**Madison Local Schools**

**Precalculus**

2016

**Unit 1: Functions from a Calculus Perspective**

**Topics:** functions, analyzing graphs of functions, continuity, end behavior, extrema, average rate of change, parent functions and transformations, function operations, inverse functions

**Learning objectives:**

1. Students will describe the subsets of real numbers.
2. Students will identify and evaluate functions and state their domains.
3. Students will use graphs of functions to estimate function values.
4. Students will describe the end behavior of functions.
5. Students will determine the average rate of change of a function on a given interval.
6. Students will identify, graph and describe parent functions.
7. Students will identify and graph transformations of functions.
8. Students will perform operations with functions
9. Students will find composition of functions.
10. Students will use the horizontal line test to determine whether a function has an inverse function
11. Students will find inverse functions algebraically and graphically.

**Key vocabulary:** set-builder notation, interval notation, domain, zeros, roots, line symmetry, point symmetry, end behavior, extrema, maximum, minimum, average rate of change, secant line, transformation, translation, reflection, dilation, parent functions (constant, identity, quadratic, cubic, square root, reciprocal, absolute value, greatest integer), composition, inverse function

**Resources:** Precalculus textbook (Carter, etc., 2014 from McGraw-Hill), online resources at [connected.mcgraw-hill.com](file:///\\MADHS01FP1\VOL1\USERS\OFFICE\LMEISTER\GroupWise\connected.mcgraw-hill.com), worksheets, TI-84 Plus CE graphing calculator, Free Graphing Calculator mobile app, student notebook, flipcharts

**Assessments:** formative (homework, classwork, cooperative activities), summative (short assessments, chapter assessments, projects)

**Pacing:** approximately 6 weeks

**Unit 2: Power, Polynomial and Rational Functions**

**Topics:** power and radical functions, polynomial functions, remainder and factor theorems, zeros of polynomial functions, rational functions

**Learning objectives:**

1. Students will graph and analyze power functions.
2. Students will graph and analyze radical functions.
3. Students will solve radical equations.
4. Students will graph and analyze the behavior of polynomial functions.
5. Students will graph polynomial functions.
6. Students will model real-world data with polynomial functions.
7. Students will divide polynomials using long division and synthetic division.
8. Students will use the remainder and factor theorems to factor polynomials.
9. Students will determine the zeros of polynomial functions.
10. Students will find complex zeros of polynomial functions.
11. Students will analyze and graph rational functions.
12. Students will solve rational equations.

**Key vocabulary:** power function, monomial function, radical function, extraneous solutions, polynomial function, leading coefficient, leading-term test, turning point, quadratic form, repeated zero, multiplicity, synthetic division, synthetic substitution, rational zero theorem, fundamental theorem of algebra, complex conjugates, rational function, asymptote, holes

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**Assessments:** formative (homework, classwork, cooperative activities), summative (short assessments, chapter assessments, projects)

**Pacing:** approximately 5 weeks

**Unit 3: Exponential and Logarithmic Functions**

**Topics:** exponential functions, logarithmic functions, properties of logarithmic functions, exponential and logarithmic equations

**Learning objectives:**

1. Students will evaluate, analyze and graph exponential functions.
2. Students will solve problems involving exponential growth and decay.
3. Students will evaluate expressions involving logarithms.
4. Students will sketch and analyze graphs of logarithmic functions.
5. Students will apply properties of logarithms.
6. Students will apply the change of base formula.
7. Students will apply the one-to-one property of exponential functions to solve equations.
8. Students will apply the one-to-one property of logarithmic functions to solve equations.

**Key vocabulary:** algebraic function, exponential function, natural base, continuous compound interest, logarithmic function with base *b*, common logarithm, natural logarithm

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**Assessments:** formative (homework, classwork, cooperative activities), summative (short assessments, chapter assessments, projects)

**Pacing:** approximately 3 weeks

**Unit 4: Trigonometric Functions**

**Topics:** right triangle trigonometry, degrees and radians, trigonometric functions on the unit circle, graphing trigonometric functions, inverse trigonometric functions, Law of Sines, Law of Cosines

**Learning objectives:**

1. Students will find values of trigonometric functions for acute angles of right triangles.
2. Students will solve right triangles.
3. Students will convert degree measures of angles to radian measures and vice versa.
4. Students will use angle measures to solve real-world problems.
5. Students will find values of trigonometric functions for any angle.
6. Students will find values of trigonometric functions using the unit circle.
7. Students will graph transformations of the sine and cosine functions.
8. Students will use sinusoidal functions to solve problems.
9. Students will graph tangent and reciprocal trigonometric functions.
10. Students will evaluate and graph inverse trigonometric functions.
11. Students will find compositions of trigonometric functions.
12. Students will solve oblique triangles by using the Law of Sines or the Law of Cosines.
13. Students will find areas of oblique triangles.

**Key vocabulary:** sine, cosine, tangent, cosecant, secant, cotangent, inverse trigonometric function, angles of elevation and depression, vertex, initial side, terminal side, standard position, radian, coterminal angles, linear speed, angular speed, sector, quadrantal angle, reference angle, unit circle, sinusoidal function, amplitude, frequency, phase shift, vertical shift, midline, period, arcsine function, arccosine function, arctangent function, oblique triangles, Law of Sines, ambiguous case, Law of Cosines, Heron’s Formula

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**Assessments:** formative (homework, classwork, cooperative activities), summative (short assessments, chapter assessments, projects)

**Pacing:** approximately 8 weeks

**Unit 5: Trigonometric Identities and Equations**

**Topics:** trigonometric identities, verifying trigonometric identities, solving trigonometric equations, sum and difference identities

**Learning objectives:**

1. Students will identify and use basic trigonometric identities to find trigonometric values.
2. Students will use basic trigonometric identities to simplify and rewrite trigonometric expressions.
3. Students will verify trigonometric identities.
4. Students will solve trigonometric equations using algebraic techniques.
5. Students will solve trigonometric equations using basic identities.
6. Students will use sum and difference identities to evaluate trigonometric functions.
7. Students will use sum and difference identities to solve trigonometric equations.

**Key vocabulary:** trigonometric identity, cofunction, odd-even identities, reduction identity

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**Assessments:** formative (homework, classwork, cooperative activities), summative (short assessments, chapter assessments, projects)

**Pacing:** approximately 4 weeks

**Unit 6: Conic Sections and Parametric Equations**

**Topics:** parabolas, ellipses, circles, hyperbolas, parametric equations

**Learning objectives:**

1. Students will analyze and graph equations of parabolas.
2. Students will write equations of parabolas.
3. Students will analyze and graph equations of ellipses and circles.
4. Students will use equations to identify ellipses and circles.
5. Students will analyze and graph equations of hyperbolas.
6. Students will use equations to identify types of conic sections.
7. Students will graph parametric equations.
8. Students will solve problems related to the motion of projectiles.

**Key vocabulary:** conic section, degenerate conic, locus, parabola, focus, directrix, axis of symmetry, vertex, latus rectum, ellipse, foci, major axis, center minor axis, vertices, co-vertices, eccentricity, hyperbola, transverse axis, conjugate axis, parametric equation, parameter, orientation, parametric curve

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**Assessments:** formative (homework, classwork, cooperative activities), summative (short assessments, chapter assessments, projects)

**Pacing:** approximately 5 weeks

**Unit 7: Polar Coordinates and Complex Numbers**

**Topics:** polar coordinates, graphs of polar equations, polar and rectangular forms of equations, polar forms of conic sections, complex numbers and DeMoivre’s Theorem

**Learning objectives:**

1. Students will graph with polar coordinates.
2. Students will graph simple polar equations.
3. Students will graph polar equations.
4. Students will identify and graph classical curves.
5. Students will convert between polar and rectangular coordinates.
6. Students will convert between polar and rectangular equations.
7. Students will identify polar equations of conics.
8. Students will write and graph the polar equation of a conic given its eccentricity and the equation of its directrix.
9. Students will convert complex numbers from rectangular to polar form and vice versa.
10. Students will find products, quotients, powers and roots of complex numbers in polar form.

**Key vocabulary:** polar coordinate system, pole, polar axis, polar coordinates, polar equation, polar graph, limacon, cardioid, rose, lemniscate, spiral of Archimedes, complex plane, real axis, imaginary axis, Argand plane, absolute value of a complex number, polar form, trigonometric form, modulus, argument, *p*th roots of unity

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**Assessments:** formative (homework, classwork, cooperative activities), summative (short assessments, chapter assessments, projects)

**Pacing:** approximately 5 weeks