MATH MCS MYP UNIT PLANNER

Teacher(s)	**Echo Fritch**	**Subject group and discipline**	**Accelerated Geo B / Algebra 2**		
Unit title	**Polynomials (DOE Units 5 and 6)**	**MYP year**	**5**	**Unit duration (hrs)**	**26 Hours (7 Weeks)**

Inquiry: Establishing the purpose of the unit

Key concept	**Related concept(s)**	**Global context**
Relationships	Generalization; Model	Scientific & Technical Innovation

Statement of inquiry

Models are used to identify and solve relationships within problems.

Inquiry questions

Factual—

- How do we add, subtract, multiply, and divide polynomials?
- How can we solve polynomial equations?
- In which operations does closure apply?
- What is the Remainder Theorem and what does it tell us?
- How can we write a polynomial in factored form?
- How can we write a polynomial in standard form?
- Which sets of numbers can be solutions to polynomial equations?

Conceptual—

- What is the relationship between zeros and factors?
- How can we apply Pascal's Triangle to expand $(x+y)^n$?
- What is the Rational Root Theorem and what does it tell us?
- What is the Fundamental Theorem Algebra and what does it tell us?
- What characteristics of polynomial functions can be seen on their graphs?

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Debatable—

- How can we solve a system of a linear equation with a polynomial equation?
- What is the purpose of Pascal's triangle and how is it useful to us?

MYP Objectives	**Assessments**
2 MYP Quizzes: Rubric B: Patterns (Pascal's triangle and Binomial Theorem) Rubric C: Communicating (Comparing 2 Polynomial Functions) Rubric D: Applying mathematics in real life (Rational Exponents)	Common Formative Assessment – 3 Quizzes, 3 MYP Quizzes (Rubrics B, C, D) - MYP B (Binomial Theorem and Pascal's Triangle) - Quiz – Operations with polynomials, rational exponents, and binomial theorem - MYP C – Characteristics of Polynomials - MYP D – Rational Exponents Common Summative Assessment – Unit 5 Test, Cumulative Unit 5 & 6 Test - Unit 5 Test – Operations with polynomials, Finding Zeros of polynomials, rational exponents - Unit 5 & 6 Test – include transformations, characteristics, and polynomial inequalities Students will use their knowledge of models and relationships to graph and solve problems involving polynomials.

Approaches to learning (ATL)

Throughout the duration of Units 5 and 6, we will utilize the following approaches to learning:

- Communication Skills – use a variety of speaking techniques to communicate, interpret models, negotiate ideas with peers and teacher
- Collaboration Skills – work in teams to help others succeed, give and receive meaningful feedback, encourage others to contribute to group discussion

Action: Teaching and learning through inquiry

Content Standards

<u>Perform arithmetic operations on polynomials</u>

MGSE9-12.A.APR.1 Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.

<u>Understand the relationship between zeros and factors of polynomials</u>

MGSE9-12.A.APR.2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

MGSE9-12.A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

<u>Use polynomial identities to solve problems</u>

MGSE9-12.A.APR.4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*

MGSE9-12.A.APR.5 Know and apply that the Binomial Theorem gives the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined using Pascal's Triangle.

<u>Rewrite rational expressions</u>

MGSE9-12.A.APR.6 Rewrite simple rational expressions in different forms using inspection, long division, or a computer algebra system; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x).

Build a function that models a relationship between two quantities
MGSE9-12.F.BF.1 Write a function that describes a relationship between two quantities.
MGSE9-12.F.BF.1b Combine standard function types using arithmetic operations in contextual situations (Adding, subtracting, and multiplying functions of different types).
MGSE9-12.F.BF.1c Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

Use complex numbers in polynomial identities and equations.
MGSE9-12.N.CN.9 Use the Fundamental Theorem of Algebra to find all roots of a polynomial equation.

Interpret the structure of expressions
MGSE9-12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.
MGSE9-12.A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients, in context.
MGSE9-12.A.SSE.1b Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.
MGSE9-12.A.SSE.2 Use the structure of an expression to rewrite it in different equivalent forms. For example, see $x^4 – y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.

Interpret functions that arise in applications in terms of the context
MGSE9-12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. *(Limit to polynomial functions.)*

Analyze functions using different representations
MGSE9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. *(Limit to polynomial functions.)*
MGSE9-12.F.IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

Extend the properties of exponents to rational exponents. Moved to Unit 5 with Polynomials
MGSE9-12.N.RN.1. Explain how the meaning of rational exponents follows from extending the properties of integer exponents to rational numbers, allowing for a notation for radicals in terms of rational exponents. For example, we define 5(1/3) to be the cube root of 5 because we want [5(1/3)]3 = 5[(1/3) x 3] to hold, so [5(1/3)]3 must equal 5.
MGSE9-12.N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Write expressions in equivalent forms to solve problems
MGSE9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, simple rational, and exponential functions (integer inputs only).
MGSE9-12.A.CED.2 Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase “in two or more variables” refers to formulas like the compound interest formula, in which A = P(1 + r/n)nt has multiple variables.)
MGSE9-12.A.CED.3 Represent constraints by equations or inequalities, and by systems of equation and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.

Build new functions from existing functions – Will be done with DOE Unit 8 Exponential and Logarithmic Relationships

MGSE9-12.F.BF.4 Find inverse functions.
MGSE9-12.F.BF.4a Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2(x^3) or f(x) = (x+1)/(x-1) for x ≠ 1.
MGSE9-12.F.BF.4b Verify by composition that one function is the inverse of another.
MGSE9-12.F.BF.4c Read values of an inverse function from a graph or a table, given that the function has an inverse.

Learning Activities and Experiences

Topic	Resource	Content Covered	Standards Addressed
Subunit – Test 1 7 Days MYP B (Binomial Theorem & Pascals Triangle) & Quiz over operations, binomial theorem, and rational exponents Common Unit Assessment			
Rational Exponents	**5-1 *n*th Roots, Radicals, and Rational Exponents** **Pearson enVision pg. 239 – 246**	● Find all real *n*th roots of a number ● Evaluate expressions with rational exponents ● Use *n*th roots to solve equations by rewriting expressions using the properties of exponents.	MGSE9-12.N.RN.1 MGSE9-12.N.RN.2
	5-2 Properties of Exponents and Radicals **Pearson enVision pg. 247 - 254**	● Use the properties of exponents and radicals to identify way to rewrite radical expressions. ● Interpret radical expressions that represent a quantity in terms of its context.	MGSE9-12.N.RN.2
Operations on Polynomials	**3-2 Adding, Subtracting, and Multiplying Polynomials** **Pearson enVision pg. 139 - 145**	● Add, subtract, and multiply polynomials and understand that polynomials are closed under these operations ● Compare a polynomial function represented algebraically with one represented graphically.	MGSE9-12.A.APR.1 MGSE9-12.F.BF.1
	5-5 Function Operations **Pearson enVision pg. 273 - 280**	● Combine functions by addition, subtraction, multiplication or division, and identify the domain of the result. ● Compose functions, specifying the order in which the functions are applied and describing the domain of the composition.	MGSE9-12.A.APR.1 MGSE9-12.A.APR.6 MGSE9-12.F.BF.1b MGSE9-12.F.BF.1c
	3-4 Dividing Polynomials **Pearson enVision pg. 154 - 161**	● Divide polynomial expressions using long division. ● Use synthetic division to rewrite rational expressions.	MGSE9-12.A.APR.6
	Additional Resources: ● DOE Framework Tasks: o Sum of Functions o Combining and Describing Functions o Cardboard Box o Divide or Conquer ● Teacher Created Materials		

Identities & Binomial Theorem	**3-3 Polynomial Identities** **Pearson enVision pg. 146 - 153**	• Prove polynomial identities and use them to multiply and factor polynomials. • Expand binomials using the Binomial Theorem and coefficients determined by Pascal's Triangle.	MGSE9-12.A.APR.4 MGSE9-12.A.APR.5 MGSE9-12.F.IF.8
	Additional Resources: • DOE Framework Task - What's Your Identity • Teacher Created Materials		
Subunit – Test 2 6 Days MYP C (characteristics of polynomials) & MYP D (rational exponents) Common Unit Assessment			
Characteristics of / Graphing Polynomials	**3-1 Graphing Polynomial Functions** **Pearson enVision pg. 131 – 138**	• Graph polynomial functions and show key features of the graph. • Predict the end behaviour of polynomial functions by interpreting the leading coefficients and degrees. • Sketch graphs showing key features, given a verbal description.	MGSE9-12.A.SSE.1 MGSE9-12.A.SSE.1a MGSE9-12.A.SSE.1b MGSE9-12.F.IF.4 MGSE9-12.F.IF.7 MGSE9-12.F.IF.7c
	3-7 Transformations of Polynomial Functions **Pearson enVision pg. 179 – 186**	• Recognize even and odd functions from their graphs and algebraic equations. • Identify the effect on the graphs of cubic and quartic functions of replacing $f(x)$, with $f(x) + k$, $kf(x)$, and $f(x + k)$.	MGSE9-12.F.IF.4 MGSE9-12.F.IF.7 MGSE9-12.F.IF.7c
	Additional Resources: • DOE Framework Tasks o Polynomial Patterns Task o Polynomial Potpourri o Representing Polynomials		
Solving Polynomial Functions	**3-5 Zeros of Polynomial Functions** **Pearson enVision pg. 162 – 169**	• Identify the zeros of a function by factoring or using synthetic division. • Use the zeros of a polynomial function to sketch its graph.	MGSE9-12.N.CN.9 MGSE9-12.A.APR.2 MGSE9-12.A.APR.3 MGSE9-12.F.IF.7c
	3-Act Task What are the Rules **Pearson enVision pg. 170**		
	3-6 Theorems about Roots of Polynomial Equations **Pearson enVision pg. 171 – 178**	• Extend polynomial theorems and identities to find the real and complex solutions of polynomial equations. • Write polynomial functions using conjugates.	MGSE9-12.N.CN.9 MGSE9-12.A.APR.2 MGSE9-12.F.IF.7c MGSE9-12.A.SSE.2
	Additional Resources: • DOE Framework Tasks		

	o Factors, Zero, Roots Oh My! o Polynomial Project Culminating Task

Personalized Learning and Differentiation

Teachers differentiate by providing examples (work samples or task-specific clarifications of assessment criteria); structuring support (advance organizers, flexible grouping, peer relationships); establishing flexible deadlines, and adjusting the pace.

-SWD/504- Accommodations provided
-ELL- Five Principle ELL Curriculum Framework and Vocabulary Supports
-Intervention Support- Re-teaching Activities in Small Groups with Progress Monitoring
-Extensions- Enrichment Tasks and Projects

Resources

DOE Framework Tasks

Pearson enVision Textbook and Pearson Realize Online Materials