PUBLIC SCHOOLS OF EDISON TOWNSHIP

OFFICE OF CURRICULUM AND INSTRUCTION

Pre-Calculus Honors/Accelerated/Academic

Length of Course:	Term
Elective/Required:	Required
Schools:	High School
Eligibility:	Grade 10-12
Credit Value:	5 Credits
Date Approved:	September 23, 2019

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Statement of Purpose

Pre-Calculus courses combine the study of Trigonometry, Elementary Functions, Analytic Geometry, and Math Analysis topics as preparation for calculus. Topics typically include the study of complex numbers; polynomial, logarithmic, exponential, rational, right trigonometric, and circular functions, and their relations, inverses and graphs; trigonometric identities and equations; solutions of right and oblique triangles; vectors; the polar coordinate system; conic sections; Boolean algebra and symbolic logic; mathematical induction; matrix algebra; sequences and series; and limits and continuity.

This course includes a review of essential skills from algebra, introduces polynomial, rational, exponential and logarithmic functions, and gives the student an in-depth study of trigonometric functions and their applications. Modern technology provides tools for supplementing the traditional focus on algebraic procedures, such as solving equations, with a more visual perspective, with graphs of equations displayed on a screen. Students can then focus on understanding the relationship and behavior of the function, in preparation for the advanced study of calculus. Students further explore functions in real-life situations, including science, economics, biology and navigation. The focus of the course will be twofold. First, students will be able to understand and describe the general behavior of functions, including transcendental functions, and secondly, to develop an in depth understanding of trigonometry and its applications. This course is a traditional fourth course pathway and all standards covered are at a reinforcement level and advanced level, as mastery was expected in the prerequisite courses.

Course Objectives

The student will be able to:

1. Analyze functions and their graphs using parent functions (Acad, Acc, H)
2. Perform operations with and graph power, polynomial, and rational functions. (Acad, Acc, H)
3. Evaluate and graph exponential and logarithmic functions. (Acad, Acc, H)
4. Evaluate and graph trigonometric functions. (Acad, Acc, H)
5. Use trigonometric functions to solve real world problems. (Acad, Acc, H)
6. Use trigonometric Identities to simplify and rewrite trigonometric expressions. (Acad, Acc, H)
7. To perform matrix operations and use them to solve systems of equations. (Acad, Acc, H)
8. To graph the equations of conic sections. (Acad, Acc, H)
9. To graph parametric equations. (H)
10. To understand vector representations algebraically and geometrically and perform vector operations. (H)
11. To understand polar coordinates and graph polar equations. (H)
12. Analyze the arithmetic and geometric sequences and series. (Acad ,Acc, H)
13. To use statistics to describe and analyze real-world scenarios. (H)
14. To understand and evaluate limits at a point and limits at infinity. (Acad*, Acc, H)
15. To become familiar with instantaneous rates of change, derivatives, and antiderivatives. (H)

All objectives will include applications to real-life situations.

For NJSLS visit https://www.nj.gov/education/cccs/2016/math/standards.pdf

Suggested Timeline: Honors

Unit	# of Periods
Unit 0: Chapter 0 - Preparing for Calculus	optional
Unit 1: Chapter 1 - Functions from a Pre-Calculus Perspective	12
Sections 1 – 7	
Unit 2: Chapter 2 - Power, Polynomial, and Rational Functions	15
Sections 1 – 6	
Unit 3: Chapter 3 - Exponential and Logarithmic Functions	14
Sections 1 – 5	
Estimated end of Marking Period 1	
Unit 4: Chapter 4 - Trigonometric Function	16
Sections 1 – 7	
Unit 5: Chapter 5 - Trigonometric Identities and Equations	13
Sections 1 – 5	
Unit 6: Chapter 6 - Systems of Equations and Matrices	12
Sections 1 – 5	
Estimated end of Marking Period 2	

Unit 7: Chapter 7 - Conic Sections and Parametric Equations	15
Sections 1 – 5	
Unit 8: Chapter 8 - Vectors	13
Sections 1 – 4	
Unit 9: Chapter 9 - Polar Coordinates and Complex Numbers	13
Sections 1 – 5	
Estimated end of Marking Period 3	
Unit 10: Chapter 10 - Sequences and Series	15
Sections 1 – 6	
Unit 11: Chapter 11 - Inferential Statistics	13
Sections 1 – 3	
Unit 12: Chapter 12 - Limits and Derivatives	13
Sections 1 – 6	
Total Class Periods	**164**

Suggested Timeline: Accelerated

Unit	# of Periods
Unit 0: Chapter 0 - Preparing for Calculus	optional
Unit 1: Chapter 1 - Functions from a Pre-Calculus Perspective	22
Sections 1, 2,3,4,5,6,7	
Unit 2: Chapter 2 - Power, Polynomial, and Rational Functions	20
Sections 1,2,3 ,5, 6*	Estimated End of MP 1
Unit 3: Chapter 3 - Exponential and Logarithmic Functions	18
Sections 0.4, 1,2,3,4	
Unit 4: Chapter 4 - Trigonometric Functions	30
Sections 1,2,3,4,5,7	Estimated End of MP 2

Unit 5: Chapter 5 - Trigonometric Identities and Equations	24
Sections 1,2,(4.6),3,4,5	
Unit 6: Chapter 6 - Systems of Equations and Matrices	optional
Unit 7: Chapter 7 - Conic Sections and Parametric Equations	12
Estimated End of MP 3	
Unit 8: Chapter 8 - Vectors	
Unit 9: Chapter 9 - Polar Coordinates and Complex Numbers	
Unit 10: Chapter 10 - Sequences and Series	15
Sections: 10.1, 10.2, 10.3, 10.5	
Unit 11: Chapter 11 - Inferential Statistics	
Unit 12: Chapter 12 - Limits and Derivatives	29
Sections 12.1,12.2,12.3 (*12.4 & 12.5 optional)	
Total Class Periods	**170**

Suggested Timeline: Academic

Unit	# of Periods
Unit 0: Chapter 0 - Preparing for Calculus	optional
Unit 1: Chapter 1 - Functions from a Pre-Calculus Perspective	28
Sections 1, 2, 3, 4, 5, 6, 7	
Unit 2: Chapter 2 - Power, Polynomial, and Rational Functions	17
Sections 1, 2, 5	Estimated End of MP 1
Unit 3: Chapter 3 - Exponential and Logarithmic Functions	20
Sections 0.4, 1, 2, 3, 4	
Unit 4: Chapter 4 - Trigonometric Functions	33
Sections 1, 2, 3, 4, 5, 7	Estimated End of MP 2 (Unit 4 sections 4.4, 4.5 and 4.7 in MP 3)
Unit 5: Chapter 5 - Trigonometric Identities and Equations	24
Sections 1, 2, 3, 4, 5	
Unit 6: Chapter 6 - Systems of Equations and Matrices Sections: 6.1, 0.6*, 6.2,	15
	Estimated End of MP 3 (Unit 6 split between MP 3 & MP 4)

Unit 7: Chapter 7 - Conic Sections and Parametric Equations	20
Unit 9: Chapter 9 - Polar Coordinates and Complex Numbers	
Unit 10: Chapter 10 - Sequences and Series	12
Sections: 10.1, 10.2, 10.3, 10.5*	
Unit 11: Chapter 11 - Inferential Statistics	
Unit 12: Chapter 12 - Limits and Derivatives	1*
Sections: 12.1*	
Total Class Periods	**170**

Note 1: Teachers will adjust their timing and pacing as they feel necessary to accommodate actual class periods available.
Let * indicate a section that may be included if time allows. If time permits, timeline will be adjusted for additional days.
Note 2: While not studied as one complete unit, sections of Chapter 0 will be incorporated throughout the curriculum as needed.

Unit Title: Chapter 1 – Functions from a Calculus Perspective

Targeted Standards: **Functions- Building Functions:** F-BF: Build a function that models a relationship between two quantities; Build new functions from existing functions.

Unit Objectives/Conceptual Understandings: Students will be able to identify functions and determine their domains, ranges, y-intercepts, and zeros. Students will be able to evaluate the continuity, end behavior, limits, and extrema of a function. Students will be able to calculate rates of change of nonlinear functions. Students will be able to identify parent functions and transformations. Students will be able to perform operations with functions, identify composite functions, and calculate inverse functions.

Essential Questions: How can mathematical ideas be represented? How are symbols useful in mathematics?

Unit Assessment:

- Mid-chapter quizzes, study guides, and Chapter 1 tests are available at www.connected.mcgraw-hill.com
- Teacher-generated assessments may be used as well

	Core Content Objectives		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
F.BF.1c: Compose functions F.BF.4b: Verify by composition that one function is the inverse of another F.BF.4c: Read values of an inverse function from a graph or table, given that the function has an inverse F.BF.4d: Produce an invertible function from a	Students will know: ● Definitions of the following terms: a. interval notation b. function c. function notation d. implied domain e. zeros f. roots g. even function h. odd function i. limit j. end behavior k. increasing l. decreasing m. constant n. maximum	Students will be able to: ● Describe subsets of real numbers ● Identify and evaluate functions and state their domains ● Use graphs of functions to estimate function values and find domains, ranges, y-intercepts, and zeros of functions ● Explore symmetries of graphs, and identify even and odd functions	● Explain that every function has a domain, which may be all real numbers or a subset of the real numbers. Domains can be described using set-builder notation or interval notation. Domains used in set-builder notation may include $\mathbb{R}$ (real numbers), $\mathbb{Z}$ (integers), or $\mathbb{N}$ (natural numbers). ● For interval notation, the symbols (or) are used with a strict inequality, while [or] are used when the endpoints are included in the interval. Note that (a, a), $[a, a)$, and $(a, a]$ all are the empty set, while $[a, a]$ is the set $\{a\}$.	● Ticket Out the Door: ● Given $f(x) = \frac{-4x}{\sqrt{x^2-1}}$, evaluate $f(3)$. $-3\sqrt{2}$ ● Journal: Describe the steps required to algebraically check whether a function is even, odd, or neither. ● Formative Assessment: Use Quiz 1 on p. 43 after 1.1, 1.2

non-invertible function by restricting the domain	o. minimum p. extrema q. secant line r. parent function s. transformation t. reflection u. dilation v. composition ● Set builder notation ● Interval notation ● Algebraic domains ● Piecewise functions ● Domain, range, y-intercepts, zeros, symmetry ● Even and odd functions ● Continuity ● Discontinuity ● Approximate Zeros ● Extrema of a function ● Analysis of increasing and decreasing behavior ● Average range of change ● Characteristics of parent functions ● Graph transformations	● Use limits to determine the continuity of a function, and apply the Intermediate Value Theorem to continuous functions ● Use limits to describe end behavior of functions ● Determine intervals on which functions are increasing, constant, or decreasing, and determine maxima and minima of functions ● Determine the average rate of change of a function ● Identify, graph, and describe parent functions ● Identify and graph transformations of parent functions ● Perform operations with functions ● Find compositions of functions ● Use the horizontal line test to determine inverse functions ● Find inverse functions algebraically and graphically	● Have students take turns graphing relations and functions on the Smart Board. ● Explain a graph conveys information about the function or relation it represents. Important characteristics of a graph include: - domain: the set of valid independent variable values - range: the set of associated dependent variable values - *y*-intercept: the point(s) at which the graph crosses the *y*-axis - zeros: the point(s) at which the graph crosses the *x*-axis - even functions: functions that have the *y*-axis as a line of symmetry - odd functions: functions that have a point of symmetry at the origin - line symmetry: the graph can be folded so that the two halves match exactly - point symmetry: the graph can be rotated 180° with respect to a point and appear unchanged ● Have students find independent and dependent variables of interest to them. Have them describe the variables and determine a	● Journal: How does understanding parent functions and transformations help you represent mathematical ideas and analyze real-world situations? What characteristics of functions help you to analyze real-world situations? ● Formative Assessment: Use Quiz 2 on p. 43 after 1.3, 1.4 ● Ticket Out the Door: Have students describe how the graph of $g(x) = -\frac{1}{4}(x+3)^2 + 4$ is related to its parent function. ● Formative Assessment: Use Quiz 3 on p. 44 after 1.5, 1.6 ● Journal: How can the inverse of a function be used to help interpret a real-world event or solve a problem? ● Formative Assessment: Use Quiz 4 on p. 44 after 1.7

	● Operations with functions ● Composition and decomposition of functions ● Finding inverse functions		realistic domain and range for the function. For example, a domain with negative numbers may make sense for temperature but not for time spent playing a game. Then have students graph their functions. ● Time a classical piece of music to determine the half-way point. Have students mark the "energy" level at 15-second intervals on graph paper. Have them mark anything that is slow or sad below the *x*-axis and anything upbeat or positive above the *x*-axis. Be sure their graphs show the half-way point being on the *y*-axis. Once students have listened and made their graphs, ask them to describe the symmetries they may see and whether the graphs are even, odd, or neither. Ask students if they like their music "even" or "odd." ● Through the following example, explain to students there is no sign change for $f(x) = (x - 1)^2$ but there is a real zero of multiplicity 2 at $x = 1$. ● In small groups, challenge students to create their own graphs that satisfy a certain set of criteria (for example, discontinuous, finite end behavior, etc.) ● Have students work in pairs. Each student thinks of a	

			function. The pair works together to find the sum, difference, product, and quotient of the functions and the composites of the two functions. ● Have students work in groups of two to four. Write integers from –10 to 10 on separate index cards. Ask one student in each group to be the gatekeeper for the first function in a composite function. Other students in the group pass the index cards to the gatekeeper who rejects or accepts each card, depending on whether the number is in the domain of the function. After the review, another student is the gatekeeper for the second function. Students can use this process to define the domain of the composite function. ● Explain that the graph of the inverse of a function is the graph of the original function reflected in the line $y = x$. The inverse of the function is itself a function if the graph of the original function passes the horizontal line test. The inverse is found algebraically by the following: - writing the function as an equation, - switching x and y variables in the equation, - solving for y, and - replacing y with $f^{-1}(x)$.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings
Use online resources available at www.connected.mcgraw-hill.com Use Geometer's Sketchpad: Introducing Dynagraphs Odd and Even Functions Transformation Challenge Composition of Functions Inverses of Functions Use graphing calculators to explore properties of graphs; find zeros, y-intercepts, maximum and minimum values; and explore limits Teacher will incorporate chapter resources (study guide, college entrance tests, test tackler, standardized test prep) as needed	● For domain problems, remind students a denominator cannot equal zero and there is no real square root of a negative number. ● Remind students that a relation with a domain that is a set of individual points is *discrete*. The domain of a discrete function cannot be described by an interval that includes an infinite number of real values. ● Students may forget to use parentheses around each polynomial when entering the function into their calculators. Remind them that parentheses are needed for the calculator to correctly graph the function. ● Students may have difficulty keeping track of the changes made by the absolute values. Suggest that students first graph the function without absolute values. Then they can reflect parts of the function in the appropriate axis. ● The composition of functions is not generally commutative. However, there are some pairs of functions where $f[g(x)] = g[f(x)]$. When $f[g(x)] = g[f(x)] = x$, f and g are inverses of each other. ● If students evaluate composite functions incorrectly by making the wrong substitutions, emphasize that the second function is the one substituted. ● Students may mistakenly try to find $f^{-1}(x)$ by finding 1/f(x) . Remind them that f^{-1} is a symbol and not a variable to the −1 power. In other words, f^{-1} is the inverse of f, while 1/f is the reciprocal of f. ● Help students work through the substitution and simplification by reminding them to use parentheses correctly when substituting. ● Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.

Unit Title: Chapter 2 - Power, Polynomial and Rational Functions

Targeted Standards: A-APR.C.4 Prove polynomial identities and use them to describe numerical relationships.A-APR.D.6 Rewrite simple rational expressions in different forms. A-APR.B.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough

Unit Objectives/Conceptual Understandings: Graph and analyze power, radical, polynomial, and rational functions. Divide polynomials using long division and synthetic division. Use the Remainder and Factor Theorems. Find all zeros of polynomial functions. Solve radical and rational equations. Solve polynomial and rational inequalities.

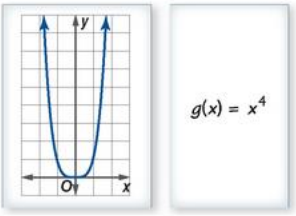
Essential Questions: How can representing the same mathematical relationship in different ways be helpful? Why would it be helpful to replace an expression with an equivalent expression?

Unit Assessment:

- 5 min checks
- Teacher-generated assessments may also be used.
- **McGraw-Hill eAssessment** Customize and create multiple versions of your chapter tests and their answer keys. All of the questions from the leveled chapter tests in the *Chapter 2 Resource Masters* are also available on McGraw-Hill eAssessment.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
A-APR.C.4 Prove polynomial identities and use them to describe numerical relationships. A-APR.D.6 Rewrite simple rational expressions in different forms; write $^{a(x)}/_{b(x)}$ in the form $q(x) + {}^{r(x)}/_{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. A-APR.B.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough	Students will know: ● Unit vocabulary including: ● power function ● monomial function ● radical function ● extraneous solutions ● polynomial function ● leading coefficient ● leading-term test ● quartic function ● quadratic form ● repeated zero ● lower bound ● upper bound ● rational function ● asymptotes ● vertical asymptote ● horizontal asymptote	● Graph and analyze power functions. ● Graph and analyze radical functions, and solve radical equations. ● Graph polynomial functions. ● Describe the end behavior of the graph of each polynomial function using limits.	● Divide students into groups of three or four. Have students take turns explaining how to determine the end behavior of the graph of a polynomial function and how to locate the zeros of the function. Have them describe how knowing this information helps them graph the polynomial. ● Have groups of students write and graph six functions, two for each of the following types: $f(x) = x^n$, $f(x) = x^{-n}$, and , f(x) = x^ p/n where n and	● **Exit Slip** Ask students to describe the graph of a polynomial function. ● **Formative Assessment** Use Quiz 1 on p. 39 as a check for student understanding of Lessons 2-1 and 2-2. ● **Ticket Out the Door** Ask students to write the remainder of $x^3 - x^2 - 5x - 3$ when it is divided by $x - 3$. 0

	● polynomial inequality ● sign chart ● rational inequality ● A polynomial function $f(x) = a_n x^n + \ldots + a_1 x + a_0$ has at most n distinct real zeros and at most n − 1 turning points. ● The zeros can be found by factoring. The repeated zero c occurs when the factor $(x - c)$ repeats itself. The number of times $(x - c)$ occurs is the multiplicity of c. ● odd multiplicity: the function's graph crosses the x-axis at c and the value of $f(x)$ changes signs at $x = c$. ● even multiplicity: the function's graph touches the x-axis at c and the value of $f(x)$ does not change signs at $x = c$. ● Show how to divide polynomials using long division and synthetic division. This includes the need for the polynomials to be in standard form and to use zero coefficients for missing powers as place holders. ● The real zeros of a polynomial function divide the x-axis into intervals for which the values of $f(x)$ are either entirely positive (the	● Divide polynomials using long division and synthetic division. ● Use the Remainder and Factor Theorems. ● Find all zeros of polynomial functions. ● Find complex zeros of polynomial functions. ● Solve radical and rational equations. ● Analyze and graph rational functions. ● Solve polynomial inequalities.	p are positive integers and is in simplest form. Have students write each function and each graph on a separate index card. Groups trade cards and try to match each graph with its function.  ● **Zeros** Emphasize to students that they can confirm the zeros (where the graph crosses the x-axis) and the number of turning points by using a graphing calculator to graph the polynomial function. ● **Tangents** Explain to students that the graph of a polynomial function can be tangent to the x-axis at a specific point and intersect the x-axis at a different point, as shown in Figure 2.2.2. ● ***x*-value in Interval** Any value for x can be chosen as long as the value falls within the interval.	● **Formative Assessment** Use Quiz 2 on p. 39 as a check for student understanding of Lesson 2-3. ● A rational function can change signs at its real zeros or at its points of discontinuity, so the zeros of both the numerator and the denominator are included in a sign chart. ● Document Camera Choose several students to demonstrate and explain to the class how to use a sign chart to test intervals when solving an inequality. ● Have students describe the mathematical procedures they would use to solve $\frac{x-3}{x+2} > 2$ ● **Ticket Out the Door** Have students

	graph is above the *x*-axis) or entirely negative (the graph is below the *x*-axis). ● The quotient of two polynomial functions is a rational function. ● Asymptotes can be horizontal, vertical, or slanted lines. Asymptotes can be determined by observing the limits, discontinuity, and end behavior of the rational function. ● Vertical asymptotes, if any, occur at real zeros (undefined values), if any, of the denominator of the function. ● $y = 0$ is a horizontal asymptote if the degree n of the numerator is less than the degree m of the denominator. No horizontal asymptotes occur if $n > m$. If $n = m$, there is a horizontal asymptote at the ratio of the leading coefficients of the numerator and denominator. ● If $n = m + 1$, where $m > 0$, the graph has an oblique asymptote. ● A polynomial inequality can be solved using a sign chart and its end behavior. ● A rational inequality can be solved by first writing the inequality in general form	● Solve rational inequalities.	● Have students work together in groups to sketch the graphs of polynomial functions having a particular degree and number of real roots, for example, degree 3 and 3 real roots or degree 3 and only 1 real root. Then have students experiment with coefficients in the general form of a polynomial in order to find functions with graphs that resemble their sketches. ● Divide students into groups of three or four. Write a rational equation on the board and have each group solve it, writing the steps they use to find the solution. Then have groups compare and contrast the processes they used.	solve $\frac{4}{x(x-1)} + \frac{4}{x} = \frac{x}{x-1}$ ● **Formative Assessment** Use Quiz 3 on p.40 as a check for student understanding of Lesson 2-4 and 2-5. ● **Formative Assessment** Use Quiz 4 on p.40 as a check for student understanding of Lesson 2-6. ● Have students complete the Lesson-by-Lesson Review on pp. 149–152. Use McGraw-Hill eAssessment to customize another review worksheet that practices all the objectives of this chapter or only the objectives on which your students need more help. ● Have students complete pp. 33 and 34 of the Study Notebook to review topics and skills presented in the chapter. ● **McGraw-Hill eAssessment** Customize and create multiple versions of your

	with a single rational expression on the left side and a 0 on the right and then creating a sign chart using its real zeros and undefined points.			chapter tests and their answer keys. All of the questions from the leveled chapter tests in the *Chapter 2 Resource Masters* are also available on McGraw-Hill eAssessment.

Resources:

EXPLORE LESSON 2-2: GRAPHING TECHNOLOGY LAB: BEHAVIOR OF GRAPHS

Graph and analyze the behavior of polynomial functions.

EXTEND LESSON 2-2: GRAPHING TECHNOLOGY LAB: HIDDEN BEHAVIOR OF GRAPHS

Use TI-Nspire technology to explore the hidden behavior of graphs.

Instructional Adjustments:

Visual/Spatial Learners Have students use grid paper and colored pencils to help organize their work when performing synthetic division. For example, have students write $6x^3 - 25x^2 + 18x + 9$ divided by $x - 3$ with color as shown. Then have them write on grid paper with the same colors.

Logical Learners To help students understand polynomial division, show some examples of division from arithmetic, such as 235 ÷ 22 = 10 R15 and 235 = 22 × 10 + 15. Work through a few examples, first with numbers and then with polynomials, to make the concepts clearer.

Extension Ask students to find the values of a, b, and c so that when $x^6 - 2x^4 + ax^2 + bx + c$ is divided by $(x - 1)$, $(x - 2)$, and $(x + 4)$, the remainder is 0.

Extension Have students determine the positive values of n for which the cube of n will be greater than 10 times the square of n.

Interpersonal Learners Have students work together in mixed-ability groups of three to factor the numerator in the rational inequality . . .

$$\frac{x^2 - x - 12}{x + 4} \geqslant 0$$

Ask each member of the groups to explain the group to name a different critical number. Then ask why the solution can be written as $(-4, -3] \cup [4, \infty)$

Unit Title: Chapter 3 Exponential and Logarithmic Functions

Targeted Standards: F.BF.5 (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents**.**

Unit Objectives/Enduring Understandings: Students will be able to evaluate, analyze, and graph, and exponential and logarithmic functions, apply properties of logarithms, solve exponential and logarithmic equations, and model real world phenomena using exponential, logarithmic, and logistic functions.

Essential Questions: What real-world situations are represented by exponential growth or decay functions? How can logarithms represent real-world situations?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Standards		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
F.BF.5 (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents**.**	Students will know: ● Unit vocabulary including: a. Algebraic function b. Transcendental function c. Exponential function d. Natural base e. Continuously compounding interest f. Exponential growth g. Exponential decay h. Domain and range i. Logarithm with base b j. Common logarithm k. Natural Logarithm l. Logistic growth function ● How to identify what real world situations can be represented by an exponential decay or growth model.	Students will be able to: ● Write and evaluate exponential expressions to model growth and decay situations ● Sketch exponential functions and describe their domains, ranges, end behavior, and where it is increasing or decreasing. ● Use basic transformations to graph more complex exponential functions ● Solve problems involving compounding interest ● Solve real-world problems that can be modeled with exponential functions	● Assign problems with green dots as problems for student self-assessment, since they have “step by step” solutions given in the back of the book. ● Have students generate the exponential growth/decay models and graphs by investigating real-world scenarios like doubling a 10 cent bet on each hole on a golf course ,etc. ● Have students complete a graphic organizer containing conditions for function to represent growth or decay as well as end behavior and intervals of increasing/decreasing. ● Have students compare and contrast exponential growth	● p.166: Graphing exponential functions (1-10, 11-20) ● P. 167: Applied exponential growth /decay problems: (22,25,26,31,32,37,41) ● p.178:Evaluating Logarithms (1-24), Graphing log functions (28-33, 90-95) ● p.185: Properties of Logarithms(29-48,69-81) Change of base formula (49-58)

	● How to use the formulas for compounding interest (including continuously) ● The bases for both common and natural logarithms ● How to interpret the log as an exponent. ● Restrictions of the domain for logarithmic functions ● How to use mental math to evaluate logs ● The three fundamental log properties	● Evaluate expressions involving logarithms without a calculator ● Sketch and analyze graphs of logarithmic functions. ● Transform exponential and logarithmic functions by changing parameters. ● Use the change of base formula to evaluate logarithms with any base (with calculator) ● Use properties to simplify/evaluate logarithmic expressions. ● Solve exponential and logarithmic equations ● Solve problems involving exponential and logarithmic equations ● Use the number *e* to write and graph exponential functions representing real-world situations ● Solve equations and problems involving *e* or natural logs. ● Model data by using exponential and logarithmic function ● Use exponential and logarithmic model to analyze and predict.	and decay functions in terms of the value of *b,* general shape of the graph, what happens to the functions as *x* increases. ● Give students a series of short series scenarios in which students will have to determine if a growth or decay model would be appropriate. ● Discuss the effect of changing the APR, length of investment time, and frequency of compounding on amount of interest earned. ● To help kids remember the relationship between $\log_b x = y$ and $b^y = x$, use the technique of "sliding" the base of *b* over to the right so it is physically underneath the y so it can help them see the exponential form: $\log \boxed{x =_b y}$ ● Discuss difference between logarithms that can be evaluated with and without a calculator ● Compare and contrast properties of exponents and logarithms. Have students notice and discuss how these two concepts are similar. ● Encourage students to check their log answers for reasonableness.	● Have students complete the mid-chapter quiz on p.189 ● P.196-199:Solving equations (1-8,10-20,22-27 more advanced 28-37,39-48,50-79) ● Use "Skills Review for standardized tests" at the end of each section for do now/closure questions throughout chapter to monitor student understanding ● P.207-209: Regression analysis(1-3,7-9,11-13,18-21) ● P.212 "Study Guide and Review" for a comprehensive lesson by lesson review

		● Use the graphing calculator to help model data with exponential and logistical regression	● Discuss how *e* and ln are related. ● Use two separate graphic organizers to understand transformations of exponential functions and logarithmic functions (vertical, horizontal, vertical stretch or compression, horizontal stretch or compression, reflection over the x or y axis). ● Use the graphing calculator to help students see transformations by plotting multiple functions on one screen.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices

Teacher will incorporate Text supplied chapter resources where appropriate

- Differentiated instruction
- study guide and intervention
- practice WS's
- Word problem practice
- Study Notebook
- Online test and study guide generators
- Standardized test prep
- Connect to AP Calculus vignettes (honors only)

Instructional Adjustments: Modifications, student difficulties, possible misunderstandings.

- Discuss "Common Errors" hints in Teacher's Edition to prevent possible misunderstandings.
- A Review of exponent properties and rules (both integer and rational) will be necessary for many students before beginning the study of exponential growth and logarithms
- Concepts of end behavior will need to be reviewed in general before applying to exponential and logarithmic functions.
- Provide students with handout of notes
- Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.

Unit Title: Chapter 4 – Trigonometric Functions

Targeted Standards: **Functions- Trigonometric Functions:** F-TF: Extend the domain of trigonometric functions using the unit circle. **Functions- Trigonometric Functions:** F-TF: Model periodic phenomena with trigonometric functions. **Geometry- Similarity, Right Triangles, and Trigonometry:** G-SRT: Apply trigonometry to general triangles

Unit Objectives/Conceptual Understandings: Students will be able to understand and use trigonometric functions in applications with right triangles and angles in standard position. Students will be able to convert angles between degrees and radians. Students will be able to evaluate trigonometric functions on the unit circle. Students will be able to evaluate inverse trigonometric functions. Students will be able to identify the characteristics of the graphs of the trigonometric functions. Students will be able to graph trigonometric functions. Students will be able to use the Law of Sines and Cosines to find the missing sides of a triangle.

Essential Questions: What is the relationship between the angles and the side lengths of a triangle? How can trigonometric functions be applied in real-life? How do the graphs of the trigonometric functions model periodic functions in real life?

Unit Assessment:

- Mid-chapter quizzes, study guides, and Chapter 4 tests are available at www.connected.mcgraw-hill.com
- Teacher-generated assessments may be used as well

	Core Content Objectives		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
F.TF.1: Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle F.TF.2: Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle	Students will know: ● Definitions of the following terms: a. trigonometric function b. sine c. cosine d. tangent e. cosecant f. secant g. cotangent h. reciprocal function i. standard position	Students will be able to: ● Apply vocabulary to math content and use appropriately in real-world contexts ● Use trigonometry to find the side lengths of a right triangle ● Apply trigonometry to real-life situations	● Review the relationships among the sides of a 30º-60º-90º triangle and a 45º-45º-90º triangle. ● Use mnemonic device SOH-CAH-TOA to remember trigonometric ratios. ● Show students how the value of a trigonometric function	● Ticket Out the Door: Ask each student to draw a right triangle, label its sides, identify an acute angle as θ, and then define one of the six trigonometric functions ● Journal Prompt: How can writing angles in

F.TF.3: Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4, and π/6, and use the unit circle to express the values of sine, cosine, and tangent for π-x, π+x, and 2π-x in terms of the values for x, where x is any real number F.TF.4: Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions F.TF.5: Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline F.TF.6: Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed F.TF.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 F.IF.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes F.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases	j. initial side k. terminal side l. angle of rotation m. coterminal angles n. reference angle o. quadrantal angle p. cofunctions q. radian r. unit circle s. angle of depression t. angle of elevation u. inverse sine function v. inverse cosine function w. inverse tangent function x. ambiguous case y. circular function z. period aa. periodic bb. sinusoid cc. amplitude dd. frequency ee. phase shift ff. midline ● Trigonometric functions ● The relationship among the sides of a 30º-60º-90º triangle and a 45º-45º-90º triangle ● How to use reference angles to find trigonometric functions in all four quadrants ● The unit circle ● How to convert angles in degrees and radians	● Find distances between two objects using the angle of elevation or the angle of depression ● Evaluate trigonometric functions using reference angles ● Convert between degrees and radians ● Find the trigonometric values of angles measured in radians ● Use the unit circle to evaluate trigonometric functions ● Find the inverses of trigonometric functions ● Evaluate inverse trigonometric functions ● Apply vocabulary to math content and use appropriately in real-world contexts ● Determine the number of periods shown given the graph of a periodic function ● Graph the sine, cosine, tangent,	depends only on the angle measure. Draw a small and large triangle, each with the same angle. Have students measure the side lengths and find the sine of that angle. They should determine that the sine value is the same for both triangles. ● Model angle of elevation and angle of depression using real-life examples. ● Give students copies of blank unit circles to label. Students could use different colored pencils to organize the information. ● Have students create a mnemonic for "ASTC" to remember which trigonometric ratios are positive in which quadrant. ● Review and summarize the different methods for finding the values of trigonometric functions: - by using the side lengths of right triangles - by using a point on the terminal side of an angle in standard position - by using the unit circle	different ways be useful? ● Formative Assessment: Use Quiz 1 on p. 43 after 4.1, 4.2. ● Ticket Out the Door: Divide the class into four groups. Assign each group one of the four quadrants. Ask students to draw the x- and y- axes and an acute reference for their quadrants. ● Journal: How are transformations of sine and cosine similar to other functions you have studied before? ● Journal: Have students write about which trig functions are continuous and which are discontinuous. ● Formative Assessment: Use Quiz 2 on p. 43 after 4.3, 4.4. ● Formative Assessment: Use the Mid-Chapter Quiz to assess students'

F.BF.3: Identify the effect on the graph of replacing *f(x)* by *f(x)+k*, *kf(x), f(kx),* and *f(x+k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs G.SRT.10: Prove the Laws of Sines and Cosines and use them to solve problems G.SRT.11: Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles	● The values of trigonometric functions on the unit circle ● How to find the inverse of trigonometric functions ● The characteristics of a periodic function ● The characteristics of the trigonometric functions ● How to graph the trigonometric functions ● The Law of Sines ● The Law of Cosines ● Heron's Formula	cosecant, secant, and cotangent functions ● Graph trigonometric inverse functions ● Apply transformations of the trigonometric functions to their graphs ● Use the Law of Sines to find the missing sides and angles of a triangle ● Use the Law of Cosines to find the missing sides and angles of a triangle	- by using reference angles ● Introduce periodic functions by having students brainstorm examples of periodic behavior. ● When discussing the definition of amplitude, students can picture the graph as an ocean wave and the x-axis as sea level. The amplitude is the height of the wave above or below sea level. ● The following order is useful when graphing sine and cosine functions; vertical shift first, then amplitude, period, and phase shift. ● Discuss the relationship among the values of sine and cosine as shown on the unit circle, at key points, and on the graphs. ● Introduce the graphs of tangent and cotangent by first drawing the unit circle and choosing values with which to plot points. Be sure to include the angle values that correspond to x-intercepts and asymptotes.	progress in the first half of the chapter. For problems answered incorrectly, have students review the lessons indicated in parentheses. ● Entrance Ticket or Ticket Out the Door: Show students cards with graphs, have students define the function. ● Journal: How does a trig inverse function compare to an algebraic inverse function? ● Formative Assessment: Use Quiz 3 on p. 44 after 4.5, 4.6. ● Triangles Around the Room Review Activity: Have different triangle cases drawn on laminated paper for students to work in small groups to solve. ● Formative Assessment: Use Quiz 4 on p. 44 after 4.7.

			● Show students how to determine the number of triangles that can be formed in the ambiguous case in the Law of Sines. ● Emphasize to students that there is no need to memorize each of the three area equations for an SAS triangle. Instead, students should learn the general form of the area equation, that is, area equals half the product of the lengths of the two sides and the sine of their included angle. ● Use real-life applications of the Law of Sines and Cosines.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings
Use online resources available at www.connected.mcgraw-hill.com Use Geometer's Sketchpad: ● Introduction to Radians ● Trigonometry Tracers ● Six Circular Functions ● Transformations of Circular Functions ● The Law of Sines ● The Law of Cosines	● Make sure students use the reference angle that is formed by the terminal side and the x-axis, not the y-axis. ● Students might forget the signs of the trigonometric functions in all four quadrants. Suggest that drawing the angle in standard position can help them determine the quadrant of its terminal side. ● Students may forget to include linear units for arc length. Remind students that a length requires a unit to define its value. Also, when measuring area, students should include square units. ● Students may have difficulty applying dimensional analysis. Remind them that any equality relationship, such as 1 hour = 60 minutes can be written as 1 hour/60 minutes, and 60 minutes/1 hour. They should multiply by the conversion factor that cancels the known unit and yields the desired (unknown unit). ● Students may ignore negative values of the trigonometric functions in the second, third, and fourth quadrants. Remind students that the first quadrant is the only quadrant in which the values of all the trigonometric functions are positive. ● Have students work in small groups to create their own real-life word problems. They can either present their work to the class or switch problems with another group and solve each other's problems. ● Provide graphing paper when students are graphing trigonometric functions.

NCTM has many activities that can be used during this chapter including activities to derive the Law of Sines and Law of Cosines: http://illuminations.nctm.org/ Use calculators to find the values of trigonometric functions in decimal form and to find inverse trigonometric values Use graphing calculators to explore trigonometric graphs and extend graphing concepts Teacher will incorporate chapter resources (study guide, college entrance tests, test tackler, standardized test prep) as needed	● If students have difficulty drawing the basic graphs of y = sinx and y = cosx, remind them that y = sinx passes through the origin and y = cosx passes through the point (0, 1). ● Remind students the period for tangent and cotangent functions is π, while the other trigonometric functions have periods of 2π. ● Remind students to be careful of restricted domains. ● Emphasize inverse trigonometric notation, emphasizing that the −1 in $\sin^{-1} x$, $\cos^{-1} x$, and $\tan^{-1} x$ means arcsin *x*, arccos *x*, and arctan *x*, not $\frac{1}{\sin x} = \csc x$, $\frac{1}{\cos x} = \sec x$, or $\frac{1}{\tan x} = \cot x$. ● Students may sometimes make mistakes with the Law of Sines by using the ratio of the sine of an angle and the length of a side that is *not* opposite that angle. Suggest that students highlight the opposite side and angle pairs. ● Students may ignore possible solutions in the case when two solutions might exist. Remind them to check for multiple solutions when given the measures of two sides and a non-included angle that is acute. ● Students may forget to include negative values of *n* when determining the domain of tangent and cotangent functions. Remind students that *n* is an integer, not a natural number. ● Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.

Unit Title: Chapter 5 Trigonometric Identities and Equations

Targeted Standards: Functions- Interpreting Functions: F-IF: Interpret functions that arise in applications in terms of the context. Functions- Interpreting Functions: F-IF: Analyze functions using different representations. Functions- Building Functions: F-BF: Build new functions from existing functions. Functions- Trigonometric Functions: F-TF: Model periodic phenomena with trigonometric functions. Functions- Trigonometric Functions: F-TF: Prove and apply trigonometric identities. Algebra-Creating Equations: A-CED: Create equations that describe numbers or relationships.

Unit Objectives/Conceptual Understandings: Students will be able to use fundamental trigonometric identities to simplify and rewrite expressions, to verify other identities, and to solve trigonometric equations.

Essential Questions:

- How can representing the same mathematical relationship in different ways be helpful? Why would it be helpful to replace an expression with an equivalent expression?

Unit Assessment:

- Tickets out the door
- 5 min checks
- *Chapter 5 Resource Masters* are also available on McGraw-Hill eAssessment.
- Teacher-generated assessments may also be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
F.TF.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 F.TF.8: Prove the Pythagorean identity $\sin^2(\theta)+\cos^2(\theta)=1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle F.TF.9: Prove the addition and subtraction formulas for sine,	Students will know: Definitions of the following terms: • trigonometric identity • reciprocal identity • quotient identity • Pythagorean identity • odd-even-identity • cofunction • verify an identity • sum identity • reduction identity • double-angle identity • power-reducing identity • half-angle identity	• Identify and use trigonometric identities to find trigonometric values. • Use trigonometric identities to simplify and rewrite trigonometric expressions. • Determine whether equations are identities.	• Have students create a mnemonic for "ASTC" to remember which trigonometric ratios are positive in which quadrant Ex: **A**ll **S**tudents **T**ake **C**alculus S A T C • students may mistake the sign of the solutions. It can be helpful for students to draw the function on a unit circle and examine the signs of the functions for that quadrant.	• **Ticket Out the Door** Have each student tell a partner or write down the steps for solving $2\sin^2 x + 2 = 3$ • **Formative Assessment**: Use Quiz 2 on p. 33 as a check for student understanding of Lesson 5-3. • Practice and Problem Solving

cosine, and tangent and use them to solve problems A.CED.1: Create equations and inequalities in one variable and use them to solve problems	● Determine whether an equation may represent an identity using a graph. If the equation is not an identity, the graph can be used to identify a value that is defined on both sides but not equal. ● The fundamental trigonometric identities ● To verify an identity is to prove that both sides of the equation are equal for all values of the variable for which both sides are defined. Transform one side of the identity into the expression on the other side. Each step is justified by a reason, usually another verified trigonometric identity or an algebraic operation. Algebraic techniques, such as factoring and combining fractions, can be utilized to verify an identity. ● The sum and difference identities ● The sum and difference identities can be used to find the exact value of a trigonometric expression. ● The sum and difference identities can be used to rewrite a trigonometric expression as an algebraic expression that does not involve trigonometric functions.	• Verify trigonometric identities. • Solve trigonometric equations using algebraic techniques. • Solve trigonometric equations using basic identities. • Use sum and difference identities to evaluate trigonometric functions. • Use sum and difference identities to solve trigonometric identities. • Use double-angle, power-reducing, half-angle, and product-to-sum identities to evaluate trigonometric expressions and solve trigonometric equations.	● Show how to determine whether an equation may represent an identity using a graph. A proof can be used to show that the equation is an identity. If the equation is not an identity, the graph can be used to identify a value that is defined on both sides but not equal. ● It is often easier to begin with the more complicated side of a trigonometric identity and match it to the simpler side. ● Converting all terms to sine and cosine may be a good strategy if students become stuck. ● You Be The Teacher Provide students with completed proofs that contain common errors. Students should identify the errors and provide a completed proof. ● In pairs have students prove the same identity but work from opposite sides. ● Have pairs of students work together to verify the identities in the Guided Practice exercises. Have students record helpful techniques and things for which they looked in getting started. Compile a class list on the board.	questions at the end of each section ● **Name the Math** Have each student write the name and an example of one of the identities in this lesson. ● **Formative Assessment** Use Quiz 3 on p. 34 as a check for student understanding of Lesson 5-4. ● **Formative Assessment** Use the Mid-Chapter Quiz to assess students' progress in the first half of the chapter. ● **McGraw-Hill eAssessment** Customize and create multiple versions of your Mid-Chapter Quiz and their answer keys. ● **Ticket Out the Door** Have each student write which type of identity they would use to evaluate $\cos\left(-\frac{\pi}{12}\right)$. ● **Formative Assessment** Use Quiz 4 on p. 34 as a check for

	● The sum and difference identities can be used to verify the cofunction and reduction identities. ● How to solve trigonometric equations ● Solve trigonometric equations by isolating trigonometric expressions. ● Solve trigonometric equations by taking the square root of each side. ● Solve trigonometric equations by factoring ● Solve trigonometric equations involving multiples of angles.		● Create a Smart Board center where students are quizzed on the basic identities. ● Have students summarize the steps of a proof with a partner. They should communicate the strategies without writing down the actual steps. ● There may be more than one way to represent an angle when using the sum and difference formulas. ● Emphasize to students not to think that for trigonometric functions, $f(x + y) = f(x) + f(y)$. ● When solving trigonometric equations, have students work in small groups to compare how they arrived at the solution. ● Have small groups prepare index cards for each identity, writing the left side of the identity on one card and the right side on another. Groups should then shuffle the cards, deal them face down, and play a memory card-matching game.	student understanding of Lesson 5-5. ● Have students complete the Lesson-by-Lesson Review on pp. 356–358. Then you can use McGraw-Hill eAssessment to customize another review worksheet that practices all the objectives of this chapter or only the objectives on which your students need more help. ● **McGraw-Hill eAssessment** Custo mize and create multiple versions of your chapter tests and their answer keys. All of the questions from the leveled chapter tests in the *Chapter 5 Resource Masters* are also available on McGraw-Hill eAssessment. ● **Document Camera** Choose several students to work through examples and explain how to apply the sum and difference of angles identities

Resources: Essential Materials, Supplementary Materials, Links to Best Practices
Chapter Resource Masters: Study guide and Intervention pp.10 - 11

Practice, p12
Teacher will incorporate chapter resources (study guide, college entrance tests, test tackler, standardized test prep) as needed

Geometer's Sketchpad.

Students explore the connections between trigonometric functions and right triangle geometry, and justify trigonometric identities.

Instructional Adjustments:

Logical Learners Have each student write an expression that contains all six trigonometric functions and is equal to 3.

Visual/Spatial Learners Have students work in groups of three or four to create a poster with all of the identities presented in the lesson. Each poster should include an example using each identity. A different color can be used for each identity. Then, when that identity is used in the example, it should be written in the matching color. Students should add identities to the posters as they progress through the chapter.

Extension Express cos *x* in terms of each of the other five trigonometric functions. Each expression should contain exactly one function other than the cosine. Assume that *x* is in Quadrant I.

Interpersonal Learners Have pairs of students work together to verify the identities in the Guided Practice exercises. Have students record helpful techniques and things for which they looked in getting started. Compile a class list on the board.

Extension Have students complete Exercise 63 individually and then with a partner. Each student should exchange the finished identities with his or her partner and see if they can verify each other's identities. Have them work together to do the same thing for cot *x* other than cotx/sinx.

Intrapersonal Learners Ask students to create a number of trigonometric equations and provide solutions for each. Suggest that they add a new problem to the set each day for the next several days.

Extension Pose the following problem.

$$a \sin (bx + c) + d = d + \frac{a}{2}$$

For the equation , where $a \neq 0$, c, d are any real numbers, and b is a positive integer, how many solutions are there on the interval $[0, 2\pi)$? $2b$

Verbal/Linguistic Learners One of the difficulties students have in mathematics is interpreting symbolism. Have students write out each identity in this lesson using words instead of mathematical notation.
Extension Use the identity for sin $(x + y)$ to develop an identity for sin $(x + y + z)$.

Unit Title: Chapter 6 System of Equations and Matrices

Targeted Standards: N.VM Perform operations on matrices and use matrices to solve problems
Unit Objectives/Conceptual Understandings: Students will be able to use matrices and matrix operations to solve systems of linear equations in two and three variables
Essential Questions: How can matrices be used to help solve linear systems?
Unit Assessment: Teacher generated assessments will be used.

	Core Content Objectives		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
N.VM.6 (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. **N.VM.7(+)** Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. **N.VM.8(+)** Add, subtract, and multiply matrices of appropriate dimensions. **N.VM.9 (+)** Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. **N.VM.10(+)** Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.	Students will know: ● Unit vocabulary including: m. Multivariable linear system n. Gaussian Elimination o. Augmented matrix p. Coefficient matrix q. Reduced row-echelon form r. Identity matrix s. Inverse matrix t. Invertible u. Singular matrix v. scalar w. Determinant x. Square system y. Cramer's rule z. Partial fraction aa. Optimization bb. Linear programming cc. Constraints dd. Feasible solutions ● How to convert a system into row-echelon form	Students will be able to: ● Solve systems of linear equations using matrices and Gaussian as well as Gauss-Jordan elimination ● Multiply matrices ● Find determinants and inverses of 2x2 and 3x3 matrices ● Solve systems of linear equations using inverse matrices	● Assign problems with green dots as problems for student self-assessment, since they have "step by step" solutions given in the back of the book. ● Use a description similar to the one on p.375 to help kids decide if 2 matrices can be multiplied and how to find the dimensions of the product. ● Show students alternate way to find the determinant of a 3x3 matrix using the "lattice method" ● Allow students to work on graph paper to help organize the entries better.	● p.372: Writing equations in triangular form (2,4,6,7) Writing augmented matrices(9-14) row-echelon form(16-21) Solving using Gaussian elimination(22-29) ● p.383: Multiplying and other operations(1-8,57-60) Inverse matrices (19-21,28-32) Finding determinants(37-41) ● p.392 Solving using inverse(2,4,6,8) Using Cramer's Rule(12,14-16) ● p.397 Mid-chapter quiz ● p.403(1-39)

A.REI.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable. **A.REI.9 (+)** Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).	● How to write an augmented/coefficient matrix for a system ● How to determine if there are infinite or no solutions to a system ● How dimensions matter in whether or not two matrices can be multiplied and determines the dimensions of the product ● That matrix multiplication is not communicative ● How to tell if a matrix will not have an inverse by examining the determinant	● Solve systems of linear equations using Cramer's rule ● Write partial fraction decompositions of rational expressions with linear or prime quadratic factors in the denominator. ● Use linear programming to solve applied problems	● Discuss the inability to use Cramer's rule if the detA=0 ● Show students the "cover-up method" to determine the coefficients for the partial fractions ● Use the "Concept Summary" on p.401 to summarize partial fraction situations ● Remind students that the number of factors in the denominator determines how many fractions there are in the decomposition. ● Use the "Key Concept" box at the top of p.406 to summarize steps for linear optimization	● p.410(1-8) Applied problems (9,11,18) ● p.413: Study Guide and Review

Resources: Essential Materials, Supplementary Materials, Links to Best Practices Teacher will incorporate Text supplied chapter resources where appropriate ● Differentiated instruction ● study guide and intervention ● practice WS's ● Word problem practice ● Study Notebook ● Online test and study guide generators ● Standardized test prep ● Connect to AP Calculus (honors only)	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings. ● Discuss "Common Errors" hints in Teacher's Edition to prevent possible misunderstandings. ● Give students graph paper to help those who have trouble lining up their matrices neatly. ● Have students circle each row and column as they multiply matrices to help keep track. ● Before writing partial fractions, students may need to review factoring, long division, and the algebraic skills needed to find coefficients ● Provide students with handout of notes ● Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.

Unit Title: Chapter 7 Conic Sections and Parametric Equations

Targeted Standards: Geometry- Expressing Geometric Properties with Equations: G-GPE: Translate between the geometric description and the equation for a conic section. Geometry- Expressing Geometric Properties with Equations: G-GPE: Use coordinates to prove simple geometric theorems algebraically.

Unit Objectives/Conceptual Understandings:

- Analyze, write, and graph equations of parabolas, ellipses, circles, and hyperbolas.
- Use equations to identify types of conic sections.
- Use rotation of axes to write equations of rotated conic sections.
- Graph rotated conic sections.
- Graph parametric equations.
- Solve problems related to the motion of projectiles.

Essential Questions: Compare and contrast the equations of circles, ellipses, hyperbolas, and parabolas. Explore real world applications.

Unit Assessment:

- Quiz 7.1 - 7.3
- Chapter 7 Test

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
G.GPE.3: Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant	Students will know: Definitions of the following terms: a. conic section b. degenerate conic c. locus d. parabola e. focus f. directrix g. axis of symmetry	. • Analyze and graph equations of parabolas. • Write equations of parabolas. • Analyze and graph equations of ellipses and circles. • Use equations to identify ellipses and circles. • Analyze and graph equations of hyperbolas. • Use equations to identify types of conic sections. • Find rotation of axes to write equations of rotated conic sections.	• Students can represent the foci of an ellipse using string and two tacks. They can explore how the shape of the ellipse changes if the distance between the tacks changes. • **Distance to a Directrix** Remind students that the distance from a point to a line, such as a directrix, is measured by the perpendicular distance from the point to the line.	**Ticket Out the Door** Have each student write the equation of an ellipse that has major axis from (−3, 0) to (3, 0) and minor axis from (0, −2) to (0, 2). $\frac{x^2}{9}+\frac{y^2}{4}=1$ **Formative Assessment** Use Quiz 1 on p. 33 as a check for student

	h. vertex i. latus rectum j. ellipse k. foci l. major axis m. center n. minor axis o. vertices p. co-vertices q. eccentricity r. hyperbola s. transverse axis t. conjugate axis u. parametric equation v. parameter w. orientation How conic sections are formed from a double right cone and a plane The characteristics of a circle algebraically and graphically The characteristics of an ellipse algebraically and graphically	• Graph rotated conic sections. • Graph parametric equations. • Solve problems related to the motion of projectiles.	• **Graphing a Parabola** Once the vertex and one point on each side of the axis of symmetry are known, students can use symmetry to see the general shape of the parabola to draw the graph of the parabola. • **Parabola:** Remind students the directrix is perpendicular to the axis of symmetry. Therefore, if the directrix is an x = equation, the parabola must open either left or right. If the directrix is y = equation, the parabola must open either up or down. • **Eccentricity** As the value of e approaches zero, the ellipse approaches a circle. As the value of e approaches 1, the ellipse approaches a line. • **Writing the Equation** Have students write a list of the values that they are given for a, b, c, h, and k. This will help them to organize what they have been given and determine what they need to find. • **Eccentricity** Emphasize that the	understanding of Lessons 7-1 and 7-2. **Formative Assessment** Use Quiz 2 on p. 33 as a check for student understanding of Lesson 7-3. **Formative Assessment** Use Quiz 3 on p. 34 as a check for student understanding of Lesson 7-4 **Ticket Out the Door** Have each student write the steps involved in writing the rectangular form of the equation when given the two parametric equations. Solve one equation for t, then substitute that value into the other equation and simplify. **Formative Assessment** Use Quiz 4 on p. 34 as a check for student understanding of Lesson 7-5.

	The characteristics of a hyperbola algebraically and graphically The characteristics of a parabola algebraically and graphically How to identify conic sections in standard form and general form How to rotate conic sections How to express conic sections in parametric form		equation relating a, b, and c is $a^2 + b^2 = c^2$ and not $a^2 - b^2 = c^2$ as it was for ellipses. Additionally, c will always be greater than a for hyperbolas. ● **Draw a Sketch** For real-world application problems, students should draw a sketch with labels of what is being described. This will help students to visualize what is happening and to ensure accuracy. ● **Extend Lesson 7-4** Use a graphing calculator to approximate solutions to systems of nonlinear equations and inequalities. ● **Extend Lesson 7-5** Use a graphing calculator to model functions parametrically.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices Encourage students to use the online resources available at my.hrw.com Teacher will incorporate chapter resources (study guide, college entrance tests, test tackler, standardized test prep) as needed	**Instructional Adjustments:** ● Modifications, student difficulties, possible misunderstandings. ● Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan. ● Graphing calculators can be used to graph parametric equations by changing the Mode from Func to Par. ● When completing the square to change the equations to standard form, students must add and subtract the same number to one side in order to not change the value of the equation. If there is a constant multiplying the x-terms, this constant must be multiplied by the number found by completing the square before adding or subtracting it to the number outside of the x-terms. ● Students may confuse the formula used to find the length of the foci, $c^2 = a^2 - b^2$, with the Pythagorean Theorem used to find the hypotenuse of a right triangle, $c^2 = a^2 + b^2$. ● If students are using a graphing calculator for graphing circles or ellipses, emphasize that they must solve the equation for y and graph the positive and negative solutions in order to see the entire circle or ellipse.

Graphing Calculator Geometer's Sketchpad	● Students may make mistakes with the orientation of their graphs. If x is in the positive term, then there is a horizontal transverse axis which means the hyperbola will open to the left and the right. If y is in the positive term, then there is a vertical transverse axis which means the hyperbola will open up and down. ● Students must first rearrange the equation into the form $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. Check to make sure that students are using the coefficient for the xy term for B. If there is no xy term in the equation, then $B = 0$. ● Make sure students use the trigonometric equations $x' = x \cos \theta + y \sin \theta$ and $y' = y \cos \theta - x \sin \theta$ to get values to substitute in for x' and y' ● Make sure students use the x- and y-coordinates to define the shape of their sketch. The locations of the parameter t should then be written on the curve.

Unit Title: Chapter 8: Vectors

Targeted Standards: Number and Quantity - Vector & Matrix Quantities- A1, A2, A3, B4, B5, C10, C11

Unit Objectives/Conceptual Understandings: Students will understand representations and basic operations with vectors. Students will be able to work with vectors in two and three dimensions to model various physical quantities and their effects on one another (e.g. flight path as the sum of still-air vector and wind vector).

Essential Questions: What kinds of quantities/measurements inherently associate with direction, and what kinds do not? How is traveling in a fixed medium (e.g. car on a road) different from traveling in a variable medium (e.g. plane in the air, ship in the water)?

Unit Assessment: Teacher-generated assessments will be used

	Core Content Objectives		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
● **N-VM.1** Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v, |v|, ||v||, v). ● **N-VM.2** Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. ● **N-VM.3** Solve problems involving velocity and other quantities that can be represented by vectors. ● **N-VM.4.a** Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two	● Unit vocabulary including: Vector, initial/terminal point, standard position, direction, magnitude (norm), quadrant bearing, true bearing, parallel vectors, equivalent vectors, opposite vectors, resultant, zero vector, component form, unit vector, dot product, work, orthogonal, *z*-axis, octants, ordered triple, cross product, triple scalar product ● Vectors can be used to represent physical quantities that cannot be seen (e.g. acceleration, force) ● Compare/contrast scalars (e.g. mass, speed)	● Resolve vectors into rectangular components ● Find the dot product of two vectors and use it to find the angle between them ● Find the projection of one vector onto another ● Plot points and vectors in the three-dimensional coordinate system ● Express algebraically and operate with vectors in space ● Find areas of parallelograms and volumes of parallelepipeds in space	● Graphing calculator activities: Chapter Resource Masters (CRM, http://connectED.mcgraw-hill.com): pg. 25, 31 ● Connection to AP Calculus- Vector Fields (pg. 530) ● Have students physically analyze vector addition graphically using ruler/protractor, as well as by computing results via Law of Cosines, component form, etc. to emphasize the connection. ● Visualization in 3-d space can be elusive for some students. Provide some samples to aid their visualization (e.g. computer models that can be rotated, using the corner of the	● Chapter Resource Masters (CRM, http://connectED.mcgraw-hill.com) ● Basic practice for each lesson: CRM pg. 7, 12, 17, 22, 28, ● Word problem/Application practice: CRM pg. 8, 13, 18, 23, 29 ● Enrichment and Extension: CRM pg. 9, 14, 19, 24, 30 ● Differentiated Instruction questions: text (TE) pg. 491, 496. 499, 508, 512. 516, 521 ● Chapter Summary- key points and vocabulary (pg. 525)

vectors is typically not the sum of the magnitudes. ● **N-VM.4.b** Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. ● **N-VM.4.c** Understand vector subtraction v – w as v + (–w), where –w is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise. ● **N-VM.5.b** Compute the magnitude of a scalar multiple cv using ||cv|| = |c|v. Compute the direction of cv knowing that when |c|v is not equal to 0, the direction of cv is either along v (for c > 0) or against v (for c < 0). ● **N-VM.10** Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. ● **N-VM.11** Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.	with vectors (e.g. force/weight, velocity) ● Previous knowledge of oblique triangles (e.g. Laws of Sines/Cosines) can aid in vector operations ● Unit vectors ***i*** and ***j*** may be used for component form (linear combination)--avoid confusion with imaginary unit i (dictated by context) ● Connections to physics (e.g. free-body force diagrams, work, torque) ● The Distance and Midpoint Formulas can be extended to three-dimensional space ● The cross-product definition only applies to vectors in three-dimensional space ● Connection of vectors to matrix operations (e.g. cross product as determinant of 3x3 matrix)		classroom to model an octant in space)	● Lesson-by-lesson Study Guide & Review (pg. 526) ● Practice Test (pg. 529)

Resources: -E-Tool Kit , Personal Tutor, Interactive Classroom (PowerPoint), Skills Practice Masters, Self-Check Quiz, Graphing Calculator	**Instructional Adjustments:** For the approaching, on level, ELL, and beyond level student: Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook. Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.

Unit Title: Chapter 9 Polar Coordinates and Complex Numbers

Targeted Standards: Perform arithmetic operations with complex numbers. Represent complex numbers and their operations on the complex plane.
Unit Objectives/Enduring Understandings: Students will be able to graph points with polar coordinates, graph simple polar equations, use a graphing calculator to explore the shape and symmetry of graphs of polar equations, identify and graph classical curves, convert between polar and rectangular coordinates and equations, identify polar equations of conics, convert complex numbers from rectangular to polar form and use DeMoivre's Theorem.
Essential Questions: Why is it helpful to have more than one coordinate system?
Unit Assessment: Teacher-generated assessments will be used.

	Core Content Standards		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
N.CN.3 (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. N.CN.4 (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. N.CN.5 (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the	Students will know: ● Unit vocabulary including: a) Polar coordinate system b) Pole c) Polar axis d) Polar coordinates e) Polar equation f) Polar graph g) Limacon h) Cardioid i) Rose j) Lemniscate k) Spiral of Archimedes l) Complex plane m) Real axis n) Imaginary axis o) Argand plane p) Modulus q) Argument r) Pth root of unity ● Graph points with polar coordinates ● Graph polar equations	Students will be able to: ● Write and evaluate polar equations ● Sketch polar equations on the polar graph paper. ● Use basic transformations to graph more complex polar functions ● Convert between polar and rectangular coordinates ● Find the roots of complex numbers by using DeMoirve's Theorem. ● Evaluate expressions complex polar numbers without a calculator	● Assign problems with green dots as problems for student self-assessment, since they have "step by step" solutions given in the back of the book. ● Have students complete a graphic organizer containing polar functions to help aide in the transformation between rectangular to polar and vice versa. ● To help kids remember the relationship between $x = rcos\sigma \wedge y = sin\sigma$, use the relationship of the unit circle ordered pairs (cos, sin) ● Discuss difference between complex polar numbers that can be evaluated with and without a calculator	● p.538 Polar Coordinates #1-41 odd, 83-86 ● p. 538 Polar Coordinates Day 2 #43-61, 63-82 ● p.548 Graphs of Polar #1-34, 84-87 ● p. 548 Graphs of Polar Day 2 #35-63, 65-83 ● p. 557 Polar and Rectangular Forms of Equations #1-47, 92-95 ● p. 557 Polar and Rectangular Forms of equations Day 2 #48-68, 70-72, 74-91

complex plane; use properties of this representation for computation. *For example,* $(-1 + \sqrt{3}\, i)3 = 8$ *because* $(-1 + \sqrt{3}\, i)$ *has modulus* 2 *and argument* 120°. N.CN.6 (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.	● Identify and graph classic polar curves ● Convert between polar and rectangular coordinates and equations ● Identify polar equations of conics ● Write and graph the polar equation of a conic given its eccentricity and the equation of its directrix. ● Convert complex numbers from rectangular to polar from and vice versa ● Find products, quotients, powers, and the roots of complex numbers in polar form.	● Sketch and analyze graphs of polar functions. ● Use the graphing calculator to help model data with polar and rectangular form.	● Encourage students to check their polar coordinate answers for reasonableness. ● Use the graphing calculator to help students see transformations by plotting multiple functions on one screen.	Have students complete the mid-chapter quiz on p. 560 ● P. 566 Polar forms of Conic Sections # 1-25, 76-79 ● P. 566 Polar Forms of Conic Sections Day 2 # 26-54, 57-79 ● P. 577 DeMoirve's Theorem #1-54, 98-100 ● P. 577 DeMoirve's Theorem Day 2 #55-74, 77-97 ● Use "Skills Review for standardized tests" at the end of each section for do now/closure questions throughout chapter to monitor student understanding ● P.584 "Study Guide and Review" for a comprehensive lesson by lesson review

Resources: Essential Materials, Supplementary Materials, Links to Best Practices	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings.
Teacher will incorporate Text supplied chapter resources where appropriate ● Differentiated instruction ● study guide and intervention ● practice WS's ● Word problem practice ● Study Notebook ● Online test and study guide generators ● Standardized test prep ● Connect to AP Calculus vignettes (honors only)	● Discuss "Common Errors" hints in Teacher's Edition to prevent possible misunderstandings. ● Concepts of end behavior will need to be reviewed in general before applying to polar and rectangular functions. ● Provide students with handout of notes ● Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.

Unit Title: Chapter 10 Sequences and Series

Targeted Standards: Algebra-Interpreting Functions: IF: Understand the concept of a function and use function notation. Algebra-Building Functions: BF: Build a function that models a relationship between two quantities. Algebra-Linear, Quadratic, and Exponential Models: LE: Construct and compare linear, quadratic, and exponential models and solve problems. Algebra-Seeing Structure in Expressions: SSE: Write expressions in equivalent forms to solve problems

Unit Objectives/Enduring Understandings: Students will be able to relate sequences and functions, represent and calculate sums of series with sigma notation, use arithmetic and geometric series and sequences, prove statements by using mathematical induction, and expand powers by using the Binomial Theorem.

Essential Questions: Where are patterns found in the real world? How can recognizing patterns solve real-world problems?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Standards		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
F.IF.3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers F.BF.1: Write a function that describes a relationship between two quantities (a) Determine an explicit expression, a recursive process, or steps for calculation from a context F.BF.2: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, model	Students will know: ● Unit vocabulary including: a) Sequence b) Term c) Finite sequence d) Infinite sequence e) Recursive sequence f) Explicit sequence g) Fibonacci Sequence h) Converge i) Diverge j) Series k) Finite series l) Nth partial sum m) Infinite series n) Sigma notation o) Arithmetic series p) Common ratio q) Geometric Series r) Binomial Coefficients	Students will be able to: ● Find the nth term of an arithmetic and geometric sequence ● Use sequences and series to predict patterns. ● Find the sum of n terms of arithmetic and geometric series ● Find the sum of a finite and infinite geometric series ● Use mathematical induction to prove summation formulas and properties of	● Assign problems with green dots as problems for student self-assessment, since they have “step by step” solutions given in the back of the book. ● Have students complete a graphic organizer containing arithmetic and geometric series and sequence formulas ● Encourage students to check their summation answers for reasonableness.	● p.595 Sequence, Series and Sigma Notation #1-45, 109-112 ● p. 595 Sequence, Series and Sigma Notation #46-81, 83-86, 88-108 ● p.605 Arithmetic Sequence and Series # 1-56, 102-105 ● p.605 Arithmetic Sequence and Series #57-82, 84-86, 88-101

situations, and translate between the two forms F.LE.2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or 2 input-output pairs. A.SSE.4: Derive the formula for the sum of a finite geometric series	s) Power Series ● Relate sequence and functions ● Use arithmetic and geometric sequences and series ● Prove Statements by using mathematical induction ● Expand powers by using the Binomial Theorem.	divisibility involving a positive integer n. ● Use extended mathematical induction ● Use Pascal's Triangle to write binomial expansions ● Use the Binomial Theorem to write and find the coefficients of specific terms in binomial expansions ● Use the power series to represent a rational function. ● Use power series representations to approximate values of transcendental functions.		● p 615 Geometric Sequence and Series # 1-63, 127-130 ● p 615 Geometric Sequence and Series #65-104, 107-111, 113-126 ● Have students complete the mid-chapter quiz on p. 620 ● P. 625 Mathematical Induction # 1-26, 77-80 ● P. 625 Mathematical Induction #27-55, 57, 58, 60-76 ● P. 633 Binomial Theorem #1-44, 92-95 ● P. 633 Binomial Theorem #45-68, 70-72, 74-91 ● P 642 Functions as Infinite Series #1-34, 74-76

				● P 642 Functions as Infinite Series #35-53, 55-57, 59-73 ● Use "Skills Review for standardized tests" at the end of each section for do now/closure questions throughout chapter to monitor student understanding ● P.645 "Study Guide and Review" for a comprehensive lesson by lesson review
Resources: Essential Materials, Supplementary Materials, Links to Best Practices Teacher will incorporate Text supplied chapter resources where appropriate ● Differentiated instruction ● study guide and intervention ● practice WS's ● Word problem practice ● Study Notebook ● Online test and study guide generators ● Standardized test prep ● Connect to AP Calculus vignettes (honors only)			**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings. ● Discuss "Common Errors" hints in Teacher's Edition to prevent possible misunderstandings. ● Concepts of end behavior will need to be reviewed in general before applying to arithmetic and geometric sequences and series. ● Provide students with handout of notes ● Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.	

Targeted Standards: Statistics and Probability-Conditional Probability and the Rules of Probability: CP: Understand independence and conditional probability and use them to interpret data. Statistics and Probability- Conditional Probability and the Rules of Probability: CP: Use the rules of probability to compute probabilities of compound events in a uniform probability model. Statistics and Probability- Using Probability to Make Decisions: MD: Use probability to evaluate outcomes of decisions.

Unit Objectives/Conceptual Understandings:

- Identify shapes of distributions.
- Construct probability distributions, including binomial distributions.
- Find probabilities for normal distributions and data values given probabilities.
- Understand and apply the Central Limit Theorem.
- Find confidence intervals using both *t* and *z* statistics.
- Formulate and test hypotheses using test statistics and *p*-values.
- Find and interpret linear correlation coefficients.
- Find linear regression lines.
- Determine the appropriateness of using a linear model.

Essential Questions: How can you effectively evaluate information? How can you use information to make decisions?

Unit Assessment:

- Quiz 11.1-11.4
- Chapter 11 Test

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
S.MD.1 (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. S.MD.2: (+) Calculate the expected value of a random	Definitions of the following terms: a. binomial distribution b. Central Limit Theorem c. confidence interval d. correlation e. correlation coefficient	• Identify the shapes of distributions in order to select more appropriate statistics. • Use measures of position to compare two sets of data. • Construct a probability distribution, and calculate its summary statistics.	**Skewed Distributions** Students may confuse negatively and positively skewed distributions. Remind them that a distribution that is negative or left-skewed is skewed away from the left, not toward the left. **Five Number Summary** If calculating the five-number summary by hand, students may	**Name the Math** Have students sketch symmetrical, positively skewed, and negatively skewed distributions, and identify the measure of central tendency and data spread that will provide the most accurate information. Students should write the mean and standard

variable; interpret it as the mean of the probability distribution. S.MD.3: (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.* S.MD.4: (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?* S.MD.5: (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a*	f. critical values g. empirical rule h. hypothesis test i. inferential statistics j. level of significance k. normal distribution l. percentiles m. probability distribution n. *P*-value o. random variable p. regression line q. residual r. standard error of the mean s. *t*-distribution t. *z*-value	• Construct and use a binomial distribution, and calculate its summary statistics • Find area under normal distribution curves. • Find probabilities for normal distributions, and find data values given probabilities. • Use the Central Limit Theorem to find probabilities. • Find normal approximations of binomial distributions. • Use the normal distributions to find confidence intervals for the mean. • Use *t*-distributions to find confidence intervals for the mean. • Write null and alternative hypotheses, and identify which represents the claims. • Perform hypothesis testing using test statistics and *p*-values. • Measure the linear correlations for sets of bivariate data using the correlation coefficient, and determine if the correlations are significant.	struggle with data sets having an even number of items. List these steps on the board. **1.** Write the data in ascending order. **2.** Find the median of the data. **3.** Split the data into two equal groups. Then repeat Step 2 for both groups to find the 1st and 3rd quartiles. **Common Errors** Students may assume that 10 heads in a row means that the next toss should result in tails. Remind them that each toss is an independent event. If students choose the incorrect distribution, remind them to use the *t*-distribution when the sample size *n* is less than 30 and use the normal distribution when the sample size is 30 or greater. **Extend Lab 11 - 3** Use a graphing calculator to transform skewed data into data that resemble a normal distribution. **Confidence Levels** As confidence level goes up, the interval widens.	deviation for the symmetric distribution and five-number summary for the skewed distributions. **Formative Assessment** Use Quiz 1 on p. 43 as a check for student understanding of Lessons 11-1 and 11-2. **Ticket Out the Door** Ask students the following question. IQ is a value that is normally distributed with average 100. Which event is less likely to occur? Explain. **A.** A person has an IQ less than 90. **B.** A person has an IQ greater than 112. B; 112 is further from the average, so it is less likely that a person has an IQ greater than 112 than a person has an IQ less than 90. **Formative Assessment** Use Quiz 2 on p. 43 as a check for student

state lottery ticket or a game at a fast-food restaurant. b. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.*		• Generate least-squares regression lines for sets of bivariate data, and use the lines to make predictions.	**Hypothesis Testing** A hypothesis test uses data to evaluate a claim about a population parameter. In a hypothesis test, there is a null and alternative hypothesis. Equality (=, ≤, ≥) is always in the null hypothesis, which is either rejected or not rejected. Two types of errors may occur when the decision to reject or not reject the null is made. A type I error occurs when the null hypothesis is falsely rejected. A type II error occurs when the null hypothesis is not rejected when it is actually false. When testing hypotheses, there are two ways to determine significance: compare a *z*-value to the critical value or compare the *p*-value to the critical area. **Extend Lab 11 - 7** Use TI-Nspire technology to find a median-fit line to model a relationship shown in a scatter plot.	understanding of Lessons 11-3 and 11-4. **Ticket Out the Door** Have students write the minimum sample size to get results that are accurate to ±0.03 degree with 95% confidence when $\sigma = 0.09$. **Name the Math** Ask students to list the steps required to test a hypothesis. **1.** State the hypotheses, and identify the claim. **2.** Determine the critical value(s) and region. **3.** Calculate the test statistic. **4.** Accept or reject the null hypothesis. **Formative Assessment** Use Quiz 3 on p. 44 as a check for student understanding of Lessons 11-5 and 11-6. **Ticket Out the Door** Have students describe the slope and *y*-intercept of a linear regression line that fits the variables shoe size and height for students aged 13 to 18 years. Sample answer:

				positive slope and a positive *y*-intercept **Formative Assessment** Use Quiz 4 on p. 44 as a check for student understanding of Lesson 11-7.

Resources: Essential Materials, Supplementary Materials, Links to Best Practices Encourage students to use the online resources available at http://connected.mcgraw-hill.com/ Teacher will incorporate chapter resources (study guide, college entrance tests, test tackler, standardized test prep) as needed Graphing calculators Geometer's Sketchpad	**Instructional Adjustments:** ● Modifications, student difficulties, possible misunderstandings. ● Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan. ● Students may assume that 10 heads in a row means that the next toss should result in tails. Remind them that each toss is an independent event. ● Remind them that they should compare the *z*-values for each test. ● If students choose the incorrect distribution, remind them to use the *t*-distribution when the sample size *n* is less than 30 and use the normal distribution when the sample size is 30 or greater. ● Students may confuse the claim and the null or alternative hypothesis. Remind students that they should first identify the hypotheses and that the null hypothesis always contains the equality. Only after doing this should they consider which hypothesis is the claim.

Unit Title: Chapter 12: Limits & Derivatives

Targeted Standards: While many of the new skills in this unit are beyond the NJSLA, students will exercise and explore a great many NJSLA skills they already have. These include: Mathematical Practice 5- Use appropriate tools strategically, Functions-Interpreting Functions, Algebra-Seeing structure in expressions, Modeling,

Unit Objectives/Conceptual Understandings: Students will learn the language of limits as a tool to describe function behavior where simple function notation fails. Students will analyze limits in three major ways-- graphically, numerically, and algebraically-- while considering the strengths and shortcomings of each in various contexts. Students will develop the concept of slope at a point, and connect this to the calculus concept of the derivative (rate of change). Students will preview some basic calculus ideas and their applications (derivative/rate of change, integral/area under a curve).

Essential Questions: We have learned about the slope of a line-- how can we talk about the slope of something curved? How can we describe irregular function behaviors (e.g. hole, asymptote) more specifically than simply stating "undefined" while using correct/standard notation? What kinds of values in everyday life are variable but limited, and how? (e.g. population of deer in a wooded area, speed of a car, height of Olympic high jump)

Unit Assessment: Teacher-generated assessments will be used

	Core Content Objectives		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
● **5.A** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example,	● Unit vocabulary including: Limit, asymptotes, holes, one-sided limit, two-sided limit, direct substitution, indeterminate form, tangent line, secant line, instantaneous rate of change, instantaneous velocity, derivative, differentiation, differential equation, differential operator, regular partition, definite integral, lower limit, upper limit, right Riemann sum, integration,	● Estimate limits of functions at fixed values and at infinity. ● Evaluate limits of polynomial and rational functions at selected points and at infinity. ● Find instantaneous rates of change by calculating slopes of tangent lines. ● Find instantaneous rates of change by calculating derivatives. ● Use the Product and Quotient Rules to calculate derivatives. ● Approximate the area under a curve using rectangles.	● Graphing calculator activities: Chapter Resource Masters (CRM, http://connectED.mcgraw-hill.com): pg. 10, 21, and textbook pg. 757 ● Connection to AP Calculus- The Chain Rule (pg. 798) ● Some students initially struggle with the concept of an indeterminate numerical form (such as 0/0). Consider the "Common Errors" on pg. 754 (TE) ● Students should already have a good sense of some limit types (ex: limits at	● Chapter Resource Masters (CRM, http://connectED.mcgraw-hill.com) ● Basic practice for each lesson: CRM pg. 7, 13, 18, 24, 29, 34 ● Word problem/Application practice: CRM pg. 8, 14, 19, 24, 30, 35 ● Enrichment and Extension: CRM pg. 9, 15, 20, 26, 31, 36 ● Differentiated Instruction questions: text (TE) pg. 742, 745, 753,

mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. ● **F-IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ● **F-IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified	antiderivative, indefinite integral, Fundamental Theorem of Calculus ● A table of values and a graph are useful tools for investigating and estimating limits. ● Left-hand and right-hand limits can be considered separately and simultaneously ● Algebraic methods can be used to investigate limits as well-- changing/simplifying a function can help avoid indeterminate forms. ● The slope of a curve at a point (slope of tangent line) is the Instantaneous Rate of Change, and can be found using the limit definition of the derivative. ● Differentiation is the name of the process for finding a function's derivative. Derivative rules can be developed to hasten the process. ● Area under a curve is a central idea in calculus, and it can be approximated to any degree of accuracy using rectangular subdivisions.	● Approximate the area under a curve using definite integrals and integration. ● Find antiderivatives. ● Use the Fundamental Theorem of Calculus.	infinity, as encountered in horizontal asymptotes of rational functions). Draw connections to such previous lessons to aid student mastery. ● Emphasize that one of the strengths of the language of limits is to discuss function behavior in places where simple function notation fails (ex: input values not within the function's domain, infinitely large inputs) ● Continually emphasize the different ways to investigate limits-- graphically, numerically, algebraically-- while discussing the strengths and shortcomings of each in context.	756, 761, 764, 771, 774, 779, 783, 788, 791 ● Chapter Summary- key points and vocabulary (pg. 792) ● Lesson-by-lesson Study Guide & Review (pg. 793) ● Practice Test (pg. 797)

interval. Estimate the rate of change from a graph. ● **F-IF.7.b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. ● **S-ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.				
Resources: -E-Tool Kit , Personal Tutor, Interactive Classroom (PowerPoint), Skills Practice Masters, Self-Check Quiz, Graphing Calculator			**Instructional Adjustments:** For the approaching, on level, ELL, and beyond level student: Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook. Individual accommodations will be made based on student's Individualized Education Plan or a 504 Plan.	