Hillside Township School District

Mathematics Department Algebra 2 CP

Grades 10 and 11

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District Mission Statement

The mission of the Hillside Public Schools is to ensure that all students at all grade levels achieve the New Jersey Core Curriculum Content Standards and make connections to real-world success. We are committed to strong parent-community school partnerships, providing a safe, engaging, and effective learning environment, and supporting a comprehensive system of academic and developmental support that meets the unique needs of each individual.

Academic Area Overview

The Hillside Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the twenty-first century. We believe that a strong foundation in mathematics provides our students with the necessary skills to become competent problem solvers and pursue math intensive careers in the sciences and engineering.

A strong foundation in mathematics is grounded in exploration and rigor. Children are actively engaged in learning as they model real-world situations to construct their own knowledge of how math principles can be applied to solve everyday problems. They have ample opportunities to manipulate materials in ways that are developmentally appropriate to their age. They work in an environment that encourages them to take risks, think critically, and make models, note patterns and anomalies in those patterns. Children are encouraged to ask questions and engage in dialogue that will lead to uncovering the math that is being learned. Facts and procedures are important to the study of mathematics. In addition to learning the common facts and procedures that lead efficient solutions of math problems, children will also have the opportunity to explore the "why" so that they can begin to understand that math is relevant to the world.

Our program provides teachers with resources both online and in print that incorporates the use of technology to help students reach the level of rigor that is outlined in the Common Core State Standards for Mathematics. Textbooks and materials have been aligned to the standards and teachers are trained on an ongoing basis to utilize the resources effectively and to implement research-based strategies in the classroom.

Affirmative Action Statement

Equality and Equity in Curriculum

The Hillside Township School District ensures that the district's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and addresses the elimination of discrimination and the achievement gap, as identified by underperforming school-level AYP reports for State assessment, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional 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 Math Department Lesson Plan Template

Lesson Information

Lesson Name:	
Unit:	 _
Date:	

Lesson Data

1.	Essential Questions &
	Enduring Understanding

2. CCSS:

3. Knowledge:

4. Skills:



7. Homework:

(+) Indicates content that is considered beyo

Pacing Chart

UNIT 1: Quadratic Functions/Equations and Complex Numbers

 ENDURING UNDERSTANDINGS ✓ The quadratic formula can be applied to any quadratic equation including those that cannot be factored ✓ The real solutions of a quadratic equation are the x intercepts of the graph ✓ The solutions of polynomial equations can be extended to include the set of all complex numbers. 		 ESSENTIAL QUESTIONS ✓ Why are complex numbers important? ✓ How does an understanding of operations on numbers help in better understanding more complex algebraic expressions or operations? ✓ How can you solve a quadratic function to find its zeros?
CCSS	KNOWLEDGE	SKILLS
Quadratic	Students will know that:	Students will be able to:
Functions/Equa	• The relation between the real solutions to a quadratic function and	• Solve for real solutions of a quadratic functions using a variety of
tions and	its x-intercepts.	methods.
Complex	• Quadratic functions can be solved by factoring, completing the	• Recognize a vertex and x intercepts from a quadratic function and its
Numbers	square and use of the quadratic formula.	graph.
	• The advantages of a quadratic equation in vertex form vs. standard	• Derive the quadratic formula from the standard form of the quadratic
	form.	equation by completing the square method.
N.CN.A.1.	Students will know that:	Students will be able to:
N.CN.A.2.		
N.CN.C.7.	• There is a complex number i such that $i^2 = -1$, and every	• Use the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

A.REI.B.4.	 complex number has the form a + bi where a and b are real numbers. (+) The <u>Fundamental Theorem of Algebra</u> states that the number of complex solutions to a polynomial equation is equal to the degree of the polynomial. Completing the square, factoring, or the quadratic formula can be used to solve quadratic equations with complex solutions. 	 (+) Extend polynomial identities to the complex numbers. o For example, x² + 4 can be written as (x+2i)(x-2i) (+) Show that The Fundamental Theorem of Algebra is true for quadratic polynomials. Solve quadratic equations with real coefficients that have complex solutions. o Recognize when the quadratic formula yields complex solutions and write them as a±bi Solve quadratic equations by inspection (e.g. for x² = 49), taking square roots, completing the square, the quadratic formula and factoring as appropriate to the initial form of the equation. Create quadratic equations and inequalities in one variable and use them to solve problems
Systems of Linear & Quadratic Functions A.REI.C.7.	• Solutions of linear systems contain different function types.	 solve a system containing one linear equation and one quadratic equation algebraically. graph a system containing one linear equation and one quadratic equation to determine a solution.
Geometric Sequence & Series	• Patterns involving a constant ratio can be modeled with algebra both recursively as well as with an explicit formula.	• Write a geometric sequence both recursively and with an explicit formula, use them to model situations, and translate between forms.
F.LE.A.2 F.BF.A.2. F.LE.B.5	• The formula for the sum of a finite geometric series is: $S_n = \frac{g_1(r^n - 1)}{r - 1}$	 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), Use the formula to solve problems. For example, calculate mortgage payments.
Radical & Rational Expressions	• A rational exponent on an expression has an equivalent radical	• Explain how the definition of rational exponents follows from extending

N.RN.A.1. N.RN.A.2.	 form. Either form can be utilized to simplify expressions and/or solve equations. O An understanding of the basic rules for exponents can be used to simplify expressions involving rational exponents or radicals. 	 the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. o For (5^{1/3})³ = 5^{(1/3)/3} to be true, (5^{1/3})³ must equal 5 Rewrite expressions involving radicals and rational exponents using the properties of exponents.
A.SSE.B.3.	• Some behaviors in the world cannot be modeled with the types of	 Students will be able to: Interpret the parameters in an exponential function in terms of the parameters
F.IF.C.8.	functions learned in prior units. These functions grow or decay exponentially. O Exponential functions are in the form: $f(x) = ab^x$ where $b \neq 0$	 context. O For example: the various components of the compound interest formula, A = P(1+r)^t, have meaning in context. Use properties of exponents to transform expressions for exponential functions. O For example: The expressions 1.15^t can be rewritten as (1.15^{1/2})^{12t} ≈ 1.012^{12t} to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. Write a function defined by an expression in different but equivalent forms to reveal and explain properties of the function. O For example: The properties of exponents can be used to manipulate exponential functions revealing whether they represent exponential growth or decay.
Logarithms F.LE.A.4	• The solution to an exponential equation can be found using the properties of logarithms. • The solution to $ab^x = d$ can be represented as $x = \log_b \left(\frac{d}{a}\right)$	 Use understanding of the relationship between exponential functions and logarithms to solve exponential equations. <i>Evaluate the logarithm using technology</i>. Create equations in one variable and use them to solve problems involving exponential functions.
	$x = \log_{b} \left(\frac{d}{a} \right)$ o a and d are numbers and the base, b is 2, 10, or e.	involving exponential functions.

Pacing Chart

UNIT 1: Quadratic Functions/Equations and Complex Numbers

	Unit Name	Topics in Curriculum	Time Frame
	<u>UNIT 1:</u> <u>Quadratic</u> <u>Functions/Equa</u> <u>tions and</u> <u>Complex</u> <u>Numbers</u>	Quadratic Functions and Transformation, Standard Form of a Quadratic Function Modeling with Quadratic Functions, Factoring Quadratic Expressions Quadratic Equations, Completing the Square, The Quadratic Formula Complex Numbers, Systems of Equations, Sequence & Series, Radical & Rational Expressions, Exponentials & Logarithms	September - Mid-November
TIME FRAME	ΤΟΡΙϹ	SUGGESTED PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS

Quadratic	Examples and visuals of linear programming:	Text Sections: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7
Functions/equa	http://www.purplemath.com/modules/linprog3.htm	
tions		
	Linear and Nonlinear Functions	
	http://www.glencoe.com/sec/math/prealg/prealg05/study_guide/pdfs/prealg_pssg_G	Teacher resources have puzzles, games, activities,
	<u>112.pdf</u>	projects, & enrichment
	YouTube video comparing linear and nonlinear functions:	
	http://www.youtube.com/watch?v=_850e1mEiD4	www.khanacadamy.com
		www.khanacadenry.com
	Discusses the reasonableness of the domain:	www.poweralgebra.com
	http://www.phschool.com/atschool/academy123/english/academy123 content/wl-	<u>1</u>
	book-demo/ph-147s.html	
	Average rate of change:	exchange.smarttech.com
	http://www.mesacc.edu/~marfv02121/readings/average/index.html	
Complex	Helpful complex number information:	Text Sections: 4.8
Numbers	http://www.mathsisfun.com/numbers/complex-numbers.html	
		Teacher resources have puzzles, games, activities,
	Questions and videos related to complex numbers:	projects, & enrichment
	https://www.khanacademy.org/math/algebra2/complex-numbers-a2	
		www.khanacademy.com
		www.noworalgebra.com
		exchange.smarttech.com
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Pacing Chart

UNIT 2: Polynomials and Polynomial Functions

 ✓ The solucomplex ✓ An undecan be a ✓ Polynon mathema 	ENDURING UNDERSTANDINGS ations of polynomial equations can be extended to include the set of all a numbers. Arrstanding of polynomial functions allows for generalization to be made that pplied to previously studied functions. Anial functions allow us to model real world applications found in various atical disciplines.	ESSENTIAL QUESTIONS ✓ How does an understanding of operations on numbers help in better understanding more complex algebraic expressions or operations? ✓ When does it make sense to use a polynomial function to model a situation?
CCSS Polynomial Expressions &	KNOWLEDGE Students will know that:	SKILLS Students will be able to:
Operations A.SSE.A.2. A.APR.B.3.	• A <u>Polynomial</u> is an expression consisting of the sum of two or more terms each of which is the product of a constant and a variable raised to a whole number exponent.	 Identify parts of an expression, such as terms, factors, and coefficients. Interpret the parts of an algebraic expression that represent a problem in context. O Apply this to complicated expressions by viewing one or more of their parts as a single entity.
F.IF.C.7. A.APR.D.6. F.IF.B.4 F.IF.B.6. A.APR.B.3.	 Polynomials form a system that is closed under the operations of addition, subtraction, and multiplication. 	 For example, interpret as the product of P and a factor not depending on P. Add, subtract, and multiply polynomials. Use the structure of an expression to identify ways to rewrite it. <i>Por example, see</i> x⁴ - y⁴ as (x²)² - (y²)², thus





¹³

A.REI.A.2.	 Inverse relationships exist between roots and powers. 	• use the inverse relationship between roots and powers when solving
A.REI.A.1.	• Extraneous solutions do not result in true statements.	radical equations.
		• identify any extraneous solutions.
A.CLD.A.I		• solve simple rational equations in one variable (degree of numerators
		and denominator is not greater than 2).
		• write simple rational equations in one variable and use the rational
		equation to solve problems.
E IE C 7	• Logarithmic functions	• graph logarithmic functions having base 2, 10 or elusing technology for
F.IF.C.7.	Logarithmic functions	• graph logarithmic functions having base 2, 10 or e, using technology for more complicated cases.
F.IF.C.7.	• Logarithmic functions	 graph logarithmic functions having base 2, 10 or e, using technology for more complicated cases. show intercents and end behavior of logarithmic functions.
F.IF.C.7.	Logarithmic functions	 graph logarithmic functions having base 2, 10 or e, using technology for more complicated cases. show intercepts and end behavior of logarithmic functions.
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A.REI.D.11	 Solutions to complex systems of nonlinear functions can be approximated graphically 	 find the solution to f(x)=g(x) approximately, e.g., using technology to graph the functions; include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. find the solution to f(x)=g(x) approximately, e.g., using technology to 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.
	Critical Vocabulary: Real Numbers , Terms, Expression, Coefficient, Consta	nt, Polynomial, Degree, Closed, Factor, Remainder, End Behavior, Equation,
	Zeros, Closed under an operation,	
	Unit 2 Common Assessment / Co	ommon Midterm Exam:

Pacing Chart UNIT 2: <u>Polynomials and Polynomial Functions</u>

	Unit Name	Topics in Curriculum	Time Frame
	<u>UNIT 2:</u> <u>Polynomials</u> <u>and Polynomial</u> <u>Functions</u>	Polynomial Functions, Linear Factors and Zeros Solving Polynomial Equations, Dividing Polynomials Theorems About Roots of Polynomial Equations The Fundamental Theorem of Algebra, Extraneous Solutions, Function Behavior, Graphs of Nonlinear Functions	Late November - Late January
TIME FRAME	ΤΟΡΙϹ	SUGGESTED PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
	Polynomial Expressions & Operations	Online calculators and solvers http://www.mathportal.org/calculators.php	Text Sections: 5.3, 5.4 Teacher resources have puzzles, games, activities, projects, & enrichment <u>www.khanacademy.com</u> <u>www.poweralgebra.com</u> exchange.smarttech.com
	Solving Polynomial Equations	Online calculator to find the roots of a polynomial <u>http://easycalculation.com/algebra/algebra.php</u> Online polynomial long division calculator <u>http://calc101.com/webMathematica/long-divide.jsp</u> Online calculators and solvers <u>http://www.mathportal.org/calculators.php</u>	Text Sections: 5.1, 5.2, 5.5 - 5.9 Teacher resources have puzzles, games, activities, projects, & enrichment <u>www.khanacademy.com</u> <u>www.poweralgebra.com</u> exchange.smarttech.com

UNIT 3: Trigonomeric Functions

	ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	
✓ Definit addres	ng trigonometric functions based on the unit circle provides a means of sing situations that cannot be modeled with the tools of geometry.	✓ Why are radian measures used rather than degree measures in working with trigonometric functions and their applications?	
√ An und trigono	lerstanding of coordinate geometry and functions are essential to the study of metry.	✓ What prior knowledge is needed for understanding trigonometric functions and its uses?	
√ Trigon	ometric functions can be applied to areas of study involving periodic behavior.	\checkmark How can you model periodic behavior?	
CCSS	KNOWLEDGE	SKILLS	
Unit Circle, Trigonometric Functions & Their Graphs	Students will know that: • The Pythagorean Theorem states that the sum of the square of each leg of a right triangle equals the square of the hypotenuse. • $a^2 + b^2 = c^2$	 Students will be able to: Use prior right triangle trigonometry knowledge from Geometry class to compute <u>exact</u> values of basic trigonometric functions without the use of a calculator. 	

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UNIT 3: Trigonometric Functions

	Unit Name	Topics in Curriculum	Time Frame
	<u>UNIT 3:</u> <u>Trigonometric</u> <u>Functions</u>	Angles and the unit circle Radian Measure, Periodic functions Sin, Cos functions and graphs Trigonometric Identities, Trigonometric Inverses, Right triangles and trigonometric ratios	February - Mid-March
TIME FRAME	ΤΟΡΙϹ	SUGGESTED PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
	Unit Circle, Trigonometric Functions & Their Graphs	In Class Activities: Pg 622 Rotations, Sines and Cosines, Pg 646 Graphing Projects: Pg 665 # 6 Area Under Graph Of Sine Curve Graphs From The Unit Circle (In class project) <u>http://illuminations.nctm.org/LessonDetail.aspx?id=L785</u> String Along with Radians (<u>http://www.nsa.gov/academia/_files/collected_learning/high_school/trigonometry/s</u> <u>tringing_along_radians.pdf</u> Period and Frequency of Sine and Cosine (graphing calculator) <u>http://algebralab.org/lessons/lesson.aspx?file=Trigonometry_TrigPeriodFreq.xml</u>	Text Sections: 13.1 - 13.5, 13.8, 14.1 - 14.3 Teacher resources have puzzles, games, activities, projects, & enrichment www.khanacademy.com www.poweralgebra.com exchange.smarttech.com

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	Trigonometric Graphing	
	http://illuminations.nctm.org/ActivityDetail.aspx?ID=174	
	Links to various trigonometric activities http://www.ies.co.jp/math/products/trig/menu.html	
	Ferris Wheel Activity http://jwilson.coe.uga.edu/EMT669/Student.Folders/Jeon.Kyungsoon/IU/trig/F.whe el.html	

UNIT 4: Probability and Statistics

	ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
\checkmark	Normal distributions model many common, natural occurring phenomena.	✓ Why do you think measurements with a bell-shaped distribution are so common in the world?
\checkmark	The way that data is collected determines the scope and nature of the conclusions that can be drawn from the data.	✓ What are the purposes of and differences among sample surveys, experiments, and observational studies?
\checkmark	Good statistical information about a population can be attained by studying a sample of the population.	✓ How can you ensure that a sample of a population is good enough to represent the population from which it was taken?
\checkmark	(+) Probability models can be used to analyze situations and make fair decisions.	✓ (+) How does the theoretical probability of an even occurring relate to the occurrence of the event?

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		\checkmark (+) How can probability be used to make decisions fairly?
CCSS	KNOWLEDGE	SKILLS
Statistical	Students will know that:	Students will be able to:
Methods		
S.ID.A.4.	• Statistics is a collection of procedures and principles for gathering data and analyzing information in order to help people make decisions when faced with uncertainty.	• Make inferences about population parameters based on a random sample from that population.
	 The mean is the average of the data and the standard deviation is a measure of the spread of the data. O Mean for a sample is:	 Use the mean and standard deviation of a data set to fit it to a normal distribution Use the normal distribution to estimate population percentages. Recognize that there are data sets for which this procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Data	Students will know that:	Students will be able to:
Analysis		
	• Data can be collected in different ways:	• Make inferences and justify conclusions from sample surveys,
	o Sample surveys	experiments, and observational studies.
S.IC.A.1.	0 Experiments	• Recognize the purposes of and differences among sample surveys
S.IC.A.2.	o Simulations	experiments, and observational studies
		• Explain how randomization relates to each.
		• Use data from a sample survey to estimate a population mean or
		proportion.
		• Develop a margin of error through the use of simulation models for random sampling
		random sampling.
	• There is variability in experiments. Statistics is used as a way of	• Use data from a randomized experiment to compare two treatments
	dealing with, not eliminating, inherent randomness.	• Use simulations to decide if differences between parameters are
		• Decide if a specified model is consistent with results from a given data-
		generating process.
		• For example, a model says a spinning coin falls heads up with
		probability 0.5. Would a result of 5 tails in a row cause you to $austion$ the model?
		 Compare theoretical and experimental results to evaluate the effectiveness
		of a treatment.
		• Evaluate reports based on data.
D 1 1. '1'		
	Students will know that:	Students will be able to:
S.IC.B.3.		• (1) Extend their knowledge of probability to more complex probability
S.IC.B.5	• (+) The <u>probability</u> of an event is the chance that an event will occur and is represented by a decimal fraction or percent with a	models. For example, situations such as those involving auality control.
	value that falls between 0 and 1.	or diagnostic tests that yields both false positive and false negative results.
		• (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a
	Probability = $\frac{\text{The number of ways an event can occur}}{1}$	random number generator).
	Total number of possible outcomes	• (+) Analyze decisions and strategies using probability concepts (e.g., product testing medical testing pulling a bockey goalie at the end of a
		game)

 (+) The <u>relative frequency</u> can be used as a measure of probability when an event occurs a large number of times.
Relative Frequency = $\frac{\text{Total number of times an event actually occurs}}{\text{Total number of trials}}$
Critical Vocabulary: Statistics, Inferences, Population, Random Sampling, Mean, Standard Deviation, Normal Distribution, Data Sets, Normal Curve, Experiment, Simulation, Theoretical, Empirical, Sample Survey, Observational Study, Randomization, Margin of Error, Treatment, Parameters, (+) Fair Decisions
Unit 4 Common Assessment / Common Final Exam

Pacing Chart
UNIT 4: Probability and Statistics

	Unit Name	Topics in Curriculum	Time Frame
	UNIT 4: Probability and Statistics	Probability, Mean & Standard Deviation Data Analysis Normal Distribution	Mid-March - June
TIME FRAME	ΤΟΡΙϹ	SUGGESTED PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
	Statistical Methods	Teacher Resources: Chapter 1 Project #3, 3 websites that explain standard deviation http://www.youtube.com/watch?v=HvDqbzu0i0E http://mathworld.wolfram.com/StandardDeviation.html http://davidmlane.com/hyperstat/A16252.html Video on standard deviation http://www.youtube.com/watch?v=Y2wnchUkTyQ Normal Distribution http://stattrek.com/Lesson2/Normal.aspx	Text Sections: 11.6, 11.7, 11.8 Teacher resources have puzzles, games, activities, projects, & enrichment <u>www.khanacademy.com</u> <u>www.poweralgebra.com</u> exchange.smarttech.com

Data Analysis	Teacher Resources: Chapter 1 Project #5, Chapter 11 #1, #2, #4	Text Sections: 11.9, 11.10
	3 websites on data collection <u>http://nnlm.gov/evaluation/workshops/measuring_your_impact/DataCollectionHando</u> <u>ut.pdf</u> <u>http://dstraub.cis.gsu.edu:88/quant/4datacoll.asp</u> <u>http://www.prm.nau.edu/prm447/methods_of_data_collection_lesson.htm</u> <u>Simulations</u> <u>http://classroom.jc-schools.net/basic/math-prob.html</u>	Teacher resources have puzzles, games, activities, projects, & enrichment www.khanacademy.com www.poweralgebra.com exchange.smarttech.com
Probability	Teacher Resources: Chapter 6 Project #1, #5	Text Sections: 11.1, 11.2, 11.3, 11.4, 11.5
	Probability and experiments <u>http://www.mathsisfun.com/data/probability.html</u> Simulations & probability <u>http://classroom.jc-schools.net/basic/math-prob.html</u>	Teacher resources have puzzles, games, activities, projects, & enrichment
	Experimental probability	www.khanacademy.com
	<u>http://www.shodor.org/interactivate/activities/ExpProbability/</u> 2 websites on conditional probability/	www.poweralgebra.com
	2 websites on conditional probability http://www.mathgoodies.com/lessons/vol6/conditional.html	
	http://www.mathgoodies.com/lessons/vol6/intro_probability.html	exchange.smarttech.com