
Mathematics Curriculum Standards, K-8

The Background:

In March 2007, Tennessee joined the American Diploma Project (ADP) Network, a network of twenty-nine states committed to restoring value to the high school diploma by increasing the rigor of high school academic standards and aligning those standards with workforce and postsecondary demands. Immediately upon joining ADP, Tennessee began the work of revising core content standards in the areas of Algebra I, Algebra II, and Geometry. These revisions require the K-8 curriculum to be revised to support the increased expectations and rigor of the ADP-aligned high school courses.

Overview of Standards Revision Process

- ❖ Writing teams comprising K-12 educators and college professors are assembled (June 2007).
- ❖ Standards are revised to ensure alignment with ADP benchmarks (including Explore), ACT benchmarks, and NAEP standards (June-December 2007).
- ❖ Draft documents are vertically aligned with the drafts of the high school core curriculum. (July-December 2007).
- ❖ Final revisions, using feedback provided via Achieve's Quality Review I of the high school courses, are made to the draft documents by the content consultants (November-December 2007).
- ❖ Revised mathematics standards are submitted for State Board approval (December 2007).

Concurrent to the K-8 revision process, final revisions to the core content standards in the areas of Algebra I, Algebra II, and Geometry are being made according to the feedback received from Achieve's Quality Review I.

The Master Plan Connection:

This item supports the State Board's Master Plan by providing a rigorous, relevant curriculum in the areas of elementary and middle school English and mathematics core. These curriculum standards have been developed in alignment with the American Diploma Project Benchmarks, the ACT Benchmarks for College Readiness (including the ACT Explore Benchmarks), the 2009 NAEP framework, and NCTE/NCTM national standards.

The Recommendation:

The Department of Education recommends adoption of the mathematics standards on final reading. The SBE staff concurs with this recommendation.

Tennessee Mathematics Standards:

Kindergarten Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0006.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0006.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0006.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0006.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0006.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0006.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0006.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0006.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0006.1.1 Model addition and subtraction (e.g., using a number chart, number line and/or concrete objects).
- ✓ 0006.1.2 Begin to develop the concept of estimation using concrete objects.
- ✓ 0006.1.3 Use words to describe time (e.g., day, night, morning, afternoon, yesterday, today, tomorrow).
- ✓ 0006.1.4 Tell time to the hour.
- ✓ 0006.1.5 Recognize a calendar as a way of measuring time.
- ✓ 0006.1.6 Name and identify coins and their values.
- ✓ 0006.1.7 Use words to describe temperature (e.g., hot, warm, cool, cold).
- ✓ 0006.1.8 Recognize a thermometer as a way of measuring temperature.
- ✓ 0006.1.9 Use age-appropriate books, stories, and videos to convey ideas of mathematics.

Standard 2 – Number and Operations

Grade Level Expectations:

- GLE 0006.2.1 Count objects in a set and use numbers, including written numerals to 25.
- GLE 0006.2.2 Create, represent and recognize a set with a given number of objects.
- GLE 0006.2.3 Recognize, compare and order sets of numerals by using both cardinal and ordinal meanings.
- GLE 0006.2.4 Understand addition as “putting together” and subtraction as “breaking apart.”
- GLE 0006.2.5 Model the numbers 1 through 10 as sums or differences of different sets of whole numbers (composing and decomposing numbers).

Check for Understanding (Formative/Summative Assessment):

- ✓ 0006.2.1 Count objects to 25 using one-to-one correspondence and identify the quantity in the counted group.
- ✓ 0006.2.2 Match quantities to 25 with numerals and written words.
- ✓ 0006.2.3 Count backward from 10 to 1.
- ✓ 0006.2.4 Count to 20 by twos.
- ✓ 0006.2.5 Create a set with a given number of objects.
- ✓ 0006.2.6 Quickly recognize the number of objects in a small set.
- ✓ 0006.2.7 Recognize zero (0) as a set with “no objects”.
- ✓ 0006.2.8 Compare sets of ten or fewer objects and identify which are equal to, more than, or less than others.
- ✓ 0006.2.9 Order the numbers through 25 using numerals and words.
- ✓ 0006.2.10 Recognize 6 through 10 as “five and some ones.”
- ✓ 0006.2.11 Recognize and use ordinal numbers (e.g., first, fourth, last).
- ✓ 0006.2.12 Model simple joining and separating situations with objects.
- ✓ 0006.2.13 Add and subtract single-digit numbers whose total or difference is between 0 and 10.
- ✓ 0006.2.14 Understand add as “put together” or “count on” and solve addition problems with sums less than 20.
- ✓ 0006.2.15 Understand subtraction as “break apart” or “take away” and solve subtraction problems using numbers 1 through 10.
- ✓ 0006.2.16 Model, demonstrate, and solve story problems that illustrate addition and subtraction.
- ✓ 0006.2.17 Understand that numbers can be represented by different groupings.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0006.3.1 Identify, duplicate, and extend simple number patterns and sequential and growing patterns.
- GLE 0006.3.2 Recognize attributes (such as color, shape, size) and patterns (such as repeated pairs, bilateral symmetry).
- GLE 0006.3.3 Describe qualitative change.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0006.3.1 Use a variety of manipulatives (such as connecting cubes, number cards, shapes) to create patterns.
- ✓ 0006.3.2 Name, copy, and extend patterns.
- ✓ 0006.3.3 Translate simple patterns into rules.
- ✓ 0006.3.4 Sort, order and classify objects by attribute and identify objects that do not belong in a particular group.
- ✓ 0006.3.5 Describe change in attributes according to qualitative criteria such as longer/shorter, colder/warmer, heavier/lighter.

Standard 4 – Geometry and Measurement

Grade Level Expectations:

- GLE 0006.4.1 Interpret and describe the physical world with geometric ideas and vocabulary.
- GLE 0006.4.2 Use positional terms to specify locations with simple relationships.
- GLE 0006.4.3 Compare and order measurable attributes of objects directly (by comparing them with each other) and indirectly (by comparing both with a third object).

Check for Understanding (Formative/Summative Assessment):

- ✓ 0006.4.1 Identify, name, and describe a variety of shapes (i.e. circles, squares, triangles, rectangles, hexagons, trapezoids) shown in various positions.
- ✓ 0006.4.2 Identify, name, and describe three-dimensional shapes (such as sphere, cube, cone, cylinder).
- ✓ 0006.4.3 Sort plane figures into groups, name and describe the attributes of the shapes (such as number of sides and corners (vertices)).
- ✓ 0006.4.4 Sort solid figures into groups, name and describe the attributes of the shapes.
- ✓ 0006.4.5 Use basic shapes and spatial reasoning to model objects and construct more complex shapes.
- ✓ 0006.4.6 Identify positions (such as beside, inside, outside, above, below, between, on, over, under, near, far, forward, backward, top, middle, bottom, left, right) using models, illustrations, and stories.
- ✓ 0006.4.7 Make direct and indirect comparisons between objects (such as recognize which is shorter, longer, taller, lighter, heavier, or holds more).

Standard 5 – Data, Probability and Statistics

Grade Level Expectations:

- GLE 0006.5.1 Sort objects and use one or more attributes to solve problems.
- GLE 0006.5.2 Re-sort objects using new attributes.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0006.5.1 Sort objects into sets and describe how the objects were sorted.

- ✓ 0006.5.2 Sort objects in different ways.
- ✓ 0006.5.3 Collect and count data.

Tennessee Mathematics Standards:

Grade One Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0106.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0106.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0106.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0106.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0106.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0106.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0106.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0106.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0106.1.1 Describe the relationship between days and months.
- ✓ 0106.1.2 Read and write time to the hour, half-hour, and quarter-hour.
- ✓ 0106.1.3 Compare units of time.
- ✓ 0106.1.4 Count the value of a set of coins up to fifty cents.
- ✓ 0106.1.5 Use a thermometer to measure temperature.
- ✓ 0106.1.6 Recognize scales as a way of measuring weight.
- ✓ 0106.1.7 Apply spatial sense to recreate a figure from memory.
- ✓ 0106.1.8 Recognize the “word clues” and mathematical symbols for addition and subtraction.
- ✓ 0106.1.9 Use age-appropriate books, stories, and videos to convey ideas of mathematics.
- ✓ 0106.1.10 Match the spoken, written, concrete, and pictorial representations of whole numbers, one-half, and one-fourth.

Standard 2 – Number and Operations

Grade Level Expectations:

- GLE 0106.2.1 Understand and use number notation and place value to 100.
- GLE 0106.2.2 Compare and order whole numbers to 100.
- GLE 0106.2.3 Develop strategies for learning basic addition facts and related subtraction facts.
- GLE 0106.2.4 Use multiple representations (including groups of ten) to model two-digit addition and subtraction.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0106.2.1 Read and write numerals up to 100.
- ✓ 0106.2.2 Write numbers up to 10 in words.
- ✓ 0106.2.3 Count forward and backward by ones beginning with any number less than 100.
- ✓ 0106.2.4 Skip count by twos, fives, and tens.
- ✓ 0106.2.5 Order and compare (less than, greater than, or equal to) whole numbers to 100.
- ✓ 0106.2.6 Recognize the place value of numbers (tens, ones).
- ✓ 0106.2.7 Develop fluency with addition and subtraction facts of sums through ten.
- ✓ 0106.2.8 Relate “counting on” and “counting back” to addition and subtraction and understand them as inverse operations.
- ✓ 0106.2.9 Add three single-digit numbers.
- ✓ 0106.2.10 Use models (such as discrete objects, connecting cubes, and number lines) to represent “part-whole,” “adding to,” “taking away from,” and “comparing to” situations to develop understanding of the meaning of addition and subtraction.
- ✓ 0106.2.11 Recognize the “part-whole” relationship in representations of basic fractions such as $\frac{1}{2}$ and $\frac{1}{4}$.
- ✓ 0106.2.12 Use various models to develop strategies for solving arithmetic problems.
- ✓ 0106.2.13 Solve problems that require addition and subtraction of numbers through 100.
- ✓ 0106.2.14 Use composition and decomposition of numbers to identify and discuss patterns.
- ✓ 0106.2.15 Represent whole numbers between 10 and 100 in groups of tens and ones.
- ✓ 0106.2.16 Represent whole numbers up to 100 on a number line.
- ✓ 0106.2.17 Use the number line to create visual representations of sequences (such as even numbers, tens, multiples of five).

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0106.3.1 Identify, describe, and extend simple number patterns to develop strategies for adding and subtracting whole numbers.
- GLE 0106.3.2 Understand that addition and subtraction are inverse operations.

GLE 0106.3.3 Extend the strategies for basic facts to include other properties of number and operations.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0106.3.1 Find repeating patterns on the number line, addition table, and hundreds chart.
- ✓ 0106.3.2 Determine a reasonable next term in a given sequence and describe the rule.
- ✓ 0106.3.3 Use objects to illustrate the commutative property with basic facts and show that subtraction is not commutative.
- ✓ 0106.3.4 Demonstrate understanding of the basic equation $a + b = c$ by using objects to illustrate the number sentences (fact families) associated with any particular sum.
- ✓ 0106.3.5 Use various strategies to find unknowns in problems involving addition and subtraction.
- ✓ 0106.3.6 Use objects to demonstrate the inverse relationship between addition and subtraction.
- ✓ 0106.3.7 Use the inverse relation between addition and subtraction to check arithmetic problems.
- ✓ 0106.3.8 Determine whether a number is odd or even by pairing objects.
- ✓ 0106.3.9 Recognize that zero is the identity element for addition.

Standard 4 – Geometry and Measurement

Grade Level Expectations:

- GLE 0106.4.1 Recognize, describe, and draw geometric figures.
- GLE 0106.4.2 Compose and decompose geometric shapes.
- GLE 0106.4.3 Use non-standard units in linear measurement.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0106.4.1 Recognize and describe similarities and differences between 2-dimensional figures (geometric attributes and properties).
- ✓ 0106.4.2 Recognize 2- and 3-dimensional figures from different perspectives and orientations.
- ✓ 0106.4.3 Model part-whole relationships and properties of plane and solid figures by combining two or more shapes to make a larger shape or by breaking apart an object into its smaller shapes.
- ✓ 0106.4.4 Identify 2-dimensional shapes as faces of 3-dimensional figures.
- ✓ 0106.4.5 Estimate and measure length using non-standard units (counting by using groups of tens and ones) to represent addition.
- ✓ 0106.4.6 Recognize the essential role of units in measurement, and understand the difference between standard and non-standard units.
- ✓ 0106.4.7 Understand and use comparative words such as long, longer, longest; short, shorter, shortest; tall, taller, tallest; high, higher, highest.

Standard 5 – Data, Probability and Statistics

Grade Level Expectations:

GLE 0106.5.1 Use various representations to display and compare data.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0106.5.1 Represent measurements and discrete data using concrete objects, picture graphs, and bar graphs.
- ✓ 0106.5.2 Represent data in both horizontal and vertical form.
- ✓ 0106.5.3 Display data using appropriate titles and labels.
- ✓ 0106.5.4 Count and compare collected data.

Tennessee Mathematics Standards:

Grade Two Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0206.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0206.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0206.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0206.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0206.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0206.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0206.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0206.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0206.1.1 Read and write time up to five-minute intervals.
- ✓ 0206.1.2 Relate days, dates, weeks, months, and years to a calendar.
- ✓ 0206.1.3 Use strategies to make estimates of time.
- ✓ 0206.1.4 Solve problems involving elapsed time in hour and half-hour intervals.
- ✓ 0206.1.5 Count the value of a set of coins up to one dollar and use the transitive property of equality to recognize equivalent forms of values up to \$1.00.
- ✓ 0206.1.6 Read thermometers with Fahrenheit and Celsius scales.
- ✓ 0206.1.7 Measure weight to the nearest pound or kilogram.
- ✓ 0206.1.8 Use concrete models or pictures to show whether a fraction is less than a half, more than a half, or equal to a half.
- ✓ 0206.1.9 Match the spoken, written, concrete, and pictorial representations of halves, thirds, and fourths.
- ✓ 0206.1.10 Develop a story problem that illustrates a given addition or subtraction number sentence.
- ✓ 0206.1.11 Use manipulatives to demonstrate addition and subtraction sentences written symbolically.

- ✓ 0206.1.12 Write numbers and translate word clues to number sentences and vice versa.
- ✓ 0206.1.13 Use manipulatives such as pattern blocks, tangrams, etc. to explore geometric concepts of symmetry and transformations.
- ✓ 0206.1.14 Create and observe numerical patterns on a calculator by repeatedly adding or subtracting the same number from some starting number.
- ✓ 0206.1.15 Use age-appropriate books, stories, and videos to convey ideas of mathematics.

Standard 2 – Number and Operations

Grade Level Expectations:

- GLE 0206.2.1 Understand and use place value concepts to 1000.
- GLE 0206.2.2 Understand and use the base-ten numeration system.
- GLE 0206.2.3 Use efficient and accurate strategies to develop fluency with multi-digit addition and subtraction.
- GLE 0206.2.4 Develop an initial understanding of multiplication.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0206.2.1 Starting at any number, count by ones, twos, fives, tens, and hundreds up to 1000.
- ✓ 0206.2.2 Read and write numbers up to 1000 using numerals and up to 100 using words.
- ✓ 0206.2.3 Locate and interpret numbers on a number line.
- ✓ 0206.2.4 Recognize that place-value notation represents the sums of multiples of powers of ten (e.g., 853 as 8 hundreds + 5 tens + 3 ones).
- ✓ 0206.2.5 Compare and order multi-digit numbers up to 1000.
- ✓ 0206.2.6 Use various models such as number lines, pictures, and base-ten blocks to illustrate addition and subtraction.
- ✓ 0206.2.7 Develop fluency at recalling basic addition facts and related subtraction facts.
- ✓ 0206.2.8 Use efficient procedures, and understand why they work, to solve problems involving the addition and subtraction of two- and three-digit whole numbers (including those that require regrouping for addition only).
- ✓ 0206.2.9 Apply appropriate methods to estimate and mentally calculate sums or differences with ones, tens, and hundreds.
- ✓ 0206.2.10 Add three two-digit numbers.
- ✓ 0206.2.11 Solve addition and subtraction problems in context using various representations.
- ✓ 0206.2.12 Demonstrate skip counting on the number line and relate to repeated addition and multiplication.
- ✓ 0206.2.13 Relate patterns in skip counting to multiplication.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0206.3.1 Develop pattern recognition.
- GLE 0206.3.2 Extend knowledge of the properties of numbers and operations to multiplication.
- GLE 0206.3.3 Solve simple arithmetic problems using various methods.
- GLE 0206.3.4 Describe quantitative change.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0206.3.1 Given rules, complete tables to reveal both arithmetic and geometric patterns.
- ✓ 0206.3.2 Given a description, extend or find a missing term in a pattern or sequence.
- ✓ 0206.3.3 Record and study patterns in lists of numbers created by repeated addition or subtraction.
- ✓ 0206.3.4 Generalize the patterns resulting from the addition, subtraction and multiplication of combinations of odd and even numbers.
- ✓ 0206.3.5 Understand and use the commutative and associative properties of addition and multiplication.
- ✓ 0206.3.6 Relate repeated addition to multiplication.
- ✓ 0206.3.7 Find unknowns in number sentences and problems involving addition, subtraction and multiplication.
- ✓ 0206.3.8 Describe change in measures according to quantitative criteria such as growing 2 inches in one year.

Standard 4 – Geometry and Measurement

Grade Level Expectations:

- GLE 0206.4.1 Recognize, classify, and transform 2- and 3-dimensional geometric figures.
- GLE 0206.4.2 Understand the meaning and process of linear measurement.
- GLE 0206.4.3 Add, subtract, compare, compute and estimate linear measurements.
- GLE 0206.4.4 Compose and decompose polygons to make other polygons.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0206.4.1 Describe common geometric attributes of familiar plane and solid objects.
- ✓ 0206.4.2 Reflect, rotate, and translate shapes to explore the effects of transformations.
- ✓ 0206.4.3 Understand the property of transitivity as it relates to linear measurement (for example: If A is longer than B, and B is longer than C, then A is longer than C).
- ✓ 0206.4.4 Estimate, measure, and calculate length to the nearest unit: meter, centimeter, yard, foot, and inch.

- ✓ 0206.4.5 Use rulers to measure the lengths of sides and diagonals of common 2-dimensional figures and polygons.
- ✓ 0206.4.6 Understand the inverse relationship between the size of a unit and the number of units used in a particular measurement (the smaller the unit, the more iterations needed to cover the length).
- ✓ 0206.4.7 Investigate and describe composition, decomposition, and transformations of polygons.
- ✓ 0206.4.8 Combine polygons to form other polygons and subdivide a polygon into other polygons.
- ✓ 0206.4.9 Recognize the composition and decomposition of polygons.

Standard 5 – Data, Probability and Statistics

Grade Level Expectations:

- GLE 0206.5.1 Use and understand various representations to depict and analyze data measurements.
- GLE 0206.5.2 Determine whether an event is likely or unlikely.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0206.5.1 Read, interpret, and analyze data shown in tables, bar graphs and picture graphs.
- ✓ 0206.5.2 Read, interpret, and create tables using tally marks.
- ✓ 0206.5.3 Explain whether a real world event is likely or unlikely.
- ✓ 0206.5.4 Predict outcomes of events based on data gathered and displayed.

Tennessee Mathematics Standards:

Grade Three Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0306.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0306.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0306.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0306.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0306.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0306.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0306.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0306.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0306.1.1 Read and write time to the nearest minute.
- ✓ 0306.1.2 Compare and order decimal amounts in the context of money.
- ✓ 0306.1.3 Count the value of combinations of coins and bills up to five dollars.
- ✓ 0306.1.4 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, and observing patterns.
- ✓ 0306.1.5 Determine when and how to break a problem into simpler parts.
- ✓ 0306.1.6 Use estimation to check answers for reasonableness, and calculators to check for accuracy.
- ✓ 0306.1.7 Make and investigate mathematical conjectures.
- ✓ 0306.1.8 Explain and justify answers on the basis of mathematical properties, structures, and relationships.
- ✓ 0306.1.9 Use manipulatives to demonstrate that the commutative property holds for addition but not for subtraction.
- ✓ 0306.1.10 Use correct, clearly written and oral mathematical language to pose questions and communicate ideas.

- ✓ 0306.1.11 Develop strategies for solving problems involving addition and subtraction of measurements.
- ✓ 0306.1.12 Analyze and evaluate the mathematical thinking and strategies of others.
- ✓ 0306.1.13 Create and use representations to organize, record, and communicate mathematical ideas.
- ✓ 0306.1.14 Use age-appropriate books, stories, and videos to convey ideas of mathematics.

State Performance Indicators:

- SPI 0306.1.1 Solve problems using a calendar.
- SPI 0306.1.2 Solve problems involving elapsed time.
- SPI 0306.1.3 Determine the correct change from a transaction less than a dollar.
- SPI 0306.1.4 Match the spoken, written, concrete, and pictorial representations of fractions with denominators up to ten.
- SPI 0306.1.5 Represent problems mathematically using diagrams, numbers, and symbolic expressions.
- SPI 0306.1.6 Identify and use vocabulary to describe attributes of two- and three-dimensional shapes.
- SPI 0306.1.7 Select appropriate units and tools to solve problems involving measures.
- SPI 0306.1.8 Express answers clearly in verbal, numerical, or graphical (bar and picture) form, using units when appropriate.

Standard 2 - Number and Operations

Grade Level Expectations:

- GLE 0306.2.1 Understand the place value of whole numbers to ten-thousands place including expanded notation for all arithmetic operations.
- GLE 0306.2.2 Develop understanding of multiplication and related division facts through multiple strategies and representations.
- GLE 0306.2.3 Relate multiplication and division as inverse operations.
- GLE 0306.2.4 Solve multiplication and division problems using various representations.
- GLE 0306.2.5 Understand the meaning and uses of fractions.
- GLE 0306.2.6 Use various strategies and models to compare and order fractions and identify equivalent fractions.
- GLE 0306.2.7 Add and subtract fractions with like denominators using various models.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0306.2.1 Represent whole numbers up to 10,000 using various models (such as base-ten blocks, number lines, place-value charts) and in standard form, written form, and expanded form.
- ✓ 0306.2.2 Understand and use the symbols =, < and > to signify order and comparison.
- ✓ 0306.2.3 Use parentheses to indicate grouping.
- ✓ 0306.2.4 Use a variety of methods to perform mental computations and compare the efficiency of those methods.

- ✓ 0306.2.5 Use highest order value (such as tens or hundreds digit) to make simple estimates.
- ✓ 0306.2.6 Solve a variety of addition and subtraction story problems including those with irrelevant information.
- ✓ 0306.2.7 Represent multiplication using various representations such as equal-size groups, arrays, area models, and equal jumps on number lines.
- ✓ 0306.2.8 Represent division using various representations such as successive subtraction, the number of equal jumps, partitioning, and sharing.
- ✓ 0306.2.9 Describe contexts for multiplication and division facts.
- ✓ 0306.2.10 Understand that symbols such as $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ represent numbers called unit fractions.
- ✓ 0306.2.11 Identify fractions as parts of whole units, as parts of sets, as locations on number lines, and as division of two whole numbers.
- ✓ 0306.2.12 Compare fractions using drawings, concrete objects, and benchmark fractions.
- ✓ 0306.2.13 Understand that when a whole is divided into equal parts to create unit fractions, the sum of all the parts adds up to one.

State Performance Indicators:

- SPI 0306.2.1 Read and write numbers up to 10,000 in numerals and up to 1,000 in words.
- SPI 0306.2.2 Identify the place value of numbers in the ten-thousands, thousands, hundreds, tens, and ones positions.
- SPI 0306.2.3 Convert between expanded and standard form with whole numbers to 10,000.
- SPI 0306.2.4 Compare and order numbers up to 10,000 using the words less than, greater than, and equal to, and the symbols $<$, $>$, $=$.
- SPI 0306.2.5 Identify various representations of multiplication and division.
- SPI 0306.2.6 Recall basic multiplication facts through 10 times 10 and the related division facts.
- SPI 0306.2.7 Compute multiplication problems that involve multiples of ten using basic number facts.
- SPI 0306.2.8 Solve problems that involve the inverse relationship between multiplication and division.
- SPI 0306.2.9 Solve contextual problems involving the addition (with and without regrouping) and subtraction (without regrouping) of two- and three digit whole numbers.
- SPI 0306.2.10 Identify equivalent fractions given by various representations.
- SPI 0306.2.11 Recognize and use different interpretations of fractions.
- SPI 0306.2.12 Name fractions in various contexts that are less than, equal to, or greater than one.
- SPI 0306.2.13 Recognize, compare, and order fractions (benchmark fractions, common numerators, or common denominators).
- SPI 0306.2.14 Add and subtract fractions with like denominators.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0306.3.1 Develop meaning for and apply the commutative, associative, and distributive properties using various representations.
- GLE 0306.3.2 Develop understanding that a letter or a symbol can represent an unknown quantity in a simple mathematical expression/equation.
- GLE 0306.3.3 Describe and analyze patterns and relationships in contexts.
- GLE 0306.3.4 Create and represent patterns using words, tables, graphs, and symbols.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0306.3.1 Show that addition and multiplication are commutative operations.
- ✓ 0306.3.2 Show that subtraction and division are not commutative operations.
- ✓ 0306.3.3 Use commutative, associative, and distributive properties to multiply whole numbers.
- ✓ 0306.3.4 Solve problems using the commutative, associative, and distributive properties.
- ✓ 0306.3.5 Find unknowns in number sentences and problems involving addition, subtraction, multiplication, or division.
- ✓ 0306.3.6 Analyze patterns in words, tables, and graphs to draw conclusions.
- ✓ 0306.3.7 Create different representations of a pattern given a verbal description.
- ✓ 0306.3.8 Analyze patterns in quantitative change resulting from computation.

State Performance Indicators:

- SPI 0306.3.1 Verify a conclusion using algebraic properties.
- SPI 0306.3.2 Express mathematical relationships using number sentences/equations.
- SPI 0306.3.3 Find the missing values in simple multiplication and division equations.
- SPI 0306.3.4 Describe or extend (including finding missing terms) geometric and numeric patterns.

Standard 4 – Geometry and Measurement

Grade Level Expectations:

- GLE 0306.4.1 Describe, compare, and analyze properties of polygons.
- GLE 0306.4.2 Understand and apply the concepts of congruence and symmetry.
- GLE 0306.4.3 Understand and use attributes of 2- and 3-dimensional figures to solve problems.
- GLE 0306.4.4 Use appropriate units, strategies and tools to solve problems involving perimeter.
- GLE 0306.4.5 Solve measurement problems involving fractional parts of linear units and capacity units.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0306.4.1 Describe properties of plane figures (such as circles, triangles, squares and rectangles) and solid shapes (such as spheres, cubes and cylinders).

- ✓ 0306.4.2 Classify polygons according to the number of their sides and angles.
- ✓ 0306.4.3 Classify lines and segments as parallel, perpendicular, or intersecting.
- ✓ 0306.4.4 Identify, create, and describe figures with line symmetry.
- ✓ 0306.4.5 Understand that all measurements require units.
- ✓ 0306.4.6 Recognize the use of fractions in liquid measures.
- ✓ 0306.4.7 Recognize the relationships among cups, pints, quarts, and gallons.
- ✓ 0306.4.8 Estimate and/or measure the capacity of a container.
- ✓ 0306.4.9 Measure weight to the nearest ounce or gram.
- ✓ 0306.4.10 Use reasonable units of length (i.e. kilometer, meter, centimeter; mile, yard, foot, inch) in estimates and measures.
- ✓ 0306.4.11 Know common equivalences for length (1 meter = 100 centimeters, 1 yard = 3 feet, 1 foot = 12 inches).
- ✓ 0306.4.12 Make and record measurements that use mixed units within the same system of measurement (such as feet and inches, meters and centimeters).
- ✓ 0306.4.13 Use common abbreviations: km, m, cm, in, ft, yd, mi.

State Performance Indicators:

- SPI 0306.4.1 Recognize polygons and be able to identify examples based on geometric definitions.
- SPI 0306.4.2 Determine if two figures are congruent based on size and shape.
- SPI 0306.4.3 Identify the line of symmetry in a two-dimensional design or shape.
- SPI 0306.4.4 Calculate the perimeter of shapes made from polygons.
- SPI 0306.4.5 Choose reasonable units of measure, estimate common measurements using benchmarks, and use appropriate tools to make measurements.
- SPI 0306.4.6 Measure length to the nearest centimeter or half inch.
- SPI 0306.4.7 Solve problems requiring the addition and subtraction of lengths.

Standard 5 – Data Analysis, Statistics, and Probability

Grade Level Expectations:

- GLE 0306.5.1 Organize, display, and analyze data using various representations to solve problems.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0306.5.1 Collect and organize data using observations, surveys, and experiments.
- ✓ 0306.5.2 Construct a frequency table, bar graph, pictograph, or line plot of collected data.
- ✓ 0306.5.3 Compare and interpret different representations of the same data.
- ✓ 0306.5.4 Solve problems using data from frequency tables, bar graphs, pictographs, or line plots.

State Performance Indicators:

- SPI 0306.5.1 Interpret a frequency table, bar graph, pictograph, or line plot.
- SPI 0306.5.2 Solve problems in which data is represented in tables or graph.
- SPI 0306.5.3 Make predictions based on various representations of data.

Tennessee Mathematics Standards:

Grade Four Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0406.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0406.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0406.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0406.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0406.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0406.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0406.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0406.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0406.1.1 Understand the relationship between use of answers and the accuracy of the number.
- ✓ 0406.1.2 Identify the range of appropriate estimates, including over-estimate and under-estimate.
- ✓ 0406.1.3 Connect operations with decimals to money and make estimates.
- ✓ 0406.1.4 Use commutative, associative, and distributive properties of numbers including oral descriptions of mathematical reasoning.
- ✓ 0406.1.5 Measure using ruler, meter stick, clock, thermometer, or other scaled instruments.
- ✓ 0406.1.6 Identify geometric or physical attributes that are appropriate to measure in a given situation.
- ✓ 0406.1.7 Translate the details of a contextual problem into diagrams and/or numerical expressions, and express answers using appropriate units.
- ✓ 0406.1.8 Match the spoken, written, concrete (including base ten blocks), and pictorial representations of decimals.

- ✓ 0406.1.9 Develop a story problem that illustrates a given multiplication or division number sentence.
- ✓ 0406.1.10 Use age-appropriate books, stories, and videos to convey ideas of mathematics.

State Performance Indicators:

- SPI 0406.1.1 Verify a conclusion using the commutative, associative and distributive properties.
- SPI 0406.1.2 Compare decimals using concrete and pictorial representations.
- SPI 0406.1.3 Determine the correct change from a transaction.
- SPI 0406.1.4 Compare objects with respect to a given geometric or physical attribute and select appropriate measurement instrument.

Standard 2 - Number and Operations

Grade Level Expectations:

- GLE 0406.2.1 Understand place value of numbers from hundredths to the hundred-thousands place.
- GLE 0406.2.2 Develop fluency with multiplication and single-digit division.
- GLE 0406.2.3 Identify prime and composite numbers.
- GLE 0406.2.4 Understand and use the connections between fractions and decimals.
- GLE 0406.2.5 Add and subtract fractions with like and unlike denominators.
- GLE 0406.2.6 Solve problems involving whole numbers, fractions, and/or decimals using all four arithmetic operations.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0406.2.1 Compose and decompose quantities according to place value.
- ✓ 0406.2.2 Understand decimal notation as an extension of the base-ten number system.
- ✓ 0406.2.3 Multiply two- and three-digit whole numbers.
- ✓ 0406.2.4 Understand and use a reliable algorithm for multiplying multi-digit numbers and dividing numbers by a single-digit divisor accurately and efficiently.
- ✓ 0406.2.5 Understand that division by zero is undefined.
- ✓ 0406.2.6 Divide three-digit whole numbers by one-digit divisors fluently with pencil and paper.
- ✓ 0406.2.7 Identify factors of whole numbers and model factors and products beyond basic multiplication facts using arrays and area models.
- ✓ 0406.2.8 Generate equivalent forms of whole numbers, decimals, and common fractions (e.g., $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$).
- ✓ 0406.2.9 Compare equivalent forms whole numbers, fractions, and decimals to each other and to benchmark numbers
- ✓ 0406.2.10 Use models to understand division as the inverse of multiplication, partitioning, and repeated subtraction.

- ✓ 0406.2.11 Use models, benchmarks, and equivalent forms to compare fractions/decimals and locate them on the number line.
- ✓ 0406.2.12 Understand and use decimal numbers up to hundredths and write them as fractions.
- ✓ 0406.2.13 Solve multi-step problems of various types using whole numbers, fractions, and decimals.
- ✓ 0406.2.14 Understand the role of the remainder in division.

State Performance Indicators:

- SPI 0406.2.1 Read and write numbers from hundredths to hundred-thousands in numerals and in words.
- SPI 0406.2.2 Locate and place mixed numbers on the number line.
- SPI 0406.2.3 Identify the place value of a specified digit in a number and the quantity it represents.
- SPI 0406.2.4 Find factors, common factors, multiples, and common multiples of two numbers.
- SPI 0406.2.5 Generate equivalent forms of common fractions and decimals and use them to compare size.
- SPI 0406.2.6 Use the symbols $<$, $>$ and $=$ to compare common fractions and decimals in both increasing and decreasing order.
- SPI 0406.2.7 Convert improper fractions into mixed numbers and/or decimals.
- SPI 0406.2.8 Add and subtract proper fractions with like and unlike denominators and simplify the answer.
- SPI 0406.2.9 Add and subtract decimals through hundredths.
- SPI 0406.2.10 Solve contextual problems using whole numbers, fractions, and decimals.
- SPI 0406.2.11 Solve problems using whole number multi-digit multiplication.
- SPI 0406.2.12 Solve problems using whole number division with one- or two-digit divisors.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0406.3.1 Extend understanding of a variable to equations involving whole numbers, fractions, decimals, and/or mixed numbers.
- GLE 0406.3.2 Use mathematical language and modeling to develop descriptions, rules and extensions of patterns.
- GLE 0406.3.3 Translate between different forms of representations of whole number relationships.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0406.3.1 Find an unknown quantity in simple equations using whole numbers, fractions, decimals, and mixed numbers.
- ✓ 0406.3.2 Translate between symbols and words to represent quantities in expressions or equations.
- ✓ 0406.3.3 Create, explain and use a rule to generate terms of a pattern or sequence.

- ✓ 0406.3.4 Translate between symbolic, numerical, verbal, or pictorial representations of a whole number pattern or relationship.

State Performance Indicators:

- SPI 0406.3.1 Use letters and symbols to represent an unknown quantity and write a simple mathematical expression.
- SPI 0406.3.2 Make generalizations about geometric and numeric patterns.
- SPI 0406.3.3 Represent and analyze patterns using words, function tables, and graphs.

Standard 4 – Geometry and Measurement

Grade Level Expectations:

- GLE 0406.4.1 Understand and use the properties of lines, segments, angles, polygons, and circles.
- GLE 0406.4.2 Understand and use measures of length, area, capacity, and weight.
- GLE 0406.4.3 Solve problems that involve estimating and measuring length, area, capacity and weight.
- GLE 0406.4.4 Understand the representation of location and movement within the first quadrant of a coordinate system.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0406.4.1 Identify the basic parts of circles.
- ✓ 0406.4.2 Understand the definition of degree as it relates to the circle.
- ✓ 0406.4.3 Classify angles and triangles as obtuse, acute, or right.
- ✓ 0406.4.4 Measure and draw angles.
- ✓ 0406.4.5 Determine if a figure is a polygon.
- ✓ 0406.4.6 Recognize the use of decimals in metric measures.
- ✓ 0406.4.7 Measure liquids using both standard units and metric units.
- ✓ 0406.4.8 Recognize that a measure of area represents the total number of same-sized units /that cover the shape without gaps or overlaps.
- ✓ 0406.4.9 Recognize that area does not change when 2-dimensional figures are cut apart and rearranged.
- ✓ 0406.4.10 Connect area measure to multiplication using a rectangular area model.
- ✓ 0406.4.11 Estimate areas of rectangles in square inches and square centimeters.
- ✓ 0406.4.12 Estimate the size of an object with respect to a given measurement attribute (length, perimeter, area, or capacity).
- ✓ 0406.4.13 Compare objects with respect to a given attribute such as length, area, and capacity.
- ✓ 0406.4.14 Explain how the components of a coordinate system are used to determine location.
- ✓ 0406.4.15 Explore properties of paths between points.
- ✓ 0406.4.16 Examine transformations in the coordinate plane.
- ✓ 0406.4.17 Predict the results of a transformation of a geometric shape.
- ✓ 0406.4.18 Determine whether a geometric shape has line and/or rotational symmetry.
- ✓ 0406.4.19 Design and analyze simple tilings and tessellations.

- ✓ 0406.4.20 Draw lines of symmetry in 2-dimensional figures.
- ✓ 0406.4.21 Recognize two-dimensional faces of three-dimensional shapes.

State Performance Indicators:

- SPI 0406.4.1 Classify lines and line segments as parallel, perpendicular, or intersecting.
- SPI 0406.4.2 Graph and interpret points with whole number or letter coordinates on grids or in the first quadrant of the coordinate plane.
- SPI 0406.4.3 Construct geometric figures with vertices at points on a coordinate grid.
- SPI 0406.4.4 Identify acute, obtuse, and right angles in 2-dimensional shapes.
- SPI 0406.4.5 Identify attributes of simple and compound figures composed of 2- and 3-dimensional shapes.
- SPI 0406.4.6 Determine situations in which a highly accurate measurement is important.
- SPI 0406.4.7 Determine appropriate size of unit of measurement in problem situations involving length, capacity or weight.
- SPI 0406.4.8 Convert measurements within a single system that are common in daily life (e.g., hours and minutes, inches and feet, centimeters and meters, quarts and gallons, liters and milliliters).
- SPI 0406.4.9 Solve problems involving area and/or perimeter of rectangular figures.
- SPI 0406.4.10 Identify images resulting from reflections, translations, or rotations.

Standard 5 – Data, Probability and Statistics

Grade Level Expectations:

- GLE 0406.5.1 Collect, record, arrange, present, and interpret data using tables and various representations.
- GLE 0406.5.2 Use probability to describe chance events.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0406.5.1 Create and label appropriate scales for graphs.
- ✓ 0406.5.2 Evaluate how well various representations show the collected data.
- ✓ 0406.5.3 Interpret and prepare pie charts using appropriate measurements of angles.
- ✓ 0406.5.4 Develop and use stem-and-leaf plots.
- ✓ 0406.5.5 Use measures of central tendency to compare two sets of related data.
- ✓ 0406.5.6 Determine a simple probability.
- ✓ 0406.5.7 Express a probability pictorially.

State Performance Indicators:

- SPI 0406.5.1 Depict data using various representations (e.g., tables, pictographs, line graphs, bar graphs).
- SPI 0406.5.2 Solve problems using estimation and comparison within a single set of data.
- SPI 0406.5.3 Given a set of data or a graph, describe the distribution of the data using median, range, or mode.
- SPI 0406.5.4 List all possible outcomes of a given situation or event.

Tennessee Mathematics Standards:

Grade Five Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0506.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0506.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0506.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0506.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0506.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0506.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0506.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0506.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0506.1.1 Make and test conjectures about geometric properties and develop logical arguments to justify conclusions.
- ✓ 0506.1.2 Make reasonable estimates of fraction and decimal sums or differences using models.
- ✓ 0506.1.3 Explore different methods of estimation including rounding and truncating.
- ✓ 0506.1.4 Explore problems in different contexts to interpret the meaning of remainders as discrete values or not.
- ✓ 0506.1.5 Solve problems in more than one way and explain why one process may be more effective than another.
- ✓ 0506.1.6 Communicate answers in correct verbal and numerical form; including use of mixed numbers or fractions and use of units.
- ✓ 0506.1.7 Organize and consolidate verbal statements involving fractions and mixed numbers into diagrams, symbols, and numerical expressions.
- ✓ 0506.1.8 Use patterns, models, and relationships as contexts for writing inequalities and simple equations.

- ✓ 0506.1.9 Use age-appropriate books, stories, and videos to convey ideas of mathematics.

State Performance Indicators:

- SPI 0506.1.1 Given a series of geometric statements, draw a conclusion about the figure described.
- SPI 0506.1.2 Estimate fraction and decimal sums or differences.
- SPI 0506.1.3 Recognize the unit associated with the remainder in a division problem or the meaning of the fractional part of a whole given in either decimal or fraction form.
- SPI 0506.1.4 Identify missing information and/or too much information in contextual problems.

Standard 2 - Number and Operations

Grade Level Expectations:

- GLE 0506.2.1 Extend the understanding of place value through millions and millionths in various contexts and representations.
- GLE 0506.2.2 Write natural numbers (to 50) as a product of prime factors and understand that this is unique (apart from order).
- GLE 0506.2.3 Develop fluency with division of whole numbers. Understand the relationship of divisor, dividend, and quotient in terms of multiplication and division.
- GLE 0506.2.4 Develop fluency with addition and subtraction of proper and improper fractions and mixed numbers; explain and model the algorithm.
- GLE 0506.2.5 Develop fluency in solving multi-step problems using whole numbers, fractions, mixed numbers, and decimals.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0506.2.1 Identify prime numbers up to 50.
- ✓ 0506.2.2 Use the prime factorization of two whole numbers to determine the greatest common factor and the least common multiple.
- ✓ 0506.2.3 Use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals.
- ✓ 0506.2.4 Use divisibility rules to factor numbers.
- ✓ 0506.2.5 Make reasonable estimates of fraction and decimal sums and differences.
- ✓ 0506.2.6 Add and subtract mixed numbers.
- ✓ 0506.2.7 Understand the placement of the decimal point in calculations of multiplication and long division, including the placement in the estimation of the answer.
- ✓ 0506.2.8 Understand that division by zero is undefined.
- ✓ 0506.2.9 Explore numbers less than 0 by extending the number line through familiar applications (e.g., temperatures below zero, owing money, measuring elevation below sea level).

- ✓ 0506.2.10 Use exponential notation to represent repeated multiplication of whole numbers.

State Performance Indicators:

- SPI 0506.2.1 Read and write numbers from millions to millionths in various contexts.
- SPI 0506.2.2 Write the prime factorization of numbers through 50 using both exponential and standard notation.
- SPI 0506.2.3 Select a reasonable solution to a real-world division problem in which the remainder must be considered.
- SPI 0506.2.4 Solve problems involving the division of two- and three-digit whole numbers by one- and two-digit whole numbers.
- SPI 0506.2.5 Solve addition and subtraction problems involving both fractions and decimals.
- SPI 0506.2.6 Add and subtract proper and improper fractions as well as mixed numbers.
- SPI 0506.2.7 Recognize equivalent representations for the same number.
- SPI 0506.2.8 Write terminating decimals in the form of fractions or mixed numbers.
- SPI 0506.2.9 Compare whole numbers, decimals and fractions using the symbols $<$, $>$, and $=$.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0506.3.1 Understand and use order of operations.
- GLE 0506.3.2 Develop and apply the concept of variable.
- GLE 0506.3.3 Understand and apply the substitution property.
- GLE 0506.3.4 Solve single-step linear equations and inequalities.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0506.3.1 Evaluate an expression by substituting non-negative rational number values for letter variables in the expression.
- ✓ 0506.3.2 Use variables appropriately to represent numbers whose values are not yet known.
- ✓ 0506.3.3 Solve single-step linear equations using inverse operations.
- ✓ 0506.3.4 Solve single-step linear inequalities and graph solutions on a number line.
- ✓ 0506.3.5 Determine if a given value is a solution to a linear equation/inequality.
- ✓ 0506.3.6 Recognize there are many numbers between any two whole numbers on the number line.

State Performance Indicators:

- SPI 0506.3.1 Evaluate algebraic expressions involving decimals and fractions using order of operations.
- SPI 0506.3.2 Evaluate multi-step numerical expressions involving fractions using order of operations.
- SPI 0506.3.3 Find the unknown in single-step equations involving fractions and mixed numbers.

- SPI 0506.3.4 Given a set of values, identify those that make an inequality a true statement.

Standard 4 – Geometry and Measurement

Grade Level Expectations:

- GLE 0506.4.1 Use basic formulas and visualization to find the area of geometric figures.
GLE 0506.4.2 Describe polyhedral solids and analyze their properties, including volume and surface area.
GLE 0506.4.3 Describe length/distance relationships using the first quadrant of the coordinate system.
GLE 0506.4.4 Solve problems that require attention to both approximation and precision of measurement.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0506.4.1 Develop the formula for the area of a triangle as it relates to the area of a parallelogram/rectangle.
- ✓ 0506.4.2 Find the area of a convex polygon by decomposing it into triangles/rectangles.
- ✓ 0506.4.3 Build, draw, and work with prisms by means of orthogonal views, projective views, and nets.
- ✓ 0506.4.4 Describe and identify the five regular (Platonic) solids and their properties with respect to faces, shapes of faces, edges, and vertices.
- ✓ 0506.4.5 Quantify total volume as filling space with same-sized units of volume without gaps or overlap.
- ✓ 0506.4.6 Decompose prisms to calculate surface area and volume.
- ✓ 0506.4.7 Understand, select and use units of appropriate size and type to measure angles, lengths/distances, area, surface area and volume.
- ✓ 0506.4.8 Identify characteristics of the set of points that define vertical and horizontal line segments.
- ✓ 0506.4.9 Correctly interpret significant digits in the accuracy of measurements and associated calculations.
- ✓ 0506.4.10 Recognize that measurements are never exact.
- ✓ 0506.4.11 Understand the usefulness of approximations.
- ✓ 0506.4.12 Develop strategies for choosing correct tools of measurement.
- ✓ 0506.4.13 Recognize and use measures of weight and temperature.

State Performance Indicators:

- SPI 0506.4.1 Solve contextual problems that require calculating the area of triangles and parallelograms.
SPI 0506.4.2 Decompose irregular shapes to find perimeter and area.
SPI 0506.4.3 Identify a three-dimensional object from two-dimensional representations of that object and vice versa.
SPI 0506.4.4 Solve problems involving surface area and volume of rectangular prisms and polyhedral solids.

- SPI 0506.4.5 Find the length of vertical or horizontal line segments in the first quadrant of the coordinate system, including problems that require the use of fractions and decimals.
- SPI 0506.4.6 Record measurements in context to reasonable degree of accuracy using decimals and/or fractions.

Standard 5 – Data, Probability and Statistics

Grade Level Expectations:

- GLE 0506.5.1 Make, record, display and interpret data and graphs that include whole numbers, decimals, and fractions.
- GLE 0506.5.2 Describe the shape and important features of a set of data using the measures of central tendency.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0506.5.1 Construct and analyze double bar and line graphs.
- ✓ 0506.5.2 Represent data using ordered pairs in the first quadrant of the coordinate system.
- ✓ 0506.5.3 Design investigations to address a question and consider how data collection methods affect the nature of the data set.
- ✓ 0506.5.4 Recognize the differences in representing categorical and numerical data.
- ✓ 0506.5.5 Evaluate how different measures of central tendency describe data.
- ✓ 0506.5.6 Identify outliers and determine their effect on mean, median, mode and range.

State Performance Indicators:

- SPI 0506.5.1 Depict data using various representations, including decimal and/or fractional data.
- SPI 0506.5.2 Make predictions based on various data representations, including double bar and line graphs.
- SPI 0506.5.3 Calculate measures of central tendency to analyze data.

Tennessee Mathematics Standards:

Grade Six Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0606.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0606.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0606.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0606.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0606.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0606.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0606.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0606.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0606.1.1 Recognize different conventions used in calculator and computer spreadsheets (e.g., * for multiplication, ^ for exponent), but use mathematical notation in written work.
- ✓ 0606.1.2 Recognize when an estimate is more appropriate than an exact answer in a variety of problem situations.
- ✓ 0606.1.3 Recognize errors generated by rounding.
- ✓ 0606.1.4 Describe how changes in one quantity or variable result in changes in another.
- ✓ 0606.1.5 Illustrate properties of operations by showing that two expressions are equivalent in a given context (e.g., using an area model for distributive property, and grouping/set models for commutative and associative properties).
- ✓ 0606.1.6 Model situations by devising and carrying out experiments and simulations.
- ✓ 0606.1.7 Formulate questions, design studies, and collect real world data.
- ✓ 0606.1.8 Determine an appropriate sample to test an hypothesis.

- ✓ 0606.1.9 Use age-appropriate books, stories, and videos to convey ideas of mathematics.
- ✓ 0606.1.10 Use various methods (such as dynamic geometry software) to explore properties of triangles and quadrilaterals.
- ✓ 0606.1.11 Model algebraic expressions with manipulatives, technology, and pencil and paper.

State Performance Indicators:

- SPI 0606.1.1 Make conjectures and predictions based on data.
- SPI 0606.1.2 Judge the reasonableness of the results of rational number estimates and/or computations.
- SPI 0606.1.3 Use concrete, pictorial, and symbolic representation for integers.
- SPI 0606.1.4 Select the representation that models one of the arithmetic properties (commutative, associative, or distributive).
- SPI 0606.1.5 Model algebraic expressions using algebra tiles.

Standard 2 – Number & Operations

Grade Level Expectations:

- GLE 0606.2.1 Understand and explain the procedures for multiplication and division of fractions, mixed numbers, and decimals.
- GLE 0606.2.2 Solve multi-step mathematical, contextual and verbal problems using fractions, mixed numbers, and decimals.
- GLE 0606.2.3 Understand and use ratios, rates and percents.
- GLE 0606.2.4 Understand and convert between fraction, decimal, and percent forms of rational numbers.
- GLE 0606.2.5 Develop meaning for integers; represent and compare quantities with integers.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0606.2.1 Efficiently compare and order fractions, decimals and percents; determine their approximate locations on a number line.
- ✓ 0606.2.2 Use area models to represent multiplication of fractions.
- ✓ 0606.2.3 Create and solve contextual problems that lead naturally to division of fractions.
- ✓ 0606.2.4 Understand ratio as a fraction used to compare two quantities by division.
- ✓ 0606.2.5 Recognize $a:b$, a/b , and “a to b” as notations for ratios.
- ✓ 0606.2.6 Recognize common percentages as ratios based on fractions whose denominators are 2, 3, 4, 5, or 10.
- ✓ 0606.2.7 Connect ratio and rate to multiplication and division.
- ✓ 0606.2.8 Recognize that a terminating decimal equals a fraction with a denominator that is a power of ten.
- ✓ 0606.2.9 Recognize that the decimal form of a rational number either terminates or repeats.

- ✓ 0606.2.10 Explore contexts that can be described with negative numbers (such as money, elevation, and temperature).

State Performance Indicators:

- SPI 0606.2.1 Solve problems involving the multiplication and division of fractions.
- SPI 0606.2.2 Solve problems involving the addition, subtraction, multiplication, and division of mixed numbers.
- SPI 0606.2.3 Solve problems involving the addition, subtraction, multiplication, and division of decimals.
- SPI 0606.2.4 Solve multi-step arithmetic problems using fractions, mixed numbers, and decimals.
- SPI 0606.2.5 Transform numbers from one form to another (fractions, decimals, percents, and mixed numbers).
- SPI 0606.2.6 Solve problems involving ratios, rates and percents.
- SPI 0606.2.7 Locate positive rational numbers on the number line.
- SPI 0606.2.8 Locate integers on the number line.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0606.3.1 Write and solve two-step equations and inequalities.
- GLE 0606.3.2 Interpret and represent algebraic relationships with variables in expressions, simple equations and inequalities.
- GLE 0606.3.3 Extend order of operations to include grouping symbols and exponents.
- GLE 0606.3.4 Use expressions, equations and formulas to solve problems.
- GLE 0606.3.5 Use multiple representations including symbolic algebra to model and/or solve contextual problems that involve linear relationships.
- GLE 0606.3.6 Understand and use the Cartesian coordinate system.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0606.3.1 Write and solve two-step linear equations corresponding to given situations (non-negative numbers only).
- ✓ 0606.3.2 Write and solve one-step inequalities corresponding to given situations (non-negative numbers only).
- ✓ 0606.3.3 Recognize the use of juxtaposition (such as $3x$, ab) to stand for multiplication, and the convention in these cases of writing numbers before letters.
- ✓ 0606.3.4 Generate data and graph relationships concerning measurement of length, area, volume, weight, time, temperature, money, and information.
- ✓ 0606.3.5 Use the commutative, associative and distributive properties to show that two expressions are equivalent.
- ✓ 0606.3.6 Use equations to describe simple relationships shown in a table or graph.
- ✓ 0606.3.7 Move fluently between different representations (such as verbal, tabular, numerical, algebraic, and graphical) of equations and expressions.
- ✓ 0606.3.8 Represent patterns using words, graphs, and simple symbolic notation.

- ✓ 0606.3.9 Write a contextual story modeled by a given graph.
- ✓ 0606.3.10 Understand that in an ordered pair (x, y) , the x represents horizontal location and y represents vertical location.
- ✓ 0606.3.11 Identify the quadrant of the coordinate system in which a point lies.

State Performance Indicators:

- SPI 0606.3.1 Represent on a number line the solution of a linear inequality.
- SPI 0606.3.2 Use order of operations and parentheses to simplify expressions and solve problems.
- SPI 0606.3.3 Write equations that correspond to given situations or represent a given mathematical relationship.
- SPI 0606.3.4 Rewrite expressions to represent quantities in different ways.
- SPI 0606.3.5 Translate between verbal expressions/sentences and algebraic expressions/equations.
- SPI 0606.3.6 Solve two-step linear equations using number sense, properties, and inverse operations.
- SPI 0606.3.7 Use algebraic expressions and properties to analyze numeric and geometric patterns.
- SPI 0606.3.8 Select the qualitative graph that models a contextual situation (e.g., water filling then draining from a bathtub).
- SPI 0606.3.9 Graph ordered pairs of integers in all four quadrants of the Cartesian coordinate system.

Standard 4 – Geometry & Measurement

Grade Level Expectations:

- GLE 0606.4.1 Understand and use basic properties of triangles, quadrilaterals, and other polygons.
- GLE 0606.4.2 Use the concepts of translation, rotation, reflection, and symmetry to understand congruence in the plane.
- GLE 0606.4.3 Develop and use formulas to determine the circumference and area of circles, and the area of trapezoids, and develop strategies to find the area of composite shapes.
- GLE 0606.4.4 Develop and use formulas for surface area and volume of 3-dimensional figures.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0606.4.1 Investigate the sum of the angles in a triangle and a quadrilateral using various methods.
- ✓ 0606.4.2 Relate the sum of the angles in a triangle to the sum of the angles in polygons.
- ✓ 0606.4.3 Verify the basic properties of triangles and quadrilaterals using a protractor and ruler.
- ✓ 0606.4.4 Classify triangles by side lengths (scalene, isosceles, and equilateral) and angle measure (acute, right, obtuse, isosceles and equiangular).

- ✓ 0606.4.5 Model and use the Triangle Inequality Theorem.
- ✓ 0606.4.6 Use the properties of interior and exterior angles of polygons to solve problems.
- ✓ 0606.4.7 Work with transformations in a plane and explore their meanings through drawings and manipulatives.
- ✓ 0606.4.8 Understand scaling, dilation and their relation to similarity.
- ✓ 0606.4.9 Analyze the differences between congruence and similarity.
- ✓ 0606.4.10 Describe the effect of a transformation on a 2-dimensional figure and the resulting symmetry.
- ✓ 0606.4.11 Relate the circumference of a circle with the perimeter of a polygonal figure.
- ✓ 0606.4.12 Derive the meaning of Pi using concrete models and/or appropriate technology.
- ✓ 0606.4.13 Understand the relationships among the radius, diameter, circumference and area of a circle, and that the ratio of the circumference to the diameter is the same as the ratio of the area to the square of the radius, and that this ratio is called Pi.
- ✓ 0606.4.14 Relate the area of a trapezoid to the area of a parallelogram.
- ✓ 0606.4.15 Find lengths given areas or volumes, and vice versa.
- ✓ 0606.4.16 Solve contextual problems involving area and circumference of circles, surface areas and volumes of prisms, pyramids, cones, and cylinders.
- ✓ 0606.4.17 Use manipulatives to discover the volume of a pyramid is one-third the volume of the related prism (the heights and base areas are equal).
- ✓ 0606.4.18 Use manipulatives to discover the volume of a cone is one-third the volume of the related cylinder (the heights and base areas are equal).

State Performance Indicators:

- SPI 0606.4.1 Identify, define or describe geometric shapes given a visual representation or a written description of its properties.
- SPI 0606.4.2 Find a missing angle measure in problems involving interior/exterior angles and/or their sums.
- SPI 0606.4.3 Solve problems using the Triangle Inequality Theorem.
- SPI 0606.4.4 Calculate with circumferences and areas of circles.
- SPI 0606.4.5 Determine the surface area and volume of prisms, pyramids and cylinders.
- SPI 0606.4.6 Given the volume of a cone/pyramid, find the volume of the related cylinder/prism or vice versa.

Standard 5 – Data Analysis, Statistics, & Probability

Grade Level Expectations:

- GLE 0606.5.1 Understand the meaning of probability and how it is expressed.
- GLE 0606.5.2 Interpret representations of data from surveys and polls, and describe sample bias and how data representations can be misleading.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0606.5.1 Understand that the probability of an event is a number between zero and one that expresses the likelihood of its occurrence.
- ✓ 0606.5.2 Identify the probability of an event as the ratio of the number of its actual occurrences to the total number of its possible occurrences.
- ✓ 0606.5.3 Express probabilities in different ways.
- ✓ 0606.5.4 Understand the difference between probability and odds.
- ✓ 0606.5.5 Analyze a situation that involves probability of an independent event.
- ✓ 0606.5.6 Estimate the probability of simple and compound events through experimentation or simulation.
- ✓ 0606.5.7 Apply procedures to calculate the probability of complimentary events.
- ✓ 0606.5.8 Connect data sets and their graphical representations (such as bar graphs, circle, graphs, and stem-and-leaf plots).
- ✓ 0606.5.9 Determine the sample space for a given situation.
- ✓ 0606.5.10 Distinguish between a random and nonrandom sample.
- ✓ 0606.5.11 Select the appropriate measure of center to describe a data set.
- ✓ 0606.5.12 Predict the characteristics of a population based on the analysis of sample data.

State Performance Indicators:

- SPI 0606.5.1 Determine the theoretical probability of simple and compound events in familiar contexts.
- SPI 0606.5.2 Identify features of graphs that may be misleading.
- SPI 0606.5.3 Determine whether or not a sample is biased.

Tennessee Mathematics Standards:

Grade Seven Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0706.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0706.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0706.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0706.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0706.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0706.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0706.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0706.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0706.1.1 Recognize common abbreviations (such as gcd/gcf and lcm).
- ✓ 0706.1.2 Recognize round-off error and the inaccuracies it introduces.
- ✓ 0706.1.3 Check answers both by estimation and by appropriate independent calculations, using calculators or computers judiciously.
- ✓ 0706.1.4 Recognize quantities that are inversely proportional (such as the relationship between the lengths of the base and the side of a rectangle with fixed area).
- ✓ 0706.1.5 Understand that a linear function in which $f(0) = 0$ is called a directly proportional relationship.
- ✓ 0706.1.6 Develop meaning of intercept and rate of change in contextual problems.
- ✓ 0706.1.7 Explain and demonstrate how scale in maps and drawings shows relative size and distance.
- ✓ 0706.1.8 Recognize the applications of scale factor by exploring blueprints, shadow measuring, and scale models.
- ✓ 0706.1.9 Use age-appropriate books, stories, and videos to convey ideas of mathematics.

- ✓ 0706.1.10 Model algebraic equations with manipulatives, technology, and pencil and paper.
- ✓ 0706.1.11 Translate from calculator notation to scientific/standard notation.
- ✓ 0706.1.12 Use dynamic geometry software to explore scale factor and similarity.

State Performance Indicators:

- SPI 0706.1.1 Use proportional reasoning to solve mixture/concentration problems.
- SPI 0706.1.2 Generalize a variety of patterns to a symbolic rule from tables, graphs, or words.
- SPI 0706.1.3 Recognize whether information given in a table, graph, or formula suggests a directly proportional, linear, inversely proportional, or other nonlinear relationship.
- SPI 0706.1.4 Use scales to read maps.

Standard 2 – Number & Operations

Grade Level Expectations:

- GLE 0706.2.1 Extend understandings of addition, subtraction, multiplication and division to integers.
- GLE 0706.2.2 Understand and work with the properties of and operations on the system of rational numbers.
- GLE 0706.2.3 Develop an understanding of and apply proportionality.
- GLE 0706.2.4 Use ratios, rates and percents to solve single- and multi-step problems in various contexts.
- GLE 0706.2.5 Understand and work with squares, cubes, square roots and cube roots.
- GLE 0706.2.6 Introduce the concept of negative exponents.
- GLE 0706.2.7 Understand and use scientific notation.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0706.2.1 Understand that the set of rational numbers includes any number that can be written as a ratio of two integers in which the denominator is not zero.
- ✓ 0706.2.2 Develop and analyze algorithms and compute efficiently with integers and rational numbers.
- ✓ 0706.2.3 Recognize that rational numbers satisfy the commutative and associative laws of addition and multiplication and the distributive law.
- ✓ 0706.2.4 Understand that a and $-a$ are additive inverses and are located the same distance from zero on the number line; relate distance from zero to absolute value.
- ✓ 0706.2.5 Understand that $-(-a) = a$ for any number a .
- ✓ 0706.2.6 Use the number line to demonstrate addition and subtraction with integers.
- ✓ 0706.2.7 Write number sentences to solve contextual problems involving ratio and percent.
- ✓ 0706.2.8 Apply ratios, rates, proportions and percents (such as discounts, interest, taxes, tips, distance/rate/time, and percent increase or decrease).

- ✓ 0706.2.9 Efficiently compare and order rational numbers and roots of perfect squares/cubes; determine their approximate locations on a number line.
- ✓ 0706.2.10 Recognize that when a whole number is not a perfect square, then its square root is not rational and cannot be written as the ratio of two integers.
- ✓ 0706.2.11 Estimate square/cube roots and use calculators to find approximations.
- ✓ 0706.2.12 Recognize $\sqrt{mn} = \sqrt{m} \cdot \sqrt{n}$ and $(\sqrt{m})^2 = m$.
- ✓ 0706.2.13 Use the meaning of negative exponents to represent small numbers; translate between scientific and standard notation.
- ✓ 0706.2.14 Express numbers in scientific notation and recognize its importance in representing the magnitude of a number.
- ✓ 0706.2.15 Report results of calculations appropriately in a given context (i.e. using rules of rounding, degree of accuracy, and/or significant digits).

State Performance Indicators:

- SPI 0706.2.1 Simplify numerical expressions involving rational numbers.
- SPI 0706.2.2 Compare rational numbers using appropriate inequality symbols.
- SPI 0706.2.3 Use rational numbers and roots of perfect squares/cubes to solve contextual problems.
- SPI 0706.2.4 Determine the approximate location of square/cube roots on a number line.
- SPI 0706.2.5 Solve contextual problems that involve operations with integers.
- SPI 0706.2.6 Express the ratio between two quantities as a percent, and a percent as a ratio or fraction.
- SPI 0706.2.7 Use ratios and proportions to solve problems.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0706.3.1 Recognize and generate equivalent forms for simple algebraic expressions.
- GLE 0706.3.2 Understand and compare various representations of relations and functions.
- GLE 0706.3.3 Understand the concept of function as a rule that assigns to a given input one and only one number (the output).
- GLE 0706.3.4 Use function notation where $f(x)$ represents the output that the function f assigns to the input x .
- GLE 0706.3.5 Understand and graph proportional relationships.
- GLE 0706.3.6 Conceptualize the meanings of slope using various interpretations, representations, and contexts.
- GLE 0706.3.7 Use mathematical models involving linear equations to analyze real-world phenomena.
- GLE 0706.3.8 Use a variety of strategies to efficiently solve linear equations and inequalities.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0706.3.1 Perform basic operations on linear expressions (including grouping, order of operations, exponents, simplifying and expanding).
- ✓ 0706.3.2 Represent and analyze mathematical situations using algebraic symbols.
- ✓ 0706.3.3 Identify a function from a written description, table, graph, rule, set of ordered pairs, and/or mapping.
- ✓ 0706.3.4 Make tables of inputs x and outputs $f(x)$ for a variety of rules that include rational numbers (including negative numbers) as inputs.
- ✓ 0706.3.5 Plot points to represent tables of linear function values.
- ✓ 0706.3.6 Understand that the graph of a linear function f is the set of points on a line representing the ordered pairs $(x, f(x))$.
- ✓ 0706.3.7 Distinguish proportional relationships ($y/x = k$, or $y = kx$) from other relationships, including inverse proportionality ($xy = k$, or $y = k/x$).
- ✓ 0706.3.8 Understand slope as the ratio of vertical change to horizontal change.
- ✓ 0706.3.9 Identify a function exhibiting a constant rate of change as a linear function and identify the slope as a unit rate.
- ✓ 0706.3.10 Solve problems involving unit rates (e.g., miles per hour, words per minute).
- ✓ 0706.3.11 Relate the features of a linear equation to a table and/or graph of the equation.
- ✓ 0706.3.12 Use linear equations to solve problems and interpret the meaning of slope, m , and the y -intercept, b , in $f(x) = mx + b$ in terms of the context.
- ✓ 0706.3.13 Given a graph that exhibits the intersection of a line and the y -axis, write a linear function in slope-intercept form: $y = mx + b$.
- ✓ 0706.3.14 Understand that when solving linear inequalities, multiplication or division by a negative reverses the inequality symbol.

State Performance Indicators:

- SPI 0706.3.1 Evaluate algebraic expressions involving rational values for coefficients and/or variables.
- SPI 0706.3.2 Determine whether a relation (represented in various ways) is a function.
- SPI 0706.3.3 Given a table of inputs x and outputs $f(x)$, identify the function rule and continue the pattern.
- SPI 0706.3.4 Interpret the slope of a line as a unit rate given the graph of a proportional relationship.
- SPI 0706.3.5 Represent proportional relationships with equations, tables and graphs.
- SPI 0706.3.6 Solve linear equations with rational coefficients symbolically or graphically.
- SPI 0706.3.7 Translate between verbal and symbolic representations of real-world phenomena involving linear equations.
- SPI 0706.3.8 Solve contextual problems involving two-step linear equations.
- SPI 0706.3.9 Solve linear inequalities in one variable with rational coefficients symbolically or graphically.

Standard 4 – Geometry & Measurement

Grade Level Expectations:

- GLE 0706.4.1 Understand the application of proportionality with similar triangles.
- GLE 0706.4.2 Apply proportionality to converting among different units of measurements to solve problems involving rates such as motion at a constant speed.
- GLE 0706.4.3 Understand and use scale factor to describe the relationships between length, area, and volume.
- GLE 0706.4.4 Understand and use ratios, derived quantities, and indirect measurements.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0706.4.1 Solve problems involving indirect measurement such as finding the height of a building by comparing its shadow with the height and shadow of a known object.
- ✓ 0706.4.2 Use similar triangles and proportionality to find the lengths of unknown line segments in a triangle.
- ✓ 0706.4.3 Understand that if a scale factor describes how corresponding lengths in two similar objects are related, then the square of the scale factor describes how corresponding areas are related, and the cube of the scale factor describes how corresponding volumes are related.
- ✓ 0706.4.4 Compare angles, side lengths, perimeters and areas of similar shapes.
- ✓ 0706.4.5 Solve problems using ratio quantities: velocity (measured in units such as miles per hour), density (measured in units such as kilograms per liter), pressure (measured in units such as pounds per square foot), and population density (measured in units such as persons per square mile).

State Performance Indicators:

- SPI 0706.4.1 Solve contextual problems involving similar triangles.
- SPI 0706.4.2 Use SSS, SAS, and AA to determine if two triangles are similar.
- SPI 0706.4.3 Apply scale factor to solve problems involving area and volume.

Standard 5 – Data Analysis, Statistics, & Probability

Grade Level Expectations:

- GLE 0706.5.1 Collect, organize, and analyze both single- and two-variable data.
- GLE 0706.5.2 Select, create, and use appropriate graphical representations of data.
- GLE 0706.5.3 Formulate questions and design studies to collect data about a characteristic shared by two populations, or different characteristics within one population.
- GLE 0706.5.4 Use descriptive statistics to summarize and compare data.
- GLE 0706.5.5 Understand and apply basic concepts of probability.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0706.5.1 Create and interpret box-and-whisker plots and stem-and-leaf plots.

- ✓ 0706.5.2 Interpret and solve problems using information presented in various visual forms.
- ✓ 0706.5.3 Predict and compare the characteristics of two populations based on the analysis of sample data.
- ✓ 0706.5.4 Use proportional reasoning to make predictions about results of experiments and simulations.
- ✓ 0706.5.5 Evaluate the design of an experiment.
- ✓ 0706.5.6 Apply percentages to make and interpret histograms and circle graphs.
- ✓ 0706.5.7 Use a tree diagram or organized list to determine all possible outcomes of a simple probability experiment.

State Performance Indicators:

- SPI 0706.5.1 Interpret and employ various graphs and charts to represent data.
- SPI 0706.5.2 Select suitable graph types (such as bar graphs, histograms, line graphs, circle graphs, box-and-whisker plots, and stem-and-leaf plots) and use them to create accurate representations of given data.
- SPI 0706.5.3 Calculate and interpret the mean, median, upper-quartile, lower-quartile, and interquartile range of a set of data.
- SPI 0706.5.4 Use theoretical probability to make predictions.

Tennessee Mathematics Standards:

Grade Eight Mathematics

Standard 1 – Mathematical Processes

Grade Level Expectations:

- GLE 0806.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0806.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- GLE 0806.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0806.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- GLE 0806.1.5 Use mathematical ideas and processes in different settings to formulate patterns, analyze graphs, set up and solve problems and interpret solutions.
- GLE 0806.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- GLE 0806.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- GLE 0806.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0806.1.1 Relate nonlinear functions to geometric contexts of length, area, and volume.
- ✓ 0806.1.2 Draw qualitative graphs (trend graphs) of functions and describe their general shape/trend.
- ✓ 0806.1.3 Research the contributions of Pythagoras to mathematics.
- ✓ 0806.1.4 Relate data concepts to relevant concepts in the earth and space, life, and physical sciences.
- ✓ 0806.1.5 Use age-appropriate books, stories, and videos to convey ideas of mathematics.
- ✓ 0806.1.6 Use models (such as dynamic geometry software, patty paper and geo boards) to explore relationships among angles (complementary, supplementary, interior, exterior, vertical, and corresponding).
- ✓ 0806.1.7 Use a graphing calculator or spreadsheet to create scatterplots of data and approximate lines of best fit.
- ✓ 0806.1.8 Use a variety of methods to solve real-world problems involving multi-step linear equations (e.g., manipulatives, technology, pencil and paper).

State Performance Indicators:

- SPI 0806.1.1 Solve problems involving rate/time/distance (i.e., $d = rt$).
- SPI 0806.1.2 Interpret a qualitative graph representing a contextual situation.
- SPI 0806.1.3 Calculates rates involving cost per unit to determine the best buy.

Standard 2 – Number & Operations

Grade Level Expectations:

- GLE 0806.2.1 Extend understanding of the real number system to include irrational numbers.
- GLE 0806.2.2 Solve problems involving exponents and scientific notation using technology appropriately.
- GLE 0806.2.3 Solve real-world problems using rational and irrational numbers.
- GLE 0806.2.4 Understand and use the laws of exponents.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0806.2.1 Recognize and use exponential, scientific, and calculator notation.
- ✓ 0806.2.2 Square numbers and simplify square roots.
- ✓ 0806.2.3 Solve contextual problems involving powers and roots.
- ✓ 0806.2.4 Use a Venn diagram to represent the subsets of the real number system.
- ✓ 0806.2.5 Identify the subset(s) of the real number system to which a number belongs.
- ✓ 0806.2.6 Simplify expressions using the laws of exponents.
- ✓ 0806.2.7 Add, subtract, multiply, and divide numbers expressed scientific notation.

State Performance Indicators:

- SPI 0806.2.1 Order and compare rational and irrational numbers and locate on the number line.
- SPI 0806.2.2 Identify numbers and square roots as rational or irrational.
- SPI 0806.2.3 Use scientific notation to compute products and quotients.
- SPI 0806.2.4 Solve real-world problems requiring scientific notation.

Standard 3 – Algebra

Grade Level Expectations:

- GLE 0806.3.1 Recognize and generate equivalent forms for algebraic expressions.
- GLE 0806.3.2 Represent, analyze, and solve problems involving linear equations and inequalities in one and two variables.
- GLE 0806.3.3 Solve systems of linear equations in two variables.
- GLE 0806.3.4 Translate among verbal, tabular, graphical and algebraic representations of linear functions.
- GLE 0806.3.5 Use slope to analyze situations and solve problems.
- GLE 0806.3.6 Compare and contrast linear and nonlinear functions.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0806.3.1 Perform basic operations on algebraic expressions (including grouping, order of operations, exponents, square/cube roots, simplifying and expanding).
- ✓ 0806.3.2 Represent algebraic relationships with equations and inequalities.
- ✓ 0806.3.3 Solve systems of linear equations in two variables and relate the systems to pairs of lines that intersect, are parallel, or are the same line.
- ✓ 0806.3.4 Understand the relationship between the graph of a linear inequality and its solutions.
- ✓ 0806.3.5 Solve linear inequalities in two variables (including those whose solutions require multiplication or division by a negative number).
- ✓ 0806.3.6 Identify x- and y-intercepts and slope of linear equations from an equation, graph or table.
- ✓ 0806.3.7 Analyze situations and solve problems involving constant rate of change.
- ✓ 0806.3.8 Recognize a proportion as a special case of a linear equation and understand that the constant of proportionality is the slope, and the resulting graph is a line through the origin.
- ✓ 0806.3.9 Given a function rule, create tables of values for x and y , and plot graphs of nonlinear functions.
- ✓ 0806.3.10 Distinguish quadratic and exponential functions as nonlinear using a graph and/or a table of values.
- ✓ 0806.3.11 Distinguish between the equations of linear, quadratic, and exponential functions (e.g. function families such as $y=x^2$, $y=2^x$, and $y=2x$).
- ✓ 0806.3.12 Understand how rates of change of nonlinear functions contrast with constant rates of change of linear functions.
- ✓ 0806.3.13 Represent situations and solve real-world problems using symbolic algebra.

State Performance Indicators:

- SPI 0806.3.1 Find solutions to systems of two linear equations in two variables.
- SPI 0806.3.2 Solve the linear equation $f(x) = g(x)$.
- SPI 0806.3.3 Solve and graph linear inequalities in two variables.
- SPI 0806.3.4 Translate between various representations of a linear function.
- SPI 0806.3.5 Determine the slope of a line from an equation, two given points, a table or a graph.
- SPI 0806.3.6 Analyze the graph of a linear function to find solutions, roots, and intercepts.
- SPI 0806.3.7 Identify, compare and contrast functions as linear or nonlinear.

Standard 4 – Geometry & Measurement

Grade Level Expectations:

- GLE 0806.4.1 Derive the Pythagorean theorem and understand its applications.
- GLE 0806.4.2 Understand the relationships among the angles formed by parallel lines cut by transversals.

- GLE 0806.4.3 Understand the necessary levels of accuracy and precision in measurement.
- GLE 0806.4.4 Understand both metric and customary units of measurement.
- GLE 0806.4.5 Use visualization to describe or identify intersections, cross-sections, and various views of geometric figures.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0806.4.1 Model the Pythagorean Theorem.
- ✓ 0806.4.2 Use the converse of the Pythagorean Theorem to determine if a triangle is a right triangle.
- ✓ 0806.4.3 Select or use the appropriate measurement instrument to determine or create a given length, area, volume, angle, weight, or mass.
- ✓ 0806.4.4 Understand how the precision of measurement influences accuracy of quantities derived from these measurements.
- ✓ 0806.4.5 Analyze the congruent and supplementary relationships of angles formed by parallel lines and transversals (such as alternate interior, alternate exterior, corresponding, and adjacent).
- ✓ 0806.4.6 Make within-system and between-system conversions of derived quantities including distance, temperature, and money.
- ✓ 0806.4.7 Visualize or describe the cross-section resulting from the intersection of a plane with a 3-dimensional figure.
- ✓ 0806.4.8 Build, draw, and work with 2- and 3-dimensional figures by means of orthogonal views, projective views, and/or nets.

State Performance Indicators:

- SPI 0806.4.1 Use the Pythagorean Theorem to find the missing angle measure in a right triangle.
- SPI 0806.4.2 Apply the Pythagorean theorem to find distances between points in the coordinate plane to measure lengths and analyze polygons and polyhedra.
- SPI 0806.4.3 Find measures of the angles formed by parallel lines cut by a transversal.
- SPI 0806.4.4 Convert between and within the U.S. Customary System and the metric system.
- SPI 0806.4.5 Identify the intersection of two or more geometric figures in the plane.

Standard 5 – Data Analysis, Statistics, & Probability

Grade Level Expectations:

- GLE 0806.5.1 Explore probabilities for compound, independent and/or dependent events.
- GLE 0806.5.2 Select, create, and use appropriate graphical representations of data (including scatterplots with lines of best fit) to make and test conjectures.
- GLE 0806.5.3 Evaluate the use of statistics in media reports.

Check for Understanding (Formative/Summative Assessment):

- ✓ 0806.5.1 Solve simple problems involving probability and relative frequency.

- ✓ 0806.5.2 Compare probabilities of two or more events and recognize when certain events are equally likely.
- ✓ 0806.5.3 Recognize common misconceptions associated with dependent and independent events.
- ✓ 0806.5.4 Explain the benefits and the limitations of various representations (i.e., bar graphs, line graphs, circle graphs, histograms, stem-and-leaf plots, box plots, scatterplots) of data.
- ✓ 0806.5.5 Create and interpret box-and-whisker plots and scatterplots.
- ✓ 0806.5.6 Use observations about differences between two or more samples to make conjectures about the populations from which the samples were taken.
- ✓ 0806.5.7 Estimate lines of best fit to make and test conjectures.
- ✓ 0806.5.8 Consider the source, design, analysis, and display of data to evaluate statistics reported in the media.

State Performance Indicators:

- SPI 0806.5.1 Calculate probabilities of events for simple experiments with equally probable outcomes.
- SPI 0806.5.2 Use a variety of methods to compute probabilities for compound events (e.g., multiplication, organized lists, tree diagrams, area models).
- SPI 0806.5.3 Generalize the relationship between two sets of data using scatterplots and lines of best fit.
- SPI 0806.5.4 Recognize misrepresentations of published data in the media.