Saskatchewan
Learning

Grade 1 Mathematics Curriculum

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Saskatchewan Learning
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- field test teachers
- other field personnel.

This curriculum in based on the Western and Northern Canadian Protocol (WNCP) Common Curriculum Framework (CCF) (2006) for Kindergarten to Grade 9 Mathematics.

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Grade One Mathematics

Purpose

The Grade 1 Mathematics Curriculum defines the outcomes to be attained by grade one students during the 210 minutes of instruction and learning time allocated per week for the entire school year. It is designed to support teachers in providing students with learning opportunities to develop appropriate mathematics knowledge, understandings, and abilities within a learning environment that supports the students' development of positive attitudes and beliefs towards mathematics. Indicators are included for each outcome to clarify the breadth and depth of learning intended by the outcome. These indicators are a representative list of the kinds of things a student needs to know, and/or be able to do in order to achieve the learnings intended by the outcome.

Outcomes are statements identifying what students are expected to know, understand, and be able to do by the end of a particular grade level.

This curriculum also provides information for teachers to understand how the outcomes of the Kindergarten Mathematics Curriculum connect to the K-12 Goals for mathematics, the Cross-curricular Competencies to be addressed in all areas of study, and the Broad Areas of Learning that summarize the Goals of Education for Saskatchewan students.

Indicators are a representative list of things students could be asked to know or do in order to show their attainment of the outcome. The indicators are intended to clarify the breadth and depth of the

Appendix A provides explanations of some of the mathematical terminology you will find in this curriculum. Appendix B: Three Grades at a Glance has been included to help teachers see how Grade 1 outcomes are related to Kindergarten and Grade 2 outcomes.

An introduction to pedagogical understandings necessary for the effective teaching of mathematics is included. Additional support resources that explore and demonstrate these pedagogical understandings will be provided online.

This curriculum has been designed to address current research in mathematics education as well as to address the learning needs of young children. Changes to the outcomes in all the grades of mathematics K to 12 have been made for a number of reasons including:

- decreasing content in each grade to allow for more depth of understanding
- rearranging concepts to allow for greater depth of learning in one year and to align related mathematical concepts
- increasing the focus on numeracy (understanding numbers) beginning in Kindergarten
- introducing algebraic thinking earlier.

Aim and Goals of K-12 Mathematics

When we ask good questions in math class, we invite our students to think, to understand, and to share a mathematical journey with their classmates and teachers alike. Students are no longer passive receivers of information when asked questions that challenge their understandings and convictions about mathematics. (Sullivan, 2002, p. 1)

The aim of the mathematics program is to prepare individuals who value mathematics and appreciate its role in society. The K-12 mathematics curricula are designed to prepare students to cope confidently and competently with everyday situations that demand the use of mathematical concepts including interpreting quantitative information, estimating, performing calculations mentally, measuring, understanding spatial relationships, and problem solving. The mathematics program is intended to stimulate the spirit of inquiry within the context of mathematical thinking and reasoning.

The four goals for K-12 mathematics are broad statements that identify the knowledge, understandings, skills, and attitudes in mathematics that students are expected to develop and demonstrate by the end of grade twelve. Within each grade level, outcomes are directly related to the development of one or more of these goals. The goals for K-12 mathematics are:

Logical Thinking: *Develop and be able to apply mathematical reasoning processes, skills, and strategies to new situations and problems*.

This goal encompasses the processes and strategies that are foundational to understanding mathematics as a discipline. These processes and strategies include:

- inductive and deductive thinking
- abstracting and generalizing
- exploring, identifying, and describing patterns
- verifying and proving
- exploring, identifying, and describing relationships
- modeling and representing (concretely, visually, physically, and symbolically)
- hypothesizing and asking “what if” (mathematical play).

Number Sense: *Develop an understanding of the meaning of, relationships between, properties of, roles of, and representations (including symbolic) of numbers and apply this understanding to new situations and problems.*

Key to developing number sense is students having ongoing experience with:

- decomposing and composing of numbers
- relating different operations to each other
- modeling and representing numbers and operations (concretely, visually, physically, and symbolically)

- understanding the origins and need for different types of numbers
- recognizing operations on different number types as being the same operations
- understanding equality and inequality
- recognizing the variety of roles for numbers
- understanding algebraic representations and manipulations in terms of extending numbers
- looking for patterns and ways to describe those patterns numerically and algebraically.

Spatial Sense: *Develop an understanding of 2-D shapes and 3-D objects and the relationships between geometrical shapes and objects, and numbers and apply this understanding to new situations and problems.*

Development of a strong spatial sense requires students to experience:
- construction and deconstruction of 2-D shapes and 3-D objects
- investigations into relationships between 2-D shapes and 3-D objects
- explorations of how number (and algebra) can be used to describe 2-D shapes and 3-D objects
- exploration of the movement of 2-D shapes and 3-D objects
- exploration of the dimensions of 2-D shapes and 3-D objects
- exploration of different forms of measurement and their meaning.

Math makes sense! This is the most fundamental idea that an elementary teacher of mathematics needs to believe and act on. It is through the teacher's actions that every child in his or her own way can come to believe this simple truth and, more importantly, believe that he or she is capable of making sense of mathematics. (Van de Walle & Lovin, 2006, p. ix)

Mathematical Attitude: *Develop a positive attitude towards the ability to understand mathematics and to use it to solve problems.*

Mathematical ability and confidence is built through playing with numbers and related concepts in a supportive environment. Students can persevere when challenged if provided with opportunities to learn mathematics within an environment that:
- supports risk taking (mathematically and personally)
- honours students' ideas
- provides engaging and responsive learning experiences.

Students who have a positive attitude towards mathematics demonstrate:
- confidence in their mathematical insights and abilities
- enjoyment, curiousity, and perseverance when encountering new problems
- appreciation of the structure and value of mathematics.

There are many "real-world" applications of the mathematics within the K-12 Mathematics curricula. The curriculum content first and foremost serves as the vehicle through which students can achieve the four goals of K-12 mathematics in Saskatchewan. Mathematically confident students apply mathematical knowledge to new situations and to solve problems.

Connections to Broad Areas of Learning

There are three Broad Areas of Learning that reflect Saskatchewan's Goals of Education.

Building a Disposition for Learning

Mathematics enables individuals to understand and explore the world, and communicate and participate in a variety of roles and settings in the home, school, and community.

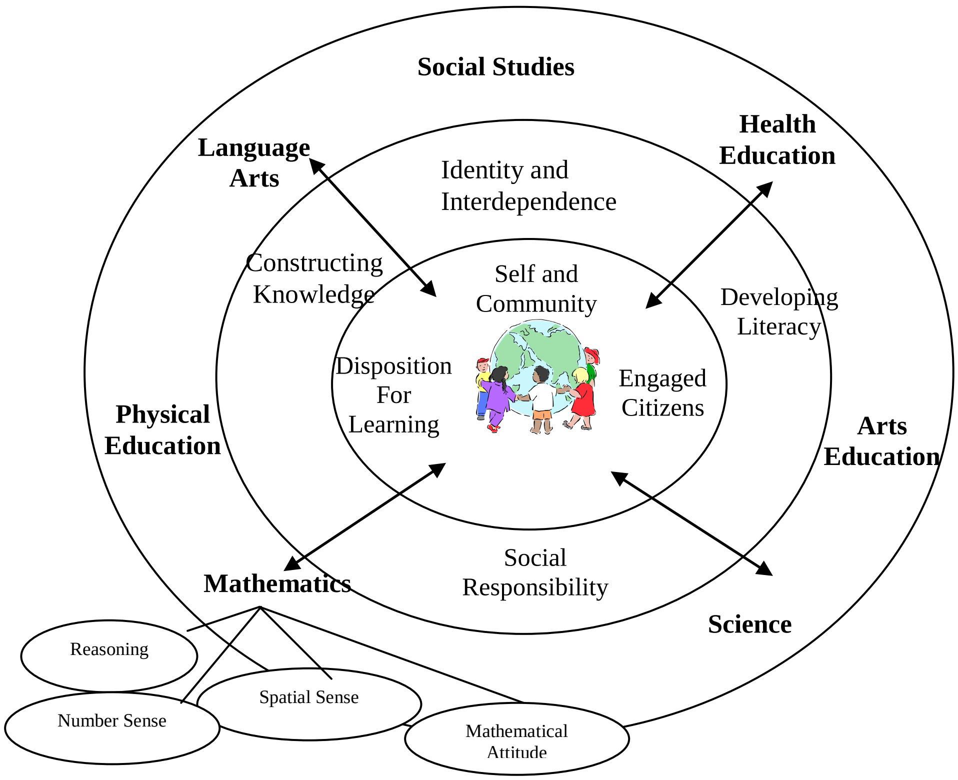
Students engaged in constructing and applying mathematical knowledge in an authentic learning environment, which includes a variety of experiences and contexts, build a positive disposition for learning. In mathematics, an environment that supports risk taking allows students to learn from errors and to appreciate the value of errors in learning. In such an environment, students manipulate objects and ideas, value multiple ways of arriving at a solution, build confidence, and develop perseverance. When actively exploring mathematical content through inquiry in an appropriate environment, students develop mathematical reasoning, number sense, spatial sense, and a positive attitude towards mathematics.

Building a Sense of Self and Community

Exploring mathematics in a collaborative learning environment, rich in dialogue, provides opportunities for students to strengthen connections with others. When students work together to explore, negotiate, reflect, and construct personal strategies, students achieve a deeper understanding of mathematics. As well, students experience different points of view and learn to value diversity of perspectives and ways of knowing. In such an environment, students learn and come to value personal understandings, accomplishments, and contributions. As a member of a group, each student contributes to the learning community and social climate of the classroom.

Building Engaged Citizens

Co-planning the learning environment empowers students to communicate and make decisions about learning. It also enables students to contribute to the social harmony of the learning community. Mathematical exploration and analysis brings a unique perspective and way of learning to view and construct one's understanding of the world through a mathematical lens. Such processes also help students develop a greater respect for and understanding of how different points of views and options can strengthen thinking and potential options. Students become engaged citizens, who solve problems and make personal decisions regarding their roles and contributions to the world.



Connections to Cross-curricular Competencies

There are four cross-curricular competencies that together contribute to an individual student's development within the four Broad Areas of Learning. These competencies are synthesized from the Common Essential Learnings. It is important, therefore, that the learning of mathematics also supports the students in their attainment of these competencies.

Constructing Knowledge

Constructing knowledge is how people make sense of the world around them.

Students construct meaning of mathematical language and concepts when engaged in an inquiry-based and problem-solving environment that provides opportunities to think critically and creatively. Moreover, students gain a deeper understanding of mathematics when actively exploring and applying mathematics in relevant and varied contexts. Mathematics enables students to consider different perspectives, connections, and relationships in the world.

Identity and Interdependence

We want students to develop a positive self-concept and to have the ability to live in harmony with others, and with the natural and constructed world.

Students become confident in mathematics when supported in taking risks in an accepting and respectful environment that promotes self-reflection. When interacting with others to explore and solve problems, students discuss and negotiate strategies and solutions. Students learn to contribute, to respect each other's ideas, and to act responsibly. A purposeful approach to learning mathematics allows students to appreciate their role in the planning, organizing, and management of the learning environment.

Developing Literacy

Students develop mathematical literacy by representing their environment through words, numbers, music, and drama. Students explore and use a variety of representations for mathematical concepts. Using auditory, visual, and symbolic representations as well as concrete manipulatives and physical movement, deepens students' understanding of mathematics and allows them to communicate understandings.

Social Responsibility

When engaged in the co-construction of mathematical knowledge, students are respectful when understanding and considering others' ideas, perspectives, suggestions, and contributions. Students become aware of the possibility of more than one solution to a problem or situation, and they learn to work with others to negotiate solutions to problems in the school, the community, and the world. When working in a group exploring mathematical problems, students learn to negotiate to resolve conflicts.

Curriculum Integration

Young students arrive at school with a natural curiosity. An engaging learning environment provides opportunities to satisfy and nourish this curiosity or thirst for knowledge. When exploring mathamatics in such an environment, students make connections within mathematics, with other curricular areas, and with the world. Experiencing mathematical concepts in rich contexts allows students to transfer knowledge and understanding to new situations. Some examples of integrating mathematics with other areas of study are described below.

When students experience mathematics as a lens through which they can view other subjects, and other subjects as lens through which they can view mathematics, they learn that mathematics is much more than a set of facts and procedures to memorize for the exam.

Arts Education **–** Patterning is a very important concept in mathematics. Students use patterns for problem solving, reasoning, and algebraic thinking. Dance movement and music are excellent contexts for exploring and deepening understanding of patterns. Viewing, discussing, and creating visual patterns in traditional arts expressions allows students to appreciate the diversity of patterns used by different cultures. At this age, students often use colour for patterning. Students are also very creative when representing number and shape with their bodies. All four of the Arts Education strands can be used as contexts to help students represent, interpret, and make sense of mathematical ideas.

English Language Arts **–** Students use language *to explore and build mathematical concepts.* Students must understand the language of instruction and the language that is specific to mathematics. Students need the opportunity to use and experience mathematical language. It is important for teachers to model mathematical language and appropriate mathematical terms. Well-developed language ability is needed to express learning and understanding of mathematical ideas. In mathematics, students use many symbols to understand and communicate. Instructional strategies for teaching language work well for teaching mathematics. These strategies need to focus on listening, speaking, reading, writing, viewing, and representing.

Language is as important to learning mathematics as it is to learning to read. (National Council of Teachers of Mathematics, 2000, p. 128)

In grade one, students are beginning to explore the concepts of addition and subtraction. Number stories add context and are meaningful for students. For most young students $2 + 5 = \square$ has no meaning; however, many students will be able to make sense of the symbols when used in a number story. Retelling number stories helps students deepen understanding of numbers. Counting and pattern books also help students make connections to prior knowledge and deepen understanding of numbers and their interrelationships. Referring to the English language arts outcomes is very important when planning the learning environment for Grade 1 mathematics.

When mathematics is taught without a rich context, it becomes a static discipline.

Health Education **–** In Grade 1 health education, students explore healthy behaviours. When exploring food choices, students can sort and describe sorting rules for different sets of food. Extending these activities to including the shape of the foods being grouped will help students connect mathematical ideas to the environment. Using simple recipes to make healthy snacks also provides meaningful counting experiences. Interactive, hands-on activities in mathematics provide meaningful opportunities to explore healthy relationships in health as well by providing an authentic environment in which students can express feelings, wants, and needs through collaborating and negotiating.

Physical Education **–** There are many possibilities to make connections with mathematics in Grade 1 physical education. An exercise circuit is an effective context for viewing numbers and counting. Students move from one station to the other in different ways. When students arrive at the station, they "read" visuals that provide instructions for that station. These visuals show the number and kind of movement to be done by the students such as jumping, moving objects, or holding one's balance while counting. The children can also represent numbers up to 20 by following instructions such as "Make groups of 3 people". Mathematics can also be included in directions such as: "Find a partner, now add two more people to your group, and walk as far as you can counting twelve steps. Now count backwards as you walk back four steps". Making groups, in an engaging environment, deepens students' understanding that sometimes it is not possible to make equal groupings. This is a foundational understanding related to place value and division. In addition, involving the students in the distribution of equipment such as scarves and skipping ropes provides an opportunity for students to explore one-to-one correspondence. Gym equipment, such as balls, can be used to provide meaningful opportunities for students to explore shapes, sort objects, and compare sizes.

Science **–** In the science units Properties of Objects, and Needs and Characteristics of Living Things, students observe and compare objects and organisms. These activities can include measurement as a process of comparing. Students can also replicate 3-D objects and identify 2-D shapes found on the objects. In addition, students can order the objects or characteristics of living organisms and develop the language of comparison through discussions. To develop a good understanding of the concept of measurement as a comparison, students must experience measurement and comparison through the five senses. By doing so, students develop an understanding of the attributes that can be measured and develop the language that is appropriate for comparing. The students can feel the mass and see the size. These two science units also provide interesting contexts for sorting activities.

In the Daily and Seasonal Changes unit, students measure and record temperatures. At this age, students can calculate differences in temperature when the temperatures are above zero or positive numbers. When investigating seasonal cycles, students can explore repeating patterns and represent these in a variety of ways.

Social Studies – Students make sense of number when it is in context and when the context is relevant. Self, family, and community provide such contexts for number stories. Students can identify numbers and begin to understand the role of number in our society as students walk through their communities. Numbers can be used to name objects such as house numbers. Sometimes numbers can imply an order (i.e., on mailboxes or in community sports events where ordinal numbers such as first, second, and third are used). Social Studies also provides many contexts that allow students to investigate and develop an understanding of quantity.

Critical Characteristics of Mathematics Education

The content of K-12 Mathematics can be organized in a variety of ways. In this document, the outcomes and indicators are grouped according to four strands: **Number, Patterns and Relations, Shape and Space, and Statistics and Probability.** Although this organization implies a relation between the outcomes identified in each of the strands, it should be noted the mathematical concepts are interrelated between strands as well as within strands.

When mathematics is taught without a rich integration of these processes, it becomes a stagnant set of facts and procedures devoid of meaning rather than the dynamic and rich discipline that it is.

The mathematics curriculum also recognizes seven processes inherent in the teaching, learning, and doing of mathematics. These processes focus on: communicating, making connections, mental mathematics and estimating, problem solving, reasoning, and visualizing along with using technology to integrate these processes into the mathematics classroom to help students learn mathematics with deeper understanding.

The outcomes in K-12 mathematics should be addressed through the appropriate mathematical processes lenses. Teachers should consider carefully in their planning those processes indicated as being important to the various outcomes.

Communication [C]

Students must be able to communicate mathematical ideas in a variety of ways and contexts.

Students need opportunities to view, read about, represent, write about, listen to, and discuss mathematical ideas. These opportunities allow students to create links between their own language and ideas, and the formal language and symbols of mathematics.

Communication is important in clarifying, reinforcing, and modifying ideas, attitudes, and beliefs about mathematics. Students should be encouraged to use a variety of forms of communication while learning mathematics. Students also need to communicate learning using mathematical terminology.

Communication can help students make connections among concrete, pictorial, symbolic, verbal, written, and mental representations of mathematical ideas.

Through connections to their prior knowledge and daily life, students begin to view mathematics as useful and relevant.

Connections [CN]

Contextualization and making connections to the experiences of learners are powerful processes in developing mathematical understanding. When mathematical ideas are connected to each other or to real-world phenomena, students begin to view mathematics as useful, relevant, and integrated.

Learning mathematics within contexts and making connections relevant to learners can validate past experiences, and increase student willingness to participate and be actively engaged.

The brain is constantly looking for and making connections. "*Because the learner is constantly searching for connections on many levels, educators need to orchestrate the experiences from which learners extract understanding …. Brain research establishes and confirms that multiple complex and concrete experiences are essential for meaningful learning and teaching*" (Caine and Caine, 1991, p.5).

Mental mathematics and estimation are fundamental components of number sense.

Mental Mathematics and Estimation [ME]

Mental mathematics is a combination of cognitive strategies that enhance flexible thinking and number sense. It is calculating mentally without the use of external memory aids.

Students proficient with mental mathematics "become liberated from calculator dependence, build confidence in doing mathematics, become more flexible thinkers and are more able to use multiple approaches to problem solving" (Rubenstein, 2001, p. 442).

Mental mathematics enables students to determine answers without paper and pencil. It improves computational fluency by developing efficiency, accuracy, and flexibility.

Estimation is a strategy for determining approximate values of quantities, usually by referring to benchmarks or using referents, or for determining the reasonableness of calculated values. Students need to know how, when, and what strategy to use when estimating.

Estimation is used to make mathematical judgements and develop useful, efficient strategies for dealing with situations in daily life.

Problem Solving [PS]

Learning through problem solving should be the focus of mathematics at all grade levels.

Learning through problem solving should be the focus of mathematics at all grade levels. When students encounter new situations and respond to questions of the type, "How would you …?" or "How could you …?", the problem-solving approach is being modelled. Students develop their own problem-solving strategies by being open to listening, discussing, and trying different strategies.

In order for an activity to be problem-solving based, it must ask students to determine a way to get from what is known to what is sought. If students have already been given ways to solve the problem, it is not problem solving, but rote practice. A true problem requires students to use prior learnings in new ways and contexts.

Problem solving requires and builds depth of conceptual understanding and student engagement.

Problem solving is a powerful teaching tool that fosters multiple and creative solutions. Creating an environment where students openly look for and engage in finding a variety of strategies for solving problems empowers students to explore alternatives and develops confidence, reasoning, and mathematical creativity.

Reasoning [R]

Mathematical reasoning helps students think logically and make sense of mathematics.

Mathematical reasoning helps students think logically and make sense of mathematics. Students need to develop confidence in their abilities to reason and explain their mathematical thinking. High-order questions challenge students to think and develop a sense of wonder about mathematics.

Mathematical experiences in and out of the classroom provide opportunities for inductive and deductive reasoning. Inductive reasoning occurs when students explore and record results, analyze observations, make generalizations from patterns, and test these generalizations. Deductive reasoning occurs when students reach new conclusions based upon what is already known or assumed to be true.

Visualization (V)

Visualization is fostered through the use of concrete materials, technology, and a variety of visual representations.

Visualization "*involves thinking in pictures and images, and the ability to perceive, transform and recreate different aspects of the visual-spatial world*" (Armstrong, 1993, p.10). The use of visualization in the study of mathematics provides students with opportunities to understand mathematical concepts and make connections among them.

Visual images and visual reasoning are important components of number, spatial, and measurement sense. Number visualization occurs when students create mental representations of numbers.

Being able to create, interpret, and describe a visual representation is part of spatial sense and spatial reasoning. Spatial visualization and reasoning enable students to describe the relationships among and between 3-D objects and 2-D shapes.

Visualization is fostered through the use of concrete materials, technology, and a variety of visual representations.

Technology [T]

Technology contributes to the learning of a wide range of mathematical outcomes, and enables students to explore and create patterns, examine relationships, test conjectures, and solve problems.

Technology contributes to the learning of a wide range of mathematical outcomes, and enables students to explore and create patterns, examine relationships, test conjectures, and solve problems.

Calculators and computers can be used to:

- explore and demonstrate mathematical relationships and patterns
- organize and display data
- extrapolate and interpolate
- assist with calculation procedures as part of solving problems
- decrease the time spent on computations when other mathematical learning is the focus
- reinforce the learning of basic facts and test properties
- develop personal procedures for mathematical operations
- create geometric displays
- simulate situations
- develop number sense.

Technology contributes to a learning environment in which the growing curiosity of students can lead to rich mathematical discoveries at all grade levels. It is important for students to understand and appreciate the appropriate use of technology in a mathematics classroom.

Teaching for Deep Understanding

In Grade 1 mathematics, students explore and uncover the meaning of addition and subtraction. Time needs to be allowed for students to explore and manipulate concrete objects, pictures, language, physical movement, and symbols. Students should be encouraged to ask questions and wonder about the mathematical ideas of adding and subtracting. Expressing these ideas deepens understanding.

Students relate numbers to story problems that they create by making connections to what they already know and have experienced. Representing 2 + 3 = 5 using objects on a balance scale helps students make connections with the language of "equal". Students may express 2 + 3 = 5 as "5 is the same as 2 + 3". By doing this, they are using prior knowledge of "the same as" to interpret "equals".

For deep understanding, it is vital that students learn by uncovering and co-constructing knowledge, with very few ideas being covered or relayed directly by the teacher. As an example, the addition sign (+) is something which the teacher must cover and teach. It is the symbol used to show the combination or addition of two quantities. The process of adding, however, and the development of addition and subtraction facts should not be covered, but rather *discovered* through the students' investigation of patterns, relationships, abstractions, and generalizations. It is important for teachers to reflect upon outcomes to identify what students need to know, understand, and be able to do. Opportunities must be provided for students to explain, apply and transfer understanding to new situations. This reflection supports professional decision making and planning effective strategies to promote deeper understanding of mathematical ideas.

It is important that a mathematics learning environment include effective interplay of:

- reflection
- exploration of patterns and relationships
- sharing of ideas and problems
- consideration of different perspectives
- decision making
- generalizing
- verifying and proving
- modeling and representing.

Mathematics is learned when students are engaged in strategic play with mathematical concepts and differing perspectives. When students learn mathematics by being told what to do, how to do it, and when to do it, they cannot make the strong learning connections necessary for learning to be meaningful, easily accessible, and transferable.

The mathematics learning environment must be respectful of individuals and groups, fostering discussion and self-reflection, the asking of questions, the seeking of multiple answers, and the co-construction of meaning.

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Grade 1 Mathematics Outcomes and Indicators

Number Strand		
Goals	**Outcomes** *It is expected that students will:*	**Achievement Indicators** *The following set of indicators may be used to determine whether students have met the corresponding specific outcome.*
Number Sense *Logical Thinking* *Mathematical Attitude*	N1.1 Say the number sequence, 0 to 100, by: • 1s forward and backward between any two given numbers • 2s to 20, forward starting at 0 • 5s and 10s to 100, forward starting at 0. [C, CN, V, ME]	a) Recite forward by 1s the number sequence between two whole numbers (0 to 100). b) Recite backward by 1s the number sequence between two whole numbers. c) Record a numeral (0 to 100) symbolically when it is presented orally. d) Read a numeral (0 to 100) when it is presented symbolically. e) Skip count by 2s to 20 starting at 0. f) Skip count by 5s to 100 starting at 0. g) Skip count forward by 10s to 100 starting at 0. h) Identify and correct errors and omissions in a number sequence.
Number Sense *Spatial Sense* *Mathematical Attitude*	N1.2 Recognize, at a glance, and name familiar arrangements of 1 to 10 objects, dots, and pictures. [C, CN, ME, V]	a) Look briefly at a familiar arrangement of objects or dots and identify the number represented without counting. b) Look briefly at a familiar arrangement and identify how many objects there are without counting. c) Identify the number represented by an arrangement of objects or dots on a ten frame.
Number Sense *Logical Thinking* *Mathematical Attitude*	N1.3 Demonstrate an understanding of counting by: • indicating that the last number said identifies "how many" • showing that any set has only one count using *(continued on next page)*	a) Answer the question, "How many are in the set?" using the last number counted in a set. b) Identify and correct counting errors in a counting sequence. c) Show that the count of the number of objects in a set does not change regardless of the order in which the objects are counted. d) Count the number of objects in a set, rearrange the objects, predict the new count, and recount to verify the prediction.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[ME]	Mental Mathematics and Estimation	[V]	Visualization
		[T]	Technology

Number Strand		
	N1.3 *(continued)* the counting on strategy • using parts or equal groups to count sets. [C, CN, ME, R, V]	e) Determine the total number of objects in a given set, starting from a known quantity and counting on. f) Determine the total number of objects in a set using groups of 2s, 5s, or 10s and counting on.
Number Sense *Logical Thinking* *Mathematical Attitude*	N1.4 Represent and describe whole numbers to 20 concretely, pictorially, and symbolically. [C, CN, V]	a) Represent a whole number using a variety of manipulatives, including ten frames and base ten materials. b) Read whole number words to 20. c) Partition any quantity into 2 parts and identify the number of objects in each part. d) Model a whole number using two different objects (e.g., 10 desks represents the same number as 10 pencils). e) Place whole numbers on a number line by using benchmarks 0, 5, 10, and 20.
Number Sense *Logical Thinking* *Mathematical Attitude*	N1.5 Compare sets containing up to 20 elements to solve problems using: • referents (known quantity) • one-to-one correspondence. [C, CN, ME, PS, R, V]	a) Build a set equal to a given set that contains up to to 20 elements. b) Build a set that has more, fewer, or as many elements as a given set. c) Build several sets of different objects that have the same number of elements in the set. d) Compare two sets using one-to-one correspondence and describe them using comparative words, such as more, fewer, or as many. e) Compare a set to a referent using comparative language. f) Solve a story problem (pictures and words) that involves the comparison of two quantities.
Number Sense *Logical Thinking* *Mathematical Attitude*	N1.6 Estimate quantities to 20 by using referents. [C, ME, PS, R, V]	a) Estimate a quantity by comparing it to a referent. b) Select an estimate for a given quantity by choosing between at least two possible options and explain the choice.

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Number Strand		
Number Sense *Logical Thinking* *Mathematical Attitude* *Spatial Sense*	N1.7 Demonstrate, concretely, physically, and pictorially, how whole numbers can be represented by a variety of equal groupings with and without singles. [C, R, V]	a) Represent a whole number in a variety of equal groupings with and without singles (e.g., 17 can be represented by 8 groups of 2 and one single, 5 groups of 3 and two singles, 4 groups of 4 and one single, and 3 groups of 5 and two singles). b) Recognize that for a number of counters, no matter how they are grouped, the total number of counters does not change. c) Group a set of counters into equal groups in more than one way.
Number Sense *Mathematical Attitude*	N1.8 Identify the number, up to 20, that is one more, two more, one less, and two less than a given number. [C, CN, ME, R, V]	a) Name the whole number that is one more, two more, one less or two less than a given whole number. b) Represent the number on a ten frame that is one more, two more, one less, or two less than a whole number.
Number Sense *Logical Thinking* *Mathematical Attitude* *Spatial Sense*	N1.9 Demonstrate an understanding of addition of numbers with answers to 20 and the corresponding subtraction facts, concretely, pictorially, physically, and symbolically by: • using familiar and mathematical language to describe additive and subtractive actions from their experience • creating and solving problems in context that involve addition and subtraction *(continued on next page)*	a) Act out a story problem presented orally or through shared reading. b) Indicate if the scenario in a story problem represents additive or subtractive action. c) Represent the numbers and actions presented in a story problem by using manipulatives, and record them using sketches and/or number sentences. d) Create a story problem involving addition that connects to personal experience and simulate the action with counters. e) Create a story problem involving subtraction that connects to personal experience and simulate the action with counters. f) Create a word problem for a whole number addition or subtraction sentence. g) Represent a story problem pictorially or symbolically to show the additive or subtractive action and solve the problem.

Number Strand		
	N1.9 (*continued)* • modelling addition and subtraction using a variety of concrete and visual representations, and recording the process symbolically. [C, CN, ME, PS, R, V]	
Number Sense *Logical Thinking* *Mathematical Attitude*	N1.10 Describe and use mental mathematics strategies (memorization not intended), such as: • counting on and counting back • making 10 • doubles • using addition to subtract to determine basic addition facts to 18 and related subtraction facts. [C, CN, ME, PS, R, V]	*(It is not intended that students recall the basic facts but become familiar with strategies to mentally determine sums and differences.)* a) Use and describe a personal strategy for determining a sum. b) Use and describe a personal strategy for determining a difference. c) Write the related subtraction fact for a given addition fact. d) Write the related addition fact for a given subtraction fact.

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Patterns and Relations Strand		
Logical Thinking *Mathematical Attitude* *Spatial Sense*	P1.1 Demonstrate an understanding of repeating patterns (two to four elements) by: • describing • reproducing • extending • creating patterns using manipulatives, diagrams, sounds, and actions. [C, PS, R, V]	a) Describe a repeating pattern containing two to four elements in its core. b) Identify errors made in a repeating pattern. c) Identify the missing element(s) in a repeating pattern. d) Create and describe a repeating pattern using a variety of manipulatives, diagrams, musical instruments, and actions. e) Reproduce and extend a repeating pattern using manipulatives, diagrams, sounds, and actions. f) Identify and describe a repeating pattern found in the environment (e.g., classroom, outdoors) using everyday language. g) Identify repeating events (e.g., days of the week, birthdays, seasons).
Logical Thinking *Mathematical Attitude* *Spatial Sense*	P1.2 Translate repeating patterns from one form of representation to another. [C, R, V]	a) Represent a repeating pattern using another mode (e.g., action to sound, colour to shape, ABC ABC to blue yellow green blue yellow green). b) Describe a repeating pattern using a letter code (e.g., ABC ABC…).
Number Sense *Logical Thinking* *Mathematical Attitude* *Spatial Sense*	P1.3 Describe equality as a balance and inequality as an imbalance, concretely, physically, and pictorially (0 to 20). [C, CN, R, V]	a) Construct two equal sets using the same objects (same shape and mass) and demonstrate their equality of number using a balance scale. b) Construct two unequal sets using the same objects (same shape and mass) and demonstrate their inequality of number using a balance scale. c) Create two groups of students and explain if the groups are equal or not in quantity. d) Draw pictures to demonstrate inequality or equality and explain. e) Determine if two given concrete sets are equal or unequal, and explain the process used.

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Patterns and Relations Strand		
Number Sense *Logical Thinking* *Mathematical Attitude*	P1.4 Record equalities using the equal symbol. [C, CN, PS, V]	a) Represent a given equality using manipulatives or pictures. b) Represent a given pictorial or concrete equality in symbolic form. c) Provide examples of equalities where the given sum or difference is on either the left or right side of the equal symbol (=). d) Record different representations of the same quantity (0 to 20) as equalities.

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Shape and Space Strand		
	Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators may be used to determine whether students have met the corresponding specific outcome.*
Spatial Sense *Logical Thinking* *Mathematical Attitude*	SS1.1 Demonstrate an understanding of measurement as a process of comparing by: • identifying attributes that can be compared • ordering objects • making statements of comparison • filling, covering, or matching. [C, CN, PS, R, V]	a) Identify common attributes, including length, height, mass, volume, capacity, and area that could be used to compare two objects. b) Compare two objects and identify the attribute(s) used to compare. c) Determine which of two or more objects is longest or shortest by matching and explain the reasoning. d) Determine which of two or more objects is heaviest or lightest by comparing and explain the reasoning. e) Determine which of two or more given objects holds the most or least by filling and explain the reasoning. f) Determine which of two or more given objects has the greatest/least area by covering and explain the reasoning.
Spatial Sense *Logical Thinking* *Mathematical Attitude*	SS1.2 Sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule. [C, CN, R, V]	a) Sort a set of familiar 3-D objects or 2-D shapes using a given sorting rule. b) Sort a set of familiar 3-D objects using a single attribute determined by the student and explain how the objects were sorted. c) Sort a set of 2-D shapes using a single attribute determined by the student and explain how the shapes were sorted. d) Determine the difference between two given pre-sorted sets of familiar 3-D objects or 2-D shapes and explain a possible sorting rule used to sort them.

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Shape and Space Strand		
Spatial Sense *Logical Thinking* *Mathematical Attitude*	SS1.3 Replicate composite 2-D shapes and 3-D objects. [CN, PS, V]	a) Select 2-D shapes from a set of 2-D shapes to reproduce a composite 2-D shape. b) Select 3-D objects from a set of 3-D objects to reproduce a composite 3-D object. c) Predict and select the 2-D shapes used to produce a composite 2-D shape, and verify by deconstructing the composite shape. d) Predict and select the 3-D objects used to produce a composite 3-D object, and verify by deconstructing the composite object.
Spatial Sense *Mathematical Attitude*	SS1.4 Compare 2-D shapes to parts of 3-D objects in the environment. [C, CN, V]	a) Identify 3-D objects in the environment that have parts similar to a given 2-D shape.

Appendix A: Terminology

Attributes: Characteristics of 2-D shapes and 3-D objects that can be used to compare and sort sets of 2-D shapes and 3-D objects (e.g., colour, relative size, number of corners, number of lines of symmetry).

Benchmarks: Numeric quantities used to compare and order other numeric quantities. For example, 0, 5, 10, and 20 are often used as benchmarks when placing whole numbers on a number line.

Familiar Arrangements: Arrangements of objects or pictures that do not need to be counted to determine the quantity such as on dice, cards, and bowling pins. Some documents refer to this as subitizing (instantly seeing how many). This is a visual process in which the quantity is known instantly rather than moving eyes from one object to the other.

Correspondence (one-to-one): A correspondence is a description of how one set of numbers (or objects) is mapped to a second set of objects. For example, a correspondence might describe how individual students can sit in a given number of chairs. One-to-one correspondence can also be used to determine if there are enough, too many or just the right number of apples in order for each child to have exactly one apple.

Equality as a Balance and Inequality as Imbalance: The equal sign represents the idea of equivalence. For many students it means *do the question*. For some students, the equal sign in an expression such as 2 + 5 = means *to add*. When exploring equality and inequality by using objects on a balance scale, students discover the relationships between and among the mass of the objects. The equal sign in an equation is like a scale: both sides, left and right, must be the same in order for the scale to stay in balance and the equation to be true. When the scale is imbalanced, the equation is not true. Using 2 + 5 = □, rather than simply 2 + 5 = helps students understand that the equal sign (=) represents equality rather than *"do the work"* or *"do the question"*.

Number, Numeral, Digit: A number is the name that we give to quantities. For example, there are 7 days in a week, or I have three brothers – both seven and three are numbers in these situations because they are defining a quantity. The symbolic representation of a number, such as 287, is called the numeral. If 287 is not being used to define a quantity, we call it a numeral.

Numerals, as the symbolic representation of numbers, are made up of a series of digits. The Hindu-Arabic number system that we use has ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. (Note: sometimes students are confused between these digits and their finger digits – this is because they count their fingers starting at one and get to ten rather than zero to nine). These digits are also numerals and can be numbers (representing a quantity), but all numbers and all numerals are combinations of digits. The placement of a digit in a number or numeral affects the place value of the digit, and hence how much of the quantity that it represents. For example, in 326, the 2 is contributing 20 to the total, while in 236 the 2 contributes 200 to the total quantity.

Personal Strategies: Personal strategies are strategies that the students have constructed and understand. Outcomes and indicators that specify the use of personal strategies convey the message that there is not a single procedure that is correct. Students should be encouraged to explore, share, and make decisions about what strategies they will use in different contexts. Development of personal strategies is an indicator of the attainment of deeper understanding.

Referents: A concrete representation of a quantity. For example, seeing what 25 beans in a container looks like makes it possible to estimate the number of beans the same container will hold when it is full of the same kind of beans. Compensation must be made if the container is filled with smaller or larger beans than the referent or if the size or shape of the container is changed.

Representations: Mathematical ideas can be represented and manipulated in a variety of forms including concrete manipulatives, visual designs, sounds, physical movements, and symbolic notations. Students need to have experiences in working with many different types of representations, and in transferring and translating knowledge between the different forms of representations.

Appendix B: Three Grades at a Glance

The chart below shows the outcomes of mathematics in grades K, 1, and 2 in each of the four strands with the outcomes being lined up to show the flow of content development.

Number Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
Whole Numbers		
NK.1 Say the number sequence by 1s starting anywhere from 0 to 10 and from 10 to 0. [C, CN, V]	N1.1 Say the number sequence, 0 to 100, by: • 1s forward and backward between any two given whole numbers • 2s to 20, forward starting at 0 • 5s and 10s to 100, forward starting at 0. [C, CN, ME, V]	N2.1 Say the number sequence from 0 to 100 by: • 2s, 5s, and 10s, forward and backward, using starting points that are multiples of 2, 5, and 10 respectively • 10s using starting points from 1 to 9 • 2s starting from 1. [C, CN, ME, R]
NK.2 Recognize, at a glance, and name familiar arrangements of 1 to 5 objects, dots, and pictures. [C, CN, ME, V]	N1.2 Recognize, at a glance, and name familiar arrangements of 1 to 10 objects, dots, and pictures. [C, CN, ME, V]	
NK.3 Relate a numeral, 0 to 10, to its respective quantity. [CN, R, V]	N1.3 Demonstrate an understanding of counting by: • indicating that the last number said identifies "how many" • showing that any set has only one count using the counting on strategy • using parts or equal groups to count sets. [C, CN, ME, R, V]	
	N1.6 Estimate quantities to 20 by using referents. [C, ME, PS, R, V]	N2.6 Estimate quantities to 100 using referents. [C, ME, PS, R, V]
		N2.2 Demonstrate if a number (up to 100) is even or odd. [C, CN, PS, R]

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Number Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
Representation		
NK.4 Represent and describe numbers 2 to 10, concretely and pictorially. [C, CN, ME, R, V]	N1.4 Represent and describe whole numbers to 20 concretely, pictorially and symbolically. [C, CN, ME, R, V]	N2.4 Represent and describe numbers to 100 concretely, pictorially, and symbolically. [C, CN, ME, R, V]
Comparison		
NK.5 Compare quantities, 1 to 10, using one-to-one correspondence. [C, CN, V]	N1.5 Compare sets containing up to 20 elements to solve problems using: • referents (known quantity) • one-to-one correspondence. [C, CN, ME, PS, R, V]	N2.5 Compare and order numbers up to 100. [C, CN, ME, PS, R, V]
Ordinal Numbers		
		N2.3 Describe order or relative position using ordinal numbers (up to tenth). [C, CN, R]
Place Value		
	N1.7 Demonstrate, concretely, physically, and pictorially, how whole numbers can be represented by a variety of equal groupings with and without singles. [C, R, V]	N2.7 Illustrate, concretely and pictorially, the meaning of place value for numerals to 100. [C, CN, R, V]

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Number Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
Adding and Subtracting Whole Numbers		
	N1.8 Identify the number, up to 20, that is one more, two more, one less, and two less than a given number. [C, CN, ME, R, V]	N2.8 Demonstrate and explain the effect of adding zero to or subtracting zero from any number. [C, R]
	N1.9 Demonstrate an understanding of addition of numbers with answers to 20 and corresponding subtraction facts, concretely, pictorially, physically, and symbolically by: • using familiar and mathematical language to describe additive and subtractive actions from experience • creating and solving problems in context that involve addition and subtraction • modelling addition and subtraction using a variety of concrete and visual representations, and recording the process symbolically. [C, CN, ME, PS, R, V]	N2.9 Demonstrate an understanding of addition (limited to 1 and 2-digit numerals) with answers to 100 and the corresponding subtraction by: • using personal strategies for adding and subtracting with and without the support of manipulatives • creating and solving problems that involve addition and subtraction • explaining that the order in which numbers are added does not affect the sum • explaining that the order in which numbers are subtracted may affect the difference. [C, CN, ME, PS, R, V]

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

<table>
<tr><th colspan="3">Number Strand</th></tr>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2 (Draft)</th></tr>
<tr><th colspan="3">Adding and Subtracting Whole Numbers</th></tr>
<tr><td></td><td>N1.10 Describe and use mental mathematics strategies (memorization not intended), such as:
• counting on and counting back
• making 10
• doubles
• using addition to subtract
• to determine basic addition facts to18 and related subtraction facts.
[C, CN, ME, PS, R, V]</td><td>N2.10 Apply mental mathematics strategies, such as:
• using doubles
• making 10
• one more, one less
• two more, two less
• addition for subtraction
• to determine basic addition facts to18 and related subtraction facts.
[C, CN, ME, PS, R, V]</td></tr>
</table>

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Patterns and Relations Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
Repeating Patterns		
PK.1 Demonstrate an understanding of repeating patterns (two or three elements) by: • identifying • reproducing • extending • creating patterns using manipulatives, sounds and actions. [C, CN, PS, V]	P1.1 Demonstrate an understanding of repeating patterns (two to four elements) by: • describing • reproducing • extending • creating patterns using manipulatives, diagrams, sounds, and actions. [C, PS, R, V]	P2.1 Demonstrate an understanding of repeating patterns (three to five elements) by: • describing • extending • comparing • creating patterns using manipulatives, diagrams, sounds, and actions. [C, CN, PS, R, V]
	P1.2 Translate repeating patterns from one form of representation to another. [C, R, V]	
Increasing Patterns		
		P2.2 Demonstrate an understanding of increasing patterns by: • describing • reproducing • extending • creating patterns using manipulatives, diagrams, sounds, and actions (numbers to 100). [C, CN, PS, R, V]

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Patterns and Relations Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
Equality and Inequality		
	P1.3 Describe equality as a balance and inequality as an imbalance, concretely, physically, and pictorially (0 to 20). [C, CN, R, V]	P2.3 Demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100). [C, CN, R, V]
	P1.4 Record equalities using the equal symbol. [C, CN, PS, V]	P2.4 Record equalities and inequalities symbolically using the equal symbol or the not equal symbol. [C, CN, R, V]

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Shape and Space Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
Time		
		SS2.1 Relate the number of days to a week and the number of months to a year in a problem-solving context. [C, CN, PS, R]
Direct Comparison		
SSK.1 Use direct comparison to compare two objects based on a single attribute, such as length including height, mass, volume, and capacity. [C, CN, PS, R, V]	SS1.1 Demonstrate an understanding of measurement as a process of comparing by: • identifying attributes that can be compared • ordering objects • making statements of comparison • filling, covering, or matching. [C, CN, PS, R, V]	
Indirect Comparison		
		SS2.2 Relate the size of a unit of measure to the number of units (limited to non-standard units) used to measure length and mass. [C, CN, ME, R, V]
		SS2.3 Compare and order objects by length, height, distance around, and mass using non-standard units, and make statements of comparison. [C, CN, ME, R, V]
		SS2.4 Measure length to the nearest non-standard unit by: • using multiple copies of a unit • using a single copy of a unit (iteration process). [C, ME, R, V]
		SS2.5 Demonstrate that changing the orientation of an object does not alter the measurement of its attributes.[C,R,V]

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Shape and Space Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
3-D Objects		
SSK.2 Sort 3-D objects using a single attribute. [C, CN, PS, R, V]		SS2.7 Describe, compare and construct 3-D objects, including: • cubes • spheres • cones • cylinders • pyramids. [C, CN, R, V]
SSK.3 Build and describe 3-D objects. [CN, PS, V]		
2-D Shapes		
		SS2.6 Describe, compare, and construct 2-D shapes, including: • triangles • squares • rectangles • circles. [C, CN, R, V]
3-D Objects and 2-D Shapes		
	SS1.2 Sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule. [C, CN, R, V]	SS2.8 Sort 2-D shapes and 3-D objects using two attributes, and explain the sorting rule. [C, CN, R, V]
	SS1.3 Replicate composite 2-D shapes and 3-D objects. [CN, PS, V]	
	SS1.4 Compare 2-D shapes to parts of 3-D objects in the environment. [C, CN, V]	SS2.9 Identify 2-D shapes as parts of 3-D objects in the environment. [C, CN, R, V]

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[V]**	Visualization
		[T]	Technology

Statistics and Probability Strand		
Kindergarten	**Grade 1**	**Grade 2 *(Draft)***
Collecting Data		
		SP2.1 Gather and record data about self and others to answer questions. [C, CN, PS, V]
Representing Data		
		SP2.2 Construct and interpret concrete graphs and pictographs to solve problems. [C, CN, PS, R, V]

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