Introduction to Complex Numbers

- Recall: We've learned real & imaginary numbers separately, but you'll see expressions with both types of numbers.
 - We call these complex numbers, which have a standard form of:

a + bi

a is the _____ part b is the _____ part

EXAMPLE: Identify the real and imaginary parts of each complex number.

COMPLEX NUMBERS

(A)

0 + 7i

(C)

2 + 0i

 $a = _{---}$ $b = _{---}$

 $a = _{---}$ $b = _{---}$

PRACTICE: Identify the real and imaginary parts of the complex number.

$$-4 - 9i$$

$$a =$$
_____ $b =$ _____

PRACTICE: Identify the real and imaginary parts of the complex number.

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

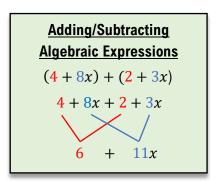
$$a =$$
____ $b =$ ____

PRACTICE: Write the complex number in standard form.

$$9+\sqrt{-16}$$

Adding & Subtracting Complex Numbers

- Just like with algebraic expressions, when you add or subtract complex #s, simply combine like terms.
 - Always express your answer in ______ form!



EXAMPLE: Perform the given operation, expressing the result in standard form.

ADDING COMPLEX NUMBERS (4 + 8i) + (2 + 3i)SUBTRACTING COMPLEX NUMBERS (4 + 8i) - (2 + 3i)

PRACTICE: Find the difference. Express your answer in standard form.

$$(2+8i)-(4-i)$$

PRACTICE: Find the sum. Express your answer in standard form.

$$5(4+7i)+6(3-2i)$$

Multiplying Complex Numbers

- Complex numbers are multiplied just like algebraic expressions! We A) _____ or B) _____
 - Multiplying will ALWAYS produce an i^2 term that will get simplified.

EXAMPLE: Find the product. Write answers in standard form. $(A) \\ 3i(7-2i) \\ \hline \\ \hline \\ MULTIPLYING COMPLEX \\ NUMBERS \\ 1) Distribute or FOIL \\ 2) Apply <math>i^2=-1$ 3) Combine like terms

PRACTICE: Perform the indicated operation. Express your answer in standard form.

$$(3 + 8i)^2$$

PRACTICE: Find the product. Express your answer in standard form.

$$2i(9-4i)(6+5i)$$

Complex Conjugates

• Reverse the _____ of only the imaginary part of a complex number to get the conjugate: $a + bi \Leftrightarrow$

EXAMPLE: Find the conjugate of each complex number.

(A)

$$1 + 2i$$

(B)

$$1 - 2i$$

(C)

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

Multiplying complex conjugates (by FOIL) ALWAYS results in a ______ number

EXAMPLE: Find the product.

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

$$(a+bi)(a-bi) = \underline{\hspace{1cm}}$$

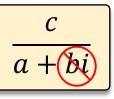
PRACTICE: Find the product of the given complex number and its conjugate.

$$4 - 5i$$

PRACTICE: Find the product of the given complex number and its conjugate.

Dividing Complex Numbers

- ullet Dividing by a complex number results in a fraction with $m{i}$ in the bottom: this is ${\bf \underline{BAD}}$
 - Denominators should ALWAYS be real! To do this, multiply by its ______



EXAMPLE: Find the quotient. Write answer in standard form.

$$\frac{3}{1+2i}$$

DIVIDING COMPLEX NUMBERS

- 1) Multiply top AND bottom by complex conj. of bottom & simplify
- 2) Expand fraction into real & imaginary parts
- 3) Simplify fractions to lowest terms

PRACTICE: Find the quotient. Express your answer in standard form.

$$\frac{6+i}{4-2i}$$

PRACTICE: Find the quotient. Express your answer in standard form.

$$\frac{-5+3i}{-7-4i}$$