Algebra 2 with Trigonometry

Correlation of the ALEKS course Algebra 2 with Trigonometry to the Tennessee Algebra II Standards

Standard 2 : Number & Operations

- = ALEKS course topic that addresses the standard
TD = Teacher Directed

Course Level Expectations:

CLE 3103.2.1: Understand the hierarchy of the complex number system and relationships between the elements, properties and operations.
- Using $i$ to rewrite square roots of negative numbers
- Simplifying a product or quotient involving roots of negative numbers
- Adding and subtracting complex numbers
- Multiplying complex numbers
- Dividing complex numbers
- Simplifying a power of $i$

CLE 3103.2.2: Connect numeric, analytic, graphical and verbal representations of both real and complex numbers.
- Plotting integers on a number line
- Fractional position on a number line
- Plotting rational numbers on a number line
- Integers and rational numbers
- Rational and irrational numbers
- Using $i$ to rewrite square roots of negative numbers

CLE 3103.2.3: Use appropriate technology (including graphing calculators and computer spreadsheets) to solve problems, recognize patterns and collect and analyze data.
- Using a graphing calculator to find zeros of a polynomial function
- Using a graphing calculator to find local extrema of a polynomial function

CLE 3103.2.4: Understand the capabilities and limitations of technology when performing operations, graphing, and solving equations involving complex numbers.
TD

Checks for Understanding (Formative/Summative Assessment):

3103.2.1: Understand that to solve certain problems and equations, the real number system needs to be extended from real numbers to complex numbers.
- Solving a quadratic equation with complex roots

3103.2.2: Define and give examples of each of the types of numbers in the complex number system.
- Integers and rational numbers
- Rational and irrational numbers
- Using $i$ to rewrite square roots of negative numbers

3103.2.3: Identify and apply properties of complex numbers (including simplification and standard form).
- Using $i$ to rewrite square roots of negative numbers
- Simplifying a product or quotient involving roots of negative numbers
- Adding and subtracting complex numbers
• Multiplying complex numbers
• Dividing complex numbers
• Simplifying a power of \( i \)

3103.2.4: Add and subtract complex numbers.
• Adding and subtracting complex numbers

3103.2.5: Multiply complex numbers.
• Multiplying complex numbers

3103.2.6: Define and utilize the complex conjugates to write the quotient of two complex numbers in standard form.
• Dividing complex numbers

3103.2.7: Graph complex numbers in the complex plane and recognize differences and similarities with the graphical representations of real numbers graphed on the number line.

3103.2.8: Solve quadratic equations over the complex number system.
• Solving a quadratic equation with complex roots

3103.2.9: Find and describe geometrically the absolute value of a complex number.

3103.2.10: Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers over complex numbers.
• Properties of addition
• Properties of real numbers
• Solving equations with zero, one, or infinitely many solutions
• Introduction to algebraic symbol manipulation

3103.2.11: Understand the capabilities and limitations of technology. Make estimations without a calculator to detect potential errors.

3103.2.12: Select and use appropriate methods to make estimations without technology when solving contextual problems.

3103.2.13: Analyze and evaluate contextual situations involving any type of number from the complex number system.
• Finding unit rates
• Solving a word problem involving rates and time conversion
• Finding the sale price given the original price and percent discount
• Finding the original price given the sale price and percent discount
• Finding the percentage increase or decrease
• Computing a percentage from a table of values
• Simple interest
• Finding the value for a new score that will yield a given mean
• Word problem on proportions: Problem type 1
• Word problem on proportions: Problem type 2
• Word problem involving multiple rates

State Performance Indicators:

SPI 3103.2.1: Describe any number in the complex number system.
• Integers and rational numbers
• Rational and irrational numbers
• Using \( i \) to rewrite square roots of negative numbers
SPI 3103.2.2: Compute with all real and complex numbers.
- Integer addition: Problem type 2
- Integer subtraction
- Signed fraction addition and subtraction: Basic
- Signed fraction addition: Advanced
- Signed decimal addition with three numbers
- Integer multiplication and division
- Signed fraction multiplication: Advanced
- Exponents and integers: Problem type 1
- Exponents and integers: Problem type 2
- Multiplying and dividing numbers written in scientific notation
- Simplifying a product or quotient involving roots of negative numbers
- Adding and subtracting complex numbers
- Multiplying complex numbers
- Dividing complex numbers
- Simplifying a power of $i$

SPI 3103.2.3: Use the number system, from real to complex, to solve equations and contextual problems.
- Solving a quadratic equation with complex roots

Standard 3 : Algebra

- = ALEKS course topic that addresses the standard
  TD = Teacher Directed

Course Level Expectations:
CLE 3103.3.1: Understand and apply properties of rational exponents and perform basic operations to simplify algebraic expressions.
- Combining like terms: Integer coefficients
- Combining like terms: Advanced
- Combining like terms in a quadratic expression
- Writing a simple algebraic expression without negative exponents
- Understanding the product rule of exponents
- Introduction to the product rule of exponents
- Product rule with positive exponents
- Product rule with negative exponents
- Quotients of expressions involving exponents
- Quotient rule with negative exponents: Problem type 1
- Understanding the power rule of exponents
- Introduction to the power rule of exponents
- Power rule with positive exponents
- Power rule with negative exponents: Problem type 1
- Power rule with negative exponents: Problem type 2
- Using the power and product rules to simplify expressions with positive exponents
- Using the power, product, and quotient rules to simplify expressions with negative exponents
- Simplifying a sum or difference of two univariate polynomials
- Simplifying a sum or difference of three univariate polynomials
- Square root of a perfect square monomial
- Simplifying a radical expression: Problem type 1
- Simplifying a radical expression: Problem type 2
- Simplifying a higher radical: Problem type 2
- Simplifying a sum of radical expressions
- Simplifying a product of radical expressions
CLE 3103.3.2: Understand, analyze, transform and generalize mathematical patterns, relations and functions using properties and various representations.

- Evaluating functions: Problem type 1
- Domain and range from ordered pairs
- Identifying functions from relations
- Vertical line test
- Determining whether an equation defines a function
- Finding inputs and outputs of a function from its graph
- Domain and range from the graph of a continuous function
- Domain and range from the graph of a piecewise function
- Writing an equation for a function after a vertical translation
- Writing an equation for a function after a vertical and horizontal translation
- Translating the graph of a function: One step
- Translating the graph of a function: Two steps
- Transforming the graph of a function by reflecting over an axis
- Transforming the graph of a function by shrinking or stretching
- Transforming the graph of a function using more than one transformation
- Finding the first terms of a sequence
- Arithmetic and geometric sequences: Identifying and writing in standard form
- Arithmetic sequences
- Geometric sequences

CLE 3103.3.3: Analyze and apply various methods to solve equations, absolute values, inequalities, and systems of equations over complex numbers.

- Additive property of equality with integers
- Additive property of equality with a negative coefficient
- Multiplicative property of equality with whole numbers
- Multiplicative property of equality with integers
- Multiplicative property of equality with signed fractions
- Solving a two-step equation with integers
- Solving a two-step equation with signed fractions
- Using two steps to solve an equation with signed decimals
- Solving a linear equation with several occurrences of the variable: Variables on the same side and distribution
- Solving a linear equation with several occurrences of the variable: Variables on both sides and fractional coefficients
• Solving a linear equation with several occurrences of the variable: Variables on both sides and distribution
• Solving a linear equation with several occurrences of the variable: Variables on both sides and two distributions
• Solving a linear equation with several occurrences of the variable: Fractional forms with binomial numerators
• Solving equations with zero, one, or infinitely many solutions
• Solving a linear inequality: Problem type 1
• Solving a linear inequality: Problem type 2
• Solving a linear inequality: Problem type 3
• Solving a linear inequality: Problem type 4
• Solving a linear inequality: Problem type 5
• Simple absolute value equation
• Solving an equation involving absolute value: Basic
• Solving an equation involving absolute value: Advanced
• Solving an inequality involving absolute value: Basic
• Solving an inequality involving absolute value
• Classifying systems of linear equations from graphs
• Graphically solving a system of linear equations
• Solving a simple system using substitution
• Solving a system of linear equations using elimination with multiplication and addition
• Solving a system that is inconsistent or consistent dependent
• Finding the roots of a quadratic equation with leading coefficient 1
• Finding the roots of a quadratic equation with leading coefficient greater than 1
• Solving a quadratic equation needing simplification
• Solving a quadratic equation using the square root property: Problem type 1
• Solving a quadratic equation using the square root property: Problem type 2
• Solving a quadratic equation by completing the square
• Applying the quadratic formula: Exact answers
• Solving a quadratic inequality written in factored form
• Solving a quadratic inequality
• Solving equations written in factored form
• Roots of a product of polynomials
• Solving a radical equation that simplifies to a linear equation: One radical, basic
• Solving a radical equation that simplifies to a linear equation: Two radicals
• Solving a radical equation that simplifies to a quadratic equation: One radical
• Solving a radical equation that simplifies to a quadratic equation: Two radicals
• Solving an equation with a root index greater than 2
• Solving a logarithmic equation: Problem type 1
• Solving a logarithmic equation: Problem type 2
• Solving a logarithmic equation: Problem type 3
• Solving a logarithmic equation: Problem type 4
• Solving a logarithmic equation: Problem type 5
• Solving an exponential equation: Problem type 1
• Solving an exponential equation: Problem type 2
• Solving an exponential equation: Problem type 3
• Solving a proportion of the form (x+a)/b = x/c
• Solving a rational equation that simplifies to a linear equation: Problem type 1
• Solving a rational equation that simplifies to a linear equation: Problem type 2
• Solving a rational equation that simplifies to a linear equation: Problem type 3
• Solving a rational equation that simplifies to a linear equation: Problem type 4
• Solving a rational equation that simplifies to a quadratic equation: Problem type 1
• Solving a rational equation that simplifies to a quadratic equation: Problem type 2
• Solving a rational equation that simplifies to a quadratic equation: Problem type 3
• Solving a rational inequality: Problem type 1
• Solving a rational inequality: Problem type 2
CLE 3103.3.4: Graph and compare equations and inequalities in two variables. Identify and understand the relationships between the algebraic and geometric properties of the graph.

- Graphing a line given its equation in slope-intercept form
- Graphing a line given its equation in standard form
- Graphing a vertical or horizontal line
- Y-intercept of a line
- Finding x- and y-intercepts of a line given the equation: Advanced
- Finding slope given the graph of a line on a grid
- Finding the slope of a line given its equation
- Writing an equation of a line given the y-intercept and another point
- Writing the equation of the line through two given points
- Writing the equations of vertical and horizontal lines through a given point
- Graphing a linear inequality in the plane: Standard form
- Graphing a linear inequality in the plane: Vertical or horizontal lines
- Graphing a linear inequality in the plane: Slope-intercept form
- Graphing a parabola of the form $y = ax^2$
- Graphing a simple cubic function
- Graphing an equation involving absolute value in the plane: Advanced
- Finding the x-intercept(s) and the vertex of a parabola
- Rewriting a quadratic function to find the vertex of its graph
- Finding the maximum or minimum of a quadratic function
- Graphing a parabola of the form $y = (x-a)^2 + c$
- Graphing a parabola of the form $y = ax^2 + bx + c$: Integer coefficients
- Classifying the graph of a function
- How the leading coefficient affects the shape of a parabola
- Writing the equation of a quadratic function given its graph
- Graphing a quadratic inequality: Problem type 1
- Graphing a quadratic inequality: Problem type 2
- Finding zeros of a polynomial function written in factored form
- Finding x- and y-intercepts given a polynomial function
- Determining the end behavior of the graph of a polynomial function
- Inferring properties of a polynomial function from its graph
- Matching graphs with polynomial functions
- Graphing a function involving a square root
- Sketching the graph of an exponential function: Basic
- The graph, domain, and range of an exponential function
- Sketching the graph of an exponential function: Advanced
- Sketching the graph of a logarithmic function: Basic
- The graph, domain, and range of a logarithmic function
- Finding the asymptotes of a rational function: Problem type 1
- Finding the asymptotes of a rational function: Problem type 2
- Sketching the graph of a rational function: Problem type 1
- Graphing rational functions with holes
- Matching graphs with rational functions: Two vertical asymptotes

CLE 3103.3.5: Use mathematical models involving equations and systems of equations to represent, interpret and analyze quantitative relationships, change in various contexts, and other real-world phenomena.

- Translating a sentence into a one-step equation
- Translating a sentence into a two-step expression
- Writing a multi-step equation for a real-world situation
- Solving a fraction word problem using a linear equation of the form $Ax = B$
- Solving a word problem with two unknowns using a linear equation
- Solving a decimal word problem using a linear equation with the variable on both sides
- Solving a decimal word problem using a linear equation of the form $Ax + B = C$
- Solving a fraction word problem using a linear equation with the variable on both sides
- Solving a word problem with three unknowns using a linear equation
- Solving a value mixture problem using a linear equation
- Solving a percent mixture problem using a linear equation
- Solving a distance, rate, time problem using a linear equation
- Writing an equation and drawing its graph to model a real-world situation
- Application problem with a linear function: Problem type 1
- Application problem with a linear function: Problem type 2
- Solving a word problem involving a sum and another simple relationship using a system of linear equations
- Solving a value mixture problem using a system of linear equations
- Solving a distance, rate, time problem using a system of linear equations
- Solving a percent mixture problem using a system of linear equations
- Solving a tax rate or interest rate problem using a system of linear equations
- Solving a word problem using a 3 by 3 system of linear equations
- Solving a word problem using a quadratic equation with rational roots
- Solving a word problem using a quadratic equation with irrational roots
- Using a graphing calculator to solve a word problem involving a polynomial of degree 3
- Using a graphing calculator to solve a word problem involving a local extremum of a polynomial function
- Solving a word problem using an exponential equation: Problem type 1
- Solving a word problem using an exponential equation: Problem type 2
- Solving a word problem using an exponential equation: Problem type 3
- Solving a word problem using an exponential equation: Problem type 4
- Compound interest
- Word problem on proportions: Problem type 1
- Word problem on proportions: Problem type 2
- Word problem involving multiple rates
- Solving a word problem using a rational equation
- Writing an equation that models variation
- Word problem on direct variation
- Word problem on inverse variation
- Word problem on combined variation

Checks for Understanding (Formative/Summative Assessment):

3103.3.1: Perform operations on algebraic expressions and justify the procedures.
- Distributive property: Whole number coefficients
- Distributive property: Integer coefficients
- Understanding the product rule of exponents
- Introduction to the product rule of exponents
- Product rule with positive exponents
- Product rule with negative exponents
- Quotients of expressions involving exponents
- Quotient rule with negative exponents: Problem type 1
- Understanding the power rule of exponents
- Introduction to the power rule of exponents
- Power rule with positive exponents
- Power rule with negative exponents: Problem type 1
- Power rule with negative exponents: Problem type 2
- Using the power and product rules to simplify expressions with positive exponents
- Using the power, product, and quotient rules to simplify expressions with negative exponents
- Simplifying a sum or difference of two univariate polynomials
- Simplifying a sum or difference of three univariate polynomials
- Multiplying a monomial and a polynomial: Univariate with positive leading coefficients
- Multiplying binomials with leading coefficients of 1
- Multiplying conjugate binomials: Univariate
• Multiplying binomials in two variables
• Squaring a binomial: Univariate
• Multiplication involving binomials and trinomials in two variables
• Dividing a polynomial by a monomial: Univariate
• Polynomial long division: Problem type 1
• Polynomial long division: Problem type 2
• Polynomial long division: Problem type 3
• Simplifying a sum of radical expressions
• Simplifying a product of radical expressions
• Simplifying a product of radical expressions: Advanced
• Special products with square roots: Conjugates and squaring
• Rational exponents: Products and quotients
• Rational exponents: Powers of powers
• Multiplying rational expressions: Problem type 1
• Multiplying rational expressions: Problem type 2
• Dividing rational expressions: Problem type 1
• Dividing rational expressions: Problem type 2
• Adding rational expressions with common denominators
• Adding rational expressions with different denominators: ax, bx
• Adding rational expressions with different denominators: Multivariate
• Adding rational expressions with different denominators: x+a, x+b
• Adding rational expressions with different denominators: Quadratic

3103.3.2: Determine the domain of a function represented in either symbolic or graphical form.
• Domain and range from ordered pairs
• Domain and range from the graph of a continuous function
• Domain and range from the graph of a piecewise function
• Domain of a square root function
• Domain of a rational function

3103.3.3: Determine and graph the inverse of a function with and without technology.
• Inverse functions: Problem type 1
• Inverse functions: Problem type 2
• Inverse functions: Problem type 3

3103.3.4: Analyze the effect of changing various parameters on functions and their graphs.
• Writing an equation for a function after a vertical translation
• Writing an equation for a function after a vertical and horizontal translation
• Translating the graph of a function: One step
• Translating the graph of a function: Two steps
• Transforming the graph of a function by reflecting over an axis
• Transforming the graph of a function by shrinking or stretching
• Transforming the graph of a function using more than one transformation
• How the leading coefficient affects the shape of a parabola

3103.3.5: Graph piece-wise and step functions.
• Graphing a piecewise-defined function

3103.3.6: Simplify expressions and solve equations containing radicals.
• Square root of a perfect square
• Square root of a rational perfect square
• Cube root of an integer
• Square root simplification
• Square root of a perfect square monomial
• Simplifying a radical expression: Problem type 1
• Simplifying a radical expression: Problem type 2
• Simplifying a higher radical: Problem type 1
- Simplifying a higher radical: Problem type 2
- Square root addition
- Simplifying a sum of radical expressions
- Square root multiplication
- Simplifying a product of radical expressions
- Simplifying a product of radical expressions: Advanced
- Simplifying a product of radical expressions using the distributive property
- Special products with square roots: Conjugates and squaring
- Rationalizing the denominator of a radical expression
- Rationalizing the denominator of a radical expression using conjugates
- Solving a radical equation that simplifies to a linear equation: One radical, basic
- Solving a radical equation that simplifies to a linear equation: Two radicals
- Solving a radical equation that simplifies to a quadratic equation: One radical
- Solving a radical equation that simplifies to a quadratic equation: Two radicals
- Solving an equation with a root index greater than 2

3103.7: Solve quadratic equations by factoring, graphing, completing the square, extracting square roots and using the quadratic formula.
- Finding the roots of a quadratic equation with leading coefficient 1
- Finding the roots of a quadratic equation with leading coefficient greater than 1
- Solving a quadratic equation needing simplification
- Solving a quadratic equation using the square root property: Problem type 1
- Solving a quadratic equation using the square root property: Problem type 2
- Solving a quadratic equation by completing the square
- Applying the quadratic formula: Exact answers
- Solving a quadratic equation with complex roots

3103.8: Solve a three by three system of linear equations algebraically and by using inverse matrices and determinants with and without technology.
- Solving a system of 3 equations in 3 unknowns
- Cramer's rule: Problem type 2
- Using the inverse of a matrix to solve a system of linear equations

3103.9: Find an equation for a parabola when given its graph or when given its roots.
- Writing a quadratic equation given the roots and the leading coefficient
- Writing the equation of a quadratic function given its graph

3103.10: Given a quadratic equation use the discriminant to determine the nature of the roots.
- Discriminant of a quadratic equation

3103.11: Describe and articulate the characteristics and parameters of a parent function.

3103.12: Understand the relationship between real zeros of a function and the x-intercepts of its graph.
- Finding the x-intercept(s) and the vertex of a parabola
- Finding x- and y-intercepts given a polynomial function
- Using a graphing calculator to find zeros of a polynomial function

3103.13: Solve problems using exponential functions requiring the use of logarithms for their solutions.
- Solving an exponential equation: Problem type 1
- Solving an exponential equation: Problem type 3
- Solving a word problem using an exponential equation: Problem type 2
- Solving a word problem using an exponential equation: Problem type 4

3103.14: Define and use arithmetic and geometric sequences and series including using sigma and pi notation.
- Arithmetic and geometric sequences: Identifying and writing in standard form
- Arithmetic sequences
- Geometric sequences
• Sum of the first n terms of an arithmetic sequence
• Sum of the first n terms of a geometric sequence

3103.3.15: Find the sum of an geometric series whose common ratio, r, is in the interval (-1,1).
• Sum of a geometric series

3103.3.16: Prove basic properties of logarithms using properties of exponents and apply those properties to solve problems.
• Basic properties of logarithms
• Writing expressions as a single logarithm
• Expanding a logarithmic expression: Problem type 1
• Expanding a logarithmic expression: Problem type 2
• Change of base for logarithms: Problem type 1
• Solving a logarithmic equation: Problem type 2
• Solving a logarithmic equation: Problem type 5

3103.3.17: Know that the logarithm and exponential functions are inverses and use this information to solve real-world problems.
• Converting between logarithmic and exponential equations
• Converting between natural logarithmic and exponential equations
• Solving a word problem using an exponential equation: Problem type 2
• Solving a word problem using an exponential equation: Problem type 4

3103.3.18: Solve compound inequalities involving disjunction and conjunction and linear inequalities containing absolute values.
• Solving a compound linear inequality: Problem type 1
• Solving a compound linear inequality: Problem type 2
• Solving an inequality involving absolute value: Basic
• Solving an inequality involving absolute value

3103.3.19: Solve linear programming problems.
• Linear programming
• Solving a word problem using linear programming

3103.3.20: Understand the relationships between the equations of conic sections and their graphs.
• Graphing a parabola with a horizontal or a vertical axis
• Writing an equation of a parabola given the vertex and the focus
• Graphing a circle given its equation in standard form
• Graphing a circle given its equation in general form
• Writing an equation of a circle given its center and a point on the circle
• Writing an equation of a circle given the endpoints of a diameter
• Graphing an ellipse centered at the origin
• Graphing an ellipse given its equation in standard form
• Graphing an ellipse given its equation in general form
• Graphing a hyperbola centered at the origin
• Graphing a hyperbola given its equation in standard form
• Graphing a hyperbola given its equation in general form
• Classifying conics given their equations

3103.3.21: Factor polynomials using a variety of methods including the factor theorem, synthetic division, long division, sums and differences of cubes, and grouping.
• Factoring out a monomial from a polynomial: Univariate
• Factoring out a monomial from a polynomial: Multivariate
• Factoring a quadratic with leading coefficient 1
• Factoring a perfect square trinomial
• Factoring a quadratic with leading coefficient greater than 1
• Factoring a quadratic polynomial in two variables with leading coefficient greater than 1
- Factoring a product of a quadratic trinomial and a monomial
- Factoring a difference of squares
- Factoring a sum or difference of two cubes
- Factoring a polynomial by grouping: Problem type 1
- Factoring a polynomial by grouping: Problem type 2
- Polynomial long division: Problem type 1
- Polynomial long division: Problem type 2
- Polynomial long division: Problem type 3
- Synthetic division

**State Performance Indicators:**

**SPI 3103.3.1:** Add, subtract and multiply polynomials; divide a polynomial by a lower degree polynomial.

- Product rule with positive exponents
- Simplifying a sum or difference of two univariate polynomials
- Simplifying a sum or difference of three univariate polynomials
- Multiplying a monomial and a polynomial: Univariate with positive leading coefficients
- Multiplying binomials with leading coefficients of 1
- Multiplying conjugate binomials: Univariate
- Multiplying binomials in two variables
- Squaring a binomial: Univariate
- Multiplication involving binomials and trinomials in two variables
- Dividing a polynomial by a monomial: Univariate
- Polynomial long division: Problem type 1
- Polynomial long division: Problem type 2
- Polynomial long division: Problem type 3

**SPI 3103.3.2:** Solve quadratic equations and systems, and determine roots of a higher order polynomial.

- Finding the roots of a quadratic equation with leading coefficient 1
- Finding the roots of a quadratic equation with leading coefficient greater than 1
- Solving a quadratic equation needing simplification
- Solving a quadratic equation using the square root property: Problem type 1
- Solving a quadratic equation using the square root property: Problem type 2
- Applying the quadratic formula: Exact answers
- Solving equations written in factored form
- Roots of a product of polynomials
- Finding zeros of a polynomial function written in factored form
- Solving a quadratic equation with complex roots
- Finding x- and y-intercepts given a polynomial function
- Odd root property
- Solving an equation with exponent using the odd-root property
- Solving a system of nonlinear equations

SPI 3103.3.3: Add, subtract, multiply, divide and simplify rational expressions including those with rational and negative exponents.
- Quotients of expressions involving exponents
- Quotient rule with negative exponents: Problem type 1
- Rational exponents: Products and quotients
- Simplifying a ratio of polynomials: Problem type 1
- Simplifying a ratio of polynomials: Problem type 2
- Ratio of multivariate polynomials
- Multiplying rational expressions: Problem type 1
- Multiplying rational expressions: Problem type 2
- Dividing rational expressions: Problem type 1
- Dividing rational expressions: Problem type 2
- Adding rational expressions with common denominators
- Adding rational expressions with different denominators: ax, bx
- Adding rational expressions with different denominators: Multivariate
- Adding rational expressions with different denominators: x+a, x+b
- Adding rational expressions with different denominators: Quadratic
- Complex fraction: Problem type 1
- Complex fraction: Problem type 3
- Complex fraction: Problem type 4

SPI 3103.3.4: Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
- Arithmetic and geometric sequences: Identifying and writing in standard form
- Arithmetic sequences
- Geometric sequences
- Sum of the first n terms of an arithmetic sequence
- Sum of the first n terms of a geometric sequence
- Sum of a geometric series

SPI 3103.3.5: Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
- Domain and range from ordered pairs
- Domain and range from the graph of a continuous function
- Domain and range from the graph of a piecewise function
- Range of a quadratic function
- Domain of a square root function
- Domain of a rational function

SPI 3103.3.6: Combine functions (such as polynomial, rational, radical and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
- Sum, difference, and product of two functions
- Quotient of two functions
- Composition of two functions: Basic
- Composition of two functions: Advanced

SPI 3103.3.7: Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line y = x.
- Horizontal line test
- Determining whether two functions are inverses of each other
- Inverse functions: Problem type 1
- Inverse functions: Problem type 3

SPI 3103.3.8: Solve systems of three linear equations in three variables.
- Solving a system of 3 equations in 3 unknowns

SPI 3103.3.9: Graph the solution set of two or three linear or quadratic inequalities.
- Graphing a system of linear inequalities
- Graphing a system of nonlinear inequalities: Problem type 1

SPI 3103.3.10: Identify and/or graph a variety of functions and their translations.
- Graphing a line given its equation in slope-intercept form
- Graphing a line given its equation in standard form
- Writing an equation for a function after a vertical translation
- Writing an equation for a function after a vertical and horizontal translation
- Translating the graph of a function: One step
- Translating the graph of a function: Two steps
- Transforming the graph of a function by reflecting over an axis
- Transforming the graph of a function by shrinking or stretching
- Transforming the graph of a function using more than one transformation
- Graphing a parabola of the form \( y = ax^2 \)
- Graphing a simple cubic function
- Graphing an equation involving absolute value in the plane: Advanced
- Graphing a parabola of the form \( y = (x-a)^2 + c \)
- Graphing a parabola of the form \( y = ax^2 + bx + c \): Integer coefficients
- Graphing a function involving a square root
- Sketching the graph of an exponential function: Basic
- The graph, domain, and range of an exponential function
- Sketching the graph of a logarithmic function: Basic
- The graph, domain, and range of a logarithmic function
- Translating the graph of a logarithmic or exponential function
- Sketching the graph of a rational function: Problem type 1

SPI 3103.3.11: Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
- Graphing a parabola with a horizontal or a vertical axis
- Graphing a circle given its equation in standard form
- Graphing a circle given its equation in general form
- Graphing an ellipse centered at the origin
- Graphing an ellipse given its equation in standard form
- Graphing an ellipse given its equation in general form
- Graphing a hyperbola centered at the origin
- Graphing a hyperbola given its equation in standard form
- Graphing a hyperbola given its equation in general form
- Classifying conics given their equations

SPI 3103.3.12: Interpret graphs that depict real-world phenomena.
- Scatter plots and correlation
- Choosing a graph to fit a narrative
- Interpreting the graphs of two functions

SPI 3103.3.13: Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series or systems of equations.
- Solving a word problem involving a sum and another simple relationship using a system of linear equations
- Solving a value mixture problem using a system of linear equations
- Solving a distance, rate, time problem using a system of linear equations
- Solving a percent mixture problem using a system of linear equations
- Solving a tax rate or interest rate problem using a system of linear equations
- Solving a word problem using a 3 by 3 system of linear equations
- Solving a word problem using a quadratic equation with rational roots
- Solving a word problem using a quadratic equation with irrational roots
- Word problem using the maximum or minimum of a quadratic function
- Evaluating an exponential function that models a real-world situation
- Solving a word problem using an exponential equation: Problem type 1
- Solving a word problem using an exponential equation: Problem type 2
- Solving a word problem using an exponential equation: Problem type 3
- Solving a word problem using an exponential equation: Problem type 4
- Compound interest
- Word problem on proportions: Problem type 1
- Word problem on proportions: Problem type 2
- Solving a word problem using a rational equation
- Word problem on inverse variation

SPI 3103.3.14: Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.
- Binomial formula

---

**Standard 4 : Geometry & Measurement**

- * = ALEKS course topic that addresses the standard
- TD = Teacher Directed

**Course Level Expectations:**

**CLE 3103.4.1:** Understand the trigonometric functions and their relationship to the unit circle.
- Sine, cosine, and tangent ratios
- Finding trigonometric ratios given a right triangle
- Trigonometric functions and special angles: Problem type 1
- Trigonometric functions and special angles: Problem type 2
- Trigonometric functions and special angles: Problem type 3

**CLE 3103.4.2:** Know and use the basic identities of sine, cosine, and tangent as well as their reciprocals.
- Sine, cosine, and tangent ratios
- Finding trigonometric ratios given a right triangle
- Using a trigonometric ratio to find a side length in a right triangle
- Using trigonometry to find distances
- Using a trigonometric ratio to find an angle measure in a right triangle
- Using trigonometry to find angles of elevation or depression
- Solving a right triangle
- Trigonometric functions and special angles: Problem type 1
- Trigonometric functions and special angles: Problem type 2
- Trigonometric functions and special angles: Problem type 3
- Finding values of trigonometric functions given information about an angle: Problem type 1

**CLE 3103.4.3:** Graph all six trigonometric functions and identify their key characteristics.
- Amplitude and period of sine and cosine functions
- Amplitude, period, and phase shift of sine and cosine functions
- Sketching the graph of a sine or cosine function: Problem type 1
- Sketching the graph of a sine or cosine function: Problem type 2
- Sketching the graph of a sine or cosine function: Problem type 3
- Sketching the graph of a secant or cosecant function: Problem type 1
- Sketching the graph of a tangent or cotangent function: Problem type 1
- Sketching the graph of a tangent or cotangent function: Problem type 2

**CLE 3103.4.4:** Know and use the Law of Sines to find missing sides and angles of a triangle, including the ambiguous
case.

- Solving a triangle with the law of sines: Problem type 1
- Solving a triangle with the law of sines: Problem type 2
- Solving a word problem using the law of sines

CLE 3103.4.5: Use trigonometric concepts, properties and graphs to solve problems.

- Using a trigonometric ratio to find a side length in a right triangle
- Using trigonometry to find distances
- Using a trigonometric ratio to find an angle measure in a right triangle
- Using trigonometry to find angles of elevation or depression
- Solving a right triangle
- Finding values of trigonometric functions given information about an angle: Problem type 1
- Finding values of trigonometric functions given information about an angle: Problem type 2
- Finding values of trigonometric functions given information about an angle: Problem type 3
- Solving a triangle with the law of sines: Problem type 1
- Solving a triangle with the law of sines: Problem type 2
- Solving a word problem using the law of sines
- Solving a triangle with the law of cosines
- Solving a word problem using the law of cosines
- Writing the equation of a sine or cosine function given its graph: Problem type 1

Checks for Understanding (Formative/Summative Assessment):

3103.4.1: Convert between radians and degrees and vice versa.

- Converting between degree and radian measure: Problem type 1
- Converting between degree and radian measure: Problem type 2

3103.4.2: Determine the period and the amplitude of a periodic function.

- Amplitude and period of sine and cosine functions
- Amplitude, period, and phase shift of sine and cosine functions

3103.4.3: Extend the trigonometric functions to periodic functions on the real line by defining them as functions on the unit circle.

- Sketching the graph of a sine or cosine function: Problem type 1
- Sketching the graph of a sine or cosine function: Problem type 2
- Sketching the graph of a sine or cosine function: Problem type 3
- Sketching the graph of a secant or cosecant function: Problem type 1
- Sketching the graph of a tangent or cotangent function: Problem type 1
- Sketching the graph of a tangent or cotangent function: Problem type 2

3103.4.4: Understand the relationship between the radius, the central angle, and radian measure.

- Arc length and central angle measure

3103.4.5: Determine the domain and range of the six trigonometric functions given a graph.

3103.4.6: Know and be able to use the fundamental trigonometric identities, including the Pythagorean identities, reciprocal identities, sum of sine and cosine, and odd and even identities.

- Finding trigonometric ratios given a right triangle
- Using a trigonometric ratio to find a side length in a right triangle
- Using trigonometry to find distances
- Using a trigonometric ratio to find an angle measure in a right triangle
- Using trigonometry to find angles of elevation or depression
- Solving a right triangle
- Finding values of trigonometric functions given information about an angle: Problem type 1
- Finding values of trigonometric functions given information about an angle: Problem type 2
- Finding values of trigonometric functions given information about an angle: Problem type 3
• Simplifying trigonometric expressions
• Using cofunction identities
• Sum and difference identities: Problem type 1
• Sum and difference identities: Problem type 2
• Sum and difference identities: Problem type 3
• Verifying a trigonometric identity
• Proving trigonometric identities: Problem type 1

State Performance Indicators:

SPI 3103.4.1: Exhibit knowledge of unit circle trigonometry.
• Trigonometric functions and special angles: Problem type 1
• Trigonometric functions and special angles: Problem type 2
• Trigonometric functions and special angles: Problem type 3

SPI 3103.4.2: Match graphs of basic trigonometric functions with their equations.
• Sketching the graph of a sine or cosine function: Problem type 1
• Sketching the graph of a sine or cosine function: Problem type 2
• Sketching the graph of a sine or cosine function: Problem type 3
• Sketching the graph of a secant or cosecant function: Problem type 1
• Sketching the graph of a tangent or cotangent function: Problem type 1
• Sketching the graph of a tangent or cotangent function: Problem type 2

SPI 3103.4.3: Describe and articulate the characteristics and parameters of parent trigonometric functions to solve contextual problems.
  TD

Standard 5: Data Analysis, Statistics, & Probability

= ALEKS course topic that addresses the standard
TD = Teacher Directed
Course Level Expectations:
CLE 3103.5.1: Describe, interpret, and apply quantitative data.
- Mode of a data set
- Finding the mode and range of a data set
- Mean and median of a data set
- Weighted mean
- Percentiles
- Population standard deviation

CLE 3103.5.2: Evaluate and critique various ways of collecting data and using information based on data published in the media.

CLE 3103.5.3: Use data and statistical thinking to draw inferences, make predictions, justify conclusions and identify and explain misleading uses of data.
- Scatter plots and correlation

CLE 3103.5.4: Develop an understanding of probability concepts in order to make informed decisions.
- Probability of an event
- Outcomes and event probability
- Die rolling
- Experimental and theoretical probability

Checks for Understanding (Formative/Summative Assessment):
3103.5.1: Collect, represent and describe both linear and non-linear data developed from contextual situations.

3103.5.2: Organize and display data using appropriate methods (including spreadsheets and technology tools) to detect patterns and departures from patterns.
- Box-and-whisker plots

3103.5.3: Read and interpret data from a two-way table.
- Computing a percentage from a table of values

3103.5.4: Understand the impact of various sampling methods and use them to draw valid conclusions.

3103.5.5: Calculate measures of central tendency and spread (variance and standard deviation).
- Mode of a data set
- Finding the mode and range of a data set
- Mean and median of a data set
- Population standard deviation

3103.5.6: Use technology to find the appropriate regression equation for both linear and non-linear data.

3103.5.7: Recognize when the correlation coefficient measures goodness of fit and does not imply causation.

3103.5.8: Know the Empirical Rule for one, two and three standard deviations for a normal distribution.
- Word problem involving calculations from a normal distribution

3103.5.9: Use data to detect patterns.

3103.5.10: Design simple experiments to collect data to answer questions of interest.

3103.5.11: Evaluate published data by considering the source, the design of the study and the analysis and
representation (or misrepresentation) of the data.

TD

3103.5.12: Investigate bias and the phrasing of questions during data acquisition to formulate reasonable conclusions.

TD

3103.5.13: Apply both theoretical and experimental probability to analyze the likelihood of an event.

- Probability of an event
- Outcomes and event probability
- Die rolling
- Experimental and theoretical probability

**State Performance Indicators:**

**SPI 3103.5.1:** Compute, compare and explain summary statistics for distributions of data including measures of center and spread.

- Mode of a data set
- Finding the mode and range of a data set
- Mean and median of a data set
- Weighted mean
- Population standard deviation

**SPI 3103.5.2:** Compare data sets using graphs and summary statistics.

TD

**SPI 3103.5.3:** Analyze patterns in a scatter-plot and describe relationships in both linear and non-linear data.

- Scatter plots and correlation
- Sketching the line of best fit

**SPI 3103.5.4:** Apply the characteristics of the normal distribution.

- Word problem involving calculations from a normal distribution

**SPI 3103.5.5:** Determine differences between randomized experiments and observational studies.

TD

**SPI 3103.5.6:** Find the regression curve that best fits both linear and non-linear data (using technology such as a graphing calculator) and use it to make predictions.

TD

**SPI 3103.5.7:** Determine/recognize when the correlation coefficient measures goodness of fit.

TD

**SPI 3103.5.8:** Apply probability concepts such as conditional probability and independent events to calculate simple probability.

- Probability of an event
- Outcomes and event probability
- Die rolling
- Experimental and theoretical probability
- Probability of independent events
- Probability of dependent events
- Probabilities of draws with replacement
- Independent events: Basic
- Conditional probability: Basic