

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

**Pre-Calculus Lesson 01 - Algebra Review for Pre-Calculus**

Math 12 Pre-Calculus Lesson 01 - Algebra Review for Pre-Calculus

<b>Standard Benchmark and Indicator</b>
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
S04. Patterns, Functions and Algebra
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)

**Pre-Calculus Lesson 02 - Graphing Techniques and Review of Conic Sections**

Math 12 Pre-Calculus Lesson 02 - Graphing Techniques and Review of Conic Sections

<b>Standard Benchmark and Indicator</b>
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
03. Relate graphical and algebraic representations of lines, simple curves and conic sections. (12)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
10. Describe the characteristics of the graphs of conic sections. (11)
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

**Pre-Calculus Lesson 03 - Sets & Intervals**

Math 12 Pre-Calculus Lesson 03 - Sets & Intervals

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
E. Compare, order and determine equivalent forms of real numbers. (08-10)
02. Compare, order and determine equivalent forms for rational and irrational numbers. (09)
S04. Patterns, Functions and Algebra
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)

**Pre-Calculus Lesson 04 - Types of Numbers and Number Classifications**

Math 12 Pre-Calculus Lesson 04 - Types of Numbers and Number Classifications

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
E. Represent and compute with complex numbers. (11-12)
07. Compute sums, differences, products and quotients of complex numbers. (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)

**Pre-Calculus Lesson 05 - Relations & Functions**

Math 12 Pre-Calculus Lesson 05 - Relations & Functions

Standard Benchmark and Indicator
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
B. Identify and classify functions as linear or nonlinear, and contrast their properties using tables, graphs or equations. (08-10)
01. Define function formally and with $f()$ (10)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

**Pre-Calculus Lesson 06 - Graphing Functions, Restricting the Domain and Range; The Vertical Line Test**

Math 12 Pre-Calculus Lesson 06 - Graphing Functions, Restricting the Domain and Range; The Vertical Line Test

<b>Standard Benchmark and Indicator</b>
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)
03. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations. (12)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
03. Relate graphical and algebraic representations of lines, simple curves and conic sections. (12)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
10. Describe the characteristics of the graphs of conic sections. (11)
S05. Data Analysis and Probability
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
08. Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions. (11)

**Pre-Calculus Lesson 07 - Use of the Graphing Calculator with Functions**

Math 12 Pre-Calculus Lesson 07 - Use of the Graphing Calculator with Functions

<b>Standard Benchmark and Indicator</b>
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
07. Make mathematical arguments using the concepts of limit. (12)
10. Describe the characteristics of the graphs of conic sections. (11)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)
<b>S05. Data Analysis and Probability</b>
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
04. Create a scatterplot of bivariate data, identify trends, and find a function to model the data. (11)
08. Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions. (11)

**Pre-Calculus Lesson 08 - The Inverse of a Function**

Math 12 Pre-Calculus Lesson 08 - The Inverse of a Function

**Standard Benchmark and Indicator**

A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms,
03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
06. Represent the inverse of a function symbolically and graphically as a reflection about (11)
07. Make mathematical arguments using the concepts of limit. (12)
10. Describe the characteristics of the graphs of conic sections. (11)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)
S05. Data Analysis and Probability
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
04. Create a scatterplot of bivariate data, identify trends, and find a function to model the data. (11)

**Pre-Calculus Lesson 09 - Two Special Functions**

Math 12 Pre-Calculus Lesson 09 - Two Special Functions

Standard Benchmark and Indicator

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

conic sections. (12)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
07. Make mathematical arguments using the concepts of limit. (12)
10. Describe the characteristics of the graphs of conic sections. (11)
C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)
01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)
D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (11-12)
05. Set up and solve systems of equations using matrices and graphs, with and without technology. (12)
<b>S05. Data Analysis and Probability</b>
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
04. Create a scatterplot of bivariate data, identify trends, and find a function to model the data. (11)

**Pre-Calculus Lesson 10 - Solving Systems of Equations for Points of Intersection**

Math 12 Pre-Calculus Lesson 10 - Solving Systems of Equations for Points of Intersection

**Standard Benchmark and Indicator**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

03. Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
10. Describe the characteristics of the graphs of conic sections. (11)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)
D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (11-12)
05. Set up and solve systems of equations using matrices and graphs, with and without technology. (12)
09. Solve 3 by 3 systems of linear equations by elimination and using technology, and interpret graphically what the solution means (a point, line, plane, or no solution). (11)
<b>S05. Data Analysis and Probability</b>
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
02. Transform bivariate data so it can be modeled by a function; e.g., use logarithms to allow nonlinear relationship to be modeled by linear function. (12)
04. Create a scatterplot of bivariate data, identify trends, and find a function to model the data. (11)

**Pre-Calculus Lesson 11 - Introduction to Matrices**

Math 12 Pre-Calculus Lesson 11 - Introduction to Matrices

<b>Standard Benchmark and Indicator</b>
<b>S01. Number, Number Sense and Operations</b>
B. Develop an understanding of properties of and representations for addition and multiplication of vectors and matrices. (11-12)
01. Determine what properties hold for matrix addition and matrix multiplication; e.g., use examples to show addition is commutative and when multiplication is not commutative. (11)
D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases. (11-12)
04. Use matrices to represent given information in a problem situation. (11)
06. Compute sums, differences and products of matrices using paper and pencil calculations for simple cases, and technology for more complicated cases. (11)
<b>S04. Patterns, Functions and Algebra</b>

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

09. Solve 3 by 3 systems of linear equations by elimination and using technology, and interpret graphically what the solution means (a point, line, plane, or no solution). (11)
--

**Pre-Calculus Lesson 12 - The Inverse of a Matrix and Solving Systems of Equations Using Matrices**

Math 12 Pre-Calculus Lesson 12 - The Inverse of a Matrix and Solving Systems of Equations Using Matrices

<b>Standard Benchmark and Indicator</b>
S01. Number, Number Sense and Operations
B. Develop an understanding of properties of and representations for addition and multiplication of vectors and matrices. (11-12)
01. Determine what properties hold for matrix addition and matrix multiplication; e.g., use examples to show addition is commutative and when multiplication is not commutative. (11)
D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases. (11-12)
04. Use matrices to represent given information in a problem situation. (11)
06. Compute sums, differences and products of matrices using paper and pencil calculations for simple cases, and technology for more complicated cases. (11)
S04. Patterns, Functions and Algebra
D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (11-12)
05. Set up and solve systems of equations using matrices and graphs, with and without technology. (12)
07. Model and solve problems with matrices and vectors. (11)
09. Solve 3 by 3 systems of linear equations by elimination and using technology, and interpret graphically what the solution means (a point, line, plane, or no solution). (11)

**Pre-Calculus Lesson 13 - Curve fitting, Scatter Plots and Regression Using the Graphing Calculator**

Math 12 Pre-Calculus Lesson 13 - Curve fitting, Scatter Plots and Regression Using the Graphing Calculator

<b>Standard Benchmark and Indicator</b>
---

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

06. Compute sums, differences and products of matrices using paper and pencil calculations for simple cases, and technology for more complicated cases. (11)
<b>S02. Measurement</b>
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
D. Solve problem situations involving derived measurements; e.g., density, acceleration. (11-12)
05. Solve real-world problems involving area, surface area, volume and density to a specified degree of precision. (11)
<b>S03. Geometry and Spatial Sense</b>
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
03. Relate graphical and algebraic representations of lines, simple curves and conic sections. (12)
B. Represent transformations within a coordinate system using vectors and matrices. (11-12)
01. Use matrices to represent translations, reflections, rotations, dilations and their compositions. (12)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
10. Describe the characteristics of the graphs of conic sections. (11)
C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)
01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)
D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (11-12)
07. Model and solve problems with matrices and vectors. (11)
09. Solve 3 by 3 systems of linear equations by elimination and using technology, and interpret graphically what the solution means (a point, line, plane, or no solution). (11)
<b>S05. Data Analysis and Probability</b>
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
02. Transform bivariate data so it can be modeled by a function; e.g., use logarithms to allow nonlinear relationship to be modeled by linear function. (12)
04. Create a scatterplot of bivariate data, identify trends, and find a function to model the data. (11)
05. Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation. (11)
08. Analyze and interpret univariate and bivariate data to identify patterns, note

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

trends, draw conclusions, and make predictions. (11)
C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (11-12)
01. Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation. (11)

**Pre-Calculus Lesson 14 - Solving Rational Expressions and Partial Fraction Decomposition**

Math 12 Pre-Calculus Lesson 14 - Solving Rational Expressions and Partial Fraction Decomposition

<b>Standard Benchmark and Indicator</b>
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., $27^{1/3}$ (11)
D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases. (11-12)
04. Use matrices to represent given information in a problem situation. (11)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)
D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (11-12)
05. Set up and solve systems of equations using matrices and graphs, with and without technology. (12)
07. Model and solve problems with matrices and vectors. (11)

**Pre-Calculus Lesson 15 - Solving Radical Equations with Restrictions; Conjugates of Rational Radical Expressions**

Math 12 Pre-Calculus Lesson 15 - Solving Radical Equations with Restrictions; Conjugates of Rational Radical Expressions

<b>Standard Benchmark and Indicator</b>
---

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

finding solutions for problem situations; e.g., 27 (11)
E. Represent and compute with complex numbers. (11-12)
07. Compute sums, differences, products and quotients of complex numbers. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)

**Pre-Calculus Lesson 16 - The Nature of Complex Numbers**

Math 12 Pre-Calculus Lesson 16 - The Nature of Complex Numbers

<b>Standard Benchmark and Indicator</b>
<b>S01. Number, Number Sense and Operations</b>
A. Demonstrate that vectors and matrices are systems having some of the same properties of the real number system. (11-12)
02. Determine what properties hold for vector addition and multiplication, and for scalar multiplication. (11)
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
02. Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations. (12)
E. Represent and compute with complex numbers. (11-12)
03. Represent complex numbers on the complex plane. (11)
07. Compute sums, differences, products and quotients of complex numbers. (11)
<b>S03. Geometry and Spatial Sense</b>
B. Represent transformations within a coordinate system using vectors and matrices. (11-12)
02. Represent translations using vectors. (11)
<b>S04. Patterns, Functions and Algebra</b>
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)
D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (11-12)
07. Model and solve problems with matrices and vectors. (11)

**Pre-Calculus Lesson 17 - Further Investigation into Complex Numbers**

Math 12 Pre-Calculus Lesson 17 - Further Investigation into Complex Numbers

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
A. Demonstrate that vectors and matrices are systems having some of the same properties of the real number system. (11-12)
02. Determine what properties hold for vector addition and multiplication, and for scalar multiplication. (11)
B. Develop an understanding of properties of and representations for addition and multiplication of vectors and matrices. (11-12)
05. Model, using the coordinate plane, vector addition and scalar multiplication. (11)
D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases. (11-12)
09. Use vector addition and scalar multiplication to solve problems. (11)
E. Represent and compute with complex numbers. (11-12)
01. Determine what properties (closure, identity, inverse, commutative and associative) hold for operations with complex numbers. (12)
03. Represent complex numbers on the complex plane. (11)
07. Compute sums, differences, products and quotients of complex numbers. (11)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
B. Represent transformations within a coordinate system using vectors and matrices. (11-12)
02. Represent translations using vectors. (11)
03. Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations. (11)
S04. Patterns, Functions and Algebra
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)
D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (11-12)
07. Model and solve problems with matrices and vectors. (11)

**Pre-Calculus Lesson 18 - Semester Exam**

**Pre-Calculus Lesson 19 - Introduction to Trigonometry**

Math 12 Pre-Calculus Lesson 19 - Introduction to Trigonometry

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
<b>S02. Measurement</b>
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)
03. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations. (12)
<b>S03. Geometry and Spatial Sense</b>
B. Represent transformations within a coordinate system using vectors and matrices. (11-12)
03. Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations. (11)
04. Recognize and compare specific shapes and properties in multiple geometries; e.g., plane, spherical, and hyperbolic. (12)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. (12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
07. Make mathematical arguments using the concepts of limit. (12)
<b>S05. Data Analysis and Probability</b>
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
04. Create a scatterplot of bivariate data, identify trends, and find a function to model the data. (11)

**Pre-Calculus Lesson 20 - Special Right Triangles and Circular Trigonometry**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., $27^{1/3}$ (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)
03. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations. (12)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
B. Represent transformations within a coordinate system using vectors and matrices. (11-12)
04. Recognize and compare specific shapes and properties in multiple geometries; e.g., plane, spherical, and hyperbolic. (12)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. (12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
S05. Data Analysis and Probability
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
05. Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation. (11)

**Pre-Calculus Lesson 21 - Graphing Trigonometric Functions**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

Math 12 Pre-Calculus Lesson 21 - Graphing Trigonometric Functions

<b>Standard Benchmark and Indicator</b>
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
S02. Measurement
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
07. Make mathematical arguments using the concepts of limit. (12)

**Pre-Calculus Lesson 22 - Inverse Trigonometric Functions**

Math 12 Pre-Calculus Lesson 22 - Inverse Trigonometric Functions

<b>Standard Benchmark and Indicator</b>
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. (12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
04. Represent the inverse of a transcendental function symbolically. (12)
06. Represent the inverse of a function symbolically and graphically as a reflection about (11)
07. Make mathematical arguments using the concepts of limit. (12)

**Pre-Calculus Lesson 22 - Inverse Trigonometric Functions**

Math 12 Pre-Calculus Lesson 22 - Inverse Trigonometric Functions

**Standard Benchmark and Indicator**

<b>S02. Measurement</b>
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
<b>S03. Geometry and Spatial Sense</b>
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms,
03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. (12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
04. Represent the inverse of a transcendental function symbolically. (12)
06. Represent the inverse of a function symbolically and graphically as a reflection about (11)
07. Make mathematical arguments using the concepts of limit. (12)

**Pre-Calculus Lesson 23 - Trigonometric Identities**

Math 12 Pre-Calculus Lesson 23 - Trigonometric Identities

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
02. Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction, and double angle. (12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. (12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

**Pre-Calculus Lesson 24 - Double and Half Angle Identities: Law of Sines and Law of Cosines**

Math 12 Pre-Calculus Lesson 24 - Double and Half Angle Identities: Law of Sines and Law of Cosines

Standard Benchmark and Indicator
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)
04. Calculate distances, areas, surface areas and volumes of composite three-dimensional objects to a specified number of significant digits. (11)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)

**Pre-Calculus Lesson 25 - The Area of Triangle and Solving Trigonometric Equations**

Math 12 Pre-Calculus Lesson 25 - The Area of Triangle and Solving Trigonometric Equations

Standard Benchmark and Indicator
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)
04. Calculate distances, areas, surface areas and volumes of composite three-dimensional objects to a specified number of significant digits. (11)
S03. Geometry and Spatial Sense
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

02. Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction, and double angle. (12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)

**Pre-Calculus Lesson 26 - Polar Coordinates, Equations and Graphs**

Math 12 Pre-Calculus Lesson 26 - Polar Coordinates, Equations and Graphs

<b>Standard Benchmark and Indicator</b>
<b>S02. Measurement</b>
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
<b>S03. Geometry and Spatial Sense</b>
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
02. Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction, and double angle. (12)
04. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11)
B. Represent transformations within a coordinate system using vectors and matrices. (11-12)
01. Use polar coordinates to specify locations on a plane. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
09. Translate freely between polar and Cartesian coordinate systems. (12)

**Pre-Calculus Lesson 27 - Graphing Polar Coordinates**

Math 12 Pre-Calculus Lesson 27 - Graphing Polar Coordinates

**Standard Benchmark and Indicator**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

<b>S02. Measurement</b>
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
B. Apply various measurement scales to describe phenomena and solve problems. (11-12)
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
<b>S03. Geometry and Spatial Sense</b>
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
02. Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction, and double angle. (12)
03. Relate graphical and algebraic representations of lines, simple curves and conic sections. (12)
B. Represent transformations within a coordinate system using vectors and matrices. (11-12)
01. Use polar coordinates to specify locations on a plane. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
09. Translate freely between polar and Cartesian coordinate systems. (12)
10. Describe the characteristics of the graphs of conic sections. (11)

**Pre-Calculus Lesson 28 - Trigonometry and the Complex Plane**

Math 12 Pre-Calculus Lesson 28 - Trigonometry and the Complex Plane

**Standard Benchmark and Indicator**

B. Represent transformations within a coordinate system using vectors and

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

matrices. (11-12)
01. Use polar coordinates to specify locations on a plane. (11)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
09. Translate freely between polar and Cartesian coordinate systems. (12)
B. Use the quadratic formula to solve quadratic equations that have complex roots. (11-12)
08. Solve equations involving radical expressions and complex roots. (11)
C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)
02. Translate a recursive function into a closed form expression or formula for the $n$ th term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years. (11)

**Pre-Calculus Lesson 29 - Introduction to Exponential Expressions and Logarithms**

Math 12 Pre-Calculus Lesson 29 - Introduction to Exponential Expressions and Logarithms

<b>Standard Benchmark and Indicator</b>
<b>S01. Number, Number Sense and Operations</b>
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
<b>S02. Measurement</b>
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)
03. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations. (12)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
06. Represent the inverse of a function symbolically and graphically as a reflection about (11)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

**Pre-Calculus Lesson 30 - Introduction to Logarithms**

Math 12 Pre-Calculus Lesson 30 - Introduction to Logarithms

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. (12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
04. Represent the inverse of a transcendental function symbolically. (12)
05. Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the (11)
06. Represent the inverse of a function symbolically and graphically as a reflection about (11)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)

**Pre-Calculus Lesson 31 - Applications of Exponential and Logarithmic Functions**

Math 12 Pre-Calculus Lesson 31 - Applications of Exponential and Logarithmic Functions

Standard Benchmark and Indicator
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
08. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., 27 (11)
S02. Measurement
A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (11-12)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

01. Determine the number of significant digits in a measurement. (11)
C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)
03. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations. (12)
D. Solve problem situations involving derived measurements; e.g., density, acceleration. (11-12)
05. Solve real-world problems involving area, surface area, volume and density to a specified degree of precision. (11)
<b>S03. Geometry and Spatial Sense</b>
A. Use trigonometric relationships to verify and determine solutions in problem situations. (11-12)
03. Relate graphical and algebraic representations of lines, simple curves and conic sections. (12)
<b>S04. Patterns, Functions and Algebra</b>
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
03. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior. (11)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
04. Represent the inverse of a transcendental function symbolically. (12)
06. Represent the inverse of a function symbolically and graphically as a reflection about (11)
07. Make mathematical arguments using the concepts of limit. (12)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)
C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)
01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)
<b>S05. Data Analysis and Probability</b>
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
02. Transform bivariate data so it can be modeled by a function; e.g., use logarithms to allow nonlinear relationship to be modeled by linear function. (12)
04. Create a scatterplot of bivariate data, identify trends, and find a function to model the data. (11)
05. Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation. (11)
08. Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions. (11)
B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (11-12)
05. Use technology to find the Least Squares Regression Line, the regression

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation. (11)
08. Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions. (11)
C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (11-12)
01. Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation. (11)
09. Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques. (11)
D. Connect statistical techniques to applications in workplace and consumer situations. (11-12)
01. Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation. (11)

**Pre-Calculus Lesson 32 - The Natural Exponential and Logarithm with Applications**

Math 12 Pre-Calculus Lesson 32 - The Natural Exponential and Logarithm with Applications

**Standard Benchmark and Indicator**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

03. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. (12)
04. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology. (11)
06. Represent the inverse of a function symbolically and graphically as a reflection about (11)
07. Make mathematical arguments using the concepts of limit. (12)
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation. (11)
C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)
01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)
02. Translate a recursive function into a closed form expression or formula for the $n$ th term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years. (11)
<b>S05. Data Analysis and Probability</b>
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (11-12)
07. Describe the standard normal curve and its general properties, and answer questions dealing with data assumed to be normal. (11)
B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (11-12)
06. Use technology to compute the standard deviation for a set of data, and interpret standard deviation in relation to the context or problem situation. (11)
C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (11-12)
09. Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques. (11)
D. Connect statistical techniques to applications in workplace and consumer situations. (11-12)
09. Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques. (11)

**Pre-Calculus Lesson 33 - Sequences and Series**

Math 12 Pre-Calculus Lesson 33 - Sequences and Series

**Standard Benchmark and Indicator**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

situations. (11-12)
03. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations. (12)
<b>S04. Patterns, Functions and Algebra</b>
<b>A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)</b>
01. Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases. (12)
02. Translate between the numeric and symbolic form of a sequence or series. (12)
<b>C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)</b>
01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)
02. Translate a recursive function into a closed form expression or formula for the $n$ th term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years. (11)

**Pre-Calculus Lesson 34 - Infinite Sequences and Series**

Math 12 Pre-Calculus Lesson 34 - Infinite Sequences and Series

**Standard Benchmark and Indicator**

each of those can affect solutions in measurement situations. (11-12)
01. Determine the number of significant digits in a measurement. (11)
<b>B. Apply various measurement scales to describe phenomena and solve problems. (11-12)</b>
02. Use radian and degree angle measures to solve problems and perform conversions as needed. (11)
<b>C. Estimate and compute areas and volume in increasingly complex problem situations. (11-12)</b>
03. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some
<b>S04. Patterns, Functions and Algebra</b>
<b>A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)</b>
01. Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases. (12)
02. Translate between the numeric and symbolic form of a sequence or series. (12)
07. Make mathematical arguments using the concepts of limit. (12)
<b>C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)</b>
01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)
02. Translate a recursive function into a closed form expression or formula for the $n$ th term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years. (11)

**Pre-Calculus Lesson 35 - Convergent and Divergent Infinite Series:  
 Mathematical Induction and the Binomial Theorem**

Math 12 Pre-Calculus Lesson 35 - Convergent and Divergent Infinite Series: Mathematical Induction and the Binomial Theorem

<b>Standard Benchmark and Indicator</b>
S01. Number, Number Sense and Operations
C. Apply factorials and exponents, including fractional exponents, to solve practical problems. (11-12)
02. Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations. (12)
S04. Patterns, Functions and Algebra
A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. (11-12)
01. Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases. (12)
02. Translate between the numeric and symbolic form of a sequence or series. (12)
06. Make arguments about mathematical properties using mathematical induction. (12)
07. Make mathematical arguments using the concepts of limit. (12)
C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (11-12)
01. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest. (11)
02. Translate a recursive function into a closed form expression or formula for the $n$ th term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years. (11)

**Pre-Calculus Lesson 36 - Second Semester Exam**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**

**Virtual Learning Academy**  
**Jefferson County Educational Service Center**  
**Academic Content Standards**  
**Pre-Calculus - 12**