Course: *Algebra II Data Science* **Unit #:** Unit 1 - *Quadratic 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:
{provide all applicable links to standards here}
https://www.state.nj.us/education/cccs/2020/

- **Unit Standards:** *(keep each of the following headings in place)*
  - ***Content Standards***
    - The Complex Number System N -CN A.1-3, C. 7
      - Perform arithmetic operations with complex numbers.
      - Use complex numbers in polynomial identities and equations.
    - Seeing Structure in Expressions A-SSE A.1-2, B. 3
      - Interpret the structure of expressions
      - Write expressions in equivalent forms to solve problems
    - Arithmetic with Polynomials and Rational Expressions A -APR: B. 3
      - Understand the relationship between zeros and factors of polynomials
    - Creating Equations A -CED: A 2-3
      - Create equations that describe numbers or relationships
    - Reasoning with Equations and Inequalities A -REI: A. 1, B. 4, C. 7, D. 10-11
      - Understand solving equations as a process of reasoning and explain the reasoning
      - Solve quadratic equations in one variable.
      - Solve systems of equations consisting of a linear equation and a quadratic equation in two variables.
      - Represent and solve equations and inequalities graphically

- Interpreting Functions F-IF: A. 1-2, B. 4-5, C. 7-9
  - Understand the concept of a function and use function notation
  - Interpret functions that arise in applications in terms of the context
  - Analyze functions using different representations
- Building Functions F-BF: B. 3
  - Build new functions from existing functions

- ***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

- ***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 interpret different models to effectively communicate their reasonings.

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

Reasoning: Students will be able to reason abstractly and quantitatively by applying mathematical representations, symbols and estimation techniques when engaging in problem solving.

Structure: Students will be able to use multiple representations, critical thinking skills and prior knowledge to solve problems in new situations.

Enduring Understandings Students will understand that. . . _EU 1_ the symbolic language and critical vocabulary of Algebra and algebraic modeling are necessary to communicate, analyze, and generalize patterns and relationships in the real world. _EU 2_ symbolic statements can be manipulated to provide equivalent forms and to model real world phenomena.	_Essential Questions_ ● What real world phenomena can be modeled using quadratics? ● How is critical vocabulary utilized to communicate information provided in a quadratic function?
Knowledge Students will know . . . _EU 1_ ● absolute value and quadratic functions can be graphed,transformed and model real-world situations. (A-CED A2, F-IF C7a,b, 8a, 9, F-BF B3) ● every function has a domain and range expressed in mathematical notation. (F-IF A1,2, B4,5) ● the critical points of a function's graph provide information about real world phenomena. (F-IF C7a,b, 8a, 9) ● the meaning of a complex number. (N-CN A1)	_Skills_ Students will be able to. . . _EU 1_ ● write the domain and range in interval notation of any function from its graph. (F-IF A1,2, B4,5) ● graph an absolute value function. (F-IF C7b) ● graph a quadratic function. (A-APR B3, A-CED A2, F-IF C7a, 8a, 9) ● describe how changing the key characteristics of the function transform the parent function. (F-BF B3) ● simplify radical expressions (real and imaginary). (N-CN A1)

- complex numbers should be simplified using order of operations. (N-CN A2) - complex zeros come in conjugate pairs. (N-CN A3, C8) - the solutions to a system represent shared points. (A-CED A3, A-REI C7, D10,11) *EU 2* - quadratic functions can be written and solved in various forms to provide different characteristics of the graph. (A-SSE A1a,2, B3a,b, A-APR B3, A-REI A1, B4a,b) - quadratic functions can provide real and complex solutions. (N-CN C7,C9)	- add, subtract, and multiply complex numbers. (N-CN A1,2) - solve a system of quadratic and linear equations graphically. (A-CED A3, A-REI C7, D10,11) - demonstrate the correct usage and application of critical vocabulary. (N-CN A1, A-SSE A1a, F-IF A1,2, B4,5, F-IF C7a,b, 8a, 9) *EU 2* - change forms and find all zeros (real and complex) of a quadratic function by graphing, factoring,taking square roots, using the quadratic formula, and using graphing technology. (N-CN C7, A-SSE A1a,2 B3a,b, A-REI A1, B4a,b, F-IF 8a) - translate and solve quadratic functions to model real-world phenomena. (A-CED A2) - recognize the relationship of the roots of a quadratic function to the x-intercepts of the graph. (N-CN C9, A-APR B3, F-IF 8a)

Stage Two - Assessment

Stage Three - Instruction

<u>*Learning Plan:*</u> **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*

- *Desmos Activity, Finding Domain & Range from a Graph (A, M, T, EU 1)*
  https://teacher.desmos.com/activitybuilder/custom/56e8442cc2a23ba41da1c7d9?collections=5e8daca7ba47980c870d2e02

- *3-Act Task - Will it Hit the Hoop (A, M, EU 1)*
  https://blog.mrmeyer.com/2016/updated-will-it-hit-the-hoop/

- *Desmos Activity, Imaginary Numbers (A, EU 1)*
  https://teacher.desmos.com/activitybuilder/custom/60ba38f3aba06408a548b273

- *Desmos Activity, Transformation of Quadratic Functions (A, M, EU 1 & 2)*
  https://teacher.desmos.com/activitybuilder/custom/5c7614041509d870d4838bfd

  - *Catapult Activity (M, T, EU 1 & 2)*
    https://docs.google.com/document/d/1OpXDzJCtjWI_gnQ7YUyIvnJh3BBOXRvTbzy_fv5ubmw/edit?usp=sharing
  - *https://docs.google.com/document/d/1P58y1iIlRllCoyLx9JMGkuO0PG19OBHS/edit?usp=sharing&ouid=116556149573535627307&rtpof=true&sd=true*

Suggested Sequence of Learning Activities:
- Quadratic function graph talk (M, EU1, EU2)
- Critical Vocabulary, see below (A, EU 1)
- Domain and Range Activity, linked above *(A, M, T, EU 1)*
- *Will it Hit the Hoop, link above (A, M, EU 1)*
- graph absolute value functions from vertex form (A, EU 1)
- graph quadratic functions from vertex form (A, EU1)
- graph quadratic functions from standard form (A, EU 1)
- determine how changing a quadratic equation affects a real-world problem (M, T, EU2)
- solve quadratic equations by factoring and write the solutions as zeros (x,0) (A, M, EU2)
- graph quadratic functions from intercept form (T, EU1, EU2)

Commented [1]: I can't seem to find the Critical Vocabulary. Do we want to add below or remove this altogether?

Commented [2]: We must've missed it when copying from the Alg 2 Functions group. I just added it.

- *Imaginary Numbers Introduction, link above (A, EU 1)*
- solve for real and imaginary solutions by square roots (A, EU2)
- solve by square root (A, EU2)
- solve and find the zeros using the quadratic formula & the discriminant (A, EU2)
- *Super Mario: Transformation of Quadratic Functions, linked above (A, M, EU 1 & 2)*
- solve a system of linear and quadratic equations (A, EU2)
- graph quadratic inequalities, solve a system of quadratic and linear inequalities (A, EU2)
- *Catapult Activity, linked above (M, T, EU 1 & 2)*

Critical Vocabulary:

Axis of symmetry	Binomial	Coefficient	Complete the Square	Complex Number
Critical Point	Degree	Discriminant	Domain, Range	Factor Completely
Intercept Form	Imaginary	Maximum, Minimum	Monomial	Parabola
Parent Quadratic Function	Perfect Square	Polynomial	Quadratic Equation	Quadratic Formula
Quadratic Function	Roots, Solutions	Standard Form	Trinomial	Vertex
Vertex Form	X-Intercept	Y-Intercept	Zeros	

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 and 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.