

**Keeper # 1**

**Name:** \_\_\_\_\_

**Complex numbers**

**Date:** \_\_\_\_\_ **Period:** \_\_\_\_\_

**What is  $i$ ?**

$i$  is an imaginary number representing the  $\sqrt{-1}$

**Powers of  $i$ :**

$i = i$                        $i^5 = i$                       exponent divided by 4 and the remainder is 1

$i^2 = -1$                        $i^6 = -1$                       exponent divided by 4 and the remainder is 2

$i^3 = -i$                        $i^7 = -i$                       exponent divided by 4 and the remainder is 3

$i^4 = 1$                        $i^8 = 1$                       exponent divided by 4 and the remainder is 0

**Practice:**

$i^{10} =$  \_\_\_\_\_  $i^{25} =$  \_\_\_\_\_  $i^{100} =$  \_\_\_\_\_  $i^{35} =$  \_\_\_\_\_  $i^{16} =$  \_\_\_\_\_

**Standard form of complex numbers**

Complex numbers look like binomials. The first term is a real number and the second term is an imaginary number. The form is  $a + bi$ , where  $a$  is the real number and  $bi$  is an imaginary number.

**Adding and Subtracting complex numbers**

Adding and subtracting complex numbers is the same as adding and subtracting polynomials. We just combine like terms. We combine the real numbers and then we combine the imaginary numbers. Write the answer in standard form  $a + bi$ .

Example 1 Addition:  $(7 + 4i) + (3 - 2i)$

Rewrite grouping like terms  $(7 + 3) + (4i + -2i)$

Combine like terms and write in standard form  $10 + 2i$

Example 2 Subtraction:  $(7 + 4i) - (3 - 2i)$

Rewrite grouping like terms and distributing the subtraction  $(7 - 3) + (4i - -2i)$

Combine like terms and write in standard form  $4 + 6i$

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**Practice:**

1.  $(3 - 5i) + (4 + 2i)$

2.  $(7 + 12i) + (-5 - 7i)$

3.  $(-5 + 10i) + (-7 + 13i)$

4.  $(-7 + 13i) - (4 + 2i)$

5.  $(7 + 12i) - (-7 + 13i)$

6.  $(3 - 5i) - (-5 - 7i)$

**Multiplying Complex Numbers**

Multiplying complex numbers is just like multiplying polynomials. Distribute each term of the first complex number to each term of the second complex number. Keep in mind the powers of  $i$ . Combine like terms and write the answer in standard form.

Example 3:

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

First distribute 7 to the second parenthesis

$$7(3) + 7(-2i) = 21 - 14i$$

2<sup>nd</sup> Distribute  $4i$  to the second parenthesis

$$(4i)(3) + (4i)(-2i) = 12i - 8i^2$$

Combine like terms

$$= 21 - 2i - 8i^2$$

Remember powers of  $i$

replace ( $i^2 = -1$ )

$$= 21 - 2i - 8(-1)$$

Simplify, combine like terms again and write in standard form

$$= 21 - 2i + 8 = 29 - 2i$$

**Practice:**

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

8.  $(3 - 5i)(-5 - 7i)$

9.  $(-5 - 7i)(4 + 2i)$