Course: *Algebra II Data Science* **Unit #:** *Unit 2 - Polynomial Functions*	**Year of Implementation:** 2024-2025

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
https://www.state.nj.us/education/cccs/2020/

- **Unit Standards:**
  - ***Content Standards***
    - The Complex Number System N -CN: C. 7-9
      - Use complex numbers in polynomial identities and equations.
    - Seeing Structure in Expressions A-SSE: C. 1; B. 3
      - Interpret the structure of expressions
    - Creating Equations A -CED: A. 2
      - Create equations that describe numbers or relationships
    - Arithmetic with Polynomials and Rational Expressions A -APR: A. 1, B. 2-3, C. 4, D. 6
      - Perform arithmetic operations on polynomials, and understand the relationship between zeros and factors of polynomials
    - Interpreting Functions F-IF: B. 4-6, C. 7-8
      - Interpret functions that arise in applications in terms of the context

21st Century Life & Career Standards

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
  https://www.state.nj.us/education/cccs/2020/2020%20NJSLS-CLKS.pdf
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Interdisciplinary Content Standards

SL.11-12.1. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
SL.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
L.11-12.6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

NJ Statutes: NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on

diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***https://www.nj.gov/education/amistad/about/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***
  A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to predict behaviors based on patterns.

As aligned with LRHSD Long Term Learning Goal(s):https://www.lrhsd.org/Page/6163

Patterns: analyze data and recognize patterns in a variety of situations

Enduring Understandings	*Essential Questions*
Students will understand that. . . *EU 1* the characteristics of polynomials and their representations can be examined depending on what information is sought. *EU 2*	• How can the correlation between the graphical and algebraic representations of a polynomial function be communicated? • How can you use the relationships between models to predict real world situations?

factors, solutions, and zeros of a polynomial function are related.	
<u>Knowledge</u> *Students will know . . .* *EU 1* ● the leading coefficient dictates the end behavior of a polynomial function. (A-SSE A1, F-IF B4, C7c) ● the maximum number of real zeros of a function coincide with its degree and are the x-intercepts of its graph. (A -APR B, F-IF B4, C7c) ● imaginary zeros are not indicated on the graph of a polynomial function. (N -CN C, F-IF B4, C7c) ● the solutions to a polynomial function represent the x-intercept. (A -APR B, F-IF B4, C7c) ● verbal models can be translated into an algebraic model. (A -CED 2, F-IF B4,5, C7c) *EU 2* ● polynomial equations can be translated from standard form to factored form and factored form to standard form in a polynomial equation. (N -CN C, A-SSE B, A -APR B) ● how to solve various polynomial equations by factoring. (N -CN C, A-SSE B, A -APR B, C4, F-IF C8a) ● how to recognize the relationship between a zero and a factor. (A -APR B, F-IF B4, C7c)	*<u>Skills</u>* *Students will be able to. . .* *EU 1* ● add, subtract, multiply, evaluate, simplify, compose, and (synthetic) divide polynomial functions. (A -APR A1, B2, D6) ● sketch a function's end behavior using the leading coefficient test. (A-SSE A1, F-IF B4, C7c) ● give a precise graph using zeros and end behavior. (F-IF B4, C) ● identify the number of real and imaginary zeros based off the degree and the graph of a polynomial function. (A -APR B, N -CN C, F-IF B4, C7c) ● recognize the relationship between the zeros of a function and the x-intercepts of a graph. (A -APR B, F-IF B4, C7c) ● model real life situations with algebraic functions(differentiate between significant and extraneous information in a given situation and distinguish between linear, quadratic, and polynomial models for a given situation). (A -CED 2, F-IF B4,5, C7c) *EU 2* ● factor a polynomial function. (N -CN C, A-SSE B, A -APR B, C4, F-IF C8a) ● solve a polynomial function to find the zeros (include: factor theorem, remainder theorem, synthetic division). (N -CN C, A-SSE B, A -APR B, D6) ● write a polynomial function of least degree given the zeros. (A-SSE , A -CED A2, F-IF 8a)

	• use the quadratic formula to find all solutions for the polynomial equation. (N -CN 7) • transform polynomial equations to expedite graphing and/or solving the polynomial equation. (A-SSE B3, A - APR B, C, D, F-IF 8a)

Stage Two - Assessment

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Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection*

- *Synthetic Division Ship Battling (A, EU 1)*
- *https://docs.google.com/document/d/1IURpf2vco905VnV3_AHWWl4kZ3FpbAHtCZTT3HqUDvQ/edit?usp=sharing*

- Desmos, Polynomial End Behavior (A, EU 1&2)
- https://teacher.desmos.com/activitybuilder/custom/63c9440073eb64692aa16385

- Desmos, Polynomial Equation Challenges (finding roots) (A, EU 1&2)
- https://teacher.desmos.com/activitybuilder/custom/561582ecbd554ea00760f933?collections=5e8daca7ba47980c870d2e02

- *Desmos Graphing Calculator Lab- Analyzing Polynomial Functions (A, M, EU 1 & 2)*
- *https://docs.google.com/document/d/1r7qGUJ2XZjPaLe_KWOo8WtgNC46c3dkfFibPioaX3SU/edit?usp=sharing*

- *Desmos, SAVVAS envisions "What are the Rules?" 3 Act Task (M, T, EU 1&2)*
- *https://teacher.desmos.com/activitybuilder/custom/6205428ab039da0a88467ad5?collections=5cd58a825a7de70cbb55328e*

- Desmos, Match My Polynomial (M, T, EU 1&2)
- https://teacher.desmos.com/activitybuilder/custom/63b6c6640b21eef767d46259

Suggested Sequence of Learning Activities:

- Polynomial function graph talk (M , EU1)
- perform operations on polynomials (+, -, x, evaluate) (A, EU1)
- perform synthetic division (A, EU1)
- *Synthetic Division Ship Battling, link above (A, EU 1)*
- Desmos, Polynomial End Behavior, link above (A, M, EU 1 & 2)
- *Desmos Graphing Calculator Lab- Analyzing Polynomial Functions, link above (A, M, EU 1 & 2)*
- factor and solve quadratic and cubic polynomials (A, EU2)
- apply the factor and remainder theorems to polynomials to find the zeros and/or factors (A,M, EU2)
- Desmos, Polynomial Equation Challenges (finding roots), link above (A, EU 1 & 2)
- use the rational root theorem to find all rational zeros of a polynomial (M, EU2)
- *Desmos, SAVVAS envisions "What are the Rules?" 3 Act Task, link above (M, T, EU 1 & 2)*
- find ALL zeros (real and imaginary) of a polynomial function (A)
- write a polynomial function of least degree given all zeros of the polynomial (M)
- sketch graphs of polynomial functions using end behavior, degree, multiplicities (real and imaginary solutions) (T)
- Desmos, Match My Polynomial, link above (M, T, EU 1 & 2).

Pacing Guide

{This chart will be identical in all of the units for this course.}

Unit #	*Title of Unit*	*Approximate # of teaching days*
1	Quadratic Functions	30
2	Polynomial Functions	19
3	Exponential and Logarithmic Functions	19
4	What Does Data Tell Us?	17
5	Modeling and Analyzing Univariate Data	17
6	Modeling and Analyzing Bivariate Data	17
7	Probability & Simulations	16

Instructional Materials

- TInSpire Calculator
- DESMOS online graphing calculator and activities
- Khan Academy
- Kuta Infinite Software

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.
Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.
English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.
Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.
Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.