

South Brunswick School District



High School Mathematics : Core and Elective Courses

PARENT GUIDE

Curriculum Aligned to NJ CCSS: August 2012

Curriculum Revised: August 2014

District Mission

The South Brunswick School District will prepare students to be lifelong learners, critical thinkers, effective communicators and wise decision makers. This will be accomplished through the use of the New Jersey Core Curriculum Content Standards (NJCCCS) and/or the Common Core State Standards (CCSS) at all grade levels. The schools will maintain an environment that promotes intellectual challenge, creativity, social and emotional growth and the healthy physical development of each student.

~Adopted 8.22.11



Annual Board Approval of Mathematics Curriculum August 2016

This curriculum is approved for all regular education programs as specified and for adoption or adaptation by all programs including those for Special Education, English Language Learners, At-Risk Students and Gifted and Talented Students in accordance with Board of Education Policy.

Note to Parents

The curriculum guide you are about to enter is just that, a guide.

Teachers use this document to steer their instruction and to ensure continuity between classes and across levels. It provides guidance to the teachers on what students need to know and able to do with regard to the learning of a particular content area.

The curriculum is intentionally written with some “spaces” in it so that teachers can add their own ideas and activities so that the world language classroom is personalized to the students.

How to Read the Curriculum Document

Curriculum	Area of content (e.g. Science)
Topic	Course or Unit of Study (e.g. Biology)
Grade Level	Grade Level Cluster (e.g. High School) or specific grade level (e.g. Kindergarten)
Summary	A brief overview of the course or unit of study.
Rationale	A statement as to why we are teaching this course or unit.
Interdisciplinary Connections	Which other areas of content to which there is major linkage. For example, a health education unit might link to science, language arts, social studies, art, physical education, etc.
21st Century Connections	How this course or unit is preparing students to be college and career ready. Referred to as S.A.L.T., each course or unit indicates which of the following it is building: <ul style="list-style-type: none">• Skills such as critical or creative thinking, collaboration, communication, or core values• Awareness such as global, cross-cultural or career.• Literacy such as information, media, technology, etc.• Traits necessary for success in life and careers such as productivity.
Terminology	Key vocabulary and terms
Standards	Here you will find the standards that this course or unit of study is addressing. Our curriculum is standards-based. The standards are the foundation of the unit. You can get more information on state standards by going to the NJ Department of Education at www.state.nj.us/education/cccs
Enduring Understandings	The big ideas, concepts or life lessons that students walk away with at the end of a unit of study.
Essential Questions	Open ended questions that are considered throughout the unit of study. These are big, “worthy of wonder” questions often with multiple responses.
Objectives	The discrete skills and knowledge that students will gain during the unit of study.
Assessments	Assessments (tests, quizzes, projects, activities) that tell us if the students grasped the enduring understandings of the unit.
Lesson Plans & Pacing	Scope and sequence of lessons: how many, how long & approximately in what order.
Resources	Major resources associated with the course or unit.

Mathematics Acknowledgments

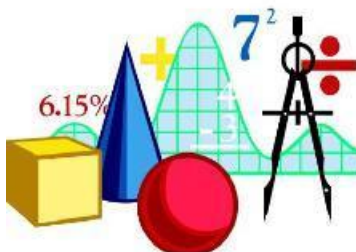
We are appreciative of the leadership provided by our curriculum specialists and the knowledge, skills, work and effort of the teachers who served on our curriculum writing teams. In many cases, our units are “home-grown.” While aligning with state and national standards, they are designed with the needs of the South Brunswick student population in mind.

Articulation

The Supervisors, Specialists, Curriculum Chairpersons, Technology Staff Developers, Directors and the Assistant Superintendent for Curriculum and Instruction meet for articulation at roundtables and ongoing administrative and content meetings throughout the year.

Among the topics of discussion are the following: curriculum review cycle, curriculum mapping, resources (ordering, budgeting, inventory), lesson plans, observation look-fors, professional development, NJ Quality Single Accountability Continuum and academic achievement, placement, acceleration, enrichment, basic skills, instructional support, technology proficiencies and content-specific technologies, formative and summative assessments, and various curriculum tasks.

Mathematics Curriculum Development Teams comprised of teachers at every grade level along with representative special education meet together throughout the year as needed. In a time period of major revision, the teams will meet with greater frequency.



Go down deep enough into anything and you will find mathematics.

~Dean Schlicter

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Note:

- The elementary curriculum can be found in the K-2 and 3-5 Mathematics Curriculum Guides.
- The middle school curriculum can be found in the Middle School Mathematics Curriculum Guide.

PREAMBLE TO THE MATHEMATICS CURRICULUM

Mission Statement

The South Brunswick Mathematics Program will be based on a well-articulated curriculum that is aligned with standards, has interwoven technology, is connected in meaningful ways to other curriculum and real life, that provides for differentiated needs of students, that is taught by teachers who are well-grounded in and comfortable with both content and methodology, and that leads to equity and excellence in math achievement for all children.

South Brunswick's Beliefs

1. Develop concepts concretely, pictorially, and then abstractly. Students use manipulatives to model abstract ideas, to represent the models as pictures, and finally to translate the model and/or picture into symbolic notation. Sometimes the transition from concrete to abstract takes years, as in the case of multi-digit addition computation; other times the transition may take a few class sessions, as in the case of multiplying fractions.

2. Require students to justify their answers. During class discussions and in written work students should always be asked *why*. Students should be able to verbalize, model, and to write the reason an answer has been given.

3. Provide time for students to write and talk mathematics. Students keep a math journal and discuss mathematical ideas as part of cooperative groups and as part of the whole class. Writing and talking mathematics allows students to clarify and explain thinking, justify answers, explain strategies, ask questions, listen to others, and react to ideas.

4. Develop problem situations from other content areas and from everyday experiences. Science, social studies, and language content are integrated into mathematics lessons. For example, when introducing 2-digit addition, the initial concrete model might be developed out of a social studies unit on Community Helpers. If the class has graphed the number of people going into different municipal buildings, finding the number of people going into 2 or 3 of the buildings together can begin the development of a 2-digit addition algorithm.

5. Give attention to connections among topics in math, between math and other content areas, and between math and daily life. Students should recognize, for example, that the array model of multiplication, the area of a rectangle, and paper folding to multiply fractions are all based on the same idea. Students should use strategies developed in math lessons in their work with other content and in their daily lives

6. Always encourage use of multiple strategies. For example, a large number of objects can be counted in several ways: by ones, by twos, by grouping into tens or by matching with a hundred-number board. Along with traditional algorithms, students should explore alternate methods of computation, including computational strategies developed by the students themselves.

7. Have students estimate quantities. Students then use that estimate to check reasonableness of answers. Estimate lengths, weights, and so on before measuring. Put out a handful of cubes and estimate the quantity.

8. Make mental math a part of any computation. Encourage students to calculate mentally. Help them to take the risk of giving an answer without using pencil and paper first. Mental math strategies are

treated as just another way, together with pencil and paper, calculators, concrete models, and pictorial models to calculate an answer.

9. Urge students to choose their tools and methods. Students are encouraged to choose among many different methods for problem solving (draw a picture, guess and check, write an equation, and so on), for calculating answers (mental math, paper and pencil, estimation, calculator), and for modeling (base ten blocks, money, geo-boards, counters, and so on).

10. Integrate computers and calculators into mathematics lessons. Students need to begin to choose technology as a tool. Graphing programs are one way to display data; spreadsheet programs are used to solve problems; calculators allow students to deal with more complicated numbers. Students should be offered the opportunity to use online virtual manipulatives, Internet resources and interactive whiteboards when available. Calculators allow students to deal with more complex problem solving.

11. Have students work in a variety of settings. The choice of settings - cooperative groups, pairs of students, individuals, and whole groups - depends on the teacher's objective and the specific content of the lesson. Students should be exposed to each kind of setting throughout the school year.

12. Design, develop, implement and evaluate digital-age learning experiences and assessments. For example, use of classroom technologies such as interactive whiteboards, projection devices, digital hardware and software.

Program Delivery

Our math classrooms are effective standards-based environments that foster understanding of big mathematical ideas, help students make connections between learning experiences, and enable students to see themselves as mathematicians. There are varied “math paths” that students follow during their course of study in South Brunswick.

Elementary School:

- Grade Level Math & Differentiation
- Accelerated Math K-5

Middle School:

- 6th Grade Unit Math
- 6th Grade Transitions (accelerated math)
- Pre-Algebra
- Concepts of Algebra
- Algebra I
- Geometry
- Algebra II (taken on the HS campus)

High School:

- Core Courses (3-Year Sequence): Algebra I¹, Geometry, Algebra II
- Illustrative Math Electives: Pre-Calculus, Calculus, Statistics, Discrete Math, Computer Science²

¹ Algebra I is a graduation requirement.

² Computer Science for the 21st Century also meets the mandate for 21st Century.

- Note: Many students begin the core sequence during their middle school years, which allows for them to take up to three Advanced Placement level courses. Although only three years of mathematics is required for graduation, the majority of South Brunswick students take four years of math. Recognizing the differing needs of our students, all of the courses offered have several levels, including Elements, Regular, Advanced, and Honors/AP

Resources

The following are resources used in our mathematics programs.

Elementary School

- Investigations in Data, Number, and Space
- Scott Foresman-Addison Wesley Mathematics
- On Core Mathematics (Houghton Mifflin Harcourt)
- Manipulatives: Hands-on and virtual
- Technologies: Scott Foresman and Calculators (Grades K-1: Calc-U-Vue; Grades 2-5: TI-108)
- SMART Boards (interactive whiteboards)
- Model classroom technologies: projectors, DVD players, speakers
- Study Island (Grades 3-5)
- Accelerated 5th Grade Math- MathScape, Connected Math

Middle School

- 6th Grade Unit Math- Big Ideas
- Accelerated 6th Grade Math- Big Ideas Advanced I
- 7th-8th McDougal Littell Pre-Algebra, Grade 7 Big Ideas Math, Grade 8 Big Ideas Math, Holt McDougal Algebra I, Jurgeson Geometry
- Manipulatives; Hands-on equations, communicators (mini-whiteboards), integer tiles, and 3-D prisms and cubes
- Technologies: SMARTBoards (interactive whiteboards); document camera; Texts Web sites & Homework Helplines; Calculators (TI 30SX II, TI-84); Study Island

High School

- Anchor Texts: Holt McDougal Texts, Houghton Mifflin Texts
- Technologies: Graphing Calculators (TI 84 and TI 89); Geometer Sketchpad
- SMART Board (interactive whiteboards)

Assessments

There are multiple and varied forms of assessment at each grade level. What follows is a list of the key assessment tools used at each level.

Assessments at the Elementary Level

- District-made Beginning of Year Math Assessment for Kindergarten
- Mid-Year Check In for Kindergarten
- District-made End of Year Competency Tests K-5
- District-made End of Year Math Acceleration Tests K-5
- District-made Pre and Posttests for grades 1-5
- State Assessments (PARCC 3-5)
- Mad Minute Drills/Otter Creek Drills
- Teacher-Made Tests, Projects

Assessments at the Middle Level:

- Teacher-made Tests, Quizzes & Projects
- District-made Pre and Post Assessments
- Mid Terms and Final exams for Algebra and Geometry (advanced math)
- Crossroads (District Placement) Test
- Algebra Predictive Test for placement
- State Assessments (PARCC 6-8)

Assessments at the High School Level

- Teacher-made tests, quizzes and projects
- District-made Pre and Post Assessments
- Midterms and final exams (upper level courses)
- Final exams (core courses)
- State Assessments (PARCC 9-11)
- SAT, PSAT, ACT, Accuplacer, ASVAB
- AP exams

Curriculum Content Standards for Mathematics

The South Brunswick mathematics curriculum was developed to meet the objectives as stated in the NJ State Department of Education Core Curriculum Content Standards 2009 and/or the Common Core State Standards 2010. Technology Education, 21st Century Life and Career Education, and Character Education lessons are embedded where meaningful. Cross-curricular connections are purposely and explicitly noted.

The curriculum is written in the Understanding by Design format and is based on enduring understandings (broad concepts) with essential questions and both formative and summative assessments.

Complete copies of the standards for mathematics may be found at:

[Common Core State Standards Initiative \(CCSI\)](http://www.corestandards.org/)<http://www.corestandards.org/>
<http://www.state.nj.us/education/cccs/><http://www.state.nj.us/education/cccs/>

HIGH SCHOOL MATHEMATICS PROGRAM OVERVIEW

Background

The courses offered at high school and the curriculum for each course follow a traditional scope and sequence, moving students from Algebra I through Geometry and Calculus.

The curricula for each course has been updated and revised within the 5-year curriculum review cycle to reflect changes in state standards, best practices, and the NCTM standards. Additionally, course offerings have changed based on the changing needs of our student population. These revisions are ongoing and are both formal and informal.

Prior to 1996, the entry-level course for many students was Basic Math or Algebra I over two years. At this time, Algebra is the minimum entry-level class and the majority of students complete Algebra I prior to grade 9.

South Brunswick High School adopted an alternating block schedule in 1996 and has been training its teachers to effectively use 90-minute time blocks effectively in math instruction.

Beliefs

The belief of the high school mathematics department is consistent with that of NCTM and the No Child Left Behind legislation, believing that “every student deserves an excellent program of instruction in mathematics that challenges each student to achieve at the high level required for productive citizenship and employment.”

Formally, the goals of the math department at South Brunswick High School have been established as follows:

- To ensure that 100% of our students meet or exceed the state standards.
- To provide a curriculum that meets the needs of all students
- To provide a course of study that meets requirements for acceptance into higher education.

Achieving these goals requires offering a variety of course selections and providing instruction that focuses on mathematical communication, mathematical reasoning, meaningful mathematics, and the use of technology.

HIGH SCHOOL MATHEMATICS CURRICULUM MATRIX

SCOPE AND SEQUENCE (Based on Common Core State Standards- Mathematics)

The Real Number System

N–RN

Extend the properties of exponents to rational exponents.	Core	Electives
1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.</i>	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents	Transitional Pre-Algebra Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus
Use properties of rational and irrational numbers.		
3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	

Quantities

N–Q

Reason quantitatively and use units to solve problems.	Core	Electives
1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Computer Science
2. Define appropriate quantities for the purpose of descriptive modeling.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Computer Science
3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Computer Science

The Complex Number System

N –CN

Perform arithmetic operations with complex numbers.	Core	Electives
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.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Pre-AP Calculus
2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Pre-AP Calculus
3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.		Pre-AP Calculus
Represent complex numbers and their operations on the complex plane.		
4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.	Advanced Algebra 2	Pre-AP Calculus
5. (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. <i>For example, $(1 - \sqrt{3}i)^3 = 8$ because $(1 - \sqrt{3}i)$ has modulus 2 and argument 120°.</i>	Advanced Algebra 2	Pre-AP Calculus
6. (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.		Pre-AP Calculus
Use complex numbers in polynomial identities and equations.		
7. Solve quadratic equations with real coefficients that have complex solutions.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Pre-AP Calculus
8. (+) Extend polynomial identities to the complex numbers. <i>For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$.</i>	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Pre-AP Calculus
9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Pre-AP Calculus

Vector and Matrix Quantities

N-VM

Represent and model with vector quantities.	Core	Electives
1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., \mathbf{v} , $ \mathbf{v} $, $\ \mathbf{v}\ $, v).	Advanced Geometry	Multivariable Calculus/Linear Algebra
2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	Advanced Geometry	Multivariable Calculus/Linear Algebra
3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.	Advanced Geometry	Multivariable Calculus/Linear Algebra
Perform operations on vectors.		
4. (+) Add and subtract vectors. a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. c. Understand vector subtraction $\mathbf{v} - \mathbf{w}$ as $\mathbf{v} + (-\mathbf{w})$, where $-\mathbf{w}$ is the additive inverse of \mathbf{w} , with the same magnitude as \mathbf{w} and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.	Advanced Geometry	Multivariable Calculus/Linear Algebra
5. (+) Multiply a vector by a scalar. a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$. b. Compute the magnitude of a scalar multiple $c\mathbf{v}$ using $\ c\mathbf{v}\ = c v$. Compute the direction of $c\mathbf{v}$ knowing that when $ c v \neq 0$, the direction of $c\mathbf{v}$ is either along \mathbf{v} (for $c > 0$) or against \mathbf{v} (for $c < 0$).	Advanced Geometry	Multivariable Calculus/Linear Algebra
Perform operations on matrices and use matrices in applications.		
6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.	Elements of Geometry	Discrete Mathematics College Prep Multivariable Calculus/Linear Algebra Computer Science
7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.	Elements of Geometry	Discrete Mathematics College Prep Trigonometry Advanced Pre-Calculus Multivariable

		Calculus/Linear Algebra Computer Science
8. (+) Add, subtract, and multiply matrices of appropriate dimensions.	Elements of Geometry	Discrete Mathematics College Prep Trigonometry Advanced Pre-Calculus Multivariable Calculus/Linear Algebra Computer Science
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.		Discrete Mathematics Trigonometry Advanced Pre-Calculus Multivariable Calculus/Linear Algebra
10. (+) Understand that the zero 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.		Trigonometry Advanced Pre-Calculus Multivariable Calculus/Linear Algebra
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.		Trigonometry Advanced Pre-Calculus Multivariable Calculus/Linear Algebra
12. (+) Work with 2×2 matrices as a transformations of the plane, and interpret the absolute value of the determinant in terms of area.		Trigonometry Advanced Pre-Calculus Multivariable Calculus/Linear Algebra

Seeing Structure in Expressions

A-SSE

Interpret the structure of expressions	Core	Electives
1. Interpret expressions that represent a quantity in terms of its context. □ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret $P(1+r)^n$</i>	Transitional Pre-Algebra Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2	College Prep

<i>as the product of P and a factor not depending on P.</i>	Advanced Algebra 2 Honors Algebra 2	
2. Use the structure of an expression to identify ways to rewrite it. <i>For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.</i>	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep
Write expressions in equivalent forms to solve problems		
3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i>	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	
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. <i>For example, calculate mortgage payments.</i>	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus AP Calculus BC

Arithmetic with Polynomials and Rational Expressions A –APR

Perform arithmetic operations on polynomials	Core	Electives
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.	Transitional Pre-Algebra Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus AP Calculus BC
Understand the relationship between zeros and factors of Polynomials		
2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep
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.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2	College Prep

	Algebra 2 Advanced Algebra 2 Honors Algebra 2	
Use polynomial identities to solve problems		
4. Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.</i>	Elements of Algebra 2 Algebra 2 Advanced Algebra 2	
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. (The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.)	Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus AP Calculus BC
Rewrite rational expressions		
6. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Advanced Pre-Calculus Pre-AP Calculus
7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Advanced Pre-Calculus Pre-AP Calculus

Creating Equations

A –CED

Create equations that describe numbers or relationships	Core	Electives
1. Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i>	Transitional Pre-Algebra Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus
2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus
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. <i>For example, represent inequalities describing nutritional and</i>	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2	College Prep Trigonometry Advanced Pre-Calculus

<i>cost constraints on combinations of different foods.</i>	Algebra 2 Advanced Algebra 2 Honors Algebra 2	
4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law $V = IR$ to highlight resistance R.</i>	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus

Reasoning with Equations and Inequalities

A -REI

Understand solving equations as a process of reasoning and explain the reasoning	Core	Electives
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.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus
2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	Elements of Algebra 1 Algebra 1 Elements of Geometry Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Advanced Pre-Calculus Pre-AP Calculus
Solve equations and inequalities in one variable		
3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep
4. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep
Solve systems of equations		

5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep
6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep
7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.</i>	Elements of Algebra 1 Algebra 1	
8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.		Trigonometry Advanced Pre-Calculus
9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).		Trigonometry Advanced Pre-Calculus
Represent and solve equations and inequalities graphically		
10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	Transitional Pre-Algebra Elements of Algebra 1 Algebra 1	Trigonometry Advanced Pre-Calculus
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. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. □	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus
12. Graph the solutions to a linear inequality in two variables as a halfplane (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.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus

Interpreting Functions

F-IF

Understand the concept of a function and use function notation	Core	Electives
1. Understand that a function from one set (called the domain)	Elements of Algebra 1	College Prep

<p>to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.</p>	<p>Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC</p>
<p>2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p>	<p>Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC</p>
<p>3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. <i>For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ for $n \leq 1$.</i></p>	<p>Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus AP Calculus BC Computer Science</p>
<p>Interpret functions that arise in applications in terms of the context</p>		
<p>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. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> □</p>	<p>Elements of Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC Computer Science</p>
<p>5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>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.</i> □</p>	<p>Elements of Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC</p>
<p>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. □</p>	<p>Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2</p>	<p>College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus</p>

	Advanced Algebra 2 Honors Algebra 2	Calculus College Calculus AP Calculus AB AP Calculus BC
Analyze functions using different representations		
7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. □ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC
8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.</i>	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC Computer Science
9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i>	Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus AP Calculus BC

Building Functions

F-BF

Build a function that models a relationship between two quantities	Core	Electives
1. Write a function that describes a relationship between two	Elements of Algebra 1	College Prep

<p>quantities. □</p> <p>a. Determine an explicit expression, a recursive process, or steps for calculation from a context.</p> <p>b. Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></p> <p>c. (+) Compose functions. <i>For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.</i></p>	<p>Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC Computer Science</p>
<p>2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. □</p>	<p>Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus AP Calculus BC Computer Science</p>
<p>Build new functions from existing functions</p>		
<p>3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>	<p>Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus</p>
<p>4. Find inverse functions.</p> <p>a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. <i>For example, $f(x) = 2x^3$ for $x > 0$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.</i></p> <p>b. (+) Verify by composition that one function is the inverse of another.</p> <p>c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.</p> <p>d. (+) Produce an invertible function from a non-invertible function by restricting the domain.</p>	<p>Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus College Calculus AP Calculus AB AP Calculus BC</p>
<p>5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.</p>		<p>Trigonometry Advanced Pre-Calculus Pre-AP Calculus College Prep Calculus College Calculus AP Calculus AB AP Calculus BC</p>

Linear and Exponential Models

F –LE

Construct and compare linear and exponential models and solve Problems	Core	Electives
<p>1. Distinguish between situations that can be modeled with linear functions and with exponential functions.</p> <p>a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.</p> <p>b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</p> <p>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</p>	<p>Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Trigonometry Advanced Pre-Calculus Pre AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC</p>
<p>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).</p>	<p>Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Calculus College Calculus AP Calculus AB AP Calculus BC</p>
<p>3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.</p>	<p>Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Calculus College Calculus AP Calculus AB AP Calculus BC</p>
<p>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.</p>	<p>Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Calculus College Calculus AP Calculus AB AP Calculus BC</p>
Interpret expressions for functions in terms of the situation they model		
<p>5. Interpret the parameters in a linear or exponential function in terms of a context.</p>	<p>Elements of Algebra 1 Algebra 1 Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2</p>	<p>Calculus College Calculus AP Calculus AB AP Calculus BC</p>

Trigonometric Functions

F-TF

Extend the domain of trigonometric functions using the unit circle	Core	Electives
1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC
2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC
3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for x , $\pi + x$, and $2\pi - x$ in terms of their values for x , where x is any real number.	Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC
4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus Calculus College Calculus AP Calculus AB AP Calculus BC
Model periodic phenomena with trigonometric functions		
5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. □	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Advanced Pre-Calculus
6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.	Advanced Algebra 2 Honors Algebra 2	Pre-AP Calculus AP Calculus AB AP Calculus BC
7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. □	Honors Algebra 2	Pre-AP Calculus AP Calculus AB AP Calculus BC

Prove and apply trigonometric identities		
8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus
9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.		Trigonometry Advanced Pre-Calculus Pre-AP Calculus

Geometry

Congruence

G-CO

Experiment with transformations in the plane	Core	Electives
1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	Elements of Geometry Geometry Advanced Geometry Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	Elements of Geometry Integrated Algebra 2 Geometry Advanced Geometry	
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	Elements of Geometry Integrated Algebra 2 Geometry Advanced Geometry	
5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	Elements of Geometry Integrated Algebra 2 Geometry Advanced Geometry	Pre-AP Calculus
Understand congruence in terms of rigid motions		
6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	Elements of Geometry Integrated Algebra 2 Geometry Advanced Geometry	
7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent	Elements of Geometry Integrated Algebra 2 Geometry Advanced Geometry	
8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	Elements of Geometry Geometry Advanced Geometry	
Prove geometric theorems		
9. Prove theorems about lines and angles. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and</i>	Elements of Geometry Integrated Algebra 2 Geometry	

<i>corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</i>	Advanced Geometry	
10. Prove theorems about triangles. <i>Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</i>	Elements of Geometry Integrated Algebra 2 Geometry Advanced Geometry	
11. Prove theorems about parallelograms. <i>Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</i>	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
Make geometric constructions		
12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</i>	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	Elements of Geometry Geometry Advanced Geometry	

Similarity, Right Triangles, and Trigonometry

G-SRT

Understand similarity in terms of similarity transformations	Core	Electives
1. Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	Elements of Geometry Geometry Advanced Geometry	

Prove theorems involving similarity		
4. Prove theorems about triangles. <i>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.</i>	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
Define trigonometric ratios and solve problems involving right Triangles		
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.	Elements of Geometry Geometry Advanced Geometry Honors Algebra 2 Integrated Algebra 2	College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus
7. Explain and use the relationship between the sine and cosine of complementary angles.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus
8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2 Honors Algebra 2	College Prep Trigonometry Advanced Pre-Calculus Pre-AP Calculus
Apply trigonometry to general triangles		
9. (+) Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	Integrated Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus
10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.	Integrated Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus
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).	Honors Algebra 2	Trigonometry Advanced Pre-Calculus Pre-AP Calculus

Circles

G-C

Understand and apply theorems about circles	Core	Electives
1. Prove that all circles are similar.	Elements of Geometry Geometry Advanced Geometry	

2. Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i>	Elements of Geometry Geometry Advanced Geometry	
3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	Elements of Geometry Geometry Advanced Geometry	
4. (+) Construct a tangent line from a point outside a given circle to the circle.	Elements of Geometry Geometry Advanced Geometry	
Find arc lengths and areas of sectors of circles		
5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus AP Calculus BC

Expressing Geometric Properties with Equations

G-GPE

Translate between the geometric description and the equation for a conic section	Core	Electives
1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus
2. Derive the equation of a parabola given a focus and directrix.	Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus
3. (+) Derive the equations of ellipses and hyperbolas given foci and directrices.	Honors Algebra 2	Trigonometry Advanced Pre-Calculus
Use coordinates to prove simple geometric theorems algebraically		
4. Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.</i>	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	Trigonometry Advanced Pre-Calculus
5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	Elements of Geometry Geometry Advanced Geometry	Trigonometry Advanced Pre-Calculus
6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio	Elements of Geometry Geometry	Trigonometry Advanced Pre-

	Advanced Geometry Integrated Algebra 2	Calculus
7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. □	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	Trigonometry Advanced Pre-Calculus

Geometric Measurement and Dimension

G-GMD

Explain volume formulas and use them to solve problems	Core	Electives
1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i>	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	
2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.		
3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. □	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	Calculus College Calculus AP Calculus AB AP Calculus BC
Visualize relationships between two-dimensional and three dimensional objects		
4. Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	Elements of Geometry Geometry Advanced Geometry	Calculus College Calculus AP Calculus AB AP Calculus BC

Modeling with Geometry

G-MG

Apply geometric concepts in modeling situations	Core	Electives
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). □	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	Calculus College Calculus AP Calculus AB AP Calculus BC
2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). □	Elements of Geometry Geometry Advanced Geometry	
3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). □	Elements of Geometry Geometry Advanced Geometry Integrated Algebra 2	Calculus College Calculus AP Calculus AB AP Calculus BC

Interpreting Categorical and Quantitative Data

S-ID

Summarize, represent, and interpret data on a single count or measurement variable	Core	Electives
1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	Elements of Geometry Elements of Algebra 1 Algebra 1	Introduction to Statistics AP Statistics Computer Science
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.	Elements of Algebra 1 Algebra 1	Introduction to Statistics AP Statistics
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	Elements of Algebra 1 Algebra 1	Introduction to Statistics AP Statistics
4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics
Summarize, represent, and interpret data on two categorical and quantitative variables		
5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	Elements of Algebra 1 Algebra 1	Introduction to Statistics AP Statistics
6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.</i> b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.	Elements of Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics
Interpret linear models		
7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	Elements of Algebra 1 Algebra 1	Introduction to Statistics AP Statistics
8. Compute (using technology) and interpret the correlation coefficient of a linear fit.	Elements of Algebra 1 Algebra 1	Introduction to Statistics AP Statistics
9. Distinguish between correlation and causation.	Elements of Algebra 1 Algebra 1	Introduction to Statistics AP Statistic

Making Inferences and Justifying Conclusions

S-IC

Understand and evaluate random processes underlying statistical experiments	Core	Electives
1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>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?</i>	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics
Make inferences and justify conclusions from sample surveys, experiments, and observational studies		
3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics
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.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics
6. Evaluate reports based on data.	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2	Introduction to Statistics AP Statistics

Conditional Probability and the Rules of Probability S-CP

Understand independence and conditional probability and use them to interpret data	Core	Electives
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”).	Transitional Pre-Algebra Algebra 1 Elements of Geometry Geometry Advanced Geometry Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Discrete Mathematics Trigonometry Advanced Pre-Calculus Pre-AP Calculus Introduction to Statistics AP Statistics
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.	Algebra 1 Elements of Algebra 2 Integrated Algebra 2 Algebra 2	Discrete Mathematics Trigonometry Advanced Pre-Calculus Pre-AP Calculus

	Advanced Algebra 2 Honors Algebra 2	Introduction to Statistics AP Statistics
3. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, 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 .	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Discrete Mathematics Trigonometry Advanced Pre-Calculus Introduction to Statistics AP Statistics
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. <i>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.</i>	Elements of Algebra 2 Algebra 2 Advanced Algebra 2	Trigonometry Advanced Pre-Calculus Introduction to Statistics AP Statistics
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>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.</i>	Elements of Algebra 2 Algebra 2 Advanced Algebra 2	Trigonometry Advanced Pre-Calculus Introduction to Statistics AP Statistics
Use the rules of probability to compute probabilities of compound events in a uniform probability model		
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.	Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Discrete Mathematics Trigonometry Advanced Pre-Calculus
7. Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.	Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Discrete Mathematics Trigonometry Advanced Pre-Calculus
8. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$, and interpret the answer in terms of the model.	Advanced Algebra 2	Trigonometry Advanced Pre-Calculus
9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.	Integrated Algebra 2 Advanced Algebra 2 Honors Algebra 2	Discrete Mathematics Trigonometry Advanced Pre-Calculus Pre-AP Calculus Introduction to Statistics AP Statistics Pre-AP Calculus

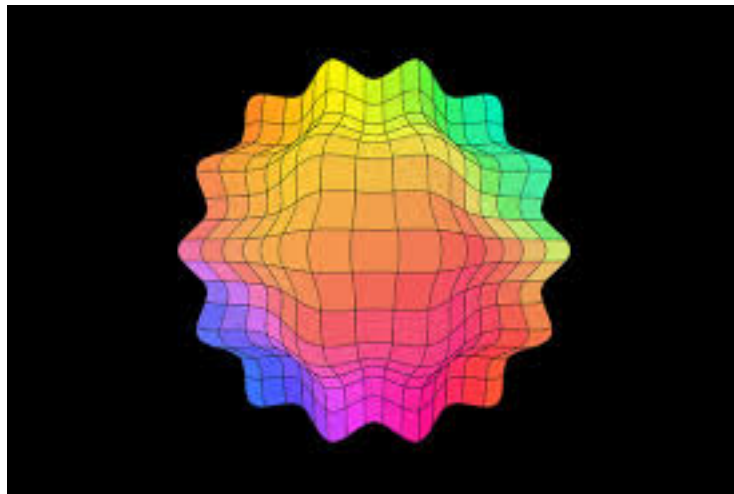
Using Probability to Make Decisions

S-MD

Calculate expected values and use them to solve problems	Core	Electives
1. (+) Define a random variable for a quantity of interest by		Introduction to Statistics

assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.		AP Statistics
2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.		Introduction to Statistics AP Statistics
3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. <i>For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.</i>	Advanced Algebra 2	Introduction to Statistics AP Statistics
4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?</i>		Introduction to Statistics AP Statistics
Use probability to evaluate outcomes of decisions		
5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a. Find the expected payoff for a game of chance. <i>For example, find the expected winnings from a state lottery ticket or a game at a fast food restaurant.</i> b. Evaluate and compare strategies on the basis of expected values. <i>For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.</i>		Introduction to Statistics AP Statistics
6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	Elements of Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	Elements of Algebra 2 Integrated Algebra 2 Algebra 2 Advanced Algebra 2 Honors Algebra 2	Trigonometry Advanced Pre-Calculus

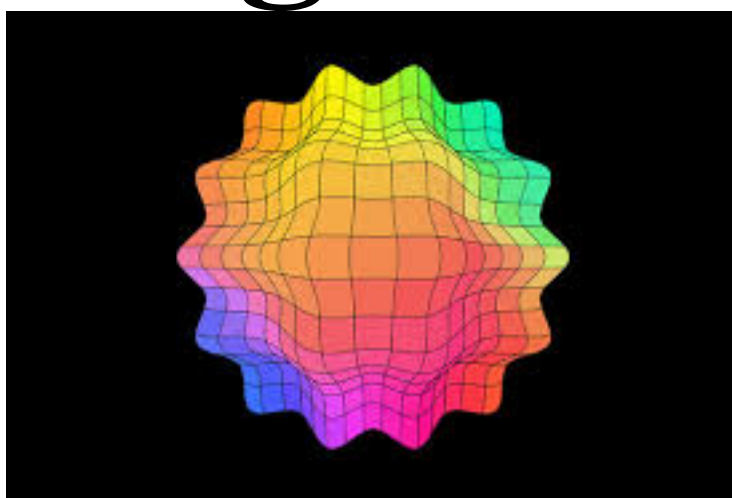
Core Math Courses



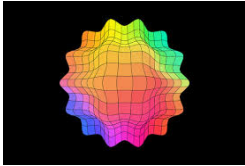
**Pre Algebra
Algebra I and II
Geometry**

CURRICULUM AND UNITS OF STUDY

Algebra



CURRICULUM OVERVIEW: TRANSITIONAL PRE ALGEBRA



Content: Pre-Algebra

Course Title: Transitional Pre-Algebra

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: This course is designed to help students bridge over to the next course Elements of Algebra I. Concepts will cover exploring patterns and number theory, modeling integers, and investigations in Algebra.

Standards:

- A-SSE.1
- A-APR.1
- N-RN.2
- A-CED.1
- N-Q.1, 2
- S-CP.1
- A-REI.10

Enduring Understandings (big ideas, life lessons, concepts):

- The learner will perform operations with numbers and expressions to solve problems.
- Algebraic representation can be used to generalize patterns and relationships.
- The learner will be able to solve linear and quadratic equations.
- The learner will collect, organize and interpret data to solve problems and make predictions.
- The learner will recognize and use the connection between equations and graphs to help solve problems.
- The learner will use linear, exponential and quadratic models to solve real life problems.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- How can patterns, relations, and functions be used as tools to best describe and help explain real-life situations?
- In what ways can algebra be used to interpret data and make predictions?
- How can number sense and knowledge of the problem in context help to determine the reasonableness of a solution?
- In what ways do linear, quadratic and exponential equations and their graphs help us to interpret real world events?

Knowledge and Skills

Skills: Students will be able to...

- Evaluate algebraic expressions
- Write a variable expression that models a real-life situation
- Organize data into tables, graphs and scatter plots
- Perform operations with real numbers
- Express the likelihood of an event as a probability or as odds
- Solve linear equations
- Solve proportions and percent problems

Terminology:

- Linear equations (distributive property, multi-step, variable, translating, standard form)
- Order of Operations
- Operations with Signed numbers
- Rate, ratio, percent
- Proportion

Assessments (how students will show what they know)

Formative (interim): Midterm Exam

Summative (final): Final Exam

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

9.1 The 21st Century Life & Career Skills

- 9.1.4.A.1 - Recognize a problem and brainstorm ways to solve the problem individually or collaboratively.
- 9.1.4.A.2 - Evaluate available resources that can assist in solving problems.
- 9.1.4.A.3 - Determine when the use of technology is appropriate to solve problems.
- 9.1.4.A.5 - Apply critical thinking and problem-solving skills in classroom and family settings.
- 9.1.8.A.1 - Develop strategies to reinforce positive attitudes and productive behaviors that impact critical thinking and problem-solving skills.
- 9.1.12.A.1 - Apply critical thinking and problem-solving strategies during structured learning experiences.
- 9.1.4.B.1 - Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.
- 9.1.8.B.1 - Use multiple points of view to create alternative solutions.
- 9.1.4.C.1 - Practice collaborative skills in groups, and explain how these skills assist in completing tasks in different settings (at home, in school, and during play).
- 9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.
- 9.1.8.C.3 - Model leadership skills during classroom and extra-curricular activities.

9.3 Career Awareness, Exploration, Preparation:

- 9.3.12.C.2 - Characterize education and skills needed to achieve career goals, and take steps to prepare for post secondary options, including making course selections, preparing for and taking assessments, and participating in extra-curricular activities.
- 9.3.12.C.3 - Develop personal interests and activities that support declared career goals and plans.

9.4 Career Cluster Specific

- 9.4.12.A.2 - *Demonstrate mathematics knowledge and skills required to pursue the full range of post secondary education and career opportunities.*
- 9.4.12.A.5 - *Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.*
- 9.4.12.A.11 - *Apply active listening skills to obtain and clarify information.*
- 9.4.12.A.12 - *Develop and interpret tables, charts, and figures to support written and oral communications.*
- 9.4.12.A.13 - *Listen to and speak with diverse individuals to enhance communication skills.*
- 9.4.12.A.16 - *Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.*
- 9.4.12.A.21 - *Employ technological tools to expedite workflow.*
- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary: Language Arts (solving word problems, translating, explanations during problem solving); Science (problem solving, scientific notation and applications); Social Studies (reading and interpreting graphs, economic applications)

Course Resources:

Technologies: Graphing Calculators (TI 84 and TI 89); TI Navigator; SMART Boards (interactive whiteboards), Notebook software

Text: Passport to Algebra and Geometry, ISBN 0-395-87988-4

Other: Helpful resources from the text include:

- Algebra tile activities
- Chapter tests
- Section standardized test practice
- Chapter readiness quizzes
- Section mixed review
- Chapter summary and review
- Section maintaining skills
- Extra chapter practice problems (pp 716-741)

Teacher's Resource Package includes:

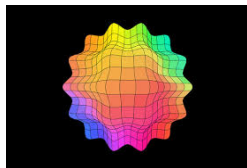
- Warm-up exercises
- Problem of the Day
- Daily quizzes
- Solutions manual
- Chapter workbooks
- Standardized test practice/workbook

Chapter workbooks include:

- Lesson opener
- Practice problems
- Reteaching examples

- Real life applications
- Challenge problems
- Chapter review games
- Chapter tests
- Cumulative review

CURRICULUM OVERVIEW: ALGEBRA



Content: Algebra 1

Course Titles: Elements of Algebra I, Algebra I

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: Algebra 1 continues the study of algebraic concepts. It includes operations with polynomials, creation and application of linear functions and relations, algebraic representations of geometric relationships, and an introduction to nonlinear functions. Students will be expected to describe and translate among graphic, algebraic, numeric, tabular, and verbal representations of relations and use those representations to solve problems. Appropriate technology, from manipulatives to calculators, should be used regularly for instruction and assessment.

Standards:

- N-RN.1,2,3
- N-Q.1,2,3
- A-SSE.1,2,3
- A-APR.1
- A-CED.1,2,3
- A-REI.1.3.4.5.6,10,11
- F-IF.1,2,6,7,8,9
- F-BF.1,3
- F-LE.1

Enduring Understandings (big ideas, life lessons, concepts):

- The learner will perform operations with numbers and expressions to solve problems.
- The learner will be able to solve linear and quadratic equations.
- The learner will collect, organize and interpret data to solve problems and make predictions.
- The learner will recognize and use the connection between equations and graphs to help solve problems.
- The learner will use linear, exponential and quadratic models to solve real life problems.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- In what ways can algebra be used to interpret data and make predictions?
- How can number sense and knowledge of the problem in context help to determine the reasonableness of a solution?
- How does an understanding of equations and their graphs help to determine which model (linear, quadratic or exponential) is appropriate to solve a real-life problem?

- In what ways do linear, quadratic and exponential equations and their graphs help us to interpret real world events?

Knowledge and Skills

Knowledge: Students will know...

- Perform operations with integers, including order of operations, absolute value, evaluating expressions and combining like terms.
- Translate English into Algebra and apply this to problem solving.
- Solve multi-step equations that include distribution, absolute value, fractions, variables on both sides, and proportions.
- Solve word problems by creating and solving a linear model.
- Graph linear equations using slope and intercepts. Create a linear equation to model a scatter plot (a linear regression model).
- Solve systems of equations using graphing, substitution and linear combinations, as well as apply this to problem solving.
- Perform operations with exponents. This includes evaluation of expressions, combining like terms, applications of rules for multiplying and dividing exponents, and raising a power to a power.
- Add, subtract, and multiply monomial, binomial, and trinomial expressions.
- Solve literal equations.
- Factor expressions by removing greatest common factor, differences of squares, trinomials, or any combination.
- Solve quadratic equations and apply this skill to solving word problems.
- Apply critical thinking skills to solving PARCC problems in these cluster areas: Numerical Operations, Fundamentals of Algebra, Patterns and Functions and Data Analysis.

Skills: Students will be able to...

- Evaluate algebraic expressions
- Write a variable expression that models a real-life situation
- Organize data into tables, graphs and scatter plots
- Identify a function and make an input-output table
- Perform operations with real numbers
- Express the likelihood of an event as a probability or as odds
- Solve linear equations and inequalities
- Solve absolute value equations
- Graph a linear equation in two variables
- Find the slope of a line and constant of variation
- Create linear models for sets of data to solve problems.
- Interpret constants and coefficients ($y=mx+b$) in the context of the data.
- Check the model for correlation and use the model, where appropriate to draw conclusions or make predictions.
- Write an equation of a line
- Determine parallelism or perpendicularity of lines
- Use systems of linear equations in two variables to model and solve problems using tables, graphs and algebraic properties; justify results.
- Use laws of exponents to evaluate expressions
- Use exponential growth and decay to solve problems
- Evaluate, approximate and perform operations with square roots

- Perform operations with polynomials
- Classify polynomials by degree and number of terms
- Factor polynomials
- Solve polynomial equations and check solutions graphically
- Solve proportions and percent problems
- Find the terms of an arithmetic sequence
- Write a rule for the nth term of an arithmetic sequence
- Find the sum of an arithmetic sequence

Terminology:

- Variable, Term, Coefficient, Like Terms, Combine Like Terms, Solution, Translating Phrases & Sentences, Algebraic Models, Scatterplot, Correlation, Probability, Slope, Function, Linear Function, Intercept, Slope-Intercept Form, Standard Form of a Line, Linear Models, Linear System, Substitution & Combination Methods, Exponential Growth & Decay, Exponential Function, Polynomial, Quadratic Function, Factoring Quadratics, Factoring Completely, Rational & irrational Numbers, Completing the Square

Assessments (how students will show what they know)

Formative (interim): Tongue Twister, Walk-the-Line, Diagnostic Benchmarks, Midterm

Summative (final): Final Exam

21st Century Connections:

8.1 Technology (Education Technology): 8.1A.3 – Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

9.1 The 21st Century Life & Career Skills

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- 9.1.12.A.1 - Apply critical thinking and problem-solving strategies during structured learning experiences.
- 9.1.4.B.1 - Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.
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- 9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.
- 9.1.8.C.3 - Model leadership skills during classroom and extra-curricular activities.

9.3 Career Awareness, Exploration, Preparation:

- 9.3.12.C.2 - Characterize education and skills needed to achieve career goals, and take steps to prepare for post secondary options, including making course selections, preparing for and taking assessments, and participating in extra-curricular activities.

- 9.3.12.C.3 - Develop personal interests and activities that support declared career goals and plans.

9.4 Career Cluster Specific

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- 9.4.12.A.16 - *Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.*
- 9.4.12.A.21 - *Employ technological tools to expedite work flow.*
- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary: Language Arts (solving word problems, translating, explanations during problem solving); Science (problem solving, scientific notation and applications); Social Studies (reading and interpreting graphs, economic applications)

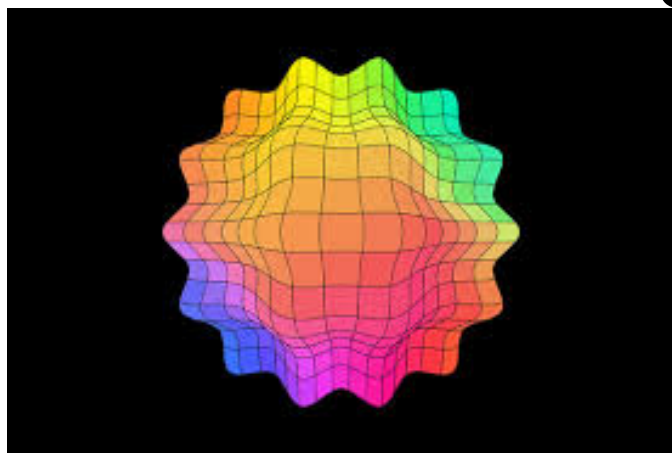
Course Resources:

Technologies: Graphing Calculators (TI 84 and TI 89); Chrome Books; SMART Board (interactive white boards), Notebook software

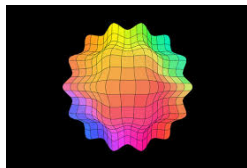
Text: **Algebra I**– Algebra 1, Holt-McDougal c2012, ISBN 9-78054747036
Elements of Algebra 1 – Algebra 1, Concepts and Skills – McDougal Littell by Larson, c2001, ISBN 0-618-05051-5

**CURRICULUM AND UNITS OF STUDY
GEOMETRY**

Geometry



CURRICULUM OVERVIEW: GEOMETRY



Content: Geometry

Course Title (if applicable): Elements of Geometry, Geometry, Advanced Geometry

Mission (optional): Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: Geometry continues students' study of geometric concepts building upon middle school topics. Students will move from an inductive approach to deductive methods of proof in their study of two- and three-dimensional geometric figures. Reasoning skills will be emphasized and students will broaden their use of the coordinate plane. Appropriate technology, from manipulatives to calculators and graphics software, should be used regularly for instruction and assessment.

Standards:

- A-REI.2 (EG only)
- G-CO.1,2,3,4,5,6,7,8,9,10,11,12,13
- G-SRT.1,2,3,4,5,6,7,8
- G-C.1,2,3,4,5
- G-GPE.1,4,5,6,7
- G-GMD.1,3,4
- G-MG.1,2,3
- N-VM.6,7,8 (EG only)
- S-CP.1
- S-ID.1 (EG only)
- N-VM.1, 2, 3, 4, 5 (Adv Geom only)

Enduring Understandings (big ideas, life lessons, concepts):

- The learner will define and use fundamental geometric terms and apply them to real-life situations.
- The learner will use geometric and algebraic properties of figures to solve problems and write proofs.
- The learner will transform geometric figures in the coordinate plane algebraically.
- The learner will apply both inductive and deductive reasoning to real-life situations.
- The learner will use the properties of solids to calculate their surface area and volume and apply to real life problems.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- How can you distinguish types of quadrilaterals by classifying them according to sides, angles, and diagonals?
- In what different ways can you prove two triangles congruent?
- In what different ways can you prove two triangles similar?
- How can you prove two lines parallel?
- How can you prove two lines perpendicular?
- What are the different pairs of angles that would be congruent?
- What is the difference between congruence and similarity?
- What is the relationship between the volume of a cone and a cylinder?
- What are the different ways to determine whether a triangle is obtuse, acute, or a right triangle?
- A metal rod that is 9 inches long is to be cut into three pieces and welded together to form a triangular brace for a stair step. If the pieces all have an integral length, name all the possible combinations of lengths.
- How can you use the trigonometric ratios to determine the distance across a lake?
- What are the major differences between inductive and deductive reasoning?
- What is the relationship between an inscribed angle and a central angle with the same intercepted arcs?

Knowledge and Skills:

Knowledge: Students will know...

- Distance and midpoint – on a line graph and a coordinate plane
- Segment bisectors
- Classify angles
- Angle bisectors
- Special Angle Pairs – adjacent, vertical, linear pair, complementary, supplementary, and perpendicular lines
- Conditional Statements – conjectures, if-then statements, (G, AG)
- Truth values and counterexamples
- Postulates about points, lines, and segments
- Algebraic proofs (G,AG)
- Segment and angle proofs
- Angles formed by a transversal
- Angle relationships formed by parallel lines and a transversal
- Slope to determine parallel or perpendicular
- Slope-Intercept form
- Angle relationships that produce parallel lines
- Classify triangles – angles and sides
- Properties of isosceles triangles
- Exterior angles and interior angles – angle sum theorem and exterior angle theorem
- Congruent triangles and corresponding parts - CPCTC
- Congruent triangles – SSS, SAS, AAS, ASA theorems
- Congruent right triangles – LL, HA, LA, HL – emphasize HL

- Proofs using congruent triangles
- Lines in a triangle – median, altitude, angle bisector, perpendicular bisector
- Triangle Inequalities – triangle inequality theorem, SAS Inequality, SSS Inequality
- Determine if triangle is acute, right, or obtuse using the Pythagorean Theorem
- Use proportions to solve problems
- Scale factor and similarity postulates – AA, SSS, SAS
- Determining similar polygons
- Proportional parts of triangles (G,AG)
- Simplify Radicals
- Geometric Mean (G,AG)
- Pythagorean Theorem
- Special right triangles - 45-45-90 and 30-60-90
- Trig Ratios – SOHCAHTOA
- Angles of Elevation and Depression
- Law of Sines, Law of Cosines
- Properties of parallelograms and ensuring parallelograms
- Special Parallelograms – Rectangle, Rhombus, Square
- Trapezoids and medians (midsegments)
- Translations
- Reflections
- Rotations
- Tessellations (OPTIONAL)
- Dilations
- Vectors – vector sum, magnitude, direction, vector addition (AG)
- Parts of a circle
- Circumference and Area
- Arcs, angles, and sectors
- Properties of chords – inscribed angles, inscribed quadrilaterals
- Properties of tangent lines and secant lines
- Equation of a circle
- Polygon classifications
- Interior and exterior angles of polygons
- Area of Polygons
- Geometric probability
- Networks (vertex-edge graphs) (EG, AG)
- Nets
- Prisms and Cylinders – lateral area and surface area
- Prisms and Cylinders – volume
- Pyramids and Cones – lateral area and surface area
- Pyramids and Cones – volume

Skills: Students will be able to...

- use the trigonometric ratios to model and solve problems involving right triangles.
- identify and use parts and types of lines, angles, and planes in problems solving.

- use logical reasoning and conditional statements to solve problems.
- use angle relationships with parallel and perpendicular lines to solve problems.
- use triangle classifications and congruent triangles to solve problems.
- to use the relationships of sides and angles in triangles to solve problems.
- use proportions to determine similar figures.
- use properties of quadrilaterals to solve problems
- use and apply properties of lines and angles in circles.
- use length, area, and volume of geometric figures to solve problems. Include arc length, area of sectors of circles; lateral area, surface area, and volume of three-dimensional figures; and perimeter, area, and volume of composite figures.
- use logic and deductive reasoning to draw conclusions and solve problems.
- apply properties, definitions, and theorems of angles and lines to solve problems and write proofs.
- develop and apply properties of solids to solve problems.
- describe the transformation (translation, reflection, rotation, dilation) of polygon polygons in the coordinate plane in simple algebraic terms
- apply properties, definitions, and theorems of two-dimensional figures to solve problems and write proofs:
 - a) Triangles.
 - b) Quadrilaterals.
 - c) Other polygons.
 - d) Circles.

Terminology:

<ul style="list-style-type: none"> ● point ● line ● plane ● collinear ● coplanar ● line segment ● endpoints ● ray ● initial point ● opposite rays ● intersect, intersection ● postulates ● coordinate ● distance, length ● between ● Distance Formula ● congruent segments ● angle ● sides, vertex of an angle ● perpendicular lines 	<ul style="list-style-type: none"> ● congruent angles ● measure of an angle ● interior of an angle ● exterior of an angle ● acute, obtuse angles ● right, straight angles ● adjacent angles ● midpoint ● bisect ● segment bisector ● compass, straightedge ● construct, construction ● Midpoint Formula ● angle bisector ● vertical angles ● linear pair ● complementary angles ● complement of an angle ● supplementary angles ● supplement of an angle
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- line perpendicular to a plane
- theorem
- parallel lines
- skew lines
- parallel planes
- transversal
- corresponding angles
- equilateral triangle
- isosceles triangle
- scalene triangle
- acute triangle
- equiangular triangle
- right triangle
- obtuse triangle
- vertex of a triangle
- adjacent sides of a triangle
- legs of a right triangle
- perpendicular bisector
- equidistant from two points
- distance from a point to a line
- equidistant from two lines
- perpendicular bisector of a triangle
- concurrent lines
- point of concurrency
- polygon
- sides of a polygon
- vertex, vertices
- convex
- nonconvex, concave
- equilateral polygon
- equiangular polygon
- regular polygon
- diagonal of a polygon
- parallelogram
- rhombus
- rectangle
- translation
- vector
- initial point
- terminal point
- component form
- glide reflection
- composition
- ratio

- two-column proof
- paragraph proof
- alternate interior angles
- alternate exterior angles
- consecutive interior angles
- same side interior angles
- hypotenuse
- legs of an isosceles triangle
- base of an isosceles triangle
- interior angle
- exterior angle
- corollary
- congruent
- corresponding angles
- corresponding sides
- base angles
- vertex angle
- circumcenter of a triangle
- angle bisector of a triangle
- incenter of a triangle
- median of a triangle
- centroid of a triangle
- altitude of a triangle
- orthocenter of a triangle
- midsegment of a triangle
- square
- trapezoid
- bases of a trapezoid
- base angles of a trapezoid
- legs of a trapezoid
- isosceles trapezoid
- midsegment of a trapezoid
- kite
- image
- preimage
- transformation
- isometry
- reflection
- line of reflection
- line of symmetry
- rotation
- center of rotation
- angle of rotation
- rotational symmetry

- proportion
- extremes
- means
- geometric mean
- similar polygons
- Pythagorean Triple
- special right triangles
- trigonometric ratio
- sine
- cosine
- tangent
- circle
- center of circle
- radius of circle
- congruent circles
- diameter of circle
- chord
- secant
- tangent
- tangent circles
- tangent segment
- secant segment
- external segment
- standard equation of a circle
- center of a polygon
- radius of a polygon
- apothem of a polygon
- central angle of a regular polygon
- circumference
- polyhedron
- face
- edge
- vertex
- regular polyhedron
- convex
- cross section
- Platonic solids
- tetrahedron
- octahedron
- dodecahedron
- icosahedron
- circular cone
- lateral surface area of a cone
- right cone

- scale factor
- dilation
- reduction
- enlargement
- angle of elevation
- solve a right triangle
- magnitude of a vector
- direction of a vector
- equal vectors
- parallel vectors
- sum of two vectors
- concentric circles
- common tangent
- interior of a circle
- exterior of a circle
- point of tangency
- central angle
- minor arc and its measure
- major arc and its measure
- semicircle
- congruent arcs
- inscribed angles
- intercepted arc
- inscribed polygon
- circumscribed circle
- arc length
- sector of a circle
- probability
- geometric probability
- prism
- bases
- lateral faces
- right prism
- oblique prism
- surface area of a polyhedron
- lateral area of a polyhedron
- net
- cylinder
- right cylinder
- lateral area of a cylinder
- surface area of a cylinder
- pyramid
- regular pyramid
- sphere

<ul style="list-style-type: none"> ● volume of a solid ● great circle ● hemisphere ● similar solids 	<ul style="list-style-type: none"> ● center of a sphere ● radius of a sphere ● chord of a sphere ● diameter of a sphere
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Assessments (how students will show what they know):

Formative (interim): Critical Question Assessment

Summative (final): Final Exam

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

9.1 The 21st Century Life & Career Skills

- 9.1.4.A.1 - Recognize a problem and brainstorm ways to solve the problem individually or collaboratively.
- 9.1.4.A.2 - Evaluate available resources that can assist in solving problems.
- 9.1.4.A.3 - Determine when the use of technology is appropriate to solve problems.
- 9.1.4.A.5 - Apply critical thinking and problem-solving skills in classroom and family settings.
- 9.1.8.A.1 - Develop strategies to reinforce positive attitudes and productive behaviors that impact critical thinking and problem-solving skills.
- 9.1.12.A.1 - Apply critical thinking and problem-solving strategies during structured learning experiences.
- 9.1.4.B.1 - Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.
- 9.1.8.B.1 - Use multiple points of view to create alternative solutions.
- 9.1.4.C.1 - Practice collaborative skills in groups, and explain how these skills assist in completing tasks in different settings (at home, in school, and during play).
- 9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.
- 9.1.8.C.3 - Model leadership skills during classroom and extra-curricular activities.

9.3 Career Awareness, Exploration, Preparation:

- 9.3.12.C.2 - Characterize education and skills needed to achieve career goals, and take steps to prepare for post secondary options, including making course selections, preparing for and taking assessments, and participating in extra-curricular activities.
- 9.3.12.C.3 - Develop personal interests and activities that support declared career goals and plans.

9.4 Career Cluster Specific

- 9.4.12.A.2 - *Demonstrate mathematics knowledge and skills required to pursue the full range of post secondary education and career opportunities.*
- 9.4.12.A.5 - *Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.*
- 9.4.12.A.11 - *Apply active listening skills to obtain and clarify information.*
- 9.4.12.A.12 - *Develop and interpret tables, charts, and figures to support written and oral communications.*
- 9.4.12.A.13 - *Listen to and speak with diverse individuals to enhance communication skills.*
- 9.4.12.A.16 - *Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.*
- 9.4.12.A.21 - *Employ technological tools to expedite work flow.*
- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary:

- Science through problem solving, scientific notation, and applications.
- Social Studies through reading and interpreting data and graphs, as well as economic applications.
- Language Arts through translating and explaining work problems during applications and problem solving.

Course Resources:

Technologies: Graphing Calculators (TI 84 and TI 89); Chrome Books; SMART Board

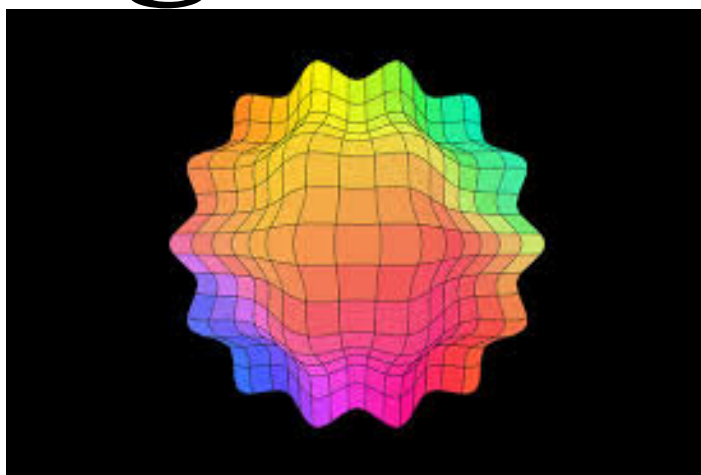
Texts:

Geometry, Carter, McGraw Hill, 2014 (Elements of Geometry and Geometry) ISBN#978-0-07-664097-3

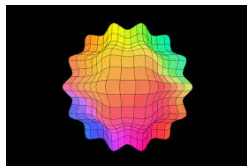
Geometry, Johnson, McDougal-Littell, 1994 (Advanced Geometry) ISBN#0-395-67612-6

CURRICULUM AND UNITS OF STUDY
ALGEBRA II

Algebra II



CURRICULUM OVERVIEW: ALGEBRA II



Content: Algebra 2

Course Title: Elements of Algebra II, Integrated Algebra II, Algebra II, Advanced Algebra II, Honors Algebra II

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: Algebra 2 continues students' study of advanced algebraic concepts including functions, polynomials, rational expressions, systems of functions and inequalities, and matrices. Students will be expected to describe and translate among graphic, algebraic, numeric, tabular, and verbal representations of relations and use those representations to solve problems. Emphasis will be placed on practical applications and modeling. Appropriate technology, from manipulatives to calculators, will be used regularly for instruction and assessment.

Standards:

- N-RN.1, 2
- N-Q.1, 2, 3
- N-CN.1, 2, 7, 8, 9
- A-SSE.1, 2, 3, 4
- A-APR.1, 2, 3, 4, 5, 6, 7
- A-CED.1, 2, 3, 4
- A-REI.1, 2, 3, 4, 11, 12
- F-IF.1, 2, 3, 4, 5, 6, 7, 8, 9
- F-BF.1, 2, 3, 4
- F-LE.1, 3, 4
- F-TF.1, 2, 5, 8
- S-ID.4, 6
- S-CP.1, 2, 3, 5, 6, 7
- S-MD.6, 7

Enduring Understandings (big ideas, life lessons, concepts):

- The learner will be able to perform operations with complex numbers, radicals, and polynomials.
- The learner will be able to solve polynomials equations.
- The learner will be able to recognize the connection between polynomial functions and their graphs in order to solve problems and make predictions.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- How are systems of equations, inequalities and their graphs used to solve real-world problems?

- In what ways do polynomial functions and their graphs help us interpret real-world events or solve problems?
- In what ways can powers, roots and radicals be used in solving real-world problems?

Knowledge and Skills

Knowledge: Students will know...

- How to solve equations
- When inequalities are used in the real world
- How to graph linear equations
- What x and y intercepts mean
- What piecewise functions look like
- Why scatterplots are useful for making predictions
- Where to find the solution to a linear system
- Multiple ways to solve a quadratic equation
- How to graph quadratic functions and inequalities
- When to use the Quadratic Formula
- How to evaluate, graph and find zeros of a polynomial function
- When imaginary solutions exist in a polynomial equation
- Why the number of solutions matches the degree of the polynomial
- How to convert between rational exponent and radical notation
- When to use a radical to solve an equation
- What the graph of a rational function looks like
- How to simplify and perform operations on rational expressions

Skills: Students will be able to...

- Evaluate and simplify numerical and algebraic expressions
- Solve linear and absolute value equations and inequalities
- Graph ordered pairs, relations, functions, linear equations and linear inequalities
- Write equations of lines
- Solve real-life problems using graphs and equations
- Solve linear systems using algebraic methods and graphing
- Solve quadratic equations by graphing, factoring and using the quadratic formula
- Add, subtract, multiply and divide radicals
- Add, subtract, multiply and divide complex numbers
- Use the discriminant to determine the nature of the roots of a quadratic equation
- Use properties of exponents to evaluate and simplify expressions
- Use exponents and scientific notation to solve real-life problems
- Add, subtract and multiply polynomials
- Divide polynomials using long division and synthetic division
- Solve polynomial equations
- Use properties of rational exponents to evaluate and simplify expressions
- Solve radical equations
- Simplify and perform operations with rational expressions
- Graph rational functions
- Write and use inverse variation models

Terminology: order of operations, variable, inequality, absolute value, relation, function, ordered pair, coordinate plane, slope, slope-intercept form, standard form, scatter plot, piecewise function, linear combination method, substitution method, linear programming, quadratic function, parabola, factoring, zero

of a function, square root, complex number, completing the square, quadratic formula, discriminant, polynomial, leading coefficient, degree, constant term, synthetic division, rational zero theorem, fundamental theorem of algebra, radical, asymptote, complex fraction

Assessments (how students will show what they know)

Formative (interim): Diagnostic Exams. Critical Question Assessments

Summative (final): Finals

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

9.1 The 21st Century Life & Career Skills

9.3 Career Awareness, Exploration, Preparation

9.4 Career Cluster Specific

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary:

- Science through problem solving, scientific notation, and applications.
- Social Studies through reading and interpreting data and graphs, as well as economic applications.
- Language Arts through translating and explaining work problems during applications and problem solving.

Course Resources:

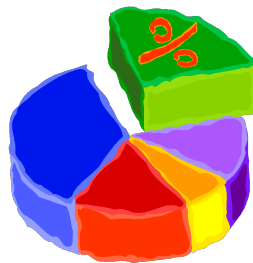
Technologies: Graphing Calculators (TI 84 and TI 89); Chrome Books; SMART Board

Text: **Integrated Algebra 2, Elements of Algebra 2 and Algebra 2** – Algebra 2, McGraw Hill c2014, ISBN 978-0-07-664004-1

Advanced Algebra 2 – Big Ideas Algebra II, Houghton Mifflin, c2014, ISBN 978-1608408405

Honors Algebra 2 – Algebra 2 and Trigonometry, Thomas Learning, c2005, ISBN 0-534-49449-8

HIGH SCHOOL MATH ELECTIVES



CURRICULUM OVERVIEW: COLLEGE PREP MATH



Content: College Prep Mathematics

Course Title: College Prep Mathematics

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: College Prep Math continues students' study of advanced algebraic concepts including functions, polynomials, rational expressions, systems of functions and inequalities, and matrices. In addition, students will study trigonometry and logarithms. Emphasis will be placed on practical applications, modeling, and test preparation. Appropriate technology, from manipulatives to calculators, will be used regularly for instruction and assessment.

Standards:

- N-RN.1, 2
- N-Q.1, 2, 3
- N-CN.1, 2, 7
- N-VM.6, 7, 8
- A-SSE.1, 2
- A-APR.2, 3, 6
- A-CED.1, 2, 3, 4
- A-REI.1, 2, 3, 4, 5, 6
- F-IF.1, 2, 5, 6, 7
- F-BF.1, 5
- G-SRT.6, 7, 8

Enduring Understandings (big ideas, life lessons, concepts):

- The learner will be able to perform operations with complex numbers, radicals, and polynomials.
- The learner will be able to solve polynomials equations.
- The learner will be able to recognize the connection between polynomial functions and their graphs in order to solve problems and make predictions.
- The learner will use relations and functions to solve problems.
- Relations and functions can be represented numerically, graphically, algebraically, and/or verbally.
- The properties of functions and function operations are used to model and analyze real-world applications and quantitative relationships.
- The characteristics of trigonometric and circular functions and their representations are useful in solving real-world problems.

- Connections among the six trigonometric and circular functions are a result of their properties.
- The characteristics of rational functions and their representations are useful in solving real-world problems.
- The characteristics of exponential and logarithmic functions and their representations are useful in solving real-world problems.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- How are systems of equations, inequalities and their graphs used to solve real-world problems?
- In what ways do polynomial functions and their graphs help us interpret real-world events or solve problems?
- In what ways can powers, roots and radicals be used in solving real-world problems?
- What factors can be used to determine whether an analytic or graphical strategy is most advantageous in solving a problem?
- Why are relations and functions represented in multiple ways?
- How are the properties of functions and functional operations useful?
- How do trigonometric and circular functions model real-world problems and their solutions?
- How are the circular functions related to the trigonometric functions?
- How are the six trigonometric and circular functions related to each other?
- How do trigonometric and circular functions model real-world problems and their solutions?
- How do rational functions model real-world problems and their solutions?
- How do exponential functions model real-world problems and their solutions?
- How do logarithmic functions model real-world problems and their solutions?
- How can analytic and graphical methods be used to support each other in the solution to a problem?
- How does the graph of a given function or relation reflect its characteristics?

Knowledge and Skills

Knowledge and Skills: Students will be able to...

- Evaluate and simplify numerical and algebraic expressions
- Solve linear and absolute value equations and inequalities
- Graph ordered pairs, relations, functions, linear equations and linear inequalities
- Write equations of lines
- Solve real-life problems using graphs and equations
- Solve quadratic equations by graphing, factoring and using the quadratic formula
- Add, subtract, multiply and divide radicals
- Add, subtract, multiply and divide complex numbers
- Use the discriminant to determine the nature of the roots of a quadratic equation
- Use properties of exponents to evaluate and simplify expressions
- Use exponents to solve real-life problems
- Add, subtract and multiply polynomials
- Divide polynomials using long division and synthetic division
- Solve polynomial equations
- Use properties of rational exponents to evaluate and simplify expressions
- Solve radical equations
- Simplify and perform operations with rational expressions
- Graph rational functions
- Write and use inverse variation models
- Transform relations in two dimensions; describe the results algebraically and geometrically.

- Use the relations and functions to model and solve problems; justify results.
 - Solve using tables, graphs, and algebraic properties.
 - Interpret the constants and coefficients in the context of the problem.
- Use trigonometric and inverse trigonometric functions to model and solve problems; justify results.
 - Solve using graphs and algebraic properties.
 - Develop and use the law of sines and the law of cosines.
 - Develop and use area formulas for triangles
- Use the composition of functions to model and solve problems.
- Use exponential and logarithmic functions to solve equations
- Use properties of exponents and logarithms to simplify algebraic expressions.

Terminology: order of operations, variable, inequality, absolute value, relation, function, ordered pair, coordinate plane, slope, slope-intercept form, standard form, scatter plot, piecewise function, linear combination method, substitution method, linear programming, quadratic function, parabola, factoring, zero of a function, square root, complex number, completing the square, quadratic formula, discriminant, polynomial, leading coefficient, degree, constant term, synthetic division, rational zero theorem, fundamental theorem of algebra, radical, asymptote, complex fraction

Assessments (how students will show what they know)

Formative (interim): Midterm Exam

Summative (final): Final Exam

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

9.1 The 21st Century Life & Career Skills

- 9.1.4.A.1 - Recognize a problem and brainstorm ways to solve the problem individually or collaboratively.
- 9.1.4.A.2 - Evaluate available resources that can assist in solving problems.
- 9.1.4.A.3 - Determine when the use of technology is appropriate to solve problems.
- 9.1.4.A.5 - Apply critical thinking and problem-solving skills in classroom and family settings.
- 9.1.8.A.1 - Develop strategies to reinforce positive attitudes and productive behaviors that impact critical thinking and problem-solving skills.
- 9.1.12.A.1 - Apply critical thinking and problem-solving strategies during structured learning experiences.
- 9.1.4.B.1 - Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.
- 9.1.8.B.1 - Use multiple points of view to create alternative solutions.
- 9.1.4.C.1 - Practice collaborative skills in groups, and explain how these skills assist in completing tasks in different settings (at home, in school, and during play).
- 9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.
- 9.1.8.C.3 - Model leadership skills during classroom and extra-curricular activities.

9.3 Career Awareness, Exploration, Preparation:

- 9.3.12.C.2 - Characterize education and skills needed to achieve career goals, and take steps to prepare for postsecondary options, including making course selections, preparing for and taking assessments, and participating in extra-curricular activities.
- 9.3.12.C.3 - Develop personal interests and activities that support declared career goals and plans.

9.4 Career Cluster Specific

- 9.4.12.A.2 - *Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.*
- 9.4.12.A.5 - *Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.*
- 9.4.12.A.11 - *Apply active listening skills to obtain and clarify information.*
- 9.4.12.A.12 - *Develop and interpret tables, charts, and figures to support written and oral communications.*
- 9.4.12.A.13 - *Listen to and speak with diverse individuals to enhance communication skills.*
- 9.4.12.A.16 - *Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.*
- 9.4.12.A.21 - *Employ technological tools to expedite workflow.*
- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

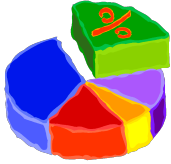
Cross Curricular / Interdisciplinary: Language Arts (solving word problems, translating, explanations during problem solving); Science (problem solving, scientific notation and applications); Social Studies (reading and interpreting graphs, economic applications)

Course Resources:

Technologies: Graphing Calculators (TI 84 and TI 89); TI Navigator; SMART Board (interactive white boards), Notebook software

Text: Algebra and Trigonometry, Holt 1992, 0-03-005433-8

CURRICULUM OVERVIEW: DISCRETE MATHEMATICS



Course Title: Discrete Mathematics

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: Discrete Mathematics. Appropriate technology, from manipulatives to calculators, will be used regularly for instruction and assessment.

Standards: N-VM.6, 7, 8, 9
S-CP.1, 2, 3, 6, 7, 9

Enduring Understandings (big ideas, life lessons, concepts):

- Students will apply election theory methods including plurality, majority, borda count, run-off, Condorcet and approval voting.
- Students will analyze each voter's power in a weighted voting election process.
- Students will apply the different apportionment methods to assign seats to a certain committee.
- Students will solve problems involving estate division.
- Students will perform matrix manipulations by hand and with a graphing calculator.
- Students will distinguish between the uses of Euler and Hamiltonian circuits.
- Students will use Kruskal's algorithm to in a minimum cost spanning tree.
- Students will find the optimal solution to a traveling salesperson problem.
- Students will identify and compute the probability of dependent and independent events.
- Students will understand game theory and compute probability odds.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- How do people analyze information to make a good and fair decision?
- What are the advantages and disadvantages of the different elections processes?
- How does the number of votes correlate to voting power?
- What is fair division and in what situations would this method be applicable?
- What are the various methods of division and the attributes of each one?
- How does a population determine it has been represented fairly?
- How do you use matrices to organize, manipulate, and display information?
- How can matrices be used to model real world phenomenon?
- What is the relationship between graphs and matrices?
- What are Euler and Hamiltonian paths and how do they apply to real word applications?
- Why does no map require five colors?
- What is probability?
- How does probability apply to real-world problem solving?
- How does counting relate to probability?

Knowledge and Skills

Skills: Students will be able to...

- Solve real-life problems using graphs and equations
- Use exponents and scientific notation to solve real-life problems
- Use the Fundamental Counting Principle, combinations and permutations to count the number of ways an event can happen
- Find theoretical and experimental probabilities
- Find the probability of dependent and independent events
- Calculate probability using normal distributions
- Use the composition of functions to model and solve problems.

Terminology:

- Electoral College
- Plurality
- Majority
- Borda Count
- Run Off
- Run Off/Elimination
- Pairwise Comparison
- Apportionment
- Standard Quota
- Standard divisor
- Sealed Bid
- Euler Path/Circuit
- Hamilton Path/Circuit
- Probability
- Game Theory
- Brute Force
- Nearest Neighbor
- Cheapest Link

Assessments (how students will show what they know)

Formative (interim) Midterm Exam

Summative (final): Final Exam

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

9.1 The 21st Century Life & Career Skills

- 9.1.4.A.1 - Recognize a problem and brainstorm ways to solve the problem individually or collaboratively.
- 9.1.4.A.2 - Evaluate available resources that can assist in solving problems.
- 9.1.4.A.3 - Determine when the use of technology is appropriate to solve problems.
- 9.1.4.A.5 - Apply critical thinking and problem-solving skills in classroom and family settings.
- 9.1.8.A.1 - Develop strategies to reinforce positive attitudes and productive behaviors that impact critical thinking and problem-solving skills.
- 9.1.12.A.1 - Apply critical thinking and problem-solving strategies during structured learning experiences.

- 9.1.4.B.1 - Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.
- 9.1.8.B.1 - Use multiple points of view to create alternative solutions.
- 9.1.4.C.1 - Practice collaborative skills in groups, and explain how these skills assist in completing tasks in different settings (at home, in school, and during play).
- 9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.
- 9.1.8.C.3 - Model leadership skills during classroom and extra-curricular activities.

9.3 Career Awareness, Exploration, Preparation:

- 9.3.12.C.2 - Characterize education and skills needed to achieve career goals, and take steps to prepare for postsecondary options, including making course selections, preparing for and taking assessments, and participating in extra-curricular activities.
- 9.3.12.C.3 - Develop personal interests and activities that support declared career goals and plans.

9.4 Career Cluster Specific

- 9.4.12.A.2 - *Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.*
- 9.4.12.A.5 - *Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.*
- 9.4.12.A.11 - *Apply active listening skills to obtain and clarify information.*
- 9.4.12.A.12 - *Develop and interpret tables, charts, and figures to support written and oral communications.*
- 9.4.12.A.13 - *Listen to and speak with diverse individuals to enhance communication skills.*
- 9.4.12.A.16 - *Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.*
- 9.4.12.A.21 - *Employ technological tools to expedite workflow.*
- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary: Language Arts (solving word problems, translating, explanations during problem solving); Science (problem solving, scientific notation and applications); Social Studies (reading and interpreting graphs, economic applications)

Course Resources:

Technologies: Graphing Calculators (TI 84 and TI 89); TI Navigator; SMART Board (interactive white boards), Notebook software

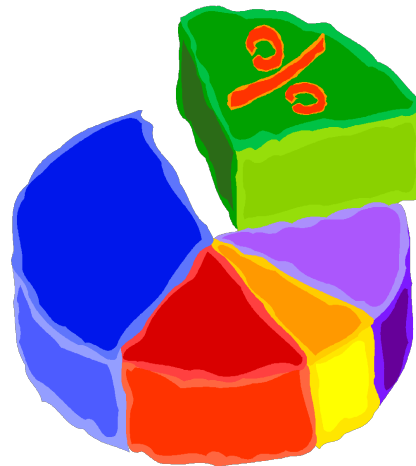
Text: Excursions in Modern Mathematics, Prentice Hall c2001, 0-13-017762

PRE-CALCULUS

**TRIGONOMETRY WITH
ALGEBRAIC FUNCTIONS**

ADVANCED PRE-CALCULUS

PRE-AP-CALCULUS



CURRICULUM OVERVIEW: PRE CALCULUS



Course Titles: Trigonometry w/ Algebraic Functions, Advanced Pre-Calculus, Pre-AP Calculus

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: Pre-Calculus provides students a study of trigonometry, advanced functions, analytic geometry, and data analysis in preparation for calculus. Applications and modeling should be included throughout the course of study. Appropriate technology, from manipulatives to calculators, should be used regularly for instruction and assessment.

Standards:

- N-RN.1,2
- N-CN.1,2,3,4,5,6,7,8,9
- N-VM.7,8,9,10,11,12
- A-SSE.4
- A-APR.1,5,6,7
- A-CED.1,2,3,4
- A-REI.1,2,8,9,10,11,12
- F-IF.3,4,5,6,7,8,9
- F-BF.3,4
- F-LE.1
- F-TF.1,2,3,4,8,9
- F-IF.6,7 (Pre AP only)
- G-CO.5 (Pre AP only)
- G-SRT.6,7,8,9,10
- G-C.5
- G-GPE.1,2,3,4,5,6,7
- S-CP.1,2,3,4,5,6,7,8,9
- S-MD.6,7

Enduring Understandings (big ideas, life lessons, concepts):

- The learner will use relations and functions to solve problems.
- Relations and functions can be represented numerically, graphically, algebraically, and/or verbally.
- The properties of functions and function operations are used to model and analyze real-world applications and quantitative relationships.
- The characteristics of trigonometric and circular functions and their representations are useful in solving real-world problems.
- Connections among the six trigonometric and circular functions are a result of their properties.

- The characteristics of rational functions and their representations are useful in solving real-world problems.
- The characteristics of exponential and logarithmic functions and their representations are useful in solving real-world problems.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- What factors can be used to determine whether an analytic or graphical strategy is most advantageous in solving a problem?
- Why are relations and functions represented in multiple ways?
- How are the properties of functions and functional operations useful?
- How do trigonometric and circular functions model real-world problems and their solutions?
- How are the circular functions related to the trigonometric functions?
- How are the six trigonometric and circular functions related to each other?
- How do trigonometric and circular functions model real-world problems and their solutions?
- How do rational functions model real-world problems and their solutions?
- How do exponential functions model real-world problems and their solutions?
- How do logarithmic functions model real-world problems and their solutions?
- How do sequences and series model real-world problems and their solutions?
- How is the binomial theorem applied?
- How can analytic and graphical methods be used to support each other in the solution to a problem?
- How does the graph of a given function or relation reflect its characteristics?
- How does the recursive nature of the trigonometric functions affect their analytic values and graphical representations?
- In what ways does the recursive nature of sequences generate formulas and effect applications of sequences and series?

Knowledge and Skills

Knowledge: Students will know...

- Transformations of functions
- Reflection in the x-axis, y-axis, and line $y=x$ (inverse functions)
- Symmetry in the x-axis, y-axis, and origin
- Periodic Functions
- Translations of $y=f(x)$ to $y-k=f(x-h)$
- Vertical ($y=cf(x)$) and horizontal ($y=f(cx)$) stretching or shrinking of $y=f(x)$.
- Degree and radian measures of angles
- Arc length and area of a sector
- Evaluating trigonometric expressions
- Graphs of trigonometric functions
- Translation of sine and cosine graphs
- Vertical and horizontal stretching and shrinking of sine and cosine functions
- Simplifying trigonometric expressions and proving trigonometric identities
- Trigonometric equations
- Measurements in right triangles
- Area of a triangle
- Law of Sines

- Law of Cosines
- Sum and difference formulas for sine, cosine, and tangent
- Double angle formulas
- Trigonometric equations
- n th term of an arithmetic sequence
- n th term of a geometric sequence
- Recursive definitions
- Sum of finite arithmetic and geometric series
- Sum of infinite geometric series
- Sigma notation
- Limits of functions that approach infinity or negative infinity
- Limits of functions that approach a real number
- Graphs of rational functions
- Simplify numeric and algebraic expressions with integral and rational exponents
- Compound interest formula and formula for interest compounded continually
- Evaluate logarithmic expressions (change of base formula)
- Expand and condense logarithmic expressions
- Logarithmic and exponential equations

Skills: Students will be able to...

- The student will be able to stretch, shrink, reflect, or translate the graph of a function, and determine the inverse of a function, if it exists.
- The student will be able to evaluate and graph trigonometric functions.
- The student will be able to stretch, shrink, and translate *sine* and *cosine* functions, simplify trigonometric expressions, and solve trigonometric equations.
- The student will be able to apply the trigonometric definitions, Law of Sines, and Law of Cosines to determine the lengths of unknown sides or measures of unknown angles in triangles.
- The student will be able to derive and apply the sum and difference formulas and the double-angle formulas for *sine*, *cosine*, and *tangent*, and apply these formulas to solve trigonometric equations.
- The student will be able to represent points in rectangular and polar coordinates, and multiply and find powers of complex numbers.
- The student will be able to identify arithmetic and geometric sequences and series, write a formula for the n th term of sequences and series using an explicit or recursive definition, apply sigma notation, and find the sum of finite arithmetic, and finite and infinite geometric series.
- The student will be able to determine the limit of a function or the quotient of two functions, and sketch the graph of a rational function using limits.
- The student will be able to simplify expressions and solve equations with exponents and logarithms.

Terminology:

- Composite
- Function
- Relation
- Domain
- Range
- Greatest Integer Function
- Piecewise Function

- Correlation Coefficient
- Absolute Maximum
- Absolute Minimum
- Relative Maximum
- Relative Minimum
- Critical Points
- Point of Inflection
- Continuity
- Discontinuous
- End Behavior
- Symmetry
- Even/Odd Functions
- Asymptote
- Inverse Functions
- Cofunctions
- Circular Functions
- Trigonometric Functions
- Hero's Formula
- Coterminal
- Quadrantal
- Phase Shift
- Frequency
- Period
- Amplitude
- Sinusoidal Function
- Directrix
- Eccentricity
- Focus
- Logarithmic Function
- Exponential Function
- Binomial theorem

Assessments (how students will show what they know)

Formative (interim): Midterm Exam

Summative (final): Final Exam

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

9.1 The 21st Century Life & Career Skills

- 9.1.4.A.1 - Recognize a problem and brainstorm ways to solve the problem individually or collaboratively.
- 9.1.4.A.2 - Evaluate available resources that can assist in solving problems.
- 9.1.4.A.3 - Determine when the use of technology is appropriate to solve problems.
- 9.1.4.A.5 - Apply critical thinking and problem-solving skills in classroom and family settings.
- 9.1.8.A.1 - Develop strategies to reinforce positive attitudes and productive behaviors that impact critical thinking and problem-solving skills.

- 9.1.12.A.1 - Apply critical thinking and problem-solving strategies during structured learning experiences.
- 9.1.4.B.1 - Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.
- 9.1.8.B.1 - Use multiple points of view to create alternative solutions.
- 9.1.4.C.1 - Practice collaborative skills in groups, and explain how these skills assist in completing tasks in different settings (at home, in school, and during play).
- 9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.
- 9.1.8.C.3 - Model leadership skills during classroom and extra-curricular activities.

9.3 Career Awareness, Exploration, Preparation:

- 9.3.12.C.2 - Characterize education and skills needed to achieve career goals, and take steps to prepare for postsecondary options, including making course selections, preparing for and taking assessments, and participating in extra-curricular activities.
- 9.3.12.C.3 - Develop personal interests and activities that support declared career goals and plans.

9.4 Career Cluster Specific

- 9.4.12.A.2 - *Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.*
- 9.4.12.A.5 - *Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.*
- 9.4.12.A.11 - *Apply active listening skills to obtain and clarify information.*
- 9.4.12.A.12 - *Develop and interpret tables, charts, and figures to support written and oral communications.*
- 9.4.12.A.13 - *Listen to and speak with diverse individuals to enhance communication skills.*
- 9.4.12.A.16 - *Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.*
- 9.4.12.A.21 - *Employ technological tools to expedite workflow.*
- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary:

- Science through problem solving, scientific notation, and applications.
- Social Studies through reading and interpreting data and graphs, as well as economic applications.
- Language Arts through translating and explaining work problems during applications and problem solving.

Course Resources:

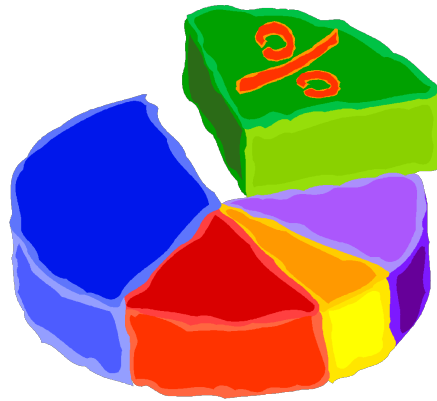
Technologies: Graphing Calculators (TI 84 and TI 89); TI Navigator; SMART Board

Text: **Advanced Pre-Calculus and Trigonometry w/ Algebraic Functions** - Advanced Mathematical Concepts, Glencoe c2004, ISBN 0-02-834174-9

Honors Pre-AP Calculus - Pre-Calculus with Limits – Houghton Mifflin by Larson, ISBN 0-618-05291

CALCULUS

CALCULUS
COLLEGE CALCULUS
AP CALCULUS AB
AP CALCULUS BC



CURRICULUM OVERVIEW: CALCULUS



Content: Calculus

Course Title: Calculus, College Calculus, AB Calculus AB, AB Calculus BC

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems. Calculus develops the student's understanding of the concepts of functions, graphs, limits, derivatives and integrals and provides experience with its methods and applications.

Course Description or Content Overview:

Calculus is a fourth year math course for students who have completed Advanced Pre-Calculus or Pre-AP-Calculus. The course covers a majority of the topics also covered in Advanced Placement Calculus, but not to the same depth. The course is equivalent to a one semester Calculus course at the college level. Midterm and final exams will be given, with students accepted into Senior Society being exempt from the final exam. To be prepared for this Calculus, students must have a mastery of Algebra I, Geometry, Algebra II and Pre-Calculus. The major concepts covered in this course are Derivatives and their applications, and Integration with applications.

Advanced Placement Calculus AB is a course designed to prepare students for the Advanced Placement AB Examination. If a student's examination grade is considered acceptable by a college or university, the student could be given credit and/or advanced placement standing in the college mathematics curricula. Since half of the exam is in essay form, the course is designed to explore not only the basic topics of differentiation and integration, but graphing, interpretation of graphs, application, theory, proofs, and topics involving the use of the graphing calculator (TI-89 plus or comparable calculator is recommended).

Advanced Placement Calculus BC is a course designed to prepare students for the Advanced Placement BC Examination. If a student's examination grade is considered acceptable by a college or university, the student could be given credit and/or advanced placement standing in the college mathematics curricula. Since half of the exam is in essay form, the course is designed to explore not only the basic topics of differentiation and integration, but graphing, interpretation of graphs, application, theory, proofs, and topics involving the use of the graphing calculator (TI-89 plus or comparable calculator is recommended).

College Calculus is a course designed to explore the concepts of derivatives and their applications, as well as integration with applications. In addition, the fundamentals of analytic geometry and transcendental functions will be presented.

Standards: A-SSE.4 (BC only)
A-APR.1,5 (BC only)
F-IF.1,2
F-IF.3 (BC only)
F-IF.4,5,6,7,8
F-IF.9 (BC only)
F-BF.1
F-BF.2 (BC only)
F-BF.4 (AB, BC, CC)
F-BF.5
F-LE.1,2,3,4,5
F-TF.1,2,3,4
F-TF.6,7 (AB, BC)
G.C.5 (BC only)
G-GMD.3,4
G-MG.1,3

Enduring Understandings (big ideas, life lessons, concepts):

- The concept of a limit is one of the foundations of calculus.
- The limit of a function is the value approached by $f(x)$ as x approaches a given value or infinity.
- The derivative is the instantaneous Rate of change at a given point.
- The integral is a function that can be used to determine the summation of an infinite set.
- Differentiation and definite integration are inverse operations.
- The slope of a line in algebra is the average rate of change while the slope of the tangent to a curve at a point in calculus is the instantaneous rate of change (the derivative of a function).
- The derivative of a function can be interpreted as an instantaneous rate of change.
- The definite integral can be used to find exact area or volume by using the limit of Riemann sums.
- There is a defined relationship between the integral of function f , the function f , and the first and second derivatives of function f .
- Derivatives can be used to solve a variety of problems involving instantaneous rate of change.
- Integrals can be used to solve a variety of problems related to area, velocity, acceleration, volume and area of a surface of revolution

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- How does the derivative represent an instantaneous rate of change?
- How does the integral represent the summation of an infinite set?
- How do you determine that a function is continuous and/or differentiable?
- Is there a way to visualize what a derivative is?
- What does the graph of a function tell about the equation?
- How can calculus be used to solve problems in business and economics?

- How are derivatives used in optimization problems?
- How does the graph of a function relate to its equation?
- How are the following defined? (the area bounded by two curves, the volume generated by rotating a plane area, the length of a plane curve, the area of a surface revolution)
- What methods involving integrals can be used to find the volume of a solid?
- How can the concept of limits be applied in mathematics?
- How is the concept of a limit connected to a derivative and to an integral?
- How do the graphs of the first and second derivatives relate to the function graph?
- How is the rate of change reflected in its table and graph?

Knowledge and Skills:

Students will be able to:

1. Find limits graphically, numerically, and analytically:
 - Limits at a point
 - One-sided limits
 - Infinite limits
2. Apply the Limit Definition of the Derivative
3. Find the derivative of a function using the following methods:
 - Power Rule
 - Product Rule
 - Quotient Rule
 - Chain Rule
 - Implicit Differentiation
4. Apply the concept of derivative to solve related rates word problems.
5. Find extrema on open and closed intervals.
6. Find points of discontinuity.
7. Find intervals where a function is increasing, decreasing or constant.
8. Apply The First Derivative Test.
9. Apply The Second Derivative Test.
10. Apply Rolle's Theorem.
11. Apply the Mean Value Theorem for derivatives and integrals.
12. Apply the Intermediate Value Theorem.
13. Apply the Extreme Value Theorem.
14. Apply various tests and knowledge of increasing, decreasing, extrema and concavity to sketch complex curves without using a calculator.
15. Apply concepts of extreme values to solve optimization word problems.
16. Use the idea of the differential to estimate function values.
17. Find the antiderivative of a function.
18. Find the area under a curve using definite integrals.
19. Approximate the area under a curve using Riemann Sums.
 - Inscribed rectangles
 - Circumscribed rectangles
 - Midpoint
20. Approximate the area under a curve using the Trapezoidal Rule and determine the error.

21. Apply The Fundamental Theorem of Calculus.
22. Apply The Second Fundamental Theorem of Calculus.
23. Integrate using the u-substitution method.
24. Apply concepts of differentiation and integration to:
 - Logarithmic Functions
 - Exponential Functions
 - Inverse Functions
25. Solve differential equations.
26. Solve problems involving growth and decay.
27. Find the area of a region between two curves.
29. Find the volume of a three dimensional solid of revolution using:
 - Disk method
 - Washer method
 - Shell method
30. Find the area of a known cross-section. (AP Calculus AB and BC only)
31. Find the volume of a solid given the base and cross-section. (AP Calculus AB and BC only)
32. Find the length of an arc using integration techniques. (AP Calculus BC only)
33. Find the area of a surface of revolution. (AP Calculus BC only)
34. Apply the Integration by Parts method. (AP Calculus AB and BC only)
35. Solve trigonometric integrals. (AP Calculus BC only)
36. Decompose partial fractions. (AP Calculus AB and BC only)
37. Use the Integration Tables method. (AP Calculus BC only)
38. Apply L'Hopital's rule. (AP Calculus BC only)
39. Solve improper integrals. (AP Calculus BC only)
40. Determine Series convergence/divergence using: (AP Calculus BC only)
 - Integral test
 - P-series test
 - Comparison test
 - Alternating series test
 - Ratio test
 - Root test
41. Work with Taylor Polynomials (AP Calculus BC only)
42. Represent a function as a Power Series. (AP Calculus BC only)
43. Apply series concepts to Taylor and Maclaurin series. (AP Calculus BC only)
44. Find the area of a polar curve. (AP Calculus BC only)

Terminology:

- Absolute Maximum
- Absolute Minimum
- Acceleration
- Antiderivative
- Area
- Asymptote
- Average Rate of Change

- Average Value of a Function
- Average Velocity
- Calculus
- Chain Rule
- Circumscribed Rectangles
- Concave Downwards
- Concave Upwards
- Concavity
- Constant of Integration
- Continuity
- Continuous Function
- Critical Point
- Cusp
- Decreasing Function
- Definite Integral
- Derivative
- Difference Quotient
- Differentiable
- Differential
- Differential Equation
- Differentiation
- Discontinuity
- Discontinuous Function
- Disk
- Even Function
- Explicit Form
- Exponential Decay
- Exponential Growth
- Extrema
- Extreme Value Theorem
- First Derivative Test
- Fundamental Theorem of Calculus
- Half-life
- Higher Order Derivative
- Horizontal Asymptote
- Implicit Differentiation
- Implicit Form
- Increasing Function
- Indefinite Integral
- Indeterminate Form
- Index of Summation
- Infinite Limit
- Inflection Point
- Inscribed Rectangles

- Instantaneous Rate of Change
- Integral
- Integration
- Intermediate Value Theorem
- Inverse Function
- Limit
- Lower Sum
- Maximum
- Mean Value Theorem
- Minimum
- Node
- Non-removable Discontinuity
- Numerical Differentiation
- Odd Function
- One-sided Limit
- Piece-Wise Function
- Point of Inflection
- Position Function
- Propagated Error
- Rate of Change
- Related Rates
- Relative Error
- Relative Maximum
- Relative Minimum
- Removable Discontinuity
- Riemann Sums
- Rolle's Theorem
- Secant Line
- Second Derivative Test
- Second Fundamental Theorem of Calculus
- Shell
- Sigma Notation
- Slant Asymptote
- Speed
- Squeeze Theorem
- Tangent Line
- Trapezoidal Rule
- Upper Sum
- Velocity
- Vertical Asymptote
- Vertical Tangent
- Volume of a Solid
- Washer

Assessments (how students will show what they know):

Formative (interim): Midterm exam

Summative (final): Final Exam

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

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9.4 Career Cluster Specific

- 9.4.12.A.2 - *Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.*
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- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values):

- The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary:

- Science through problem solving, scientific notation, and applications.
- Social Studies through reading and interpreting data and graphs, as well as economic applications.
- Language Arts through translating and explaining work problems during applications and problem solving.

Course Resources:

Technologies: Graphing Calculators (TI 84, TI 89, and TI-Nspire); TI Navigator; SMART Board, Geometer Sketchpad, Calculus in Motion

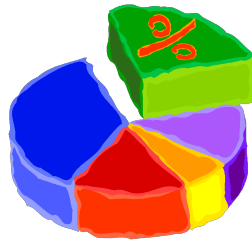
Text:

- Calculus of a Single Variable, 9th edition, Houghton Mifflin, by Larson and Edwards, 2010. (College Calculus) ISBN#0-547-21290-9
- Calculus of a Single Variable, 8th edition– Houghton Mifflin Company by Larson, Hostetler, and Edwards. 2006 (AP Calculus AB) ISBN#0-618-54725-8
- Calculus of a Single Variable, 7th edition– Houghton Mifflin Company by Larson, Hostetler, and Edwards. 2002 (AP Calculus BC) ISBN#0-618-14916-3
- Calculus, An Applied Approach 7th edition– Houghton Mifflin Company by Larson, and Edwards. 2006 (Calculus) ISBN#0-618-54718-5

STATISTICS

INTRODUCTION TO STATISTICS

AP STATISTICS



CURRICULUM OVERVIEW: STATISTICS



Content: Statistics

Course Title: AP Statistics, Introduction to Statistics

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: The SBHS Advanced Placement Statistics Course has been approved by the College Board. Our texts and content are aligned with the requirements of the College Board and the AP Statistics Exam. Only seniors can register for the course.

AP Statistics is an elementary, college level, statistics course. Emphasis is placed on the fundamental concepts of statistical reasoning that lead to proper collection, organization, analysis, testing, and interpretation of data. Accurate and precise presentation of conclusions is essential. Students use TI 83, TI 84, or TI 89 calculators to organize, graph, test and analyze data. Students will also use statistical software and receive output from statistical software.

Standards: S-ID.1, 2, 3, 4, 5, 6, 7, 8, 9
S-IC.1, 2, 3, 4, 5, 6
S-CP.1, 2, 3, 4, 5, 9
S-MD.1, 2, 3, 4, 5

Enduring Understandings (big ideas, life lessons, concepts):

- Randomness and probability are the theoretical bases of statistical theory.
- Data can be analyzed to reveal patterns and to make inferences.
- Models can be developed from the patterns in data.
- The normal distribution is a fundamental component of statistical inference.
- Valid patterns and inferences can only be drawn from data that is collected from randomized samples and experiments
- Inferences can be made about a population mean from a sample mean computed from a randomized sample or experiment.
- Inferences can be made about a population proportion from a sample proportion computed from a randomized sample or experiment.

Essential Questions (open ended questions that are worthy of wonder; connected to EU):

- What are the fundamental components of the study of statistics?
- What is randomness?
- What are the appropriate methods for data collection? How does randomness affect data collection?
- How is randomness incorporated into sampling and experimentation?
- What is bias? How can it be identified? How can it be prevented?

- What are the appropriate methods for analyzing quantitative data?
- How does graphical representation reveal patterns in data?
- Why are shape, center and spread in a univariate data set important?
- How are the mean and the standard deviation of a univariate data set connected?
- How are the median and the interquartile range of a univariate data set connected?
- What are the appropriate methods for analyzing qualitative data?
- How does graphical representation reveal relationships in categorical data?
- Why are scatterplots appropriate for bivariate data sets?
- What is association? What is correlation? How are they connected?
- Why is the correlations coefficient the appropriate measure of the strength of a linear relationship between two variables?
- Why is the coefficient of determination the appropriate measure of least square regression line's validity as a model for prediction?
- How are probabilities calculated?
- How does randomness affect theoretical and experimental probabilities?
- How can simulation reflect the randomness of an actual experiment?
- How are random variables connected to sampling?
- What is the theoretical basis of a confidence interval?
- What is the theoretical basis of a significant test?

Knowledge and Skills

Skills: Students will be able to...

I. Students will analyze data by looking for patterns and departures from patterns. This includes:

UNIVARIATE DATA

- displaying distributions with graphs and numbers—boxplots, dotplots, histograms for quantitative data; bargraphs and pie charts for categorical data,
- computing appropriate measures of relative standing, mean, median, five number summary and standard deviation
- analyzing density curves and identifying distributions that are normal and non-normal

BIVARIATE DATA:

- displaying and analyzing scatterplots, correlation, and least squares regression
- interpreting correlation and regression
- defining and computing residuals
- using LSRL as a model for prediction—identifying explanatory and response variables
- transforming data to achieve linearity

CATAGORICAL VARIABLES:

- displaying and analyzing two way tables, marginal distributions and conditional distributions

ESTABLISHING CAUSATION:

- defining and identifying common response, confounding, causation

II. Students learn the fundamentals of scientifically randomized data production: This includes surveys, studies, and experiments:

DESIGNING SAMPLES—Defining, identifying, and constructing a Simple Random Sample (SRS)

DESIGNING RANDOMIZED EXPERIMENTS—defining and identifying blind and double blind conditions, bias, treatments, response variables, placebo effect; defining, identifying, and constructing block and matched-pair designs

III. Students learn the connections between probability and random variables. This includes:

PROBABILITY:

- defining probability, randomness, sample space, event, probability model
- defining and identifying disjoint events, mutually exclusive events, independent and dependent events
- constructing and interpreting Venn diagrams, tree diagrams
- Applying the Multiplication Principle,
- developing probability models and applying the general probability rules
- conducting and analyzing simulations

RANDOM VARIABLES:

- Defining and identifying discrete and continuous random variables
- Computing and comparing means and variances of random variables
- Analyzing and comparing density curves
- Combining means and variances of random variables

THE BINOMIAL AND GEOMETRIC DISTRIBUTIONS:

- Identifying the binomial setting and computing probabilities using the binomial distribution
- Identifying the geometric distribution and compute probabilities using the geometric distribution

SAMPLING DISTRIBUTIONS:

- Identifying parameters and statistics
- Describe sampling distributions for sample proportions and sample means
- Defining and identifying bias and variability of a statistic
- Using the normal approximation for sample proportions and sample means

IV. Students learn the fundamentals of inference. This includes:

ESTIMATING WITH CONFIDENCE:

- constructing and interpreting confidence intervals for population proportions and means

TESTING A CLAIM:

- identifying and applying the theory of significance tests
- identifying and applying the procedures for significance testing
- identifying the uses and abuses of significance testing
- applying inference for decision making

SIGNIFICANCE TESTS IN PRACTICE

- conducting and interpreting tests about a population mean and tests about a population proportion

COMPARING TWO POPULATION PARAMETERS

- conducting and interpreting tests to compare two means and to compare two proportions

INFERENCE FOR DISTRIBUTIONS OF CATEGORICAL VARIABLES

- conducting and interpreting the chi-square procedures
- conducting and interpreting test for goodness of fit and inference for two way tables

INFERENCE FOR REGRESSION

- defining the meaning of the slope of the true regression line
- carryout and interpret significance tests for
- construct and interpret confidence intervals for

Terminology:

- 5-Number Summary
- Empirical Rule
- Alpha level
- Alternative hypothesis:

- Assumptions:
- Association:
- Bias:
- Bimodal:
- Boxplot:
- Categorical variable:
- Cell:
- Central Limit Theorem:
- Chi-squared distribution
- Conditional Probabilities:
- Confidence levels
- Binomial Distribution
- Control group
- Correlation:
- Degrees of freedom:
- Discrete variable:
- Dotplot:
- Double-blind
- Experiment
- Explanatory variable
- Extrapolation:
- Histogram
- Conditional distribution
- Hypothesis test:
- Independent
- Inference:
- Law of Large Numbers
- Least squares regression:
- Continuous Random Variable
- Linear association:
- Normal Distribution
- Null hypothesis:
- Observational study
- Paired t -test
- Parameter:
- Pooling:
- Probability
- Quartile:
- R^2 :
- Random sample:
- Range
- Relative frequency:
- Residual:
- Response variable:
- Sampling:
- Scatterplot:
- Significance level
- Simulation

- Skew:
- Slope:
- Spread:
- Standard deviation:
- Standard error:
- Standardized:
- Statistic:
- Stem-and-leaf:
- Student's t :
- Linear Transformation:
- Treatment:
- Two-sample t test:
- Type I error
- Type II error:
- Variance:
- Voluntary response bias:
- z-score:
- Confidence Intervals
- Geometric Distribution
- Population Mean
- Population Proportion
- Marginal distributions
- Interquartile range
- Probability Model
- Placebo
- Population
- Correlation Coefficient
- Coefficient of determination
- Residual/Residual Plot
- Simple random Sample
- Cluster sampling
- Block design
- Match pair design
- Sample
- Standard normal distribution
- Chi-Square Test of Goodness of fit

Assessments (how students will show what they know)

Formative (interim): Multiple Choice and Open Response tests for each chapter, Classroom Projects, Open Book Quizzes

Summative (final): AP Exam (AP Statistics Only), Final Assessment

21st Century Connections:

8.1 Technology (Education Technology) : 8.1 A3 Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.

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- 9.1.4.C.1 - Practice collaborative skills in groups, and explain how these skills assist in completing tasks in different settings (at home, in school, and during play).
- 9.1.8.C.1 - Determine an individual's responsibility for personal actions and contributions to group activities.
- 9.1.8.C.3 - Model leadership skills during classroom and extra-curricular activities.

9.3 Career Awareness, Exploration, Preparation:

- 9.3.12.C.2 - Characterize education and skills needed to achieve career goals, and take steps to prepare for postsecondary options, including making course selections, preparing for and taking assessments, and participating in extra-curricular activities.
- 9.3.12.C.3 - Develop personal interests and activities that support declared career goals and plans.

9.4 Career Cluster Specific

- 9.4.12.A.2 - *Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.*
- 9.4.12.A.5 - *Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.*
- 9.4.12.A.11 - *Apply active listening skills to obtain and clarify information.*
- 9.4.12.A.12 - *Develop and interpret tables, charts, and figures to support written and oral communications.*
- 9.4.12.A.13 - *Listen to and speak with diverse individuals to enhance communication skills.*
- 9.4.12.A.16 - *Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.*
- 9.4.12.A.21 - *Employ technological tools to expedite workflow.*
- 9.4.12.A.26 - *Employ spreadsheet applications to organize and manipulate data.*

Character Education (Core Values): The core values of honesty, respect, responsibility, kindness, and service are addressed and stressed in all math courses throughout the year.

Cross Curricular / Interdisciplinary: Language Arts (solving word problems, translating, explanations during problem solving); Science (problem solving, scientific notation and applications); Social Studies (reading and interpreting graphs, economic applications)

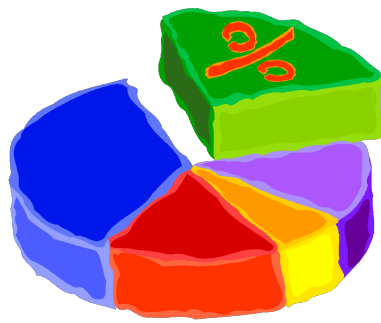
Course Resources:

Technologies: TI-84 or TI-89 Graphing Calculator, Smart Board and Notebook Software

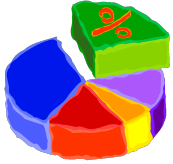
Text: AP Statistics: The Practice of Statistics, third edition, Yates, Moore, Starnes, 2006, Or
Elementary Statistics, ninth edition, Triola, 2004, ISBN 0-201-77570-0
Introduction to Statistics: Statistics Through Applications, W. H. Freeman Publishers, 2004,
ISBN 0-716-74772-3

COMPUTER SCIENCE

Computer Science I
Computer Science in the 21st Century
Computer Science III



CURRICULUM OVERVIEW: COMPUTER SCIENCE



Content: Computer Science

Course Titles: Computer Science I, Computer Science in the 21st Century, AP Computer Science A, Honors Computer Science

Mission: Through mathematics, students communicate, make connections, reason, and represent the world quantitatively in order to pose and solve problems.

Course Description or Content Overview: Students enrolling in this course will be taught to program a PC and to apply their programming skills to problem-solving situations. The course requires good computer knowledge, solid mathematical sense, and sharp analytical skills. Topics include mathematical notation, input, output, decision control statements, looping, generation of random numbers, procedures, strings, text files, and arrays. The emphasis will be on developing good programming technique and problem solving skills.

Big Idea: Computer Science uses problem solving, communication, and collaboration in applications to design and implement solutions to real world 21st century technological problems.

Standards (NJCCS):

- **STANDARD 6.3 Active Citizenship in the 21st-Century:** All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world.
- **STANDARD 8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.
- **STANDARD 9.1 21st-Century Life & Career Skills:** All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.
- **STANDARD 9.3 Career Awareness, Exploration, and Preparation:** All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Standards (CCSS):

- **English Language Arts Standards** » Writing » Grade 9-10
- **English Language Arts Standards** » Speaking & Listening » Grade 9-10
- **English Language Arts Standards** » Language » Grade 9-10
- **Mathematics** » High School: Number & Quantity » Quantities

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12

Grades 9–10 students:

1. Write arguments focused on *discipline-specific content*.
 - a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
 - b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
 - c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
 - d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
 - e. Provide a concluding statement or section that follows from or supports the argument presented

Reading Standards for Literacy in Science and Technical Subjects 6–12

Grades 9–10 students:

Key Ideas and Details

1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
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.

Craft and Structure

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*.
5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).
6. Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

Integration of Knowledge and Ideas

7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
8. Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.
9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Range of Reading and Level of Text Complexity

10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Quantities N -Q

Reason quantitatively and use units to solve problems.

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
2. Define appropriate quantities for the purpose of descriptive modeling.
3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities

Vector and Matrix Quantities

Perform operations on matrices and use matrices in applications.

6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
8. (+) Add, subtract, and multiply matrices of appropriate dimensions.

Interpreting Functions F-IF

Understand the concept of a function and use function notation

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

Interpret functions that arise in applications in terms of the context

4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

Analyze functions using different representations

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

Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities.
 - a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Interpreting Categorical and Quantitative Data S-ID

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

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

STANDARD 8.1.12A (BASIC COMPUTER SKILLS AND TOOLS)

All students will...

- Create documents including a resume and a business letter using professional format.
- Produce a multimedia project using text, graphics, and moving images.
- Discuss and/or demonstrate the capability of emerging technologies and software in the creation of documents or files.

- Merge information from one document to another.

STANDARD 8.1.12B (APPLICATION OF PRODUCTIVITY TOOLS)

Social Aspects

- Describe the potential and implications of contemporary and emerging computer applications for personal, social, life-long learning, and workplace needs.
- Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
- Make informed choices among technology systems, resources, and services in a variety of contexts.
- Use appropriate language when communicating with diverse audiences using computer and information literacy.

Information Access and Research

- Select and use specialized databases for advanced research to solve real world problems.
- Identify new technologies and other organizational tools to use in personal, home and/or work environments for information retrieval, entry and presentation.
- Compose, send and organize e-mail messages with and without attachments.

Problem-Solving and Decision Making

- Create and manipulate information, independently and/or collaboratively, to solve problems and design and develop products.
- Identify, diagnose, and suggest solutions for non-functioning technology systems.
- Identify a problem in a content area and formulate a strategy to solve the problem using brainstorming, flowcharting, and appropriate resources.
- Integrate new information into an existing knowledge base and communicate the results in a project or presentation.

STANDARD 8.2.12 B (DESIGN PROCESS AND IMPACT ASSESSMENT)

- Evaluate the function, value, and appearance of technological products, systems, and environments from the perspective of the user and the producer.
- Develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed design in the solution of a technological problem using hands-on activities.
- Diagnose a malfunctioning product and system using appropriate critical thinking methods.
- Create a technological product, system, or environment using given design specifications and constraints by applying design and engineering principles.

Enduring Understandings (big ideas, life lessons, concepts):

- Why in the 21st-century, it is imperative to acquire the skills needed to stay current in the global landscape in order to protect and sustain democracy in a world that does not share the same cultural beliefs?
- Why is success in the 21st-century dependent on the ability to utilize digital tools and new technologies for collecting, organizing and managing data in order to stay competitive in an ever changing global computing environment?
- Why has the global economy and access to digital tools created an environment in the 21st Century that is dependent on problem solving through collaboration to reflect diverse opinions in order to stay competitive in a connected world?
- Students must begin to explore their talents and interests during their primary years and continue throughout their lives. Why must individuals effectively explore and prepare for a career in a

world that is consistently evolving, in order to understand that lifelong learning and skill building is imperative to sustain employment in the 21st-century?

- What are the major hardware and software components a computer system, their relationship to one another, and the roles of these components within the system?
- What are the ethical and social implications of computer use?
- Why are problem solving and critical thinking skills necessary to be successful in the 21st-century?
- Why is understanding other cultures so imperative when working collaboratively in a global economy?
- Why is gathering and learning how to evaluate data from multiple sources so important in the 21st-century?
- How does collaboration enable groups to achieve common goals more efficiently?
- Why are collaboration and the opportunity to compete necessary in order to develop leadership skills?
- How do we learn to effectively communicate with people from different cultural backgrounds in order to understand their cultural perspective?
- How will career plans be affected and altered in response to changes in society and the economy?
- Why are digital tools and their effective use so vital for success in the 21st-century?
- How do we as citizens in the 21st-century navigate through the ethical and unethical uses of communication and media?
- How are computers used in the real world?
- What is the purpose of computer programming?
- How do computers function and how do we get them to do what we need them to do?
- How do we tell computers what we need them to do?

Knowledge and Skills

Knowledge: Students will be able to...

- There are a variety of technologies and tools available to create, access, and share information.
- Online learning communities are a viable source for knowledge sharing.
- There are safety, societal, ethical, and legal concerns regarding the use of technology.
- Critical thinking, collaboration and problem solving skills are necessary to function both as a global citizen and worker in the 21st Century.
- Teamwork and leadership enable groups to achieve common goals with greater efficiency.
- Understanding other cultures' perspectives will facilitate communication with people from different backgrounds.
- Digital media can be used for both local and global communication; there are ethical and unethical uses of these 21st Century tools.
- The 21st-century workplace will demand greater individual collaboration, productivity and collaboration from its workers.
- Career preparation is a process that requires purposeful planning based on research, self-knowledge, and informed choices.
- Workers are entitled to a safe and healthy work environment by state and federal laws and regulations that regulate employment practices and workplace safety.
- Employers and employees are responsible to act professionally, legally, and ethically in the workplace and global marketplace.
- Design and implement computer-based solutions to problems in a variety of application areas
- Use and implement commonly-used algorithms and data structures
- Develop and select appropriate algorithms and data structures to solve problems

- Code fluently. Students are expected to be able to use decision and repetition control statements and different data types.

Skills: Students will be able to...

- Select and utilize information from a variety of digital resources and databases
- Select appropriate digital tools to assemble, evaluate, and utilize information
- Appropriately use a variety of digital technology and communication tools
- Use information and resources to accomplish real-world tasks
- Utilize functions to interpret results
- Use multiple resources to create and manage documents
- Participate in online learning environments
- Create and launch a digital learning game
- Adhere to Fair Use and Multimedia Copyright Guidelines and cite sources of copyrighted materials in all work
- Practice safe, legal and ethical behaviors around technology and the internet
- Share knowledge and participate ethically and productively in group settings
- Communicate and collaborate with others both locally and globally
- Evaluate the impact that digital media has on international business and globalization
- Demonstrate leadership skills when participating in classroom settings and online learning communities
- Explore post-secondary options and investigate areas of interest for future career pursuits
- Develop transferrable work and life skills that will make them valuable workers and citizens
- Justify employee and employer rights and responsibilities in the workplace
- Assess and predict both current and future employment trends across various industries
- Understand the computer system
- Navigate the programming environment and use a compiler
- Read and understand a problem description, purpose and goals
- Identify reusable components from existing code
- Create a program header and declare identifiers and constants
- Construct a main execution section with proper formatting/indentation
- Understand basic input/output structure including read/readLn/write/writeLn
- Categorize errors as compile-time, run-time, or logic and correct
- Employ debugging techniques such as adding extra output statements or hand-tracing code
- Classify data and choose an appropriate size for an identifier
- Use predefined functions or ordinal types
- Use operations for Boolean expressions and apply relationals to order alpha-numeric data
- Create If-Then control instructions and determine need for Else condition
- Nest If statements for compound decision making
- Rewrite nested If statements as Case-Of-End statement
- Rate efficiency of different decision control choices
- Find the final value of an accumulation loop
- Rewrite one type of loop into another
- Define local variable section for individual procedures
- Make use of parameters to transfer data between procedure and program
- Choose correct predefined procedures to read from or write to a text file
- Navigate through multiple open text files to retrieve data
- Understand storage capabilities or arrays
- Declare array variables of multiple dimensions

- Know sorting techniques for ordering array
- Students should be able to read and understand a large program consisting of procedures, arrays, varied decision control, and looping structures. Students should be able to read and understand a description of the design and the development process which lead to the creation of that program.

Terminology: ABS, AND, APPEND, ASSIGN, BEGIN, CASE-OF-END, CHAR, CHR, CLOSE, CLREOL, CLRSCR, CONCAT, CONST, COPY, DELETE, DIV, DOWNTO, ELSE, END, EOF, FOR-DO, GOTOXY, IF-THEN-ELSE, INSERT, INTEGER, KEYPRESSED, LENGTH, LN, MAXINT, MOD, NEW, NOT, ODD, OF, OR, ORD, POS, PRED, PROCEDURE, PROGRAM, RANDOM, READ, REAL, REPEAT-UNTIL, RESET, REWRITE, ROUND, SQR, SQRT, STRING, TEXT, TRUNC, UNTIL, UPCASE, VAR, WHILE-DO, WRITE, Actual parameters, Algorithm, Alphanumeric, Array, ASCII, Binary numbers, Boolean, Boxing, Braces, Brackets, Bug, Call statements, Central Processing Unit, Characters, Cipher, Clear, Column, Comma, Commenting, Comparison, Compile, Compound instructions, Computer system, Constant, Data storage, Data structure, Data type, Debug, Decision control, Decryption, Deleting, Efficiency, Encoding, Encryption, Error, Exit Condition, Fields, File, Formatting, Functions, Header section, Identifiers, Indentation, Index, Initializing a variable, Input, Keyboard, Language, Lists, Local variables, Loops, Menu, Merge, Modular, Multiple decision making, Negative, Nested statements, One-dimensional array, Open Source, Operating system, Operations, Ordinal, Outline, Output, Parallel arrays, Parameters, Parentheses, Period, Predefined functions, Prime numbers, Printing, Problem solving, Procedure call, Processing, Programming, Punctuation, Quotient, Random numbers, Readability, Recursion, Remainder, Repetition control, Reserved words, Runtime error, Saving, Searching, Semicolon, Sets, Simulation, Software, Solution, Solving, Sorting, Structured data, Style rules, Syntax, Tables, Testing, Text files, Top down design, Type, User, Value parameter, Variable section, Variable parameter, Accountability, Career Plan, Career Clusters, Censorship, Character Education, Collaboration, Communication, Copyright, Creative Commons Guidelines, Creativity, Cyber Bullying, Cyber Crimes, Cyber Ethics, Cyber Security, Digital Learning Game, Digital Portfolio, Digital Media, Digital Media Campaign, Diversity in the Workplace, Globalization, Goal Setting, Electronic Authoring Tools, Employee Rights, Employer Responsibilities, Employment Trends, Entrepreneurship, Ethics, Free Enterprise, Hacking, Information Age, Interpersonal Communication, Initiative, Innovation, Integrity, Intellectual Property Rights, Interview Techniques, Job Entrance Criteria, Job Performance, Job Retention, Job Advancement, Leadership, Media-fluency, Multi-National Workplace, Multimedia presentation, Online Behavior, Online Discussion, Online Learning Community, Personalized Digital Portfolio, Post-Secondary Options, Productivity, Resumes, Service Economy, Social Networks, Stakeholders, Specialized Database, Teamwork, Transferable Skills, Virtual Environments, Web-based Publication, Workplace Safety

Assessments (how students will show what they know)

Formative (interim): Midterm Exam

Summative (final): Final Exam

21st Century Connections:

- 8.1 Technology (Education Technology)
- 8.2 Technology (Engineering and Design)
- 9.1 The 21st Century Life & Career Skills
- 9.3 Career Awareness, Exploration, Preparation

Character Education (Core Values):

South Brunswick High School's core values of honesty, respect, responsibility, kindness, and service are addressed and stressed throughout the year. In addition, the [Institute for Excellence and Ethics](#) program, Power2Learn will be incorporated. Units focusing on character development, setting goals and attitude will provide engaging and authentic opportunities for students to develop and exhibit character strength.

The program builds both the moral and performance character that all students need for success in school, work and life.

Power2Learn

- Unit 1: Strategies for maximizing the power of character to achieve desired goals.
- Unit 3: Strategies for working harder and smarter.

Assessments

- Regularly scheduled assessments and projects
- Midterm Exam
- Final Exam

Connections

- **Cross Curricular:** Language Arts (solving word problems, translating, explanations during problem solving); Science (problem solving, scientific notation and applications, simulation); Social Studies (reading and interpreting graphs, economic applications)
- **Technology:** 8.1A.3 – Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.
- **Character Education:** (Core Values-Honesty, Respect, Responsibility, Kindness, Service)
- **Career:** 9.1 B2, 9.1 B4, 9.1 B5, 9.2 A1-4, 9.2 B2-3, 9.2 C1-2, 9.2 D1

Course Resources:

- **Technology:** PC Computer, SMART Board

South Brunswick School District



DISTRICT APPENDIX

There are the various strands that cross content.

They have relevance to every curricular area and all grade levels.

The strands are interwoven into content and integrated into instruction.

They do not stand alone.

A synopsis of each strand is included in this document.

**The full SBSB K-12 District Appendix, with detailed information about each strand,
can be found as a separate document.**

Topics

Teaching for the 21st Century

Educational Technology Standards

21st Century Life and Career Education Skills

Character Education

Differentiation

Understanding by Design (UbD): “Reader’s Digest” Version

Topic

Teaching for the 21st Century:

What does this mean and how do you do it?

Students need to gain skills that will enable them to learn on their own, think critically and creatively, and apply knowledge to new situations. An emphasis needs to be placed on problem solving, teamwork skills, global awareness, and proficiency in using technology. Students need to learn to collaborate and work on authentic problems that they will likely encounter in their future careers. This section will outline what this means and how you “teach” for the 21st century: Elementary, Middle and High.

Tools for the 21st Century:

Life, Careers, and Digital Environments

21st Century Life and Career Education Skills and Educational Technology Skills outline the NJ Core Curriculum Content Standards for these areas that align with PK-12 learning.

These standards are written into the curriculum documents for all areas of content—English Language Arts, Mathematics, Science, Social Studies, PE/Health Education, Visual Art, Music, World Language and Library-Media. They are integrated into curriculum and instruction in places where it is relevant and meaningful to do so, and in ways that enhance learning. You will see these integrations explicitly noted in the curriculum guides: Elementary, Middle and High.

Character Education:

Safe and Caring Learning Communities

South Brunswick takes an “approach” to character education that fosters the social, emotional and academic growth of each child. The intent is to create a safe and caring community while building life skills based on the five core values (CARES):

- C Cooperation
- A Assertion
- R Responsibility (and Respect)
- E Empathy
- S Self-Control

For over ten years, the K-5 teachers have been trained in and have followed the *Responsive Classroom (RC)* approach.

The middle school teachers have studied and/or been trained in the *Developmental Designs (DD)* approach to character education.

The high school approach has been named “Strive for Five” and includes an annual theme with related activities to bring Character Education to the forefront. There is always a service-learning project connected to the theme. In addition, the high school also follows the *Institute of Excellence and Ethics* (IEE) approach. The IEE approach allows for explicit teaching of Character Education through a series of multimedia lessons that are embedded into the students’ schedules.

Differentiation

Differentiation of instruction is a deliberate and conscious method of planning and teaching that provides multiple avenues of learning. It means different challenges to different students. It is characterized by strategies that use an assessment of each individual student for readiness, interest and learning style to modify instruction in three ways: by content, process and product.

In this document, there is a brief description of several approaches and methods that have long been utilized in South Brunswick to meet the differentiated needs of students within the classroom.

- Bloom’s Taxonomy
- Gardner’s Multiple Intelligences
- Learning Styles
- Inclusion Classrooms
- Kagan Cooperative Learning
- Principles of Differentiation

It is expected that classroom instruction will be differentiated. This expectation is predicated upon the belief or disposition that “all students can learn.”

Understanding by Design

For nearly two decades, the South Brunswick School District has held much value in the Understanding by Design (UbD) or Backward Design model of curriculum writing by Grant Wiggins. This model and the process of curriculum development, has been used in the district for many years. The curriculum template—which was recommended by the State of NJ and adopted/adapted by the District, includes elements of the UbD approach.)

You will note that in every curricular area, we begin with the end in mind (that is, the big idea). Enduring understandings, essential questions and performance assessments—all based on standards- - are used in the process of curriculum development.

With this being said, it is not only important to understand the process of UbD, but also how to implement curriculum designed in such a way.

A brief overview of how to use Understanding by Design in delivering curriculum is included in the Appendix.