CCSS Advanced Algebra 4 Operations with Complex Numbers Name _____

1. Use an area model to show that the function $g(x) = (x - 2 - i)(x - 2 + i)$ is equivalent to $g(x) = x^2 - 4x + 5$ in Standard Form.

2. *Addition and Subtraction of Complex Numbers (think like terms…)*
Simplify each sum or difference to the form $a + bi$.
   a. $(3 + i) + (2i - 1)$ b. $(3i - 4) - (5 - 2i)$ c. $(i^2 + 2i + 1) - (3i - 5)$

3. *Complex Equations*. Check your answers.
   a. Solve $w + (6 + i) = 3$ for w b. Solve $3w - 2i = w + 4i - 6$ for w

4. Two Complex Numbers are called **Conjugates** if they are in the form $a + bi$ and $a - bi$.
   a. Which of the following pairs of complex numbers are conjugates? Select all that apply.

$3 + 2i \text{ and } -3 + 2i$ $3 + 2i \text{ and } -3 - 2i$ $i \text{ and } -i$ $3 + 2i \text{ and } 3 - 2i$

   b. What happens when you add conjugates? In other words, what is $(a + bi) + (a - bi)$?

   c. What happens when you subtract conjugates? In other words, what is $(a + bi) - (a - bi)$?

4. *Multiplication of Complex Numbers*:
Use an Area Model to complete each product. Write the answer in the form $a + bi$.
   a. $(3 + i)(2i - 1)$ b. $(3i - 4)(5 - 2i)$ c. $i(2i - 5)$

   d. $(-i + 5)(-i - 5)$ e. $(4 + 2i)(4 - 2i)$

5. Given your answer to parts (d) and (e), what is the product of Conjugate Complex Numbers? In other words, what is $(a+bi)(a-bi)$ for any values of a and b?

6. a. Find the roots of $f(x) = 4x^2 + 9$ and show they are Conjugate Complex Numbers.

b. Find the roots of $g(x) = x^2 + 2x + 3$ and show they are Conjugate Complex Numbers.

c. Use the Quadratic Formula to explain why the complex roots of $y = ax^2 + bx + c$ must be conjugates.

7. A polynomial has roots $x = 1,\ x = 2,\ x = 4 - i \text{ and } x = 4 + i$. Write the polynomial in Standard Form.

8. Challenge: Solve $w(1-i) = 5 - i$ Solve for w.

9. Practice Rational Expressions:

Simplify each of the following:

a. $\frac{2x^2}{x+1} - \frac{2}{x+1}$

b. $\frac{3}{x-2} + \frac{1}{x+3}$

c. $\frac{4}{(x-2)(x+2)} - \frac{1}{x-2}$

d. $\frac{5}{x} + \frac{x}{x^2+x}$

e. $\frac{(x-3)(x+4)}{(x-1)^2} \cdot \frac{(x-1)}{(x-3)(x-4)^2}$

f. $\frac{x^2+2x+1}{x^2-25} \cdot \frac{x^2-6x+5}{x^2-1}$