

**ELEMENTARY MATHEMATICS  
CURRICULUM STANDARDS  
K-8**

**Catholic Schools Office  
Diocese of Phoenix  
June, 2008**

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K-8**

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**June, 2008**

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June, 2008

The Catholic Schools office of the Diocese of Phoenix expresses gratitude to the Elementary Mathematics Curriculum Committee for its work in revising and updating the Elementary Mathematics Curriculum Standards K-8.

Mathematics is recognized as a great example of God's gift of the human mind and its capacity in understanding creation for the betterment of all mankind.

Mathematics is basic to our daily lives. Mathematical truths and methods can be used to solve problems in the real world. It provides tools for research, enables the analysis of economic trends to make informed decisions in health care, weather forecasting, space exploration, and foreign policies, to name a few, along with the vast myriad of ordinary day-to-day life decisions.

Teachers are expected to be creative as they teach their students how to correctly use new mathematical tools, communication media, and technology to solve cross-curricular problems and integration.

It is our hope that these standards assist our schools and teachers in developing in our students an interest, curiosity, and mastery in Mathematics as they recognize the integration of Catholic/Christian values that involves beliefs, communications, and technology.

Sincerely

MaryBeth Mueller  
Superintendent of Catholic Schools  
Executive Director of the Division of Education and Evangelization

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## INTRODUCTION

The Mathematics Standards of the Diocese of Phoenix are based on and aligned with the *Arizona Academic Content Standards: Mathematics* approved 03/31/2003 and updated 08/12/2003 <http://www.ade.state.az.us/standards/math/articulated.asp>. The Diocese of Phoenix Elementary Mathematics Standards meet and exceed the Arizona State Standards.

In addition the Elementary Mathematics Committee of the Diocese of Phoenix consulted and incorporated within the Standards the *Principles and Standards of School Mathematics K-12 (2000)* and the *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence (2006)* from the National Council of Teachers of Mathematics.

The Code used in this document is:

- Mathematics Standard Articulated by Grade Level
- Grade Level
- Strand
- Concept
- PO Performance Objectives as they appear in the State document-sequence remains
- DPO Diocesan Performance Objectives numbered in sequence

For Curriculum Mapping purposes the following brief form can be used:

- MATH 5.S1.C1.PO1 (M5.S1.C1.PO1)
- Mathematics Grade 5. Strand 1.Concept 1.Performance Objective 1

# **ELEMENTARY MATHEMATICS CURRICULUM STANDARDS**

## **PHILOSOPHY**

The Elementary Mathematics Curriculum Standards outline the essential components of the Mathematics curriculum for each grade level (K-8) for the Catholic Schools of the Diocese of Phoenix. The overall academic, personal, spiritual, and physical development of the child is an integral part of these standards necessary for functioning and contributing to society in the 21<sup>st</sup> Century. Mathematics is recognized as a great example of God's gift of the human mind and its capacity in understanding creation for the betterment of all mankind.

As educators in today's global society, we are challenged to fully understand and expand mathematical accomplishments to assure a peaceful, productive, and more equitable world. Our daily lives are increasingly mathematical and technological. Understanding and applying quantitative skills and solving real-life problems are essential educational goals. All students are given the opportunity to learn and understand mathematical concepts. Teaching strategies and learning experiences must be varied, meaningful, and engaging to students.

Students need to learn how to correctly use new tools, communication media, and technology to solve cross-curricular mathematical problems. Mastery of computational skills, proper mathematical terminology, and uniform problem solving techniques should be accomplished at the appropriate grade level. The students are led to raise questions, to think critically and creatively, to apply mathematical skills, concepts, and technology, and to participate in discussions. It is through communication and collaboration that we will advance our students towards a deeper appreciation and knowledge of mathematics.

## **GOALS**

The goals for the Elementary Mathematics Curriculum Standards are that all students will develop:

- an understanding of the mathematical skills and concepts necessary for problem-solving and critical thinking.
- an interest and curiosity to communicate and have a deeper appreciation and knowledge of mathematics.
- a recognition that mathematics integrates Catholic/Christian values that involve beliefs, communications, and technology.
- a mastery and application of specific mathematics skills as accomplished at the appropriate grade level.
- an understanding of the practical relationship of mathematics, along with a sense of mastery and appreciation for its power and beauty, in everyday life.

## KINDERGARTEN

### STRAND 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Number Sense</b>
	Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.
DPO1	Make a model to represent a given whole number 0-31.
DPO2	Identify orally a whole number represented by a model with a word name and symbol 0-31.
DPO3	Count from any number, forward or backwards, 1-31.
DPO4	Understand concepts: few, many, more, less, equal, zero.
PO4	Identify whole numbers through 20 in or out of order.
PO5	Write whole numbers through 20 in or out of order.
PO6	Construct equivalent forms of whole numbers, using manipulatives, through 10.
PO7	Compare two whole numbers through 20.
DPO5	Recognize the ordinal numbers through the 10 <sup>th</sup> place.
DPO6	Count objects to 100.
PO9	Order three or more whole numbers through 20 (least to greatest or greatest to least).
PO10	Identify penny, nickel, dime, quarter, and dollar using manipulatives or pictures.

	<b>CONCEPT 2: Numerical Operations</b>
	Understand and apply numerical operations and their relationship to one another.
PO1	Model addition through sums of 10 using manipulatives.

Concept 2 – Continued

PO2	Model subtraction through minuends of 10 using manipulatives.
PO3	Select the operation to solve word problems using numbers 0 through 9.
PO4	Solve word problems presented orally using addition or subtraction with numbers through 9.
DPO1	Understand concepts: minus, plus.
PO5	Identify the symbols: +, -, =, .
PO6	Use grade-level appropriate mathematical terminology.
DPO2	Count by 2's, 5's and 10's.
DPO3	Fractions: Recognize equal and unequal parts of a whole.
DPO4	Fractions: Identify equal halves.

	<b>CONCEPT 3: Estimation</b>
	Use estimation strategies reasonably and fluently.
PO1	Solve problems using a variety of mental computations and reasonable estimations.

**STRAND 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Data Analysis (Statistics)</b>
	Understand and apply data collection, organization and representation to analyze and sort data.
DPO1	Collect, organize and describe simple data.
PO1	Formulate questions to collect data in contextual situations.
DPO2	Interpret a pictograph and a bar graph.

Concept 1 – Continued

PO3	Answer questions about a pictograph and bar graph.
PO4	Formulate questions based on data displayed in graphs, charts and tables.
DPO3	Understand tallying.

	<p><b>CONCEPT 3: Discrete Mathematics-Systematic Listing and Systematic Counting</b>            Understand and demonstrate the systematic listing and counting of possible outcomes.</p>
PO1	Make arrangements that represent the number of combinations that can be formed by pairing items taken from two sets, using manipulatives (e.g., How many outfits can one make with 2 different color shirts and 2 different pairs of pants?).

	<p><b>CONCEPT 4: Vertex-Edge Graphs</b>            Understand and apply vertex-edge graphs.</p>
PO1	Color pictures with the least number of colors so that no common edges share the same colors (increased complexity K-5).

**STRAND 3: Patterns, Algebra, and Functions**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<p><b>CONCEPT 1: Patterns</b>            Identify patterns and apply pattern recognition to reason mathematically.</p>
DPO1	Create, describe and extend a variety of patterns, using concrete objects.
DPO2	Recognize that the same patterns can emerge from a variety of manipulatives and real-world situations.

## STRAND 4: Geometry and Measurement

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Geometric Properties</b>	
	Analyze the attributes and properties of 2- and 3- dimensional shapes and develop mathematical arguments about their relationships.
PO1	Identify 2-dimensional shapes by attribute (size, shape, number of sides).
DPO1	Compare, classify, draw and make models of shapes.
PO2	Identify concepts and terms of position and size in contextual situations: <ul style="list-style-type: none"> <li>• Inside/outside,</li> <li>• Above/below/between</li> <li>• Smaller/larger, and</li> <li>• Longer/shorter.</li> </ul>
PO3	Identify shapes in different environments (e.g. nature, buildings, classroom).
DPO2	Recognize geometry in their surroundings <ul style="list-style-type: none"> <li>• Identify days, weeks, months on calendar</li> <li>• Understand concepts: yesterday, today, tomorrow, last night, etc.</li> <li>• Tell time to the hour.</li> </ul>

<b>CONCEPT 4: Measurement- Units of Measure /Geometric Objects</b>	
	Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
DPO1	Recognize that a single object has different attributes (e.g., length, color, size, texture) that can be measured in different ways.
DPO2	Verbally and physically compare objects according to observable and measurable attributes.
PO3	Order objects according to observable and measurable attributes.
DPO3	Compare capacity, sizes, temperatures, and weights.

## STRAND 5: Structure and Logic

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b> Use reasoning to solve mathematical problems in contextual situations.
DPO1	Use a variety of puzzles and games involving counting problems

	<b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b> Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.
PO1	Sort objects according to observable attributes.
PO2	Provide rationale for classifying objects according to observable attributes (color, size, shape, weight, etc.).
DPO1	Using attributes of objects to problem solve.

## GRADE 1

### STRAND 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Number Sense</b> Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.
PO1	Make a model to represent a given whole number 0 through 100
PO2	Identify a whole number represented by a model with a word name and symbol 0 to 100.
PO3	Count aloud forward or backward in consecutive order (0 through 100)
PO4	Identify whole numbers through 100 in or out of order.
PO5	Write whole numbers through 100 in or out of order.
PO6	Construct equivalent forms of whole numbers using manipulatives or symbols through 99.
PO7	State verbally whole numbers through 100 using correct place values.
PO8	Construct models to represent place value concepts for the ones and tens places.
PO9	Apply expanded notation to model place value through 99.
PO10	Identify odd and even whole numbers through 100.
PO11	Compare two whole numbers through 100.
PO12	Use ordinal numbers through tenth and show position.
PO13	Order three or more whole numbers through 100 (least to greatest, greatest to least).
DPO 1	Make models that represent given fractions. (halves, thirds, fourths, eighths and tenths).
DPO 2	Identify in symbols and in words a model that is divided into equal fractional parts (halves, thirds, fourths, eighths and tenths).
PO16	Identify money by name and value: penny, nickel, dime, quarter, and one dollar.

Concept 1 – Continued

PO17	Count money through \$1.00 using coins.
PO18	Identify the value of a collection of coins using the cent and dollar symbols.
DPO 3	Name digits in ones and tens place.
DPO 4	Round numbers to nearest ten.
DPO 5	Write whole numbers in expanded notation.

	<b>CONCEPT 2: Numerical Operations</b>
	Understand and apply numerical operations and their relationship to one another.
PO1	Demonstrate the process of addition through sums of 20 using manipulatives.
PO2	Demonstrate the process of subtraction with minuends of 20 using manipulatives.
PO3	State addition facts for sums through 18 and subtraction for differences with minuends through 9 or less.
PO4	Add one and two digit whole numbers without regrouping.
PO5	Subtract one and two digit whole numbers without regrouping.
PO6	Select the grade level appropriate operation to solve word problems.
PO7	Solve word problems using addition and subtraction of 2 digit numbers without regrouping.
PO8	Count by multiples to show the process of multiplication (2's, 5's, and 10's).
PO9	Demonstrate families of equations for addition and subtraction through 18.
PO10	Demonstrate the identity and commutative properties of addition through 18.
PO11	Identify addition and subtraction as inverse operations.
PO12	Apply the symbols: +, -, =.
DPO 1	Write equations.
PO13	Use grade-level appropriate mathematical terminology.

Concept 2 – Continued

PO14	Demonstrate addition of fractions with like denominators (halves) using models.
PO15	Demonstrate subtraction of fractions with like denominators (halves) using models.
PO16	Add and subtract money without regrouping using manipulatives and paper and pencil through 99¢.
DPO 2	Use the symbols $<$ , $>$ , $=$ to compare whole numbers.

	<b>CONCEPT 3: Estimation</b>
	Use estimation strategies reasonably and fluently.
PO1	Solve problems using a variety of mental computations and reasonable estimation.
PO2	Estimate the measurement of an object using U.S. customary standard and non-standard units of measurement.
DPO 1	Estimate the number of objects in a set.

**STRAND 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Data Analysis (Statistics)</b>
	Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.
PO2	Make a simple pictograph or tally chart with appropriate labels from organized data.
PO3	Interpret pictographs using terms such as most, least, equal, more than, less than, and greatest.
PO4	Answer questions about pictographs using terms such as most, least, equal, more than, less than, and greatest.
PO5	Formulate questions based on graphs, charts, and tables.

Concept 1 – Continued

PO6	Solve problems using graphs, charts, and tables.
DPO 1	Collect and record data from surveys or experiments.
DPO 2	Organize information from surveys or experiments, write a title to represent the main idea of a graph.
DPO 3	Locate points on a line graph using ordered pairs.
DPO 4	Draw conclusions from graphed data.

	<p><b>CONCEPT 3: Discrete Mathematics- Systematic Listing and Systematic Counting</b></p> <p>Understand and demonstrate the systematic listing and counting of possible outcomes.</p>
PO1	Make arrangements that represent the number of combinations that can be formed by pairing items taken from two sets, using manipulatives.
DPO 1	Recognize that the same patterns can emerge from a variety of manipulatives and real-world situations.

	<p><b>CONCEPT 4: Vertex-Edge Graphs</b></p> <p>Understand and apply vertex-edge graphs.</p>
PO1	Color pictures with the least number of colors so that no common edges share the same colors (increased complexity K-5)

### STRAND 3: Patterns, Algebra, and Functions

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Patterns</b> Identify patterns and apply pattern recognition to reason mathematically.
PO1	Communicate a grade level appropriate pattern.
PO2	Extend a simple grade level appropriate repetitive pattern.
PO3	Create grade level appropriate patterns.
DPO 1	Create, describe and extend a variety of patterns, using concrete objects.
DPO 2	Predict and extend a given pattern occurring in a sequence of numbers.
DPO 3	Make predictions based on a given pattern.

	<b>CONCEPT 3: Algebraic Representations</b> Represent and analyze mathematical situations and structures using algebraic representations.
PO1	Use variables in contextual situations.
DPO 1	Find the missing elements in number sentences.

	<b>CONCEPT 4: Analysis of Change</b> Analyze change in a variable over time and in various contexts.
PO1	Identify the change in a variable over time.
PO2	Make simple predictions based on a variable

## STRAND 4: Geometry and Measurement

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Geometric Properties</b>	
	Analyze the attributes and properties of 2- and 3- dimensional shapes and develop mathematical arguments about their relationships.
PO1	Use the words vertex and side when describing simple 2-dimensional geometric shapes.
PO2	Identify 2-dimensional shapes by attribute.
PO3	Use concepts and terms of position and size in contextual situations: Inside/Outside, left/right, above/below/between, smaller/larger, longer/shorter.
PO5	Draw 2-dimensional shapes.
PO6	Recognize where a line of symmetry divides a two dimensional shapes into mirror images.
DPO 1	Identify 3-dimensional figures by name or attributes.
DPO 2	Compare attributes of 2-dimensional shapes.

<b>CONCEPT 2: Transformation of Shapes</b>	
	Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.
PO1	Recognize same shape in different positions (slide/ translations)
DPO1	Build geometric shapes with other common shapes (tangrams, pattern blocks)

<b>CONCEPT 4: Measurement- Units of Measure /Geometric Objects</b>	
	Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
PO1	Compare the measurable characteristics of two objects (e.g., length weight, and size).
PO2	Select the appropriate measure of accuracy: length, capacity/volume, mass/weight.

Concept 4 – Continued

PO3	Tell time to the hour using analog and digital clocks.
PO4	Name the days of the week for yesterday, today, and tomorrow.
PO5	Name the 12 months of the year in proper order, starting with January.
PO6	Name the 7 days of the week in proper order, starting with Sunday.
PO7	Measure a given object using the appropriate unit of measure: length, capacity, mass/volume.
DPO 1	Measure a given characteristic of an object using non-standard units of measure.
DPO 2	Determine dates on a calendar.
DPO 3	Estimate a measurement.

**STRAND 5: Structure and Logic**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b> Use reasoning to solve mathematical problems in contextual situations
PO1	Create problems based on contextual situations (addition facts up to 18 and subtraction facts from 9)

	<b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b> Evaluate situations, select problem solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.
PO1	List the quantitative components found in word problems.
PO2	Provide rationale for classifying objects according to observable attributes (color, size, shape, weight, etc.)
DPO 1	Extend a pattern using inductive reasoning.
DPO 2	Select the information necessary to solve a given problem.

## GRADE 2

### STRAND 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Number Sense</b> Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.
PO1	Make a model to represent a given whole number 0 through 999.
PO2	Identify a whole number represented by a model with a word name and symbol 0 to 999.
PO3	Count aloud forward or backward in consecutive order (0 through 999)
PO4	Identify whole numbers through 999 in or out of order.
DPO 1	State verbally and write whole numbers through 999 using correct place value.
PO6	State equivalent forms of whole numbers using multiples of tens through 1,000.
PO8	Construct models to represent place value concepts for the ones, tens, and hundreds.
PO9	Apply expanded notation to model place value through 999.
PO10	Identify odd and even whole numbers (including 0) through 999.
DPO 2	Compare and order whole numbers through 1,000.
PO12	Use ordinal numbers.
DPO 3	Identify and make models that represent given fractions (halves, thirds, and fourths).
DPO 4	Identify fractions represented by a model with a word name and symbol (halves, thirds, fourths, eighths and tenths).

Concept 1 – Continued

PO16	Count money through five dollars using manipulatives and pictures of bills and coins.
PO17	Identify the value of a collection of money using the cent and dollar symbols up to \$5.00.
PO18	Use decimals through hundredths in contextual situations with money.
PO19	Compare two decimals using money through hundredths using models, illustrations or symbols.
DPO 5	Make change with coins up to \$1.00.
DPO 6	Recognize Roman Numerals 1 through 20.
PO20	Distinguish the equivalency among decimals, fractions, and percents.

	<b>CONCEPT 2: Numerical Operations</b>
	Understand and apply numerical operations and their relationship to one another.
PO1	Demonstrate the process of addition through two 3 digit whole numbers using manipulatives.
PO2	Demonstrate the process of subtraction using manipulatives with two digit whole numbers.
PO3	State addition and subtraction facts for sums.
PO4	Add one and two digit whole numbers without regrouping.
PO5	Subtract one and two digit whole numbers without regrouping.
PO6	Add three one or two digit addends.
PO7	Select the grade level appropriate operation to solve word problems.
DPO 1	Solve word problems using addition and subtraction of two 2 and 3 digit numbers, with regrouping.
DPO 2	Demonstrate with models to show the process used in multiplication (uses repeated addition, counts by multiples, combines things that come in groups of equal size, make arrays, uses area models).
DPO 3	Demonstrate with models to show the process used in division (put things in groups of equal size, shares equally, uses repeated subtraction).
DPO 4	Demonstrate multiplication and division facts (1's, 2's, 3's, 4's, 5's, 10's).

Concept 2 – Continued

PO11	Demonstrate the associative property of addition.
PO12	Apply grade level appropriate properties to assist in computation.
PO13	Apply symbols: +, -, x, ÷, =, ≠, <, >, %
PO14	Use grade level appropriate mathematical terminology.
DPO 5	Demonstrate addition and subtraction of fractions with like denominators (halves, thirds, fourths) using models.
PO 17	Add and subtract money without regrouping using manipulatives and paper and pencil through \$5.00.

	<b>CONCEPT 3: Estimation</b>
	Use estimation strategies reasonably and fluently.
PO1	Solve problems using a variety of mental computations and reasonable estimation.
PO2	Estimate the measurement of an object using U.S. customary standard and non-standard units of measurement.
PO3	Compare and estimate to the actual measure.
PO4	Evaluate the reasonableness of estimate.

**STRAND 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Data Analysis (Statistics)</b>
	Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.
DPO 1	Make a graph (horizontal bar, vertical bar, pictograph or tally chart) with appropriate labels from organized data.

Concept 1 – Continued

PO3	Interpret pictographs using terms such as most, least, equal, more than, less than, and greatest.
PO4	Answer questions about a pictograph using terms such as most, least, equal, more than, less than, and greatest.
DPO 2	Answer questions about a circle graph divided into halves and fourths.
PO5	Formulate questions based on graphs, charts, and tables.
PO6	Solve problems using graphs, charts and tables.
DPO 3	Write a title representing the main idea of a graph.
DPO 4	Locate points on a line graph using ordered pairs.
DPO 5	Draw conclusions from graphed data.

	<b>CONCEPT 2: Probability</b>
	Understand and apply the basic concepts of probability.
DPO 1	Organize (sorting, sequencing and tallying) and name outcomes for a probability experiment.
PO2	Predict the most likely or least likely outcome in probability experiments.
PO3	Predict the outcome of a grade level appropriate probability experiment.
PO4	Record the data from performing a grade level appropriate probability experiment.
PO5	Compare the outcome of an experiment to predictions made prior to performing the experiment.
PO6	Compare the results of two repetitions of the same grade level appropriate probability experiment.

	<b>CONCEPT 3: Discrete Mathematics Systematic Listing and Counting</b>
	Understand and demonstrate the systematic listing and counting of possible outcomes.
PO1	Make arrangements that represent the number of combinations that can be formed by pairing items taken from two sets, using manipulatives.

	<b>CONCEPT 4: Vertex-Edge Graphs</b> Understand and apply vertex-edge graphs.
PO1	Color pictures with the least number of colors so that no common edges share the same colors (increased complexity K-5).

### **STRAND 3: Patterns, Algebra, and Functions**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Patterns</b> Identify patterns and apply pattern recognition to reason mathematically.
PO1	Communicate a grade level appropriate pattern using symbols or numbers.
PO2	Extend a grade level appropriate repetitive pattern.
DPO 1	Create a pattern using a model (symbolically: numbers or letters; visually: shapes, designs, numbers or pictures; auditorially: clapping, singing or listening; and kinesthetically: dancing, movement or tactile).
DPO 2	Communicate orally or in written form a given pattern occurring in a sequence of numbers.

	<b>CONCEPT 2: Functions and Relationships</b> Describe and model functions and their relationships.
PO1	Describe the rule used in simple grade level appropriate functions.

	<b>CONCEPT 3: Algebraic Representations</b> Represent and analyze mathematical situations and structures using algebraic representations.
PO1	Use variables in contextual situations.
DPO 1	Describe in a given situation how a change in one variable results in a change of another variable.
PO2	Find the missing element (addend, subtrahend, minuend, sum, difference) in addition and subtraction number sentences for sums through 18 and minuends through 9.

	<b>CONCEPT 4: Analysis of Change</b> Analyze change in a variable over time and in various contexts.
PO1	Identify the change in a variable over time.
PO2	Make simple predictions based on a variable.

### **STRAND 4: Geometry and Measurement**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Geometric Properties</b> Analyze the attributes and properties of 2- and 3- dimensional shapes and develop mathematical arguments about their relationships.
DPO 1	Identify draw and compare two and three dimensional shapes by name and attributes.
PO2	Recognize congruent shapes.
PO3	Recognize line (s) of symmetry for a two dimensional shape.

	<b>CONCEPT 2: Transformation of Shapes</b> Apply spatial reasoning to create transformations and use symmetry to analyze the mathematical situations.
PO1	Recognize the same shape in different positions.
DPO1	Build geometric shapes with other common shapes.

	<b>CONCEPT 3: Coordinate Geometry</b> Specify and describe spatial relationships using coordinate geometry and other representational systems
DPO1	Use discrete mathematical models for graphs to represent everyday situations (e.g., determine how many ways to move from point A to point B on a grid).

<b>CONCEPT 4: Measurement- Units of Measure /Geometric Objects</b>	
	Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
PO1	Identify the type of measure for each attribute of an object.
PO2	Select the appropriate U.S. customary measure of accuracy: length, capacity/volume, mass/weight.
DPO 1	Tell time to the nearest minute using analog and digital clocks.
PO4	Determine the passage of time using units of days and weeks within a month using a calendar.
PO5	Select the appropriate tool to measure the given characteristics of an object.
PO6	Measure a given object using the appropriate unit of measure (length: inches, miles; Capacity/Volume: pints, quarts; Mass/ Weight: ounces).
PO7	State equivalent relationships (12 inches = 1 foot, 60 minutes = 1 hour, 24 hours = 1 day, 7 days = 1 week, 12 months = 1 year; 100 pennies = 1 dollar, 10 dimes = 1 dollar, 4 quarters = 1 dollar).
DPO 2	Read a thermometer in Celsius and Fahrenheit to the nearest degree.
DPO 3	Round to the nearest dollar.

### **STRAND 5: Structure and Logic**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b>	
PO1	Create contextual problems that require addition or subtraction with one or two digit numbers.

	<p align="center"><b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b></p> <p>Evaluate situations, select problem-solving strategies, draw conclusions, develop and describe solutions and recognize their application.</p>
PO1	Identify the concepts “sum, every and many” within the context of logical reasoning.
PO2	Identify the concepts “all and none” within the context of logical reasoning.
DPO 1	Select the information necessary to solve a given problem.

## GRADE 3

### Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Number Sense</b>	
Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.	
PO1	Read whole numbers in contextual situations (through six-digit numbers).
PO2	Identify six-digit whole numbers in or out of order.
DPO 1	Read aloud a whole number with correct place value words through thousands.
PO3	Write whole numbers through six-digits in or out of order.
PO4	State whole numbers, through six-digits, with correct place value, by using models, illustrations, symbols, or expanded notation (e.g., $53,941 = 50,000 + 3,000 + 900 + 40 + 1$ ).
PO5	Construct models to represent place value concepts for the one's, ten's, and hundred's places.
PO6	Apply expanded notation to model place value through 9,999 (e.g., $5,378 = 5,000 + 300 + 70 + 8$ ).
DPO 2	Write whole numbers in expanded notation.
PO7	Sort whole numbers into sets containing only odd numbers or only even numbers.
PO8	Compare two whole numbers, through six-digits.
DPO 3	Use the symbols $< > =$ to compare whole numbers.
PO9	Order three or more whole numbers through six-digit numbers (least to greatest, or greatest to least).
PO10	Make models that represent proper fractions (halves, thirds, fourths, eighths, and tenths).

Concept 1 – Continued

PO11	Identify symbols, words, or models that represent proper fractions (halves, thirds, fourths, eighths and tenths).
DPO 4	Identify the fraction represented by a model with a word name and symbol.
PO12	Use proper fractions in contextual situations.
PO13	Compare two proper fractions with like denominators.
PO14	Order three or more proper fractions with like denominators (halves, thirds, fourths, eighths, and tenths).
PO15	Count amounts of money through \$20.00 using pictures or actual bills and coins.
PO16	Use decimals through hundredths in contextual situations.
PO17	Compare two decimals, through hundredths, using models, illustrations, or symbols.
PO18	Order three or more decimals, through hundredths, using models, illustrations, or symbols.
PO19	Determine the equivalency among decimals, fractions, and percents (e.g., half-dollar = 50¢ = 50% and $1/4 = 0.25 = 25%$ ).
PO20	Identify whole-number factors and/or pairs of factors for a given whole number through 24.
PO21	Determine multiples of a given whole number with products through 24 (skip counting).
DPO 5	Use grade-level appropriate mathematical terminology for number sense.

	<b>CONCEPT 2: Numerical Operations</b>
	Understand and apply numerical operations and their relationship to one another.
PO1	Demonstrate the process of subtraction using manipulatives through three-digit whole numbers.
PO2	Add two three-digit whole numbers.
DPO 1	Add and subtract 2 three digit whole numbers with regrouping in written and manipulative form.

Concept 2 – Continued

PO3	Subtract two three-digit whole numbers.
DPO 2	Demonstrates with models the operations of subtraction up to 2 - 3digit whole numbers.
PO4	Add a column of numbers.
DPO 3	Demonstrate with models to show process used in addition.
PO5	Select the grade-level appropriate operation to solve word problems.
PO6	Solve word problems using grade-level appropriate operations and numbers.
PO7	Demonstrate the process of multiplication as repeatedly adding the same number, counting by multiples, combining equal sets, and making arrays.
PO8	Demonstrate the process of division with one-digit divisors (separating elements of a set into smaller equal sets, sharing equally, or repeatedly subtracting the same number).
PO9	Demonstrate families of equations for multiplication and division through 9s.
PO10	State multiplication and division facts through 9s.
PO11	Demonstrate the commutative and identity properties of multiplication.
PO12	Identify multiplication and division as inverse operations.
PO13	Apply grade-level appropriate properties to assist in computation.
PO14	Apply the symbols: $\times$ , $\div$ , $/$ , $*$ , $\%$ , and the grouping symbols ( ) and “,”.
DPO 4	Apply mathematical operations in everyday situations.
PO15	Use grade-level appropriate mathematical terminology.
PO16	Add or subtract fractions with like denominators (halves, thirds, fourths, eighths, and tenths) appropriate to grade level.
DPO 5	Demonstrate with models addition and subtraction of fractions with common denominators.
PO17	Apply addition and subtraction in contextual situations, through \$20.00.

	<b>CONCEPT 3 - Estimation</b> Use estimation strategies reasonably and fluently.
PO1	Solve grade-level appropriate problems using estimation.
PO2	Estimate length and weight using U.S. customary units.
PO3	Record estimated and actual linear measurements for real-life objects (e.g., length of fingernail; height of desk).
PO4	Compare estimations of appropriate measures to the actual measures.
PO5	Evaluate the reasonableness of estimated measures.

## **Strand 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Data Analysis (Statistics)</b> Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.
DPO 1	Collect and record data from surveys or experiments.
PO2	Construct a horizontal bar, vertical bar, pictograph, or tally chart with appropriate labels and title from organized data.
PO3	Interpret data found in line plots, pictographs, and single-bar graphs (horizontal and vertical).
DPO 2	Identify largest, smallest, mode and median using sorted data.
PO4	Answer questions based on data found in line plots, pictographs, and single-bar graphs (horizontal and vertical).
PO5	Formulate questions based on graphs, charts, and tables to solve problems.
PO6	Solve problems using graphs, charts and tables.
DPO 3	Use grade-level appropriate mathematical terminology for data analysis.

<b>CONCEPT 2: Probability</b>	
	Understand and apply the basic concepts of probability.
PO1	Name the possible outcomes for a probability experiment.
PO2	Make predictions about the probability of events being more likely, less likely, equally likely or unlikely.
PO3	Predict the outcome of a grade-level appropriate probability experiment.
PO4	Record the data from performing a grade-level appropriate probability experiment.
PO5	Compare the outcome of an experiment to predictions made prior to performing the experiment.
PO6	Compare the results of two repetitions of the same grade-level appropriate probability experiment.
DPO 1	Compare data from probability experiments where the experiments are performed a different number of times with the given expected outcomes.
DPO 2	Use grade-level appropriate mathematical terminology for probability.

<b>CONCEPT 3: Discrete Mathematics-Systematic Listing and Counting</b>	
	Understand and demonstrate the systematic listing and counting of possible outcomes.
PO1	Make a diagram to represent the number of combinations available when 1 item is selected from each of 3 sets of 2 items (e.g., 2 different shirts, 2 different hats, 2 different belts).
DPO 1	Use grade-level appropriate mathematical terminology for discrete mathematics.

<b>CONCEPT 4: Vertex-Edge Graphs</b>	
	Understand and apply vertex-edge graphs.
PO1	Color maps with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).
DPO 1	Use grade-level appropriate mathematical terminology for graphs.

### Strand 3: Patterns, Algebra, and Functions

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Patterns</b>	
Identify patterns and apply pattern recognition to reason mathematically.	
PO1	Communicate a grade-level appropriate iterative pattern, using symbols or numbers.
DPO 1	Communicate orally or in written form the repetition of objects in a pattern and occurring in a sequence of numbers.
PO2	Extend a grade-level appropriate repetitive pattern (e.g., 5, 10, 15, 20, . . . rule: add five or count by five's).
DPO 2	Extend patterns using a model and extend a given pattern occurring in a sequence of numbers.
PO3	Solve grade-level appropriate pattern problems.
DPO 3	Create a pattern using a model.
DPO 4	Use grade-level appropriate mathematical terminology for patterns.

<b>CONCEPT 2: Functions and Relationships</b>	
Describe and model functions and their relationships.	
PO1	Describe the rule used in a simple grade-level appropriate function (e.g., T-chart, input/output model, and frames and arrows).

<b>CONCEPT 3: Algebraic Representations</b>	
Represent and analyze mathematical situations and structures algebraic representations.	
PO1	Use variables in contextual situations.
PO2	Solve equations with one variable using missing addends to sums of 18 (e.g., $+ 9 = 18$ , $9 + = 18$ ); and using minuend through 18 (e.g., $18 - = 9$ , $18 - 9 =$ ).
DPO 1	Find missing number in adding, subtracting, multiplying, dividing number sentences.

<b>CONCEPT 4: Analysis of Change</b>	
	Analyze change in a variable over time and in various contexts.
PO1	Identify the change in a variable over time (e.g., an object gets taller, colder, heavier).
DPO 1	Solve problems using graphs, charts, and tables
PO2	Make simple predictions based on a variable (e.g., increases in allowance as you get older).
DPO 2	Draw conclusions from graphed data.

### **Strand 4: Geometry and Measurement**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Geometric Properties</b>	
	Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.
PO1	Build geometric figures with other common shapes (e.g., tangrams, pattern blocks, geoboards).
DPO 1	Predict how shapes can be changed by combining or dividing them.
PO2	Name concrete objects and pictures of 3-dimensional solids (cones, spheres, and cubes).
PO3	Describe relationships between 2-dimensional and 3-dimensional objects (squares/cubes, circles/spheres, triangles/cones).
DPO 2	Compare attributes of 2 and 3 dimensional figures.
PO4	Recognize similar shapes.
PO5	Identify a line of symmetry in a 2-dimensional shape.
DPO 3	Identify 2 dimensional shapes by name and attributes.
DPO 4	Use grade-level appropriate mathematical terminology for geometry and measurement.

	<b>CONCEPT 2: Transformation of Shapes</b> Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.
PO1	Recognize same shape in different positions (turn/rotation).
DPO 1	Recognize congruent figures.

	<b>CONCEPT 3: Coordinate Geometry</b> Specify and describe spatial relationships using coordinate geometry and other representational systems.
PO1	Identify points in the first quadrant of a grid using ordered pairs.

	<b>CONCEPT 4: Measurement – Units of Measure – Geometric Objects</b> Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
PO1	Select the appropriate measure of accuracy: <ul style="list-style-type: none"> <li>• length – centimeters, meters, kilometers</li> <li>• capacity/volume – liters</li> <li>• mass/weight – grams.</li> </ul>
PO2	Tell time with one-minute precision (analog).
DPO 1	Tell time to the nearest minute on digital clocks.
PO3	Determine the passage of time across months (units of days, weeks, months) using a calendar.
PO4	Measure a given object using the appropriate unit of measure: <ul style="list-style-type: none"> <li>• length – centimeters, millimeters, meters, kilometers,</li> <li>• capacity/volume – liters</li> <li>• mass/weight - grams</li> </ul>
PO5	Record temperatures to the nearest degree in degrees Fahrenheit and degrees Celsius as shown on a thermometer.
PO6	Compare units of measure to determine more or less relationships for: <ul style="list-style-type: none"> <li>• length – inches to feet, centimeters to meters,</li> <li>• time – minutes to hours; hours to days; days to weeks; months to years, and</li> <li>• money – pennies, nickels, dimes, quarters, and dollars.</li> </ul>

Concept 4 – Continued

PO7	Determine relationships for: <ul style="list-style-type: none"> <li>• volume – cups and gallons</li> <li>• weight – ounces and gallons</li> <li>• money – extend to amounts greater than one dollar</li> </ul>
DPO 2	Identify the type of measure for each attribute
PO8	Compare the length of two objects using U.S. customary or metric units.
PO9	Determine the perimeter using a rectangular array.
PO10	Represent area using a rectangular array.

**Strand 5: Structure and Logic**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b> Use reasoning to solve mathematical problems in contextual situations.
PO1	Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.
DPO 1	Use grade-level appropriate mathematical terminology for structure and logic.

	<b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b> Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.
PO1	Draw conclusions based on existing information (e.g., All students in Ms. Dean's 1st grade class are less than 7 years old. Rafael is in Ms. Dean's class. Conclusion: Rafael is less than 7 years old.).
DPO 1	Make a prediction based on existing information.

## GRADE 4

### Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Number Sense</b>	
Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.	
PO1	Read whole numbers in contextual situations.
DPO 1	Read and write whole numbers using real-world situations of whole to the millions place, using whole numbers.
PO2	Identify whole numbers in or out of order.
PO3	Write whole numbers in or out of order.
PO4	State place values for whole numbers (e.g., In the number 203,495 what is the value of the 2?).
PO5	Construct models to represent place value concepts for the one's, ten's, hundred's, and thousand's places.
DPO 2	Represent place value using concrete or illustrated models of round whole numbers to millions place.
DPO 3	Represent place value using concrete or illustrated models of round decimals through thousandths place.
PO6	Apply expanded notation to model place value (e.g., $203,495 = 200,000 + 3,000 + 400 + 90 + 5$ ).
PO7	Compare two whole numbers.
DPO 4	Compare and order using concrete and illustrated models of whole numbers to the millions place.
PO8	Order three or more whole numbers.
PO9	Make models that represent mixed numbers.
DPO 5	Read and write fractions using real-world situations.
PO10	Identify symbols, words, or models that represent mixed numbers.

Concept 1 – continued

PO11	Use mixed numbers in contextual situations.
PO12	Compare two unit fractions (e.g., $\frac{1}{2}$ to $\frac{1}{5}$ ) or proper or mixed numbers with like denominators.
DPO 6	Compare and order fractions using concrete and illustrated models (e.g., halves, thirds, fourths, eighths)
DPO 7	Recognize fractions as division of the numerator by the denominator.
PO13	Order three or more unit fractions or proper or improper fractions with like denominators.
PO14	Use decimals in contextual situations.
DPO 8	Read and write decimals using real-world situations of fractions (halves, thirds, fourths, eighths)
PO15	Compare two decimals.
DPO 9	Compare and order decimals using concrete and illustrated models. (thousandths)
PO16	Order three or more decimals.
PO17	Determine the equivalency among decimals, fractions, and percents (e.g., $\frac{49}{100} = 0.49 = 49\%$ ).
PO18	Identify all whole number factors and pairs of factors for a given whole number through 144.
DPO 10	State the factors for a given whole number.
PO19	Determine multiples of a given whole number with products through 144.
DPO 11	Use grade-level appropriate mathematical terminology for number sense.

	<b>CONCEPT 2: Numerical Operations</b>
	Understand and apply numerical operations and their relationship to one another.
PO1	Add whole numbers.
DPO 1	Regroup in addition to the millions place.

Concept 2 – Continued

DPO 2	Represent the process of multiplication of whole numbers as repeated addition, using concrete or illustrative models.
PO2	Subtract whole numbers.
DPO 3	Regroup in subtraction to the millions place.
DPO 4	Represent the process of division of whole numbers as repeated subtraction, partitioning a group and partitioning a whole, using concrete or illustrative models.
PO3	Select the grade-level appropriate operation to solve word problems.
PO4	Solve word problems using grade-level appropriate operations and numbers.
PO5	Multiply multi-digit numbers by two-digit numbers.
PO6	Divide with one-digit divisors.
DPO 5	Divide with one digit divisors to find quotients with remainders.
PO7	State multiplication and division facts through 12s.
PO8	Demonstrate the associative property of multiplication.
PO9	Apply grade-level appropriate properties to assist in computation.
PO10	Apply the symbol: $\bullet$ and $( )$ for multiplication, and $\leq$ , $\geq$ .
PO11	Use grade-level appropriate mathematical terminology for number sense.
PO12	Add or subtract fractions with like denominators, no regrouping.
PO13	Simplify numerical expressions using the order of operations with grade-appropriate operations on number sets.
DPO 6	Simplify a fraction to lowest terms.

	<b>CONCEPT 3: Estimation</b>
	Use estimation strategies reasonably and fluently.
PO1	Solve grade-level appropriate problems using estimation.
DPO 1	Apply the appropriate strategy when calculating to solve problems (estimation, approximation, rounding, exact number)

Concept 3 – Continued

PO2	Use estimation to verify the reasonableness of a calculation (e.g., Is $3284 \times 343 = 1200$ reasonable?).
PO3	Estimate length and weight using both U.S. customary and metric units.
PO4	Estimate and measure for distance.

**Strand 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Data Analysis (Statistics)</b>	
	Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.
PO2	Construct a single-bar graph, line graph or two-set Venn diagram with appropriate labels and title from organized data.
DPO 1	Organize data by constructing bar graphs, line graphs, picture graphs, frequency tables and Venn diagrams.
PO3	Interpret graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data.
DPO 2	Interpret and analyze data from graphical representations and draw simple conclusions, using bar graphs, line graphs, picture graphs, circle graphs, frequency tables and Venn diagrams.
PO4	Answer questions based on graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data.
PO5	Identify the mode(s) of given data.
PO6	Formulate predictions from a given set of data.
PO7	Solve contextual problems using graphs, charts, and tables.
DPO 3	Use grade-level appropriate mathematical terminology for data analysis, probability, and discrete mathematics.

<b>CONCEPT 2: Probability</b>	
	Understand and apply the basic concepts of probability.
PO1	Name the possible outcomes for a probability experiment.
PO2	Describe the probability of events as being more likely, less likely, equally likely, unlikely, certain, impossible, fair or unfair.
PO3	Predict the outcome of a grade-level appropriate probability experiment.
PO4	Record the data from performing a grade-level appropriate probability experiment.
PO5	Compare the outcome of an experiment to predictions made prior to performing the experiment.
PO6	Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes).
PO7	Compare the results of two repetitions of the same grade-level appropriate probability experiment.

<b>CONCEPT 3: Discrete Mathematics – Systematic Listing and Counting</b>	
	Understand and demonstrate the systematic listing and counting of possible outcomes.
PO1	Find all possible combinations when one item is selected from each of two sets containing up to three objects (e.g., How many outfits can be made with 3 pants and 2 tee shirts?).
DPO 1	Use formulas to determine number of possible outcomes.

<b>CONCEPT 4: Vertex-Edge Graphs</b>	
	Understand and apply vertex-edge graphs.
PO1	Color maps with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).

### Strand 3: Patterns, Algebra, and Functions

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Patterns</b>	
	Identify patterns and apply pattern recognition to reason mathematically.
DPO 1	Describe a rule for a grade-level appropriate iterative pattern, using symbols or numbers.
PO2	Extend a grade-level appropriate iterative pattern.
PO3	Create grade-level appropriate iterative patterns.
DPO 2	Use grade-level appropriate mathematical terminology for patterns, algebra, and functions.

<b>CONCEPT 2: Functions and Relationships</b>	
	Describe and model functions and their relationships.
PO1	Describe the rule used in a simple grade-level appropriate function (e.g., T chart, input/output model).
DPO 1	Describe a real-life situation in which a change in one variable results in a change of the other.
DPO 2	Compute an “output” for a given “input” in a function.

<b>CONCEPT 3: Algebraic Representations</b>	
	Represent and analyze mathematical situations and structures using algebraic representations.
PO1	Evaluate expressions involving the four basic operations by substituting given whole numbers for the variable.
DPO 1	Recognize the importance of using proper order of operations.
PO2	Use variables in contextual situations.
PO3	Solve one-step equations with one variable represented by a letter or symbol using multiplication of whole numbers (e.g., $12 = n \times 4$ ).

<b>CONCEPT 4: Analysis of Change</b>	
	Analyze change in a variable over time and in various contexts.
PO1	Identify the change in a variable over time (e.g., an object gets taller, colder, heavier).
PO2	Make simple predictions based on a variable (e.g., increase homework time as you progress through the grades).

### **Strand 4 – Geometry and Measurement**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Geometric Properties</b>	
	Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.
PO1	Identify the properties of 2-dimensional figures using appropriate terminology.
DPO 1	Classify two-dimensional shapes and three-dimensional figures by their properties.
PO2	Identify models or illustrations of prisms, pyramids, cones, cylinders, and spheres.
PO3	Draw points, lines, line segments (open or closed endpoints), rays, or angles.
DPO 2	Identify lines that are parallel and perpendicular.
PO4	Classify angles (e.g., right, acute, obtuse, straight).
PO5	Classify triangles as right, acute, or obtuse.
PO6	Identify congruent geometric shapes.
DPO 3	Draw or build shapes that have symmetry and are congruent.
PO7	Identify similar shapes.
PO8	Draw a 2-dimensional shape that has line symmetry.

Concept 1 – Continued

DPO 4	Draw or build two-dimensional shapes by applying significant properties of each (e.g., draw a rectangle with two sets of parallel sides and four right angles).
DPO 5	Use grade-level appropriate mathematical terminology for geometry and measurement.

	<b>CONCEPT 2: Transformation of Shapes</b>
	Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.
PO 1	Demonstrate translation using geometric figures.
DPO 1	Illustrate slide, flip or turn (e.g., quilts) using concrete or pictorial models.
DPO 2	Recognize lines of symmetry.
PO 2	Identify a tessellation.

	<b>CONCEPT 3: Coordinate Geometry</b>
	Specify and describe spatial relationships using coordinate geometry and other representational systems.
PO 1	Name the coordinates of a point plotted in the first quadrant.
DPO 1	Use ordered pairs to plot a point in the first quadrant

	<b>CONCEPT 4: Measurement - Units of Measure - Geometric Objects</b>
	Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
PO1	Identify the appropriate measure of accuracy for the area of an object (e.g., sq. feet or sq. miles).
DPO 1	Identify a variety of shapes having the same perimeter and area.
DPO 2	Solve problems using given formulas for simple area and perimeter.
PO2	Compute elapsed time using a clock (e.g., hours and minutes since or until...) or a calendar (e.g., days, weeks, years since or until...).
PO3	Select an appropriate tool to use in a particular measurement situation.
PO4	Approximate measurements to the appropriate degree of accuracy.

Concept 4 – Continued

DPO 3	Measure length, volume and weight in both U.S. customary and metric units.
PO5	Compare units of measure to determine <i>more</i> or <i>less</i> relationships including: <ul style="list-style-type: none"> <li>• length - yards and miles, meters and kilometers, and</li> <li>• weight - pounds and tons, grams and kilograms.</li> </ul>
PO 6	State equivalent relationships (e.g., 3 teaspoons = 1 tablespoon, 16 cups = 1 gallon, 2000 pounds = 1 ton).
PO7	Compare the weight of two objects using both U.S. customary and metric units.
PO8	Determine the perimeter of simple polygons (e.g., square, rectangle, triangle).
PO9	Determine the area of squares and rectangles.
PO10	Differentiate between perimeter and area of quadrilaterals.
DPO 4	Interpret calculations and calculator results within a contextual situation.

**Strand 5: Structure and Logic**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b>
	Use reasoning to solve mathematical problems in contextual situations.
PO1	Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.
DPO 1	Justify the method the method used to design simple algorithms.
PO2	Develop an algorithm to calculate the perimeter of simple polygons.
DPO 2	Use grade-level appropriate mathematical terminology for structure and logic.

	<p><b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b></p> <p>Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.</p>
PO1	<p>Draw conclusions based on existing information (e.g., All students in Ms. Dean's 1st grade class are less than 7 years old. Rafael is in Ms. Dean's class. Conclusion: Rafael is less than 7 years old).</p>
PO2	<p>Identify simple valid arguments using <i>if...then</i> statements based on graphic organizers (e.g., 2-set Venn diagrams and pictures).</p>
DPO 1	<p>Construct simple valid arguments using <i>if...then</i> statements based on graphic organizers.</p>
DPO 2	<p>Construct simple valid arguments using <i>if...then</i> statements based on geometric shapes.</p>

# GRADE 5

## Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Number Sense</b> Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems..
PO1	Make models that represent improper fractions.
PO2	Identify symbols, words, or models that represent improper fractions
PO3	Use improper fractions in contextual situations
DPO 1	Determine reciprocal of whole numbers, fractions and mixed numbers.
PO4	Compare two proper fractions or improper fractions with like denominators.
PO5	Order three or more unit fractions, proper or improper fractions with like denominators, or mixed numbers with like denominators.
PO6	Compare two whole numbers, fractions, and decimals (e.g., $\frac{1}{2}$ to 0.6).
DPO 2	Identify frequently used fraction, decimal and percent equivalents.
PO7	Order whole numbers, fractions, and decimals.
DPO 3	Represent place value ranging from millions to thousandths.
PO8	Determine the equivalency between and among fractions, decimals, and percents in contextual situations.
PO9	Identify all whole number factors and pairs of factors for a number.
DPO 4	Determine lowest common multiples and greatest common factors for a set of two whole numbers.
PO10	Recognize that 1 is neither a prime nor a composite number.
PO11	Sort whole numbers (through 50) into sets containing only prime number or composite numbers.

Concept 1 – Continued

DPO 6	Identify/sort numbers by their even and odd properties
DPO 7	Recognize negative numbers as integers less than zero by extending the number line.
DPO 8	Use grade-level appropriate mathematical terminology for number sense.

<b>CONCEPT 2: Numerical Operations</b>	
	Understand and apply numerical operations and their relationship to one another.
PO1	Select the grade-level appropriate operation to solve word problems.
PO2	Solve word problems using grade-level appropriate operations and numbers.
PO3	Multiply whole numbers.
DPO 1	Recognize multiplication as repeated addition and division as repeated subtraction.
DPO 2	Demonstrate memorization of multiplication facts through 12.
DPO 3	Calculate multiplication of three digit by four digit numbers.
PO4	Divide with whole numbers.
DPO 4	Calculate division with two digit divisors.
DPO 5	Use divisibility rules to determine divisibility of whole numbers by 1-10.
PO5	Demonstrate the distributive property of multiplication over addition.
PO6	Demonstrate the addition and multiplication properties of equality.
PO7	Apply grade-level appropriate properties to assist in computation.
PO8	Apply the symbol “[ ]” to represent grouping.
PO9	Use grade-level appropriate mathematical terminology.
DPO 6	Define the commutative and associative properties of addition and multiplication.
PO10	Simplify fractions to lowest terms.

Concept 2 – Continued

DPO 7	Add and subtract mixed fractions with unlike denominators.
PO11	Add or subtract proper fractions and mixed numbers with like denominators with regrouping.
PO12	Add or subtract decimals.
PO13	Multiply decimals.
DPO 8	Demonstrate relationship and equivalency among decimals, fractions and percents.
PO14	Divide decimals “to hundredths place”.
DPO 9	Convert fractions to percents to the hundredths place value.
PO15	Simplify numerical expressions using the order of operations with grade-appropriate operations on number sets.

	<b>CONCEPT 3 – Estimation</b>
	Use estimation strategies reasonably and fluently.
PO 1	Solve grade-level appropriate problems using estimation.
PO 2	Use estimation to verify the reasonableness of a calculation (e.g., is $4.1 \times 2.7$ about 12?).
PO 3	Round to estimate quantities.
PO 4	Estimate and measure for area and perimeter.
PO 5	Compare estimated measurements between U.S. customary and metric systems (e.g., a yard is about a meter.).
DPO 1	Estimate fractions 0, $\frac{1}{2}$ , 1...

**Strand 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1 – Data Analysis (Statistics)</b>
	Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.

Concept 1 – Continued

DPO 1	Recognize that groups are representative of a given population.
PO2	Construct a double-bar graph, line plot, frequency table, or three-set Venn diagram with appropriate labels and title from organized data.
PO3	Interpret graphical representations and data displays including bar graphs (including double-bar), circle graphs, frequency tables, three-set Venn diagrams, and line graphs that display continuous data.
DPO 2	Construct line graphs, circle graphs, and picture graphs with appropriate labels and title from organized data
DPO 3	Analyze data and draw conclusions using bar graphs, line graphs, circle graphs, picture graphs, frequency tables, and Venn diagrams.
PO4	Answer questions based on graphical representations, and data displays including bar graphs (including double-bar), circle graphs, frequency tables, three-set Venn diagrams, and line graphs that display continuous data.
PO5	Identify the mode(s) and mean (average) of given data.
DPO 4	Find the mean, median, mode, and range of data using concrete and illustrative models.
PO6	Formulate reasonable predictions from a given set of data.
DPO 5	Justify predictions made from a given set of data.
PO7	Compare two sets of data related to the same investigation.
PO8	Solve contextual problems using graphs, charts, and tables.
DPO 6	Solve contextual problems using equations.
DPO 7	Use grade-level appropriate mathematical terminology for data analysis, probability, and discrete mathematics.

	<b>CONCEPT 2: Probability</b>
	Understand and apply the basic concepts of probability.
PO1	Name the possible outcomes for a probability experiment.
PO2	Describe the probability of events as being: <ul style="list-style-type: none"> <li>• certain (represented by “1”),</li> <li>• impossible, (represented by “0”), or</li> <li>• neither certain nor impossible (represented by a fraction less than 1).</li> </ul>

## Concept 2 – Continued

PO3	Predict the outcome of a grade-level appropriate probability experiment.
PO4	Record the data from performing a grade-level appropriate probability experiment.
PO5	Compare the outcome of an experiment to predictions made prior to performing the experiment.
PO6	Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes).
PO7	Compare the results of two repetitions of the same grade-level appropriate probability experiment.

	<p><b>CONCEPT 3: Discrete Mathematics – Systematic Listing and Counting</b> Understand and demonstrate the systematic listing and counting of possible outcomes.</p>
PO1	Find all possible combinations when one item is selected from each of two sets of different items, using a systematic approach. (e.g., shirts: tee shirt, tank top, sweatshirt; pants: shorts, jeans).

	<p><b>CONCEPT 4: Vertex-Edge Graphs</b> Understand and apply vertex-edge graphs.</p>
PO1	Color maps with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).

## Strand 3: Patterns, Algebra, and Functions

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<p><b>CONCEPT 1: Patterns</b> Identify patterns and apply pattern recognition to reason mathematically.</p>
PO1	Communicate a grade-level appropriate iterative pattern, using symbols or numbers.

Concept 1 – Continued

PO2	Extend a grade-level appropriate iterative pattern.
DPO 1	Create simple geometric and number patterns and describe the rule.
PO3	Solve grade-level appropriate iterative pattern problems.

	<b>CONCEPT 2: Functions and Relationships</b> Describe and model functions and their relationships.
PO1	Describe the rule used in a simple grade-level appropriate function (e.g., T-chart, input/output model).
DPO 1	Use substitution of variables to complete input/output models

	<b>CONCEPT 3: Algebraic Representations</b> Represent and analyze mathematical situations and structures using algebraic representations.
PO1	Evaluate expressions involving the four basic operations by substituting given decimals for the variable
PO2	Use variables in contextual situations
DPO 1	Create numerical and algebraic expressions and equations using contextual situations.
PO3	Solve one-step equations with one variable represented by a letter or symbol (e.g., $15 = 45 \div n$ ).

	<b>CONCEPT 4: Analysis of Change</b> Analyze change in variable over time and in various contexts.
PO1	Describe patterns of change: <ul style="list-style-type: none"> <li>• constant rate (speed of movement of the hands on a clock), and</li> <li>• increasing or decreasing rate (rate of plant growth).</li> </ul>
DPO 1	Describe a real-life situation in which a change in one variable results in a change of the other.
DPO 2	Compute an “output” for given “input” in a function.

## Strand 4: Geometry and Measurement

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Geometric Properties</b>	
	Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.
PO1	Recognize regular polygons.
PO2	Draw 2-dimensional figures by applying significant properties of each (e.g., Draw a quadrilateral with two sets of parallel sides and four right angles.).
PO3	Sketch prisms, pyramids, cones, and cylinders.
PO4	Identify the properties of 2- and 3-dimensional geometric figures using appropriate terminology and vocabulary. (parallelism, perpendicularity, congruency, similarity).
DPO 1	Identify lines that are parallel and perpendicular.
PO5	Draw points, lines, line segments, rays, and angles with appropriate labels.
PO6	Recognize that all pairs of vertical angles are congruent.
PO7	Classify triangles as scalene, isosceles, or equilateral.
PO8	Recognize that a circle is a 360° rotation about a point.
PO9	Identify the diameter, radius, and circumference of a circle.
PO10	Understand that the sum of the angles of a triangle is 180°.
PO11	Draw two congruent geometric figures.
DPO 2	Distinguish shapes that are congruent.
PO12	Draw two similar geometric figures.
PO13	Identify the lines of symmetry in a 2-dimensional shape.
DPO 3	Draw or build a shape that has symmetry.
DPO 4	Use grade-level appropriate mathematical terminology for geometry and measurement.

	<p style="text-align: center;"><b>CONCEPT 2: Transformation of Shapes</b></p> <p>Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.</p>
PO1	Demonstrate reflections using geometric figures.
DPO 1	Recognize lines of symmetry.
DPO 2	Draw or build a shape that has symmetry.
PO2	Describe the transformations that created a tessellation.

	<p style="text-align: center;"><b>CONCEPT 3: Coordinate Geometry</b></p> <p>Specify and describe spatial relationships using coordinate geometry and other representational systems.</p>
PO1	Graph points in the first quadrant on a grid using ordered pairs.

	<p style="text-align: center;"><b>CONCEPT 4: Measurement - Units of Measure Geometric Objects</b></p> <p>Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.</p>
PO1	State an appropriate measure of accuracy for a contextual situation (e.g., What unit of measurement would you use to measure the top of your desk?).
DPO 1	State the appropriate tool to use to measure in a particular situation.
PO2	Draw 2-dimensional figures to specifications using the appropriate tools (e.g., draw a circle with a 2-inch radius.).
PO3	Determine relationships including volume (e.g., pints and quarts, milliliters and liters).
PO4	Convert measurement units to equivalent units within a given system (U.S. customary and metric) (e.g., 12 inches = 1 foot; 10 decimeters = 1 meter).
DPO 2	Estimate measurements within a given system for both U.S. customary and metric units.
PO5	Solve problems involving the perimeter of convex polygons.
PO6	Determine the area of figures composed of two or more rectangles on a grid.

Concept 4 – Continued

DPO 3	Develop, understand, and use formulas to find the area of rectangles, related triangles, and parallelograms.
PO7	Solve problems involving the area of simple polygons.
PO8	Describe the change in perimeter or area when one attribute (length, width) of a rectangle is altered.
DPO 4	Measure length, volume, weight, and temperature in both U.S. customary and metric units.
DPO 5	Develop strategies to determine the surface area and volume of rectangular solids.

### Strand 5: Structure and Logic

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b> Use reasoning to solve mathematical problems in contextual situations.
PO1	Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.
PO2	Design simple algorithms using whole numbers.
DPO 1	Justify the method used to design simple algorithms.
PO3	Develop an algorithm or formula to calculate areas of simply polygons.
DPO 2	Use grade-level appropriate mathematical terminology for structure and logic.

	<p><b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b></p> <p>Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.</p>
PO1	Construct <i>if..then</i> statements.
PO2	Identify simple valid arguments using <i>if...then</i> statements based on graphic organizers (e.g., 3-set Venn diagrams and pictures).
DPO 1	Identify simple valid arguments using <i>if ...then</i> statements based on geometric shapes.

## GRADE 6

### Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Number Sense</b> Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.
PO1	Express fractions as ratios, comparing two whole numbers (e.g., $\frac{3}{4}$ is equivalent to 3:4 and 3 to 4).
DPO 1	Develop, analyze and explain methods for solving proportions by identifying equal ratios.
DPO 2	Describe how to solve a problem in context using a proportion.
DPO 3	Solve proportions and ratios using formal (cross multiplication) and informal (diagrams, geometric models) methods.
PO2	Compare two proper fractions, improper fractions, or mixed numbers.
PO3	Order three or more proper fractions, improper fractions, or mixed numbers
PO4	Determine the equivalency between and among fractions, decimals, and percents in contextual situations.
DPO 4	Simplify a fraction to lowest terms.
DPO 5	Recognize a fraction in lowest terms.
DPO 6	Find equivalent fractions
DPO 7	Determine the reciprocals of whole numbers, fractions and mixed numbers.
DPO 8	Convert fractions, decimals and percents from one to another.
DPO 9	Memorize the most frequently used fraction/decimal/percent equivalents.

Concept 1 (Continued)

DPO 10	Calculate the percent of a number (e.g. find 50% of 100) utilizing concrete and illustrative models.
DPO 11	Factor numbers into prime form and express in exponential form.
DPO 12	Read, write and evaluate numbers involving exponents.
DPO 13	Convert standard notation to scientific notation and vice versa with positive exponents.
DPO 14	Determine the square root of a perfect square.
PO5	Identify the greatest common factor for two whole numbers.
PO6	Determine the least common multiple for two whole numbers.
PO7	Express a whole number as a product of its prime factors, using exponents when appropriate.

	<b>CONCEPT 2: Numerical Operations</b>
	Understand and apply numerical operations and their relationship to one another.
PO1	Select the grade-level appropriate operation to solve word problems.
PO2	Solve word problems using grade-level appropriate operations and numbers.
PO3	Apply grade-level appropriate properties to assist in computation.
PO4	Apply the symbols for “...” or “—” to represent repeating decimals and “:” to represent ratios, superscripts as exponents.
PO5	Use grade-level appropriate mathematical terminology.
PO6	Simply fractions to lowest terms.
PO7	Add or subtract proper fractions and mixed numbers with unlike denominators with regrouping.
PO8	Demonstrate the process of multiplication of proper fractions using models.
PO9	Multiply proper fractions.
PO10	Multiply mixed numbers.

Concept 2 - Continued

PO11	Demonstrate that division is the inverse of multiplication of proper fractions.
PO12	Divide proper fractions.
PO13	Divide mixed numbers.
PO14	Solve problems involving fractions or decimals (including money) in contextual situations.
PO15	Simplify numerical expressions using the order of operations with grade-appropriate operations on number sets.

<b>CONCEPT 3: Estimation</b>	
	Use estimation strategies reasonably and fluently.
PO1	Solve grade-level appropriate problems using estimation.
DPO 1	Estimate and measure of distance, perimeter, area, volume, capacity, weight, mass and angles.
DPO 2	Compare weight to mass and capacity to volume.
DPO 3	Develop and use formulas and procedures to solve problems involving measurement.
DPO 4	Describe how a change in the linear dimension of an object effects its perimeter, area and volume.
PO2	Use estimation to verify the reasonableness of a calculation (e.g., Is $5/9 \times 3/7$ more than 1?).
PO3	Round to estimate quantities in contextual situations (e.g., round up or round down).
PO4	Estimate and measure for the area and perimeter of polygons using a grid.
PO5	Verify the reasonableness of estimates made from calculator results within a contextual situation.

## Strand 2: Data Analysis, Probability, and Discrete Mathematics

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Data Analysis (Statistics)</b> Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.
PO2	Construct a histogram, line graph, scatter plot, or stem-and-leaf plot with appropriate labels and title from organized data.
PO3	Interpret simple displays of data including double bar graphs, tally charts, frequency tables, circle graphs, and line graphs.
PO4	Answer questions based on simple displays of data including double bar graphs, tally charts, frequency tables, circle graphs, and line graphs.
PO5	Find the mean, median (odd number of data points), mode, range, and extreme values of a given numerical data set.
PO6	Identify a trend (variable increasing, decreasing, remaining constant) from displayed data.
PO7	Compare trends in data related to the same investigation.
PO8	Solve contextual problems using bar graphs, tally charts, and frequency tables.

	<b>CONCEPT 2: Probability</b> Understand and apply the basic concepts of probability.
PO1	Name the possible outcomes for a probability experiment.
PO2	Express probabilities of a single event as a decimal.
PO3	Predict the outcome of a grade-level appropriate probability experiment.
PO4	Record the data from performing a grade-level appropriate probability experiment.
PO5	Compare the outcome of an experiment to predictions made prior to performing the experiment.

Concept 2 – Continued

PO6	Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes, cards).
PO7	Compare the results of two repetitions of the same grade-level appropriate probability experiment.

	<b>CONCEPT 3: Discrete Mathematics - Systematic Listing and Counting</b> Understand and demonstrate the systematic listing and counting of possible outcomes.
PO1	Determine all possible outcomes involving a combination of three sets of three items, using a systematic approach (e.g., 3 different shirts, 3 different pairs of pants, and 3 different belts).
PO2	Determine all possible arrangements given a set with four or fewer objects using a systematic list, table or tree diagram when order is not important.

	<b>CONCEPT 4: Vertex-Edge Graphs</b> Understand and apply vertex-edge graphs.
PO1	Find the shortest route on a map from one site to another (vertex-edge graph).

**Strand 3: Patterns, Algebra, and Functions**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Patterns</b> Identify patterns and apply pattern recognition to reason mathematically.
PO1	Communicate a grade-level appropriate recursive pattern, using symbols or numbers.
DPO 1	Use calculators and computers to perform basic recursive (of, relating to, or constituting a procedure that can repeat itself indefinitely) and iterative (repetitious, repeated or repeating) processes.

Concept 1 – Continued

PO2	Extend a grade-level appropriate iterative pattern.
PO3	Solve grade-level appropriate iterative pattern problems.

	<b>CONCEPT 2: Functions and Relationships</b> Describe and model functions and their relationships.
PO1	Describe the rule used in a simple grade-level appropriate function (e.g., T-chart, input/output model).

	<b>CONCEPT 3: Algebraic Representations</b> Represent and analyze mathematical situations and structures using algebraic representations.
PO1	Evaluate expressions involving the four basic operations by substituting given fractions for the variable (e.g., $n+3$ , when $n = \frac{1}{2}$ ).
PO2	Use variables in contextual situations.
PO3	Translate a written phrase to an algebraic expression (e.g., The quotient of $m$ and 5 is $\frac{m}{5}$ or $m \div 5$ ).
PO4	Translate a phrase written in context into an algebraic expression (e.g., Write an expression to describe the situation: John has $x$ pieces of candy and buys three more. $x + 3$ ).
PO5	Solve one-step equations with one variable represented by a letter or symbol, using inverse operations with whole numbers.

	<b>CONCEPT 4: Analysis of Change</b> Analyze change in a variable over time and in various contexts.
PO1	Identify values on a given line graph or scatter plot (e.g., Given a line showing wages earned per hour, what is the wage at five hours?).

## Strand 4: Geometry and Measurement

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Geometric Properties</b>	
	Analyze the attributes and properties of 2- and 3- dimensional shapes and develop mathematical arguments about their relationships.
PO1	Classify polygons by their attributes (e.g., number of sides, length of sides, angles, parallelism, perpendicularity).
DPO 1	Identify and distinguish congruent and similar figures.
DPO 2	Apply geometric properties and relationships such as congruency, similarity, parallelism and perpendicularity to real-world situations.
PO2	Draw a geometric figure showing specified properties, such as parallelism and perpendicularity.
PO3	Classify prisms, pyramids, cones, and cylinders by base shape and lateral surface shape.
PO4	Classify 3-dimensional figures by their attributes.
DPO 3	Draw or build three-dimensional shapes by applying significant properties of each.
PO5	Compare attributes of 2-dimensional figures with 3-dimensional figures.
PO6	Draw triangles with appropriate labels.
PO7	Identify supplementary or complementary angles.
PO8	Identify the diameter, radius, and circumference of a circle or sphere.
PO9	Draw a 2-dimensional shape with a given number of lines of symmetry.

<b>CONCEPT 2: Transformation of Shapes</b>	
	Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.
PO1	Identify reflections and translations using pictures.
PO2	Perform elementary transformations to create a tessellation.

	<b>CONCEPT 3: Coordinate Geometry</b>
	Specify and describe spatial relationships using coordinate geometry and other representational systems.
PO1	Graph a polygon in the first quadrant using ordered pairs.
PO2	State the missing coordinate of a given figure in the first quadrant of a coordinate grid using geometric properties (e.g., Find the coordinates of the missing vertex of a rectangle when two adjacent sides are drawn.).

	<b>CONCEPT 4: Measurement – Units of Measure – Geometric Objects</b>
	Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
PO1	Determine the appropriate measure of accuracy within a system for a given contextual situation (e.g., Would you measure the length of your bedroom wall using inches or feet?).
PO2	Determine the appropriate tool needed to measure to the needed accuracy.
PO3	Determine a linear measurement to the appropriate degree of accuracy.
PO4	Measure angles using a protractor.
PO5	Convert within a single measurement system (U.S. customary or metric) (e.g., How many ounces are equivalent to 2 pounds?).
PO6	Solve problems involving the perimeter of polygons.
PO7	Determine the area of triangles.
PO8	Distinguish between perimeter and area in contextual situation.

Concept 4 – Continued

PO9	Solve problems for the areas of parallelograms (includes rectangles).
DPO 1	Solve problems using given formulas for perimeter/circumference and area of various polygons/circles.
DPO 2	Solve problems using given formulas for volume of prisms.
DPO 3	Draw or build a variety of shapes having the same perimeter and area.
PO10	Identify parallelograms having the same perimeter or area.
PO11	Determine the actual measure of objects using a scale drawing or map.

### Strand 5: Structure and Logic

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b> Use reasoning to solve mathematical problems in contextual situations.
PO1	Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.
PO2	Analyze algorithms for computing with decimals.

	<b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b> Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.
PO1	Solve a simple logic problem from given information (e.g., Which of three different people live in which of three different colored houses?).
DPO 1	Construct simple valid arguments using if...then statements based on <ul style="list-style-type: none"> <li>• Geometric shapes</li> <li>• Proportional reasoning in probability</li> </ul>
DPO 2	Solve problems using deductive reasoning.

## GRADE 7

### Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Number Sense</b>
	Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.
PO1	Express fractions as terminating or repeating decimals.
PO2	Identify the greatest common factor for a set of whole numbers.
PO3	Determine the least common multiple for a set of whole numbers.
PO4	Choose the appropriate signed real number to represent a contextual situation.
PO5	Recognize the absolute value of a number used in contextual situations.
PO6	Locate integers on a number line.
PO7	Order integers.
PO8	Classify rational numbers as natural, whole, or integers.

	<b>CONCEPT 2: Numerical Operations</b>
	Understand and apply numerical operations and their relationship to one another.
PO1	Add integers.
DPO 1	Add, subtract, multiply and divide rational numbers.
DPO 2	Use mental math to multiply and divide decimals by powers of 10.
DPO 3	Convert ratios, fractions, decimals and percents from one to another.
PO2	Subtract integers.

Concept 2 – Continued

PO3	Select the grade-level appropriate operation to solve word problems.
PO4	Solve word problems using grade-level appropriate operations and numbers.
PO5	Multiply integers.
DPO 4	Represent the process of multiplication as repeated addition using concrete or illustrated models using integers, fractions and decimals.
PO6	Divide integers.
DPO 5	Represent the process of division as repeated subtraction using concrete or illustrated models using integers, fractions and decimals.
PO7	Apply grade-level appropriate properties to assist in computation.
DPO 6	Identify the properties of addition and multiplication: Commutative, Associative, Distributive, and Identity.
DPO 7	Understand that operations do have inverses and apply this knowledge to solve algebraic equations.
PO8	Apply the symbols + and – to represent positive and negative, and “   ” to represent absolute value.
PO9	Use grade-level appropriate mathematical terminology.
PO10	Calculate the percent of a given number.
PO11	Convert numbers expressed in standard notation to scientific notation and vice versa (positive exponents only).
DPO 8	Read, write and evaluate numbers involving negative and positive exponents.
DPO 9	Determine the square root of a perfect square.
PO12	Simplify numerical expressions using the order of operations with grade appropriate operations on number sets.

	<b>CONCEPT 3: Estimation</b> Use estimation strategies reasonably and fluently.
PO1	Solve grade-level appropriate problems using estimation.
PO2	Use estimation to verify the reasonableness of a calculation (e.g., Is $-2.5 \times 18$ about $-50$ ?).
PO3	Determine whether an estimation of an area is approximately equal to the actual measure.
PO4	Determine whether an estimation of an angle is approximately equal to the actual measure.
PO5	Determine whether an estimation of the circumference of a circle is approximately equal to the actual measure.
PO6	Verify the reasonableness of estimates made from calculator results within a contextual situation.

## **Strand 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Data analysis (Statistics)</b> Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.
PO2	Construct a circle graph with appropriate labels and title from organized data.
PO3	Determine when it is appropriate to use histograms, line graphs, double bar graphs, and stem-and-leaf plots.
PO4	Interpret data displays including histograms, stem-and-leaf plots, circle graphs, and double line graphs.
PO5	Answer questions based on data displays including histograms, stem-and-leaf plots, circle graphs, and double line graphs.
PO6	Find the mean, median, mode, and range of a given numerical data set.

Concept 1 – Continued

PO7	Interpret trends from displayed data.
PO8	Compare trends in data related to the same investigation.
PO9	Solve contextual problems using histograms, line graphs of continuous data, double bar graphs, and stem-and-leaf plots.

<b>CONCEPT 2: Probability</b>	
	Understand and apply the basic concepts of probability.
PO1	Determine the probability that a specific event will occur in a single stage probability experiment (e.g., Find the probability of drawing a red marble from a bag with 3 red, 5 blue, and 9 black marbles.).
PO2	Compare probabilities to determine the fairness of a contextual situation (e.g. If John wins when two or greater shows after a six-sided number cube is rolled and Joaquin wins otherwise, is this a fair game?).
PO3	Predict the outcome of a grade-level appropriate probability experiment.
PO4	Record the data from performing a grade-level appropriate probability experiment.
PO5	Compare the outcome of an experiment to predictions made prior to performing the experiment.
PO6	Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes, cards).
PO7	Compare the results of two repetitions of the same grade-level appropriate probability experiment.

<b>CONCEPT 3: Discrete Mathematics - Systematic Listing and Counting</b>	
	Understand and demonstrate the systematic listing and counting of possible outcomes.
PO1	Determine all possible outcomes involving the combination of up to three sets of objects (e.g., How many outfits can be made with 3 pants, 2 tee shirts and 2 pairs of shoes?).
PO2	Determine all possible arrangements of a given set, using a systematic list, table, tree diagram, or other representation.

	<b>CONCEPT 4: Vertex-Edge Graphs</b> Understand and apply vertex-edge graphs.
PO1	Find the shortest circuit on a map that makes a tour of specified sites (vertex-edge graph).

### **Strand 3: Patterns, Algebra, and Functions**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Patterns</b> Identify patterns and apply pattern recognition to reason mathematically.
PO1	Communicate a grade-level appropriate recursive pattern, using symbols or numbers.
PO2	Extend a grade-level appropriate recursive pattern.
PO3	Solve grade-level appropriate recursive pattern problems.

	<b>CONCEPT 2: Functions and Relationships</b> Describe and model functions and their relationships.
PO1	Describe the rule used in a simple grade-level appropriate function (e.g., T-chart, input/output model).

	<b>CONCEPT 3: Algebraic Representations</b> Represent and analyze mathematical situations and structures using algebraic representations.
PO1	Evaluate an expression containing two variables by substituting integers for the variable (e.g., $7x + m$ , when $x = -4$ and $m = 12$ ).
PO2	Use variables in contextual situations.
PO3	Translate a written sentence into a one-step, one-variable algebraic equation.
DPO 1	Translate a written sentence into a two-step, one-variable algebraic equation.

### Concept 3 – Continued

PO4	Translate a sentence written in context into an algebraic equation involving one operation.
PO5	Solve one-step equations using inverse operations with positive rational numbers (e.g., $\frac{2}{3}n = 6$ ).
DPO 2	Solve one-step and two-step equations involving inverse operations using whole numbers, rational numbers and integers with one variable.
DPO 3	Express a simple inequality from a contextual situation (e.g. Joe earns more than \$5.00 an hour; therefore, $x > 5$ )
DPO 4	Compare, identify and write quantities using ratios.
DPO 5	Determine and identify equal ratios as proportions.
DPO 6	Solve problems using ratios, proportions and percents.

	<b>CONCEPT 4: Analysis of Change</b> Analyze change in a variable over time and in various contexts.
PO1	Analyze change in various linear contextual situations.

### Strand 4: Geometry and Measurement

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Geometric Properties</b> Analyze the attributes and properties of 2 and 3 dimensional shapes and develop mathematical arguments about their relationships.
PO1	Draw a geometric figure showing specified properties (e.g., Draw an obtuse triangle.).
PO2	Classify 3-dimensional solids by their configuration and properties (e.g., parallelism, perpendicularity and congruency).
PO3	Identify the net (2-dimensional representation) that corresponds to a rectangular prism, cone, or cylinder.

Concept 3 – Continued

PO4	Distinguish between length, area, and volume, using 2- and 3-dimensional geometric figures.
PO5	Draw polygons with appropriate labels.
PO6	Identify the angles created by two lines and a transversal.
PO7	Recognize the relationship between central angles and intercepted arcs.
PO8	Identify arcs and chords of a circle.
PO9	Model the triangle inequality theorem using manipulatives.
PO10	Identify corresponding parts of congruent polygons as congruent.
DPO1	Construct bisectors, congruent angles and parallel and perpendicular lines using a compass.

	<b>CONCEPT 2: Transformation of Shapes</b>
	Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.
PO1	Identify rotations about a point, using pictorial models.
PO2	Recognize simple single rotations, translations or reflections on a coordinate grid.

	<b>CONCEPT 3: Coordinate Geometry</b>
	Specify and describe spatial relationships using coordinate geometry and other representational systems.
PO1	Graph data points in (x, y) form in any quadrant of a coordinate grid.
PO2	State the missing coordinate of a given figure in any quadrant of a coordinate grid using geometric properties (e.g., Find the coordinates of the missing vertex of a rectangle when two adjacent sides are drawn).

	<b>CONCEPT 4: Measurement - Units of Measure - Geometric Objects</b>
	Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
PO1	Identify the appropriate unit of measure for the volume of an object (e.g., cubic inches or cubic cm).

Concept 4 – Continued

PO2	Measure to the appropriate degree of accuracy.
DPO 1	Compare estimated measurements between U.S. customary and metric systems, and vice versa. (e.g., a yard is about one meter)
DPO 2	Convert units to equivalent units within a given system (customary and metric) (e.g. 12 inches = 1 foot, 10 decimeters = 1 meter)
DPO 3	Recognize the difference in scales and convert Celsius and Fahrenheit temperatures.
PO4	Solve problems involving the circumference of a circle.
PO5	Solve problems involving the area of a circle.
PO6	Solve problems for the areas of parallelograms, triangles, and circles.
PO7	Identify polygons having the same perimeter or area.
PO8	Compare estimated to actual lengths based on scale drawings or maps.

**Strand 5: Structure and Logic**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b> Use reasoning to solve mathematical problems in contextual situations.
PO1	Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.
PO2	Analyze algorithms for computing with fractions.

	<b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b> Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.
PO1	Solve a logic problem using multiple variables.
DPO 1	Construct simple valid arguments using if... then statements to solve problems.

## GRADE 8

### Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Number Sense</b>	
Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.	
PO1	Locate rational numbers on a number line.
PO2	Identify irrational numbers.
PO3	Classify real numbers as rational or irrational.
DPO 1	Represent and use numbers in equivalent forms (integers, fractions, percents, decimals, exponents, scientific notation and square roots)
DPO 2	Identify greatest common factor and least common multiple for a set of whole numbers <ul style="list-style-type: none"> <li>• find multiples, common multiples and least common multiple of two or more numbers</li> <li>• find factors, common factors and greatest common factor of two or more numbers</li> </ul>

<b>CONCEPT 2: Numerical Operations</b>	
Understand and apply numerical operations and their relationship to one another.	
PO1	Select the grade-level appropriate operation to solve word problems.
PO2	Solve word problems using grade-level appropriate operations and numbers.
PO3	Determine the square of an integer.
PO4	Determine the square root of an integer.
PO5	Identify squaring and finding square roots as inverse operations.
PO6	Apply grade-level appropriate properties to assist in computation.
DPO 1	Identify the properties of addition and multiplication: Commutative, Associative, Distributive, and Identity.
PO7	Apply the symbols “ $\sqrt{\quad}$ ” to represent square root, “ $\pm$ ” to represent roots, and “ $\{\}$ ” as grouping symbols.

Concept 2 – Continued

PO8	Use grade-level appropriate mathematical terminology.
PO9	Calculate the missing value in a percentage problem.
PO10	Convert standard notation to scientific notation, and vice versa.
PO11	Simplify numerical expressions using the order of operations with grade-appropriate operations on number sets.

	<b>CONCEPT 3: Estimation</b>
	Use estimation strategies reasonably and fluently.
PO1	Solve grade-level appropriate problems using estimation.
PO2	Use estimation to verify the reasonableness of a calculation (e.g., Is 32 the square root of 64?).
PO3	Express answers to the appropriate place or degree of precision (e.g., time, money).
PO4	Verify the reasonableness of estimates made from calculator results within a contextual situation.

**Strand 2: Data Analysis, Probability, and Discrete Mathematics**

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Data analysis (Statistics)</b>
	Understand and apply data collection, organization and representation to analyze and sort data.
PO1	Formulate questions to collect data in contextual situations.
PO2	Construct box-and-whisker plots.
PO3	Determine the appropriate type of graphical display for a given data set.
PO4	Interpret box-and-whisker plots, circle graphs, and scatter plots.
PO5	Answer questions based on box-and-whisker plots, circle graphs, and scatter plots.

Concept 1 – Continued

PO6	Solve problems in contextual situations using the mean, median, mode, and range of a given data set.
PO7	Formulate reasonable predictions based on a given set of data.
PO8	Compare trends in data related to the same investigation.
PO9	Solve contextual problems using scatter plots, box-and-whiskers plots, and double line graphs of continuous data.
PO10	Evaluate the effects of missing or incorrect data on the results of an investigation (e.g., Susie’s teacher recorded a 39 instead of a 93 for her last quiz, what will happen to Susie’s average?).
PO11	Identify a line of best fit for a scatter plot.
PO12	Distinguish between causation and correlation.

<b>CONCEPT 2: Probability</b>	
	Understand and apply the basic concepts of probability.
PO1	Determine the probability that a specific event will occur in a 2-stage probability experiment.
PO2	Solve contextual situations using probability (e.g., If the probability of Michelle making a free throw is 0.25, what is the probability that she will make three free throws in a row?).
DPO 1	Express probability as a fraction, zero or one.
PO3	Predict the outcome of a grade-level appropriate probability experiment.
PO4	Record the data from performing a grade-level appropriate probability experiment.
PO5	Compare the outcome of an experiment to predictions made prior to performing the experiment.
PO6	Distinguish between independent and dependent events.
PO7	Compare the results of two repetitions of the same grade-level appropriate probability experiment.

	<p><b>CONCEPT 3: Discrete Mathematics - Systematic Listing and Counting</b></p> <p>Understand and demonstrate the systematic listing and counting of possible outcomes.</p>
PO1	Determine all possible outcomes involving the combination of two or more sets of objects (e.g., If you roll a six-sided number cube 4 times, how many possible outcomes are possible?).
PO2	Determine all possible arrangements given a set (e.g., How many ways can you arrange a set of 7 books on a shelf?).

	<p><b>CONCEPT 4: Vertex-Edge Graphs</b></p> <p>Understand and apply vertex-edge graphs.</p>
PO1	Solve contextual problems represented by vertex-edge graphs.

### Strand 3: Patterns, Algebra, and Functions

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<p><b>CONCEPT 1: Patterns</b></p> <p>Identify patterns and apply pattern recognition to reason mathematically.</p>
PO1	Communicate a grade-level appropriate iterative or recursive pattern, using symbols or numbers.
PO 2	Extend a grade-level appropriate iterative or recursive pattern.
PO 3	Solve grade-level appropriate iterative or recursive pattern problems.

	<p><b>Concept 2: Functions and Relationships</b></p> <p>Describe and model functions and their relationships.</p>
PO1	Describe the rule used in a simple grade-level appropriate function (e.g., T-chart, input/output model).
DPO 1	Represent and analyze patterns and relationships using shapes, tables, graphs, data points, verbal rules and standard algebraic notation.
PO2	Distinguish between linear and nonlinear functions, given graphic examples.

Concept 2 – Continued

PO3	Determine whether a graph or table is related to a given equation of the form $y=ax^2$ where 'a' is a natural number.
PO4	Identify independent and dependent variables for a contextual situation.

<b>CONCEPT 3: Algebraic Representations</b>	
Represent and analyze mathematical situations and structures using algebraic representations.	
PO1	Evaluate algebraic expressions by substituting rational values for variables [e.g., $2(ab+ac+bc)$ , when $a = 2$ , $b = 3/5$ , and $c = 4$ ].
PO2	Use variables in contextual situations
PO3	Translate a written sentence or phrase into an algebraic equation or expression, and vice versa (e.g., Three less than twice a number is $2n-3$ ).
PO4	Translate a sentence written in context into an algebraic equation involving two operations.
PO5	Translate a contextual situation into an algebraic inequality (e.g., Joe earns more than \$5.00 an hour; therefore, $x > 5$ ).
PO6	Identify an equation or inequality that represents a contextual situation.
PO7	Solve one-step equations with rational numbers as coefficients or as solutions.
PO8	Solve one-step equations that model contextual situations.
PO9	Solve two-step equations with rational coefficients and integer solutions (e.g., $3x + 5 = 11$ , $4x - 20 = 8$ ).
PO10	Graph an inequality on a number line.
DPO 1	Solve a one- and- two step inequality with one variable.
PO11	Solve a simple algebraic proportion.
PO 12	Solve applied problems using the Pythagorean theorem.

<b>CONCEPT 4: Analysis of Change</b>	
Analyze change in a variable over time and in various contexts.	
PO1	Identify the slope of a line as the rate of change (the ratio of rise over run).

## Strand 4: Geometry and Measurement

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

<b>CONCEPT 1: Geometric Properties</b>	
	Analyze the attributes and properties of 2 and 3 dimensional shapes and develop mathematical arguments about their relationships.
PO1	Draw a model that demonstrates basic geometric relationships such as parallelism, perpendicularity, similarity/proportionality, and congruence.
PO2	Draw 3-dimensional figures by applying properties of each (e.g., parallelism, perpendicularity, congruency).
PO3	Recognize the 3-dimensional figure represented by a net.
PO4	Represent the surface area of rectangular prisms and cylinders as the area of their net.
PO5	Draw regular polygons with appropriate labels.
PO6	Identify the properties of angles created by a transversal intersecting two parallel lines (e.g., corresponding angles are congruent).
PO7	Recognize the relationship between inscribed angles and intercepted arcs.
PO8	Identify tangents and secants of a circle.
PO9	Determine whether three given lengths can form a triangle.
PO10	Identify corresponding angles of similar polygons as congruent and sides as proportional.

<b>CONCEPT 2: Transformation of Shapes</b>	
	Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.
PO1	Identify the planar geometric figure that is the result of a given rigid transformation.

	<b>CONCEPT 3: Coordinate Geometry</b> Specify and describe spatial relationships using coordinate geometry and other representational systems.
PO1	Use a table of values to graph a linear equation.
PO2	Determine the midpoint given two points on a number line.
PO3	Determine the distance between two points on a number line.

	<b>CONCEPT 4: Measurement - Units of Measure Geometric Objects</b> Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
PO1	Solve problems for the area of a trapezoid.
PO2	Solve problems involving the volume of rectangular prisms and cylinders
PO3	Calculate the surface area of rectangular prisms or cylinders.
PO4	Identify rectangular prisms and cylinders having the same volume.
PO5	Find the measure of a missing interior angle in a triangle or quadrilateral.
PO6	Solve problems using ratios and proportions, given the scale factor.
PO7	Calculate the length of a side, given two similar triangles.

## Strand 5: Structure and Logic

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

	<b>CONCEPT 1: Algorithms and Algorithmic Thinking</b> Use reasoning to solve mathematical problems in contextual situations.
PO1	Describe how to use a proportion to solve a problem in context.
PO2	Analyze algorithms

	<b>CONCEPT 2: Logic, Reasoning, Arguments, and Mathematical Proof</b> Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.
PO1	Solve a logic problem given the necessary information.
PO2	Identify simple valid arguments using <i>if...then</i> statements (e.g., All squares are rectangles. If quadrilateral ABCD is a rectangle, is it a square?).
PO 3	Model a contextual situation using a flow chart.
PO 4	Verify the Pythagorean theorem using an area dissection argument.