# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

| ***Topics & Standards*** | |
|---|---|
| ***Quarter 1*** | |
| ***Time Frame Weeks 1-8*** | |

**I. ALGEBRA**

**SEEING STRUCTURE IN EXPRESSIONS**

**Interpret the structure of expressions**

- **A.SSE.1** Interpret expressions that represent a quantity in terms of its context.*
  **a.** Interpret parts of an expression, such as terms, factors, and coefficients.
  **b.** Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P.*
- **A.SSE.2** Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*

**CREATING EQUATIONS***

**Create equations that describe numbers or relationships**

- **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
- **A.CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

**REASONING WITH EQUATIONS AND INEQUALITIES**

**Represent and solve equations and inequalities graphically**

- **A.REI.11** Explain why the x-coordinates of the points where the graphs of the equations *y = f(x)* and *y = g(x)* intersect are the solutions of the equation *f(x) = g(x);* find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f(x)* and/or *g(x)* are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

**II. FUNCTIONS**

**Interpret functions that arise in applications in terms of the context**

- **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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**
- **F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

• **F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

**Analyze functions using different representations**

• **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.*

**a**. Graph linear and quadratic functions and show intercepts, maxima, and minima.

**b.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

**c**. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

**d.** (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

**e.** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

**BUILDING FUNCTIONS**

**Build new functions from existing functions**

• **F.BF.3** Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(x), f(kx),* and *f(x + k)* for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

**For guidance with I can statements, clarifications, Enduring Understandings, and Essential Questions, see your resource titled, The Common Core, Clarifying Expectations for Teachers & Students, 2011 Edition.**

**Be sure to use the "Why" information at the beginning of each chapter for support with the Big Ideas.**

**Key Concepts and Skills**

- Identify functions and determine their domains, ranges, y-intercepts, and zeros.
- Evaluate the continuity, end behavior, limits, and extrema of a function.
- Calculate rates of change of nonlinear functions.
- Identify parent functions and transformations.
- Perform operations with functions, identify composite functions, and calculate inverse functions.
- 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.
- 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.

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

| | *Curriculum Units & Assessment (Evidence)* | *Opportunities for Integration* | *Resources (Curriculum & Textbook)* | *Key Concept tools & practices for Differentiation* |
|---|---|---|---|---|
| | **UBD Framework**<br>**Units: _____**<br><br>**Formative & Summative Assessments**<br>• 4-7 tasks that reach DOK 3-4 AND/OR<br>• 3-5 FATPs / RAFTs<br>• At least (1) GRASPS per quarter &<br>• At least 1 common short cycle per quarter<br>*Assessments are located within unit<br><br>**MGraw-Hill Glencoe Assessment Resources (Formative, Pre/Post, and Summative):**<br>• Chapter Readiness Checks, Chapter Tests, Quizzes, & Mid-chapter tests<br>• "Free Response Questions" provided to prepare students for AP Exams<br>• Aleks Software | | **Glencoe Pre-Calculus**<br>• Chapter 1: Functions from a Calculus Perspective<br>• Chapter 2: Power, Polynomial, and Rational Functions<br>• Chapter 3: Exponential and Logarithmic Functions<br><br>***Be sure to use the following instructional resources available for each chapter; found in the "Resources" tab:**<br>• Intro. Video & Animations<br>• Interactive Guides<br>• Anticipation Guides & Student Built Vocabulary<br>• eSolutions<br>• "Before you Read" & "Key Points" notes guide<br>• Chapter Projects<br>• Interactive Whiteboard Presentations<br>• *Connection to AP Calculus Lesson (provided in the Plan and Present Tab)<br><br>**Other Resources**<br>• Illustrative Mathematics - https://www.illustrativemathematics.org/content-standards/HSA<br>• ODE Math Model Curriculum | **Available on ConnectED:**<br>• Dinah Zike's Foldables<br>• Virtual Manipulatives<br>• *"abc* Vocab" Activities<br>• TI Easy Files<br>• H.O.T. Questions embedded in each textbook lesson<br>• *Multi-lingual Glossary & Audio in the ebook<br><br>**Other tools and practices:**<br>• Algebra Tiles<br>• Graphing Calculators<br>• Graphing Software<br>• Graphs and equations of real-world applications that apply quadratic and exponential functions<br>• Computer software that generate graphs of functions<br>• Examples of real-world situations that lend themselves to writing equations that model the contexts<br>• Computer Algebra Systems<br>• Area models<br>• Journals<br>• Concept/Anchor Charts<br>• Non-linguistic representations<br>• Discourse and questioning |

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

| ***Topics & Standards*** <br><br> ***Quarter 2*** <br><br> ***Time Frame Weeks 1-8*** | **I. THE COMPLEX NUMBER SYSTEM**<br>**Perform arithmetic operations with complex numbers.**<br>• **N.CN.1** Know there is a complex number *i* such that $i^2 = -1$, and every complex number has the form $a + bi$ with *a* and *b* real.<br>• **N.CN.2** Use the relation i 2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.<br>**Use complex numbers in polynomial identities and equations.**<br>• **N.CN.7** Solve quadratic equations with real coefficients that have complex solutions.<br>• **N.CN.9** (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.<br><br>**II. ALGEBRA**<br>**SEEING STRUCTURE IN EXPRESSIONS**<br>**Interpret the structure of expressions**<br>• **A.SSE.1** Interpret expressions that represent a quantity in terms of its context.*<br>**a.** Interpret parts of an expression, such as terms, factors, and coefficients.<br>**b.** Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P.*<br>• **A.SSE.2** Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*<br><br>**CREATING EQUATIONS***<br>**Create equations that describe numbers or relationships**<br>• **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.<br>• **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.<br>• **A.CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*<br><br>**ARITHMETIC WITH POLYNOMIALS AND RATIONALEXPRESSIONS**<br>**Perform arithmetic operations on polynomials**<br>• **A.APR.1** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.<br>**Understand the relationship between zeros and factors of polynomials**<br>• **A.APR.2** Know and apply the Remainder Theorem: For a polynomial *p(x)* and a number a, the remainder on division by $x – a$ is *p(a),* so p(a) = 0 if and only if $(x – a)$ is a factor of *p(x).* |
|---|---|

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

**Use polynomial identities to solve problems**

• **A.APR.**4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity (x2 + y2) 2 = (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples.*

**Rewrite rational expressions**

• **A.APR.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.7** (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

**REASONING WITH EQUATIONS AND INEQUALITIES A-REI**

**Represent and solve equations and inequalities graphically**

• **A.REI.11** Explain why the x-coordinates of the points where the graphs of the equations *y = f(x)* and *y = g(x)* intersect are the solutions of the equation *f(x) = g(x);* find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f(x)* and/or *g(x)* are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

• **A.REI.12** Graph the solutions to a linear inequality in two variables as a half- plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

**III. FUNCTIONS**

**INTERPRETING FUNCTIONS**

**Understand the concept of a function and use function notation**

• **F.IF.1** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then *f(x)* denotes the output of f corresponding to the input *x*. The graph of *f* is the graph of the equation *y = f(x).*

• **F.IF.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context**

•**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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**

• **F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

• **F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

**Analyze functions using different representations**

• **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.*

**a**. Graph linear and quadratic functions and show intercepts, maxima, and minima.

**b.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

**c**. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

**d.** (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

**e.** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

**BUILDING FUNCTIONS**

**Build new functions from existing functions**

• **F.BF.3** Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(x), f(kx),* and *f(x + k)* for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

• **F.BF.4** Find inverse functions.

**a.** Solve an equation of the form *f(x) = c* for a simple function f that has an inverse and write an expression for the inverse. *For example, f(x) =2 x3 or f(x) = (x+1)/(x–1) for x ≠ 1.*

**b.** (+) Verify by composition that one function is the inverse of another.

**c.** (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

**d.** (+) Produce an invertible function from a non-invertible function by restricting the domain.

**For guidance with I can statements, clarifications, Enduring Understandings, and Essential Questions, see your provided resource titled, The Common Core, Clarifying Expectations for Teachers & Students, 2011 Edition.**

**Be sure to use the "Why" information at the beginning of each chapter for support with the Big Ideas.**

**Key Concepts and Skills:**

- Solve right triangles using trigonometric and inverse trigonometric functions.
- Convert between degrees and radians.
- Solve real-world problems using trigonometric functions.
- Graph trigonometric functions and their inverses.
- Use sum and difference identities to evaluate trigonometric functions.
- Use double-angle, power-reducing, half-angle, and product-to-sum identities to evaluate trigonometric expressions and solve trigonometric equations.
- Solve systems of linear equations using matrices and Gaussian or Gauss-Jordan elimination.
- Multiply matrices.
- Find determinants and inverses of 2 × 2 and 3 × 3 matrices.

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

| | | | | |
|---|---|---|---|---|
| | • Solve oblique triangles and find their area using various laws and formulas.<br>• Identify and use trigonometric identities to find trigonometric values.<br>• Use trigonometric identities to simplify and rewrite trigonometric expressions.<br>• Verify trigonometric identities.<br>• Solve trigonometric equations. | | • Solve systems of linear equations using inverse matrices and Cramer's Rule.<br>• Write partial fraction decompositions of rational expressions with linear and irreducible quadratic factors.<br>• Use linear programming to solve applications.<br>• Recognize situations in which there are no solutions or more than one solution of a linear programming application. | |
| | ***Curriculum Unis & Assessment (Evidence)*** | ***Opportunities for Integration*** | ***Resources (Curriculum & supplemental)*** | ***Key Concept tools & Practices for Differentiation*** |
| | **UBD Framework**<br>**Units: _____**<br><br>**Formative & Summative Assessments**<br>• 4-7 tasks that reach DOK 3-4 AND/OR<br>• 3-5 FATPs / RAFTs<br>• At least (1) GRASPS per quarter &<br>• At least 1 common short cycle per quarter<br>*Assessments are located within unit<br><br>**MGraw-Hill Glencoe Assessment Resources (Formative, Pre/Post, and Summative):**<br>• Chapter Readiness Checks, Chapter Tests, Quizzes, & Mid-chapter tests | | **Glencoe PreCalculus**<br>• Chapter 4: Trigonometric Functions<br>• Chapter 5: Trigonometric Identities and Equations<br>• Chapter 6: Systems of Equations and Matrices<br><br>***Be sure to use the following instructional resources available for each chapter; found in the "Resources" tab:**<br>• Intro. Video & Animations<br>• Interactive Student Guide<br>• Anticipation Guides & Student Built Vocabulary<br>• eSolutions<br>• "Before you Read" & "Key Points" notes guide<br>• Chapter Projects | **Available on ConnectED:**<br>• Dinah Zike's Foldables<br>• Virtual Manipulatives<br>• *"abc* Vocab" Activities<br>• TI Easy Files<br>• H.O.T. Questions embedded in each textbook lesson<br>• *Multi-lingual Glossary & Audio in the ebook<br><br>**Other tools and practices:**<br>• Algebra Tiles<br>• Graphing Calculators<br>• Graphing Software<br>• Graphs and equations of real-world applications that apply quadratic and exponential functions<br>• Computer software that generate graphs of functions |

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

| | | | | |
|---|---|---|---|---|
| | • "Free Response Questions" provided to prepare students for AP Exams<br>• Aleks Software | | • Interactive Whiteboard Presentations<br>• *Connection to AP Calculus Lesson (provided in the Plan and Present Tab)<br><br>**Other Resources**<br>• Illustrative Mathematics - https://www.illustrativemathematics.org/content-standards/HSA<br>• ODE Math Model Curriculum | • Examples of real-world situations that lend themselves to writing equations that model the contexts<br>• Computer Algebra Systems<br>• Area models<br>• Journals<br>• Concept/Anchor Charts<br>• Non-linguistic representations<br>• Discourse and questioning |
| ***Topic & Standard***<br><br>***Quarter 3***<br><br>***Time Frame Weeks 1-8*** | **I. ALGEBRA**<br>**SEEING STRUCTURE IN EXPRESSIONS**<br>**Interpret the structure of expressions**<br>• **A.SSE.1** Interpret expressions that represent a quantity in terms of its context.*<br>**a.** Interpret parts of an expression, such as terms, factors, and coefficients.<br>**b.** Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P.*<br>• **A.SSE.2** Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*<br>Write expressions in equivalent forms to solve problems<br>• **A.SSE.4** Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.**<br><br>**REASONING WITH EQUATIONS AND INEQUALITIES**<br>**Understand solving equations as a process of reasoning and explain the reasoning**<br>• **A.REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.<br>**Represent and solve equations and inequalities graphically**<br>• **A.REI.11** Explain why the x-coordinates of the points where the graphs of the equations *y = f(x)* and *y = g(x)* intersect are the solutions of the equation *f(x) = g(x);* find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f(x)* and/or *g(x)* are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. | | | |

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

**CREATING EQUATIONS***

**Create equations that describe numbers or relationships**

- **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
- **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*

**ARITHMETIC WITH POLYNOMIALS AND RATIONALEXPRESSIONS**

**Use polynomial identities to solve problems**

- **A.APR.5** (+) Know and apply the Binomial Theorem for the expansion of *(x + y)n* in powers of *x* and y for a positive integer n, where *x* and *y* are any numbers, with coefficients determined for example by Pascal's Triangle.1

**Rewrite rational expressions**

- **A.APR.7** (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

**II. FUNCTIONS**

**Interpret functions that arise in applications in terms of the context**

- **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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**

**Analyze functions using different representations**

- **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.*
  - **a**. Graph linear and quadratic functions and show intercepts, maxima, and minima.
  - **b.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
  - **c**. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
  - **d.** (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
  - **e.** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- **F.IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

**a.** Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

**b**. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.*

- **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

**LINEAR, QUADRATIC, AND EXPONENTIAL MODELS***

**Construct and compare linear, quadratic, and exponential models and solve problems**

- **F.LE.4** For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a, c,* and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.

**BUILDING FUNCTIONS**

**Build a function that models a relationship between two quantities**

- **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.
  - **b.** Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
  - **c.** (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.

**Build new functions from existing functions**

- **F.BF.3** Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(x), f(kx),* and *f(x + k)* for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

**For guidance with I can statements, clarifications, Enduring Understandings, and Essential Questions, see your provided resource titled, The Common Core, Clarifying Expectations for Teachers & Students, 2011 Edition.**

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

**Be sure to use the "Why" information at the beginning of each chapter for support with the Big Ideas.**

**Key Concepts and Skills:**

- 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.
- Represent and operate with vectors both geometrically and algebraically.
- Resolve vectors into their rectangular components.
- Write a vector as the linear combination of unit vectors.
- Find the dot product of two vectors and use the dot product to find the angle between them.
- Find the projection of one vector onto another.
- Graph and operate with vectors in space.
- Find the dot and cross products of and angles between vectors in space.
- Find areas of parallelograms and volumes of parallelepipeds in space.

- Graph points with polar coordinates.
- Graph polar equations.
- Identify and graph classic polar curves.
- Convert between polar and rectangular coordinates.
- Convert between polar and rectangular 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 form and vice versa.
- Find products, quotients, powers, and roots of complex numbers in polar form.

| *Curriculum Units & Assessment (Evidence)* | *Opportunities for Integration* | *Resources (Curriculum /Textbook)* | *Concept Tools & Practices for Differentiation* |
|---|---|---|---|
| **UBD Framework**<br>**Units: _____**<br><br>**Formative & Summative Assessments**<br>• 4-7 tasks that reach DOK 3-4 AND/OR<br>• 3-5 FATPs / RAFTs<br>• At least (1) GRASPS per quarter &<br>• At least 1 common short cycle per quarter | | **Glencoe Pre-Calculus**<br>• Chapter 7: Conic Sections and Parametric Equations<br>• Chapter 8: Vectors<br>• Chapter 9: Polar Coordinates and Complex Numbers<br><br>***Be sure to use the following instructional resources available for each chapter; found in the "Resources" tab:**<br>• Intro. Video & Animations | **Available on ConnectED:**<br>• Dinah Zike's Foldables<br>• Virtual Manipulatives<br>• *"abc* Vocab" Activities<br>• TI Easy Files<br>• H.O.T. Questions embedded in each textbook lesson<br>• *Multi-lingual Glossary & Audio in the ebook<br><br>**Other tools and practices:**<br>• Algebra Tiles<br>• Graphing Calculators |

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

| | | | | |
|---|---|---|---|---|
| | *Assessments are located within unit<br><br>**MGraw-Hill Glencoe Assessment Resources (Formative, Pre/Post, and Summative):**<br>• Chapter Readiness Checks, Chapter Tests, Quizzes, & Mid-chapter tests<br>• "Free Response Questions" provided to prepare students for AP Exams<br>• Aleks Software | | • Interactive Student Guides<br>• Anticipation Guides & Student Built Vocabulary<br>• eSolutions<br>• "Before you Read" & "Key Points" notes guide<br>• Chapter Projects<br>• Interactive Whiteboard Presentations<br>• *Connection to AP Calculus Lesson (provided in the Plan and Present Tab)<br><br>**Other Resources**<br>• Illustrative Mathematics - https://www.illustrativemathematics.org/content-standards/HSA<br>• ODE Math Model Curriculum | • Graphing Software<br>• Graphs and equations of real-world applications that apply quadratic and exponential functions<br>• Computer software that generate graphs of functions<br>• Examples of real-world situations that lend themselves to writing equations that model the contexts<br>• Computer Algebra Systems<br>• Area models<br>• Journals<br>• Concept/Anchor Charts<br>• Non-linguistic representations<br>• Discourse and questioning |
| ***Topic & Standard Quarter 4***<br><br>***Time Frame Weeks 1-8*** | **I. STATISTICS**<br>**MAKING INFERENCES AND JUSTIFYING CONCLUSIONS**<br>**Understand and evaluate random processes underlying statistical experiments**<br>• **S.IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population.<br>**Make inferences and justify conclusions from sample surveys, experiments, and observational studies**<br>• **S.IC.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.<br>• **S.IC.6** Evaluate reports based on data.<br><br>**INTERPRETING CATEGORICAL AND QUANTITATIVE DATA**<br>**Summarize, represent, and interpret data on a single count or measurement variable**<br>• **S.ID.4** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. | | | |

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

**USING PROBABILITY TO MAKE DECISIONS**

**Use probability to evaluate outcomes of decisions**

- **S.MD.6** (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
- **S.MD.7** (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

**II. ALGEBRA**

**CREATING EQUATIONS***

**Create equations that describe numbers or relationships**

- **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

**II. FUNCTIONS**

**Analyze functions using different representations**

- **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.*
  - **a**. Graph linear and quadratic functions and show intercepts, maxima, and minima.
  - **b.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
  - **c**. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
  - **d.** (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
  - **e.** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

**TRIGONOMETRIC FUNCTIONS F-TF**

**Extend the domain of trigonometric functions using the unit circle**

- **F.FT.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- **F.FT.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.

**Model periodic phenomena with trigonometric functions**

- **F.FT.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*

**Prove and apply trigonometric identities**

- **F.FT.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

<table>
<tr><td></td><td colspan="2"><u>BUILDING FUNCTIONS</u><br><u>Build new functions from existing functions</u><br>• F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.<br><br>For guidance with I can statements, clarifications, Enduring Understandings, and Essential Questions, see your provided resource titled, The Common Core, Clarifying Expectations for Teachers & Students, 2011 Edition.</td></tr>
<tr><td></td><td>Be sure to use the “Why” information at the beginning of each chapter for support with the Big Ideas.<br><br>Key Concepts and Skills:<br><br>• Use sigma notation to represent and calculate sums of series.<br>• Find nth terms of arithmetic sequences and arithmetic series.<br>• Find nth terms of geometric sequences and geometric series. Find sums of infinite geometric series.<br>• Use mathematical induction to prove summation formulas and properties of divisibility involving a positive integer n.<br>• Use Pascal's Triangle or the Binomial Theorem to write binomial expansions.<br>• Use the Binomial Theorem to find the coefficients of specified terms in binomial expansions.<br>• Use a power series to represent a rational function.<br>• Use power series representations to approximate values of transcendental functions.</td><td>• Identify shapes of distributions.<br>• Construct probability distributions, including binomial distributions.<br>• Find probabilities for normal distributions and data values given probabilities.<br>• Understand and apply the Central Limit Theorem.<br>• Find confidence intervals using both t and z statistics.<br>• Formulate and test hypotheses using test statistics and p-values.<br>• Find and interpret linear correlation coefficients.<br>• Find linear regression lines.<br><br>• Determine the appropriateness of using a linear model. Estimate limits of functions at fixed values and at infinity.<br>• Evaluate limits of polynomial and rational functions at selected points and at infinity.<br>• Find instantaneous rates of change by calculating slopes of tangent lines.<br>• Find instantaneous rates of change by calculating derivatives.<br>• Use the Product and Quotient Rules to calculate derivatives.<br>• Approximate the area under a curve using rectangles.<br>• Approximate the area under a curve using definite integrals and integration.<br>• Find antiderivatives.<br>  • Use the Fundamental Theorem of Calculus.</td></tr>
</table>

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017

| | *Curriculum Units & Assessment (Evidence)* | *Opportunities for Integration* | *Resources (Curriculum /Textbook)* | *Concept Tools & Practices for Differentiation* |
|---|---|---|---|---|
| | **UBD Framework**<br>**Units: _____**<br><br>**Formative & Summative Assessments**<br>• 4-7 tasks that reach DOK 3-4<br>AND/OR<br>• 3-5 FATPs / RAFTs<br>• At least (1) GRASPS per quarter &<br>• At least 1 common short cycle per quarter<br>*Assessments are located within unit<br><br>**MGraw-Hill Glencoe Assessment Resources (Formative, Pre/Post, and Summative):**<br>• Chapter Readiness Checks, Chapter Tests, Quizzes, & Mid-chapter tests<br>• "Free Response Questions" provided to prepare students for AP Exams<br>• Aleks Software | | **Glencoe Pre-Calculus**<br>• Chapter 10: Sequences and Series<br>• Chapter 11: Inferential Statistics<br>• Chapter 12: Limits and Derivatives<br><br>***Be sure to use the following instructional resources available for each chapter; found in the "Resources" tab:**<br>• Intro. Video & Animations<br>• Interactive Student Guides<br>• Anticipation Guides & Student Built Vocabulary<br>• eSolutions<br>• "Before you Read" & "Key Points" notes guide<br>• Chapter Projects<br>• Interactive Whiteboard Presentations<br>• *Connection to AP Calculus Lesson (provided in the Plan and Present Tab)<br><br>**Other Resources**<br>• Illustrative Mathematics - https://www.illustrativemathematics.org/content-standards/HSA<br>• ODE Math Model Curriculum | **Available on ConnectED:**<br>• Dinah Zike's Foldables<br>• Virtual Manipulatives<br>• *"abc* Vocab" Activities<br>• TI Easy Files<br>• H.O.T. Questions embedded in each textbook lesson<br>• *Multi-lingual Glossary & Audio in the ebook<br><br>**Other tools and practices:**<br>• Algebra Tiles<br>• Graphing Calculators<br>• Graphing Software<br>• Graphs and equations of real-world applications that apply quadratic and exponential functions<br>• Computer software that generate graphs of functions<br>• Examples of real-world situations that lend themselves to writing equations that model the contexts<br>• Computer Algebra Systems<br>• Area models<br>• Journals<br>• Concept/Anchor Charts<br>• Non-linguistic representations<br>• Discourse and questioning |

# Pre-Calculus Mathematics Map/Pacing Guide
# 2016-2017