Second Grade Mathematics Curriculum Essentials

American Prep International School Mathematics Background

The National Mathematics Advisory Panel's Final Report (2008) and the National Council of Teachers of Mathematics' *Curriculum Focal Points* (2006) provided the structure and guiding principals for the APIS revision of the mathematics curriculum. The National Mathematics Advisory Panel's Report delineated the prerequisite knowledge necessary for success in algebra and key algebra topics students should learn. The *Curriculum Focal Points* recommended focusing each year on relatively few but highly important topics. As a result of these recommendations, this APIS mathematics curriculum asks students to focus on only a few essential learnings designed to prepare students for learning in future mathematical courses and careers.

By focusing on only a few essential learnings students receive extended experiences with key ideas that build deep understanding, fluency with skills, and the ability to generalize and transfer knowledge to future learning.

American Prep International School Mathematics Technology & Information Literacy

The National Council of Teachers of Mathematics Principles and Standards (2000) states that "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p. 24). The use of technology in APIS mathematics classrooms is chosen carefully and integrated consistently throughout the curriculum in order to enhance learning and support effective teaching. Technology is not a replacement for understanding of key ideas and skills, however it can and should be used to expand the topics that are accessible to all students at each grade level. The use of technology provides opportunities for students to focus on mathematical concepts, create conjectures, generalize their thinking, and create justifications. Technology has the potential for extending the boundaries of the classroom and providing students with opportunities for increased practice and access to novel problems deemed inaccessible prior to technology.

American Prep International School Mathematics Process Standards

The Process Standards of the National Council of Teachers of Mathematics are a key component to the APIS mathematics curriculum. They indicate the ways in which students should acquire and use their content knowledge. The five process standards in mathematics are problem solving, reasoning, communication, connections, and representations. These processes are an integral part of all mathematics learning and teaching. A mathematical learning experience focused on the five process standards prepares students with the processes necessary for continued learning in future mathematical courses and careers. Therefore every process standard should be an integral part of the learning and assessment of every essential learning.

Communication

- Organizes and consolidates their mathematical thinking through communication
- Communicates their mathematical thinking coherently and clearly to peers, teachers, and others
- Analyzes and evaluates the mathematical thinking and strategies of others
- Uses the language of mathematics to express mathematical ideas precisely

Representations

- Creates and uses representations to organize, record, and communicate mathematical ideas
- Selects, applies, and translate among mathematical representations to solve problems
- Uses representations to model and interpret physical, social, and mathematical phenomena

Reasoning

- Recognizes reasoning and proof and fundamental aspects of math
- Makes and investigates mathematical conjectures
- Develops and evaluates mathematical arguments
- Selects and uses various types of reasoning and methods of proof

Connections

- Recognizes and uses connections among mathematical ideas
- Understands how mathematical ideas interconnect and build on one another to produce a coherent whole
- Recognizes and applies mathematics in contexts outside of mathematics

Problem Solving

- Builds new mathematical knowledge through problem solving
- Solves problems that arise in mathematics and in other contexts
- Applies and adapts a variety of appropriate strategies to solve problems
- Monitors and reflects on the process of mathematical problem solving

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*. Reston, VA: Author.

American Prep International School Mathematics Content Standards

Mathematics Standard 1 (Number)

Students develop number sense and use number relationships to solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 2 (Algebra)

Students use algebraic methods to solve problems by exploring, modeling, and describing patterns and relations involving numbers, shapes, data, and graphs. They communicate their reasoning used to solve these problems.

Mathematics Standard 3 (Data Analysis and Probability)

Students use data collection and analysis, statistics, and probability to solve problems. They communicate their reasoning used to solve these problems and accurately display the data in a way that conclusions can be drawn.

Mathematics Standard 4 (Geometry)

Students use geometric concepts, properties, and relationships in one, two, and three dimensions to model and solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 5 (Measurement)

Students use a variety of measurement tools, techniques, and systems to solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 6 (Operations)

Students make connections between concepts and procedures to effectively use computational skills to solve problems. They use appropriate techniques for the problem or situation (for example: estimation, mental math, paper and pencil, calculators, computers). They communicate their reasoning used to solve these problems.

Mathematics Overarching Enduring Understandings and Essential Questions

Overarching Enduring Understandings	Overarching Essential Questions
• Mathematics can be used to solve problems outside of the mathematics classroom.	• Is your plan working? • Do you need to reconsider what you are doing?
• Mathematics is built on reasoning and logic.	• How are solving and proving different? • How are showing and explaining different?
• Reasoning allows us to make conjectures and to prove conjectures.	• How do you know when you have proven something? • What does it take to verify a conjecture? • How do you develop a convincing argument?
• Classifying helps us to build networks of mathematical ideas.	• Why do we classify? • Why do we classify numbers, geometric objects and functions?
• Precise language helps us express mathematical ideas and receive them.	• How do you make sense of different strategies? How do you determine their strengths and weaknesses? • How do you determine similarities and differences?

American Prep International School Mathematic Content Standards and Second Grade Essential Learnings

Mathematic Standard 1 (Number): *Students develop number sense and use number relationships to solve problems. They communicate their reasoning used to solve these problems.*

Mathematic Standard 6 (Operations): *Students make connections between concepts and procedures to effectively use computational skills to solve problems. They use appropriate techniques for the problem or situation (for example: estimation, mental math, paper and pencil, calculators, computers). They communicate their reasoning used to solve these problems.*

To meet this standard, a Second Grade student:

√ Estimates and compares quantities using the structure of the base-ten numeration system.

√ Demonstrates fluency with multi-digit addition and subtraction supported by quick recall of addition and related subtraction facts to 20.

Mathematic Standard 2 (Algebra): *Students use algebraic methods to solve problems by exploring, modeling, and describing patterns and relations involving numbers, shapes, data, and graphs. They communicate their reasoning used to solve these problems.*

No essential learning at this grade level. Addressed through connections.

Mathematic Standard 3 (Data Analysis and Probability): *Students use data collection and analysis, statistics, and probability to solve problems. They communicate their reasoning used to solve these problems and accurately display the data in a way that conclusions can be drawn.*

To meet this standard, a Second Grade student:

√ Performs the four parts of a statistical investigation by posing questions, collecting data, creating informal and formal representations, and interpreting data.

Mathematic Standard 4 (Geometry): *Students use geometric concepts, properties, and relationships in one, two, and three dimensions to model and solve problems. They communicate their reasoning used to solve these problems.*

Mathematic Standard 5 (Measurement): *Students use a variety of measurement tools, techniques, and systems to solve problems. They communicate their reasoning used to solve these problems.*

To meet this standard, a Second Grade student:

√ Describes geometric representations and measurement through number.

Mathematical Processes: Students use the mathematical processes of problem solving, reasoning and proof, communication,
connections and representations to acquire and use mathematical knowledge.

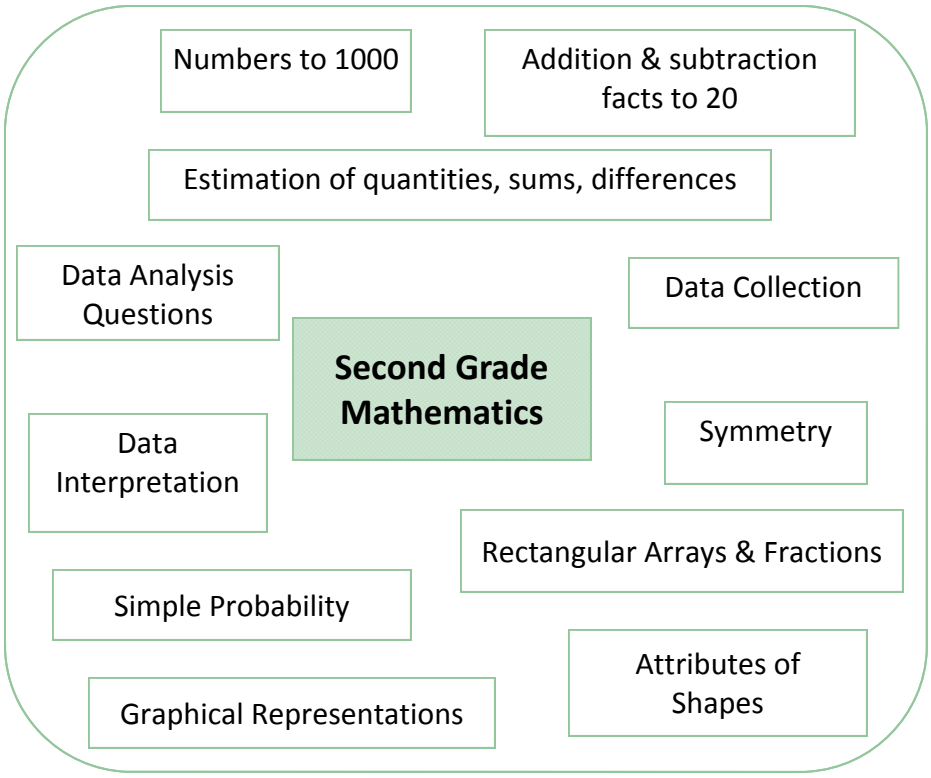
To meet this process, a Second Grade student:

√ Uses the language of mathematics to express ideas precisely through reasoning, representations, and communication.

APIS Second Grade Mathematics Overview

Course Description

Mathematics at the second grade level focuses on knowing numbers to 1000, fluency with addition and subtraction facts to 20, the four parts of a statistical investigation, and attributes of shapes such as symmetry. Problem solving, representations, reasoning, communication, and connections within and outside of mathematics underline all of the teaching and learning at second grade.



Assessment

- √ District Screeners
- √ Add+Vantage Math Diagnostic Assessments
- √ Performance tasks from *Investigations*
- √ Math Notebooks

Effective Components of a Second Grade Math Program

- Provides 60 minutes a day for math.
- Opportunities for mental math are utilized regularly.
- Mathematical ideas are connected to experiences and prior knowledge.
- Misconceptions are addressed quickly.
- Students communicate using mathematical language.
- Varied representations and models are used to learn a concept.
- Strategies and conjectures are justified and explained.

Essential Questions

- Why do we represent numbers in different ways?
- What makes an estimate reasonable?
- What makes a strategy both effective and efficient?
- What makes an answer exact?
- What makes a data representation useful?
- How are measurement and counting related?

Technology Integration & Information Literacy

- ⓘ Employs technology to visualize, investigate, and extend mathematical reasoning
- ⓘ Uses technology to practice needed math skills
- ⓘ Accesses school library, teacher-librarian, teacher-selected web pages, and other age-appropriate mathematical resources
- ⓘ Uses technology responsibly

For information about available core software, relevant web resources, and other integration activities, please use the following website: http://APIS.org/iteach/integration

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Mathematics Standard 1 (Number)

Students develop number sense and use number relationships to solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 6 (Operations)

Students make connections between concepts and procedures to effectively use computational skills to solve problems. They use appropriate techniques for the problem or situation (for example: estimation, mental math, paper and pencil, calculators, computers). They communicate their reasoning used to solve these problems.

Enduring Understandings

Numbers can be represented in multiple ways. Knowing the reasonableness of an answer comes from using good number sense and estimation strategies.

Essential Questions

Why do we represent numbers in different ways?
What makes an estimate reasonable?

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts			
	2M1	**Estimate and compare quantities using the structure and sequence of the base-ten numeration system**	
		a	Reads, writes, compares, and orders whole numbers from 0-1000 including the use of symbolic notation (e.g., <, >, =)
		b	Says the number word sequence: • By 1s: forward to 1000 and backward from 100 starting from any number in the sequence; • By 2s and 10s: forward and backward between 0-100 starting from any number; • By 5s: forward and backward between 0-100 starting from any multiple of 5; • By 100s: forward and backward on the century 0-1000 ***Measurement Connection:*** *Tells/reads time to nearest five minutes* ***Algebra Connection****: Recognizes and models repeating and growing patterns (e.g., two eyes for one head) and uses them to solve related problems* ***Geometry Connection****: Arranges objects in arrays and determines quantity by skip or stress counting*

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Mathematics Standard 1 (Number) (continued)

Students develop number sense and use number relationships to solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 6 (Operations) (continued)

Students make connections between concepts and procedures to effectively use computational skills to solve problems. They use appropriate techniques for the problem or situation (for example: estimation, mental math, paper and pencil, calculators, computers). They communicate their reasoning used to solve these problems.

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts		
	c	Estimates a quantity for a group of 0-100 objects using landmark numbers such as multiples of 5 (e.g. This small jar holds ten marbles. How many marbles do you think this large jar holds?)
	d	Creates equivalent representations of whole numbers (e.g., 35 can be represented by 35 ones, 3 tens and 5 ones, or 2 tens and 15 ones) ***Number (Money) Connection**: Creates equivalent combinations for coins to $1.00 (e.g., a quarter equals five nickels or two dimes and one nickel)*

Key Academic Vocabulary: add, after, before, combine, count, difference, less than, more than, number words 0-20, order, separate, take away

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Mathematics Standard 1 (Number) (continued)

Students develop number sense and use number relationships to solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 6 (Operations) (continued)

Students make connections between concepts and procedures to effectively use computational skills to solve problems. They use appropriate techniques for the problem or situation (for example: estimation, mental math, paper and pencil, calculators, computers). They communicate their reasoning used to solve these problems.

Enduring Understandings

Being able to compute fluently means making smart choices about which tolls to use and when to use them.

An operation can be ”undone” by its inverse.

Knowing the reasonableness of an answer comes from using good number sense and estimation strategies.

Essential Questions

What makes a strategy both effective and efficient?

What makes an estimate reasonable?

What makes an answer exact?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	2M2	Demonstrates fluency with multi-digit addition and subtraction supported by quick recall of addition and related subtraction facts to 20
	a	Uses efficient mental strategies to calculate addition and subtraction facts to 20
	b	Solves two-digit addition and subtraction situations to 100 using mental and written base-ten strategies and explains them using models and representation
	c	Uses part-part-whole knowledge of quantity to model and solve related addition and subtraction problems (e.g., 19 + 3 = 22; 22 - 3 =19; 22 - 19 = 3)

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Mathematics Standard 1 (Number) (continued)

Students develop number sense and use number relationships to solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 6 (Operations) (continued)

Students make connections between concepts and procedures to effectively use computational skills to solve problems. They use appropriate techniques for the problem or situation (for example: estimation, mental math, paper and pencil, calculators, computers). They communicate their reasoning used to solve these problems.

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts		
	d	Models situations and solves problems involving missing addends and subtrahends with whole numbers to 100, emphasizing the concept of equivalency (see Table A)
	e	Uses the commutative and associative properties to solve multi-digit addition problems
	f	Adds and subtracts multiples of 100 in the range of 1 to 1000
	g	Estimates sums and differences using landmark numbers

Key Academic Vocabulary: add, after, arrays, before, combine, count, difference, digits, equal to/not equal, equation, equivalent, estimate, expanded form, greater than/less than, growing pattern, hundreds, keep track, landmark numbers, less than, mental math, more than, number sentence, number words to 1000, ones, order, separate, skip counting, standard form, sum, take away, tens

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Mathematics Standard 3 (Data Analysis and Probability)

Students use data collection and analysis, statistics, and probability to solve problems. They communicate their reasoning used to solve these problems and accurately display the data in a way that conclusions can be drawn.

Enduring Understanding

The question to be answered determines the data to be collected and how best to collect it.

Essential Question

What makes a data representation useful?

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

2M3	Performs the four parts of a statistical investigation by posing questions, collecting data, creating informal and formal representations, and interpreting data
	a Creates questions for collecting categorical data
	b Collects data using observation, counting, and surveys ***Measurement Connection**: Uses centimeters and inches to collect quantifiable data related to length*
	c Creates a concrete or pictorial representation of data (e.g., tallies, pictographs, line plots, bar graphs, frequency tables, and Venn diagrams).
	d Interprets and makes accurate statements about a representation of data including identifying the mode and shape of the data ***Algebra Connection**: Describes qualitative change (e.g., student is growing taller) and* *quantitative change (e.g., the student grew 2 inches)* ***Probability Connection**: Determines which outcomes are the most likely, least likely, or equally likely when using a chance device*

Key Academic Vocabulary: bar graph, category, centimeter, data, equal to/not equal, equally likely, estimate, frequency table, greater than/less than, growing pattern, inch, likely, line plot, mode, pictograph, shape of data, survey, tally, unlikely, Venn diagram

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Mathematics Standard 4 (Geometry)

Students use geometric concepts, properties, and relationships in one, two, and three dimensions to model and solve problems. They communicate their reasoning used to solve these problems.

Mathematics Standard 5 (Measurement)

Students use a variety of measurement tools, techniques, and systems to solve problems. They communicate their reasoning used to solve these problems.

Enduring Understanding

Linear measure, area, and volume are fundamentally different but may be related to one another in ways that permit calculation of one give the other.

Essential Question

How are measurement and counting related?

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

2M4	Describes and compares geometric representations using properties, number, and relationships	
	a	Constructs rectangular arrays and uses number to describe and compare the rectangular arrays
	b	Can construct and identify rows and columns in rectangular arrays
	c	Identify halves, thirds, and fourths of rectangular arrays ***Number Connection:*** *Reads, writes, and identifies thirds, fourths, and halves* ***Measurement Connection****: Relates halves and fourths to half and quarter hours on a clock*
	d	Shows halves through making, finding, and describing mirror symmetries
	e	Identifies and classifies rectangles and triangles based on the number of sides, angles, and right angle

Key Academic Vocabulary: angles, array, column, fourths, halves, right angles, quarter, row, sides, symmetry, thirds, shape

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Mathematical Processes

Students use the mathematical processes of problem solving, reasoning and proof, communication, connections and representations to acquire and use mathematical knowledge.

Enduring Understandings

Mathematics can be used to solve problems outside of the mathematics classroom.
Mathematics is built on reason and always makes sense.
Reasoning allows us to make conjectures and to prove conjectures.
Precise language helps us express mathematical ideas and receive them.

Essential Questions

Is your plan working? Do you need to reconsider what your are doing?
How are showing and explaining different?
How do you develop a convincing argument?
How do you make sense of different strategies? How do you determine their strengths and weaknesses?

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts	2M5	Uses the language of mathematics to express ideas precisely through reasoning, representations, and communication
		a Selects, applies, and translates among mathematical representations to solve problems and justifies the reasonableness of solutions
		b Creates and uses representations to organize, record and explain mathematical ideas clearly to peers, teachers and others
		c Analyzes and evaluates the mathematical thinking, strategies and arguments of peers, teachers and others
		d Recognizes, uses, and explains connections among mathematical ideas in contexts both inside and outside of mathematics classrooms
		e Develops, tests and explains mathematical conjectures
		f Recognizes and utilizes key academic vocabulary relevant to mathematics in verbal and written communication
		g Given a real-world problems selects an appropriate method to solve the problem by determining if the information provided is sufficient, insufficient or extraneous
		h Creates and illustrates a real-world problem from a given math sentence

<table>
<tr><th colspan="5">Table A</th></tr>
<tr><td>Problem Type</td><td>(Result Unknown)</td><td>(Change Unknown)</td><td colspan="2">(Start Unknown)</td></tr>
<tr><td>Join</td><td>Connie had 5 marbles. Juan gave her 8 more marbles. How many marbles does Connie have altogether?</td><td>Connie has 5 marbles. How many more marbles does she need to have 13 marbles altogether?</td><td colspan="2">Connie had some marbles. Juan gave her 5 more marbles. Now she has 13 marbles. How many marbles did Connie have to start with?</td></tr>
<tr><td>Separate</td><td>Connie had 13 marbles. She gave 5 to Juan. How many marbles does Connie have left?</td><td>Connie had 13 marbles. She gave some to Juan. Now she has 5 marbles left. How many marbles did Connie give to Juan?</td><td colspan="2">Connie had some marbles. She gave 5 to Juan. Now she has 8 marbles left. How many marbles did Connie have to start with?</td></tr>
<tr><td rowspan="2">Part-Part-Whole</td><td colspan="2">(Whole Unknown)</td><td colspan="2">(Part Unknown)</td></tr>
<tr><td colspan="2">Connie has 5 red marbles and 8 blue marbles. How many marbles does she have?</td><td colspan="2">Connie has 13 marbles. 5 are red and the rest blue. How many blue marbles does Connie have?</td></tr>
<tr><td rowspan="2">Compare</td><td>(Difference Unknown)</td><td>(Compare Quantity Unknown)</td><td colspan="2">(Referent Unknown)</td></tr>
<tr><td>Connie has 13 marbles. Juan has 5 marbles. How many more marbles does Connie have than Juan?</td><td>Juan has 5 marbles. Connie has 8 more than Juan. How many marbles does Connie have?</td><td colspan="2">Connie has 13 marbles. She has 5 more marbles than Juan. How many marbles does Juan have?</td></tr>
<tr><td colspan="5">Reference: Carpenter, T.P., Fennema, E., Franke, M.L., Levi, L., & Empson, S.B., (1999) Children's Mathematics: Cognitively Guided Instruction, Reston, NCTM, (p.12)</td></tr>
</table>

Suggested Timelines

Topic	Suggested Timeframe
Estimates and compares quantities using the structure of the base-ten numeration system	Eight weeks of intensive study over the course of the year with periodic revisiting on a weekly basis during other units.
Demonstrates fluency with multi-digit addition and subtraction supported by quick recall of addition and related subtraction facts.	Eight weeks of instruction over the course of the school year with periodic revisiting on a weekly basis during other units.
Describes geometric representations and measurement through number.	Four weeks of instruction over the course of the school year.
Performs the four parts of a statistical investigation by posing questions, collecting data, creating informal and formal representations and interpreting data.	Four weeks of instruction over the course of the school year.

Mathematics Scope & Sequence K-1

Standard	K	1	2
Number and Operation	Numbers to 20 Combinations to 5 Coin Identification	Numbers to 100 Ordinal Numbers Combinations to 10 Skip Counts Addition and Subtraction Contexts Values of Coins	Numbers to 1000 Addition and Subtraction Facts Estimation of Sums and Differences Halves, Thirds and Fourths Combinations of Coins
Algebra	Repeating patterns	Repeating Patterns Number Equality Odd and Even Commutative Property of Addition Inverse Relationship of Addition and Subtraction	Growing and Repeating Patterns Commutative Property of Addition Qualitative and Quantitative Change
Geometry and Measurement	Basic Shapes Days of Week Relative Location Non-Standard Measurement	Time to half hour Months of the Year Inch and Foot Shapes and Solids Tessellations	Time to five minute Inches and Centimeters Attributes of Shapes Symmetry Rectangular Arrays
Data Analysis and Probability	Data Collection	Data Collection Data Interpretation	Data Analysis Questions Data Collection Graphical Representations Data Interpretation Mode Simple Probability
Mathematical Processes	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections

Mathematics Scope & Sequence 3-5

Standard	3	4	5
Number and Operation	Numbers to 10,000 Multi-Digit Addition and Subtraction Multiplication and Division Context Fraction Models Money Addition and Subtraction	Number to 100,000 Multiplication Facts Multi-Digit Multiplication Multiples and Factors Prime and Composite Divisibility Rules Rational Number Comparison	Multi-Digit Multiplication and Division Remainders as Decimals and Fractions Addition and Subtraction of Rational Numbers
Algebra	Growing Patterns Properties of Addition Odd and Even In/Out Tables Inverse Relationship of Multiplication and Division	Properties of Multiplication In/Out Tables Tabular and Graphical Patterns Distributive Property	Growth Pattern Equations Rates of Change Variables Rational Number Conjectures
Geometry and Measurement	Measurement Time to minute Perimeter Parallel Congruence Points, Lines and Rays	Area and Perimeter Distance and Scale Coordinate Graphing Measurement to half unit	Angles Transformations Measurement to quarter unit 2-D Representations of Solids
Data Analysis and Probability	Combination Problems Graphical Representations Data Interpretation	Fairness Sample Space Likelihood of Events Data Analysis Mode, Median, Range Clusters, Outliers	Categorical and Numerical Questions Data Collection Methods Graphical Representations Data Descriptions and Analysis
Mathematical Processes	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections

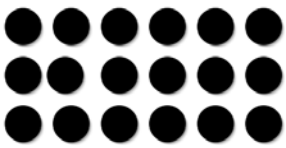
Mathematics Scope & Sequence 6-8

Standard	6	7	8
Number and Operation	Positive Rational Numbers Addition, Subtraction Multiplication, Division Estimation Percent Problems Properties of Positive Rational Numbers	Integers Negative Rational Numbers Addition, Subtraction Multiplication, Division Properties of Rational Numbers Order of operations Distributive Property Ratios and Proportion	Exponents Scientific Notation Irrational Numbers Estimation
Algebra	Linear and Nonlinear Relationships Represent and Analyze Patterns Variables, Expressions, Equations, Inequalities Descriptions of Change	Linear Relationships Slope Analysis of Change Verbal Rules, Graphs, Tables, and Symbolic Expressions/ Equations Simple Linear Equation Solutions	Slope Direct variation Linear and Nonlinear Relationships Functional Relationships Linear Equations Systems of Linear Equations
Geometry and Measurement	Area and Perimeter Formulas Estimation of Irregular Areas Maximum/Minimum Area and Perimeter Problems Circumference and Area of Circles	Similarity Similar Figures Scale Factor Linear Dimensions, Angles, Perimeters and Areas Four Quadrant Coordinate Graphs	Pythagorean Theorem Rectangular Prisms Pyramids Volume Surface Area
Data Analysis and Probability	Measures of Central Tendency Mean, Median, Mode Graphical Representations Data Analysis Hypotheses and Conclusions	Coordinate Graphing Data Analysis	Population and Samples Sample Size Random Samples Probability Sample Distributions Measures of Variability
Mathematical Processes	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections

Mathematics Scope & Sequence 9-12

Standard	Algebra	Geometry	Algebra 2
Number and Operation	Real Number Operations Law of Exponents Absolute Value Scientific Notation		Complex Number Operations
	Polynomial Operations Functions Linear Equations/Inequalities Quadratic Equations		Families of Functions Polynomial, Absolute Value, Rational, Radical Exponential/Logarithmic and Trigonmetric
Geometry and Measurement		Congruence/Similarity Properties of Polygons Properties of Circles Pythagorean Theorem Trigonometric Ratios Perimeter, Area, Volume Unit Conversions Proof and Argument	
Data Analysis and Probability			
Mathematical Processes	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections	Communication Representations Reasoning and Proof Problem Solving Connections

Mathematics Glossary of Terms

addend	Any number being added.
adding and subtracting through ten	A non-unitary addition and subtraction strategy that uses ten and its multiples as landmark numbers. (e.g., 8+5 is thought of as 8+2=10 and 10+3=13; 23-7 is thought of 23-3=20 and 20-4=16).
algorithm	A specific step-by-step procedure for solving a problem.
analog clock	A clock with a face and hands.
angle	Two rays that share an endpoint.
area	The measure, in square units, of the inside of a plane figure.
array	A rectangular arrangement of objects in rows and columns.  dot array (discrete array) area model array
associative property	For any rational numbers: (a + b) + c =a + b = c) and (a x b) x c = a x (b x c)
bar graph	A graph that uses the height or length of rectangles to compare data.
base ten	A number system in which each place has 10 times the value of the next place to its right.
benchmark fractions	Commonly halves and whole numbers.
benchmark numbers	Numbers used in estimation and mental calculation; most commonly multiples of 10, but also including numbers like 25 with which can be readily manipulated.
capacity	The maximum amount that can be contained by an object, usually measured in liquid units. (e.g. tablespoons, cups, gallons. "A vase can hold 3 cups of water.)

Mathematics Glossary of Terms

cardinal number	A number that is used in simple counting and that indicates how many elements there are in a set.
cardinality	The cardinality of a set is the number of elements or members (numerosity) of a set. The Cardinality Principle is the connection that the last number word of the count indicates the amount of the set.
categorical data	Data that is grouped by category or attribute (e.g., What kind of pets do you have? Cats, dogs, rabbits, etc.).
clusters	Data that are grouped around a value in a set of values.
combination	A group of items or events. Placing these items or events in a different order does not create a new combination.
combine	Put together.
common denominator	For two or more fractions, a common denominator is a common multiple of the denominators.
commutative property	For any rational numbers: a + b = b + a and a x b = b x a. (changing the order of the addends or factors does not affect the sum or product (e.g. 7 + 5 = 5 + 7 and
compare	See Elementary Math Curriculum: Table A
composite number	A natural number that has more than two factors (e.g., The factors of 10 are 1, 2, 5, and 10).
compose	Put together or combine quantities.
congruent	Having exactly the same size and shape.
conjecture	A mathematical hypothesis that has not been proved or disproved.
counting back	Counting back from or to a number. Example of counting back from: 11-3 is solved by counting back from 11: "10, 9, 8." Example of counting back to:

Mathematics Glossary of Terms

counting on	Counting up from or to a number. Example of counting up from: 7+5 is solved by counting up 5 from 7: 8, 9, 10, 11, 12. Example of counting up to: 7 +__=12 is solved by counting from 7 up to 12 and keeping track of 5 counts.
cubic unit	A unit such as a cubic meter used to measure volume or capacity.
data	Information, usually numerical information.
decimal number	A number that uses a decimal point to indicate parts of a whole (e.g., 3.25).
decompose	Breaking quantities into useful chunks.
difference	The amount that remains after one quantity is subtracted from another.
digit	Any one of the ten symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
distributive property	a(b + c) = ab + ac and a(b — c) = ab — ac, where a, b, and c are any real
division	See attached "Teacher Note: Two Kinds of Division: Sharing and Partitioning."
doubles plus one	An addition strategy that utilizes knowledge of doubles facts to add two numbers that are one away from each other (e.g., 5 + 6 can be found by knowing
edge	The line segment where two faces of a solid figure meet.
elements (of a pattern)	The individual items in a set.
equality	Represented by an equal sign. In an equation, the equal sign represents a relationship between two expressions that have the same value
equal partitions/part	Pieces of an object or set that are equivalent in amount.

Mathematics Glossary of Terms

estimate	A number close to an exact amount. An estimate tells about how much or about how many.
even number	A whole number that has 2 as a factor. All even numbers are divisible by two and have 0, 2, 4, 6, or 8 in the ones place.
expanded form	A way to write numbers that shows the place value of each digit (e.g., 789= 700+80+9).
expression	A group of characters or symbols representing a quantity (example: 5+6=11, 7x8, 3x+6)
face	A flat surface of a solid figure.
factors	Numbers that are multiplied together to form a product (e.g., 6 x 7 = 42, 6 and 7 are factors).
flip	(see transformations)
fluency	Efficiency, accuracy, and flexibility in solving computation problems.
fraction	A number that describes a part of a whole or group, usually in the form a/b where "a" is any real number and "b" is any real number >0.
frequency table	A table that depicts the number of times that something occurs in an interval or set of data.
function table	A table that matches each input value with an output value. The output values are determined by the function. x: 0, 1, 2, 3 y: 3, 4, 5, 6
generalizable	The ability to extend a number of results to form a rule. For example 5+3=3+5 and 1.5+2.7=2.7+1.5 can be generalized to a+b=b+a.
graph	A drawing that shows a relationship between sets of data.

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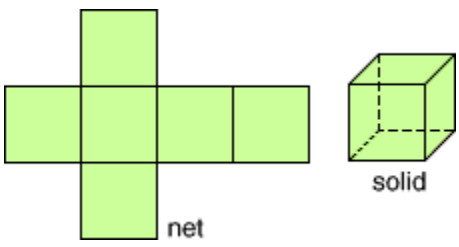
hexagon	A polygon with six sides.
horizontal	Parallel to the horizon.
identify (numeral identification)	To give the name of a written numeral or other symbol in isolation (e.g., When presented a card with the numeral 563, the child says "five hundred sixty-three). (compare to recognize)
identity property **of Addition** **of Subtraction** **of Multiplication** **of Division**	 for any number n; n+0=0 for any number n; n-0=n for any number n, nx1=n for any number n, n/1=n
improper fraction	A fraction with a value greater than 1 that is not written as a mixed number.
in/out tables	Also called function tables.
integer	The set of whole numbers and their opposites (e.g., …… -2, -1, 0, 1, 2…).
inverse operation	An operation that undoes another operation (e.g. addition and subtraction are inverse operations).
join	See Elementary Math Curriculum, Table A.
landmark number	Numbers that are familiar landing places that make for simple calculations and to which other numbers can be related (e.g., 10, 50, and 100 are commonly used landmarks).
length	The distance along a line or figure from one point to another. One dimension of a two- or three-dimensional figure.
line plot	A graph showing frequency of data on a number line.
line	An infinite set of points forming a straight path in 2 directions.

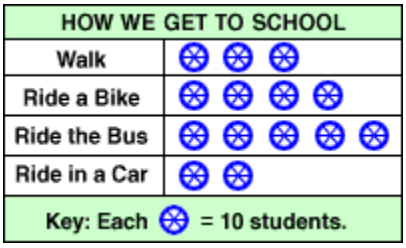
Mathematics Glossary of Terms

line segment	A part of a line defined by 2 end points.
line of symmetry	A line that divides a figure into two halves that are mirror images of each other.
mean	The average of a set of data. It is the number found by dividing the sum of the numbers in a set of data by the number of addends. (calculation of the mean is not a expectation of this elementary curriculum)
median	In a set of data, the number in the middle when the data is organized from least to greatest. When there are an even number of data, the median is the mean of the two middle values. (e.g. For the set of numbers 2, 4, 6, 8, 10, 12 the median is 7)
mental computation	Computing an exact answer without using paper and pencil or other physical aids.
metric system	An international system of measurement based on tens. The basic units of measure are meter, liter, gram, degrees Celsius.
minuend	The number you subtract from (e.g., 8-3=5; 8 is the minuend).
mixed number	A number consisting of an integer and a fraction.
mode	The number or item that appears most often in a set of data. There may be one, more than one, or no mode. (when there are 2 modes we say that the data set is bimodal. When there are more than 2 modes we say that there is no mode.)
multiple	The product of the number and any whole number (e.g., The multiples of 4 are 0, 4, 8, 12, 16…).
natural number	The counting numbers. {1,2,3,4,…} Natural numbers include all the cardinal numbers except 0.
net	A two-dimensional shape that can be folded into a three-dimensional figure. 

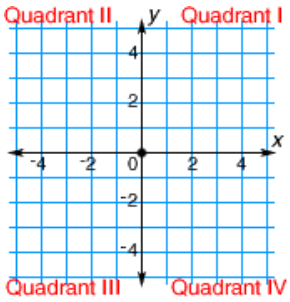
Mathematics Glossary of Terms

non-standard units	Units other than customary or metric units used for measurement (e.g. a paper clip might be used as a non-standard unit of length).
number line	A diagram that represents numbers as points on a line.
number sentence	An equation or inequality with numbers (e.g., 6 + 3 = 9 or 8 + 1 < 12).
number word sequence	A regular sequence of number words, typically, but not necessarily, by ones.
numeral	A symbol used to represent a number.
numeric expression	A mathematical combination of numbers, variables, and operations. (e.g,. a box with an amount of pencils, x, with 3 missing is x-3).
numerical data	Data expressed in or involving numbers.
odd number	A whole number that is not divisible by 2. All odd numbers have 1, 3, 5, 7, or 9 in the ones place.
off-century counting	Counting forward or backward by 100, starting at any number that is not a multiple of one hundred (e.g., 125, 225, 325…).
off-decade counting	Counting forward or backward by 10, starting at any number that is not a multiple of ten (e.g., 54, 44, 34…).
on-century counting	Counting forward or backward by 100 starting at any multiple of 100. (e.g. 100, 200, 300 …)
on-decade counting	Counting forward or backward by 10 starting at any multiple of ten (e.g. 10, 20, 30…)
one-to-one correspondence	Assigning one counting number for each object counted in order to determine how many in a set.
open number sentence	A number sentence in which one or more numerical values is missing (e.g., __+6=13).
operation	A mathematical process; addition, subtraction, multiplication, division, and raising a number to a power are some mathematical operations.

Mathematics Glossary of Terms

ordered pair	A pair of numbers used to name a location on a grid (x,y); the first number is the horizontal distance from the origin, the second is the vertical distance from the origin.
ordinal number	Indicates the relative position of an object in an ordered set (e.g., 1st, 2nd, 5th).
origin	The intersection of the x and y axes in a coordinate plane. Its coordinates are (0,0).
outcome	A possible result of a random process (e.g., Heads and tails are the two possible outcomes of flipping a coin.)
outlier	An item of data that is significantly greater or less than all the other items of data.
parallel lines	Lines that are always the same distance apart; never meeting.
partition	Breaking quantities into useful chunks in order to solve problems.
part-part-whole	See Elementary Math Curriculum, p. 29.
perimeter	The measure of the lines forming a polygon.
perpendicular pictograph	A graph using pictures or symbols to show data. 

Mathematics Glossary of Terms

pictorial representation	Using a picture to model a solution strategy or mathematical idea.
place value	The value of the place of a digit of a number (e.g., In the number 7324, 4 is 4 ones, 2 is 2 tens, 3 is 3 hundreds, and 7 is 7 thousands)
polygon	A closed plane figure formed from line segments that meet only at their end-points.
powers of ten	Any number that can be expressed as repeated multiplication of 10 (e.g., 10, 100, 1000)
prime number	A whole number that has exactly two different positive factors, itself and 1 (e.g., 7 is a prime number because its only factors are 7 and 1). 1 is not a prime number because it does not have 2 factors.
proper fraction	A fraction less than one.
quadrant one	On a Cartesian coordinate grid, the quadrant that includes positive x and y values. 
qualitative	of, or relating to descriptions based on some quality rather than quantity. (e.g. “Today is hotter than yesterday.” “It is very likely to rain today”)
quantitative	Data of, relating to, or expressible in numeric terms. (e.g. “It is 98° outside.” “There is an 85% chance of rain today”)
quotient	The answer to a division problem.

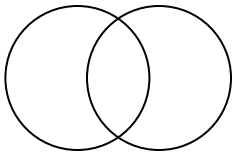
Mathematics Glossary of Terms

range	The difference between the least and greatest values in a set of data.
rate of change	The rate at which a pattern changes.
rational number	Any number that can be expressed as a quotient of two integers, a/b, with a divisor b not equal to zero. The set of rational numbers includes every integer, whole number, fraction, mixed number, and some of the decimal numbers.
ray	a part of a line that has one endpoint and extends indefinitely in one direction.
reflection	(see transformations)
recognize (numeral recognition)	The ability to pick out a written symbol or figure from a group when given the name of the number or figure. (e.g. A child points to the correct number when asked to point to the number 8.)
regular polygon	A polygon with all sides the same length and all angles the same measure.
relative position/location	A description of the location of one object in relation to another.
rotation	(see transformations)
right angle	An angle with a measure of 90°; a square corner.
round	To express a number in a simplified form by finding the nearest whole number, ten, hundred, thousand, etc. (e.g., 537 to the nearest hundred rounds to 500, to the nearest 10 rounds to 540).
sample space	The set of all possible outcomes of an experiment.
scale	(1) The ratio between the actual size of an object and a proportional representation. (2) A system of marks at fixed intervals used in measurement or graphing.
separate	See Elementary Math Curriculum, Table A.

Mathematics Glossary of Terms

shape	A two-dimensional figure having length and width.
side	Any one of the line segments that make up a polygon.
skip counting	Counting by multiples.
slide	(see transformations)
solid	A geometric figure with three dimensions.
square number	A number that is the result of multiplying an integer by itself.
standard form	A number written with one digit for each place value (e.g., The standard form for the number two hundred six is 206).
standard units	Units from the customary system or metric system used for measurement (e.g. inch and centimeter are standard units of length).
subtrahend	In subtraction, the number being subtracted (e.g., In 8 — 5 = 3, 5 is the subtrahend).
stress counting	Counting by ones, emphasizing a multiplicative pattern (1, 2, **3**, 4, 5, **6**).
subitize	Instantly quantifying a small collection without counting.
sum	The result of addition.
symmetry	The property of exact balance in a figure; having the same size and shape across a dividing line (line/mirror symmetry) or around a point (rotational).
symbolic notation	A mathematical idea represented with symbols.
table	An organized way to list data. Tables usually have rows and columns of data.

Mathematics Glossary of Terms

tally marks	Marks used to keep track of things being counted, usually organized in groups of five.
t-chart	A chart showing the relationship between two variables.
translation	(see transformations)
transformation *__slides__ (translations) *__flips__ (reflections) *__turns__ (rotations)	A rule for moving every point in a plane figure to a new location. Three types of transformations are A transformation that moves a figure a given distance in a given direction. A transformation that creates a mirror image of a figure on the opposite side of a line. A transformation in which a figure is turned a given angle and direction around a point.
tree diagrams	An organized way of listing all the possible outcomes of an experiment.
variable	A symbol that can be replaced by a number in an expression, equation, or formula. Variables are often letters of the alphabet (e.g. in the expression y+3, y is the variable).
Venn Diagram	A drawing that uses circles to show relationships among sets. 
vertex	In 2 or 3 dimensional figures, the point at which two line segments, lines, or rays meet to form an angle.
vertices	Plural of vertex.

Mathematics Glossary of Terms

vertical	Upright; perpendicular to the horizon.
volume	A measure of the amount of space occupied by a three-dimensional figure, generally expressed in cubic units.
weight	The measure of the heaviness of an object.
whole numbers	The set of natural numbers plus the number zero {0,1,2,3…}
zero property of multiplication	a x 0 = 0