Mathematical Process Standards

These student expectations will not be listed under a separate reporting category. Instead, they will be incorporated into test questions across reporting categories since the application of mathematical process standards is part of each knowledge statement.

5.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**5.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**5.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**5.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**5.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**5.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**5.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Reporting Category 1
Numerical Representations and Relationships
6 Questions

The student will demonstrate an understanding of how to represent and manipulate numbers and expressions.

(5.2) Number and operations. The student applies mathematical process standards to represent, compare, and order positive rational numbers and understand relationships as related to place value. The student is expected to:

- **(A)** represent the value of the digit in decimals through the thousandths using expanded notation and numerals; ***Supporting Standard***
- **(B)** compare and order two decimals to thousandths and represent comparisons using the symbols >, <, or =; and ***Readiness Standard***
- **(C)** round decimals to tenths or hundredths. ***Supporting Standard***

(5.4) Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

- **(A)** identify prime and composite numbers; ***Supporting Standard***
- **(E)** describe the meaning of parentheses and brackets in a numeric expression; and ***Supporting Standard***
- **(F)** simplify numerical expressions that do not involve exponents, including up to two levels of grouping. ***Readiness Standard***

Reporting Category 2
Computations and Algebraic Relationships
17 Questions

The student will demonstrate an understanding of how to perform operations and represent algebraic relationships.

(5.3) Number and operations. The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:

- **(A)** estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division; ***Supporting Standard***
- **(B)** multiply with fluency a three-digit number by a two-digit number using the standard algorithm; ***Supporting Standard***
- **(C)** solve with proficiency for quotients of up to a four-digit dividend by a two-digit divisor using strategies and the standard algorithm; ***Supporting Standard***
- **(D)** represent multiplication of decimals with products to the hundredths using objects and pictorial models, including area models; ***Supporting Standard***
- **(E)** solve for products of decimals to the hundredths, including situations involving money, using strategies based on place-value understandings, properties of operations, and the relationship to the multiplication of whole numbers; ***Readiness Standard***
- **(F)** represent quotients of decimals to the hundredths, up to four-digit dividends and two-digit whole number divisors, using objects and pictorial models, including area models; ***Supporting Standard***
- **(G)** solve for quotients of decimals to the hundredths, up to four-digit dividends and two-digit whole number divisors, using strategies and algorithms, including the standard algorithm; ***Readiness Standard***
- **(H)** represent and solve addition and subtraction of fractions with unequal denominators referring to the same whole using objects and pictorial models and properties of operations; ***Supporting Standard***
- **(I)** represent and solve multiplication of a whole number and a fraction that refers to the same whole using objects and pictorial models, including area models; ***Supporting Standard***
- **(J)** represent division of a unit fraction by a whole number and the division of a whole number by a unit fraction such as 1/3 ÷ 7 and 7 ÷ 1/3 using objects and pictorial models, including area models; ***Supporting Standard***
- **(K)** add and subtract positive rational numbers fluently; and ***Readiness Standard***
- **(L)** divide whole numbers by unit fractions and unit fractions by whole numbers. ***Readiness Standard***

(5.4) Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

- **(B)** represent and solve multi-step problems involving the four operations with whole numbers using equations with a letter standing for the unknown quantity; ***Readiness Standard***
- **(C)** generate a numerical pattern when given a rule in the form y = ax or y = x + a and graph; and ***Readiness Standard***
- **(D)** recognize the difference between additive and multiplicative numerical patterns given in a table or graph. ***Supporting Standard***

Reporting Category 3
Geometry and Measurement
9 Questions

The student will demonstrate an understanding of how to represent and apply geometry and measurement concepts.

(5.4) Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

- **(H)** represent and solve problems related to perimeter and/or area and related to volume. ***Readiness Standard***

(5.5) Geometry and measurement. The student applies mathematical process standards to classify two-dimensional figures by attributes and properties. The student is expected to:

- **(A)** classify two-dimensional figures in a hierarchy of sets and subsets using graphic organizers based on their attributes and properties. ***Readiness Standard***

(5.6) Geometry and measurement. The student applies mathematical process standards to understand, recognize, and quantify volume. The student is expected to:

- **(A)** recognize a cube with side length of one unit as a unit cube having one cubic unit of volume and the volume of a three-dimensional figure as the number of unit cubes (n cubic units) needed to fill it with no gaps or overlaps if possible; and ***Supporting Standard***
- **(B)** determine the volume of a rectangular prism with whole number side lengths in problems related to the number of layers times the number of unit cubes in the area of the base. ***Supporting Standard***

(5.7) Geometry and measurement. The student applies mathematical process standards to select appropriate units, strategies, and tools to solve problems involving measurement. The student is expected to:

- **(A)** solve problems by calculating conversions within a measurement system, customary or metric. ***Supporting Standard***

(5.8) Geometry and measurement. The student applies mathematical process standards to identify locations on a coordinate plane. The student is expected to:

- **(A)** describe the key attributes of the coordinate plane, including perpendicular number lines (axes) where the intersection (origin) of the two lines coincides with zero on each number line and the given point (0, 0); the x-coordinate, the first number in an ordered pair, indicates movement parallel to the x-axis starting at the origin; and the y-coordinate, the second number, indicates movement parallel to the y-axis starting at the origin; ***Supporting Standard***
- **(B)** describe the process for graphing ordered pairs of numbers in the first quadrant of the coordinate plane; and ***Supporting Standard***
- **(C)** graph in the first quadrant of the coordinate plane ordered pairs of numbers arising from mathematical and real-world problems, including those generated by number patterns or found in an input-output table. ***Readiness Standard***

Reporting Category 4
Data Analysis and Personal Financial Literacy
4 Questions

The student will demonstrate an understanding of how to represent and analyze data and how to describe and apply personal financial concepts.

(5.9) Data analysis. The student applies mathematical process standards to solve problems by collecting, organizing, displaying, and interpreting data. The student is expected to:

- **(A)** represent categorical data with bar graphs or frequency tables and numerical data, including data sets of measurements in fractions or decimals, with dot plots or stem-and-leaf plots; ***Supporting Standard***
- **(B)** represent discrete paired data on a scatterplot; and ***Supporting Standard***
- **(C)** solve one- and two-step problems using data from a frequency table, dot plot, bar graph, stem-and-leaf plot, or scatterplot. ***Readiness Standard***

(5.10) Personal financial literacy. The student applies mathematical process standards to manage one's financial resources effectively for lifetime financial security. The student is expected to:

- **(A)** define income tax, payroll tax, sales tax, and property tax; ***Supporting Standard***
- **(B)** explain the difference between gross income and net income; ***Supporting Standard***
- **(E)** describe actions that might be taken to balance a budget when expenses exceed income; and ***Supporting Standard***
- **(F)** balance a simple budget. ***Supporting Standard***

§111.7 Grade 5, Adopted 2012.

(a) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on computational thinking, mathematical fluency, and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, algorithms, paper and pencil, and technology and techniques such as mental math, estimation, number sense, and generalization and abstraction to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, computer programs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) For students to become fluent in mathematics, students must develop a robust sense of number. The National Research Council's report, "Adding It Up," defines procedural fluency as "skill in carrying out procedures flexibly, accurately, efficiently, and appropriately." As students develop procedural fluency, they must also realize that true problem solving may take time, effort, and perseverance. Students in Grade 5 are expected to perform their work without the use of calculators.

(4) The primary focal areas in Grade 5 are solving problems involving all four operations with positive rational numbers, determining and generating formulas and solutions to expressions, and extending measurement to area and volume. These focal areas are supported throughout the mathematical strands of number and operations, algebraic reasoning, geometry and measurement, and data analysis. In Grades 3-5, the number set is limited to positive rational numbers. In number and operations, students will apply place value and identify part-to-whole relationships and equivalence. In algebraic reasoning, students will represent and solve problems with expressions and equations, build foundations of functions through patterning, identify prime and composite numbers, and use the order of operations. In geometry and measurement, students will classify two-dimensional figures, connect geometric attributes to the measures of three-dimensional figures, use units of measure, and represent location using a coordinate plane. In data analysis, students will represent and interpret data.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and skills

Mathematical Process Standards

(5.1) Mathematical process standards. *The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:*

5.1(A) apply mathematics to problems rising in everyday life, society, and the workplace;	**5.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**5.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**5.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**5.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**5.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**5.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Numbers and Operations

(5.2) Number and operations. The student applies mathematical process standards to represent, compare, and order positive rational numbers and understand relationships as related to place value. The student is expected to:

(A) represent the value of the digit in decimals through the thousandths using expanded notation and numerals; ***Supporting Standard***

(B) compare and order two decimals to thousandths and represent comparisons using the symbols >, <, or =; and ***Readiness Standard***

(C) round decimals to tenths or hundredths. ***Supporting Standard***

(5.3) Number and operations. The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:

(A) estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division; ***Supporting Standard***

(B) multiply with fluency a three-digit number by a two-digit number using the standard algorithm; ***Supporting Standard***

(C) solve with proficiency for quotients of up to a four-digit dividend by a two-digit divisor using strategies and the standard algorithm; ***Supporting Standard***

(D) represent multiplication of decimals with products to the hundredths using objects and pictorial models, including area models; ***Supporting Standard***

(E) solve for products of decimals to the hundredths, including situations involving money, using strategies based on place-value understandings, properties of operations, and the relationship to the multiplication of whole numbers; ***Readiness Standard***

(F) represent quotients of decimals to the hundredths, up to four-digit dividends and two-digit whole number divisors, using objects and pictorial models, including area models; ***Supporting Standard***

(G) solve for quotients of decimals to the hundredths, up to four-digit dividends and two-digit whole number divisors, using strategies and algorithms, including the standard algorithm; ***Readiness Standard***

(H) represent and solve addition and subtraction of fractions with unequal denominators referring to the same whole using objects and pictorial models and properties of operations; ***Supporting Standard***

(I) represent and solve multiplication of a whole number and a fraction that refers to the same whole using objects and pictorial models, including area models; ***Supporting Standard***

(J) represent division of a unit fraction by a whole number and the division of a whole number by a unit fraction such as 1/3 ÷ 7 and 7 ÷ 1/3 using objects and pictorial models, including area models; ***Supporting Standard***

(K) add and subtract positive rational numbers fluently; and ***Readiness Standard***

(L) divide whole numbers by unit fractions and unit fractions by whole numbers. ***Readiness Standard***

Algebraic Reasoning

(5.4) Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

(A) identify prime and composite numbers; ***Supporting Standard***

(B) represent and solve multi-step problems involving the four operations with whole numbers using equations with a letter standing for the unknown quantity; ***Readiness Standard***

(C) generate a numerical pattern when given a rule in the form y = ax or y = x + a and graph; ***Readiness Standard***

(D) recognize the difference between additive and multiplicative numerical patterns given in a table or graph; ***Supporting Standard***

(E) describe the meaning of parentheses and brackets in a numeric expression; ***Supporting Standard***

(F) simplify numerical expressions that do not involve exponents, including up to two levels of grouping; ***Readiness Standard***

(G) use concrete objects and pictorial models to develop the formulas for the volume of a rectangular prism, including the special form for a cube (V=l x w x h, V=s x s x s, and V=Bh); and

(H) represent and solve problems related to perimeter and/or area and related to volume. ***Readiness Standard***

Geometry and Measurement

(5.5) Geometry and measurement. The student applies mathematical process standards to classify two-dimensional figures by attributes and properties. The student is expected to classify two-dimensional figures in a hierarchy of sets and subsets using graphic organizers based on their attributes and properties. ***Readiness Standard***

(5.6) Geometry and measurement. The student applies mathematical process standards to understand, recognize, and quantify volume. The student is expected to:

(A) recognize a cube with side length of one unit as a unit cube having one cubic unit of volume and the volume of a three-dimensional figure as the number of unit cubes (n cubic units) needed to fill it with no gaps or overlaps if possible; and ***Supporting Standard***

(B) determine the volume of a rectangular prism with whole number side lengths in problems related to the number of layers times the number of unit cubes in the area of the base. ***Supporting Standard***

(5.7) Geometry and measurement. The student applies mathematical process standards to select appropriate units, strategies, and tools to solve problems involving measurement. The student is expected to solve problems by calculating conversions within a measurement system, customary or metric. ***Supporting Standard***

(5.8) Geometry and measurement. The student applies mathematical process standards to identify locations on a coordinate plane. The student is expected to:

(A) describe the key attributes of the coordinate plane, including perpendicular number lines (axes) where the intersection (origin) of the two lines coincides with zero on each number line and the given point (0, 0); the x-coordinate, the first number in an ordered pair, indicates movement parallel to the x-axis starting at the origin; and the y-coordinate, the second number, indicates movement parallel to the y-axis starting at the origin; ***Supporting Standard***

(B) describe the process for graphing ordered pairs of numbers in the first quadrant of the coordinate plane; and ***Supporting Standard***

(C) graph in the first quadrant of the coordinate plane ordered pairs of numbers arising from mathematical and real-world problems, including those generated by number patterns or found in an input-output table. ***Readiness Standard***

Data Anaysis

(5.9) Data analysis. The student applies mathematical process standards to solve problems by collecting, organizing, displaying, and interpreting data. The student is expected to:

(A) represent categorical data with bar graphs or frequency tables and numerical data, including data sets of measurements in fractions or decimals, with dot plots or stem-and-leaf plots; ***Supporting Standard***

(B) represent discrete paired data on a scatterplot; and ***Supporting Standard***

(C) solve one- and two-step problems using data from a frequency table, dot plot, bar graph, stem-and-leaf plot, or scatterplot. ***Readiness Standard***

Personal Financial Literacy

(5.10) Personal financial literacy. The student applies mathematical process standards to manage one's financial resources effectively for lifetime financial security. The student is expected to:

(A) define income tax, payroll tax, sales tax, and property tax; ***Supporting Standard***

(B) explain the difference between gross income and net income; ***Supporting Standard***

(C) identify the advantages and disadvantages of different methods of payment, including check, credit card, debit card, and electronic payments;

(D) develop a system for keeping and using financial records;

(E) describe actions that might be taken to balance a budget when expenses exceed income; and ***Supporting Standard***

(F) balance a simple budget. ***Supporting Standard***

Mathematical Process Standards

These student expectations will not be listed under a separate reporting category. Instead, they will be incorporated into test questions across reporting categories since the application of mathematical process standards is part of each knowledge statement.

6.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;

6.1 (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

6.1 (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

6.1 (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

6.1 (E) create and use representations to organize, record, and communicate mathematical ideas;

6.1 (F) analyze mathematical relationships to connect and communicate mathematical ideas; and

6.1 (G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Reporting Category 1
Numerical Representations and Relationships
10 Questions

The student will demonstrate an understanding of how to represent and manipulate numbers and expressions.

(6.2) Number and operations. The student applies mathematical process standards to represent and use rational numbers in a variety of forms. The student is expected to:

- **(A)** classify whole numbers, integers, and rational numbers using a visual representation such as a Venn diagram to describe relationships between sets of numbers; ***Supporting Standard***
- **(B)** identify a number, its opposite, and its absolute value; ***Supporting Standard***
- **(C)** locate, compare, and order integers and rational numbers using a number line; ***Supporting Standard***
- **(D)** order a set of rational numbers arising from mathematical and real-world contexts; and ***Readiness Standard***
- **(E)** extend representations for division to include fraction notation such as a/b represents the same number as $a \div b$ where $b \neq 0$. ***Supporting Standard***

(6.4) Proportionality. The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

- **(C)** give examples of ratios as multiplicative comparisons of two quantities describing the same attribute; ***Supporting Standard***
- **(D)** give examples of rates as the comparison by division of two quantities having different attributes, including rates as quotients; ***Supporting Standard***
- **(E)** represent ratios and percents with concrete models, fractions, and decimals; ***Supporting Standard***
- **(F)** represent benchmark fractions and percents such as 1%, 10%, 25%, 33 1/3%, and multiples of these values using 10 by 10 grids, strip diagrams, number lines, and numbers; and ***Supporting Standard***
- **(G)** generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that money. ***Readiness Standard***

(6.5) Proportionality. The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to

- **(C)** use equivalent fractions, decimals, and percents to show equal parts of the same whole. ***Supporting Standard***

(6.7) Expressions, equations, and relationships. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

- **(A)** generate equivalent numerical expressions using order of operations, including whole n umber exponents, and prime factorization; ***Readiness Standard***
- **(B)** distinguish between expressions and equations verbally, numerically, and algebraically; ***Supporting Standard***
- **(C)** determine if two expressions are equivalent using concrete models, pictorial models, and algebraic representations; and ***Supporting Standard***
- **(D)** generate equivalent expressions using the properties of operations: inverse, identity, commutative, associative, and distributive properties. ***Readiness Standard***

Reporting Category 2
Computations and Algebraic Relationships
15 Questions

The student will demonstrate an understanding of how to perform operations and represent algebraic relationships.

(6.3) Number and operations. The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions. The student is expected to:

- **(A)** recognize that dividing by a rational number and multiplying by its reciprocal result in equivalent values; ***Supporting Standard***
- **(B)** determine, with and without computation, whether a quantity is increased or decreased when multiplied by a fraction, including values greater than or less than one; ***Supporting Standard***
- **(C)** represent integer operations with concrete models and connect the actions with the models to standardized algorithms; ***Supporting Standard***
- **(D)** add, subtract, multiply, and divide integers fluently; and ***Readiness Standard***
- **(E)** multiply and divide positive rational numbers fluently. ***Readiness Standard***

(6.4) Proportionality. The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

- **(A)** compare two rules verbally, numerically, graphically, and symbolically in the form of $y = ax$ or $y = x + a$ in order to differentiate between additive and multiplicative relationships; and ***Supporting Standard***
- **(B)** apply qualitative and quantitative reasoning to solve prediction and comparison of real-world problems involving ratios and rates. ***Readiness Standard***

(6.5) Proportionality. The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:

- **(A)** represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions; and ***Supporting Standard***
- **(B)** solve real-world problems to find the whole given a part and the percent, to find the part given the whole and the percent, and to find the percent given the part and the whole, including the use of concrete and pictorial models. ***Readiness Standard***

(6.6) Expressions, equations, and relationships. The student applies mathematical process standards to use multiple representations to describe algebraic relationships. The student is expected to:

- **(A)** identify independent and dependent quantities from tables and graphs; ***Supporting Standard***
- **(B)** write an equation that represents the relationship between independent and dependent quantities from a table; and ***Supporting Standard***
- **(C)** represent a given situation using verbal descriptions, tables, graphs, and equations in the form $y = kx$ or $y = x + b$. ***Readiness Standard***

(6.9) Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to represent situations. The student is expected to:

- **(A)** write one-variable, one-step equations and inequalities to represent constraints or conditions within problems; ***Supporting Standard***
- **(B)** represent solutions for one-variable, one-step equations and inequalities on number lines; and ***Supporting Standard***
- **(C)** write corresponding real-world problems given one-variable, one-step equations or inequalities. ***Supporting Standard***

(6.10) Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to solve problems. The student is expected to

- **(A)** model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts; and ***Readiness Standard***
- **(B)** determine if the given value(s) make(s) one-variable, one-step equations or inequalities true. ***Supporting Standard***

Reporting Category 3
Geometry and Measurement
6 Questions

The student will demonstrate an understanding of how to represent and apply geometry and measurement concepts.

(6.4) Proportionality. The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

- **(H)** convert units within a measurement system, including the use of proportions and unit rates. ***Readiness Standard***

(6.8) Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to represent relationships and solve problems. The student is expected to:

- **(A)** extend previous knowledge of triangles and their properties to include the sum of angles of a triangle, the relationship between the lengths of sides and measures of angles in a triangle, and determining when three lengths form a triangle; ***Supporting Standard***
- **(B)** model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes; ***Supporting Standard***
- **(C)** write equations that represent problems related to the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers; and ***Supporting Standard***
- **(D)** determine solutions for problems involving the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers. ***Readiness Standard***

(6.11) Measurement and data. The student applies mathematical process standards to use coordinate geometry to identify locations on a plane. The student is expected to:

- **(A)** graph points in all four quadrants using ordered pairs of rational numbers. ***Readiness Standard***

Reporting Category 4
Data Analysis and Personal Financial Literacy
7 Questions

The student will demonstrate an understanding of how to represent and analyze data and how to describe and apply personal financial concepts.

(6.12) Measurement and data. The student applies mathematical process standards to use numerical or graphical representations to analyze problems. The student is expected to:

- **(A)** represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots; ***Supporting Standard***
- **(B)** use the graphical representation of numeric data to describe the center, spread, and shape of the data distribution; ***Supporting Standard***
- **(C)** summarize numeric data with numerical summaries, including the mean and median (measures of center) and the range and interquartile range (IQR) (measures of spread), and use these summaries to describe the center, spread, and shape of the data distribution; and ***Readiness Standard***
- **(D)** summarize categorical data with numerical and graphical summaries, including the m ode, the percent of values in each category (relative frequency table), and the percent bar graph, and use these summaries to describe the data distribution. ***Readiness Standard***

(6.13) Measurement and data. The student applies mathematical process standards to use numerical or graphical representations to solve problems. The student is expected to:

- **(A)** interpret numeric data summarized in dot plots, stem-and-leaf plots, histograms, and box plots; and ***Readiness Standard***
- **(B)** distinguish between situations that yield data with and without variability. ***Supporting Standard***

(6.14) Personal financial literacy. The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

- **(A)** compare the features and costs of a checking account and a debit card offered by different local financial institutions; ***Supporting Standard***
- **(B)** distinguish between debit cards and credit cards; ***Supporting Standard***
- **(C)** balance a check register that includes deposits, withdrawals, and transfers; ***Supporting Standard***
- **(E)** describe the information in a credit report and how long it is retained; ***Supporting Standard***
- **(F)** describe the value of credit reports to borrowers and to lenders; ***Supporting Standard***
- **(G)** explain various methods to pay for college, including through savings, grants, scholarships, student loans, and work-study; and ***Supporting Standard***
- **(H)** compare the annual salary of several occupations requiring various levels of post-secondary education or vocational training and calculate the effects of the different annual salaries on lifetime income. ***Supporting Standard***

§111.26. Grade 6, Adopted 2012.

(a) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on computational thinking, mathematical fluency, and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, algorithms, paper and pencil, and technology and techniques such as mental math, estimation, number sense, and generalization and abstraction to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, computer programs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) The primary focal areas in Grade 6 are number and operations; proportionality; expressions, equations, and relationships; and measurement and data. Students use concepts, algorithms, and properties of rational numbers to explore mathematical relationships and to describe increasingly complex situations. Students use concepts of proportionality to explore, develop, and communicate mathematical relationships. Students use algebraic thinking to describe how a change in one quantity in a relationship results in a change in the other. Students connect verbal, numeric, graphic, and symbolic representations of relationships, including equations and inequalities. Students use geometric properties and relationships, as well as spatial reasoning, to model and analyze situations and solve problems. Students communicate information about geometric figures or situations by quantifying attributes, generalize procedures from measurement experiences, and use the procedures to solve problems. Students use appropriate statistics, representations of data, and reasoning to draw conclusions, evaluate arguments, and make recommendations. While the use of all types of technology is important, the emphasis on algebra readiness skills necessitates the implementation of graphing technology.

(4) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and Skills.

Mathematical Process Standards

(6.1) Mathematical process standards. *The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:*

6.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**6.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**6.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**6.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**6.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**6.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**6.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Numbers and Operations

(6.2) The student applies mathematical process standards to represent and use rational numbers in a variety of forms. The student is expected to:

(A) classify whole numbers, integers, and rational numbers using a visual representation such as a Venn diagram to describe relationships between sets of numbers; ***Supporting Standard***

(B) identify a number, its opposite, and its absolute value; ***Supporting Standard***

(C) locate, compare, and order integers and rational numbers using a number line; ***Supporting Standard***

(D) order a set of rational numbers arising from mathematical and real-world contexts; and ***Readiness Standard***

(E) extend representations for division to include fraction notation such as a/b represents the same number as a ÷ b where b ≠ 0. ***Supporting Standard***

(6.3) The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions. The student is expected to:

(A) recognize that dividing by a rational number and multiplying by its reciprocal result in equivalent values; ***Supporting Standard***

(B) determine, with and without computation, whether a quantity is increased or decreased when multiplied by a fraction, including values greater than or less than one; ***Supporting Standard***

(C) represent integer operations with concrete models and connect the actions with the models to standardized algorithms; ***Supporting Standard***

(D) add, subtract, multiply, and divide integers fluently; and ***Readiness Standard***

(E) multiply and divide positive rational numbers fluently. ***Readiness Standard***

Proportionality

(6.4) The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

(A) compare two rules verbally, numerically, graphically, and symbolically in the form of y = ax or y = x + a in order to differentiate between additive and multiplicative relationships; ***Supporting Standard***

(B) apply qualitative and quantitative reasoning to solve prediction and comparison of real-world problems involving ratios and rates; ***Readiness Standard***

(C) give examples of ratios as multiplicative comparisons of two quantities describing the same attribute; ***Supporting Standard***

(D) give examples of rates as the comparison by division of two quantities having different attributes, including rates as quotients; ***Supporting Standard***

(E) represent ratios and percents with concrete models, fractions, and decimals; ***Supporting Standard***

(F) represent benchmark fractions and percents such as 1%, 10%, 25%, 33 1/3%, and multiples of these values using 10 by 10 grids, strip diagrams, number lines, and numbers; ***Supporting Standard***

(G) generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that involve money; and ***Readiness Standard***

(H) convert units within a measurement system, including the use of proportions and unit rates. ***Readiness Standard***

(6.5) The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:

(A) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions; ***Supporting Standard***

(B) solve real-world problems to find the whole given a part and the percent, to find the part given the whole and the percent, and to find the percent given the part and the whole, including the use of concrete and pictorial models; and ***Readiness Standard***

(C) use equivalent fractions, decimals, and percents to show equal parts of the same whole. ***Supporting Standard***

Expressions, Equations, and Relationships

(6.6) The student applies mathematical process standards to use multiple representations to describe algebraic relationships. The student is expected to:

(A) identify independent and dependent quantities from tables and graphs; ***Supporting Standard***

(B) write an equation that represents the relationship between independent and dependent quantities from a table; and ***Supporting Standard***

(C) represent a given situation using verbal descriptions, tables, graphs, and equations in the form $y = kx$ or $y = x + b$. ***Readiness Standard***

(6.7) The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

(A) generate equivalent numerical expressions using order of operations, including whole number exponents and prime factorization; ***Readiness Standard***

(B) distinguish between expressions and equations verbally, numerically, and algebraically; ***Readiness Standard***

(C) determine if two expressions are equivalent using concrete models, pictorial models, and algebraic representations; and ***Supporting Standard***

(D) generate equivalent expressions using the properties of operations: inverse, identity, commutative, associative, and distributive properties. ***Supporting Standard***

(6.8) The student applies mathematical process standards to use geometry to represent relationships and solve problems. The student is expected to:

(A) extend previous knowledge of triangles and their properties to include the sum of angles of a triangle, the relationship between the lengths of sides and measures of angles in a triangle, and determining when three lengths form a triangle; ***Supporting Standard***

(B) model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes; ***Supporting Standard***

(C) write equations that represent problems related to the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers; and ***Supporting Standard***

(D) determine solutions for problems involving the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers. ***Readiness Standard***

(6.9) The student applies mathematical process standards to use equations and inequalities to represent situations. The student is expected to:

(A) write one-variable, one-step equations and inequalities to represent constraints or conditions within problems; ***Supporting Standard***

(B) represent solutions for one-variable, one-step equations and inequalities on number lines; and ***Supporting Standard***

(C) write corresponding real-world problems given one-variable, one-step equations or inequalities. ***Supporting Standard***

(6.10) The student applies mathematical process standards to use equations and inequalities to solve problems. The student is expected to:

(A) model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts; and ***Readiness Standard***

(B) determine if the given value(s) make(s) one-variable, one-step equations or inequalities true. ***Supporting Standard***

Measurement and Data

(6.11) The student applies mathematical process standards to use coordinate geometry to identify locations on a plane. The student is expected to graph points in all four quadrants using ordered pairs of rational numbers. ***Readiness Standard***

(6.12) The student applies mathematical process standards to use numerical or graphical representations to analyze problems. The student is expected to:

(A) represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots; ***Supporting Standard***

(B) use the graphical representation of numeric data to describe the center, spread, and shape of the data distribution; ***Supporting Standard***

(C) summarize numeric data with numerical summaries, including the mean and median (measures of center) and the range and interquartile range (IQR) (measures of spread), and use these summaries to describe the center, spread, and shape of the data distribution; and ***Readiness Standard***

(D) summarize categorical data with numerical and graphical summaries, including the mode, the percent of values in each category (relative frequency table), and the percent bar graph, and use these summaries to describe the data distribution. ***Readiness Standard***

(6.13) The student applies mathematical process standards to use numerical or graphical representations to solve problems. The student is expected to:

(A) interpret numeric data summarized in dot plots, stem-and-leaf plots, histograms, and box plots; and ***Readiness Standard***

(B) distinguish between situations that yield data with and without variability. ***Supporting Standard***

Personal Financial Literacy

(6.14) The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

(A) compare the features and costs of a checking account and a debit card offered by different local financial institutions; ***Supporting Standard***

(B) distinguish between debit cards and credit cards; ***Supporting Standard***

(C) balance a check register that includes deposits, withdrawals, and transfers; ***Supporting Standard***

(D) explain why it is important to establish a positive credit history; ***Supporting Standard***

(E) describe the information in a credit report and how long it is retained; ***Supporting Standard***

(F) describe the value of credit reports to borrowers and to lenders; ***Supporting Standard***

(G) explain various methods to pay for college, including through savings, grants, scholarships, student loans, and work-study; and ***Supporting Standard***

(H) compare the annual salary of several occupations requiring various levels of post-secondary education or vocational training and calculate the effects of the different annual salaries on lifetime income. ***Supporting Standard***

Mathematical Process Standards

These student expectations will not be listed under a separate reporting category. Instead, they will be incorporated into test questions across reporting categories since the application of mathematical process standards is part of each knowledge statement.

7.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**7.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**7.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**7.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**7.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**7.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**7.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Reporting Category 1
Probability and Numerical Representations
6 Questions

The student will demonstrate an understanding of how to represent probabilities and numbers.

(7.2) Number and Operations. The student applies mathematical process standards to represent and use rational numbers in a variety of forms.

- **(A)** The student is expected to extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of rational numbers. ***Supporting Standard.***

(7.6) Proportionality. The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

- **(A)** represent sample spaces for simple and compound events using lists and tree diagrams. ***Supporting Standard***
- **(C)** make predictions and determine solutions using experimental data for simple and compound events. ***Supporting Standard***
- **(D)** make predictions and determine solutions using theoretical probability for simple and compound events. ***Supporting Standard***
- **(E)** find the probabilities of a simple event and its complement and describe the relationship between the two. ***Supporting Standard***
- **(H)** solve problems using qualitative and quantitative predictions and comparisons from simple experiments. ***Readiness Standard***
- **(I)** determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces. ***Readiness Standard***

Reporting Category 2
Computations and Algebraic Relationships
15 Questions

The student will demonstrate an understanding of how to perform operations and represent algebraic relationships.

(7.3) Number and Operations. The student applies mathematical process standards to add, subtract, multiply, and divide while solving problems and justifying solutions. The student is expected to:

- **(A)** add, subtract, multiply, and divide rational numbers fluently; and ***Supporting Standard***
- **(B)** apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication, and division of rational numbers. ***Readiness Standard***

(7.4) Proportionality. The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:

- **(A)** represent constant rates of change in mathematical and real-world problems given pictorial, tabular, verbal, numeric, graphical, and algebraic representations, including d = rt; ***Readiness Standard***
- **(B)** calculate unit rates from rates in mathematical and real-world problems; ***Supporting Standard***
- **(C)** determine the constant of proportionality (k = y/x) within mathematical and real-world problems; and ***Supporting Standard***
- **(D)** solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems. ***Readiness Standard***

(7.7) Expressions, equations, and relationships. The student applies mathematical process standards to represent linear relationships using multiple representations. The student is expected to:

- **(A)** represent linear relationships using verbal descriptions, tables, graphs, and equations that simplify to the form y = mx + b. ***Readiness Standard***

(7.10) Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations and inequalities to represent situations. The student is expected to:

- **(A)** write one-variable, two-step equations and inequalities to represent constraints or conditions within problems; ***Supporting Standard***
- **(B)** represent solutions for one-variable, two-step equations and inequalities on number lines; and ***Supporting Standard***
- **(C)** write a corresponding real-world problem given a one-variable, two-step equation or inequality. ***Supporting Standard***

(7.11) Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:

- **(A)** model and solve one-variable, two-step equations and inequalities; and ***Readiness Standard***
- **(B)** determine if the given value(s) make(s) one-variable, two-step equations and inequalities true. ***Supporting Standard***

Reporting Category 3
Geometry and Measurement
12 Questions

The student will demonstrate an understanding of how to represent and apply geometry and measurement concepts.

(7.4) Proportionality. The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:

- **(E)** convert between measurement systems, including the use of proportions and the use of unit rates. ***Supporting Standard***

(7.5) Proportionality. The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships. The student is expected to:

- **(A)** generalize the critical attributes of similarity, including ratios within and between similar shapes; ***Supporting Standard***
- **(B)** describe π as the ratio of the circumference of a circle to its diameter; and ***Supporting Standard***
- **(C)** solve mathematical and real-world problems involving similar shape and scale drawings. ***Readiness Standard***

(7.9) Expressions, equations, and relationships. The student applies mathematical process standards to solve geometric problems. The student is expected to:

- **(A)** solve problems involving the volume of rectangular prisms, triangular prisms, rectangular pyramids, and triangular pyramids. ***Readiness Standard***
- **(B)** determine the circumference and area of circles. ***Readiness Standard***
- **(C)** determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles. ***Readiness Standard***
- **(D)** solve problems involving the lateral and total surface area of a rectangular prism, rectangular pyramid, triangular prism, and triangular pyramid by determining the area of the shape's net. ***Supporting Standard***

(7.11) Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:

- **(C)** write and solve equations using geometry concepts, including the sum of the angles in a triangle, and angle relationships. **Supporting Standard**

Reporting Category 4
Data Analysis and Personal Financial Literacy
7 Questions

The student will demonstrate an understanding of how to represent and analyze data and how to describe and apply personal financial concepts.

(7.6) Proportionality. The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

- **(G)** solve problems using data represented in bar graphs, dot plots, and circle graphs, including part-to- whole and part-to-part comparisons and equivalents. ***Readiness Standard***

(7.12) Measurement and data. The student applies mathematical process standards to use statistical representations to analyze data. The student is expected to:

- **(A)** compare two groups of numeric data using comparative dot plots or box plots by comparing their shapes, centers, and spreads; ***Readiness Standard***
- **(B)** use data from a random sample to make inferences about a population; and ***Supporting Standard***
- **(C)** compare two populations based on data in random samples from these populations, including informal comparative inferences about differences between the two populations. ***Supporting Standard***

(7.13) Personal financial literacy. The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

- **(A)** calculate the sales tax for a given purchase and calculate income tax for earned wages; ***Supporting Standard***
- **(B)** identify the components of a personal budget, including income; planned savings for college, retirement, and emergencies; taxes; and fixed and variable expenses, and calculate what percentage each category comprises of the total budget; ***Supporting Standard***
- **(C)** create and organize a financial assets and liabilities record and construct a net worth statement; ***Supporting Standard***
- **(D)** use a family budget estimator to determine the minimum household budget and average hourly wage needed for a family to meet its basic needs in the student's city or another large city nearby; ***Supporting Standard***
- **(E)** calculate and compare simple interest and compound interest earnings; and **Supporting Standard**
- **(F)** analyze and compare monetary incentives, including sales, rebates, and coupons. **Supporting Standard**

§111.27. Grade 7, Adopted 2012.

(a) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on computational thinking, mathematical fluency, and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, algorithms, paper and pencil, and technology and techniques such as mental math, estimation, number sense, and generalization and abstraction to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, computer programs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) The primary focal areas in Grade 7 are number and operations; proportionality; expressions, equations, and relationships; and measurement and data. Students use concepts, algorithms, and properties of rational numbers to explore mathematical relationships and to describe increasingly complex situations. Students use concepts of proportionality to explore, develop, and communicate mathematical relationships, including number, geometry and measurement, and statistics and probability. Students use algebraic thinking to describe how a change in one quantity in a relationship results in a change in the other. Students connect verbal, numeric, graphic, and symbolic representations of relationships, including equations and inequalities. Students use geometric properties and relationships, as well as spatial reasoning, to model and analyze situations and solve problems. Students communicate information about geometric figures or situations by quantifying attributes, generalize procedures from measurement experiences, and use the procedures to solve problems. Students use appropriate statistics, representations of data, and reasoning to draw conclusions, evaluate arguments, and make recommendations. While the use of all types of technology is important, the emphasis on algebra readiness skills necessitates the implementation of graphing technology.

(4) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and Skills

Mathematical Process Standards

(7.1) Mathematical process standards. *The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:*

7.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**7.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**7.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**7.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**7.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**7.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**7.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Number and Operations

(7.2) The student applies mathematical process standards to represent and use rational numbers in a variety of forms. The student is expected to extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of rational numbers. ***Supporting Standard.***

(7.3) The student applies mathematical process standards to add, subtract, multiply, and divide while solving problems and justifying solutions. The student is expected to:

(A) add, subtract, multiply, and divide rational numbers fluently; and ***Supporting Standard***

(B) apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication and division of rational numbers. ***Readiness Standard***

Proportionality

(7.4) The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:

(A) represent constant rates of change in mathematical and real-world problems given pictorial, tabular, verbal, numeric, graphical, and algebraic representations, including d = rt; ***Readiness Standard***

(B) calculate unit rates from rates in mathematical and real-world problems; ***Supporting Standard***

(C) determine the constant of proportionality (k = y/x) within mathematical and real-world problems; and ***Supporting Standard***

(D) solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems. ***Readiness Standard***

(E) convert between measurement systems, including the use of proportions and the use of unit rates. ***Supporting Standard***

(7.5) The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships. The student is expected to:

(A) generalize the critical attributes of similarity, including ratios within and between similar shapes; ***Supporting Standard***

(B) describe π as the ratio of the circumference of a circle to its diameter; and ***Supporting Standard***

(C) solve mathematical and real-world problems involving similar shape and scale drawings. ***Readiness Standard***

(7.6) The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(A) represent sample spaces for simple and compound events using lists and tree diagrams. ***Supporting Standard***

(B) select and use different simulations to represent simple and compound events with and without technology

(C) make predictions and determine solutions using experimental data for simple and compound events. ***Supporting Standard***

(D) make predictions and determine solutions using theoretical probability for simple and compound events. ***Supporting Standard***

(E) find the probabilities of a simple event and its complement and describe the relationship between the two. ***Supporting Standard***

(F) use data from a random sample to make inferences about a population. ***Supporting Standard***

(G) solve problems using data represented in bar graphs, dot plots, and circle graphs, including part-to-whole and part-to-part comparisons and equivalents. ***Readiness Standard***

(H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments. ***Readiness Standard***

(I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces. ***Readiness Standard***

Expressions, Equations, and Relationships

(7.7) The student applies mathematical process standards to represent linear relationships using multiple representations. The student is expected to represent linear relationships using verbal descriptions, tables, graphs, and equations that simplify to the form y = mx + b. ***Readiness Standard***

(7.8) The student applies mathematical process standards to develop geometric relationships with volume. The student is expected to:

(A) model the relationship between the volume of a rectangular prism and a rectangular pyramid having both congruent bases and heights and connect that relationship to the formulas;

(B) explain verbally and symbolically the relationship between the volume of a triangular prism and a triangular pyramid having both congruent bases and heights and connect that relationship to the formulas; and

(C) use models to determine the approximate formulas for the circumference and area of a circle and connect the models to the actual formulas.

(7.9) The student applies mathematical process standards to solve geometric problems. The student is expected to:

(A) solve problems involving the volume of rectangular prisms, triangular prisms, rectangular pyramids, and triangular pyramids. ***Readiness Standard***

(B) determine the circumference and area of circles. ***Readiness Standard***

(C) determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles. ***Readiness Standard***

(D) solve problems involving the lateral and total surface area of a rectangular prism, rectangular pyramid, triangular prism, and triangular pyramid by determining the area of the shape's net. ***Supporting Standard***

(7.10) The student applies mathematical process standards to use one-variable equations and inequalities to represent situations. The student is expected to:

(A) write one-variable, two-step equations and inequalities to represent constraints or conditions within problems; ***Supporting Standard***

(B) represent solutions for one-variable, two-step equations and inequalities on number lines; and ***Supporting Standard***

(C) write a corresponding real-world problem given a one-variable, two-step equation or inequality. ***Supporting Standard***

(7.11) The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:

(A) model and solve one-variable, two-step equations and inequalities; and ***Readiness Standard***

(B) determine if the given value(s) make(s) one-variable, two-step equations and inequalities true. ***Supporting Standard***

(C) write and solve equations using geometry concepts, including the sum of the angles in a triangle, and angle relationships. ***Supporting Standard***

Measurement and Data

(7.12) Measurement and data. The student applies mathematical process standards to use statistical representations to analyze data. The student is expected to:

(A) compare two groups of numeric data using comparative dot plots or box plots by comparing their shapes, centers, and spreads; ***Readiness Standard***

(B) use data from a random sample to make inferences about a population; and ***Supporting Standard***

(C) compare two populations based on data in random samples from these populations, including informal comparative inferences about differences between the two populations. ***Supporting Standard***

Personal Financial Literacy

(7.13) Personal financial literacy. The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

(A) calculate the sales tax for a given purchase and calculate income tax for earned wages; ***Supporting Standard***

(B) identify the components of a personal budget, including income; planned savings for college, retirement, and emergencies; taxes; and fixed and variable expenses, and calculate what percentage each category comprises of the total budget; ***Supporting Standard***

(C) create and organize a financial assets and liabilities record and construct a net worth statement; ***Supporting Standard***

(D) use a family budget estimator to determine the minimum household budget and average hourly wage needed for a family to meet its basic needs in the student's city or another large city nearby; ***Supporting Standard***

(E) calculate and compare simple interest and compound interest earnings; and ***Supporting Standard***

(F) analyze and compare monetary incentives, including sales, rebates, and coupons. ***Supporting Standard***

Mathematical Process Standards

These student expectations will not be listed under a separate reporting category. Instead, they will be incorporated into test questions across reporting categories since the application of mathematical process standards is part of each knowledge statement.

8.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**8.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**8.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**8.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**8.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**8.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**8.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Reporting Category 1
Numerical Representations and Relationships
4 Questions

The student will demonstrate an understanding of how to represent and manipulate numbers and expressions.

(8.2) Number and operations. The student applies mathematical process standards to represent and use real numbers in a variety of forms. The student is expected to:

- **(A)** extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of real numbers; ***Supporting Standard***
- **(B)** approximate the value of an irrational number, including p and square roots of numbers less than 225, and locate that rational number approximation on a number line; ***Supporting Standard***
- **(C)** convert between standard decimal notation and scientific notation; and ***Supporting Standard***
- **(D)** order a set of real numbers arising from mathematical and real-world contexts. ***Readiness Standard***

Reporting Category 2
Computations and Algebraic Relationships
16 Questions

The student will demonstrate an understanding of how to perform operations and represent algebraic relationships.

(8.4) Proportionality. The student applies mathematical process standards to explain proportional and non-proportional relationships involving slope. The student is expected to:

- **(A)** use similar right triangles to develop an understanding that slope, m, given as the rate comparing the change in y-values to the change in x-values, $\frac{y_2 - y_1}{x_2 - x_1}$, is the same for any two points (x_1, y_1) and (x_2, y_2) on the same line; ***Supporting Standard***
- **(B)** graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship; and ***Readiness Standard***
- **(C)** use data from a table or graph to determine the rate of change or slope and y-intercept in mathematical and real-world problems. ***Readiness Standard***

(8.5) Proportionality. The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:

- **(A)** represent linear proportional situations with tables, graphs, and equations in the form of $y = kx$; ***Supporting Standard***
- **(B)** represent linear non-proportional situations with tables, graphs, and equations in the form of $y = mx + b$, where $b \neq 0$; ***Supporting Standard***
- **(E)** solve problems involving direct variation; ***Supporting Standard***
- **(F)** distinguish between proportional and non-proportional situations using tables, graphs, and equations in the form $y = kx$ or $y = mx + b$, where $b \neq 0$; ***Supporting Standard***
- **(G)** identify functions using sets of ordered pairs, tables, mappings, and graphs; ***Readiness Standard***
- **(H)** identify examples of proportional and non-proportional functions that arise from mathematical and real-world problems; and ***Supporting Standard***
- **(I)** write an equation in the form $y = mx + b$ to model a linear relationship between two quantities using verbal, numerical, tabular, and graphical representations. ***Readiness Standard***

(8.8) Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

- **(A)** write one-variable equations or inequalities with variables on both sides that represent problems using rational number coefficients and constants; ***Supporting Standard***
- **(B)** write a corresponding real-world problem when given a one-variable equation or inequality with variables on both sides of the equal sign using rational number coefficients and constants; and ***Supporting Standard***
- **(C)** model and solve one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants. ***Readiness Standard***

(8.9) Expressions, equations, and relationships. The student applies mathematical process standards to use multiple representations to develop foundational concepts of simultaneous linear equations. The student is expected to:

- **(A)** identify and verify the values of x and y that simultaneously satisfy two linear equations in the form $y = mx + b$ from the intersections of the graphed equations. ***Supporting Standard***

Reporting Category 3
Geometry and Measurement
15 Questions

The student will demonstrate an understanding of how to represent and apply geometry and measurement concepts.

(8.3) Proportionality. The student applies mathematical process standards to use proportional relationships to describe dilations. The student is expected to:

- **(A)** generalize that the ratio of corresponding sides of similar shapes are proportional, including a shape and its dilation; ***Supporting Standard***
- **(B)** compare and contrast the attributes of a shape and its dilation(s) on a coordinate plane; and ***Supporting Standard***
- **(C)** use an algebraic representation to explain the effect of a given positive rational scale factor applied to two-dimensional figures on a coordinate plane with the origin as the center of dilation. ***Readiness Standard***

(8.6) Expressions, equations, and relationships. The student applies mathematical process standards to develop mathematical relationships and make connections to geometric formulas. The student is expected to:

- **(A)** describe the volume formula $V = Bh$ of a cylinder in terms of its base area and its height; and ***Supporting Standard***
- **(C)** use models and diagrams to explain the Pythagorean theorem. ***Supporting Standard***

(8.7) Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to solve problems. The student is expected to:

- **(A)** solve problems involving the volume of cylinders, cones, and spheres; ***Readiness Standard***
- **(B)** use previous knowledge of surface area to make connections to the formulas for lateral and total surface area and determine solutions for problems involving rectangular prisms, triangular prisms, and cylinders; ***Readiness Standard***
- **(C)** use the Pythagorean theorem and its converse to solve problems; and ***Readiness Standard***
- **(D)** determine the distance between two points on a coordinate plane using the Pythagorean theorem. ***Supporting Standard***

(8.8) Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

- **(D)** use informal arguments to establish facts about the angle sum and exterior angle of triangles, the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. ***Supporting Standard***

(8.10) Two-dimensional shapes. The student applies mathematical process standards to develop transformational geometry concepts. The student is expected to:

- **(A)** generalize the properties of orientation and congruence of rotations, reflections, translations, and dilations of two-dimensional shapes on a coordinate plane; ***Supporting Standard***
- **(B)** differentiate between transformations that preserve congruence and those that do not; ***Supporting Standard***
- **(C)** explain the effect of translations, reflections over the x- or y-axis, and rotations limited to 90°, 180°, 270°, and 360° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation; and ***Readiness Standard***
- **(D)** model the effect on linear and area measurements of dilated two-dimensional shapes. ***Supporting Standard***

Reporting Category 4
Data Analysis and Personal Financial Literacy
7 Questions

The student will demonstrate an understanding of how to represent and analyze data and how to describe and apply personal financial concepts.

(8.5) Proportionality. The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:

- **(C)** contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation; and ***Supporting Standard***
- **(D)** use a trend line that approximates the linear relationship between bivariate sets of data to make predictions. ***Readiness Standard***

(8.11) Measurement and data. The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:

- **(A)** construct a scatterplot and d escribe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data; and ***Supporting Standard***
- **(B)** determine the mean absolute deviation and use this quantity as a measure of the average distance data are from the mean using a data set of no more than 10 data points. ***Supporting Standard***

(8.12) Personal financial literacy. The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

- **(A)** solve real-world problems comparing how interest rate and loan length affect the cost of credit; ***Supporting Standard***
- **(C)** explain how small amounts of money invested regularly, including money saved for college and retirement, grow over time; ***Supporting Standard***
- **(D)** calculate and compare simple interest and compound interest earnings; and ***Readiness Standard***
- **(G)** estimate the cost of a two-year and four-year college education, including family contribution, and devise a periodic savings plan for accumulating the money needed to contribute to the total cost of attendance for at least the first year of college. ***Supporting Standard***

§111.27. Grade 8, Adopted 2012.

(a) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on computational thinking, mathematical fluency, and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, algorithms, paper and pencil, and technology and techniques such as mental math, estimation, number sense, and generalization and abstraction to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, computer programs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) The primary focal areas in Grade 8 are proportionality; expressions, equations, relationships, and foundations of functions; and measurement and data. Students use concepts, algorithms, and properties of real numbers to explore mathematical relationships and to describe increasingly complex situations. Students use concepts of proportionality to explore, develop, and communicate mathematical relationships. Students use algebraic thinking to describe how a change in one quantity in a relationship results in a change in the other. Students connect verbal, numeric, graphic, and symbolic representations of relationships, including equations and inequalities. Students begin to develop an understanding of functional relationships. Students use geometric properties and relationships, as well as spatial reasoning, to model and analyze situations and solve problems. Students communicate information about geometric figures or situations by quantifying attributes, generalize procedures from measurement experiences, and use the procedures to solve problems. Students use appropriate statistics, representations of data, and reasoning to draw conclusions, evaluate arguments, and make recommendations. While the use of all types of technology is important, the emphasis on algebra readiness skills necessitates the implementation of graphing technology.

(4) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and Skills

Mathematical Process Standards

(8.1) Mathematical process standards. *The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:*

8.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**8.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**8.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**8.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**8.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**8.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**8.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Number and Operations

(8.2) The student applies mathematical process standards to represent and use real numbers in a variety of forms. The student is expected to:

(A) extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of real numbers; ***Supporting Standard***

(B) approximate the value of an irrational number, including p and square roots of numbers less than 225, and locate that rational number approximation on a number line; ***Supporting Standard***

(C) convert between standard decimal notation and scientific notation; and ***Supporting Standard***

(D) order a set of real numbers arising from mathematical and real-world contexts. ***Readiness Standard***

Proportionality

(8.3) The student applies mathematical process standards to use proportional relationships to describe dilations. The student is expected to:

(A) generalize that the ratio of corresponding sides of similar shapes are proportional, including a shape and its dilation; ***Supporting Standard***

(B) compare and contrast the attributes of a shape and its dilation(s) on a coordinate plane; and ***Supporting Standard***

(C) use an algebraic representation to explain the effect of a given positive rational scale factor applied to two-dimensional figures on a coordinate plane with the origin as the center of dilation. ***Readiness Standard***

(8.4) The student applies mathematical process standards to explain proportional and non-proportional relationships involving slope. The student is expected to:

(A) use similar right triangles to develop an understanding that slope, m, given as the rate comparing the change in y-values to the change in x-values, $\frac{y_2 - y_1}{x_2 - x_1}$, is the same for any two points (x_1, y_1) and (x_2, y_2) on the same line; ***Supporting Standard***

(B) graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship; and ***Readiness Standard***

(C) use data from a table or graph to determine the rate of change or slope and y-intercept in mathematical and real-world problems. ***Readiness Standard***

(8.5) The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:

(A) represent linear proportional situations with tables, graphs, and equations in the form of $y = kx$; ***Supporting Standard***

(B) represent linear non-proportional situations with tables, graphs, and equations in the form of $y = mx + b$, where $b \neq 0$; ***Supporting Standard***

(C) contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation; and ***Supporting Standard***

(D) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions. ***Readiness Standard***

(E) solve problems involving direct variation; ***Supporting Standard***

(F) distinguish between proportional and non-proportional situations using tables, graphs, and equations in the form $y = kx$ or $y = mx + b$, where $b \neq 0$; ***Supporting Standard***

(G) identify functions using sets of ordered pairs, tables, mappings, and graphs; ***Readiness Standard***

(H) identify examples of proportional and non-proportional functions that arise from mathematical and real-world problems; and ***Supporting Standard***

(I) write an equation in the form $y = mx + b$ to model a linear relationship between two quantities using verbal, numerical, tabular, and graphical representations. ***Readiness Standard***

Expressions, Equations, and Relationships

(8.6) Expressions, equations, and relationships. The student applies mathematical process standards to develop mathematical relationships and make connections to geometric formulas. The student is expected to:

(A) describe the volume formula $V = Bh$ of a cylinder in terms of its base area and its height; and ***Supporting Standard***

(C) use models and diagrams to explain the Pythagorean theorem. ***Supporting Standard***

(8.7) Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to solve problems. The student is expected to:

(A) solve problems involving the volume of cylinders, cones, and spheres; ***Readiness Standard***

(B) use previous knowledge of surface area to make connections to the formulas for lateral and total surface area and determine solutions for problems involving rectangular prisms, triangular prisms, and cylinders; ***Readiness Standard***

(C) use the Pythagorean theorem and its converse to solve problems; and ***Readiness Standard***

(D) determine the distance between two points on a coordinate plane using the Pythagorean theorem. ***Supporting Standard***

(8.8) Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

(A) write one-variable equations or inequalities with variables on both sides that represent problems using rational number coefficients and constants; ***Supporting Standard***

(B) write a corresponding real-world problem when given a one-variable equation or inequality with variables on both sides of the equal sign using rational number coefficients and constants; and ***Supporting Standard***

(C) model and solve one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants. ***Readiness Standard***

(D) use informal arguments to establish facts about the angle sum and exterior angle of triangles, the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. ***Supporting Standard***

(8.9) Expressions, equations, and relationships. The student applies mathematical process standards to use multiple representations to develop foundational concepts of simultaneous linear equations. The student is expected to:

(A) identify and verify the values of x and y that simultaneously satisfy two linear equations in the form $y = mx + b$ from the intersections of the graphed equations. ***Supporting Standard***

Two-Dimensional Shapes

(8.10) The student applies mathematical process standards to develop transformational geometry concepts. The student is expected to:

(A) generalize the properties of orientation and congruence of rotations, reflections, translations, and dilations of two-dimensional shapes on a coordinate plane; ***Supporting Standard***

(B) differentiate between transformations that preserve congruence and those that do not; ***Supporting Standard***

(C) explain the effect of translations, reflections over the x- or y-axis, and rotations limited to 90°, 180°, 270°, and 360° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation; and ***Readiness Standard***

(D) model the effect on linear and area measurements of dilated two-dimensional shapes. ***Supporting Standard***

Measurement and Data

(8.11) The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:

(A) construct a scatterplot and describe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data; and ***Supporting Standard***

(B) determine the mean absolute deviation and use this quantity as a measure of the average distance data are from the mean using a data set of no more than 10 data points. ***Supporting Standard***

Personal Financial Literacy

(8.12) The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

(A) solve real-world problems comparing how interest rate and loan length affect the cost of credit; ***Supporting Standard***

(B) calculate the total cost of repaying a loan, including credit cards and easy access loans, under various rates of interest and over different periods using an online calculator;

(C) explain how small amounts of money invested regularly, including money saved for college and retirement, grow over time; ***Supporting Standard***

(D) calculate and compare simple interest and compound interest earnings; and ***Readiness Standard***

(E) identify and explain the advantages and disadvantages of different payment methods;

(F) analyze situations to determine if they represent financially responsible decisions and identify the benefits of financial responsibility and the costs of financial irresponsibility; and

(G) estimate the cost of a two-year and four-year college education, including family contribution, and devise a periodic savings plan for accumulating the money needed to contribute to the total cost of attendance for at least the first year of college. ***Supporting Standard***

Mathematical Process Standards

These student expectations will not be listed under a separate reporting category. Instead, they will be incorporated into test questions across reporting categories since the application of mathematical process standards is part of each knowledge statement.

A.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**A.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**A.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**A.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**A.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**A.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**A.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Reporting Category 1
Number and Algebraic Methods
11 Questions

The student will demonstrate an understanding of how to use algebraic methods to manipulate numbers, expressions, and equations.

(A.10) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to rewrite in equivalent forms and perform operations on polynomial expressions. The student is expected to:

(A) add and subtract polynomials of degree one and degree two; ***Supporting Standard***

(B) multiply polynomials of degree one and degree two; ***Supporting Standard***

(C) determine the quotient of a polynomial of degree one and polynomial of degree two when divided by a polynomial of degree one and polynomial of degree two when the degree of the divisor does not exceed the degree of the dividend; ***Supporting Standard***

(D) rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property; ***Supporting Standard***

(E) factor, if possible, trinomials with real factors in the form ax2 + bx + c, including perfect square t rinomials of degree two; and ***Readiness Standard***

(F) decide if a binomial can be written as the difference of two squares and, if possible, use the structure of a difference of two squares to rewrite the binomial. ***Supporting Standard***

(A.11) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to rewrite algebraic expressions into equivalent forms. The student is expected to

(A) simplify numerical radical expressions involving square roots; and ***Supporting Standard***

(B) simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents. ***Readiness Standard***

(A.12) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to write, solve, analyze, and evaluate equations, relations, and functions. The student is expected to:

(A) decide whether relations represented verbally, tabularly, graphically, and symbolically define a function; ***Supporting Standard***

(B) evaluate functions, expressed in function notation, given one or more elements in their domains; ***Supporting Standard***

(C) identify terms of arithmetic and geometric sequences when the sequences are given in function form using recursive processes; ***Supporting Standard***

(D) write a formula for the nth term of arithmetic and geometric sequences, given the value of several of their terms; and ***Supporting Standard***

(E) solve mathematic and scientific formulas, and other literal equations, for a specified variable. ***Supporting Standard***

Reporting Category 2
Describing and Graphing Linear Functions, Equations, and Inequalities
12 Questions

The student will demonstrate an understanding of how to describe and graph linear functions, equations, and inequalities.

(A.3) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using graphs of linear functions, key features, and related transformations to represent in multiple ways and solve, with and without technology, equations, inequalities, and systems of equations. The student is expected to:

(A) determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including y = mx + b, Ax + By = C, and y – y1 = m(x – x1); ***Supporting Standard***

(B) calculate the rate of change of a linear function represented tabularly, graphically, or algebraically i n context of mathematical and real-world problems; **Readiness Standard**

(C) graph linear functions on the coordinate plane and identify key features, including x-intercept, y-intercept, zeros, and slope, in mathematical and real-world problems; ***Readiness Standard***

(D) graph the solution set of linear inequalities in two variables on the coordinate plane; ***Readiness Standard***

(E) determine the effects on the graph of the parent function f(x) = x when f(x) is replaced by **a**f(x), f(x) + **d**, f(x – **c**), f(**b**x) for specific values of a, b, c, and d; ***Supporting Standard***

(F) graph systems of two linear equations in two variables on the coordinate plane and determine the solutions if they exist; ***Supporting Standard***

(G) estimate graphically the solutions to systems of two linear equations with two variables in real-world problems; and ***Supporting Standard***

(H) graph the solution set of systems of two linear inequalities in two variables on the coordinate plane. ***Supporting Standard***

(A.4) Linear functions, equations, and inequalities. The student applies the mathematical process standards to formulate statistical relationships and evaluate their reasonableness based on real-world data. The student is expected to:

(A) calculate, using technology, the correlation coefficient between two quantitative variables and interpret this quantity a s a measure of the strength of the linear association; ***Supporting Standard***

(B) compare and contrast association and causation in real-world problems; and ***Supporting Standard***

(C) write, with and without technology, linear functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems. **Supporting Standard**

Reporting Category 3
Writing and Solving Linear Functions, Equations, and Inequalities
14 Questions

The student will demonstrate an understanding of how to write and solve linear functions, equations, and inequalities.

(A.2) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using properties of linear functions to write and represent in multiple ways, with and without technology, linear equations, inequalities, and systems of equations. The student is expected to:

(A) determine the domain and range of a linear function in mathematical problems; determine reasonable domain and range values for real-world situations, both continuous and discrete; and represent domain and range using inequalities; ***Readiness Standard***

(B) write linear equations in two variables in various forms, including y = mx + b, Ax + By = C, and $y - y_1 = m(x - x_1)$, given one point and the slope and given two points; ***Supporting Standard***

(C) write linear equations in two variables given a table of values, a graph, and a verbal description; ***Readiness Standard***

(D) write and solve equations involving direct variation; ***Supporting Standard***

(E) write the equation of a line that contains a given point and is parallel to a given line; ***Supporting Standard***

(F) write the equation of a line that contains a given point and is perpendicular t o a given line; ***Supporting Standard***

(G) write an equation of a line that is parallel or perpendicular to the x- or y-axis and determine whether the slope of the line is zero or undefined; ***Supporting Standard***

(H) write linear inequalities in two variables given a table of values, a graph, and a verbal description; and ***Supporting Standard***

(I) write systems of two linear equations given a table of values, a graph, and a verbal description. ***Readiness Standard***

(A.5) Linear functions, equations, and inequalities. The student applies the mathematical process standards to solve, with and without technology, linear equations and evaluate the reasonableness of their solutions. The student is expected to:

(A) solve linear equations in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides; ***Readiness Standard***

(B) solve linear inequalities in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides; and ***Supporting Standard***

(C) solve systems of two linear equations with two variables for mathematical and real-world problems. ***Readiness Standard***

Reporting Category 4
Quadratic Functions and Equations
11 Questions

The student will demonstrate an understanding of how to describe, write, and solve quadratic functions and equations.

(A.6) Quadratic functions and equations. The student applies the mathematical process standards when using properties of quadratic functions to write and represent in multiple ways, with and without technology, quadratic equations. The student is expected to:

(A) determine the domain and range of quadratic functions and represent the domain and range using inequalities; ***Readiness Standard***

(B) write equations of quadratic functions given the vertex and another point on the graph, write the equation in vertex form ($f(x) = a(x - h)^2 + k$), and rewrite the equation from vertex form to standard form ($f(x) = ax^2 + bx + c$); and ***Supporting Standard***

(C) write quadratic functions when given real solutions and graphs of their related equations. ***Supporting Standard***

(A.7) Quadratic functions and equations. The student applies the mathematical process standards when using graphs of quadratic functions and their related transformations to represent in multiple ways and determine, with and without technology, the solutions to equations. The student is expected to:

(A) graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x-intercept, y-intercept, zeros, maximum value, minimum values, vertex, and the equation of the axis of symmetry; ***Readiness Standard***

(B) describe the relationship between the linear factors of quadratic expressions and the zeros of their associated quadratic functions; and ***Supporting Standard***

(C) determine the effects on the graph of the parent function $f(x) = x^2$ when f(x) is replaced by **a**f(x), f(x) + **d**, f(x – **c**), f(**b**x) for specific values o f a, b, c, and d. ***Readiness Standard***

(A.8) Quadratic functions and equations. The student applies the mathematical process standards to solve, with and without technology, quadratic equations and evaluate the reasonableness of their solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

(A) solve quadratic equations having real solutions by factoring, taking square roots, completing the square, and applying the quadratic formula; and ***Readiness Standard***

(B) write, using technology, quadratic functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems. ***Supporting Standard***

Reporting Category 5
Exponential Functions and Equations
6 Questions

The student will demonstrate an understanding of how to describe and write exponential functions and equations.

(A.9) Exponential functions and equations. The student applies the mathematical process standards when using properties of exponential functions and their related transformations to write, graph, and represent in multiple ways exponential equations and evaluate, with and without technology, the reasonableness of their solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

(A) determine the domain and range of exponential functions of the form $f(x) = ab^x$ and represent the domain and range using inequalities; ***Supporting Standard***

(B) interpret the meaning of the values of a and b in exponential functions of the form $f(x) = ab^x$ in real-world problems; ***Supporting Standard***

(C) write exponential functions in the form $f(x) = ab^x$ (where b is a rational number) to describe problems arising from mathematical and real-world situations, including growth and decay; ***Readiness Standard***

(D) graph exponential functions that model growth and decay and identify key features, including y-intercept and asymptote, in mathematical and real-world problems; and ***Readiness Standard***

(E) write, using technology, exponential functions that provide a reasonable fit to data and make predictions for real-world problems. ***Supporting Standard***

§111.39. Algebra I, Adopted 2012 (One Credit).

(a) General requirements. Students shall be awarded one credit for successful completion of this course. This course is recommended for students in Grade 8 or 9. Prerequisite: Mathematics, Grade 8 or its equivalent.

(b) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on fluency and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) In Algebra I, students will build on the knowledge and skills for mathematics in Grades 6-8, which provide a foundation in linear relationships, number and operations, and proportionality. Students will study linear, quadratic, and exponential functions and their related transformations, equations, and associated solutions. Students will connect functions and their associated solutions in both mathematical and real-world situations. Students will use technology to collect and explore data and analyze statistical relationships. In addition, students will study polynomials of degree one and two, radical expressions, sequences, and laws of exponents. Students will generate and solve linear systems with two equations and two variables and will create new functions through transformations.

(4) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills

Mathematical Process Standards

(A.1) Mathematical process standards. *The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:*

A.1(A) apply mathematics to problems arising in everyday life, society, and the workplace;	**A.1 (B)** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	**A.1 (C)** select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	**A.1 (D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	**A.1 (E)** create and use representations to organize, record, and communicate mathematical ideas;	**A.1 (F)** analyze mathematical relationships to connect and communicate mathematical ideas; and	**A.1 (G)** display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Linear Equations and Inequalities

(A.2) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using properties of linear functions to write and represent in multiple ways, with and without technology, linear equations, inequalities, and systems of equations. The student is expected to:

- **(A)** determine the domain and range of a linear function in mathematical problems; determine reasonable domain and range values for real-world situations, both continuous and discrete; and represent domain and range using inequalities; ***Readiness Standard***
- **(B)** write linear equations in two variables in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$, given one point and the slope and given two points; ***Supporting Standard***
- **(C)** write linear equations in two variables given a table of values, a graph, and a verbal description; ***Readiness Standard***
- **(D)** write and solve equations involving direct variation; ***Supporting Standard***
- **(E)** write the equation of a line that contains a given point and is parallel to a given line; ***Supporting Standard***
- **(F)** write the equation of a line that contains a given point and is perpendicular t o a given line; ***Supporting Standard***
- **(G)** write an equation of a line that is parallel or perpendicular to the x- or y-axis and determine whether the slope of the line is zero or undefined; ***Supporting Standard***
- **(H)** write linear inequalities in two variables given a table of values, a graph, and a verbal description; and ***Supporting Standard***
- **(I)** write systems of two linear equations given a table of values, a graph, and a verbal description. ***Readiness Standard***

(A.3) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using graphs of linear functions, key features, and related transformations to represent in multiple ways and solve, with and without technology, equations, inequalities, and systems of equations. The student is expected to:

- **(A)** determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$; ***Supporting Standard***
- **(B)** calculate the rate of change of a linear function represented tabularly, graphically, or algebraically in context of mathematical and real-world problems; **Readiness Standard**
- **(C)** graph linear functions on the coordinate plane and identify key features, including x-intercept, y-intercept, zeros, and slope, in mathematical and real-world problems; ***Readiness Standard***
- **(D)** graph the solution set of linear inequalities in two variables on the coordinate plane; ***Readiness Standard***
- **(E)** determine the effects on the graph of the parent function $f(x) = x$ when f(x) is replaced by af(x), f(x) + d, f(x – c), f(bx) for specific values o f a, b, c, and d; ***Supporting Standard***
- **(F)** graph systems of two linear equations in two variables on the coordinate plane and determine the solutions if they exist; ***Supporting Standard***
- **(G)** estimate graphically the solutions to systems of two linear equations with two variables in real-world problems; and ***Supporting Standard***
- **(H)** graph the solution set of systems of two linear inequalities in two variables on the coordinate plane. ***Supporting Standard***

(A.4) Linear functions, equations, and inequalities. The student applies the mathematical process standards to formulate statistical relationships and evaluate their reasonableness based on real-world data. The student is expected to:

- **(A)** calculate, using technology, the correlation coefficient between two quantitative variables and interpret this quantity a s a measure of the strength of the linear association; ***Supporting Standard***
- **(B)** compare and contrast association and causation in real-world problems; and ***Supporting Standard***
- **(C)** write, with and without technology, linear functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems. **Supporting Standard**

(A.5) Linear functions, equations, and inequalities. The student applies the mathematical process standards to solve, with and without technology, linear equations and evaluate the reasonableness of their solutions. The student is expected to:

- **(A)** solve linear equations in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides; ***Readiness Standard***
- **(B)** solve linear inequalities in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides; and ***Supporting Standard***
- **(C)** solve systems of two linear equations with two variables for mathematical and real-world problems. ***Readiness Standard***

Quadratic Functions and Equations

(A.6) Quadratic functions and equations. The student applies the mathematical process standards when using properties of quadratic functions to write and represent in multiple ways, with and without technology, quadratic equations. The student is expected to:

- **(A)** determine the domain and range of quadratic functions and represent the domain and range using inequalities; ***Readiness Standard***
- **(B)** write equations of quadratic functions given the vertex and another point on the graph, write the equation in vertex form ($f(x) = a(x - h)^2 + k$), and rewrite the equation from vertex form to standard form ($f(x) = ax^2 + bx + c$); and ***Supporting Standard***
- **(C)** write quadratic functions when given real solutions and graphs of their related equations. ***Supporting Standard***

(A.7) Quadratic functions and equations. The student applies the mathematical process standards when using graphs of quadratic functions and their related transformations to represent in multiple ways and determine, with and without technology, the solutions to equations. The student is expected to:

- **(D)** graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x-intercept, y-intercept, zeros, maximum value, minimum values, vertex, and the equation of the axis of symmetry; ***Readiness Standard***
- **(E)** describe the relationship between the linear factors of quadratic expressions and the zeros of their associated quadratic functions; and ***Supporting Standard***
- **(F)** determine the effects on the graph of the parent function $f(x) = x2$ when f(x) is replaced by af(x), f(x) + d, f(x – c), f(bx) for specific values o f a, b, c, and d. ***Readiness Standard***

(A.8) Quadratic functions and equations. The student applies the mathematical process standards to solve, with and without technology, quadratic equations and evaluate the reasonableness of their solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

- **(A)** solve quadratic equations having real solutions by factoring, taking square roots, completing the square, and applying the quadratic formula; and ***Readiness Standard***
- **(B)** write, using technology, quadratic functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems. ***Supporting Standard***

Exponential Functions and Equations

(A.9) Exponential functions and equations. The student applies the mathematical process standards when using properties of exponential functions and their related transformations to write, graph, and represent in multiple ways exponential equations and evaluate, with and without technology, the reasonableness of their solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

- **(A)** determine the domain and range of exponential functions of the form $f(x) = ab^x$ and represent the domain and range using inequalities; ***Supporting Standard***
- **(B)** interpret the meaning of the values of a and b in exponential functions of the form $f(x) = ab^x$ in real-world problems; ***Supporting Standard***
- **(C)** write exponential functions in the form $f(x) = ab^x$ (where b is a rational number) to describe problems arising from mathematical and real-world situations, including growth and decay; ***Readiness Standard***
- **(D)** graph exponential functions that model growth and decay and identify key features, including y-intercept and asymptote, in mathematical and real-world problems; and ***Readiness Standard***
- **(E)** write, using technology, exponential functions that provide a reasonable fit to data and make predictions for real-world problems. ***Supporting Standard***

Number and Algebraic Methods

(A.10) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to rewrite in equivalent forms and perform operations on polynomial expressions. The student is expected to:

- **(A)** add and subtract polynomials of degree one and degree two; ***Supporting Standard***
- **(B)** multiply polynomials of degree one and degree two; ***Supporting Standard***
- **(C)** determine the quotient of a polynomial of degree one and polynomial of degree two when divided by a polynomial of degree one and polynomial of degree two when the degree of the divisor does not exceed the degree of the dividend; ***Supporting Standard***
- **(D)** rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property; ***Supporting Standard***
- **(E)** factor, if possible, trinomials with real factors in the form $ax2 + bx + c$, including perfect square t rinomials of degree two; and ***Readiness Standard***
- **(F)** decide if a binomial can be written as the difference of two squares and, if possible, use the structure of a difference of two squares to rewrite the binomial. ***Supporting Standard***

(A.11) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to rewrite algebraic expressions into equivalent forms. The student is expected to:

- **(A)** simplify numerical radical expressions involving square roots; and ***Supporting Standard***
- **(B)** simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents. ***Readiness Standard***

(A.12) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to write, solve, analyze, and evaluate equations, relations, and functions. The student is expected to:

- **(A)** decide whether relations represented verbally, tabularly, graphically, and symbolically define a function; ***Supporting Standard***
- **(B)** evaluate functions, expressed in function notation, given one or more elements in their domains; ***Supporting Standard***
- **(C)** identify terms of arithmetic and geometric sequences when the sequences are given in function form using recursive processes; ***Supporting Standard***
- **(D)** write a formula for the nth term of arithmetic and geometric sequences, given the value of several of their terms; and ***Supporting Standard***
- **(E)** solve mathematic and scientific formulas, and other literal equations, for a specified variable. ***Supporting Standard***