Billings Public Schools
Algebra 3—Aligned to CCSS

Chapter 2: Functions and Their Graphs

Topics Covered:

- Introduction to Functions (F.BF.1)
- Graphs of Functions (F.BF.1, F.IF.7)
- Transformations (F.BF.1, F.IF.7)
- Domain and Range (F.IF.7)
- Operations on Functions (F.BF.1, F.IF.7)
- Rates of Change (F.BF.1)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Determine** whether the function is a relation
- **Find** the domain and range of a function
- **Determine** whether a graph is a function
- **Identify** key features of graphed functions
- **Determine** parent functions
- **Transform** graphs of parent functions
- **Form** sum, difference, product, and quotient functions and **find** their domain
- **Determine** if a function is even, odd, or neither
- **Find** the average rate of change of a function over an interval
- **Work** with and **solve** various problems involving an average rate of change

Essential Questions:

- How is the domain and range of a function determined from the graph of a function?
- What happens to a parent function when you transform its graph?

Montana Core Standards

The student will…

F.IF.1: Write a function that describes a relationship between two quantities.

F.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in the simple cases and using technology for more complicated cases.

Teacher Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Even, Odd, or Neither Worksheet: http://northcobbhs.blogs.com/files/even-odd-neither-hw-1.doc

Media/Technology Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Refer to website: http://bpshsmath.weebly.com
- Even, Odd, or Neither Website: http://www.mathsisfun.com/algebra/functions-odd-even.html

Note: If a chapter section is not listed, it is meant to be skipped.

Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving functions and their graphs.	• Honors teachers: curriculum could include instantaneous rate of change. • Discussion of interval notation for domain and range.

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 3: Linear and Quadratic Functions

Topics Covered:

- Linear: Functions and Their Properties (F.BF.1, F.IF.7, A.CED.1, A.REI.3)
- Quadratics: Functions and Their Properties (F.BF.1, F.IF.7, A.CED.1, A.REI.4)
- Inequalities Involving Quadratic Functions (A.CED.1, A.REI.3)
- Models of Functions Based Upon Data (S.ID.6a, S.ID.7)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Identify** key features of linear and quadratic functions, including intercepts, extreme values, and symmetry
- **Graph** and **build** linear and quadratic functions
- **Utilize** appropriate technology to determine regression equations
- **Solve** equations and inequalities involving a linear or quadratic function

Essential Questions:

- What are the similarities and differences between solving/graphing linear and quadratic functions?

Montana Core Standards

The student will…

A.CED.1: Create equations and inequalities in one variable and use them to solve problems from a variety of contexts (e.g., science, history, and culture), including those of Montana American Indians. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

A.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A.REI.4: Solve quadratic equations in one variable.

S.ID.6a: Fit a [linear or quadratic] function to the data; use function fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context.

S.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear [or quadratic] model in the context of the data.

Teacher Resources:

- Pearson Precalculus Enriched with Graphing Utilities

Media/Technology Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Refer to website: http://bpshsmath.weebly.com

Note: If a chapter section is not listed, it is meant to be skipped.

Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving linear and quadratic functions.	• Honors teachers: curriculum could include use of sum of squares of residuals to determine the better model.

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 11: Systems of Equations
Sections 1-4 only

Topics Covered:

- Substitution and Elimination (A.REI.7)
- Matrices (N.VM.6, N.VM.7, A.REI.7)
- Determinants (N.VM.10, A.REI.7)
- Matrix Algebra (N.VM.8, N.VM.9, A.REI.7, A.REI.9)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Solve** systems of equations by using substitution and elimination
- **Recognize** consistent and inconsistent systems
- **Solve** systems of equations using matrices
- **Evaluate** determinants of square matrices
- **Solve** systems of equations using Cramer's Rule
- **Perform** operations with matrices (add, subtract, multiply scalars, and multiply matrices)
- **Find** the inverse matrix
- **Solve** square systems of equations using inverse matrices

Essential Questions:

- What are methods used to solve systems of equations?
- How do you determine whether two matrices can be added, subtracted, multiplied, or solved?

Montana Core Standards

The student will…

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 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 associate 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.

A.REI.7: Solve a simple system consisting of a linear and a quadratic equation in two variables algebraically and graphically.

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 x 3 or greater).

Note: If a chapter section is not listed, it is meant to be skipped.

Teacher Resources:	**Media/Technology Resources:**
• Pearson Precalculus Enriched with Graphing Utilities • SIMMS Level 2 Marvelous Matrices	• Pearson Precalculus Enriched with Graphing Utilities • Refer to website: http://bpshsmath.weebly.com
Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving systems of equations.	• Regular teachers: focus on 2 x 2 and 3 x 3 examples. • Honors teachers: include 4 x 4 examples.

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 4: Polynomial and Rational Functions

Topics Covered:

- Polynomial Functions and Models (A.SSE.1, A.APR.6, F.IF.7)
- Properties of Rational Functions (A.APR.6, A.APR.7)
- The Graph of a Rational Function (F.IF.7, F.IF.7d)
- Polynomial and Rational Inequalities (A.REI.11)
- The Real Zeroes of a Polynomial Function (A.APR.6, A.APR.7)
- Complex Zeroes; Fundamental Theorem of Algebra (N.CN.3, N.CN.8, N.CN.9)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Recognize** and **describe** graphs of polynomial functions
- **Identify** key features of polynomial and rational functions (including zeroes and their multiplicities, asymptotes, holes, turning points, and end behavior)
- **Find** the domain of a rational function
- **Analyze** the graphs of polynomial and rational functions
- **Solve** polynomial and rational inequalities graphically
- **Apply** the Remainder and Factor Theorems and make connections between remainders, factors, and zeroes
- **Determine** the maximum number of zeroes of a polynomial
- **Solve** polynomials for real and/or complex roots
- **Solve** applied problems

Essential Questions:

- Given a polynomial in factored form, how do you find the intercepts and end behavior of the graph?
- Given a rational function in factored form, how do you determine where the zeroes, holes, and asymptotes are?
- How many complex zeroes could a polynomial function have?

Montana Core Standards

The student will…

A.SSE.1: Interpret [polynomial and rational] expressions that represent a quantity in terms of its context. (Also, see part b).

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.

A.REI.11: Represent and solve equations and inequalities graphically. *Combine polynomial, rational, radical, absolute value, and exponential functions.*

F.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in the simple cases and using technology for more complicated cases.

F.IF.7d: Graph rational functions, identifying zeroes when suitable factorizations are available, and showing end behavior.

N.CN.3: Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Note: If a chapter section is not listed, it is meant to be skipped.

N.CN.8: Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.

N.CN.9: Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Teacher Resources:	**Media/Technology Resources:**
• Pearson Precalculus Enriched with Graphing Utilities • UCSMP Functions, Statistics, and Trigonometry (for applications)	• Pearson Precalculus Enriched with Graphing Utilities • Refer to website: http://bpshsmath.weebly.com • Inverse Rational Function Website: http://wmueller.com/precalculus/newfunc/invrat.html
Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving polynomial and rational functions.	• Use graphical approach in Section 4.4 (when solving inequalities) • Honors teachers: include Descartes' Rule of Signs, Rational Zeroes Theorem, and (upper and lower) bounds tests • Look for real-world applications of polynomials (FST book)

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 5: Exponential and Logarithmic Functions

Topics Covered:

- Composite Functions (F.BF.5)
- One-to-One Functions; Inverse Functions (F.BF.5)
- Exponential Functions (F.BF.5, F.IF.7e)
- Logarithmic Functions (F.BF.5, F.IF.7e)
- Properties of Logarithms (F.BF.5)
- Exponential Growth and Decay Models; Newton's Law; Logistical Growth and Decay Models (F.BF.5)
- Building Exponential, Logarithmic, and Logistical Models from Data (F.BF.5)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Recognize** and **describe** graphs of exponential and logarithmic functions
- **Form** the composite function of two functions and find its domain
- **Find** an inverse function
- **Verify** whether two functions are inverses
- **Identify** key features of exponential and logarithmic functions (including common vs. natural logs)
- **Analyze** the graphs of exponential and logarithmic functions
- **Solve** exponential and logarithmic functions
- **Change** between exponential and logarithmic forms
- **Solve** applied problems using exponential and logarithmic equations

Essential Questions:

- How are exponential and logarithmic models used along with polynomial models to solve real-world situations?
- How do you find the inverse graphically or given an equation or a set of points?

Montana Core Standards

The student will…

F.BF.5: Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

F.IF.7e: Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Teacher Resources:

- Pearson Precalculus Enriched with Graphing Utilities

Media/Technology Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Refer to website: http://bpshsmath.weebly.com

Note: If a chapter section is not listed, it is meant to be skipped.

Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving exponential and logarithmic functions.	• Honors teachers: include logistic functions in section 5.8 • Regular teachers: leave out logistic functions in section 5.8

Note: If a chapter section is not listed, it is meant to be skipped.

Probability

Topics Covered:	**Mathematical Practices:**
• Probability Distributions & Expected Value (S.MD.1, S.MD.2, S.MD.3, S.MD.4, S.MD.5)	1: Make sense of problems and persevere in solving them. 2: Reason abstractly and quantitatively. 3: Construct viable arguments and critique the reasoning of others. 4: Model with mathematics. 5: Use appropriate tools strategically. 6: Attend to precision. 7: Look for and make use of structure. 8: Look for and express regularity in repeated reasoning.
Objectives: The student will be able to… • **Predict** the expected value (mean) of a random variable modeled by a probability distribution • **Determine** probabilities involving binomial experiments	**Essential Questions:** • How can you predict an expected outcome given a probability distribution?

Montana Core Standards

The student will…

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 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 for the number of TV sets per household in the United States, and calculate the expected 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.

S.MD.5a: 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.

S.MD.5b: Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

Note: If a chapter section is not listed, it is meant to be skipped.

Teacher Resources:	**Media/Technology Resources:**
• UCSMP Functions, Statistics, and Trigonometry (Sect 6.8 – Expected Count, Sect 10.4 – Probability Distribution & Expected Value, and if time, Sect 10.5 – Binomial Probabilities) • Georgia CCGPS Pre-Calculus Unit 7: Probability (Georgia Lottery Task, Mega Millions Practice Task) • Illustrative Mathematics (S-MD Fred's Fun Factory) https://www.illustrativemathematics.org/illustrations/1197	• Refer to website: http://bpshsmath.weebly.com
Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving probability.	• Expand this unit as time allows at the end of the semester (i.e., more tasks from the Georgia website).

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 6: Trigonometric Functions

Topics Covered:

- Angles and Their Measure (F.TF.3)
- Trigonometric Functions: Unit Circle Approach (F.TF.3, F.TF.4)
- Properties of the Trigonometric Functions (F.TF.9)
- Graphs of the Sine and Cosine Functions (F.TF.6)
- Graphs of the Tangent, Cotangent, Cosecant, and Secant Functions (F.TF.6)
- Phase Shift; Sinusoidal Curve Fitting (F.TF.6)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Define** radian measure and **convert** angle measures between degrees and radians
- **Define** the trigonometric functions in term of the unit circle
- **Prove** and **work** with the basic trigonometric identities such as periodicity, reciprocal, and quotient identities
- **Graph** the basic trigonometric functions and **state** the domain and range of these trigonometric functions
- **Transform** graphs of parent functions and **state** the period, amplitude, phase shift, and vertical shift of the transformed trigonometric functions
- **Find** an equation for a sinusoidal graph
- **Build** sinusoidal models from data

Essential Questions:

- How is the unit circle used to describe trigonometric functions?
- How do you convert between radians and degrees?
- How do transformations affect the trigonometric graphs of each function?

Montana Core Standards

The student will…

F.TF.3: Use special triangles to determine geometrically the values of sine, cosine, and tangent for $\pi/3$, $\pi/4$, and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$. $\pi + x$, and $2\pi - x$ in terms of their 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.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.9: Prove and apply trigonometric identities.

Teacher Resources:

- Pearson Precalculus Enriched with Graphing Utilities

Media/Technology Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Refer to website: http://bpshsmath.weebly.com

Note: If a chapter section is not listed, it is meant to be skipped.

Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving trigonometric functions.	• Regular teachers: focus on sine, cosine, tangent functions • Honors teachers: include secant, cosecant, and cotangent

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 7: Analytic Trigonometry

Topics Covered:

- The Inverse Sine, Cosine, and Tangent Functions (F.TF.7)
- The Inverse Trigonometric Functions Continued (F.TF.7)
- Trigonometric Identities (F.TF.9)
- Sum and Difference Formulas (F.TF.9)
- Double-angle and Half-angle Formulas (F.TF.9)
- Product-to-Sum and Sum-to-Product Formulas (F.TF.9)
- Trigonometric Equations (I) (F.TF.7, F.TF.9)
- Trigonometric Equations (II) (F.TF.7, F.TF.9)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Use** the graphs of sine, cosine and tangent to define their inverse trigonometric functions
- **Use** inverse trigonometric notation
- **Use** properties of inverse functions to find exact values of composite functions
- **Apply** strategies to prove identities
- **Use** addition and subtraction identities for sine, cosine, and tangent functions
- **Use** double angle and half angle identities
- **Solve** trigonometric equations algebraically and **state** the complete solution
- **Work** with a variety of techniques to solve trigonometric equations
- **Use** the appropriate identity rule to solve trigonometric equations

Essential Questions:

- Why is it important to restrict the domain of a trigonometric function when working with inverses?
- How is proving or verifying a trigonometric identity different than solving a trigonometric equation?

Montana Core Standards

The student will…

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.9: Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Teacher Resources:

- Pearson Precalculus Enriched with Graphing Utilities

Media/Technology Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Refer to website: http://bpshsmath.weebly.com

Note: If a chapter section is not listed, it is meant to be skipped.

Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving analytic trigonometry.	• If time allows, honors teachers could do Sect 7.6 • Regular teachers should introduce secant, cosecant, and cotangent using the reciprocal identities and the Pythagorean identities • Honors teachers should expand the sum and difference identity concepts to secant, cosecant, and cotangent functions

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 8: Applications of Trigonometric Functions

Topics Covered:

- Right Triangle Trigonometry; Applications (F.TF.3)
- The Law of Sines (G.SRT.10)
- The Law of Cosines (G.SRT.10)
- Area of a Triangle (G.SRT.9)
- Simple Harmonic Motion, Damped Motion, Combining Waves (G.SRT.11)

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Solve** right triangles and applied problems using trigonometric functions
- **Use** the Law of Sines and the Law of Cosines to find measurements of triangles and to solve applied problems
- **Find** the area of triangles using the appropriate methods
- **Build** and **analyze** a model for simple harmonic function

Essential Questions:

- How do you find side lengths and angle measures of triangles (right and non-right)?
- How do you model simple harmonic motion?

Montana Core Standards

The student will…

F.TF.3: Use special triangles to determine geometrically the values of sine, cosine, and tangent for $\pi/3$, $\pi/4$, and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$. $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.

G.SRT.9: Derive the formula $A = absin(c)$ for the area of a triangle by drawing an auxiliary line from a vertex to the opposite side.

G.SRT.10: Prove the Laws of Sines and Cosines and use them to solve problems.

G.SRT.11: Understand and apply the Laws of Sines and Cosines to find unknown measurements in right and non-right triangles, e.g., surveying problems, resultant forces.

Teacher Resources:

- Pearson Precalculus Enriched with Graphing Utilities

Media/Technology Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Refer to website: http://bpshsmath.weebly.com

Note: If a chapter section is not listed, it is meant to be skipped.

Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving applications of trigonometric functions.	

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 9: Polar Coordinates; Vectors

Topics Covered:

- Polar Coordinates ( )
- Polar Equations and Graphs ( )
- The Complex Plane, De Movre's Theorem ( )
- Vectors ( )
- The Dot Product ( )
- Vectors in Space ( )
- The Cross Product ( )

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Define** radian measure and **convert** angle measures between degrees and radians
- **Define** the trigonometric functions in term of the unit circle
- **Prove** and **work** with the basic trigonometric identities such as periodicity, reciprocal, and quotient identities
- **Graph** the basic trigonometric functions
- **State** the period, amplitude, phase shift, and vertical shift of the basic trigonometric functions
- **Transform** graphs of parent functions
- **Form** sum, difference, product, and quotient functions and find their domain
- **Determine** whether a function is even, odd, or neither
- **Find** the average rate of change of a function over an interval
- **Work** with and **solve** various problems involving an average rate of change

Essential Questions:

- How is the unit circle used to describe trigonometric functions?
- How do you convert between radians and degrees?

Montana Core Standards

The student will…

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.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.

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 from a variety of contexts (e.g., science, history, and culture), including those of Montana American Indians, involving velocity and other quantities that can be represented by vectors.

N.VM.4: Add and subtract vectors.

Note: If a chapter section is not listed, it is meant to be skipped.

N.VM.4a: Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.

N.VM.4b: Given two vectors in magnitude and directions form, determine the magnitude and direction of their sum.

N.VM.4c: Understand vector subtraction as 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 I the appropriate order, and perform vector subtraction component-wise.

N.VM.5: Multiply a vector by a scalar.

N.VM.5a: Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.

N.VM.5b: Compute the magnitude of a scalar multiple cv using ||cv|| = |c|v. Compute the direction of cv knowing that when |c|v0, the direction of cv is either along v (for c > 0) or against v (for c < 0).

Teacher Resources:	**Media/Technology Resources:**
• Pearson Precalculus Enriched with Graphing Utilities	• Pearson Precalculus Enriched with Graphing Utilities • Refer to website: http://bpshsmath.weebly.com
Assessments: • **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving polar coordinates and vectors.	**Suggested Instructional Practices:**

Note: If a chapter section is not listed, it is meant to be skipped.

Chapter 10: Analytic Geometry

Topics Covered:

- Conics ( )
- The Parabola (G.GPE.2)
- The Ellipse (G.GPE.3)
- The Hyperbola (G.GPE.3)
- Rotation of Axes; General Form of a Conic ( )
- Polar Equations of Conics (N.CN.4)
- Plane Curves and Parametric Equations ( )

Mathematical Practices:

1: Make sense of problems and persevere in solving them.
2: Reason abstractly and quantitatively.
3: Construct viable arguments and critique the reasoning of others.
4: Model with mathematics.
5: Use appropriate tools strategically.
6: Attend to precision.
7: Look for and make use of structure.
8: Look for and express regularity in repeated reasoning.

Objectives:

The student will be able to…

- **Recognize** the various conics
- **Analyze** conics with vertex at the origin
- **Analyze** conics with vertex at .
- **Solve** applied problems involving conics
- **Graph** the basic trigonometric functions
- **State** the period, amplitude, phase shift, and vertical shift of the basic trigonometric functions
- **Transform** graphs of parent functions
- **Form** sum, difference, product, and quotient functions and find their domain
- **Determine** whether a function is even, odd, or neither
- **Find** the average rate of change of a function over an interval
- **Work** with and **solve** various problems involving an average rate of change

Essential Questions:

- How are conics used to solve real-world situations?

Montana Core Standards

The student will…

G.GPE.2: Derive the equation of a parabola given a focus and directrix.

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.

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.

Apply here? G.MD.A2: Give an informal argument using Cavalieri's Principle for the formulas for the volume of a sphere and other solid figures.

Teacher Resources:

- Pearson Precalculus Enriched with Graphing Utilities

Media/Technology Resources:

- Pearson Precalculus Enriched with Graphing Utilities
- Refer to website: http://bpshsmath.weebly.com

Note: If a chapter section is not listed, it is meant to be skipped.

Assessments:	**Suggested Instructional Practices:**
• **Homework:** To be given daily on each introduced topic. • **Class discussion:** Students will be expected to be prepared for class, participate in class activities and actively engage in class discussion. • **Formative Assessments:** On current chapter concepts. • **Summative Assessments:** On concepts involving analytic geometry.	

Note: If a chapter section is not listed, it is meant to be skipped.