex number by its complex conjugate?

Try it out...

Example: $(7+4i)(7-4i)$ FOIL!

$$49 - \cancel{28i} + \cancel{28i} - 16i^2$$

you get a real #!

$$49 - 16(-1) = 49 + 16 = \boxed{65}$$

Why do we need the complex conjugate?

When a denominator is multiplied by its complex conjugate, the result is a real #!

Why do we need to change the denominator to a real number?

Having "i" in the denominator isn't allowed b/c it represents $\sqrt{-1}$, can't have radicals in the bottom of a fraction!

5. Simplify $\frac{(2-i)}{(3+5i)} \cdot \frac{(3-5i)}{(3-5i)}$

FOIL top & bottom:

$$\frac{6 - 10i - 3i + 5i^2}{9 - \cancel{15i} + \cancel{15i} - 25i^2} =$$

$$= \frac{6 - 13i + 5(-1)}{9 - 25(-1)}$$

$$= \frac{6 - 13i - 5}{9 + 25}$$

$$= \frac{1 - 13i}{34} = \boxed{\frac{1}{34} - \frac{13i}{34}}$$