Texas Essential Knowledge and Skills – Mathematics
EducAide's Coverage of Grades 1–8 and High School

This document shows EducAide's coverage of the TEKS for mathematics, grades 1–8 and High School (2012 adoption). It is current as of June 1, 2016, though subject to change. The number of items in Problem-Attic is shown to the right. For information about the TEKS, please go to **http://tea.texas.gov** (curriculum and instructional resources).

Note: item counts are not shown for process standards, which are integrated into other TEKS. Financial literacy and math modeling are not yet covered.

Grade 1

1.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

1.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

1.1.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.

1.1.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.

1.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

1.1.E Create and use representations to organize, record, and communicate mathematical ideas.

1.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

1.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

1.2 **Number and operations. The student applies mathematical process standards to represent and compare whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system related to place value.**

1.2.A Recognize instantly the quantity of structured arrangements. — 10

1.2.B Use concrete and pictorial models to compose and decompose numbers up to 120 in more than one way as so many hundreds, so many tens, and so many ones. — 36

1.2.C Use objects, pictures, and expanded and standard forms to represent numbers up to 120. — 6

1.2.D Generate a number that is greater than or less than a given whole number up to 120. — 18

1.2.E Use place value to compare whole numbers up to 120 using comparative language. 32

1.2.F Order whole numbers up to 120 using place value and open number lines. 12

1.2.G Represent the comparison of two numbers to 100 using the symbols >, <, or =. 16

1.3 Number and operations. The student applies mathematical process standards to develop and use strategies for whole number addition and subtraction computations in order to solve problems.

1.3.A Use concrete and pictorial models to determine the sum of a multiple of 10 and a one-digit number in problems up to 99.

1.3.B Use objects and pictorial models to solve word problems involving joining, separating, and comparing sets within 20 and unknowns as any one of the terms in the problem such as 2 + 4 = [ ]; 3 + [ ] = 7; and 5 = [ ] − 3. 16

1.3.C Compose 10 with two or more addends with and without concrete objects.

1.3.D Apply basic fact strategies to add and subtract within 20, including making 10 and decomposing a number leading to a 10. 22

1.3.E Explain strategies used to solve addition and subtraction problems up to 20 using spoken words, objects, pictorial models, and number sentences. 34

1.3.F Generate and solve problem situations when given a number sentence involving addition or subtraction of numbers within 20. 2

1.4 Number and operations. The student applies mathematical process standards to identify coins, their values, and the relationships among them in order to recognize the need for monetary transactions.

1.4.A Identify U.S. coins, including pennies, nickels, dimes, and quarters, by value and describe the relationships among them. 48

1.4.B Write a number with the cent symbol to describe the value of a coin.

1.4.C Use relationships to count by twos, fives, and tens to determine the value of a collection of pennies, nickels, and/or dimes.

1.5 Algebraic reasoning. The student applies mathematical process standards to identify and apply number patterns within properties of numbers and operations in order to describe relationships.

1.5.A Recite numbers forward and backward from any given number between 1 and 120. 16

1.5.B Skip count by twos, fives, and tens to determine the total number of objects up to 120 in a set. 34

1.5.C Use relationships to determine the number that is 10 more and 10 less than a given number up to 120. 4

1.5.D Represent word problems involving addition and subtraction of whole numbers up to 20 using concrete and pictorial models and number sentences. 158

1.5.E Understand that the equal sign represents a relationship where expressions on each side of the equal sign represent the same value(s). **12**

1.5.F Determine the unknown whole number in an addition or subtraction equation when the unknown may be any one of the three or four terms in the equation. **12**

1.5.G Apply properties of operations to add and subtract two or three numbers. **84**

1.6 **Geometry and measurement. The student applies mathematical process standards to analyze attributes of two-dimensional shapes and three-dimensional solids to develop generalizations about their properties.**

1.6.A Classify and sort regular and irregular two-dimensional shapes based on attributes using informal geometric language. **16**

1.6.B Distinguish between attributes that define a two-dimensional or three-dimensional figure and attributes that do not define the shape.

1.6.C Create two-dimensional figures, including circles, triangles, rectangles, and squares, as special rectangles, rhombuses, and hexagons. **2**

1.6.D Identify two-dimensional shapes, including circles, triangles, rectangles, and squares, as special rectangles, rhombuses, and hexagons and describe their attributes using formal geometric language. **30**

1.6.E Identify three-dimensional solids, including spheres, cones, cylinders, rectangular prisms (including cubes), and triangular prisms, and describe their attributes using formal geometric language. **70**

1.6.F Compose two-dimensional shapes by joining two, three, or four figures to produce a target shape in more than one way if possible. **12**

1.6.G Partition two-dimensional figures into two and four fair shares or equal parts and describe the parts using words. **8**

1.6.H Identify examples and non-examples of halves and fourths.

1.7 **Geometry and measurement. The student applies mathematical process standards to select and use units to describe length and time.**

1.7.A Use measuring tools to measure the length of objects to reinforce the continuous nature of linear measurement. **18**

1.7.B Illustrate that the length of an object is the number of same-size units of length that, when laid end-to-end with no gaps or overlaps, reach from one end of the object to the other. **18**

1.7.C Measure the same object/distance with units of two different lengths and describe how and why the measurements differ. **18**

1.7.D Describe a length to the nearest whole unit using a number and a unit. **12**

1.7.E Tell time to the hour and half hour using analog and digital clocks. **26**

1.8 Data analysis. The student applies mathematical process standards to organize data to make it useful for interpreting information and solving problems.

1.8.A   Collect, sort, and organize data in up to three categories using models/representations such as tally marks or T-charts.   **10**

1.8.B   Use data to create picture and bar-type graphs.   **12**

1.8.C   Draw conclusions and generate and answer questions using information from picture and bar-type graphs.   **18**

1.9 Personal financial literacy. The student applies mathematical process standards to manage one's financial resources effectively for lifetime financial security.

1.9.A   Define money earned as income.

1.9.B   Identify income as a means of obtaining goods and services, oftentimes making choices between wants and needs.

1.9.C   Distinguish between spending and saving.

1.9.D   Consider charitable giving.

Grade 2

2.1 Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.

2.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

2.1.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.

2.1.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.

2.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

2.1.E Create and use representations to organize, record, and communicate mathematical ideas.

2.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

2.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

2.2 Number and operations. The student applies mathematical process standards to understand how to represent and compare whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system related to place value.

2.2.A Use concrete and pictorial models to compose and decompose numbers up to 1,200 in more than one way as a sum of so many thousands, hundreds, tens, and ones.   32

2.2.B Use standard, word, and expanded forms to represent numbers up to 1,200.   50

2.2.C Generate a number that is greater than or less than a given whole number up to 1,200.   4

2.2.D Use place value to compare and order whole numbers up to 1,200 using comparative language, numbers, and symbols ($>$, $<$, or $=$).   66

2.2.E Locate the position of a given whole number on an open number line.   30

2.2.F Name the whole number that corresponds to a specific point on a number line.   12

2.3 **Number and operations. The student applies mathematical process standards to recognize and represent fractional units and communicates how they are used to name parts of a whole.**

2.3.A Partition objects into equal parts and name the parts, including halves, fourths, and eighths, using words.   24

2.3.B Explain that the more fractional parts used to make a whole, the smaller the part; and the fewer the fractional parts, the larger the part.

2.3.C Use concrete models to count fractional parts beyond one whole using words and recognize how many parts it takes to equal one whole.   2

2.3.D Identify examples and non-examples of halves, fourths, and eighths.

2.4 **Number and operations. The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve addition and subtraction problems with efficiency and accuracy.**

2.4.A Recall basic facts to add and subtract within 20 with automaticity.   4

2.4.B Add up to four two-digit numbers and subtract two-digit numbers using mental strategies and algorithms based on knowledge of place value and properties of operations.   38

2.4.C Solve one-step and multi-step word problems involving addition and subtraction within 1,000 using a variety of strategies based on place value, including algorithms.   38

2.4.D Generate and solve problem situations for a given mathematical number sentence involving addition and subtraction of whole numbers within 1,000.   10

2.5 **Number and operations. The student applies mathematical process standards to determine the value of coins in order to solve monetary transactions.**

2.5.A Determine the value of a collection of coins up to one dollar.   38

2.5.B Use the cent symbol, dollar sign, and the decimal point to name the value of a collection of coins.   44

2.6 **Number and operations. The student applies mathematical process standards to connect repeated addition and subtraction to multiplication and division situations that involve equal groupings and shares.**

2.6.A Model, create, and describe contextual multiplication situations in which equivalent sets of concrete objects are joined.   16

2.6.B Model, create, and describe contextual division situations in which a set of concrete objects is separated into equivalent sets.

2.7 **Algebraic reasoning. The student applies mathematical process standards to identify and apply number patterns within properties of numbers and operations in order to describe relationships.**

    2.7.A Determine whether a number up to 40 is even or odd using pairings of objects to represent the number.   **2**

    2.7.B Use an understanding of place value to determine the number that is 10 or 100 more or less than a given number up to 1,200.   **12**

    2.7.C Represent and solve addition and subtraction word problems where unknowns may be any one of the terms in the problem.   **208**

2.8 **Geometry and measurement. The student applies mathematical process standards to analyze attributes of two-dimensional shapes and three-dimensional solids to develop generalizations about their properties.**

    2.8.A Create two-dimensional shapes based on given attributes, including number of sides and vertices.

    2.8.B Classify and sort three-dimensional solids, including spheres, cones, cylinders, rectangular prisms (including cubes as special rectangular prisms), and triangular prisms, based on attributes using formal geometric language.   **24**

    2.8.C Classify and sort polygons with 12 or fewer sides according to attributes, including identifying the number of sides and number of vertices.

    2.8.D Compose two-dimensional shapes and three-dimensional solids with given properties or attributes.   **4**

    2.8.E Decompose two-dimensional shapes such as cutting out a square from a rectangle, dividing a shape in half, or partitioning a rectangle into identical triangles and identify the resulting geometric parts.

2.9 **Geometry and measurement. The student applies mathematical process standards to select and use units to describe length, area, and time.**

    2.9.A Find the length of objects using concrete models for standard units of length.   **14**

    2.9.B Describe the inverse relationship between the size of the unit and the number of units needed to equal the length of an object.

    2.9.C Represent whole numbers as distances from any given location on a number line.

    2.9.D Determine the length of an object to the nearest marked unit using rulers, yardsticks, meter sticks, or measuring tapes.   **6**

    2.9.E Determine a solution to a problem involving length, including estimating lengths.   **78**

    2.9.F Use concrete models of square units to find the area of a rectangle by covering it with no gaps or overlaps, counting to find the total number of square units, and describing the measurement using a number and the unit.   **50**

    2.9.G Read and write time to the nearest one-minute increment using analog and digital clocks and distinguish between a.m. and p.m.   **90**

2.10 **Data analysis. The student applies mathematical process standards to organize data to make it useful for interpreting information and solving problems.**

    2.10.A Explain that the length of a bar in a bar graph or the number of pictures in a pictograph represents the number of data points for a given category.

    2.10.B Organize a collection of data with up to four categories using pictographs and bar graphs with intervals of one or more.   **28**

    2.10.C Write and solve one-step word problems involving addition or subtraction using data represented within pictographs and bar graphs with intervals of one.   **28**

    2.10.D Draw conclusions and make predictions from information in a graph.

2.11 **Personal financial literacy. The student applies mathematical process standards to manage one's financial resources effectively for lifetime financial security.**

    2.11.A Calculate how money saved can accumulate into a larger amount over time.

    2.11.B Explain that saving is an alternative to spending.

    2.11.C Distinguish between a deposit and a withdrawal.

    2.11.D Identify examples of borrowing and distinguish between responsible and irresponsible borrowing.

    2.11.E Identify examples of lending and use concepts of benefits and costs to evaluate lending decisions.

    2.11.F Differentiate between producers and consumers and calculate the cost to produce a simple item.

Grade 3

3.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

    3.1.A   Apply mathematics to problems arising in everyday life, society, and the workplace.

    3.1.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.

    3.1.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.

    3.1.D   Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

    3.1.E   Create and use representations to organize, record, and communicate mathematical ideas.

    3.1.F   Analyze mathematical relationships to connect and communicate mathematical ideas.

    3.1.G   Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

3.2 **Number and operations. The student applies mathematical process standards to represent and compare whole numbers and understand relationships related to place value.**

    3.2.A   Compose and decompose numbers up to 100,000 as a sum of so many ten thousands, so many thousands, so many hundreds, so many tens, and so many ones using objects, pictorial models, and numbers, including expanded notation as appropriate.   **24**

    3.2.B   Describe the mathematical relationships found in the base-10 place value system through the hundred thousands place.   **26**

    3.2.C   Represent a number on a number line as being between two consecutive multiples of 10; 100; 1,000; or 10,000 and use words to describe relative size of numbers in order to round whole numbers.

    3.2.D   Compare and order whole numbers up to 100,000 and represent comparisons using the symbols >, <, or =.   **14**

3.3 **Number and operations. The student applies mathematical process standards to represent and explain fractional units.**

3.3.A Represent fractions greater than zero and less than or equal to one with **56**
denominators of 2, 3, 4, 6, and 8 using concrete objects and pictorial
models, including strip diagrams and number lines.

3.3.B Determine the corresponding fraction greater than zero and less than or **6**
equal to one with denominators of 2, 3, 4, 6, and 8 given a specified point
on a number line.

3.3.C Explain that the unit fraction $1/b$ represents the quantity formed by one **14**
part of a whole that has been partitioned into b equal parts where b is a
non-zero whole number.

3.3.D Compose and decompose a fraction a/b with a numerator greater than zero
and less than or equal to b as a sum of parts $1/b$.

3.3.E Solve problems involving partitioning an object or a set of objects among **56**
two or more recipients using pictorial representations of fractions with
denominators of 2, 3, 4, 6, and 8.

3.3.F Represent equivalent fractions with denominators of 2, 3, 4, 6, and 8 using **36**
a variety of objects and pictorial models, including number lines.

3.3.G Explain that two fractions are equivalent if and only if they are both **36**
represented by the same point on the number line or represent the same
portion of a same size whole for an area model.

3.3.H Compare two fractions having the same numerator or denominator in **30**
problems by reasoning about their sizes and justifying the conclusion using
symbols, words, objects, and pictorial models.

3.4 **Number and operations. The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve problems with efficiency and accuracy.**

3.4.A Solve with fluency one-step and two-step problems involving addition and **100**
subtraction within 1,000 using strategies based on place value, properties of
operations, and the relationship between addition and subtraction.

3.4.B Round to the nearest 10 or 100 or use compatible numbers to estimate **74**
solutions to addition and subtraction problems.

3.4.C Determine the value of a collection of coins and bills. **44**

3.4.D Determine the total number of objects when equally-sized groups of objects
are combined or arranged in arrays up to 10 by 10.

3.4.E Represent multiplication facts by using a variety of approaches such as **60**
repeated addition, equal-sized groups, arrays, area models, equal jumps on
a number line, and skip counting.

3.4.F Recall facts to multiply up to 10 by 10 with automaticity and recall the **26**
corresponding division facts.

3.4.G   Use strategies and algorithms, including the standard algorithm, to multiply   4
a two-digit number by a one-digit number. Strategies may include mental
math, partial products, and the commutative, associative, and distributive
properties.

3.4.H   Determine the number of objects in each group when a set of objects is   26
partitioned into equal shares or a set of objects is shared equally.

3.4.I   Determine if a number is even or odd using divisibility rules.   22

3.4.J   Determine a quotient using the relationship between multiplication and   14
division.

3.4.K   Solve one-step and two-step problems involving multiplication and division   32
within 100 using strategies based on objects; pictorial models, including
arrays, area models, and equal groups; properties of operations; or recall of
facts.

3.5   **Algebraic reasoning. The student applies mathematical process standards to
analyze and create patterns and relationships.**

3.5.A   Represent one- and two-step problems involving addition and subtraction   14
of whole numbers to 1,000 using pictorial models, number lines, and
equations.

3.5.B   Represent and solve one- and two-step multiplication and division problems   220
within 100 using arrays, strip diagrams, and equations.

3.5.C   Describe a multiplication expression as a comparison such as 3×24 32
represents 3 times as much as 24.

3.5.D   Determine the unknown whole number in a multiplication or division   32
equation relating three whole numbers when the unknown is either a
missing factor or product.

3.5.E   Represent real-world relationships using number pairs in a table and verbal   20
descriptions.

3.6   **Geometry and measurement. The student applies mathematical process
standards to analyze attributes of two-dimensional geometric figures to develop
generalizations about their properties.**

3.6.A   Classify and sort two- and three-dimensional figures, including cones,   50
cylinders, spheres, triangular and rectangular prisms, and cubes, based on
attributes using formal geometric language.

3.6.B   Use attributes to recognize rhombuses, parallelograms, trapezoids,   26
rectangles, and squares as examples of quadrilaterals and draw examples of
quadrilaterals that do not belong to any of these subcategories.

3.6.C   Determine the area of rectangles with whole number side lengths in   20
problems using multiplication related to the number of rows times the
number of unit squares in each row.

3.6.D   Decompose composite figures formed by rectangles into non-overlapping   22
rectangles to determine the area of the original figure using the additive
property of area.

3.6.E Decompose two congruent two-dimensional figures into parts with equal areas and express the area of each part as a unit fraction of the whole and recognize that equal shares of identical wholes need not have the same shape.

3.7 **Geometry and measurement. The student applies mathematical process standards to select appropriate units, strategies, and tools to solve problems involving customary and metric measurement.**

3.7.A Represent fractions of halves, fourths, and eighths as distances from zero on a number line.

3.7.B Determine the perimeter of a polygon or a missing length when given perimeter and remaining side lengths in problems. 90

3.7.C Determine the solutions to problems involving addition and subtraction of time intervals in minutes using pictorial models or tools such as a 15-minute event plus a 30-minute event equals 45 minutes. 42

3.7.D Determine when it is appropriate to use measurements of liquid volume (capacity) or weight. 16

3.7.E Determine liquid volume (capacity) or weight using appropriate units and tools. 30

3.8 **Data analysis. The student applies mathematical process standards to solve problems by collecting, organizing, displaying, and interpreting data.**

3.8.A Summarize a data set with multiple categories using a frequency table, dot plot, pictograph, or bar graph with scaled intervals. 8

3.8.B Solve one- and two-step problems using categorical data represented with a frequency table, dot plot, pictograph, or bar graph with scaled intervals. 44

3.9 **Personal financial literacy. The student applies mathematical process standards to manage one's financial resources effectively for lifetime financial security.**

3.9.A Explain the connection between human capital/labor and income.

3.9.B Describe the relationship between the availability or scarcity of resources and how that impacts cost.

3.9.C Identify the costs and benefits of planned and unplanned spending decisions.

3.9.D Explain that credit is used when wants or needs exceed the ability to pay and that it is the borrower's responsibility to pay it back to the lender, usually with interest.

3.9.E List reasons to save and explain the benefit of a savings plan, including for college.

3.9.F Identify decisions involving income, spending, saving, credit, and charitable giving.

Grade 4

4.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

4.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

4.1.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.

4.1.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.

4.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

4.1.E Create and use representations to organize, record, and communicate mathematical ideas.

4.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

4.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

4.2 **Number and operations. The student applies mathematical process standards to represent, compare, and order whole numbers and decimals and understand relationships related to place value.**

4.2.A Interpret the value of each place-value position as 10 times the position to the right and as one-tenth of the value of the place to its left. | 20

4.2.B Represent the value of the digit in whole numbers through 1,000,000,000 and decimals to the hundredths using expanded notation and numerals. | 102

4.2.C Compare and order whole numbers to 1,000,000,000 and represent comparisons using the symbols >, <, or =. | 14

4.2.D Round whole numbers to a given place value through the hundred thousands place.

4.2.E Represent decimals, including tenths and hundredths, using concrete and visual models and money. | 50

4.2.F Compare and order decimals using concrete and visual models to the hundredths. | 10

4.2.G Relate decimals to fractions that name tenths and hundredths. | 58

4.2.H Determine the corresponding decimal to the tenths or hundredths place of a specified point on a number line. | 24

4.3 **Number and operations. The student applies mathematical process standards to represent and generate fractions to solve problems.**

4.3.A Represent a fraction a/b as a sum of fractions $1/b$, where a and b are whole numbers and $b > 0$, including when $a > b$. | 72

4.3.B Decompose a fraction in more than one way into a sum of fractions with the same denominator using concrete and pictorial models and recording results with symbolic representations.

4.3.C Determine if two given fractions are equivalent using a variety of methods. | 48

4.3.D Compare two fractions with different numerators and different denominators and represent the comparison using the symbols >, =, or <. | 74

4.3.E Represent and solve addition and subtraction of fractions with equal denominators using objects and pictorial models that build to the number line and properties of operations. | 58

4.3.F Evaluate the reasonableness of sums and differences of fractions using benchmark fractions 0, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1, referring to the same whole. | 16

4.3.G Represent fractions and decimals to the tenths or hundredths as distances from zero on a number line. | 12

4.4 **Number and operations. The student applies mathematical process standards to develop and use strategies and methods for whole number computations and decimal sums and differences in order to solve problems with efficiency and accuracy.**

4.4.A Add and subtract whole numbers and decimals to the hundredths place using the standard algorithm. | 116

4.4.B Determine products of a number and 10 or 100 using properties of operations and place value understandings. | 10

4.4.C Represent the product of 2 two-digit numbers using arrays, area models, or equations, including perfect squares through 15 by 15.

4.4.D Use strategies and algorithms, including the standard algorithm, to multiply up to a four-digit number by a one-digit number and to multiply a two-digit number by a two-digit number. Strategies may include mental math, partial products, and the commutative, associative, and distributive properties. | 10

4.4.E Represent the quotient of up to a four-digit whole number divided by a one-digit whole number using arrays, area models, or equations. | 12

4.4.F Use strategies and algorithms, including the standard algorithm, to divide up to a four-digit dividend by a one-digit divisor. | 18

4.4.G Round to the nearest 10, 100, or 1,000 or use compatible numbers to estimate solutions involving whole numbers. | 78

4.4.H Solve with fluency one- and two-step problems involving multiplication and division, including interpreting remainders. | 152

4.5   Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations.

4.5.A	Represent multi-step problems involving the four operations with whole numbers using strip diagrams and equations with a letter standing for the unknown quantity.	**32**
4.5.B	Represent problems using an input-output table and numerical expressions to generate a number pattern that follows a given rule representing the relationship of the values in the resulting sequence and their position in the sequence.	**12**
4.5.C	Use models to determine the formulas for the perimeter of a rectangle ($l + w + l + w$ or $2l + 2w$), including the special form for perimeter of a square ($4s$) and the area of a rectangle ($l \times w$).	**10**
4.5.D	Solve problems related to perimeter and area of rectangles where dimensions are whole numbers.	**128**

4.6   Geometry and measurement. The student applies mathematical process standards to analyze geometric attributes in order to develop generalizations about their properties.

4.6.A	Identify points, lines, line segments, rays, angles, and perpendicular and parallel lines.	**90**
4.6.B	Identify and draw one or more lines of symmetry, if they exist, for a two-dimensional figure.	**72**
4.6.C	Apply knowledge of right angles to identify acute, right, and obtuse triangles.	**26**
4.6.D	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines or the presence or absence of angles of a specified size.	**54**

4.7   Geometry and measurement. The student applies mathematical process standards to solve problems involving angles less than or equal to 180 degrees.

4.7.A	Illustrate the measure of an angle as the part of a circle whose center is at the vertex of the angle that is "cut out" by the rays of the angle. Angle measures are limited to whole numbers.	**18**
4.7.B	Illustrate degrees as the units used to measure an angle, where 1/360 of any circle is one degree and an angle that "cuts" $n/360$ out of any circle whose center is at the angle's vertex has a measure of n degrees. Angle measures are limited to whole numbers.	**24**
4.7.C	Determine the approximate measures of angles in degrees to the nearest whole number using a protractor.	**36**
4.7.D	Draw an angle with a given measure.	
4.7.E	Determine the measure of an unknown angle formed by two non-overlapping adjacent angles given one or both angle measures.	**16**

4.8 **Geometry and measurement. The student applies mathematical process standards to select appropriate customary and metric units, strategies, and tools to solve problems involving measurement.**

4.8.A	Identify relative sizes of measurement units within the customary and metric systems.	**48**
4.8.B	Convert measurements within the same measurement system, customary or metric, from a smaller unit into a larger unit or a larger unit into a smaller unit when given other equivalent measures represented in a table.	**116**
4.8.C	Solve problems that deal with measurements of length, intervals of time, liquid volumes, mass, and money using addition, subtraction, multiplication, or division as appropriate.	**154**

4.9 **Data analysis. The student applies mathematical process standards to solve problems by collecting, organizing, displaying, and interpreting data.**

4.9.A	Represent data on a frequency table, dot plot, or stem-and-leaf plot marked with whole numbers and fractions.	**12**
4.9.B	Solve one- and two-step problems using data in whole number, decimal, and fraction form in a frequency table, dot plot, or stem-and-leaf plot.	**32**

4.10 **Personal financial literacy. The student applies mathematical process standards to manage one's financial resources effectively for lifetime financial security.**

4.10.A	Distinguish between fixed and variable expenses.
4.10.B	Calculate profit in a given situation.
4.10.C	Compare the advantages and disadvantages of various savings options.
4.10.D	Describe how to allocate a weekly allowance among spending; saving, including for college; and sharing.
4.10.E	Describe the basic purpose of financial institutions, including keeping money safe, borrowing money, and lending.

Grade 5

5.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

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.

5.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

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.**

5.2.A Represent the value of the digit in decimals through the thousandths using expanded notation and numerals. 36

5.2.B Compare and order two decimals to thousandths and represent comparisons using the symbols >, <, or =. 34

5.2.C Round decimals to tenths or hundredths. 134

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.**

5.3.A Estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division. 230

5.3.B Multiply with fluency a three-digit number by a two-digit number using the standard algorithm. 36

5.3.C Solve with proficiency for quotients of up to a four-digit dividend by a two-digit divisor using strategies and the standard algorithm. 30

5.3.D Represent multiplication of decimals with products to the hundredths using objects and pictorial models, including area models. 6

5.3.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.	28
5.3.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.	
5.3.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.	16
5.3.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.	84
5.3.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.	36
5.3.J	Represent division of a unit fraction by a whole number and the division of a whole number by a unit fraction such as $\frac{1}{3} \div 7$ and $7 \div \frac{1}{3}$ using objects and pictorial models, including area models.	24
5.3.K	Add and subtract positive rational numbers fluently.	76
5.3.L	Divide whole numbers by unit fractions and unit fractions by whole numbers.	52

5.4 Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations.

5.4.A	Identify prime and composite numbers.	76
5.4.B	Represent and solve multi-step problems involving the four operations with whole numbers using equations with a letter standing for the unknown quantity.	152
5.4.C	Generate a numerical pattern when given a rule in the form $y = ax$ or $y = x + a$ and graph.	72
5.4.D	Recognize the difference between additive and multiplicative numerical patterns given in a table or graph.	42
5.4.E	Describe the meaning of parentheses and brackets in a numeric expression.	76
5.4.F	Simplify numerical expressions that do not involve exponents, including up to two levels of grouping.	46
5.4.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 ($V = l \times w \times h$, $V = s \times s \times s$, and $V = Bh$).	18
5.4.H	Represent and solve problems related to perimeter and/or area and related to volume.	80

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.** 60

5.6 **Geometry and measurement. The student applies mathematical process standards to understand, recognize, and quantify volume.**

5.6.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. 24

5.6.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. 46

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.** 200

5.8 **Geometry and measurement. The student applies mathematical process standards to identify locations on a coordinate plane.**

5.8.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. 10

5.8.B Describe the process for graphing ordered pairs of numbers in the first quadrant of the coordinate plane. 4

5.8.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. 56

5.9 **Data analysis. The student applies mathematical process standards to solve problems by collecting, organizing, displaying, and interpreting data.**

5.9.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. 4

5.9.B Represent discrete paired data on a scatterplot. 4

5.9.C Solve one- and two-step problems using data from a frequency table, dot plot, bar graph, stem-and-leaf plot, or scatterplot. 24

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

5.10.A   Define income tax, payroll tax, sales tax, and property tax.

5.10.B   Explain the difference between gross income and net income.

5.10.C   Identify the advantages and disadvantages of different methods of payment, including check, credit card, debit card, and electronic payments.

5.10.D   Develop a system for keeping and using financial records.

5.10.E   Describe actions that might be taken to balance a budget when expenses exceed income.

5.10.F   Balance a simple budget.

Grade 6

6.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

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.

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

6.2 **Number and operations. The student applies mathematical process standards to represent and use rational numbers in a variety of forms.**

6.2.A Classify whole numbers, integers, and rational numbers using a visual representation such as a Venn diagram to describe relationships between sets of numbers.   6

6.2.B Identify a number, its opposite, and its absolute value.   38

6.2.C Locate, compare, and order integers and rational numbers using a number line.   102

6.2.D Order a set of rational numbers arising from mathematical and real-world contexts.   110

6.2.E Extend representations for division to include fraction notation such as a/b represents the same number as $a \div b$ where $b \neq 0$.   48

6.3 **Number and operations. The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions.**

6.3.A	Recognize that dividing by a rational number and multiplying by its reciprocal result in equivalent values.	8
6.3.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.	42
6.3.C	Represent integer operations with concrete models and connect the actions with the models to standardized algorithms.	80
6.3.D	Add, subtract, multiply, and divide integers fluently.	154
6.3.E	Multiply and divide positive rational numbers fluently.	202

6.4 **Proportionality. The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations.**

6.4.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.	10
6.4.B	Apply qualitative and quantitative reasoning to solve prediction and comparison of real-world problems involving ratios and rates.	140
6.4.C	Give examples of ratios as multiplicative comparisons of two quantities describing the same attribute.	56
6.4.D	Give examples of rates as the comparison by division of two quantities having different attributes, including rates as quotients.	44
6.4.E	Represent ratios and percents with concrete models, fractions, and decimals.	54
6.4.F	Represent benchmark fractions and percents such as 1%, 10%, 25%, $33\frac{1}{3}$%, and multiples of these values using 10 by 10 grids, strip diagrams, number lines, and numbers.	6
6.4.G	Generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that involve money.	66
6.4.H	Convert units within a measurement system, including the use of proportions and unit rates.	56

6.5 **Proportionality. The student applies mathematical process standards to solve problems involving proportional relationships.**

6.5.A	Represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions.	26
6.5.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.	74
6.5.C	Use equivalent fractions, decimals, and percents to show equal parts of the same whole.	74

6.6   **Expressions, equations, and relationships. The student applies mathematical process standards to use multiple representations to describe algebraic relationships.**

    6.6.A   Identify independent and dependent quantities from tables and graphs.   **20**

    6.6.B   Write an equation that represents the relationship between independent and dependent quantities from a table.   **16**

    6.6.C   Represent a given situation using verbal descriptions, tables, graphs, and equations in the form $y = kx$ or $y = x + b$.   **32**

6.7   **Expressions, equations, and relationships. The student applies mathematical process standards to develop concepts of expressions and equations.**

    6.7.A   Generate equivalent numerical expressions using order of operations, including whole number exponents and prime factorization.   **170**

    6.7.B   Distinguish between expressions and equations verbally, numerically, and algebraically.   **110**

    6.7.C   Determine if two expressions are equivalent using concrete models, pictorial models, and algebraic representations.   **82**

    6.7.D   Generate equivalent expressions using the properties of operations: inverse, identity, commutative, associative, and distributive properties.   **88**

6.8   **Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to represent relationships and solve problems.**

    6.8.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.   **70**

    6.8.B   Model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes.   **20**

    6.8.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.   **16**

    6.8.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.   **172**

6.9   **Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to represent situations.**

    6.9.A   Write one-variable, one-step equations and inequalities to represent constraints or conditions within problems.   **78**

    6.9.B   Represent solutions for one-variable, one-step equations and inequalities on number lines.   **6**

    6.9.C   Write corresponding real-world problems given one-variable, one-step equations or inequalities.   **20**

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

6.10.A Model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts.   120

6.10.B Determine if the given value(s) make(s) one-variable, one-step equations or inequalities true.

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 graph points in all four quadrants using ordered pairs of rational numbers.   134

6.12 Measurement and data. The student applies mathematical process standards to use numerical or graphical representations to analyze problems.

6.12.A Represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots.   44

6.12.B Use the graphical representation of numeric data to describe the center, spread, and shape of the data distribution.   22

6.12.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.   118

6.12.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.   42

6.13 Measurement and data. The student applies mathematical process standards to use numerical or graphical representations to solve problems.

6.13.A Interpret numeric data summarized in dot plots, stem-and-leaf plots, histograms, and box plots.   96

6.13.B Distinguish between situations that yield data with and without variability.   6

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.

6.14.A Compare the features and costs of a checking account and a debit card offered by different local financial institutions.

6.14.B Distinguish between debit cards and credit cards.

6.14.C Balance a check register that includes deposits, withdrawals, and transfers.

6.14.D Explain why it is important to establish a positive credit history.

6.14.E Describe the information in a credit report and how long it is retained.

6.14.F Describe the value of credit reports to borrowers and to lenders.

6.14.G Explain various methods to pay for college, including through savings, grants, scholarships, student loans, and work-study.

6.14.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.

Grade 7

7.1 Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.

    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.

    7.1.G   Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

7.2 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 extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of rational numbers.   70

7.3 Number and operations. The student applies mathematical process standards to add, subtract, multiply, and divide while solving problems and justifying solutions.

    7.3.A   Add, subtract, multiply, and divide rational numbers fluently.   108

    7.3.B   Apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication, and division of rational numbers.   184

7.4 **Proportionality. The student applies mathematical process standards to represent and solve problems involving proportional relationships.**

7.4.A	Represent constant rates of change in mathematical and real-world problems given pictorial, tabular, verbal, numeric, graphical, and algebraic representations, including $d = rt$.	76
7.4.B	Calculate unit rates from rates in mathematical and real-world problems.	88
7.4.C	Determine the constant of proportionality ($k = y/x$) within mathematical and real-world problems.	48
7.4.D	Solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems.	258
7.4.E	Convert between measurement systems, including the use of proportions and the use of unit rates.	12

7.5 **Proportionality. The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships.**

7.5.A	Generalize the critical attributes of similarity, including ratios within and between similar shapes.	42
7.5.B	Describe ? as the ratio of the circumference of a circle to its diameter.	18
7.5.C	Solve mathematical and real-world problems involving similar shape and scale drawings.	72

7.6 **Proportionality. The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships.**

7.6.A	Represent sample spaces for simple and compound events using lists and tree diagrams.	98
7.6.B	Select and use different simulations to represent simple and compound events with and without technology.	44
7.6.C	Make predictions and determine solutions using experimental data for simple and compound events.	52
7.6.D	Make predictions and determine solutions using theoretical probability for simple and compound events.	60
7.6.E	Find the probabilities of a simple event and its complement and describe the relationship between the two.	20
7.6.F	Use data from a random sample to make inferences about a population.	22
7.6.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.	20
7.6.H	Solve problems using qualitative and quantitative predictions and comparisons from simple experiments.	20
7.6.I	Determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces.	242

7.7 **Expressions, equations, and relationships. 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** $y = mx + b$**.** 20

7.8 **Expressions, equations, and relationships. The student applies mathematical process standards to develop geometric relationships with volume.**

7.8.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. 4

7.8.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. 4

7.8.C Use models to determine the approximate formulas for the circumference and area of a circle and connect the models to the actual formulas. 52

7.9 **Expressions, equations, and relationships. The student applies mathematical process standards to solve geometric problems.**

7.9.A Solve problems involving the volume of rectangular prisms, triangular prisms, rectangular pyramids, and triangular pyramids. 34

7.9.B Determine the circumference and area of circles. 78

7.9.C Determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles. 26

7.9.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. 78

7.10 **Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations and inequalities to represent situations.**

7.10.A Write one-variable, two-step equations and inequalities to represent constraints or conditions within problems. 68

7.10.B Represent solutions for one-variable, two-step equations and inequalities on number lines. 8

7.10.C Write a corresponding real-world problem given a one-variable, two-step equation or inequality. 6

7.11 **Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities.**

7.11.A Model and solve one-variable, two-step equations and inequalities. 124

7.11.B Determine if the given value(s) make(s) one-variable, two-step equations and inequalities true. 92

7.11.C Write and solve equations using geometry concepts, including the sum of the angles in a triangle, and angle relationships. 106

7.12 Measurement and data. The student applies mathematical process standards to use statistical representations to analyze data.

7.12.A   Compare two groups of numeric data using comparative dot plots or box plots by comparing their shapes, centers, and spreads.   **32**

7.12.B   Use data from a random sample to make inferences about a population.   **10**

7.12.C   Compare two populations based on data in random samples from these populations, including informal comparative inferences about differences between the two populations.   **20**

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.

7.13.A   Calculate the sales tax for a given purchase and calculate income tax for earned wages.

7.13.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.

7.13.C   Create and organize a financial assets and liabilities record and construct a net worth statement.

7.13.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.

7.13.E   Calculate and compare simple interest and compound interest earnings.

7.13.F   Analyze and compare monetary incentives, including sales, rebates, and coupons.

Grade 8

8.1   Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.

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.

8.1.G   Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

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

8.2.A   Extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of real numbers.   36

8.2.B   Approximate the value of an irrational number, including ? and square roots of numbers less than 225, and locate that rational number approximation on a number line.   148

8.2.C   Convert between standard decimal notation and scientific notation.   98

8.2.D   Order a set of real numbers arising from mathematical and real-world contexts.   24

8.3   Proportionality. The student applies mathematical process standards to use proportional relationships to describe dilations.

8.3.A   Generalize that the ratio of corresponding sides of similar shapes are proportional, including a shape and its dilation.   38

8.3.B   Compare and contrast the attributes of a shape and its dilation(s) on a coordinate plane.   8

8.3.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.

8.4 **Proportionality. The student applies mathematical process standards to explain proportional and non-proportional relationships involving slope.**

8.4.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, $(y_2 - y_1)/(x_2 - x_1)$, is the same for any two points (x_1, y_1) and (x_2, y_2) on the same line.   16

8.4.B Graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship.   18

8.4.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.   34

8.5 **Proportionality. The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions.**

8.5.A Represent linear proportional situations with tables, graphs, and equations in the form of $y = kx$.

8.5.B Represent linear non-proportional situations with tables, graphs, and equations in the form of $y = mx + b$, where $b \neq 0$.   64

8.5.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.   4

8.5.D Use a trend line that approximates the linear relationship between bivariate sets of data to make predictions.   52

8.5.E Solve problems involving direct variation.   32

8.5.F Distinguish between proportional and non-proportional situations using tables, graphs, and equations in the form $y = kx$ or $y = mx + b$, where $b \neq 0$.   16

8.5.G Identify functions using sets of ordered pairs, tables, mappings, and graphs.   74

8.5.H Identify examples of proportional and non-proportional functions that arise from mathematical and real-world problems.   4

8.5.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.   50

8.6 **Expressions, equations, and relationships. The student applies mathematical process standards to develop mathematical relationships and make connections to geometric formulas.**

8.6.A Describe the volume formula $V = Bh$ of a cylinder in terms of its base area and its height.   12

8.6.B Model the relationship between the volume of a cylinder and a cone having both congruent bases and heights and connect that relationship to the formulas.   4

8.6.C Use models and diagrams to explain the Pythagorean theorem.   6

8.7 **Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to solve problems.**

    8.7.A Solve problems involving the volume of cylinders, cones, and spheres.   62

    8.7.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.   38

    8.7.C Use the Pythagorean Theorem and its converse to solve problems.   108

    8.7.D Determine the distance between two points on a coordinate plane using the Pythagorean Theorem.   48

8.8 **Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations or inequalities in problem situations.**

    8.8.A Write one-variable equations or inequalities with variables on both sides that represent problems using rational number coefficients and constants.   6

    8.8.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.

    8.8.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.   26

    8.8.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.   64

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 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.**   20

8.10 **Two-dimensional shapes. The student applies mathematical process standards to develop transformational geometry concepts.**

    8.10.A Generalize the properties of orientation and congruence of rotations, reflections, translations, and dilations of two-dimensional shapes on a coordinate plane.   144

    8.10.B Differentiate between transformations that preserve congruence and those that do not.   80

    8.10.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.   38

    8.10.D Model the effect on linear and area measurements of dilated two-dimensional shapes.   28

8.11 Measurement and data. The student applies mathematical process standards to use statistical procedures to describe data.

8.11.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.   56

8.11.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.   6

8.11.C Simulate generating random samples of the same size from a population with known characteristics to develop the notion of a random sample being representative of the population from which it was selected.   36

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.

8.12.A Solve real-world problems comparing how interest rate and loan length affect the cost of credit.

8.12.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.

8.12.C Explain how small amounts of money invested regularly, including money saved for college and retirement, grow over time.

8.12.D Calculate and compare simple interest and compound interest earnings.

8.12.E Identify and explain the advantages and disadvantages of different payment methods.

8.12.F Analyze situations to determine if they represent financially responsible decisions and identify the benefits of financial responsibility and the costs of financial irresponsibility.

8.12.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.

Algebra I

A.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

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.

A.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

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.**

A.2.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. 26

A.2.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. 60

A.2.C Write linear equations in two variables given a table of values, a graph, and a verbal description. 32

A.2.D Write and solve equations involving direct variation. 16

A.2.E Write the equation of a line that contains a given point and is parallel to a given line. 8

A.2.F Write the equation of a line that contains a given point and is perpendicular to a given line. 10

A.2.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. 2

A.2.H	Write linear inequalities in two variables given a table of values, a graph, and a verbal description.	20
A.2.I	Write systems of two linear equations given a table of values, a graph, and a verbal description.	36

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.**

A.3.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 $y - y_1 = m(x - x_1)$.	34
A.3.B	Calculate the rate of change of a linear function represented tabularly, graphically, or algebraically in context of mathematical and real-world problems.	6
A.3.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.	102
A.3.D	Graph the solution set of linear inequalities in two variables on the coordinate plane.	14
A.3.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 of a, b, c, and d.	30
A.3.F	Graph systems of two linear equations in two variables on the coordinate plane and determine the solutions if they exist.	30
A.3.G	Estimate graphically the solutions to systems of two linear equations with two variables in real-world problems.	6
A.3.H	Graph the solution set of systems of two linear inequalities in two variables on the coordinate plane.	10

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.**

A.4.A	Calculate, using technology, the correlation coefficient between two quantitative variables and interpret this quantity as a measure of the strength of the linear association.	84
A.4.B	Compare and contrast association and causation in real-world problems.	8
A.4.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.	34

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.**

    A.5.A   Solve linear equations in one variable, including those for which the   **86** application of the distributive property is necessary and for which variables are included on both sides.

    A.5.B   Solve linear inequalities in one variable, including those for which the   **60** application of the distributive property is necessary and for which variables are included on both sides.

    A.5.C   Solve systems of two linear equations with two variables for mathematical   **146** and real-world problems.

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.**

    A.6.A   Determine the domain and range of quadratic functions and represent the   **18** domain and range using inequalities.

    A.6.B   Write equations of quadratic functions given the vertex and another point   **18** 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 ($f(x) = ax^2 + bx + c$).

    A.6.C   Write quadratic functions when given real solutions and graphs of their   **22** related equations.

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.**

    A.7.A   Graph quadratic functions on the coordinate plane and use the graph to   **60** identify key attributes, if possible, including *x*-intercept, *y*-intercept, zeros, maximum value, minimum values, vertex, and the equation of the axis of symmetry.

    A.7.B   Describe the relationship between the linear factors of quadratic expressions   **74** and the zeros of their associated quadratic functions.

    A.7.C   Determine the effects on the graph of the parent function $f(x) = x^2$ when   **64** $f(x)$ is replaced by $af(x)$, $f(x) + d$, $f(x - c)$, $f(bx)$ for specific values of a, b, c, and d.

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.**

    A.8.A   Solve quadratic equations having real solutions by factoring, taking square   **150** roots, completing the square, and applying the quadratic formula.

    A.8.B   Write, using technology, quadratic functions that provide a reasonable fit to   **2** data to estimate solutions and make predictions for real-world problems.

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.**

A.9.A	Determine the domain and range of exponential functions of the form $f(x) = abx$ and represent the domain and range using inequalities.	6
A.9.B	Interpret the meaning of the values of a and b in exponential functions of the form $f(x) = abx$ in real-world problems.	30
A.9.C	Write exponential functions in the form $f(x) = abx$ (where b is a rational number) to describe problems arising from mathematical and real-world situations, including growth and decay.	4
A.9.D	Graph exponential functions that model growth and decay and identify key features, including y-intercept and asymptote, in mathematical and real-world problems.	16
A.9.E	Write, using technology, exponential functions that provide a reasonable fit to data and make predictions for real-world problems.	2

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.**

A.10.A	Add and subtract polynomials of degree one and degree two.	72
A.10.B	Multiply polynomials of degree one and degree two.	106
A.10.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.	14
A.10.D	Rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property.	40
A.10.E	Factor, if possible, trinomials with real factors in the form $ax^2 + bx + c$, including perfect square trinomials of degree two.	74
A.10.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.	22

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

A.11.A	Simplify numerical radical expressions involving square roots.	106
A.11.B	Simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents.	210

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.

A.12.A	Decide whether relations represented verbally, tabularly, graphically, and symbolically define a function.	**36**
A.12.B	Evaluate functions, expressed in function notation, given one or more elements in their domains.	**28**
A.12.C	Identify terms of arithmetic and geometric sequences when the sequences are given in function form using recursive processes.	**54**
A.12.D	Write a formula for the nth term of arithmetic and geometric sequences, given the value of several of their terms.	**26**
A.12.E	Solve mathematic and scientific formulas, and other literal equations, for a specified variable.	**46**

Algebra II

L.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

    L.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

    L.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.

    L.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.

    L.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

    L.1.E Create and use representations to organize, record, and communicate mathematical ideas.

    L.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

    L.1.G Display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

L.2 **Attributes of functions and their inverses. The student applies mathematical processes to understand that functions have distinct key attributes and understand the relationship between a function and its inverse.**

    L.2.A Graph the functions $f(x) = \sqrt{x}$, $f(x) = 1/x$, $f(x) = x^3$, $f(x) = \sqrt[3]{x}$, $f(x) = b^x$, $f(x) = |x|$, and $f(x) = \log_b(x)$ where b is 2, 10, and e, and, when applicable, analyze the key attributes such as domain, range, intercepts, symmetries, asymptotic behavior, and maximum and minimum given an interval.   66

    L.2.B Graph and write the inverse of a function using notation such as $f^{-1}(x)$.   40

    L.2.C Describe and analyze the relationship between a function and its inverse (quadratic and square root, logarithmic and exponential), including the restriction(s) on domain, which will restrict its range.   16

    L.2.D Use the composition of two functions, including the necessary restrictions on the domain, to determine if the functions are inverses of each other.   14

L.3   **Systems of equations and inequalities. The student applies mathematical processes to formulate systems of equations and inequalities, use a variety of methods to solve, and analyze reasonableness of solutions.**

    L.3.A   Formulate systems of equations, including systems consisting of three linear equations in three variables and systems consisting of two equations, the first linear and the second quadratic.

    L.3.B   Solve systems of three linear equations in three variables by using Gaussian elimination, technology with matrices, and substitution.   **88**

    L.3.C   Solve, algebraically, systems of two equations in two variables consisting of a linear equation and a quadratic equation.   **26**

    L.3.D   Determine the reasonableness of solutions to systems of a linear equation and a quadratic equation in two variables.   **6**

    L.3.E   Formulate systems of at least two linear inequalities in two variables.   **18**

    L.3.F   Solve systems of two or more linear inequalities in two variables.   **16**

    L.3.G   Determine possible solutions in the solution set of systems of two or more linear inequalities in two variables.   **14**

L.4   **Quadratic and square root functions, equations, and inequalities. The student applies mathematical processes to understand that quadratic and square root functions, equations, and quadratic inequalities can be used to model situations, solve problems, and make predictions.**

    L.4.A   Write the quadratic function given three specified points in the plane.   **6**

    L.4.B   Write the equation of a parabola using given attributes, including vertex, focus, directrix, axis of symmetry, and direction of opening.   **20**

    L.4.C   Determine the effect on the graph of $f(x) = \sqrt{x}$ when $f(x)$ is replaced by $af(x)$, $f(x) + d$, $f(bx)$, and $f(x - c)$ for specific positive and negative values of a, b, c, and d.   **24**

    L.4.D   Transform a quadratic function $f(x) = ax^2 + bx + c$ to the form $f(x) = a(x - h)^2 + k$ to identify the different attributes of $f(x)$.   **24**

    L.4.E   Formulate quadratic and square root equations using technology given a table of data.   **2**

    L.4.F   Solve quadratic and square root equations.   **108**

    L.4.G   Identify extraneous solutions of square root equations.   **6**

    L.4.H   Solve quadratic inequalities.   **10**

L.5 **Exponential and logarithmic functions and equations. The student applies mathematical processes to understand that exponential and logarithmic functions can be used to model situations and solve problems.**

    L.5.A   Determine the effects on the key attributes on the graphs of $f(x) = bx$ and $f(x) = \log_b(x)$ where b is 2, 10, and e when $f(x)$ is replaced by $af(x)$, $f(x) + d$, and $f(x - c)$ for specific positive and negative real values of a, c, and d.   8

    L.5.B   Formulate exponential and logarithmic equations that model real-world situations, including exponential relationships written in recursive notation.   8

    L.5.C   Rewrite exponential equations as their corresponding logarithmic equations and logarithmic equations as their corresponding exponential equations.   8

    L.5.D   Solve exponential equations of the form $y = abx$ where a is a nonzero real number and b is greater than zero and not equal to one and single logarithmic equations having real solutions.   52

    L.5.E   Determine the reasonableness of a solution to a logarithmic equation.   4

L.6 **Cubic, cube root, absolute value and rational functions, equations, and inequalities. The student applies mathematical processes to understand that cubic, cube root, absolute value and rational functions, equations, and inequalities can be used to model situations, solve problems, and make predictions.**

    L.6.A   Analyze the effect on the graphs of $f(x) = x^3$ and $f(x) = 3\sqrt{x}$ when $f(x)$ is replaced by $af(x)$, $f(bx)$, $f(x - c)$, and $f(x) + d$ for specific positive and negative real values of a, b, c, and d.   16

    L.6.B   Solve cube root equations that have real roots.   2

    L.6.C   Analyze the effect on the graphs of $f(x) = |x|$ when $f(x)$ is replaced by $af(x)$, $f(bx)$, $f(x - c)$, and $f(x) + d$ for specific positive and negative real values of a, b, c, and d.   10

    L.6.D   Formulate absolute value linear equations.   12

    L.6.E   Solve absolute value linear equations.   12

    L.6.F   Solve absolute value linear inequalities.   22

    L.6.G   Analyze the effect on the graphs of $f(x) = 1/x$ when $f(x)$ is replaced by $af(x)$, $f(bx)$, $f(x - c)$, and $f(x) + d$ for specific positive and negative real values of a, b, c, and d.   2

    L.6.H   Formulate rational equations that model real-world situations.   10

    L.6.I   Solve rational equations that have real solutions.   42

    L.6.J   Determine the reasonableness of a solution to a rational equation.   6

    L.6.K   Determine the asymptotic restrictions on the domain of a rational function and represent domain and range using interval notation, inequalities, and set notation.   28

    L.6.L   Formulate and solve equations involving inverse variation.   24

L.7 **Number and algebraic methods. The student applies mathematical processes to simplify and perform operations on expressions and to solve equations.**

    L.7.A   Add, subtract, and multiply complex numbers.   92

    L.7.B   Add, subtract, and multiply polynomials.   52

    L.7.C   Determine the quotient of a polynomial of degree three and of degree four when divided by a polynomial of degree one and of degree two.   56

    L.7.D   Determine the linear factors of a polynomial function of degree three and of degree four using algebraic methods.   2

    L.7.E   Determine linear and quadratic factors of a polynomial expression of degree three and of degree four, including factoring the sum and difference of two cubes and factoring by grouping.   6

    L.7.F   Determine the sum, difference, product, and quotient of rational expressions with integral exponents of degree one and of degree two.   100

    L.7.G   Rewrite radical expressions that contain variables to equivalent forms.   18

    L.7.H   Solve equations involving rational exponents.   24

    L.7.I   Write the domain and range of a function in interval notation, inequalities, and set notation.   42

L.8 **Data. The student applies mathematical processes to analyze data, select appropriate models, write corresponding functions, and make predictions.**

    L.8.A   Analyze data to select the appropriate model from among linear, quadratic, and exponential models.   28

    L.8.B   Use regression methods available through technology to write a linear function, a quadratic function, and an exponential function from a given set of data.   32

    L.8.C   Predict and make decisions and critical judgments from a given set of data using linear, quadratic, and exponential models.   40

Geometry

G.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

G.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

G.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.

G.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.

G.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

G.1.E Create and use representations to organize, record, and communicate mathematical ideas.

G.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

G.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

G.2 **Coordinate and transformational geometry. The student uses the process skills to understand the connections between algebra and geometry and uses the one- and two-dimensional coordinate systems to verify geometric conjectures.**

G.2.A Determine the coordinates of a point that is a given fractional distance less than one from one end of a line segment to the other in one- and two-dimensional coordinate systems, including finding the midpoint. 40

G.2.B Derive and use the distance, slope, and midpoint formulas to verify geometric relationships, including congruence of segments and parallelism or perpendicularity of pairs of lines. 114

G.2.C Determine an equation of a line parallel or perpendicular to a given line that passes through a given point. 28

G.3 **Coordinate and transformational geometry. The student uses the process skills to generate and describe rigid transformations (translation, reflection, and rotation) and non-rigid transformations (dilations that preserve similarity and reductions and enlargements that do not preserve similarity).**

G.3.A Describe and perform transformations of figures in a plane using coordinate notation. 8

G.3.B Determine the image or pre-image of a given two-dimensional figure under a composition of rigid transformations, a composition of non-rigid transformations, and a composition of both, including dilations where the center can be any point in the plane. 44

G.3.C Identify the sequence of transformations that will carry a given pre-image onto an image on and off the coordinate plane. 48

G.3.D Identify and distinguish between reflectional and rotational symmetry in a plane figure. 24

G.4 **Logical argument and constructions. The student uses the process skills with deductive reasoning to understand geometric relationships.**

G.4.A Distinguish between undefined terms, definitions, postulates, conjectures, and theorems. 12

G.4.B Identify and determine the validity of the converse, inverse, and contrapositive of a conditional statement and recognize the connection between a biconditional statement and a true conditional statement with a true converse. 14

G.4.C Verify that a conjecture is false using a counterexample. 6

G.4.D Compare geometric relationships between Euclidean and spherical geometries, including parallel lines and the sum of the angles in a triangle. 10

G.5 **Logical argument and constructions. The student uses constructions to validate conjectures about geometric figures.**

G.5.A Investigate patterns to make conjectures about geometric relationships, including angles formed by parallel lines cut by a transversal, criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments and angles of circles choosing from a variety of tools. 74

G.5.B Construct congruent segments, congruent angles, a segment bisector, an angle bisector, perpendicular lines, the perpendicular bisector of a line segment, and a line parallel to a given line through a point not on a line using a compass and a straightedge. 32

G.5.C Use the constructions of congruent segments, congruent angles, angle bisectors, and perpendicular bisectors to make conjectures about geometric relationships. 8

G.5.D Verify the Triangle Inequality theorem using constructions and apply the theorem to solve problems. 14

G.6 **Proof and congruence. The student uses the process skills with deductive reasoning to prove and apply theorems by using a variety of methods such as coordinate, transformational, and axiomatic and formats such as two-column, paragraph, and flow chart.**

G.6.A Verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector and apply these relationships to solve problems. 12

G.6.B Prove two triangles are congruent by applying the Side-Angle-Side, Angle-Side-Angle, Side-Side-Side, Angle-Angle-Side, and Hypotenuse-Leg congruence conditions. 46

G.6.C Apply the definition of congruence, in terms of rigid transformations, to identify congruent figures and their corresponding sides and angles. 24

G.6.D Verify theorems about the relationships in triangles, including proof of the Pythagorean Theorem, the sum of interior angles, base angles of isosceles triangles, midsegments, and medians, and apply these relationships to solve problems. 24

G.6.E Prove a quadrilateral is a parallelogram, rectangle, square, or rhombus using opposite sides, opposite angles, or diagonals and apply these relationships to solve problems. 10

G.7 **Similarity, proof, and trigonometry. The student uses the process skills in applying similarity to solve problems.**

G.7.A Apply the definition of similarity in terms of a dilation to identify similar figures and their proportional sides and the congruent corresponding angles. 16

G.7.B Apply the Angle-Angle criterion to verify similar triangles and apply the proportionality of the corresponding sides to solve problems. 42

G.8 **Similarity, proof, and trigonometry. The student uses the process skills with deductive reasoning to prove and apply theorems by using a variety of methods such as coordinate, transformational, and axiomatic and formats such as two-column, paragraph, and flow chart.**

G.8.A Prove theorems about similar triangles, including the Triangle Proportionality theorem, and apply these theorems to solve problems. 8

G.8.B Identify and apply the relationships that exist when an altitude is drawn to the hypotenuse of a right triangle, including the geometric mean, to solve problems. 4

G.9 **Similarity, proof, and trigonometry. The student uses the process skills to understand and apply relationships in right triangles.**

G.9.A Determine the lengths of sides and measures of angles in a right triangle by applying the trigonometric ratios sine, cosine, and tangent to solve problems. 106

G.9.B Apply the relationships in special right triangles $30°$-$60°$-$90°$ and $45°$-$45°$-$90°$ and the Pythagorean theorem, including Pythagorean triples, to solve problems. 56

G.10 Two-dimensional and three-dimensional figures. The student uses the process skills to recognize characteristics and dimensional changes of two- and three-dimensional figures.

G.10.A Identify the shapes of two-dimensional cross-sections of prisms, pyramids, cylinders, cones, and spheres and identify three-dimensional objects generated by rotations of two-dimensional shapes. 32

G.10.B Determine and describe how changes in the linear dimensions of a shape affect its perimeter, area, surface area, or volume, including proportional and non-proportional dimensional change. 74

G.11 Two-dimensional and three-dimensional figures. The student uses the process skills in the application of formulas to determine measures of two- and three-dimensional figures.

G.11.A Apply the formula for the area of regular polygons to solve problems using appropriate units of measure. 24

G.11.B Determine the area of composite two-dimensional figures comprised of a combination of triangles, parallelograms, trapezoids, kites, regular polygons, or sectors of circles to solve problems using appropriate units of measure. 2

G.11.C Apply the formulas for the total and lateral surface area of three-dimensional figures, including prisms, pyramids, cones, cylinders, spheres, and composite figures, to solve problems using appropriate units of measure. 20

G.11.D Apply the formulas for the volume of three-dimensional figures, including prisms, pyramids, cones, cylinders, spheres, and composite figures, to solve problems using appropriate units of measure. 16

G.12 Circles. The student uses the process skills to understand geometric relationships and apply theorems and equations about circles.

G.12.A Apply theorems about circles, including relationships among angles, radii, chords, tangents, and secants, to solve non-contextual problems. 100

G.12.B Apply the proportional relationship between the measure of an arc length of a circle and the circumference of the circle to solve problems. 28

G.12.C Apply the proportional relationship between the measure of the area of a sector of a circle and the area of the circle to solve problems. 10

G.12.D Describe radian measure of an angle as the ratio of the length of an arc intercepted by a central angle and the radius of the circle. 2

G.12.E Show that the equation of a circle with center at the origin and radius r is $x^2 + y^2 = r^2$ and determine the equation for the graph of a circle with radius r and center (h, k), $(x - h)^2 + (y - k)^2 = r^2$. 38

G.13 Probability. The student uses the process skills to understand probability in real-world situations and how to apply independence and dependence of events.

G.13.A Develop strategies to use permutations and combinations to solve contextual problems. **24**

G.13.B Determine probabilities based on area to solve contextual problems. **16**

G.13.C Identify whether two events are independent and compute the probability of the two events occurring together with or without replacement. **42**

G.13.D Apply conditional probability in contextual problems.

G.13.E Apply independence in contextual problems.

Precalculus

P.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

   P.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

   P.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.

   P.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.

   P.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

   P.1.E Create and use representations to organize, record, and communicate mathematical ideas.

   P.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

   P.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

P.2 **Functions. The student uses process standards in mathematics to explore, describe, and analyze the attributes of functions. The student makes connections between multiple representations of functions and algebraically constructs new functions. The student analyzes and uses functions to model real-world problems.**

   P.2.A Use the composition of two functions to model and solve real-world problems.   14

   P.2.B Demonstrate that function composition is not always commutative.

   P.2.C Represent a given function as a composite function of two or more functions.

   P.2.D Describe symmetry of graphs of even and odd functions.   12

   P.2.E Determine an inverse function, when it exists, for a given function over its domain or a subset of its domain and represent the inverse using multiple representations.   20

   P.2.F Graph exponential, logarithmic, rational, polynomial, power, trigonometric, inverse trigonometric, and piecewise defined functions, including step functions.   34

   P.2.G Graph functions, including exponential, logarithmic, sine, cosine, rational, polynomial, and power functions and their transformations, including $af(x)$, $f(x) + d$, $f(x - c)$, $f(bx)$ for specific values of a, b, c, and d, in mathematical and real-world problems.   44

P.2.H	Graph arcsin x and arccos x and describe the limitations on the domain.	**8**
P.2.I	Determine and analyze the key features of exponential, logarithmic, rational, polynomial, power, trigonometric, inverse trigonometric, and piecewise defined functions, including step functions such as domain, range, symmetry, relative maximum, relative minimum, zeros, asymptotes, and intervals over which the function is increasing or decreasing.	**70**
P.2.J	Analyze and describe end behavior of functions, including exponential, logarithmic, rational, polynomial, and power functions, using infinity notation to communicate this characteristic in mathematical and real-world problems.	**4**
P.2.K	Analyze characteristics of rational functions and the behavior of the function around the asymptotes, including horizontal, vertical, and oblique asymptotes.	**8**
P.2.L	Determine various types of discontinuities in the interval $(-\infty, \infty)$ as they relate to functions and explore the limitations of the graphing calculator as it relates to the behavior of the function around discontinuities.	**6**
P.2.M	Describe the left-sided behavior and the right-sided behavior of the graph of a function around discontinuities.	
P.2.N	Analyze situations modeled by functions, including exponential, logarithmic, rational, polynomial, and power functions, to solve real-world problems.	**12**
P.2.O	Develop and use a sinusoidal function that models a situation in mathematical and real-world problems.	**4**
P.2.P	Determine the values of the trigonometric functions at the special angles and relate them in mathematical and real-world problems.	

P.3 **Relations and geometric reasoning. The student uses the process standards in mathematics to model and make connections between algebraic and geometric relations.**

P.3.A	Graph a set of parametric equations.	**6**
P.3.B	Convert parametric equations into rectangular relations and convert rectangular relations into parametric equations.	**2**
P.3.C	Use parametric equations to model and solve mathematical and real-world problems.	**22**
P.3.D	Graph points in the polar coordinate system and convert between rectangular coordinates and polar coordinates.	**10**
P.3.E	Graph polar equations by plotting points and using technology.	
P.3.F	Determine the conic section formed when a plane intersects a double-napped cone.	
P.3.G	Make connections between the locus definition of conic sections and their equations in rectangular coordinates.	**36**
P.3.H	Use the characteristics of an ellipse to write the equation of an ellipse with center (h, k).	**34**
P.3.I	Use the characteristics of a hyperbola to write the equation of a hyperbola with center (h, k).	**20**

P.4 **Number and measure. The student uses process standards in mathematics to apply appropriate techniques, tools, and formulas to calculate measures in mathematical and real-world problems.**

P.4.A	Determine the relationship between the unit circle and the definition of a periodic function to evaluate trigonometric functions in mathematical and real-world problems.	10
P.4.B	Describe the relationship between degree and radian measure on the unit circle.	2
P.4.C	Represent angles in radians or degrees based on the concept of rotation and find the measure of reference angles and angles in standard position.	20
P.4.D	Represent angles in radians or degrees based on the concept of rotation in mathematical and real-world problems, including linear and angular velocity.	
P.4.E	Determine the value of trigonometric ratios of angles and solve problems involving trigonometric ratios in mathematical and real-world problems.	34
P.4.F	Use trigonometry in mathematical and real-world problems, including directional bearing.	92
P.4.G	Use the Law of Sines in mathematical and real-world problems.	42
P.4.H	Use the Law of Cosines in mathematical and real-world problems.	48
P.4.I	Use vectors to model situations involving magnitude and direction.	80
P.4.J	Represent the addition of vectors and the multiplication of a vector by a scalar geometrically and symbolically.	50
P.4.K	Apply vector addition and multiplication of a vector by a scalar in mathematical and real-world problems.	96

P.5 **Algebraic reasoning. The student uses process standards in mathematics to evaluate expressions, describe patterns, formulate models, and solve equations and inequalities using properties, procedures, or algorithms.**

P.5.A	Evaluate finite sums and geometric series, when possible, written in sigma notation.	24
P.5.B	Represent arithmetic sequences and geometric sequences using recursive formulas.	50
P.5.C	Calculate the nth term and the nth partial sum of an arithmetic series in mathematical and real-world problems.	34
P.5.D	Represent arithmetic series and geometric series using sigma notation.	10
P.5.E	Calculate the nth term of a geometric series, the nth partial sum of a geometric series, and sum of an infinite geometric series when it exists.	72
P.5.F	Apply the Binomial Theorem for the expansion of $(a + b)^n$ in powers of a and b for a positive integer n, where a and b are any numbers.	76
P.5.G	Use the properties of logarithms to evaluate or transform logarithmic expressions.	76

P.5.H   Generate and solve logarithmic equations in mathematical and real-world problems.

P.5.I   Generate and solve exponential equations in mathematical and real-world problems.   54

P.5.J   Solve polynomial equations with real coefficients by applying a variety of techniques in mathematical and real-world problems.   42

P.5.K   Solve polynomial inequalities with real coefficients by applying a variety of techniques and write the solution set of the polynomial inequality in interval notation in mathematical and real-world problems.   2

P.5.L   Solve rational inequalities with real coefficients by applying a variety of techniques and write the solution set of the rational inequality in interval notation in mathematical and real-world problems.   12

P.5.M   Use trigonometric identities such as reciprocal, quotient, Pythagorean, cofunctions, even/odd, and sum and difference identities for cosine and sine to simplify trigonometric expressions.   116

P.5.N   Generate and solve trigonometric equations in mathematical and real-world problems.   86

Mathematical Models with Applications

M.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

M.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

M.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.

M.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.

M.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

M.1.E Create and use representations to organize, record, and communicate mathematical ideas.

M.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

M.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

M.2 **Mathematical modeling in personal finance. The student uses mathematical processes with graphical and numerical techniques to study patterns and analyze data related to personal finance.**

M.2.A Use rates and linear functions to solve problems involving personal finance and budgeting, including compensations and deductions.

M.2.B Solve problems involving personal taxes.

M.2.C Analyze data to make decisions about banking, including options for online banking, checking accounts, overdraft protection, processing fees, and debit card/ATM fees.

M.3 **Mathematical modeling in personal finance. The student uses mathematical processes with algebraic formulas, graphs, and amortization modeling to solve problems involving credit.**

M.3.A Use formulas to generate tables to display series of payments for loan amortizations resulting from financed purchases.

M.3.B Analyze personal credit options in retail purchasing and compare relative advantages and disadvantages of each option.

M.3.C Use technology to create amortization models to investigate home financing and compare buying a home to renting a home.

M.3.D Use technology to create amortization models to investigate automobile financing and compare buying a vehicle to leasing a vehicle.

M.4 **Mathematical modeling in personal finance. The student uses mathematical processes with algebraic formulas, numerical techniques, and graphs to solve problems related to financial planning.**

    M.4.A Analyze and compare coverage options and rates in insurance.

    M.4.B Investigate and compare investment options, including stocks, bonds, annuities, certificates of deposit, and retirement plans.

    M.4.C Analyze types of savings options involving simple and compound interest and compare relative advantages of these options.

M.5 **Mathematical modeling in science and engineering. The student applies mathematical processes with algebraic techniques to study patterns and analyze data as it applies to science.**

    M.5.A Use proportionality and inverse variation to describe physical laws such as Hook's Law, Newton's Second Law of Motion, and Boyle's Law.

    M.5.B Use exponential models available through technology to model growth and decay in areas, including radioactive decay.

    M.5.C Use quadratic functions to model motion.

M.6 **Mathematical modeling in science and engineering. The student applies mathematical processes with algebra and geometry to study patterns and analyze data as it applies to architecture and engineering.**

    M.6.A Use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in architecture.

    M.6.B Use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and non-proportional changes in surface area and volume as applied to fields.

    M.6.C Use the Pythagorean Theorem and special right-triangle relationships to calculate distances.

    M.6.D Use trigonometric ratios to calculate distances and angle measures as applied to fields.

M.7 **Mathematical modeling in fine arts. The student uses mathematical processes with algebra and geometry to study patterns and analyze data as it applies to fine arts.**

    M.7.A Use trigonometric ratios and functions available through technology to model periodic behavior in art and music.

    M.7.B Use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in art and photography.

    M.7.C Use geometric transformations, proportions, and periodic motion to describe mathematical patterns and structure in music.

    M.7.D Use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and non-proportional changes in surface area and volume as applied to fields.

M.8 **Mathematical modeling in social sciences. The student applies mathematical processes to determine the number of elements in a finite sample space and compute the probability of an event.**

    M.8.A Determine the number of ways an event may occur using combinations, permutations, and the Fundamental Counting Principle.

    M.8.B Compare theoretical to empirical probability.

    M.8.C Use experiments to determine the reasonableness of a theoretical model such as binomial or geometric.

M.9 **Mathematical modeling in social sciences. The student applies mathematical processes and mathematical models to analyze data as it applies to social sciences.**

    M.9.A Interpret information from various graphs, including line graphs, bar graphs, circle graphs, histograms, scatterplots, dot plots, stem-and-leaf plots, and box and whisker plots, to draw conclusions from the data and determine the strengths and weaknesses of conclusions.

    M.9.B Analyze numerical data using measures of central tendency (mean, median, and mode) and variability (range, interquartile range or IQR, and standard deviation) in order to make inferences with normal distributions.

    M.9.C Distinguish the purposes and differences among types of research, including surveys, experiments, and observational studies.

    M.9.D Use data from a sample to estimate population mean or population proportion.

    M.9.E Analyze marketing claims based on graphs and statistics from electronic and print media and justify the validity of stated or implied conclusions.

    M.9.F Use regression methods available through technology to model linear and exponential functions, interpret correlations, and make predictions.

M.10 **Mathematical modeling in social sciences. The student applies mathematical processes to design a study and use graphical, numerical, and analytical techniques to communicate the results of the study.**

    M.10.A Formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions.

    M.10.B Communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project through the use of one or more of the following: a written report, a visual display, an oral report, or a multi-media presentation.

Advanced Quantitative Reasoning

Q.1 **Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding.**

Q.1.A Apply mathematics to problems arising in everyday life, society, and the workplace.

Q.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.

Q.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.

Q.1.D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

Q.1.E Create and use representations to organize, record, and communicate mathematical ideas.

Q.1.F Analyze mathematical relationships to connect and communicate mathematical ideas.

Q.1.G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Q.2 **Numeric reasoning. The student applies the process standards in mathematics to generate new understandings by extending existing knowledge. The student generates new mathematical understandings through problems involving numerical data that arise in everyday life, society, and the workplace. The student extends existing knowledge and skills to analyze real-world situations.**

Q.2.A Use precision and accuracy in real-life situations related to measurement and significant figures. 62

Q.2.B Apply and analyze published ratings, weighted averages, and indices to make informed decisions. 6

Q.2.C Solve problems involving quantities that are not easily measured using proportionality.

Q.2.D Solve geometric problems involving indirect measurement, including similar triangles, the Pythagorean Theorem, Law of Sines, Law of Cosines, and the use of dynamic geometry software.

Q.2.E Solve problems involving large quantities using combinatorics. 144

Q.2.F Use arrays to efficiently manage large collections of data and add, subtract, and multiply matrices to solve applied problems, including geometric transformations. 198

Q.2.G Analyze various voting and selection processes to compare results in given situations.

Q.2.H Select and apply an algorithm of interest to solve real-life problems such as problems using recursion or iteration involving population growth or decline, fractals, and compound interest; the validity in recorded and transmitted data using checksums and hashing; sports rankings, weighted class rankings, and search engine rankings; and problems involving scheduling or routing situations using vertex-edge graphs, critical paths, Euler paths, and minimal spanning trees and communicate to peers the application of the algorithm in precise mathematical and nontechnical language.

Q.3 **Algebraic reasoning (expressions, equations, and generalized relationships). The student applies the process standards in mathematics to create and analyze mathematical models of everyday situations to make informed decisions related to earning, investing, spending, and borrowing money by appropriate, proficient, and efficient use of tools, including technology. The student uses mathematical relationships to make connections and predictions. The student judges the validity of a prediction and uses mathematical models to represent, analyze, and solve dynamic real-world problems.**

Q.3.A Collect numerical bivariate data to create a scatterplot, select a function to model the data, justify the model selection, and use the model to interpret results and make predictions.   70

Q.3.B Describe the degree to which uncorrelated variables may or may not be related and analyze situations where correlated variables do or do not indicate a cause-and-effect relationship.   30

Q.3.C Determine or analyze an appropriate growth or decay model for problem situations, including linear, exponential, and logistic functions.

Q.3.D Determine or analyze an appropriate cyclical model for problem situations that can be modeled with periodic functions.

Q.3.E Determine or analyze an appropriate piecewise model for problem situations.   2

Q.3.F Create, represent, and analyze mathematical models for various types of income calculations to determine the best option for a given situation.

Q.3.G Create, represent, and analyze mathematical models for expenditures, including those involving credit, to determine the best option for a given situation.

Q.3.H Create, represent, and analyze mathematical models and appropriate representations, including formulas and amortization tables, for various types of loans and investments to determine the best option for a given situation.

Q.4 **Probabilistic and statistical reasoning. The student uses the process standards in mathematics to generate new understandings of probability and statistics. The student analyzes statistical information and evaluates risk and return to connect mathematical ideas and make informed decisions. The student applies a problem-solving model and statistical methods to design and conduct a study that addresses one or more particular question(s). The student uses multiple representations to communicate effectively the results of student-generated statistical studies and the critical analysis of published statistical studies.**

Q.4.A	Use a two-way frequency table as a sample space to identify whether two events are independent and to interpret the results.	12
Q.4.B	Use the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), in mathematical and real-world problems.	36
Q.4.C	Calculate conditional probabilities and probabilities of compound events using tree diagrams, Venn diagrams, area models, and formulas.	128
Q.4.D	Interpret conditional probabilities and probabilities of compound events by analyzing representations to make decisions in problem situations.	24
Q.4.E	Use probabilities to make and justify decisions about risks in everyday life.	2
Q.4.F	Calculate expected value to analyze mathematical fairness, payoff, and risk.	78
Q.4.G	Determine the validity of logical arguments that include compound conditional statements by constructing truth tables.	
Q.4.H	Identify limitations and lack of relevant information in studies reporting statistical information, especially when studies are reported in condensed form.	4
Q.4.I	Interpret and compare statistical results using appropriate technology given a margin of error.	8
Q.4.J	Identify potential misuses of statistics to justify particular conclusions, including assertions of a cause-and-effect relationship rather than an association, and missteps or fallacies in logical reasoning.	8
Q.4.K	Describe strengths and weaknesses of sampling techniques, data and graphical displays, and interpretations of summary statistics and other results appearing in a study, including reports published in the media.	68
Q.4.L	Determine the need for and purpose of a statistical investigation and what type of statistical analysis can be used to answer a specific question or set of questions.	4
Q.4.M	Identify the population of interest for a statistical investigation, select an appropriate sampling technique, and collect data.	92
Q.4.N	Identify the variables to be used in a study.	16
Q.4.O	Determine possible sources of statistical bias in a study and how bias may affect the validity of the results.	30
Q.4.P	Create data displays for given data sets to investigate, compare, and estimate center, shape, spread, and unusual features of the data.	26

Q.4.Q Analyze possible sources of data variability, including those that can be controlled and those that cannot be controlled.　**6**

Q.4.R Report results of statistical studies to a particular audience, including selecting an appropriate presentation format, creating graphical data displays, and interpreting results in terms of the question studied.

Q.4.S Justify the design and the conclusion(s) of statistical studies, including the methods used.　**32**

Q.4.T Communicate statistical results in oral and written formats using appropriate statistical and nontechnical language.　**2**