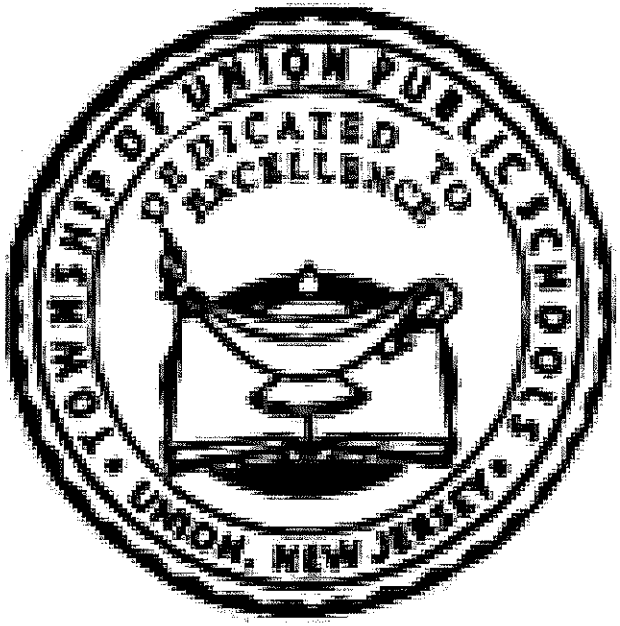
TOWNSHIP OF UNION PUBLIC SCHOOLS



College Algebra
Adopted June 17, 2015
Updated December 18, 2018

District Mission Statement

The Township of Union Board of Education believes that every child is entitled to an education, designed to meet his or her individual needs, in an environment that is conducive to learning. State standards, federal and state mandates, and local goals and objectives, along with community input, must be reviewed and evaluated on a regular basis to ensure that an atmosphere of learning is both encouraged and implemented. Furthermore, any disruption to or interference with a healthy and safe educational environment must be addressed, corrected, or, when necessary, removed, in order for the district to maintain the appropriate educational setting.

District Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is the formulation of a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

Course Description

College Algebra has three fundamental goals:

1. To reinforce and extend upon Algebra II concepts thereby preparing them for other courses such as calculus, business calculus, and finite mathematics.
2. To show students how Algebra can model and solve authentic real-world problems.
3. To enable students to develop problem-solving skills while fostering critical thinking, within an interesting setting.

To this end, students will model and solve algebraic problems that involve the study of polynomial, quadratic, radical, rational, exponential and logarithmic functions. Students will model and solve basic trigonometry, trigonometric identities, equations and application problems. Each unit of student will include the use of group explorations, and scientific and graphing calculators.

Recommended Textbook:

College Algebra Essentials 4e
George Blitzer

Units of Study:

Unit 1: Exponents and Polynomial Functions
Unit 2 Factoring and Quadratics
Unit 3 Rational Expressions and Functions
Unit 4 Roots and Radicals
Unit 5 Inverse, Exponential and Logarithmic Functions
Unit 6 Trigonometry

Pacing Guide

Unit 1	Exponents and Polynomial Function	20 days
Unit 2	Factoring and Quadratics	30 days
Unit 3	Rational Expressions and Functions	20 days
Unit 4	Roots and Radicals	20 days
Unit 5	Inverse, Exponential and Logarithmic Functions	30 days
Unit 6	Trigonometry	40 days

Allowances given for additional review days, if necessary, and assessments.

Course Proficiencies

EACH STUDENT WILL BE ABLE TO:

- Simplify, graph, solve and apply exponential and radical functions.
- Simplify, graph, solve and apply logarithmic functions.
- Simplify, graph, solve and apply rational equations.
- Simplify and apply composite functions.
- Graph and solve functions and extract information from multiple forms.
- Perform all operations with polynomials, and to factor polynomials.
- To determine if a function has an inverse, and if it has one, find its equation.
- Use algebraic expressions as models of real-life situations.
- Use all methods of factoring polynomials.
- Examine and solve quadratic models involving objects, parabolic shaped regions and quantities related to time
- Find values of trigonometric functions for acute and general angles.
- Find exact and approximate values for the six trigonometric functions.
- Verify trigonometric identities, simplify/evaluate expressions and solve trigonometric equations.
- Identify graphs of the basic trigonometric functions
- Understand and apply trigonometric functions to solve real-life problems about measurement.
- Choose the appropriate trigonometric function to find missing parts of right and oblique triangles.
- Use identities to find values of trigonometric functions and to solve trigonometric equations.

Curriculum Units

Unit 1: Exponents and Polynomial Functions

NJSLS	NJSLS Content	Learning Activities
HSN.RN.A-1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define to be the cube root of 5 because we want = to hold, so must equal 5.	Homework review Direct instruction (board notes/presentations) Guided and independent practice Investigation activities Flipped classroom
HSF-LE-A-1.c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	
HAS.APR.A-1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	
HSF.IF.C.7-c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	
HSF-BF-B-4.b	Verify by composition that one function is the inverse of another.	

Unit 1 Proficiencies

Students will be able to:

- Use rules of exponents
- Recognize exponential functions
- Use Operations with polynomials
- Graph polynomial functions
- Find composite functions

Suggested Differentiation for Unit 1

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
  - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Resources

- Textbook - College Algebra Essentials 4e
- Desmos: https://teacher.desmos.com/exponential

- Desmos: https://teacher.desmos.com/quadratic
- Math literacy resources (e.g., Sir Cumference series, Scholastic MATH Magazine)
- Internet based resources - videos, interactive manipulative, online tutors
    - Khan Academy
    - Virtual Nerd
    - BuzzMath
    - Kuta Software
    - YouTube

Formative Assessments	**Summative Assessments**
Homework Classroom whiteboard problem solving Exit tickets Review Games Teacher Observations Use of technology (Google Suite) Do nows Oral questioning Short constructed responses	Quiz Chapter Test Projects Simplify the expression The approximate number of fruit flies in an experimental population after t hours is given by the function: , where a. Find the initial number of fruit flies in the population. b. How large is the population of fruit flies after 72 hours? c. Graph *Q* A candy factory needs a box that has a volume of 30 cubic inches. The width should be 2 inches less than the height and the length should be 5 inches greater than the height. What should the dimensions of the box be?

	One zero of is $x = 2$. Find the other zeroes of the function. Use synthetic division and factoring. Verify the zeroes by graphing the function. Verify that the function and are inverse functions of each other numerically. Use and

Interdisciplinary Connections/Technology

Global Perspectives: Real data that describes different nations' economies and populations will be used as examples of linear growth, exponential growth, exponential decay, and periodic functions

Unit 2 Factoring and Quadratics

NJSLS	NJSLS Content	Learning Activities
HAS.SSE.A-2	Use the structure of an expression to identify ways to rewrite it. For example, see as, thus recognizing it as a difference of squares that can	Homework review

	be factored as	Direct instruction (board notes/presentations) Guided and independent practice Investigation activities Flipped classroom
HAS.REI.B.4-b	Solve quadratic equations by inspection (e.g., for = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.	
HSF.BF.A.1	Write a function that describes a relationship between two quantities.	
HAS.CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	

Unit 2 Proficiencies

Students will be able to:

- Determine all methods of factoring polynomials
- Solve polynomial equations by factoring
- Solve quadratic equations by the following methods: zero-product property, square root property, completing the square, quadratic formula and graphing.
- Use quadratic equations to solve real-life problems
- Solve quadratic inequalities algebraically

Suggested Differentiation for Unit 2

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students

should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
  - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Resources

- Textbook - College Algebra Essentials 4e
- Desmos: https://teacher.desmos.com/quadratic
- Desmos: https://teacher.desmos.com/functions
- Math literacy resources (e.g., Sir Cumference series, Scholastic MATH Magazine)
- Internet based resources - videos, interactive manipulative, online tutors
  - Khan Academy
  - Virtual Nerd
  - BuzzMath
  - Kuta Software
  - YouTube

Formative Assessments	Summative Assessments

Homework Classroom whiteboard problem solving Exit tickets Review Games Teacher Observations Use of technology (Google Suite) Do nows Oral questioning Short constructed responses	Quiz Chapter Test Projects • Write a paragraph explaining why • Given the equation use three different methods of solving quadratic equations to find the solutions. Compare and discuss the methods used. • Maurice Daniels wants to buy a rug for a room that is 12 ft wide and 15 ft long. He wants to leave a uniform strip of floor around the rug. He can afford to buy 108 square feet of carpeting. What dimensions should the rug have? • If a projectile is launched from ground level with an initial velocity of 96 ft/sec, its height *s* in feet *t* seconds after launching is given by the following equation: . When will the projectile be greater than 80 feet above ground level?

Interdisciplinary Connections/Technology

Interdisciplinary Connections:.

From 1960 to 1990, the total government payroll in the US can be modeled by $P = 35t^2 + 115t + 3410$, where P is in millions of dollars and t = 0 corresponds to 1960. Judging from the payroll between 1960 and 1990, is it possible that the government payroll will reach 70 billion dollars a year?

Global Perspective:

The Arecibo Observatory is a radio telescope located in Puerto Rico. The observatory's 1,000 ft radio telescope is the world's largest single–aperture telescope. The shape of the dish used can be modeled with a quadratic equation. Research the dimensions of the telescope and write an equation that closely models the telescope and describe some of the research done by radio telescopes.

Unit 3 Rational Expressions and Functions

NJSLS	NJSLS Content	Learning Activities
HAS.APR.D.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.	Homework review Direct instruction (board notes/presentations) Guided and independent practice
HAS.APR.D.6	Rewrite simple rational expressions in different forms	
HSF.IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.	

HAS.CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	Investigation activities Flipped classroom
HAS.REI.D.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.*	

Unit 3 Proficiencies

Students will be able to:

- Simplify and perform operations with rational expressions
- Simplify complex fractions
- Determine domain of rational expressions/equations
- Solve rational equations and apply to real-life settings
- Graph rational equations

Suggested Differentiation for Unit 3

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.

- Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
- Group students by similar interest when working on application problems.
- Use mini lessons to reteach to those having difficulty.
- Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
- Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
- Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.

- **Tier 2 Learners:**
  - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Resources

- Textbook - College Algebra Essentials 4e
- Desmos: https://teacher.desmos.com/functions
- Math literacy resources (e.g., Sir Cumference series, Scholastic MATH Magazine)
- Internet based resources - videos, interactive manipulative, online tutors
  - Khan Academy
  - Virtual Nerd
  - BuzzMath
  - Kuta Software
  - YouTube

Formative Assessments	Summative Assessments

Homework Classroom whiteboard problem solving Exit tickets Review Games Teacher Observations Use of technology (Google Suite) Do nows Oral questioning Short constructed responses	Quiz Chapter Test Projects Write the rational expression in lowest terms: Simplify: Graph and determine the domain: Letitia and Kareem are working on a neighborhood cleanup. Kareem can clean up all the trash in the area in 7 hours, while Letitia can do the same job in 5 hours. How long will it take them if they work together? Graph: and determine the asymptotes, domain and range

Interdisciplinary Connections/Technology

Technology

- Students will be encouraged to use calculators and other technology to validate solutions found using "pencil and paper", particularly when manipulating expressions with rational exponents.

http:// www.mrperezonlinemathtutor.com/A2/4_2_Radicals_Rational_Exponents.html

- The above link is a good resource for students to use when simplifying rational expressions.

Interdisciplinary Connections: Students will learn that complex numbers are widely used in the fields of physics and engineering, as well as in advanced mathematics. Students will learn the history of complex numbers, as well as the connections between complex numbers and fractal geometry, which appears in both art and nature.

Unit 4 Roots and Radicals

NJSLS	NJSLS Content	Learning Activities
HSN.RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.	Homework review Direct instruction (board notes/presentations) Guided and independent practice Investigation activities Flipped classroom
HSN.RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.	
HAS.REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	

Unit 4 Proficiencies

Students will be able to:

- Find the n-th root of an expression
- Convert radicals to rational exponents and vice versa
- Use rules of exponents with rational exponents to simplify rational expressions
- Operations with radicals (including use of the conjugate to rationalize the denominator)
- Solve radical/rational exponential equations

Suggested Differentiation for Unit 4

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
  - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Resources

- Textbook - College Algebra Essentials 4e
- Desmos: https://teacher.desmos.com/functions
- Khan: https://www.khanacademy.org/math/algebra2/radical-equations-and-functions
- Internet based resources - videos, interactive manipulative, online tutors
    - Khan Academy
    - Virtual Nerd
    - BuzzMath
    - Kuta Software
    - YouTube

Formative Assessments	Summative Assessments
Homework Classroom whiteboard problem solving Exit tickets Review Games Teacher Observations Use of technology (Google Suite) Do nows Oral questioning Short constructed responses	Quiz Chapter Test Projects Simplify: Rewrite in rational form: . Rewrite in radical form: Simplify: Solve: ; Solve

Interdisciplinary Connections/Technology

Technology – Use Graphing Calculator to simplify radicals.

Interdisciplinary Connection: https://sciencing.com/how-are-radical-expressions-rational-exponents-used-in-real-life-12751906.html

Unit 5 Inverse, Exponential and Logarithmic Functions

NJSLS	NJSLS Content	Learning Activities
HSF-IF-A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).	Homework review Direct instruction (board notes/presentations) Guided and independent practice Investigation activities
HSF-BF-B.4	Find inverse functions. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x3 or f(x) = (x+1)/(x-1) for $x \neq 1$. Verify by composition that one function is the inverse of another. Read values of an inverse function from a graph or a table, given that the function has an inverse. Produce an invertible function from a non-invertible function by restricting the domain	
HSF-IF-C.7.e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and	

	amplitude.	Flipped classroom
HSF-BF-B.5	Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	
HSF-LE-A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.	
HSF-LE-A.4	For exponential models, express as a logarithm the solution to where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	

Unit 5 Proficiencies

Students will be able to:

- One-to-one functions
- Find the equation of the inverse and graph the inverse
- Define, graph and apply exponential functions
- Define, graph and apply logarithmic functions
- Use properties of logarithms
- Solve and apply exponential and logarithmic equations

Suggested Differentiation for Unit 5

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the

assignment rather than completing the entire assignment.
    - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
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Curriculum Resources

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- Desmos: https://teacher.desmos.com/exponential
- Internet based resources - videos, interactive manipulative, online tutors
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    - Virtual Nerd
    - BuzzMath
    - Kuta Software
    - YouTube

Formative Assessments	**Summative Assessments**
Homework Classroom whiteboard problem solving Exit tickets Review Games Teacher Observations Use of technology (Google Suite)	Quiz Chapter Test Projects

Do nows Oral questioning Short constructed responses	• Is the function one-to-one? Find the solution graphically and algebraically. • Verify that the functions and are inverses of each other, both graphically and algebraically. • There are three options for investing $500. The first earns 7% compounded annually, the second earns 7% compounded quarterly and the third earns 7% compounded continuously. Find the equations that model the growth of each investment and use a graph to determine which investment yields the highest return after 20 years. What are the differences in earnings among the three investments? • Graph: . Determine the domain, range and asymptote(s). • Use the properties of logarithms to rewrite as a single logarithm: • Kurt wants to buy a $30,000 car. He has saved $27,000. Find the number of years (to the nearest tenth) it will take for his $27,000 to grow to $30,000 at 4% interest compounded quarterly.

Interdisciplinary Connections/Technology

Global Perspectives: Real data that describes different nations' economies and populations will be used as examples of linear growth, exponential growth, exponential decay, and periodic functions

Unit 6 Trigonometry

NJSLS	NJSLS Content	Learning Activities
HSF.TF.A.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, cosine, and tangent for x, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.	Homework review Direct instruction (board notes/presentations) Guided and independent practice Investigation activities Flipped classroom
HSF.TF.A.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	
HSF.TF.C	Prove and apply trigonometric identities.	
HSF.TF.B.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.	
HSG.SRT.C	High School right triangles and Trigonometry; To solve problems involving right triangles.	

Unit 6 Proficiencies

Students will be able to:

- Solve Angles and the Unit Circle
- Identify Degree and Radian Measure
- Identify Trigonometric Functions and Trigonometric Identities
- Solve trigonometric equations using inverses and identities
- Solve a right triangle and applications

Suggested Differentiation for Unit 6

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
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  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
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Curriculum Resources

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- BuzzMath
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- YouTube

Formative Assessments	Summative Assessments
Homework Classroom whiteboard problem solving Exit tickets Review Games Teacher Observations Use of technology (Google Suite) Do nows Oral questioning Short constructed responses	Quiz Chapter Test Projects • Find the least positive coterminal angle of 690° and graph the angle. • Convert radians to degrees; Convert 245° to radian measure. • Simplify: • , find the value of x • Solve the right triangle, given: „ and m.

Interdisciplinary Connections/Technology

Physics: Rates of change can be applied to motion, electricity, heat, light, and astronomy.

Additional Suggested Modifications for Units

Below is an additional list of modifications and accommodations opportunities. This includes, but is not limited to,:

1. English Language Learners.
    a. Read written instructions.
    b. Model and provide examples
    c. Extended time on assessments when needed.
    d. Establish a non-verbal cue to redirect student when not on task.
    e. Students may use a bilingual dictionary.

English Language Development Standard 3: Language of Mathematics: English language learners communicate information, ideas and concepts necessary for academic success in the content area of mathematics.

2. Special Education/504 Students.
    a. Extended time on assessments when needed.
    b. Preferred seating to be determined by student and teacher.
    c. Provide modified assessments when necessary.
    d. Student may complete assessments in alternate setting when requested.
    e. Establish a non-verbal cue to redirect student when not on task.
    f. Maintain strong teacher / parent communication.
    g. Conversion chart

New Jersey Student Learning Standards - Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to

solve problems individually and collaborate and to create and communicate knowledge.

A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations

B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.

C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning.

E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

***See Guide for Technology Integration.**

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

TOWNSHIP OF UNION PUBLIC SCHOOLS

Math Readiness for College & Careers
Adopted June 17, 2015
Updated December 18, 2018

Mission Statement

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Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is to formulate a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

Course Description

The purpose of this senior-level math course is to provide instructions in general mathematical concepts with a heavy concentration in real-world applications of mathematics. Students will improve their reasoning abilities by making generalizations and drawing logical conclusions. Concepts in Algebra 1, Geometry, Algebra 2, & Trigonometry are explored as they relate to business, science, finance, data collection, and careers.

Curriculum Units

Unit 1: Foundations of Algebra

Unit 2: Real-World Functions and Formulas

Unit 3: Linear Relationships

Unit 4: Non-Linear Relationships

Unit 5: Polynomials, Rational Functions, and Trigonometry

Pacing Guide

Content	Number of Days
Unit 1: Foundations of Algebra	35
Unit 2: Real-World Functions and Formulas	35
Unit 3: Linear Relationships	35
Unit 4: Non-Linear Relationships	35
Unit 5: Polynomials, Rational Functions, and Trigonometry	40

Unit 1: Foundations of Algebra

Essential Questions	Instructional Outcomes	Activities	Assessments	NJSLS
• When is it advantageous to use fractions instead of decimals/percents, decimals instead of fractions/percents, or percents instead of fractions/decimals?	• Convert between fractions, decimals, and percents • Use <, =, or > to compare rational numbers • Plot and order rational numbers on a number line	• Choose the rational number (fraction, decimal, or percent) that is most sensible • Given a pair of rational numbers, fill in <, =, or > • Given a list of rational numbers, plot and order them on a number line	• Given a real life scenario and a list of 3 equivalent rational numbers, choose the most appropriate rational number (fraction, decimal, or percent) • Fill in <, =, or > 2/3 ___ 0.6 • Plot and order the following: 4/9, 2/5, 42%, 0.41, 9/20	6.RP.2-3 7.RP.1-3 7.SP.1-2, 5 S-ID.1-4 S-CP.2, 6-9
• How are rational numbers used to solve real-life problems? • What is the best way to simplify expressions involving several operations?	• Perform all operations on rational numbers • Use exponents & radicals to simplify expressions • Use order of operations to simplify	• Simplify numerical expressions by adding, subtracting, multiplying, and dividing • Simplify numerical expressions using exponents and radicals • Simplify numerical expressions using	• The Lincoln Tunnel EZPass weekday off-peak toll is $9.75 and peak toll is $11.75. If you travel into NYC through the Lincoln Tunnel Monday – Friday for four weeks, how much money would you save when traveling	6.RP.2-3 7.RP.1-3 7.SP.1-2, 5 S-ID.1-4 S-CP.2, 6-9

	expressions	the order of operations	off-peak hours compared to peak hours? • Simplify $4+8\times\sqrt[3]{27}\div(2+4)$	
• When are rational numbers used to solve real-life problems? • How are rational numbers used to analyze information and guide decision-making?	• Use fractions, decimals, and percents to calculate sales tax, tip, commissions, percent change • Use mean, median, mode, and range to organize and summarize data • Calculate theoretical and experimental probability	• Given real life scenarios involving fractions, decimals, and percents, write and solve equations to solve problems **(Interdisciplinary Connection)** • Given a list of values from a real-life scenario, calculate the mean, median, mode, and range and determine what's the most revealing measure of central tendency • Given a real-life scenario, calculate the experimental probability • Given an event or series of events,	• Calculate the final price of a refrigerator costing $850, with a 15% off coupon, and 7% sales tax. • Find the real estate's commission for a house sold at $375,000 at a 6% rate. • Given a list of values from a real-life scenario, calculate the mean, median, mode, and range and determine what's the most revealing measure of central tendency • The skateboard manufacturer inspects 2500 skateboards and	6.RP.2-3 7.RP.1-3 7.SP.1-2, 5 S-ID.1-4 S-CP.2, 6-9

		calculate the theoretical probability that the scenario occurs.	found that 2450 of them had no defects. Find the probability that a skateboard selected at random has no defects. • You take a five-question multiple choice quiz and guess on all questions selecting one of four answers randomly each time. What is the probability you will get a perfect score?	
How are graphs used to analyze data and guide decision-making?	• Use bar graphs, histograms, flow charts, circle graphs, line graphs, and scatter plots to interpret and analyze data	• Given a graph, interpret and analyze the data presented • Given a table of data or word problem, create a graph that best depicts this data	• Given three tables, create a graph for each that best depicts the data (bar graph, line graph, circle graph). • Analyze graph to make decisions	6.RP.2-3 7.RP.1-3 7.SP.1-2, 5 S-ID.1-4 S-CP.2, 6-9

Unit I Proficiencies

Students will be able to:

- Convert between fractions, decimals, and percents
- Use <, =, or > to compare rational numbers
- Plot and order rational numbers on a number line
- Perform all operations on rational numbers
- Use exponents & radicals to simplify expressions
- Use order of operations to simplify expressions
- Use fractions, decimals, and percents to calculate sales tax, tip, commissions, percent change
- Use mean, median, mode, and range to organize and summarize data
- Calculate theoretical and experimental probability
- Use bar graphs, histograms, flow charts, circle graphs, line graphs, and scatter plots to interpret and analyze data

Suggested Differentiation for Unit 1

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**

- Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.

- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Resources

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- Rudolph Academy
- Khan Academy
- College Readiness for SAT
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- https://www-math.umd.edu/cgi-bin/placement/index.cgi
- www.math.com

Formative Assessments	Summative Assessments
Homework Classroom whiteboard problem solving Exit tickets Mini whiteboards Use of technology (Google Suite) Do nows Oral questioning Short constructed responses	Quiz Chapter Test Projects

Unit 2: Real World Functions and Formulas

Essential Questions	Instructional Outcomes	Activities	Assessments	NJSLS
• What are functions and how are they used to help us understand the relationship between two quantities? • How are graphs used to represent and analyze functions? • What are examples of real-world linear functions and how can we model them with equations? • How are geometry formulas used in the real	• A function is a rule that assigns to each input exactly one output. • The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. • Geometry formulas allow us to calculate the distance of line segments, the perimeter and area of 2D shapes, the circumference and area of circles, and the surface area and volume of 3D shapes.	• Given a function rule, fill out an input-output table. • Given two sets of quantities, write the function rule and graph the function. • Given the graph of a function, identify the ordered pairs and write the function rule. • Use an appropriate domain for a given real world scenario, find the corresponding range, write and graph the function.	• Given $y = 5x-2$, complete an input-output table. • Given (0,1), (2, 4), (4, 7), (6, 10), write the function rule and graph the function. • Al's Auto Rental charges $32 per day plus $0.28 per mile for an automobile rental. Elaine rented a car for 2 days and drove 83 miles. How much did she pay? Ramon paid $60 to rent a car for	F-IF.4, 6-9 F-LE.1-3 A-SSE.3

world?		• Solve real world problems involving coordinate geometry using formulas for distance, midpoint, perimeter, circumference, and area. **(Interdisciplinary Connection)**	one day. How far did he drive? • A bakery sells a 9" by 13" cake for the same price as an 8" diameter round cake. If the round cake is twice the height of the rectangular cake, which option gives the most cake for the money?	

Unit 2 Proficiencies

Students will be able to:

- Define a function
- Graph a function using the set of ordered pairs consisting of an input and the corresponding output
- Find the domain and range of a function
- Read, interpret, and analyze functions graphically
- Calculate the distance of line segments, the perimeter and area of 2D shapes, the circumference and area of circles, and the surface area and volume of 3D shapes.

Suggested Differentiation for Unit 2

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
  - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Development Resources	
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Formative Assessments Homework Classroom whiteboard problem solving Exit tickets Mini whiteboards Use of technology (Google Suite) Do nows Oral questioning Short constructed responses	**Summative Assessments** Quiz Chapter Test Projects

Unit 3: Linear Relationships

Essential Questions	Instructional Outcomes	Activities	Assessments	NJSLS
• Is there an advantage to solve equations algebraically vs. guess and check method?	• Solving Equations In one variable (One-Step, Two-Step, Multi-step, Variables on both sides)	• Show slight differences in problems and common mistakes. • Creating equations to help solve real-life problems.	• 3 consecutive integers add up to 39. What are the 3 integers?	• HSA.REI.A.1, HSA.REI.A.2

• What is the best way to represent change mathematically?	• Finding slope of a line when given two points on the line. • Identifying slope of a linear equation (Slope-intercept form, standard form, and point-slope form). • Finding intercepts of linear equations. • Solving literal equations.	• Slope-Speed Dating: Each student will be given a unique ordered pair, students will be given a time to pair with another student and find the slope of the line that passes between their points, after the time passes students will go on the next student. (This activity could be	• Find the slope of the line that passes through the following points: (2,3) and (12,6). • Rental Car Company "A" charges $30 to rent a car and $0.50 for each mile driven. Rental car company "B" charges a flat rate of $75. If you have to use a rental car to	• HSA.REI.B.3

		done with midpoint formula, distance formula, or equation of a line.) • Convert the following equation to slope-intercept form. • Students will be separated and asked to graph an equation using 3 different methods. (Slope-intercept form, intercepts, and using t-chart)	drive 80 miles, which company is economically better? • List the pros and cons of each of the methods of graphing. • A^2 + B^2 = C^2 ; solve for B, then solve for C. Compare your results to a formula that you already know.	
• How can linear inequalities be used to solve real-life problems?	• Solve and graph inequalities written in one variable. • Graph linear inequalities.	• Use the smart board to show how changing an inequality affects the graph of that inequality.	• Give an example of a real life limit and express that limit as an inequality. • Solve and graph the following inequality: $2x - 5x > 2(x-4)$	• HSA.REI.B.3

• How can systems be used to help solve real-life problems? • When can a system of equations be used? • When can a system of inequalities be used?	• Solve systems of equations using both the elimination and substitution methods. • Graph systems of inequalities. (Tell whether a point falls within the solution.)	• Have students solve systems using graphing, elimination, and substitution and show them that each method will provide the same answer if done correctly. • Give students a linear equation and tell them to find a partner and choose a method to tell where there equations meet.	• Kimberly went to the movie theatre and purchased 2 adult tickets and 5 student tickets for $45. Malcolm went to the same theatre and purchased 5 adult tickets and 2 student tickets for $65. What is the price of each ticket?	• HSA.REI.C.5-9
• What is the meaning of absolute value and when does it apply?	• Solve absolute value equations.	• Students will review common mistakes	• What are the differences between the two absolute value equations: $3\|x+1\|=30$ and $\|3x+3\|=30$	• HSA.REI.D.11

Unit 3 Proficiencies
Students will be able to: • Solve equations in one variable (one-step, two-step, multi-step, double-side variable).

- Find slope when given two points and when given a linear equation written in any form.
- Write equation in slope-intercept form or standard form when given two points.
- Convert equations in between forms (slope-intercept form, standard form, point-slope form).
- Solve literal equation.
- Find intercepts of a line when given two points or when given a linear equation in any form.
- Graph linear equations written in standard form or slope-intercept form.
- Solve and graph inequalities, both in one variable and linear.
- Solve absolute value equations.
- Solve systems (Systems of Equations, 2 Equations w/ 2 variables; Systems of Inequalities)

Suggested Differentiation for Unit 3

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
  - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

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- www.math.com

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Unit 4: Non Linear Relationships

Essential Questions	Instructional Outcomes	Activities	Assessments	NJSLS
• How can we use mathematical language to describe non-linear change? • How can we model situations using quadratics? • How can we model situations using exponents?	• Use the properties of exponents to simplify the following exponential expressions. • Recognize and solve problems that can be modeled using a quadratic function. Interpret the solution in terms of the context of the original problem. • Solve equations involving several variables for one variable in terms of the others. • Solve single-variable quadratic equations. • Provide and describe multiple representations of	• Show video clip of Tarzan swinging from vine and baseball hit to represent parabolic curves and discuss shape, location, and meaning of vertex, domain, range, max/min and opening direction. • Have students choose between an allowance of $5 a day or start with a penny and double daily for one month. • Use the Smart Board to illustrate changes to the vertical motion model in real-life problems **(Interdisciplinary – Physics).**	• Determine the vertex of the function $F(x) = 4x^2 - 4x + 8$ • Given the following increasing numerical pattern, determine the type of relationship that exists (linear quadratic or exponential) and justify your conclusion: -3, -1, 5, 23, 77, … • An owl is circling a field at a height of 70 feet and sees a mouse. The owl folds its wings and begins to dive with an initial speed of 6 feet per second. Estimate the time the mouse has to escape. The model for the height of the	HAS.REI.B.4

	solutions to simple exponential equations using concrete models, tables, graphs, symbolic expressions and technology.	• Given the volume of various solids, students will rewrite the formulas in terms of height. • Use the graphing calculator to identify the zeroes of the quadratic equation. • Students will track a credit card purchase over a given period of time. Students will graph the final result.	owl at time t is $h = -16t^2 - 6t + 70$ • Solve for r: $V = \frac{1}{3}\pi r^2 h$ • Solve for x: $(3x - 7)^3 = 0$ • Solve for x: $5x^2 - 2x - 10 = -13$ • What is the solution set for $6x^2 + 7x - 5 = 0$? • Using a table, graph, and/or symbolic expressions, solve the following equation. Provide more than one representation of the solutions and explain your work. $16 = 2^x$	

Unit 4 Proficiencies

Students will be able to:

- Simplify expressions using the properties of exponents.
- Add, subtract, and Multiply Polynomials (Recognize Special Polynomial Products).
- Factor monomials and quadratics.
- Solve quadratic equations (Factoring, Completing the Square, and Quadratic Formula).
- Solve Rational Expressions

Suggested Differentiation for Unit 4

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
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- www.math.com

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Unit 5: Polynomials, Rational Functions, and Trigonometry

Essential Questions	Instructional Outcomes	Activities	Assessments	NJSLS
• Is there a way to easily factor polynomials when the leading coefficient is not one? • Why can I not solve for two variables with one equation? • How can I find the area of a polygon on a coordinate plane? • How can I figure out how to maximize profits and minimize costs? • How can I determine if a business is profitable?	• Factor polynomials, expand polynomials, simplify rational expressions. • Solve a two variable system using graphing, elimination, and substitution. • Solve a system of inequalities by graphing. • Solve a quadratic equation by factoring, completing the square, and using the quadratic formula. • Calculate the area of a polygon on a coordinate plane. • Calculate the area of	• Expand polynomials by distributing, multiplying polynomials using distribution. • Simplifying rational expressions by factoring and identifying any restrictions on variables. • Graphing various costs for a cell phone plan to see which plan is better for the consumer. • Splitting the class in two to substitute and eliminate (one side solves for x first while the	• Algebra Operations- Evaluate . State all restrictions on the variables. • Solutions of Equations and Inequalities- A restaurant's supper club offers 6 meals for $300 and 12 meals for $480. Each package requires you to buy into the supper club at the restaurant and includes a one-time membership fee in the package price. What is the cost of each meal? • Coordinate Geometry- A boat has a speed of 48 mi/h in still water. A river is flowing at 14 mi/h due south. If the boat is heading due east, what are the boats	• HSA.APR.A.1, HSA.APR.B.2 • HSA.REI.C.(5-9) • HSG.GPE.B.7 • HSA.CED.A.3 • HSG.SRT.C.8

• Is there any way to tell if parts of a building will violate the building code?	a triangle on a coordinate plane using Heron's Formula. • Perform vector operations. • Calculate distance and magnitudes of resultant vectors • Perform function operations • Determine maximum profits using linear programming. • Perform function operations • Determine the break-even point for a production of a product or event. • Use Pythagorean Theorem to find missing sides of right triangles • Use trigonometry to find missing parts of	other side solves for y first to show that order is not important) • Modeling a quadratic equation by throwing a ball in an arc and determining when it's at a certain height. • Plot a figure on a plane and calculate the area. This is done using normally oriented figures and abnormally oriented figures. Use Heron's formula for area of a triangle including calculating semiperimeter. • Add and subtract vectors to show	resultant speed and direction? • Applications and other Algebra Topics- A t-shirt takes 10 min to make, costs $4 to make, and yields a profit of $6. A sweatshirt takes 30 min to make, costs $20 to make, and yields a profit of $20. Fred is selling the shirts at a summer concert series. He will spend no more than 20 hours making shirts, no more than $600 making shirts, and will make at least 50 total shirts. How many of each shirt should Fred make to maximize profit? How much is the profit? • Functions- The CookieMan Cookie shop sells all cookies for $2. The daily cost of	

	right triangles.	resultant magnitude. • Show how water affects vectors by putting a boat in a bucket of water and having the students blow the boat in different directions. • Have the students each open a business and put different parameters on the business to try to prevent profitability. See which student of group of students can remain profitable despite different constraints. • Examine the cost of doing business in the United	the shop (gas, electricity) is $120. Each cookie costs $1.40 to make. How many cookies must the CookieMan sell to break even daily? • Trigonometry- A town's building code requires a ramp to be 6 in. high for every 3 ft long. The ramp must attach to a landing that is 5 ft high. If there are 45 ft. available in which to build the ramp, will it be up to code? What angle will the ramp and the ground form?	

		States versus the cost of moving production overseas. Identify why business' move production overseas and identify factors that could keep production in the US. Have students start businesses in the US and overseas and identify which are more profitable. **(Interdisciplinary – SS)** • Build a model handicapped ramp. Identify the angle that the ramp rises at and the different lengths of the sides. Examine different national building codes to		

		determine if the ramp is within the building codes.		

Unit 5 Proficiencies
Students will be able to: • Factor polynomials, expand polynomials, simplify rational expressions. • Solve a two variable system using graphing, elimination, and substitution. • Solve a system of inequalities by graphing. • Solve a quadratic equation by factoring, completing the square, and using the quadratic formula. • Calculate the area of a polygon on a coordinate plane. • Calculate the area of a triangle on a coordinate plane using Heron's Formula. • Perform vector operations. • Calculate distance and magnitudes of resultant vectors • Perform function operations • Determine maximum profits using linear programming. • Perform function operations • Determine the break-even point for a production of a product or event. • Use Pythagorean Theorem to find missing sides of right triangles • Use trigonometry to find missing parts of right triangles.

Suggested Differentiation for Unit 5

- **Tier 1 Learners:**
  - Have guided notes filled out at different levels according to ability.
  - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
  - Group students by similar interest when working on application problems.
  - Use mini lessons to reteach to those having difficulty.
  - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
  - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
  - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
  - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
  - Have problems posted around the room. Have students loop to specific questions based on difficulty.

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- www.math.com

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Additional Suggested Modifications for Units

Below is an additional list of modifications and accommodations opportunities. This includes, but is not limited to,:

1. English Language Learners.
    a. Read written instructions.
    b. Model and provide examples
    c. Extended time on assessments when needed.
    d. Establish a non-verbal cue to redirect student when not on task.
    e. Students may use a bilingual dictionary.

English Language Development Standard 3: Language of Mathematics: English language learners communicate information, ideas and concepts necessary for academic success in the content area of mathematics.

2. Special Education/504 Students.
    a. Extended time on assessments when needed.
    b. Preferred seating to be determined by student and teacher.
    c. Provide modified assessments when necessary.
    d. Student may complete assessments in alternate setting when requested.
    e. Establish a non-verbal cue to redirect student when not on task.
    f. Maintain strong teacher / parent communication.
    g. Conversion chart

New Jersey Student Learning Standards - Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations

B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products

and process using technology.

C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning.

E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

***See Activities for Technology Integration.**

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

NJSLS 9.2 - Career Awareness, Exploration, and Preparation

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.