

**PASSAIC COUNTY TECHNICAL INSTITUTE**

**Advanced Algebra/Trigonometry**

July 2011

# **Advanced Algebra/Trigonometry**

## **COURSE DESCRIPTION**

This course is designed to follow Algebra 2, providing students with a fourth year of college preparatory mathematics. It is an overview of many algebraic topics with an introduction to trigonometry and real-world applications. Some topics of study are equations, inequalities, functions, exponents, logarithms, conic sections, and trigonometry with applications. This course is not as rigorous as Pre-Calculus, which covers similar content.

## **COURSE OBJECTIVES/OUTLINE**

### **I. EQUATIONS AND INEQUALITIES**

1. Sketch graphs of equations by point plotting. (A-REI10)
2. Find the x- and y-intercepts of graphs of equations. (F-IF7a)
3. Find equations and sketch graphs of circles. (G-GPE1)
4. Solve linear equations in one variable. (A-REI3)
5. Write and use linear models to solve real-life problems. (A-CED2)
6. Solve quadratic functions by factoring, extracting square roots, completing the square, and the Quadratic Formula. (A-REI4)
7. Use quadratic equations to model and solve real-life problems. (A-CED1, N-CN7)
8. Use the imaginary unit  $i$  to write complex numbers. (N-CN1)
9. Write, add, subtract, and multiply complex numbers. (N-CN2)
10. Use complex conjugates to divide complex numbers. (N-CN3)
11. Solve polynomial equations of degree three or higher. (A-APR3)
12. Solve equations involving radicals, fractions, and absolute values. (A-REI2)
13. Use polynomial and radical equations to model and solve real-life problems. A-CED1
14. Solve and sketch the solutions of linear, absolute values, polynomial, and rational inequalities in one variable. (A-REI3,12)

## II. FUNCTIONS AND THEIR GRAPHS

1. Write Slope-Intercept and Point-Slope forms of lines. (A-CED2)
2. Use slope to identify parallel and perpendicular lines. (G-GPE5)
3. Determine if a relation is a function by definition and using the Vertical Line Test. (F-IF1)
4. Use functional notation and evaluate functions. (F-IF2)
5. Find domain and range of functions. (F-IF1)
6. Evaluate difference quotients. (F-BF1c)
7. Use functions to model and solve real-life problems. (F-LE1)
8. Find the zeros graphically of a function. (F-IF7)
9. Determine intervals on which functions are increasing, decreasing and constant. (F-IF4)
10. Determine graphically the relative minimum and relative maximum values of functions. (A-SSE3b; F-IF4, 7a)
11. Identify even and odd functions. (F-BF3)
12. Identify and graph parent functions. (F-IF7)
13. Use vertical and horizontal shifts, reflections, and nonrigid transformations to sketch the graphs of functions. (F-BF3)
14. Add, subtract, multiply and divide functions. (F-BF1b)
15. Find compositions of functions. (F-BF1c)
16. Use combinations and compositions of functions to model and solve real-life problems.
17. Find inverse functions. (F-BF4, 5)
18. Use the Horizontal Line Test to determine if a function is one-to-one. (F-BF4a)
19. Verify algebraically and graphically that functions are inverses of one another. (F-BF4, 5)
20. Use the Horizontal Line Test to determine if a function is one-to-one. (F-BF4a)

## III. POLYNOMIAL FUNCTIONS

1. Write quadratic function in standard form. (A-REI4a)
2. Find the minimum and maximum algebraically of a quadratic function.
3. Use the Leading Coefficient Test to determine end behavior of a polynomial function.
4. Use long division and synthetic division to divide polynomials. (A-APR6)
5. Use the Remainder and Factor Theorems. (A-APR2)
6. Use the Fundamental Theorem of Algebra to determine the number of zeros of polynomial functions. (N-CN7, 9, A-REI4b)
7. Use the Rational Zero Test to determine possible zeros of polynomial functions. (F-IF8a)
8. Find conjugate pairs of complex zeros. (N-CN3)
9. Find zeros of polynomials by factoring. (A-APR3)
10. Use Descartes's Rule of Signs and Upper and Lower Bound Rules to find zeros of polynomials. (F-IF5)
11. Construct scatter plots from data points. (S-ID6)
12. Write mathematical models for direct, inverse, and joint variation. (A-CED2)

#### IV. RATIONAL FUNCTIONS AND CONICS

1. Find domains of rational functions. (F-IF5)
2. Find vertical, horizontal, and slant asymptotes to sketch graphs of rational functions. (F-IF7d)
3. Use rational functions to model and solve real-life problems. (F-BF1)
4. Recognize, graph, and write equations of the four basic conic sections. (G-GPE1-3)
5. Identify the translations from the equations of conics. (G-GPE1-3)
6. Write and graph equation of translated conics. (G-GPE1-3)

#### V. EXPONENTIAL AND LOGARITHMIC FUNCTIONS.

1. Recognize, evaluate and graph exponential functions with base  $a$  and  $e$ . (F-LE1 F-IF7e)
2. Recognize, evaluate and graph logarithmic functions with base  $a$  and  $e$ . (F-LE1 F-IF7e)
3. Rewrite logarithms with different bases. (F-LE4)
4. Use properties of logarithms to evaluate or rewrite logarithmic expressions. (F-IF8b)
5. Use properties of logarithms to expand or condense logarithmic expressions. (F-IF8b)
6. Solve exponential and logarithmic equations. (F-BF5)
7. Recognize and use the five most common types of exponential and logarithmic models to solve real - life problems.(F-LE1c,4)
8. Use scatter plots and a graphing utility to find the model that best fits a set of data. (S-ID6a, b)

#### VI. TRIGONOMETRY

1. Describe angles and convert between radian and degree measures. (F-TF1)
2. Use angles to model and solve real-life problems. (G-SRT8)
3. Evaluate trigonometric functions of acute angles. (G-SRT7)
4. Use fundamental trigonometric identities. (F-TF8)
5. Use trigonometric functions to model and solve real-life problems. (G-SRT7,8)
6. Sketch the graphs of basic sine, cosine and tangent functions. (F-IF7,F-TF5)
7. Solve real-life problems involving right triangles. (G-SRT8)

#### VII. SYSTEMS OF EQUATIONS AND INEQUALITIES

1. Solve systems of nonlinear equations using the method of substitution. (A-REI7)
2. Solve systems of linear equations in two or more variables using the substitution, elimination, and graphing methods. (A-REI6)
3. Solve and graph systems of inequalities. ((A-REI12)
4. Use systems of linear equations and inequalities to model and solve real-life problems. (A-REI6)

#### VIII. MATRICES AND DETERMINANTS

1. Write and perform elementary row operations on matrices. (N-VM6)
2. Use matrices to solve systems of linear equations. (A-REI9)
3. Add, subtract, and multiply matrices. (N-VM7,8)
4. Find the inverse of a matrix. (A-REI9)
5. Find the determinant of a matrix. (N-VM12)
6. Use matrices to solve real-life problems. (N-VM6)

## **METHODS OF STUDENT EVALUATION**

The student will be evaluated using the following criteria:

1. Test
2. Quizzes
3. Homework
4. Class participation
5. Notebook
6. Projects
7. Journals
8. Presentations

## **TEXTBOOKS, INSTRUCTIONAL & SOFTWARE MATERIALS**

Brooks/Cole, Algebra and Trigonometry, Eighth Edition by Ron Larson

ISBN 978-1-4390-4847-4

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Includes teacher's edition, resources, test generator

TI-83, TI-84 & TI-Nspire graphing calculator

Various computer programs including Power Point, Sketchpad, TI-Nspire Emulator

## **INSTRUCTIONAL STRATEGIES**

Various teaching methods are used in this course. Instruction will be given using class notes, exercises from the book, prepared worksheets and a graphing calculator. Classroom demonstrations of concepts will be included. Group activities, cooperative learning, and differentiated instructions will be used. Alternate assessments will be comprised of partner, group and class grades.

## SCOPE AND SEQUENCE

**KEY:** I = INTRODUCED    D = DEVELOPED IN DEPTH    R = REINFORCED

SKILL TO BE LEARNED	9	10	11	12
Write and graph linear equations.	I	D	D	R
Solve equations involving radicals, fractions, and absolute values.	I	D	D	R
Solve and sketch the solutions of linear, absolute values, polynomial, and rational inequalities in one variable.	I	D	D	R
Evaluate functions and find their domain and range.	I	D	D	R
Identify and graph shifts, reflections, and non-rigid transformations of functions.	I	D	D	R
Find arithmetic combinations and compositions of functions.	I	D	D	R
Find inverse functions.		I	D	D
Use scatter plots to find models for data.	I	D	D	R
Determine the zeros and sketch polynomial functions.	I	D	D	R
Use polynomial functions to model and solve real-life problems.	I	D	D	D
Perform operations with complex numbers and plot complex numbers in complex plane.		I	D	R
Determine the range, find the asymptotes, and sketch the graphs of rational functions.		I	D	D
Recognize, graph, and write equations of the four basic conic sections.		I	D	D
Recognize, evaluate, and graph exponential and logarithmic functions.		I	D	D
Rewrite logarithms with different bases.		I	D	D
Use properties of logarithms to evaluate, rewrite, expand, or condense logarithmic equations.		I	D	D
Solve exponential and logarithmic equations.		I	D	D
Solve real-life problems involving exponential and logarithmic functions.		I	D	D
Evaluate trigonometric functions of acute angles.	I	I	D	D
Use fundamental trigonometric identities.		I	D	D
Sketch graphs of sine, cosine, and tangent functions.		I	D	D
Use trigonometric functions to model and solve real-life problems.	I	I	D	D
Solve systems of linear equations in two or more variables using the substitution, elimination, and graphing methods.	I	D	D	R
Solve and graph systems of inequalities.	I	D	D	R
Use systems of linear equations and inequalities to model and solve real-life problems.	I	D	D	R
Use matrices to solve systems of linear equations.		I	D	D
Add, subtract, and multiply matrices.		I	D	D
Find the inverse and the determinant of a matrix.		I	D	D
Use matrices to solve real-life problems.		I	D	D



## PACING GUIDE

MARKING PERIOD	CONTENT
<b>1</b> Review Topics	<p><b>EQUATIONS, INEQUALITIES, AND MATHEMATICAL MODELING</b></p> <ul style="list-style-type: none"> <li>1.1 Graphs of Equations</li> <li>1.2 Linear Equations in One Variable</li> <li>1.3 Modeling with Linear Equations</li> <li>1.4 Quadratic Equations and Applications</li> <li>1.5 Complex Numbers</li> <li>1.6 Other Types of Equations</li> <li>1.7 Linear Inequalities in One Variable</li> <li>1.8 Other Types of Inequalities</li> </ul> <p><b>FUNCTIONS AND THEIR GRAPHS</b></p> <ul style="list-style-type: none"> <li>2.1 Linear Equations in Two Variables</li> <li>2.2 Functions</li> <li>2.3 Analyzing Graphs of Functions</li> <li>2.4 A Library of Parent Functions</li> <li>2.5 Transformations of Functions</li> <li>2.6 Combination of Functions: Composite Functions</li> <li>2.7 Inverse Functions</li> </ul> <p><b>POLYNOMIAL FUNCTIONS</b></p> <ul style="list-style-type: none"> <li>3.1 Quadratic Functions and Models</li> <li>3.2 Polynomial Functions of Higher Degree</li> <li>3.3 Polynomial and Synthetic Division</li> <li>3.4 Zeros of Polynomial Functions</li> <li>3.5 Mathematical Modeling and Variation</li> </ul>
<b>2</b>	<p><b>RATIONAL FUNCTIONS AND CONICS</b></p> <ul style="list-style-type: none"> <li>4.1 Rational Functions and Asymptotes</li> <li>4.2 Graphs of Rational Functions</li> <li>4.3 Conics</li> <li>4.4 Translations of Conics</li> </ul> <p><b>EXPONENTIAL AND LOGARITHMIC FUNCTIONS</b></p> <ul style="list-style-type: none"> <li>5.1 Exponential Functions and Their Graphs</li> <li>5.2 Logarithmic Functions and Their Graphs</li> <li>5.3 Properties of Logarithms</li> <li>5.4 Exponential and Logarithmic Equations</li> <li>5.5 Exponential and Logarithmic Models</li> </ul>
<b>3</b>	<p><b>TRIGONOMETRY</b></p> <ul style="list-style-type: none"> <li>6.1 Angles and Their Measures</li> <li>6.2 Right Triangle Trigonometry</li> <li>6.3 Trigonometric Functions of Any Angle</li> <li>6.4 Graphs of Sine and Cosine Functions</li> <li>6.5 Graphs of Other Trigonometric Functions</li> <li>6.7 Applications and Models</li> </ul>
<b>4</b>	<p><b>Systems of Equations and Inequalities</b></p> <ul style="list-style-type: none"> <li>9.1 Linear and Nonlinear Systems of Equations</li> <li>9.2 Two-Variable Linear Systems</li> <li>9.3 Multivariable Linear Systems</li> <li>9.4 Partial Fractions</li> <li>9.5 Systems of Inequalities</li> <li>9.6 Linear Programming</li> </ul> <p><b>Matrices and Determinants</b></p> <ul style="list-style-type: none"> <li>10.1 Matrices and Systems of Equations</li> <li>10.2 Operations with Matrices</li> <li>10.3 The Inverse of a Square Matrix</li> <li>10.4 The Determinant of a Square Matrix</li> <li>10.5 Applications of Matrices and Determinants</li> </ul>

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## ADVANCED ALGEBRA/TRIGONOMETRY

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### PROFICIENCIES

1. Write and graph linear equations.
2. Solve equations involving radicals, fractions, and absolute values.
3. Solve and sketch the solutions of linear, absolute values, polynomial, and rational inequalities in one variable.
4. Evaluate functions and find their domain and range.
5. Identify and graph shifts, reflections, and non-rigid transformations of functions.
6. Find arithmetic combinations and compositions of functions.
7. Find inverse functions.
8. Use scatter plots to find models for data.
9. Determine the zeros and sketch polynomial functions.
10. Use polynomial functions to model and solve real-life problems.
11. Perform operations with complex numbers and plot complex numbers in the complex plane.
12. Determine the range, find the asymptotes, and sketch the graphs of rational functions.
13. Recognize, graph, and write equations of the four basic conic sections.
14. Recognize, evaluate, and graph exponential and logarithmic functions.
15. Rewrite logarithms with different bases.
16. Use properties of logarithms to evaluate, rewrite, expand, or condense logarithmic equations.
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24. Solve and graph systems of inequalities.
25. Use systems of linear equations and inequalities to model and solve real-life problems.
26. Use systems of linear equations and inequalities to model and solve real-life problems.
27. Use matrices to solve systems of linear equations.
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