Topic List

- Complex Numbers **(#2-10)**
  - (3F) Real vs Imaginary parts
  - (3F) Modulus (Notation |z| and using Pythagorean Theorem to determine distance from (0,0))
- Operations with Complex Numbers **(#2-5,8,10)**
  - (3F) Addition and subtraction (Like terms, real and imaginary)
  - (3G) Multiplication (Simplifying with powers of i)
  - (3G) Division (Complex conjugates)
  - (3G) Solving for the complex number z (using add, subt, mult, and div)
- Higher Powers of i and Complex Roots **(#6-8,10)**
  - (3H) Patterns with powers of i repeating every 4 powers ($i^0 = 1$, $i^1 = i$, $i^2 = -1$, $i^3 = -i$)
  - (3H) Complex Roots (using $a^2 - b^2$ = Real and $2ab$ = Imaginary)
- Synthetic Division and Polynomial Roots (Both real and complex) **(#1,5)**
  - (3J and 3K) Real Roots and Rational Root Theorem (**3K #5,6 are important!)**
  - (3L) Complex Roots and Conjugate Root Theorem (Complex roots exist in conjugate pairs)
- Systems of Equations **(#9)**
  - (3R) Solving 3 Variable Systems

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1. (a) Show that $p = 2$ is a solution to the equation $p^3 + p^2 - 5p - 2 = 0$.

(b) Find the values of a and b such that $p^3 + p^2 - 5p - 2 = (p - 2)(p^2 + ap + b)$.

(c) Hence find the other two roots to the equation $p^3 + p^2 - 5p - 2 = 0$.

2. Find the values of a and b, where a and b are real, given that $(a + bi)(2 - \mathrm{i}) = 5 - i$.

3. Given $(5+zi)(2-i)=2z+8i$, find the value of z in the form $a + bi$.

4. Given that $(a + i)(2 - bi) = 7 - i$, find the value of a and of b, where $a, b \in \mathbb{Z}$.

5. Given that $2 + i$ is a root of the equation $x^3 - 6x^2 + 13x - 10 = 0$ find the other two roots.

6. Find the two square roots of $6-8i$.

7. Find the two square roots of $5+12i$.

8. Expand $(2-3i)^4$, expressing your answer in the form $a+bi$.

9. Solve the following 3 variable systems.

(a) $2x - 3y + z = 10$
$5x + 2y + 2z = 15$
$x + 4y - 2z = -3$

(b) $2x + 14y + 9z = -7$
$4x - 7y - 3z = 4$
$10x - 28y - 6z = 5$

10. Evaluate the following expressions.

(a) $3(4 - 7i) \cdot (3 - i)$

(b) $\dfrac{(1 + 2i)^2}{5 - 2i}$

(c) $(1 - i)^{20}$