Randolph Township Schools
Randolph High School

Algebra III / Trigonometry

Department of Science, Technology, Engineering and Math
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Curriculum Committee
Judy LeBlanc
Meghan Altis

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Board of Education Approval
October 17, 2017
Randolph Township Schools

Mission Statement

It is the mission of the Randolph Township Schools to help prepare all our students for further education, productive work, responsible citizenship and personal fulfillment. Toward that end, we will provide students with educational experiences that enable them to acquire the knowledge and develop the thinking and problem-solving skills necessary for a lifelong process of learning. We will guide all students in discovering, valuing and developing their unique talents in order to realize their potential.

EDUCATIONAL GOALS
RANDOLPH TOWNSHIP BOARD OF EDUCATION
VALUES IN EDUCATION

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:

- The needs of the child come first.
- Mutual respect and trust are the cornerstones of a learning community.
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members.
- A successful learning community communicates honestly and openly in a non-threatening environment.
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways.
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences.
- Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth.
All students in Randolph Township Schools will be mathematically empowered to acquire knowledge and develop communication and problem solving skills that will serve as tools to promote their lifelong learning as confident, flexible, and resourceful thinkers in anticipation of a global future. The goal of this vision is to engage students’ interest and intellect through rich mathematical exploration; fostering a diverse and equitable environment that is challenging, caring, and technologically-equipped for the 21st century. This vision is consistent with that of the National Council of Teachers of Mathematics in their Principles and Standards for School Mathematics (2000).
Beginning in 1989 and continuing through the present, the National Council of Teachers of Mathematics has focused national attention on a new set of goals and expectations for school mathematics and the design of curriculum. Their visionary document, *Curriculum and Evaluation Standards for School Mathematics*, provided a framework for what the mathematics curriculum in grades K – 12 should include in terms of content priority, emphasis, methodologies and evaluation standards. Indeed, most State Curriculum Content Standards in Mathematics, including those of the State of New Jersey, are fashioned from this document.

No longer does American Society hold the view that sustained and detailed instruction in mathematics and science is suitable only for the most academically talented. In our global society, virtually every area of life requires a higher competence with mathematics for full participation in our information society. New approaches to instruction and assessment have made it possible to increase the scope and the depth of the study of mathematics for wider and a more diverse student population. Realistically, we are preparing our students today for jobs and professions that may not even exist right now; therefore the nature of mathematics education must be always changing, subject to new discoveries and to emerging needs for mathematical literacy.

The mathematics department of the Randolph Township Schools is committed to providing a curriculum that reflects these standards; identifying a common core of topics that *all* students should have the opportunity to learn. Our goal is to prepare our students for the workplace, for college, and for citizenship. The traditional strands of algebra, geometry, trigonometry and calculus must be balanced with topics from data analysis and statistics, probability, and discrete mathematics. Conceptual understanding, mathematical modeling, problem solving, integration of appropriate technology and the fostering of reasoning skills must become the focus of our curricula, our instruction and our assessment; rather than the more narrow curricular expectations of memorizing isolated facts, procedures and proficiency with calculations.

We are committed to the process of change and transition to keep abreast with societal expectations. We will continue to reexamine our teaching, to challenge our beliefs, to redesign goals and our curricula, to explore alternate methods of evaluation and to integrate technology into instruction in order to meet the changing needs of our global society.
Equality and Equity in Curriculum

The Randolph township School district ensures that the district's curriculum and instruction are aligned to the State’s Core Curriculum Content Standards. The curriculum addresses the elimination of discrimination and the achievement gap, as identified by underperforming school-level AYP reports for State assessment. The Curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affecional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972
# Equations, Inequalities, and Mathematical Modeling

## Enduring Understandings
- Real life data can be modeled by many types of equations.
- It is possible to manipulate algebraic expressions with both real and non-real values.
- Imaginary numbers were “invented” to take care of the non-real solutions to quadratic equations and are defined as the square roots of negative numbers.

## Essential Questions
- How can algebraic symbols be used to represent and model mathematical situations?
- How can tables, graphs, and equations be used to represent verbal descriptions of quantitative relationships and vice versa?
- How are mathematical operations performed with imaginary and complex numbers?
- How could we represent a number that has both a real and imaginary part?
- How is solving inequalities the same and different from solving equations?

## Knowledge
**Students will know:**
- How to identify and classify the basic shape of a graph from its equation
- That mathematical models can be used to solve real life problems
- That there are various solution methods for solving quadratics
- That complex solutions can occur when solving quadratic equations
- That there are several methods for solving polynomial equations
- Extraneous solutions can occur and have meaning when certain algebraic manipulations are performed

## Skills
**Students will be able to:**
- Find x and y intercepts of a graph
- Use symmetry to sketch graphs of equations
- Translate verbal phrase and key words into algebraic equations
- Use literal equations and common formulas to write and solve equations
- Factor quadratic equations, complete the square, use the square roots method, and the quadratic formula to solve quadratic equations
- Add, subtract, multiply, and divide complex numbers
- Multiply conjugates
- Simplify radicals and check for extraneous solutions
- Write the solutions of inequalities in three forms: inequality, graphical, and interval notation
- Choose the appropriate method to solve polynomial equations (absolute value, square roots)

## Standards
- SMP.1-8
- HSA-SSE.2
- HSA-CED.4
- HSA-REI.2,4
- HSF-IF.8
- HSN-CN.1,2,7
- ELA-Literacy.WHST.11-12.2
- ELA-Literacy.WHST.11-12.3
- ELA-Literacy.WHST.11-12.4
- ELA-Literacy.WHST.11-12.5
- ELA-Literacy.WHST.11-12.6
- ELA-Literacy.WHST.11-12.8
- ELA-Literacy.WHST.11-12.10
## UNIT: Functions and their graphs

### ENDURING UNDERSTANDINGS

- Functions show how one variable is related to another variable
- All functions have algebraic, numerical, and graphical representations
- Functions and their representations are used to model and analyze real world applications and quantitative relationships
- Functions can be combined and/or transformed to create new functions that have meaning

### ESSENTIAL QUESTIONS

- What strategies can be used to identify patterns in functions?
- How can graphs be used to describe relationships?
- What happens to a graph when we change the conditions within the algebraic equation, and vice versa?
- How can algebraic and geometric representations be used to describe the behavior of a function?
- How can you use functions to solve real world problems?
- How are the algebraic, numerical, and graphical representations of functions related?

### KNOWLEDGE

**Students will know:**

- How to perform algebraic calculations in the Cartesian coordinate plane
- How to determine whether relations between two variables are functions
- That there are certain values that restrict the domain of a function
- That functions can be classified based on certain characteristics
- A library of parent functions exists and can be used to create transformations

### SKILLS

**Students will be able to:**

- Graph linear equations in two variables and identify slope
- Identify parallel and perpendicular lines
- Identify the domain of a function from its equation or graph
- Use function notation and evaluate functions
- Use functions to model and solve real world problems
- Use the vertical line test and to determine the zeros of functions
- Determine the critical points of a function
- Identify and graph linear, quadratic, cubic, square root, reciprocal, piecewise functions
- Use translations and reflections to sketch graphs
- Find the composition of one function with another function
- Find inverse functions informally and verify that two functions are inverses of each other
- Determine if a function is one to one

### STANDARDS

- SMP.1-8
- HSF-BF.1.3, 4
- HSS-ID.6-9
- HSF-IF.1,2,4,5,7
- HSF-LE.2
- ELA-Literacy.WHST.11-12.2
- ELA-Literacy.WHST.11-12.3
- ELA-Literacy.WHST.11-12.4
- ELA-Literacy.WHST.11-12.5
- ELA-Literacy.WHST.11-12.6
- ELA-Literacy.WHST.11-12.8
- ELA-Literacy.WHST.11-12.10
### UNIT: Polynomial Functions

#### ENDURING UNDERSTANDINGS

- The essential arithmetic operations can be extended and applied to functions and polynomials.
- A relationship exists between a polynomial’s factors, zeros, roots, and x-intercepts.
- It is possible to determine the number and nature of a polynomial’s roots by analyzing its equation and graph.

#### ESSENTIAL QUESTIONS

- How do you determine the number of solutions an equation has?
- How do we classify polynomials by degree and number of terms?
- What techniques and theorems are used to find the zeros of a polynomial function?

#### KNOWLEDGE

**Students will know:**

- How to analyze the graph of a quadratic function
- That the maximum or minimum value of a quadratic occurs at its vertex
- That all functions share governing rules
- How to quickly assess how the function’s equation will affect its graphical behavior
- That there exists various theorems to efficiently assist in determining the roots of a polynomial

#### SKILLS

**Students will be able to:**

- Write quadratic equations in standard form and use the results to sketch graphs of functions
- Use quadratics to model and solve real world problems
- Determine a graphs end behavior and critical points
- Use long/ synthetic division to divide polynomials
- Use the remainder and factor theorem
- Use the Fundamental Theorem of Algebra to find zeros of polynomials
- Model and solve real world problems using functions

#### STANDARDS

<table>
<thead>
<tr>
<th>SMP.1-8</th>
<th>HSA-APR.1, 2, 3, 4</th>
<th>HSN-CN.1,2,3,7,8,9</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>HSF-BF.1,3, 4</td>
<td>HSF-BF.1,3, 4</td>
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<td>HAS-SSE.3</td>
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<td>HSS-ID.6</td>
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<td>HSF-IF.7,8</td>
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<td>HSF-LE.2</td>
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<td>ELA-Literacy.WHST.11-12.2</td>
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<td>ELA-Literacy.WHST.11-12.3</td>
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<td>ELA-Literacy.WHST.11-12.4</td>
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<td>ELA-Literacy.WHST.11-12.8</td>
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<td>ELA-Literacy.WHST.11-12.10</td>
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</tr>
</tbody>
</table>
## UNIT: Rational Functions

### ENDURING UNDERSTANDINGS

- A rational function is quite unique in its algebraic and graphical properties.
- The behavior of rational functions provides an introduction to the idea of a limit.

### ESSENTIAL QUESTIONS

- What algebraic and graphical observations make rational functions unique?
- What determines whether or not a function will be continuous?
- How can asymptotes help you graph rational functions?
- What techniques are used to analyze and sketch rational functions?
- What real world interpretation does a limit have?

### KNOWLEDGE

**Students will know:**
- Rational functions can be used to model real life problems.
- How to analyze and sketch the graphs of rational functions.
- That points of discontinuity in a function’s graph can exist.
- That minor variations in an equation can have major impact on its graph.

### SKILLS

**Students will be able to:**
- Find the domain of rational functions.
- Find the vertical, horizontal, and slant asymptotes of graphs of rational functions.
- Sketch and analyze the graphs of rational functions.
- Identify the parent function and apply transformations accordingly.

### STANDARDS

SMP.1-8  
HSA-APR.6.7  
HSF-BF. 3  
HSF-IF.7  
ELA-Literacy.WHST.11-12.2  
ELA-Literacy.WHST.11-12.3  
ELA-Literacy.WHST.11-12.4  
ELA-Literacy.WHST.11-12.5  
ELA-Literacy.WHST.11-12.6  
ELA-Literacy.WHST.11-12.8  
ELA-Literacy.WHST.11-12.10
## UNIT: Exponential and Logarithmic Functions

### ENDURING UNDERSTANDINGS
- When an individual uses graphs, table, and equations to represent an exponential relationship, they develop a deeper understanding of that relationship.
- Exponential functions and their graphical representations can be used to model extreme growth or decay.
- Logarithmic and exponential functions are inverses of each other and as such logarithmic functions can be used to determine an unknown exponent.

### ESSENTIAL QUESTIONS
- What is the relationship between exponential and logarithmic functions?
- What are some of the most important characteristics of exponential and logarithmic functions?
- How does the base affect exponential growth and decay in applied settings?
- How do different laws govern logarithmic functions?

### KNOWLEDGE

**Students will know:**
- How to recognize if data represents exponential growth or decay
- What the implications of the asymptotes are and how it relates to domain and range
- What the log / ln buttons on the calculator represent
- That you can use the properties of logs to evaluate the product, sum or difference of other logs with or without the use of a calculator
- The concept of the common logarithm and how this applies to other bases

### SKILLS

**Students will be able to:**
- Recognize and evaluate exponential functions with base a or base $e$
- Graph exponential functions and use the “one to one” property
- Use logarithmic functions to model and solve real world problems
- Recognize, evaluate, and graph logarithmic relationships
- Use the change of base formula and properties of logarithms to rewrite logarithmic expressions
- Use properties of logarithms to expand or condense logarithmic expressions
- Solve simple and complicated exponential and logarithmic equations

### STANDARDS

| SMP.1-8 | HSA-APR.1,2,3,4,6,7 | HSN-CN.1,2,3,7,8,9 | HSF-BF.5 | HSS-ID.6 | HSF-IF.7,8 | HSF-LE.2,3,4 | ELA-Literacy.WHST.11-12.2 | ELA-Literacy.WHST.11-12.3 | ELA-Literacy.WHST.11-12.4 | ELA-Literacy.WHST.11-12.5 | ELA-Literacy.WHST.11-12.6 | ELA-Literacy.WHST.11-12.8 | ELA-Literacy.WHST.11-12.10 |
## UNIT: Trigonometry

<table>
<thead>
<tr>
<th>ENDURING UNDERSTANDINGS</th>
<th>ESSENTIAL QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trigonometric functions describe triangular and circular relationships.</td>
<td>• How did right triangle trigonometry develop and what is its purpose?</td>
</tr>
<tr>
<td>• There are fixed relationships between the angles and side lengths of a right triangle.</td>
<td>• How does the unit circle relate to right triangle trigonometry?</td>
</tr>
<tr>
<td>• Trigonometry can be used to determine indirect measurements of lengths and angles to solve a variety of problems</td>
<td>• In what setting can knowledge of triangles, trigonometry and ratios be applied?</td>
</tr>
<tr>
<td>• The periodic nature of trigonometric functions affects their analytic values and graphical representation.</td>
<td>• Why are some values undefined for certain trigonometric functions?</td>
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<tr>
<td></td>
<td>• How do you relate algebraic procedures and geometric concepts?</td>
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<td></td>
<td>• How can sine and cosine be defined in terms of any circle?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KNOWLEDGE</th>
<th>SKILLS</th>
<th>STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Students will know:</strong></td>
<td><strong>Students will be able to:</strong></td>
<td>SMP.1-8</td>
</tr>
<tr>
<td>• That angles can be measured in both degrees and radians</td>
<td>• Identify the unit circle and describe its relationship to real numbers</td>
<td>HSG-C.5</td>
</tr>
<tr>
<td>• That trigonometric functions can be used to model and solve real world problems</td>
<td>• Convert angle measures between degrees and radians</td>
<td>HSG-SRT.8,9</td>
</tr>
<tr>
<td>• That reference angles and special right triangles can be used to evaluate trigonometric ratios of any angle</td>
<td>• Evaluate trigonometric functions with or without a calculator</td>
<td>HSF-TF.1-7</td>
</tr>
<tr>
<td>• That indirect measurement can be used to estimate distances that cannot be measured directly.</td>
<td>• Use the fundamental trigonometric identities</td>
<td>HSF-LE.2</td>
</tr>
<tr>
<td>• That the periodic nature of the trigonometric functions is mirrored in their graphical representation</td>
<td>• Sketch a graph of Sine and Cosine trigonometric functions and their transformations</td>
<td>ELA-Literacy.WHST.11-12.2</td>
</tr>
<tr>
<td></td>
<td>• Find and sketch coterminal, complementary, and supplementary angles</td>
<td>ELA-Literacy.WHST.11-12.3</td>
</tr>
<tr>
<td></td>
<td>• Find the area of a sector of a circle</td>
<td>ELA-Literacy.WHST.11-12.4</td>
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<td>ELA-Literacy.WHST.11-12.5</td>
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<td>ELA-Literacy.WHST.11-12.6</td>
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<td>ELA-Literacy.WHST.11-12.8</td>
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</tbody>
</table>
# UNIT: Analytic Trigonometry

## Enduring Understandings
- Geometric theorems and trigonometric relationships may be used to solve a variety of problems
- All trigonometric functions are related to each other

## Essential Questions
- What type of real world problem would use trigonometry to model and solve it?
- What is the best approach when trying to verify a trigonometric identity?

## Knowledge

**Students will know:**
- That fundamental trigonometric identities exist and can be used to build and prove new identities
- That trigonometric identities can be verified both algebraically and graphically
- That standard algebraic techniques can be used to solve trigonometric equations (collecting like terms, factoring, and square roots)
- That trigonometric equations can be over a specified domain

## Skills

**Students will be able to:**
- Use the fundamental trigonometric identities to evaluate trigonometric functions, simplify trigonometric expressions, and rewrite trigonometric expressions
- Verify trigonometric identities
- Utilize standard and advanced algebraic techniques to solve trigonometric expressions
- Use the sum and difference formulas to evaluate trigonometric functions, verify identities, and solve trigonometric equations
- Use multiple angle formulas to rewrite and evaluate trigonometric functions

## Standards

- SMP.1-8
- HSG-C.5
- HSG-SRT.6,7
- HSF-TF.8,9
- HSF-LE.2
- ELA-Literacy.WHST.11-12.2
- ELA-Literacy.WHST.11-12.3
- ELA-Literacy.WHST.11-12.4
- ELA-Literacy.WHST.11-12.5
- ELA-Literacy.WHST.11-12.6
- ELA-Literacy.WHST.11-12.8
- ELA-Literacy.WHST.11-12.10
<table>
<thead>
<tr>
<th><strong>SUGGESTED TIME ALLOTMENT</strong></th>
<th><strong>CONTENT-UNIT OF STUDY</strong></th>
<th><strong>SUPPLEMENTAL UNIT RESOURCES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 weeks</td>
<td>Complete Prerequisite Sections (P1 – P5) Review and Assessment</td>
<td>Intro To Graphing Calculator Graphic Organizers</td>
</tr>
<tr>
<td>4 weeks</td>
<td>Chapter 1: Equations, Inequalities, and Mathematical Models Chapter 1 review and test</td>
<td>Capstone Activities Word Problem Think Pair Share</td>
</tr>
<tr>
<td>6 weeks</td>
<td>Chapter 2: Functions and Their Graphs Chapter 2 review and test</td>
<td>Graphing Calculator Activities CBR(Computer Based Ranger)Activities PowerPoint Presentations</td>
</tr>
<tr>
<td>4 weeks</td>
<td>Chapter 3: Polynomial Functions Chapter 3 review and test</td>
<td>Graphing Calculator Activities</td>
</tr>
<tr>
<td>3 weeks</td>
<td>Chapter 4: Rational Functions Chapter 4 review and test</td>
<td>Graphing Calculator Activities</td>
</tr>
<tr>
<td>4 weeks</td>
<td>Chapter 5: Exponential and Logarithmic Functions Chapter 5 review and test</td>
<td>Graphing Calculator Activities M&amp;M Lab</td>
</tr>
<tr>
<td>9 weeks</td>
<td>Chapter 6: Trigonometry Chapter 6 review and test</td>
<td>Interactive Notebook Pages Unit Circle Analysis Trig Function Chart</td>
</tr>
<tr>
<td>6 weeks</td>
<td>Chapter 7: Analytic Trigonometry Chapter 7 review and test</td>
<td>Hands on Proof Activity Capstone Activities</td>
</tr>
<tr>
<td>2 weeks</td>
<td>Quarterly Reviews and Assessments</td>
<td>Quarterly Reviews and Assessments</td>
</tr>
</tbody>
</table>
APPENDIX A

RESOURCES:

TEXT AND ELECTRONIC TEXT: Algebra and Trigonometry


WEB ADDRESSES

www.thinkcentral.com
www.classzone.com
www.mathgraphs.com

SOFTWARE NAMES:
APPENDIX B
ASSESSMENT:

Assessments:

- Quiz
- Test
- Daily Warm-Ups
- Homework
- Desmos.com
- TI-84 Graphing Calculator Lab Activities
- Online Resources
APPENDIX C
SAMPLE INTERDISCIPLINARY UNITS

Interdisciplinary units to follow as curriculum is implemented.
APPENDIX D
Placement Criteria

It is assumed that the Algebra III Trigonometry student will have successfully completed Algebra 2A or completed Algebra 2B with a high success rate in that course. Students will be placed here based on the recommendation of their Algebra 2 teacher.