

Core Content

Cluster Title: Use complex numbers in polynomial identities and equations.
Standard N.CN.8: Extend polynomial identities to the complex numbers. <i>For example, rewrite $x^2 + 4$ as $(x+2i)(x-2i)$.</i>
Concepts and Skills to Master
<ul style="list-style-type: none"> Use polynomial identities to rewrite polynomial expressions using complex numbers. Factor polynomial expressions over the set of complex numbers.

Supports for Teachers

Critical Background Knowledge	
<ul style="list-style-type: none"> The meaning and form of complex numbers (II.N.CN.1) Adding, subtracting, and multiplying complex numbers (II.N.CN.2) Solving quadratic equations and understand the nature of the roots (II.N.CN.7) 	
Academic Vocabulary	
i , complex number, imaginary, root, zero, factor, coefficient, conjugate pair	
Suggested Instructional Strategies	Resources
<ul style="list-style-type: none"> Build on work with quadratic equations from Secondary Mathematics II. Use technology to illustrate the relationship of non-real roots to the graph of a polynomial. 	
Sample Formative Assessment Tasks	
Skill-Based Task: Determine linear factors of $x^3 - 8$ over the complex number system.	Problem Task: Assume that $1+i$ is a zero of the polynomial f with real coefficients. Justify that $X^2 - 2x + 2$ is a factor.

Core Content

Cluster Title: Use complex numbers in polynomial identities and equations.
Standard N.CN.9: Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
Concepts and Skills to Master
<ul style="list-style-type: none"> • Show that polynomials with degree n have at most n roots over the real number system. • Show that polynomials with degree n have exactly n roots over the complex number system.

Supports for Teachers

Critical Background Knowledge	
<ul style="list-style-type: none"> • Meaning and form of complex numbers (II.N.CN.1) • Adding, subtracting, and multiplying complex numbers (II.N.CN.2) 	
Academic Vocabulary	
degree, i , complex numbers, imaginary, root, zero, factor, coefficient, conjugate	
Suggested Instructional Strategies	Resources
<ul style="list-style-type: none"> • Graph polynomial functions and pose the question, “What is the maximum number of times this polynomial can cross the axis?” • Using a polynomial function of degree n that appears to have fewer than n roots, have students explain where the other roots are. 	
Sample Formative Assessment Tasks	
<p>Skill-Based Task: Use the Fundamental Theorem of Algebra to help identify the roots of the polynomials:</p> $x^3 - 2x^2 + 4x - 8$ $x^3 + x^2 - x - 1$ $x^4 + x^3 - 4x^2 - 4x$	<p>Problem Task: Sketch a polynomial function of degree 5 with the following characteristics:</p> <ul style="list-style-type: none"> • One real root • Three real roots • Five real roots <p>Why can the polynomial function of degree 5 not have exactly two distinct roots?</p>