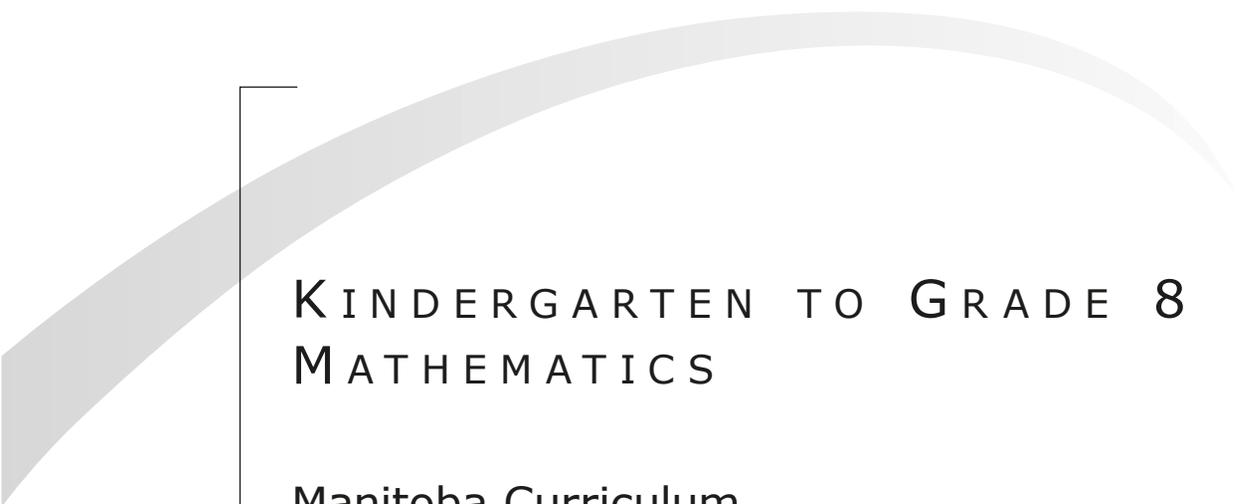




Kindergarten to Grade 8 Mathematics

Manitoba Curriculum
Framework of Outcomes

2013



KINDERGARTEN TO GRADE 8
MATHEMATICS

Manitoba Curriculum
Framework of Outcomes

2013

Manitoba Education Cataloguing in Publication Data

Kindergarten to Grade 8 mathematics : Manitoba
curriculum framework of outcomes (2013) [electronic resource]

Based on 'The common curriculum framework for K-9
mathematics'/developed by the Western and Northern
Canadian Protocol.

Includes bibliographical references.

ISBN: 978-0-7711-5527-7

1. Mathematics—Study and teaching.
 2. Mathematics—Study and teaching—Manitoba.
 3. Mathematics—Manitoba—Curricula.
- I. Manitoba. Manitoba Education.
II. Title: The common curriculum framework for K-9 mathematics
510.71

Copyright © 2013, the Government of Manitoba, represented by the Minister
of Education.

Manitoba Education
School Programs Division
Winnipeg, Manitoba, Canada

Every effort has been made to acknowledge original sources and to comply
with copyright law. If cases are identified where this has not been done,
please notify Manitoba Education. Sincere thanks to the authors, artists, and
publishers who allowed their original material to be used.

Permission is hereby given to reproduce this document for non-profit
educational purposes provided the source is cited.

Any websites referenced in this document are subject to change.

Print copies of this resource can be purchased from the Manitoba Text
Book Bureau (stock number 80684). Order online at <www.mtbb.mb.ca>.

This resource is also available on the Manitoba Education website at
<<http://www.edu.gov.mb.ca/k12/cur/math/frameworks.html>>.

Websites are subject to change without notice.

Disponible en français.

Available in alternate formats upon request.

CONTENTS

Acknowledgements	v
Background	1
Introduction	3
Purpose of the Document	3
Beliefs about Students and Mathematics Learning	3
First Nations, Métis, and Inuit Perspectives	4
Affective Domain	4
Early Childhood	5
Goals for Students	5
Conceptual Framework for K–9 Mathematics	7
Nature of Mathematics	8
Mathematical Processes	11
Strands	15
Learning Outcomes and Achievement Indicators	16
Summary	16
Instructional Focus	17

General and Specific Learning Outcomes	19
General and Specific Learning Outcomes by Strand	
Number	20
Patterns and Relations	32
Shape and Space	38
Statistics and Probability	46
General and Specific Learning Outcomes with Achievement Indicators by Grade	52
Kindergarten	52
Grade 1	57
Grade 2	65
Grade 3	76
Grade 4	89
Grade 5	100
Grade 6	114
Grade 7	126
Grade 8	138

References	151
-------------------	-----

ACKNOWLEDGEMENTS

Manitoba Education would like to acknowledge the contributions of the following individuals in the development of *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes (2013)*.

**Manitoba Education
School Programs Division
Staff**

Nicole Allain Fox Project Leader	Curriculum, Development and Implementation Bureau de l'éducation française
Heather Anderson Consultant (until June 2007)	Development Unit Instruction, Curriculum and Assessment Branch
Carole Bilyk Project Manager	Development Unit Instruction, Curriculum and Assessment Branch
Louise Boissonneault Coordinator	Document Production Services Unit Educational Resources Branch
Paule Buors Consultant (until June 2009)	Curriculum, Development and Implementation Bureau de l'éducation française
Ian Donnelly Consultant	Development Unit Instruction, Curriculum and Assessment Branch
Linda Girling Project Leader	Development Unit Instruction, Curriculum and Assessment Branch
Heather Knight-Wells Consultant	Development Unit Instruction, Curriculum and Assessment Branch
Philippe Leclercq Consultant	Curriculum, Development and Implementation Bureau de l'éducation française
Gilbert Le Néal Consultant (until June 2006)	Curriculum, Development and Implementation Bureau de l'éducation française
Cyril Parent Desktop Publisher	Document Production Services Unit Educational Resources Branch

Sherry Perih
Project Leader

Marjorie Poor
Publications Editor

Development Unit
Instruction, Curriculum and Assessment Branch

Document Production Services Unit
Educational Resources Branch

BACKGROUND

The Western Canadian Protocol for Collaboration in Basic Education Kindergarten to Grade 12 was signed December 1993 by the Ministers of Education from Alberta, British Columbia, Manitoba, Northwest Territories, Saskatchewan, and Yukon Territory. In February 2000, following the addition of Nunavut, the protocol was renamed the Western and Northern Canadian Protocol (WNCP) for Basic Education.

In 2005, the Ministers of Education from all the WNCP jurisdictions unanimously concurred with the rationale of the original partnership because of the importance placed on

- common educational goals
- the ability to collaborate to achieve common goals
- high standards in education
- planning an array of educational opportunities
- removing obstacles to accessibility for individual learners
- optimum use of limited educational resources

The Common Curriculum Framework for K–9 Mathematics was developed by the seven ministries of education in collaboration with teachers, administrators, parents, business representatives, post-secondary educators, and others.

The framework identifies beliefs about mathematics, general and specific student outcomes, and achievement indicators agreed upon by the seven jurisdictions. Each of the provinces and territories will determine when and how the framework will be implemented within its own jurisdiction.

INTRODUCTION

Purpose of the Document

This document provides a common base for the curriculum expectations mandated by Manitoba

The framework communicates high expectations for students.

Education, which will result in consistent student outcomes in mathematics across Manitoba and enable easier transfer for students moving from one region to another. Its intent is to clearly communicate high expectations for students in mathematics education to all

education partners across Manitoba, and to facilitate the development of common learning resources.

Beliefs about Students and Mathematics Learning

Mathematical understanding is fostered when students build on their own experiences and prior knowledge.

Students are curious, active learners with individual interests, abilities, and needs. They come to classrooms with varying knowledge, life experiences, and backgrounds. A key component in successfully developing numeracy is making connections to these backgrounds and experiences.

Students learn by attaching meaning to what they do, and need to construct their own meaning of mathematics. This meaning is best developed when learners encounter mathematical experiences that proceed from the simple to the complex and from the concrete to the abstract. The use of manipulatives and a variety of pedagogical approaches can address the diversity of learning styles and developmental stages of students, and enhance the formation of sound, transferable mathematical concepts. At all levels, students benefit from working with a variety of materials, tools, and contexts when constructing meaning about new mathematical ideas. Meaningful student discussions can provide essential links among concrete, pictorial, and symbolic representations of mathematics.

Students need frequent opportunities to develop and reinforce their conceptual understanding, procedural thinking, and problem-solving abilities. By addressing these three interrelated components, students will strengthen their ability to apply mathematical learning to their daily lives.

Conceptual understanding: comprehending mathematical concepts, relations, and operations to build new knowledge. (Kilpatrick, Swafford, and Findell 5)

Procedural thinking: carrying out procedures flexibly, accurately, efficiently, and appropriately.

Problem solving: engaging in understanding and resolving problem situations where a method or solution is not immediately obvious. (OECD 12)

The learning environment should value and respect all students' experiences and ways of thinking, so that

learners are comfortable taking intellectual risks, asking questions, and posing conjectures. Students need to explore problem-solving situations in order to develop personal strategies and become mathematically literate. Learners must realize that it is acceptable to solve problems in different ways and that solutions may vary.

First Nations, Métis, and Inuit Perspectives

First Nations, Métis, and Inuit students in Manitoba come from diverse geographic areas with varied cultural and linguistic backgrounds. Students attend schools in a

Teachers need to understand the diversity of cultures and experiences of students.

variety of settings including urban, rural, and isolated communities. Teachers need to understand the diversity of cultures and experiences of students.

First Nations, Métis, and Inuit students often have a whole-world view of the environment in which

they live, and learn best in a holistic way. This means that students look for connections in learning, and learn best when mathematics is contextualized and not taught as discrete components.

First Nations, Métis, and Inuit students come from cultures where learning takes place through active participation. Traditionally, little emphasis was placed upon the written word. Oral communication along with practical applications and experiences are important to student learning and understanding.

It is also vital that teachers understand and respond to non-verbal cues so that student learning and mathematical understanding are optimized.

A variety of teaching and assessment strategies is required to build upon the diverse knowledge, cultures, communication styles, skills, attitudes, experiences, and learning styles of students.

The strategies used must go beyond the incidental inclusion of topics and objects unique to a culture or region, and strive to achieve higher levels of multicultural education (Banks and Banks).

Affective Domain

A positive attitude is an important aspect of the affective domain that has a profound effect on learning. Environments that create a sense of belonging, encourage risk taking, and provide opportunities for success help students develop and maintain positive attitudes and self-confidence. Students with positive attitudes toward learning mathematics are likely to be motivated and prepared to learn, participate willingly in classroom activities, persist in challenging situations, and engage in reflective practices.

To experience success, students must be taught to set achievable goals and assess themselves as they work toward these goals.

Teachers, students, and parents need to recognize the relationship between the affective and cognitive domains, and attempt to nurture those aspects of the affective

domain that contribute to positive attitudes. To experience success, students must be taught to set achievable goals and assess themselves as they work toward these goals.

Striving toward success and becoming autonomous and responsible learners are ongoing, reflective processes that involve revisiting the setting and assessing of personal goals.

Early Childhood

Young children are naturally curious and develop a variety of mathematical ideas before they enter Kindergarten. Children make sense of their environment through observations and interactions at home, in daycares, preschools, and in the community. Mathematics learning is embedded in everyday activities, such as playing, reading, storytelling, and helping around the home.

Curiosity about mathematics is fostered when children are actively engaged in their environment.

Activities can contribute to the development of number and spatial sense in children. Curiosity about mathematics is fostered when children are engaged in activities such as comparing quantities, searching for patterns, sorting objects, ordering objects, creating designs, building with blocks, and talking about these activities.

Positive early experiences in mathematics are as critical to child development as are early literacy experiences.

Goals for Students

The main goals of mathematics education are to prepare students to

- communicate and reason mathematically
- use mathematics confidently, accurately, and efficiently to solve problems
- appreciate and value mathematics
- make connections between mathematical knowledge and skills and their applications
- commit themselves to lifelong learning
- become mathematically literate citizens, using mathematics to contribute to society and to think critically about the world

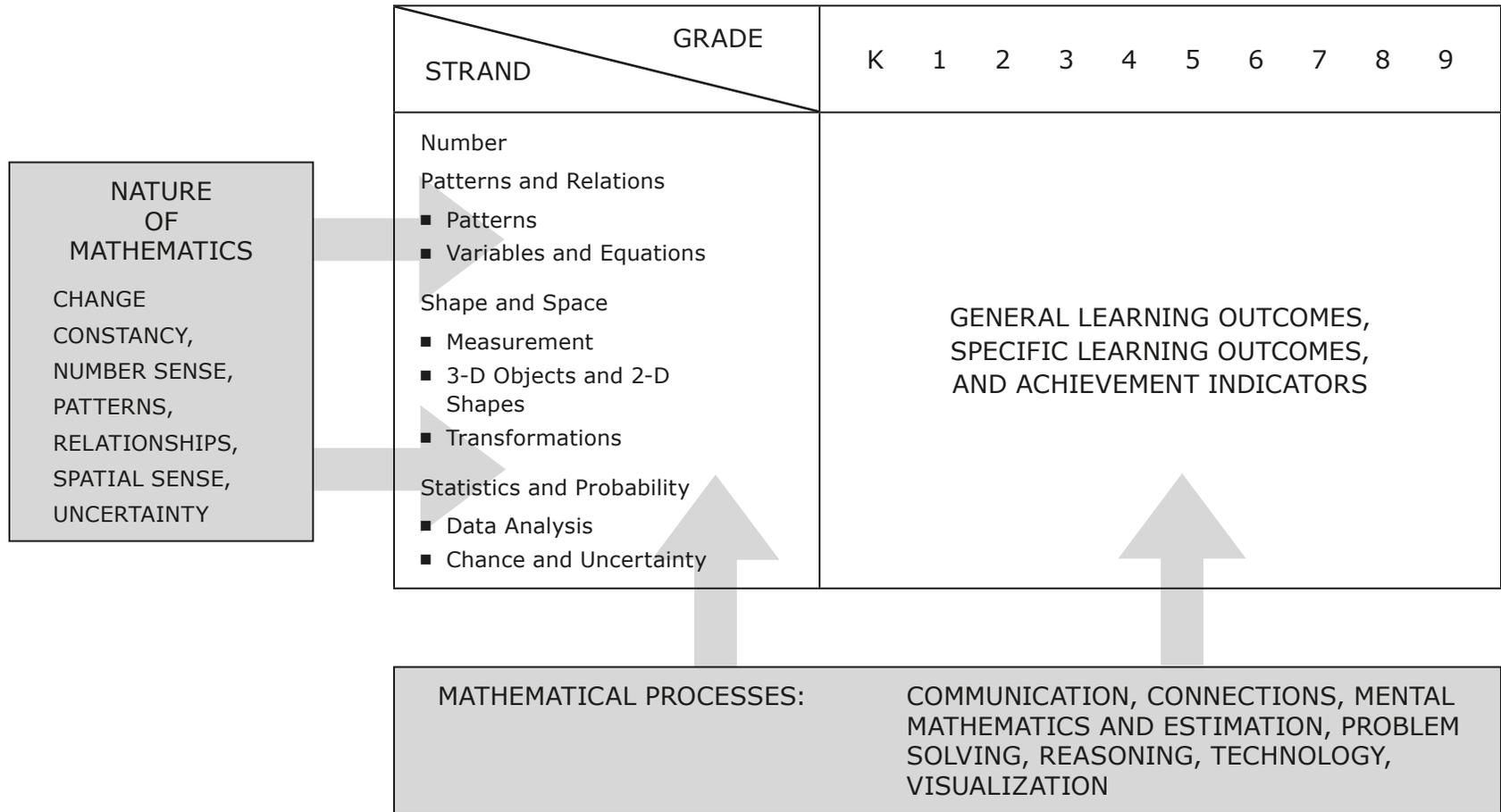
Mathematics education must prepare students to use mathematics to think critically about the world.

Students who have met these goals will

- gain understanding and appreciation of the contributions of mathematics as a science, philosophy, and art
- exhibit a positive attitude toward mathematics
- engage and persevere in mathematical tasks and projects
- contribute to mathematical discussions
- take risks in performing mathematical tasks
- exhibit curiosity

CONCEPTUAL FRAMEWORK FOR K-9 MATHEMATICS

The chart below provides an overview of how mathematical processes and the nature of mathematics influence learning outcomes.



Nature of Mathematics

- Change
- Constancy
- Number Sense
- Patterns
- Relationships
- Spatial Sense
- Uncertainty

Mathematics is one way of trying to understand, interpret, and describe our world. There are a number of components that define the nature of mathematics and these are woven throughout this document. These components include change, constancy, number sense, patterns, relationships, spatial sense, and uncertainty.

Change

It is important for students to understand that mathematics is dynamic and not static. As a result, recognizing change is a key component in understanding and developing mathematics.

Within mathematics, students encounter conditions of change and are required to search for explanations of that change. To make predictions, students need to describe and quantify their observations, look for patterns, and describe those quantities that remain fixed and those that change. For example, the sequence 4, 6, 8, 10, 12, ... can be described as

- skip-counting by 2s, starting from 4

Change is an integral part of mathematics and the learning of mathematics.

- an arithmetic sequence, with first term 4 and a common difference of 2
 - a linear function with a discrete domain
- (Steen 184)

Constancy

Different aspects of constancy are described by the terms *stability*, *conservation*, *equilibrium*, *steady state*, and *symmetry* (AAAS-Benchmarks 270).

Many important properties in mathematics and science relate to properties that do not change when outside conditions change.

Examples of constancy include the following:

- the area of a rectangular region is the same regardless of the methods used to determine the solution
- the sum of the interior angles of any triangle is 180°
- the theoretical probability of flipping a coin and getting heads is 0.5

Some problems in mathematics require students to focus on properties that remain constant. The recognition of constancy enables students to solve problems involving constant rates of change, lines with constant slope, direct variation situations, or the angle sums of polygons.

Constancy is described by the terms *stability*, *conservation*, *equilibrium*, *steady state*, and *symmetry*.

Number Sense

Number sense, which can be thought of as intuition about numbers, is the most important foundation of numeracy (BC Ministry of Education 146).

Number sense is an awareness and understanding of what numbers are.

Number sense is an awareness and understanding of what numbers are, their relationships, their magnitude, and the relative effect of operating on numbers, including the use of mental mathematics and estimation (Fennell and Landis 187).

Number sense develops when students connect numbers to real-life experiences, and use benchmarks and referents. Students who have number sense are computationally fluent, are flexible with numbers, and have intuition about numbers. Number sense evolves and typically results as a by-product of learning rather than through direct instruction. Number sense can be developed by providing rich mathematical tasks that allow students to make connections.

Patterns

Mathematics is about recognizing, describing, and working with numerical and non-numerical patterns. Patterns exist in all strands and it is important that connections are made among strands. Working with patterns enables students to make connections within and beyond mathematics.

These skills contribute to students' interaction with and understanding of their environment.

Patterns may be represented in concrete, visual, or symbolic form. Students should develop fluency in moving from one representation to another.

Students must learn to recognize, extend, create, and use mathematical patterns. Patterns allow students to make predictions and justify their reasoning when solving routine and non-routine problems.

Learning to work with patterns in the early grades helps develop students' algebraic thinking, which is foundational for working with more abstract mathematics in higher grades.

Relationships

Mathematics is used to describe and explain relationships. As part of the study of mathematics, students look for

Mathematics is used to describe and explain relationships.

relationships among numbers, sets, shapes, objects, and concepts. The discovery of possible relationships involves the collection and analysis of data, and describing relationships visually, symbolically, orally, or in written form.

Mathematics is about recognizing, describing, and working with numerical and non-numerical patterns.

Spatial Sense

Spatial sense involves visualization, mental imagery, and spatial reasoning. These skills are central to the

Spatial sense offers a way to interpret and reflect on the physical environment.

understanding of mathematics. Spatial sense enables students to reason and interpret among and between 3-D and 2-D representations and identify relationships to mathematical strands.

Spatial sense is developed through a variety of experiences and interactions within the environment. The development of spatial sense enables students to solve problems involving 3-D objects and 2-D shapes.

Spatial sense offers a way to interpret and reflect on the physical environment and its 3-D or 2-D representations.

Some problems involve attaching numerals and appropriate units (measurement) to dimensions of objects. Spatial sense allows students to make predictions about the results of changing these dimensions. For example:

- knowing the dimensions of an object enables students to communicate about the object and create representations
- the volume of a rectangular solid can be calculated from given dimensions
- doubling the length of the side of a square increases the area by a factor of four

Uncertainty

In mathematics, interpretations of data and the predictions made from data may lack certainty.

Uncertainty is an inherent part of making predictions.

Events and experiments generate statistical data that can be used to make predictions. It is important to recognize that these predictions (interpolations and extrapolations) are based upon patterns that have a degree of uncertainty.

The quality of the interpretation is directly related to the quality of the data. An awareness of uncertainty allows students to assess the reliability of data and data interpretation.

Chance addresses the predictability of the occurrence of an outcome. As students develop their understanding of probability, the language of mathematics becomes more specific and describes the degree of uncertainty more accurately.

Mathematical Processes

There are critical components that students must encounter in a mathematics program in order to achieve

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

the goals of mathematics education and encourage lifelong learning in mathematics.

Students are expected to

- communicate in order to learn and express their understanding
- connect mathematical ideas to other concepts in mathematics, to everyday experiences, and to other disciplines
- demonstrate fluency with mental mathematics and estimation
- develop and apply new mathematical knowledge through problem solving
- develop mathematical reasoning
- select and use technologies as tools for learning and solving problems
- develop visualization skills to assist in processing information, making connections, and solving problems

The *Common Curriculum Framework* incorporates these seven interrelated mathematical processes that are intended to permeate teaching and learning.

Communication [C]

Students need opportunities to read about, represent, view, 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.

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

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 their learning using mathematical terminology.

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

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 can begin to view mathematics as useful, relevant, and integrated.

Through connections, students should begin to view mathematics as useful and relevant.

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 5).

Mental Mathematics and Estimation [ME]

Mental mathematics and estimation is a combination of cognitive strategies that enhances flexible thinking and

Mental mathematics and estimation are fundamental concepts of number sense.

number sense. It is calculating mentally without the use of external memory aids. It improves computational fluency by developing efficiency, accuracy, and flexibility.

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 442).

Mental mathematics “provides a cornerstone for all estimation processes offering a variety of alternate algorithms and non-standard techniques for finding answers” (Hope V).

Estimation is a strategy for determining approximate values or quantities, usually by referring to benchmarks or using referents, or for determining the reasonableness of calculated values. Estimation is also used to make mathematical judgments and to develop useful, efficient strategies for dealing with situations in daily life. When estimating, students need to know which strategy to use and how to use it.

To help students become efficient with computational fluency, students need to develop mental math skills and recall math facts automatically. Learning math facts is a developmental process where the focus of instruction is on thinking and building number relationships. Facts become automatic for students through repeated exposure and practice. When a student recalls facts, the answer should be produced without resorting to inefficient means, such as counting. When facts are automatic, students are no longer using strategies to retrieve them from memory.

Problem Solving [PS]

“Problem solving is an integral part of all mathematics learning” (NCTM, *Problem Solving*). Learning through

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

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 a problem, but practice. A true problem requires students to use prior knowledge 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 creative and innovative 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 confident, cognitive, mathematical risk takers.

Reasoning [R]

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

Mathematical reasoning helps students think logically and make sense of 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.

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 has the potential to enhance the teaching and learning of mathematics. It can be used to

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.

- 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. Students need to know when it is appropriate to use technology such as a calculator and when to apply their mental computation, reasoning, and estimation skills to predict and check answers. The use of technology can enhance, although it should not replace, conceptual understanding, procedural thinking, and problem solving throughout Kindergarten to Grade 8. While technology can be used in Kindergarten to Grade 3 to enrich learning, it is expected that students will meet all outcomes without the use of calculators.

Visualization [V]

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

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

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.

Measurement visualization goes beyond the acquisition of specific measurement skills. Measurement sense includes the ability to determine when to measure and when to estimate, and to know several estimation strategies (Shaw and Cliatt 150).

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

Strands

The learning outcomes in the *Manitoba Curriculum Framework* are organized into four strands across the grades, K-9. Some strands are further subdivided into substrands. There is one general learning outcome per substrand across the grades, K-9.

The strands and substrands, including the general learning outcome for each, follow.

- Number
- Patterns and Relations
- Shape and Space
- Statistics and Probability

Number

- Develop number sense.

Patterns and Relations

Patterns

- Use patterns to describe the world and solve problems.

Variables and Equations

- Represent algebraic expressions in multiple ways.

Shape and Space

Measurement

- Use direct and indirect measure to solve problems.

3-D Objects and 2-D Shapes

- Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

Transformations

- Describe and analyze position and motion of objects and shapes.

Statistics and Probability

Data Analysis

- Collect, display, and analyze data to solve problems.

Chance and Uncertainty

- Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Learning Outcomes and Achievement Indicators

The *Manitoba Curriculum Framework* is stated in terms of general learning outcomes, specific learning outcomes, and achievement indicators.

General learning outcomes are overarching statements about what students are expected to learn in each strand/substrand. The general learning outcome for each strand/substrand is the same throughout the grades.

Specific learning outcomes are statements that identify the specific skills, understanding, and knowledge students are required to attain by the end of a given grade.

Achievement indicators are samples of how students may demonstrate their achievement of the goals of a specific learning outcome. The range of samples provided is meant to reflect the depth, breadth, and expectations of the specific learning outcome. While they provide some examples of student achievement, they are not meant to reflect the sole indicators of success.

In this document, the word *including* indicates that any ensuing items **must be addressed** to fully meet the learning outcome. The phrase *such as* indicates that the ensuing items are provided for illustrative purposes or clarification, and are **not requirements that must be addressed** to fully meet the learning outcome.

Summary

The conceptual framework for K–8 mathematics describes the nature of mathematics, mathematical processes, and the mathematical concepts to be addressed in Kindergarten to Grade 8 mathematics. The components are not meant to stand alone. Learning activities that take place in the mathematics classroom should stem from a problem-solving approach, be based on mathematical processes, and lead students to an understanding of the nature of mathematics through specific knowledge, skills, and attitudes among and between strands.

INSTRUCTIONAL FOCUS

The *Manitoba Curriculum Framework* is arranged into four strands. These strands are not intended to be discrete units of instruction. The integration of learning outcomes across strands makes mathematical experiences meaningful. Students should make the connection between concepts both within and across strands.

Consider the following when planning for instruction:

- Routinely incorporating conceptual understanding, procedural thinking, and problem solving within instructional design will enable students to master the mathematical skills and concepts of the curriculum.
 - Integration of the mathematical processes within each strand is expected.
 - Problem solving, conceptual understanding, reasoning, making connections, and procedural thinking are vital to increasing mathematical fluency, and must be integrated throughout the program.
 - Concepts should be introduced using manipulatives and gradually developed from the concrete to the pictorial to the symbolic.
 - Students in Manitoba bring a diversity of learning styles and cultural backgrounds to the classroom and they may be at varying developmental stages. Methods of instruction should be based on the learning styles and abilities of the students.
 - Use educational resources by adapting to the context, experiences, and interests of students.
- Collaborate with teachers at other grade levels to ensure the continuity of learning of all students.
 - Familiarize yourself with exemplary practices supported by pedagogical research in continuous professional learning.
 - Provide students with several opportunities to communicate mathematical concepts and to discuss them in their own words.

“Students in a mathematics class typically demonstrate diversity in the ways they learn best. It is important, therefore, that students have opportunities to learn in a variety of ways—individually, cooperatively, independently, with teacher direction, through hands-on experience, through examples followed by practice. In addition, mathematics requires students to learn concepts and procedures, acquire skills, and learn and apply mathematical processes. These different areas of learning may involve different teaching and learning strategies. It is assumed, therefore, that the strategies teachers employ will vary according to both the object of the learning and the needs of the students” (Ontario 24).

GENERAL AND SPECIFIC LEARNING OUTCOMES

General and Specific Learning Outcomes by Strand

(pages 20–51)

This section presents the general and specific learning outcomes for each strand, Kindergarten through Grade 9.

General and Specific Learning Outcomes with Achievement Indicators by Grade

(pages 52–150)

This section presents specific learning outcomes with corresponding achievement indicators and is organized by strand within each grade. The list of indicators contained in this document is not intended to be exhaustive but rather to provide teachers with examples of evidence of understanding that may be used in determining whether or not students understand a given learning outcome. Teachers may use any number of these indicators, or they may choose to use other indicators as evidence that the desired learning has been achieved. Achievement indicators should also help teachers form a clear picture of the intent and scope of each mathematics learning outcome.

General and Specific Learning Outcomes by Strand

Number

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
<p>K.N.1. Say the number sequence by 1s, starting anywhere from 1 to 30 and from 10 to 1. [C, CN, V]</p> <p>K.N.2. Subitize and name familiar arrangements of 1 to 6 dots (or objects). [C, CN, ME, V]</p> <p>K.N.3. Relate a numeral, 1 to 10, to its respective quantity. [CN, R, V]</p> <p>K.N.4. Represent and describe numbers 2 to 10 in two parts, concretely and pictorially. [C, CN, ME, R, V]</p> <p>K.N.5. Demonstrate an understanding of counting to 10 by</p> <ul style="list-style-type: none"> ■ indicating that the last number said identifies “how many” ■ showing that any set has only one count <p>[C, CN, ME, R, V]</p>	<p>1.N.1. Say the number sequence by</p> <ul style="list-style-type: none"> ■ 1s forward and backward between any two given numbers (0 to 100) ■ 2s to 30, forward starting at 0 ■ 5s and 10s to 100, forward starting at 0 <p>[C, CN, ME, V]</p> <p>1.N.2. Subitize and name familiar arrangements of 1 to 10 dots (or objects). [C, CN, ME, V]</p> <p>1.N.3. Demonstrate an understanding of counting by</p> <ul style="list-style-type: none"> ■ using the counting-on strategy ■ using parts or equal groups to count sets <p>[C, CN, ME, R, V]</p>	<p>2.N.1. Say the number sequence from 0 to 100 by</p> <ul style="list-style-type: none"> ■ 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 <p>[C, CN, ME, R]</p> <p>2.N.2. Demonstrate if a number (up to 100) is even or odd. [C, CN, PS, R]</p> <p>2.N.3. Describe order or relative position using ordinal numbers. [C, CN, R]</p> <p>2.N.4. Represent and describe numbers to 100, concretely, pictorially, and symbolically. [C, CN, V]</p>	<p>3.N.1. Say the number sequence between any two given numbers forward and backward</p> <ul style="list-style-type: none"> ■ from 0 to 1000 by <ul style="list-style-type: none"> ■ 10s or 100s, using any starting point ■ 5s, using starting points that are multiples of 5 ■ 25s, using starting points that are multiples of 25 ■ from 0 to 100 by <ul style="list-style-type: none"> ■ 3s, using starting points that are multiples of 3 ■ 4s, using starting points that are multiples of 4 <p>[C, CN, ME]</p> <p>3.N.2. Represent and describe numbers to 1000, concretely, pictorially, and symbolically. [C, CN, V]</p> <p>3.N.3. Compare and order numbers to 1000. [CN, R, V]</p> <p>3.N.4. Estimate quantities less than 1000 using referents. [ME, PS, R, V]</p>	<p>4.N.1. Represent and describe whole numbers to 10 000, pictorially and symbolically. [C, CN, V]</p> <p>4.N.2. Compare and order numbers to 10 000. [C, CN]</p> <p>4.N.3. Demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3- and 4-digit numerals), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithms ■ estimating sums and differences ■ solving problems <p>[C, CN, ME, PS, R]</p>

Number (*continued*)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
5.N.1. Represent and describe whole numbers to 1 000 000. [C, CN, T, V] 5.N.2. Apply estimation strategies, including <ul style="list-style-type: none"> ■ front-end rounding ■ compensation ■ compatible numbers in problem-solving contexts. [C, CN, ME, PS, R, V] 5.N.3. Apply mental math strategies to determine multiplication and related division facts to 81 (9 x 9). [C, CN, ME, R, V]	6.N.1. Demonstrate an understanding of place value for numbers <ul style="list-style-type: none"> ■ greater than one million ■ less than one-thousandth [C, CN, R, T] 6.N.2. Solve problems involving large numbers, using technology. [ME, PS, T] 6.N.3. Demonstrate an understanding of factors and multiples by <ul style="list-style-type: none"> ■ determining multiples and factors of numbers less than 100 ■ identifying prime and composite numbers ■ solving problems involving factors or multiples [PS, R, V] 6.N.4. Relate improper fractions to mixed numbers. [CN, ME, R, V]	7.N.1. Determine and explain why a number is divisible by 2, 3, 4, 5, 6, 8, 9, or 10, and why a number cannot be divided by 0. [C, R] 7.N.2. Demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, technology could be used). [ME, PS, T] 7.N.3. Solve problems involving percents from 1% to 100%. [C, CN, PS, ME, R, T] 7.N.4. Demonstrate an understanding of the relationship between repeating decimals and fractions, and terminating decimals and fractions. [C, CN, R, T]	8.N.1. Demonstrate an understanding of perfect squares and square roots, concretely, pictorially, and symbolically (limited to whole numbers). [C, CN, R, V] 8.N.2. Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers). [C, CN, ME, R, T] 8.N.3. Demonstrate an understanding of percents greater than or equal to 0%. [CN, PS, R, V] 8.N.4. Demonstrate an understanding of ratio and rate. [C, CN, V] 8.N.5. Solve problems that involve rates, ratios, and proportional reasoning. [C, CN, PS, R]	9.N.1. Demonstrate an understanding of powers with integral bases (excluding base 0) and whole-number exponents by <ul style="list-style-type: none"> ■ representing repeated multiplication using powers ■ using patterns to show that a power with an exponent of zero is equal to 1 ■ solving problems involving powers [C, CN, PS, R] 9.N.2. Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole-number exponents. [C, CN, PS, R, T] 9.N.3. Demonstrate an understanding of rational numbers by <ul style="list-style-type: none"> ■ comparing and ordering rational numbers ■ solving problems that involve arithmetic operations on rational numbers [C, CN, PS, R, T, V]

Recall of multiplication facts to 81 and related division facts is expected by the end of Grade 5.

Number (*continued*)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
<p>K.N.6. Compare quantities, 1 to 10,</p> <ul style="list-style-type: none"> ■ using one-to-one correspondence ■ by ordering numbers representing different quantities <p>[C, CN, V]</p>	<p>1.N.4. Represent and describe numbers to 20, concretely, pictorially, and symbolically. [C, CN, V]</p> <p>1.N.5. Compare and order sets containing up to 20 elements to solve problems by using</p> <ul style="list-style-type: none"> ■ referents ■ one-to-one correspondence <p>[C, CN, ME, PS, R, V]</p> <p>1.N.6. Estimate quantities to 20 by using referents. [C, ME, PS, R, V]</p> <p>1.N.7. Demonstrate, concretely and pictorially, how a number, up to 30, can be represented by a variety of equal groups with and without singles. [C, R, V]</p> <p>1.N.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]</p>	<p>2.N.5. Compare and order numbers up to 100. [C, CN, R, V]</p> <p>2.N.6. Estimate quantities to 100 using referents. [C, ME, PS, R]</p> <p>2.N.7. Illustrate, concretely and pictorially, the meaning of place value for numbers to 100. [C, CN, R, V]</p> <p>2.N.8. Demonstrate and explain the effect of adding zero to or subtracting zero from any number. [C, R]</p>	<p>3.N.5. Illustrate, concretely and pictorially, the meaning of place value for numerals to 1000. [C, CN, R, V]</p> <p>3.N.6. Describe and apply mental mathematics strategies for adding two 2-digit numerals, such as</p> <ul style="list-style-type: none"> ■ adding from left to right ■ taking one addend to the nearest multiple of ten and then compensating ■ using doubles <p>[C, ME, PS, R, V]</p> <p>3.N.7. Describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as</p> <ul style="list-style-type: none"> ■ taking the subtrahend to the nearest multiple of ten and then compensating ■ thinking of addition ■ using doubles <p>[C, ME, PS, R, V]</p>	<p>4.N.4. Explain the properties of 0 and 1 for multiplication, and the property of 1 for division. [C, CN, R]</p> <p>4.N.5. Describe and apply mental mathematics strategies, such as</p> <ul style="list-style-type: none"> ■ skip-counting from a known fact ■ using doubling, halving ■ using doubling and adding one more group ■ using patterns in the 9s facts ■ using repeated doubling to develop an understanding of basic multiplication facts to 9 x 9 and related division facts. <p>[C, CN, ME, PS, R]</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Recall of the multiplication and related division facts up to 5 x 5 is expected by the end of Grade 4.</p> </div>

Number (*continued*)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
<p>5.N.4. Apply mental mathematics strategies for multiplication, such as</p> <ul style="list-style-type: none"> ■ annexing then adding zeros ■ halving and doubling ■ using the distributive property <p>[C, ME, R]</p> <p>5.N.5. Demonstrate an understanding of multiplication (1- and 2-digit multipliers and up to 4-digit multiplicands), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithm ■ estimating products to solve problems. <p>[C, CN, ME, PS, V]</p> <p>5.N.6. Demonstrate an understanding of division (1- and 2-digit divisors and up to 4-digit dividends), concretely, pictorially, and symbolically, and interpret remainders by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithm ■ estimating quotients to solve problems. <p>[C, CN, ME, PS]</p>	<p>6.N.5. Demonstrate an understanding of ratio, concretely, pictorially, and symbolically.</p> <p>[C, CN, PS, R, V]</p> <p>6.N.6. Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially, and symbolically.</p> <p>[C, CN, PS, R, V]</p> <p>6.N.7. Demonstrate an understanding of integers, concretely, pictorially, and symbolically.</p> <p>[C, CN, R, V]</p>	<p>7.N.5. Demonstrate an understanding of adding and subtracting positive fractions and mixed numbers, with like and unlike denominators, concretely, pictorially, and symbolically (limited to positive sums and differences).</p> <p>[C, CN, ME, PS, R, V]</p> <p>7.N.6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially, and symbolically.</p> <p>[C, CN, PS, R, V]</p> <p>7.N.7. Compare and order fractions, decimals (to thousandths), and integers by using</p> <ul style="list-style-type: none"> ■ benchmarks ■ place value ■ equivalent fractions and/or decimals <p>[CN, R, V]</p>	<p>8.N.6. Demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially, and symbolically.</p> <p>[C, CN, ME, PS]</p> <p>8.N.7. Demonstrate an understanding of multiplication and division of integers, concretely, pictorially, and symbolically.</p> <p>[C, CN, PS, R, V]</p> <p>8.N.8. Solve problems involving positive rational numbers.</p> <p>[C, CN, ME, PS, R, T, V]</p>	<p>9.N.4. Explain and apply the order of operations, including exponents, with and without technology.</p> <p>[PS, T]</p> <p>9.N.5. Determine the square root of positive rational numbers that are perfect squares.</p> <p>[C, CN, PS, R, T]</p> <p>9.N.6. Determine an approximate square root of positive rational numbers that are non-perfect squares.</p> <p>[C, CN, PS, R, T]</p>

Number (*continued*)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
	<p>1.N.9. Demonstrate an understanding of addition of numbers with answers to 20 and their corresponding subtraction facts, concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ 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 ■ modelling addition and subtraction using a variety of concrete and visual representations, and recording the process symbolically <p>[C, CN, ME, PS, R, V]</p>	<p>2.N.9. Demonstrate an understanding of addition (limited to 1- and 2-digit numerals) with answers to 100 and the corresponding subtraction by</p> <ul style="list-style-type: none"> ■ 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 <p>[C, CN, ME, PS, R, V]</p>	<p>3.N.8. Apply estimation strategies to predict sums and differences of two 2-digit numerals in a problem-solving context. [C, ME, PS, R]</p> <p>3.N.9. Demonstrate an understanding of addition and subtraction of numbers with answers to 1000 (limited to 1-, 2-, and 3-digit numerals) by</p> <ul style="list-style-type: none"> ■ using personal strategies for adding and subtracting with and without the support of manipulatives ■ creating and solving problems in contexts that involve addition and subtraction of numbers, concretely, pictorially, and symbolically. <p>[C, CN, ME, PS, R]</p>	<p>4.N.6. Demonstrate an understanding of multiplication (2- or 3-digit numerals by 1-digit numerals) to solve problems by</p> <ul style="list-style-type: none"> ■ using personal strategies for multiplication with and without concrete materials ■ using arrays to represent multiplication ■ connecting concrete representations to symbolic representations ■ estimating products <p>[C, CN, ME, PS, R, V]</p> <p>4.N.7. Demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by</p> <ul style="list-style-type: none"> ■ using personal strategies for dividing with and without concrete materials ■ estimating quotients ■ relating division to multiplication <p>[C, CN, ME, PS, R, V]</p>

Number (*continued*)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.			
Specific Learning Outcomes	Specific Learning Outcomes			
<p>5.N.7. Demonstrate an understanding of fractions by using concrete and pictorial representations to</p> <ul style="list-style-type: none"> ■ create sets of equivalent fractions ■ compare fractions with like and unlike denominators <p>[C, CN, PS, R, V]</p> <p>5.N.8. Describe and represent decimals (tenths, hundredths, thousandths), concretely, pictorially, and symbolically. [C, CN, R, V]</p> <p>5.N.9. Relate decimals to fractions (tenths, hundredths, thousandths). [CN, R, V]</p> <p>5.N.10. Compare and order decimals (tenths, hundredths, thousandths) by using</p> <ul style="list-style-type: none"> ■ benchmarks ■ place value ■ equivalent decimals <p>[CN, R, V]</p>	<p>6.N.8. Demonstrate an understanding of multiplication and division of decimals (involving 1-digit whole-number multipliers, 1-digit natural number divisors, and multipliers and divisors that are multiples of 10), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithms ■ using estimation ■ solving problems <p>[C, CN, ME, PS, R, V]</p> <p>6.N.9. Explain and apply the order of operations, excluding exponents (limited to whole numbers). [CN, ME, PS, T]</p>			

Number (*continued*)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
	<p>1.N.10. Describe and use mental mathematics strategies, including</p> <ul style="list-style-type: none"> ■ counting on, counting back ■ using one more, one less ■ making 10 ■ starting from known doubles ■ using addition to subtract to determine the basic addition and related subtraction facts to 18. <p>[C, CN, ME, PS, R, V]</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Recall of one more and one less, complementary (compatible) numbers that add up to 5 and 10, doubles (up to 5 + 5), and related subtraction facts is expected by the end of Grade 1. </div>	<p>2.N.10. Apply mental mathematics strategies, including</p> <ul style="list-style-type: none"> ■ using doubles ■ making 10 ■ using one more, one less ■ using two more, two less ■ building on a known double ■ using addition for subtraction <p>to develop recall of basic addition facts to 18 and related subtraction facts.</p> <p>[C, CN, ME, R, V]</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Recall of facts to 10, doubles to 9 + 9, and related subtraction facts is expected by the end of Grade 2. </div>	<p>3.N.10. Apply mental math strategies to determine addition facts and related subtraction facts to 18 (9 + 9).</p> <p>[C, CN, ME, R, V]</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Recall of addition and related subtraction facts to 18 is expected by the end of Grade 3. </div> <p>3.N.11. Demonstrate an understanding of multiplication to 5×5 by</p> <ul style="list-style-type: none"> ■ representing and explaining multiplication using equal grouping and arrays ■ creating and solving problems in context that involve multiplication ■ modelling multiplication using concrete and visual representations, and recording the process symbolically ■ relating multiplication to repeated addition ■ relating multiplication to division <p>[C, CN, PS, R]</p>	<p>4.N.8. Demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to</p> <ul style="list-style-type: none"> ■ name and record fractions for the parts of a whole or a set ■ compare and order fractions ■ model and explain that for different wholes, two identical fractions may not represent the same quantity ■ provide examples of where fractions are used <p>[C, CN, PS, R, V]</p> <p>4.N.9. Describe and represent decimals (tenths and hundredths) concretely, pictorially, and symbolically.</p> <p>[C, CN, R, V]</p>

Number (*continued*)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Develop number sense.				
Specific Learning Outcomes				
5.N.11. Demonstrate an understanding of addition and subtraction of decimals (to thousandths), concretely, pictorially, and symbolically, by <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithms ■ using estimation ■ solving problems [C, CN, ME, PS, R, V]				

Number (continued)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
			General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.
			Specific Learning Outcomes	Specific Learning Outcomes
			3.N.12. Demonstrate an understanding of division by <ul style="list-style-type: none"> ■ representing and explaining division using equal sharing and equal grouping ■ creating and solving problems in context that involve equal sharing and equal grouping ■ modelling equal sharing and equal grouping using concrete and visual representations, and recording the process symbolically ■ relating division to repeated subtraction ■ relating division to multiplication (limited to division related to multiplication facts up to 5×5). [C, CN, PS, R]	4.N.10. Relate decimals to fractions (to hundredths). [CN, R, V] 4.N.11. Demonstrate an understanding of addition and subtraction of decimals (limited to hundredths) by <ul style="list-style-type: none"> ■ using compatible numbers ■ estimating sums and differences ■ using mental math strategies to solve problems. [C, ME, PS, R, V]

Number (*continued*)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
---------	---------	---------	---------	---------

Number (*continued*)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
			General Learning Outcome Develop number sense.	
			Specific Learning Outcomes	
			3.N.13. Demonstrate an understanding of fractions by <ul style="list-style-type: none"> ■ explaining that a fraction represents a portion of a whole divided into equal parts ■ describing situations in which fractions are used ■ comparing fractions of the same whole with like denominators [C, CN, ME, R, V]	

Number (*continued*)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
---------	---------	---------	---------	---------

Patterns and Relations (Patterns)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
<p>K.PR.1. Demonstrate an understanding of repeating patterns (two or three elements) by</p> <ul style="list-style-type: none"> ■ identifying ■ reproducing ■ extending ■ creating <p>patterns using manipulatives, sounds, and actions. [C, CN, PS, V]</p>	<p>1.PR.1. Demonstrate an understanding of repeating patterns (two to four elements) by</p> <ul style="list-style-type: none"> ■ describing ■ reproducing ■ extending ■ creating <p>patterns using manipulatives, diagrams, sounds, and actions. [C, PS, R, V]</p> <p>1.PR.2. Translate repeating patterns from one representation to another. [C, R, V]</p>	<p>2.PR.1. Predict an element in a repeating pattern using a variety of strategies. [C, CN, PS, R, V]</p> <p>2.PR.2. Demonstrate an understanding of increasing patterns by</p> <ul style="list-style-type: none"> ■ describing ■ reproducing ■ extending ■ creating <p>patterns using manipulatives, diagrams, sounds, and actions (numbers to 100). [C, CN, PS, R, V]</p>	<p>3.PR.1. Demonstrate an understanding of increasing patterns by</p> <ul style="list-style-type: none"> ■ describing ■ extending ■ comparing ■ creating <p>patterns using manipulatives, diagrams, and numbers (to 1000). [C, CN, PS, R, V]</p> <p>3.PR.2. Demonstrate an understanding of decreasing patterns by</p> <ul style="list-style-type: none"> ■ describing ■ extending ■ comparing ■ creating <p>patterns using manipulatives, diagrams, and numbers (starting from 1000 or less). [C, CN, PS, R, V]</p>	<p>4.PR.1. Identify and describe patterns found in tables and charts, including a multiplication chart. [C, CN, PS, V]</p> <p>4.PR.2. Reproduce a pattern shown in a table or chart using concrete materials. [C, CN, V]</p> <p>4.PR.3. Represent and describe patterns and relationships using charts and tables to solve problems. [C, CN, PS, R, V]</p> <p>4.PR.4. Identify and explain mathematical relationships using charts and diagrams to solve problems. [CN, PS, R, V]</p>

Patterns and Relations (Patterns)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
5.PR.1. Determine the pattern rule to make predictions about subsequent elements. [C, CN, PS, R, V]	6.PR.1. Demonstrate an understanding of the relationships within tables of values to solve problems. [C, CN, PS, R] 6.PR.2. Represent and describe patterns and relationships using graphs and tables. [C, CN, ME, PS, R, V]	7.PR.1. Demonstrate an understanding of oral and written patterns and their corresponding relations. [C, CN, R] 7.PR.2. Construct a table of values from a relation, graph the table of values, and analyze the graph to draw conclusions and solve problems. [C, CN, R, V]	8.PR.1. Graph and analyze two-variable linear relations. [C, ME, PS, R, T, V]	9.PR.1. Generalize a pattern arising from a problem-solving context using linear equations, and verify by substitution. [C, CN, PS, R, V] 9.PR.2. Graph linear relations, analyze the graph, and interpolate or extrapolate to solve problems. [C, CN, PS, R, T, V]

Patterns and Relations (Variables and Equations)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
	General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.
	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
	1.PR.3. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20). [C, CN, R, V]	2.PR.3. Demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100). [C, CN, R, V]	3.PR.3. Solve one-step addition and subtraction equations involving symbols representing an unknown number. [C, CN, PS, R, V]	4.PR.5. Express a problem as an equation in which a symbol is used to represent an unknown number. [CN, PS, R]
	1.PR.4. Record equalities using the equal symbol (0 to 20). [C, CN, PS, V]	2.PR.4. Record equalities and inequalities symbolically using the equal symbol or the not-equal symbol. [C, CN, R, V]		4.PR.6. Solve one-step equations involving a symbol to represent an unknown number. [C, CN, PS, R, V]

Patterns and Relations (Variables and Equations)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
5.PR.2. Solve problems involving single-variable (expressed as symbols or letters), one-step equations with whole-number coefficients, and whole-number solutions. [C, CN, PS, R]	6.PR.3. Represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V] 6.PR.4. Demonstrate and explain the meaning of preservation of equality, concretely, pictorially, and symbolically. [C, CN, PS, R, V]	7.PR.3. Demonstrate an understanding of preservation of equality by <ul style="list-style-type: none"> ■ modelling preservation of equality, concretely, pictorially, and symbolically ■ applying preservation of equality to solve equations [C, CN, PS, R, V] 7.PR.4. Explain the difference between an expression and an equation. [C, CN] 7.PR.5. Evaluate an expression given the value of the variable(s). [CN, R] 7.PR.6. Model and solve problems that can be represented by one-step linear equations of the form $x + a = b$, concretely, pictorially, and symbolically, where a and b are integers. [CN, PS, R, V]	8.PR.2. Model and solve problems using linear equations of the form: <ul style="list-style-type: none"> ■ $ax = b$ ■ $\frac{x}{a} = b, a \neq 0$ ■ $ax + b = c$ ■ $\frac{x}{a} + b = c, a \neq 0$ ■ $a(x + b) = c$ concretely, pictorially, and symbolically, where a, b, and c are integers. [C, CN, PS, V]	9.PR.3. Model and solve problems using linear equations of the form: <ul style="list-style-type: none"> ■ $ax = b$ ■ $\frac{x}{a} = b, a \neq 0$ ■ $ax + b = c$ ■ $\frac{x}{a} + b = c, a \neq 0$ ■ $ax = b + cx$ ■ $a(x + b) = c$ ■ $ax + b = cx + d$ ■ $a(bx + c) = d(ex + f)$ ■ $\frac{x}{a} = b, x \neq 0$ where a, b, c, d, e, and f are rational numbers. [C, CN, PS, V] 9.PR.4. Explain and illustrate strategies to solve single variable linear inequalities with rational number coefficients within a problem-solving context. [C, CN, PS, R, V] 9.PR.5. Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2). [C, CN, R, V]

Patterns and Relations (Variables and Equations) *(continued)*

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
--------------	---------	---------	---------	---------

Patterns and Relations (Variables and Equations) *(continued)*

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
		General Learning Outcome Represent algebraic expressions in multiple ways.		General Learning Outcome Represent algebraic expressions in multiple ways.
		Specific Learning Outcomes		Specific Learning Outcomes
		7.PR.7. Model and solve problems that can be represented by linear equations of the form: <ul style="list-style-type: none"> ■ $ax + b = c$ ■ $ax = b$ ■ $\frac{x}{a} = b, a \neq 0$ concretely, pictorially, and symbolically, where a, b, and c are whole numbers. [CN, PS, R, V]		9.PR.6. Model, record, and explain the operations of addition and subtraction of polynomial expressions, concretely, pictorially, and symbolically (limited to polynomials of degree less than or equal to 2). [C, CN, PS, R, V] 9.PR.7. Model, record, and explain the operations of multiplication and division of polynomial expressions (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially, and symbolically. [C, CN, R, V]

Shape and Space (Measurement)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
K.SS.1. Use direct comparison to compare two objects based on a single attribute, such as length (height), mass (weight), and volume (capacity). [C, CN, PS, R, V]	1.SS.1. Demonstrate an understanding of measurement as a process of comparing by <ul style="list-style-type: none"> ■ identifying attributes that can be compared ■ ordering objects ■ making statements of comparison ■ filling, covering, or matching [C, CN, PS, R, V]	2.SS.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] 2.SS.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 (weight). [C, CN, ME, R, V] 2.SS.3. Compare and order objects by length, height, distance around, and mass (weight) using non-standard units, and make statements of comparison. [C, CN, ME, R, V] 2.SS.4. Measure length to the nearest non-standard unit by <ul style="list-style-type: none"> ■ using multiple copies of a unit ■ using a single copy of a unit (iteration process) [C, ME, R, V]	3.SS.1. Relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years). [CN, ME, R] 3.SS.2. Relate the number of seconds to a minute, the number of minutes to an hour, and the number of days to a month in a problem-solving context. [C, CN, PS, R, V] 3.SS.3. Demonstrate an understanding of measuring length (cm, m) by <ul style="list-style-type: none"> ■ selecting and justifying referents for the units cm and m ■ modelling and describing the relationship between the units cm and m ■ estimating length using referents ■ measuring and recording length, width, and height [C, CN, ME, PS, R, V]	4.SS.1. Read and record time using digital and analog clocks, including 24-hour clocks. [C, CN, V] 4.SS.2. Read and record calendar dates in a variety of formats. [C, V] 4.SS.3. Demonstrate an understanding of area of regular and irregular 2-D shapes by <ul style="list-style-type: none"> ■ recognizing that area is measured in square units ■ selecting and justifying referents for the units cm^2 or m^2 ■ estimating area by using referents for cm^2 or m^2 ■ determining and recording area (cm^2 or m^2) ■ constructing different rectangles for a given area (cm^2 or m^2) in order to demonstrate that many different rectangles may have the same area [C, CN, ME, PS, R, V]

Shape and Space (Measurement)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
<p>5.SS.1. Design and construct different rectangles given either perimeter or area, or both (whole numbers), and draw conclusions. [C, CN, PS, R, V]</p> <p>5.SS.2. Demonstrate an understanding of measuring length (mm) by</p> <ul style="list-style-type: none"> ■ selecting and justifying referents for the unit mm ■ modelling and describing the relationship between mm and cm units, and between mm and m units <p>[C, CN, ME, PS, R, V]</p>	<p>6.SS.1. Demonstrate an understanding of angles by</p> <ul style="list-style-type: none"> ■ identifying examples of angles in the environment ■ classifying angles according to their measure ■ estimating the measure of angles using 45°, 90°, and 180° as reference angles ■ determining angle measures in degrees ■ drawing and labelling angles when the measure is specified <p>[C, CN, ME, V]</p> <p>6.SS.2. Demonstrate that the sum of interior angles is</p> <ul style="list-style-type: none"> ■ 180° in a triangle ■ 360° in a quadrilateral <p>[C, R]</p>	<p>7.SS.1. Demonstrate an understanding of circles by</p> <ul style="list-style-type: none"> ■ describing the relationships among radius, diameter, and circumference of circles ■ relating circumference to π (π) ■ determining the sum of the central angles ■ constructing circles with a given radius or diameter ■ solving problems involving the radii, diameters, and circumferences of circles <p>[C, CN, R, V]</p> <p>7.SS.2. Develop and apply a formula for determining the area of</p> <ul style="list-style-type: none"> ■ triangles ■ parallelograms ■ circles <p>[CN, PS, R, V]</p>	<p>8.SS.1. Develop and apply the Pythagorean theorem to solve problems. [CN, PS, R, T, V]</p> <p>8.SS.2. Draw and construct nets for 3-D objects. [C, CN, PS, V]</p> <p>8.SS.3. Determine the surface area of</p> <ul style="list-style-type: none"> ■ right rectangular prisms ■ right triangular prisms ■ right cylinders <p>to solve problems. [C, CN, PS, R, V]</p> <p>8.SS.4. Develop and apply formulas for determining the volume of right prisms and right cylinders. [C, CN, PS, R, V]</p>	<p>9.SS.1. Solve problems and justify the solution strategy using circle properties, including</p> <ul style="list-style-type: none"> ■ the perpendicular from the centre of a circle to a chord bisects the chord ■ the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc ■ the inscribed angles subtended by the same arc are congruent ■ a tangent to a circle is perpendicular to the radius at the point of tangency <p>[C, CN, PS, R, T, V]</p>

Shape and Space (Measurement) *(continued)*

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
		General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	
		Specific Learning Outcomes	Specific Learning Outcomes	
		2.SS.5. Demonstrate that changing the orientation of an object does not alter the measurements of its attributes. [C, R, V]	3.SS.4. Demonstrate an understanding of measuring mass (g, kg) by <ul style="list-style-type: none"> ■ selecting and justifying referents for the units g and kg ■ modelling and describing the relationship between the units g and kg ■ estimating mass using referents ■ measuring and recording mass [C, CN, ME, PS, R, V]	
			3.SS.5. Demonstrate an understanding of perimeter of regular and irregular shapes by <ul style="list-style-type: none"> ■ estimating perimeter using referents for centimetre or metre ■ measuring and recording perimeter (cm, m) ■ constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter [C, ME, PS, R, V]	

Shape and Space (Measurement) *(continued)*

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.			
Specific Learning Outcomes	Specific Learning Outcomes			
5.SS.3. Demonstrate an understanding of volume by <ul style="list-style-type: none"> ■ selecting and justifying referents for cm^3 or m^3 units ■ estimating volume by using referents for cm^3 or m^3 ■ measuring and recording volume (cm^3 or m^3) ■ constructing rectangular prisms for a given volume [C, CN, ME, PS, R, V]	6.SS.3. Develop and apply a formula for determining the <ul style="list-style-type: none"> ■ perimeter of polygons ■ area of rectangles ■ volume of right rectangular prisms [C, CN, PS, R, V]			
5.SS.4. Demonstrate an understanding of capacity by <ul style="list-style-type: none"> ■ describing the relationship between mL and L ■ selecting and justifying referents for mL or L units ■ estimating capacity by using referents for mL or L ■ measuring and recording capacity (mL or L) [C, CN, ME, PS, R, V]				

Shape and Space (3-D Objects and 2-D Shapes)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
K.SS.2. Sort 3-D objects using a single attribute. [C, CN, PS, R, V]	1.SS.2. Sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule. [C, CN, R, V]	2.SS.6. Sort 2-D shapes and 3-D objects using two attributes, and explain the sorting rule. [C, CN, R, V]	3.SS.6. Describe 3-D objects according to the shape of the faces and the number of edges and vertices. [C, CN, PS, R, V]	4.SS.4. Solve problems involving 2-D shapes and 3-D objects. [CN, PS, V]
K.SS.3. Build and describe 3-D objects. [CN, PS, V]	1.SS.3. Replicate composite 2-D shapes and 3-D objects. [CN, PS, V]	2.SS.7. Describe, compare, and construct 3-D objects, including <ul style="list-style-type: none"> ■ cubes ■ spheres ■ cones ■ cylinders ■ prisms ■ pyramids [C, CN, R, V]	3.SS.7. Sort regular and irregular polygons, including <ul style="list-style-type: none"> ■ triangles ■ quadrilaterals ■ pentagons ■ hexagons ■ octagons according to the number of sides. [C, CN, R, V]	4.SS.5. Describe and construct rectangular and triangular prisms. [C, CN, R, V]
	1.SS.4. Compare 2-D shapes to parts of 3-D objects in the environment. [C, CN, V]	2.SS.8. Describe, compare, and construct 2-D shapes, including <ul style="list-style-type: none"> ■ triangles ■ squares ■ rectangles ■ circles [C, CN, R, V]		
		2.SS.9. Identify 2-D shapes as parts of 3-D objects in the environment. [C, CN, R, V]		

Shape and Space (3-D Objects and 2-D Shapes)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
<p>General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.</p>	<p>General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.</p>	<p>General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.</p>	<p>General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.</p>	<p>General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.</p>
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
<p>5.SS.5. Describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes, that are</p> <ul style="list-style-type: none"> ■ parallel ■ intersecting ■ perpendicular ■ vertical ■ horizontal <p>[C, CN, R, T, V]</p> <p>5.SS.6. Identify and sort quadrilaterals, including</p> <ul style="list-style-type: none"> ■ rectangles ■ squares ■ trapezoids ■ parallelograms ■ rhombuses <p>according to their attributes. [C, R, V]</p>	<p>6.SS.4. Construct and compare triangles, including</p> <ul style="list-style-type: none"> ■ scalene ■ isosceles ■ equilateral ■ right ■ obtuse ■ acute <p>in different orientations. [C, PS, R, V]</p> <p>6.SS.5. Describe and compare the sides and angles of regular and irregular polygons. [C, PS, R, V]</p>	<p>7.SS.3. Perform geometric constructions, including</p> <ul style="list-style-type: none"> ■ perpendicular line segments ■ parallel line segments ■ perpendicular bisectors ■ angle bisectors <p>[CN, R, V]</p>	<p>8.SS.5. Draw and interpret top, front, and side views of 3-D objects composed of right rectangular prisms. [C, CN, R, T, V]</p>	<p>9.SS.2. Determine the surface area of composite 3-D objects to solve problems. [C, CN, PS, R, V]</p> <p>9.SS.3. Demonstrate an understanding of similarity of polygons. [C, CN, PS, R, V]</p>

Shape and Space (Transformations)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
				General Learning Outcome Describe and analyze position and motion of objects and shapes.
				Specific Learning Outcomes
				4.SS.6. Demonstrate an understanding of line symmetry by <ul style="list-style-type: none"> ■ identifying symmetrical 2-D shapes ■ creating symmetrical 2-D shapes ■ drawing one or more lines of symmetry in a 2-D shape [C, CN, V]

Shape and Space (Transformations)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Describe and analyze position and motion of objects and shapes.	General Learning Outcome Describe and analyze position and motion of objects and shapes.	General Learning Outcome Describe and analyze position and motion of objects and shapes.	General Learning Outcome Describe and analyze position and motion of objects and shapes.	General Learning Outcome Describe and analyze position and motion of objects and shapes.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
<p>5.SS.7. Perform a single transformation (translation, rotation, or reflection) of a 2-D shape, and draw and describe the image. [C, CN, T, V]</p> <p>5.SS.8. Identify a single transformation (translation, rotation, or reflection) of 2-D shapes. [C, T, V]</p>	<p>6.SS.6. Perform a combination of transformations (translations, rotations, or reflections) on a single 2-D shape, and draw and describe the image. [C, CN, PS, T, V]</p> <p>6.SS.7. Perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations. [C, CN, T, V]</p> <p>6.SS.8. Identify and plot points in the first quadrant of a Cartesian plane using whole-number ordered pairs. [C, CN, V]</p> <p>6.SS.9. Perform and describe single transformations of a 2-D shape in the first quadrant of a Cartesian plane (limited to whole-number vertices). [C, CN, PS, T, V]</p>	<p>7.SS.4. Identify and plot points in the four quadrants of a Cartesian plane using ordered pairs. [C, CN, V]</p> <p>7.SS.5. Perform and describe transformations of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral vertices). [C, CN, PS, T, V]</p>	<p>8.SS.6. Demonstrate an understanding of tessellation by</p> <ul style="list-style-type: none"> ■ explaining the properties of shapes that make tessellating possible ■ creating tessellations ■ identifying tessellations in the environment <p>[C, CN, PS, T, V]</p>	<p>9.SS.4. Draw and interpret scale diagrams of 2-D shapes. [CN, R, T, V]</p> <p>9.SS.5. Demonstrate an understanding of line and rotation symmetry. [C, CN, PS, V]</p>

Statistics and Probability (Data Analysis)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
		General Learning Outcome Collect, display, and analyze data to solve problems.	General Learning Outcome Collect, display, and analyze data to solve problems.	General Learning Outcome Collect, display, and analyze data to solve problems.
		Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
		2.SP.1. Gather and record data about self and others to answer questions. [C, CN, PS, V]	3.SP.1. Collect first-hand data and organize it using ■ tally marks ■ line plots ■ charts ■ lists to answer questions. [C, CN, V]	4.SP.1. Demonstrate an understanding of many-to-one correspondence. [C, R, T, V]
		2.SP.2. Construct and interpret concrete graphs and pictographs to solve problems. [C, CN, PS, R, V]	3.SP.2. Construct, label, and interpret bar graphs to solve problems. [PS, R, V]	4.SP.2. Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions. [C, PS, R, V]

Statistics and Probability (Data Analysis)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
General Learning Outcome Collect, display, and analyze data to solve problems.	General Learning Outcome Collect, display, and analyze data to solve problems.	General Learning Outcome Collect, display, and analyze data to solve problems.	General Learning Outcome Collect, display, and analyze data to solve problems.	General Learning Outcome Collect, display, and analyze data to solve problems.
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
5.SP.1. Differentiate between first-hand and second-hand data. [C, R, T, V]	6.SP.1. Create, label, and interpret line graphs to draw conclusions. [C, CN, PS, R, V]	7.SP.1. Demonstrate an understanding of central tendency and range by <ul style="list-style-type: none"> ■ determining the measures of central tendency (mean, median, mode) and range ■ determining the most appropriate measures of central tendency to report findings [C, PS, R, T]	8.SP.1. Critique ways in which data are presented. [C, R, T, V]	9.SP.1. Describe the effect of <ul style="list-style-type: none"> ■ bias ■ use of language ■ ethics ■ cost ■ time and timing ■ privacy ■ cultural sensitivity on the collection of data. [C, CN, R, T]
5.SP.2. Construct and interpret double bar graphs to draw conclusions. [C, PS, R, T, V]	6.SP.2. Select, justify, and use appropriate methods of collecting data, including <ul style="list-style-type: none"> ■ questionnaires ■ experiments ■ databases ■ electronic media [C, PS, T]	7.SP.2. Determine the effect on the mean, median, and mode when an outlier is included in a data set. [C, CN, PS, R]		9.SP.2. Select and defend the choice of using either a population or a sample of a population to answer a question. [C, CN, PS, R]
	6.SP.3. Graph collected data and analyze the graph to solve problems. [C, CN, PS]	7.SP.3. Construct, label, and interpret circle graphs to solve problems. [C, CN, PS, R, T, V]		

Statistics and Probability (Data Analysis) *(continued)*

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
--------------	---------	---------	---------	---------

Statistics and Probability (Data Analysis) *(continued)*

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
				General Learning Outcome Collect, display, and analyze data to solve problems.
				Specific Learning Outcomes
				9.SP.3. Develop and implement a project plan for the collection, display, and analysis of data by <ul style="list-style-type: none"> ■ formulating a question for investigation ■ choosing a data collection method that includes social considerations ■ selecting a population or a sample ■ collecting the data ■ displaying the collected data in an appropriate manner ■ drawing conclusions to answer the question [C, PS, R, T, V]

Statistics and Probability (Chance and Uncertainty)

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

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4
--------------	---------	---------	---------	---------

Statistics and Probability (Chance and Uncertainty)

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

Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
<p>General Learning Outcome Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.</p>	<p>General Learning Outcome Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.</p>	<p>General Learning Outcome Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.</p>	<p>General Learning Outcome Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.</p>	<p>General Learning Outcome Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.</p>
<p>Specific Learning Outcomes</p> <p>5.SP.3. Describe the likelihood of a single outcome occurring, using words such as</p> <ul style="list-style-type: none"> ■ impossible ■ possible ■ certain <p>[C, CN, PS, R]</p> <p>5.SP.4. Compare the likelihood of two possible outcomes occurring, using words such as</p> <ul style="list-style-type: none"> ■ less likely ■ equally likely ■ more likely <p>[C, CN, PS, R]</p>	<p>6.SP.4. Demonstrate an understanding of probability by</p> <ul style="list-style-type: none"> ■ identifying all possible outcomes of a probability experiment ■ differentiating between experimental and theoretical probability ■ determining the theoretical probability of outcomes in a probability experiment ■ determining the experimental probability of outcomes in a probability experiment ■ comparing experimental results with the theoretical probability for an experiment <p>[C, ME, PS, T]</p>	<p>7.SP.4. Express probabilities as ratios, fractions, and percents. [C, CN, R, T, V]</p> <p>7.SP.5. Identify the sample space (where the combined sample space has 36 or fewer elements) for a probability experiment involving two independent events. [C, ME, PS]</p> <p>7.SP.6. Conduct a probability experiment to compare the theoretical probability (determined using a tree diagram, table, or another graphic organizer) and experimental probability of two independent events. [C, PS, R, T]</p>	<p>8.SP.2. Solve problems involving the probability of independent events. [C, CN, PS, T]</p>	<p>9.SP.4. Demonstrate an understanding of the role of probability in society. [C, CN, R, T]</p>

General and Specific Learning Outcomes with Achievement Indicators by Grade

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

Kindergarten Strand: Number		General Learning Outcome: Develop number sense.	
Specific Learning Outcomes <i>It is expected that students will:</i>		Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	
K.N.1.	Say the number sequence by 1s, starting anywhere from 1 to 30 and from 10 to 1. [C, CN, V]	<ul style="list-style-type: none"> ■ Recite the number sequence from 1 to 30 and from 10 to 1. ■ Name the number that comes after a given number, 1 to 9. ■ Name the number that comes before a given number, 2 to 10. ■ Recite number names from a given number to a stated number (forward – 1 to 10, backward – 10 to 1) using visual aids. 	
K.N.2.	Subitize and name familiar arrangements of 1 to 6 dots (or objects). [C, CN, ME, V]	<ul style="list-style-type: none"> ■ Look briefly at a given familiar arrangement of 1 to 6 dots (or objects), and identify the number represented without counting. ■ Identify the number represented by a given dot arrangement on a five frame, and describe the number's relationship to 5. ■ Identify the number represented by a given dot arrangement on a five frame, and identify the numbers that are one more and one less. 	
K.N.3.	Relate a numeral, 1 to 10, to its respective quantity. [CN, R, V]	<ul style="list-style-type: none"> ■ Construct a set of objects corresponding to a given numeral. ■ Name the number for a set of objects. ■ Hold up the appropriate number of fingers for a given numeral. ■ Match numerals with their pictorial representations. 	
K.N.4.	Represent and describe numbers 2 to 10 in two parts, concretely and pictorially. [C, CN, ME, R, V]	<ul style="list-style-type: none"> ■ Show a number as two parts, using fingers, counters, or other objects, and name the number of objects in each part. ■ Show a number as two parts using pictures, and name the number of objects in each part. 	

Kindergarten

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

Strand: Number	General Learning Outcome: Develop number sense.
--------------------------	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>K.N.5. Demonstrate an understanding of counting to 10 by</p> <ul style="list-style-type: none"> ■ indicating that the last number said identifies “how many” ■ showing that any set has only one count <p>[C, CN, ME, R, V]</p>	<ul style="list-style-type: none"> ■ Answer the question, “How many are in the set?” using the last number counted in a set. ■ 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. ■ Count the number of objects in a given set, rearrange the objects, predict the new count, and recount to verify the prediction.
<p>K.N.6. Compare quantities, 1 to 10,</p> <ul style="list-style-type: none"> ■ using one-to-one correspondence ■ by ordering numbers representing different quantities <p>[C, CN, V]</p>	<ul style="list-style-type: none"> ■ Construct a set to show more than, fewer than, or as many as a given set. ■ Compare two sets through direct comparison, and describe the sets using words such as “more,” “fewer,” “as many as,” or “the same number.” ■ Order quantities using objects, five frames, ten frames, or dot cards. ■ Order, using at least two benchmarks, numerals 1 to 10 on a vertical or horizontal number line.

Kindergarten

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

Strand: Patterns and Relations (Patterns)		General Learning Outcome: Use patterns to describe the world and solve problems.	
Specific Learning Outcomes <i>It is expected that students will:</i>		Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	
<p>K.PR.1. Demonstrate an understanding of repeating patterns (two or three elements) by</p> <ul style="list-style-type: none"> ■ identifying ■ reproducing ■ extending ■ creating <p>patterns using manipulatives, sounds, and actions. [C, CN, PS, V]</p>	<ul style="list-style-type: none"> ■ Distinguish between repeating patterns and non-repeating sequences in a set by identifying the part that repeats. ■ Copy a repeating pattern (e.g., actions, sound, colour, size, shape, orientation) and describe the pattern. ■ Extend a variety of repeating patterns to two more repetitions. ■ Create a repeating pattern using manipulatives, musical instruments, or actions, and describe the pattern. ■ Identify and describe a repeating pattern in the classroom, the school, and outdoors (e.g., in a familiar song, in a nursery rhyme). 		

Kindergarten

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>K.SS.1. Use direct comparison to compare two objects based on a single attribute, such as length (height), mass (weight), and volume (capacity). [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Compare the length (height) of two objects, and explain the comparison using the words "shorter," "longer (taller)," or "almost the same." ■ Compare the mass (weight) of two objects, and explain the comparison using the words "lighter," "heavier," or "almost the same." ■ Compare the volume (capacity) of two objects, and explain the comparison using the words "less," "more," "bigger," "smaller," or "almost the same."

Kindergarten

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
K.SS.2. Sort 3-D objects using a single attribute. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Sort a set of familiar 3-D objects using a single attribute, such as size or shape, and explain the sorting rule. ■ Determine the difference between two pre-sorted sets by explaining a sorting rule used to sort them.
K.SS.3. Build and describe 3-D objects. [CN, PS, V]	<ul style="list-style-type: none"> ■ Create a representation of a 3-D object using materials such as modelling clay and building blocks, and compare the representation to the original 3-D object. ■ Describe a 3-D object using words such as “big,” “little,” “round,” “like a box,” and “like a can.”

Grade 1

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

Strand: Number	General Learning Outcome: Develop number sense.
--------------------------	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>1.N.1. Say the number sequence by</p> <ul style="list-style-type: none"> ■ 1s forward and backward between any two given numbers (0 to 100) ■ 2s to 30, forward starting at 0 ■ 5s and 10s to 100, forward starting at 0 <p>[C, CN, ME, V]</p>	<ul style="list-style-type: none"> ■ Recite forward by 1s the number sequence between two given numbers (0 to 100). ■ Recite backward by 1s the number sequence between two given numbers. ■ Record a numeral (0 to 100) symbolically when it is presented orally. ■ Read a numeral (0 to 100) when it is presented symbolically. ■ Skip-count by 2s to 30 starting at 0. ■ Skip-count by 5s to 100 starting at 0. ■ Skip-count by 10s to 100 starting at 0. ■ Identify and correct errors and omissions in a number sequence.
<p>1.N.2. Subitize and name familiar arrangements of 1 to 10 dots (or objects).</p> <p>[C, CN, ME, V]</p>	<ul style="list-style-type: none"> ■ Look briefly at a familiar dice arrangement of 1 to 6 dots, and identify the number represented without counting. ■ Look briefly at a familiar ten-frame arrangement of 1 to 10 dots (or objects), and identify the number represented without counting. ■ Look briefly at a finger arrangement, and identify how many fingers there are without counting. ■ Identify the number represented by an arrangement of dots (or objects) on a ten frame, and describe the number's relationship to 5 and to 10.
<p>1.N.3. Demonstrate an understanding of counting by</p> <ul style="list-style-type: none"> ■ using the counting-on strategy ■ using parts or equal groups to count sets <p>[C, CN, ME, R, V]</p>	<p>(It is intended that the sets be limited to less than 30 objects and that students count on from multiples of 2, 5, and 10 respectively.)</p> <ul style="list-style-type: none"> ■ Determine the total number of objects in a set, starting from a known quantity and counting on by 1s. ■ Count number of objects in a set using groups of 2s, 5s, or 10s. ■ Count the total number of objects in a set, starting from a known quantity and counting on by using groups of 2s, 5s, or 10s.

Grade 1

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

Strand: Number (<i>continued</i>)	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

<p>1.N.4. Represent and describe numbers to 20, concretely, pictorially, and symbolically. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Represent a number up to 20 using a variety of manipulatives, including ten frames and base-10 materials. ■ Read number words to 20. ■ Partition any quantity up to 20 into two parts, and identify the number of objects in each part. ■ Represent a number to 20 in two parts, concretely, pictorially, and symbolically. ■ Determine compatible number pairs for 5, 10, and 20. ■ Model a number using two different objects (e.g., 10 desks represents the same number as 10 pencils). ■ Place numerals on a horizontal or vertical number line with benchmarks 0, 5, 10, and 20.
<p>1.N.5. Compare and order sets containing up to 20 elements to solve problems using</p> <ul style="list-style-type: none"> ■ referents ■ one-to-one correspondence <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Build a set equal to another set that contains up to 20 elements. ■ Build a set that has more, fewer, or as many elements as another set. ■ Build several sets of different objects that have the same number of elements in the set. ■ Compare two sets using one-to-one correspondence, and describe them using comparative words such as “more,” “fewer,” or “as many.” ■ Compare a set to a referent using comparative language. ■ Solve a story problem (pictures and words) that involves the comparison of two quantities.
<p>1.N.6. Estimate quantities to 20 by using referents. [C, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Estimate a quantity by comparing it to a referent (known quantity). ■ Select an estimate for a quantity by choosing between at least two possible choices, and explain the choice.

Grade 1

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>1.N.7. Demonstrate, concretely and pictorially, how a number, up to 30, can be represented by a variety of equal groups with and without singles. [C, R, V]</p>	<ul style="list-style-type: none"> ■ Represent a number in a variety of equal groups 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, 3 groups of 5 and two singles, and 1 group of 10 with seven singles). ■ Recognize that for a number of counters, no matter how they are grouped, the total number of counters does not change. ■ Group a set of counters into equal groups with and without singles in more than one way, and explain which grouping makes counting easier.
<p>1.N.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]</p>	<ul style="list-style-type: none"> ■ Name the number that is one more, two more, one less, or two less than a given number, up to 20. ■ Represent a number on a ten frame that is one more, two more, one less, or two less than a given number.

Grade 1

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

- 1.N.9. Demonstrate an understanding of addition of numbers with answers to 20 and their corresponding subtraction facts, concretely, pictorially, 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
 - modelling addition and subtraction using a variety of concrete and visual representations, and recording the process symbolically
- [C, CN, ME, PS, R, V]

- Act out a story problem presented orally or through shared reading.
- Indicate if the scenario in a story problem represents additive or subtractive action.
- Represent the numbers and actions presented in a story problem by using manipulatives, and record them using sketches and/or number sentences.
- Create a story problem for addition that connects to student experience, and simulate the action with counters.
- Create a story problem for subtraction that connects to student experience, and simulate the action with counters.
- Create a story problem for a number sentence.
- Represent a story problem pictorially or symbolically to show the additive or subtractive action, and solve the problem.

- 1.N.10. Describe and use mental mathematics strategies including
- counting on, counting back
 - using one more, one less
 - making 10
 - starting from known doubles
 - using addition to subtract
- to determine the basic addition and related subtraction facts to 18.
- [C, CN, ME, PS, R, V]

- (It is intended that students show their understanding of strategies using manipulatives, pictorial representations, and/or patterns when determining sums and differences.)
- Use and describe a mental mathematics strategy for determining a sum.
 - Use and describe a mental mathematics strategy for determining a difference.
 - Use and describe the related addition facts for a subtraction fact (fact family) (e.g., $6 - 4 = 2$ has two related addition facts: $4 + 2 = 6$, $2 + 4 = 6$).
 - Use and describe related subtraction facts for an addition fact (fact family) (e.g., $2 + 3 = 5$ has two related subtraction facts: $5 - 3 = 2$, $5 - 2 = 3$).

Recall of one more and one less, complementary (compatible) numbers that add up to 5 and 10, doubles (up to $5 + 5$), and related subtraction facts is expected by the end of Grade 1.

Grade 1

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

Strand: Patterns and Relations (Patterns)	General Learning Outcome: Use patterns to describe the world and solve problems.
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>1.PR.1. Demonstrate an understanding of repeating patterns (two to four elements) by</p> <ul style="list-style-type: none"> ■ describing ■ reproducing ■ extending ■ creating <p>patterns using manipulatives, diagrams, sounds, and actions. [C, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Describe a repeating pattern containing two to four elements in its core. ■ Identify errors in a repeating pattern. ■ Identify the missing element(s) in a repeating pattern. ■ Create and describe a repeating pattern using a variety of manipulatives, musical instruments, and actions. ■ Reproduce and extend a repeating pattern using manipulatives, diagrams, sounds, and actions. ■ Identify and describe, using everyday language, a repeating pattern in the environment (e.g., classroom, outdoors). ■ Identify repeating events (e.g., days of the week, birthdays, seasons).
<p>1.PR.2. Translate repeating patterns from one representation to another. [C, R, V]</p>	<ul style="list-style-type: none"> ■ Represent a repeating pattern using another mode (e.g., actions to sound, colour to shape, ABC ABC to blue yellow green blue yellow green). ■ Describe a repeating pattern using a letter code (e.g., ABC ABC...).

Grade 1

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning 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.*

<p>1.PR.3. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20). [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Construct two equal sets using the same objects (same shape and mass), and demonstrate their equality of number using a balance scale. ■ Construct two unequal sets using the same objects (same shape and mass), and demonstrate their inequality of number using a balance scale. ■ Determine if two concrete sets are equal or unequal, and explain the process used.
<p>1.PR.4. Record equalities using the equal symbol (0 to 20). [C, CN, PS, V]</p>	<ul style="list-style-type: none"> ■ Represent an equality using manipulatives or pictures. ■ Represent a pictorial or concrete equality in symbolic form. ■ Provide examples of equalities where the sum or difference is on either the left or right side of the equal symbol (=). ■ Record different representations of the same quantity (0 to 20) as equalities.

Grade 1

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

1.SS.1. Demonstrate an understanding of measurement as a process of comparing by <ul style="list-style-type: none">■ identifying attributes that can be compared■ ordering objects■ making statements of comparison■ filling, covering, or matching [C, CN, PS, R, V]	<ul style="list-style-type: none">■ Identify common attributes, such as length (height), mass (weight), volume (capacity), and area, which could be used to compare a set of two objects.■ Compare two objects and identify the attributes used to compare.■ Determine which of two or more objects is longest/shortest by matching, and explain the reasoning.■ Determine which of two or more objects is heaviest/lightest by comparing, and explain the reasoning.■ Determine which of two or more objects holds the most/least by filling, and explain the reasoning.■ Determine which of two or more objects has the greatest/least area by covering, and explain the reasoning.
--	--

Grade 1

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>1.SS.2. Sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule. [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Sort a set of familiar 3-D objects or 2-D shapes using a given sorting rule. ■ Sort a set of familiar 3-D objects using a single attribute determined by the student, and explain the sorting rule. ■ Sort a set of 2-D shapes using a single attribute determined by the student, and explain the sorting rule. ■ Determine the difference between two pre-sorted sets of familiar 3-D objects or 2-D shapes, and explain a possible sorting rule used to sort them.
<p>1.SS.3. Replicate composite 2-D shapes and 3-D objects. [CN, PS, V]</p>	<ul style="list-style-type: none"> ■ Select 2-D shapes from a given set of 2-D shapes to reproduce a composite 2-D shape. ■ Select 3-D objects from a given set of 3-D objects to reproduce a composite 3-D object. ■ Predict and select the 2-D shapes used to produce a composite 2-D shape, and verify by deconstructing the composite shape. ■ Predict and select the 3-D objects used to produce a composite 3-D object, and verify by deconstructing the composite object.
<p>1.SS.4. Compare 2-D shapes to parts of 3-D objects in the environment. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Identify 3-D objects in the environment that have parts similar to a 2-D shape.

Grade 2

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

Strand: Number	General Learning Outcome: Develop number sense.
--------------------------	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>2.N.1. Say the number sequence from 0 to 100 by</p> <ul style="list-style-type: none"> ■ 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 <p>[C, CN, ME, R]</p>	<ul style="list-style-type: none"> ■ Extend a skip-counting sequence by 2s, 5s, or 10s forward and backward. ■ Skip-count by 10s, given any number from 1 to 9 as a starting point. ■ Count by 2s starting from 1 or from any odd number. ■ Identify and correct errors and omissions in a skip-counting sequence. ■ Count a sum of money with pennies, nickels, or dimes (to 100¢). ■ Count quantity using groups of 2s, 5s, or 10s and counting on.
<p>2.N.2. Demonstrate if a number (up to 100) is even or odd.</p> <p>[C, CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Determine if a number is even or odd by using concrete materials or pictorial representations. ■ Identify even and odd numbers in a sequence, such as in a hundred chart. ■ Sort a set of numbers into even and odd.
<p>2.N.3. Describe order or relative position using ordinal numbers.</p> <p>[C, CN, R]</p>	<ul style="list-style-type: none"> ■ Indicate the position of an object in a sequence by using ordinal numbers. ■ Compare the relative position of an object in two different sequences.
<p>2.N.4. Represent and describe numbers to 100, concretely, pictorially, and symbolically.</p> <p>[C, CN, V]</p>	<ul style="list-style-type: none"> ■ Represent a number using concrete materials, such as ten frames and base-10 materials. ■ Represent a number using coins (pennies, nickels, dimes, and quarters). ■ Represent a number using tallies. ■ Represent a number pictorially. ■ Represent a number using expressions (e.g., $24 + 6$, $15 + 15$, $40 - 10$). ■ Read a number (0–100) in symbolic or word form. ■ Record a number (0–20) in words. ■ Determine compatible number pairs for 20 or 50.

Grade 2

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

<p>2.N.5. Compare and order numbers up to 100. [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Order a set of numbers in ascending or descending order, and verify the result using a hundred chart, number line, ten frames, or by making reference to place value. ■ Identify errors in an ordered sequence. ■ Identify missing numbers in a hundred chart. ■ Identify errors in a hundred chart.
<p>2.N.6. Estimate quantities to 100 using referents. [C, ME, PS, R]</p>	<ul style="list-style-type: none"> ■ Estimate a quantity by comparing it to a referent (known quantity). ■ Estimate the number of groups of 10 in a quantity using 10 as a referent. ■ Select between two possible estimates for a quantity, and explain the choice.
<p>2.N.7. Illustrate, concretely and pictorially, the meaning of place value for numbers to 100. [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Explain and show with counters the meaning of each digit for a 2-digit numeral with both digits the same (e.g., for the numeral 22, the first digit represents two tens [twenty counters] and the second digit represents two ones [two counters]). ■ Count the number of objects in a set using groups of 10s and 1s, and record the result as a 2-digit numeral under the headings of 10s and 1s. ■ Describe a 2-digit numeral in at least two ways (e.g., 24 as two tens and four ones, twenty and four, two groups of ten and four left over, and twenty-four ones). ■ Illustrate using 10 frames and diagrams that a numeral consists of a certain number of groups of 10 and a certain number of 1s. ■ Illustrate using proportional base-10 materials that a numeral consists of a certain number of tens and a certain number of ones. ■ Explain why the value of a digit depends on its placement within a numeral.

Grade 2

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>2.N.8. Demonstrate and explain the effect of adding zero to or subtracting zero from any number. [C, R]</p>	<ul style="list-style-type: none"> ■ Add zero to a number and explain why the sum is the same as the addend. ■ Subtract zero from a number and explain why the difference is the same as the number.
<p>2.N.9. Demonstrate an understanding of addition (limited to 1- and 2-digit numerals) with answers to 100 and the corresponding subtraction by</p> <ul style="list-style-type: none"> ■ 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 <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Model addition and subtraction using concrete materials or visual representations, and record the process symbolically. ■ Create an addition or a subtraction number sentence and a story problem for a solution. ■ Solve a problem involving a missing addend, and describe the strategy used. ■ Solve a problem involving a missing minuend or subtrahend, and describe the strategy used. ■ Match a number sentence to a missing addend problem. ■ Match a number sentence to a missing subtrahend or minuend problem. ■ Add a set of numbers in two different ways, and explain that the sum is the same (e.g., $2 + 5 + 3 + 8 = 2 + 3 + 5 + 8$ or $5 + 3 + 8 + 2$).

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

Strand:
Number (*continued*)

General Learning Outcome:
Develop number sense.

Specific Learning 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.*

2.N.10. Apply mental mathematics strategies, including

- using doubles
- making 10
- using one more, one less
- using two more, two less
- building on a known double
- using addition for subtraction

to develop recall of basic addition facts to 18 and related subtraction facts.

[C, CN, ME, R, V]

Recall of facts to 10, doubles to 9 + 9, and related subtraction facts is expected by the end of Grade 2.

- Explain the mental mathematics strategy that could be used to determine an addition or subtraction fact, such as
 - using doubles (e.g., for $4 + 6$, think $5 + 5$)
 - using doubles plus one (e.g., for $4 + 5$, think $4 + 4 + 1$)
 - using doubles take away one (e.g., for $4 + 5$, think $5 + 5 - 1$)
 - using doubles plus two (e.g., for $4 + 6$, think $4 + 4 + 2$)
 - using doubles take away two (e.g., for $4 + 6$, think $6 + 6 - 2$)
 - making 10 (e.g., for $7 + 5$, think $7 + 3 + 2$)
 - building on a known double (e.g., $6 + 6 = 12$, so $6 + 7 = 12 + 1 = 13$)
 - using addition for subtraction (e.g., for $7 - 3$, think $3 + ? = 7$)
- Use and describe a personal strategy for determining a sum to 18 and the corresponding subtraction.

Grade 2

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

Strand: Patterns and Relations (Patterns)	General Learning Outcome: Use patterns to describe the world and solve problems.
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>2.PR.1. Predict an element in a repeating pattern using a variety of strategies. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Identify the core of a repeating pattern. ■ Describe and extend a pattern with two attributes. ■ Explain the rule used to create a repeating non-numerical pattern. ■ Predict an element in a repeating pattern using a variety of strategies. ■ Predict an element of a repeating pattern, and extend the pattern to verify the prediction.
<p>2.PR.2. Demonstrate an understanding of increasing patterns by</p> <ul style="list-style-type: none"> ■ describing ■ reproducing ■ extending ■ creating <p>patterns using manipulatives, diagrams, sounds, and actions (numbers to 100). [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Identify and describe increasing patterns in a variety of contexts (e.g., hundred chart, number line, addition tables, calendar, a tiling pattern, or drawings). ■ Represent an increasing pattern concretely and pictorially. ■ Identify errors in an increasing pattern. ■ Explain the rule used to create an increasing pattern. ■ Create an increasing pattern and explain the pattern rule. ■ Represent an increasing pattern using another mode (e.g., colour to shape). ■ Solve a problem using increasing patterns. ■ Identify and describe increasing patterns in the environment (e.g., house/room numbers, flower petals, book pages, calendar, pine cones, leap years). ■ Determine missing elements in a concrete, pictorial, or symbolic increasing pattern, and explain the reasoning.

Grade 2

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning 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.*

<p>2.PR.3. Demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100). [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Determine whether two quantities of the same object (same shape and mass) are equal by using a balance scale. ■ Construct and draw two unequal sets using the same object (same shape and mass), and explain the reasoning. ■ Demonstrate how to change two sets, equal in number, to create inequality. ■ Choose from three or more sets the one that does not have a quantity equal to the others, and explain why.
<p>2.PR.4. Record equalities and inequalities symbolically using the equal symbol or the not-equal symbol. [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Determine whether two sides of a number sentence are equal (=) or not equal (≠). Write the appropriate symbol and justify the answer. ■ Model equalities using a variety of concrete representations, and record. ■ Model inequalities using a variety of concrete representations, and record symbolically.

Grade 2

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>2.SS.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]</p>	<ul style="list-style-type: none"> ■ Read a date on a calendar. ■ Name and order the days of the week. ■ Identify the day of the week and the month of the year for an identified calendar date. ■ State that there are seven days in a week and twelve months in a year. ■ Determine whether a set of days is more or less than a week. ■ Identify yesterday's/tomorrow's date. ■ Identify the month that comes before and the month that comes after a given month. ■ Name and order the months of the year. ■ Solve a problem involving time that is limited to the number of days in a week and the number of months in a year.
<p>2.SS.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 (weight). [C, CN, ME, R, V]</p>	<ul style="list-style-type: none"> ■ Explain why one of two non-standard units may be a better choice for measuring the length of an object. ■ Explain why one of two non-standard units may be a better choice for measuring the mass of an object. ■ Select a non-standard unit for measuring the length or mass of an object, and explain why it was chosen. ■ Estimate the number of non-standard units needed for a measurement task. ■ Explain why the number of units of a measurement will vary depending upon the unit of measure used.
<p>2.SS.3. Compare and order objects by length, height, distance around, and mass (weight) using non-standard units, and make statements of comparison. [C, CN, ME, R, V]</p>	<ul style="list-style-type: none"> ■ Estimate, measure, and record the length, height, distance around, or mass (weight) of an object using non-standard units. ■ Compare and order the measure of two or more objects in ascending or descending order, and explain the method of ordering.

Grade 2

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

Strand: Shape and Space (Measurement) <i>(continued)</i>	General Learning Outcome: Use direct or indirect measurement to solve problems.
--	---

Specific Learning 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.*

<p>2.SS.4. Measure length to the nearest non-standard unit by</p> <ul style="list-style-type: none"> ■ using multiple copies of a unit ■ using a single copy of a unit (iteration process) <p>[C, ME, R, V]</p>	<ul style="list-style-type: none"> ■ Explain why overlapping or leaving gaps does not result in accurate measures. ■ Count the number of non-standard units required to measure the length of an object using a single copy or multiple copies of the same unit of measure. ■ Estimate and measure an object using multiple copies of a non-standard unit and using a single copy of the same unit many times, and explain the results. ■ Estimate and measure, using non-standard units, a length that is not a straight line. ■ Create different rulers, using non-standard units of measure, and use these rulers to measure length.
<p>2.SS.5. Demonstrate that changing the orientation of an object does not alter the measurements of its attributes.</p> <p>[C, R, V]</p>	<ul style="list-style-type: none"> ■ Measure an object, change the orientation, re-measure, and explain the results.

Grade 2

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

2.SS.6. Sort 2-D shapes and 3-D objects using two attributes, and explain the sorting rule. [C, CN, R, V]	<ul style="list-style-type: none"> ■ Determine the differences between two pre-sorted sets, and explain the sorting rule. ■ Identify and name two common attributes of items within a sorted group. ■ Sort a set of 2-D shapes (regular and irregular) according to two attributes, and explain the sorting rule. ■ Sort a set of 3-D objects according to two attributes, and explain the sorting rule.
2.SS.7. Describe, compare, and construct 3-D objects, including <ul style="list-style-type: none"> ■ cubes ■ spheres ■ cones ■ cylinders ■ prisms ■ pyramids [C, CN, R, V]	<ul style="list-style-type: none"> ■ Sort a set of 3-D objects, and explain the sorting rule. ■ Identify common attributes of cubes, spheres, cones, cylinders, prisms, or pyramids from sets of the same 3-D objects. ■ Identify and describe 3-D objects with different dimensions. ■ Identify and describe 3-D objects with different orientations. ■ Create and describe a representation of a 3-D object using materials such as modelling clay. ■ Identify examples of cubes, spheres, cones, cylinders, prisms, or pyramids found in the environment.

Grade 2

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

Strand: Shape and Space (3-D Objects and 2-D Shapes) <i>(continued)</i>	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
--	--

Specific Learning 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.*

2.SS.8. Describe, compare, and construct 2-D shapes, including <ul style="list-style-type: none"> ■ triangles ■ squares ■ rectangles ■ circles [C, CN, R, V]	<ul style="list-style-type: none"> ■ Sort a set of 2-D shapes, and explain the sorting rule. ■ Identify common attributes of triangles, squares, rectangles, or circles from sets of the same type of 2-D shapes. ■ Identify 2-D shapes with different dimensions. ■ Identify 2-D shapes with different orientations. ■ Create a model to represent a 2-D shape. ■ Create a pictorial representation of a 2-D shape.
2.SS.9. Identify 2-D shapes as parts of 3-D objects in the environment. [C, CN, R, V]	<ul style="list-style-type: none"> ■ Compare and match a 2-D shape, such as a triangle, square, rectangle, or circle, to the faces of 3-D objects in the environment. ■ Name the 2-D faces of a 3-D object.

Grade 2

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

Strand: Statistics and Probability (Data Analysis)	General Learning Outcome: Collect, display, and analyze data to solve problems.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
2.SP.1. Gather and record data about self and others to answer questions. [C, CN, PS, V]	<ul style="list-style-type: none"> ■ Formulate a question that can be answered by gathering information about self and others. ■ Organize data as it is collected using concrete objects, tallies, checkmarks, charts, or lists. ■ Answer questions using collected data.
2.SP.2. Construct and interpret concrete graphs and pictographs to solve problems. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Determine the common attributes of concrete graphs by comparing a set of concrete graphs. ■ Determine the common attributes of pictographs by comparing a set of pictographs. ■ Answer questions pertaining to a concrete graph or pictograph. ■ Create a concrete graph to display a set of data and draw conclusions. ■ Create a pictograph to represent a set of data using one-to-one correspondence. ■ Solve a problem by constructing and interpreting a concrete graph or pictograph.

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

Strand:
Number

General Learning Outcome:
Develop number sense.

Specific Learning 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.*

<p>3.N.1. Say the number sequence between any two given numbers forward and backward</p> <ul style="list-style-type: none"> ■ from 0 to 1000 by <ul style="list-style-type: none"> ■ 10s or 100s, using any starting point ■ 5s, using starting points that are multiples of 5 ■ 25s, using starting points that are multiples of 25 ■ from 0 to 100 by <ul style="list-style-type: none"> ■ 3s, using starting points that are multiples of 3 ■ 4s, using starting points that are multiples of 4 <p>[C, CN, ME]</p>	<ul style="list-style-type: none"> ■ Extend a skip-counting sequence by 10s or 100s, forward and backward, using a given starting point. ■ Extend a skip-counting sequence by 5s, forward and backward, starting at a given multiple of 5. ■ Extend a skip-counting sequence by 25s, forward and backward, starting at a given multiple of 25. ■ Extend a given skip-counting sequence by 3s, forward, starting at a given multiple of 3. ■ Extend a given skip-counting sequence by 4s, starting at a given multiple of 4. ■ Identify and correct errors and omissions in a skip-counting sequence. ■ Determine the value of a set of coins (nickels, dimes, quarters, loonies) by using skip-counting. ■ Identify and explain the skip-counting pattern for a number sequence.
<p>3.N.2. Represent and describe numbers to 1000, concretely, pictorially, and symbolically.</p> <p>[C, CN, V]</p>	<ul style="list-style-type: none"> ■ Read a 3-digit numeral without using the word “and” (e.g., 321 is three hundred twenty-one, NOT three hundred AND twenty-one). ■ Read a number word (0 to 1000). ■ Represent a number as an expression (e.g., $300 - 44$ for 256 or $20 + 236$). ■ Represent a number using manipulatives, such as base-10 materials. ■ Represent a number pictorially. ■ Write number words for multiples of ten to 90. ■ Write number words for multiples of a hundred to 900. ■ Determine compatible number pairs for 100.

Grade 3

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>3.N.3. Compare and order numbers to 1000. [CN, R, V]</p>	<ul style="list-style-type: none"> ■ Place a set of numbers in ascending or descending order, and verify the result by using a hundred chart (e.g., a one hundred chart, a two hundred chart, a three hundred chart, a number line, or by making references to place value). ■ Create as many different 3-digit numerals as possible, given three different digits. Place the numbers in ascending or descending order. ■ Identify errors in an ordered sequence. ■ Identify missing numbers in parts of a hundred chart. ■ Identify errors in a hundred chart.
<p>3.N.4. Estimate quantities less than 1000 using referents. [ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Estimate the number of groups of ten in a quantity using 10 as a referent (known quantity). ■ Estimate the number of groups of a hundred in a quantity using 100 as a referent. ■ Estimate a quantity by comparing it to a referent. ■ Select an estimate for a quantity by choosing among three possible choices. ■ Select and justify a referent for determining an estimate for a quantity.
<p>3.N.5. Illustrate, concretely and pictorially, the meaning of place value for numerals to 1000. [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Record in more than one way the number represented by proportional and non-proportional concrete materials. ■ Represent a number in different ways using proportional and non-proportional concrete materials, and explain how they are equivalent (e.g., 351 can be represented as three 100s, five 10s and one 1, or as two 100s, fifteen 10s, and one 1, or as three 100s, four 10s, and eleven 1s). ■ Explain, and show with counters, the meaning of each digit for a 3-digit numeral with all digits the same (e.g., for the numeral 222, the first digit represents two hundreds [two hundred counters] the second digit represents two tens [twenty counters], and the third digit represents two ones [two counters]).

Grade 3

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

<p>3.N.6. Describe and apply mental mathematics strategies for adding two 2-digit numerals, such as</p> <ul style="list-style-type: none"> ■ adding from left to right ■ taking one addend to the nearest multiple of ten and then compensating ■ using doubles <p>[C, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Add two 2-digit numerals using a mental mathematics strategy, and explain or model the strategy. ■ Explain how to use the “adding from left to right” strategy (e.g., to determine the sum of $23 + 46$, think $20 + 40$ and $3 + 6$). ■ Explain how to use the “taking one addend to the nearest multiple of ten” strategy (e.g., to determine the sum of $28 + 47$, think $30 + 47 - 2$ or $50 + 28 - 3$). ■ Explain how to use the “using doubles” strategy (e.g., to determine the sum of $24 + 26$, think $25 + 25$; to determine the sum of $25 + 26$, think $25 + 25 + 1$ or doubles plus 1). ■ Apply a mental mathematics strategy for adding two 2-digit numerals.
<p>3.N.7. Describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as</p> <ul style="list-style-type: none"> ■ taking the subtrahend to the nearest multiple of ten and then compensating ■ thinking of addition ■ using doubles <p>[C, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Subtract two 2-digit numerals using a mental mathematics strategy, and explain or model the strategy. ■ Explain how to use the “taking the subtrahend to the nearest multiple of ten” and then compensating strategy (e.g., to determine the difference of $48 - 19$, think $48 - 20 + 1$). ■ Explain how to use the “thinking of addition” strategy (e.g., to determine the difference of $62 - 45$, think $45 + 5$, then $50 + 12$, and then $5 + 12$). ■ Explain how to use the “using doubles” strategy (e.g., to determine the difference of $24 - 12$, think $12 + 12$). ■ Apply a mental mathematics strategy for subtracting two 2-digit numerals.
<p>3.N.8. Apply estimation strategies to predict sums and differences of two 2-digit numerals in a problem-solving context.</p> <p>[C, ME, PS, R]</p>	<ul style="list-style-type: none"> ■ Estimate the solution for a story problem involving the sum of two 2-digit numerals (e.g., to estimate the sum of $43 + 56$, use $40 + 50$; the sum is close to 90). ■ Estimate the solution for a story problem involving the difference of two 2-digit numerals (e.g., to estimate the difference of $56 - 23$, use $50 - 20$; the difference is close to 30).

Grade 3

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>3.N.9. Demonstrate an understanding of addition and subtraction of numbers with answers to 1000 (limited to 1-, 2-, and 3-digit numerals) by</p> <ul style="list-style-type: none"> ■ using personal strategies for adding and subtracting with and without the support of manipulatives ■ creating and solving problems in contexts that involve addition and subtraction of numbers concretely, pictorially, and symbolically. <p>[C, CN, ME, PS, R]</p>	<ul style="list-style-type: none"> ■ Model the addition of two or more numbers using concrete or visual representations, and record the process symbolically. ■ Model the subtraction of two numbers using concrete or visual representations, and record the process symbolically. ■ Create an addition or subtraction story problem for a solution. ■ Determine the sum of two numbers using a personal strategy (e.g., for $326 + 48$, record $300 + 60 + 14$). ■ Determine the difference of two numbers using a personal strategy (e.g., for $127 - 38$, record $38 + 2 + 80 + 7$ or $127 - 20 - 10 - 8$). ■ Solve a problem involving the sum or difference of two numbers.
<p>3.N.10. Apply mental math strategies to determine addition facts and related subtraction facts to 18 ($9 + 9$).</p> <p>[C, CN, ME, R, V]</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Recall of addition and related subtraction facts to 18 is expected by the end of Grade 3.</p> </div>	<ul style="list-style-type: none"> ■ Describe a mental mathematics strategy that could be used to determine a given basic fact, such as <ul style="list-style-type: none"> ■ doubles (e.g., for $6 + 8$, think $7 + 7$) ■ doubles plus one (e.g., for $6 + 7$, think $6 + 6 + 1$) ■ doubles take away one (e.g., for $6 + 7$, think $7 + 7 - 1$) ■ doubles plus two (e.g., for $6 + 8$, think $6 + 6 + 2$) ■ doubles take away two (e.g., for $6 + 8$, think $8 + 8 - 2$) ■ making 10 (e.g., for $6 + 8$, think $6 + 4 + 4$ or $8 + 2 + 4$) ■ commutative property (e.g., for $3 + 9$, think $9 + 3$) ■ addition to subtraction (e.g., for $13 - 7$, think $7 + \square = 13$) ■ Provide a rule for determining answers for adding and subtracting zero.

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

Strand:
Number (*continued*)

General Learning Outcome:
Develop number sense.

Specific Learning 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.*

- 3.N.11. Demonstrate an understanding of multiplication to 5×5 by
- representing and explaining multiplication using equal grouping and arrays
 - creating and solving problems in context that involve multiplication
 - modelling multiplication using concrete and visual representations, and recording the process symbolically
 - relating multiplication to repeated addition
 - relating multiplication to division
- [C, CN, PS, R]

- (It is intended that students show their understanding of strategies using manipulatives, pictorial representations, and/or patterns when determining products.)
- Identify events from experience that can be described as multiplication.
 - Represent a story problem (orally, shared reading, written) using manipulatives or diagrams, and record in a number sentence.
 - Skip-count by 2s, 3s, 4s, and 5s to determine the answer to a multiplication problem represented as equal groups.
 - Represent a multiplication expression as repeated addition.
 - Represent a repeated addition as multiplication.
 - Create and illustrate a story problem for a number sentence.
 - Represent, concretely or pictorially, equal groups for a number sentence.
 - Represent a multiplication expression using an array.
 - Create an array to model the commutative property of multiplication.
 - Relate multiplication to division by using arrays and by writing related number sentences.
 - Solve a problem in context involving multiplication.

- 3.N.12. Demonstrate an understanding of division by
- representing and explaining division using equal sharing and equal grouping
 - creating and solving problems in context that involve equal sharing and equal grouping
 - modelling equal sharing and equal grouping using concrete and visual representations, and recording the process symbolically
 - relating division to repeated subtraction
 - relating division to multiplication
- (limited to division related to multiplication facts up to 5×5).
- [C, CN, PS, R]

- (It is intended that students show their understanding of strategies using manipulatives, pictorial representations, and/or patterns when determining quotients.)
- Identify events from experience that can be described as equal sharing.
 - Identify events from experience that can be described as equal grouping.
 - Illustrate, with counters or a diagram, a story problem involving equal sharing, presented orally or through shared reading, and solve the problem.
 - Illustrate, with counters or a diagram, a story problem involving equal grouping, presented orally or through shared reading, and solve the problem.
 - Listen to a story problem, represent the numbers using manipulatives or a sketch, and record the problem with a number sentence.
 - Create, and illustrate with counters, a story problem for a number sentence.
 - Represent a division expression as repeated subtraction.
 - Represent a repeated subtraction as a division expression.
 - Relate division to multiplication by using arrays and by writing related number sentences.
 - Solve a problem involving division.

Grade 3

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

- 3.N.13. Demonstrate an understanding of fractions by
- explaining that a fraction represents a portion of a whole divided into equal parts
 - describing situations in which fractions are used
 - comparing fractions of the same whole with like denominators
- [C, CN, ME, R, V]

- Identify common characteristics of a set of fractions.
- Describe everyday situations where fractions are used.
- Cut or fold a whole into equal parts, or draw a whole in equal parts; demonstrate that the parts are equal and name the parts.
- Sort a set of diagrams of regions into those that represent equal parts and those that do not, and explain the sorting.
- Represent a fraction concretely or pictorially.
- Name and record the fraction represented by the shaded and non-shaded parts of a region.
- Compare fractions with the same denominator using models.
- Identify the numerator and denominator for a fraction.
- Model and explain the meaning of *numerator* and *denominator*.

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

Strand:
Patterns and Relations (Patterns)

General Learning Outcome:
Use patterns to describe the world and solve problems.

Specific Learning 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.*

- 3.PR.1. Demonstrate an understanding of increasing patterns by
- describing
 - extending
 - comparing
 - creating
- patterns using manipulatives, diagrams, and numbers (to 1000).
[C, CN, PS, R, V]

- Describe an increasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues.
- Identify the pattern rule of an increasing pattern, and extend the pattern for the next three terms.
- Identify and explain errors in an increasing pattern.
- Identify and describe various increasing patterns found on a hundred chart, such as horizontal, vertical, and diagonal patterns.
- Compare numeric patterns of counting by 2s, 3s, 4s, 5s, 10s, 25s, and 100s.
- Create a concrete, pictorial, or symbolic representation of an increasing pattern for a pattern rule.
- Create a concrete, pictorial, or symbolic increasing pattern, and describe the pattern rule.
- Solve a problem using increasing patterns.
- Identify and describe increasing patterns in the environment.
- Identify and apply a pattern rule to determine missing elements for a pattern.
- Describe the strategy used to determine missing elements in an increasing pattern.

Grade 3

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

Strand: Patterns and Relations (Patterns) <i>(continued)</i>	General Learning Outcome: Use patterns to describe the world and solve problems.
--	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>3.PR.2. Demonstrate an understanding of decreasing patterns by</p> <ul style="list-style-type: none"> ■ describing ■ extending ■ comparing ■ creating <p>patterns using manipulatives, diagrams, and numbers (starting from 1000 or less). [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Describe a decreasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues. ■ Identify the pattern rule of a decreasing pattern, and extend the pattern for the next three terms. ■ Identify and explain errors in a decreasing pattern. ■ Identify and describe various decreasing patterns found on a hundred chart, such as horizontal, vertical, and diagonal patterns. ■ Compare decreasing numeric patterns of counting backward by 2s, 3s, 4s, 5s, 10s, 25s, and 100s. ■ Create a concrete, pictorial, or symbolic decreasing pattern for a pattern rule. ■ Create a concrete, pictorial, or symbolic decreasing pattern, and describe the pattern rule. ■ Solve a problem using decreasing patterns. ■ Identify and describe decreasing patterns in the environment. ■ Identify and apply a pattern rule to determine missing elements for a pattern. ■ Describe the strategy used to determine missing elements in a decreasing pattern.
---	--

Grade 3

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning 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.*

3.PR.3. Solve one-step addition and subtraction equations involving symbols representing an unknown number.
[C, CN, PS, R, V]

- Explain the purpose of the symbol, such as a triangle or a circle, in an addition or a subtraction equation with one unknown.
- Create an addition or subtraction equation with one unknown to represent a combination or separation action.
- Provide an alternative symbol for the unknown in an addition or subtraction equation.
- Solve an addition or subtraction equation that represents combining or separating actions with one unknown, using manipulatives.
- Solve an addition or subtraction equation with one unknown using a variety of strategies including guess and test.
- Explain why the unknown in an addition or subtraction equation has only one value.

Grade 3

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>3.SS.1. Relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years). [CN, ME, R]</p>	<ul style="list-style-type: none"> ■ Select and use a non-standard unit of measure, such as television shows or pendulum swings, to measure the passage of time, and explain the choice. ■ Identify activities that can or cannot be accomplished in minutes, hours, days, months, and years. ■ Provide personal referents for minutes and hours.
<p>3.SS.2. Relate the number of seconds to a minute, the number of minutes to an hour, and the number of days to a month in a problem-solving context. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Determine the number of days in any month using a calendar. ■ Solve a problem involving the number of minutes in an hour or the number of days in a given month. ■ Create a calendar that includes days of the week, dates, and events.
<p>3.SS.3. Demonstrate an understanding of measuring length (cm, m) by</p> <ul style="list-style-type: none"> ■ selecting and justifying referents for the units cm and m ■ modelling and describing the relationship between the units cm and m ■ estimating length using referents ■ measuring and recording length, width, and height <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Provide a personal referent for one centimetre and explain the choice. ■ Provide a personal referent for one metre and explain the choice. ■ Match a standard unit to a referent. ■ Show that 100 centimetres is equivalent to 1 metre by using concrete materials. ■ Estimate the length of an object using personal referents. ■ Determine and record the length or width of a 2-D shape. ■ Determine and record the length, width, or height of a 3-D object. ■ Draw a line segment of a given length using a ruler. ■ Sketch a line segment of a given length without using a ruler.

Grade 3

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

Strand: Shape and Space (Measurement) <i>(continued)</i>	General Learning Outcome: Use direct or indirect measurement to solve problems.
--	---

Specific Learning 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.*

<p>3.SS.4. Demonstrate an understanding of measuring mass (g, kg) by</p> <ul style="list-style-type: none"> ■ selecting and justifying referents for the units g and kg ■ modelling and describing the relationship between the units g and kg ■ estimating mass using referents ■ measuring and recording mass <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Provide a personal referent for one gram and explain the choice. ■ Provide a personal referent for one kilogram and explain the choice. ■ Match a standard unit to a referent. ■ Explain the relationship between 1000 grams and 1 kilogram using a model. ■ Estimate the mass of an object using personal referents. ■ Determine and record the mass of a 3-D object. ■ Measure, using a scale, and record the mass of everyday objects using the units g and kg. ■ Provide examples of 3-D objects that have a mass of approximately 1g, 100g, and 1kg. ■ Determine the mass of two similar objects with different masses, and explain the results. ■ Determine the mass of an object, change its shape, re-measure its mass, and explain the results.
<p>3.SS.5. Demonstrate an understanding of perimeter of regular and irregular shapes by</p> <ul style="list-style-type: none"> ■ estimating perimeter using referents for centimetre or metre ■ measuring and recording perimeter (cm, m) ■ constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter <p>[C, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Measure and record the perimeter of a regular shape, and explain the strategy used. ■ Measure and record the perimeter of an irregular shape, and explain the strategy used. ■ Construct a shape for a given perimeter (cm, m). ■ Construct or draw more than one shape for the same perimeter. ■ Estimate the perimeter of a shape (cm, m) using personal referents.

Grade 3

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

3.SS.6. Describe 3-D objects according to the shape of the faces, and the number of edges and vertices. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Identify the faces, edges, and vertices of a 3-D object, including cubes, spheres, cones, cylinders, pyramids, and prisms. ■ Identify the shape of the faces of a 3-D object. ■ Determine the number of faces, edges, and vertices of a 3-D object. ■ Construct a skeleton of a 3-D object, and describe how the skeleton relates to the 3-D object. ■ Sort a set of 3-D objects according to the number of faces, edges, or vertices.
3.SS.7. Sort regular and irregular polygons, including <ul style="list-style-type: none"> ■ triangles ■ quadrilaterals ■ pentagons ■ hexagons ■ octagons according to the number of sides. [C, CN, R, V]	<ul style="list-style-type: none"> ■ Classify a set of regular and irregular polygons according to the number of sides. ■ Identify regular and irregular polygons having different dimensions. ■ Identify regular and irregular polygons having different orientations.

Grade 3

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

Strand: Statistics and Probability (Data Analysis)	General Learning Outcome: Collect, display, and analyze data to solve problems.
--	---

Specific Learning 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.*

<p>3.SP.1. Collect first-hand data and organize it using</p> <ul style="list-style-type: none"> ■ tally marks ■ line plots ■ charts ■ lists <p>to answer questions. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Record the number of objects in a set using tally marks. ■ Determine the attributes of line plots. ■ Organize a set of data using tally marks, line plots, charts, or lists. ■ Collect and organize data using tally marks, line plots, charts, or lists. ■ Answer questions arising from a line plot, chart, or list. ■ Answer questions using collected data.
<p>3.SP.2. Construct, label, and interpret bar graphs to solve problems. [PS, R, V]</p>	<ul style="list-style-type: none"> ■ Determine the attributes of bar graphs. ■ Create bar graphs from a set of data including labelling the title and axes. ■ Draw conclusions from a bar graph to solve problems. ■ Solve problems by constructing and interpreting a bar graph.

Grade 4

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

Strand: Number	General Learning Outcome: Develop number sense.
--------------------------	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>4.N.1. Represent and describe whole numbers to 10 000, pictorially and symbolically. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Read a four-digit numeral without using the word “and” (e.g., 5321 is five thousand three hundred twenty-one, NOT five thousand three hundred AND twenty-one). ■ Write a numeral using proper spacing without commas (e.g., 4567 or 4 567, 10 000). ■ Write a numeral 0 – 10 000 in words. ■ Represent a numeral using a place value chart or diagrams. ■ Describe the meaning of each digit in a numeral. ■ Express a numeral in expanded notation (e.g., 321 = 300 + 20 + 1). ■ Write the numeral represented in expanded notation. ■ Explain the meaning of each digit in a 4-digit numeral with all digits the same (e.g., for the numeral 2222, the first digit represents two thousands, the second digit two hundreds, the third digit two tens, and the fourth digit two ones).
<p>4.N.2. Compare and order numbers to 10 000. [C, CN]</p>	<ul style="list-style-type: none"> ■ Order a set of numbers in ascending or descending order, and explain the order by making references to place value. ■ Create and order three 4-digit numerals. ■ Identify the missing numbers in an ordered sequence or between two benchmarks on a number line (vertical or horizontal). ■ Identify incorrectly placed numbers in an ordered sequence or between two benchmarks on a number line (vertical or horizontal).

Grade 4

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

Strand: Number (continued)	General Learning Outcome: Develop number sense.
--------------------------------------	---

Specific Learning 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.*

<p>4.N.3. Demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3- and 4-digit numerals), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithms ■ estimating sums and differences ■ solving problems <p>[C, CN, ME, PS, R]</p>	<ul style="list-style-type: none"> ■ Model addition and subtraction using concrete materials and visual representations, and record the process symbolically. ■ Determine the sum of two numbers using a personal strategy (e.g., for $1326 + 548$, record $1300 + 500 + 74$). ■ Determine the difference of two numbers using a personal strategy (e.g., for $4127 - 238$, record $238 + 2 + 60 + 700 + 3000 + 127$ or $4127 - 27 - 100 - 100 - 11$). ■ Model and explain the relationship that exists between an algorithm, place value, and number properties. ■ Determine the sum and difference using the standard algorithms of vertical addition and subtraction. (Numbers are arranged vertically with corresponding place value digits aligned.) ■ Describe a situation in which an estimate rather than an exact answer is sufficient. ■ Estimate sums and differences using different strategies (e.g., front-end estimation and compensation). ■ Solve problems that involve addition and subtraction of more than 2 numbers. ■ Refine personal strategies to increase efficiency when appropriate (e.g., $3000 - 2999$ should not require the use of an algorithm).
<p>4.N.4. Explain the properties of 0 and 1 for multiplication and the property of 1 for division.</p> <p>[C, CN, R]</p>	<ul style="list-style-type: none"> ■ Explain the property for determining the answer when multiplying numbers by one. ■ Explain the property for determining the answer when multiplying numbers by zero. ■ Explain the property for determining the answer when dividing numbers by one.

Grade 4

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>4.N.5. Describe and apply mental mathematics strategies, such as</p> <ul style="list-style-type: none"> ■ skip-counting from a known fact ■ using halving/doubling ■ using doubling and adding one more group ■ using patterns in the 9s facts ■ using repeated doubling <p>to develop an understanding of basic multiplication facts to 9×9 and related division facts. [C, CN, ME, PS, R]</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Recall of the multiplication and related division facts up to 5×5 is expected by the end of Grade 4.</p> </div>	<ul style="list-style-type: none"> ■ Provide examples for applying mental mathematics strategies: <ul style="list-style-type: none"> ■ skip-counting from a known fact (e.g., for 6×3, think $5 \times 3 = 15$, then $15 + 3 = 18$) ■ halving/doubling (e.g., for 4×3, think $2 \times 6 = 12$) ■ using a known double and adding one more group (e.g., for 3×7, think $2 \times 7 = 14$, then $14 + 7 = 21$) ■ repeated doubling (e.g., for 4×6, think $2 \times 6 = 12$ and $2 \times 12 = 24$) ■ use ten facts when multiplying by 9 (e.g., for 9×6, think $10 \times 6 = 60$, and $60 - 6 = 54$; for 7×9, think $7 \times 10 = 70$, and $70 - 7 = 63$) ■ halving (e.g., for $30 \div 6$, think $15 \div 3 = 5$) ■ relating division to multiplication (e.g., for $64 \div 8$, think $8 \times \square = 64$)
---	--

<p>4.N.6. Demonstrate an understanding of multiplication (2- or 3-digit numerals by 1-digit numerals) to solve problems by</p> <ul style="list-style-type: none"> ■ using personal strategies for multiplication with and without concrete materials ■ using arrays to represent multiplication ■ connecting concrete representations to symbolic representations ■ estimating products <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Model a multiplication problem using the distributive property [e.g., $8 \times 365 = (8 \times 300) + (8 \times 60) + (8 \times 5)$]. ■ Use concrete materials, such as base-10 blocks or their pictorial representations, to represent multiplication, and record the process symbolically. ■ Create and solve a multiplication problem that is limited to 2 or 3 digits by 1 digit. ■ Estimate a product using a personal strategy (e.g., 2×243 is close to or a little more than 2×200, or close to or a little less than 2×250). ■ Model and solve a multiplication problem using an array, and record the process. ■ Solve a multiplication problem and record the process.
--	---

<p>4.N.7. Demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by</p> <ul style="list-style-type: none"> ■ using personal strategies for dividing with and without concrete materials ■ estimating quotients ■ relating division to multiplication <p>[C, CN, ME, PS, R, V]</p>	<p>(It is not intended that remainders be expressed as decimals or fractions.)</p> <ul style="list-style-type: none"> ■ Solve a division problem without a remainder using arrays or base-10 materials. ■ Solve a division problem with a remainder using arrays or base-10 materials. ■ Solve a division problem using a personal strategy, and record the process. ■ Create and solve a word problem involving a 1- or 2-digit dividend. ■ Estimate a quotient using a personal strategy (e.g., $86 \div 4$ is close to $80 \div 4$ or close to $80 \div 5$).
---	---

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

Strand:
Number (*continued*)

General Learning Outcome:
Develop number sense.

Specific Learning 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.*

<p>4.N.8. Demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to</p> <ul style="list-style-type: none"> ■ name and record fractions for the parts of a whole or a set ■ compare and order fractions ■ model and explain that for different wholes, two identical fractions may not represent the same quantity ■ provide examples of where fractions are used <p>[C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Represent a fraction using concrete materials. ■ Identify a fraction from its concrete representation. ■ Name and record the shaded and non-shaded parts of a set. ■ Name and record the shaded and non-shaded parts of a whole. ■ Represent a fraction pictorially by shading parts of a set. ■ Represent a fraction pictorially by shading parts of a whole. ■ Explain how denominators can be used to compare two unit fractions. ■ Order a set of fractions that have the same numerator, and explain the ordering. ■ Order a set of fractions that have the same denominator, and explain the ordering. ■ Identify which of the benchmarks 0, $\frac{1}{2}$, or 1 is closest to a fraction. ■ Name fractions between two benchmarks on a number line (horizontal or vertical). ■ Order a set of fractions by placing them on a number line (horizontal or vertical) with benchmarks. ■ Provide examples where two identical fractions may not represent the same quantity (e.g., half of a large apple is not equivalent to half of a small apple; half of ten berries is not equivalent to half of sixteen berries). ■ Provide an example of a fraction that represents part of a set, and a fraction that represents part of a whole, from everyday contexts.
<p>4.N.9. Describe and represent decimals (tenths and hundredths), concretely, pictorially, and symbolically.</p> <p>[C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Write the decimal for a concrete or pictorial representation of part of a set, part of a region or part of a unit of measure. ■ Represent a decimal using concrete materials or a pictorial representation. ■ Explain the meaning of each digit in a decimal with all digits the same. ■ Represent a decimal using money values (pennies and dimes). ■ Record a money value using decimals. ■ Provide examples of everyday contexts in which tenths and hundredths are used. ■ Model, using manipulatives or pictures, that a tenth can be expressed as hundredths (e.g., 0.9 is equivalent to 0.90 or 9 dimes is equivalent to 90 pennies).

Grade 4

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>4.N.10. Relate decimals to fractions (to hundredths). [CN, R, V]</p>	<ul style="list-style-type: none"> ■ Read decimals as fractions (e.g., 0.5 is zero and five-tenths). ■ Express orally and in written form a decimal in fractional form. ■ Express orally and in written form a fraction with a denominator of 10 or 100 as a decimal. ■ Express a pictorial or concrete representation as a fraction or decimal (e.g., 15 shaded squares on a hundred grid can be expressed as 0.15 or $\frac{15}{100}$). ■ Express orally and in written form the decimal equivalent for a fraction (e.g., $\frac{50}{100}$ can be expressed as 0.50).
<p>4.N.11. Demonstrate an understanding of addition and subtraction of decimals (limited to hundredths) by</p> <ul style="list-style-type: none"> ■ using compatible numbers ■ estimating sums and differences ■ using mental math strategies to solve problems. <p>[C, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Predict sums and differences of decimals using estimation strategies. ■ Solve problems, including money problems, which involve addition and subtraction of decimals, limited to hundredths. ■ Determine the approximate solution of a problem not requiring an exact answer. ■ Estimate a sum or difference using compatible numbers. ■ Count back change for a purchase.

Grade 4

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

Strand: Patterns and Relations (Patterns)		General Learning Outcome: Use patterns to describe the world and solve problems.	
Specific Learning Outcomes <i>It is expected that students will:</i>		Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	
4.PR.1. Identify and describe patterns found in tables and charts, including a multiplication chart. [C, CN, PS, V]		<ul style="list-style-type: none"> ■ Identify and describe a variety of patterns in a multiplication chart. ■ Determine the missing elements in a table or chart. ■ Identify error(s) in a table or chart. ■ Describe the pattern found in a table or chart. 	
4.PR.2. Reproduce a pattern shown in a table or chart using concrete materials. [C, CN, V]		<ul style="list-style-type: none"> ■ Create a concrete representation of a pattern displayed in a table or chart. ■ Explain why the same relationship exists between the pattern in a table and its concrete representation. 	
4.PR.3. Represent and describe patterns and relationships using charts and tables to solve problems. [C, CN, PS, R, V]		<ul style="list-style-type: none"> ■ Extend patterns found in a table or chart to solve a problem. ■ Translate the information provided in a problem into a table or chart. ■ Identify and extend the patterns in a table or chart to solve a problem. 	
4.PR.4. Identify and explain mathematical relationships using charts and diagrams to solve problems. [CN, PS, R, V]		<ul style="list-style-type: none"> ■ Complete a Carroll diagram by entering data into correct squares to solve a given problem. ■ Determine where new elements belong in a Carroll diagram. ■ Solve a problem using a Carroll diagram. ■ Identify a sorting rule for a Venn diagram. ■ Describe the relationship shown in a Venn diagram when the circles intersect, when one circle is contained in the other, and when the circles are separate. ■ Determine where new elements belong in a Venn diagram. ■ Solve a problem by using a chart or diagram to identify mathematical relationships. 	

Grade 4

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>4.PR.5. Express a problem as an equation in which a symbol is used to represent an unknown number. [CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Explain the purpose of the symbol, such as a triangle or circle, in an addition, subtraction, multiplication, or division equation with one unknown (e.g., $6 = 36 \div \square$). ■ Express a pictorial or concrete representation of an equation in symbolic form. ■ Identify the unknown in a story problem, represent the problem with an equation, and solve the problem concretely, pictorially, or symbolically. ■ Create a problem in context for an equation with one unknown.
<p>4.PR.6. Solve one-step equations involving a symbol to represent an unknown number. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Solve a one-step equation using manipulatives. ■ Solve a one-step equation using guess and test. ■ Describe, orally, the meaning of a one-step equation with one unknown. ■ Solve an equation when the unknown is on the left or right side of the equation. ■ Represent and solve an addition or subtraction problem involving a “part-part-whole” or comparison context using a symbol to represent the unknown. ■ Represent and solve a multiplication or division problem involving equal grouping or partitioning (equal sharing), using symbols to represent the unknown.

Grade 4

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning 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.*

<p>4.SS.1. Read and record time using digital and analog clocks, including 24-hour clocks. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ State the number of hours in a day. ■ Express the time orally and numerically from a 12-hour analog clock. ■ Express the time orally and numerically from a 24-hour analog clock. ■ Express the time orally and numerically from a 12-hour digital clock. ■ Describe time orally and numerically from a 24-hour digital clock. ■ Describe time orally as “minutes to” or “minutes after” the hour. ■ Explain the meaning of AM and PM, and provide an example of an activity that occurs during the AM and another that occurs during the PM.
<p>4.SS.2. Read and record calendar dates in a variety of formats. [C, V]</p>	<ul style="list-style-type: none"> ■ Write dates in a variety of formats (e.g., yyyy/mm/dd, dd/mm/yyyy, March 21, 2006, dd/mm/yy). ■ Relate dates written in the format yyyy/mm/dd to dates on a calendar. ■ Identify possible interpretations of a given date (e.g., 06/03/04).
<p>4.SS.3. Demonstrate an understanding of area of regular and irregular 2-D shapes by</p> <ul style="list-style-type: none"> ■ recognizing that area is measured in square units ■ selecting and justifying referents for the units cm^2 or m^2 ■ estimating area by using referents for cm^2 or m^2 ■ determining and recording area (cm^2 or m^2) ■ constructing different rectangles for a given area (cm^2 or m^2) in order to demonstrate that many different rectangles may have the same area <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Describe area as the measure of surface recorded in square units. ■ Identify and explain why the square is the most efficient unit for measuring area. ■ Provide a referent for a square centimetre and explain the choice. ■ Provide a referent for a square metre and explain the choice. ■ Determine which standard square unit is represented by a referent. ■ Estimate the area of a 2-D shape using personal referents. ■ Determine the area of a regular 2-D shape and explain the strategy. ■ Determine the area of an irregular 2-D shape and explain the strategy. ■ Construct a rectangle for a given area. ■ Demonstrate that many rectangles are possible for an area by drawing at least two different rectangles for the same area.

Grade 4

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

4.SS.4. Solve problems involving 2-D shapes and 3-D objects. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Fill an outline with 2-D shapes (e.g., tangram pieces, pentominoes, or polygons). ■ Reproduce 2-D shapes from drawings, real objects (e.g., tables, houses, letters of the alphabet), or attributes on geo-boards. ■ Reproduce a structure using 3-D objects (e.g., cubes, 3-D pentominoes).
4.SS.5. Describe and construct rectangular and triangular prisms. [C, CN, R, V]	<ul style="list-style-type: none"> ■ Identify and name common attributes of rectangular prisms from sets of rectangular prisms. ■ Identify and name common attributes of triangular prisms from sets of triangular prisms. ■ Sort a set of rectangular and triangular prisms using the shape of the base. ■ Construct and describe a model of rectangular and triangular prisms using materials such as pattern blocks or modelling clay. ■ Construct rectangular prisms from their nets. ■ Construct triangular prisms from their nets. ■ Identify examples of rectangular and triangular prisms found in the environment.

Grade 4

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

Strand: Shape and Space (Transformations)	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
---	---

Specific Learning 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.*

- 4.SS.6. Demonstrate an understanding of line symmetry by
- identifying symmetrical 2-D shapes
 - creating symmetrical 2-D shapes
 - drawing one or more lines of symmetry in a 2-D shape
- [C, CN, V]

- Identify the characteristics of symmetrical and non-symmetrical 2-D shapes.
- Sort a set of 2-D shapes as symmetrical and non-symmetrical.
- Complete a symmetrical 2-D shape, half the shape, and its line of symmetry.
- Identify lines of symmetry of a set of 2-D shapes, and explain why each shape is symmetrical.
- Determine whether or not a 2-D shape is symmetrical by using a Mira or by folding and superimposing.
- Create a symmetrical shape with or without manipulatives.
- Provide examples of symmetrical shapes found in the environment, and identify the line(s) of symmetry.
- Sort a set of 2-D shapes as those that have no lines of symmetry, one line of symmetry, or more than one line of symmetry.

Grade 4

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

Strand: Statistics and Probability (Data Analysis)	General Learning Outcome: Collect, display, and analyze data to solve problems.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>4.SP.1. Demonstrate an understanding of many-to-one correspondence. [C, R, T, V]</p>	<ul style="list-style-type: none"> ■ Compare graphs in which different intervals or correspondences are used, and explain why the interval or correspondence was used. ■ Compare graphs in which the same data has been displayed using one-to-one and many-to-one correspondences, and explain how they are the same and different. ■ Explain why many-to-one correspondence is sometimes used rather than one-to-one correspondence. ■ Find examples of graphs in which many-to-one correspondence is used in print and electronic media, such as newspapers, magazines, and the Internet, and describe the correspondence used.
<p>4.SP.2. Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions. [C, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Identify an interval and correspondence for displaying a set of data in a graph, and justify the choice. ■ Create and label (with categories, title, and legend) a pictograph to display a set of data using many-to-one correspondence, and justify the choice of correspondence used. ■ Create and label (with axes and title) a bar graph to display a set of data using many-to-one correspondence, and justify the choice of interval used. ■ Answer a question using a graph in which data is displayed using many-to-one correspondence.

Grade 5

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

Strand: Number	General Learning Outcome: Develop number sense.
--------------------------	---

Specific Learning 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.*

5.N.1. Represent and describe whole numbers to 1 000 000.
[C, CN, T, V]

- Write a numeral using proper spacing without commas (e.g., 934 567 and not 934,567).
- Describe the pattern of adjacent place positions moving from right to left.
- Describe the meaning of each digit in a numeral.
- Provide examples of large numbers used in print or electronic media.
- Express a given numeral in expanded notation (e.g., $45\,321 = [4 \times 10\,000] + [5 \times 1000] + [3 \times 100] + [2 \times 10] + [1 \times 1]$ or $40\,000 + 5000 + 300 + 20 + 1$).
- Write the numeral represented in expanded notation.

5.N.2. Apply estimation strategies, including

- front-end rounding
- compensation
- compatible numbers

in problem-solving contexts.
[C, CN, ME, PS, R, V]

- Provide a context for when estimation is used to
 - make predictions
 - check reasonableness of an answer
 - determine approximate answers
- Describe contexts in which overestimating is important.
- Determine the approximate solution to a problem not requiring an exact answer.
- Estimate a sum or product using compatible numbers.
- Estimate the solution to a problem using compensation, and explain the reason for compensation.
- Select and use an estimation strategy to solve a problem.
- Apply front-end rounding to estimate
 - sums (e.g., $253 + 615$ is more than $200 + 600 = 800$)
 - differences (e.g., $974 - 250$ is close to $900 - 200 = 700$)
 - products (e.g., the product of 23×24 is greater than 20×20 or 400 and less than 25×25 or 625)
 - quotients (e.g., the quotient of $831 \div 4$ is greater than $800 \div 4$ or 200)

Grade 5

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

5.N.3. Apply mental math strategies to determine multiplication and related division facts to 81 (9×9).
[C, CN, ME, R, V]

Recall of multiplication facts to 81 and related division facts is expected by the end of Grade 5.

- Describe the mental mathematics strategy used to determine a basic fact, such as
 - skip-count up by one or two groups from a known fact (e.g., if $5 \times 7 = 35$, then 6×7 is equal to $35 + 7$ and 7×7 is equal to $35 + 7 + 7$)
 - skip-count down by one or two groups from a known fact (e.g., if $8 \times 8 = 64$, then 7×8 is equal to $64 - 8$ and 6×8 is equal to $64 - 8 - 8$)
 - halving/doubling (e.g., for 8×3 think $4 \times 6 = 24$)
 - use patterns when multiplying by 9 (e.g., for 9×6 , think $10 \times 6 = 60$, then $60 - 6 = 54$; for 7×9 , think $7 \times 10 = 70$, and $70 - 7 = 63$)
 - repeated doubling (e.g., if 2×6 is equal to 12, then 4×6 is equal to 24, and 8×6 is equal to 48)
 - repeated halving (e.g., for $60 \div 4$, think $60 \div 2 = 30$ and $30 \div 2 = 15$)
 - relating multiplication to division facts (e.g., for 7×8 , think $56 \div 7 = \square$)
 - use multiplication facts that are squares (1×1 , 2×2 , up to 9×9)
- Refine personal strategies to increase efficiency (e.g., for 7×6 , use known square $6 \times 6 + 6$ instead of repeated addition $6 + 6 + 6 + 6 + 6 + 6 + 6$).

5.N.4. Apply mental mathematics strategies for multiplication, such as

- annexing then adding zeros
- halving and doubling
- using the distributive property

[C, ME, R]

- Determine the products when one factor is a multiple of 10, 100, or 1000 by annexing zero or adding zeros (e.g., for 3×200 think 3×2 and then add two zeros).
- Apply halving and doubling when determining a product (e.g., 32×5 is the same as 16×10).
- Apply the distributive property to determine a product involving multiplying factors that are close to multiples of 10 [e.g., $98 \times 7 = (100 \times 7) - (2 \times 7)$].

Grade 5

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

<p>5.N.5. Demonstrate an understanding of multiplication (1- and 2-digit multipliers and up to 4-digit multiplicands), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithm ■ estimating products <p>to solve problems. [C, CN, ME, PS, V]</p>	<ul style="list-style-type: none"> ■ Illustrate partial products in expanded notation for both factors [e.g., for 36×42, determine the partial products for $(30 + 6) \times (40 + 2)$]. ■ Represent both 2-digit factors in expanded notation to illustrate the distributive property [e.g., to determine the partial products of 36×42, $(30 + 6) \times (40 + 2) = 30 \times 40 + 30 \times 2 + 6 \times 40 + 6 \times 2 = 1200 + 60 + 240 + 12 = 1512$]. ■ Model the steps for multiplying 2-digit factors using an array and base-10 blocks, and record the process symbolically. ■ Describe a solution procedure for determining the product of two 2-digit factors using a pictorial representation, such as an area model. ■ Model and explain the relationship that exists between an algorithm, place value, and number properties. ■ Determine products using the standard algorithm of vertical multiplication. (Numbers arranged vertically and multiplied using single digits which are added to form a final product.) ■ Solve a multiplication problem in context using personal strategies, and record the process. ■ Refine personal strategies such as mental math strategies to increase efficiency when appropriate [e.g., 16×25 think $4 \times (4 \times 25) = 400$].
<p>5.N.6. Demonstrate an understanding of division (1- and 2-digit divisors and up to 4-digit dividends), concretely, pictorially, and symbolically, and interpret remainders by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithm ■ estimating quotients <p>to solve problems. [C, CN, ME, PS]</p>	<ul style="list-style-type: none"> ■ Model the division process as equal sharing using base-10 blocks, and record it symbolically. ■ Explain that the interpretation of a remainder depends on the context: <ul style="list-style-type: none"> ■ ignore the remainder (e.g., making teams of 4 from 22 people) ■ round up the quotient (e.g., the number of five passenger cars required to transport 13 people) ■ express remainders as fractions (e.g., five apples shared by two people) ■ express remainders as decimals (e.g., measurement or money) ■ Model and explain the relationship that exists between algorithm, place value, and number properties. ■ Determine quotients using the standard algorithm of long division. (The multiples of the divisor are subtracted from the dividend.) ■ Solve a division problem in context using personal strategies, and record the process. ■ Refine personal strategies such as mental math strategies to increase efficiency when appropriate (e.g., $860 \div 2$ think $86 \div 2 = 43$ then $860 \div 2$ is 430).

Grade 5

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>5.N.7. Demonstrate an understanding of fractions by using concrete and pictorial representations to</p> <ul style="list-style-type: none"> ■ create sets of equivalent fractions ■ compare fractions with like and unlike denominators <p>[C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Create a set of equivalent fractions and explain why there are many equivalent fractions for any fraction using concrete materials. ■ Model and explain that equivalent fractions represent the same quantity. ■ Determine if two fractions are equivalent using concrete materials or pictorial representations. ■ Formulate and verify a rule for developing a set of equivalent fractions. ■ Identify equivalent fractions for a fraction. ■ Compare two fractions with unlike denominators by creating equivalent fractions. ■ Position a set of fractions with like and unlike denominators on a number line (vertical or horizontal), and explain strategies used to determine the order.
<p>5.N.8. Describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially, and symbolically.</p> <p>[C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Write the decimal for a concrete or pictorial representation of part of a set, part of a region, or part of a unit of measure. ■ Represent a decimal using concrete materials or a pictorial representation. ■ Represent an equivalent tenth, hundredth, or thousandth for a decimal, using a grid. ■ Express a tenth as an equivalent hundredth and thousandth. ■ Express a hundredth as an equivalent thousandth. ■ Describe the value of each digit in a decimal.
<p>5.N.9. Relate decimals to fractions (tenths, hundredths, thousandths).</p> <p>[CN, R, V]</p>	<ul style="list-style-type: none"> ■ Write a decimal in fractional form. ■ Write a fraction with a denominator of 10, 100, or 1000 as a decimal. ■ Express a pictorial or concrete representation as a fraction or decimal (e.g., 250 shaded squares on a thousandth grid can be expressed as 0.250 or $\frac{250}{1000}$).
<p>5.N.10. Compare and order decimals (tenths, hundredths, thousandths) by using</p> <ul style="list-style-type: none"> ■ benchmarks ■ place value ■ equivalent decimals <p>[CN, R, V]</p>	<ul style="list-style-type: none"> ■ Order a set of decimals by placing them on a number line (vertical or horizontal) that contains benchmarks, 0.0, 0.5, 1.0. ■ Order a set of decimals including only tenths using place value. ■ Order a set of decimals including only hundredths using place value. ■ Order a set of decimals including only thousandths using place value. ■ Explain what is the same and what is different about 0.2, 0.20, and 0.200. ■ Order a set of decimals including tenths, hundredths, and thousandths using equivalent decimals.

Grade 5

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

<p>5.N.11. Demonstrate an understanding of addition and subtraction of decimals (to thousandths), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithms ■ using estimation ■ solving problems <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Estimate a sum or difference using front-end estimation (e.g., for $6.3 + 0.25 + 306.158$, think $6 + 306$, so the sum is greater than 312) and place the decimal in the appropriate place. ■ Correct errors of decimal point placements in sums and differences without using paper and pencil. ■ Explain why keeping track of place value positions is important when adding and subtracting decimals. ■ Predict sums and differences of decimals using estimation strategies. ■ Solve a problem that involves addition and subtraction of decimals, to thousandths. ■ Model and explain the relationship that exists between an algorithm, place value, and number properties. ■ Determine the sum and difference using the standard algorithms of vertical addition and subtraction. (Numbers are arranged vertically with corresponding place value digits aligned.) ■ Refine personal strategies, such as mental math, to increase efficiency when appropriate (e.g., $3.36 + 9.65$ think, $0.35 + 0.65 = 1.00$, therefore, $0.36 + 0.65 = 1.01$ and $3 + 9 = 12$ for a total of 13.01).
---	---

Grade 5

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

Strand: Patterns and Relations (Patterns)	General Learning Outcome: Use patterns to describe the world and solve problems.
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

5.PR.1. Determine the pattern rule to make predictions about subsequent elements.
[C, CN, PS, R, V]

- Extend a pattern with or without concrete materials, and explain how each element differs from the proceeding one.
- Describe, orally or in writing, a pattern using mathematical language, such as one more, one less, five more.
- Write a mathematical expression to represent a pattern, such as $r + 1, r - 1, r + 5$.
- Describe the relationship in a table or chart using a mathematical expression.
- Determine and explain why a number is or is not the next element in a pattern.
- Predict subsequent elements in a pattern.
- Solve a problem by using a pattern rule to determine subsequent elements.
- Represent a pattern visually to verify predictions.

Grade 5

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning 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.*

<p>5.PR.2. Solve problems involving single-variable (expressed as symbols or letters), one-step equations with whole-number coefficients, and whole-number solutions. [C, CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Express a problem in context as an equation where the unknown is represented by a letter variable. ■ Solve a single-variable equation with the unknown in any of the terms (e.g., $n + 2 = 5$, $4 + a = 7$, $6 = r - 2$, $10 = 2c$). ■ Create a problem in context for an equation.
--	---

Grade 5

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>5.SS.1. Design and construct different rectangles given either perimeter or area or both (whole numbers), and draw conclusions. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Construct or draw two or more rectangles for a given perimeter in a problem-solving context. ■ Construct or draw two or more rectangles for a given area in a problem-solving context. ■ Illustrate that for any perimeter, the square or shape closest to a square will result in the greatest area. ■ Illustrate that for any perimeter, the rectangle with the smallest possible width will result in the least area. ■ Provide a real-life context for when it is important to consider the relationship between area and perimeter.
<p>5.SS.2. Demonstrate an understanding of measuring length (mm) by</p> <ul style="list-style-type: none"> ■ selecting and justifying referents for the unit mm ■ modelling and describing the relationship between mm and cm units, and between mm and m units <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Provide a referent for one millimetre and explain the choice. ■ Provide a referent for one centimetre and explain the choice. ■ Provide a referent for one metre and explain the choice. ■ Show that 10 millimetres is equivalent to 1 centimetre using concrete materials (e.g., ruler). ■ Show that 1000 millimetres is equivalent to 1 metre using concrete materials (e.g., metre stick). ■ Provide examples of when millimetres are used as the unit of measure.

Grade 5

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

Strand: Shape and Space (Measurement) <i>(continued)</i>	General Learning Outcome: Use direct or indirect measurement to solve problems.
--	---

Specific Learning 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.*

<p>5.SS.3. Demonstrate an understanding of volume by</p> <ul style="list-style-type: none"> ■ selecting and justifying referents for cm^3 or m^3 units ■ estimating volume by using referents for cm^3 or m^3 ■ measuring and recording volume (cm^3 or m^3) ■ constructing rectangular prisms for a given volume <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Identify the cube as the most efficient unit for measuring volume and explain why. ■ Provide a referent for a cubic centimetre and explain the choice. ■ Provide a referent for a cubic metre and explain the choice. ■ Determine which standard cubic unit is represented by a given referent. ■ Estimate the volume of a 3-D object using personal referents. ■ Determine the volume of a 3-D object using manipulatives and explain the strategy. ■ Construct a rectangular prism for a given volume. ■ Explain that many rectangular prisms are possible for a given volume by constructing more than one rectangular prism for the same volume.
<p>5.SS.4. Demonstrate an understanding of capacity by</p> <ul style="list-style-type: none"> ■ describing the relationship between mL and L ■ selecting and justifying referents for mL or L units ■ estimating capacity by using referents for mL or L ■ measuring and recording capacity (mL or L) <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Demonstrate that 1000 millilitres is equivalent to 1 litre by filling a 1-litre container using a combination of smaller containers. ■ Provide a referent for a litre and explain the choice. ■ Provide a referent for a millilitre and explain the choice. ■ Determine which capacity unit (mL or L) is represented by a given referent. ■ Estimate the capacity of a container using personal referents. ■ Determine the capacity of a container using materials that take the shape of the inside of the container (e.g., a liquid, rice, sand, beads), and explain the strategy.

Grade 5

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

5.SS.5. Describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes, that are <ul style="list-style-type: none"> ■ parallel ■ intersecting ■ perpendicular ■ vertical ■ horizontal [C, CN, R, T, V]	<ul style="list-style-type: none"> ■ Identify parallel, intersecting, perpendicular, vertical, and horizontal edges and faces on 3-D objects. ■ Identify parallel, intersecting, perpendicular, vertical, and horizontal sides on 2-D shapes. ■ Provide examples from the environment that show parallel, intersecting, perpendicular, vertical, and horizontal line segments. ■ Find examples of edges, faces, and sides that are parallel, intersecting, perpendicular, vertical, and horizontal in print and electronic media, such as newspapers, magazines, and the Internet. ■ Draw 2-D shapes or 3-D objects that have edges, faces, and sides that are parallel, intersecting, perpendicular, vertical, or horizontal. ■ Describe the faces and edges of a 3-D object using terms such as parallel, intersecting, perpendicular, vertical, or horizontal. ■ Describe the sides of a 2-D shape using terms such as parallel, intersecting, perpendicular, vertical, or horizontal.
5.SS.6. Identify and sort quadrilaterals, including <ul style="list-style-type: none"> ■ rectangles ■ squares ■ trapezoids ■ parallelograms ■ rhombuses according to their attributes. [C, R, V]	<ul style="list-style-type: none"> ■ Identify and describe the characteristics of a pre-sorted set of quadrilaterals. ■ Sort a set of quadrilaterals and explain the sorting rule. ■ Sort a set of quadrilaterals according to the lengths of the sides. ■ Sort a set of quadrilaterals according to whether or not opposite sides are parallel.

Grade 5

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

Strand: Shape and Space (Transformations)	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
---	---

Specific Learning 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.*

5.SS.7. Perform a single transformation (translation, rotation, or reflection) of a 2-D shape, and draw and describe the image.
[C, CN, T, V]

- Translate a 2-D shape horizontally, vertically, or diagonally, and describe the position and orientation of the image.
- Rotate a 2-D shape about a point, and describe the position and orientation of the image.
- Reflect a 2-D shape in a line of reflection, and describe the position and orientation of the image.
- Perform a transformation of a 2-D shape by following instructions.
- Draw a 2-D shape, translate the shape, and record the translation by describing the direction and magnitude of the movement (e.g., the circle moved 3 cm to the left).
- Draw a 2-D shape, rotate the shape, and describe the direction of the turn (clockwise or counter-clockwise), the fraction of the turn, and point of rotation.
- Draw a 2-D shape, reflect the shape, and identify the line of reflection and the distance of the image from the line of reflection.
- Predict the result of a single transformation of a 2-D shape and verify the prediction.

Grade 5

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

Strand: Shape and Space (Transformations) <i>(continued)</i>	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>5.SS.8. Identify a single transformation (translation, rotation, or reflection) of 2-D shapes. [C, T, V]</p>	<ul style="list-style-type: none"> ■ Provide an example of a translation, a rotation, and a reflection. ■ Identify a single transformation as a translation, rotation, or reflection. ■ Describe a rotation by the direction of the turn (clockwise or counter-clockwise).
---	---

Grade 5

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

Strand: Statistics and Probability (Data Analysis)	General Learning Outcome: Collect, display, and analyze data to solve problems.
--	---

Specific Learning 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.*

<p>5.SP.1. Differentiate between first-hand and second-hand data. [C, R, T, V]</p>	<ul style="list-style-type: none"> ■ Explain the difference between first-hand and second-hand data. ■ Formulate a question that can best be answered using first-hand data and explain why. ■ Formulate a question that can best be answered using second-hand data and explain why. ■ Find examples of second-hand data in print and electronic media, such as newspapers, magazines, and the Internet.
<p>5.SP.2. Construct and interpret double bar graphs to draw conclusions. [C, PS, R, T, V]</p>	<ul style="list-style-type: none"> ■ Determine the attributes (title, axes, intervals, and legend) of double bar graphs by comparing a set of double bar graphs. ■ Represent a set of data by creating a double bar graph, label the title and axes, and create a legend with or without the use of technology. ■ Draw conclusions from a double bar graph to answer questions. ■ Provide examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines, and the Internet. ■ Solve a problem by constructing and interpreting a double bar graph.

Grade 5

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

Strand: Statistics and Probability (Chance and Uncertainty)	General Learning Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.
--	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>5.SP.3. Describe the likelihood of a single outcome occurring, using words such as</p> <ul style="list-style-type: none"> ■ impossible ■ possible ■ certain <p>[C, CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Provide examples of events that are impossible, possible, or certain from personal contexts. ■ Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible, or certain. ■ Design and conduct a probability experiment in which the likelihood of a single outcome occurring is impossible, possible, or certain. ■ Conduct a probability experiment a number of times, record the outcomes, and explain the results.
<p>5.SP.4. Compare the likelihood of two possible outcomes occurring, using words such as</p> <ul style="list-style-type: none"> ■ less likely ■ equally likely ■ more likely <p>[C, CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Identify outcomes from a probability experiment which are less likely, equally likely, or more likely to occur than other outcomes. ■ Design and conduct a probability experiment in which one outcome is less likely to occur than the other outcome. ■ Design and conduct a probability experiment in which one outcome is equally as likely to occur as the other outcome. ■ Design and conduct a probability experiment in which one outcome is more likely to occur than the other outcome.

Grade 6

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

Strand: Number	General Learning Outcome: Develop number sense
--------------------------	--

Specific Learning 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.*

<p>6.N.1. Demonstrate an understanding of place value for numbers</p> <ul style="list-style-type: none"> ■ greater than one million ■ less than one-thousandth <p>[C, CN, R, T]</p>	<ul style="list-style-type: none"> ■ Explain how the pattern of the place value system (e.g., the repetition of ones, tens, and hundreds) makes it possible to read and write numerals for numbers of any magnitude. ■ Provide examples of where large numbers and small decimals are used (e.g., media, science, medicine, technology).
<p>6.N.2. Solve problems involving large numbers, using technology.</p> <p>[ME, PS, T]</p>	<ul style="list-style-type: none"> ■ Identify which operation is necessary to solve a problem and solve it. ■ Determine the reasonableness of an answer. ■ Estimate the answer and solve a problem. ■ Identify and correct errors in a solution to a problem that involves large numbers.
<p>6.N.3. Demonstrate an understanding of factors and multiples by</p> <ul style="list-style-type: none"> ■ determining multiples and factors of numbers less than 100 ■ identifying prime and composite numbers ■ solving problems involving factors or multiples <p>[PS, R, V]</p>	<ul style="list-style-type: none"> ■ Identify multiples for a number and explain the strategy used to identify them. ■ Determine all the whole-number factors of a number using arrays. ■ Identify the factors for a number and explain the strategy used (e.g., concrete or visual representations, repeated division by prime numbers or factor trees). ■ Identify common factors and common multiples for 2 or 3 numbers. ■ Provide an example of a prime number and explain why it is a prime number. ■ Provide an example of a composite number and explain why it is a composite number. ■ Sort a set of numbers as prime and composite. ■ Solve a problem involving factors, multiples, the largest common factor or the lowest common multiple. ■ Explain why 0 and 1 are neither prime nor composite.

Grade 6

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
6.N.4. Relate improper fractions to mixed numbers. [CN, ME, R, V]	<ul style="list-style-type: none"> ■ Demonstrate using models that an improper fraction represents a number greater than 1. ■ Express improper fractions as mixed numbers. ■ Express mixed numbers as improper fractions. ■ Place a set of fractions, including mixed numbers and improper fractions, on a horizontal or vertical number line, and explain strategies used to determine position.
6.N.5. Demonstrate an understanding of ratio, concretely, pictorially, and symbolically. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Provide a concrete or pictorial representation for a ratio. ■ Write a ratio from a concrete or pictorial representation. ■ Express a ratio in multiple forms, such as 3:5, $\frac{3}{5}$, or 3 to 5. ■ Identify and describe ratios from real-life contexts and record them symbolically. ■ Explain the part/whole and part/part ratios of a set (e.g., for a group of 3 girls and 5 boys, explain the ratios 3:5, 3:8, and 5:8). ■ Solve a problem involving ratio.
6.N.6. Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially, and symbolically. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Explain that “percent” means “out of 100.” ■ Explain that percent is the ratio of a certain number of units to 100 units. ■ Use concrete materials and pictorial representations to illustrate a percent. ■ Record the percent displayed in a concrete or pictorial representation. ■ Express a percent as a fraction and a decimal. ■ Identify and describe percents from real-life contexts and record them symbolically. ■ Solve a problem involving percents.

Grade 6

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>6.N.7. Demonstrate an understanding of integers, concretely, pictorially, and symbolically. [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Extend a horizontal or vertical number line by adding numbers less than zero and explain the pattern on each side of zero. ■ Place a set of integers on a horizontal or vertical number line and explain how integers are ordered. ■ Describe contexts in which integers are used (e.g., on a thermometer). ■ Compare two integers, represent their relationship using the symbols $<$, $>$, and $=$, and verify using a horizontal or vertical number line. ■ Order a set of integers in ascending or descending order.
<p>6.N.8. Demonstrate an understanding of multiplication and division of decimals (involving 1-digit whole-number multipliers, 1-digit natural number divisors, and multipliers and divisors that are multiples of 10), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithms ■ using estimation ■ solving problems <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Estimate a product using front-end estimation (e.g., for $15.205 \text{ m} \times 4$, think $15 \text{ m} \times 4$, so the product is greater than 60 m), and place the decimal in the appropriate place. ■ Estimate a quotient using front-end estimation (e.g., for $\\$26.83 \div 4$, think $24 \div 4$, so the quotient is greater than \$6), and place the decimal in the appropriate place. ■ Predict products and quotients of decimals using estimation strategies. ■ Identify and correct errors of decimal point placement in a product or quotient by estimating. ■ Solve a problem that involves multiplication and division of decimals using multipliers from 0 to 9 and divisors from 1 to 9. ■ Use mental math to determine products or quotients involving decimals when the multiplier or divisor is a multiple of 10 (e.g., $2.47 \times 10 = 24.7$; $31.9 \div 100 = 0.319$). ■ Model and explain the relationship that exists between an algorithm, place value, and number properties. ■ Determine products and quotients using the standard algorithms of vertical multiplication (numbers arranged vertically and multiplied using single digits which are added to form a final product) and long division (the multiples of the divisor are subtracted from the dividend). ■ Solve multiplication and division problems in context using personal strategies, and record the process. ■ Refine personal strategies, such as mental math, to increase their efficiency when appropriate (e.g., $4.46 \div 2$ think $446 \div 2 = 223$, and then use front-end estimation to determine the placement of the decimal 2.23).
<p>6.N.9. Explain and apply the order of operations, excluding exponents (limited to whole numbers). [CN, ME, PS, T]</p>	<ul style="list-style-type: none"> ■ Demonstrate and explain with examples why there is a need to have a standardized order of operations. ■ Apply the order of operations to solve multi-step problems with or without technology.

Grade 6

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

Strand: Patterns and Relations (Patterns)	General Learning Outcome: Use patterns to describe the world and solve problems.
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>6.PR.1. Demonstrate an understanding of the relationships within tables of values to solve problems. [C, CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Generate values in one column of a table of values, values in the other column, and a pattern rule. ■ State, using mathematical language, the relationship in a table of values. ■ Create a concrete or pictorial representation of the relationship shown in a table of values. ■ Predict the value of an unknown term using the relationship in a table of values and verify the prediction. ■ Formulate a rule to describe the relationship between two columns of numbers in a table of values. ■ Identify missing elements in a table of values. ■ Identify and correct errors in a table of values. ■ Describe the pattern within each column of a table of values. ■ Create a table of values to record and reveal a pattern to solve a problem.
<p>6.PR.2. Represent and describe patterns and relationships using graphs and tables. [C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Translate a pattern to a table of values and graph the table of values (limit to linear graphs with discrete elements). ■ Create a table of values from a pattern or a graph. ■ Describe, using everyday language, orally or in writing, the relationship shown on a graph.

Grade 6

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning 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.*

<p>6.PR.3. Represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Write and explain the formula for finding the perimeter of any rectangle. ■ Write and explain the formula for finding the area of any rectangle. ■ Develop and justify equations using letter variables that illustrate the commutative property of addition and multiplication (e.g., $a + b = b + a$ or $a \times b = b \times a$). ■ Describe the relationship in a table using a mathematical expression. ■ Represent a pattern rule using a simple mathematical expression, such as $4d$ or $2n + 1$.
<p>6.PR.4. Demonstrate and explain the meaning of preservation of equality, concretely, pictorially, and symbolically. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Model the preservation of equality for addition using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Model the preservation of equality for subtraction using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Model the preservation of equality for multiplication using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Model the preservation of equality for division using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Write equivalent forms of an equation by applying the preservation of equality, and verify using concrete materials [e.g., $3b = 12$ is the same as $3b + 5 = 12 + 5$ or $2r = 7$ is the same as $3(2r) = 3(7)$].

Grade 6

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>6.SS.1. Demonstrate an understanding of angles by</p> <ul style="list-style-type: none"> ■ identifying examples of angles in the environment ■ classifying angles according to their measure ■ estimating the measure of angles using 45°, 90°, and 180° as reference angles ■ determining angle measures in degrees ■ drawing and labelling angles when the measure is specified <p>[C, CN, ME, V]</p>	<ul style="list-style-type: none"> ■ Provide examples of angles found in the environment. ■ Classify a set of angles according to their measure (e.g., acute, right, obtuse, straight, reflex). ■ Sketch 45°, 90°, and 180° angles without the use of a protractor, and describe the relationship among them. ■ Estimate the measure of an angle using 45°, 90°, and 180° as reference angles. ■ Measure, using a protractor, angles in various orientations. ■ Draw and label an angle in various orientations using a protractor. ■ Describe the measure of an angle as the measure of rotation of one of its sides. ■ Describe the measure of angles as the measure of an interior angle of a polygon.
<p>6.SS.2. Demonstrate that the sum of interior angles is</p> <ul style="list-style-type: none"> ■ 180° in a triangle ■ 360° in a quadrilateral <p>[C, R]</p>	<ul style="list-style-type: none"> ■ Explain, using models, that the sum of the interior angles of a triangle is the same for all triangles. ■ Explain, using models, that the sum of the interior angles of a quadrilateral is the same for all quadrilaterals.

Grade 6

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

Strand: Shape and Space (Measurement) <i>(continued)</i>	General Learning Outcome: Use direct or indirect measurement to solve problems.
--	---

Specific Learning 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.*

- 6.SS.3. Develop and apply a formula for determining the
- perimeter of polygons
 - area of rectangles
 - volume of right rectangular prisms
- [C, CN, PS, R, V]

- Explain, using models, how the perimeter of any polygon can be determined.
- Generalize a rule for determining the perimeter of polygons.
- Explain, using models, how the area of any rectangle can be determined.
- Generalize a rule for determining the area of rectangles.
- Explain, using models, how the volume of any right rectangular prism can be determined.
- Generalize a rule for determining the volume of right rectangular prisms.
- Solve a problem involving the perimeter of polygons, the area of rectangles, or the volume of right rectangular prisms.

Grade 6

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

6.SS.4. Construct and compare triangles, including <ul style="list-style-type: none"> ■ scalene ■ isosceles ■ equilateral ■ right ■ obtuse ■ acute in different orientations. [C, PS, R, V]	<ul style="list-style-type: none"> ■ Sort a set of triangles according to the length of the sides. ■ Sort a set of triangles according to the measures of the interior angles. ■ Identify the characteristics of a set of triangles according to their sides or their interior angles. ■ Sort a set of triangles and explain the sorting rule. ■ Draw a triangle (e.g., scalene). ■ Replicate a triangle in a different orientation and show that the two are congruent.
6.SS.5. Describe and compare the sides and angles of regular and irregular polygons. [C, PS, R, V]	<ul style="list-style-type: none"> ■ Sort a set of 2-D shapes into polygons and non-polygons, and explain the sorting rule. ■ Demonstrate congruence (sides to sides and angles to angles) in a regular polygon by superimposing. ■ Demonstrate congruence (sides to sides and angles to angles) in a regular polygon by measuring. ■ Demonstrate that the sides of a regular polygon are of the same length and that the angles of a regular polygon are of the same measure. ■ Sort a set of polygons as regular or irregular and justify the sorting. ■ Identify and describe regular and irregular polygons in the environment.

Grade 6

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

Strand: Shape and Space (Transformations)	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
---	---

Specific Learning 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.*

<p>6.SS.6. Perform a combination of transformations (translations, rotations, or reflections) on a single 2-D shape, and draw and describe the image. [C, CN, PS, T, V]</p>	<ul style="list-style-type: none"> ■ Demonstrate that a 2-D shape and its transformation image are congruent. ■ Model a set of successive translations, successive rotations, or successive reflections of a 2-D shape. ■ Model a combination of two different types of transformations of a 2-D shape. ■ Draw and describe a 2-D shape and its image, given a combination of transformations. ■ Describe the transformations performed on a 2-D shape to produce a given image. ■ Model a set of successive transformations (translation, rotation, or reflection) of a 2-D shape. ■ Perform and record one or more transformations of a 2-D shape that will result in a given image.
<p>6.SS.7. Perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations. [C, CN, T, V]</p>	<ul style="list-style-type: none"> ■ Analyze a design created by transforming one or more 2-D shapes, and identify the original shape and the transformations used to create the design. ■ Create a design using one or more 2-D shapes and describe the transformations used.

Grade 6

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

Strand: Shape and Space (Transformations) <i>(continued)</i>	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>6.SS.8. Identify and plot points in the first quadrant of a Cartesian plane using whole-number ordered pairs. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Label the axes of the first quadrant of a Cartesian plane and identify the origin. ■ Plot a point in the first quadrant of a Cartesian plane given its ordered pair. ■ Match points in the first quadrant of a Cartesian plane with their corresponding ordered pair. ■ Plot points in the first quadrant of a Cartesian plane with intervals of 1, 2, 5, or 10 on its axes, given whole-number ordered pairs. ■ Draw shapes or designs, given ordered pairs in the first quadrant of a Cartesian plane. ■ Determine the distance between points along horizontal and vertical lines in the first quadrant of a Cartesian plane. ■ Draw shapes or designs in the first quadrant of a Cartesian plane and identify the points used to produce them.
<p>6.SS.9. Perform and describe single transformations of a 2-D shape in the first quadrant of a Cartesian plane (limited to whole-number vertices). [C, CN, PS, T, V]</p>	<ul style="list-style-type: none"> ■ Identify the coordinates of the vertices of a 2-D shape (limited to the first quadrant of a Cartesian plane). ■ Perform a transformation on a given 2-D shape and identify the coordinates of the vertices of the image (limited to the first quadrant). ■ Describe the positional change of the vertices of a 2-D shape to the corresponding vertices of its image as a result of a transformation (limited to first quadrant).

Grade 6

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

Strand: Statistics and Probability (Data Analysis)	General Learning Outcome: Collect, display, and analyze data to solve problems.
--	---

Specific Learning 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.*

<p>6.SP.1. Create, label, and interpret line graphs to draw conclusions. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Determine the common attributes (title, axes, and intervals) of line graphs by comparing a set of line graphs. ■ Determine whether a set of data can be represented by a line graph (continuous data) or a series of points (discrete data), and explain why. ■ Create a line graph from a table of values or set of data. ■ Interpret a line graph to draw conclusions.
<p>6.SP.2. Select, justify, and use appropriate methods of collecting data, including</p> <ul style="list-style-type: none"> ■ questionnaires ■ experiments ■ databases ■ electronic media <p>[C, PS, T]</p>	<ul style="list-style-type: none"> ■ Select a method for collecting data to answer a question, and justify the choice. ■ Design and administer a questionnaire for collecting data to answer a question and record the results. ■ Answer a question by performing an experiment, recording the results, and drawing a conclusion. ■ Explain when it is appropriate to use a database as a source of data. ■ Gather data for a question by using electronic media, including selecting data from databases.
<p>6.SP.3. Graph collected data and analyze the graph to solve problems. [C, CN, PS]</p>	<ul style="list-style-type: none"> ■ Select a type of graph for displaying a set of collected data, and justify the choice of graph. ■ Solve a problem by graphing data and interpreting the resulting graph.

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

Strand: Statistics and Probability (Chance and Uncertainty)	General Learning Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>6.SP.4. Demonstrate an understanding of probability by</p> <ul style="list-style-type: none"> ■ identifying all possible outcomes of a probability experiment ■ differentiating between experimental and theoretical probability ■ determining the theoretical probability of outcomes in a probability experiment ■ determining the experimental probability of outcomes in a probability experiment ■ comparing experimental results with the theoretical probability for an experiment <p>[C, ME, PS, T]</p>	<ul style="list-style-type: none"> ■ List the possible outcomes of a probability experiment, such as <ul style="list-style-type: none"> ■ tossing a coin ■ rolling a die with any number of sides ■ spinning a spinner with any number of sectors ■ Determine the theoretical probability of an outcome occurring for a probability experiment. ■ Predict the probability of an outcome occurring for a probability experiment by using theoretical probability. ■ Conduct a probability experiment, with or without technology, and compare the experimental results to the theoretical probability. ■ Explain that as the number of trials in a probability experiment increases, the experimental probability approaches theoretical probability of a particular outcome. ■ Distinguish between theoretical probability and experimental probability, and explain the differences.
---	---

Grade 7

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

Strand: Number	General Learning Outcome: Develop number sense.
--------------------------	---

Specific Learning 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.*

<p>7.N.1. Determine and explain why a number is divisible by 2, 3, 4, 5, 6, 8, 9, or 10, and why a number cannot be divided by 0. [C, R]</p>	<ul style="list-style-type: none"> ■ Determine if a number is divisible by 2, 3, 4, 5, 6, 8, 9, or 10, and explain why. ■ Sort a set of numbers based upon their divisibility using organizers, such as Venn or Carroll diagrams. ■ Determine the factors of a number using the divisibility rules. ■ Explain, using an example, why numbers cannot be divided by 0.
<p>7.N.2. Demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, technology could be used). [ME, PS, T]</p>	<ul style="list-style-type: none"> ■ Solve a problem involving the addition of two or more decimal numbers. ■ Solve a problem involving the subtraction of decimal numbers. ■ Solve a problem involving the multiplication or division of decimal numbers (for more than 1-digit divisors or 2-digit multipliers, technology could be used). ■ Place the decimal in a sum or difference using front-end estimation (e.g., for $4.5 + 0.73 + 256.458$, think $4 + 256$, so the sum is greater than 260). ■ Place the decimal in a product using front-end estimation (e.g., for $\\$12.33 \times 2.4$, think $\\$12 \times 2$, so the product is greater than \$24). ■ Place the decimal in a quotient using front-end estimation (e.g., for $51.50 \text{ m} \div 2.1$, think $50 \text{ m} \div 2$, so the quotient is approximately 25 m). ■ Check the reasonableness of answers using estimation. ■ Solve a problem that involves operations on decimals (limited to thousandths), taking into consideration the order of operations. ■ Explain, using an example, how to use mental math for products or quotients when the multiplier or the divisor is 0.1 or 0.5 or 0.25.

Grade 7

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>7.N.3. Solve problems involving percents from 1% to 100%. [C, CN, ME, PS, R, T]</p>	<ul style="list-style-type: none"> ■ Express a percent as a decimal or fraction. ■ Solve a problem that involves finding a percent. ■ Determine the answer to a percent problem where the answer requires rounding, and explain why an approximate answer is needed (e.g., total cost including taxes).
<p>7.N.4. Demonstrate an understanding of the relationship between repeating decimals and fractions, and terminating decimals and fractions. [C, CN, R, T]</p>	<ul style="list-style-type: none"> ■ Predict the decimal representation of a fraction using patterns (e.g., $\frac{1}{11} = 0.\overline{09}$, $\frac{2}{11} = 0.\overline{18}$, $\frac{3}{11} = ? \dots$). ■ Match a set of fractions to their decimal representations. ■ Sort a set of fractions as repeating or terminating decimals. ■ Express a fraction as a terminating or repeating decimal. ■ Express a repeating decimal as a fraction. ■ Express a terminating decimal as a fraction. ■ Provide an example where the decimal representation of a fraction is an approximation of its exact value.

Grade 7

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

Strand: Number (continued)	General Learning Outcome: Develop number sense.
--------------------------------------	---

Specific Learning 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.*

7.N.5. Demonstrate an understanding of adding and subtracting positive fractions and mixed numbers, with like and unlike denominators, concretely, pictorially, and symbolically (limited to positive sums and differences).
[C, CN, ME, PS, R, V]

- Model addition and subtraction of positive fractions or mixed numbers using concrete representations, and record symbolically.
- Determine the sum of two positive fractions or mixed numbers with like denominators.
- Determine the difference of two positive fractions or mixed numbers with like denominators.
- Determine a common denominator for a set of positive fractions or mixed numbers.
- Determine the sum of two positive fractions or mixed numbers with unlike denominators.
- Determine the difference of two positive fractions or mixed numbers with unlike denominators.
- Simplify a positive fraction or mixed number by identifying the common factor between the numerator and denominator.
- Simplify the solution to a problem involving the sum or difference of two positive fractions or mixed numbers.
- Solve a problem involving the addition or subtraction of positive fractions or mixed numbers, and determine if the solution is reasonable.

7.N.6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially, and symbolically.
[C, CN, PS, R, V]

- Explain, using concrete materials such as integer tiles and diagrams, that the sum of opposite integers is equal to zero.
- Illustrate, using a horizontal or vertical number line, the results of adding or subtracting negative and positive integers (e.g., a move in one direction followed by an equivalent move in the opposite direction results in no net change in position).
- Add two integers using concrete materials or pictorial representations, and record the process symbolically.
- Subtract two integers using concrete materials or pictorial representations, and record the process symbolically.
- Solve a problem involving the addition and subtraction of integers.

Grade 7

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>7.N.7. Compare and order fractions, decimals (to thousandths), and integers by using</p> <ul style="list-style-type: none"> ■ benchmarks ■ place value ■ equivalent fractions and/or decimals <p>[CN, R, V]</p>	<ul style="list-style-type: none"> ■ Order the numbers of a set that includes fractions, decimals, or integers in ascending or descending order, and verify the result using a variety of strategies. ■ Identify a number that would be between two numbers in an ordered sequence or on a horizontal or vertical number line. ■ Identify incorrectly placed numbers in an ordered sequence or on a horizontal or vertical number line. ■ Position fractions with like and unlike denominators from a set on a horizontal or vertical number line, and explain strategies used to determine order. ■ Order the numbers of a set by placing them on a horizontal or vertical number line that contains benchmarks, such as 0 and 1 or 0 and 5. ■ Position a set of fractions, including mixed numbers and improper fractions, on a horizontal or vertical number line, and explain strategies used to determine position.
---	--

Grade 7

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

Strand: Patterns and Relations (Patterns)		General Learning Outcome: Use patterns to describe the world and solve problems.	
Specific Learning Outcomes <i>It is expected that students will:</i>		Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	
7.PR.1. Demonstrate an understanding of oral and written patterns and their corresponding relations. [C, CN, R]		<ul style="list-style-type: none"> ■ Formulate a relation to represent the relationship in an oral or written pattern. ■ Provide a context for a relation that represents a pattern. ■ Represent a pattern in the environment using a relation. 	
7.PR.2. Construct a table of values from a relation, graph the table of values, and analyze the graph to draw conclusions and solve problems. [C, CN, R, V]		<ul style="list-style-type: none"> ■ Create a table of values for a relation by substituting values for the variable. ■ Create a table of values using a relation, and graph the table of values (limited to discrete elements). ■ Sketch the graph from a table of values created for a relation, and describe the patterns found in the graph to draw conclusions (e.g., graph the relationship between n and $2n + 3$). ■ Describe the relationship shown on a graph using everyday language in spoken or written form to solve problems. ■ Match a set of relations to a set of graphs. ■ Match a set of graphs to a set of relations. 	

Grade 7

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>7.PR.3. Demonstrate an understanding of preservation of equality by</p> <ul style="list-style-type: none"> ■ modelling preservation of equality, concretely, pictorially, and symbolically ■ applying preservation of equality to solve equations <p>[C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Model the preservation of equality for addition, subtraction, multiplication, or division using concrete materials or using pictorial representations, explain the process orally, and record it symbolically. ■ Solve a problem by applying preservation of equality.
<p>7.PR.4. Explain the difference between an expression and an equation.</p> <p>[C, CN]</p>	<ul style="list-style-type: none"> ■ Identify and provide an example of a constant term, a numerical coefficient, and a variable in an expression and an equation. ■ Explain what a variable is and how it is used in an expression. ■ Provide an example of an expression and an equation, and explain how they are similar and different.
<p>7.PR.5. Evaluate an expression given the value of the variable(s).</p> <p>[CN, R]</p>	<ul style="list-style-type: none"> ■ Substitute a value for each unknown in an expression and evaluate the expression.
<p>7.PR.6. Model and solve problems that can be represented by one-step linear equations of the form $x + a = b$, concretely, pictorially, and symbolically, where a and b are integers.</p> <p>[CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Represent a problem with a linear equation and solve the equation using concrete models. ■ Draw a visual representation of the steps required to solve a linear equation. ■ Solve a problem using a linear equation. ■ Verify the solution to a linear equation using concrete materials or diagrams. ■ Substitute a possible solution for the variable in a linear equation to verify the equality.

Grade 7

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

Strand: Patterns and Relations (Variables and Equations) <i>(continued)</i>	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning 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.*

- 7.PR.7. Model and solve problems that can be represented by linear equations of the form:
- $ax + b = c$
 - $ax = b$
 - $\frac{x}{a} = b, a \neq 0$
- concretely, pictorially, and symbolically, where $a, b,$ and $c,$ are whole numbers.
[CN, PS, R, V]

- Model a problem with a linear equation and solve the equation using concrete models.
- Draw a visual representation of the steps used to solve a linear equation.
- Solve a problem using a linear equation and record the process.
- Verify the solution to a linear equation using concrete materials or diagrams.
- Substitute a possible solution for the variable in a linear equation to verify the equality.

Grade 7

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>7.SS.1. Demonstrate an understanding of circles by</p> <ul style="list-style-type: none"> ■ describing the relationships among radius, diameter, and circumference of circles ■ relating circumference to pi (π) ■ determining the sum of the central angles ■ constructing circles with a given radius or diameter ■ solving problems involving the radii, diameters, and circumferences of circles <p>[C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Illustrate and explain that the diameter is twice the radius in a circle. ■ Illustrate and explain that the circumference is approximately three times the diameter in a circle. ■ Explain that, for all circles, pi (π) is the ratio of the circumference to the diameter ($\frac{C}{d}$), and its value is approximately 3.14. ■ Explain, using an illustration, that the sum of the central angles of a circle is 360°. ■ Draw a circle with a given radius or diameter with or without a compass. ■ Solve a contextual problem involving circles.
<p>7.SS.2. Develop and apply a formula for determining the area of</p> <ul style="list-style-type: none"> ■ triangles ■ parallelograms ■ circles <p>[CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Illustrate and explain how the area of a rectangle can be used to determine the area of a triangle. ■ Generalize a rule to create a formula for determining the area of triangles. ■ Illustrate and explain how the area of a rectangle can be used to determine the area of a parallelogram. ■ Generalize a rule to create a formula for determining the area of parallelograms. ■ Illustrate and explain how to estimate the area of a circle without the use of a formula. ■ Apply a formula for determining the area of a circle. ■ Solve a problem involving the area of triangles, parallelograms, or circles.

Grade 7

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

Strand: Shape and Space (3-D objects and 2-D shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	--

Specific Learning 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.*

- 7.SS.3. Perform geometric constructions, including
- perpendicular line segments
 - parallel line segments
 - perpendicular bisectors
 - angle bisectors
- [CN, R, V]

- Describe examples of parallel line segments, perpendicular line segments, perpendicular bisectors, and angle bisectors in the environment.
- Identify line segments on a diagram that are parallel or perpendicular.
- Draw a line segment perpendicular to another line segment, and explain why they are perpendicular.
- Draw a line segment parallel to another line segment, and explain why they are parallel.
- Draw the bisector of an angle using more than one method, and verify that the resulting angles are equal.
- Draw the perpendicular bisector of a line segment using more than one method, and verify the construction.

Grade 7

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

Strand: Shape and Space (Transformations)	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>7.SS.4. Identify and plot points in the four quadrants of a Cartesian plane using ordered pairs. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Label the axes of a Cartesian plane and identify the origin. ■ Identify the location of a point in any quadrant of a Cartesian plane using an ordered pair. ■ Plot the point corresponding to a ordered pair on a Cartesian plane with units of 1, 2, 5, or 10 on its axes. ■ Draw shapes and designs, using ordered pairs, in a Cartesian plane. ■ Create shapes and designs in a Cartesian plane and identify the points used.
<p>7.SS.5. Perform and describe transformations of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral vertices). [C, CN, PS, T, V]</p>	<p>(It is intended that the original shape and its image have vertices with integral coordinates.)</p> <ul style="list-style-type: none"> ■ Identify the coordinates of the vertices of a 2-D shape on a Cartesian plane. ■ Describe the horizontal and vertical movement required to move from a given point to another point on a Cartesian plane. ■ Describe the positional change of the vertices of a 2-D shape to the corresponding vertices of its image as a result of a transformation or successive transformations on a Cartesian plane. ■ Perform a transformation or consecutive transformations on a 2-D shape, and identify coordinates of the vertices of the image. ■ Describe the image resulting from the transformation of a 2-D shape on a Cartesian plane by comparing the coordinates of the vertices of the image.

Grade 7

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

Strand: Statistics and Probability (Data Analysis)		General Learning Outcome: Describe and analyze position and motion of objects and shapes.
Specific Learning Outcomes <i>It is expected that students will:</i>		Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
7.SP.1. Demonstrate an understanding of central tendency and range by <ul style="list-style-type: none"> ■ determining the measures of central tendency (mean, median, mode) and range ■ determining the most appropriate measures of central tendency to report findings [C, PS, R, T]	<ul style="list-style-type: none"> ■ Determine mean, median, and mode for a set of data, and explain why these values may be the same or different. ■ Determine the range of a set of data. ■ Provide a context in which the mean, median, or mode is the most appropriate measure of central tendency to use when reporting findings. ■ Solve a problem involving the measures of central tendency. 	
7.SP.2. Determine the effect on the mean, median, and mode when an outlier is included in a data set. [C, CN, PS, R]	<ul style="list-style-type: none"> ■ Analyze a set of data to identify any outliers. ■ Explain the effect of outliers on the measures of central tendency for a data set. ■ Identify outliers in a set of data and justify whether or not they are to be included in the reporting of the measures of central tendency. ■ Provide examples of situations in which outliers would or would not be used in determining the measures of central tendency. 	
7.SP.3. Construct, label, and interpret circle graphs to solve problems. [C, CN, PS, R, T, V]	<ul style="list-style-type: none"> ■ Identify common attributes of circle graphs, such as <ul style="list-style-type: none"> ■ title, label, or legend ■ the sum of the central angles is 360° ■ the data is reported as a percent of the total and the sum of the percents is equal to 100% ■ Create and label a circle graph, with or without technology, to display a set of data. ■ Find and compare circle graphs in a variety of print and electronic media, such as newspapers, magazines, and the Internet. ■ Translate percentages displayed in a circle graph into quantities to solve a problem. ■ Interpret a circle graph to answer questions. 	

Grade 7

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

Strand: Statistics and Probability (Chance and Uncertainty)	General Learning Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.
--	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

7.SP.4. Express probabilities as ratios, fractions, and percents. [C, CN, R, T, V]	<ul style="list-style-type: none"> ■ Determine the probability of an outcome occurring for a probability experiment, and express it as a ratio, fraction, or percent. ■ Provide an example of an event with a probability of 0 or 0% (impossible) and an event with a probability of 1 or 100% (certain).
7.SP.5. Identify the sample space (where the combined sample space has 36 or fewer elements) for a probability experiment involving two independent events. [C, ME, PS]	<ul style="list-style-type: none"> ■ Provide an example of two independent events, such as <ul style="list-style-type: none"> ■ spinning a four-section spinner and an eight-sided die ■ tossing a coin and rolling a twelve-sided die ■ tossing two coins ■ rolling two dice and explain why they are independent. ■ Identify the sample space (all possible outcomes) for an experiment involving two independent events using a tree diagram, table, or another graphic organizer.
7.SP.6. Conduct a probability experiment to compare the theoretical probability (determined using a tree diagram, table, or another graphic organizer) and experimental probability of two independent events. [C, PS, R, T]	<ul style="list-style-type: none"> ■ Determine the theoretical probability of an outcome for an experiment involving two independent events. ■ Conduct a probability experiment for an outcome involving two independent events, with or without technology, to compare the experimental probability to the theoretical probability. ■ Solve a probability problem involving two independent events.

Grade 8

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

Strand: Number	General Learning Outcome: Develop number sense.
--------------------------	---

Specific Learning 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.*

<p>8.N.1. Demonstrate an understanding of perfect squares and square roots, concretely, pictorially, and symbolically (limited to whole numbers). [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Represent a perfect square as a square region using materials, such as grid paper or square shapes. ■ Determine the factors of a perfect square, and explain why one of the factors is the square root and the others are not. ■ Determine whether or not a number is a perfect square using materials and strategies such as square shapes, grid paper, or prime factorization, and explain the reasoning. ■ Determine the square root of a perfect square, and record it symbolically. ■ Determine the square of a number.
<p>8.N.2. Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers). [C, CN, ME, R, T]</p>	<ul style="list-style-type: none"> ■ Estimate the square root of a number that is not a perfect square using the roots of perfect squares as benchmarks. ■ Approximate the square root of a number that is not a perfect square using technology (e.g., calculator, computer). ■ Explain why the square root of a number shown on a calculator may be an approximation. ■ Identify a number with a square root that is between two given numbers.

Grade 8

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

8.N.3. Demonstrate an understanding of percents greater than or equal to 0%. [CN, PS, R, V]	<ul style="list-style-type: none">■ Provide a context where a percent may be more than 100% or between 0% and 1%.■ Represent a fractional percent using grid paper.■ Represent a percent greater than 100% using grid paper.■ Determine the percent represented by a shaded region on a grid, and record it in decimal, fractional, or percent form.■ Express a percent in decimal or fractional form.■ Express a decimal in percent or fractional form.■ Express a fraction in decimal or percent form.■ Solve a problem involving percents.■ Solve a problem involving combined percents (e.g., addition of percents, such as GST + PST).■ Solve a problem that involves finding the percent of a percent (e.g., A population increased by 10% one year and then increased by 15% the next year. Explain why there was not a 25% increase in population over the two years).
--	---

Grade 8

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

<p>8.N.4. Demonstrate an understanding of ratio and rate. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Express a two-term ratio from a context in the forms 3:5 or 3 to 5. ■ Express a three-term ratio from a context in the forms 4:7:3 or 4 to 7 to 3. ■ Express a part-to-part ratio as a part to whole ratio (e.g., Given the ratio of frozen juice to water is 1 can to 4 cans, this can be written as 1/4 or 1:4 or 1 to 4, [part-to-part ratio]. Related part-to-whole ratios are $\frac{1}{5}$ or 1:5 or 1 to 5, which is the ratio of juice to solution, or $\frac{4}{5}$, or 4:5 or 4 to 5, which is the ratio of water to solution). ■ Identify and describe ratios and rates from real-life examples, and record them symbolically. ■ Express a rate using words or symbols (e.g., 20 L per 100 km or 20 L/100 km). ■ Express a ratio as a percent, and explain why a rate cannot be represented as a percent.
<p>8.N.5. Solve problems that involve rates, ratios, and proportional reasoning. [C, CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Explain the meaning of $\frac{a}{b}$ within a context. ■ Provide a context in which $\frac{a}{b}$ represents a <ul style="list-style-type: none"> ■ fraction ■ rate ■ ratio ■ quotient ■ probability ■ Solve a problem involving rate, ratio, or percent.

Grade 8

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

8.N.6. Demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially, and symbolically.
[C, CN, ME, PS]

- Identify the operation(s) required to solve a problem involving positive fractions.
- Provide a context involving the multiplying of two positive fractions.
- Provide a context involving the dividing of two positive fractions.
- Express a positive mixed number as an improper fraction and a positive improper fraction as a mixed number.
- Model multiplication of a positive fraction by a whole number, concretely or pictorially, and record the process.
- Model multiplication of a positive fraction by a positive fraction, concretely or pictorially, and record the process.
- Model division of a positive fraction by a whole number, concretely or pictorially, and record the process.
- Generalize and apply rules for multiplying and dividing positive fractions, including mixed numbers.
- Solve a problem involving positive fractions, taking into consideration order of operations (limited to problems with positive solutions).

Grade 8

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

Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense.
---	---

Specific Learning 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.*

<p>8.N.7. Demonstrate an understanding of multiplication and division of integers, concretely, pictorially, and symbolically. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Identify the operation(s) required to solve a problem involving integers. ■ Provide a context that requires multiplying two integers. ■ Provide a context that requires dividing two integers. ■ Model the process of multiplying two integers using concrete materials or pictorial representations, and record the process. ■ Model the process of dividing an integer by an integer using concrete materials or pictorial representations, and record the process. ■ Generalize and apply a rule for determining the sign of the product or quotient of integers. ■ Solve a problem involving integers, taking into consideration order of operations.
<p>8.N.8. Solve problems involving positive rational numbers. [C, CN, ME, PS, R, T, V]</p>	<ul style="list-style-type: none"> ■ Identify the operation(s) required to solve a problem involving positive rational numbers. ■ Determine the reasonableness of an answer to a problem involving positive rational numbers. ■ Estimate the solution and solve a problem involving positive rational numbers. ■ Identify and correct errors in the solution to a problem involving positive rational numbers.

Grade 8

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

Strand: Patterns and Relations (Patterns)	General Learning Outcome: Use patterns to describe the world and solve problems.
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

8.PR.1. Graph and analyze two-variable linear relations. [C, ME, PS, R, T, V]	<ul style="list-style-type: none">■ Determine the missing value in an ordered pair for an equation of a linear relation.■ Create a table of values for the equation of a linear relation.■ Construct a graph from the equation of a linear relation (limited to discrete data).■ Describe the relationship between the variables of a graph.
--	---

Grade 8

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

Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
--	---

Specific Learning 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.*

<p>8.PR.2. Model and solve problems using linear equations of the form:</p> <ul style="list-style-type: none"> ■ $ax = b$ ■ $\frac{x}{a} = b, a \neq 0$ ■ $ax + b = c$ ■ $\frac{x}{a} + b = c, a \neq 0$ ■ $a(x + b) = c$ <p>concretely, pictorially, and symbolically, where $a, b,$ and $c,$ are integers. [C, CN, PS, V]</p>	<ul style="list-style-type: none"> ■ Model a problem with a linear equation, and solve the equation using concrete models. ■ Verify the solution to a linear equation using a variety of methods, including concrete materials, diagrams, and substitution. ■ Draw a visual representation of the steps used to solve a linear equation, and record each step symbolically. ■ Solve a linear equation symbolically. ■ Identify and correct errors in an incorrect solution of a linear equation. ■ Solve a linear equation by applying the distributive property [e.g., $2(x + 3) = 5; 2x + 6 = 5; \dots$]. ■ Solve a problem using a linear equation, and record the process.
---	--

Grade 8

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

Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
---	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

<p>8.SS.1. Develop and apply the Pythagorean theorem to solve problems. [CN, PS, R, T, V]</p>	<ul style="list-style-type: none"> ■ Model and explain the Pythagorean theorem concretely, pictorially, or by using technology. ■ Explain, using examples, that the Pythagorean theorem applies only to right triangles. ■ Determine whether or not a triangle is a right triangle by applying the Pythagorean theorem. ■ Solve a problem that involves determining the measure of the third side of a right triangle, given the measures of the other two sides. ■ Solve a problem that involves Pythagorean triples (e.g., 3, 4, 5 or 5, 12, 13).
<p>8.SS.2. Draw and construct nets for 3-D objects. [C, CN, PS, V]</p>	<ul style="list-style-type: none"> ■ Match a net to the 3-D object it represents. ■ Construct a 3-D object from a net. ■ Draw nets for a right circular cylinder, right rectangular prism, and right triangular prism, and verify by constructing the 3-D objects from the nets. ■ Predict 3-D objects that can be created from a net and verify the prediction.
<p>8.SS.3. Determine the surface area of</p> <ul style="list-style-type: none"> ■ right rectangular prisms ■ right triangular prisms ■ right cylinders <p>to solve problems. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Explain, using examples, the relationship between the area of 2-D shapes and the surface area of a 3-D object. ■ Identify all the faces of a prism, including right rectangular and right triangular prisms. ■ Describe and apply strategies for determining the surface area of a right rectangular or right triangular prism. ■ Describe and apply strategies for determining the surface area of a right cylinder. ■ Solve a problem involving surface area.

Grade 8

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

Strand: Shape and Space (Measurement) <i>(continued)</i>	General Learning Outcome: Use direct or indirect measurement to solve problems.
--	---

Specific Learning 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.*

8.SS.4. Develop and apply formulas for determining the volume of right prisms and right cylinders. [C, CN, PS, R, V]	<ul style="list-style-type: none">■ Determine the volume of a right prism, given the area of the base.■ Generalize and apply a rule for determining the volume of right cylinders.■ Explain the relationship between the area of the base of a right 3-D object and the formula for the volume of the object.■ Demonstrate that the orientation of a 3-D object does not affect its volume.■ Apply a formula to solve a problem involving the volume of a right cylinder or a right prism.
---	--

Grade 8

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
---	--

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

8.SS.5. Draw and interpret top, front, and side views of 3-D objects composed of right rectangular prisms.
[C, CN, R, T, V]

- Draw and label the top, front, and side views for a 3-D object on isometric dot paper.
- Compare different views of a 3-D object to the object.
- Predict the top, front, and side views that will result from a described rotation (limited to multiples of 90°) and verify predictions.
- Draw and label the top, front, and side views that result from a rotation (limited to multiples of 90°).
- Build a 3-D block object, given the top, front, and side views, with or without the use of technology.
- Sketch and label the top, front, and side views of a 3-D object in the environment, with or without the use of technology.

Grade 8

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

Strand: Shape and Space (Transformations)	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
---	---

Specific Learning 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.*

- 8.SS.6. Demonstrate an understanding of tessellation by
- explaining the properties of shapes that make tessellating possible
 - creating tessellations
 - identifying tessellations in the environment
- [C, CN, PS, T, V]

- Identify in a set of regular polygons those shapes and combinations of shapes that will tessellate, and use angle measurements to justify choices.
- Identify in a set of irregular polygons those shapes and combinations of shapes that will tessellate, and use angle measurements to justify choices.
- Identify a translation, reflection, or rotation in a tessellation.
- Identify a combination of transformations in a tessellation.
- Create a tessellation using one or more 2-D shapes, and describe the tessellation in terms of transformations and conservation of area.
- Create a new tessellating shape (polygon or non-polygon) by transforming a portion of a tessellating polygon, and describe the resulting tessellation in terms of transformations and conservation of area.
- Identify and describe tessellations in the environment.

Grade 8

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

Strand: Statistics and Probability (Data Analysis)	General Learning Outcome: Collect, display, and analyze data to solve problems.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
--	---

8.SP.1. Critique ways in which data are presented. [C, R, T, V]	<ul style="list-style-type: none">■ Compare the information that is provided for the same data set by a set of graphs, such as circle graphs, line graphs, bar graphs, double bar graphs, or pictographs, to determine the strengths and limitations of each graph.■ Identify the advantages and disadvantages of different graphs, such as circle graphs, line graphs, bar graphs, double bar graphs, or pictographs, in representing a specific set of data.■ Justify the choice of a graphical representation for a situation and its corresponding data set.■ Explain how a formatting choice, such as the size of the intervals, the width of bars, or the visual representation, may lead to misinterpretation of the data.■ Identify conclusions that are inconsistent with a data set or graph, and explain the misinterpretation.
--	--

Grade 8

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

Strand: Statistics and Probability (Chance and Uncertainty)	General Learning Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.
--	---

Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
8.SP.2. Solve problems involving the probability of independent events. [C, CN, PS, T]	<ul style="list-style-type: none">■ Determine the probability of two independent events and verify the probability using a different strategy.■ Generalize and apply a rule for determining the probability of independent events.■ Solve a problem that involves determining the probability of independent events.

REFERENCES

- Alberta Education. *The Alberta K–9 Mathematics: Program of Studies with Achievement Indicators*. Edmonton, AB: Alberta Education, 2007. Available online at <http://education.alberta.ca/media/645598/kto9math_ind.pdf>
- American Association for the Advancement of Science [AAAS-Benchmarks]. *Benchmark for Science Literacy*. New York, NY: Oxford University Press, 1993.
- Anderson, A.G. "Parents as Partners: Supporting Children's Mathematics Learning Prior to School." *Teaching Children Mathematics* 4.6 (February 1998): 331–337.
- Armstrong, Thomas. *Seven Kinds of Smart: Identifying and Developing Your Many Intelligences*. New York, NY: NAL-Dutton, 1993.
- Ashlock, R. "Diagnosing Error Patterns in Computation." *Error Patterns in Computation*. Columbus, OH: Prentice Hall, 1998. 9–42.
- Banks, J.A., and C.A.M. Banks. *Multicultural Education: Issues and Perspectives*. Boston, MA: Allyn and Bacon, 1993.
- Battista, Michael T. *Cognition-Based Assessment and Teaching of Addition and Subtraction: Building on Students' Reasoning*. Portsmouth, NH: Heinemann, 2012.
- Becker, J.P., and S. Shimada. *The Open-Ended Approach: A New Proposal for Teaching Mathematics*. Reston, VA: National Council of Teachers of Mathematics, 1997.
- Ben-Chaim, D., et al. "Adolescents Ability to Communicate Spatial Information: Analyzing and Effecting Students' Performance." *Educational Studies Mathematics* 20.2 (May 1989): 121–146.
- Borasi, R. *Learning Mathematics through Inquiry*. Portsmouth, NH: Heinmann, 1992.
- Borsari, R. *Reconceiving Mathematics Instruction: A Focus on Errors*. Norwood, NJ: Ablex, 1996.
- Bright, George W., Wallece Brewer, Kay McClain, and Edward S. Mooney. *Navigating through Data Analysis in Grades 6–8*. Reston, VA: National Council of Teachers of Mathematics, 2003.
- British Columbia Ministry of Education. *The Primary Program: A Framework for Teaching*, Victoria, BC: British Columbia Ministry of Education, 2000.
- Burke, M.J., and F.R. Curcio. *Learning Mathematics for a New Century* (2000 yearbook). Reston, VA: National Council of Teachers of Mathematics, 2000.
- Burke, M., D. Erickson, J. Lott, and M. Obert. *Navigating through Algebra in Grades 9–12*. Reston, VA: National Council of Teachers of Mathematics, 2001.

- Burns, Marilyn. *About Teaching Mathematics: A K-8 Resource*. 2nd ed. Sausalito, CA: Math Solutions Publications, 2000.
- Buschman, Larry. "Using Student Interviews to Guide Classroom Instruction: An Action Research Project." *Teaching Children Mathematics* (December 2001): 222-227.
- Caine, Renate Numella, and Geoffrey Caine. *Making Connections: Teaching and the Human Brain*. Menlo Park, CA: Addison-Wesley Publishing Company, 1991.
- Chambers, D.L., ed. *Putting Research into Practice in the Elementary Grades*. Reston, VA: National Council of Teachers of Mathematics, 2002.
- Chapin, Suzanne, Alice Koziol, Jennifer MacPherson, and Carol Rezba. *Navigating through Data Analysis and Probability in Grades 3-5*. Reston VA: National Council of Teachers of Mathematics, 2003.
- Charles, Randall, and Joanne Lobato. *Future Basics: Developing Numerical Power, a Monograph of the National Council of Supervisors of Mathematics*. Golden, CO: National Council of Supervisors of Mathematics, 1998.
- Clements, D.H. "Geometric and Spatial Thinking in Young Children." *Mathematics in the Early Years*. Ed. J. Copley. Reston, VA: National Council of Teachers of Mathematics, 1999. 66-79.
- . "Subitizing: What is it? Why teach it?" *Teaching Children Mathematics* (March 1999): 400-405.
- Colan, L., and J. Pegis. *Elementary Mathematics in Canada: Research Summary and Classroom Implications*. Toronto, ON: Pearson Education Canada, 2003.
- Confrey, J. "A Review of the Research on Student Conceptions in Mathematics, Science and Programming." *Review of Research in Education* 16. Ed. C. Cadzen. Washington, DC: American Educational Research Association, 1990. 3-56.
- Cuevas, G., and K. Yeatt. *Navigating through Algebra in Grades 3-5*. Reston VA: National Council of Teachers of Mathematics, 2001.
- Dacey, Linda, Mary Cavanagh, Carol R. Findell, Carole E. Greenes, Linda Jensen Sheffield, and Marion Small. *Navigating through Measurement in Prekindergarten - Grade 2*. Reston, VA: National Council of Teachers of Mathematics, 2003.
- Davis, R.B., and C.M. Maher. "What Do We Do When We 'Do Mathematics'?" *Constructivist Views on the Teaching and Learning of Mathematics*. Reston, VA: The National Council of the Teachers of Mathematics, 1990. 195-210.
- Day, Roger, Paul Kelley, Libby Krussel, Johnny Wilott, and James Hirstein. *Navigating through Geometry in Grades 9-12*. Reston VA: National Council of Teachers of Mathematics, 2002.

- Egan, K. *The Educated Mind: How Cognitive Tools Shape our Understanding*. Chicago, IL: University of Chicago Press, 1997.
- Fennell, F., and T. E. Landis. "Number Sense and Operations Sense." *Windows of Opportunity: Mathematics for Students with Special Needs*. Eds. C. A. Thornton and N. S. Blay. Reston, VA: National Council of Teachers of Mathematics, 1994. 187–203.
- Findell, C., M. Small, M. Cavanagh, L. Dacey, C. Greenes, and L. Sheffield. *Navigating through Geometry in Prekindergarten – Grade 2*. Reston, VA: National Council of Teachers of Mathematics, 2001.
- Friel, S., S. Rachlin, and D. Doyle. *Navigating through Algebra in Grades 6–8*. Reston, VA: National Council of Teachers of Mathematics, 2001.
- Fuys, D., D. Geddes, and R. Tischler. *The van Hiele Model of Thinking in Geometry among Adolescents*. Reston, VA: National Council of Teachers of Mathematics, 1998.
- Gattegno, C. *The Common Sense of Teaching Mathematics*. New York, NY: Educational Solutions, 1974.
- Gavin, M., Belkin, A. Spinelli, and J. St. Marie. *Navigating through Geometry in Grades 3–5*. Reston, VA: National Council of Teachers of Mathematics, 2001.
- Gay, S., and M. Thomas. "Just Because They Got It Right, Does it Mean They Know It?" *Assessment in the Mathematics Classroom*. Ed. N.L. Webb. Reston, VA: National Council of Teachers of Mathematics, 1993. 130–134.
- Ginsburg, H.P., L.S. Lopez Choi, R. Netley, and C. Chao-Yuan. "Happy Birthday to You: Early Mathematical Thinking of Asian, South American, and U.S. Children." *Learning and Teaching Mathematics: An International Perspective*. Eds. T. Nunes and P. Bryant. Hove, East Sussex: Psychology Press, 1997. 163–207.
- Greenes, C.M., M. Cavanagh, L. Dacey, C. Findell, and M. Small. *Navigating through Algebra in Prekindergarten – Grade 2*. Reston, VA: National Council of Teachers of Mathematics, 2001.
- Greeno, J. "Number sense as a situated knowing in a conceptual domain." *Journal for Research in Mathematics Education* 22.3 (1991): 170–218.
- Griffin, S. "Teaching Number Sense." *ASCD Educational Leadership* (February 2004): 39–42.
- Haylock, Derek, and Anne Cockburn. *Understanding Mathematics in the Lower Primary Years*. Thousand Oaks, CA: SAGE Publications Inc., 2003.
- Heaton, R.M. *Teaching Mathematics to the New Standards: Relearning the Dance*. New York, NY: Teachers College Press, 2001.

- Hope, Jack A., Larry Leutzinger, Barbara J. Reys, and Robert E. Reys. *Mental Math in the Primary Grades*. New York, NY: Dale Seymour Publications, 1988.
- Hopkins, Ros, ed. *Early Numeracy in the Classroom*. Melbourne, AU: State of Victoria, 2001.
- Howden, H. "Teaching Number Sense." *Arithmetic Teacher* 36.6 (1989): 6–11.
- Howe, R. "Knowing and Teaching Elementary Mathematics." *Journal of Research in Mathematics Education* 30.5 (1999): 556–558.
- Hunting, R.P. "Clinical Interview Methods in Mathematics Education Research and Practice." *Journal of Mathematical Behavior* 16.2 (1997): 145–165.
- Kamii, C. *Multidigit Division – Two Teachers Using Piaget’s Theory*. Colchester, VT: Teachers College Press, 1990.
- Kamii, C., and A. Dominick. "To Teach or Not to Teach Algorithms." *Journal of Mathematical Behavior* 16.1 (1997): 51–61.
- Kelly, A.G. "Why Can’t I See the Tree? A Study of Perspective." *Teaching Children Mathematics* 9.3 (October 2002): 158–161.
- Kersaint, G. "Raking Leaves – The Thinking of Students." *Mathematics Teaching in the Middle School* 9.3 (November 2002): 158–161.
- Kilpatrick, J., J. Swafford, and B. Findell, eds. *Adding it Up: Helping Children Learn Mathematics*. Washington, DC: National Academy Press, 2001.
- Kilpatrick, J., W.G. Martin, and D. Schifter, eds. *A Research Companion to Principles and Standards for School Mathematics*, Reston, VA: National Council of Teachers of Mathematics, 2003.
- King, J. *The Art of Mathematics*. New York, NY: Fawcett Columbine, 1992.
- Lakoff, G., and R.E. Nunez. *Where Mathematics Comes From – How the Embodied Mind Brings Mathematics into Being*. New York, NY: Basic Books, 2000.
- Lampert, M. *Teaching Problems and the Problems of Teaching*. New Haven, CT: Yale University Press, 2001.
- Ma, L. *Knowing and Teaching Elementary Mathematics: Teachers’ Understanding of Fundamental Mathematics in China and the United States*. Mahwah, NJ: Lawrence Erlbaum, 1999.
- Mann, R. *Balancing Act: The Truth behind the Equals Sign*. *Teaching Children Mathematics* (September 2004): 65–69.
- Martine, S.L., and J. Bay-Williams. "Investigating Students’ Conceptual Understanding of Decimal Fractions." *Mathematics Teaching in the Middle School* 8.5 (January 2003): 244–247.

- McAskill, Bruce, Glen Holmes, Leslee Francis-Pelton, and Wayne Watt. *WNCP Mathematics Research Project: Final Report*. Victoria, BC: Holdfast Consultants Inc., 2004.
- McAskill, B., G. Holmes, and L. Francis-Pelton. *Consultation Draft for the Common Curriculum Framework Kindergarten to Grade 9 Mathematics*. Victoria, BC: Holdfast Consultants Inc., 2005.
- Moran, G.J.W. *Identifying the van Hiele Levels of Geometry Thinking in Seventh-Grade Students through the Use of Journal Writing*. Diss. University of Massachusetts, Abstracts International 54.02 (1993): 464A.
- National Council of Teachers of Mathematics. *Computation, Calculators, and Common Sense*. Reston, VA: National Council of Teachers of Mathematics, May 2005.
- . *Problem Solving*. 2012. <www.nctm.org/standards/content.aspx?id=26860>. (26 Nov. 2012).
- . *The Teaching and Learning of Algorithms in School Mathematics, 1998 Yearbook*. Lorna J. Morrow (1998 Yearbook Ed.) and Margaret J. Kenney (General Yearbook Ed.). Reston, VA: National Council of Teachers of Mathematics, 1998.
- National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO). *Common Core Standards Initiative. Common Core State Standards for Mathematics*. United States: NGA Center and CCSSO, 2010. Available online at <www.corestandards.org/assets/CCSSI_Math%20Standards.pdf>.
- National Research Council. *Adding It Up: Helping Children Learn Mathematics*. Jeremy Kilpatrick, Jane Swafford, and Bradford Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral Sciences and Education. Washington, DC: National Academy Press, 2001.
- Nelson-Thomson. *Mathematics Education: A Summary of Research, Theories, and Practice*. Scarborough, ON: Nelson, 2002.
- OECD (Organisation for Economic Co-operation and Development). *PISA 2012 Field Trial Problem Solving Framework*. September 30, 2012. <www.oecd.org/pisa/pisaproducts/46962005.pdf>.
- Ontario. Ministry of Education. *The Ontario Curriculum Grades 1–8: Mathematics*. Ontario: Ministry of Education, 2005. Available online at <www.edu.gov.on.ca/eng/curriculum/elementary/math18curr.pdf>.
- Pape, S.J., and M.A. Tchshanov. “The Role of Representation(s) in Developing Mathematical Understanding.” *Theory into Practice* 40.2 (Spring 2001): 118–127.
- Paulos, J. *Innumeracy: Mathematical Illiteracy and its Consequences*. New York, NY: Vintage Books, 1998.

- Peck, D., S. Jencks, and M. Connell. "Improving Instruction through Brief Interviews." *Arithmetic Teacher*, 37.3 (1989): 15-17.
- Pepper, K.L., and R.P. Hunting. "Preschoolers' Counting and Sharing." *Journal for Research in Mathematics Education* 28.2 (March 1998): 164-183.
- Peressini D., and J. Bassett. "Mathematical Communication in Students' Responses to a Performance-Assessment Task." *Communication in Mathematics K-12 and Beyond*. Ed. P.C. Elliot. Reston, VA: National Council of Teachers of Mathematics, 1996. 146-158.
- Perry, J.A., and S.L. Atkins. "It's Not Just Notation: Valuing Children's Representations." *Teaching Children Mathematics*. 9.1 (September 2002): 196-201.
- Prince Edward Island. Department of Education. *Mental Math: Fact Learning, Mental Computation, Estimation – Grade 3 Teacher's Guide*. Charlottetown, PE: Prince Edward Island Department of Education, 2008. Available online at <www.gov.pe.ca/photos/original/eecd_gr3math.pdf>.
- Pugalee, D., J. Frykholm, A. Johnson, M. Slovin, C. Malloy, and R. Preston. *Navigating Through Geometry in Grades 6-8*. Reston, VA: National Council of Teachers of Mathematics, 2002.
- Québec. Ministère de l'Éducation. *Québec Education Program: Preschool Education, Elementary Education*. Quebec: Government of Quebec, 2001. Available online at <www.mels.gouv.qc.ca/DGFJ/dp/programme_de_formation/primaire/educprg2001h.htm>.
- Rigby-Heinemann. *First Steps in Mathematics: Number*. Sydney, AU: Rigby-Heinemann, 2004.
- Robitaille, D., G. Orpwood, and A. Taylor. *The TIMSS-Canada Report, Vol. 2-G4*. Vancouver, BC: Dept. of CUST - UBC, 1997.
- Romagnano, L. *Wrestling with Change - The Dilemmas of Teaching Mathematics*. Portsmouth, NH: Heinemann, 1994.
- Rubenstein, Rheta N. *Mental Mathematics beyond the Middle School: Why? What? How?* 94.6 (September 2001): 442.
- Sakshaug, L., M. Olson, and J. Olson. *How much film? Children are mathematical problem solvers*. Reston, VA: National Council of Teachers of Mathematics, 2002. 17-20.
- Sawyer, W.W. *Mathematician's Delight*. New York, NY: Penguin Books, 1943. Cited in Moran, G.J.W., 1993.
- Seymour, Dale. *Mental Math in the Primary Grades*. Palo Alto, CA: Dale Seymour Publications, 1998.

- Shaw, J.M., and M.F.P. Cliatt. "Developing Measurement Sense." *New Directions for Elementary School Mathematics*. Ed. P.R. Trafton. Reston, VA: National Council of Teachers of Mathematics, 1989. 149–155.
- Sheffield, Linda Jensen, Mary Cavanagh, Linda Darcey, Carol R. Findell, Carol Greenes, and Marion Small. *Navigating through Data Analysis and Probability in Prekindergarten – Grade 2*. Reston, VA: National Council of Teachers of Mathematics, 2002.
- Singapore. Ministry of Education. Curriculum Planning and Development Division. *Mathematics Syllabus: Primary*. Singapore: Ministry of Education, 2006. Available online at <www.moe.gov.sg/education/syllabuses/sciences/files/maths-primary-2007.pdf>.
- Small, M. *PRIME: Patterns and Algebra*. Toronto, ON: Nelson Publishing, 2005.
- . *PRIME: Number and Operations*. Toronto, ON: Nelson Publishing, 2005.
- Solomon, Pearl Gold. *The Math We Need to "Know" and "Do."* Thousand Oaks, CA: Sage Publications, 2001.
- Steen, L.A., ed. *On the Shoulders of Giants – New Approaches to Numeracy*. Washington, DC: National Research Council, 1990.
- Stiff, Lee. "Constructivist Mathematics and Unicorns (President's Message)." *NCTM News Bulletin* July/August 2001: 3.
- Swarthout, M. "Average Days of Spring – Problem Solvers." *Teaching Children Mathematics* 8.7 (March 2002): 404–406.
- Tang, E.P., and H.P. Ginsburg. "Young Children's Mathematical Reasoning – A Psychological View." *Developing Mathematical Reasoning in Grades K–12*. Eds. L. Stiff and F. Curcio. Reston, VA: National Council of Teachers of Mathematics, 1999. 45–61.
- Teppo, Anne R. *Reflecting on NCTM's Principles and Standards in Elementary and Middle School Mathematics*. Preston, VA: National Council of Teachers of Mathematics, 2002.
- Van de Walle, John A. *Elementary and Middle School Mathematics: Teaching Developmentally*. 5th ed. Boston, MA: Pearson Education, Inc., 2004.
- Van de Walle, John A., Sandra Folk, Karen S. Karp, and Jennifer M. Bay-Williams. *Elementary and Middle School Mathematics: Teaching Developmentally*. 3rd Can. ed. Toronto, ON: Pearson Canada Inc., 2011.
- Van den Heuvel-Panhuizen, M., and Gravemejer. "Tests Aren't All Bad – An Attempt to Change the Face of Written Tests in Primary School Mathematics Instruction." *Realistic Mathematics Education in Primary School: On the Occasion of the Opening of the Freudenthal Institute*. Ed. L. Streefland. Utrecht, Netherlands: CD-B Press, 1991. 54–64.
- Van Hiele, P.M. *Structure and Insight: A Theory of Mathematics Education*. Orlando, FL: Academic Press, 1986.

Vygotsky, L.S. *Thought and Language*. Cambridge, MA: MIT Press, 1986.

———. *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press, 1978.

Western and Northern Protocol (WNCP). *The Common Curriculum Framework for K–9 Mathematics*. Alberta, British Columbia, Manitoba, Northwest Territories, Nunavut Territory, Saskatchewan, and Yukon Territory: Ministries of Education of Alberta, British Columbia, Manitoba, Northwest Territories, Nunavut, Saskatchewan, and the Yukon Territory, 2006.

Willoughby, Steven. *Mathematics Education for a Changing World*. Alexandria, VA: Association of Supervision and Curriculum Development, 1990.

Wright, R.J. Martland, A.K. Stafford, and G. Stanger. *Teaching Number*, London, UK: Paul Chapman, 2002.



Printed in Canada
Imprimé au Canada