

## Algebra I

### Standard – Processes or Content Strand

#### CLE – Course Level Expectation

##### *SPI – State Performance Indicator*

✓ – Check for Understanding

### Standard 1 – Mathematical Processes

**CLE 3102.1.1 Use mathematical language, symbols, definitions, proofs and counterexamples correctly and precisely in mathematical reasoning.**

*SPI 3102.1.1 Interpret patterns found in sequences, tables, and other forms of quantitative information using variables or function notation.*

✓3102.1.1 Develop meaning for mathematical vocabulary.

✓3102.1.2 Use the terminology of mathematics correctly.

✓3102.1.3 Understand and use mathematical symbols, notation, and common mathematical abbreviations correctly.

✓3102.1.4 Write a rule with variables that expresses a pattern.

**CLE 3102.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including testing cases, estimation, and then checking induced errors and the reasonableness of the solution.**

*SPI 3102.1.2 Write an equation symbolically to express a contextual problem.*

✓3102.1.5 Use formulas, equations, and inequalities to solve real-world problems including time/rate/distance, percent increase/decrease, ratio/proportion, and mixture problems.

✓3102.1.6 Use a variety of strategies to estimate and compute solutions, including real-world problems.

✓3102.1.7 Identify missing or irrelevant information in problems.

✓3102.1.8 Recognize and perform multiple steps in problem solving when necessary.

**CLE 3102.1.3 Develop inductive and deductive reasoning to independently make and evaluate mathematical arguments and construct appropriate proofs; include various types of reasoning, logic, and intuition.**

*SPI 3102.1.3 Apply properties to evaluate expressions, simplify expressions, and justify solutions to problems.*

✓3102.1.9 Identify and use properties of the real numbers (including commutative, associative, distributive, inverse, identity element, closure, reflexive, symmetric, transitive, operation properties of equality).

✓3102.1.10 Use algebraic properties to develop a valid mathematical argument.

**CLE 3102.1.4 Move flexibly between multiple representations (contextual, physical, written, verbal, iconic/pictorial, graphical, tabular, and symbolic), to solve problems, to model mathematical ideas, and to communicate solution strategies.**

*SPI 3102.1.4 Translate between representations of functions that depict real-world situations.*

*SPI 3102.1.5 Recognize and express the effect of changing constants and/or coefficients in problem solving.*

✓3102.1.11 Use manipulatives to model algebraic concepts.

✓3102.1.12 Create and work flexibly among representations of relations (including verbal, equations, tables, mappings, graphs).

✓3102.1.13 Change from one representation of a relation to another representation, for example, change from a verbal description to a graph.

✓3102.1.14 Apply graphical transformations that occur when changes are made to coefficients and constants in functions.

**CLE 3102.1.5 Recognize and use mathematical ideas and processes that arise in different settings, with an emphasis on formulating a problem in mathematical terms, interpreting the solutions, mathematical ideas, and communication of solution strategies.**

*SPI 3102.1.6 Determine and interpret slope in multiple contexts including rate of change in real-world problems.*

✓3102.1.15 Apply arithmetic concepts in algebraic contexts.

✓3102.1.16 Understand and express the meaning of the slope and y-intercept of linear functions in real-world contexts.

**CLE 3102.1.6 Employ reading and writing to recognize the major themes of mathematical processes, the historical development of mathematics, and the connections between mathematics and the real world.**

✓3102.1.17 Connect the study of algebra to the historical development of algebra.

**CLE 3102.1.7 Use technologies appropriately to develop understanding of abstract mathematical ideas, to facilitate problem solving, and to produce accurate and reliable models.**

✓3102.1.18 Translate syntax of technology to appropriate mathematical notation.

✓3102.1.19 Recognize and practice appropriate use of technology in representations and in problem solving.

✓3102.1.20 Estimate solutions to evaluate the reasonableness of results and to check technological computation.

## Standard 2 – Number & Operations

**CLE 3102.2.1 Understand computational results and operations involving real numbers in multiple representations.**

✓3102.2.1 Recognize and use like terms to simplify expressions.

✓3102.2.2 Apply the order of operations to simplify and evaluate algebraic expressions.

*SPI 3102.2.1 Operate (add, subtract, multiply, divide, simplify, powers) with radicals and radical expressions including radicands involving rational numbers and algebraic expressions.*

✓3102.2.3 Operate with and simplify radicals (index 2, 3, n) and radical expressions including rational numbers and variables in the radicand.

✓3102.2.4 Operate efficiently with both rational and irrational numbers.

*SPI 3102.2.2 Multiply, divide, and square numbers expressed in scientific notation.*

✓3102.2.5 Perform operations with numbers in scientific notation (multiply, divide, powers).

✓3102.2.6 Use appropriate technologies to apply scientific notation to real-world problems.

**CLE 3102.2.2 Understand properties of and relationships between subsets and elements of the real number system.**

*SPI 3102.2.3 Describe and/or order a given set of real numbers including both rational and irrational numbers.*

✓3102.2.7 Identify the subsets in the real number system and understand their relationships.

✓3102.2.8 Use multiple strategies to approximate the value of an irrational number including irrational square roots and including location on the real number line.

## Standard 3 – Algebra

**CLE 3102.3.1 Use algebraic thinking to analyze and generalize patterns.**

*SPI 3102.3.1 Express a generalization of a pattern in various representations including algebraic and function notation.*

✓3102.3.1 Recognize and extend arithmetic and geometric sequences.

✓3102.3.2 Explore patterns including Pascal's Triangle and the Fibonacci sequence..

**CLE 3102.3.2 Understand and apply properties in order to perform operations with, evaluate, simplify, and factor expressions and polynomials.**

***SPI 3102.3.2 Operate with polynomials and simplify results.***

- ✓3102.3.3 Justify correct results of algebraic procedures using extension of properties of real numbers to algebraic expressions.
- ✓3102.3.5 Add, subtract, and multiply polynomials including squaring a binomial.
- ✓3102.3.6 Find the quotient of a polynomial and a monomial.
- ✓3102.3.7 Use various models (including area models) to represent products of polynomials.

***SPI 3102.3.3 Factor polynomials.***

- ✓3102.3.8 Find the GCF of the terms in a polynomial.
- ✓3102.3.9 Find two binomial factors of a quadratic expression.

**CLE 3102.3.3 Understand and apply operations with rational expressions and equations.**

***SPI 3102.3.4 Operate with, evaluate, and simplify rational expressions including determining restrictions on the domain of the variables***

- ✓3102.3.4 Simplify expressions using exponent rules including negative exponents and zero exponents
- ✓3102.3.10 Add, subtract, multiply, and divide rational expressions and simplify results

**CLE 3102.3.4 Solve problems involving linear equations and linear inequalities.**

***SPI 3102.3.5 Write and/or solve linear equations, inequalities, and compound inequalities including those containing absolute value.***

- ✓3102.3.11 Solve multi-step linear equations with one variable.
- ✓3102.3.12 Recognize and articulate when an equation has no solution, a single solution, or all real numbers as solutions.
- ✓3102.3.13 Solve multi-step linear inequalities with one variable and graph the solution on a number line.
- ✓3102.3.14 Solve absolute value equations and inequalities (including compound inequalities) with one variable and graph their solutions on a number line.
- ✓3102.3.15 Determine domain and range of a relation and articulate restrictions imposed either by the operations or by the real life situation that the function represents.
- ✓3102.3.25 Find function values using  $f(x)$  notation or graphs.
- ✓3102.3.26 Graph linear inequalities on the coordinate plane and identify regions of the graph containing ordered pairs in the solution

**CLE 3102.3.5 Manipulate formulas and solve literal equations..**

**CLE 3102.3.6 Understand and use relations and functions in various representations to solve contextual problems.**

***SPI 3102.3.6 Interpret various relations in multiple representations.***

***SPI 3102.3.7 Determine domain and range of a relation, determine whether a relation is a function and/or evaluate a function at a specified rational value.***

- ✓3102.3.16 Determine if a relation is a function from its graph or from a set of ordered pairs.

***SPI 3102.3.8 Determine the equation of a line and/or graph a linear equation.***

- ✓3102.3.18 Analyze the characteristics of graphs of basic linear relations and linear functions including constant function, direct variation, identity function, vertical lines, absolute value of linear functions. Use technology where appropriate.
- ✓3102.3.20 Understand that a linear equation has a constant rate of change called slope and represent slope in various forms.
- ✓3102.3.21 Determine the equation of a line using given information including a point and slope, two points, a point and a line parallel or perpendicular, graph, intercepts.
- ✓3102.3.22 Express the equation of a line in standard form, slope-intercept, and point-slope form.
- ✓3102.3.23 Determine the graph of a linear equation including those that depict contextual situations.
- ✓3102.3.24 Interpret the changes in the slope-intercept form and graph of a linear equation by looking at different parameters,  $m$  and  $b$  in the slope-intercept form.

**CLE 3102.3.7 Construct and solve systems of linear equations and inequalities in two variables by various methods.**

***SPI 3102.3.9 Solve systems of linear equation/inequalities in two variables.***

- ✓3102.3.27 Determine the number of solutions for a system of linear equations (0, 1, or infinitely many solutions).
- ✓3102.3.28 Solve systems of linear equations graphically, algebraically, and with technology.
- ✓3102.3.29 Solve contextual problems involving systems of linear equations or inequalities and interpret solutions in context

**CLE 3102.3.8 Solve and understand solutions of quadratic equations with real roots.**

***SPI 3102.3.10 Find the solution of a quadratic equation and/or zeros of a quadratic function.***

- ✓3102.3.30 Solve quadratic equations using multiple methods: factoring, graphing, quadratic formula, or square root principle.
- ✓3102.3.31 Determine the number of real solutions for a quadratic equation including using the discriminant and its graph.
- ✓3102.3.32 Recognize the connection among factors, solutions (roots), zeros of related functions, and x-intercepts in equations that arise from quadratic functions.

**CLE 3102.3.9 Understand and use exponential functions to solve contextual problems.**

***SPI 3102.3.11 Analyze nonlinear graphs including quadratic and exponential functions that model a contextual situation.***

- ✓3102.3.17 Recognize “families” of functions.
- ✓3102.3.19 Explore the characteristics of graphs of various nonlinear relations and functions including inverse variation, quadratic, and square root function. Use technology where appropriate.
- ✓3102.3.33 Recognize data that can be modeled by an exponential function.
- ✓3102.3.34 Graph exponential functions in the form  $y = a(bx)$  where  $b \neq 0$ .
- ✓3102.3.35 Apply growth/decay and simple/compound interest formulas to solve contextual problems.

**Standard 4 – Geometry & Measurement**

**CLE 3102.4.1 Use algebraic reasoning in applications involving geometric formulas and contextual problems.**

***SPI 3102.4.1 Develop and apply strategies to estimate the area of any shape on a plane grid.***

- ✓3102.4.1 Using algebraic expressions solve for measures in geometric figures as well as for perimeter, area, and volume.

***SPI 3102.4.2 Solve contextual problems using the Pythagorean Theorem.***

- ✓3102.4.2 Use the Pythagorean Theorem to find the missing measure in a right triangle including those from contextual situations.

***SPI 3102.4.3 Solve problems involving the distance between points or midpoint of a segment.***

- ✓3102.4.3 Understand horizontal/vertical distance in a coordinate system as absolute value of the difference between coordinates; develop the distance formula for a coordinate plane using the Pythagorean Theorem.
- ✓3102.4.4 Develop the midpoint formula for segments on a number line or in the coordinate plane.

**CLE 3102.4.2 Apply appropriate units of measure and convert measures in problem solving situations.**

***SPI 3102.4.4 Convert rates and measurements.***

- ✓3102.4.5 Use dimensional analysis to convert rates and measurements both within a system and between systems and check the appropriateness of the solution.

## Standard 5 – Data Analysis, Statistics, & Probability

### CLE 3102.5.1 Describe and interpret quantitative information.

*SPI 3102.5.1 Interpret displays of data to answer questions about the data set(s) (e.g., identify pattern, trends, and/or outliers in a data set).*

- ✓3102.5.1 Identify patterns or trends in data.
- ✓3102.5.2 Develop a meaning for and identify outliers in a data set and verify.
- ✓3102.5.5 Construct and interpret various forms of data representations, (including line graphs, bar graphs, circle graphs, histograms, scatter-plots, box-and-whiskers, stem-and-leaf, and frequency tables).
- ✓3102.5.6 Draw qualitative graphs of functions and describe a general trend or shape.
- ✓3102.5.7 Compare two data sets using graphs and descriptive statistics.

### CLE 3102.5.2 Use statistical thinking to draw conclusions and make predictions.

*SPI 3102.5.2 Identify the effect on mean, median, mode, and range when values in the data set are changed.*

- ✓3102.5.3 When a set of data is changed, identify effects on measures of central tendency, range, and inter-quartile range.
- ✓3102.5.4 Explore quartiles, deciles, and percentiles of a distribution.

*SPI 3102.5.3 Using a scatter-plot, determine if a linear relationship exists and describe the association between variables.*

*SPI 3102.5.4 Generate the equation of a line that fits linear data and use it to make a prediction.*

- ✓3102.5.8 Examine real-world graphical relationship (including scatter-plots) to determine type of relationship (linear or nonlinear) and any association (positive, negative or none) between the variables of the data set.
- ✓3102.5.9 Determine an equation for a line that fits real-world linear data; interpret the meaning of the slope and y-intercept in context of the data.
- ✓3102.5.10 Using technology with a set of contextual linear data to examine the line of best fit; determine and interpret the correlation coefficient.
- ✓3102.5.11 Use an equation that fits data to make a prediction.

### CLE 3102.5.3 Understand basic counting procedures and concepts of probability.

*SPI 3102.5.5 Determine theoretical and/or experimental probability of an event and/or its complement including using relative frequency.*

- ✓3102.5.12 Use techniques (Venn Diagrams, tree diagrams, or counting procedures) to identify the possible outcomes of an experiment or sample space and compute the probability of an event.
- ✓3102.5.13 Determine the complement of an event and the probability of that complement.
- ✓3102.5.14 Determine if two events are independent or dependent.
- ✓3102.5.15 Explore joint and conditional probability.
- ✓3102.5.16 Identify situations for which the Law of Large Numbers applies.
- ✓3102.5.17 Perform simulations to estimate probabilities.
- ✓3102.5.18 Make informed decisions about practical situations using probability concepts.