Readington Township Public Schools

Algebra 2

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Algebra II

Overview

This full-year Algebra II course for advanced 8th-grade students provides a comprehensive exploration of algebraic concepts and functions. Aligned with the New Jersey Student Learning Standards, the curriculum covers a range of topics including the extension of exponent properties to rational exponents, rewriting and simplifying radicals, and performing arithmetic operations with complex numbers. Students will also create and solve equations and inequalities involving linear, quadratic, rational, and exponential functions. They will interpret and rewrite expressions, perform arithmetic operations on polynomials, and understand the relationship between polynomial zeros and factors. Additionally, the course includes solving systems of equations, both algebraically and graphically, and representing equations and inequalities graphically.

The curriculum further focuses on understanding and using function notation, interpreting and analyzing functions in various contexts, and graphing different types of functions. Students will build functions that model relationships between quantities and create new functions from existing ones. They will also construct and compare linear and exponential models, interpret data, and summarize, represent, and analyze single and dual-variable data sets. Throughout the course, students will refine their mathematical modeling skills, reason abstractly and quantitatively, and attend to precision, ensuring they develop a solid foundation for future mathematical studies.

STUDENT OUTCOMES

(Linked to New Jersey Student Learning Standards for Mathematics 2023)

The Real Number System (N.RN)

A. Extend the properties of exponents to rational exponents

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. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.
3. Simplify radicals, including algebraic radicals (e.g. $\sqrt[3]{54} = 3\sqrt[3]{2}$, simplify $\sqrt{32x^2}$).

Quantities (N.Q)

A. Reason quantitatively and use units to solve problems

2. Define appropriate quantities for the purpose of descriptive modeling.

The Complex Number System (N.CN)

A. Perform arithmetic operations with complex numbers

1. Know there is a complex number i such that $i^2 = -1$ and every complex number has the form $a + bi$ with a and b real.
2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

C. Use complex numbers in polynomial identities and equations

7. Solve quadratic equations with real coefficients that have complex solutions.

Creating Equations (A.CED)

A. Create equations that describe numbers or relationships

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.

Seeing Structure in Expressions (A.SSE)

A. Interpret the structure of expressions

2. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.

B. Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
    c. Use the properties of exponents to transform expressions for exponential functions. For example, the expression 1.15'can be rewritten as$(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

Arithmetic with Polynomials and Rational Expressions (A.APR)

A. Perform arithmetic operations on polynomials

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.

B. Understand the relationship between zeros and factors of polynomials

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)*.
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.

D. Rewrite rational expressions

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

Reasoning with Equations and Inequalities (A.REI)

A. Understand solving equations as a process of reasoning and explain the reasoning

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.
2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

B. Solve equations and inequalities in one variable

4. Solve quadratic equations in one variable.
    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±bi* for real numbers *a* and *b*.

C. Solve systems of equations

6. Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.
7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.

D. Represent and solve equations and inequalities graphically

11. Explain why the *x*-coordinates of the points where the graphs of the equations *y = f(x)* and *y = f(x)*intersect are the solutions of the equation *f(x) = g(x)*; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f(x)* and/or *g(x)* are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Interpreting Functions (F.IF)

A. Understand the concept of a function and use function notation

3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.

B. Interpret functions that arise in applications in terms of the context

4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

C. Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
    b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
    c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
    e. Graph exponential and logarithmic functions, showing intercepts and end behavior**.**
8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
    b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (.97)^t$, $y = (1.01)^{12t}$, $y = (1.01)^{t/10}$ and classify them as representing exponential growth or decay.
9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Building Functions (F.BF)

A. Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities.
    a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
    b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

B. Build new functions from existing functions

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $(x+k)$ 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. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
4. Find inverse functions.
    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. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.

Linear and Exponential Models (F.LE)

A. Construct and compare linear and exponential models and solve problems

2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
4. Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

B. Interpret expressions for functions in terms of the situation they model

5. Interpret the parameters in a linear or exponential function in terms of a context.

Interpreting Categorical and Quantitative Data (S.ID)

A. Summarize, represent, and interpret data on a single count or measurement variable

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
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.
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
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.

B. Summarize, represent, and interpret data on two categorical and quantitative variables

1. 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.
2. Represent data on two quantitative variables on a scatter plot and describe how the variables are related.
    a. 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. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.
    b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Strategies

- Teacher presentation
- Group discussion
- Small group instruction
- Partner work
- Math talk (students explain their thinking)
- Games
- Use of technology (calculators, computer software, online resources)

Accommodations

Accommodations and Modification Addendum

Assessments

Formative	Summative
● Independent student work ● Ready Classroom Lesson Quizzes ● Teacher Observations ● Class Participation	● Mid-Unit Test ● Unit Test

• Class Discussions • Class Assignments • Homework Assignments • Notebooks • Anecdotal Records	
Benchmark	**Alternative**
• I-Ready Diagnostic • Performance Assessments	• Live Online Assessment Tools (Kahoot, Brainpop) • Student Projects • Student Presentations • Self-Assessments
Resources	
Required/Primary	**Supplemental**
• *Big Ideas MATH Algebra 2*, Larson, R., Boswell, L. Copyright 2015 by Big Ideas Learning, LLC.	• IXL • Online Tutorials Khan Academy) • Online Math Games (Math is Fun, Funbrain, Cool Math Games, Math Playground) • Desmos (graphing calculator and interactive math activities) • GeoGebra (dynamic mathematics software for geometry, algebra, and calculus) • Edpuzzle (interactive video lessons) • Quizlet (flashcards and study games) • Online Review Games (GimKit, Quizizz, Kahoot, Google Forms) , • *McDougal Littell Algebra 2.* Larson, R., Boswell, L., Kanold & Stiff, L. Copyright 2004 by McDougal Littell, a Houghton Mifflin Company, Evanston, IL.

Essential Questions And Content

The Real Number System (N.RN)

Essential Questions:

- How can we extend the properties of integer exponents to rational exponents?
- How do rational exponents relate to radicals?

Content:

- Definition and properties of rational exponents
- Rewriting expressions involving radicals and rational exponents
- Simplifying radicals, including algebraic radicals

Quantities (N.Q)

Essential Questions:

- How can we reason quantitatively to solve real-world problems?
- What units are appropriate for different types of descriptive modeling?

Content:

- Defining and using appropriate quantities for modeling
- Applying units and quantitative reasoning in problem-solving

The Complex Number System (N.CN)

Essential Questions:

- What is the significance of the imaginary unit *i* and how does it extend our number system?
- How can we perform arithmetic operations with complex numbers?

Content:

- Definition and properties of complex numbers
- Addition, subtraction, and multiplication of complex numbers
- Solving quadratic equations with complex solutions

Creating Equations (A.CED)

Essential Questions:

- How can equations and inequalities be used to model and solve real-world problems?

Content:

- Creating and solving equations and inequalities in one variable
- Applications involving linear, quadratic, rational, and exponential functions

Seeing Structure in Expressions (A.SSE)

Essential Questions:

- How can the structure of an expression help us to rewrite and understand it better?
- How can we use the properties of exponents to transform expressions?

Content:

- Identifying and using the structure of expressions
- Rewriting expressions to reveal properties and simplify
- Transforming exponential expressions

Arithmetic with Polynomials and Rational Expressions (A.APR)

Essential Questions:

- How do the arithmetic operations on polynomials compare to those on integers?
- How can we understand and use the relationship between zeros and factors of polynomials?

Content:

- Addition, subtraction, and multiplication of polynomials
- The Remainder Theorem and factorization
- Identifying zeros and graphing polynomial functions
- Rewriting rational expressions using long division and other methods

Reasoning with Equations and Inequalities (A.REI)

Essential Questions:

- What are the logical steps involved in solving equations and inequalities?
- How can we represent and solve systems of equations and inequalities graphically and algebraically?

Content:

- Step-by-step reasoning in solving equations
- Solving rational and radical equations
- Solving quadratic equations by various methods

- Solving systems of linear and quadratic equations
- Graphical representation of equations and inequalities

Interpreting Functions (F.IF)

Essential Questions:

- What is a function and how can we use function notation effectively?
- How can we interpret functions in real-world contexts?

Content:

- Understanding functions and function notation
- Interpreting graphs and tables of functions
- Key features of functions (intercepts, intervals, maxima, minima, etc.)
- Average rate of change and end behavior
- Graphing and analyzing different types of functions

Building Functions (F.BF)

Essential Questions:

- How can we build functions to model real-world relationships?
- How can existing functions be combined or transformed to create new functions?

Content:

- Writing functions to describe relationships
- Recursive and explicit definitions of sequences
- Combining functions using arithmetic operations
- Identifying effects of transformations on function graphs
- Finding and interpreting inverse functions

Linear and Exponential Models (F.LE)

Essential Questions:

- How can we construct and compare linear and exponential models?
- What is the inverse relationship between exponents and logarithms?

Content:

- Constructing linear and exponential functions from data
- Understanding and interpreting linear and exponential models
- Solving exponential equations using logarithms

Interpreting Categorical and Quantitative Data (S.ID)

Essential Questions:

- How can we summarize and interpret data effectively?
- How can we represent data graphically and analyze relationships between variables?

Content:

- Representing data with plots (dot plots, histograms, box plots)
- Comparing data sets using statistical measures (mean, median, standard deviation)
- Fitting data to normal distributions
- Summarizing categorical data with frequency tables
- Representing quantitative data with scatter plots
- Fitting functions to data and assessing fit with residuals

Pacing and Interdisciplinary Connections

A. Quadratics and Complex Numbers(34 Days)

a. Describe transformations of quadratic functions.
b. Write transformations of quadratic functions.
c. Explore properties of parabolas.
d. Find maximum and minimum values of quadratic functions.
e. Graph quadratic functions using x-intercepts.
f. Solve real-life problems.
g. Explore the focus and the directrix of a parabola.
h. Write equations of parabolas.
i. Write equations of quadratic functions using vertices, points, and x-intercepts.
j. Write quadratic equations.
k. Solve quadratic equations algebraically.
l. Solve quadratic equations using square roots.
m. Solve quadratic equations by completing the square.
n. Write quadratic functions in vertex form.
o. Solve quadratic equations using the Quadratic Formula.
p. Analyze the discriminant to determine the number and type of solutions.
q. Solve real-life problems.

Interdisciplinary Connections:

- **RI.CR.8.1** Cite a range of textual evidence and make clear and relevant connections (including informational text features such as charts, graphs, and diagrams) that strongly support an analysis of multiple aspects of what an informational text explicitly, as well as inferences drawn from the text. Activity: Explore the trajectory of projectiles, which can be modeled using quadratic functions. Discuss how understanding parabolas and their properties helps predict the path of projectiles in physics. Students can visually analyze graphs of quadratic functions, understanding transformations, maximum and minimum points, and the shape of parabolas.

B. Polynomials (20 days)

a. Identify polynomial functions
b. Graph polynomial functions using tables and end behavior
c. Add and subtract polynomials
d. Multiply polynomials
e. Factor polynomials
f. Find solutions of polynomial equations and zeros of polynomial functions
g. Describe transformations of polynomial functions
h. Write transformations of polynomial functions
i. Use x-intercepts to graph polynomial functions
j. Use the Location Principle to identify zeros of polynomial functions
k. Find turning points and identify local maximums and local minimums of graphs of polynomial functions
l. Identify even and odd functions

Interdisciplinary Connections:

- **RI.CR.8.1** Cite a range of textual evidence and make clear and relevant connections (including informational text features such as charts, graphs, and diagrams) that strongly support an analysis of multiple aspects of what an informational text explicitly, as well as inferences drawn from the text. Activity: Music: Discuss how polynomial functions are used in sound engineering and music theory, such as in designing musical instruments or analyzing sound waves. Explore the mathematical basis of

harmonics and resonance, which can be modeled using polynomial equations. Students can visually analyze graphs of polynomial functions, understanding their end behavior, turning points, and symmetry (even and odd functions).

C. Rational Exponents and Radical Functions (20 days)

a. Find nth roots of numbers
b. Evaluate expressions with rational exponents
c. Solve equations using nth roots
d. Use properties of rational exponents to simplify expressions with rational exponents
e. Use properties of radicals to simplify and write radical expressions in simplest form
f. Graph radical functions
g. Write transformations of radical functions
h. Graph parabolas and circles
i. Solve equations containing radicals and rational exponents
j. Solve radical inequalities
k. Add, subtract, multiply, and divide functions
l. Explore inverses of functions
m. Find and verify inverses of nonlinear functions
n. Solve real-life problems using inverse functions

Interdisciplinary Connections:

- ETS1.B: focuses on the process of designing solutions to engineering problems or addressing societal needs through engineering design.
  Activity: Engineers often encounter complex calculations involving roots, exponents, and functions when designing systems or structures. For example, Structural Engineers use radical and exponential functions to model stress distribution in materials, where understanding transformations and graphing of radical functions help predict structural integrity.

D. Exponential and Logarithmic Functions (20 days)

a. Graph exponential growth and decay functions.
b. Define and use the natural base e.
c. Graph natural base functions.
d. Define and evaluate logarithms.
e. Use inverse properties of logarithmic and exponential functions.
f. Graph logarithmic functions.
g. Transform graphs of exponential functions.
h. Transform graphs of logarithmic functions.
i. Use the properties of logarithms to evaluate logarithms.
j. Use the properties of logarithms to expand or condense logarithmic expressions.
k. Use the change-of-base formula to evaluate logarithms.
l. Solve exponential equations.
m. Solve logarithmic equations.
n. Solve exponential and logarithmic inequalities.
o. Write exponential functions.

Interdisciplinary Connections:

- ETS1.A: emphasizes the process of defining and delimiting engineering problems to ensure they are manageable, solvable, and aligned with criteria for success.
  Activity: Engineers frequently encounter scenarios involving exponential growth, decay, and logarithmic

functions when designing solutions in various fields. Engineers use exponential growth and decay models to predict population changes or the decay of pollutants over time. Understanding transformations and graphing of exponential functions help in analyzing environmental impacts and designing effective mitigation strategies.

E. Rational Functions (20 Days)

a. Graph other rational functions.
b. Simplify rational expressions.
c. Multiply rational expressions.
d. Divide rational expressions.
e. Add or subtract rational expressions.
f. Rewrite rational expressions and graph the related function.
g. Simplify complex fractions.
h. Solve rational equations by using the least common denominator.
i. Use inverses of functions.

Interdisciplinary Connections:

- MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

  Activity: Students will study ecological systems and biodiversity where mathematical models can be applied to understand population dynamics, food webs, or ecosystem interactions. They will analyze how rational functions can model growth rates, carrying capacities, or predator-prey relationships in ecosystems.

F. Arithmetic and Geometric Sequences and Series (17 days)

a. Use sequence notation to write terms of sequence.
b. Write a rule for the nth term of a sequence.
c. Identify arithmetic sequences.
d. Write rules for arithmetic sequences.
e. Find sums of finite arithmetic series.
f. Identify geometric sequences.
g. Write rules for geometric sequences.
h. Find sums of finite geometric series.
i. Evaluate recursive rules for sequences.
j. Write recursive rules for sequences.
k. Translate between recursive and explicit rules for sequences.
l. Use recursive rules to solve real-life problems.

Interdisciplinary Connections:

- MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

  Activity: Students will research biological systems where patterns and sequences are evident, such as growth patterns of organisms, population dynamics, or ecological cycles. They will analyze data from biological studies that describe sequences in genetic mutations, species interactions, or environmental changes over time.

G. Data Analysis and Statistics (16 Days)

a. Calculate probabilities using normal distributions.
b. Use z-scores and the standard normal table to find probabilities.

c. Distinguish between populations and samples.
d. Analyze hypotheses.
e. Identify types of sampling methods in statistical studies.
f. Recognize bias in sampling.
g. Recognize bias in survey questions.
h. Describe experiments.
i. Recognize how randomization applies to experiments and observational studies.
j. Analyze experimental designs.
k. Estimate population parameters.
l. Analyze estimated population parameters.
m. Find margins of error for surveys.
n. Organize data from an experiment with two samples.
o. Resample data using a simulation to analyze a hypothesis.
p. Make inferences about a treatment.

Interdisciplinary Connections:

- Social Studies Common Core Standard: SS.8.C&G.1

  Activity: Students will examine historical events or trends where statistical analysis played a crucial role in understanding societal changes or decision-making processes. They will identify primary and secondary sources that include statistical data, such as population studies, economic trends, or public opinion polls from specific historical periods.

H. Trigonometry (20 days)

a. Evaluate trigonometric functions of acute angles.
b. Find unknown side lengths and angle measures of right triangles.
c. Use trigonometric functions to solve real-life problems.
d. Draw angles in standard position.
e. Use radian measure.
f. Evaluate trigonometric functions of any angle.
g. Use sum and difference formulas to solve trigonometric equations and rewrite real-life formulas.
h. Find and use reference angles to evaluate trigonometric functions.
i. Explore characteristics of sine and cosine functions.
j. Stretch and shrink graphs of sine and cosine functions.
k. Graph tangent and cotangent functions.
l. Interpret and use frequency.
m. Write trigonometric functions.
n. Use technology to find trigonometric models.
o. Use trigonometric identities to evaluate trigonometric functions and simplify trigonometric expressions.
p. Verify trigonometric identities.
q. Use sum and difference formulas to evaluate and simplify trigonometric expressions.
r. Graph secant and cosecant functions.
s. Translate graphs of sine and cosine functions.
t. Reflect graphs of sine and cosine functions.
u. Explore characteristics of tangent and cotangent functions.

Interdisciplinary Connections:

- **RI.CR.8.1** Cite a range of textual evidence and make clear and relevant connections (including informational text features such as charts, graphs, and diagrams) that strongly support an analysis of multiple aspects of what an informational text explicitly, as well as inferences drawn from the text.
  W.AW.8.1 Write arguments on discipline-specific content to support claims with clear reasons and relevant evidence.
  Activity: Students will read informational texts about the history and applications of trigonometry. They will analyze these texts to identify how trigonometric functions are used in real-life scenarios, citing charts, graphs, and diagrams that illustrate key concepts.

I. Probability (13 days)

a. Find sample spaces.
b. Find theoretical probabilities.
c. Find experimental probabilities.
d. Determine whether events are independent events.
e. Find probabilities of independent and dependent events.
f. Find conditional probabilities.
g. Make two-way tables.
h. Find relative and conditional relative frequencies.
i. Use conditional relative frequencies to find conditional probabilities.
j. Find probabilities of compound events.
k. Use more than one probability rule to solve real-life problems.
l. Use the formula for the number of permutations.
m. Use the formula for the number of combinations.
n. Use combinations and the Binomial Theorem to expand binomials.
o. Construct and interpret probability distributions.
p. Construct and interpret binomial distributions.

Interdisciplinary Connections:

- **RI.MF.8.6** Evaluate the choices made when presenting an idea in different mediums and the advantages and disadvantages of using different mediums or formats to address a question or solve a problem.
  Activity: Students will research different methods of presenting probability data and analyses, such as written reports, digital presentations, and multimedia formats (e.g., videos, and interactive simulations). They will evaluate the advantages and disadvantages of each medium in terms of clarity, engagement, and effectiveness in communicating statistical information.

Career, Computer Science, and Key Skills

The Real Number System (N.RN)

Activity: Have students use an online exponent calculator or an algebra software (like Desmos) to input expressions with rational exponents and verify the results.

- Career Readiness: Relate the activity to critical thinking and problem-solving skills (Standard 9.4.8.CT.2), as students develop multiple solutions to simplify expressions and evaluate the most efficient method.
- Career Awareness: Discuss how rational exponents are used in fields such as engineering and technology, encouraging students to explore related careers (Standard 9.2.8.CAP.2).
- Technology Literacy: Have students use spreadsheet software to create tables of values for expressions with rational exponents, comparing them with their radical form (Standard 9.4.8.TL.1).
- Digital Citizenship: Emphasize the importance of managing digital tools responsibly while using online calculators and algebra software to explore rational exponents (Standard 9.4.8.DC.5).

Quantities (N.Q)

Activity: Students will plan a community garden by determining the amount of space needed for various plants, calculating the required soil and water quantities, and estimating the total cost. They will define appropriate quantities for each variable (e.g., area per plant, water per week, soil depth) and create a descriptive model of the garden layout using these quantities.

- Career Readiness, Life Literacies, and Key Skills Practices: Consider the environmental, social, and economic impacts of decisions.
    - Students will consider the environmental impact of their garden, such as using sustainable practices and choosing plants that benefit the local ecosystem.
- Career Awareness (9.2.8.CAP.3): Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
    - Discuss how skills in planning and resource management are valuable in careers related to environmental science, agriculture, and urban planning.
- Life Literacies, and Key Skills (9.4.8.TL.)1: Construct a spreadsheet to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
    - Students will use a spreadsheet to organize their garden data, calculate totals, and analyze the relationships between space, cost, and resources.
- Life Literacies, and Key Skills (9.4.8.DC.7): Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.
    - Students will collaborate online to gather information on the best plants for their climate and soil type, possibly using surveys to gather community input on preferred plants.

The Complex Number System (N.CN)

Activity: Present a simple AC circuit problem where students must calculate the total impedance using addition and multiplication of complex numbers. This exercise shows how complex numbers solve real-life problems in engineering careers.

- Career Awareness (9.2.8.CAP.8): Compare education and training requirements, income potential, and primary duties of electrical engineers and software developers. Discuss the importance of understanding complex numbers in these fields.
- Critical Thinking and Problem Solving (9.4.8.CT.2): Develop and evaluate multiple solutions to the AC circuit problem. Discuss short- and long-term effects of accurate calculations on the safety and efficiency of electrical systems.
- Technology Literacy (9.4.8.TL.1): Construct a spreadsheet to analyze and visualize the relationship between different components in an AC circuit. Use this tool to facilitate data-based decision-making in designing circuits.
- Digital Citizenship (9.4.8.DC.5): Discuss the importance of managing digital identity and practicing positive online behavior. Highlight how engineers collaborate online and share solutions responsibly, maintaining the integrity of shared information.

Creating Equations (A.CED)

Activity: Students will create and solve linear equations to simulate the budgeting process for a teen starting a small business, such as a lemonade stand.

- Career Readiness, Life Literacies, and Key Skills Practices:
    - Attend to financial well-being: This activity helps students understand the financial aspects of running a business and the importance of budgeting and financial planning.
- Career Awareness (9.2.8.CAP.5): Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals, and an educational plan. This activity encourages students to think about entrepreneurship and career planning.
- Technology Literacy (9.4.8.TL.1): Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making. Students can use spreadsheet software to input their equations and analyze the data.
- Digital Citizenship (9.4.8.DC.5): Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure. Students will be reminded to consider the implications of sharing their business plans and financial data online, focusing on digital responsibility and privacy.

Seeing Structure in Expressions (A.SSE)

Activity: Students will explore the concept of rewriting expressions, specifically focusing on the difference of squares, in the context of financial calculations, such as calculating interest rates or simplifying loan payment formulas.

- Career Readiness, Life Literacies, and Key Skills Practices:
    - Utilize critical thinking to make sense of problems and persevere in solving them: Students will employ critical thinking to rewrite and factor expressions, allowing them to solve financial problems more efficiently.
- Career Awareness (9.2.8.CAP.3): Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income. Through this activity, students learn to apply algebraic techniques to financial scenarios, linking their mathematical skills to potential career and life choices.
- Technology Literacy (9.4.8.TL.1): Construct a spreadsheet to analyze multiple data sets. Have students use spreadsheet software to input and manipulate expressions, observing how different forms of an expression can impact calculations and financial outcomes.
- Digital Citizenship (9.4.8.DC.4): Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences. Discuss the importance of accuracy and transparency when sharing financial calculations and models online, ensuring students understand the implications of their digital footprint in professional contexts.

Arithmetic with Polynomials and Rational Expressions (A.APR)

Activity: Students will create a digital presentation that includes: A summary of the polynomial operations they performed, Graphs generated using technology tools, A section on how these mathematical skills can be applied in real-world careers, and Proper citations for any digital tools and resources used, emphasizing digital citizenship.

- Career Readiness, Life Literacies, and Key Skills Practice: Utilize critical thinking to make sense of problems and persevere in solving them.
- 9.2 Career Awareness, Exploration, Preparation, and Training by the End of Grade 8: Develop a plan that includes information about career areas of interest. Students will explore how skills in algebra and technology can apply to various career paths, such as engineering, data analysis, and finance.
- Technology Literacy: Construct a spreadsheet to analyze polynomial data sets and facilitate data-based decision-making.
- Digital Citizenship: Manage digital identity and practice positive online behavior. Students will discuss the importance of ethical behavior and proper citation when using digital tools and resources.

Reasoning with Equations and Inequalities (A.REI)

Activity: Present students with a scenario where they need to solve a system of equations related to a career context. For example, "A small business is analyzing the budget for a marketing campaign. They need to determine how many units of two products (Product A and Product B) to sell to meet a specific revenue goal. The revenue from Product A is given by a linear equation and from Product B by a quadratic equation."

- Career Readiness, Life Literacies, and Key Skills Practices:Use technology to enhance productivity, increase collaboration, and communicate effectively.
    - Discuss how understanding and solving these equations is crucial for careers in business, finance, and marketing.
- Career Awareness (9.2.8.CAP.4): Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement.
- Technology Literacy (9.4.8.TL.1): Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
    - Use graphing software or a calculator to solve and visualize the equations.
- Digital Citizenship (9.4.8.DC.3): Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure.
    - Ensure students are aware of proper citation and attribution when using online tools for their calculations.

Interpreting Functions (F.IF)

Activity: Present students with a function that models a real-world scenario, such as the amount of money saved over time with a certain interest rate. Students will write a brief reflection on how understanding and analyzing functions can help in real-world problem-solving and decision-making. They will also discuss how their use of technology in graphing and analyzing functions (such as using graphing calculators or software) can impact their

future career opportunities. Additionally, they will reflect on the importance of maintaining a positive digital presence to support their career goals.

- Career Readiness, Life Literacies, and Key Skills Practices:Act as a responsible and contributing community member and employee: Understanding how analyzing functions can aid in real-world problem-solving and decision-making.
- Career Awareness (9.2.8.CAP.4): Explain how an individual's online behavior may impact opportunities for employment or advancement.
- Technology Literacy (9.4.8.TL.3): Select appropriate tools to organize and present information digitally.
- Digital Citizenship (9.4.8.DC.5): Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure.

Building Functions (F.BF)

Activity: Students will create and solve linear equations to simulate the budgeting process for a teen starting a small business, such as a lemonade stand.

- Career Readiness, Life Literacies, and Key Skills Practices:
  - Attend to financial well-being: This activity helps students understand the financial aspects of running a business and the importance of budgeting and financial planning.
- Career Awareness (9.2.8.CAP.5): Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals, and an educational plan. This activity encourages students to think about entrepreneurship and career planning.
- Technology Literacy (9.4.8.TL.1): Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making. Students can use spreadsheet software to input their equations and analyze the data.
- Digital Citizenship (9.4.8.DC.5): Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure. Students will be reminded to consider the implications of sharing their business plans and financial data online, focusing on digital responsibility and privacy.

Linear and Exponential Models (F.LE)

Activity: Present students with a function that models a real-world scenario, such as the amount of money saved over time with a certain interest rate. Students will write a brief reflection on how understanding and analyzing functions can help in real-world problem-solving and decision-making. They will also discuss how their use of technology in graphing and analyzing functions (such as using graphing calculators or software) can impact their future career opportunities. Additionally, they will reflect on the importance of maintaining a positive digital presence to support their career goals.

- Career Readiness, Life Literacies, and Key Skills Practices:Act as a responsible and contributing community member and employee: Understanding how analyzing functions can aid in real-world problem-solving and decision-making.
- Career Awareness (9.2.8.CAP.4): Explain how an individual's online behavior may impact opportunities for employment or advancement.
- Technology Literacy (9.4.8.TL.3): Select appropriate tools to organize and present information digitally.
- Digital Citizenship (9.4.8.DC.5): Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure.

Interpreting Categorical and Quantitative Data (S.ID)

Activity: Analyze and interpret data related to career trends, focusing on how data analysis skills are crucial in various fields, including career planning and technology use.

- Career Readiness, Life Literacies, and Key Skills:Use technology to enhance productivity, increase collaboration and communicate effectively.
  - Students will use spreadsheets to create plots and perform calculations, showcasing how technology can enhance productivity and data analysis.
- Career Awareness (9.2.8.CAP.8): Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.
  - Students will analyze career-related data to compare different career fields, understanding how data can impact career choices.
- Technology Literacy (9.4.8.TL.1): Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.

    - Students will use spreadsheets to analyze and represent career data, applying their technology skills to solve real-world problems.
- Digital Citizenship (9.4.8.DC.4): Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences.
    - `Students will discuss how data interpretation and sharing can impact career decisions and emphasize the importance of ethical data use and privacy.