Washington Township School District

The mission of the Washington Township Public Schools *is to provide a safe, positive, and progressive educational environment that provides opportunity for all students to attain the knowledge and skills specified in the NJ Learning Standards at all grade levels, so as to ensure their full participation in an ever-changing world as responsible, self-directed and civic-minded citizens.*

Course Title:	**Honors Algebra 2**
Grade Level(s):	9th

Duration:	*Full Year:*	**x**	*Semester:*		*Marking Period:*	
Course Description:	This course is an honors level Algebra 2 course which builds upon the skills learned in Algebra 1. Students will begin by extending knowledge on linear functions with graphs, equations and transformations as well as solving systems of equations in three variables. Students will then progress into quadratic functions – graphs, writing equations, and solving equations with real and complex solutions. Students will next explore polynomial functions and equations with graphs and solving equations. Students will then expand their knowledge on exponents into rational exponents and radical expressions into inverse functions. Students will expand their knowledge of exponential functions to their inverse functions, logarithms, then to the properties of logarithms, graph of logarithms and finally solve logarithmic and exponential equations. The next function students will expand their knowledge on is rational functions by graphing rational functions, simplifying rational functions, and solving rational functions. Students will be introduced to matrices and how to use matrices to solve systems of equations. Students will be introduced to trigonometric functions, the unit circle, graphs of sine and cosine and graphs of tangent and reciprocal functions. Students will be introduced to trigonometric identities. Students will build upon their knowledge of basic probability and will expand to combinations, permutations, as well as conditional probability. Students will explore arithmetic and geometric series.					
Grading Procedures:	Each semester will be a composite of quiz scores, test scores, homework, and participation reflecting a student's mastery of the areas outlined above. The student can pass the course with an overall average of 70%. The individual teacher will explain the grading system to the student.					
Primary Resources:	**NJDOE HS Algebra Model Curriculum** **NJ Student Learning Standards Mathematics (NJSLS-M)** **Algebra 2 with CalcChat and CalcView Common Core, Ron Larson, and Laurie Boswell; Big Ideas Learning, LLC**					

Washington Township Principles for Effective Teaching and Learning

- Implementing a standards-based curriculum
- Facilitating a learner-centered environment
- Using academic target language and providing comprehensible instruction
- Adapting and using age-appropriate authentic materials
- Providing performance-based assessment experiences
- Infusing 21st century skills for College and Career Readiness in a global society

Designed by:	Patricia Pinder

Under the Direction of:	Dr. Carole English

Written: 7/30/2022

Revised: _____

BOE Approval: _____

Unit 1: Linear Functions

Unit Description:
This chapter consists of work on transformations of functions and building new functions from existing functions, building upon skills learned in Algebra 1. The goal is to identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(x)*, *f(kx)*, and *f(x + k)* for specific values of k. Modeling with linear functions and solving linear systems in three variables are also included in this chapter.

Unit Duration: 2 weeks

Desired Results

Standard(s):

A-CED.A Create equations that describe numbers or relationships.

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

F-IF.C Analyze functions using different representations.

F-BF.B Build new functions from existing functions.

Indicators:

A-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales

A-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

F-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes

F-IF.C.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.B.3 Identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(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. Include recognizing even and odd functions from their graphs and algebraic expression for them.

Understandings:
Students will understand that…

- There are families of functions for parent functions in Algebra.
- Parent functions can be transformed using transformations on the parent function.
- Functions can be written by using transformations on parent functions.
- Linear functions can be used to model and analyze real-life situations.
- Systems of equations in three-variables have solutions, no solution, or the identity as a solution.

Essential Questions:

- What are the characteristics of some of the basic family of functions?
- How do the graphs of $y = f(x) + k, y = f(x + h)$ and $y = -f(x)$ compare to the graph of the parent function f ?
- How can you use a linear function to model and analyze a real-life situation?
- How can you determine the number of solutions of a linear system?

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Mid-Chapter Quiz Formative Checks Homework Practice Workbook Test Prep Activities Self-Assessments	Dynamic Assessment System • Section review and refresh • Point-of-use remediation • Reports • Homework

Benchmarks:
Chapter 1 Test

Performance Task: Flying Robot Design

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now

Explore It!

Go Formative Assessments

Guided Notes

Class Discussion

Ed Puzzle Activities

Self-Assessments

Independent Practice

Homework

Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 1 Activity

- Prerequisite Knowledge Skills Review

1.1/1.2 Parent Functions and Transformations & Transformations of Linear and Absolute Value Functions (1-2 Days)

- Families of Functions
- Transformation on Functions
- Writing Function Rules using Transformations

1.3 Modeling with Linear Functions (2-3 Days)

- Writing linear equations given a point and a slope, or two points, from a graph

- Find line of best fit/linear regression

1.4 Solving Linear Systems (2-3 Days)

- Solve three variable systems algebraically
- Solve and interpret special solutions to three variables systems

Chapter Review (1 Day)
Chapter Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

Dynamic Classroom with interactive content from Dynamic Student Edition for Explore It! And Performance Tasks

Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
Advanced Learners	• Invite students to explore different points of view on a topic of study and compare the two. • Assign a leadership role in classroom learning • Determine where student's interests lie and capitalize on their inquisitiveness. • Expose students to a selection and use of specialized resources
Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information • Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
Special Needs Learners	• Accommodate with completed study guides to assist with preparation on tests. • Allow more time to complete task, project, or test • Allow students to give responses in a form (oral or written) that's easier for him • Be flexible with time frames, deadlines, or modify assessments • Give alternate or paper copies to replace electronic assignments • Have another student share class notes with the special needs learner. • Higher level reasoning and questioning would have less weight than other assignments. • Receive study skill instructions. • Work with fewer items per page or line and/or materials in a larger print
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.4.12.O.17: Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

Life Literacies & Key Skills

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration and critical thinking.

Unit 2: Quadratic Functions

Unit Description:
This chapter is about the understanding of the characteristics of quadratic functions and writing equations of parabolas. The focus and the directrix are introduced to write and graph parabolas. Modeling with quadratic functions and graphing transformations of quadratic functions are also included in this chapter.

Unit Duration: 3 weeks

Desired Results

Standard(s):

A-CED.A Create equations that describe numbers or relationships.

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

F-IF.C Analyze functions using different representations.

F-BF.B Build new functions from existing functions.

Indicators:

A-CED.A.2 Create equation in two or more variables to represent relationships between quantities; graph equation on coordinate axes with labels and scales.

F-IF.B.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 relationships.

F-IF.B.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.

F-IF.C.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.B.3 Identify the effect on the graph of replacing *f(x)* by *f(x)* + *k*, *kf(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. Include recognizing even and odd functions from their graphs and algebraic expression for them.

Understandings:
Students will understand that…

- Quadratic functions can be transformed by using transformations.
- Quadratic functions can be graphed by using transformations.
- Quadratic functions can be written that represent transformations of the parent function.
- Properties of parabolas can be used to graph quadratic function.
- Characteristics of quadratic functions can be found from graphs of quadratics as well as equations.
- Characteristics of quadratic functions can be used to solve real-life problems.
- There is a relationship among the focus, the

Essential Questions:

- How do the constants *a*, *h* and *k* affect the graph of the quadratic function $g(x)=a(x-h)^2+k$?
- What type of symmetry does the graph of $g(x)=a(x-h)^2+k$ have and how can you describe this symmetry?
- What is the focus of a parabola?
- How can you use a quadratic function to model a real-life situation

directrix and the graph of the parabola.
- Graphs of parabolas can be made by using the focus and directrix of the parabola.
- Equations of parabolas can be written using the characteristics of parabolas.
- Equations of quadratic functions can be written using vertices, points, and x-intercepts.
- Equations of quadratic functions can be written to model data sets.
- Technology can be used to find a quadratic model for a set of data.

Assessment Evidence

Performance Tasks:

Mid-Chapter Quiz

Formative Checks

Homework

Practice Workbook

Test Prep Activities

Self-Assessments

Other Evidence:

Dynamic Assessment System

- Section review and refresh
- Point-of-use remediation
- Reports

Benchmarks:
Chapter 2 Test

Performance Task: Stargazing

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now

Explore It!

Go Formative Assessments

Guided Notes

Class Discussion

Ed Puzzle Activities

Self-Assessments

Independent Practice

Homework

Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 2 Activity

- Prerequisite Knowledge Skills Review

2.1 Transformations of Quadratic Functions (2 Days)

- Describe transformations on quadratics
- Graph using transformations on quadratics
- Write function rules using transformations on quadratics

2.2 Characteristics of Quadratic Functions (3 Days)

- Find parts of a parabola and graph in standard form
- Find parts of a parabola and graph in vertex form
- Find parts of a parabola and graph in intercept form

2.3 Focus of a Parabola (2 Days)

- Derive an equation of a parabola by using the focus and directrix
- Graph a quadratic using the focus and directrix
- Write equations of parabolas from a graph using the focus and directrix

2.4 Modeling with Quadratic Functions (2 Days)

- Write an equation of a quadratic by using the vertex and a point
- Write an equation of a quadratic by using a point and x-intercepts
- Find a quadratic model by using differences and quadratic regression

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

Dynamic Classroom with interactive content from Dynamic Student Edition for Explore It! And Performance Tasks

Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
Advanced Learners	• Invite students to explore different points of view on a topic of study and compare the two. • Assign a leadership role in classroom learning • Determine where student's interests lie and capitalize on their inquisitiveness. • Expose students to a selection and use of specialized resources
Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information • Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
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Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
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RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.4.12.O.17: Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

Life Literacies & Key Skills

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration and critical thinking.

Unit 3: Quadratic Equations and Complex Numbers

Unit Description:
This chapter contains solving quadratic equations and inequalities, which may include imaginary solutions. Complex numbers are introduced after a review of methods used in Algebra 1 to solve quadratic equations with real solutions. Methods for solving quadratics will include factoring, square roots, completing the square and the quadratic formula. Students will also extend their understanding of solving non-linear systems of equations.

Unit Duration: 4 weeks

Desired Results

Standard(s):

N-CN.A Perform arithmetic operations with complex numbers.

N-CN.C Use complex numbers in polynomial identities and equations.

A-CED.A Create equations that describe numbers or relationships.

A-REI.D Represent and solve equations and inequalities graphically.

F-IF.C Analyze functions using different representations.

Indicators:

N-CN.A.1 Know there is a complex number i such that $i^2 = -1$, and every complex number has the from a + bi with a and b real.

N-CN.A.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

A-CED.A.1 Create equations and inequalities in one variable and use them to solve problems.

A-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

A-REI.D.11 Explain why the x-coordinate of the points where the graphs of the equations y = f(x) and y = g(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.

F-IF.C.8 Write a function defined by expression in different but equivalent forms to reveal and explain different properties of the function.

Understandings:
Students will understand that…

- Quadratic equations can have real and complex solutions which can be found graphically and algebraically.
- Properties of addition, subtraction, and multiplication be used to simplify expressions with imaginary and complex numbers.
- Quadratic equations can be solved by inspection taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation.
- Similar to linear systems, nonlinear systems of equations can be solved by graphing, substitution, and/or elimination.
- Quadratic inequalities can be solved graphically and algebraically.

Essential Questions:

- How can you use the graph of a quadratic equation to determine the number of real solutions of the equation?
- What are the subsets of the set of complex numbers?
- How can you complete the square for a quadratic expression?
- How can you derive a general formula for solving a quadratic equation?
- How can you solve a nonlinear system of equations?
- How can you solve a quadratic inequality?

Assessment Evidence

Performance Tasks:

Mid-Chapter Quiz
Formative Checks
Homework
Practice Workbook
Test Prep Activities
Self-Assessments

Other Evidence:

Dynamic Assessment System

- Section review and refresh
- Point-of-use remediation
- Reports

Benchmarks:
Chapter 3 Test

Performance Task: Radioactive!

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now
Explore It!
Go Formative Assessments
Guided Notes
Class Discussion
Ed Puzzle Activities
Self-Assessments
Independent Practice
Homework
Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 3 Activity

- Prerequisite Knowledge Skills Review

3.1 Solving Quadratic Equations (3 Days)

- Solve quadratic equations by graphing
- Solve quadratic equations algebraically
- Use quadratic equations to solve real-life problems

3.2 Complex Numbers (2 Days)

- Define the imaginary unit *i* and use it to rewrite the square root of a negative number

- Add, subtract, and multiply complex numbers
- Find complex solutions of quadratic equations and complex zeros of quadratic functions.

3.3 Completing the Square (3 Days)

- Solve quadratic equations by using square roots.
- Solve quadratic equations by completing the square.
- Apply completing the square to write quadratic functions in vertex form.

3.4 Using the Quadratic Formula (2 Days)

- Solve quadratic equations using the Quadratic Formula.
- Find and interpret the discriminant of an equation.
- Write quadratic equations with different numbers of solutions using the discriminant.

3.5 Solving Non-Linear Systems of Equations (2 Days)

- Describe what a non-linear system of equations is.
- Solve nonlinear systems using graphing, substitution, or elimination.
- Solve quadratic equations by graphing each side of the equation.

3.6 Quadratic Inequalities (2 Days)

- Describe the graph of a quadratic inequality.
- Graph quadratic inequalities.
- Graph systems of quadratic inequalities.
- Solve quadratic inequalities algebraically and graphically.

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

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Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
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Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
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Computer and Design Thinking

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Life Literacies & Key Skills

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Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration and critical thinking.

Unit 4: Polynomial Functions

Unit Description:
This chapter extends students' knowledge of linear and quadratic functions to other polynomial functions. Students will graph polynomial functions and write and solve polynomial equations. Characteristics of polynomials will be explored and utilized for solving and sketching polynomials. Long division and synthetic division will be used a tool to find zeros of polynomials. The Fundamental Theorem of Algebra will be introduced and used to solve for all the roots of polynomials.

Unit Duration: 4-5 weeks

Desired Results

Standard(s):

N-CN.C Use complex numbers in polynomial identities and equations.

A-SSE.A Interpret structure of expressions

A-APR.A Perform arithmetic operations on polynomials

A-APR.B Understand the relationship between zeros and factors of polynomials

A-APR.C Use polynomial identities to solve problems

A.APR.D Rewrite rational expressions

A-CED.A Create equations that describe numbers or relationships

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

F-IF.C Analyze functions using different representations

F-BF.B Build new functions from existing functions

Indicators:

N-CN.C.8 Extend polynomial identities to the complex numbers

N-CN.C.9 Know the Fundamental Theorem of Algebra, show that it is true for quadratic polynomials

A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it.

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.

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 $p(x)$.

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.

A-APR.C.4 Prove polynomial identities and use them to describe numerical relationships.

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

A-APR.D.6 Rewrite simple rational expressions in different form, write $a(x)/b(x)$ in the from of $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with degrees of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or , for the more complicated algebra system.

A-CED.A.2 Create equations in two or more variables to represent relationships between quantities, graph equations on coordinate axes with labels and scales.

F-IF.B.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.

F-IF.C.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F-BF.B.3 Identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(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. Include recognizing even and odd functions from their graphs and algebraic expression for them.

Understandings:

Students will understand that…

- Polynomials can be classified be degree, leading coefficient, and end behavior.
- Binomials raised to an exponent can be expanded using special patterns, identities, and Pascal's Triangle
- Polynomials can be divided using long division, or synthetic division if the divisor is in the form *x-k*.
- Polynomials can be factored using common monomial factors, sum/difference of cubes, quadratic factoring strategies, and the factor theorem.
- Using the rational root theorem, possible solutions for a polynomial can be determined, and then tested using synthetic division to find the actual solutions.
- If a polynomial a degree *n* where *n>0*, then the equation f(x)=0 has *n* number of solutions. Solutions can be repeated.
- Descartes's rule of signs can determine the number of positive and negative real zeros.
- Polynomial functions can be transformed in the same way linear, absolute-value, and quadratic functions are transformed.
- Every polynomial function of degree *n* has *at most n-1* turning points.
- Real-life data can be modeled as a polynomial using finite differences and/or the regression feature via technology.

Essential Questions:

- What are some common characteristics of the graphs of cubic and quartic polynomial functions?
- How can you cube a binomial?
- How can you use the factors of a cubic polynomial to solve a division problem involving the polynomial?
- How can you factor a polynomial?
- How can you determine whether a polynomial equation has a repeated solution?
- How can you determine whether a polynomial equation has imaginary solutions?
- How can you transform the graph of a polynomial function?
- How many turning points can the graph of polynomial function have?
- How can you find a polynomial model for a real-life data?

Assessment Evidence

Performance Tasks:

Mid-Chapter Quiz

Formative Checks

Homework

Practice Workbook

Test Prep Activities

Self-Assessments

Other Evidence:

Dynamic Assessment System

- Section review and refresh
- Point-of-use remediation
- Reports

Benchmarks:
Chapter 4 Test

Performance Task: Thrown to the Wolves

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now

Explore It!

Go Formative Assessments

Guided Notes

Class Discussion

Ed Puzzle Activities

Self-Assessments

Independent Practice

Homework

Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 4 Activity

- Prerequisite Knowledge Skills Review

4.1 Graphing Polynomial Functions (2 Days)

- Identify and evaluate polynomial functions.
- Graph polynomial functions.
- Describe end behavior of polynomial functions.

4.2 Adding, Subtracting, and Multiplying Polynomials (2 Days)

- Add and subtract polynomials
- Multiply polynomials and use special product patterns.
- Use Pascal's Triangle to expand binomials. *(Optional)*

4.3 Dividing Polynomials (1 Day)

- Use long division to divide polynomials by other polynomials.
- Divide polynomials by binomials of the form x – k using synthetic division.
- Explain the Remainder Theorem.

4.4 Factoring Polynomials (2 Days)

- Find common monomial factors of polynomials.
- Factor polynomials.
- Use the Factor Theorem.

4.5 Solving Polynomial Equations (2-3 Days)

- Explain how solutions of equations and zeros of functions are related.
- Solve polynomial equations.
- Write a polynomial function when given information about its zeros.

4.6 The Fundamental Theorem of Algebra (2 Days)

- Identify the degree of a polynomial.
- Explain the Fundamental Theorem of Algebra.
- Find all the zeros of a polynomial function.

4.7 Transformations of Polynomial Functions (1 Day)

- Describe transformations of polynomial functions
- Graph transformations of polynomial functions.
- Write functions that represent transformations of polynomial functions.

4.8 Analyzing Graphs of Polynomial Functions (2 Days)

- Identify a turning point of a polynomial function.
- Analyze real zeros and turning points numerically.
- Explain the relationship among the degree of a polynomial function, real zeros, and turning points.

4.9 Modeling with Polynomial Functions (1 Day)

- Write polynomial function given a graph or a set of points.
- Write a polynomial function using finite differences.
- Use technology to find a polynomial model for a set of data.

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

Dynamic Classroom with interactive content from Dynamic Student Edition for Explore It! And Performance Tasks

Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
Advanced Learners	• Invite students to explore different points of view on a topic of study and compare the two. • Assign a leadership role in classroom learning • Determine where student's interests lie and capitalize on their inquisitiveness. • Expose students to a selection and use of specialized resources
Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information • Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
Special Needs Learners	• Accommodate with completed study guides to assist with preparation on tests. • Allow more time to complete task, project, or test • Allow students to give responses in a form (oral or written) that's easier for him • Be flexible with time frames, deadlines, or modify assessments • Give alternate or paper copies to replace electronic assignments • Have another student share class notes with the special needs learner. • Higher level reasoning and questioning would have less weight than other assignments. • Receive study skill instructions. • Work with fewer items per page or line and/or materials in a larger print
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.4.12.O.17: Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

Life Literacies & Key Skills

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration, communication, and critical thinking.

Unit 5: Rational Exponents and Radical Functions

Unit Description:
This unit will extend students' knowledge of exponents to rational exponents. Properties of exponents of will be expanded from Algebra 1 to rational exponents. The connection from rational exponents to radical expressions will be made in this chapter. Students will simplify higher degree radicals and lead to solving radical equations. Students will also graph and transform graphs of radical functions.

Unit Duration: 4 weeks

Desired Results

Standard(s):

N-RN.A Extend the properties of exponents to rational exponents

A-CED.A Create equations that describe numbers or relationships

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

F-IF.C Analyze functions using different representations

F-BF.A Understand the concept of a function and use function notation

F-BF.B Build new functions from existing functions

Indicators:

N-RNA.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integers exponents to those values, allowing for a notation for radicals in terms of rational exponents.

N-RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

A-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

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

F-IF.C.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute functions

F-BF.A.1b Combine standard function types using arithmetic operations.

F-BF.A.1c Compose functions

F-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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. Include recognizing even and odd functions from their graphs and algebraic expression for them.

F-BF.B.4a Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse

Understandings:	**Essential Questions:**
Students will understand that… • The denominator of a rational exponent is the index when written in radical form. • Rewriting a radical into rational exponent form can allow the use of exponent properties when simplifying rational expressions. • Radical functions can be graphed using the parent function and function transformations. • Radical equations can be solved by isolating the radical and raising both sides of the equation to	• How can you use rational exponent to represent a power involving a radical? • How can you use properties of exponent to simplify products and quotients of radicals? • How can you identify the domain and range of a radical function? • How can you solve a radical equation? • How can you use the graphs of two functions to sketch the graph of an arithmetic combination of the two functions? • How can you find the composition of two functions?

the same exponent number as the index in order to eliminate the radical. • Polynomial operations can also be defined for functions. Technology can also be used to perform function operations, using the trace feature. • Compositions of functions can be found by using the output of one function as the input of the other function. • The graph of an inverse function is a reflection of the graph of the original function over the line y=x.	• How can you sketch the graph of an inverse of a function?

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Mid-Chapter Quiz Formative Checks Homework Practice Workbook Test Prep Activities Self-Assessments	Dynamic Assessment System • Section review and refresh • Point-of-use remediation • Reports

Benchmarks:
Chapter 5 Test

Performance Task: The Sounds of Music

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now
Explore It!
Go Formative Assessments
Guided Notes
Class Discussion
Ed Puzzle Activities
Self-Assessments
Independent Practice
Homework
Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 5 Activity

- Prerequisite Knowledge Skills Review

5.1 n^{th} Root and Rational Exponents (1 Day)

- Explain the meaning of a rational exponent.
- Evaluate expressions with rational exponents.
- Solve equations using n^{th} roots.

5.2 Properties of Rational Exponents and Radicals (2-3 Days)

- Simplify radical expressions with rational exponents.
- Explain when radical expressions are in simplest form.
- Simplify variable expressions containing rational exponents and radicals.

5.3 Graphing Radical Functions (2 Days)

- Graph radical functions.
- Describe transformations of radical functions.
- Write functions that represent transformations of radical functions.

5.4 Solving Radical Equations and Inequalities (2 Days)

- Identify radical equations and inequalities
- Solve radical equations and inequalities.
- Identify extraneous solutions of radical equations.
- Solve real-life problems involving radical equations.

5.5 Performing Function Operations (1 Day)

- Explain what it means to perform an arithmetic operation on two functions.
- Find arithmetic combinations of two functions.
- State the domain of an arithmetic combination of two functions.
- Evaluate an arithmetic combination of two functions for a given input.

5.6 Composition of Functions (1-2 Days)

- Evaluate a composition of functions.
- Find a composition of functions.
- State the domain of a composition of functions.

5.7 Inverse of a Function (2-3 Days)

- Explain what inverse functions are.
- Find inverses of linear and nonlinear functions.
- Determine whether a pair of functions are inverses.

Chapter Review (1 Day)

Test (1 Day)

Resources:

- “Laurie’s Notes” per chapter throughout TE
- Everyday Connection Videos via QR-Codes
- Dynamic Classroom with interactive content from Dynamic Student Edition for Explore It! And Performance Tasks
- Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
Advanced Learners	• Invite students to explore different points of view on a topic of study and compare the two. • Assign a leadership role in classroom learning • Determine where student's interests lie and capitalize on their inquisitiveness. • Expose students to a selection and use of specialized resources
Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information • Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
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Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
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RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
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9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
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9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration, communication, and critical thinking.

Unit 6: Exponential and Logarithmic Functions

Unit Description:
This chapter extends students' knowledge of functions to exponential and logarithmic functions. Connections from exponential functions to logarithmic functions will be studied. Students will study the behavior, graphs, and real-life applications of exponential and logarithmic functions. Properties of logarithmic functions will be analyzed and used to solve exponential and logarithmic equations.

Unit Duration: 3 weeks

Desired Results

Standard(s):

A-SSE.A Interpret structure of expressions

A-CED.A Create equations that describe numbers or relationships

F-IF.C Analyze functions using different representations

F-BF.B Build new functions from existing functions

F-LE.A Construct and compare linear and exponential models and solve problems

Indicators:

A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it.

A-CED.A.2 Create equation in two or more variables to represent relationships between quantities; graph equation on coordinate axes with labels and scales.

F-IF.C.7e Graph exponential and logarithmic functions, showing intercepts and end behaviors, and trigonometric functions, showing period, midline, and amplitude

F-IF.C.8b Use properties of exponents to interpret expressions for exponential functions

F-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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. Include recognizing even and odd functions from their graphs and algebraic expression for them.

F-BF.B.4a Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse

F-BF.B.4 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

Understandings:
Students will understand that…

- Exponential growth models go away from the graph's asymptote, whereas exponential decay models go towards the graph's asymptote from left to right.
- The natural base e is an irrational number that represent continuous compounding of an exponential function.
- The graph of a logarithmic function is the inverse of an exponential function.
- Exponential and logarithmic functions can be transformed in the same way linear, absolute-value, polynomial and quadratic functions are transformed.
- Due to logarithmic and exponential functions being inverses, the product, quotient, and power

Essential Questions:

- What are some of the characteristics of the graph of an exponential function?
- What is the natural base e?
- What are some of the characteristics of the graph of a logarithmic function?
- How can you transform the graphs of exponential and logarithmic functions?
- How can you use the properties of exponents to derive properties of logarithms?
- How can you solve exponential and logarithmic equations?
- How can you recognize polynomial, exponential, and logarithmic models?

property of logarithms correspond to the exponential properties.
- When solving exponential equations, the exponents can be set equal once a common base if found. If the bases are not the same, the logarithm must be taken on each side.
- When solving logarithmic equations, each side of the equation can be exponentiated to obtain an equation with no logarithms.
- Analyzing the outputs of a functions table, scatter plots, and regression technology are methods for modeling with logarithmic and exponential functions.

Assessment Evidence

Performance Tasks:

Mid-Chapter Quiz

Formative Checks

Homework

Practice Workbook

Test Prep Activities

Self-Assessments

Other Evidence:

Dynamic Assessment System

- Section review and refresh
- Point-of-use remediation
- Reports

Benchmarks:
Chapter 6 Test

Performance Task: Carbon Dating

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now

Explore It!

Go Formative Assessments

Guided Notes

Class Discussion

Ed Puzzle Activities

Self-Assessments

Independent Practice

Homework

Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 6 Activity

- Prerequisite Knowledge Skills Review

6.1 Exponential Growth and Decay Functions (2 Days)

- Identify and graph exponential growth and decay.
- Write exponential growth and decay functions.
- Solve real-life problems using exponential growth and decay

6.2 The Natural Base e (1 Day)

- Explain the natural base e
- Simplify natural base expressions.
- Graph natural base functions.
- Solve real-life problems using exponential growth and decay functions.

6.3 Logarithms and Logarithmic Functions (1 Day)

- Explain the meaning of a logarithm with base b.
- Evaluate logarithmic expressions.
- Graph logarithmic functions.

6.4 Transformations of Exponential and Logarithmic Functions (2 Days)

- Describe transformations of exponential and logarithmic functions.
- Graph transformations of exponential and logarithmic functions.
- Write functions that represent transformations of exponential and logarithmic functions.

6.5 Properties of Logarithms (1 Day)

- Evaluate logarithms.
- Expand or condense logarithmic expressions.
- Explain how to use the change-of-base formula.

6.6 Solving Exponential and Logarithmic Equations (2 Days)

- Solve exponential equations
- Solve logarithmic equations.
- Solve exponential and logarithmic inequalities.

6.7 Modeling with Exponential and Logarithmic Functions (2 Days)

- Use common ration to determine whether data can be represented by an exponential function.
- Write an exponential function using two points.
- Use technology to find exponential models and logarithmic models for sets of data.

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

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Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

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Interdisciplinary Connections

Indicators:

ELA 9-12

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Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
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Life Literacies & Key Skills

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Financial Literacy

9.1.12.CDM.6: Compute and assess the accumulating effect of interest paid over time when using a variety of sources of credit. (e.g., student loans, credit cards, auto loans, mortgages, etc.).
9.1.12.CDM.8: Compare and compute interest and compound interest and develop an amortization table using business tools.

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration, communication, and critical thinking.

Unit 7: Rational Functions

Unit Description:
This chapter extends students' knowledge of functions to rational functions. Students will study the behavior, graphs, and real-life applications of rational functions. Characteristics of rational functions will be explored, and transformations of rational functions will be analyzed. Operations on rational expressions will be extended from Algebra 1. Students will solve rational equations.

Unit Duration: 3 weeks

Desired Results

Standard(s):

A-APR.D Rewrite rational expressions

A-CED.A Create equations that describe numbers or relationships

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

F-BF.B Build new functions from existing functions

Indicators:

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

A-APR.D.7 Understand that rational expressions form a system of analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

A-CED.A.1 Create equations and inequalities in one variable and use them to solve problems

A-CED.A.2 Create equation in two or more variables to represent relationships between quantities; graph equation on coordinate axes with labels and scales.

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

F-BF.B.3 Identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(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. Include recognizing even and odd functions from their graphs and algebraic expression for them.

Understandings:
Students will understand that…

- Quantities vary directly when their ratios are constant, they vary inversely when their products are constant.
- The graph of the parent function $f(x) = \frac{1}{x}$ is a hyperbola which consists of two symmetrical parts called branches separated by vertical and horizontal asymptotes.
- The domain of rational expression excludes values that make the denominator zero in the given and/or simplified expressions.
- Rational equations can be solved by multiplying each side of the equation by the least common denominator; or using cross-multiplication when

Essential Questions:

- How can you recognize when two quantities vary directly or inversely?
- What are some of the characteristics of the graph of a rational function?
- How can you determine the excluded values in a product or quotient of two rational expressions?
- How can you determine the domain of the sum or difference of two rational expressions?
- How can you solve a rational equation?

each side of the equation is a single rational expression.

Assessment Evidence

Performance Tasks:

Mid-Chapter Quiz

Formative Checks

Homework

Practice Workbook

Test Prep Activities

Self-Assessments

Other Evidence:

Dynamic Assessment System

- Section review and refresh
- Point-of-use remediation
- Reports

Benchmarks:
Chapter 7 Test

Performance Task: 3-D Printing

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now

Explore It!

Go Formative Assessments

Guided Notes

Class Discussion

Ed Puzzle Activities

Self-Assessments

Independent Practice

Homework

Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 7 Activity

- Prerequisite Knowledge Skills Review

7.1 Inverse Variation (1 Day)

- Identify equations and data sets that show direct variation.
- Identify equations and data sets that show inverse variation.
- Write inverse variation equations.
- Solve real-life problems using inverse variation functions.

7.2 Graphing Rational Functions (2 Days)

- Graph rational functions.
- Describe transformations of rational functions.
- Explain how to find the asymptotes of a rational function from an equation.
- Write rational functions in different forms.

7.3 Multiplying and Dividing Rational Expressions (2 Days)

- Simplify rational expressions and identify any excluded values.
- Multiply rational expressions.
- Divide rational expressions.

7.4 Adding and Subtracting Rational Expressions (2 Days)

- Add and subtract rational expressions with like denominators.
- Explain how to find a common denominator for rational expressions.
- Add or subtract rational expressions with unlike denominators.

7.5 Solving Rational Equations (2 Days)

- Solve rational equations by cross multiplying and by using least common denominators.
- Identify extraneous solutions of rational equations.
- Solve real-life problems using inverses of rational functions.

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

Dynamic Classroom with interactive content from Dynamic Student Edition for Explore It! And Performance Tasks

Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
Advanced Learners	• Invite students to explore different points of view on a topic of study and compare the two. • Assign a leadership role in classroom learning • Determine where student's interests lie and capitalize on their inquisitiveness. • Expose students to a selection and use of specialized resources
Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information • Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
Special Needs Learners	• Accommodate with completed study guides to assist with preparation on tests. • Allow more time to complete task, project, or test • Allow students to give responses in a form (oral or written) that's easier for him • Be flexible with time frames, deadlines, or modify assessments • Give alternate or paper copies to replace electronic assignments • Have another student share class notes with the special needs learner. • Higher level reasoning and questioning would have less weight than other assignments. • Receive study skill instructions. • Work with fewer items per page or line and/or materials in a larger print
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.4.12.O.17: Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

Life Literacies & Key Skills

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration and critical thinking.

Unit 8: Matrices

Unit Description:

This chapter focuses on performing operations with matrices and using matrices to solve applicable problems, including systems of linear equations. Students will be introduced to what a matrix is and the operations that can be performed on matrices. Matrix multiplication will be introduced and used to find inverse matrices. Methods for solving systems of equations using matrices will be explored.

Unit Duration: 2-3 weeks

Desired Results

Standard(s):

N-VM.C Perform operations on matrices and use matrices in applications

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

Indicators:

N-VM.C.6 Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network

N-VM.C.7 Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

N-VM.C.8 Add, subtract, and multiply matrices of appropriate dimensions.

N-VM.C.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.

N-VM.C.10 Understand that the zeros and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

N-VM.C.12 Wort 2 x 2 matrices as a transformation of the plane and interpret the absolute value of the determinant in terms of area.

A-REI.C.8 Represent a system of linear equations as a single matrix equation in a vector variable.

A-REI.C.9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimensions 3 x 3 or greater).

Understandings:

Students will understand that…

- Addition and subtraction operations and scalar multiplication can be done on matrices.
- Real-life problems can be solved by using matrix equations.
- Multiplication of matrices can only be done when it is defined.
- Matrix multiplication can be used to solve real-life problems.
- Square matrices have determinants.
- Determinants of matrices can be used to find area of triangles.
- Determinants of matrices can be used to solve systems of equations.
- Matrices have inverses.

Essential Questions:

- How do you perform operations with matrices?
- How do you determine when a product of matrices is defined?
- How do you evaluate determinants of matrices?
- How do you use inverse matrices to solve problems?

- Linear systems of equations can be solved using inverse matrices.
- Real-life problems can be solved using inverse matrices.

Assessment Evidence

Performance Tasks:

Mid-Chapter Quiz

Formative Checks

Homework

Practice Workbook

Test Prep Activities

Self-Assessments

Other Evidence:

Dynamic Assessment System

- Section review and refresh
- Point-of-use remediation
- Reports

Benchmarks:
Chapter 12 Test

Performance Task: Food Webs

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now

Explore It!

Go Formative Assessments

Guided Notes

Class Discussion

Ed Puzzle Activities

Self-Assessments

Independent Practice

Homework

Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 12 Activity

- Prerequisite Knowledge Skills Review

12.1 Basic Matrix Operations (1Day)

- Add and subtract matrices
- Multiply matrices by scalars.
- Solve matrix equations.
- Represent data in a matrix to solve real-life problems.

12.2 Multiplying Matrices (1 Day)

- Determine whether a product of a matrices is defined.
- Multiply matrices.
- Use matrix multiplication to solve real-life problems.

12.3 Determinants and Cramer's Rule (2-3 Days)

- Find the determinant of a square matrix.
- Use determinants to find area of triangles.
- Use determinants to solve systems of equations.

12.4 Inverse Matrices (1 Day)

- Find the inverse of a matrix.
- Solve linear systems using inverse matrix.
- Solve real-life problems using matrices.

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

Dynamic Classroom with interactive content from Dynamic Student Edition for Explore It! And Performance Tasks

Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
Advanced Learners	• Invite students to explore different points of view on a topic of study and compare the two. • Assign a leadership role in classroom learning • Determine where student's interests lie and capitalize on their inquisitiveness. • Expose students to a selection and use of specialized resources
Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background

	• Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information • Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
Special Needs Learners	• Accommodate with completed study guides to assist with preparation on tests. • Allow more time to complete task, project, or test • Allow students to give responses in a form (oral or written) that's easier for him • Be flexible with time frames, deadlines, or modify assessments • Give alternate or paper copies to replace electronic assignments • Have another student share class notes with the special needs learner. • Higher level reasoning and questioning would have less weight than other assignments. • Receive study skill instructions. • Work with fewer items per page or line and/or materials in a larger print
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.

RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.4.12.O.17: Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

Life Literacies & Key Skills

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration, communication, and critical thinking.

Unit 9: Trigonometric Ratios and Functions

Unit Description:

This chapter extends students' knowledge of functions to trigonometric functions. The unit circle will be introduced for students to evaluate the six trigonometric functions leading students to find the trigonometric functions of any angle. Right triangle trigonometry will be used to solve real-life problems. Students will evaluate and graph trigonometric functions, model using trigonometric functions, and use trigonometry identities.

Unit Duration: 3-4 weeks

Desired Results

Standard(s):

A-CED.A Create equations that describe numbers or relationships

F-IF.C Analyze functions using different representations

F-BF.B Build new functions from existing functions

F-TF.A Extend the domain of trigonometric functions using the unit circle

F-TF.B Model periodic phenomena with trigonometric functions

F-TF.C Prove and apply trigonometric identities

Indicators:

A-CED.A.2 Create equation in two or more variables to represent relationships between quantities; graph equation on coordinate axes with labels and scales.

F-IF.C.7e Graph exponential and logarithmic functions, showing intercepts and end behaviors, and trigonometric functions, showing period, midline, and amplitude

F-BF.B.3 Identify the effect on the graph of replacing *f(x)* by *f(x)* + *k*, *kf(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. Include recognizing even and odd functions from their graphs and algebraic expression for them.

F-TF.A.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F-TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measure of angles traversed counter-clockwise around the unit circle.

F-TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

F-TF.C.8 Prove the Pythagorean identify $\sin^2\theta + \cos^2\theta = 1$ and use it find sin Θ, cos Θ, or tan Θ given sin Θ, cos Θ, or tan Θ and the quadrant of the angle.

F-TF.C.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Understandings:	**Essential Questions:**
Students will understand that… • The ratios of a right triangle's side lengths (hypotenuse, opposite, and adjacent) are used to determine the six trigonometric functions. • To convert between degree and radian measure use the fact that $\frac{\pi\ radians}{180^\circ} = 1$	• How can you find a trigonometric function of the acute angle θ? • How can you find the measure of an angle in radians? • How can you use the unit circle to define the trigonometric functions of any angle? • What are the characteristics of the graphs of the sine and cosine functions?

• The values of sinθ ad cosθ are the y-coordinate and x-coordinate of the point where the terminal side of θ intersects the unit circle • Sine and Cosine functions are period functions with amplitude, periods, and cycles. • Tangent function graphs are periodic with asymptotes separating each cycle. Tangent functions do not have an amplitude • Trigonometric function graphs are used for real-life problems involving oscillating motions or repeating patterns. • To prove an identity, one side of the equation is manipulated using algebra and trigonometric properties to match the other side of the equation.	• What are the characteristics of the graph of the tangent function? • What are the characteristics of the real-life problems that can be modeled by trigonometric functions? • How can you verify a trigonometric identity?

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Mid-Chapter Quiz Formative Checks Homework Practice Workbook Test Prep Activities Self-Assessments	Dynamic Assessment System • Section review and refresh • Point-of-use remediation • Reports

Benchmarks:
Chapter 10 Test

Performance Task: Smooth Sailing

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now
Explore It!
Go Formative Assessments
Guided Notes
Class Discussion
Ed Puzzle Activities
Self-Assessments
Independent Practice
Homework
Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 10 Activity

- Prerequisite Knowledge Skills Review

10.1 Right Triangle Trigonometry (2 Days)

- Define the six trigonometric functions.
- Evaluate trigonometric functions.
- Use trigonometric functions to find the side lengths of right triangles.

10.2 Angles and Radian Measure (2 Days)

- Draw angles in standard position.
- Explain the meaning of radian measure.
- Convert between degrees and radians.

10.3 Trigonometric Functions of Any Angle (2 Days)

- Evaluate trigonometric functions given a point on an angle.
- Evaluate trigonometric functions using the unit circle.
- Find and use reference angles to evaluate trigonometric functions.
- Solve real-life problems involving projectiles.

10. 4 Graphing Sine and Cosine Function (3 Days)

- Identify characteristics of sine and cosine functions.
- Graph transformations of sine and cosine functions.

10.5 Graphing Other Trigonometric Functions (2 Days)

- Identify characteristics of tangent, cotangent, secant, and cosecant functions.
- Graph tangent and cotangent functions.
- Graph secant and cosecant functions.

10.6 Modeling with Trigonometric Functions (1 Day)

- Write and graph trigonometric functions using frequency.
- Write trigonometric functions for a given graph.
- Find a trigonometric model for a set of data using technology.

10.7 Using Trigonometric Identities (optional)

- Evaluate trigonometric functions using trigonometric identities.
- Simplify trigonometric expressions using trigonometric identities.

- Verify trigonometric identities.

10.8 Using Sum and Difference Formulas (optional)

- Evaluate trigonometric expressions using sum and difference formulas.
- Simplify trigonometric expressions using sum and difference formulas.
- Solve trigonometric equations using sum and difference formulas

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

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Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
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Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information

	• Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
Special Needs Learners	• Accommodate with completed study guides to assist with preparation on tests. • Allow more time to complete task, project, or test • Allow students to give responses in a form (oral or written) that's easier for him • Be flexible with time frames, deadlines, or modify assessments • Give alternate or paper copies to replace electronic assignments • Have another student share class notes with the special needs learner. • Higher level reasoning and questioning would have less weight than other assignments. • Receive study skill instructions. • Work with fewer items per page or line and/or materials in a larger print
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
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RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education

9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.4.12.O.17: Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

Life Literacies & Key Skills

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:

From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration, communication, and critical thinking.

Unit 10: Probability

Unit Description:

This chapter consists of independent probability and conditional probability, using them to interpret data, and using probability rules to find probabilities of compound events. Students will be introduced to simple probability and extend to conditional probability. Two-way charts will be explored as a tool for finding probability. Students will explore the differences between independent and dependent events.

Unit Duration: 2-3 weeks

Desired Results

Standard(s):

A-APR.C Use polynomial identities to solve problems

S-CP.A Understand independence of conditional probability and use them to interpret data.

S-CP.B Use the rules of probability to compute probabilities of compound events in a uniform probability model.

S-IC Making inferences and justifying conclusions.

S-ID Interpreting categorical and quantitative data.

Indicators:

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

S-CP.A.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or", "and", "not")

S-CP.A.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent

S-CP.A.3 Understand the conditional probability of A given B as P(A and B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

S-CP.A.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

S-CP.A.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

S-CP.B. 6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A and interpret the answer in terms of the model.

S-CP.B.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and P) and interpret the answer in terms of the model.

S-CP.B.8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B) and interpret the answer in terms of the model.

S-CP.B.9 Use the permutations and combinations to compute probabilities of compound events and solve problems.

S.ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution, estimate population percentages, and 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).

S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population

S.IC.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0. 5. Would a result of 5 tails in a row cause you to question the model?*

S.IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

S.IC.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.

S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

S.IC.6 Evaluate reports based on data.

Understandings:

Students will understand that…

- Sample spaces have theoretical and experimental probability.
- Two-way tables can be used to find and interpret relative frequencies and conditional frequencies.
- Conditional relative frequencies can be used to find probabilities.
- Conditional probability can be used in decision making.
- Sample space can be used to determine if events are independent.
- Conditional probability can be used to determine if events are independent.
- The union of two events is the compound event.
- Overlapping events occur when events have one or more common events.
- Disjoint events have no common events.
- Real-life problems can be solved using more than one probability rule.
- Permutations and combinations have unique characteristics that are used to find the value of each numerically and with probability.
- Probability distribution can be constructed and interpreted to find outcomes.
- Binomial distribution can be used to find probabilities.

Essential Questions:

- How can you list the possible outcomes in the sample space of an experiment?
- How can you determine whether two events are independent or dependent?
- How can you construct and interpret a two-way table?
- How can you use conditional probability in decision making?
- What is the difference between independent and dependent probability?
- How can you find probabilities of disjoint and overlapping events?
- How can a tree diagram help you visualize the number of ways in which two or more events can occur?
- What are the differences between permutations and combinations?
- How can you determine the frequency of each outcome of an event?

Assessment Evidence

Performance Tasks:

Mid-Chapter Quiz

Formative Checks

Homework

Practice Workbook

Test Prep Activities

Self-Assessments

Other Evidence:

Dynamic Assessment System

- Section review and refresh
- Point-of-use remediation
- Reports

Benchmarks:
Chapter 8 Test

Performance Task: Buried Treasures

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now

Explore It!

Go Formative Assessments

Guided Notes

Class Discussion

Ed Puzzle Activities

Self-Assessments

Independent Practice

Homework

Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)

Preparing for Chapter 8 Activity

- Prerequisite Knowledge Skills Review

8.1 Sample Spaces and Probability (2 Days)

- List the possible outcomes in a sample space.
- Find theoretical probabilities.
- Find experimental probabilities.

8.2 Two-Way Tables and Probability (2 Days)

- Make two-way tables.
- Find and interpret relative frequencies and conditional relative frequencies.
- Use conditional relative frequencies to find probabilities.

8.3 Conditional Probability (2 Days)

- Explain the meaning of conditional probability.
- Find conditional probabilities.
- Make decisions using probabilities.

8.4 Independent and Dependent Events (2 Days)

- Explain how independent events and dependent events

are different.

- Determine whether evens are independent.
- Find probabilities of independent and dependent events.

8.5 Probability of Disjoint and Overlapping Events (optional)

- Explain how disjoint events and overlapping events are different.
- Find probabilities of disjoint events.
- Find probabilities of overlapping events.
- Solve real-life problems using more than one probability rule.

8.6 Permutations and Combinations (1 Day)

- Explain the difference between permutations and combinations.
- Find numbers of permutations and combinations.
- Find probabilities using permutations and combinations.

8.7 Binomial Distributions (optional)

- Explain the meaning of probability distribution.
- Construct and interpret probability distributions.
- Find probabilities using binomial distributions.

Chapter Review (1 Day)

Test (1 Day)

Resources:

"Laurie's Notes" per chapter throughout TE

Everyday Connection Videos via QR-Codes

Dynamic Classroom with interactive content from Dynamic Student Edition for Explore It! And Performance Tasks

Dynamic Assessment System with digital assessment and reporting system with digital practice and assessments.

Unit Modifications for Special Population Students	
Advanced Learners	• Invite students to explore different points of view on a topic of study and compare the two. • Assign a leadership role in classroom learning • Determine where student's interests lie and capitalize on their inquisitiveness. • Expose students to a selection and use of specialized resources

Struggling Learners	• Be flexible with time frames and deadlines • Create planned opportunities for interaction between individuals in the classroom: cooperative and collaborative learning, pair and share with peers • Group students • Intentional scheduling/grouping with student/teacher of alternative background • Provide support as at-risk students move through all levels of knowledge acquisition • Tap prior knowledge
English Language Learners	• Accommodate with completed study guides to assist with preparation on tests • Allow students to give responses in a form (oral or written) that's easier for him/her • Be flexible with time frames, deadlines, or modify assessments • Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience • Establish a framework allowing ELL students to understand and assimilate new ideas and information • Focus on domain specific vocabulary and keywords • Give alternate or paper copies to accommodate electronic assignments. • Have another student share class notes with the ELL student. • Intentional scheduling/grouping with student/teacher of language if possible • Mark texts with a highlighter. • Take more time to complete a task, project, or test. • Use manipulatives, graphic organizer, and real objects when possible • Use visual presentations/verbal materials (ex: word webs and visual organizers).
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Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

ELA 9-12

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and

phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
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RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Computer and Design Thinking
8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models.

Technology Education
9.3.ST.1: Use technology to acquire, manipulate, analyze, and report data.
9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.4.12.O.17: Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

Life Literacies & Key Skills
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Integration of 21st Century Skills

Indicators:
From the Partnership for 21st Century Skills (P21), the deeper learning competencies and skills for 21st century learning in this unit include collaboration and critical thinking.

Unit 11: Sequences and Series

Unit Description:

This chapter extends students' understanding of arithmetic and geometric sequences to include work with arithmetic and geometric series. Students will analyze, write, and predict using arithmetic and geometric sequences and series. Connections to linear and exponential functions are made throughout the chapter.

Unit Duration: 2-3 weeks

Desired Results

Standard(s):

A.SSE.B Write expressions in equivalent forms

F-IF.A Understand the concept of a function and use function notation

F-FB.A Build a function that models a relationship between two quantities

F-LE.A Construct and compare linear and exponential models and solve problems

Indicators:

A-SSE.B.4 Derive the formula for the sum of finite geometric series (when the common ratio is not 1), and use the formula to solve problems

F-IF.A.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

F-BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

F-LE.A.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)

Understandings:

Students will understand that…

- Sequences and series have rules to represent them.
- Arithmetic sequences have unique characteristics that are used to write rules for the sequences.
- Finite arithmetic series have sums.
- Geometric series have unique characteristics that are used to write rules for the series.
- Finite geometric series have sums.
- Infinite geometric series have partial sums.
- Infinite geometric series have sums.
- Real-life problems can be solved using geometric series.
- Recursively defined sequences can be written in terms.
- Recursive rules can be written for sequences.
- You can translate between recursive rules and explicit rules.
- Real-life problems can be solved using recursive rules.

Essential Questions:

- How do you define and use sequences and series?
- How do you describe how to find sums of infinite geometric series?
- How do you analyze arithmetic and geometric sequences and series?
- How do you explain how to write recursive rules for sequences?

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Mid-Chapter Quiz Formative Checks Homework Practice Workbook Test Prep Activities Self-Assessments	Dynamic Assessment System • Section review and refresh • Point-of-use remediation • Reports

Benchmarks:
Chapter 11 Test

Performance Task: Walleye Stocking

Learning Plan

Learning Activities:

*Daily lessons will include some or all learning activities

Daily Warm Up/Do Now
Explore It!
Go Formative Assessments
Guided Notes
Class Discussion
Ed Puzzle Activities
Self-Assessments
Independent Practice
Homework
Exit Tickets

Unit Content:

Chapter Opener – National Geographic Explorer Video (1 Day)
Preparing for Chapter 11 Activity

- Prerequisite Knowledge Skills Review

11.1 Defining and Using Sequences and Series (2 Days)

- Use rules to write terms of sequences.
- Write rules for sequences.
- Write and find sums of series.

11.2 Analyzing Arithmetic Sequences and Series (2 Days)

- Identify arithmetic sequences.
- Write rules for arithmetic sequences.

- Find sums of finite arithmetic series.

11.3 Analyzing Geometric Sequences and Series (2 Days)

- Identify geometric sequences.
- Write rules for geometric sequences.
- Find sums of finite geometric series.

11.4 Finding Sums of Infinite Geometric Series (1 Day)

- Find partial sums of infinite geometric series.
- Find sums of infinite geometric series.
- Solve real-life problems using infinite geometric series.

11.5 Using Recursive Rules with Sequences (optional)

- Write terms of recursively defined sequences.
- Write recursive rules for sequences.
- Translate between recursive rules and explicit rules.
- Use recursive rules to solve real-life problems

Chapter Review (1 Day)
Test (1 Day)

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