Verona Public School District
Curriculum Overview

College Algebra

Curriculum Committee Members:
Danielle Mutovic

Supervisor:
Glen Stevenson

Curriculum Developed:
August 2011
Winter/Spring 2016

Board Approval Date:
September 27, 2011
June 14, 2016

Verona Public Schools
121 Fairview Ave., Verona, NJ 07044
www.veronaschools.org

Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

This course is designed for students who have completed Algebra II, but are not planning on majoring in a STEM-related field. This course will cover topics in a standard college-level Algebra course, including Linear, Quadratic, Polynomial, Exponential Functions, Transformations, Sequences and Series, Systems, Absolute Value and Applied Probability and Statistics. These topics will be put in the context of real world applications. Graphing calculators will be an important tool that will routinely be used in instruction.

Prerequisite(s):

Algebra II

Verona High School College Algebra

Standard 8: Technology Standards

8.1: Educational Technology: *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.*	8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming: *All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*
X A. Technology Operations and Concepts **X** B. Creativity and Innovation C. Communication and Collaboration D. Digital Citizenship E. Research and Information Fluency **X** F. Critical thinking, problem solving, and decision making	**X** A. The Nature of Technology: Creativity and Innovation B. Technology and Society C. Design D. Abilities for a Technological World E. Computational Thinking: Programming

SEL Competencies and Career Ready Practices

Social and Emotional Learning Core Competencies: *These competencies are identified as five interrelated sets of cognitive, affective, and behavioral capabilities*	Career Ready Practices: *These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.*
Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.	**X** CRP2. Apply appropriate academic and technical skills. CRP9. Model integrity, ethical leadership, and effective management. CRP10. Plan education and career paths aligned to personal goals.
Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.	CRP3. Attend to personal health and financial well-being. CRP6. Demonstrate creativity and innovation. **X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.
Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.	**X** CRP1. Act as a responsible and contributing citizen and employee. CRP9. Model integrity, ethical leadership, and effective management.
Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.	**X** CRP4. Communicate clearly and effectively and with reason. CRP9. Model integrity, ethical leadership, and effective management. CRP12. Work productively in teams while using cultural global competence.
Responsible decision making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.	CRP5. Consider the environmental, social, and economic impact of decisions. CRP7. Employ valid and reliable research strategies. **X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership, and effective management.

Standard 9: 21st Century Life and Careers

9.1: Personal Financial Literacy: *This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.*	9.2: Career Awareness, Exploration & Preparation: *This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.*	9.3: Career and Technical Education: *This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.*
X A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing **X** E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting	A. Career Awareness (K-4) B. Career Exploration (5-8) **X** C. Career Preparation (9-12)	A. Agriculture, Food & Natural Res. B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services K. Information Technology L. Law, Public, Safety, Corrections & Security M. Manufacturing N. Marketing **X** O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log.

Course Materials

Core Instructional Materials: *These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.*	Differentiated Resources: *These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.*
•	• Regents Prep - Pick Your Topic • Next Generation PARCC Resources • PARCC EOY Assessment Evidence Table • Regents Exam Questions by topic • Math Videos By Topic • NCTM Illuminations Activities - Probability and Data • Common Core Standard Based Activities and tasks. • Math Assessment Project - Tasks by Standard

Verona High School College Algebra

Data Analysis and Applications - 1 Month	Cross-curricular Opportunities: Science Labs, Social Studies, AP Statistics

Stage 1: Desired Results

Established Goals:

S.ID.1 - Represent data with plots on the real number line (dot plots, histograms, and box plots).
S.ID.2 - Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
S.ID.3 - Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
S.CP.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. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
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.

Transfer Goal:

Students will be able to independently use their learning to …… perform a statistical analysis on a data set

Students will understand that:

1. The method of presentation can affect how data is understood.
2. The validity of conclusions is based on the bias of data and data collection
3. Measures of dispersion provide additional information os a data set

Essential/Central Questions:

1. What is the most accurate way to present statistics?
2. How can you eliminate bias from statistical analysis?
3. What indicators more accurately describe a data set and why?

Students will know:

1. Definitions of Mean median and mode
2. The differences among various charts, graphs and tables

Students will be able to:

1. Construct and analyze box and whisker plots
2. Construct and analyze a histogram
3. Construct and Analyze stem and leaf plots
4. Rationalize and use measures of central tendency

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

Students will show that they really understand by evidence of:

- The Data Project - Students will conduct topically approves surveys to gather data, analyze the data, interpret the data and create displays to support their interpretation.
- Quizzes
- Tests
- Do nows
- exit tickets

Other Evidence:

Students will show that they have achieved Stage 1 goals by:
Formal:

- Providing written/oral response to the EQs
- Passing all quizzes on basic concepts in unit.

Informal

- Students should also troubleshoot examples and explain misapplications of the conventions or properties

Reference Materials

- Regents Prep - Pick Your Topic
- Next Generation PARCC Resources
- PARCC EOY Assessment Evidence Table
- Regents Exam Questions by topic
- Math Videos By Topic
- NCTM Illuminations Activities - Probability and Data
- Common Core Standard Based Activities and tasks.
- Math Assessment Project - Tasks by Standard

Verona High School College Algebra

Modeling Functions - 2 months	Cross-curricular Opportunities: Physics, Social Studies

Stage 1: Desired Results

Established Goals:

S-ID.6 - *Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions, or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. Informally assess the fit of a function by plotting and analyzing residuals. Fit a linear function for a scatter plot that suggests a linear association.*

A-CED.1 - *Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions.*

A-REI.1 - *Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.*

A-REI.3 - *Solve linear equations and inequalities in one variable.*

A-REI.10 - *Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, which may form a curve or a line.*

A-REI.11 - *Explain why the x-coordinates 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).*

A-REI.12 - *Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.*

F-IF.1 - *Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range.*

F-IF.2 - *Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.*

F-IF.5 - *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

S-ID.7 - *Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*

S-ID.8 - *Compute (using technology) and interpret the correlation coefficient of a linear fit.*

S-ID.9 - *Distinguish between correlation and causation.*

Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

evaluate whether a mathematical model can accurately predict behavior in real world phenomena

Students will understand that:

U1. Data can be modeled by mathematical functions
U2. Models allow you to make predictions either by interpolating or extrapolating
U3. Different real world phenomena lend themselves to different types of functions

Essential/Central Questions:

Q1. How can you determine whether a trend exists?
Q2. How can you determine the accuracy os a prediction?
Q3. What types of real world phenomena can be modeled most accurately with mathematics?

Students will know:

K1. The differenced in graphs among linear, exponential, quadratic, etc.
K2. The difference forms of equations for each function.

Students will be able to:

A1. Calculate a curve or line of best fit
A2. Make predictions based on the line or curve of best fit
A3. Solve equations
A4. Graph equations
A5. Solve inequalities
A6. Graph inequalities

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

- CPI Project - Students will analyze the Consumer Price index (or the price of some other commodity) for the past 25 years. They will analyze the data to determine what type of function represents the best fit. Using this model, they will calculate the cost of certain items 5, 10 and 20 years from now.
- Quizzes
- Test
- Do Nows
- Exit Tickets

Other Evidence:

Formal:
-
Informal
-

Reference Materials

- Regents Exam Questions by topic
- Math Videos By Topic
- Math Assessment Project - Tasks by Standard

Verona High School College Algebra

Functions - 1 month	Cross-curricular Opportunities: Physics

Stage 1: Desired Results

Established Goals:

F.BF1 - *Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context. Combine standard function types using arithmetic operations. Compose functions. For example, find quadratic function or cubic function having desired characteristics, or containing given ordered pairs.*

F.BF3 - *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

F.BF.4 *– Find inverse functions. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x^3 or f(x) = (x+1)/(x-1) for x 1. Verify by composition that one function is the inverse of another. Read values of an inverse function from a graph or a table, given that the function has an inverse. Produce an invertible function from a non-invertible function by restricting the domain.*

F.IF.7 *– Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*[*]

Graph linear and quadratic functions and show intercepts, maxima, and minima. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

manipulate functions in later units on polynomials and quadratics.

Students will understand that:

U1. There is a relationship between graphical transformation and algebraic equations
U2. Function composition had a myriad of real-world applications
U3. Every function has an inverse.
U4. Function Inverses can be found algebraically, graphically or by using a table.
U5. A function and its inverse reverse the roles of the domain and range values.

Students will keep considering:

Q1. What is the relationship between algebra and graphing?
Q2. How are function composition and function inverses applicable to real life?
Q3. Does an inverse always have the same properties as the original?

Students will know:

K1. The definition of a function
K2. How to analyze function operations
K3. How to analyze function compositions
K4. Algebraic algorithms appropriate to function analysis
K5. How to use and apply inverse functions

Students will be skilled at:

A1. Composing functions involving a numerical input
A2. Composing functions with a non-numerical input
A3. Determining critical points for a given function.
A4. Writing a translated functions given a parent function

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

Students will show that they really understand by evidence of:

- Snapshot Transfer task - The skills developed in this unit are foundational for later work with polynomial, quadratic , exponential and rational functions. The task is how well students can manipulate functions using compositions or find function inverses. Further evidence of transfer will be evident in Units 4 and 5.
- Unit 3 Test
- Unit 3 Quizzes
- Do Nows
- Exit Tickets

Other Evidence:

Students will show that they have achieved Stage 1 goals by:

Formal:
- Providing written/oral response to the EQs
- Passing all quizzes on basic concepts in unit.

Informal:
- Troubleshooting examples explaining errors in reasoning and misuse of conventions or properties

Reference Materials

- Click on the Standard to find Sample Tasks
- PARCC EOY Assessment Evidence Table
- Next Generation PARCC Resources
- Regents Exam Questions by topic
- Math Videos By Topic
- Math Assessment Project - Tasks by Standard

Verona High School College Algebra

Polynomial Functions - 2 months	Cross-curricular Opportunities: Physics

Stage 1: Desired Results

Established Goals:

N.CN.1 *- Know there is a complex number i such that* $i^2 = -1$*, and every complex number has the form a + bi with a and b real.*
N.CN.2 *- Use the relation* $i^2 = -1$ *and appropriate algebraic properties to add, subtract, and multiply complex numbers.*
N.CN.7 *- Solve quadratic equations with real coefficients that have complex solutions.*
N.CN.8 *– Extend polynomial identities to the complex numbers (i.e. factoring/Foiling, etc.)*
N.CN.9 *– Know the Fundamental Theorem of Algebra; Show that it is true for quadratic polynomials.*
A.SSE.3 *- Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. use and apply quadratic formula as needed to reveal the zeros of a function.*
F.IF.4 *– For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of quantities and sketch graphs showing key features given a verbal description of the relationship. Key features include intercepts, intervals where the function is increasing, decreasing positive of negative, relative minimum and maximums, symmetries, end behavior and periodicity.*
F.IF.5 *– Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
F.IF.7 *– Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Graph linear and quadratic functions and show intercepts, maxima, and minima. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.*
F.IF.8 *- Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02) , y = (0.97) , y = (1.01)12 , y = (1.2) /10, and classify them as representing exponential growth or decay.*
F.IF.9 *– Compare properties to two functions each function each represented in a different way (algebraically, graphically, numerically in tables or by verbal descriptions). For examples, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
A.APR.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.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.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.6 *- Rewrite simple rational expressions in different forms, using inspection, long division, and various algorithms of algebra and arithmetic, as required.*
A.REI.2 *– Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.*
A.REI.4 *-Solve quadratic equations in one variable;*
solve quadratic equations by inspection (e.g., for $x^2 = 49$*), taking square roots, the quadratic formula and factoring, as appropriate to the initial form of the equation;recognize when the quadratic formula gives complex solutions and write them as a ± **bi** for real n*umbers a and b.

Transfer Goal:

Students will be able to <u>independently</u> use their learning to…analyze real-world phenomena that behave like polynomial functions.

Students will understand that:

U1. Quadratic equations can be solved in several ways
U2. Word problems and graphs are tools that can help us make meaningful connections to solve real world problems.
U3. In the set of complex numbers, -1 is a perfect square
U4. Division allows us to find zeroes of a polynomial with degree of 3 or higher
U5. You can only cancel factors
U6. Rational functions are two polynomials in the form of a fraction.
U7. Analysis of the numerator and denominator, separately, will determine the solution to a rational equation.

Students will keep considering:

Q1. How do we solve quadratic equations?
Q2. How do you decide which method to use to best solve a problem?
Q3. What are the benefits of imaginary numbers?
Q4. What is the utility of algebraic long division?
Q5. How do we know when an expression is completely simplified?
Q6. What is the relationship between the graph and the equation of a polynomial?
Q7. How are the properties of rational functions similar to properties of polynomials?

Students will know:

K1. The Quadratic Formula
K2. Definition of *i*
K3. How to solve polynomials of degree greater than 2
K4. How to divide polynomials
K5. How to simplify polynomials
K6. The fundamental theorem of algebra
K7. Key features of polynomial graphs
K8. How to solve rational equations

Students will be skilled at:

A1. Performing computations with polynomials and imaginary numbers
A2. Solving quadratics by factoring
A3. Solving quadratics using the Quadratic Formula
A4. Solving a Quadratic with complex roots
A5. Finding the zeroes of polynomial functions
A6. Simplifying and performing operations on rational expressions
A7. Solving rational equations
A8. Choosing the best way to solve a problem

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

Students will show that they really understand by evidence of:

- Stock Market Task - Students will analyze one of the major stock market indices over a given period of time. They will construct a polynomial function of best fit, and then they will use this function to make predictions. They will then discuss the strengths and limitations of real world models.
- Unit 4 Test
- Quizzes
- Do Nows
- Exit Tickets

Other Evidence:

Formal:
- Providing written/oral response to the EQs
- Passing all quizzes on basic concepts in unit.

Informal:
- Identify parts of a polynomial while working towards other parts of problems
- Students should also troubleshoot examples and explain misapplications of the conventions or properties.

References Materials

- Polynomials Topical Outline.docx
- Create Your Own Worksheet by Difficulty (see Alg1 and Alg 2)
- Next Generation PARCC Resources
- Kahn Academy - Polynomials & Rationals
- Math is Fun - Polynomials
- Spark Note - Polynomials (Ignore Nested Form)
- PARCC EOY Assessment Evidence Table
- Click on the specific Standard to find Sample Tasks
- Regents Exam Questions by topic
- Math Videos By Topic
- Kahn Academy - Rational Expressions
- Sparknotes - Rational Expressions
- Math Assessment Project - Tasks by Standard
-

Verona High School College Algebra

Trigonometry - 2 months	Cross-curricular Opportunities: Physics

Stage 1: Desired Results

Established Goals:

G.MG.1 - Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
G.SRT.4 - Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.
G.SRT.6 - Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
G.SRT.7 - Explain and use the relationship between the sine and cosine of complementary angles.
G.SRT.8 - Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G.SRT.9 - Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
G.SRT.10 - Prove the Laws of Sines and Cosines and use them to solve problems.
G.SRT.11 - Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
A.SSE.2 - Use the structure of an expression to identify ways to rewrite it. For example, see x4 - y4 as (x2)2 - (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 - y2)(x2 + y2).

Transfer Goal:

Students will be able to <u>independently</u> use their learning to… apply ideas from Geometry and Algebra 2 to solve problems involving trigonometric functions and to understand applications in everyday life.

Students will understand that:

U1. Trig functions are ratios of sides of right triangles
U2. Trig functions evaluated at a certain angle are constant, regardless of the size of the triangle
U3. Radians are often a more appropriate way of describing angles
U4. Tangent and Secant are named after their relationship to the unit circle
U5. Changes to the algebraic equation of a function cause predictable changes to the function's graph

Students will keep considering:

Q1. What are examples of things that happen periodically?
Q2. How can trigonometry be used in the real world?
Q3. How does changing one part of a triangle affect other parts of the triangle?
Q4. How can radian measures be used in the real world?
Q5. What is the benefit of having different representations?

Students will know:

K1. Basic trig identities
K2. Pythagorean identities
K3. Cofunction relationships
K4. Basic trig functions of 30, 45 60 degree angles
K5. Sin, cos and tan of 30, 45, 60
K6. Sin, cos and tan of quadrantal angles
K7. Inverse trig functions
K8. Laws of Sines and Cosines

Students will be skilled at:

A1. Simplify radicals
A2. Solve basic right triangle trig word problems
A3. Convert between radians and degrees
A4. Evaluate a trigonometric function for any multiple of 30, 45, 60 or 90
A5. Find all six trig functions of an angle, given one
A6. Graph all trigonometric functions and reciprocals by hand or on calculator
A7. Solve linear trig equations
A8. Solve trig equations with more than one function
A9. Solve trig equations graphically

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

Students will show that they really understand by evidence of:

Unit 5 Topical Outline

- Part One: Preliminary Ideas From Geometry and ALgebra
  - 180° in a triangle
  - Pythagorean Theorem and Pythagorean Triples
  - right triangle ideas
  - 30-60-90 rules
  - 45-45-90 rules
  - formulas: area, perimeter
  - simplifying radicals
  - rationalize radicals
  - operations with radicals
  - Pre-Trig and Elementary Trig Test Outline
  - Pre-Trig Skills Quiz
- Part Two: Basics of Trigonometry (Right Triangle Trig Only)
  - SOHCAHTOA (meaning and use)
  - from a right triangle info given, find sin, cos and tan
  - know and apply: sin/cos = tan
  - calculator use (degree vs radian)
  - Use of student's own sketched of right triangles, pretend sketches, coordinate system sketches
  - Trig Basics and Applications Worksheet
  - Trig Basics and Applications Test
  - Geometric and Trig Ideas - Answers
- Part Three: Verbal Right Triangle Trig Problems and Non-Right Triangle Trig Problems
  - Verbal problems including angles of ascent and descent
  - find unknowns lengths
  - find unknown angle
  - solving a triangle
  - Law of Sines
  - Law of Cosines
  - verbal problems with pictures

Other Evidence:

Students will show that they have achieved Stage 1 goals by:

Formal:
- Providing written/oral response to the EQs
- Passing all quizzes on basic concepts in unit.

Informal
- Students should also troubleshoot examples and explain misapplications of the conventions or properties
- Students can explain how triangles apply to specific real life problems.

Reference Materials

- Periodic Functions and Trig Topical Outline
- Next Generation PARCC Resources
- PARCC EOY Assessment Evidence Table
- Regents Exam Questions by topic
- Math Videos By Topic
- Kahn Academy - Modeling Periodic Functions
- Regents Prep - Arc Length and Radian Measure
- Regents Prep - Trig Graphing and Translation
- Trig translations - Lab, Notes and Practice
- Kahn Academy - Trig Graphs
- Law of Sines and COsines - Lab, Notes, Practice
- Another Ferris Wheel Scaffolded Example
- More complex Ferris Wheel Scaffolded Example
- Math Assessment Project - Tasks by Standard

Verona High School College Algebra

Sequences and Series - 1 Month	Cross-curricular Opportunities: Excel, Banking

Stage 1: Desired Results

Established Goals:

A.SSE.4 - *Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.*

A.APR.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.*

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

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

Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

analyze the behavior of real world sequences or series.

Students will understand that:

U1. Sequences and series formulas are common sense shortcuts
U2. Some infinite series converge
U3. Sequences and series can be used to model real-life situations.
U4. Sequences and series provide the foundation for upper level mathematics, especially calculus.
U5. Sequences and series are a direct result of finding patterns.

Students will keep considering:

Q1. How can we generalize the behavior of sequences or seires
Q2. How can we determine the convergence or divergence of a sequence or series?
Q3. Why do mathematical problems require proof?
Q4. Why is it beneficial to generalize a pattern with an equation?
Q5. How can your calculator be used to help make things easier?
Q6. What is the benefit of learning sequences and series?

Students will know:

K1. Formulas for nth terms of arithmetic and geometric sequences
K2. Formulas for finite arithmetic and geometric sequences
K3. Formulas for infinite geometric series
K4. The basics of Excel
K5. how to tell when a series converges or diverges

Students will be skilled at:

A1. Finding nth terms of sequences
A2. Evaluating series
A3. Evaluating summations
A4. setting up spreadsheets in Excel

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

Students will show that they really understand by evidence of:

- Credit Card Project - Students will be presented with the fine print of a credit card special offer. They will determine the amount of money they would have to pay for an item if they a) only make minimum monthly payments, b) pay substantially more than the minimum required each time, c) find themselves in default
- Unit 6 Test
- Quizzes
- Exit Cards

Other Evidence:

Students will show that they have achieved Stage 1 goals by:

Formal:
- Providing written/oral response to the EQs
- Passing all quizzes on basic concepts in unit.

Informal:
- Students should also troubleshoot examples and explain misapplications of the conventions or properties.
- Identifying which formula(s) to use for each problem given from reference sheet.

Reference Materials

-
- Sequences and Series Topical Outline
- Student Note Taking Packet
- Teacher Notes
- Student Note Taking Guides by Section
  - 9-1 Worktext
  - 9-2 Worktext
  - 9-3 Worktext
  - 9-4 Worktext
  - 9-5 Worktext
- Next Generation PARCC Resources
- PARCC EOY Assessment Evidence Table
- Regents Exam Questions by topic
- Math Videos By Topic
- Interactive Sequences and Series Applications
- Math Assessment Project - Tasks by Standard

Verona High School College Algebra

Additional Topics - 1 months	Cross-curricular Opportunities:

Stage 1: Desired Results

Established Goals:

N.VM.6 *- Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.*
N.VM.7 *- Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.*
N.VM.8 *- Add, subtract, and multiply matrices of appropriate dimensions.*
N.VM.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.11 *- Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.*
A.APR.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.CED.2 *- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
A.REI.6 *- Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.*

Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

Count without counting, ie determine the number of ways a described event can occur.

Students will understand that:

U1. You must expand a binomial by massive foiling, NOT by distributing an exponent.
U2. The solution to a system of linear equations is the intersections of the two lines
U3. Absolute value is the distance from the origin to a point on a number line.

Students will keep considering:

Q1. How do you simplify algebraic equations?
Q2. What is the benefit of representing a function in different ways?
Q3. How do you count without counting?

Students will know:

K1. how to apply the binomial theorem
K2. Different methods for solving a system
K3. The formulas for calculating combinations
K4. The uses of Pascal's Triangle

Students will be skilled at:

A1. Solving absolute value equations and inequalities
A2. Solving systems of equations and inequalities
A3. Differentiating between permutations and combinations
A4. Expanding binomials
A5. FInding nth terms of binomials

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

Students will show that they really understand by evidence of:

- Classic Counting Task - In New York City, students will be directed to determine how many different ways they can get from one intersection to another.
- Quizzes
- Project - STudents will look for number patterns and counting patterns within Pascal's Triangle
- HW

Other Evidence:

Students will show that they have achieved Stage 1 goals by:

Formal:
- Providing written/oral response to the EQs
- Passing all quizzes on basic concepts in unit.

Informal:
- Students should also troubleshoot examples and explain misapplications of the conventions or properties.
- Correctly decide which type of problem that is being solved BEFORE attempting to solve it

Reference Materials

- Next Generation PARCC Resources
- PARCC EOY Assessment Evidence Table
- Click on the specific Standard to find Sample Tasks
- Regents Exam Questions by topic
- Math Videos By Topic
- Kahn Academy - Combinatorics
- Math Assessment Project - Tasks by Standard

Verona High School College Algebra

Probability - 2 weeks	Cross-curricular Opportunities: AP Statistics

Stage 1: Desired Results

Established Goals:

S.CP.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.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.3 - Understand the conditional probability of A given B as P(A and B)/P(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.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. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
S.CP.5 - Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

analyze a data set using statistical tools

Students will understand that:

U1. Inferences can be made about any data set that is normally distributed
U2. The counting principle must be combined with combinations to determine binomial probabilities

Students will keep considering:

Q1. How do we calculate probabilities?
Q2. How can we use statistics to make inferences and predictions?

Students will know:

K1. Bernoulli's Probability Theorem
K2. Difference between a permutation and a combination
K3. Permutations
K4. Combinations
K5. How to calculate standard deviation
K6. How to analyze a normal curve
K7. How to calculate a Z-Score

Students will be skilled at:

A1. Finding probabilities of Bernoulli trials
A2. Solving normal curve problems
A3. Finding the standard deviation of a data set
A4. Evaluating and Analyzing Z-Scores

Stage 2: Acceptable Evidence

Performance Task & Unit Assessments:

Students will show that they really understand by evidence of:

- Unit 8 Task - Students will perform a statistical analysis to determine the "best" baseball player of all time, at a given position.
- Quizzes
- HW
- Classwork

Other Evidence:

Students will show that they have achieved Stage 1 goals by:

Formal:
- Providing written/oral response to the EQs
- Passing all quizzes on basic concepts in unit.

Informal:
- Students should also troubleshoot examples and explain misapplications of the conventions or properties.

Reference Materials

- Next Generation PARCC Resources
- PARCC EOY Assessment Evidence Table
- Click on the specific Standard to find Sample Tasks
- Regents Exam Questions by topic
- Math Videos By Topic
- Theme based units on compound probability
- Kahn Academy - Combinatorics
- TI-Nspire Probability Lessons
- NCTM Illuminations Activities - Probability and Data
- Common Core Standard Based Activities and tasks,