Algebra 2 and Data Science Cover Page

Content Area: **Mathematics**
Course(s): Algebra 2 and Data Science
Time Period:
Length: **180-184 days**
Status: **Published**

Course Overview: Objectives, benchmarking and screening plan

This course integrates core Algebra 2 concepts with foundational data science skills to prepare students for the analytical demands of the modern world. Students will explore topics such as quadratic functions and polynomial functions, while simultaneously learning how to collect, analyze, and interpret real-world data.

Through hands-on projects and technology-based tools, students will apply algebraic reasoning to datasets, develop data visualizations, and use statistical methods to draw meaningful conclusions. Emphasis is placed on problem-solving, critical thinking, and ethical use of data. This course is ideal for students interested in STEM fields, business, social sciences, or any discipline where data-driven decision-making is essential.

Key Topics:

- Quadratic Functions
- Polynomial Equations and Operations
- Data Literacy and Interpretation
- Real-World Applications in Business, Science, Economics, and Social Issues

Key Themes and Focus Areas:

- Quadratic Functions and Equations: Students will review and extend their knowledge of quadratic functions, including vertex form, standard form, and factored form. Quadratics will serve as a tool for understanding curved trends in data.
- Polynomials: Students will explore in-depth operations with polynomials, including factoring, graphing, end behavior, and roots, and solving polynomial equations. The fundamental theorem of algebra will be introduced, along with its implications for finding roots of polynomials. Students will understand polynomials as flexible models for complex patterns, balanced with an understanding of model limitations.
- Data Tells The Story will focus on data literacy and interpretation. Core skills include reading, representing and interpreting data in tables, graphs and summaries. Students will learn to think like data analysts and that data isn't just numbers but it's evidence that answers questions and uncovers patterns.
- Data Analytics, Modeling and Real-World Applications: Students will learn that mathematics becomes a tool for solving meaningful, real-world problems and making data-driven decisions.

Course Name, Length, Date of Revision and Curriculum Writer

Course Name: Algebra 2 / Data Science

Length: Full Year

Date of Revision: September 1, 2025

Curriculum Writers: Valarmathi Jayaraman & Chantel Robinson

Table of Contents

Unit 1: Quadratic Functions

Content Area: **Mathematics**
Course(s): **Algebra 2**
Time Period: **1st Marking Period**
Length: **40-45 days**
Status: **Awaiting Review**

Summary of the Unit

This unit delves into the foundations of quadratic functions. It begins with an exploration of the parent function and transformations, emphasizing how changes in parameters affect the graph's shape, position, and orientation.

Students discover the characteristics of parabolas, including vertex, axis of symmetry, and direction of opening. They explore transformations of quadratic functions and learn how to identify the focus of a parabola. Additionally, students apply quadratic functions to model real-world phenomena.

The unit also covers solving quadratic equations using a variety of techniques, including factoring, completing the square, and the quadratic formula.

Finally, students investigate nonlinear systems and quadratic inequalities, utilizing their knowledge of quadratic functions and equations to solve these more complex problems.

Enduring Understandings

- Different Forms, Different Insights: A quadratic function can be expressed in various equivalent forms (standard form: $ax2+bx+c$, vertex form: $a(x−h)2+k$, and factored form: $a(x−p)(x−q)$). Each form reveals different, key characteristics of the function, such as the y-intercept, the vertex (maximum or minimum point), and the x-intercepts (roots or zeros).

- Connecting Representations: The algebraic representation of a quadratic function, its graphical representation as a parabola, and the numerical data in a table are all interconnected. Understanding how to transition between these representations is crucial for solving problems. For example, the x-intercepts on the graph correspond to the zeros found by solving the equation.

- Multiple Solution Methods: There are several strategies to solve a quadratic equation, including factoring, completing the square, using the quadratic formula, and graphing. The most efficient method depends on the specific equation and the information needed.

- Real-World Applications: Quadratic functions model phenomena that involve a maximum or minimum value, such as the trajectory of a launched object, the path of a parabolic antenna, or the optimization of business profit.

- The Nature of Solutions: A quadratic equation can have two real solutions, one real solution, or two complex solutions. The discriminant, $b2−4ac$, provides insight into the nature and number of solutions without actually solving the equation.

Essential Questions

- How are quadratic functions different from other functions? This question gets students to compare and contrast quadratic functions with linear, exponential, and other function types they may already know.

- What are the key features of a quadratic function and how do they relate to real-world applications? This question prompts students to identify and understand the significance of the vertex, axis of symmetry, and intercepts in practical contexts.

- What are the different forms of a quadratic function and why might you choose one form over another? This question encourages students to see the value in standard, vertex, and factored forms and to understand what information each form reveals about the function.

- How many solutions can a quadratic equation have and what do these solutions mean in a real-world context? This question focuses on the number and nature of roots and connects the algebraic solution to the graphical representation and a practical scenario.

- What methods can be used to solve a quadratic equation and when is one method more efficient than another? This question encourages a deeper understanding of factoring, the quadratic formula, and completing the square, helping students develop a strategic approach to problem-solving.

Unit Summative Assessment and Alternate Assessment Options

The summative assessment for this unit will consist of two parts:

- Individual Assessment:
    - A written test covering a range of question types (multiple-choice, short answer, problem-solving) assessing students' understanding of the enduring understandings outlined above.
    - Questions will require students to:
        - Identify and graph parent functions
        - Perform transformations on functions given equations or graphs
        - Solve linear and quadratic equations and systems
        - Interpret and analyze real-world scenarios using linear and quadratic models
        - Identify key characteristics of quadratic functions
        - Solve quadratic inequalities
        - Perform operations with complex numbers
        - Solve nonlinear systems

- Performance Task:
    - A real-world problem-solving task where students will apply their knowledge of functions and transformations to model and analyze a given situation.

- Students will be assessed on their ability to:
  - Choose appropriate functions to model the problem
  - Apply transformations to the functions as needed
  - Solve relevant equations or inequalities
  - Interpret their solutions in the context of the problem
  - Communicate their findings effectively

Resources

Internet4Classrooms www.internet4classrooms.com

Desmos https://www.desmos.com/

Math Open Reference www.mathopenref.com

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/index.html

Georgia Department of Education https://www.georgiastandards.org/Georgia-Standards/Pages/Math-9-12.aspx

Illustrative Mathematics www.illustrativemathematics.org/

Khan Academy https://www.khanacademy.org/math/algebra-home/algebra2

Math Planet http://www.mathplanet.com/education/algebra-2

IXL Learning https://www.ixl.com/math/algebra-2

Math Is Fun Advanced http://www.mathsisfun.com/algebra/index-2.html

Cambium Assessment Portal: https://nj.portal.cambiumast.com/families.html

Mathematics Assessment Project http://map.mathshell.org/materials/lessons.php?gradeid=24

Achieve the Core http://www.achieve.org/ccss-cte-classroom-tasks

NYLearns http://www.nylearns.org/module/Standards/Tools/Browse?linkStandardId=0&standardId=97817

Learning Progression Framework K-12 http://www.nciea.org/publications/Math_LPF_KH11.pdf

PARCC Mathematics Evidence Tables. https://parcc-assessment.org/mathematics/

Unit Plan

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmark / Assessments
1-1 Transformations of Quadratic Functions.	Transformations of Quadratic Functions.	Describe transformations of quadratic functions. Write transformations of quadratic functions. Model how the function notation of transformations correlates to changes in the values and graph of a function. Provide students with a reference document that verbally and pictorially illustrates a function's features and how they are changed due to transformation.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.
1-2 Characteristics of Quadratic Functions.	Characteristics of Quadratic Functions.	Explore properties of parabolas. Find maximum and minimum values of quadratic functions—graph quadratic functions using x-intercepts. Solve real-life problems. Students should be able to state the vertex in addition to describing the symmetry.	Check student understanding via oral participation. Check student work and graphs. Check for correct use of graphing calculator. Classwork assigned. Homework assigned
1-3 Focus of a Parabola.	Focus of a Parabola.	Explore the focus and the directrix of a parabola. Write equations of parabolas. Solve real-life problems. Pre-teach vocabulary using visual and verbal models that are connected to real-life situations and ensure that students include these definitions in their reference notebooks. Model how to derive the equation of a circle given the center and radius using the Pythagorean Theorem. Ensure that students include this information in their reference notebook. Model how to use the equation of a circle to determine the radius and center. Provide students with hands-on opportunities to explore and extend their understanding by working in small groups, see the application to real life.	Check student understanding via oral participation. Check student work and graphs. Classwork assigned. Homework assigned.
2-4 Modeling with Quadratic Functions	Modeling with Quadratic Functions	Write equations of quadratic functions using vertices, points, and x-intercepts. Write quadratic equations to model data sets. Students should be familiar with	Check student understanding via oral participation. Check student work and graphs. Classwork assigned.

		identifying a linear function from a table of values where the constant rate of change was found in the first differences. Introduce the idea that when second differences are equal, the data is quadratic. Model the thinking behind determining when and how to use the graphing calculator to graph complicated polynomials.	Homework assigned.
2-1 Solving Quadratic Equations	Solving Quadratic Equations	The goal is for students to use their understanding of the standard form of a quadratic equation to match the equations and graphs. Expect students to look at the leading coefficient to determine whether the graph opens upward or downward. Students should also look at the constant term to determine the y-intercept. Students should make the connection between an x-intercept and the value of a function being 0 and, therefore, the solution to the quadratic equation. The real number solutions are all integers so that students may find the solutions by eyesight. Have students recall methods of solving linear systems (graphing, elimination, and substitution). Have students recall how many solutions a systems of linear equations can have. Indicate that the same techniques can be used for quadratic systems. Discuss the number of solutions possible in a quadratic system. Solve multiple systems using the above techniques, stressing that solutions can be checked algebraically.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.
2-3 Completing the Square	Completing the Square	Provide details in the process of completing the square (both when a=1 and when a≠1). Model practice problems of both types. Model practice problems of converting a quadratic function in standard form to vertex form using this process. Include word	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.
2-4 Using the Quadratic Formula	Using the Quadratic Formula	Instead of using the technique of completing the square each time we want to solve a quadratic, the technique is applied to the standard form of a quadratic equation, 0 = ax2 + bx + c, and the result is called the Quadratic Formula. Solve the general	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned.

		case and then use the result to solve other quadratics. Help students see the connection between the Quadratic Formula and the equation for the vertex of a parabola. Explain to students that at the end of the lesson they will be introduced to a new model that takes the initial velocity into account. Write the Core Concept. Remind students that the quadratic equation must be in standard form that is, set equal to 0.	Homework assigned.
2-5 Solving Nonlinear Systems	Solving Nonlinear Systems	How can you solve a nonlinear system of equations? What are the intersection possibilities for a parabola and a line?" two, one, or no intersections "two parabolas?" two, one, or no intersections Can you solve an equation by rewriting it as a system of equations and then solving the system by graphing?	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned
2-6 Quadratic Inequalities	How can you solve a quadratic inequality? what would an ordered pair inside the parabola represent?	To graph a quadratic inequality in one of the forms above, follow these steps. Step 1 Graph the parabola with the equation $y = ax2 + bx + c$. Make the parabola dashed for inequalities with $<$ or $>$ and solid for inequalities with $\leq$ or $\geq$. Step 2 Test a point (x, y) inside the parabola to determine whether the point is a solution of the inequality. Step 3 Shade the region inside the parabola if the point from Step 2 is a solution. Shade the region outside the parabola if it is not a solution. Have students write an equation for perimeter and an inequality for area and then discuss an approach with their partners.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned

Standards for Course Content Area and Cross Content Standards Addressed

MATH.9-12.F.BF.A	Build a function that models a relationship between two quantities
MATH.9-12.A.APR.B	Understand the relationship between zeros and factors of polynomials

MATH.9-12.F.BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\ f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k(both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
MATH.9-12.A.CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
MATH.9-12.F.IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
MATH.9-12.A.REI.B.4	Solve quadratic equations in one variable.
MATH.9-12.A.REI.B.4.b	Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
MATH.9-12.A.SSE.A.2	Use the structure of an expression to identify ways to rewrite it.

Suggested Modifications for Students with Disabilities, 504 eligible, Multilingual Learners, At Risk Students and Gifted Students

Special Education Students:

- Visual Aids and Manipulatives: Provide visual aids such as graphic organizers, anchor charts, and manipulatives like algebra tiles or graphing boards to help students visualize concepts and relationships.
- Simplified Instructions: Break down complex concepts into smaller, more manageable steps with clear and concise instructions.
- Extra Practice and Scaffolding: Offer additional practice problems with varying difficulty levels, along with scaffolding (hints, prompts, worked examples) to support students as they progress.
- Alternative Assessments: Provide alternative assessment options, such as oral presentations, projects, or portfolios, to demonstrate understanding.
- Individualized Instruction: Tailor instruction to meet individual needs, considering learning styles, strengths, and weaknesses.

English Language Learners (ELLs):

- Visual Support: Incorporate visuals, such as diagrams, graphs, and real-world examples, to enhance understanding of vocabulary and concepts.
- Simplified Language: Use clear and concise language, avoiding jargon and idioms. Provide a glossary of key terms with definitions and translations.
- Bilingual Resources: Offer bilingual dictionaries, textbooks, or online resources to support students' understanding.
- Collaborative Learning: Encourage peer-to-peer interaction and group work to provide opportunities for language practice and collaborative problem-solving.
- Differentiated Instruction: This method tailors instruction to meet individual language proficiency levels, providing additional support for students who need it.

Gifted Students:

- Extension Activities: Provide opportunities for enrichment and extension beyond the standard curriculum, such as exploring advanced topics, independent research projects, or problem-solving challenges.

- Inquiry-Based Learning: Encourage students to ask questions, explore concepts independently, and develop their solutions.
- Higher-Order Thinking Skills: Challenge students with complex problems that require critical thinking, analysis, and synthesis.
- Acceleration: Consider accelerating gifted students to higher-level math courses if they demonstrate readiness.
- Mentorship: Pair gifted students with mentors who can guide and support their academic pursuits.

By implementing these modifications, teachers can create a more inclusive and equitable learning environment where all students, regardless of their diverse needs and abilities, can succeed in Algebra 2

Computer Sci Design Thinking

Computer Science and Design Thinking (Standard 8)

- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real-world phenomena, including climate change.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.NT.2: Redesign an existing product to improve form or function.

Career Readiness, Life Literacies and Key Skills Practice

PFL.9.1.12.EG.5	Relate a country's economic system of production and consumption to building personal wealth, the mindset of social comparison, and achieving societal responsibilities.
WRK.9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
WRK.9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.

TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

Unit 2: Polynomial Functions

Content Area: **Mathematics**
Course(s): **Algebra 2**
Time Period: **2nd Marking Period**
Length: **40-45 days**
Status: Published

Summary of the Unit

This Algebra 2 unit explores polynomials, delving into their graphs, operations (addition, subtraction, multiplication, and division), factoring, and equation solving. The unit emphasizes real-world applications, using polynomials to model various scenarios.

This unit also explores the fascinating world of exponential functions, aligning with the New Jersey Student Learning Standards (NJSLS). Students will delve into the concepts of exponential growth and decay, discovering how these functions model real-world phenomena like population growth, radioactive decay, and compound interest. Through graphing and transformations, students gain a deeper understanding of the behavior of these functions. This unit equips students with essential algebraic tools for modeling, analyzing, and solving problems involving exponential functions, fostering a deeper understanding of mathematical relationships and their real-world applications.

Enduring Understandings

- Polynomials follow consistent algebraic rules and form a structured system.
  Students understand that polynomial expressions can be added, subtracted, and multiplied using predictable patterns, and these operations result in new polynomials.

- Factoring polynomials helps identify their roots and simplifies expressions.
  Students understand that factoring is a powerful tool for solving equations and analyzing graphs, and that different techniques apply depending on the structure of the polynomial.

- Solving polynomial equations involves finding values that make the function zero.
  Students recognize that the solutions to polynomial equations correspond to the x-intercepts of the graph and can be found through factoring, graphing, or other algebraic methods.

- Algebraic and graphical representations of polynomials are interconnected.
  Students learn to interpret and move between equations, graphs, and tables to gain insight into the behavior of polynomial functions.

- Polynomial functions can model real-world situations and support decision-making.
  Students understand that polynomials are useful for representing and solving problems in various contexts, including physics, economics, and engineering.

- Exponential Functions: Students will understand that exponential functions can be used to explain real world scenarios. They will recognize how these functions model real-world phenomena involving growth, decay, and change.
- Properties of Exponents: Students will grasp the fundamental properties of exponents, using them to simplify expressions, graph, and manipulate functions.

- Transformations of Functions: Students will understand how transformations (translations, reflections, stretches, and compressions) affect the graphs and equations of exponential functions, enabling them to analyze and interpret them in different contexts.

Essential Questions

- How can we use polynomial functions to model and solve real-world problems?
    - Focus: Applications in physics, economics, and engineering
- What do the zeros of a polynomial tell us about its graph and behavior?
    - Focus: Roots, multiplicity, and x-intercepts
- In what ways can factoring help us understand and solve polynomial equations?
    - Focus: Techniques like grouping, synthetic division, and the Rational Root Theorem
- Why is it important to understand the limitations of polynomial models when analyzing data?
    - Focus: Overfitting, extrapolation, and choosing appropriate models
- How can technology help us explore and visualize polynomial functions more effectively?
    - Focus: Use of graphing calculators, Desmos, or spreadsheet tools
- How do exponential functions model real-world situations involving growth and decay?
- How do transformations affect the graphs and equations of exponential functions?

These essential questions are designed to stimulate critical thinking, inquiry, and deeper understanding of the concepts covered in this unit. They encourage students to explore the connections between different mathematical ideas and to apply their knowledge to solve problems and model real-world situations.

Unit Summative Assessment and Alternate Assessment Options

- Unit Test: A comprehensive test covering all major topics in the unit, including:
    - Performing operations with polynomials (addition, subtraction, multiplication, division)
    - Factoring polynomials
    - Solving polynomial equations
    - Applying the Fundamental Theorem of Algebra
    - Modeling real-world scenarios with polynomials.
    - Graphing and analyzing exponential functions
    - Properties of exponents
    - Modeling real-world scenarios with exponential functions

- Project/Presentation: A project or presentation where students apply their knowledge to a real-world scenario, such as modeling a physical phenomenon with a polynomial function or analyzing a data set using radical functions. The project should demonstrate understanding of the concepts and ability to apply them meaningfully.
- Formative Assessments: Throughout the unit, incorporate formative assessments (quizzes, exit tickets, homework assignments) to monitor student progress and identify areas for additional support.
- Differentiation: Tailor the assessments to meet the diverse needs of learners by providing modifications or accommodations as needed.
- Feedback: Provide timely and constructive feedback to students on their performance, highlighting strengths and areas for improvement.

Resources

Textbooks:

- Algebra 2 Textbook: Any standard Algebra 2 textbook aligned with New Jersey Student Learning Standards will cover the topics in this unit. Look for chapters on polynomials and operations with functions.

- AGA Algebra 2 - McGraw-Hill
- OpenStax Algebra 2: A free, open-source textbook available online that covers all the necessary content in a comprehensive and accessible manner.

Websites and Online Resources:

- Khan Academy: Offers a wide range of instructional videos, practice exercises, and articles on all Algebra 2 topics, including polynomials, radical functions, and function operations.
- Math Planet: Provides comprehensive explanations, examples, and practice problems on polynomials and radical expressions, as well as interactive tools and calculators.
- Desmos: A free online graphing calculator that allows students to visualize functions, explore transformations, and solve equations graphically.
- GeoGebra: Similar to Desmos, GeoGebra offers a free online graphing calculator with additional features for geometry and statistics.
- CK-12: Provides free, customizable textbooks and interactive activities on various math topics, including Algebra 2.

Additional Resources:

- Manipulatives: Algebra tiles and graphing boards can be used to help students visualize operations with polynomials and transformations of functions.
- Graphic Organizers: Flowcharts, concept maps, and other graphic organizers can help students organize their understanding of complex concepts and relationships.
- Online Quizzes and Games: Websites like Kahoot! and Quizlet offer interactive quizzes and games that can be used for formative assessment and review.
- Real-World Applications: Look for examples of how polynomials and radical functions are used in fields like physics, engineering, and finance to demonstrate the relevance of the concepts.

Unit Plan

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmark / Assessments
4-1 Classifying Polnomials	Name polynomials and recognize parts of a polynomial	Classify polynomials by the number of terms and the degree. Understand and identify - Degree, Leading term, Leading coefficient, Constant etc.	Check student understanding via oral participation. Check student work. Check for the correct use of the graphing calculator. Classwork assigned. Homework assigned.
4-2 Adding, Subtracting, and Multiplying Polynomials	Adding, Subtracting, and Multiplying Polynomials	Add, subtract and multiply the polynomials Use Pascal's Triangle to expand binomials. Write the expression (5x2 + 7x + 1) + (3x2 − 4x + 2) on the board as a warm-up problem. If students are unfamiliar with Pascal's Triangle, give an introduction.	Check translations of word problems into algebra. Classwork assigned. Homework assigned Assess student recall of this topic and review as needed. Check student responses.
4-3 Dividing Polynomials	Dividing polynomials	Use long division to divide polynomials by other polynomials. Use synthetic division to divide polynomials by binomials of the form x − k. Use the Remainder Theorem. Use a completed polynomial long division problem as an example. Circle the coefficients throughout the example. Explain to students that the numeric portion is the key part of the problem. Writing variables and exponents is extraneous. The like terms are aligned for a reason. • Explain and model the steps of synthetic division. Compare the results with the same problem done as long division so that students see the parallel work and the same numbers. It may take several examples for students to understand why synthetic division works.	Check student understanding via oral participation. Check student work and graphs. Check for the correct use of the graphing calculator. Classwork assigned. Homework assigned.

4-4 Factoring Polynomials	Factoring Polynomials	Factor polynomials and use the **Factor Theorem**. Students may think that factors must be binomials. Show them whether there is a common monomial factor. A polynomial f (x) has a factor x − k if and only if f (k) = 0. Use technology to make a table of values to verify the positive zeros and heights between the zeros.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.
4-5 Solving Polynomial Equations	Solving Polynomial Equations	Find solutions of polynomial equations and zeros of polynomial functions. Use the Rational Root Theorem and the Irrational Conjugates Theorem. Give an example of a cubic with only one solution. Use the word multiplicity to describe the repeated roots. Discuss the difference between a graph crossing at a root versus touching the axis at a root. Explain why synthetic division is more efficient for finding the roots than substituting the possible roots into the equation. Explain that from the Rational Root Theorem a list of possible roots can be written, but the actual roots still need to be found. Explain why the Irrational Conjugates Theorem should make sense.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.
6-1 Exponential Growth and Decay Functions	Exponential Growth and Decay Functions	Graph exponential growth functions and their transformations, and identify their growth factors, domains, ranges, intercepts and asymptotes. Use the exponential growth formula and compound interest formula to solve real-world problems Students will graph a simple exponential growth function, such as $y = 2^x$ by hand or by calculator, and as a class will explore domain, range, asymptotes and intercepts. Formalize notes on the graph of $f(x) = ab^x$ to include definition of a growth factor, and a restriction that	Check student graphs. Check for correct use of the graphing calculator. Check translations of word problems into algebra. Classwork assigned. Homework assigned Assess student recall of this topic and review as needed.

		b>1. Graph exponential decay functions and their transformations, and identify their growth factors, domains, ranges, intercepts and asymptotes.	
6-4 Transformations of Exponential Functions	Transformations of Exponential Functions	Transform graphs of exponential functions. Discuss the Core Concept with students. Again, the issue for students is to be able to distinguish whether the transformation affects the graph horizontally or vertically. Students also need to be aware of what the parent logarithmic function looks like, as well as its domain and its range.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.

Standards for Course Content Area and Cross Content Standards Addressed

MATH.9-12.A.APR.A.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
MATH.9-12.N.RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
MATH.9-12.F.BF.A.1.a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
MATH.9-12.F.BF.A.1.b	Combine standard function types using arithmetic operations.
MATH.9-12.N.RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MATH.9-12.A.APR.B.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 $p(x)$.
MATH.9-12.A.APR.B.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.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MATH.9-12.F.BF.B.4.a	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.
MATH.9-12.F.BF.B.4.b	Verify by composition that one function is the inverse of another.
MATH.9-12.F.BF.B.4.c	Read values of an inverse function from a graph or a table, given that the function has an inverse.
MATH.9-12.F.BF.B.4.d	Produce an invertible function from a non-invertible function by restricting the domain.
MATH.9-12.A.REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MATH.9-12.A.REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MATH.9-12.F.IF.C.7.e	Graph exponential and logarithmic functions, showing intercepts and end behavior.
MATH.9-12.F.IF.C.8.b	Use the properties of exponents to interpret expressions for exponential functions.
MATH.9-12.F.LE	Linear and Exponential Models
MATH.9-12.F.LE.A	Construct and compare linear and exponential models and solve problems
MATH.9-12.F.LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
MATH.9-12.F.LE.A.1.a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
MATH.9-12.A.SSE.A.2	Use the structure of an expression to identify ways to rewrite it.
MATH.9-12.F.LE.A.1.b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
MATH.9-12.F.LE.A.1.c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MATH.9-12.F.LE.A.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
MATH.9-12.F.LE.B	Interpret expressions for functions in terms of the situation they model
MATH.9-12.F.LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Modifications for Students with Disabilities, 504 eligible, Multilingual Learners, At Risk Students and Gifted Students

Special Education Students:

- Visual Aids and Manipulatives: Provide visual aids such as graphic organizers, anchor charts, color-coded notes, and manipulatives like algebra tiles or graphing boards to help students visualize concepts like

factoring, polynomial division, and function transformations.

- Simplified Instructions and Chunking: Break down complex concepts into smaller, more manageable steps with clear and concise instructions. Use chunking to present information in smaller portions, allowing for better comprehension and retention.
- Multi-Sensory Learning: Incorporate multi-sensory approaches, such as using manipulatives, drawing diagrams, or creating songs/mnemonics to help students grasp abstract concepts like the Fundamental Theorem of Algebra or rational exponents.
- Extended Time and Alternative Assessments: Offer additional time for completing assignments and assessments. Provide alternative assessment options, such as oral presentations, projects, or portfolios, to demonstrate understanding.
- Individualized Instruction and Scaffolding: Tailor instruction to meet individual needs, considering learning styles, strengths, and weaknesses. Provide scaffolding (hints, prompts, worked examples) to support students as they progress.

English Language Learners (ELLs):

- Visual Support and Real-World Connections: Utilize visuals, such as diagrams, graphs, charts, and real-world examples to enhance understanding of vocabulary and concepts. Connect mathematical concepts to familiar scenarios to make them more relatable.
- Simplified Language and Bilingual Resources: Use clear and concise language, avoiding jargon and idioms. Provide a glossary of key terms with definitions and translations in the student's native language. Offer bilingual dictionaries, textbooks, or online resources for additional support.
- Pre-Teaching Vocabulary: Introduce key vocabulary terms before each lesson, using visual aids and examples to reinforce understanding.
- Collaborative Learning and Peer Tutoring: Encourage peer-to-peer interaction and group work to provide opportunities for language practice and collaborative problem-solving. Pair ELL students with native English speakers for additional support.
- Differentiated Instruction: Tailor instruction to meet individual language proficiency levels, providing additional support, such as simplified texts or visual aids, for students who need it.

Gifted Students:

- Extension Activities and Enrichment: Offer opportunities for enrichment and extension beyond the standard curriculum, such as exploring advanced topics like complex polynomials, fractional exponents, or connections between polynomial and trigonometric functions.
- Inquiry-Based Learning and Problem-Solving Challenges: Encourage students to ask questions, explore concepts independently, and develop their own solutions. Challenge them with complex, open-ended problems that require critical thinking, analysis, and creativity.
- Independent Research Projects: Provide opportunities for students to conduct independent research projects on topics of interest related to polynomials, radicals, or functions.
- Mentorship and Competitions: Pair gifted students with mentors who can provide guidance and support in their academic pursuits. Encourage participation in math competitions to challenge their skills and foster a love for mathematics.
- Acceleration: Consider accelerating gifted students to higher-level math courses if they demonstrate readiness and a strong interest in the subject.

Student Group	Instructional Strategy	Supports & Tools	Assessment Modifications	Examples
Special Education (SpEd)	- Break tasks into small steps- Use guided practice- Provide visual aids and manipulatives	- Graphic organizers- Algebra tiles- Color-coded notes- Calculator access	- Extended time- Simplified problems- Oral or visual response options	- Break down factoring into steps: GCF → grouping → binomial factoring- Use color to highlight terms in a polynomial (e.g., red for coefficients, blue for variables)- Provide a scaffolded worksheet with partially completed examples

English Language Learners (ELLs)	- Pre-teach vocabulary- Use visuals and real-life examples- Pair with fluent peers	- Word banks & sentence frames- Bilingual glossaries- Visual aids (graphs, diagrams)	- Allow oral explanations- Use translated instructions- Focus on conceptual understanding	- Use a vocabulary card for “root” with definition, picture, and example- Provide sentence starters: “The degree of the polynomial is ___ because…”- Use a graph of a roller coaster to explain turning points and intercepts
Gifted & Talented (GT)	- Offer enrichment tasks- Encourage independent exploration- Use open-ended problems	- Technology tools (Desmos, GeoGebra)- Research-based projects- Advanced problem sets	- Project-based assessments- Peer teaching opportunities- Challenge problems with multiple solutions	- Ask students to explore how polynomial functions model population growth or physics motion- Challenge: “Create a polynomial with 4 real roots and explain its graph”- Use Desmos to investigate how changing coefficients affects the graph

Computer Sci Design Thinking

Computer Science and Design Thinking (Standard 8)

- **8.1.12.DA.1:** Create interactive data visualizations using software tools to help others better understand real-world phenomena. (Aligns with modeling physical phenomena or economics with polynomials).
- **8.1.12.DA.6:** Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process. (Directly supports using polynomials to model data sets).
- **8.1.12.AP.1:** Design algorithms to solve computational problems using a combination of original and existing algorithms. (Aligns with the step-by-step "algorithmic" nature of synthetic and long division).
- **8.2.12.NT.1:** Explain how different groups can contribute to the overall design of a product. (Supports collaborative learning and peer tutoring mentioned in the instructional strategies).
- **8.2.12.NT.2:** Redesign an existing product to improve form or function. (Aligns with transforming exponential functions to change their graphical "form").

Career Readiness, Life Literacies and Key Skills Practice

Career Readiness, Life Literacies, and Key Skills (Standard 9)

- **9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice. (Aligns with choosing appropriate factoring or solving techniques based on the polynomial's structure).
- **9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving. (Directly supports the "Collaborative Learning" strategy for ELL and SpEd students).

- **9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas. (Aligns with the unit's "Essential Questions" designed to stimulate inquiry and deeper understanding).
- **9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims. (Supports the exploration of exponential growth/decay in population or interest).
- **9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task. (Aligns with determining when to use graphing calculators versus manual algebraic methods)

Unit 3: Data Tells A Story

Content Area: **Mathematics**
Course(s): Algebra 2 and Data Science
Time Period: **3rd Marking Period**
Length: **40-45 Days**
Status: **Published**

Summary of the Unit

In this introductory unit of Data Science, students learn how data can be used to understand real-world situations, tell compelling stories, and support evidence-based claims. They explore how to collect, analyze, and visually represent data using a variety of mathematical tools. Students investigate key concepts such as variability, important quantities, and modeling while building the ability to interpret results within context. They examine how mathematical models represent relationships, reveal patterns, and enable predictions—and how those models can be evaluated, refined, or redesigned to improve their accuracy. Throughout the unit, students also engage with data ethics, learning how to use and share data responsibly. By the end, students can synthesize information from multiple sources, construct meaningful visualizations, and communicate clear, ethical narratives grounded in data.

Enduring Understandings

- Data gains meaning through context. Interpreting results within a real situation leads to deeper and more accurate understanding.
- Strong problem-solving requires synthesizing relevant external resources. Real-world questions often rely on outside information to pose, refine, or solve problems.
- Practical situations contain identifiable quantities and relationships. Mapping these relationships helps build meaningful mathematical representations.
- Mathematical models are simplifications of reality that help interpret behavior, test ideas, and make predictions. Models can and should be evaluated, improved, or rebuilt to better capture real phenomena.
- Variability exists in all data. Understanding patterns, spread, and uncertainty helps us make sound conclusions.
- Visual representations communicate ideas clearly. Effective displays make data accessible and support storytelling.
- Ethical data practices matter. Responsible use of data includes respecting privacy, acknowledging limitations, avoiding bias, and representing information truthfully.

Essential Questions

- How can I use data to tell a meaningful story or support a claim?
- How do I choose, design, and interpret visual representations of data?
- How do mathematical models help me understand, explain, or predict real-world situations?
- How can I identify important quantities in a situation and map their relationships?
- How do I evaluate the adequacy of a mathematical model, and how can I improve or develop a new one?
- What is variability, and how does it affect the conclusions I draw from data?
- How do I incorporate external resources to better pose or solve problems?
- What does it mean to use data ethically, and why is it important?

Unit Summative Assessment and Alternate Assessment Options

Major Assessment:

Students will create a personal data collection project on a topic of their choice. They will be assessed on the following criteria:

Asking Questions

- Poses a creative and relevant question connected to the chosen topic
- Clearly shows evidence of data science inquiry
- Demonstrates curiosity and purpose behind the question

Gathering and Organizing Data

- Provides a detailed plan for how data will be collected
- Explains how long data will be gathered and how often it will be recorded
- Documents raw data on scratch paper, spreadsheet, notebook, or digital tool
- Shows a creative, organized, and thorough data-gathering process
- Demonstrates understanding of variability, data, and models

Modeling

- Creates a clear and descriptive visual model of collected data
- Shows variability (differences, changes, spread) directly in the visual
- Includes a key/legend that helps the viewer understand the representation
- Uses visual design choices that support meaning and communication

Analyzing and Synthesizing

- Identifies and describes variability in the collected data
- Explains notable patterns, trends, or anomalies
- Draws logical and meaningful conclusions from the final visual

- Answers: “What story can I tell from this data?”
- Uses evidence from the visual to support claims

Communicating

- Creates an engaging slideshow or presentation of the process
- Clearly walks through steps from question → collection → model → analysis
- Includes documentation of feedback received
- Shows thoughtful revisions made based on peer/instructor feedback

Ethical Considerations

- Reflects on whether the data was accurately represented
- Discusses any possible bias or misrepresentation
- Considers “the whole story” behind the data
- Connects reflection to the Data Ethics Intermission concepts
- Responds fully to all reflection questions in this section

Reflection

- Lists concepts they feel confident about
- Identifies concepts that still feel uncertain or tricky
- Provides specific examples to support both strengths and areas for growth
- Connects learning to future units

Alternate Assessment Options
Main Assessment Options (Choose ONE)

• Traditional Postcard + Slideshow: Create your Dear Data postcard and a slideshow.

• Data Story Video (2–4 minutes): Explain your question, data collection, visual, analysis, and ethics.

• Interactive Digital Dashboard: Build charts/graphs and include written analysis.

• Illustrated Data Zine (8 pages): A mini-book showing your data question, process, visual, and insights.

• Podcast Episode (3–5 minutes): Record an audio story of your data journey.

• Museum Exhibit Poster: A poster designed like a museum display with your visual model and analysis.

Side Assessment Options (Choose TWO)

• Annotated Drafts: Submit 2–3 drafts with notes about revisions.

• Data Ethics Reflection Paragraph: Discuss accuracy, bias, privacy, and representation.

• Before & After Reflection: Explain how your thinking changed throughout the project.

• Planning Notes / Sketches: Include scans/photos of planning pages or data logs.

• Mini Pattern Report: A short analysis of key patterns and variability.

• Peer-Teaching Organizer: Create a one-page summary to teach someone your data story.

Optional Extension (Extra Credit)

• Data Comic Strip: Tell your data story in comic form.

• Alternate Visual Representation: Create a second visual using a different representation.

• Audience Interpretation Reflection: Interview someone who views your visual and document their interpretation.

Required Criteria (All options must address):

• A clear and creative data question

• A thoughtful data collection plan

• Evidence of organized data gathering

• A visual model with clear labels and a key

• Analysis of variability and patterns

• A conclusion explaining the story your data tells

• Ethical considerations

• Revisions based on feedback

Resources

Data Basics

- Crash Course Data Literacy
- Khan Academy Statistics
- Dear Data Project - Youcubed.org

Interactive Tools

- Google Sheets
- Datawrapper

- RAWGraphs
- CODAP

Exploring Real Data

- Gapminder
- Our World in Data
- Tuva Labs

Data Ethics

- Algorithmic Justice League
- MIT Data Ethics Curriculum

Public Datasets

- Data.gov
- NOAA Climate
- Our World in Data
- Kaggle (Beginner datasets)

Unit Plan

Topic Selection	General Objective	Instructional Strategies	Benchmarks / Assessments
4.1 Data Tells a Story: Welcome to Data Science	Students will understand that data can communicate patterns, trends, and stories about the world and begin recognizing how data science is used in everyday life.	Class discussion on everyday data; introduction to data types; analyzing real-world examples; think-pair-share activity.	Exit ticket explaining one data story; quiz on key terms.
4.2 Misuse of Data	Students will identify common ways data can be misrepresented or misinterpreted and explain why misuse of	Review misleading graphs; group critique sessions; demonstration of how scale and sampling	Annotated misleading graph; short written explanation of misuse.

	data leads to false conclusions.	bias distort data; correct-the-graph activity.	
4.3 Dear Data	Students will explore personal data tracking and understand how everyday behaviors can be represented visually in creative ways.	Introduce Dear Data project; collect personal data; sketch analog visualization; peer feedback gallery walk.	Completed Dear Data sketch; written reflection.
4.4 Data Ethics	Students will understand ethical responsibilities in data collection, storage, privacy, and representation.	Case studies; data privacy videos; Socratic seminar; create class data ethics code.	Seminar participation; ethics scenario quiz; personal ethics statement.
4.5 Me and the Bees	Students will analyze a real entrepreneurial story involving data-driven decision-making and understand how data helps solve real problems.	Read/watch story; identify data use in marketing and problem-solving; discuss data and innovation; design a data plan for a product.	Group presentation of product idea; key insights worksheet.
4.6 Smartphone Graph	Students will collect, organize, and graph their own smartphone usage data to identify patterns and draw conclusions.	Track smartphone use; model graph creation; construct graphs; partner analysis.	Completed smartphone graph; written pattern interpretation.
4.7 Pew Data with CODAP	Students will explore multivariate datasets using CODAP and learn to analyze large-scale survey data from Pew Research.	CODAP tutorial; explore Pew dataset; inquiry-based investigation; group discussion.	CODAP investigation report; claims supported by data; rubric evaluation.

Standards for Course Content Area and Cross Content Standards Addressed

MA.S-ID	Interpreting Categorical and Quantitative Data
MA.S-ID.A	Summarize, represent, and interpret data on a single count or measurement variable
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MA.S-ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
MA.S-ID.B	Summarize, represent, and interpret data on two categorical and quantitative variables
MA.S-ID.B.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.S-ID.B.6a	Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
MA.S-IC	Making Inferences and Justifying Conclusions
MA.S-IC.B	Make inferences and justify conclusions from sample surveys, experiments, and observational studies

Suggested Modifications for Students with Disabilities, 504 eligible, Multilingual Learners, At Risk Students and Gifted Students

Modifications & Accommodations for Data Science Projects

Students with Disabilities (IEP)

• Provide step-by-step checklists and chunked instructions.

• Use guided templates and graphic organizers.

• Allow reduced data collection periods.

• Permit alternate visual formats (video/audio/oral presentation).

• Provide vocabulary supports with visuals.

• Allow adult or peer support during data collection.

Students with 504 Plans

• Offer extended time on all project components.

• Provide digital copies of instructions and simplified directions.

• Use chunked tasks and visual highlights.

• Allow assistive tech (speech-to-text, chart tools).

• Permit simplified data categories or smaller dataset.

Multilingual Learners (MLLs/ELLs)

• Provide bilingual glossaries and visual vocabulary.

• Use sentence frames for analysis.

• Allow oral or visual responses instead of written paragraphs.

• Offer instructions in simplified English or home language.

• Allow use of bilingual partners during data collection.

Universal Design for Learning (UDL)

• Provide multiple representation formats for content.

• Allow multiple ways to demonstrate understanding.

• Provide choices in data topic, visual formats, and reflection modes.

Computer Sci Design Thinking

CS.K-2.8.1.2.DA.1	Collect and present data, including climate change data, in various visual formats.
CS.K-2.8.1.2.DA.2	Store, copy, search, retrieve, modify, and delete data using a computing device.
CS.K-2.8.1.2.DA.3	Identify and describe patterns in data visualizations.
CS.K-2.8.1.2.DA.4	Make predictions based on data using charts or graphs.
CS.K-2.8.2.2.EC.1	Identify and compare technology used in different schools, communities, regions, and parts of the world.
CS.K-2.DA	Data & Analysis
CS.K-2.EC	Ethics & Culture
CS.K-2.ETW	Effects of Technology on the Natural World
	Computers store data that can be retrieved later. Data can be copied, stored in multiple locations, and retrieved.
	The availability of technology for essential tasks varies in different parts of the world.
	Data can be used to make predictions about the world.
	Individuals collect, use, and display data about individuals and the world around them.
	The use of technology developed for the human designed world can affect the environment, including land, water, air, plants, and animals. Technologies that use natural sources can have negative effects on the environment, its quality, and inhabitants. Reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment.

Career Readiness, Life Literacies and Key Skills Practice

Career Readiness, Life Literacies, and Key Skills (NJSLS 2020)

- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information. (Supports the objective of evaluating models and identifying data misuse).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data and generation of data through automated processes. (Directly aligns with the "Data Ethics" lesson and respecting privacy).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

Unit 4: Data Analytics, Modeling, and Real-World Applications

Content Area: **Mathematics**
Course(s): Algebra 2 and Data Science
Time Period: **4th Marking Period**
Length: **40-45 Days**
Status: **Published**

Summary of the Unit

In this unit, students apply their data science foundations to analyze relationships, build models, and make predictions. They will explore regression, correlation, and multivariable data to understand how variables interact. Students practice cleaning and interpreting real datasets, making evidence-based conclusions, and presenting their findings through clear visuals and explanations. The unit culminates in a real-world data project where students investigate a question of their choice and communicate their results like data analysts and storytellers.

Enduring Understandings

1. Data Models: Students will learn that data models help us understand relationships and make predictions, but all models have limitations that require careful interpretation.
2. Real World Datasets: Students will grasp that real-world datasets are often messy, and cleaning and preparing data is essential for producing accurate and meaningful results.
3. Patterns: Students will understand that patterns in data can guide conclusions, but correlation does not imply causation.
4. Effective Data Analysis: Students will recognize that effective data analysis depends on clear communication through visuals, explanations, and evidence-based reasoning.
5. Data Driven Insights: Students will learn that data-driven insights are strongest when they address meaningful questions and rely on transparent, reproducible methods.

Essential Questions

Data Models

1. How can we use data models to make predictions about real-world situations?
2. What factors limit how much we can trust a model's predictions?
3. How do we decide whether a model is a good fit for the data?

Real-World Datasets

1. Why is data cleaning an essential first step in data analysis?
2. How can errors, missing values, or bias in a dataset affect the conclusions we draw?
3. What strategies help us transform messy, real-world data into usable information?

Patterns in Data

1. What can patterns, trends, and correlations in data tell us about the relationships between variables?
2. Why doesn't correlation guarantee causation?
3. How do we avoid misinterpreting or overstating what the data shows?

Effective Data Analysis / Communication

1. How can we communicate our findings clearly using visuals, explanations, and evidence?
2. What makes a data visualization accurate, useful, and honest?
3. How does transparency and reproducibility strengthen the quality of a data investigation?

Data-Driven Insights

1. What makes a data-driven insight meaningful, useful, or trustworthy?
2. How can we determine whether a conclusion is supported by evidence or influenced by bias?
3. Why is transparency in data sources, methods, and assumptions important for building credible insights?
4. How does reproducibility strengthen the validity of a data investigation?
5. In what ways can data help answer important questions, and how do we choose which questions are worth investigating?

These essential questions are designed to stimulate critical thinking, inquiry, and deeper understanding of the concepts covered in this unit. They encourage students to explore the connections between different mathematical ideas, data science and to apply their knowledge to solve problems and model real-world situations.

Unit Summative Assessment and Alternate Assessment Options

Unit Test: Students will complete a full data-analysis investigation that demonstrates their ability to clean data, analyze patterns, build models, and communicate evidence-based insights using real-world datasets.

Student will:

- Choose or receive a real-world dataset (teacher-provided or student-selected).
- Clean and prepare the data, documenting decisions such as missing values, outliers, and inconsistencies.
- Identify key variables and create a guiding analytical question.
- Conduct analysis, including:
    - appropriate visualizations (scatterplots, histograms, box plots)
    - summary statistics (mean, mode, average)
    - correlation analysis
    - linear regression or another applicable model
- Evaluate the model by discussing strength of fit, limitations, and potential sources of bias.
- Communicate findings through a written report, slide presentation, or recorded walkthrough.
- Conclude with insights supported by evidence and an acknowledgment of uncertainty or limitations.

What the assessment measures:

- Data cleaning and preparation
- Analysis of patterns and relationships
- Model interpretation
- Critical thinking about limitations
- Clear communication using visuals and reasoning

Alternate Assessment options include the following:

Option 1; Data Story Telling Presentation - Students create a data-driven visual story using slides or an infographic. They must include a guiding question, 3–4 visuals, and clear explanations of trends and limitations.

Option 2: Applied Case Study / Consultant Report - Students act as consultants for a fictional or real client. They produce an executive summary, data insights, a model (if appropriate), limitations, and recommendations supported by analysis.

Option 3: Data Portfolio (Series of Smaller Tasks) - Students complete multiple shorter tasks such as:

- cleaning a dataset
- creating visualizations
- calculating and interpreting correlations
- doing a small regression task
- writing a short reflection

This option supports chunking and scaffolding.

Option 4: Oral Defense or Conference: Students verbally explain their analysis steps, show visuals, defend their conclusions, and discuss limitations and next steps.

Resources

Concord Consortium. (2026). Common Online Data Analysis Platform (CODAP). https://codap.concord.org/

Google Research. (2026). Google Colab. https://colab.research.google.com/

Harvard University. (n.d.). Harvard Data Science Review. https://hdsr.mitpress.mit.edu

Khan Academy. (n.d.). Statistics and probability. https://www.khanacademy.org/math/statistics-probability

National Council of Teachers of Mathematics. (2014). Principles to actions: Ensuring mathematical success for all. NCTM.

https://www.nctm.org

New Jersey Department of Education. (2026). *New Jersey Student Learning Standards: Mathematics, https://www.nj.gov/education/standards/math/

Posavec, S., & Lupi, G. (2016). Dear data. Princeton Architectural Press.

Stanford University. (n.d.). Stanford University official website. https://www.stanford.edu

U.S. Department of Education. (2020). STEM education strategic plan. https://www.ed.gov/stem

YouCubed. (n.d.). YouCubed: Inspiring math success for all students. Stanford University. https://youcubed.org

Unit Plan

TOPIC/SELECTION TIMEFRAME	GENERAL OBJECTIVES	INSTRUCTIONAL STRATEGIES	BENCHMARKS/ASSESSMENTS
6.1 American Community Survey (ACS)	Students will analyze data from ACS to understand how population, economic and housing variables are measured, interpreted and explained.	▪ Introduce ACS, what it measures and why communities use it? ▪ Partner Activity: students choose one ACS variable and compare patterns between two communities and discuss possible causes of differences and share findings with the class.	Students create a simple visualization using ACS data and write a short paragraph interpreting the pattern and explaining how their findings could be useful for community planning or decision-making
6.2 Probability Modeling (Song Simulator Project)	Students will be able to understand probabilistic modeling	Students will design a simple playlist model by assigning probabilities to different song categories, then use a digital simulator to generate random "plays" and compare the simulated results to their theoretical expectations.	▪ Formative: Students run a small batch of simulated song plays, compare the results to their theoretical probabilities and explain any mismatches. ▪ Summative: Students complete a short analysis running a full simulation and then create a simple chart of outcomes and explain in a brief paragraph how well the simulation matched their model.
6.3 Music Popcorn (4 days) 6.4 Sums of Two Dice (2 days)	Students will explore the difference between theoretical and experimental probability.	Music Popcorn: What outcomes do you expect before we run our Music Popcorn experiment? Sums of Two Dice Chart: What do you notice? What do you wonder? What story does the graph tell?	Quiz on Theoretical and Experimental Probability Exit Ticket: Students collect real world data and create a visualization of their outcomes and reflections.
6.5 Simulating Songs (3 days) 6.6 Creating a Final Class Music Playlist (2 days)	Students will simulate playing songs from the class playlist and compare the theoretical and experimental	▪ Class Launch - modeling using Google sheets ▪ Group Exploration - simulating song shuffle ▪ Class Discussion -	Exit Ticket / Reflection Analysis: Students will compile a song list and write a brief explanation describing why the theoretical and experimental probabilities may differ. Students will present their findings.

	probabilities.	comparing theoretical and experimental probability	
7.1 Categorical Data: Colorism	Students will explore a Class Project on Colorism in technology and around the world. They will be introduced to categorical data and watch and discuss a TEDX Talk on Colorism.	Class Discussion: Questions and Takeaways from the TedX Talk Video	Mini-Reflection: Explain how to gather data to analyze skin tone representation in the media and present my findings and reflection.
7.2 Data Collection	Students will work in groups to explore possible magazines that they can use to analyze skin tone representation in ads and articles.	Group Exploration: Discuss why explore magazines versus other types of media available? Group to start data collection and initial design	Students code a small section of their magazine article into categories, explain coding choices in 2-3 sentences and identify one possible source of bias in their data collection
7.3 Data Analysis	Students will consider and discuss the class decisions they need to make about their data collection	▪ Group Exploration: Looking at our magazine, what decisions make sense for our data collection. ▪ Class Discussion: Why is it important to collect data consistently and sensibly?	Visualization: Students analyze a small dataset from a magazine article by creating at least one visualization with a 2-3 sentence interpretation of how dataset quality influences model outcomes
7.4 Conjectures	Students will learn to observe patterns in technology-related datasets and form conjectures; and to test their conjectures using visualizations and statistical evidence.	▪ Turn & Data Talk- students review and detect patterns from a simplified image dataset and make initial conjectures. ▪ Group Exploration - Students compare model performance across categories to confirm or revise their predictions.	Exit Ticket / Mini-Reflection: State one conjecture and what evidence currently supports it along with key limitations of the data set
7.5 Plotting Numerical Data	Students will collect numerical data values for each person in the images they collected and use Colab to generate 3D scatter plots of their data	Group Exploration: Colab scatter plot, RGB values and plotting data points	Summarize findings and consider categorical and numerical approaches to collecting data

	and analyze the results.		
7.7 Interpret and Discuss Numerical Data	Students will write an article to communicate their learning about skin tone representations with an audience of their choice.	Class Launch: Choosing an audience for your final project Partner / Peer Review: Questions, Progress and Challenges	Final Project: Skin Tone Representations in Magazines Class Presentations

Standards for Course Content Area and Cross Content Standards Addressed

MATH.9-12.S.ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MATH.9-12.S.ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MATH.9-12.S.ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MATH.9-12.S.ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
MATH.9-12.S.ID.B.5	Summarize categorical data for two categories in two-way frequency tables Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MATH.9-12.S.ID.B.6	Represent data on two quantitative variables on a scatter plot and describe how the variables are related.
MATH.9-12.S.IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MATH.9-12.S.IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MATH.9-12.S.IC.B.4	Use data from a sample survey to estimate a population mean or proportion develop a margin of error through the use of simulation models for random sampling.
MATH.9-12.S.IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

MATH.9-12.S.IC.B.6	Evaluate reports based on data (e.g., interrogate study design, data sources, randomization, the way the data are analyzed and displayed, inferences drawn and methods used; identify and explain misleading uses of data; recognize when arguments based on data are flawed).

Suggested Modifications for Students with Disabilities, 504 eligible, Multilingual Learners, At Risk Students and Gifted Students

Suggested Modifications & Supports:

- Students with Disabilities (SWD / IEP)
- Students who are 504-eligible
- Multilingual Learners (MLLs / ENLs)
- At-Risk Students
- Gifted & Talented (G&T)

Students with Disabilities (SWD / IEP)

Instructional Supports

- Break complex data science tasks (e.g., coding, modeling, visualizations) into step-by-step chunks.
- Provide guided notes with definitions, formulas, and code syntax.
- Offer pre-taught vocabulary (algorithm, dataset, variable, correlation, etc.).
- Use graphic organizers, such as:
    - Data analysis cycle charts
    - Flowcharts for algorithms
    - Code scaffolds
- Provide multi-sensory instruction (visual diagrams, manipulatives, video demos).

Assessment Modifications

- Allow simplified tasks (e.g., fewer variables to analyze or a smaller dataset).
- Provide template code to reduce cognitive load on syntax.
- Offer oral assessments or alternative formats (video explanation, infographic, recorded reasoning).

Environment & Tools

- Preferential seating and minimized distractions.
- Access to assistive technologies:
    - Text-to-speech for instructions and datasets
    - Speech-to-text for reflections
    - Color-blind-friendly graphs

2. Students with 504 Plans

Most 504 supports are accommodations rather than instructional modifications.

Possible Supports

- Extended time for coding labs, quizzes, and data analysis tasks.
- Breaks during long problem-solving activities.
- Use of calculation aids, including:
    - Formula sheets
    - Graphing calculators
    - Code reference cards
- Reduced copying demands (provide digital copies of code / notes).
- Option to complete work using technology instead of handwriting.

3. Multilingual Learners (MLLs / ELLs)

Language Supports

- Provide vocabulary lists with visuals, sentence frames, and translations.
- Model how to read data tables, graphs, and outputs using think-alouds.
- Allow bilingual dictionaries and translation tools.

Modified Tasks

- Allow multilingual learners to focus more on concept understanding rather than perfect English grammar.
- Let students demonstrate understanding through:
    - labeled diagrams
    - charts / plots
    - simplified written explanations

Instructional Techniques

- Use scaffolded code examples with highlighted syntax.
- Provide a word bank of data science terminology (e.g., variable, dataset, mean, outlier).
- Pair with supportive peers for collaborative problem-solving.

4. At-Risk Students

Motivation & Engagement Supports

- Incorporate real-world, relevant datasets (sports, music, gaming, social trends).
- Provide choice-based projects to increase ownership.
- Use short, frequent check-ins to monitor progress.

Academic Supports

- Offer after-school or small-group tutoring sessions.
- Provide structured guides for coding and data analysis tasks.
- Break long assignments into mini-deadlines with feedback.

Social-Emotional Supports

- Build confidence with quick wins, like simple data visualizations before moving to modeling.
- Celebrate incremental successes and growth.

5. Gifted & Talented (G&T) Students

Enrichment Opportunities

- Access to advanced datasets (big data sets, API pulling, time-series data).
- Encourage exploration of:
    - Machine learning basics
    - Predictive modeling
    - Optimization algorithms
- Allow them to build larger-scale projects, such as dashboards or interactive visualizations.

Acceleration Options

- Independent study elements (e.g., Kaggle-style challenges, coding deep dives).
- Optional advanced programming languages or libraries (R, NumPy, Matplotlib, Pandas).
- Leadership opportunities:
    - Peer tutoring
    - Presenting their findings
    - Leading data collection in group projects

Creative Extensions

- Integrate ethics in AI, bias detection, and fairness in data analysis.
- Allow them to design their own datasets or run surveys for exploratory analysis.

Computer Sci Design Thinking

CS.K-2.8.1.2.DA.1	Collect and present data, including climate change data, in various visual formats.
CS.K-2.8.1.2.DA.2	Store, copy, search, retrieve, modify, and delete data using a computing

	device.
CS.K-2.8.1.2.DA.3	Identify and describe patterns in data visualizations.
CS.K-2.8.1.2.DA.4	Make predictions based on data using charts or graphs.
CS.K-2.8.2.2.EC.1	Identify and compare technology used in different schools, communities, regions, and parts of the world.
CS.K-2.DA	Data & Analysis
CS.K-2.EC	Ethics & Culture
CS.K-2.ETW	Effects of Technology on the Natural World
	Individuals collect, use, and display data about individuals and the world around them.
	The availability of technology for essential tasks varies in different parts of the world.
	Data can be used to make predictions about the world.
	Real world information can be stored and manipulated in programs as data (e.g., numbers, words, colors, images).
	Computers store data that can be retrieved later. Data can be copied, stored in multiple locations, and retrieved.
	The use of technology developed for the human designed world can affect the environment, including land, water, air, plants, and animals. Technologies that use natural sources can have negative effects on the environment, its quality, and inhabitants. Reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment.

Career Readiness, Life Literacies and Key Skills Practice

Career Readiness, Life Literacies, and Key Skills (NJSLS 2020)

- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. (Directly supports the "Group Exploration" activities in the unit plan).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations. (Directly connects to the unit's lesson on analyzing skin tone representation in magazines).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

Standards for Course Content Area and Cross Content Standards Addressed

MATH.9-12.S.ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MATH.9-12.S.ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MATH.9-12.S.ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MATH.9-12.S.ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
MATH.9-12.S.ID.B.5	Summarize categorical data for two categories in two-way frequency tables Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MATH.9-12.S.ID.B.6	Represent data on two quantitative variables on a scatter plot and describe how the variables are related.
MATH.9-12.S.IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MATH.9-12.S.IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MATH.9-12.S.IC.B.4	Use data from a sample survey to estimate a population mean or proportion develop a margin of error through the use of simulation models for random sampling.
MATH.9-12.S.IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MATH.9-12.S.IC.B.6	Evaluate reports based on data (e.g., interrogate study design, data sources, randomization, the way the data are analyzed and displayed, inferences drawn and methods used; identify and explain misleading uses of data; recognize when arguments based on data are flawed).

Suggested Modifications for Students with Disabilities, 504 eligible, Multilingual Learners, At Risk Students and Gifted Students

Suggested Modifications & Supports:

- Students with Disabilities (SWD / IEP)
- Students who are 504-eligible
- Multilingual Learners (MLLs / ENLs)
- At-Risk Students
- Gifted & Talented (G&T)

Students with Disabilities (SWD / IEP)

Instructional Supports

- Break complex data science tasks (e.g., coding, modeling, visualizations) into step-by-step chunks.
- Provide guided notes with definitions, formulas, and code syntax.
- Offer pre-taught vocabulary (algorithm, dataset, variable, correlation, etc.).
- Use graphic organizers, such as:
    - Data analysis cycle charts
    - Flowcharts for algorithms
    - Code scaffolds
- Provide multi-sensory instruction (visual diagrams, manipulatives, video demos).

Assessment Modifications

- Allow simplified tasks (e.g., fewer variables to analyze or a smaller dataset).
- Provide template code to reduce cognitive load on syntax.
- Offer oral assessments or alternative formats (video explanation, infographic, recorded reasoning).

Environment & Tools

- Preferential seating and minimized distractions.
- Access to assistive technologies:
    - Text-to-speech for instructions and datasets
    - Speech-to-text for reflections
    - Color-blind-friendly graphs

2. Students with 504 Plans

Most 504 supports are accommodations rather than instructional modifications.

Possible Supports

- Extended time for coding labs, quizzes, and data analysis tasks.
- Breaks during long problem-solving activities.
- Use of calculation aids, including:
    - Formula sheets
    - Graphing calculators
    - Code reference cards
- Reduced copying demands (provide digital copies of code / notes).

- Option to complete work using technology instead of handwriting.

3. Multilingual Learners (MLLs / ELLs)

Language Supports

- Provide vocabulary lists with visuals, sentence frames, and translations.
- Model how to read data tables, graphs, and outputs using think-alouds.
- Allow bilingual dictionaries and translation tools.

Modified Tasks

- Allow multilingual learners to focus more on concept understanding rather than perfect English grammar.
- Let students demonstrate understanding through:
    - labeled diagrams
    - charts / plots
    - simplified written explanations

Instructional Techniques

- Use scaffolded code examples with highlighted syntax.
- Provide a word bank of data science terminology (e.g., variable, dataset, mean, outlier).
- Pair with supportive peers for collaborative problem-solving.

4. At-Risk Students

Motivation & Engagement Supports

- Incorporate real-world, relevant datasets (sports, music, gaming, social trends).
- Provide choice-based projects to increase ownership.
- Use short, frequent check-ins to monitor progress.

Academic Supports

- Offer after-school or small-group tutoring sessions.
- Provide structured guides for coding and data analysis tasks.
- Break long assignments into mini-deadlines with feedback.

Social-Emotional Supports

- Build confidence with quick wins, like simple data visualizations before moving to modeling.
- Celebrate incremental successes and growth.

5. Gifted & Talented (G&T) Students

Enrichment Opportunities

- Access to advanced datasets (big data sets, API pulling, time-series data).
- Encourage exploration of:
    - Machine learning basics
    - Predictive modeling
    - Optimization algorithms
- Allow them to build larger-scale projects, such as dashboards or interactive visualizations.

Acceleration Options

- Independent study elements (e.g., Kaggle-style challenges, coding deep dives).
- Optional advanced programming languages or libraries (R, NumPy, Matplotlib, Pandas).
- Leadership opportunities:
    - Peer tutoring
    - Presenting their findings
    - Leading data collection in group projects

Creative Extensions

- Integrate ethics in AI, bias detection, and fairness in data analysis.
- Allow them to design their own datasets or run surveys for exploratory analysis.

Computer Sci Design Thinking

CS.K-2.8.1.2.DA.1	Collect and present data, including climate change data, in various visual formats.
CS.K-2.8.1.2.DA.2	Store, copy, search, retrieve, modify, and delete data using a computing device.
CS.K-2.8.1.2.DA.3	Identify and describe patterns in data visualizations.
CS.K-2.8.1.2.DA.4	Make predictions based on data using charts or graphs.
CS.K-2.8.2.2.EC.1	Identify and compare technology used in different schools, communities, regions, and parts of the world.
CS.K-2.DA	Data & Analysis
CS.K-2.EC	Ethics & Culture
CS.K-2.ETW	Effects of Technology on the Natural World
	Individuals collect, use, and display data about individuals and the world around them.
	The availability of technology for essential tasks varies in different parts of the world.
	Data can be used to make predictions about the world.

Real world information can be stored and manipulated in programs as data (e.g., numbers, words, colors, images).

Computers store data that can be retrieved later. Data can be copied, stored in multiple locations, and retrieved.

The use of technology developed for the human designed world can affect the environment, including land, water, air, plants, and animals. Technologies that use natural sources can have negative effects on the environment, its quality, and inhabitants. Reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment.

Career Readiness, Life Literacies and Key Skills Practice

Career Readiness, Life Literacies, and Key Skills (NJSLS 2020)

- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. (Directly supports the "Group Exploration" activities in the unit plan).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations. (Directly connects to the unit's lesson on analyzing skin tone representation in magazines).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.