



Manhattan Center for Science and Math High School

Mathematics Department Curriculum

Content/Discipline      Pre-Calculus

<http://mcsportal.net>

Marking Period 1

Topic and Essential Question

- Unit 1** - 1. How do you divide a polynomial by another polynomial and use polynomial division to find the rational and real zeros of polynomials?  
2. How do you find all the zeros of a polynomial function?  
3. How do you divide a polynomial by another polynomial and use polynomial division to find the rational and real zeroes of polynomial?

- Unit 2** – 1. What are the important defining characteristics and representations of a function?  
2. How is the graph of a function used to determine the key elements of that function?  
3. How do we write equations and draw graphs for the simple transformations of functions?  
4. How do you find all the zeros of a polynomial function?  
5. How do you combine two functions to form a new function?  
6. What is the inverse of a function, and how do you represent it graphically and algebraically?

Unit/Topics      **Unit 1** – Polynomial and Rational Functions  
                         **Unit 2** – Functions and Their Graphs

SWBAT/Objectives      **Unit 1**

1. Students will be able to answer this question by studying long division; synthetic division and use the characteristics of polynomial functions.
2. Students will be able to answer this question by studying strategies for identifying rational, irrational, and complex zeros.
3. Students will learn how to answer this question by studying long division; synthetic division; and the characteristics of polynomial fractions

## Unit 2

1. Students will learn how to answer this question by studying relations between two variables represented in verbal, numeric graphical and algebraic form.
2. Students will learn how to answer this question by locating key points and identifying symmetry for a given function.
3. Students will learn how to answer this question by studying the effects of translations, reflections, stretches and shrinks on the equations and graphs of functions.
4. Students will learn how to answer this question by studying strategies for identifying rational, irrational, and complex roots.
5. Students will learn how to answer this question by finding the sum, difference, product, quotient, and composition of two functions.
6. Students will learn how to answer this question by comparing the solution set of its inverse numerically, graphically, and algebraically.

### Vocabulary/Key Terms

Unit 1: irrational, rational, synthetic division

Unit 2: composition, dependent, domain, function, independent, imply, inverse, piecewise, range, rigid and transformation

### Assessments:

Uniform Test/Quiz

### Common Core Standards:

CCSS.Math.Content.HSA.APR.A.1

CCSS.Math.Content.HSA.APR.B.2

CCSS.Math.Content.HSA.APR.B.3

CCSS.Math.Content.HSA.APR.D.2

CCSS.Math.Content.HSA.APR.D.7

### Differentiated Instruction:

Teacher performs formative assessments through lessons to check student understanding, including cold-calling, student board work, and exit tickets. Teacher circulates room to perform further formative assessments and to guide small groups and individuals.

### ELLs:

*Lower-performing students* are grouped heterogeneously with higher-performing students using assessment data, interests, and work habits, to encourage student-to-student engagement and learning. They are also provided guided notes and graphic organizers to build schemas.

### SWDs:

### High-Achievers:

*English Language Learners* are paired with students who are fluent in English, and given extra time. Vocabulary is pronounced several times and accompanied by alternative words or phrases that are simplified. Visual aids, including pictures, Smartboards, and manipulatives, help students make clear connections to the text.

*Students with Special Needs* are grouped with helpers and given instructions or assessments with simplified language or extra time. Color-coding on the Smartboard help illustrate steps required to solve a problem. Hands-on activities are provided to help construct student learning.

*Gifted/Honor students* are given challenge problems during lessons, homework, and summative assessments, which earn extra credits. They are expected to complete the whole worksheet, and are given challenge (e.g. open-ended) problems that develop higher-level thinking.

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**Resources/Books**

Pre-Calculus with Limits by Larson  
Class Website

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Homework: Lists of HW Assignments are given out to students at the beginning of every unit.



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Marking Period 2

Topic and Essential Question

- Unit 3** - 1. How do we perform transformations on functions?  
2. What are non-rigid transformations?  
3. How do we find arithmetic combinations of functions?  
4. How do we find compositions of functions?  
5. How do we find inverse of a function?

- Unit 4** - 1. How do we use completing the square to graph quadratics?  
2. How do we find the equation of a quadratic given the vertex and a point on the graph?  
3. How do we use quadratic equations to solve optimization problems?  
4. How do we solve max/min problems?  
5. How do we graph more complicated polynomial functions?  
6. How do we use zeros to help graph polynomial functions?  
7. How can we use the Intermediate Value Theorem to find zeros of polynomials?

Unit/Topics      **Unit 3** – Function Transformations and Compositions of Functions  
                         **Unit 4** – Higher Degree Polynomials and Optimization

SWBAT/Objectives      **Unit 3**

4. Students will be able to add, subtract, multiply, and divide two functions
5. Students will be able to apply composition of functions to numerical and algebraic examples
6. Students will be able to find the domain of composition functions
7. Students will be able to determine the inverse of given functions
8. Students will be able to determine if the graph of a given inverse function is an one-to-one function

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## Unit 4

7. Students will be able to express a perfect square trinomial as the square of a binomial
8. Students will be able to rewrite a quadratic equation in vertex form
9. Students will be able to use the vertex form of a parabola and the 1a 3a 5a method to graph quadratics
10. Students will be able to find the max/min value of quadratic equations
11. Students will be able to solve optimization word problems by finding the vertex of quadratic equations
12. Students will be able to describe the end behaviors of higher polynomial functions using the leading coefficient test
13. Students will be able to graph polynomial functions
14. Students will be able to apply the Intermediate Value Theorem to find roots of polynomial equations.

### Vocabulary/Key Terms

Unit 3: composition of functions, inverse functions, one-to-one functions, function transformation  
Unit 4: perfect square trinomial, binomial, vertex form of a quadratic equation, optimization, leading coefficient test, intermediate value theorem, roots

### Assessments:

Uniform Test/Quiz

### Common Core Standards:

CCSS.Math.Content.HSF-BF.A.1  
CCSS.Math.Content.HSF-BF.A.1b  
CCSS.MATH.CONTENT.HSF.BF.A.1.C(+)  
CCSS.MATH.CONTENT.HSF.BF.B.4  
CCSS.MATH.CONTENT.HSA.REI.B.4.A  
CCSS.MATH.CONTENT.HSA.REI.B.4.A  
CCSS.Math.Content.HSF-IF.C.7  
CCSS.Math.Content.HSF-IF.C.7c

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### ELLs:

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Marking Period 3

Topic and Essential Question

- Unit 5** – 1. How do you sketch graphs and write equations of parabolas?  
2. How do you sketch graphs of polynomial functions?  
3. How do you divide a polynomial by another polynomial and use polynomial division to find the rational and real zeroes of polynomial?  
4. How do you perform operations with complex numbers?  
5. How do you find all the zeros of a polynomial function?  
6. How do you find the domain and asymptotes of a rational function?  
7. How do you sketch the graph of the rational function  $f(x) = N(x)/D(x)$ ?

- Unit M** – 1. How do we solve system of equations?  
2. How do we perform operations on matrices?  
3. How do we solve system of equations using Gauss Jordan elimination?  
4. How do we find the inverse of a matrix?  
5. How do we find the determinant of a matrix?  
6. What are some applications of matrices?

- Unit 6** – 1. How do you represent a sequence of numbers or the sum of a sequence?  
2. How do you find the  $n$ th term or partial sum of an arithmetic sequence?  
3. How do you find terms and sums of geometric sequences?

**Unit 5** – Graphing Rational Functions and Partial Fractions

**Unit M** – Matrices

**Unit 6** – Series and Sequences

SWBAT/Objectives      Unit 5

15. Students will learn how to answer this question by studying transformations of  $y = x^2$ .
16. Students will learn how to answer this question by identifying end behavior, finding zeros, and plotting additional points.
17. Students will learn how to answer this question by studying long division; synthetic division; and the characteristics of polynomial fractions
18. Students will learn how to answer this question by comparing operations with complex numbers and operations with binomials
19. Students will learn how to answer this question by studying strategies for identifying rational, irrational, and complex roots.
20. Students will learn how to answer this question by finding intercepts, locating asymptotes, and plotting select points

### Unit M

1. Students will be able to define vocabulary such as matrix and dimension.
2. Students will be able to determine the dimensions of a matrix.
3. Students will be able to determine when two matrices can be added together and when they cannot be added together based on their dimensions. Students will be able to calculate the sum of two matrices
4. Students will be able to show that matrix addition is commutative.
5. Students will be able to determine when two matrices can be multiplied and when they cannot.
6. Students will be able to determine through examples that matrix multiplication is not commutative.
7. When given two matrix dimensions, students will be able to determine what the dimensions of the product will be.

### Unit 6

1. Students will learn how to answer this question by studying factorial and summation notation
2. Students will learn how to answer this question by studying a list, formula, and recursive formula representations of arithmetic sequence
3. Students will learn how to answer this question by studying formulas to find the nth terms and sums of geometric sequences and series.
4. Students will learn how to answer this question by testing whether the truth of one term implies the truth of next term

#### Vocabulary/Key Terms

Unit 5: asymptote, conjugate, continuous, fundamental, parabola, quadratic, slant and transformation  
Unit M: dimensions, row by column, Gauss Jordan, coefficient, determinant, inverse  
Unit 6: finite, infinite and recursive

#### Assessments:

Uniform Test/Quiz

#### Common Core Standards:

CCSS.Math.Content.HSA.APR.A.1  
CCSS.Math.Content.HSA.APR.B.2  
CCSS.Math.Content.HSA.APR.B.3  
CCSS.Math.Content.HSA.APR.D.2  
CCSS.Math.Content.HSA.APR.D.7  
[www.corestandards.org/Math/Content/HSF/BF/A/2/](http://www.corestandards.org/Math/Content/HSF/BF/A/2/)  
[www.corestandards.org/Math/Content/HSF/IF/A/3/](http://www.corestandards.org/Math/Content/HSF/IF/A/3/)  
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