MATHEMATICS K TO 7

Integrated Resource Package 2007

Many people contributed their expertise to this document. The Project Co-ordinator was Mr. Richard DeMerchant of the Ministry of Education, working with other ministry personnel and our partners in education. We would like to thank all who participated in this process with a special thank you to Western and Northern Canadian Protocol (WNCP) partners in education for creation of the WNCP Common Curriculum Framework (CCF) for Kindergarten to Grade 9 Mathematics from which this IRP is based.

MATHEMATICS K TO 7 IRP DEVELOPMENT TEAM

Lori Boychuk	School District No. 91 (Nechako Lakes)
Rosamar Garcia	School District No. 38 (Richmond)
Glen Gough	School District No. 81 (Fort Nelson)
Linda Jensen	School District No. 35 (Langley)
Carollee Norris	School District No. 60 (Peace River North)
Barb Wagner	School District No. 60 (Peace River North)
Joan Wilson	School District No. 46 (Sunshine Coast)
Donna Wong	School District No. 36 (Surrey)

MATHEMATICS K TO 7 IRP DEVELOPMENT TEAM SUPPORT PROVIDED BY

Liliane Gauthier	Saskatchewan Learning
Pamela Hagen	School District 43 (Coquitlam), University of British Columbia
Jack Kinakin	School District 20 (Kootney-Columbia)
Heather Morin	British Columbia Ministry of Education
Janice Novakowski	School District 38 (Richmond), University of British Columbia
GT Publishing Services Ltd.	Project co-ordination, writing, and editing

This Integrated Resource Package (IRP) provides basic information teachers will require in order to implement Mathematics K to 7. Once fully implemented, this document will supersede Mathematics K to 7 (1995).

> The information contained in this document is also available on the Internet at www.bced.gov.bc.ca/irp/irp.htm

The following paragraphs provide brief descriptions of the components of the IRP.

INTRODUCTION

The Introduction provides general information about Mathematics K to 7, including special features and requirements.

Included in this section are
- a rationale for teaching Mathematics K to 7 in BC schools
- goals for Mathematics K to 7
- descriptions of the curriculum organizers – groupings for prescribed learning outcomes that share a common focus
- a suggested timeframe for each grade
- a graphic overview of the curriculum content from K to 7
- additional information that sets the context for teaching Mathematics K to 7

CONSIDERATIONS FOR PROGRAM DELIVERY

This section of the IRP contains additional information to help educators develop their school practices and plan their program delivery to meet the needs of all learners.

PRESCRIBED LEARNING OUTCOMES

This section contains the *prescribed learning outcomes.* Prescribed learning outcomes are the legally required content standards for the provincial education system. They define the required attitudes, skills, and knowledge for each subject. The learning outcomes are statements of what students are expected to know and be able to do by the end of the grade.

The prescribed learning outcomes for the Mathematics K to 7 IRP are based on the Learning Outcomes contained within the Western and Northern Canadian Protocol (WNCP) Common Curriculum Framework (CCF) for K to 9 Mathematics available at www.wncp.ca.

STUDENT ACHIEVEMENT

This section of the IRP contains information about classroom assessment and measuring student achievement, including sets of specific achievement indicators for each prescribed learning outcome. Achievement indicators are statements that describe what students should be able to do in order to demonstrate that they fully meet the expectations set out by the prescribed learning outcomes. Achievement indicators are not mandatory; they are provided to assist teachers in assessing how well their students achieve the prescribed learning outcomes.

The achievement indicators for the Mathematics K to 7 IRP are based on the achievement indicators contained within the WNCP Common Curriculum Framework for K to 9 Mathematics.

> The WNCP CCF for K to 9 Mathematics is available online at www.wncp.ca

Also included in this section are key elements – descriptions of content that help determine the intended depth and breadth of prescribed learning outcomes.

CLASSROOM ASSESSMENT MODEL

This section contains a series of classroom units that address the learning outcomes. The units have been developed by BC teachers, and are provided to support classroom assessment. These units are suggestions only – teachers may use or modify the units to assist them as they plan for the implementation of this curriculum.

Each unit includes the prescribed learning outcomes and suggested achievement indicators, a suggested timeframe, a sequence of suggested assessment activities, and sample assessment instruments.

LEARNING RESOURCES

This section contains general information on learning resources, providing a link to titles, descriptions, and ordering information for the recommended learning resources in the Mathematics K to 7 Grade Collections. [*Note: Grade Collections for Mathematics K to 7 will be updated as new resources matching the IRP are authorized.*]

GLOSSARY

The glossary section provides a link to an online glossary that contains definitions for selected terms used in this Integrated Resource Package

INTRODUCTION
Mathematics K to 7

This Integrated Resource Package (IRP) sets out the provincially prescribed curriculum for Mathematics K to 7. The development of this IRP has been guided by the principles of learning:

- Learning requires the active participation of the student.
- People learn in a variety of ways and at different rates.
- Learning is both an individual and a group process.

In addition to these three principles, this document recognizes that British Columbia's schools include young people of varied backgrounds, interests, abilities, and needs. Wherever appropriate for this curriculum, ways to meet these needs and to ensure equity and access for all learners have been integrated as much as possible into the learning outcomes and achievement indicators.

The Mathematics K to 7 IRP is based on the Western and Northern Canadian Protocol (WNCP) Common Curriculum Framework (CCF) for Kindergarten to Grade 9 Mathematics (May 2006). A complete list of references used to inform the revisions of the WNCP CCF for K to 9 Mathematics as well as this IRP can be found at the end of this section of the IRP.

Mathematics K to 7, in draft form, was available for public review and response from September to November, 2006. Input from educators, students, parents, and other educational partners informed the development of this document.

RATIONALE

The aim of Mathematics K to 7 is to provide students with the opportunity to further their knowledge, skills, and attitudes related to mathematics.

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.

Numeracy can be defined as the combination of mathematical knowledge, problem solving and communication skills required by all persons to function successfully within our technological world. Numeracy is more than knowing about numbers and number operations. (British Columbia Association of Mathematics Teachers 1998)

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 a variety of manipulatives and 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. Information gathered from these discussions can be used for formative assessment to guide instruction.

As facilitators of learning educators are encouraged to highlight mathematics concepts as they occur within the K to 7 school environment and within home environments. Mathematics concepts are present within every school's subjects and drawing students' attention to these concepts as they occur can help to provide the "teachable moment."

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. Positive learning experiences build self-confidence and develop attitudes that value learning mathematics.

ABORIGINAL PERSPECTIVE

Aboriginal students in British Columbia come from diverse geographic areas with varied cultural and linguistic backgrounds. Students attend schools in a variety of settings including urban, rural, and isolated communities. Teachers need to understand the diversity of cultures and experiences of students.

Aboriginal 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. Depending on their learning styles, students may look for connections in learning and learn best when mathematics is contextualized and not taught as discrete components.

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 1993).*

AFFECTIVE DOMAIN

Bloom's taxonomy of learning behaviours identified three domains of educational activities, affective (growth in feelings or emotional areas – attitude), cognitive (mental skills – knowledge), and psychomotor (manual or physical skills – skills). The affective domain involves the way in which we perceive and respond to things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

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. Research has shown that students who are more engaged with school and with mathematics are far more likely to be successful in school and in learning mathematics. (Nardi & Steward 2003). 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.

Substantial progress has been made in research in the last decade that has examined the importance and use of the affective domain as part of the learning process. In addition there has been a parallel increase in specific research involving the affective domain and its' relationship to the learning of mathematics which has provided powerful evidence of the importance of this area to the learning of mathematics (McLeod 1988, 1992 & 1994; Hannula 2002 & 2006; Malmivuori 2001 & 2006). 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.

Students who are feeling more comfortable with a subject, demonstrate more confidence and have the opportunity for greater academic achievement (Denton & McKinney 2004; Hannula 2006; Smith et al. 1998). Educators can include opportunities for active and co-operative learning in their mathematics lessons which has been shown in research to promote greater conceptual understanding, more positive attitudes and subsequently improved academic achievement from students (Denton & McKinney 2004). By allowing the sharing and discussion of answers and strategies used in mathematics, educators are providing rich opportunities for students mathematical development. Educators can foster greater conceptual understanding in students by having students practice certain topics and concepts in mathematics in a meaningful and engaging manner.

It is important for educators, students, and parents 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 and success in learning.

NATURE OF MATHEMATICS

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

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

(Steen 1990, p. 184).

Constancy

Different aspects of constancy are described by the terms stability, conservation, equilibrium, steady state and symmetry (AAAS–Benchmarks 1993, p. 270). Many important properties in mathematics and science relate to properties that do not change when outside conditions change. Examples of constancy include:
- 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.

Number Sense

Number sense, which can be thought of as intuition about numbers, is the most important foundation of numeracy (The Primary Program 2000, p. 146).

A true sense of number goes well beyond the skills of simply counting, memorizing facts and the situational rote use of algorithms.

Number sense develops when students connect numbers to real-life experiences, and use benchmarks and referents. This results in students who are computationally fluent, flexible with numbers and have intuition about numbers. The evolving number sense typically comes as a by-product of learning rather than through direct instruction. However, 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 that 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 relationships among numbers, sets, shapes, objects and concepts. The search for possible relationships involves the collection and analysis of data, and describing relationships visually, symbolically, orally or in written form.

Spatial Sense

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

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.

GOALS FOR MATHEMATICS K TO 7

Mathematics K to 7 represents the first formal steps that students make towards becoming life-long learners of mathematics.

GOALS FOR MATHEMATICS K TO 7

The Mathematics K-7 curriculum is meant to start students toward achieving the main goals of mathematics education:

- using mathematics confidently to solve problems
- using mathematics to better understand the world around us
- communicating and reasoning mathematically
- appreciating and valuing mathematics
- making connections between mathematics and its applications
- committing themselves to lifelong learning
- becoming mathematically literate and using mathematics to participate in, and contribute to, society

Students who have met these goals will

- gain understanding and appreciation of the contributions of mathematics as a science, philosophy and art
- be able to use mathematics to make and justify decisions about the world around us
- 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

CURRICULUM ORGANIZERS

A curriculum organizer consists of a set of prescribed learning outcomes that share a common focus. The prescribed learning outcomes for Mathematics K to 7 progress in age-appropriate ways, and are grouped under the following curriculum organizers and suborganizers:

Curriculum Organizers and Suborganizers
MATHEMATICS K-7
NUMBER
PATTERNS AND RELATIONS • Patterns • Variables and Equations
SHAPE AND SPACE • Measurement • 3-D Objects and 2-D Shapes • Transformations
STATISTICS AND PROBABILITY • Data Analysis • Chance and Uncertainty

These curriculum organizers reflect the main areas of mathematics that students are expected to address. The ordering of organizers, suborganizers, and outcomes in the Mathematics K to 7 curriculum does not imply an order of instruction. The order in which various topics are addressed is left to the professional judgment of teachers. Mathematics teachers are encouraged to integrate topics throughout the curriculum and within other subject areas to emphasize the connections between mathematics concepts.

Number

Students develop their concept of the number system and relationships between numbers. Concrete, pictorial and symbolic representations are used to help students develop their number sense. Computational fluency, the ability to connect understanding of the concepts with accurate, efficient and flexible computation strategies for multiple purposes, is stressed throughout the number organizer with an emphasis on the development of personal strategies, mental mathematics and estimation strategies.

The Number organizer does not contain any suborganizers.

Patterns and Relations

Students develop their ability to recognize, extend, create, and use numerical and non- numerical patterns to better understand the world around them as well as the world of mathematics. This organizer provides opportunities for students to look for relationships in the environment and to describe the relationships. These relationships should be examined in multiple sensory forms.

The Patterns and Relations organizer includes the following suborganizers:
• Patterns
• Variables and Equations

Shape and Space

Students develop their understanding of objects and shapes in the environment around them. This includes recognition of attributes that can be measured, measurement of these attributes, description of these attributes, the identification and use of referents, and positional change of 3-D objects and 2-D shapes on the environment and on the Cartesian plane.

The Shape and Space organizer includes the following suborganizers:
• Measurement
• 3-D Objects and 2-D Shapes
• Transformations

Statistics and Probability

Students collect, interpret and present data sets in relevant contexts to make decisions. The development of the concepts involving probability is also presented as a means to make decisions. The Shape and Space organizer includes the following suborganizers:
• Data Analysis
• Chance and Uncertainty

KEY CONCEPTS: OVERVIEW OF MATHEMATICS K TO 7 TOPICS

	Kindergarten	Grade 1	Grade 2	Grade 3
NUMBER	• number sequence to 10 • familiar number arrangements up to 5 objects • one-to-one correspondence • numbers in-depth to 10	• skip counting starting at 0 to 100 • arrangements up to 10 objects • numbers in-depth to 20 • addition & subtraction to 20 • mental math strategies to 18	• skip counting at starting points other than 0 to 100 • numbers in-depth to 100 • even, odd & ordinal numbers • addition & subtraction to 100 • mental math strategies to 18	• skip counting at starting points other than 0 to 1000 • numbers in-depth to 1000 • addition & subtraction to 1000 • mental math strategies for 2-digit numerals • multiplication up to 5 × 5 • representation of fractions
PATTERNS & RELATIONS *Patterns*	• repeating patterns of two or three elements	• repeating patterns of two to four elements • representation of pattern	• repeating patterns of three to five elements • increasing patterns	• increasing patterns • decreasing patterns
PATTERNS & RELATIONS *Variables & Equations*		• equalities & inequalities • symbol for equality	• equality & inequality • symbols for equality & inequality	• one-step addition and subtraction equations
SHAPE & SPACE *Measurement*	• direct comparison for length, mass & volume	• process of measurement using comparison	• days, weeks, months, & years • non-standard units of measure for length, height distance around, mass (weight)	• non-standard & standard units of time • measurements of length (cm, m) & mass (g, kg) • perimeter of regular & irregular shapes
SHAPE & SPACE *3-D Objects & 2-D Shapes*	• single attribute of 3-D objects	• one attribute of 3-D objects & 2-D shapes • composite 2-D shapes & 3-D objects • 2-D shapes in the environment	• two attributes of 3-D objects & 2-D shapes • cubes, spheres, cones, cylinders, pyramids • triangles, squares, rectangles, circles • 2-D shapes in the environment	• faces, edges & vertices of 3-D objects • triangles, quadrilaterals, pentagons, hexagons, octagons
SHAPE & SPACE *Transformations*				
STATISTICS & PROBABILITY *Data Analysis*			• data about self and others • concrete graphs and pictographs	• first-hand data • bar graphs
STATISTICS & PROBABILITY *Chance & Uncertainty*				

KEY CONCEPTS: OVERVIEW OF MATHEMATICS K TO 7 TOPICS *(continued)*

Grade 4	Grade 5	Grade 6	Grade 7
• numbers in-depth to 10 000 • addition & subtraction to 10 000 • multiplication & division of numbers • fractions less than or equal to one • decimals to hundredths	• numbers in-depth to 1 000 000 • estimation strategies for calculations & problem solving • mental mathematics strategies for multiplication facts to 81 & corresponding division facts • mental mathematics for multiplication • multiplication for 2-digit by 2-digit & division for 3-digit by 1-digit • decimal & fraction comparison • addition & subtraction of decimals	• numbers in-depth greater than 1 000 000 & smaller than one thousandth • factors & multiples • improper fractions & mixed numbers • ratio & whole number percent • integers • multiplication & division of decimals • order of operations excluding exponents	• divisibility rules • addition, subtraction, multiplication, & division of numbers • percents from 1% to 100% • decimal & fraction relationships for repeating & terminating decimals • addition & subtraction of positive fractions & mixed numbers • addition & subtraction of integers
• patterns in tables & charts	• prediction using a pattern rule	• patterns & relationships in graphs & tables including tables of value	• table of values & graphs of linear relations
• symbols to represent unknowns • one-step equations	• single-variable, one-step equations with whole number coefficients & solutions	• letter variable representation of number relationships • preservation of equality	• preservation of equality • expressions & equations • one-step linear equations
• digital clocks, analog clocks, & calendar dates • area of regular & irregular 2-D shapes	• perimeter & area of rectangles • length, volume, & capacity	• perimeter & area of rectangles • length, volume, & capacity	• properties of circles • area of triangles, parallelograms, & circles
• rectangular & triangular prisms	• parallel, intersecting, perpendicular, vertical & horizontal edges & faces • rectangles, squares, trapezoids, parallelograms & rhombuses	• types of triangles • regular & irregular polygons	• geometric constructions
• line symmetry	• 2-D shape single transformation	• combinations of transformations • single transformation in the first quadrant of the Cartesian plane	• four quadrants of the Cartesian plane • transformations in the four quadrants of the Cartesian plane
• many-to-one correspondence including bar graphs & pictographs	• first-hand & second-hand data • double bar graphs	• line graphs • methods of data collection • graph data	• central tendency, outliers & range • circle graphs
	• likelihood of a single outcome	• experimental & theoretical probability	• ratios, fractions, & percents to express probabilities • two independent events • tree diagrams for two independent events

MATHEMATICAL PROCESSES

There are critical components that students must encounter in a mathematics program in order to achieve 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 following seven mathematical processes should be integrated within Mathematics K to 7.

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.

Communication is important in clarifying, reinforcing, and modifying ideas, attitudes, and beliefs about mathematics. Students need to 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, 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.

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

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

Mental Mathematics and Estimation [ME]

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

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

Even more important than performing computational procedures or using calculators is the greater facility that students need – more than ever before – with estimation and mental mathematics (NCTM May 2005).

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

Mental mathematics "provides a cornerstone for all estimation processes offering a variety of alternate algorithms and non-standard techniques for finding answers" (Hope 1988).

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. Students need to know how, when, and what strategy to use when estimating.

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

Problem Solving [PS]

Learning through problem solving should be the focus of mathematics at all grade levels. 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 learnings in new ways and contexts. Problem solving requires and builds depth of conceptual understanding and student engagement.

Problem solving is a powerful teaching tool that fosters multiple 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 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.

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

Technology contributes to a learning environment in which the growing curiosity of students can lead to rich mathematical discoveries at all grade levels. While technology can be used in K to 3 to enrich learning, it is expected that students will meet all outcomes without the use of technology.

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 1993, p. 10). The use of visualization in the study of mathematics provides students with the opportunity to understand mathematical concepts and make connections among them.

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

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

Measurement visualization goes beyond the acquisition of specific measurement skills. Measurement sense includes the ability to decide when to measure, when to estimate and to know several estimation strategies (Shaw & Cliatt 1989).

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

SUGGESTED TIMEFRAME

Provincial curricula are developed in accordance with the amount of instructional time recommended by the Ministry of Education for each subject area. For Mathematics K to 7, the Ministry of Education recommends a time allotment of 20% (approximately 95 hours in Kindergarten and 185 hours in Grades 1 to 7) of the total instructional time for each school year. In the primary years, teachers determine the time allotments for each required area of study and may choose to combine various curricula to enable students to integrate ideas and see the application of mathematics concepts across curricula.

The Mathematics K to 7 IRP for grades 1 to 7 is based on approximately 170 hours of instructional time to allow flexibility to address local needs. For Kindergarten, this estimate is approximately 75 hours. Based on these recommendations, teachers should be spending about 2 to 2.5 hours each week on Mathematics in Kindergarten and 4.5 to 5 hours of instructional time each week on Mathematics grades 1 to 7.

REFERENCES

The following references have been used to inform the revisions of the BC Mathematics K to 7 IRP as well as the WNCP CCF for K-9 Mathematics upon which the Prescribed Learning Outcomes and Achievement Indicators are based.

American Association for the Advancement of Science. *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, pp. 331–337.

Armstrong, T. *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, Ohio: Prentice Hall, 1998, pp. 9–42.

Banks, J.A. and C.A.M. Banks. *Multicultural Education: Issues and Perspectives.* Boston: Allyn and Bacon, 1993.

Becker, J.P. and S. Shimada. *The Open-Ended Approach: A New Proposal for Teaching Mathematics.* Reston, VA: The 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, pp. 121–146.

Barton, M. and C. Heidema. *Teaching Reading in Mathematics (2nd ed.).* Aurora, CO: McRel, 2002.

Billmeyer, R. and M. Barton. *Teaching Reading in the Conent Areas: If Not Me Then Who? (2nd ed.).* Aurora, CO: McRel, 1998.

Bloom B. S. Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain. New York: David McKay Co Inc., 1956.

Borasi, R. *Learning Mathematics through Inquiry.* Portsmouth, NH: Heinmann, 1992.

Borsai, R. *Reconceiving Mathematics Instruction: A Focus on Errors.* Norwood, NJ: Ablex, 1996.

Bright, George W. et al. *Navigating through Data Analysis in Grades 6−8.* Reston, VA: The National Council of Teachers of Mathematics, 2003.

British Columbia Ministry of Education. *The Primary Program: A Framework for Teaching*, Victoria BC: Queens Printer, 2000.

British Columbia Ministry of Education. *Mathematics K to 7 Integrated Resource Package (1995). Victoria BC: Queens Printer*, 1995.

British Columbia Ministry of Education. *Shared Learnings: Integrating BC Aboriginal Content K-10.* Victoria, BC. Queens Printer, 2006.

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: The National Council of Teachers of Mathematics, 2001.

Burns, M. *About Teaching Mathematics: A K-8 Resource.* Sausalto, CA: Math Solutions Publications, 2000.

Buschman, L. "Using Student Interviews to Guide Classroom Instruction: An Action Research Project." *Teaching Children Mathematics,* December 2001, pp. 222–227.

Caine, R. N. and G. Caine. *Making Connections: Teaching and the Human Brain.* Menlo Park, CA: Addison-Wesley Publishing Company, 1991.

Chambers, D.L., Editor. *Putting Research into Practice in the Elementary Grades.* Virginia: The National Council of Teachers of Mathematics, 2002.

Chapin, Suzanne et al. *Navigating through Data Analysis and Probability in Grades 3–5.* Reston VA: The 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." In J. Copley (ed.), *Mathematics in the Early Years.* Reston, VA: The National Council of Teachers of Mathematics, 1999, pp. 66–79.

Clements, D.H. "Subitizing: What is it? Why teach it?" *Teaching Children Mathematics,* March, 1999, pp. 400–405.

Colan, L., 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." In C. Cadzen (ed.), *Review of Research in Education,* 16. Washington, DC: American Educational Research Association, 1990, pp. 3–56.

Cuevas, G., K. Yeatt. *Navigating through Algebra in Grades 3–5.* Reston VA: The National Council of Teachers of Mathematics, 2001.

Dacey, Linda et al. *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, pp. 195–210.

Day, Roger et al. *Navigating through Geometry in Grades 9–12.* Reston VA: The National Council of Teachers of Mathematics, 2002.

Denton, L.F., McKinney, D., Affective Factors and Student Achievement: A Quantitative and Qualitative Study, Proceedings of the 34th ASEE/IEEE Conference on Frontiers in Education, Downloaded 13.12.06 www.cis.usouthal.edu/~mckinney/FIE2004-1447DentonMcKinney.pdf, 2004.

Egan, K. *The Educated Mind: How Cognitive Tools Shape our Understanding.* Chicago & London: University of Chicago Press, 1997.

Findell, C. et al. *Navigating through Geometry in Prekindergarten – Grade 2.* Reston, VA: The National Council of Teachers of Mathematics, 2001.

Friel, S., S. Rachlin and D. Doyle. *Navigating through Algebra in Grades 6–8.* Reston, VA: The 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: The 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: The National Council of Teachers of Mathematics, 2001.

Gay, S. and M. Thomas. "Just Because They Got It Right, Does it Mean They Know It?" In N.L. Webb (ed.), *Assessment in the Mathematics Classroom.* Reston, VA: The National Council of Teachers of Mathematics, 1993, pp. 130–134.

Ginsburg, H.P. et al. "Happy Birthday to You: Early Mathematical Thinking of Asian, South American, and U.S. Children." In T. Nunes and P. Bryant (eds.), *Learning and Teaching Mathematics: An International Perspective.* Hove, East Sussex: Psychology Press, 1997, pp. 163–207.

Goldin, G.A., Problem Solving Heuristics, Affect and Discrete Mathematics, Zentralblatt fur Didaktik der Mathematik (International Reviews on Mathematical Education), 36, 2, 2004.

Goldin, G.A., Children's Visual Imagery: Aspects of Cognitive Representation in Solving Problems with Fractions. Mediterranean Journal for Research in Mathematics Education. 2, 1, 2003, pp. 1-42.

Goldin, G.A. Affective Pathways and Representation in Mathematical Problem Solving, Mathematical Thinking and Learning, 2, 3, 2000, pp. 209-219.

Greenes, C., M. et al. *Navigating through Algebra in Prekindergarten − Grade 2.* Reston, VA: The 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, pp. 170–218.

Griffin, S. *Teaching Number Sense.* ASCD Educational Leadership, February, 2004, pp. 39–42.

Griffin, L., Demoss, G. *Problem of the Week: A Fresh Approach to Problem-Solving.* Instructional Fair TS Denison, Grand Rapids, Michigan 1998.

Hannula, M.S. Motivation in Mathematics: Goals Reflected in Emotions, Educational Studies in Mathematics, Retrieved 17.10.06 from 10.1007/ s10649-005-9019-8, 2006.

Hannula, M.S.,Attitude Towards Mathematics: Emotions, Expectations and Values, Educational Studies in Mathematics, 49, 200225-46.

Haylock, Derek and Anne Cockburn. *Understanding Mathematics in the Lower Primary Years.* Thousand Oaks, California: SAGE Publications Inc., 2003.

Heaton, R.M. *Teaching Mathematics to the New Standards: Relearning the Dance.* New York, NY: Teachers College Press, 2001.

Hiebert, J. et al. *Making Sense: Teaching and Learning Mathematics with Understanding.* Portsmouth NH: Heinemann, 1997.

Hiebert, J. et al. Rejoiner: Making mathematics problematic: A rejoiner to Pratwat and Smith. *Educational Researcher* 26 (2), 1997, pp. 24-26.

Hiebert, J. et al. Problem solving as a basis for reform in curriculum and instruction: The case of mathematics. *Educational Researcher* 25 (4), 1996, pp. 12-21.

Hope, Jack A. et al. *Mental Math in the Primary Grades* (p. v)*.* Dale Seymour Publications, 1988.

Hope, Jack A. et al. *Mental Math in Junior High* (p. v)*.* Dale Seymour Publications, 1988.

Hopkins, Ros (ed.). *Early Numeracy in the Classroom.* Melbourne, Australia: State of Victoria, 2001.

Howden, H. Teaching Number Sense. *Arithmetic Teacher,* 36 (6), 1989, pp. 6–11.

Howe R. "Knowing and Teaching Elementary Mathematics: *Journal of Research in Mathematics Education,* 1999. 30(5), pp. 556–558.

Hunting, R. P. "Clinical Interview Methods in Mathematics Education Research and Practice." *Journal of Mathematical Behavior,* 1997, 16(2), pp. 145–165.

Identifying the van Hiele Levels of Geometry Thinking in Seventh-Grade Students through the Use of Journal Writing. Doctoral dissertation. University of Massachusetts, 1993, Dissertation Abstracts International, 54 (02), 464A.

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,* 1997, 16(1), pp. 51–61.

Kelly, A.G. "Why Can't I See the Tree? A Study of Perspective." *Teaching Children Mathematics,* October 2002, 9(3), pp. 158–161.

Kersaint, G. "Raking Leaves – The Thinking of Students." *Mathematics Teaching in the Middle School,* November 2002, 9(3), pp. 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,* Virginia: The National Council of Teachers of Mathematics, 2003.

King, J. *The Art of Mathematics.* New York: Fawcett Columbine, 1992.

Krathwohl, D. R., Bloom, B. S., & Bertram, B. M., *Taxonomy of Educational Objectives, the Classification of Educational Goals. Handbook II: Affective Domain.* New York: David McKay Co., Inc., 1973.

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 & London: 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.

Malmivuori, M., Affect and Self-Regulation, Educational Studies in Mathematics, Educational Studies in Mathematics, Retrieved 17.10.06 from Springer Link 10.1007/s10649-006-9022-8, 2006.

Malmivuori, M-L., The dynamics of affect, cognition, and social environment in the regulation of personal learning processes: The case of mathematics, Research report 172, http://ethesis.helsinki.fi/julkaisut/kas/kasva/vk/malmivuori/, University of Helsinki, Helsinki., 2001.

Mann, R. *Balancing Act: The Truth Behind the Equals Sign. Teaching Children Mathematics,* September 2004, pp. 65–69.

Martine, S.L. and J. Bay-Williams. "Investigating Students' Conceptual Understanding of Decimal Fractions." *Mathematics Teaching in the Middle School,* January 2003, 8(5), pp. 244–247.

McAskill, B. et al. *WNCP Mathematics Research Project: Final Report.* Victoria, BC: Holdfast Consultants Inc., 2004.

McAskill, B., G. Holmes, L. Francis-Pelton. *Consultation Draft for the Common Curriculum Framework Kindergarten to Grade 9 Mathematics.* Victoria, BC: Holdfast Consultants Inc., 2005.

McLeod, D.B., Research on Affect and Mathematics Learning in the JRME: 1970 to the Present, Journal for Research in Mathematics Education, 25, 6,1994, p. 637 – 647.

McLeod, D.B. Research on affect in mathematics education: A Reconceptualization. In D.A. Grouws (Ed.), Handbook of research on mathematics teaching and learning, 575 – 596, Old Tappan, NJ: Macmillan, 2002.

McLeod, D.B. 1988, Affective Issues in Mathematical Problem Solving: Some Theoretical Considerations, Journal for Research in Mathematics Education, 19, 2, 1988, p. 134 – 141.

National Council of Teachers of Mathematics, *Computation, Calculators, and Common Sense.* May 2005, NCTM Position Statement.

Nardi, E. & Steward, S., Attitude and Achievement of the disengaged pupil in the mathematics Classroom, Downloaded 20.6.06 from www.standards.dfes.gov.uk, 2003.

Nardi, E. & Steward, S., Is Mathematics T.I.R.E.D? A profile of Quiet Disaffection in the Secondary Mathematics Classroom, British Educational Research Journal, 29, 3, 2003, pp. 4-9.

Nardi, E. & Steward, S., I Could be the Best Mathematician in the World…If I Actually Enjoyed It – Part 1. Mathematics Teaching, 179, 2002, pp. 41-45.

Nardi, E. & Steward, S., 2002, I Could be the Best Mathematician in the World…If I Actually Enjoyed It – Part 2. Mathematics Teaching, 180, 4-9, 2002.

Nelson-Thomson. *Mathematics Education: A Summary of Research, Theories, and Practice.* Scarborough, ON: Nelson, 2002.

Pape, S. J. and M.A Tchshanov. "The Role of Representation(s) in Developing Mathematical Understanding." *Theory into Practice,* Spring 2001, 40(2), pp. 118–127.

Paulos, J. *Innumeracy: Mathematical Illiteracy and its Consequences.* Vintage Books, New York, 1998.

Peck, D., S. Jencks and M. Connell. "Improving Instruction through Brief Interviews." *Arithmetic Teacher,* 1989, 37(3), 15–17.

Pepper, K.L. and R.P. Hunting. "Preschoolers' Counting and Sharing." *Journal for Research in Mathematics Education,* March 1998, 28(2), pp. 164–183.

Peressini D. and J. Bassett. "Mathematical Communication in Students' Responses to a Performance-Assessment Task." In P.C. Elliot, *Communication in Mathematics K–12 and Beyond.* Reston, VA: The National Council of Teachers of Mathematics, 1996, pp. 146–158.

Perry, J.A. and S.L. Atkins. "It's Not Just Notation: Valuing Children's Representations." *Teaching Children Mathematics.* September 2002, 9(1), pp. 196–201.

Polya, G. *G. How to Solve It 2nd ed.*, Princeton, NJ. Princeton University Press, 1957.

Pugalee, D. et al. *Navigating Through Geometry in Grades 6–8.* Reston, VA: The National Council of Teachers of Mathematics, 2002.

Rasokas, P. et al. *Harcourt Math Assessment: Measuring Student Performance (K – 8 Series).* Toronto, ON: 2001

Rigby-Heinemann. *First Steps in Mathematics: Number.* Sydney, AU: Regby-Heinemann, 2004.

Robitaille, D., G. Orpwood, and A. Taylor. *The TIMSS-Canada Report, Vol. 2–G4.* Vancouver, BC: Dept. of CUST – UBC, 1997.

Robitaille, D., Beaton, A.E., Plomp, T., 2000, The Impact of TIMSS on the Teaching and Learning of Mathematics and Science, Vancouver, BC: Pacific Education Press.

Robitaille, D.F, Taylor, A.R. & Orpwood, G., The Third International Mathematics & Science Study TIMMSS-Canada Report Vol.1: Grade 8, Dept. of Curriculum Studies, Faculty of Education, UBC, Vancouver: BC, 1996.

Romagnano, L. *Wrestling with Change – The Dilemmas of Teaching Mathematics.* Portsmouth, NH: Heinemann, 1994.

Rubenstein, R. N. *Mental Mathematics beyond the Middle School: Why? What? How?* September 2001, Vol. 94, Issue 6, p. 442.

Sakshaug, L., M. Olson, and J. Olson. *Children are mathematical problem solvers.* Reston, VA: The National Council of Teachers of Mathematics, 2002, pp. 17–20.

Sawyer, W.W. *Mathematician's Delight.* New York: Penguin Books, 1943. Cited in Moran, G.J.W., 1993.

Schuster, L. and N. Canavan Anderson. Good Questions for Math Teaching: Why Ask Them and What to Ask, Grades 5–8. Sausalto, CA: Math Solutions Publications, 2005.

Seymour, D. *Mental Math in the Primary Grades.* Palo Alto, CA: Dale Seymour Publications, 1998.

Sakshaug, L. E., *Children Are Mathematical Problem Solvers.* Reston, VA: National Council of Teachers of Mathematics: 2002

Shaw, J.M. and M.F.P Cliatt. (1989). "Developing Measurement Sense." In P.R. Trafton (Ed.), *New Directions for Elementary School Mathematics* (pp. 149–155). Reston, VA: National Council of Teachers of Mathematics.

Sheffield, L. J. et al. *Navigating through Data Analysis and Probability in Prekindergarten – Grade 2.* Reston, VA: The National Council of Teachers of Mathematics, 2002.

Small, M. *PRIME: Patterns and Algebra.* Toronto, ON: Nelson Publishing, 2005.

Small, M. *PRIME: Number and Operations.* Toronto, ON: Nelson Publishing, 2005.

Smith, W.J., Butler-Kisber, L., LaRoque, L., Portelli, J., Shields, C., Sturge Sparkes, C., & Vilbert, A., Student Engagement in Learning and School Life: National Project Report, Montreal. Quebec: Ed-Lex., 1998.

Solomon, P. G. *The Math We Need to "Know" and "Do."* Thousand Oaks, California: Sage Publications, 2001.

Steen, L.A. (ed.). *On the Shoulders of Giants – New Approaches to Numeracy.* Washington, DC: National Research Council, 1990.

Stiff, L. *Constructivist Mathematics and Unicorns* (President's Message). In NCTM News Bulletin July/August 2001, 3.

Sullivan, P., Lilburn P. Good Questions for Math Teaching: Why Ask Them and What to Ask, Grades K–6. Sausalto, CA: Math Solutions Publications, 2002.

Swarthout, M. "Average Days of Spring – Problem Solvers." *Teaching Children Mathematics,* March 2002, 8(7), pp. 404–406.

Tang, E.P., H.P. Ginsburg. "Young Children's Mathematical Reasoning – A Psychological View." In Stiff, L. and F. Curcio, *Developing Mathematical Reasoning in Grades K–12.* Reston, VA: The National Council of Teachers of Mathematics, 1999, pp. 45–61.

Teppo, Anne R. *Reflecting on NCTM's Principles and Standards in Elementary and Middle School Mathematics.* Preston, VA: The National Council of Teachers of Mathematics, 2002.

Van de Walle, J. and A. L. Lovin, *Teaching Student-Centered Mathematics Grades K-3.* Boston, MA: Pearson Education, Inc., 2006.

Van de Walle, J. and A. L. Lovin, *Teaching Student-Centered Mathematics Grades 3-5.* Boston, MA: Pearson Education, Inc., 2006.

Van de Walle, J. and A. L. Lovin, *Teaching Student-Centered Mathematics Grades 5-8.* Boston, MA: Pearson Education, Inc., 2006.

Van de Walle, J. A. *Elementary and Middle School Mathematics: Teaching Developmentally.* 5th ed. Boston, MA: Pearson Education, Inc., 2004.

Van den Heuvel-Panhuizen, M. and Gravemejer (1991). "Tests Aren't All Bad – An Attempt to Change the Face of Written Tests in Primary School Mathematics Instruction." In Streefland, L., *Realistic Mathematics Education in Primary School: On the Occasion of the Opening of the Freudenthal Institute.* Utrecht, Netherlands: CD-B Press, 1991, pp. 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, Mass: MIT Press, 1986.

Vygotsky, L.S. *Mind in Society: The Development of Higher Psychological Processes.* Cambridge, Mass: Harvard University Press, 1978.

Westley, J. (ed.) *Puddle Questions Assessing Mathematical Thinking (Grades 1 – 7 Series).* Chicago, IL: Creative Publications, 1995.

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

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

CONSIDERATIONS FOR PROGRAM DELIVERY

Mathematics K to 7

This section of the IRP contains additional information to help educators develop their school practices and plan their program delivery to meet the needs of all learners. Included in this section is information about

- alternative delivery policy
- inclusion, equity, and accessibility for all learners
- working with the Aboriginal community
- information and communications technology
- copyright and responsibility
- fostering the development of positive attitudes
- instructional focus
- applying mathematics

ALTERNATIVE DELIVERY POLICY

The Alternative Delivery policy does not apply to the Mathematics K to 7 curriculum.

The Alternative Delivery policy outlines how students, and their parents or guardians, in consultation with their local school authority, may choose means other than instruction by a teacher within the regular classroom setting for addressing prescribed learning outcomes contained in the Health curriculum organizer of the following curriculum documents:

- Health and Career Education K to 7, and Personal Planning K to 7 Personal Development curriculum organizer (until September 2008)
- Health and Career Education 8 and 9
- Planning 10

The policy recognizes the family as the primary educator in the development of children's attitudes, standards, and values, but the policy still requires that all prescribed learning outcomes be addressed and assessed in the agreed-upon alternative manner of delivery.

It is important to note the significance of the term "alternative delivery" as it relates to the Alternative Delivery policy. The policy does not permit schools to omit addressing or assessing any of the prescribed learning outcomes within the health and career education curriculum. Neither does it allow students to be excused from meeting any learning outcomes related to health. It is expected that students who arrange for alternative delivery will address the health-related

learning outcomes and will be able to demonstrate their understanding of these learning outcomes.

> For more information about policy relating to alternative delivery, refer to
> www.bced.gov.bc.ca/policy/

INCLUSION, EQUITY, AND ACCESSIBILITY FOR ALL LEARNERS

British Columbia's schools include young people of varied backgrounds, interests, and abilities. The Kindergarten to Grade 12 school system focuses on meeting the needs of all students. When selecting specific topics, activities, and resources to support the implementation of Mathematics K to 7, teachers are encouraged to ensure that these choices support inclusion, equity, and accessibility for all students. In particular, teachers should ensure that classroom instruction, assessment, and resources reflect sensitivity to diversity and incorporate positive role portrayals, relevant issues, and themes such as inclusion, respect, and acceptance.

Government policy supports the principles of integration and inclusion of students who have English as a second language and of students with special needs. Most of the prescribed learning outcomes and suggested achievement indicators in this IRP can be met by all students, including those with special needs and/or ESL needs. Some strategies may require adaptations to ensure that those with special and/or ESL needs can successfully achieve the learning outcomes. Where necessary, modifications can be made to the prescribed learning outcomes for students with Individual Education Plans.

> For more information about resources and support for students with special needs, refer to www.bced.gov.bc.ca/specialed/
>
> For more information about resources and support for ESL students, refer to www.bced.gov.bc.ca/esl/

WORKING WITH THE ABORIGINAL COMMUNITY

The Ministry of Education is dedicated to ensuring that the cultures and contributions of Aboriginal peoples in BC are reflected in all provincial curricula. To address these topics in the classroom in a way that is accurate and that respectfully reflects Aboriginal concepts of teaching and learning, teachers are strongly encouraged to seek the advice and support of local Aboriginal communities. Aboriginal communities are diverse in terms of language, culture, and available resources, and each community will have its own unique protocol to gain support for integration of local knowledge and expertise. To begin discussion of possible instructional and assessment activities, teachers should first contact Aboriginal education co-ordinators, teachers, support workers, and counsellors in their district who will be able to facilitate the identification of local resources and contacts such as Elders, chiefs, tribal or band councils, Aboriginal cultural centres, Aboriginal Friendship Centres, and Métis or Inuit organizations.

In addition, teachers may wish to consult the various Ministry of Education publications available, including the "Planning Your Program" section of the resource, *Shared Learnings* (2006). This resource was developed to help all teachers provide students with knowledge of, and opportunities to share experiences with, Aboriginal peoples in BC.

> For more information about these documents, consult the Aboriginal Education web site: www.bced.gov.bc.ca/abed/welcome.htm

INFORMATION AND COMMUNICATIONS TECHNOLOGY

The study of information and communications technology is increasingly important in our society. Students need to be able to acquire and analyze information, to reason and communicate, to make informed decisions, and to understand and use information and communications technology for a variety of purposes. Development of these skills is important for students in their education, their future careers, and their everyday lives.

Literacy in the area of information and communications technology can be defined as the ability to obtain and share knowledge through investigation, study, instruction, or transmission of information by means of media technology. Becoming literate in this area involves finding, gathering, assessing, and communicating information using electronic means, as well as developing the knowledge and skills to use and solve problems effectively with the technology. Literacy also involves a critical examination and understanding of the ethical and social issues related to the use of information and communications technology. Mathematics K to 7 provides opportunities for students to develop literacy in relation to information and communications technology sources, and to reflect critically on the role of these technologies in society.

COPYRIGHT AND RESPONSIBILITY

Copyright is the legal protection of literary, dramatic, artistic, and musical works; sound recordings; performances; and communications signals. Copyright provides creators with the legal right to be paid for their work and the right to say how their work is to be used. There are some exceptions in the law (i.e., specific things permitted) for schools but these are very limited, such as copying for private study or research. The copyright law determines how resources can be used in the classroom and by students at home

In order to respect copyright it is necessary to understand the law. It is unlawful to do the following, unless permission has been given by a copyright owner:
- photocopy copyrighted material to avoid purchasing the original resource for any reason
- photocopy or perform copyrighted material beyond a very small part – in some cases the copyright law considers it "fair" to copy whole works, such as an article in a journal or a photograph, for purposes of research and private study, criticism, and review
- show recorded television or radio programs to students in the classroom unless these are cleared for copyright for educational use (there are exceptions such as for news and news commentary taped within one year of broadcast that by law have record-keeping requirements – see the web site at the end of this section for more details)
- photocopy print music, workbooks, instructional materials, instruction manuals, teacher guides, and commercially available tests and examinations

- show video recordings at schools that are not cleared for public performance
- perform music or do performances of copyrighted material for entertainment (i.e., for purposes other than a specific educational objective)
- copy work from the Internet without an express message that the work can be copied

Permission from or on behalf of the copyright owner must be given in writing. Permission may also be given to copy or use all or some portion of copyrighted work through a licence or agreement. Many creators, publishers, and producers have formed groups or "collectives" to negotiate royalty payments and copying conditions for educational institutions. It is important to know what licences are in place and how these affect the activities schools are involved in. Some licences may also require royalty payments that are determined by the quantity of photocopying or the length of performances. In these cases, it is important to assess the educational value and merits of copying or performing certain works to protect the school's financial exposure (i.e., only copy or use that portion that is absolutely necessary to meet an educational objective).

It is important for education professionals, parents, and students to respect the value of original thinking and the importance of not plagiarizing the work of others. The works of others should not be used without their permission.

> For more information about copyright, refer to www.cmec.ca/copyright/indexe.stm

FOSTERING THE DEVELOPMENT OF POSITIVE ATTITUDES IN MATHEMATICS

A positive attitude toward mathematics is often a result of a learning environment in the classroom that encourages students' own mathematical thinking and contributions to classroom activities and discussions. Teachers should provide a variety of instructional approaches used in the classroom in order to reach a variety of learning styles and dispositions. These include experiences that encourage students to
- enjoy and value mathematics
- develop mathematical habits of mind

- explore
- take risks
- exhibit curiosity
- make and correct errors
- persevere
- experience mathematics in non-threatening, engaging ways
- understand and appreciate the role of mathematics in human affairs

These learning opportunities enable students to gain confidence in their abilities to solve complex problems.

The assessment of attitudes is indirect, and based on inferences drawn from students' behaviour. We can see what students do and hear what they say, and from these observations make inferences and draw conclusions about their attitudes.

It is important for teachers to consider their role in developing a positive attitude in mathematics. Teachers and parents are role models from which students begin to develop their disposition toward mathematics. Teachers need to model these attitudes in order to help students develop them (Burns 2000). In this manner teachers need to "present themselves as problem solvers, as active learners who are seekers, willing to plunge into new situations, not always knowing the answer or what the outcome will be" (p. 29).

INSTRUCTIONAL FOCUS

The Mathematics K to 7 courses are arranged into a number of organizers with mathematical processes integrated throughout. Students learn in different ways and at different rates. As in other subject areas, it is essential when teaching mathematics, that concepts are introduced to students in a variety of ways. Students should hear explanations, watch demonstrations, draw to represent their thinking, engage in experiences with concrete materials and be encouraged to visualize and discuss their understanding of concepts. Most students need a range of concrete or representational experiences with mathematics concepts before they develop symbolic or abstract understanding. The development of conceptual understanding should be emphasized throughout the curriculum as a means to develop students to become mathematical problem solvers.

Teaching through Problem Solving

Problem solving should be an integral part of all mathematics classrooms. Teachers are encouraged to weave problem solving throughout all curriculum organizers in the K to 7 mathematics curriculum on a regular basis. Problem solving provides a way of helping students learn mathematics.

Hiebert et al. (1996) encourage teachers to make mathematics problematic. A problem can be defined as any task or activity for which the students have not memorized a method or rule, nor is there an assumption by the students that there is only one correct way to solve the problem (Hiebert et al. 1997). Van de Walle (2006) notes that "a problem for learning mathematics also has these features:
- The problem must begin where the students are.
- The problematic or engaging aspect of the problem must be due to the mathematics that the students are to learn.
- The problem must require justifications and explanations for answers and methods. (p. 11)

Why teach through problem solving?
- The math makes more sense. When using real world math problems, students are able to make the connections between what math is and how they can apply it.
- Problems are more motivating when they are challenging. Although some students are anxious when they are not directed by the teacher, most enjoy a challenge they can be successful in solving.
- Problem solving builds confidence. It maximizes the potential for understanding as each child makes his own sense out of the problem and allows for individual strategies.
- Problem solving builds perseverance. Because an answer is not instantaneous, many children think they are unable to do the math. Through the experience of problem solving they learn to apply themselves for longer periods of time and not give up.
- Problems can provide practice with concepts and skills. Good problems enable students to learn and apply the concepts in a meaningful way and an opportunity to practice the skills.
- Problem solving provides students with insight into the world of mathematics. Mathematicians struggle to find solutions to many problems and often need to go down more than one path to arrive at a solution. This is a creative process that is difficult to understand if one has never had to struggle.
- Problem solving provides the teacher with insight into a student's mathematical thinking. As students choose strategies and solve problems, the teacher has evidence of their thinking and can inform instruction based on this.
- Students need to practice problem solving. If we are expecting students to confront new situations involving mathematics, they need practice to become independent problem solvers (Small 2005).

Polya (1957) characterized a general method which can be used to solve problems, and to describe how problem-solving should be taught and learned. He advocated for the following steps in solving a mathematical problem:
- Understand the problem – What is unknown? What is known? Is enough information provided to determine the solution? Can a figure or model be used to represent the situation?
- Make a plan – Is there a similar problem that has been solved before? Can the problem be restated so it makes more sense?
- Carry out the plan – Have all of the steps been completed correctly?
- Look back – Do the results look correct? Is there another way to solve the problem that would verify the results?

While a number of variations of the problem solving model proposed by Polya (Van de Walle 2006; Small 2006; Burns 2000) they all have similar characteristics. The incorporation of a wide variety of strategies to solve problems is essential to developing students' ability to be flexible problem solvers.

The Mathematics K to 7 (1995) IRP provides a number of useful strategies that students can use to increase their flexibility in solving problems. These include:
- look for a pattern
- construct a table
- make an organized list
- act it out
- draw a picture
- use objects
- guess and check
- work backward
- write an equation
- solve a simpler (or similar) problem
- make a model (BC Ministry of Education 1995)

During problem-solving experiences, students are encouraged to solve problems using ways that make sense to them. As students share different ways of solving problems they can learn strategies from each other. Teachers are encouraged to facilitate this process to in an open and non-threatening environment. I this manner, students can develop a repertoire of strategies from which to draw upon when mathematical problems are presented to them.

Problem solving requires a shift in student attitudes and how teachers model these attitudes in the classroom. In order to be successful, students must develop, and teachers model, the following characteristics:
- interest in finding solutions to problems
- confidence to try various strategies
- willingness to take risks
- ability to accept frustration when not knowing
- understanding the difference between not knowing the answer and not having found it yet (Burns 2000)

Problems are not just simple computations embedded in a story nor are they contrived, that is, they do not exist outside the math classroom. Students will be engaged if the problems relate to their lives; their culture, interests, families, current events. They are tasks that are rich and open-ended so there is more than one way of arriving at a solution, or multiple answers. Good problems should allow for every student in the class to demonstrate their knowledge, skill or understanding. The students should not know the answer immediately. Problem solving takes time and effort on the part of the student and the teacher. Teaching thought problem solving is one of the ways that teachers can bring increased depth to the Mathematics K to 7 curriculum.

Instruction should provide an emphasis on mental mathematics and estimation to check the reasonableness of paper and pencil exercises, and the solutions to problems which are determined through the use of technology, including calculators and computers. (It is assumed that all students have regular access to appropriate technology such calculators, or computers with graphing software and standard spreadsheet programs.) Concepts should be introduced using manipulatives, and gradually developed from the concrete to the pictorial to the symbolic.

APPLYING MATHEMATICS

For students to view mathematics as relevant and useful, they must see how it can be applied in a variety of contexts. Mathematics helps students understand and interpret their world and solve problems that occur in their daily lives both within and outside of the school context.

Teachers are encouraged to incorporate, and make explicit, mathematics concepts which naturally occur across the subject areas. Possible situations where cross curricular integration may occur in K to 7 include the following:

Fine Arts
- pattern, line, and form
- fractions in rhythm and metre
- spatial awareness in dance, drama, and visual arts
- geometric shapes in visual arts, drama, and dance
- symmetry and unison
- transformations
- perspective and proportion in visual arts
- measuring and proportional reasoning for mixing and applying materials in visual arts

Health and Career Education
- creating schedules
- interpreting statistical data
- collecting, organizing, and interpreting data charts, graphs, diagrams, and tables
- using mathematics to develop a logical argument to support a position on a topic or issue

Language Arts
- reading literature with a mathematics theme
- creating a picture book or writing a story with mathematical content
- listening to stories to decode mathematical contexts
- examine the plot of a story from a mathematical perspective
- create graphic organizers provide an explanation, proof, or justification for an argument
- role-play or oral presentations of problems and solutions
- creating word walls, personal dictionaries, or glossaries of mathematics terms
- examine the roots of mathematical terms

Physical Education

- examining the benefits of various physical activity (e.g. burning calories)
- examining patterns in physical movement
- measuring distances
- estimate distances and other quantise using referents
- reading and recording dates and time

Science

- discussing the magnitude of numbers
- classifying and sorting objects
- examining patterns to make a hypothesis
- measuring quantities
- use of referents for measurement
- units and conversions between units
- reading and writing quantities in multiple formats (e.g., numerals, words)
- collecting, organizing and interpreting data charts, graphs, diagrams, and tables
- creating a logical argument to support a hypothesis
- mental mathematics for calculations

Social Studies

- discussing the magnitude of numbers and building referents for numbers
- using concepts of area, perimeter, and distances when mapping

- graphing using the Cartesian plane
- using circle concepts to explain latitude and longitude, time zones, great circle routes
- interpreting statistical data
- collecting, organizing, and interpreting data charts, graphs, diagrams, and tables
- reading and recording dates and time
- examining the history of mathematics in context of world events
- using mathematics to develop a logical argument to support a position on a topic or issue

Students can also be encouraged to identify and examine the mathematics around them. In this way, students will come to see that mathematics is present outside of the classroom. There are many aspects of students' daily lives where they may encounter mathematic such as

- making purchases
- reading bus schedules
- reading sports statistics
- interpreting newspaper and media sources
- following a recipe
- estimating time to complete tasks
- estimating quantities
- creating patterns when doodling

Making these connections explicit for students helps to solidify the importance of mathematics.

PRESCRIBED LEARNING OUTCOMES

Mathematics K to 7

Prescribed learning outcomes are content standards for the provincial education system; they are the prescribed curriculum. Clearly stated and expressed in measurable and observable terms, learning outcomes set out the required attitudes, skills, and knowledge – what students are expected to know and be able to do – by the end of the subject and grade.

Schools have the responsibility to ensure that all prescribed learning outcomes in this curriculum are met; however, schools have flexibility in determining how delivery of the curriculum can best take place.

It is expected that student achievement will vary in relation to the learning outcomes. Evaluation, reporting, and student placement with respect to these outcomes are dependent on the professional judgment and experience of teachers, guided by provincial policy.

Prescribed learning outcomes for Mathematics K to 7 are presented by grade and by curriculum organizer and suborganizer, and are coded alphanumerically for ease of reference; however, this arrangement is not intended to imply a required instructional sequence.

Wording of Prescribed Learning Outcomes

All learning outcomes complete the stem, "It is expected that students will …."

When used in a prescribed learning outcome, the word "including" indicates that any ensuing item **must be addressed**. Lists of items introduced by the word "including" represent a set of minimum requirements associated with the general requirement set out by the outcome. The lists are not necessarily exhaustive, however, and teachers may choose to address additional items that also fall under the general requirement set out by the outcome.

Domains of Learning

Prescribed learning outcomes in BC curricula identify required learning in relation to one or more of the three domains of learning: cognitive, psychomotor, and affective. The following definitions of the three domains are based on Bloom's taxonomy.

The **cognitive domain** deals with the recall or recognition of knowledge and the development of intellectual abilities. The cognitive domain can be further specified as including three cognitive levels: knowledge, understanding and application, and higher mental processes. These levels are determined by the verb used in the learning outcome, and illustrate how student learning develops over time.

- Knowledge includes those behaviours that emphasize the recognition or recall of ideas, material, or phenomena.
- Understanding and application represents a comprehension of the literal message contained in a communication, and the ability to apply an appropriate theory, principle, idea, or method to a new situation.
- Higher mental processes include analysis, synthesis, and evaluation. The higher mental processes level subsumes both the knowledge and the understanding and application levels.

The **affective domain** concerns attitudes, beliefs, and the spectrum of values and value systems.

The **psychomotor domain** includes those aspects of learning associated with movement and skill demonstration, and integrates the cognitive and affective consequences with physical performances.

Domains of learning and cognitive levels also form the basis of the Assessment Overview Tables provided for each grade in the Classroom Assessment Model. In addition, domains of learning and, particularly, cognitive levels, inform the design and development of the Grades 4 and 7 Foundation Skills Assessment (FSA).

PRESCRIBED LEARNING OUTCOMES

By Grade

KINDERGARTEN

It is expected that students will:

NUMBER

A1   say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1 [C, CN, V]
A2   recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots [C, CN, ME, V]
A3   relate a numeral, 1 to 10, to its respective quantity [CN, R, V]
A4   represent and describe numbers 2 to 10, concretely and pictorially [C, CN, ME, R, V]
A5   compare quantities, 1 to 10, using one-to-one correspondence [C, CN, V]

PATTERNS AND RELATIONS

Patterns

B1   demonstrate an understanding of repeating patterns (two or three elements) by
  − identifying
  − reproducing
  − extending
  − creating
  patterns, using manipulatives, sounds, and actions [C, CN, PS, V]

Variables and Equations
  not applicable at this grade level

SHAPE AND SPACE

Measurement

C1   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]

3-D Objects and 2-D Shapes

C2   sort 3-D objects using a single attribute [C, CN, PS, R, V]
C3   build and describe 3-D objects [CN, PS, V]

Transformations
  not applicable at this grade level

STATISTICS AND PROBABILITY

Data Analysis
  not applicable at this grade level

Chance and Uncertainty
  not applicable at this grade level

GRADE 1

It is expected that students will:

NUMBER

A1 say the number sequence, 0 to 100, by
- 1s forward and backward between any two given numbers
- 2s to 20, forward starting at 0
- 5s and 10s to 100, forward starting at 0 [C, CN, V, ME]

A2 recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots [C, CN, ME, V]

A3 demonstrate an understanding of counting by
- indicating that the last number said identifies "how many"
- showing that any set has only one count
- using the counting on strategy
- using parts or equal groups to count sets [C, CN, ME, R, V]

A4 represent and describe numbers to 20 concretely, pictorially, and symbolically [C, CN, V]

A5 compare sets containing up to 20 elements to solve problems using
- referents
- one-to-one correspondence [C, CN, ME, PS, R, V]

A6 estimate quantities to 20 by using referents [C, ME, PS, R, V]

A7 demonstrate, concretely and pictorially, how a given number can be represented by a variety of equal groups with and without singles [C, R, V]

A8 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]

A9 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]

A10 describe and use mental mathematics strategies (memorization not intended), such as
- counting on and counting back
- making 10
- doubles
- using addition to subtract

to determine the basic addition facts to 18 and related subtraction facts [C, CN, ME, PS, R, V]

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

GRADE 1

PATTERNS AND RELATIONS

Patterns

B1   demonstrate an understanding of repeating patterns (two to four elements) by
- describing
- reproducing
- extending
- creating

patterns using manipulatives, diagrams, sounds, and actions [C, PS, R, V]

B2   translate repeating patterns from one representation to another [C, R, V]

Variables and Equations

B3   describe equality as a balance and inequality as an imbalance, concretely, and pictorially (0 to 20) [C, CN, R, V]

B4   record equalities using the equal symbol [C, CN, PS, V]

SHAPE AND SPACE

Measurement

C1   demonstrate an understanding of measurement as a process of comparing by
- identifying attributes that can be compared
- ordering objects
- making statements of comparison
- filling, covering, or matching [C, CN, PS, R, V]

3-D Objects and 2-D Shapes

C2   sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule [C, CN, R, V]

C3   replicate composite 2-D shapes and 3-D objects [CN, PS, V]

C4   compare 2-D shapes to parts of 3-D objects in the environment [C, CN, V]

Transformations

not applicable at this grade level

STATISTICS AND PROBABILITY

Data Analysis

not applicable at this grade level

Chance and Uncertainty

not applicable at this grade level

GRADE 2

It is expected that students will:

NUMBER

A1 say the number sequence from 0 to 100 by
  - 2s, 5s and 10s, forward and backward, using starting points that are multiples of 2, 5, and 10 respectively
  - 10s using starting points from 1 to 9
  - 2s starting from 1 [C, CN, ME, R]
A2 demonstrate if a number (up to 100) is even or odd [C, CN, PS, R]
A3 describe order or relative position using ordinal numbers (up to tenth) [C, CN, R]
A4 represent and describe numbers to 100, concretely, pictorially, and symbolically [C, CN, V]
A5 compare and order numbers up to 100 [C, CN, R, V]
A6 estimate quantities to 100 using referents [C, ME, PS, R]
A7 illustrate, concretely and pictorially, the meaning of place value for numerals to 100 [C, CN, R, V]
A8 demonstrate and explain the effect of adding zero to or subtracting zero from any number [C, R]
A9 demonstrate an understanding of addition (limited to 1 and 2-digit numerals) with answers to 100 and the corresponding subtraction by
  - using personal strategies for adding and subtracting with and without the support of manipulatives
  - creating and solving problems that involve addition and subtraction
  - explaining that the order in which numbers are added does not affect the sum
  - explaining that the order in which numbers are subtracted may affect the difference
  [C, CN, ME, PS, R, V]
A10 apply mental mathematics strategies, such as
  - using doubles
  - making 10
  - one more, one less
  - two more, two less
  - building on a known double
  - addition for subtraction
  to determine basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]

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

GRADE 2

PATTERNS AND RELATIONS

Patterns

B1 demonstrate an understanding of repeating patterns (three to five elements) by
- describing
- extending
- comparing
- creating

patterns using manipulatives, diagrams, sounds, and actions. [C, CN, PS, R, V]

B2 demonstrate an understanding of increasing patterns by
- describing
- reproducing
- extending
- creating

patterns using manipulatives, diagrams, sounds, and actions (numbers to 100) [C, CN, PS, R, V]

Variables and Equations

B3 demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100) [C, CN, R, V]

B4 record equalities and inequalities symbolically using the equal symbol or the not equal symbol [C, CN, R, V]

SHAPE AND SPACE

Measurement

C1 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]

C2 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]

C3 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]

C4 measure length to the nearest non-standard unit by
- using multiple copies of a unit
- using a single copy of a unit (iteration process) [C, ME, R, V]

C5 demonstrate that changing the orientation of an object does not alter the measurements of its attributes [C, R, V]

GRADE 2

3-D Objects and 2-D Shapes

C6   sort 2-D shapes and 3-D objects using two attributes and explain the sorting rule [C, CN, R, V]
C7   describe, compare, and construct 3-D objects, including
   − cubes
   − spheres
   − cones
   − cylinders
   − pyramids [C, CN, R, V]
C8   describe, compare, and construct 2-D shapes, including
   − triangles
   − squares
   − rectangles
   − circles [C, CN, R, V]
C9   identify 2-D shapes as parts of 3-D objects in the environment [C, CN, R, V]

Transformations

   not applicable at this grade level

STATISTICS AND PROBABILITY

Data Analysis

D1   gather and record data about self and others to answer questions [C, CN, PS, V]
D2   construct and interpret concrete graphs and pictographs to solve problems [C, CN, PS, R, V]

Chance and Uncertainty

   not applicable at this grade level

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

GRADE 3

It is expected that students will:

NUMBER

A1   say the number sequence forward and backward from 0 to 1000 by
   - 5s, 10s or 100s using any starting point
   - 3s using starting points that are multiples of 3
   - 4s using starting points that are multiples of 4
   - 25s using starting points that are multiples of 25 [C, CN, ME]

A2   represent and describe numbers to 1000, concretely, pictorially, and symbolically [C, CN, V]

A3   compare and order numbers to 1000 [CN, R, V]

A4   estimate quantities less than 1000 using referents [ME, PS, R, V]

A5   illustrate, concretely and pictorially, the meaning of place value for numerals to 1000 [C, CN, R, V]

A6   describe and apply mental mathematics strategies for adding two 2-digit numerals, such as
   - adding from left to right
   - taking one addend to the nearest multiple of ten and then compensating
   - using doubles [C, ME, PS, R, V]

A7   describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as
   - taking the subtrahend to the nearest multiple of ten and then compensating
   - thinking of addition
   - using doubles [C, ME, PS, R, V]

A8   apply estimation strategies to predict sums and differences of two 2-digit numerals in a problem-solving context [C, ME, PS, R]

A9   demonstrate an understanding of addition and subtraction of numbers with answers to 1000 (limited to 1, 2 and 3-digit numerals) by
   - 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 [C, CN, ME, PS, R]

A10   apply mental mathematics strategies and number properties, such as
   - using doubles
   - making 10
   - using the commutative property
   - using the property of zero
   - thinking addition for subtraction
   to recall basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]

A11   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]

GRADE 3

A12 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]

A13 demonstrate an understanding of fractions by
- explaining that a fraction represents a part of a whole
- describing situations in which fractions are used
- comparing fractions of the same whole with like denominators [C, CN, ME, R, V]

PATTERNS AND RELATIONS

Patterns

B1 demonstrate an understanding of increasing patterns by
- describing
- extending
- comparing
- creating

patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

B2 demonstrate an understanding of decreasing patterns by
- describing
- extending
- comparing
- creating

patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

Variables and Equations

B3 solve one-step addition and subtraction equations involving symbols representing an unknown number [C, CN, PS, R, V]

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

GRADE 3

SHAPE AND SPACE

Measurement

C1 relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years) [CN, ME, R]

C2 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]

C3 demonstrate an understanding of measuring length (cm, m) by
  – 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]

C4 demonstrate an understanding of measuring mass (g, kg) by
  – 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]

C5 demonstrate an understanding of perimeter of regular and irregular shapes by
  – 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]

3-D Objects and 2-D Shapes

C6 describe 3-D objects according to the shape of the faces, and the number of edges and vertices [C, CN, PS, R, V]

C7 sort regular and irregular polygons, including
  – triangles
  – quadrilaterals
  – pentagons
  – hexagons
  – octagons
  according to the number of sides [C, CN, R, V]

Transformations

  not applicable at this grade level

GRADE 3

STATISTICS AND PROBABILITY

Data Analysis

D1   collect first-hand data and organize it using
  – tally marks
  – line plots
  – charts
  – lists
  to answer questions [C, CN, V]

D2   construct, label and interpret bar graphs to solve problems [PS, R, V]

Chance and Uncertainty

  not applicable at this grade level

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

Grade 4

It is expected that students will:

Number

A1 represent and describe whole numbers to 10 000, pictorially and symbolically [C, CN, V]
A2 compare and order numbers to 10 000 [C, CN]
A3 demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals) by
  − using personal strategies for adding and subtracting
  − estimating sums and differences
  − solving problems involving addition and subtraction [C, CN, ME, PS, R]
A4 explain the properties of 0 and 1 for multiplication, and the property of 1 for division [C, CN, R]
A5 describe and apply mental mathematics strategies, such as
  − skip counting from a known fact
  − using doubling or halving
  − using doubling or halving and adding or subtracting one more group
  − using patterns in the 9s facts
  − using repeated doubling
  to determine basic multiplication facts to 9 × 9 and related division facts [C, CN, ME, PS, R]
A6 demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by
  − using personal strategies for multiplication with and without concrete materials
  − using arrays to represent multiplication
  − connecting concrete representations to symbolic representations
  − estimating products [C, CN, ME, PS, R, V]
A7 demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by
  − using personal strategies for dividing with and without concrete materials
  − estimating quotients
  − relating division to multiplication [C, CN, ME, PS, R, V]
A8 demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to
  − 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 [C, CN, PS, R, V]
A9 describe and represent decimals (tenths and hundredths) concretely, pictorially, and symbolically [C, CN, R, V]
A10 relate decimals to fractions (to hundredths) [CN, R, V]
A11 demonstrate an understanding of addition and subtraction of decimals (limited to hundredths) by
  − using compatible numbers
  − estimating sums and differences
  − using mental math strategies
  to solve problems [C, ME, PS, R, V]

GRADE 4

PATTERNS AND RELATIONS

Patterns

B1   identify and describe patterns found in tables and charts, including a multiplication chart [C, CN, PS, V]

B2   reproduce a pattern shown in a table or chart using concrete materials [C, CN, V]

B3   represent and describe patterns and relationships using charts and tables to solve problems [C, CN, PS, R, V]

B4   identify and explain mathematical relationships using charts and diagrams to solve problems [CN, PS, R, V]

Variables and Equations

B5   express a given problem as an equation in which a symbol is used to represent an unknown number [CN, PS, R]

B6   solve one-step equations involving a symbol to represent an unknown number [C, CN, PS, R, V]

SHAPE AND SPACE

Measurement

C1   read and record time using digital and analog clocks, including 24-hour clocks [C, CN, V]

C2   read and record calendar dates in a variety of formats [C, V]

C3   demonstrate an understanding of area of regular and irregular 2-D shapes by
  − 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]

3-D Objects and 2-D Shapes

C4   describe and construct rectangular and triangular prisms [C, CN, R, V]

Transformations

C5   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]

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

GRADE 4

STATISTICS AND PROBABILITY

Data Analysis

D1   demonstrate an understanding of many-to-one correspondence [C, R, T, V]

D2   construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions [C, PS, R, V]

CHANCE AND UNCERTAINTY

     not applicable at this grade level

GRADE 5

It is expected that students will:

NUMBER

A1 represent and describe whole numbers to 1 000 000 [C, CN, V, T]

A2 use estimation strategies including
- front-end rounding
- compensation
- compatible numbers

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

A3 apply mental mathematics strategies and number properties, such as
- skip counting from a known fact
- using doubling or halving
- using patterns in the 9s facts
- using repeated doubling or halving

to determine answers for basic multiplication facts to 81 and related division facts [C, CN, ME, R, V]

A4 apply mental mathematics strategies for multiplication, such as
- annexing then adding zero
- halving and doubling
- using the distributive property [C, ME, R]

A5 demonstrate an understanding of multiplication (2-digit by 2-digit) to solve problems [C, CN, PS, V]

A6 Demonstrate, with and without concrete materials, an understanding of division (3-digit by 1-digit) and interpret remainders to solve problems [C, CN, PS]

A7 demonstrate an understanding of fractions by using concrete and pictorial representations to
- create sets of equivalent fractions
- compare fractions with like and unlike denominators [C, CN, PS, R, V]

A8 describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially, and symbolically [C, CN, R, V]

A9 relate decimals to fractions (to thousandths) [CN, R, V]

A10 compare and order decimals (to thousandths) by using
- benchmarks
- place value
- equivalent decimals [CN, R, V]

A11 demonstrate an understanding of addition and subtraction of decimals (limited to thousandths) [C, CN, PS, R, V]

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

GRADE 5

PATTERNS AND RELATIONS

Patterns

B1   determine the pattern rule to make predictions about subsequent elements [C, CN, PS, R, V]

Variables and Equations

B2   solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions [C, CN, PS, R]

SHAPE AND SPACE

Measurement

C1   design and construct different rectangles given either perimeter or area, or both (whole numbers) and draw conclusions [C, CN, PS, R, V]

C2   demonstrate an understanding of measuring length (mm) by
– selecting and justifying referents for the unit mm
– modelling and describing the relationship between mm and cm units, and between mm and m units [C, CN, ME, PS, R, V]

C3   demonstrate an understanding of volume by
– 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]

C4   demonstrate an understanding of capacity by
– 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]

3-D Objects and 2-D Shapes

C5   describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes that are
– parallel
– intersecting
– perpendicular
– vertical
– horizontal [C, CN, R, T, V]

C6   identify and sort quadrilaterals, including
– rectangles
– squares
– trapezoids
– parallelograms
– rhombuses
according to their attributes [C, R, V]

GRADE 5

Transformations

C7 perform a single transformation (translation, rotation, or reflection) of a 2-D shape (with and without technology) and draw and describe the image [C, CN, T, V]

C8 identify a single transformation, including a translation, rotation, and reflection of 2-D shapes [C, T, V]

STATISTICS AND PROBABILITY

Data Analysis

D1 differentiate between first-hand and second-hand data [C, R, T, V]

D2 construct and interpret double bar graphs to draw conclusions [C, PS, R, T, V]

Chance and Uncertainty

D3 describe the likelihood of a single outcome occurring using words such as
  – impossible
  – possible
  – certain [C, CN, PS, R]

D4 compare the likelihood of two possible outcomes occurring using words such as
  – less likely
  – equally likely
  – more likely [C, CN, PS, R]

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

GRADE 6

It is expected that students will:

NUMBER

A1   demonstrate an understanding of place value for numbers
  − greater than one million
  − less than one thousandth [C, CN, R, T]
A2   solve problems involving large numbers, using technology [ME, PS, T]
A3   demonstrate an understanding of factors and multiples by
  − determining multiples and factors of numbers less than 100
  − identifying prime and composite numbers
  − solving problems involving multiples [PS, R, V]
A4   relate improper fractions to mixed numbers [CN, ME, R, V]
A5   demonstrate an understanding of ratio, concretely, pictorially, and symbolically [C, CN, PS, R, V]
A6   demonstrate an understanding of percent (limited to whole numbers) concretely, pictorially, and symbolically [C, CN, PS, R, V]
A7   demonstrate an understanding of integers, concretely, pictorially, and symbolically [C, CN, R, V]
A8   demonstrate an understanding of multiplication and division of decimals (1-digit whole number multipliers and 1-digit natural number divisors) [C, CN, ME ,PS, R, V]
A9   explain and apply the order of operations, excluding exponents, with and without technology (limited to whole numbers) [CN, ME, PS, T]

PATTERNS AND RELATIONS

Patterns

B1   demonstrate an understanding of the relationships within tables of values to solve problems [C, CN, PS, R]
B2   represent and describe patterns and relationships using graphs and tables [C, CN, ME, PS, R, V]

Variables and Equations

B3   represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V]
B4   demonstrate and explain the meaning of preservation of equality concretely, pictorially, and symbolically [C, CN, PS, R, V]

GRADE 6

SHAPE AND SPACE

Measurement

C1 demonstrate an understanding of angles by
  − 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 [C, CN, ME, V]
C2 demonstrate that the sum of interior angles is:
  − 180° in a triangle
  − 360° in a quadrilateral [C, R]
C3 develop and apply a formula for determining the
  − perimeter of polygons
  − area of rectangles
  − volume of right rectangular prisms [C, CN, PS, R, V]

3-D Objects and 2-D Shapes

C4 construct and compare triangles, including
  − scalene
  − isosceles
  − equilateral
  − right
  − obtuse
  − acute
  in different orientations [C, PS, R, V]
C5 describe and compare the sides and angles of regular and irregular polygons [C, PS, R, V]

Transformations

C6 perform a combination of translation(s), rotation(s) and/or reflection(s) on a single 2-D shape, with and without technology, and draw and describe the image [C, CN, PS, T, V]
C7 perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations [C, CN, T, V]
C8 identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs [C, CN, V]
C9 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]

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

GRADE 6

STATISTICS AND PROBABILITY

Data Analysis

D1   create, label, and interpret line graphs to draw conclusions [C, CN, PS, R, V]

D2   select, justify, and use appropriate methods of collecting data, including
   − questionnaires
   − experiments
   − databases
   − electronic media [C, PS, T]

D3   graph collected data and analyze the graph to solve problems [C, CN, PS]

Chance and Uncertainty

D4   demonstrate an understanding of probability by
   − 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 [C, ME, PS, T]

GRADE 7

It is expected that students will:

NUMBER

A1   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]

A2   demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems [ME, PS, T]

A3   solve problems involving percents from 1% to 100% [C, CN, PS, R, T]

A4   demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions [C, CN, R, T]

A5   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]

A6   demonstrate an understanding of addition and subtraction of integers, concretely, pictorially, and symbolically [C, CN, PS, R, V]

A7   compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using
   − benchmarks
   − place value
   − equivalent fractions and/or decimals [CN, R, V]

PATTERNS AND RELATIONS

Patterns

B1   demonstrate an understanding of oral and written patterns and their equivalent linear relations [C, CN, R]

B2   create a table of values from a linear relation, graph the table of values, and analyze the graph to draw conclusions and solve problems [C, CN, R, V]

Variables and Equations

B3   demonstrate an understanding of preservation of equality by
   − modelling preservation of equality concretely, pictorially, and symbolically
   − applying preservation of equality to solve equations [C, CN, PS, R, V]

B4   explain the difference between an expression and an equation [C, CN]

B5   evaluate an expression given the value of the variable(s) [CN, R]

B6   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]

B7   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]

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

GRADE 7

SHAPE AND SPACE

Measurement

C1 demonstrate an understanding of circles by
- describing the relationships among radius, diameter, and circumference of circles
- relating circumference to pi
- 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 [C, CN, R, V]

C2 develop and apply a formula for determining the area of
- triangles
- parallelograms
- circles [CN, PS, R, V]

3-D Objects and 2-D Shapes

C3 perform geometric constructions, including
- perpendicular line segments
- parallel line segments
- perpendicular bisectors
- angle bisectors [CN, R, V]

Transformations

C4 identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs [C, CN, V]

C5 perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices) [CN, PS, T, V]

STATISTICS AND PROBABILITY

Data Analysis

D1 demonstrate an understanding of central tendency and range by
- 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]

D2 determine the effect on the mean, median, and mode when an outlier is included in a data set [C, CN, PS, R]

D3 construct, label, and interpret circle graphs to solve problems [C, CN, PS, R, T, V]

Chance and Uncertainty

D4 express probabilities as ratios, fractions, and percents [C, CN, R, V, T]

D5 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]

D6 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]

PRESCRIBED LEARNING OUTCOMES
By Curriculum Organizer

NUMBER

It is expected that students will:

KINDERGARTEN

A1   say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1 [C, CN, V]
A2   recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots [C, CN, ME, V]
A3   relate a numeral, 1 to 10, to its respective quantity [CN, R, V]
A4   represent and describe numbers 2 to 10, concretely and pictorially [C, CN, ME, R, V]
A5   compare quantities, 1 to 10, using one-to-one correspondence [C, CN, V]

GRADE 1

A1   say the number sequence, 0 to 100, by
   − 1s forward and backward between any two given numbers
   − 2s to 20, forward starting at 0
   − 5s and 10s to 100, forward starting at 0 [C, CN, V, ME]
A2   recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots [C, CN, ME, V]
A3   demonstrate an understanding of counting by
   − indicating that the last number said identifies "how many"
   − showing that any set has only one count
   − using the counting on strategy
   − using parts or equal groups to count sets [C, CN, ME, R, V]
A4   represent and describe numbers to 20 concretely, pictorially, and symbolically [C, CN, V]
A5   compare sets containing up to 20 elements to solve problems using
   − referents
   − one-to-one correspondence [C, CN, ME, PS, R, V]
A6   estimate quantities to 20 by using referents [C, ME, PS, R, V]
A7   demonstrate, concretely and pictorially, how a given number can be represented by a variety of equal groups with and without singles [C, R, V]
A8   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]
A9   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]
A10 describe and use mental mathematics strategies (memorization not intended), such as
   − counting on and counting back
   − making 10
   − doubles
   − using addition to subtract
   to determine the basic addition facts to 18 and related subtraction facts [C, CN, ME, PS, R, V]

GRADE 2

A1 say the number sequence from 0 to 100 by
   − 2s, 5s and 10s, forward and backward, using starting points that are multiples of 2, 5, and 10 respectively
   − 10s using starting points from 1 to 9
   − 2s starting from 1 [C, CN, ME, R]
A2 demonstrate if a number (up to 100) is even or odd [C, CN, PS, R]
A3 describe order or relative position using ordinal numbers (up to tenth) [C, CN, R]
A4 represent and describe numbers to 100, concretely, pictorially, and symbolically [C, CN, V]
A5 compare and order numbers up to 100 [C, CN, R, V]
A6 estimate quantities to 100 using referents [C, ME, PS, R]
A7 illustrate, concretely and pictorially, the meaning of place value for numerals to 100 [C, CN, R, V]
A8 demonstrate and explain the effect of adding zero to or subtracting zero from any number [C, R]
A9 demonstrate an understanding of addition (limited to 1 and 2-digit numerals) with answers to 100 and the corresponding subtraction by
   − using personal strategies for adding and subtracting with and without the support of manipulatives
   − creating and solving problems that involve addition and subtraction
   − explaining that the order in which numbers are added does not affect the sum
   − explaining that the order in which numbers are subtracted may affect the difference
   [C, CN, ME, PS, R, V]
A10 apply mental mathematics strategies, such as
   − using doubles
   − making 10
   − one more, one less
   − two more, two less
   − building on a known double
   − addition for subtraction
   to determine basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]

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

GRADE 3

A1 say the number sequence forward and backward from 0 to 1000 by
- 5s, 10s or 100s using any starting point
- 3s using starting points that are multiples of 3
- 4s using starting points that are multiples of 4
- 25s using starting points that are multiples of 25 [C, CN, ME]

A2 represent and describe numbers to 1000, concretely, pictorially, and symbolically [C, CN, V]

A3 compare and order numbers to 1000 [CN, R, V]

A4 estimate quantities less than 1000 using referents [ME, PS, R, V]

A5 illustrate, concretely and pictorially, the meaning of place value for numerals to 1000 [C, CN, R, V]

A6 describe and apply mental mathematics strategies for adding two 2-digit numerals, such as
- adding from left to right
- taking one addend to the nearest multiple of ten and then compensating
- using doubles [C, ME, PS, R, V]

A7 describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as
- taking the subtrahend to the nearest multiple of ten and then compensating
- thinking of addition
- using doubles [C, ME, PS, R, V]

A8 apply estimation strategies to predict sums and differences of two 2-digit numerals in a problem-solving context [C, ME, PS, R]

A9 demonstrate an understanding of addition and subtraction of numbers with answers to 1000 (limited to 1, 2 and 3-digit numerals) by
- 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 [C, CN, ME, PS, R]

A10 apply mental mathematics strategies and number properties, such as
- using doubles
- making 10
- using the commutative property
- using the property of zero
- thinking addition for subtraction
to recall basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]

A11 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]

A12 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]

A13 demonstrate an understanding of fractions by
- explaining that a fraction represents a part of a whole
- describing situations in which fractions are used
- comparing fractions of the same whole with like denominators [C, CN, ME, R, V]

GRADE 4

A1 represent and describe whole numbers to 10 000, pictorially and symbolically [C, CN, V]

A2 compare and order numbers to 10 000 [C, CN]

A3 demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals) by
  − using personal strategies for adding and subtracting
  − estimating sums and differences
  − solving problems involving addition and subtraction [C, CN, ME, PS, R]

A4 explain the properties of 0 and 1 for multiplication, and the property of 1 for division [C, CN, R]

A5 describe and apply mental mathematics strategies, such as
  − skip counting from a known fact
  − using doubling or halving
  − using doubling or halving and adding or subtracting one more group
  − using patterns in the 9s facts
  − using repeated doubling
  to determine basic multiplication facts to 9 × 9 and related division facts [C, CN, ME, PS, R]

A6 demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by
  − using personal strategies for multiplication with and without concrete materials
  − using arrays to represent multiplication
  − connecting concrete representations to symbolic representations
  − estimating products [C, CN, ME, PS, R, V]

A7 demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by
  − using personal strategies for dividing with and without concrete materials
  − estimating quotients
  − relating division to multiplication [C, CN, ME, PS, R, V]

A8 demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to
  − 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 [C, CN, PS, R, V]

A9 describe and represent decimals (tenths and hundredths) concretely, pictorially, and symbolically [C, CN, R, V]

A10 relate decimals to fractions (to hundredths) [CN, R, V]

A11 demonstrate an understanding of addition and subtraction of decimals (limited to hundredths) by
  − using compatible numbers
  − estimating sums and differences
  − using mental math strategies
  to solve problems [C, ME, PS, R, V]

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

GRADE 5

A1 represent and describe whole numbers to 1 000 000 [C, CN, V, T]
A2 use estimation strategies including
   − front-end rounding
   − compensation
   − compatible numbers
   in problem-solving contexts [C, CN, ME, PS, R, V]
A3 apply mental mathematics strategies and number properties, such as
   − skip counting from a known fact
   − using doubling or halving
   − using patterns in the 9s facts
   − using repeated doubling or halving
   to determine answers for basic multiplication facts to 81 and related division facts [C, CN, ME, R, V]
A4 apply mental mathematics strategies for multiplication, such as
   − annexing then adding zero
   − halving and doubling
   − using the distributive property [C, ME, R]
A5 demonstrate an understanding of multiplication (2-digit by 2-digit) to solve problems [C, CN, PS, V]
A6 Demonstrate, with and without concrete materials, an understanding of division (3-digit by 1-digit) and interpret remainders to solve problems [C, CN, PS]
A7 demonstrate an understanding of fractions by using concrete and pictorial representations to
   − create sets of equivalent fractions
   − compare fractions with like and unlike denominators [C, CN, PS, R, V]
A8 describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially, and symbolically [C, CN, R, V]
A9 relate decimals to fractions (to thousandths) [CN, R, V]
A10 compare and order decimals (to thousandths) by using
   − benchmarks
   − place value
   − equivalent decimals [CN, R, V]
A11 demonstrate an understanding of addition and subtraction of decimals (limited to thousandths) [C, CN, PS, R, V]

GRADE 6

A1 demonstrate an understanding of place value for numbers
   − greater than one million
   − less than one thousandth [C, CN, R, T]
A2 solve problems involving large numbers, using technology [ME, PS, T]
A3 demonstrate an understanding of factors and multiples by
   − determining multiples and factors of numbers less than 100
   − identifying prime and composite numbers
   − solving problems involving multiples [PS, R, V]
A4 relate improper fractions to mixed numbers [CN, ME, R, V]
A5 demonstrate an understanding of ratio, concretely, pictorially, and symbolically [C, CN, PS, R, V]
A6 demonstrate an understanding of percent (limited to whole numbers) concretely, pictorially, and symbolically [C, CN, PS, R, V]
A7 demonstrate an understanding of integers, concretely, pictorially, and symbolically [C, CN, R, V]
A8 demonstrate an understanding of multiplication and division of decimals (1-digit whole number multipliers and 1-digit natural number divisors) [C, CN, ME ,PS, R, V]
A9 explain and apply the order of operations, excluding exponents, with and without technology (limited to whole numbers) [CN, ME, PS, T]

GRADE 7

A1 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]

A2 demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems [ME, PS, T]

A3 solve problems involving percents from 1% to 100% [C, CN, PS, R, T]

A4 demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions [C, CN, R, T]

A5 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]

A6 demonstrate an understanding of addition and subtraction of integers, concretely, pictorially, and symbolically [C, CN, PS, R, V]

A7 compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using
  − benchmarks
  − place value
  − equivalent fractions and/or decimals [CN, R, V]

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

PATTERNS AND RELATIONS

It is expected that students will:

KINDERGARTEN

Patterns

B1   demonstrate an understanding of repeating patterns (two or three elements) by
  − identifying
  − reproducing
  − extending
  − creating
  patterns, using manipulatives, sounds, and actions [C, CN, PS, V]

Variables and Equations
  not applicable at this grade level

GRADE 1

Patterns

B1   demonstrate an understanding of repeating patterns (two to four elements) by
  − describing
  − reproducing
  − extending
  − creating
  patterns using manipulatives, diagrams, sounds, and actions [C, PS, R, V]
B2   translate repeating patterns from one representation to another [C, R, V]

Variables and Equations

B3   describe equality as a balance and inequality as an imbalance, concretely, and pictorially (0 to 20) [C, CN, R, V]
B4   record equalities using the equal symbol [C, CN, PS, V]

GRADE 2

Patterns

B1   demonstrate an understanding of repeating patterns (three to five elements) by
  − describing
  − extending
  − comparing
  − creating
  patterns using manipulatives, diagrams, sounds, and actions. [C, CN, PS, R, V]
B2   demonstrate an understanding of increasing patterns by
  − describing
  − reproducing
  − extending
  − creating
  patterns using manipulatives, diagrams, sounds, and actions (numbers to 100) [C, CN, PS, R, V]

Variables and Equations

B3 demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100) [C, CN, R, V]

B4 record equalities and inequalities symbolically using the equal symbol or the not equal symbol [C, CN, R, V]

GRADE 3

Patterns

B1 demonstrate an understanding of increasing patterns by
 − describing
 − extending
 − comparing
 − creating
 patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

B2 demonstrate an understanding of decreasing patterns by
 − describing
 − extending
 − comparing
 − creating
 patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

Variables and Equations

B3 solve one-step addition and subtraction equations involving symbols representing an unknown number [C, CN, PS, R, V]

GRADE 4

Patterns

B1 identify and describe patterns found in tables and charts, including a multiplication chart [C, CN, PS, V]

B2 reproduce a pattern shown in a table or chart using concrete materials [C, CN, V]

B3 represent and describe patterns and relationships using charts and tables to solve problems [C, CN, PS, R, V]

B4 identify and explain mathematical relationships using charts and diagrams to solve problems [CN, PS, R, V]

Variables and Equations

B5 express a given problem as an equation in which a symbol is used to represent an unknown number [CN, PS, R]

B6 solve one-step equations involving a symbol to represent an unknown number [C, CN, PS, R, V]

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

GRADE 5

Patterns

B1   determine the pattern rule to make predictions about subsequent elements [C, CN, PS, R, V]

Variables and Equations

B2   solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions [C, CN, PS, R]

GRADE 6

Patterns

B1   demonstrate an understanding of the relationships within tables of values to solve problems [C, CN, PS, R]

B2   represent and describe patterns and relationships using graphs and tables [C, CN, ME, PS, R, V]

Variables and Equations

B3   represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V]

B4   demonstrate and explain the meaning of preservation of equality concretely, pictorially, and symbolically [C, CN, PS, R, V]

GRADE 7

Patterns

B1   demonstrate an understanding of oral and written patterns and their equivalent linear relations [C, CN, R]

B2   create a table of values from a linear relation, graph the table of values, and analyze the graph to draw conclusions and solve problems [C, CN, R, V]

Variables and Equations

B3   demonstrate an understanding of preservation of equality by
  – modelling preservation of equality concretely, pictorially, and symbolically
  – applying preservation of equality to solve equations [C, CN, PS, R, V]

B4   explain the difference between an expression and an equation [C, CN]

B5   evaluate an expression given the value of the variable(s) [CN, R]

B6   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]

B7   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]

SHAPE AND SPACE

It is expected that students will:

KINDERGARTEN

Measurement

C1 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]

3-D Objects and 2-D Shapes

C2 sort 3-D objects using a single attribute [C, CN, PS, R, V]
C3 build and describe 3-D objects [CN, PS, V]

Transformations

not applicable at this grade level

GRADE 1

Measurement

C1 demonstrate an understanding of measurement as a process of comparing by
  − identifying attributes that can be compared
  − ordering objects
  − making statements of comparison
  − filling, covering, or matching [C, CN, PS, R, V]

3-D Objects and 2-D Shapes

C2 sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule [C, CN, R, V]
C3 replicate composite 2-D shapes and 3-D objects [CN, PS, V]
C4 compare 2-D shapes to parts of 3-D objects in the environment [C, CN, V]

Transformations

not applicable at this grade level

GRADE 2

Measurement

C1 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]
C2 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]
C3 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]
C4 measure length to the nearest non-standard unit by
  − using multiple copies of a unit
  − using a single copy of a unit (iteration process) [C, ME, R, V]
C5 demonstrate that changing the orientation of an object does not alter the measurements of its attributes [C, R, V]

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

3-D Objects and 2-D Shapes

C6 sort 2-D shapes and 3-D objects using two attributes and explain the sorting rule [C, CN, R, V]
C7 describe, compare, and construct 3-D objects, including
    − cubes
    − spheres
    − cones
    − cylinders
    − pyramids [C, CN, R, V]
C8 describe, compare, and construct 2-D shapes, including
    − triangles
    − squares
    − rectangles
    − circles [C, CN, R, V]
C9 identify 2-D shapes as parts of 3-D objects in the environment [C, CN, R, V]

Transformations

    not applicable at this grade level

GRADE 3

Measurement

C1 relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years) [CN, ME, R]
C2 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]
C3 demonstrate an understanding of measuring length (cm, m) by
    − 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]
C4 demonstrate an understanding of measuring mass (g, kg) by
    − 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]
C5 demonstrate an understanding of perimeter of regular and irregular shapes by
    − 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]

3-D Objects and 2-D Shapes

C6 describe 3-D objects according to the shape of the faces, and the number of edges and vertices [C, CN, PS, R, V]
C7 sort regular and irregular polygons, including
    − triangles
    − quadrilaterals
    − pentagons
    − hexagons
    − octagons
    according to the number of sides [C, CN, R, V]

Transformations
not applicable at this grade level

GRADE 4

Measurement

C1 read and record time using digital and analog clocks, including 24-hour clocks [C, CN, V]
C2 read and record calendar dates in a variety of formats [C, V]
C3 demonstrate an understanding of area of regular and irregular 2-D shapes by
  - 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]

3-D Objects and 2-D Shapes

C4 describe and construct rectangular and triangular prisms [C, CN, R, V]

Transformations

C5 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]

GRADE 5

Measurement

C1 design and construct different rectangles given either perimeter or area, or both (whole numbers) and draw conclusions [C, CN, PS, R, V]
C2 demonstrate an understanding of measuring length (mm) by
  - selecting and justifying referents for the unit mm
  - modelling and describing the relationship between mm and cm units, and between mm and m units [C, CN, ME, PS, R, V]
C3 demonstrate an understanding of volume by
  - 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]
C4 demonstrate an understanding of capacity by
  - 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]

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

3-D Objects and 2-D Shapes

C5   describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes that are
   − parallel
   − intersecting
   − perpendicular
   − vertical
   − horizontal [C, CN, R, T, V]
C6   identify and sort quadrilaterals, including
   − rectangles
   − squares
   − trapezoids
   − parallelograms
   − rhombuses
   according to their attributes [C, R, V]

Transformations

C7   perform a single transformation (translation, rotation, or reflection) of a 2-D shape (with and without technology) and draw and describe the image [C, CN, T, V]
C8   identify a single transformation, including a translation, rotation, and reflection of 2-D shapes [C, T, V]

GRADE 6

Measurement

C1   demonstrate an understanding of angles by
   − 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 [C, CN, ME, V]
C2   demonstrate that the sum of interior angles is:
   − 180° in a triangle
   − 360° in a quadrilateral [C, R]
C3   develop and apply a formula for determining the
   − perimeter of polygons
   − area of rectangles
   − volume of right rectangular prisms [C, CN, PS, R, V]

3-D Objects and 2-D Shapes

C4   construct and compare triangles, including
   − scalene
   − isosceles
   − equilateral
   − right
   − obtuse
   − acute
   in different orientations [C, PS, R, V]
C5   describe and compare the sides and angles of regular and irregular polygons [C, PS, R, V]

Transformations

C6 perform a combination of translation(s), rotation(s) and/or reflection(s) on a single 2-D shape, with and without technology, and draw and describe the image [C, CN, PS, T, V]

C7 perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations [C, CN, T, V]

C8 identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs [C, CN, V]

C9 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]

GRADE 7

Measurement

C1 demonstrate an understanding of circles by
  − describing the relationships among radius, diameter, and circumference of circles
  − relating circumference to pi
  − 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 [C, CN, R, V]

C2 develop and apply a formula for determining the area of
  − triangles
  − parallelograms
  − circles [CN, PS, R, V]

3-D Objects and 2-D Shapes

C3 perform geometric constructions, including
  − perpendicular line segments
  − parallel line segments
  − perpendicular bisectors
  − angle bisectors [CN, R, V]

Transformations

C4 identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs [C, CN, V]

C5 perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices) [CN, PS, T, V]

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

STATISTICS AND PROBABILITY

It is expected that students will:

KINDERGARTEN

Data Analysis

not applicable at this grade level

Chance and Uncertainty

not applicable at this grade level

GRADE 1

Data Analysis

not applicable at this grade level

Chance and Uncertainty

not applicable at this grade level

GRADE 2

Data Analysis

D1 gather and record data about self and others to answer questions [C, CN, PS, V]
D2 construct and interpret concrete graphs and pictographs to solve problems [C, CN, PS, R, V]

Chance and Uncertainty

not applicable at this grade level

GRADE 3

Data Analysis

D1 collect first-hand data and organize it using
  − tally marks
  − line plots
  − charts
  − lists
  to answer questions [C, CN, V]
D2 construct, label and interpret bar graphs to solve problems [PS, R, V]

Chance and Uncertainty

not applicable at this grade level

GRADE 4

Data Analysis

D1 demonstrate an understanding of many-to-one correspondence [C, R, T, V]
D2 construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions [C, PS, R, V]

Chance and Uncertainty

not applicable at this grade level

GRADE 5

Data Analysis

D1 differentiate between first-hand and second-hand data [C, R, T, V]
D2 construct and interpret double bar graphs to draw conclusions [C, PS, R, T, V]

Chance and Uncertainty

D3 describe the likelihood of a single outcome occurring using words such as
  − impossible
  − possible
  − certain [C, CN, PS, R]
D4 compare the likelihood of two possible outcomes occurring using words such as
  − less likely
  − equally likely
  − more likely [C, CN, PS, R]

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

GRADE 6

Data Analysis

D1 create, label, and interpret line graphs to draw conclusions [C, CN, PS, R, V]
D2 select, justify, and use appropriate methods of collecting data, including
  − questionnaires
  − experiments
  − databases
  − electronic media [C, PS, T]
D3 graph collected data and analyze the graph to solve problems [C, CN, PS]

Chance and Uncertainty

D4 demonstrate an understanding of probability by
  − 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 [C, ME, PS, T]

GRADE 7

Data Analysis

D1 demonstrate an understanding of central tendency and range by
  − 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]
D2 determine the effect on the mean, median, and mode when an outlier is included in a data set
  [C, CN, PS, R]
D3 construct, label, and interpret circle graphs to solve problems [C, CN, PS, R, T, V]

Chance and Uncertainty

D4 express probabilities as ratios, fractions, and percents [C, CN, R, T, V]
D5 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]
D6 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]

STUDENT ACHIEVEMENT
Mathematics K to 7

This section of the IRP contains information about classroom assessment and student achievement, including specific achievement indicators that may be used to assess student performance in relation to each prescribed learning outcome. Also included in this section are key elements – descriptions of content that help determine the intended depth and breadth of prescribed learning outcomes.

CLASSROOM ASSESSMENT AND EVALUATION

Assessment is the systematic gathering of information about what students know, are able to do, and are working toward. Assessment evidence can be collected using a wide variety of methods, such as
- observation
- student self-assessments and peer assessments
- quizzes and tests (written, oral, practical)
- samples of student work
- projects and presentations
- oral and written reports
- journals and learning logs
- performance reviews
- portfolio assessments

Assessment of student achievement is based on the information collected through assessment activities. Teachers use their insight, knowledge about learning, and experience with students, along with the specific criteria they establish, to make judgments about student performance in relation to prescribed learning outcomes.

Three major types of assessment can be used in conjunction with each other to support student achievement.
- Assessment for learning is assessment for purposes of greater learning achievement.
- Assessment as learning is assessment as a process of developing and supporting students' active participation in their own learning.
- Assessment of learning is assessment for purposes of providing evidence of achievement for reporting.

Assessment for Learning

Classroom assessment for learning provides ways to engage and encourage students to become involved in their own day-to-day assessment – to acquire the skills of thoughtful self-assessment and to promote their own achievement.

This type of assessment serves to answer the following questions:
- What do students need to learn to be successful?
- What does the evidence of this learning look like?

Assessment for learning is criterion-referenced, in which a student's achievement is compared to established criteria rather than to the performance of other students. Criteria are based on prescribed learning outcomes, as well as on suggested achievement indicators or other learning expectations.

Students benefit most when assessment feedback is provided on a regular, ongoing basis. When assessment is seen as an opportunity to promote learning rather than as a final judgment, it shows students their strengths and suggests how they can develop further. Students can use this information to redirect their efforts, make plans, communicate with others (e.g., peers, teachers, parents) about their growth, and set future learning goals.

Assessment for learning also provides an opportunity for teachers to review what their students are learning and what areas need further attention. This information can be used to inform teaching and create a direct link between assessment and instruction. Using assessment as a way of obtaining feedback on instruction supports student achievement by informing teacher planning and classroom practice.

Assessment as Learning

Assessment as learning actively involves students in their own learning processes. With support and guidance from their teacher, students take responsibility for their own learning, constructing meaning for themselves. Through a process of continuous self-assessment, students develop the ability to take stock of what they have already learned, determine what they have not yet learned, and decide how they can best improve their own achievement.

Although assessment as learning is student-driven, teachers can play a key role in facilitating how this assessment takes place. By providing regular opportunities for reflection and self-assessment, teachers can help students develop, practise, and become comfortable with critical analysis of their own learning.

Assessment of Learning

Assessment of learning can be addressed through summative assessment, including large-scale assessments and teacher assessments. These summative assessments can occur at the end of the year or at periodic stages in the instructional process.

Large-scale assessments, such as Foundation Skills Assessment (FSA) and Graduation Program exams, gather information on student performance throughout the province and provide information

for the development and revision of curriculum. These assessments are used to make judgments about students' achievement in relation to provincial and national standards.

Assessment of learning is also used to inform formal reporting of student achievement.

> For Ministry of Education reporting policy, refer to www.bced.gov.bc.ca/policy/policies/student_reporting.htm

Assessment *for* Learning	Assessment *as* Learning	Assessment *of* Learning
Formative assessment *ongoing in the classroom*	Formative assessment *ongoing in the classroom*	Summative assessment *occurs at end of year or at key stages*
• teacher assessment, student self-assessment, and/or student peer assessment • criterion-referenced criteria based on prescribed learning outcomes identified in the provincial curriculum, reflecting performance in relation to a specific learning task • involves both teacher and student in a process of continual reflection and review about progress • teachers adjust their plans and engage in corrective teaching in response to formative assessment	• self-assessment • provides students with information on their own achievement and prompts them to consider how they can continue to improve their learning • student-determined criteria based on previous learning and personal learning goals • students use assessment information to make adaptations to their learning process and to develop new understandings	• teacher assessment • may be either criterion-referenced (based on prescribed learning outcomes) or norm-referenced (comparing student achievement to that of others) • information on student performance can be shared with parents/guardians, school and district staff, and other education professionals (e.g., for the purposes of curriculum development) • used to make judgments about students' performance in relation to provincial standards

For more information about assessment for, as, and of learning, refer to the following resource developed by the Western and Northern Canadian Protocol (WNCP): *Rethinking Assessment with Purpose in Mind.*

> This resource is available online at www.wncp.ca

In addition, the BC Performance Standards describe levels of achievement in key areas of learning (reading, writing, numeracy, social responsibility, and information and communications technology integration) relevant to all subject areas. Teachers may wish to use the Performance Standards as resources to support ongoing formative assessment in mathematics.

> BC Performance Standards are available at www.bced.gov.bc.ca/perf_stands/

Criterion-Referenced Assessment and Evaluation

In criterion-referenced evaluation, a student's performance is compared to established criteria rather than to the performance of other students. Evaluation in relation to prescribed curriculum requires that criteria be established based on the learning outcomes.

Criteria are the basis for evaluating student progress. They identify, in specific terms, the critical aspects of a performance or a product that indicate how well the student is meeting the prescribed learning outcomes. For example, weighted criteria, rating scales, or scoring guides (reference sets) are ways that student performance can be evaluated using criteria.

Wherever possible, students should be involved in setting the assessment criteria. This helps students develop an understanding of what high-quality work or performance looks like.

Criterion-referenced assessment and evaluation may involve these steps:

Step 1   Identify the prescribed learning outcomes and suggested achievement indicators (as articulated in this IRP) that will be used as the basis for assessment.

Step 2   Establish criteria. When appropriate, involve students in establishing criteria.

Step 3   Plan learning activities that will help students gain the attitudes, skills, or knowledge outlined in the criteria.

Step 4   Prior to the learning activity, inform students of the criteria against which their work will be evaluated.

Step 5   Provide examples of the desired levels of performance.

Step 6   Conduct the learning activities.

Step 7   Use appropriate assessment instruments (e.g., rating scale, checklist, scoring guide) and methods (e.g., observation, collection, self-assessment) based on the particular assignment and student.

Step 8   Review the assessment data and evaluate each student's level of performance or quality of work in relation to criteria.

Step 9   Where appropriate, provide feedback and/or a letter grade to indicate how well the criteria are met.

Step 10   Communicate the results of the assessment and evaluation to students and parents/guardians.

KEY ELEMENTS

Key elements provide an overview of content in each curriculum organizer. They can be used to determine the expected depth and breadth of the prescribed learning outcomes.

Note that some topics appear at multiple grade levels in order to emphasize their importance and to allow for developmental learning.

ACHIEVEMENT INDICATORS

To support the assessment of provincially prescribed curricula, this IRP includes sets of achievement indicators in relation to each learning outcome.

Achievement indicators, taken together as a set, define the specific level of attitudes demonstrated, skills applied, or knowledge acquired by the student in relation to a corresponding prescribed learning outcome. They describe what evidence to look for to determine whether or not the student has fully met the intent of the learning outcome. Since each achievement indicator defines only one aspect of the corresponding learning outcome, the entire set of achievement indicators should be considered when determining whether students have fully met the learning outcome.

In some cases, achievement indicators may also include suggestions as to the type of task that would provide evidence of having met the learning outcome (e.g., a constructed response such as a list, comparison, or analysis; a product created and presented such as a report, poster, letter, or model; a particular skill demonstrated such as map making or critical thinking).

Achievement indicators support the principles of assessment for learning, assessment as learning, and assessment of learning. They provide teachers and parents with tools that can be used to reflect on what students are learning, as well as provide students with a means of self-assessment and ways of defining how they can improve their own achievement.

Achievement indicators are not mandatory; they are suggestions only, provided to assist in the assessment of how well students achieve the prescribed learning outcomes.

The following pages contain the suggested achievement indicators corresponding to each prescribed learning outcome for the Mathematics K to 7 curriculum. The achievement indicators are arranged by curriculum organizer for each grade; however, this order is not intended to imply a required sequence of instruction and assessment.

STUDENT ACHIEVEMENT

Kindergarten

KEY ELEMENTS: KINDERGARTEN

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense
- number sequence forward and backward to 10
- familiar number arrangements
- one-to-one correspondence

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns
- repeating patterns of two or three elements

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement
- direct comparison for length, mass, and volume

3-D Objects and 2-D Shapes
- single attribute of a 3-D objects

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
A1 say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1 [C, CN, V]	❏ name the number that comes after a given number, one to nine ❏ name the number that comes before a given number, two to ten ❏ recite number names from a given number to a stated number (forward – one to ten, backward – ten to one) using visual aids
A2 recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots [C, CN, ME, V]	❏ look briefly at a given familiar arrangement of 1 to 5 objects or dots and identify the number represented without counting ❏ identify the number represented by a given dot arrangement on a five frame
A3 relate a numeral, 1 to 10, to its respective quantity [CN, R, V]	❏ construct a set of objects corresponding to a given numeral ❏ name the number for a given set of objects ❏ hold up the appropriate number of fingers for a given numeral ❏ match numerals with their given pictorial representations
A4 represent and describe numbers 2 to 10, concretely and pictorially [C, CN, ME, R, V]	❏ show a given number as two parts, using fingers, counters or other objects, and name the number of objects in each part ❏ show a given number as two parts using pictures and name the number of objects in each part
A5 compare quantities, 1 to 10, using one-to-one correspondence [C, CN, V]	❏ construct a set to show more than, fewer than or as many as a given set ❏ compare two given sets through direct comparison and describe the sets using words, such as more, fewer, as many as, or the same number

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

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B1 demonstrate an understanding of repeating patterns (two or three elements) by – identifying – reproducing – extending – creating patterns, using manipulatives, sounds, and actions [C, CN, PS, V]	❏ distinguish between repeating patterns and non-repeating sequences in a given set by identifying the part that repeats ❏ copy a given repeating pattern (e.g., actions, sound, colour, size, shape, orientation) and describe the pattern ❏ extend a variety of given 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)

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C1 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]	❏ compare the length (height) of two given objects and explain the comparison using the words shorter, longer (taller), or almost the same ❏ compare the mass (weight) of two given objects and explain the comparison using the words lighter, heavier, or almost the same ❏ compare the volume (capacity) of two given objects and explain the comparison using the words less, more, bigger, smaller, or almost the same

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

[T]	Technology		
[V]	Visualization		

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C2 sort 3-D objects using a single attribute [C, CN, PS, R, V]	❏ sort a given 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 given pre-sorted sets by explaining a sorting rule used to sort them
C3 build and describe 3-D objects [CN, PS, V]	❏ create a representation of a given 3-D object using materials, such as modelling clay and building blocks, and compare the representation to the original 3-D object ❏ describe a given 3-D object using words such as big, little, round, like a box, and like a can

STUDENT ACHIEVEMENT

Grade 1

KEY ELEMENTS: GRADE 1

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense
- number sequence forward and backward to 100
- skip counting
- representation of number
- referents and one-to one-correspondence for sets up to 20 elements
- addition to 20 and basic addition and subtraction facts

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns
- repeating patterns of two to four elements
- representation of pattern
- equalities and inequalities

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement
- process of measurement using comparison

3-D Objects and 2-D Shapes
- one attribute of 3-D objects and 2-D shapes
- composite 2-D shapes and 3-D objects
- 2-D shapes in the environment

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

A1 say the number sequence, 0 to 100, by
  − 1s forward and backward between any two given numbers
  − 2s to 20, forward starting at 0
  − 5s and 10s to 100, forward starting at 0 [C, CN, V, ME]
	❑ 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 given numeral (0 to 100) symbolically when it is presented orally
	❑ read a given numeral (0 to 100) when it is presented symbolically
	❑ skip count by 2s to 20 starting at 0
	❑ skip count by 5s to 100 starting at 0
	❑ skip count forward by 10s to 100 starting at 0
	❑ identify and correct errors and omissions in a given number sequence

A2 recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots [C, CN, ME, V]	❑ look briefly at a given familiar arrangement of objects or dots and identify the number represented without counting ❑ look briefly at a given familiar arrangement and identify how many objects there are without counting ❑ identify the number represented by a given arrangement of objects or dots on a ten frame

A3 demonstrate an understanding of counting by
  − indicating that the last number said identifies "how many"
  − showing that any set has only one count
  − using the counting on strategy
  − using parts or equal groups to count sets
  [C, CN, ME, R, V]
	❑ answer the question, "How many are in the set?" using the last number counted in a given set
	❑ identify and correct counting errors in a given counting sequence
	❑ show that the count of the number of objects in a given 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
	❑ determine the total number of objects in a given set, starting from a known quantity and counting on
	❑ count quantity using groups of 2s, 5s, or 10s and counting on

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A4 represent and describe numbers to 20 concretely, pictorially, and symbolically [C, CN, V]	❏ represent a given number up to 20 using a variety of manipulatives, including ten frames and base ten materials ❏ read given number words to 20 ❏ partition any given quantity up to 20 into 2 parts and identify the number of objects in each part ❏ model a given number using two different objects (e.g., 10 desks represents the same number as 10 pencils) ❏ place given numerals on a number line with benchmarks 0, 5, 10, and 20
A5 compare sets containing up to 20 elements to solve problems using – referents – one-to-one correspondence [C, CN, ME, PS, R, V]	❏ build a set equal to a given set that contains up to 20 elements ❏ build a set that has more, fewer, or as many elements as a given set ❏ build several sets of different objects that have the same given number of elements in the set ❏ compare two given sets using one-to-one correspondence and describe them using comparative words, such as more, fewer, or as many ❏ compare a set to a given referent using comparative language ❏ solve a given story problem (pictures and words) that involves the comparison of two quantities
A6 estimate quantities to 20 by using referents [C, ME, PS, R, V]	❏ estimate a given quantity by comparing it to a given referent (known quantity) ❏ select an estimate for a given quantity by choosing between at least two possible choices and explain the choice
A7 demonstrate, concretely and pictorially, how a given number can be represented by a variety of equal groups with and without singles [C, R, V]	❏ represent a given 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, and 3 groups of 5 and two singles ❏ recognize that for a given number of counters, no matter how they are grouped, the total number of counters does not change ❏ group a set of given counters into equal groups in more than one way
A8 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]	❏ 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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A9 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 given story problem presented orally or through shared reading ❏ indicate if the scenario in a given story problem represents additive or subtractive action ❏ represent the numbers and actions presented in a given 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 word problem for a given number sentence ❏ represent a given story problem pictorially or symbolically to show the additive or subtractive action and solve the problem
A10 describe and use mental mathematics strategies (memorization not intended), such as – counting on and counting back – making 10 – doubles – using addition to subtract to determine the basic addition facts to 18 and related subtraction facts [C, CN, ME, PS, R, V]	*(It is not intended that students recall the basic facts but become familiar with strategies to mentally determine sums and differences.)* ❏ use and describe a personal strategy for determining a given sum ❏ use and describe a personal strategy for determining a given difference ❏ write the related subtraction fact for a given addition fact ❏ write the related addition fact for a given subtraction fact

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

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

B1 demonstrate an understanding of repeating patterns (two to four elements) by
  − describing
  − reproducing
  − extending
  − creating
patterns using manipulatives, diagrams, sounds, and actions [C, PS, R, V]
	❏ describe a given repeating pattern containing two to four elements in its core
	❏ identify errors in a given repeating pattern
	❏ identify the missing element(s) in a given repeating pattern
	❏ create and describe a repeating pattern using a variety of manipulatives, musical instruments, and actions
	❏ reproduce and extend a given repeating pattern using manipulatives, diagrams, sounds, and actions
	❏ identify and describe a repeating pattern in the environment (e.g., classroom, outdoors) using everyday language
	❏ identify repeating events (e.g., days of the week, birthdays, seasons)

B2 translate repeating patterns from one representation to another [C, R, V]	❏ represent a given repeating pattern using another mode (e.g., actions to sound, colour to shape, ABC ABC to blue yellow green blue yellow green ❏ describe a given repeating pattern using a letter code (e.g., ABC ABC…)

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome: Represent algebraic expressions in multiple ways.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B3 describe equality as a balance and inequality as an imbalance, concretely, and pictorially (0 to 20) [C, CN, R, V]	❏ 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 given concrete sets are equal or unequal and explain the process used
B4 record equalities using the equal symbol [C, CN, PS, V]	❏ represent a given equality using manipulatives or pictures ❏ represent a given pictorial or concrete equality in symbolic form ❏ provide examples of equalities where the given 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

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

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

C1 demonstrate an understanding of measurement as a process of comparing by
  − identifying attributes that can be compared
  − ordering objects
  − making statements of comparison
  − filling, covering, or matching
  [C, CN, PS, R, V]
	❏ identify common attributes, such as length (height), mass (weight), volume (capacity), and area, that could be used to compare a given set of two objects
	❏ compare two given objects and identify the attributes used to compare
	❏ determine which of two or more given objects is longest/shortest by matching and explain the reasoning
	❏ determine which of two or more given objects is heaviest/lightest by comparing and explain the reasoning
	❏ determine which of two or more given objects holds the most/least by filling and explain the reasoning
	❏ determine which of two or more given objects has the greatest/least area by covering and explain the reasoning

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C2 sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule [C, CN, R, V]	❏ sort a given set of familiar 3-D objects or 2-D shapes using a given sorting rule ❏ sort a given set of familiar 3-D objects using a single attribute determined by the student and explain the sorting rule ❏ sort a given set of 2-D shapes using a single attribute determined by the student and explain the sorting rule ❏ determine the difference between two given pre-sorted sets of familiar 3-D objects or 2-D shapes and explain a possible sorting rule used to sort them
C3 replicate composite 2-D shapes and 3-D objects [CN, PS, V]	❏ select 2-D shapes from a given set of 2-D shapes to reproduce a given composite 2-D shape ❏ select 3-D objects from a given set of 3-D objects to reproduce a given 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
C4 compare 2-D shapes to parts of 3-D objects in the environment [C, CN, V]	❏ identify 3-D objects in the environment that have parts similar to a given 2-D shape

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

STUDENT ACHIEVEMENT

Grade 2

KEY ELEMENTS: GRADE 2

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense
- whole numbers to 100
- skip counting
- referents to 100
- even, odd and ordinal numbers
- place value for numerals to 100
- addition to 100 and corresponding subtraction
- mental math strategies to 18

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns
- repeating patterns of three to five elements
- increasing patterns

Variables and Equations
- equality and inequality
- symbols for equality and inequality

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement
- days, weeks, months, and years
- non-standard units of measure for length, height distance around, mass (weight)

3-D Objects and 2-D Shapes
- two attributes of 3-D objects and 2-D shapes
- cubes, spheres, cones, cylinders, pyramids
- triangles, squares, rectangles, circles
- 2-D shapes in the environment

STATISTICS AND PROBABILITY – collect, display and analyze data to solve problems

Data Analysis
- data about self and others
- concrete graphs and pictographs

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

A1 say the number sequence from 0 to 100 by
  − 2s, 5s and 10s, forward and backward, using starting points that are multiples of 2, 5, and 10 respectively
  − 10s using starting points from 1 to 9
  − 2s starting from 1
  [C, CN, ME, R]
	❑ extend a given 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
	❑ identify and correct errors and omissions in a given skip counting sequence
	❑ count a given sum of money with pennies, nickels or dimes (to 100¢)
	❑ count quantity using groups of 2s, 5s, or 10s and counting on

A2 demonstrate if a number (up to 100) is even or odd [C, CN, PS, R]	❑ use concrete materials or pictorial representations to determine if a given number is even or odd ❑ identify even and odd numbers in a given sequence, such as in a hundred chart ❑ sort a given set of numbers into even and odd
A3 describe order or relative position using ordinal numbers (up to tenth) [C, CN, R]	❑ indicate a position of a specific object in a sequence by using ordinal numbers up to tenth ❑ compare the ordinal position of a specific object in two different given sequences
A4 represent and describe numbers to 100, concretely, pictorially, and symbolically [C, CN, V]	❑ represent a given number using concrete materials, such as ten frames and base ten materials ❑ represent a given number using coins (pennies, nickels, dimes, and quarters) ❑ represent a given number using tallies ❑ represent a given number pictorially ❑ represent a given number using expressions (e.g., 24 + 6, 15 + 15, 40 − 10) ❑ read a given number (0–100) in symbolic or word form ❑ record a given number (0–20) in words
A5 compare and order numbers up to 100 [C, CN, R, V]	❑ order a given set of numbers in ascending or descending order and verify the result using a hundred chart, number line, ten frames or by making references to place value ❑ identify errors in a given ordered sequence ❑ identify missing numbers in a given hundred chart ❑ identify errors in a given hundred chart

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A6 estimate quantities to 100 using referents [C, ME, PS, R]	❑ estimate a given quantity by comparing it to a referent (known quantity) ❑ estimate the number of groups of ten in a given quantity using 10 as a referent ❑ select between two possible estimates for a given quantity and explain the choice
A7 illustrate, concretely and pictorially, the meaning of place value for numerals to 100 [C, CN, R, V]	❑ explain and show with counters the meaning of each digit for a given 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 given 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 given 2-digit numeral in at least two ways (e.g., 24 as two 10s and four 1s, twenty and four, two groups of ten and four left over, and twenty four ones) ❑ illustrate using ten frames and diagrams that a given numeral consists of a certain number of groups of ten and a certain number of ones ❑ illustrate using proportional base 10 materials that a given 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
A8 demonstrate and explain the effect of adding zero to or subtracting zero from any number [C, R]	❑ add zero to a given number and explain why the sum is the same as the addend ❑ subtract zero from a given number and explain why the difference is the same as the given number
A9 demonstrate an understanding of addition (limited to 1 and 2-digit numerals) with answers to 100 and the corresponding subtraction by − using personal strategies for adding and subtracting with and without the support of manipulatives − creating and solving problems that involve addition and subtraction − explaining that the order in which numbers are added does not affect the sum − explaining that the order in which numbers are subtracted may affect the difference [C, CN, ME, PS, R, V]	❑ 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 given solution ❑ solve a given problem involving a missing addend and describe the strategy used ❑ solve a given problem involving a missing minuend or subtrahend and describe the strategy used ❑ match a number sentence to a given missing addend problem ❑ match a number sentence to a given missing subtrahend or minuend problem ❑ add a given set of numbers in two different ways, and explain why the sum is the same, (e.g., $2 + 5 + 3 + 8 = (2 + 3) + 5 + 8$ or $5 + 3 + (8 + 2)$)

Prescribed Learning Outcomes	Suggested Achievement Indicators

A10 apply mental mathematics strategies, such as
  − using doubles
  − making 10
  − one more, one less
  − two more, two less
  − building on a known double
  − addition for subtraction
to determine basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]
	❑ explain the mental mathematics strategy that could be used to determine a basic fact, such as
	  − doubles (e.g., for 4 + 6, think 5 + 5)
	  − doubles plus one (e.g., for 4 + 5, think 4 + 4 + 1)
	  − doubles take away one (e.g., for 4 + 5, think 5 + 5 − 1)
	  − doubles plus two (e.g., for 4 + 6, think 4 + 4 + 2)
	  − 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)
	  − addition to 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

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

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

B1 demonstrate an understanding of repeating patterns (three to five elements) by
  – describing
  – extending
  – comparing
  – creating
patterns using manipulatives, diagrams, sounds, and actions. [C, CN, PS, R, V]
	❏ identify the core of a given repeating pattern
	❏ describe and extend a given double attribute pattern
	❏ explain the rule used to create a given repeating non-numerical pattern
	❏ predict an element in a given repeating pattern using a variety of strategies
	❏ predict an element of a given repeating pattern and extend the pattern to verify the prediction

B2 demonstrate an understanding of increasing patterns by
  – describing
  – reproducing
  – extending
  – creating
patterns using manipulatives, diagrams, sounds, and actions (numbers to 100) [C, CN, PS, R, V]
	❏ identify and describe increasing patterns in a variety of given contexts (e.g., hundred chart, number line, addition tables, calendar, a tiling pattern, or drawings)
	❏ represent a given increasing pattern concretely and pictorially
	❏ identify errors in a given increasing pattern
	❏ explain the rule used to create a given increasing pattern
	❏ create an increasing pattern and explain the pattern rule
	❏ represent a given increasing pattern using another mode (e.g., colour to shape)
	❏ solve a given 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 given concrete, pictorial or symbolic increasing pattern and explain the reasoning

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome: Represent algebraic expressions in multiple ways.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B3 demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100) [C, CN, R, V]	❏ determine whether two given 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 given sets, equal in number, to create inequality ❏ choose from three or more given sets the one that does not have a quantity equal to the others and explain why
B4 record equalities and inequalities symbolically using the equal symbol or the not equal symbol [C, CN, R, V]	❏ determine whether two sides of a given 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 the equality ❏ model inequalities using a variety of concrete representations and record the inequality

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

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C1 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]	❏ 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 ❏ communicate that there are seven days in a week and twelve months in a year ❏ determine whether a given 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 given problem involving time which is limited to the number of days in a week and the number of months in a year
C2 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]	❏ explain why one of two given non-standard units may be a better choice for measuring the length of an object ❏ explain why one of two given 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 given measurement task ❏ explain why the number of units of a measurement will vary depending upon the unit of measure used
C3 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]	❏ estimate, measure, and record the length, height, distance around, or mass (weight) of a given 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

C4 measure length to the nearest non-standard unit by
   – using multiple copies of a unit
   – using a single copy of a unit (iteration process)
  [C, ME, R, V]
	❏ 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 a given object using a single copy or multiple copies of a unit
	❏ estimate and measure a given 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 given length that is not a straight line

Prescribed Learning Outcomes	Suggested Achievement Indicators
C5 demonstrate that changing the orientation of an object does not alter the measurements of its attributes [C, R, V]	❏ measure a given object, change the orientation, re-measure, and explain the results

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

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C6 sort 2-D shapes and 3-D objects using two attributes and explain the sorting rule [C, CN, R, V]	❏ determine the differences between two given pre-sorted sets and explain the sorting rule ❏ identify and name two common attributes of items within a given sorted group ❏ sort a given set of 2-D shapes (regular and irregular) according to two attributes and explain the sorting rule ❏ sort a given set of 3-D objects according to two attributes and explain the sorting rule
C7 describe, compare, and construct 3-D objects, including – cubes – spheres – cones – cylinders – pyramids [C, CN, R, V]	❏ sort a given set of 3-D objects and explain the sorting rule ❏ identify common attributes of cubes, spheres, cones, cylinders, and pyramids from given sets of the same 3-D objects ❏ identify and describe given 3-D objects with different dimensions ❏ identify and describe given 3-D objects with different orientations ❏ create and describe a representation of a given 3-D object using materials such as modelling clay ❏ identify examples of cubes, spheres, cones, cylinders, and pyramids found in the environment
C8 describe, compare, and construct 2-D shapes, including – triangles – squares – rectangles – circles [C, CN, R, V]	❏ sort a given set of 2-D shapes and explain the sorting rule ❏ identify common attributes of triangles, squares, rectangles, and circles from given sets of the same type of 2-D shapes ❏ identify given 2-D shapes with different dimensions ❏ identify given 2-D shapes with different orientations ❏ create a model to represent a given 2-D shape ❏ create a pictorial representation of a given 2-D shape
C9 identify 2-D shapes as parts of 3-D objects in the environment [C, CN, R, V]	❏ compare and match a given 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 given 3-D object

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome: Collect, display and analyze data to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
D1 gather and record data about self and others to answer questions [C, CN, PS, V]	❏ 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
D2 construct and interpret concrete graphs and pictographs to solve problems [C, CN, PS, R, V]	❏ determine the common attributes of concrete graphs by comparing a given set of concrete graphs ❏ determine the common attributes of pictographs by comparing a given set of pictographs ❏ answer questions pertaining to a given concrete graph or pictograph ❏ create a concrete graph to display a given set of data and draw conclusions ❏ create a pictograph to represent a given set of data using one-to-one correspondence ❏ solve a given problem by constructing and interpreting a concrete graph or pictograph

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

STUDENT ACHIEVEMENT
Grade 3

KEY ELEMENTS: GRADE 3

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense

- whole numbers to 1000
- skip counting
- referents to 1000
- place value to 1000
- mental mathematics for adding and subtracting two digit numerals
- addition with answers to 1000 and corresponding subtraction
- mental math strategies for addition facts to 18 and corresponding subtraction facts
- multiplication to 5 × 5 and corresponding division
- representation of fractions

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns

- increasing patterns
- decreasing patterns

Variables and Equations

- one-step addition and subtraction equations involving symbols for the unknown

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement

- non-standard and standard units of time
- measurements of length (cm, m) and mass (g, kg)
- perimeter of regular and irregular shapes

3-D Objects and 2-D Shapes

- faces, edges and vertices of 3-D objects
- triangles, quadrilaterals, pentagons, hexagons, octagons

STATISTICS AND PROBABILITY – collect, display and analyze data to solve problems

Data Analysis

- first-hand data
- bar graphs

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
A1 say the number sequence forward and backward from 0 to 1000 by − 5s, 10s or 100s using any starting point − 3s using starting points that are multiples of 3 − 4s using starting points that are multiples of 4 − 25s using starting points that are multiples of 25 [C, CN, ME]	❏ extend a given skip counting sequence by 5s, 10s or 100s, forward and backward, using a given starting point ❏ extend a given skip counting sequence by 3s, forward and backward, starting at a given multiple of 3 ❏ extend a given skip counting sequence by 4s, forward and backward, starting at a given multiple of 4 ❏ extend a given skip counting sequence by 25s, forward and backward, starting at a given multiple of 25 ❏ identify and correct errors and omissions in a given skip counting sequence ❏ determine the value of a given set of coins (nickels, dimes, quarters, loonies) by using skip counting ❏ identify and explain the skip counting pattern for a given number sequence
A2 represent and describe numbers to 1000, concretely, pictorially, and symbolically [C, CN, V]	❏ read a given three-digit numeral without using the word "and," (e.g., 321 is three hundred twenty one, not three hundred and twenty one) ❏ read a given number word (0 to 1000) ❏ represent a given number as an expression (e.g., 300 – 44 for 256 or 20 + 236) ❏ represent a given number using manipulatives, such as base ten materials ❏ represent a given number pictorially ❏ write number words for given multiples of ten to 90 ❏ write number words for given multiples of a hundred to 900
A3 compare and order numbers to 1000 [CN, R, V]	❏ place a given 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), by using 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 a given ordered sequence ❏ identify missing numbers in parts of a given hundred chart ❏ identify errors in a given hundred chart

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A4 estimate quantities less than 1000 using referents [ME, PS, R, V]	❏ estimate the number of groups of ten in a given quantity using 10 as a referent (known quantity) ❏ estimate the number of groups of a hundred in a given quantity using 100 as a referent ❏ estimate a given quantity by comparing it to a referent ❏ select an estimate for a given quantity by choosing among three possible choices ❏ select and justify a referent for determining an estimate for a given quantity
A5 illustrate, concretely and pictorially, the meaning of place value for numerals to 1000 [C, CN, R, V]	❏ record, in more than one way, the number represented by given proportional and non-proportional concrete materials ❏ represent a given 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 1s, or two 100s, fifteen 10s and one 1s, or three 100s, four 10s and eleven 1s) ❏ explain, and show with counters, the meaning of each digit for a given 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)
A6 describe and apply mental mathematics strategies for adding two 2-digit numerals, such as – adding from left to right – taking one addend to the nearest multiple of ten and then compensating – using doubles [C, ME, PS, R, V]	❏ add two given 2-digit numerals using a mental mathematics strategy and explain or illustrate 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 given 2-digit numerals
A7 describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as – taking the subtrahend to the nearest multiple of ten and then compensating – thinking of addition – using doubles [C, ME, PS, R, V]	❏ subtract two given 2-digit numerals using a mental mathematics strategy and explain or model the strategy used ❏ 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 given 2-digit numerals

Prescribed Learning Outcomes	Suggested Achievement Indicators
A8 apply estimation strategies to predict sums and differences of two 2-digit numerals in a problem-solving context [C, ME, PS, R]	❏ estimate the solution for a given 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 given 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)
A9 demonstrate an understanding of addition and subtraction of numbers with answers to 1000 (limited to 1, 2 and 3-digit numerals) by – 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 [C, CN, ME, PS, R]	❏ model the addition of two or more given numbers using concrete or visual representations and record the process symbolically ❏ model the subtraction of two given numbers using concrete or visual representations and record the process symbolically ❏ create an addition or subtraction story problem for a given solution ❏ determine the sum of two given numbers using a personal strategy (e.g., for 326 + 48, record 300 + 60 + 14) ❏ determine the difference of two given numbers using a personal strategy (e.g., for 127 – 38, record 38 + 2 + 80 + 7 or 127 – 20 – 10 – 8) ❏ solve a given problem involving the sum or difference of two given numbers
A10 apply mental mathematics strategies and number properties, such as – using doubles – making 10 – using the commutative property – using the property of zero – thinking addition for subtraction to recall basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]	❏ describe a mental mathematics strategy that could be used to determine a given basic fact, such as – 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 + ? = 13) ❏ provide a rule for determining answers for adding and subtracting zero ❏ recall basic addition facts to 18 and related subtraction facts to solve problems

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A11 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 not intended that students recall the basic facts but become familiar with strategies to mentally determine products.) ❏ identify events from experience that can be described as multiplication ❏ represent a given story problem (orally, shared reading, written) using manipulatives or diagrams and record in a number sentence ❏ represent a given multiplication expression as repeated addition ❏ represent a given repeated addition as multiplication ❏ create and illustrate a story problem for a given number sentence (e.g., given 2 × 3, create and illustrate a story problem ❏ represent, concretely or pictorially, equal groups for a given number sentence ❏ represent a given multiplication expression using an array ❏ create an array to model the commutative property of multiplication ❏ relate multiplication to division by using arrays and writing related number sentences ❏ solve a given problem in context involving multiplication
A12 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]	❏ 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 given story problem involving equal sharing, presented orally or through shared reading, and solve the problem ❏ illustrate, with counters or a diagram, a given 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 given number sentence (e.g., given 6 ÷ 3, create and illustrate a story problem) ❏ represent a given division expression as repeated subtraction ❏ represent a given repeated subtraction as a division expression ❏ relate division to multiplication by using arrays and writing related number sentences ❏ solve a given problem involving division

Prescribed Learning Outcomes	Suggested Achievement Indicators

A13 demonstrate an understanding of fractions by
  − explaining that a fraction represents a part of a whole
  − 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 given 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 given set of diagrams of regions into those that represent equal parts and those that do not, and explain the sorting
	❏ represent a given fraction concretely or pictorially
	❏ name and record the fraction represented by the shaded and non-shaded parts of a given region
	❏ compare given fractions with the same denominator using models
	❏ identify the numerator and denominator for a given fraction
	❏ model and explain the meaning of numerator and denominator

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

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

B1 demonstrate an understanding of increasing patterns by
  − describing
  − extending
  − comparing
  − creating
patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000)
[C, CN, PS, R, V]
	❏ describe a given 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 a given increasing pattern and extend the pattern for the next three terms
	❏ identify and explain errors in a given increasing pattern
	❏ locate and describe various increasing patterns found on a hundred chart, such as horizontal, vertical, and diagonal patterns
	❏ compare numeric patterns of counting by 2s, 5s, 10s, 25s, and 100s
	❏ create a concrete, pictorial or symbolic representation of an increasing pattern for a given pattern rule
	❏ create a concrete, pictorial, or symbolic increasing pattern and describe the pattern rule
	❏ solve a given problem using increasing patterns
	❏ identify and describe increasing patterns in the environment
	❏ identify and apply a pattern rule to determine missing elements for a given pattern
	❏ describe the strategy used to determine missing elements in a given increasing pattern

B2 demonstrate an understanding of decreasing patterns by
  − describing
  − extending
  − comparing
  − creating
patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000)
[C, CN, PS, R, V]
	❏ describe a given 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 given decreasing pattern and extend the pattern for the next three terms
	❏ identify and explain errors in a given 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, 5s, 10s, 25s, and 100s
	❏ create a concrete, pictorial or symbolic decreasing pattern for a given pattern rule
	❏ create a concrete, pictorial, or symbolic decreasing pattern and describe the pattern rule
	❏ solve a given problem using decreasing patterns
	❏ identify and describe decreasing patterns in the environment
	❏ identify and apply a pattern rule to determine missing elements for a given pattern
	❏ describe the strategy used to determine missing elements in a given decreasing pattern

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome: Represent algebraic expressions in multiple ways.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B3 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 a given addition and in a given subtraction equation with one unknown ❏ create an addition or subtraction equation with one unknown to represent a given combination or separation action ❏ provide an alternative symbol for the unknown in a given addition or subtraction equation ❏ solve a given addition or subtraction equation that represents combining or separating actions with one unknown using manipulatives ❏ solve a given addition or subtraction equation with one unknown using a variety of strategies, including guess and test ❏ explain why the unknown in a given addition or subtraction equation has only one value

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

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C1 relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years) [CN, ME, R]	❏ 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
C2 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]	❏ determine the number of days in any given month using a calendar ❏ solve a given 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 personal events
C3 demonstrate an understanding of measuring length (cm, m) by – 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]	❏ provide a personal referent for one centimetre and explain the choice ❏ provide a personal referent for one metre and explain the choice ❏ match a given standard unit to a given 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 and width of a given 2-D shape ❏ determine and record the length, width, or height of a given 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
C4 demonstrate an understanding of measuring mass (g, kg) by – 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]	❏ provide a personal referent for one gram and explain the choice ❏ provide a personal referent for one kilogram and explain the choice ❏ match a given standard unit to a given referent ❏ explain the relationship between 1000 grams and 1 kilogram using a model ❏ estimate the mass of a given object using personal referents ❏ determine and record the mass of a given 3-D object ❏ measure, using a scale, and record the mass of given 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 given 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

Prescribed Learning Outcomes	Suggested Achievement Indicators
C5 demonstrate an understanding of perimeter of regular and irregular shapes by – 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]	❏ measure and record the perimeter of a given regular shape, and explain the strategy used ❏ measure and record the perimeter of a given 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 given perimeter ❏ estimate the perimeter of a given shape (cm, m) using personal referents

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

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C6 describe 3-D objects according to the shape of the faces, and the number of edges and vertices [C, CN, PS, R, V]	❏ identify the faces, edges, and vertices of given 3-D objects, including cubes, spheres, cones, cylinders, pyramids, and prisms ❏ identify the shape of the faces of a given 3-D object ❏ determine the number of faces, edges, and vertices of a given 3-D object ❏ construct a skeleton of a given 3-D object and describe how the skeleton relates to the 3-D object ❏ sort a given set of 3-D objects according to the number of faces, edges, or vertices
C7 sort regular and irregular polygons, including – triangles – quadrilaterals – pentagons – hexagons – octagons according to the number of sides [C, CN, R, V]	❏ classify a given set of regular and irregular polygons according to the number of sides ❏ identify given regular and irregular polygons having different dimensions ❏ identify given regular and irregular polygons having different orientations

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome: Collect, display, and analyze data to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
D1 collect first-hand data and organize it using − tally marks − line plots − charts − lists to answer questions [C, CN, V]	❏ record the number of objects in a given set using tally marks ❏ determine the common attributes of line plots by comparing line plots in a given set ❏ organize a given set of data using tally marks, line plots, charts, or lists ❏ collect and organize data using tally marks, line plots, charts, and lists ❏ answer questions arising from a given line plot, chart, or list ❏ answer questions using collected data
D2 construct, label and interpret bar graphs to solve problems [PS, R, V]	❏ determine the common attributes, title and axes, of bar graphs by comparing bar graphs in a given set ❏ create bar graphs from a given set of data including labelling the title and axes ❏ draw conclusions from a given bar graph to solve problems ❏ solve problems by constructing and interpreting a bar graph

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

STUDENT ACHIEVEMENT

Grade 4

KEY ELEMENTS: GRADE 4

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense

- whole numbers to 10 000
- addition with answers to 10 000 and corresponding subtraction
- multiplication by 0 and 1 and division by 1
- mental mathematics strategies for multiplication facts to 9 × 9 and corresponding division facts
- multiplication of 2- or 3- digit by 1-digit
- division of 2-digit divisor by 1-digit dividend
- fractions less than or equal to one
- decimal representation to hundredths and relation to fractions
- addition and subtraction of decimals to hundredths

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns

- pattern relationships in tables and charts

Variables and Equations

- symbols to represent unknowns
- one-step equations

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement

- digital, analog and 24 hour clocks and calendar dates
- area of regular and irregular 2-D shapes

3-D Objects and 2-D Shapes

- rectangular and triangular prisms

Transformations

- line symmetry

STATISTICS AND PROBABILITY – collect, display and analyze data to solve problems

Data Analysis

- many-to-one correspondence including bar graphs and pictographs

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
A1 represent and describe whole numbers to 10 000, pictorially and symbolically [C, CN, V]	❏ read a given 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 given numeral using proper spacing without commas (e.g., 4567 or 4 567, 10 000) ❏ write a given numeral 0 – 10 000 in words ❏ represent a given numeral using a place value chart or diagrams ❏ describe the meaning of each digit in a given numeral ❏ express a given numeral in expanded notation (e.g., 321 = 300 + 20 + 1) ❏ write the numeral represented by a given expanded notation ❏ explain and show the meaning of each digit in a given 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)
A2 compare and order numbers to 10 000 [C, CN]	❏ order a given set of numbers in ascending or descending order and explain the order by making references to place value ❏ create and order three different 4-digit numerals ❏ identify the missing numbers in an ordered sequence or on a number line ❏ identify incorrectly placed numbers in an ordered sequence or on a number line
A3 demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals) by – using personal strategies for adding and subtracting – estimating sums and differences – solving problems involving addition and subtraction [C, CN, ME, PS, R]	❏ explain how to keep track of digits that have the same place value when adding numbers, limited to 3- and 4-digit numerals ❏ explain how to keep track of digits that have the same place value when subtracting numbers, limited to 3- and 4-digit numerals ❏ 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

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A4 explain the properties of 0 and 1 for multiplication, and the property of 1 for division [C, CN, R]	❏ 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
A5 describe and apply mental mathematics strategies, such as – skip counting from a known fact – using doubling or halving – using doubling or halving and adding or subtracting one more group – using patterns in the 9s facts – using repeated doubling to determine basic multiplication facts to 9 × 9 and related division facts [C, CN, ME, PS, R]	❏ provide examples for applying mental mathematics strategies: – doubling (e.g., for 4 × 3, think 2 × 3 = 6, and 4 × 3 = 6 + 6 – doubling and adding one more group (e.g., for 3 × 7, think 2 × 7 = 14, and 14 + 7 = 21 – use ten facts when multiplying by 9 (e.g., for 9 × 6, think 10 × 6 = 60, and 60 – 6 = 54; for 7 × 9, think 7 × 10 = 70, and 70 – 7 = 63 – halving (e.g., if 4 × 6 is equal to 24, then 2 × 6 is equal to 12 – relating division to multiplication (e.g., for 64 ÷ 8, think 8 × □ = 64)
A6 demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by – using personal strategies for multiplication with and without concrete materials – using arrays to represent multiplication – connecting concrete representations to symbolic representations – estimating products [C, CN, ME, PS, R, V]	❏ model a given multiplication problem using the distributive property (e.g., 8 × 365 = (8 × 300) + (8 × 60) + (8 × 5)) ❏ use concrete materials, such as base ten 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 given multiplication problem using an array and record the process ❏ solve a given multiplication problem and record the process
A7 demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by – using personal strategies for dividing with and without concrete materials – estimating quotients – elating division to multiplication [C, CN, ME, PS, R, V]	(It is not intended that remainders be expressed as decimals or fractions.) ❏ solve a given division problem without a remainder using arrays or base ten materials ❏ solve a given division problem with a remainder using arrays or base ten materials ❏ solve a given 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 ÷ 4 is close to 80 ÷ 4 or close to 80 ÷ 5)

Prescribed Learning Outcomes	Suggested Achievement Indicators
A8 demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to – 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 [C, CN, PS, R, V]	❑ represent a given fraction using concrete materials ❑ identify a fraction from its given concrete representation ❑ name and record the shaded and non-shaded parts of a given set ❑ name and record the shaded and non-shaded parts of a given whole ❑ represent a given fraction pictorially by shading parts of a given set ❑ represent a given fraction pictorially by shading parts of a given whole ❑ explain how denominators can be used to compare two given unit fractions with numerator 1 ❑ order a given set of fractions that have the same numerator and explain the ordering ❑ order a given set of fractions that have the same denominator and explain the ordering ❑ identify which of the benchmarks 0, $\frac{1}{2}$, or 1 is closer to a given fraction ❑ name fractions between two given benchmarks on a number line ❑ order a given set of fractions by placing them on a number line with given benchmarks ❑ provide examples of when 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 cloudberries is not equivalent to half of sixteen cloudberries) ❑ provide an example of a fraction that represents part of a set and a fraction that represents part of a whole from everyday contexts
A9 describe and represent decimals (tenths and hundredths) concretely, pictorially, and symbolically [C, CN, R, V]	❑ write the decimal for a given concrete or pictorial representation of part of a set, part of a region, or part of a unit of measure ❑ represent a given decimal using concrete materials or a pictorial representation ❑ explain the meaning of each digit in a given decimal with all digits the same ❑ represent a given decimal using money values (dimes and pennies) ❑ record a given money value using decimals ❑ provide examples of everyday contexts in which tenths and hundredths are used ❑ model, using manipulatives or pictures, that a given tenth can be expressed as hundredths (e.g., 0.9 is equivalent to 0.90 or 9 dimes is equivalent to 90 pennies)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A10 relate decimals to fractions (to hundredths) [CN, R, V]	❏ read decimals as fractions (e.g., 0.5 is zero and five tenths) ❏ express orally and in written form a given decimal in fractional form ❏ express orally and in written form a given fraction with a denominator of 10 or 100 as a decimal ❏ express a given 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 $^{15}/_{100}$) ❏ express orally and in written form the decimal equivalent for a given fraction (e.g., $^{50}/_{100}$ can be expressed as 0.50)

A11 demonstrate an understanding of addition and subtraction of decimals (limited to hundredths) by
  − using compatible numbers
  − estimating sums and differences
  − using mental math strategies to solve problems
  [C, ME, PS, R, V]
	❏ read decimals as fractions (e.g., 0.5 is zero and five tenths)
	❏ express orally and in written form a given decimal in fractional form
	❏ express orally and in written form a given fraction with a denominator of 10 or 100 as a decimal
	❏ express a given 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)
	❏ express orally and in written form the decimal equivalent for a given fraction (e.g., can be expressed as 0.50)

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B1 identify and describe patterns found in tables and charts, including a multiplication chart [C, CN, PS, V]	❏ identify and describe a variety of patterns in a multiplication chart ❏ determine the missing element(s) in a given table or chart ❏ identify error(s) in a given table or chart ❏ describe the pattern found in a given table or chart
B2 reproduce a pattern shown in a table or chart using concrete materials [C, CN, V]	❏ create a concrete representation of a given pattern displayed in a table or chart ❏ explain why the same relationship exists between the pattern in a table and its concrete representation
B3 represent and describe patterns and relationships using charts and tables to solve problems [C, CN, PS, R, V]	❏ extend patterns found in a table or chart to solve a given problem ❏ translate the information provided in a given problem into a table or chart ❏ identify and extend the patterns in a table or chart to solve a given problem
B4 identify and explain mathematical relationships using charts and diagrams to solve problems [CN, PS, R, V]	❏ complete a Carroll diagram by entering given data into correct squares to solve a given problem ❏ determine where new elements belong in a given Carroll diagram ❏ solve a given problem using a Carroll diagram ❏ identify a sorting rule for a given Venn diagram ❏ describe the relationship shown in a given 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 given Venn diagram ❏ solve a given problem by using a chart or diagram to identify mathematical relationships

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

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome: Represent algebraic expressions in multiple ways.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B5 express a given problem as an equation in which a symbol is used to represent an unknown number [CN, PS, R]	❏ explain the purpose of the symbol, such as a triangle or circle, in a given addition, subtraction, multiplication, or division equation with one unknown (e.g. $36 \div \square = 6$) ❏ express a given 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 a given equation with one unknown
B6 solve one-step equations involving a symbol to represent an unknown number [C, CN, PS, R, V]	❏ solve a given one-step equation using manipulatives ❏ solve a given one-step equation using guess and test ❏ describe orally the meaning of a given one-step equation with one unknown ❏ solve a given equation when the unknown is on the left or right side of the equation ❏ represent and solve a given addition or subtraction problem involving a "part-part-whole" or comparison context using a symbol to represent the unknown ❏ represent and solve a given multiplication or division problem involving equal grouping or partitioning (equal sharing) using symbols to represent the unknown

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C1 read and record time using digital and analog clocks, including 24-hour clocks [C, CN, V]	❏ 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
C2 read and record calendar dates in a variety of formats [C, V]	❏ 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)
C3 demonstrate an understanding of area of regular and irregular 2-D shapes by – recognizing that area is measured in square units – selecting and justifying referents for the units cm² or m² – estimating area by using referents for cm² or m² – determining and recording area (cm² or m²) – constructing different rectangles for a given area (cm² or m²) in order to demonstrate that many different rectangles may have the same area [C, CN, ME, PS, R, V]	❏ 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 given referent ❏ estimate the area of a given 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 a given area by drawing at least two different rectangles for the same given area

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

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
	The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.
It is expected that students will:	*Students who have fully met the prescribed learning outcome are able to:*
C4 describe and construct rectangular and triangular prisms [C, CN, R, V]	❏ identify and name common attributes of rectangular prisms from given sets of rectangular prisms ❏ identify and name common attributes of triangular prisms from given sets of triangular prisms ❏ sort a given 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

SHAPE AND SPACE (TRANSFORMATIONS)

General Outcome: Describe and analyze position and motion of objects and shapes.

Prescribed Learning Outcomes	Suggested Achievement Indicators
	The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.
It is expected that students will:	*Students who have fully met the prescribed learning outcome are able to:*
C5 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 given symmetrical and non-symmetrical 2-D shapes ❏ sort a given set of 2-D shapes as symmetrical and non-symmetrical ❏ complete a symmetrical 2-D shape given half the shape and its line of symmetry ❏ identify lines of symmetry of a given set of 2-D shapes and explain why each shape is symmetrical ❏ determine whether or not a given 2-D shape is symmetrical by using a Mira or by folding and superimposing ❏ create a symmetrical shape with and without manipulatives ❏ provide examples of symmetrical shapes found in the environment and identify the line(s) of symmetry ❏ sort a given set of 2-D shapes as those that have no lines of symmetry, one line of symmetry, or more than one line of symmetry

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

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome: Collect, display and analyze data to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
D1 demonstrate an understanding of many-to-one correspondence [C, R, T, V]	❏ 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
D2 construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions [C, PS, R, V]	❏ identify an interval and correspondence for displaying a given set of data in a graph and justify the choice ❏ create and label (with categories, title, and legend) a pictograph to display a given 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 given set of data using many-to-one correspondence, and justify the choice of interval used ❏ answer a given question using a given graph in which data is displayed using many-to-one correspondence

STUDENT ACHIEVEMENT
Grade 5

KEY ELEMENTS: GRADE 5

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense

- whole numbers to 1 000 000
- estimation strategies for calculations and problem solving
- mental mathematics strategies for multiplication facts to 81 and corresponding division facts
- mental mathematics for multiplication
- multiplication for 2-digit by 2-digit and division for 3-digit by 1-digit
- decimal and fraction comparison
- addition and subtraction of decimals to thousandths

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns

- prediction using a pattern rule

Variables and Equations

- single-variable, one-step equations with whole number coefficients and solutions

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement

- perimeter and area of rectangles
- length, volume and capacity

3-D Objects and 2-D Shapes

- parallel, intersecting, perpendicular, vertical and horizontal edges and faces
- quadrilaterals including rectangles, squares, trapezoids, parallelograms and rhombuses

Transformations

- 2-D shape single transformation

STATISTICS AND PROBABILITY – collect, display and analyze data to solve problems

Data Analysis

- first-hand and second-hand data
- double bar graphs

Chance and Uncertainty

- likelihood of a single outcome

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
A1 represent and describe whole numbers to 1 000 000 [C, CN, V, T]	❏ write a given numeral using proper spacing without commas (e.g., 934 567) ❏ describe the pattern of adjacent place positions moving from right to left ❏ describe the meaning of each digit in a given numeral ❏ provide examples of large numbers used in print or electronic media ❏ express a given numeral in expanded notation (e.g., 45 321 = (4 × 10 000) + (5 × 1000) + (3 × 100) + (2 × 10) + (1 × 1) or 40 000 + 5000 + 300 + 20 + 1) ❏ write the numeral represented by a given expanded notation
A2 use 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 given problem not requiring an exact answer ❏ estimate a sum or product using compatible numbers ❏ estimate the solution to a given problem using compensation and explain the reason for compensation ❏ select and use an estimation strategy for a given 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 (400) and less than 25 × 25 (625)) − quotients (e.g., the quotient of 831 ÷ 4 is greater than 800 ÷ 4 (200))

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A3 apply mental mathematics strategies and number properties, such as – skip counting from a known fact – using doubling or halving – using patterns in the 9s facts – using repeated doubling or halving to determine answers for basic multiplication facts to 81 and related division facts [C, CN, ME, R, V]	❏ describe the mental mathematics strategy used to determine a given basic fact, such as – skip count up by one or two groups from a known fact (e.g., if 5 × 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 × 8 = 64, then 7 × 8 is equal to 64 − 8 and 6 × 8 is equal to 64 − 8 − 8) – doubling (e.g., for 8 × 3 think 4 × 3 = 12, and 8 × 3 = 12 + 12) – patterns when multiplying by 9 (e.g., for 9 × 6, think 10 × 6 = 60, and 60 − 6 = 54; for 7 × 9, think 7 × 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 ÷ 4, think 60 ÷ 2 = 30 and 30 ÷ 2 = 15) ❏ explain why multiplying by zero produces a product of zero ❏ explain why division by zero is not possible or undefined (e.g., 8 ÷ 0) ❏ recall multiplication facts to 81and related division facts
A4 apply mental mathematics strategies for multiplication, such as – annexing then adding zero – 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 given product (e.g., 32 × 5 is the same as 16 × 10) ❏ apply the distributive property to determine a given product involving multiplying factors that are close to multiples of 10 (e.g., 98 × 7 = (100 × 7) − (2 × 7))
A5 demonstrate an understanding of multiplication (2-digit by 2-digit) to solve problems [C, CN, PS, V]	❏ illustrate partial products in expanded notation for both factors (e.g., for 36 × 42, determine the partial products for (30 + 6) × (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) × (40 + 2) = 30 × 40 + 30 × 2 + 6 × 40 + 6 × 2 = 1200 + 60 + 240 + 12 = 1512) ❏ model the steps for multiplying 2-digit factors using an array and base ten blocks, and record the process symbolically ❏ describe a solution procedure for determining the product of two given 2-digit factors using a pictorial representation, such as an area model ❏ solve a given multiplication problem in context using personal strategies and record the process

Prescribed Learning Outcomes	Suggested Achievement Indicators
A6 Demonstrate, with and without concrete materials, an understanding of division (3-digit by 1-digit) and interpret remainders to solve problems [C, CN, PS]	❏ model the division process as equal sharing using base ten blocks and record it symbolically ❏ explain that the interpretation of a remainder depends on the context ❏ 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 and money) ❏ solve a given division problem in context using personal strategies, and record the process
A7 demonstrate an understanding of fractions by using concrete and pictorial representations to – create sets of equivalent fractions – compare fractions with like and unlike denominators [C, CN, PS, R, V]	❏ create a set of equivalent fractions and explain why there are many equivalent fractions for any given fraction using concrete materials ❏ model and explain that equivalent fractions represent the same quantity ❏ determine if two given fractions are equivalent using concrete materials or pictorial representations ❏ formulate and verify a rule for developing a set of equivalent fractions
A8 describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially, and symbolically [C, CN, R, V]	❏ identify equivalent fractions for a given fraction ❏ compare two given fractions with unlike denominators by creating equivalent fractions ❏ position a given set of fractions with like and unlike denominators on a number line and explain strategies used to determine the order ❏ write the decimal for a given concrete or pictorial representation of part of a set, part of a region, or part of a unit of measure ❏ represent a given decimal using concrete materials or a pictorial representation ❏ represent an equivalent tenth, hundredth, or thousandth for a given decimal using a grid ❏ express a given tenth as an equivalent hundredth and thousandth ❏ express a given hundredth as an equivalent thousandth ❏ describe the value of each digit in a given decimal
A9 relate decimals to fractions (to thousandths) [CN, R, V]	❏ write a given decimal in fractional form ❏ write a given fraction with a denominator of 10, 100, or 1000 as a decimal ❏ express a given 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 $\frac{25}{1000}$)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A10 compare and order decimals (to thousandths) by using – benchmarks – place value – equivalent decimals [CN, R, V]	❏ order a given set of decimals by placing them on a number line that contains benchmarks, 0.0, 0.5, 1.0 ❏ order a given set of decimals including only tenths using place value ❏ order a given set of decimals including only hundredths using place value ❏ order a given 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 given set of decimals including tenths, hundredths, and thousandths using equivalent decimals
A11 demonstrate an understanding of addition and subtraction of decimals (limited to thousandths) [C, CN, PS, R, V]	❏ place the decimal point in 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) ❏ 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 given problem that involves addition and subtraction of decimals, limited to thousandths

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
	The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.
It is expected that students will:	*Students who have fully met the prescribed learning outcome are able to:*
B1 determine the pattern rule to make predictions about subsequent elements [C, CN, PS, R, V]	❏ extend a given pattern with and without concrete materials, and explain how each element differs from the proceeding one ❏ describe, orally or in writing, a given pattern using mathematical language, such as one more, one less, five more ❏ write a mathematical expression to represent a given pattern, such as $r + 1$, $r - 1$, $r + 5$ ❏ describe the relationship in a given table or chart using a mathematical expression ❏ determine and explain why a given number is or is not the next element in a pattern ❏ predict subsequent elements in a given pattern ❏ solve a given problem by using a pattern rule to determine subsequent elements ❏ represent a given pattern visually to verify predictions

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

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome: Represent algebraic expressions in multiple ways.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B2 solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions [C, CN, PS, R]	❏ express a given problem in context as an equation where the unknown is represented by a letter variable ❏ solve a given 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 a given equation

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C1 design and construct different rectangles given either perimeter or area, or both (whole numbers) and draw conclusions [C, CN, PS, R, V]	❏ 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 given perimeter, the square or shape closest to a square will result in the greatest area ❏ illustrate that for any given 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
C2 demonstrate an understanding of measuring length (mm) by – selecting and justifying referents for the unit mm – modelling and describing the relationship between mm and cm units, and between mm and m units [C, CN, ME, PS, R, V]	❏ 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
C3 demonstrate an understanding of volume by – 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]	❏ 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 given 3-D object using personal referents ❏ determine the volume of a given 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 given volume

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

Prescribed Learning Outcomes	Suggested Achievement Indicators

C4 demonstrate an understanding of capacity by
  − 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]
	❏ 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 is represented by a given referent
	❏ estimate the capacity of a given container using personal referents
	❏ determine the capacity of a given container using materials that take the shape of the inside of the container (e.g., a liquid, rice, sand, beads) and explain the strategy

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
	The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.
It is expected that students will:	*Students who have fully met the prescribed learning outcome are able to:*

C5 describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes that are
  − parallel
  − intersecting
  − perpendicular
  − vertical
  − horizontal [C, CN, R, T, V]
	❏ 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 given 3-D object using terms, such as parallel, intersecting, perpendicular, vertical, or horizontal
	❏ describe the sides of a given 2-D shape using terms, such as parallel, intersecting, perpendicular, vertical, or horizontal

C6 identify and sort quadrilaterals, including
  − rectangles
  − squares
  − trapezoids
  − parallelograms
  − rhombuses
  according to their attributes
  [C, R, V]
	❏ identify and describe the characteristics of a pre-sorted set of quadrilaterals
	❏ sort a given set of quadrilaterals and explain the sorting rule
	❏ sort a given set of quadrilaterals according to the lengths of the sides
	❏ sort a given set of quadrilaterals according to whether or not opposite sides are parallel

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

SHAPE AND SPACE (TRANSFORMATIONS)

General Outcome: Describe and analyze position and motion of objects and shapes.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C7 perform a single transformation (translation, rotation, or reflection) of a 2-D shape (with and without technology) and draw and describe the image [C, CN, T, V]	❏ translate a given 2-D shape horizontally, vertically or diagonally, and describe the position and orientation of the image ❏ rotate a given 2-D shape about a point, and describe the position and orientation of the image ❏ reflect a given 2-D shape in a line of reflection, and describe the position and orientation of the image ❏ perform a transformation of a given 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 ❏ draw a 2-D shape, rotate the shape, and describe the direction of the turn (clockwise or counterclockwise), the fraction of the turn, and the 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
C8 identify a single transformation, including a translation, rotation, and reflection of 2-D shapes [C, T, V]	❏ provide an example of a translation, a rotation and a reflection ❏ identify a given single transformation as a translation, rotation, or reflection ❏ describe a given rotation by the direction of the turn (clockwise or counterclockwise)

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome: Collect, display and analyze data to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
D1 differentiate between first-hand and second-hand data [C, R, T, V]	❏ 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
D2 construct and interpret double bar graphs to draw conclusions [C, PS, R, T, V]	❏ determine the attributes (title, axes, intervals, and legend) of double bar graphs by comparing a given set of double bar graphs ❏ represent a given set of data by creating a double bar graph, label the title and axes, and create a legend without the use of technology ❏ draw conclusions from a given 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 given problem by constructing and interpreting a double bar graph

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

STATISTICS AND PROBABILITY (CHANCE AND UNCERTAINTY)

General Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

D3   describe the likelihood of a single outcome occurring using words such as
  − impossible
  − possible
  − certain [C, CN, PS, R]
	❏ 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 given probability experiment a number of times, record the outcomes, and explain the results

D4   compare the likelihood of two possible outcomes occurring using words such as
  − less likely
  − equally likely
  − more likely [C, CN, PS, R]
	❏ identify outcomes from a given 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

STUDENT ACHIEVEMENT
Grade 6

KEY ELEMENTS: GRADE 6

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense

- numbers greater than 1 000 000 and smaller than one thousandth
- factors and multiples
- improper fractions and mixed numbers
- ratio and whole number percent
- integers
- multiplication and division of decimals
- order of operations excluding exponents

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns

- patterns and relationships in graphs and tables including a tables of value

Variables and Equations

- letter variable representation of number relationships
- preservation of equality

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement

- angle measure and construction
- sum of interior angles of a triangle and quadrilateral
- formulas for the perimeter of polygons, area of rectangles and volume of right rectangular prisms

3-D Objects and 2-D Shapes

- types of triangles
- regular and irregular polygons

Transformations

- combinations of transformations
- single transformation in the first quadrant of the Cartesian plane

STATISTICS AND PROBABILITY – collect, display and analyze data to solve problems

Data Analysis

- line graphs
- methods of data collection
- graph data

Chance and Uncertainty

- experimental and theoretical probability

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
A1 demonstrate an understanding of place value for numbers − greater than one million − less than one thousandth [C, CN, R, T]	❏ 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)
A2 solve problems involving large numbers, using technology [ME, PS, T]	❏ identify which operation is necessary to solve a given problem and solve it ❏ determine the reasonableness of an answer ❏ estimate the solution and solve a given problem.
A3 demonstrate an understanding of factors and multiples by − determining multiples and factors of numbers less than 100 − identifying prime and composite numbers − solving problems involving multiples [PS, R, V]	❏ identify multiples for a given number and explain the strategy used to identify them ❏ determine all the whole number factors of a given number using arrays ❏ identify the factors for a given number and explain the strategy used (e.g., concrete or visual representations, repeated division by prime numbers, or factor trees) ❏ 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 given set of numbers as prime and composite ❏ solve a given problem involving factors or multiples ❏ explain why 0 and 1 are neither prime nor composite
A4 relate improper fractions to mixed numbers [CN, ME, R, V]	❏ demonstrate using models that a given improper fraction represents a number greater than 1 ❏ express improper fractions as mixed numbers ❏ express mixed numbers as improper fractions ❏ place a given set of fractions, including mixed numbers and improper fractions, on a number line and explain strategies used to determine position

Prescribed Learning Outcomes	Suggested Achievement Indicators
A5 demonstrate an understanding of ratio, concretely, pictorially, and symbolically [C, CN, PS, R, V]	❏ provide a concrete or pictorial representation for a given ratio ❏ write a ratio from a given concrete or pictorial representation ❏ express a given ratio in multiple forms, such as 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 given problem involving ratio
A6 demonstrate an understanding of percent (limited to whole numbers) concretely, pictorially, and symbolically [C, CN, PS, R, V]	❏ explain that "percent" means "out of 100." ❏ explain that percent is a ratio out of 100 ❏ use concrete materials and pictorial representations to illustrate a given percent ❏ record the percent displayed in a given concrete or pictorial representation ❏ express a given percent as a fraction and a decimal ❏ identify and describe percents from real-life contexts, and record them symbolically ❏ solve a given problem involving percents
A7 demonstrate an understanding of integers, concretely, pictorially, and symbolically [C, CN, R, V]	❏ extend a given number line by adding numbers less than zero and explain the pattern on each side of zero ❏ place given integers on a 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 number line ❏ order given integers in ascending or descending order.
A8 demonstrate an understanding of multiplication and division of decimals (1-digit whole number multipliers and 1-digit natural number divisors) [C, CN, ME, PS, R, V]	❏ place the decimal point in a product using front-end estimation (e.g., for 15.205 m × 4, think 15 m × 4, so the product is greater than 60 m ❏ place the decimal point in a quotient using front-end estimation (e.g., for $26.83 ÷ 4, think $24 ÷ 4, so the quotient is greater than $6 ❏ correct errors of decimal point placement in a given product or quotient without using paper and pencil ❏ predict products and quotients of decimals using estimation strategies ❏ solve a given problem that involves multiplication and division of decimals using multipliers from 0 to 9 and divisors from 1 to 9
A9 explain and apply the order of operations, excluding exponents, with and without technology (limited to whole numbers) [CN, ME, PS, T]	❏ 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 (e.g., computer, calculator)

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B1 demonstrate an understanding of the relationships within tables of values to solve problems [C, CN, PS, R]	❏ generate values in one column of a table of values, given values in the other column and a pattern rule ❏ state, using mathematical language, the relationship in a given 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 given table of values ❏ identify errors in a given table of values ❏ describe the pattern within each column of a given table of values ❏ create a table of values to record and reveal a pattern to solve a given problem
B2 represent and describe patterns and relationships using graphs and tables [C, CN, ME, PS, R, V]	❏ 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 given pattern or a given graph ❏ describe, using everyday language, orally or in writing, the relationship shown on a graph

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

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome: Represent algebraic expressions in multiple ways.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B3 represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V]	❑ write and explain the formula for finding the perimeter of any given rectangle ❑ write and explain the formula for finding the area of any given 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 given table using a mathematical expression ❑ represent a pattern rule using a simple mathematical expression, such as $4d$ or $2n + 1$
B4 demonstrate and explain the meaning of preservation of equality concretely, pictorially, and symbolically [C, CN, PS, R, V]	❑ 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 a given 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 $3(2r) = 3(7)$)

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C1 demonstrate an understanding of angles by – 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 [C, CN, ME, V]	❏ provide examples of angles found in the environment ❏ classify a given 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, given angles in various orientations ❏ draw and label a specified 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
C2 demonstrate that the sum of interior angles is: – 180° in a triangle – 360° in a quadrilateral [C, R]	❏ 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
C3 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 (formula) for determining the perimeter of polygons, including rectangles and squares ❏ explain, using models, how the area of any rectangle can be determined ❏ generalize a rule (formula) for determining the area of rectangles ❏ explain, using models, how the volume of any right rectangular prism can be determined ❏ generalize a rule (formula) for determining the volume of right rectangular prisms ❏ solve a given problem involving the perimeter of polygons, the area of rectangles, and/or the volume of right rectangular prisms

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

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C4 construct and compare triangles, including – scalene – isosceles – equilateral – right – obtuse – acute in different orientations [C, PS, R, V]	❏ sort a given set of triangles according to the length of the sides ❏ sort a given set of triangles according to the measures of the interior angles ❏ identify the characteristics of a given set of triangles according to their sides and/or their interior angles ❏ sort a given set of triangles and explain the sorting rule ❏ draw a specified triangle (e.g., scalene) ❏ replicate a given triangle in a different orientation and show that the two are congruent
C5 describe and compare the sides and angles of regular and irregular polygons [C, PS, R, V]	❏ sort a given 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 given set of polygons as regular or irregular and justify the sorting ❏ identify and describe regular and irregular polygons in the environment

SHAPE AND SPACE (TRANSFORMATIONS)

General Outcome: Describe and analyze position and motion of objects and shapes.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C6 perform a combination of translation(s), rotation(s) and/or reflection(s) on a single 2-D shape, with and without technology, and draw and describe the image [C, CN, PS, T, V]	❏ demonstrate that a 2-D shape and its transformation image are congruent ❏ model a given set of successive translations, successive rotations or successive reflections of a 2-D shape ❏ model a given 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 given set of successive transformations (translation, rotation, and/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
C7 perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations [C, CN, T, V]	❏ analyze a given 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
C8 identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs [C, CN, V]	❏ 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

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
C9 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]	❏ identify the coordinates of the vertices of a given 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 given 2-D shape to the corresponding vertices of its image as a result of a transformation (limited to first quadrant)

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome: Collect, display and analyze data to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
D1 create, label, and interpret line graphs to draw conclusions [C, CN, PS, R, V]	❏ determine the common attributes (title, axes and intervals) of line graphs by comparing a given set of line graphs ❏ determine whether a given 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 given table of values or set of data ❏ interpret a given line graph to draw conclusions
D2 select, justify, and use appropriate methods of collecting data, including – questionnaires – experiments – databases – electronic media [C, PS, T]	❏ select a method for collecting data to answer a given question and justify the choice ❏ design and administer a questionnaire for collecting data to answer a given question, and record the results ❏ answer a given 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 given question by using electronic media including selecting data from databases
D3 graph collected data and analyze the graph to solve problems [C, CN, PS]	❏ determine an appropriate type of graph for displaying a set of collected data and justify the choice of graph ❏ solve a given problem by graphing data and interpreting the resulting graph

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

STATISTICS AND PROBABILITY (CHANCE AND UNCERTAINTY)

General Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*

D4 demonstrate an understanding of probability by
  – 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
  [C, ME, PS, T]
	❏ list the possible outcomes of a probability experiment, such as
	  – tossing a coin
	  – rolling a die with a given number of sides
	  – spinning a spinner with a given number of sectors
	❏ determine the theoretical probability of an outcome occurring for a given probability experiment
	❏ predict the probability of a given outcome occurring for a given 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 the theoretical probability of a particular outcome
	❏ distinguish between theoretical probability and experimental probability, and explain the difference

STUDENT ACHIEVEMENT

Grade 7

KEY ELEMENTS: GRADE 7

MATHEMATICAL PROCESS (INTEGRATED)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for the grade: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

NUMBER – develop number sense

- divisibility rules
- addition, subtraction, multiplication and division of numbers
- percents from 1% to 100%
- decimal and fraction relationships for repeating and terminating decimals
- addition and subtraction of positive fractions and mixed numbers
- addition and subtraction of integers

PATTERNS AND RELATIONS – use patterns to describe the world and solve problems

Patterns

- table of values and graphs of linear relations

Variables and Equations

- preservation of equality
- expressions and equations
- one-step linear equations

SHAPE AND SPACE – use direct and indirect measurement to solve problems

Measurement

- properties of circles
- area of triangles, parallelograms, and circles

3-D Objects and 2-D Shapes

- geometric constructions

Transformations

- four quadrants of the Cartesian plane
- transformations in the four quadrants of the Cartesian plane

STATISTICS AND PROBABILITY – collect, display and analyze data to solve problems

Data Analysis

- central tendency, outliers and range
- circle graphs

Chance and Uncertainty

- ratios, fractions and percents to express probabilities
- two independent events
- tree diagrams for two independent events

NUMBER

General Outcome: Develop number sense.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
A1 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]	❏ determine if a given number is divisible by 2, 3, 4, 5, 6, 8, 9, or 10 and explain why ❏ sort a given set of numbers based upon their divisibility using organizers, such as Venn and Carroll diagrams ❏ determine the factors of a given number using the divisibility rules ❏ explain, using an example, why numbers cannot be divided by 0
A2 demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems [ME, PS, T]	❏ solve a given problem involving the addition of two or more decimal numbers ❏ solve a given problem involving the subtraction of decimal numbers ❏ solve a given problem involving the multiplication of decimal numbers ❏ solve a given problem involving the multiplication or division of decimal numbers with 2-digit multipliers or 1-digit divisors (whole numbers or decimals) without the use of technology ❏ solve a given problem involving the multiplication or division of decimal numbers with more than a 2-digit multiplier or 1-digit divisor (whole number or decimal), with the use of technology ❏ 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 × 2.4, think $12 × 2, so the product is greater than $24) ❏ place the decimal in a quotient using front-end estimation (e.g., for 51.50 m ÷ 2.1, think 50 m ÷ 2, so the quotient is approximately 25 m) ❏ check the reasonableness of solutions using estimation ❏ solve a given problem that involves operations on decimals (limited to thousandths) taking into consideration the order of operations
A3 solve problems involving percents from 1% to 100% [C, CN, PS, R, T]	❏ express a given percent as a decimal or fraction ❏ solve a given problem that involves finding a percent ❏ determine the answer to a given percent problem where the answer requires rounding and explain why an approximate answer is needed (e.g., total cost including taxes)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
A4 demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions [C, CN, R, T]	❏ predict the decimal representation of a given fraction using patterns (e.g. $\frac{1}{11} = 0.\overline{09}$, $\frac{2}{11} = 0.\overline{18}$, $\frac{3}{11} = ?$ …) ❏ match a given set of fractions to their decimal representations ❏ sort a given set of fractions as repeating or terminating decimals ❏ express a given fraction as a terminating or repeating decimal ❏ express a given repeating decimal as a fraction ❏ express a given terminating decimal as a fraction ❏ provide an example where the decimal representation of a fraction is an approximation of its exact value
A5 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 a given positive fraction or a given mixed number using concrete representations, and record symbolically ❏ determine the sum of two given positive fractions or mixed numbers with like denominators ❏ determine the difference of two given positive fractions or mixed numbers with like denominators ❏ determine a common denominator for a given set of positive fractions or mixed numbers ❏ determine the sum of two given positive fractions or mixed numbers with unlike denominators ❏ determine the difference of two given positive fractions or mixed numbers with unlike denominators ❏ simplify a given positive fraction or mixed number by identifying the common factor between the numerator and denominator ❏ simplify the solution to a given problem involving the sum or difference of two positive fractions or mixed numbers ❏ solve a given problem involving the addition or subtraction of positive fractions or mixed numbers and determine if the solution is reasonable
A6 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 zero ❏ illustrate, using a 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 given integers using concrete materials or pictorial representations and record the process symbolically ❏ subtract two given integers using concrete materials or pictorial representations and record the process symbolically ❏ solve a given problem involving the addition and subtraction of integers

Prescribed Learning Outcomes	Suggested Achievement Indicators
A7 compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using – benchmarks – place value – equivalent fractions and/or decimals [CN, R, V]	❏ order the numbers of a given set that includes positive fractions, positive decimals and/or whole numbers in ascending or descending order, and verify the result using a variety of strategies ❏ identify a number that would be between two given numbers in an ordered sequence or on a number line ❏ identify incorrectly placed numbers in an ordered sequence or on a number line ❏ position fractions with like and unlike denominators from a given set on a number line and explain strategies used to determine order ❏ order the numbers of a given set by placing them on a number line that contains benchmarks, such as 0 and 1 or 0 and 5 ❏ position a given set of positive fractions, including mixed numbers and improper fractions, on a number line and explain strategies used to determine position

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

PATTERNS AND RELATIONS (PATTERNS)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B1 demonstrate an understanding of oral and written patterns and their equivalent linear relations [C, CN, R]	❏ formulate a linear relation to represent the relationship in a given oral or written pattern ❏ provide a context for a given linear relation that represents a pattern ❏ represent a pattern in the environment using a linear relation
B2 create a table of values from a linear relation, graph the table of values, and analyze the graph to draw conclusions and solve problems [C, CN, R, V]	❏ create a table of values for a given linear relation by substituting values for the variable ❏ create a table of values using a linear relation and graph the table of values (limited to discrete elements) ❏ sketch the graph from a table of values created for a given linear 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 given set of linear relations to a given set of graphs ❏ match a given set of graphs to a given set of linear relations

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome: Represent algebraic expressions in multiple ways.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
B3 demonstrate an understanding of preservation of equality by – modelling preservation of equality concretely, pictorially, and symbolically – applying preservation of equality to solve equations [C, CN, PS, R, V]	❏ model the preservation of equality for each of the four operations using concrete materials or using pictorial representations, explain the process orally and record it symbolically ❏ solve a given problem by applying preservation of equality
B4 explain the difference between an expression and an equation [C, CN]	❏ 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 a given expression ❏ provide an example of an expression and an equation, and explain how they are similar and different
B5 evaluate an expression given the value of the variable(s) [CN, R]	❏ substitute a value for an unknown in a given expression and evaluate the expression
B6 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]	❏ represent a given problem with a linear equation and solve the equation using concrete models (e.g., counters, integer tiles) ❏ draw a visual representation of the steps required to solve a given linear equation ❏ solve a given problem using a linear equation ❏ verify the solution to a given linear equation using concrete materials and diagrams ❏ substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality
B7 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 given problem with a linear equation and solve the equation using concrete models (e.g., counters, integer tiles ❏ draw a visual representation of the steps used to solve a given linear equation ❏ solve a given problem using a linear equation and record the process ❏ verify the solution to a given linear equation using concrete materials and diagrams ❏ substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality

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

SHAPE AND SPACE (MEASUREMENT)

General Outcome: Use direct or indirect measurement to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C1 demonstrate an understanding of circles by – describing the relationships among radius, diameter, and circumference of circles – relating circumference to pi – 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 [C, CN, R, V]	❏ illustrate and explain that the diameter is twice the radius in a given circle ❏ illustrate and explain that the circumference is approximately three times the diameter in a given circle ❏ explain that, for all circles, pi 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 and without a compass ❏ solve a given contextual problem involving circles
C2 develop and apply a formula for determining the area of – triangles – parallelograms – circles [CN, PS, R, V]	❏ 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 given circle ❏ solve a given problem involving the area of triangles, parallelograms, and/or circles

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

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

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C3 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 given 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 a given 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

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

SHAPE AND SPACE (TRANSFORMATIONS)

General Outcome: Describe and analyze position and motion of objects and shapes.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
C4 identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs [C, CN, V]	❏ label the axes of a four quadrant Cartesian plane and identify the origin ❏ identify the location of a given point in any quadrant of a Cartesian plane using an integral ordered pair ❏ plot the point corresponding to a given integral ordered pair on a Cartesian plane with units of 1, 2, 5 or 10 on its axes ❏ draw shapes and designs, using given integral ordered pairs, in a Cartesian plane ❏ create shapes and designs, and identify the points used to produce the shapes and designs in any quadrant of a Cartesian plane
C5 perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices) [CN, PS, T, V]	(It is intended that the original shape and its image have vertices with integral coordinates.) ❏ identify the coordinates of the vertices of a given 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 given 2-D shape to the corresponding vertices of its image as a result of a transformation or successive transformations on a Cartesian plane ❏ determine the distance between points along horizontal and vertical lines in a Cartesian plane ❏ perform a transformation or consecutive transformations on a given 2-D shape and identify coordinates of the vertices of the image ❏ 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 a combination of successive transformations ❏ describe the image resulting from the transformation of a given 2-D shape on a Cartesian plane by identifying the coordinates of the vertices of the image

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome: Collect, display and analyze data to solve problems.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
D1 demonstrate an understanding of central tendency and range by – 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]	❏ determine mean, median and mode for a given set of data, and explain why these values may be the same or different ❏ determine the range of given sets 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 given problem involving the measures of central tendency
D2 determine the effect on the mean, median, and mode when an outlier is included in a data set [C, CN, PS, R]	❏ analyze a given set of data to identify any outliers ❏ explain the effect of outliers on the measures of central tendency for a given data set ❏ identify outliers in a given 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 and would not be used in reporting the measures of central tendency
D3 construct, label, and interpret circle graphs to solve problems [C, CN, PS, R, T, V]	❏ identify common attributes of circle graphs, such as – 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 and without technology, to display a given 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 given problem ❏ interpret a given circle graph to answer questions

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

STATISTICS AND PROBABILITY (CHANCE AND UNCERTAINTY)

General Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Prescribed Learning Outcomes	Suggested Achievement Indicators
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding prescribed learning outcome.* *Students who have fully met the prescribed learning outcome are able to:*
D4 express probabilities as ratios, fractions, and percents [C, CN, R,T,V]	❏ determine the probability of a given outcome occurring for a given probability experiment, and express it as a ratio, fraction and 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)
D5 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]	❏ provide an example of two independent events, such as 　－ 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 each of two independent events using a tree diagram, table, or another graphic organizer
D6 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]	❏ determine the theoretical probability of a given outcome involving two independent events ❏ conduct a probability experiment for an outcome involving two independent events, with and without technology, to compare the experimental probability to the theoretical probability ❏ solve a given probability problem involving two independent events

CLASSROOM ASSESSMENT MODEL
Mathematics K to 7

The Classroom Assessment Model outlines a series of assessment units for Mathematics K to 7.

These units have been structured by grade level and theme. Collectively the units address all of the prescribed learning outcomes for each grade, and provide one suggested means of organizing, ordering, and delivering the required content. This organization is not intended to prescribe a linear means of delivery. Teachers are encouraged to reorder the learning outcomes and to modify, organize, and expand on the units to meet the needs of their students, to respond to local requirements, and to incorporate relevant recommended learning resources as applicable. (See the Learning Resources section later in this IRP for information about the recommended learning resources for Mathematics K to 7). In addition, teachers are encouraged to consider ways to adapt assessment strategies from one grade to another.

CONSIDERATIONS FOR INSTRUCTION AND ASSESSMENT IN MATHEMATICS K TO 7

It is highly recommended that parents and guardians be kept informed about all aspects of Mathematics K to 7. Suggested strategies for involving parents and guardians are found in the Introduction to this IRP.

Teachers are responsible for setting a positive classroom climate in which students feel comfortable learning about and discussing topics in Mathematics K to 7. Guidelines that may help educators establish a positive climate that is open to free inquiry and respectful of various points of view can be found in the section on Establishing a Positive Classroom Climate in the Introduction to this IRP.

Teachers may also wish to consider the following:
- Involve students in establishing guidelines for group discussion and presentations. Guidelines might include using appropriate listening and speaking skills, respecting students who are reluctant to share personal information in group settings, and agreeing to maintain confidentiality if sharing of personal information occurs.
- Promote critical thinking and open-mindedness, and refrain from taking sides on one point of view.
- Develop and discuss procedures associated with recording and using personal information that may be collected as part of students' work for the purposes of instruction and/or assessment (e.g., why the information is being collected, what the information will be used for, where the information will be kept; who can access it – students, administrators, parents; how safely it will be kept).
- Ensure students are aware that if they disclose personal information that indicates they are at risk for harm, then that information cannot be kept confidential. For more information, see the section on Confidentiality in the Introduction to this IRP.

Classroom Assessment and Evaluation

Teachers should consider using a variety of assessment instruments and techniques to assess students' abilities to meet the prescribed learning outcomes. Tools and techniques for assessment in Mathematics K to 7 can include
- teacher assessment tools such as observation checklists, rating scales, and scoring guides
- self-assessment tools such as checklists, rating scales, and scoring guides
- peer assessment tools such as checklists, rating scales, and scoring guides
- journals or learning logs
- video (to record and critique student demonstration or performance)
- written tests, oral tests (true/false, multiple choice, short answer)
- questionnaires, worksheets
- portfolios
- student-teacher conferences

Assessment in Mathematics K to 7 can also occur while students are engaged in, and based on the product of, activities such as
- class and group discussions
- interviews and questioning
- sharing strategies
- object manipulation
- models and constructions
- charts, graphs, diagrams
- games
- experiments
- artwork, songs/stories, dramas
- centres/stations
- demonstrations and presentations
- performance tasks
- projects

For more information about student assessment, refer to the section on Student Achievement, as well as to the Assessment Overview Tables in each grade of the Classroom Assessment Model.

Information and Communications Technology

The Mathematics K to 7 curriculum requires students to be able to use and analyse the most current information to make informed decisions on a range of topics. This information is often found on the Internet as well as in other information and communications technology resources. When organizing for instruction and assessment, teachers should consider how students will best be able to access the relevant technology, and ensure that students are aware of school district policies on safe and responsible Internet and computer use.

CONTENTS OF THE MODEL

Assessment Overview Tables

The Assessment Overview Tables provide teachers with suggestions and guidelines for assessment of each grade of the curriculum. These tables identify the domains of learning and cognitive levels of the learning outcomes, along with a listing of suggested assessment activities and a suggested weight for grading for each curriculum organizer.

Overview

Each grade includes an overview of the assessment units:

- Learning at Previous Grades, indicating any relevant learning based on prescribed learning outcomes from earlier grades of the same subject area. It is assumed that students will have already acquired this learning; if they have not, additional introductory instruction may need to take place before undertaking the suggested assessment outlined in the unit. Note that some topics appear at multiple grade levels in order to emphasize their importance and to allow for reinforcement and developmental learning.
- Curriculum Correlation – a table that shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model.

Prescribed Learning Outcomes

Each unit begins with a listing of the prescribed learning outcomes that are addressed by that unit. Collectively, the units address all the learning outcomes for that grade; some outcomes may appear in more than one unit. The units may not address all of the achievement indicators for each of the outcomes.

Suggested Assessment Activities

Assessment activities have been included for each set of prescribed learning outcomes and corresponding achievement indicators. Each assessment activity consists of two parts:

- Planning for Assessment – outlining the background information to explain the classroom context, opportunities for students to gain and practise learning, and suggestions for preparing the students for assessment
- Assessment Strategies – describing the assessment task, the method of gathering assessment information, and the assessment criteria as defined by the learning outcomes and achievement indicators.

A wide variety of activities have been included to address a variety of learning and teaching styles. The assessment activities describe a variety of tools and methods for gathering evidence of student performance. These assessment activities are also referenced in the Assessment Overview Tables, found at the beginning of each grade in the Model.

These strategies are suggestions only, designed to provide guidance for teachers in planning instruction and assessment to meet the prescribed learning outcomes.

Assessment Instruments

Sample assessment instruments have been included at the end of each grade where applicable, and are provided to help teachers determine the extent to which students are meeting the prescribed learning outcomes. These instruments contain criteria specifically keyed to one or more of the suggested assessment activities contained in the units. Ongoing formative assessment will be required throughout the year to guide instruction and provide evidence that students have met the breadth and depth of the prescribed learning outcomes.

CLASSROOM ASSESSMENT MODEL
Kindergarten

KINDERGARTEN: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Kindergarten Mathematics.

Curriculum Organizers	Suggested Assessment Activities	Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
				K	U&A	HMP
NUMBER	- class discussions - interviews - sharing strategies - questioning - observation - self assessment - student conference object manipulation • games • progress record • models • artwork • songs/stories • anecdotal comments	55–65%	5	2	2	1
PATTERNS AND RELATIONS	- class discussion - dramas - photo journals - observation - object manipulation - anecdotal comments artwork • models • progress record • self assessment • interviews	15–25%	1	0	1	0
SHAPE AND SPACE	- class discussion - models/ constructions - self assessment - interviews centres/stations • artwork • progress record • anecdotal comments	15–25%	3	0	2	1
Totals		100%	9	2	5	2

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

KINDERGARTEN

OVERVIEW

Learning at Previous Grades
- not applicable

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit. Grey shading on the table indicates that the organizer or suborganizer in question is not addressed at this grade level.

	Early Numeracy	Counting in our Classroom	Quantity Card Games	Take it Apart	Patterns	Patterns in the Playground	Measuring	3-D Objects
Number	X	X	X	X				
Patterns and Relations *Patterns*	X				X	X		
Variables and Equations								
Space and Shape *Measurement*							X	
3-D Objects and 2-D Shapes								X
Transformations								
Statistics and Probability *Data Analysis*								
Chance and Uncertainty								

Early Numeracy

Prescribed Learning Outcomes

It is expected that students will:

A1   say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1 [C, CN, V]

A2   recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots [C, CN, ME, V]

A3   relate a numeral, 1 to 10, to its respective quantity [CN, R, V]

A4   represent and describe numbers 2 to 10, concretely and pictorially [C, CN, ME, R, V]

A5   compare quantities, 1 to 10, using one-to-one correspondence [C, CN, V]

B1   demonstrate an understanding of repeating patterns (two or three elements) by
   − identifying
   − reproducing
   − extending
   − creating
   patterns, using manipulatives, sounds, and actions [C, CN, PS, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• From time to time you may need to conduct more detailed, individual or small-group assessments as indicators of performance level and to identify areas where students may require additional support.	• Provide individual students with tasks to allow them to show their level of understanding and areas of weakness in chosen concepts.

• The BC Early Numeracy Project (K-1) "…was designed to be used at the end of Kindergarten or early grade one, with a focus on identifying children at risk in mathematics. The assessment helps teachers consider which students would benefit from intervention support in grade one and which need extra attention given to the development of specific skills." (Assessing Early Numeracy(RB 0152): BC Early Numeracy Project (K-1), 2003, pg.3)

Refer to The BC Early Numeracy Project (K-1): (Assessing Early Numeracy (RB 0152), Supporting Early Numeracy (RB 0153), Whole Group Follow-Up (RB 0154)

Counting in our Classroom

Prescribed Learning Outcomes
It is expected that students will: A1 say the number sequence by 1s starting anywhere from 1 to 10 and from 10 to 1 [C, CN, V]   A3 relate a numeral, 1 to 10, to its respective quantity [CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Most students arrive in the Kindergarten classroom with some prior knowledge of the number sequence from 1 to 10. This is a precursor for counting to determine the number of items in a set. Students need to experience activities which involve saying the number sequence from 1 to 10 and 10 to 1. These might include rhymes, songs, games, choral counting, etc. (Some possible ones might be One Two Buckle My Shoe, Five Little Ducks, Over in the Meadow.) These activities assist in developing students' abilities to learn the names of the numbers as well as their order.	• While singing counting songs with the group look for evidence of student's knowledge of the counting sequences. While students are working in learning centres or engaged in free play, question and observe students' abilities to say the number sequence from 1 to 10 or 10 to 1. Many activities in Kindergarten involve counting, providing opportunities to observe progress throughout the year. Use interview questions such as the following to determine the level of individual competency in counting: − Please count for me starting at 1. − Start at 10 and count backwards. − Which number comes after 3? After 7? − Which umber comes before 6? Before 2? − Start at 3 and count to 8. − Start at 7 and count to 2.
• Provide opportunities for students to develop counting and sequence number understandings as they count objects in their play environment. Use naturally occurring opportunities to help students develop number concepts by posing questions such as − How many plates do we need at this table? − Let's count how many steps to the playground. − Who is third in line? − In this story, how many fish did Kim have? − How many claps are there when we sing "B-I-N-G-O"?	• Students should be observed for evidence that they can do the following: − associate one and only one number to an object − count each object only once − know the last number counted determines the quantity − say the number sequence in order − know that the order the objects are counted does not affect the quantity of objects − know that the characteristics of objects (e.g., size of object) do not influence the quantity Summarize in the **Student Math Profile** (see the sample provided at the end of this grade). In an interview or conference setting, ask students to count given objects. This type of request can be repeated using fixed objects, moveable or circular objects, randomly placed objects, etc.

Quantity Card Games

Prescribed Learning Outcomes

It is expected that students will:

A2 recognize, at a glance, and name familiar arrangements of 1 to 5 objects or dots [C, CN, ME, V]
A3 relate a numeral, 1 to 10, to its respective quantity [CN, R, V]
A5 compare quantities, 1 to 10, using one-to-one correspondence [C, CN, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Provide objects for each student in the group. Show students a set of objects and ask them to build a set that has "as many as" that set. Repeat several times using different numbers of objects in the set or varying the instruction to include sets should have "more than" or "less than" the given set.	• Observe the students to see who can build equivalent sets. Record and summarize in the **Student Math Profile** (see the sample provided at the end of this grade).
• To compare, students can use one-to-one correspondence strategies using concrete objects. The objects should be identical and placed in the same position. The concept can then be developed to related objects such as heads and hats or students and chairs. Finally, students can progress to one-to-one correspondence with unrelated objects arranged randomly be used.	• Observe students, noting the extent to which the are able to demonstrate the following: – Count the objects in both sets. (This also implies that she or he can say the sequence of numbers in order.) – Recognize at a glance the number of objects in both sets. (For Kindergarten students this is limited and can be done only with small sets; for, 1 to 5.) – Use the appearance of the 2 sets. (Size is often used. This can cause errors. Air space between the objects may give the impression that a set is larger than it really is.)
• Provide a matching/memory game for students to play (individually or with a partner) during centre time, using quantity cards such as the following: During early stages of learning use only 2 sets of cards. Cards are upside down and the students flip 2 cards each turn verbalizing the number represented on each card. The goal is to find 2 cards representing the same quantity. When a 2-way match is made students collect the set. Game is complete when all matches are made.	• Circulate and record students' abilities to verbalize and make matches to the quantity representations using the **Student Math Profile** (see the sample provided at the end of this grade). For students having difficulty finding matches, check for understanding by playing individually with a child and place all the cards face-up and have the child find the matches (therefore visual/special memory doesn't become a factor). Now it can be determined conclusively which area is causing the student difficulties. This would lead to small group practice or re-teaching. Look for evidence that students can recognize the arrangements at a glance (no counting), and relate the numerals to the set with the same quantity.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• After playing the game many times, a third element can be introduced. Students can show further understand by being asked to create their own pictorial representation of the quantities 1-5 (such as fingers, dogs, etc.) using blank Quantity Cards. Replace one of the other sets of cards to the game with these.	• After practice, a whole group discussion can be had asking the questions related to what they have learned playing the game.
• Using the same Quantity Cards (after students have added their own set) a complete set of 20 cards is available for partners to play a game More Than. They deal out all the cards between them, face down. Students each turn one card and verbalize the quantity of their card. They identify which card has more. The student with the more card takes both. In case of a tie (as many), each student plays another card. Again, the more card takes all. Once all cards are turned, students count to determine which player has the most cards. This game can also be played as Less Than.	• To guide and provide opportunities for students to monitor and critically reflect on their learning, ask them questions such as the following: − Is the game getting easier? − Why is it getting easier? − Which set of cards do you know the best? − How can you make the game more challenging? (e.g., go to 10). Have the students work to add the more challenging elements to the game. While the game is played, look for evidence the students' abilities to verbalize the quantity and identifying whether one quantity is more or less than another. Record observations using the **Student Math Profile** provided at the end of this grade.

Take it Apart

Prescribed Learning Outcomes	
It is expected that students will: A4 represent and describe numbers 2 to 10, concretely and pictorially [C, CN, ME, R, V]	
PLANNING FOR ASSESSMENT	**ASSESSMENT STRATEGIES**
• Provide students with a given number of linking cubes connected in a continuous row (according to the number you are working on). Have students snap apart the row of cubes into 2 parts. Help students look for different configurations for the given number and each make a chart of their findings (e.g., Names for 5).	• Once students have confidence using one-to-one correspondence, they should be able to represent a quantity of objects in a variety of ways. Look for the students' abilities to − recognize that a set of objects that then gets divided into 2 or more sets still has the same quantity − recognize at a glance without counting Through the process, observe the success and ability of students to represent and name the combinations that make up the given number. Record the results on the **Student Math Profile** supplied at the end of this grade.
• Provide students with a given amount of 2-sided counters. The counters are placed in their hands, shaken and then dumped onto a surface. The student separates the counters into the 2 colour piles. Students count the amount in each pile and records the numbers on a paper circling each pair.	• To check for understanding students repeat the activity but instead of recording the number only, traces and colours each counter as it appears in the 2 groups. Use the work sample as evidence of the student's learning (e.g., scrapbook, portfolio, conference).
• With the whole class (e.g., during calendar time) ask students to show me a number using their fingers. Records the number of fingers on each hand that students use. (If only one hand is used, you can introduce the concept of 0, which is represented on the other hand). Then ask students to show another way to make that number with their fingers. Record this combination as well. This continues until there are no more combinations (treat reversals as new combinations, e.g., 4 and 3, 3 and 4).	• Students should be observed for evidence that they can do the following: − identify multiple sets which will create the same number − explain how a set of objects that gets divided into two sets has the same total quantity (conservation of number) − recognize patterns that are created through dividing sets (e.g., $0 + 6 = 6$, $1 + 5 = 6$, $2 + 4 = 6$, $3 + 3 = 6$, $4 + 2 = 6$, $5 + 1 = 6$, $6 + 0 = 6$) − visualize the process of dividing a set into 2 or more subsets

Patterns

Prescribed Learning Outcomes

It is expected that students will:

B1   demonstrate an understanding of repeating patterns (two or three elements) by
  − identifying
  − reproducing
  − extending
  − creating
  patterns, using manipulatives, sounds, and actions [C, CN, PS, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Present (on a magnetic board, or objects on a floor) a variety of different patterns such as the following:
  − ABABAB
  − AABBAABB
using a variety of objects, pictures, shapes, symbols, sounds, etc. to represent the As and Bs.
 	
Have students examine the patterns. Ask questions such as
  − What do you notice?
  − Let's name the objects. What do you hear?
 	
Tell students that this is a pattern, something that repeats exactly the same. Then present examples of non-repeating sequences, and ask
  − Is this a pattern? Why/why not?
  − What should come next in this pattern?
After time for practice, have students create their own patterns individually, using manipulatives in prepared stations around the room.
 	
Provide frequent opportunities for students to explore and discover patterns and non-repeating sequences using manipulatives, in stories, in songs and rhymes, through movement, and in their environment.
	• Check for understanding by presenting a mixture of patterns and non-patterns, and have students to give a thumbs up or down to answer whether or not this is a pattern. Observe students for evidence that they can reproduce and extend the following:
	  − 2-element patterns (ABABAB) (early)
	  − complex patterns (AABAAB, AABBAABB) (later)
	  − 3-elements (ABCABC, AABCAABC) (late stage)
	  − create patterns using sounds, actions, manipulatives, and pictures
	Have students justify the reproductions and the extensions they created.
	
	Photo evidence can be taken of created patterns and added to a journal/scrapbook or student file.
	
	Circulate and observe if students are creating proper patterns. Record observations on the **Student Math Profile** (see the sample included at the end of this grade).

Patterns on the Playground

Prescribed Learning Outcomes

It is expected that students will:

B1   demonstrate an understanding of repeating patterns (two or three elements) by
- identifying
- reproducing
- extending
- creating

patterns, using manipulatives, sounds, and actions [C, CN, PS, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Move outside to the playground area with the class to perform a variety of large action patterns, such as: hands up-hands down, stand up-sit down, right knee up-hand touch head. Have a class discussion about why these are patterns. The students can begin creating their own patterns by playing Copy Me using body actions/sounds. Make a pattern using body actions and have the students copy the pattern. Repeat using other actions and/or sounds.	• Note whether the students can – follow a pattern – continue (extend) a pattern after it has stopped – create their own body action/sound pattern
• Take the class outside to show a pattern in the environment (e.g., fence, swings, bicycle rack, row of trees). Ask students to describe or read the example of the found pattern(s). Challenge the students to find their own pattern in the environment and draw a representation of the found pattern.	• Circulate to view and question students work, noticing whether – students can find an appropriate pattern – can represent it on paper – can verbalize why it is a pattern Advanced understanding may be shown by a student using symbols to represent a real world pattern. Note student ability in the **Student Math Profile** (see the sample included at the end of this grade).

Measuring

Prescribed Learning Outcomes
It is expected that students will:
C1 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Look for opportunities during classroom activities that occur throughout the day to link to measurement concepts.	• While students are going about daily tasks, be aware and observe students comparing objects by length, weight, capacity, or by another attribute. Note their ability on Student Math Profile (see the sample included at the end of this grade level).

• Introduce measurement with direct comparison. During free play time, encourage students to look and touch concrete materials. For example, students will find more meaning in activities where they actually test which object is heavier by picking it up, or by manipulating objects to compare their length. Use cues to help students recognize attributes, such as
  – That block is too long; can you find a shorter one?
  – Can you throw a heavy or lighter ball higher in the air?
	• Listen for the language of measurement throughout the day, being ready to expand student's knowledge and assess their understanding of measurement in real world situations.
	
	For students who haven't demonstrated the skill through their play, initiate actions or responses by asking questions such as the following:
	  – Can you find a block longer than this one?
	  – Who has the taller tower?
	  – Which clay ball is heavier?
	  – Who has more sand? Why?
	  – Which tub holds more water? How could we find out?
	Ask students to explain how they know their response is possible.

• After brainstorming pairs of opposing measuring words, ask students to choose one pair to represent in a drawing. Examples could include: tall/short, wide/narrow, heavy/light, long/short, full/empty. After making their drawings, students then circulate and try and determine which pair their classmates had illustrated. Then students can have the opportunity to describe their drawing to classmates and their measuring pair.	• Ask students asked how easy it was for them to recognize the pair which was illustrated, and how successful they were in describing their illustrations to others.

3-D Objects

Prescribed Learning Outcomes

It is expected that students will:

C2 sort 3-D objects using a single attribute [C, CN, PS, R, V]
C3 build and describe 3-D objects [CN, PS, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Set up stations such as the following to allow opportunities for hands-on learning that provides a vehicle for assessing students' understanding. Station #1: Sorting and describing 3-D objects. – Students will be given a set of objects with multiple attributes such as: keys, coloured tiles, buttons, etc. – Students will sort the objects into groups at the table and describe their sorting rule. Station #2: Building 3-D objects – Using materials such as blocks or modelling clay, students will recreate a chosen object, such as: a fish, a box, or a tower. – Students copy one 3-D object using the given material. Station #3: Pre-sorted objects – Using attribute blocks, set up 3 sorted piles, with multiple possibilities for what the sorting rule could be (e.g., Pile #1 big, red, squares, Pile #2 medium, blue, circles Pile#3 small, yellow, triangles). In this way, students are able to have 3 possible sorting rules to identify and explain. – Have them explain the rule.	• While they sort the objects, observe and record whether students can accurately make groups using the Student Math Profile (see the sample provided at the end of this grade). Questioning students to determine their sorting rule will make their thinking transparent. Possible questions include – Tell me why you have 3 piles. – What is the same about this pile? – Where does this object belong? Why? Observe or question students and record their ability to compare their model to the original object – use the **Student Math Profile**. Possible questions may include – Show me this part on your model. – Is your model as big as _____? – Tell me how your model and the object are the same/different. Ask students to consider how they sorted the objects. What rule did they follow? Students at an early level of understanding will identify only one rule (e.g., colour). Students with an advanced understanding will identify 2 or all 3 possible sorting rules. Record level of success using the **Student Math Profile**. Provide opportunities for peer and self-assessment, considering whether the task was easy or hard.

STUDENT MATH PROFILE: KINDERGARTEN

Name:_____

	Early-Year Evidence	Mid-Year Evidence	Year-End Evidence
Number			
1-10 counting • Forwards • Backwards • Given point			
Recognize sets 1-5			
1-10 • Quantity • Numeral • Matching			
Number 1-10 in 2 parts			
One-to-one • More • Less • Same			
PATTERNS			
Demonstrate • Identify • Reproduce • Extend • Create Types of patterns • Manipulatives • Sounds • Actions • Environment			
SHAPE AND SPACE (MEASUREMENT)			
Compare 2 objects: • Length • Mass • Volume			
SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)			
Sort/single attribute			
Build 3-D object			
Describe 3-D			

CLASSROOM ASSESSMENT MODEL
Grade 1

GRADE 1: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Grade 1 Mathematics.

Curriculum Organizers	Suggested Assessment Activities	Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
				K	U&A	HMP
NUMBER	• class discussions • interviews • sharing strategies • questioning • observation • self assessment • journals • anecdotal comments • object manipulation • games • portfolios • models • artwork • songs/stories • student conferences • peer assessment	65-75%	10	3	3	4
PATTERNS AND RELATIONS	• dramas • observation • object manipulation • peer assessment • anecdotal comments • photo evidence • interviews • class discussion • student work • artwork • models • self assessment • portfolios	10-20%	4	0	3	1
SHAPE AND SPACE	• class discussion • models/ constructions • self assessment • peer assessment • anecdotal comments • centres/stations • artwork • portfolios • photo evidence • interviews	10-20%	4	1	3	0
Totals		100%	18	4	9	5

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

GRADE 1

OVERVIEW

> ### *Learning at Previous Grades*
> - number sequence forward and backward to 10
> - familiar number arrangements
> - one-to-one correspondence
> - repeating patterns of 2 or 3 elements
> - direct comparison for length, mass and volume
> - single attribute of a 3-D objects

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit. Grey shading on the table indicates that the organizer or suborganizer in question is not addressed at this grade level.

	Early Numeracy	Number of the Day	Comparing Quantities	Math Story Time	Everyday Estimating	Number Balancing	Patterns in Your World	Sort By Length	Copy Me
Number	X	X	X	X	X	X			
Patterns and Relations *Patterns*	X					X	X		
Variables and Equations									
Space and Shape *Measurement*								X	
3-D Objects and 2-D Shapes									X
Transformations									
Statistics and Probability *Data Analysis*									
Chance and Uncertainty									

Early Numeracy

Prescribed Learning Outcomes

It is expected that students will:

A1   say the number sequence, 0 to 100, by
  − 1s forward and backward between any two given numbers
  − 2s to 20, forward starting at 0
  − 5s and 10s to 100, forward starting at 0 [C, CN, V, ME]
A2   recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots [C, CN, ME, V]
A3   demonstrate an understanding of counting by
  − indicating that the last number said identifies "how many"
  − showing that any set has only one count
  − using the counting on strategy
  − using parts or equal groups to count sets [C, CN, ME, R, V]
A4   represent and describe numbers to 20 concretely, pictorially, and symbolically [C, CN, V]
A5   compare sets containing up to 20 elements to solve problems using
  − referents
  − one-to-one correspondence [C, CN, ME, PS, R, V]
A6   estimate quantities to 20 by using referents [C, ME, PS, R, V]
A7   demonstrate, concretely and pictorially, how a given number can be represented by a variety of equal groups with and without singles [C, R, V]
A8   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]
B1   demonstrate an understanding of repeating patterns (two to four elements) by
  − describing
  − reproducing
  − extending
  − creating
  patterns using manipulatives, diagrams, sounds, and actions [C, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

- Periodically, students may need more detailed, individual, or small-group assessments as indicators of performance level and areas of weakness. The BC Early Numeracy Project (K-1) "…was designed to be used at the end of Kindergarten or early grade one, with a focus on identifying children at risk in mathematics." (Assessing Early Numeracy(RB 0152): BC Early Numeracy Project (K-1), 2003, p.3)

  Use assessment resources developed as part of the BC Early Numeracy Project (K-1) to set appropriate tasks and assess students' level of understanding and/or areas of weakness with respect to chosen concepts: *Assessing Early Numeracy* (RB 0152), *Supporting Early Numeracy* (RB 0153), *Whole Group Follow-Up* (RB 0154)

Number of the Day

Prescribed Learning Outcomes

It is expected that students will:

A1 say the number sequence, 0 to 100, by
 − 1s forward and backward between any two given numbers
 − 2s to 20, forward starting at 0
 − 5s and 10s to 100, forward starting at 0 [C, CN, V, ME]
A2 recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots [C, CN, ME, V]
A3 demonstrate an understanding of counting by
 − indicating that the last number said identifies "how many"
 − showing that any set has only one count
 − using the counting on strategy
 − using parts or equal groups to count sets [C, CN, ME, R, V]
A4 represent and describe numbers to 20 concretely, pictorially, and symbolically [C, CN, V]
A6 estimate quantities to 20 by using referents [C, ME, PS, R, V]
A8 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]
A9 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Use calendar activities to provide opportunity for practice of number sequences and number patterns. Choose a number of the day (e.g., from calendar, attendance, days in school, weather tally). Have individual students − count up/down from that number in a variety of ways (e.g., by 1s, 2s, 5s). − identify the numbers before and after the given number (later, small groups of students can play What's My number? where clues are given (e.g., My number is 2 more/less than 5.) − count onward to a special event on the calendar and use counters to represent the number of days until that event − add tally marks (e.g.,////, forming groups of five) to represent each day's weather over a period of time (e.g., weeks); eventually, use the tallies to have students practice counting by 5s and group tallies into 10 groups with a circle.	• Students should be observed for evidence that they can − follow the counting sequence − recognize that the last number said identifies "how many" − count forwards by 1s from any number − count backwards by 1s from any number − identify the numbers 1 or 2 more and less from the number (1-20) − count by 2s, 5s, or 10s Have students keep a math portfolio as a way of organizing evidence of their learning. The portfolio can be as simple as a scrapbook, file folder, or accordion file. This portfolio can include work samples, photos, anecdotal notes/evidence, self/peer assessments, checklists, etc. Anecdotal records could be kept and added to their portfolio.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• After choosing the Number of the Day, students can be challenged to make a collage of the number by cutting photos out of a magazine. Use this opportunity to highlight the importance of numbers in a variety of cultures. For example, the number four has significance in Aboriginal cultures when examining the seasons, directions, elements (air, fire, wind and water).
• In their Journal/work page the class can be given the task of printing the Number of the Day and then finding 10 different ways of making that number using simple addition and subtraction facts. These numeric sentences could then be read.
	• Using the work samples, look for evidence that the students are
	  − accurately representing the numbers concretely, pictorially, and symbolically
	  − using familiar mathematical language for addition actions
	  − using familiar mathematical language for subtraction actions
	  − able to justify their solutions using concrete objects or pictures
	Work samples can be added to students' math portfolios.

• The 100th day of school is an opportunity to motivate the students to use mathematics in a meaningful way. Have students
  − make a number line to count the days in school; numbers can be coloured, underlined, circled, or bolded indicating counting by 5s, and 10s; students can be a part of printing/ coding the numbers; the class counts and claps as they reach marked numbers depending on the counting pattern
  − collect 100 things from home; at school on the 100th day they sort the items into groups of 10 on a Sorting Mat similar to the following (with decades printed):
 	
| 50
	100

40	90
30	80
20	70

10	60 |
	
	  − work in pairs to print one decade of numbers on individual cards; the class can glue their numbers in the appropriate spot to make a complete 100's chart.
	  − working in pairs, one partner picks 2 numbers one line apart on a 100 chart; the other needs to say the numbers between the 2
		• Students should be observed for evidence that they can
		  − follow the counting sequence
		  − count forwards by 1s from any number
		  − count backwards by 1s from any number
		  − count by 5s
		  − count by 10s
		  − read the numerals 0-100
		  − write the numerals 0-100
		Notes can be added to students' math portfolios.

Comparing Quantities

Prescribed Learning Outcomes

It is expected that students will:

A5 compare sets containing up to 20 elements to solve problems using
– referents
– one-to-one correspondence [C, CN, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Using an interview with individual or small group of students, present a dot cards with given quantities and manipulatives. Ask the student(s) a set of questions designed to assess their level of understanding of creating equal sets, sets with more or less, and solving a problem involving the comparison of 2 quantities.	• Questions could include the following: – Make a group of counters that has the same number as mine. How do you know it's the same? – Present 2 different dot cards. Which group has more? Less? How do you know? – Make a group with 2 more than mine. How do you know? – Make a group with 2 fewer than mine. How do you know?
• Present a story problem using 2 different dot cards (e.g., The first dock has this many canoes, and the second dock has this many. Which dock has more/fewer canoes?) You may find that using little pictures of canoes on the cards instead of dots can help reduce confusion for students. Challenge the students to create their own more/less/same problem stories including a visual representation of the numbers included in the story (e.g., How many hands in my family? Which bear has more honey pots?).	• Students should be able to – identify the card with more dots by either using one-to-one correspondence or counting – present a clear problem – make an accurate visual representation – be able to explain their solution Work samples can be added to students' math portfolios.

Math Story Time

Prescribed Learning Outcomes

It is expected that students will:

A10 describe and use mental mathematics strategies (memorization not intended), such as
- counting on and counting back
- making 10
- doubles
- using addition to subtract

to determine the basic addition facts to 18 and related subtraction facts [C, CN, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• When reading and listening to math literature, ask students to represent the mathematics presented in the story. For example, represent 5 monkeys jumping on the bed with 1 falling off, concretely and pictorially. Follow up by posing additional problems related to the story to build on other strategies for addition or subtraction (e.g., Doubles: How many eyes are on the bed?). Students can also represent these new numbers in that problem concretely or pictorially. Ask students to suggest a fast way to find the answer.	• Students should be observed for evidence that they can solve problems using
	  − making a visual of the problem
	  − building up and down
	  − counting on and back
	  − knowing/using doubles
	  − using anchors of 5 and 10
	  − connecting addition and subtraction.
	Individual conferences may be needed in order to determine students' abilities to use the above strategies or where errors are occurring.

• Model the process of creating their own story problems using a similar format, which they can pose to the class (e.g., If a boy had 2 wagons and 1 bicycle, how many wheels in total?). Ask students to consider how they figured it out, and whether there is another way.
 	
Then have students create their own story using the same pattern as the presented story. The students should create 2 questions related to their story to present to a partner to solve. The partner then tries to solve the problem in 2 different ways and explains how they did it. Partner share information about
  − how easy the problem was to understand and solve
  − the method used to solve the problem
  − how they came up with the idea for the problem.
	• Ask students to think about their own learning by asking them whether it was easier to solve a problem or create a problem. Journal responses can be placed in students' math portfolios.

Everyday Estimating

Prescribed Learning Outcomes

It is expected that students will:

A6   estimate quantities to 20 by using referents [C, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Using everyday classroom activities present a referent of 5 or 10 items to students and then ask them to estimate whether a set is enough for given purpose. For example: "This is 5 crayons. How many do you think are in this can? Do you think this is enough for the group?"
 	
To model and encourage the use of comparative language, use examples such as: "Take 2 steps. Now estimate how many you think it would be to cross the court. Would it be more or fewer than 15?"
	• During a variety of class activities, look for
	  – the mathematical language students use
	  – their ability to use a referent
	  – ability to make reasonable estimates
	  – use of comparative language (e.g., more or less, closer to ____, about ____)
	
	One way to record student responses and understanding is to use sticky notes on a clipboard or folder, where each sticky is particular to an individual student. Make anecdotal comments about student learning and the particular language they use. Once a sticky is full it is placed in students' math portfolios.

Number Balance

Prescribed Learning Outcomes

It is expected that students will:

A2 recognize, at a glance, and name familiar arrangements of 1 to 10 objects or dots [C, CN, ME, V]

A4 represent and describe numbers to 20 concretely, pictorially, and symbolically [C, CN, V]

A7 demonstrate, concretely and pictorially, how a given number can be represented by a variety of equal groups with and without singles [C, R, V]

A9 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]

B3 describe equality as a balance and inequality as an imbalance, concretely, and pictorially (0 to 20) [C, CN, R, V]

B4 record equalities using the equal symbol [C, CN, PS, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Present students with 2 different colour stickers and sturdy paper cookie shapes. Ask the students to decorate cookie shapes with a specific number of stickers. Continue decorating cookie shapes that represent different numbers. These decorated cookies can be used in several activities. After each number is completed, analyse the different ways the number is configured (familiar arrangements) and represented by the 2 types of items (5 represented as 3 squares and 2 circles). After completing this activity for several numbers, the cookies can be used as flash cards for games or group practice recognizing at a glance familiar arrangements of numbers. They could also be used in a matching game to find cookies with the same number regardless of the configuration. Students print addition and subtraction sentences to match the arrangements of decorations on the cookies using an equal symbol appropriately.	• Preliminary assessment of students' understanding of the concept of conservation of number can be observed and assessed in many different classroom circumstances such as the following: − We are working in groups of 4 today, show me on your fingers how many books do you need for your group. − In the gym, organize the class in groups of 5. Have one student from each group go and get a beanbag for every child in their group. As students engage in activities that illustrate different ways to configure the same number, observe for evidence that they can − represent numbers pictorially and concretely accurately − recognize equal values − recognize quickly familiar arrangements of numbers. − use familiar and mathematical language to describe additive and subtractive actions − record equalities using the equal symbol

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• After modelling and practice with objects and a 2-pan balance, provide each student with a 2-pan balance with equal weight objects. Provide also a set of diagrams such as the following for students to complete: □ + □ ◯ □ □ ◯ □ + □ Working in small groups, ask students to manipulate the weights to find one or more configurations that would match each diagram. Students would record their representation by drawing pictures on the line and putting the numerals in the boxes, including the appropriate symbol in the oval (=), making a complete number sentence.	• Circulate and have students explain their work, focussing on − representing the quantities correctly − equality and balance − inequality and imbalance − solving simple addition problems − appropriate use of the equal symbol Take notes on each student's level of understanding. Students can add their sheet to their math portfolios. Student conferences may be necessary to ask more probative questions to diagnosis areas of difficulty.

Patterns in Your World

Prescribed Learning Outcomes

It is expected that students will:

B1 demonstrate an understanding of repeating patterns (two to four elements) by
- describing
- reproducing
- extending
- creating

patterns using manipulatives, diagrams, sounds, and actions [C, PS, R, V]

B2 translate repeating patterns from one representation to another [C, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Show a variety of patterns and ask to describe why (in what way) each is a pattern. Then have students
  – use concrete classroom materials to create a repeating pattern at their work stations
  – work in pairs, taking turns to describe each other's pattern using a letter code and then show further understanding by extending the pattern on both ends
  – draw a pictorial reproduction of that same pattern using a different representation (e.g., colours to letters); partners then exchange papers and extend each others' patterns by at least 4 elements, identifying their work with their name to hand in; students could also discuss with their partners whether they figured out the pattern and extended it correctly.
	• While students are working, look for
	  – complexity of patterns (ABBABB vs. ABABAB)
	  – extending the pattern on both ends
	  – number of elements used (ABCABC vs. ABABAB)
	  – ability to describe their pattern
	Early on in the student's understanding focus will be on 2-element patterns (ABABAB). As their sense of pattern grows they will begin creating complex patterns using more elements.
	
	The pictorial reproduction and some photographic evidence of completed patterns can be placed in students' math portfolios.
	
	Have students complete a pictorial self-assessment checklist to record their abilities to
	  – find a pattern
	  – tell about the pattern they find
	  – change the pattern
	  – extend the pattern
	Provide opportunities for students to share their self-assessments with partners. Conduct interviews to ensure the checklist is completed properly and accurately. The self assessment can be a part of students' math portfolios.

• Interview students to check their understanding and justify their self-assessment.	• Possible interview questions may include
	  – Can you identify the missing element (cover 1 or 2 elements)? How do you know?
	  – I have extended your pattern. Have I done a good job? Tell me why.
	  – You said you changed how you showed your pattern. How did you show this change?

Sort by Length

Prescribed Learning Outcomes

It is expected that students will:

C1 demonstrate an understanding of measurement as a process of comparing by
- identifying attributes that can be compared
- ordering objects
- making statements of comparison
- filling, covering, or matching [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Provide opportunities for students to explore and practise measurement using direct comparison, by looking and touching concrete materials to compare their length, weight, and area.
 	
Set up a sort by length activity consisting of a can of straws, scissors, tape, and blank paper. Students take 3 straws and cut 2 of them to get a total of 5 segments. They take the segments and order them from shortest to longest by matching. Students then tape the ordered straw segments onto a blank page.
 	
Replicate this idea but replace sorting objects by length with mass (heaviest/lightest), volume (holding most/least), or area (being covered by most/least tiles).
	• Watch for evidence that the students are able to
	  – use common attributes of measurement (length, mass, volume, etc.) when measuring
	  – use comparative language (longer, heavier, holds more)
	  – can order objects by attribute (e.g., from largest to smallest and smallest to largest)
	  – directly compare objects to verify the comparison and justify the solution
	  – explain their reasoning when making statements involving comparative measurements
	During an interview ask students why they ordered the way they did, and how they decided where to put their straws? Students can add the page to their math portfolios. Not all activities would need a collectable work sample for a portfolio; instead, students could give a verbal explanation after completing the task. Anecdotal records could be kept and added to their portfolio or file.

Copy Me

Prescribed Learning Outcomes

It is expected that students will:

C2   sort 3-D objects and 2-D shapes using one attribute, and explain the sorting rule [C, CN, R, V]

C3   replicate composite 2-D shapes and 3-D objects [CN, PS, V]

C4   compare 2-D shapes to parts of 3-D objects in the environment [C, CN, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Set out a variety of 2-D shapes on a surface with a ring for the purpose of categorizing the shapes. Without telling the students your sorting rule, choose 2 or 3 shapes that have a same property to sort into the ring. Then ask students continue to sort appropriate shapes to match the rule. Then have students try and verbalize the sorting rule you used.	• As students participate in the sorting activity, check the extent to which they are able to – sort, following an established sorting rule or principle – verbalize what they are doing (i.e., identify individual attributes that are similar or different) and explain their reasoning
• After sufficient practice, have the students work in small groups with one child creating a 'secret rule' for sorting their shapes. The rest of the group tries to sort and predict the rule. Give each child a turn to be the 'secret rule maker.' This same game can be repeated using 3-D objects. Repeat the process using 2-D shapes and 3-D objects together. Students need to explain the sorting rule with specific mention to why some 2-D shapes and 3-D objects are together in the sort.	• Circulate to observe and make notes whether students are able to – create a valid "secret" sorting rule – find another student's sorting rule and follow it – explain the sorting rule Ask students to show the parts that are the same/different. Student responses might resemble the following: – There is a curve on the cone just like all the other shapes. – All these shapes and objects have pointy parts.
• Show the students a composite of 2-D shapes. Provide students with a set of shapes (paper shapes, pattern blocks, tangram shapes) and ask them to make one just like the one shown. Next, students are divided into pairs and given a limited number of shapes. One student chooses which shapes to use and constructs a composite 2-D shape. The other student will then try to duplicate the design. This activity can be repeated using 3-D objects.	• Circulate and makes notes regarding the accuracy of the duplication and level of understanding. Watch for students who may have difficulty – moving from 2-D shapes to 3-D objects – finding appropriate shapes to include – duplicating a partner's work The partner then tries to copy the shape. Partners share information about – how easy it was to make the shape – any parts that were more difficult – whether they found 2-D or 3-D more challenging Photo evidence can be used and added to students' math portfolios.
• Provide students with a set of paper 2-D shapes and have them circulate finding parts of 3-D objects in the classroom or another environment. Students should be able to explain why they made their matches.	• The Copy Me rubric (see sample supplied at the end of this grade) provides sample criteria for assessing students' level of understanding of 2-D shapes and 3-D objects.

COPY ME

4	• Evidence is clearly communicated, students can explain their understanding without clues. • Student is able to sort, copy, explain, find and compare 2-D shapes and 3-D objects independently and shows creativity or original thinking.
3	• Evidence is clearly communicated, and students can explain their understanding with minimal clues. • Student is able to sort, copy, explain, find and compare 2-D shapes and 3-D objects independently with minimal clues.
2	• Evidence is not clearly communicated, and understanding is limited or not present. • Student is willing to attempt and complete the tasks of sorting, copying, explaining, finding and comparing 2-D shapes and 3-D objects but needs significant help to complete many tasks.
1	• Evidence is not clearly communicated, and understanding is limited or not present. • There may be attempts to sort, copy, explain, find and compare 2-D shapes and 3-D objects but has little success without one-on-one help.

CLASSROOM ASSESSMENT MODEL

Grade 2

GRADE 2: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Grade 2 Mathematics.

Curriculum Organizers	Suggested Assessment Activities	Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
				K	U&A	HMP
NUMBER	• class discussions • interviews • portfolios • sharing strategies • questioning • observation • games • checklists • math journals • models • student work • tests	45-55%	10	2	4	4
PATTERNS AND RELATIONS	• class discussion • constructions • photo journals • observation • class discussion • computer generated work • artwork	10-20%	4	1	2	1
SHAPE AND SPACE	• class discussion • collages, artwork • photo journals • models and constructions	25-35%	9	1	7	1
STATISTICS AND PROBABILITY	• class discussions • charts and graphs • explanations	5-10%	2	1	1	0
Totals		100%	25	5	14	6

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

GRADE 2

OVERVIEW

Learning at Previous Grades

- number sequence forward and backward to 100
- skip counting
- representation of number
- referents and one-to one-correspondence for sets up to 20 elements
- addition to 20 and basic addition and subtraction facts
- repeating patterns of 2 to 4 elements
- representation of pattern
- equalities and inequalities
- process of measurement using comparison
- one attribute of 3-D objects and 2-D shapes
- composite 2-D shapes and 3-D objects
- 2-D shapes in the environment

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit. Grey shading on the table indicates that the organizer or suborganizer in question is not addressed at this grade level.

	Circle Time Math	What's on Your Mind?	Up and Down	Our Favourites	Building a "Model" Community	Balancing Act	Measure It!	Pattern Walk and Talk	1's, 10's, 100's	Plus and Minus
Number	X	X	X						X	X
Patterns and Relations *Patterns*	X							X		
Variables and Equations						X				
Space and Shape *Measurement*	X						X			
3-D Objects and 2-D Shapes					X					
Transformations										
Statistics and Probability *Data Analysis*				X						
Chance and Uncertainty										

Circle Time Math

Prescribed Learning Outcomes

It is expected that students will:

A6   estimate quantities to 100 using referents [C, ME, PS, R]

B2   demonstrate an understanding of increasing patterns by
- describing
- reproducing
- extending
- creating

  patterns using manipulatives, diagrams, sounds, and actions (numbers to 100) [C, CN, PS, R, V]

C1   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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• As part of a weekly routine, present students with 2 identical containers, one filled with an indeterminate number of a given object (e.g., marbles, jelly beans, clothes pins) and the other containing a specified number of the same object (e.g., 5 or 10) to serve as a referent. Have students use the referent to estimate the number of objects in the filled container.	• As students engage in estimation activities, ask questions to probe their understanding, such as – How did you figure that out? What was your referent? – Why do you think your estimate was too low?… too high? How do you know? Look for evidence that students are able to – make estimates that are based on a referent – use a range of strategies, including direct/ hands-on comparison, indirect comparison, and logical reasoning – explain their thinking when making referents – use a variety of referents to refine their estimates
• Use songs, rhymes, and daily questioning to reinforce students' memory of – days of the week – months of the year	• Observe and note on a checklist whether students can – remember the days of the week in order – remember the months of the year in order – read the date on a calendar – identify yesterday's and tomorrow's dates
• Regularly pose questions that involve using the calendar, such as – How many days until the weekend? Until sports day? Spring break? – How many more school days in October? – On what date/day of the week does our next school assembly occur?	• Look for evidence that students are able to use a range of strategies, including – counting on the calendar – using personal units of measurement (e.g., sleeps, weekends, recesses) – using standard units (e.g., days, weeks) to determine the passage of time

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Regularly pose questions that involve using the number line, hundreds chart and/or calendar to identify, describe, and extend increasing patterns. such as
  – What is the pattern when counting by 2s? By5s? By 10's? (skip counting)
  – How do the numbers increase on the 100s chart?
  – What number patterns can you see on the calendar?
• Ask students to create an increasing pattern such as the following, using manipulatives such as coloured tiles:
	• As students are answering questions or creating patterns look for evidence that they can
	  – identify and describe increasing patterns in a variety of given contexts
	  – represent a given a pattern concretely and pictorially
	  – create an increasing pattern and explain the pattern rule
	  – represent the same pattern in another mode (e.g., triangle-square-triangle-square-square to red-blue-red-blue-blue)
	  – identify and correct errors in a given pattern

What's on Your Mind?

Prescribed Learning Outcomes

It is expected that students will:

A10 apply mental mathematics strategies, such as
  – using doubles
  – making 10
  – one more, one less
  – two more, two less
  – building on a known double
  – addition for subtraction
  to determine basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Use 10-frames, dot cards, other manipulatives, and songs to demonstrate different strategies for quickly figuring out simple addition and subtraction facts to 18, including
  – using doubles
  – making 10
  – 1 more, 1 less
  – 2 more, 2 less
  – addition for subtraction
	• Have students explain their thinking when doing mental math. Observe and record students' use of strategies. Consider whether they
	  – use a range of strategies
	  – become progressively more fluent in their computations (quicker and more accurate)
	Students may develop personal strategies that make sense to them for mentally determining answers for basic facts. Encourage students to develop and share their personal strategies with others.

Up and Down

Prescribed Learning Outcomes

It is expected that students will:

A1   say the number sequence from 0 to 100 by
  − 2s, 5s and 10s, forward and backward, using starting points that are multiples of 2, 5, and 10 respectively
  − 10s using starting points from 1 to 9
  − 2s starting from 1 [C, CN, ME, R]
A2   demonstrate if a number (up to 100) is even or odd [C, CN, PS, R]
A3   describe order or relative position using ordinal numbers (up to tenth) [C, CN, R]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Ensure that each student has frequent opportunities to count forward, backward and skip count. Songs, rhymes, number lines, 100 charts, calendars, and classroom routines such as counting the class for attendance, can provide opportunities for learning, practice, and informal assessment.	• Observe students to determine their mastery of the number sequence from 0 to 100. Use strategies such as the following in student assessment interviews: − Ask the student to identify a counting chain (forward, backward) on a 0-99 chart (e.g., If I want to count by 2s, 5s, 10s from 10, show and tell me the numerals I would say. If I want to count by 10s starting at 3, 6, 7, show and tell me the numerals I would say.). − Point to a numeral on the chart. Ask the student to identify the numeral as being odd or even, and show why, using concrete objects such as cubes or tiles to represent the numeral. − Arrange 10 objects in a row. Ask the student to describe the position of a given object using ordinal numbers (e.g., Which object is first? In which position is the ____?). Use an individual interview form for each student to record observations on the stages of learning (e.g., cannot yet do, can do with support, can do independently, can do fluently).

Our Favourites

Prescribed Learning Outcomes

It is expected that students will:

D1   gather and record data about self and others to answer questions [C, CN, PS, V]

D2   construct and interpret concrete graphs and pictographs to solve problems [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Ask students to each develop a question about classroom favourites (e.g., flavour of ice cream, type of wild meat, team sport, colour, holiday). Have students use the question to poll their classmates (gather data) and create a graph from the findings. Display the graphs created by the class and pose questions, such as – What do you notice about the graphs? – What are the common attributes of the different graphs?	• Observe how well students are able to – record and organize data as it is collected using concrete objects, tallies, checkmarks, charts or lists; – display their data in a concrete graph or pictograph; – present their data to the class Have students individually solve a problem relating to the data collected such as – We need to buy ice cream for the class picnic. Which flavours shall we buy? – We want to paint our puppet theatre. Which colour should we use? Observe whether students can interpret the data and explain their answer.

Building a "Model" Community

Prescribed Learning Outcomes

It is expected that students will
C6 sort 2-D shapes and 3-D objects using two attributes and explain the sorting rule [C, CN, R, V]
C7 describe, compare, and construct 3-D objects, including
  − cubes
  − spheres
  − cones
  − cylinders
  − pyramids [C, CN, R, V]
C8 describe, compare, and construct 2-D shapes, including
  − triangles
  − squares
  − rectangles
  − circles [C, CN, R, V]
C9 identify 2-D shapes as parts of 3-D objects in the environment [C, CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Choose a community or part of a community (e.g., your town, school, park, long house, pit house) that the class can represent, using 2-D shapes and 3-D solids. Discuss what shapes and solids you need to include and how they might be constructed. Provide a wide variety of materials for the class to use, including blocks, recyclables, paper, tubing, modelling materials, etc. In small groups, or as a class, design and construct a model (or mural) of the community you have chosen.	• Observe students as they work, using anecdotal notes, the 2-D, 3-D Checklist (included at the end of this grade), photo journals, and/or videos to record
	  − their use of vocabulary
	  − ability to identify 2-D shapes and 3-D objects
	  As students are engaged in these activities, listen and record students' use of vocabulary, noting their ability to identify, sort, describe, represent and explain constructions. Ask probing questions (e.g., Is a square a rectangle? Can you tell me why or why not?)

• Play games such as "What's My Rule?" Choose several items with 2 common attributes from a set of 2-D shapes or 3-D objects and show them to the class, asking students to determine your sorting rule.	• Observe and record students' ability to sort 2-D shapes and 3-D objects according to 2 attributes.

Balancing Act

Prescribed Learning Outcomes

It is expected that students will:

B3 demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100) [C, CN, R, V]

B4 record equalities and inequalities symbolically using the equal symbol or the not equal symbol [C, CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Model different ways of representing number sentences to demonstrate that both sides of the equal signs mean equal quantities (e.g., $12 = 4 + 8$; $4 + 7 = 3 + 8$; $12 - 7 = 5$).
 	
Model inequality using a variety of concrete representations and show how to record an inequality using the $\neq$ (e.g., $12 \neq 4 + 9$; $4 + 7 \neq 3 + 10$; $12 - 7 \neq 4$).
	• Ask students to write number sentences using the = and $\neq$ signs to represent given sets, as in the following examples:
	  – $3 + 4 \ \square \ 8$
	  – $8 \ \square \ 4 + 4$
	  – $12 - 3 \ \square \ 10$
	  – $10 \ \square \ 12 - 2$
	Ask students to represent the number sentences using concrete or pictorial representations.

• Use a set of objects (up to 100) such as blocks, cubes, or tiles, to construct 2 equal sets and demonstrate how to change them to an inequality.	• Observe whether students are able to
	  – construct 2 equal sets and explain why they are equal
	  – construct 2 unequal sets and explain why they are not equal
	  – change 2 given sets, equal in number, to create inequality
	  – choose from 3 or more given sets the one that does not have a quantity equal to the others and explain why

Measure It!

Prescribed Learning Outcomes

It is expected that students will:

C2   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]

C3   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]

C4   measure length to the nearest non-standard unit by
  − using multiple copies of a unit
  − using a single copy of a unit (iteration process) [C, ME, R, V]

C5   demonstrate that changing the orientation of an object does not alter the measurements of its attributes [C, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have the students work in pairs to trace the outline of their partner's body on a large piece of paper, and cut it out. Have the students estimate, then measure the length of their bodies, using a non-standard unit of measurement chosen from a given range. Ask the students to explain why they chose that unit. Ask students to arrange the body outlines, and explain their method of ordering. Reorient a body outline, and ask students what the measure is now? Has it changed? How do they know?	• Note and record student skills in measuring and comparing, using a checklist or other assessment tool (e.g., Measurement, included at the end of this grade).

• Assemble a collection of assorted objects, such as boxes, cans, blocks, containers or other objects. Ask students to choose one object and measure it, using non-standard units, and record its length, height, distance around and mass. Ask students to make a comparison of their item with another student's.	• As students measure their items, monitor their work to ensure they have
	  − correctly used the unit of measure
	  − correctly recorded the measures of length, height, distance around, and mass
	  − ordered their objects by a given attribute
	  − made statements of comparison (e.g., My box is heavier than _____'s block.)

Pattern Walk and Talk

Prescribed Learning Outcomes

It is expected that students will:

B1 demonstrate an understanding of repeating patterns (three to five elements) by
   − describing
   − extending
   − comparing
   − creating
   patterns using manipulatives, diagrams, sounds, and actions. [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• During a class Pattern Walk, inside or outside, ask students to find and describe patterns such as rungs on the monkey bar, windows on the building, veins on a leaf, tiles on the floor.	• As students are on the Pattern Walk, and during class discussion, observe and record their abilities to − find, identify, describe and compare repeating patterns − create patterns using sounds and actions − predict what will come next − extend the pattern to verify the prediction
• As a class, discuss celebrations in families, the school and community that honour and respect cultural diversity. Have each student create a border using a symbol representing a celebration they have chosen to show their understanding of pattern.	• As students' display their borders, observe and record their abilities ability to − create a border using a repeated pattern − describe and compare repeating patterns. − predict what will come next − extend the pattern to verify the prediction
• Use computer-drawing programs as an opportunity for students to create, copy, compare, and extend patterns.	• Print computer generated students' work and put in Student Portfolio. Over time, look for evidence that students are able to − find patterns and describe them using appropriate vocabulary and terms, − compare their patterns with the patterns created by others − extend identified patterns

1s, 10s, 100s

Prescribed Learning Outcomes

It is expected that students will:

A4   represent and describe numbers to 100, concretely, pictorially, and symbolically [C, CN, V]

A5   compare and order numbers up to 100 [C, CN, R, V]

A7   illustrate, concretely and pictorially, the meaning of place value for numerals to 100 [C, CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Use individual interviews to identify what each student knows. The interview could include tasks such as the following:
  − Ask the student to name and write a given numeral modeled with base 10 blocks or other proportional materials.
  − Ask the student to build a given number to100 using base 10 blocks or other proportional materials on a place value mat, then draw what they have built and write the numeral.
  − Provide a set of cards with 2-digit numerals. Ask the students to read each numeral in 2 different ways (e.g., 24 as 2 tens and four ones or 24, or 2 tens and 4 left over)
  − Using the same set of numeral cards, ask the students to arrange them in ascending or descending order and then explain their reasoning.
  − Ask the students to choose and write a 2-digit numeral in the centre of a mat, then represent that number with tallies, pictures, and/or manipulatives.
	• Identify and record students' understanding of these concepts based on their performance and explanations. Observe how the student is able to
	  − name the given numeral
	  − build a given number
	  − represent the number they built pictorially
	  − write the numeral
	  − read a given numeral in more than one way
	  − arrange the numerals in ascending and descending order and explain their reasoning
	
	Observe whether students are able to
	  − correctly write a 2-digit numeral
	  − represent the number in four different ways
	You may wish to take photographic evidence of the students' work to add to their portfolios to show progress over time.

Plus and Minus

Prescribed Learning Outcomes

It is expected that students will:

A8   demonstrate and explain the effect of adding zero to or subtracting zero from any number [C, R]

A9   demonstrate an understanding of addition (limited to 1 and 2-digit numerals) with answers to 100 and the corresponding subtraction by
  – using personal strategies for adding and subtracting with and without the support of manipulatives
  – creating and solving problems that involve addition and subtraction
  – explaining that the order in which numbers are added does not affect the sum
  – explaining that the order in which numbers are subtracted may affect the difference
  [C, CN, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Use activities such as the following to provide addition and subtraction practice:
  – Ask students to model and explain addition and subtraction processes, such as 25 + 31 or 65 – 24, concretely (e.g., using base 10 blocks or other materials) or pictorially.
  – Give students a set of numerals such as 13, 5, 18, and ask them to create a story problem and write number sentences to represent the problem.
  – Ask the students to solve a simple word problem (e.g., Sam has 7 marbles. He buys some more. Now he has 10. How many did he buy?)
  – Ask the students to write a number sentence for the problem (e.g., 7 + □ = 10), and then explain their strategies (e.g., counting on to, known fact, subtraction).
	• Note how students are able to separate 10s and 1s when adding and subtracting 2-digit numerals.
	
	Observe whether the student is able to
	  – create a story problem using the numerals
	  – write a correct number sentence using the numerals
	Note what strategy the students uses.

• Ask students questions to illustrate the communicative principle of addition (e.g., Is the sum of 2 + 4 the same as the sum of 4 + 2?). Ask students to explain and/or show their thinking with manipulatives or pictures. Follow up with subtraction (e.g., Is 10 – 4 the same as 4 – 10?) Ask students to explain and/or show with manipulatives or pictures, their thinking and understanding that the commutative principle does not apply to subtraction.	• Observe whether the student is able to demonstrate understanding of the commutative principle using words, pictures or with manipulatives. Observe whether the student is able to demonstrate understanding that the commutative principle does not apply to subtraction using words, pictures or with manipulatives.
• Use manipulatives to show adding and subtracting zero (e.g., What happens if I add zero to 11? What happens if I subtract zero from 11? Does every number stay the same when I add or subtract zero?).	• Observe whether the student is able to demonstrate understanding that adding or subtracting zero to a number does not change the number.

2-D, 3-D CHECKLIST

Date(s): _____

Name	is able to sort 3-D objects and 2-D shapes by 2 attributes and explain the sorting rule	is able to describe, compare, construct and name 3-D objects.	is able to describe, compare, construct and name 2-D shapes.	identify and name 2-D shapes as parts of 3-D objects.

				On target
Teacher notes: Possible extensions:			A	Additional instruction and practice
Extra guided practice:			E	Extend and enrich

MEASUREMENT

Outcome	Got it! Student names	Not yet! Student names
measure using single or multiple copies of a non-standard unit		
choose, use and explain the choice of a non-standard unit		
compare and order objects and make statements of comparison		
measure and re-measure, changing orientation and explain the results		

CLASSROOM ASSESSMENT MODEL
Grade 3

GRADE 3: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Grade 3 Mathematics.

Curriculum Organizers	Suggested Assessment Activities	Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
				K	U&A	HMP
NUMBER	• class discussions • interviews • portfolios • sharing strategies • questioning • observation • games • checklists • math journals • models • student work • tests	50-60%	13	1	7	5
PATTERNS AND RELATIONS	• class discussion • constructions • observation • class discussions • photo journals • computer generated work • artwork	15-25%	3	0	1	2
SHAPE AND SPACE	• class discussions • explanations • observation • models • artwork	15-25%	7	3	3	1
STATISTICS AND PROBABILITY	• class discussions • charts and graphs • portfolios	5-10%	2	1	1	0
Totals		100%	25	5	12	8

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

GRADE 3

OVERVIEW

Learning at Previous Grades
- whole numbers to 100
- skip counting
- referents to 100
- even, odd and ordinal numbers
- place value for numerals to 100
- addition to 100 and corresponding subtraction
- mental math strategies to 18
- repeating patterns of three to five elements
- increasing patterns
- equality and inequality; symbols for equality and inequality
- days, weeks, months, and years
- non-standard units of measure for length, height distance around, mass (weight)
- two attributes of 3-D objects and 2-D shapes
- cubes, spheres, cones, cylinders, pyramids
- triangles, squares, rectangles, circles
- 2-D shapes in the environment
- data about self and others
- concrete graphs and pictographs

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit. Grey shading on the table indicates that the organizer or suborganizer in question is not addressed at this grade level.

	Good Math Morning	Working with larger Numbers	A Mind for Math	Number Juggling	Making Rectangles	Sharing and Grouping	Fractions	Patterns on the Move	Measurement Fair	Getting to Know You	Geometry Plane and Fancy
Number	X	X	X	X	X	X	X				
Patterns and Relations *Patterns*	X							X			
Variables and Equations				X							
Space and Shape *Measurement*	X								X		
3-D Objects and 2-D Shapes											X
Transformations											
Statistics and Probability *Data Analysis*										X	
Chance and Uncertainty											

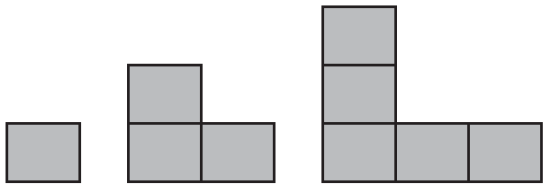## *Good Math Morning*

Prescribed Learning Outcomes

It is expected that students will:

A1 say the number sequence forward and backward from 0 to 1000 by
- 5s, 10s or 100s using any starting point
- 3s using starting points that are multiples of 3
- 4s using starting points that are multiples of 4
- 25s using starting points that are multiples of 25 [C, CN, ME]

A4 estimate quantities less than 1000 using referents [ME, PS, R, V]

B1 demonstrate an understanding of increasing patterns by
- describing
- extending
- comparing
- creating

patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

B2 demonstrate an understanding of decreasing patterns by
- describing
- extending
- comparing
- creating

patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

C1 relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years) [CN, ME, R]

C2 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Provide frequent opportunities for students to count forward, backward and skip count. Songs, rhymes, number lines, 100 charts, calendars, and classroom routines such as counting the class for attendance, can provide opportunities for learning, practice, and informal assessment.	• Use an individual interview form to record observations on each student's stage of learning (e.g., cannot yet do, can do with support, can do independently, can do fluently). Ask the student to identify a counting chain forward (or backward) to 1000 (e.g., If I want to count by 10s, by 25s, by 100s from various starting points, tell me the numerals I would say.).

• As part of a weekly routine, present students with 2 identical containers – one filled with an indeterminate number of a given object (e.g., beans, candies, pennies) and the other containing a specified number of the same object (e.g., 10 or 100) to serve as a referent. Have students use the referent to estimate the number of objects in the filled container	• As students engage in estimation activities, ask questions to probe their understanding, such as
	  – How did you figure that out?
	  – Why do you think your estimate was too low?
	  Look for evidence that students are able to
	  – relate their estimate to a referent and justify their choice
	  – make estimates that are increasingly accurate (with practice over time) as a result of using a wider range of referents

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Regularly pose questions that involve using the number line, hundreds chart, and/or calendar to identify, describe, and extend increasing and decreasing patterns. such as
  − What is the pattern when counting by 10s? By 25's? By 100s? (skip-counting)
  − What would the next term in this pattern be?
  − What number patterns can you see on the 100 chart (horizontal, vertical, diagonal?
Ask students to find the number of tiles for the next (e.g., fourth, fifth) extension of a given increasing pattern, as in the following example:
 	
	• As students are answering questions or creating patterns look for evidence that they can
	  − identify, describe and create increasing and decreasing patterns in a variety of given contexts
	  − identify and explain errors in a given pattern
	  − create a concrete, pictorial or symbolic representation of an increasing pattern for a given pattern rule
	  − solve a given problem using increasing patterns

• Pose problems relating to time and involving the use of a clock and calendar. As well, encourage students to discuss, solve, and pose their own problems, such as the following:
  − If school starts at 9:00 and ends at 3:00, how many hours are you at school?
  − If lunch is 1 hour long, how many minutes is that?
	• Look for evidence that students are able to
	  − select and use non-standard, personal units of measurement (e.g., number of sleeps, weekends, grades, birthdays)
	  − select standard units (e.g., minutes, hours, days, weeks, months, years) to measure the passage of time
	  − convert passage of time to and from seconds to minutes, minutes to hours

Working with Larger Numbers

Prescribed Learning Outcomes
It is expected that students will:
A2 represent and describe numbers to 1000, concretely, pictorially, and symbolically [C, CN, V]
A3 compare and order numbers to 1000 [CN, R, V]
A5 illustrate, concretely and pictorially, the meaning of place value for numerals to 1000 [C, CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Give each student a small whiteboard or chalkboard. Think of a target number and give them a clue (e.g., I'm thinking of a number that is greater than 200 and less than 300) Students show their boards. Note students' accuracy in meeting the criteria. Reveal the target number and ask students
  − Who is the closest?
  − Who has a number that is less than mine, greater than mine?
 Ask them to stand with their boards, read their number and then put the numerals in order.
	• Observe and record the student's ability to
	  − write
	  − read
	  − compare
	  − order numbers to 1000

• Ask students to write 3 different numbers between 100 and 1000 on index cards. On the back of each card they write the number in words. Collect the cards, draw one (e.g., 435) and ask the students to read the number aloud, write the number in words (four hundred thirty-five) and as an expression. (200 + 200 + 35)	• As you play the game repeatedly over time, observe and record how well students are able to read, write and represent the numbers.

• Create Number Mats such as the following to use with the whole class, a small group, or individual students:
 	
![place mat diagram]
 	
 Ask the students to choose and write a 3-digit numeral in the centre of the place mat, then represent that number
  − with base 10 blocks
  − with coins
  − as expressions
	• Observe whether students are able to
	  − correctly write a 3-digit numeral
	  − represent the number in different ways
	 You may wish to take photos of the students' work to add to their portfolios to show progress over time.

A Mind for Math

Prescribed Learning Outcomes

It is expected that students will:

NUMBER:

A6 describe and apply mental mathematics strategies for adding two 2-digit numerals, such as
  − adding from left to right
  − taking one addend to the nearest multiple of ten and then compensating
  − using doubles [C, ME, PS, R, V]
A7 describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as
  − taking the subtrahend to the nearest multiple of ten and then compensating
  − thinking of addition
  − using doubles [C, ME, PS, R, V]
A8 apply estimation strategies to predict sums and differences of two 2-digit numerals in a problem-solving context [C, ME, PS, R]
A10 apply mental mathematics strategies and number properties, such as
  − using doubles
  − making 10
  − using the commutative property
  − using the property of zero
  − thinking addition for subtraction
  to recall basic addition facts to 18 and related subtraction facts [C, CN, ME, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Ask students to create and record their own story problems in a math journal that involve addition or subtraction of 2 -digit numerals. Share the stories with the class and have the students make estimates of the sums or differences. Have students share their strategies.	• During the year, observe and record on a checklist or other assessment template − students' choice and use of different mental math strategies; − students' personal strategies for mental math Look for evidence that students are able to use and explain a range of strategies including − using doubles − doubles plus (minus) 1, doubles plus (minus) 2 − adding from left to right − taking one addend to the nearest multiple of 10 and then compensating (e.g., $49 + 27 = 50 + 27 - 1$) − taking the subtrahend to the nearest multiple of 10 and then compensating (e.g., $49 - 27 = 50 - 27 + 1$) − thinking addition for subtraction (e.g., $47 - 25 = 25 + \square = 47$) − using the commutative property and the property of 0

Number Juggling

Prescribed Learning Outcomes

It is expected that students will:

A9 demonstrate an understanding of addition and subtraction of numbers with answers to 1000 (limited to 1, 2 and 3-digit numerals) by
  − 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 [C, CN, ME, PS, R]

B3 solve one-step addition and subtraction equations involving symbols representing an unknown number [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Ask students to solve story problems involving addition or subtraction, created by students or teacher. In a math journal (any notebook), students explain their strategies with words and/or pictures	• Observe and note students' growth in solving word problems, with reference to
	  − the students' understanding of the concepts and the ability to apply them
	  − the strategies that are used
	  − use of manipulatives
	  − how well the students communicate their thinking
	  − accuracy of computations

• Ask students to write the equation with an unknown, solve the equation, and write the complete equation. (e.g., A pirate had 58 jewels. She found some more. Now she has 110 jewels. How many did she find?) Some possible answers might be
  − $58 + \square = 110$: $58 + 52 = 110$
  − $110 - 58 = \square$: $110 - 58 = 52$
	• Have students share their responses with the class. Observe and note how the students explain their personal strategies for addition and subtraction, which may be invented or algorithmic. For example:
	  − for $326 + 48$, record $300 + 60 + 14$
	  − for $127 - 38$, record $127 - 20 - 10 - 8$ or $38 + 2 + 80 + 7$

Making Rectangles

Prescribed Learning Outcomes

It is expected that students will:

A11 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Give each group of students a set of no more than 25 tiles. Ask them to make as many rectangles as they can, using some or all of the tiles. (There are many possibilities) As they make their rectangles (arrays), they represent them on grid paper and write the equation on the back. When all groups have completed the task, students cut out their rectangles and mount them onto a large mural or chart paper, copying the equation below the rectangle.	• As students are working, look for evidence that they are able to − construct the rectangles with concrete objects − represent them accurately on grid paper − write an equation for their rectangle (array) in more than one way
• From the representations, students work in pairs to create a word problem for one of the rectangles and share it with the class. The rest of the class solves the problem and determines which rectangle represents that solution (e.g., 4 ducks each laid 3 eggs. How many eggs are there?). Challenge the students to describe a given rectangle in more than one way (e.g., 4 + 4 + 4, 3 + 3 + 3 + 3, 4 × 3, 3 × 4)	• Observe and note how students are able to − model multiplication using concrete materials − demonstrate an understanding of multiplication − represent and explain the process of multiplication − create and solve problems in context − relate multiplication to repeated addition

Sharing and Grouping

Prescribed Learning Outcomes

It is expected that students will:

A12 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Pose problems such as the following that involve equal sharing and equal grouping: – Tom has 12 cookies. He puts an equal number of cookies on each of 3 plates. How many cookies will be on each plate? (equal sharing) – Tom has 12 cookies. He wants to put 3 cookies on each plate. How many plates will he need? (equal grouping) Have students act out and/or illustrate the story problem with manipulatives, drawings or diagrams, explain their thinking and record the problem with an equation. Ask students to create their own story problems for other students to solve, using manipulatives or drawings.	• As students work, look for evidence of how they are able to – demonstrate an understanding of division – identify events from experience that can be described as equal sharing or equal grouping – represent a giving division expression as repeated subtraction – represent a given repeated subtraction as a division expression – relate division to multiplication – create and solve given division problems

Fractions

Prescribed Learning Outcomes

It is expected that students will:

A13 demonstrate an understanding of fractions by
  − explaining that a fraction represents a part of a whole
  − describing situations in which fractions are used
  − comparing fractions of the same whole with like denominators [C, CN, ME, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Students create their own set of fraction bars by folding and cutting strips of paper of equal length into equal parts. Each fraction should be represented by a different colour. Each piece should be labelled (e.g. ½, ¾, ⅛)
 	
Use the fraction bars to represent story problems from everyday situations. For example, Mrs. Smith has a piece of ribbon. She needs 2 equal pieces for some crafts. Show with the fraction bars how she would divide her ribbon and name each piece as a fraction.
 	
Students decorate paper circles as pizzas. They fold and cut some of the "pizzas" into halves, some into quarters and others into eighths. Use the pizza fractions to compare fractions with like denominators (e.g., compare ⅖ to ⅝, ¼ to ¾). Students can use the pizzas to create and represent their own story problems.
	• As students are engaged in the activities, observe and note student's ability to
	  − cut or fold a whole into equal parts
	  − describe where fractions are used
	  − represent a fraction concretely or pictorially
	  − explain that a fraction represents a part of a whole
	  − show the meaning of numerator and denominator using objects or pictures
	  − compare fractions of the same whole with like denominators
	  − compare fractions with the same denominator using models
	  − identify common characteristics of a given set of fractions

Patterns on the Move

Prescribed Learning Outcomes

It is expected that students will:

B1   demonstrate an understanding of increasing patterns by
  − describing
  − extending
  − comparing
  − creating
  patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

B2   demonstrate an understanding of decreasing patterns by
  − describing
  − extending
  − comparing
  − creating
  patterns using manipulatives, diagrams, sounds, and actions (numbers to 1000) [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Look for opportunities to incorporate math into various class activities across the subject areas. For example, when investigating different ways of moving across the floor or playground (e.g., hop, jump, step, slide), experiment with patterns of movement and model increasing and decreasing patterns. For example, students might hop, step, hop, step, step; hop, step, step, step across the room. Conversely a decreasing pattern might be created, such as: jump, jump, jump, slide, slide, slide; jump, jump, slide, slide; jump, slide. Using music, encourage students to create patterns using rhythm instruments, body percussion, singing, and/or movement. Have students create a sequence of different moves to demonstrate their individual understanding of increasing and decreasing patterns.	• As students are engaged in the activity, observe and note how well they are able to
	  − understand patterns and pattern rules
	  − create a simple pattern
	  − create increasingly complex patterns
	  − extend and compare patterns
	  − explain pattern rules

Measurement Fair

Prescribed Learning Outcomes

It is expected that students will:

C3 demonstrate an understanding of measuring length (cm, m) by
- 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]

C4 demonstrate an understanding of measuring mass (g, kg) by
- 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]

C5 demonstrate an understanding of perimeter of regular and irregular shapes by
- 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Plan and set up measurement stations around the classroom, school, and/or playground, with 2-D shapes such as cardboard or paper cut-outs, and 3-D objects such as boxes, crates, sports equipment. Set measurement tasks at each station (e.g., find the perimeter, height, mass). Have students move with a partner from station to station to estimate, measure, and record as indicated using a booklet or worksheet provided. Students may also use everyday objects as referents for mass (e.g., a one litre juice box, filled, weighs 1 kg and a cm cube weighs 1 g). Body measures can be used as referents for length (e.g., arm span, length of foot). After the activity, encourage discussion so that students can explain and compare their findings. Include prompts for writing in the booklet or worksheet (e.g., My estimates were _____. The most difficult task for me was _____. I used _____ as a referent when I measured _____.)	• Throughout the activity and following discussion, note and record students' ability to – match a standard unit to a referent – use a referent to estimate – determine and record the length and width of a given 2-D shape – determine and record the length, width, and height of a given 3-D object – explain their measurements and compare them with those of other students – For more information, collect the completed measurement booklets to assess students' ability to record estimates and measures accurately in centimetres and metres.
• Using geoboards and/or toothpicks, ask students to construct different shapes with the same perimeter to solve word problems (e.g., A farmer has __ units of fencing. How many different ways can the farmer make a 4-sided pigpen?) Have students record the different shapes on dot paper.	• Look for evidence that students are able to – estimate perimeter using referents – measure and record the perimeters of given regular and irregular shapes – explain their strategies for these measurements – construct more than one shape for a given perimeter

Getting to Know You

Prescribed Learning Outcomes

It is expected that students will:

D1   collect first-hand data and organize it using
  − tally marks
  − line plots
  − charts
  − lists
  to answer questions [C, CN, V]

D2   construct, label and interpret bar graphs to solve problems [PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Brainstorm the kinds of information the students would like to know about each other (e.g., number of people in family, pets, favourites, number of TVs). Ask the students to create their own question, choose a method of collecting their data and organize it.	• Observe and note how well students are able to
	  − formulate a question
	  − collect first-hand data
	  − organize the data
	  − use a variety of organizers including tally marks, line plots, charts and lists

• From a list of choices (up to 10) ask the students to pick their favourite snack. Tally the results. A bar graph can be used to display the information they collect so that students are able to compare the data and make a decision. Ask the students to construct and label a bar graph with a title and axes. Ask them to draw at least 2 conclusions, using comparative language (e.g., 7 more students prefer carrot sticks to celery).	• Observe and note how well students are able to
	  − construct and label a bar graph to display data
	  − interpret the data
	  − answer questions about the data
	Assess using criteria such as those found in the **Graphing** rubric provided at the end of this grade.

Geometry Plane and Fancy

Prescribed Learning Outcomes

It is expected that students will:

C6 describe 3-D objects according to the shape of the faces, and the number of edges and vertices [C, CN, PS, R, V]

C7 sort regular and irregular polygons, including
- triangles
- quadrilaterals
- pentagons
- hexagons
- octagons

according to the number of sides [C, CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Create a graphic organizer on a large piece of chart paper, with columns for the object, number of faces, number of edges, and number of vertices. Subdivide the column for the number of faces into 4 quadrants: squares, triangles, rectangles, and circles.
 	
Give students a varied collection of 3-D objects (e.g., boxes, cans, geometric solids). Ask them to place one object at a time on the chart, then identify, count and record the data for each object.
	• As students are engaged in the activity, look for and record evidence that they can
	  – identify the faces as triangles, squares, rectangles or circles
	  – sort regular and irregular polygons according to the number of sides
	  – count number of edges and vertices

• Using a large set of regular and irregular polygons cut from construction paper, origami paper, wrapping paper, and/or greeting cards, ask students to sort the shapes according to the number of sides. Students then work together to create a collage using each of the sorted groups of shapes (e.g., a triangle collage, a collage of hexagons).	• As students are engaged in the activity, note how they are able to sort shapes. Ask students how they sorted the shapes. Is there another way to sort them?

GRAPHING

	Not yet meeting	Approaching	Meeting
Application	needs assistance to create a bar graph	needs minimal assistance to create a bar graph	independently creates a bar graph
Graph Title	no title	partial or incorrect title	accurate title
Labels	no labels	incompletely or inaccurately labelled	completely and correctly labelled
Accuracy of representing information	incomplete	may have one or two minor errors	all information correctly represented
Accuracy of representing information	unable to draw any conclusions	draws one accurate conclusion	draws two or more accurate conclusions

CLASSROOM ASSESSMENT MODEL

Grade 4

GRADE 4: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Grade 4 Mathematics.

Curriculum Organizers	Suggested Assessment Activities		Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
					K	U&A	HMP
NUMBER	• checklists • observations • interviews, • questioning • portfolios • games • models	• journals/logs • demonstrations • presentations • projects • self-assessment • peer assessment	45-55%	11	4	5	2
PATTERNS AND RELATIONS	• observations • interviews • portfolios • journals/logs • graphic organizers	• games • checklists • models • questioning • self-assessment • peer assessment	10-20%	6	0	4	2
SHAPE AND SPACE	• interviews • portfolios • journals/logs • self-assessments • peer assessments • games	• checklists • models • demonstrations • presentations • graphic organizers • discussions	25-35%	5	3	1	1
STATISTICS AND PROBABILITY	• observations • interviews • discussions • self-assessments • checklists	• journals/logs • questioning • presentations • performance tasks • projects	5-10%	2	0	1	1
Totals			100%	24	7	11	6

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

GRADE 4

OVERVIEW

> ### *Learning at Previous Grades*
> - whole numbers to 1000
> - skip counting
> - referents to 1000
> - place value to 1000
> - mental mathematics for adding and subtracting 2-digit numerals
> - addition with answers to 1000 and corresponding subtraction
> - mental math strategies for addition facts to 18 and corresponding subtraction facts
> - multiplication to 5 × 5 and corresponding division
> - fraction representation
> - increasing patterns
> - decreasing patterns
> - one-step addition and subtraction equations involving symbols for the unknown
> - non-standard and standard units of time
> - measurements of length (cm, m) and mass (g, kg)
> - perimeter of regular and irregular shapes
> - faces, edges and vertices of 3-D objects
> - triangles, quadrilaterals, pentagons, hexagons, octagons
> - first hand data
> - bar graphs

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit. Grey shading on the table indicates that the organizer or suborganizer in question is not addressed at this grade level.
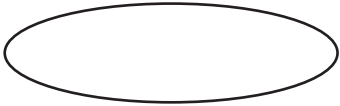
	Shapes Around Us	TV Program Infomercial	Schedule	Number Game	Equation Challenges	Racing to 100	Writing a Math Book	Concentration Game	Crossword Puzzle	Constructing Rectangles	Patterns	Data Analysis	Show What You Know	Fractions and Decimals	Can You Spot the Errors?
Number		X		X		X	X	X	X	X			X	X	X
Patterns and Relations *Patterns*	X										X				
Variables and Equations					X										
Space and Shape *Measurement*			X				X	X		X					
3-D Objects and 2-D Shapes	X														
Transformations	X						X								
Statistics and Probability *Data Analysis*												X			
Chance and Uncertainty															

Shapes Around Us

Prescribed Learning Outcomes

It is expected that students will:

C4 describe and construct rectangular and triangular prisms [C, CN, R, V]
C5 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]
B4 identify and explain mathematical relationships using charts and diagrams to solve problems [CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students identify real-world examples of triangular and rectangular prisms. They then describe their common attributes and record this information on a graphic organizer such as a Frayer model:
 	
Definition / Essential Characteristics
 	
( )
 	
Examples / Non-examples
 	
Have them sort these on a Venn diagram using the shapes of the bases.
	• Look for evidence that the students are
	  − providing real world examples of triangular and rectangular prisms
	  − clearly describing common attributes of triangular and rectangular prisms and are using appropriate vocabulary such as faces, edges, vertices
	  − able to identify non-examples of rectangular and triangular prisms and give reasons why these are not prisms
	  − able to sort these prisms using the shapes of their bases
	  − able to explain why the entry for a particular part of the Frayer model is correct

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students construct models of rectangular and triangular prisms. Provide materials such as modelling clay, toothpicks, paper, or cardboard to create models of prisms. Nets for rectangular and triangular prisms could be given to students to create paper models of these prisms. Encourage students to use vocabulary such as edges, vertices, parallel faces, etc to describe their creations.	• Interview, conversation, and discussion prompts might include the following: − Tell me about your model. Describe it. − How do you know this is an example of a rectangular (or triangular) prism? What features or attributes of a rectangular/triangular prism does it have? − Which objects in the real world look like these prisms? How do you know? − Why do you think that most containers, packages are shaped like rectangular prisms? When assessing student models of triangular and rectangular prisms, look for evidence that − models constructed include the attributes of rectangular and triangular prisms and are examples of rectangular or triangular prisms − student persevered during the activity − student engaged in conversation with peers about the activity and used mathematical vocabulary to describe his/her creations Include photographs of student models in their math portfolios. Suggested comments for students to attach to photographs might include the following: − This is an example of ____. − I want you to notice that ____ − I think I did a good job on it because ____ − Something new I learned by doing this activity was ____. − Some things I know about rectangular (or triangular prisms) are ____. − I know that the model I created is a rectangular prism because I know that ____. − I know that the model I created is a triangular prism because I know that ____. − Some attributes that rectangular prisms and triangular prisms have in common are ____. − Some things that are different about rectangular prisms and triangular prisms are ____. − Here are some examples of things around me that are rectangular prisms ____. − Here are some examples of things around me that are triangular prisms. − I think most packages and containers are shaped like rectangular prisms because ____.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Present students with examples of Canadian Aboriginal art. These may include paintings, tapestries or totem poles. On a graphic organizer such as a t-chart, have them sort the shapes into these categories: non-symmetrical, 1 line of symmetry, 2 or more lines of symmetry. Students could use Miras or folding strategies to determine whether or not shapes are symmetrical. At the bottom of the chart, have students explain in writing how they know a shape is symmetrical or not. Have students use the shapes that are common to Northwest coastal Aboriginal art to draw their own design of an animal. Students should use both symmetrical (with one or more lines of symmetry) and non-symmetrical shapes. (Students may draw these by hand or using a computer drawing program.) A unit on symmetry has also been created in *Shared Learnings* (pp. 134-136) which teachers may want to adapt to meet the needs of students at a Grade 4 level.	• Circulate as students complete the task and verify through conversations and student demonstrations that students are indeed able to identify symmetrical shapes and their respective lines of symmetry. Prompts to guide conversations might include the following: − Tell me how you know that shape is symmetrical or not? What is the difference between a symmetrical shape and a shape that is not symmetrical? − Tell me how you decided that the shape is not symmetrical? What strategies did you use, Miras, folding? − Show me the lines of symmetry on this shape. Are there other lines of symmetry? How do you know? Have students write in their learning logs. They may use these sentence prompts: − Something I know about symmetrical shapes are that ____. − A strategy I use to find out if a shape is symmetrical or not is ____. − Here is a shape that is symmetrical ____. − Here is a shape that is not symmetrical ____. − I know I did a good job because ____. − If I had to explain symmetry to someone else I would say ____.
• With the whole class, have students play a sorting game with geometric solids or attribute blocks. Use a Carroll diagram as a gameboard. Post the gameboard for all to see. Give each student an object. On his or her turn, have the student place the object in the appropriate cell and explains his or her reasons for doing so. Play a similar game using the Venn diagram. As a variation of this game, have students play in pairs. Partner A uses a blank Carroll or Venn diagram and places several objects according to a rule that he or she has created. Partner B identifies the rule then places an object in the appropriate box. Partners switch roles.	• While students are playing the game, look for evidence that students are able to − sort shapes into Venn diagram or Carroll diagram − identify a sorting rule for Venn or Carroll diagram − determine where a new element belongs in a Carroll or Venn diagram − explain the relationships among elements in the Venn/Carroll diagram

TV Program Infomercial

Prescribed Learning Outcomes

It is expected that students will:

A3 demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals) by
  − using personal strategies for adding and subtracting
  − estimating sums and differences
  − solving problems involving addition and subtraction [C, CN, ME, PS, R]

A6 demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by
  − using personal strategies for multiplication with and without concrete materials
  − using arrays to represent multiplication
  − connecting concrete representations to symbolic representations
  − estimating products [C, CN, ME, PS, R, V]

A7 demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by
  − using personal strategies for dividing with and without concrete materials
  − estimating quotients
  relating division to multiplication [C, CN, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students prepare an infomercial for a fictitious TV show, Math News, explaining their personal strategies for solving a given addition, subtraction, multiplication or division problem. Students may use concrete materials or pictures to demonstrate personal strategies.	• While students are presenting their infomercial, look for evidence that − personal strategies were clearly described − personal strategies were effective and solved the problem accurately − students included models, illustrations, symbolic representations in their descriptions of personal strategies Have students assess each others' work by completing a peer assessment sheet, using criteria established as a class such as the following: − The presentation and explanations were clear. I understood what ____ was trying to say. − Here is what I think ____ said. − This group used graphic presentations that were clear and had something important to show. − ____'s strategy of ____ solved the problem correctly. − Everyone in the group worked well together. − This group used appropriate mathematical vocabulary. − Something that ____ did really well was ____. − A question I would like to ask ____ about is ____.

Schedule

Prescribed Learning Outcomes
It is expected that students will: C1 read and record time using digital and analog clocks, including 24-hour clocks [C, CN, V] C2 read and record calendar dates in a variety of formats [C, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students use a table or chart to record a schedule of their typical daily activities. Have students record the date in the format *yyyy/mm/dd,* draw the clock and state the time using both digital and 24-hour format. Activities should be labelled am or pm. Alternatively, students could construct a schedule of their ideal day; a timetable for the class; a practise schedule for sports team, etc.	• When assessing student schedules, consider whether the student is able to
	  − use or draw an analog clock and show the time accurately
	  − use digital or 24 format to represent a given time
	  − illustrate the meaning of am and pm and labelled daily activities appropriately. (e.g., breakfast is labelled using am)
	  − record the date using a variety of formats such as *yyyy/mm/dd* and *dd/mm/yy*
	  − identify possible interpretations of a given date (e.g., 06/03/04)

Number Game

Prescribed Learning Outcomes
It is expected that students will:
A1 represent and describe whole numbers to 10 000, pictorially and symbolically [C, CN, V]
A2 compare and order numbers to 10 000 [C, CN]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students play a card game in groups of four. Before starting the game have each player create a deck of 10 cards, labelling each card with a single digit 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9. Combine each player's deck to create a team deck of 40 cards. Have one student shuffle the deck and deal out four cards to each player. Each player then uses the digits to form the largest number possible. (e.g., If a player is dealt 3, 5, 1, 9, then the largest number he or she can create using those digits is 9531).
 	
 Players compare their numbers. The player with largest number scores 4 points. The player with second largest number scores 3 points, and so on. The player with the smallest number scores 1 point. The game continues for several rounds with players adding up their scores from previous rounds.
 	
 Students should record the numbers they have been creating. This information will be used at the end of the game when they reflect on their learning in their math journals. Students can decide how many rounds to play before a champion is declared. Tell students that you will be circulating and listening to see if students justify their numbers (I know this is the largest number I can create because ____) and challenge inaccuracies with good reasons.
 	
 As a variation, play the game so that the person who creates the smallest number wins.
	• Circulate and observe students playing the game. Look for evidence that students are able to
	  – understand that the order of the digits determines the size of the number (student should create the largest number possible using the digits he/she has been dealt)
	  – order all players' numbers from largest to smallest
	  – understand that the each digit represents a different quantity (e.g., in 2457, 2 represents 2 thousands, 4 = 4 hundreds)
	  – give reasons why their number is the largest possible one they can make given the digits they were dealt
	  – challenge other players if they have ordered the players' numbers incorrectly
	 Students should reflect on the game by writing in their math journals, using prompts such as the following:
	  – Today I (describe how to play the game)
	  – Here are the numbers that I got ____.
	  – The largest number I got today was ____. (have them write out the number in at least 2 ways: numerical form, expanded notation, written form, or pictorially)
	  – I know that this is the largest number I got because ____. (explanation should show student understanding of place value)
	  – The smallest number I got was ____.
	  – I know that this is the smallest number because ____.
	  – Here is a drawing of that number using Dienes blocks.
	  – Circulate and listen as students play the game. Suggested prompts:
	  – Tell me how you know this is the biggest number you can create given those digits.
	  – What would be the smallest number you could create using the same digits?

Equation Challenges

Prescribed Learning Outcomes

It is expected that students will:

B5   express a given problem as an equation in which a symbol is used to represent an unknown number [CN, PS, R]

B6   solve one-step equations involving a symbol to represent an unknown number [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Given a story problem, have students write an equation to match the problem (e.g., there are 4 sandwiches on a tray; there were 13 at the start; some are missing). Students create an equation to match (e.g., $4 + n = 13$).
 	
This activity can be reversed. Given an equation (e.g., $5n = 15$), students create a story problem.
	• Observe to what extent students were able to
	  − create an equation to match the story
	  − create a story to match the equation
	  − explain the meaning of the unknown variable
	  − solve the problem in one or more ways
	
	Have students write in their math journals using the following the prompts:
	  − I know I am right because I _____.
	  − Something I learned was _____.
	  − Some strategies I used to solve the problems were _____.
	  − I wonder _____.
	  − Something challenging was _____.
	  − When I don't know what to do, I _____.

• Have students solve equations with one unknown variable such as the following (include all operations $+, -, \div, \times$ with the unknown on both right and left sides of the equation):
  − $16 + n = 20$
  − $23 - n = 18$
  − $5n = 25$
  − $n - 3 = 7$
  − $17 - 9 = n$
  − $12 \div n = 4$
Given these as examples, have students create their own equations. Have students pair up and solve their partner's equations. In a variation of this task, Partner A creates a word problem from a given equation and hands the word problem only for his or her partner to solve. Partner B represents the word problem with an equation and then solves it concretely, pictorially or symbolically.
	• Verify that students are able to
	  − solve equations using the four operations with the unknown on the right or on the left side of the equation
	  − create a word problem in context for a given equation
	  − solve a given one step equation with one unknown using manipulatives, guess and test, and other strategies

- Give students a "function machine" such as the following:

1	4
2	8
3	12
4	16
5	20
6	22
7	28
8	32
9	36

Challenge students to identify (in their math logs or journals) where the machine breaks down. Have students explain in writing how they know they are right.

- Verify to what extent students are able to identify the mistake in the pattern and explain how they correct the problem. Verify to what extent students are able to explain how they know they are right.

Have students include this entry from their journals into their math portfolios.

Racing to 100

Prescribed Learning Outcomes

It is expected that students will:

A3 demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals) by
   − using personal strategies for adding and subtracting
   − estimating sums and differences
   − solving problems involving addition and subtraction [C, CN, ME, PS, R]

A5 describe and apply mental mathematics strategies, such as
   − skip counting from a known fact
   − using doubling or halving
   − using doubling or halving and adding or subtracting one more group
   − using patterns in the 9s facts
   − using repeated doubling
   to determine basic multiplication facts to 9 × 9 and related division facts [C, CN, ME, PS, R]

A6 demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by
   − using personal strategies for multiplication with and without concrete materials
   − using arrays to represent multiplication
   − connecting concrete representations to symbolic representations
   − estimating products [C, CN, ME, PS, R, V]

A7 demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by
   − using personal strategies for dividing with and without concrete materials
   − estimating quotients
   − relating division to multiplication [C, CN, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students play a dice game using 2 dice. On his or her turn, player A may choose to add, subtract, multiply or divide the dice outcome. This is player A's score for that round. On his or her next turn, Player A obtains a score for that round in the same way. He or she may then choose to add, subtract, multiply or divide the new score to his or her previous score. The first player to reach 100 wins.	• Circulate as students play game and look for evidence that students
	  − are adding, subtracting, multiplying or dividing accurately
	  − understand that adding and multiplying increase scores and that subtracting and dividing reduce scores
	  − are using mental math strategies to arrive at totals
	  − are able to estimate quotients as they are tallying their scores using mental mathematical strategies
	  − are able to estimate products
	  − are able to estimate differences and sums
	  − are using personal strategies to determine sums, differences, products and quotients
	  − are using the properties of 0 and 1 to determine products
	  − are using the property of 1 to determine quotients when dividing
	Circulate and interview students or invite them into a conversation to explain their thinking and justify their actions as they play the game. Suggested prompts for interviews, conversations and discussions.
	  − What would be your best move given those dice outcomes? Explain why you think that.
	  − Explain why you chose to add (subtract, multiply or divide) those dice outcomes. How will that affect your score for this round? How will this affect your total score?
	  − Explain why you chose to add (subtract, multiply or divide your scores. How will this affect your score for this round? How will it affect your total score?
	  − If you could wish for the best score on your next turn, what numbers would you hope to roll?
	Students reflect on the game in their math journals. Some suggested prompts include
	  − Today I ____.
	  − Some good decisions I made were ____.
	  − The next time I play this game, I will ____.
	  − A hint I would give to a player who is new to this game is ____. because ____.
	  − I learned ____.
	  − Something surprising was ____.
	  − I noticed ____.
	Have students include this entry from their journals into their math portfolios.

Writing a Math Book

Prescribed Learning Outcomes

It is expected that students will:

A3   demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals) by
   – using personal strategies for adding and subtracting
   – estimating sums and differences
   – solving problems involving addition and subtraction [C, CN, ME, PS, R]
A4   explain the properties of 0 and 1 for multiplication, and the property of 1 for division [C, CN, R]
A6   demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by
   – using personal strategies for multiplication with and without concrete materials
   – using arrays to represent multiplication
   – connecting concrete representations to symbolic representations
   – estimating products [C, CN, ME, PS, R, V]
A7   demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by
   – using personal strategies for dividing with and without concrete materials
   – estimating quotients
   – relating division to multiplication [C, CN, ME, PS, R, V]
A8   demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to
   – 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 [C, CN, PS, R, V]
C1   read and record time using digital and analog clocks, including 24-hour clocks [C, CN, V]
C5   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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students create a picture book about fractions for younger students. Included in this book, will be illustrations of fractions from everyday contexts, illustrations of fractions depicting both fractional parts of a set and fractional parts of a whole.	• Students could include this picture book in their portfolios to demonstrate their learning, adding comments about what they learned from this activity. Work with students to create an assessment tool for the picture book. Ask students how they will you know they have done a good job. The following are criteria to consider including: – fractions depicted include examples of fractional parts of a set as well as fractional parts of a whole – models of fractions match their symbolic representations – contexts from real life are included as well as fractions illustrated on a model

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students create a picture book for the class library explaining any one of the following concepts:
  − the properties of 0 and 1 for multiplication and the properties of 1 for division
  − personal strategies for computation in addition, subtraction, multiplication and division
  − telling time using analog, digital, and 24-hour clocks including examples of activities that occur in the am and in the pm
  − a picture book showing symmetrical and a symmetrical designs that they have drawn as well as examples from real life contexts
	• When reviewing the books that students have created, look for evidence that they
	  − clearly explained the properties of 0 and 1 for multiplication and the property of 1 for division
	  − clearly described (verbally and pictorially) personal strategies for computation in addition, subtraction, multiplication and division
	  − clearly described how to tell time using analog, digital, and 24-hour clocks and provided examples of activities that occurred in the am and pm.
	  − were able to draw symmetrical and asymmetrical objects and provide examples of real life objects that are symmetrical and asymmetrical

Concentration Game

Prescribed Learning Outcomes
It is expected that students will: A1 represent and describe whole numbers to 10 000, pictorially and symbolically [C, CN, V] A9 describe and represent decimals (tenths and hundredths) concretely, pictorially and symbolically [C, CN, R, V] A10 relate decimals to fractions (to hundredths) [CN, R, V] C1 read and record time using digital and analog clocks, including 24-hour clocks [C, CN, V] C2 read and record calendar dates in a variety of formats [C, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students play a concentration game to match decimals to their pictorial representations (e.g., using a 10 × 10 grid to equal 1) or the decimal fractional form (e.g., .50, 5, $\frac{5}{10}$, $\frac{50}{100}$)	• Circulate and look for evidence that students are
	  − matching decimals and decimal fractional forms correctly and are able to justify the matches by using models or illustrations to demonstrate equivalence of decimals and their corresponding decimal fraction form.
	  − able to explain the meaning of each digit in a given decimal
	  − able to provide examples of everyday contexts for the decimals and decimal fractions that they are pairing

• Have students play a concentration game to match a whole number to its expanded or written form (e.g., 9456 = 9 000 + 400 + 50 + 6 = nine thousand four hundred fifty six).	• Circulate and look for evidence that each student
	  − recognizes a given numeral in its expanded form
	  − can explain and show the meaning of each digit in a given numeral
	  − can read a given 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)
	  − can express a given numeral in written words
	  − recognizes a given numeral represented by its expanded form

• Have students play a concentration game to match calendar dates that are written in a variety of formats (e.g., *yyyy/mm/dd;* 08/03/07; *dd/mm/yy;* March 8, 2007)	• Circulate and look for evidence that students
	  − are able to write the date using a variety of formats
	  − given a date written in one format, are able to recognize the date written in different formats

• Have students play a concentration game to match times from an analog, digital and 24-hour clock.	• Observe students to note evidence of the extent to which they are able to
	  − identify the correct time when given a variety of formats
	  − recognize and correctly use am and pm
	  − provide an example of an activity that occurs in the am and in the pm

Crossword Puzzle

Prescribed Learning Outcomes

It is expected that students will:

A1 represent and describe whole numbers to 10 000, pictorially and symbolically [C, CN, V]

A2 compare and order numbers to 10 000 [C, CN]

A9 describe and represent decimals (tenths and hundredths) concretely, pictorially and symbolically [C, CN, R, V]

A10 relate decimals to fractions (to hundredths) [CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students design a crossword type puzzle and create clues as well as an answer key. Have students trade crosswords with partners and complete the partner's puzzle. Clues could, for example, − have the numbers written out in words (e.g., two thousand two hundred twenty two) − include numbers written out in expanded notation (e.g., 3000 + 500 + 60 = 8) − include equality statements e.g., 25/100 is the same as what decimal? − be pictorial representations (e.g., drawings of Dienes blocks showing 3 456) − require the identification of missing numbers in a sequence (e.g., 7 542, 7 642, 7 742, __ ? __, 7 942)	• When assessing student work, verify to what extent − the student was able to vary the clues given (clues were varied: some pictorial representations, some expanded notations clues, some written words, some sequencing, etc.) − the student was able to provide an accurate answer key (e.g., How well did he/she answer his own questions) − the student was able to solve a partner's puzzle As a class, create a peer assessment sheet to assess each others' puzzles. The assessment might include criteria such as the following: − The clues were clear. I understood what ____ was trying to say. − 1 2 3 4 5 6 7 8 9 10 (score out of 10) − Something that ____ did really well was ____. − A questions I would like to ask ____ is ____ Have students include their crossword puzzle into their math portfolios, annotated with descriptive comments.

Constructing Rectangles

Prescribed Learning Outcomes

It is expected that students will:

A6 demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by
- using personal strategies for multiplication with and without concrete materials
- using arrays to represent multiplication
- connecting concrete representations to symbolic representations
- estimating products [C, CN, ME, PS, R, V]

C3 demonstrate an understanding of area of regular and irregular 2-D shapes by
- 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Given an area in square units, have students use manipulatives such as cm cubes (e.g., Dienes blocks) to construct different sized rectangles.	• Look for evidence that students are able to create many different rectangles for a given area.
	• Some suggested questions to elicit student understanding:
	  – What are some things in the real world that have these dimensions and or this area?
	  – How do you know that you have come up with all the possible rectangles for this area?
	  – Tell me why we measure area in square units instead of units?

• Give students dimensions (length and width) of a rectangle in cm/m, and have them estimate the area of a rectangle (e.g., Estimate the area of a 13 × 15 rectangle. Tell why you think this is a reasonable estimate. Give some examples of things in your environment that are this size.)	• When reviewing student responses look for evidence that
	  – estimates are reasonable
	  – students are able to justify their estimates
	  – the referents they have chosen are reasonable

• Present class with a pair of old jeans with a stain on it. Have students determine the area of the stain so that a patch can cover it.
 	
Have students record in their math journals
  – the method used to determine area of the stain
  – the area in square units
  – how they know results are reasonable
	• When reviewing student responses to this problem, look for evidence
	  – that the method used to determine the area leads to a reasonable solution
	  – that a student's answer is reasonable
	  – that a student is able to choose appropriate tools and units to measure the stain
	  – of how clearly a student can justify his or her answer

Patterns

Prescribed Learning Outcomes

It is expected that students will:

B1   identify and describe patterns found in tables and charts, including a multiplication chart [C, CN, PS, V]

B2   reproduce a pattern shown in a table or chart using concrete materials [C, CN, V]

B3   represent and describe patterns and relationships using charts and tables to solve problems [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Given this numerical pattern, have students extend the pattern and explain − how they determined the pattern and its missing elements − what real world situation could be described by this pattern. Have students use manipulatives to illustrate this pattern. Ask them to describe how the concrete representation illustrates this pattern.	• Verify that students are able to − identify the pattern in the table − extend the pattern − determine the missing element − describe the pattern by identifying a real world situations that could reflect this pattern − create a concrete representation of this pattern using manipulatives
• Using a 1 – 144 grid (use a 12 × 12 grid with numbers 1 through 144), have students find all the multiples of 2 and colour them in. Have students describe the pattern (e.g., It looks like a checkerboard.). Repeat this for the multiples of 3, 4, 5, 6, 7, 8, and 9. Ask students to describe what changes they notice as the numbers increase.	• When reviewing student work, notice to what extent students − identify all (some or none) of the multiples of the given number − are able to predict and extend the pattern of multiples − describe pattern (clearly, partially, with difficulty) by relating it to similar designs in the real and world
• Given the 9 times table (e.g., 9 × 1 = 9, 9 × 2 = 18, 9 × 3 = 27 etc.), have students describe in writing all the patterns they can find. (e.g., the sum digits of the products equal 9)	• Students may include this in their portfolios as a sample of their thinking. Encourage students to reflect on how their work demonstrates that they were good mathematicians (e.g., by looking for patterns, using mathematical vocabulary to describe my thinking, persevering even though the task was difficult, accepting a challenge, asking good questions; offering a conjecture) When reviewing student responses, look for evidence that the student is able to identify and describe patterns found in the 9 times table.

Table within first row:

A	B
1	2
2	4
3	
4	8

Data Analysis

Prescribed Learning Outcomes
It is expected that students will: D1 demonstrate an understanding of many-to-one correspondence [C, R, T, V] D2 construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions [C, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Pose a question such as the following: Are you watching too much television?
 	
Have students estimate about how many hours of television (or video games/computer time) they have watched in a week, in a month. Have students construct 2 graphs for the same data: a bar graph and pictograph. The intervals in the bar graph could be drawn using one-to-one correspondence. The pictograph could be drawn using many-to-one correspondence (e.g., *n* = 5 hours). Have students use this data to draw conclusions about whether or not they are watching too much television. Have students explain which of the 2 graphs, the bar graph or the pictograph best represents their data. Students should give reasons for their choices.
	• Have students self-assess their graphs by writing in a math journal, using sentence stems such as the following:
	  – I know I constructed a good graph because ____.
	  – Some things that are similar about my 2 graphs are ____.
	  – Some things that are different about my 2 graphs are ____.
	  – When I make a graph I choose intervals of 2 or 5 or 10 when ____.
	  – When I make a graph, I choose to use an interval of one when ____.
	Work with students to create an assessment tool using criteria such as the extent to which each student
	  – draws graphs accurately and labels them correctly
	  – can use a many-to-one correspondence to represent the data they have collected
	  – is able to explain why many-to-one correspondence is used sometimes instead of one-to-one correspondence
	  – can give reasons for why one graph is preferred over the other
	  – is able to interpret pictographs and bar graphs involving a many-to-one correspondence
	  – is able to draw conclusions based on the data and the graphs
	  – labels axis and titles accurately
	Have students include this report in their math portfolios.

Show What You Know

Prescribed Learning Outcomes

It is expected that students will:

A5 describe and apply mental mathematics strategies, such as
   - skip counting from a known fact
   - using doubling or halving
   - using doubling or halving and adding or subtracting one more group
   - using patterns in the 9s facts
   - using repeated doubling
   to determine basic multiplication facts to 9 × 9 and related division facts [C, CN, ME, PS, R]

A6 demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by
   - using personal strategies for multiplication with and without concrete materials
   - using arrays to represent multiplication
   - connecting concrete representations to symbolic representations
   - estimating products [C, CN, ME, PS, R, V]

A7 demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by
   - using personal strategies for dividing with and without concrete materials
   - estimating quotients
   - relating division to multiplication [C, CN, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Conduct interviews with individuals to determine students' abilities to use mental math and/or personal strategies such as the following when solving multiplication and division equations:
  − To assess the mental math strategy of doubling, ask students to show how they can use 2 × 3 = 6 to help find the answer to 4 × 3 (e.g., think 2 × 3 = 6, and 4 × 3 = 6 + 6).
  − To assess the mental math strategy of doubling and adding one more group, ask students to show how you would solve 3 × 7 using this strategy (e.g., think 2 × 7 = 14, and 14 + 7 = 21).
  − To assess skip counting from a known fact, ask students to show how they would solve 7 x 9 using this strategy (e.g., think 7 × 10 = 70, and 70 - 7 = 63).
  − To assess halving, ask students to show how you would solve 2 × 6 by halving (e.g., think 4 × 6 = 24, then 2 × 6 = 12).
  − To assess relating division to multiplication, ask students to solve this problem 64 ÷ 8 by using a related multiplication fact (e.g., think 8 × □ = 64).
	• During the interview, make and record observations about how students apply mental mathematics strategies. Look for evidence of
	  − skip counting from a known fact
	  − using double or halving
	  − using doubling or halving and adding or subtracting one more group
	  − using the patterns in the 9s facts
	  − using repeated doubling
	  − student using personal strategies in combination with the mental math strategies described above
	  − student's confidence in solving the problem

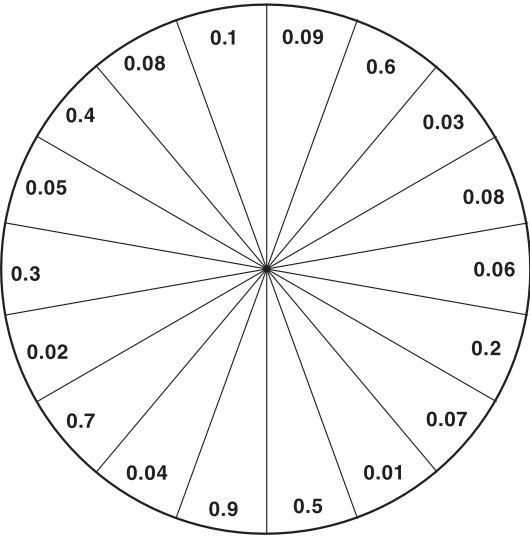| PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Conduct interviews with individual students to determine their understanding of multiplication. Ask students to solve problems such as
  − Show 3 different ways you could solve this equation using concrete materials, personal strategies, distributive property ($200 \times 5 + 60 \times 5$), arrays or algorithms. Explain your thinking.
  − Create a multiplication problem for this equation: 260×5
	• Look for evidence to what extent the student is able to
	  − show multiple ways to solve this problem
	  − explain his or her thinking
	  − use an array to solve this problem
	  − demonstrate personal strategies
	  − use concrete materials to solve the problem

− Conduct interviews with individual students to determine their understanding of division. Ask students to solve problems such as
− Show 3 different ways you could solve this equation using concrete materials, personal strategies or algorithms: $89 \div 5$. Explain your thinking.
− Create a division problem for this equation.
	• Look for evidence to what extent the student is able to
	  − show multiple ways to solve this problem
	  − explain his or her thinking
	  − use an array to solve this problem
	  − demonstrate personal strategies
	  − use concrete materials to solve the problem

Fractions and Decimals

Prescribed Learning Outcomes

It is expected that students will:

A8   demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representations to
  − 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 [C, CN, PS, R, V]

A9   describe and represent decimals (tenths and hundredths) concretely, pictorially and symbolically [C, CN, R, V]

A11 demonstrate an understanding of addition and subtraction of decimals (limited to hundredths) by
  − using compatible numbers
  − estimating sums and differences
  − using mental math strategies
  to solve problems [C, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Using manipulatives such as tiles or pattern blocks, have students create designs as specified by these "blueprints":
  − a garden that has ⅓ tulips and ⅔ roses
  − a quilt that is ¼ blue, ¾ red and the rest green
  − a watercolour set where more than half the colours are cool colours (blues and greens)
  − a box of crayons where less than half the colours are warm colours (reds and yellows)
Invite students to create 3 or 4 different ways to illustrate each blueprint. Students may then create their own blueprints and have a partner build them with tiles or pattern blocks.
	• When reviewing student interpretations of the blueprints, look for evidence that students
	  − can name and record fractions for parts of a whole
	  − can name and record fractions for parts of a set
	  − explain that the denominator specifies how many pieces the whole is set is divided into
	  − explain that the numerator specifies how many parts of the whole or set we are interested in
	  − are able to solve the problem in more than one way (e.g., provides more than one example of each blueprint)

• Given a fraction that represent different quantities, have students compare the quantities and indicate which is the larger or the smaller or if both are the same (e.g., given an apple and a watermelon, both cut in half, ask students, "Both these are cut in half; are the halves the same size? Why or why not? Which is larger: half of an apple (A) or half of a watermelon (B)?")
 	
To include the whole class in this assessment, give each student 2 different coloured flags. Have students raise one colour to indicate choice A, the other colour to represent choice B. As students become familiar with the game, have them think up different quantities to compare.
	• Pose various comparison questions and look for evidence that students are making the appropriate choices (e.g., call on individual students to justify their choices). Conversation prompts might include the following
	  − Explain why you think that B is larger than A.
	  − Why would you say that the halves are not equal?

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students in pairs play a game using Dienes blocks and a spinner such as the following **[spinner diagram with values: 0.1, 0.09, 0.08, 0.6, 0.4, 0.03, 0.05, 0.08, 0.3, 0.06, 0.02, 0.2, 0.7, 0.07, 0.04, 0.01, 0.9, 0.5]** Students should use the Dienes blocks as follows: − a flat (10 × 10 piece) = 1.0 or the whole − rods = .10 − cubes = .01 Each player starts off with a "flat" (1.0), which serves as a gameboard. The goal is to be the first player in the pair to cover the flat and reach 1.0 exactly. On their turn, students spin the spinner to determine the amount that they place on their gameboard (e.g., if the spinner lands on .03, the student adds 3 cubes onto the gameboard). Students should read the decimal on the spinner out loud to their partners (e.g., for .03 say three hundredths). If on his or her turn a player exceeds 1.0, he or she should subtract the amount and continue until the 10 × 10 gameboard is covered. During the game, have students keep track of their progress on a recording sheet. For each turn, they write the decimal amount earned on that turn, add it to the previous amounts, and colour the corresponding quantity on a printed version of a 10 × 10 grid, using a different colour for each turn. Once again, if on a turn, adding the amount indicated by the spinner were to cause the student's total to exceed 1.0 (on the 10 × 10 grid), the student will instead subtract this from her or his previous total and carry on.	• Circulate while students play the game. Ask students to explain the meaning of each digit in a given decimal. Ask students to suggest everyday contexts in which tenths and hundredths are used. Assess students on the basis of their abilities to − write the decimal for a given pictorial representation of part of a region − use concrete materials or pictorial representations to illustrate a given decimal − explain the meaning of each digit in a given decimal (e.g., given .03, 0 stands for no tenths and 3 stands for 3 out of hundred or three hundredths) − add or subtract decimal amounts − use money values to represent a given decimal (e.g., If the pieces on your gameboard were worth money, how much would you have right now?) − provide examples of everyday contexts in which tenths and hundredths are used – real-life situations that could be true for the amount represented on the gameboard (e.g., .25 = 25 cents or 25 out of 100 candies from a package) − illustrate using manipulatives or pictures how a given tenth can be expressed as equivalent hundredths (e.g., 0.9 is equivalent to 0.9 or 9 dimes or 90 pennies)

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Play a game with the whole class in which students use tile or pattern blocks to illustrate fractional amounts. Place fractions on a number line labelled 0, ½ and 1. Place some in the correct spots, some in the wrong places (e.g., place ⁹⁄₁₀ between 0 and ½). Have students illustrate the specified amount with their manipulatives. Then have them close their eyes and respond by showing thumbs up to indicate agreement with your placement or thumbs down to show that they disagree. Students can then play this game in pairs taking turns placing fractions on the number line and responding.	• As students play the game, look for evidence that they
	  − have a sense of the size of a fraction, .i.e. that it is larger than ½, smaller than a half, closer to one, closer to zero
	  − understand that the denominator specifies how many pieces the whole is set is divided into
	  − understand that the numerator specifies how many parts of the whole or set
	Notice which students need continuing support with manipulatives in order to complete this task.

Can You Spot the Errors?

Prescribed Learning Outcomes

It is expected that students will:

A11 demonstrate an understanding of addition and subtraction of decimals (limited to hundredths) by
   − using compatible numbers
   − estimating sums and differences
   − using mental math strategies
   to solve problems [C, ME, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students correct a fictitious student's worksheet, supplying written explanations about why a given answer is incorrect. The fictitious worksheet might contain entries such as the following: (a) $\begin{array}{r} 56 \\ \times 15 \\ \hline 280 \\ +56 \\ \hline \textbf{336} \end{array}$ (b) $\begin{array}{r} 1.560 \\ 1.23 \\ .18 \\ \hline \textbf{17.01} \end{array}$ (c) $250 \div 5 = \textbf{50}$ $\begin{array}{r} 58.4 \\ -1.45 \\ \hline \textbf{56.95} \end{array}$ (d) $\textbf{4 517 063} = (4 \times 1\ 000\ 000) + (5 \times 100\ 000) + (1 \times 1000) + (7 \times 1000) + (6 \times 10) + (3 \times 1)$ (e) $60\ 000 + 7000 + 500 + 2 = \textbf{67 502}$ Have students make up their own version using the sample provided as a template. Students then exchange sheets with a partner and repeat the exercise.	• When reviewing students' work, look for evidence of their − understanding of multiplication of 2-digit by 2-digit problems − understanding of division (3 digit by 1 digit) with and without remainders − ability to explain why keeping track of place value positions is important when adding and subtracting decimals − ability to solve a problem that involves addition and subtraction of decimals, limited to thousandths − ability to represent and describe whole numbers to 10 000 by expressing a given numeral in expanded notation − ability to represent and describe whole numbers to 10 000 by describing the meaning of each digit in a given numeral − ability to represent and describe whole numbers to 10 000 by writing a given numeral represented by expanded notation − ability to use more than one strategy to determine errors

CLASSROOM ASSESSMENT MODEL
Grade 5

GRADE 5: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Grade 5 Mathematics.

Curriculum Organizers	Suggested Assessment Activities	Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
				K	U&A	HMP
NUMBER	• observations • interviews • journals/logs • games • models • questioning					
	• portfolios • presentations • projects • self-assessment • peer assessment	45-55%	11	4	5	2
PATTERNS AND RELATIONS	• observations • interviews • portfolios • journals/logs • questioning					
	• demonstrations • projects • peer assessment • self-assessment	5-15%	2	0	1	1
SHAPE AND SPACE	• observations • interviews • journals/logs • games • questioning					
	• portfolios • demonstrations • projects • self-assessment • peer assessment	25-35%	8	3	5	0
STATISTICS AND PROBABILITY	• observations • interviews • journals/logs • games					
	• questioning • self-assessment • peer assessment • portfolios	5-15%	4	0	3	1
Totals		100%	25	7	14	4

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

GRADE 5

OVERVIEW

Learning at Previous Grades

- whole numbers to 10 000
- addition with answers to 10 000 and corresponding subtraction
- multiplication by 0 and 1 and division by 1
- mental mathematics strategies for multiplication facts to 9 × 9 and corresponding division facts
- multiplication of 2- or 3- digit by 1-digit
- division of 2-digit divisor by 1-digit dividend
- fractions less than or equal to one
- decimal representation to hundredths and relation to fractions
- addition and subtraction of decimals to hundredths
- pattern relationships in tables and charts
- symbols to represent unknowns
- one-step equations
- digital, analog and 24 hour clocks and calendar dates
- area of regular and irregular 2-D shapes
- rectangular and triangular prisms
- line symmetry
- many-to-one correspondence including bar graphs and pictographs

---

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit.

	Party Planning	Amusement Park Games	Volume/ Capacity	Quadrilaterals	2-D, 3-D	Number Balance Scale	Math in Art	Find the Errors
Number	X	X						X
Patterns and Relations *Patterns*	X							
Variables and Equations						X		
Space and Shape *Measurement*	X		X					
3-D Objects and 2-D Shapes		X		X	X		X	
Transformations		X						
Statistics and Probability *Data Analysis*	X							
Chance and Uncertainty		X						

Party Planning

Prescribed Learning Outcomes
It is expected that students will:
A1   represent and describe whole numbers to 1 000 000 [C, CN, V, T]
A2   use estimation strategies including
− front-end rounding
− compensation
− compatible numbers
in problem-solving contexts [C, CN, ME, PS, R, V]
A3   apply mental mathematics strategies and number properties, such as
− skip counting from a known fact
− using doubling or halving
− using patterns in the 9s facts
− using repeated doubling or halving
to determine answers for basic multiplication facts to 81 and related division facts [C, CN, ME, R, V]
A4   apply mental mathematics strategies for multiplication, such as
− annexing then adding zero
− halving and doubling
− using the distributive property [C, ME, R]
A5   demonstrate an understanding of multiplication (2-digit by 2-digit) to solve problems [C, CN, PS, V]
A6   Demonstrate, with and without concrete materials, an understanding of division (3-digit by 1-digit) and interpret remainders to solve problems [C, CN, PS]
B1   determine the pattern rule to make predictions about subsequent elements [C, CN, PS, R, V]
C4   demonstrate an understanding of capacity by
− 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]
D1   differentiate between first-hand and second-hand data [C, R, T, V]
D2   construct and interpret double bar graphs to draw conclusions [C, PS, R, T, V]

PLANNING FOR ASSESSMENT	**ASSESSMENT STRATEGIES**

• Have students work in groups to create and submit a proposal for a class party. The proposal is to include
  – menu choices
  – entertainment choices
  – a budget
  – a justification for cost per students and total cost of the party
As a class, select the best proposal and justify their decisions.
 	
In many Aboriginal communities feasts are held. Students may be able to assist in planning for the feast.
	• Prior to the start of the project, discuss criteria for assessing the presentation. Ask students to consider how they will know what is the best proposal? What does "best" mean?
	
	Suggested criteria could include
	  – data are accurately represented by graphs, charts and tables
	  – conclusions drawn from the data are logical
	  – arguments are supported by the data
	For more detailed suggestions as to possible criteria, see the **Party Planning** rubric provided at the end of this grade.
	
	Have students include their final proposals in their math portfolios, adding comments such as the following:
	  – This is an example of ____.
	  – I want you to notice that ____.
	  – I think I did a good job on it because ____.
	  – Something new I learned by doing this activity was ____.

• Have students formulate a question and survey their classmates in order to determine menu and entertainment choices. Proposals should include evidence that this menu would appeal to other students in the class. (e.g., a survey of student preferences would provide evidence that potato chips are preferred over popcorn).
 	
Have students create graphs, tables or charts to represent their findings. Explain that they will use this evidence to support their arguments.
	• Assess students' ability to gather data, using interview questions such as the following:
	  – Why did you choose this question?
	  – Who are you going to survey and why did you select these people?
	  – What are you noticing?
	  – When interviewing students look for evidence that the questions they formulated can be answered by surveying the class and will lead to information about the class' food preference.
	Look for evidence to verify that
	  – graphs are legible
	  – graphs accurately represent the data
	  – intervals are clearly identifiable
	  – labels are visible

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Prior to calculating costs, verify that students are able to identify equivalent capacities (e.g., have students explain how many 250 ml sized individual servings are contained in a 2L bottle).	• Observe students' ability to demonstrate an understanding of capacity by having them – demonstrate that 1 000 mL is equivalent to 1 L by filling a 1 L container using a combination of smaller containers, or by describing the relationship between mL and L – identify an appropriate referent when estimating capacity of a container (e.g., I think there are about 6 pop cans in a 2 L bottle)
• Have students estimate the quantity and cost of various food and beverage items. Proposals will outline unit costs of food items as well as the total cost for quantities required.	• To assess students' abilities to calculate costs: – observe students' use of personal procedures, base 10 blocks, manipulatives, or pictorial representations when applying multiplication and division in determining cost of menu items – observe what strategies students use when applying mental math strategies for multiplication (e.g., annexing zero; halving or doubling or using the distributive property) to determine food costs – verify that students can use division strategies when calculating unit costs (students may demonstrate this using manipulatives, an algorithm or verbal explanation) – verify that students can describe the meaning of each digit in a given numeral when talking about large quantities – verify students' abilities to round to the nearest dollar and to explain why their estimate is reasonable – verify that students use estimation strategies (e.g., front-end rounding, compensations, compatible numbers) when calculating costs – verify that students can predict patterns when projecting unit costs to determine costs for whole class

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Provide opportunities for students to present their proposals to a committee of peers (the class) and justify their arguments using results from the data they collected. As well, students can submit a written report that includes charts, tables, graphs, discussion, rationale, etc.	• When reviewing written reports or listening to presentations, look for evidence
	  − that students are able to formulate a question that can be answered by gathering first-hand data and provide justification for using first-hand data as opposed to second-hand data (e.g., second-hand data will not show us what our class wants)
	  − of students' ability to create a double bar graph, interpret the data and draw conclusions
	  − of students' ability to represent, extend and explain a pattern (e.g., unit cost, cost for 2 units, 3 units)
	  − of students' ability to justify their argument using the data collected
	Use questions or discussion prompts such as the following to interview students after their oral presentations:
	  − Explain why you selected these menu items. (What questions did you ask in your survey?)
	  − Explain how you gathered evidence for your suggestions and what conclusions you drew from your data.
	  − Which food items were good bargains? Why do you think they are good value for your money?
	  − Explain any decisions you had to make about choosing one food item over another when calculating food costs.
	  − Explain how you used multiplication or division strategies (including mental math strategies) to help figure out food costs.

• After oral presentations of all the proposals, each student will then select the best, least expensive proposal and explain why he or she thinks this is the "best" (most desirable, most economic). If necessary, prompt for an explanation: After listening to other proposals have you changed your mind about which is the most desirable and least expensive proposal? If so, what convinced you of this?	• To assess student selections, look for evidence of
	  − students' abilities to justify their choices using criteria specified (most desirable/least expensive)
	  − students' references to the data, charts, tables, and graphs to explain or justify their choices

Amusement Park Games

Prescribed Learning Outcomes

It is expected that students will:

A7 demonstrate an understanding of fractions by using concrete and pictorial representations to
- create sets of equivalent fractions
- compare fractions with like and unlike denominators [C, CN, PS, R, V]

A8 describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially and symbolically [C, CN, R, V]

A9 relate decimals to fractions (to thousandths) [CN, R, V]

A10 compare and order decimals (to thousandths) by using
- benchmarks
- place value
- equivalent decimals [CN, R, V]

C1 design and construct different rectangles given either perimeter or area, or both (whole numbers) and draw conclusions [C, CN, PS, R, V]

C2 demonstrate an understanding of measuring length (mm) by
- selecting and justifying referents for the unit mm
- modelling and describing the relationship between mm and cm units, and between mm and m units [C, CN, ME, PS, R, V]

C7 perform a single transformation (translation, rotation, or reflection) of a 2-D shape (with and without technology) and draw and describe the image [C, CN, T, V]

C8 identify a single transformation, including a translation, rotation, and reflection of 2-D shapes [C, T, V]

D3 describe the likelihood of a single outcome occurring using words such as
- impossible
- possible
- certain [C, CN, PS, R]

D4 compare the likelihood of two possible outcomes occurring using words such as
- less likely
- equally likely
- more likely [C, CN, PS, R]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• In this unit, students will design part of an amusement park by creating 3 games of chance, a booth from which the games are played, and decorations for the area surrounding the booth.	• Have students include their final products (games, designs for booth and tileway) in their math portfolios, adding comments describing their work and what it represents.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Explain to students that they will be creating games of chance for an amusement park. They will design 3 different games of chance: one that favours the vendor, another that favours the customer, and a third that offers an equally likely chance for either vendor or customer to win.	• Work with students to establish criteria for assessing this task. Suggested criteria to consider include the following: – games created reflect conditions specified by the project (e.g., vendor has a more than likely chance to win, customer has a more likely chance to win, and both customer and vendor have an equally likely chance to win) – student is able to use the language of probability (likely, equally likely, etc.) to describe his or her game While students are working on the project, circulate and initiate conversation, using prompts such as the following: – explain how this game favours the vendor – explain how this game favours the customer – explain how this game gives both the customer and the vendor an equal opportunity of winning While student are working on the project, circulate and observe, looking for evidence of how students – use the language of probability to describe their games – explain outcomes of chance events – compare the likelihood of 2 possible outcomes demonstrate how different outcomes can occur when the games are played repeatedly Have students reflect on their learning in their math journals. Encourage them to consider ways that they were good mathematicians (e.g., persevered, asked good questions, took risks and tried new ideas, talked about math ideas with a buddy; used mathematical language such as *likely, unlikely, equally likely*). When assessing math journals, look for evidence that students are able to reflect on their learning and identify ideas that are confusing, difficult, or new learning.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students design a booth for their game. The booth should fit onto a platform that has an area which can comfortably fit 3 players and take up the smallest area possible on the fairgrounds. Have students specify the dimensions of the booth and platform using appropriate units of measurement.	• Discuss criteria for assessment. Criteria will ideally include the extent to which students identify a referent and explain the reason why they chose this referent for the measurements they used. Circulate while students are working on the task and look for evidence that students are – designing a booth to specs – using appropriate units of measurement Circulate as students work on task and use the following prompts to invite conversation, discussions: – Explain why you chose to design your model using those dimensions. – Explain why you chose to measure your booth using that unit of measurement. – If you had to measure your booth using only mm, what would the dimensions be? – If you had to measure your booth using only cm, what would the dimensions be? – Give a referent for the booth using millimetres, centimetres, or metres (e.g., this booth is as tall as …, as wide as…). Listen for students' ability to – justify their choice of a referent – explain how the referent was used to make the estimate – describe the relationship between millimetres, centimetres, and metres Have students reflect on their learning in their math journals. When assessing math journals, look for evidence that students are able to reflect on their learning and identify ideas that are confusing, difficult, or new learning.
• Have students design a tiled pathway around the perimeter of the amusement park using a tile pattern that is transformed by reflection, rotation or translation. Offer students the choice of drawing the tile by hand or using technology. Ask students to – describe the transformed pattern using the vocabulary translation, rotation, and reflection – describe what happens to a shape when it is moved (translated, rotated, reflected)	• When reviewing students' work, look for evidence that – the shapes are indeed transformed – the reflections, rotations, and translations preserve the integrity of the shape and are correct transformations As students describe their designs, listen for appropriate use of vocabulary, including *rotation*, *translation*, and *reflection*. For example: – students should recognize that when you slide an image it remains the same size and shape – students should be able to identify the line of reflection between a 2-D shape and its reflected image – given a rotation, students identify the fraction of the turn (¼, ½, ¾)

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

PLANNING FOR ASSESSMENT

- Have students work in pairs to create a gameboard and play a racing game. The gameboard is to contain seven number lines (lanes) that are variously divided into halves, thirds, quarters, fifths, sixths, eighths, and tenths (see the Gameboard Samples sheet included at the end of this grade). Have students label the intervals using proper fractions.

Once the boards are complete, give each pair of students a set of cards such as the following to play the game:

$\frac{1}{2}$	$\frac{2}{4}$	$\frac{3}{6}$	$\frac{4}{8}$	$\frac{2}{10}$
$\frac{1}{5}$	$\frac{2}{5}$	$\frac{4}{10}$	$\frac{6}{10}$	$\frac{3}{5}$
$\frac{4}{6}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{6}{8}$	$\frac{10}{10}$

The game is a race is for a player to be the first to get all of the markers to the finish line. On their turn, students will move along the race lanes according to distance indicated on a chosen card. Encourage them to check their opponent's moves and to challenge those they feel are inappropriate (even when these moves are in their favour). Encourage a spirit of collaboration, so that students help each other make the best moves possible.

In another version of this game, students draw a second gameboard using decimals and fractions with denominators of 10, 100, and 1000 (again, see the Gameboard Samples sheet included at the end of this grade). They play the game as described previously, using cards such as the following:

$\frac{200}{100}$	0.4	0.50	0.800	$\frac{70}{100}$
$\frac{3}{10}$	$\frac{60}{100}$	0.20	$\frac{30}{100}$	$\frac{500}{100}$
0.10	0.2	$\frac{5}{10}$	0.400	$\frac{600}{1000}$
0.100	$\frac{100}{100}$	$\frac{4}{10}$	0.3	0.90

ASSESSMENT STRATEGIES

- As students are creating the board or playing the game, observe to look for evidence that they
  - are dividing and labelling the intervals accurately
  - understand equivalent fractions and are able to compare fractions with like and unlike denominators
  - are able to relate proper fractions to their decimal equivalents (e.g., $5 = \frac{5}{10}$, $0.50 = \frac{50}{100}$, $0.500 = \frac{50}{1000}$)
  - are having conversations with their peers involving explanations and justifications of moves they are making
  - are challenging each other when they perceive a wrong move

To enrich your assessment, circulate while students are playing the games, and have them
  - explain how they know they are moving the correct distance as specified on the card (e.g., Why are you moving $\frac{250}{1000}$ of the way when the card reads 0.25 or 0.250?)
  - given a decimal, show the equivalent fraction by moving their marker on the gameboard and explaining their action
  - given a tenth, express an equivalent in hundredths and thousandths
  - explain the value of each digit in a given decimal

Volume/Capacity

Prescribed Learning Outcomes

It is expected that students will:

C3 demonstrate an understanding of volume by
  − 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]

C4 demonstrate an understanding of capacity by
  − 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Give students containers of different sizes and shapes. Have them order these from largest capacity/volume to smallest capacity/volume. Have them provide examples from real life contexts that represent these quantities (e.g., 250 ml contains a bit less than the average pop can; the smallest Dienes block has a volume of 1 cm^3).	• As students are ordering the containers, ask them to provide a referent for each of the different containers. (e.g., 250 ml contains a bit less than the average pop can. The smallest Dienes block has a volume of 1 cm^3) Have them explain why they chose this referent. Ask them to give the approximate capacity/volume in L and then give an equivalent in mL. Have students use their journals to illustrate and explain how they know their ordering is correct. An exemplary journal entry is one that includes an illustration and detailed explanation justifying the ordering using referents. Students should be able to explain how they know they are right. A minimally meet expectations journal entry includes an illustration and some explanation, but no/little justification for the ordering or use of referents.
• Have students predict how many small containers (50 ml, 100 ml, 125 ml, 250 ml, 500 ml) are needed to fill a one litre container. Ask them to justify their predictions. Have students think of as many possible combinations to fill a one litre containers, using the following containers: 50 ml, 100 ml, 125 ml, 250 ml, 500 ml. Have them write or draw these in their math journals.	• When observing students performing this task look for evidence that predictions are reasonable, and that students are able to identify appropriate combinations. When reviewing math journal entries look for evidence that students are able to − give a range of combinations − identify appropriate combinations

Quadrilaterals

Prescribed Learning Outcomes

It is expected that students will:
C6 identify and sort quadrilaterals, including
    − rectangles
    − squares
    − trapezoids
    − parallelograms
    − rhombuses
  according to their attributes [C, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students work in partners to play a classifying game:
  − partner A classifies a given set of quadrilaterals
  − partner B attempts to guess the classification rule, selects another quadrilateral that would fit into that set, and then explains why that piece belongs to the set
  − on the next turn, partners switch roles (partner B becomes the rule maker and partner A guesses)
  Have student write instructions for how to play the game and include examples of possible scenarios.
	• While students are playing the game, circulate and look for evidence that they are able to correctly sort and identify quadrilaterals according to their attributes.
	
	  When reviewing students' game instructions, look for evidence that they are able to explain the game and attributes of quadrilaterals as they describe their examples.

2-D, 3-D

Prescribed Learning Outcomes

It is expected that students will:

C5   describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes that are
- –parallel
- –intersecting
- –perpendicular
- –vertical
- –horizontal [C, CN, R, T, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students create a glossary (in comic strip/ dictionary/short story format) to define these words: parallel, intersecting, perpendicular, vertical, and horizontal.	• Work with students to establish criteria for a good glossary. Some suggested criteria could include
	  – defining the terms clearly using mathematical language
	  – giving examples from the real world
	  – including pertinent and accurate illustrations
	  Have students include their glossary in their math portfolios.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students pair up to play a shape-describing game. Partner A draws a 2-D shape that Partner B cannot see and describes it to Partner B using appropriate vocabulary (parallel, intersecting, perpendicular, horizontal, vertical lines). Partner B responds by drawing a shape with these criteria, and may ask questions as he or she attempts to draw. When Partner B is finished, Partner B will verify the shape with Partner A. Partners switch roles.	• As students play the shape-describing game, notice whether or not a student is able to use the vocabulary to describe a shape's attributes. Have students conduct self-assessment in pairs. Partners reflect on how they did on the task, with reference to questions such as the following: − How well did you work together as a team? − How did you deal with disagreements? − What did you enjoy about this collaborative activity? − What were the challenges faced? − What would you do differently next time? − How can working with a partner help you with your learning? Have students comment on the activity and on the self-assessment process in their math journals. Suggested sentence prompts for math journals include the following: − Today, I ____. − Something surprising was ____. − I noticed that ____. − Something challenging was ____. − Something my partner and I did well ____. − Next time I would ____. • Have students share their math journal entry with the class. When reviewing student journal entries notice the extent to which students − used the vocabulary to explain the task. − are able to reflect on their learning, identify new ideas, areas of confusion or difficulty, surprises, misconceptions in their prior knowledge, etc. − are able to describe how well they are working with partners

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students pair up. Partner A chooses a geometric object from a set of geometric solids. He or she then describes its attributes using vocabulary such as parallel faces, perpendicular sides, horizontal, vertical, etc without naming the object to Partner B, who cannot see the object. Partner B tries to identify the object. Partners switch roles.	• As students play the game, notice whether or not a student is able to use the vocabulary to describe a shape's attributes Ask partners to reflect on how they did on the task, with reference to questions such as the following: – How well did they work together as a team? – How did they deal with disagreements? – What did they enjoy about this collaborative activity? – What were the challenges faced? – What would they do differently next time? – How can working with a partner help you with your learning? Have students use their math journals to record their reflections. When reviewing student journal entries, notice – how students used the vocabulary to explain the task. – to what extent students are able to reflect on their learning, identify new ideas, areas of confusion or difficulty, surprises, misconceptions in their prior knowledge, etc. – to what extent students are able to describe how well they are working with partners

Number Balance Scale

Prescribed Learning Outcomes
It is expected that students will: B2   solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions [C, CN, PS, R]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students draw a balance scale. In pairs, have Partner A think of a number and write the number on one side of the scale. On the other side of the scale, Partner B creates a single variable equation to match that number. For ex. $12 = n + 4$. Have students take turns and switch roles. Have students create examples for each of the operations of multiplication, addition, subtraction and division.	• Circulate and observe, looking for evidence of students' ability to match numbers with single variable equations. Have students include their working sheet in their math portfolios.

• Have students, given an equation, describe a context that represents that equation (e.g., given $2n = 10$, students might write "John is 10 and he is twice as old as Sherry. How old is Sherry?").
 	
Given a word problem, have students write an equation.
	• Circulate and observe students' ability to
	  − create an appropriate context for a given equation and vice versa
	  − represent a situation using an equation
	Have students include this work in their math journals. Look for evidence that students are able to create a word problem for a given equation and explain their answer to their particular problem.

Math in Art

Prescribed Learning Outcomes

It is expected that students will:

C5 describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes that are
  − parallel
  − intersecting
  − perpendicular
  − vertical
  − horizontal [C, CN, R, T, V]
C6 identify and sort quadrilaterals, including
  − rectangles
  − squares
  − trapezoids
  − parallelograms
  − rhombuses
  according to their attributes [C, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Show students prints of paintings by Robert Davidson, Emily Carr, Pablo Picasso, Georges Braques, or other artists. Conduct a whole class discussion where you model how to describe these paintings using vocabulary such as parallel, perpendicular, intersecting, vertical, horizontal, trapezoids, parallelograms, rectangles, squares, and rhombuses. Then have students describe what they see. Students may then select a print and, using the vocabulary, describe in writing what they see.	• When listening to student discussions and/or when reviewing their writing or drawings look for evidence that students are able to − use the vocabulary correctly − identify quadrilaterals − can explain the difference between different quadrilaterals
• Using specified criteria, have students draw a scene such as landscape. Sample instructions to students: Draw a landscape that includes parallel, perpendicular, intersecting, vertical, and horizontal lines, trapezoids, parallelograms, rectangles, squares, and rhombuses.	• Have students include their art work in their math portfolios along with annotations describing their work and what they have learned.

Find The Errors

Prescribed Learning Outcomes

It is expected that students will:

A1   represent and describe whole numbers to 1 000 000 [C, CN, V, T]
A5   demonstrate an understanding of multiplication (2-digit by 2-digit) to solve problems [C, CN, PS, V]
A6   Demonstrate, with and without concrete materials, an understanding of division (3-digit by 1-digit) and interpret remainders to solve problems [C, CN, PS]
A11 demonstrate an understanding of addition and subtraction of decimals (limited to thousandths) [C, CN, PS, R, V]
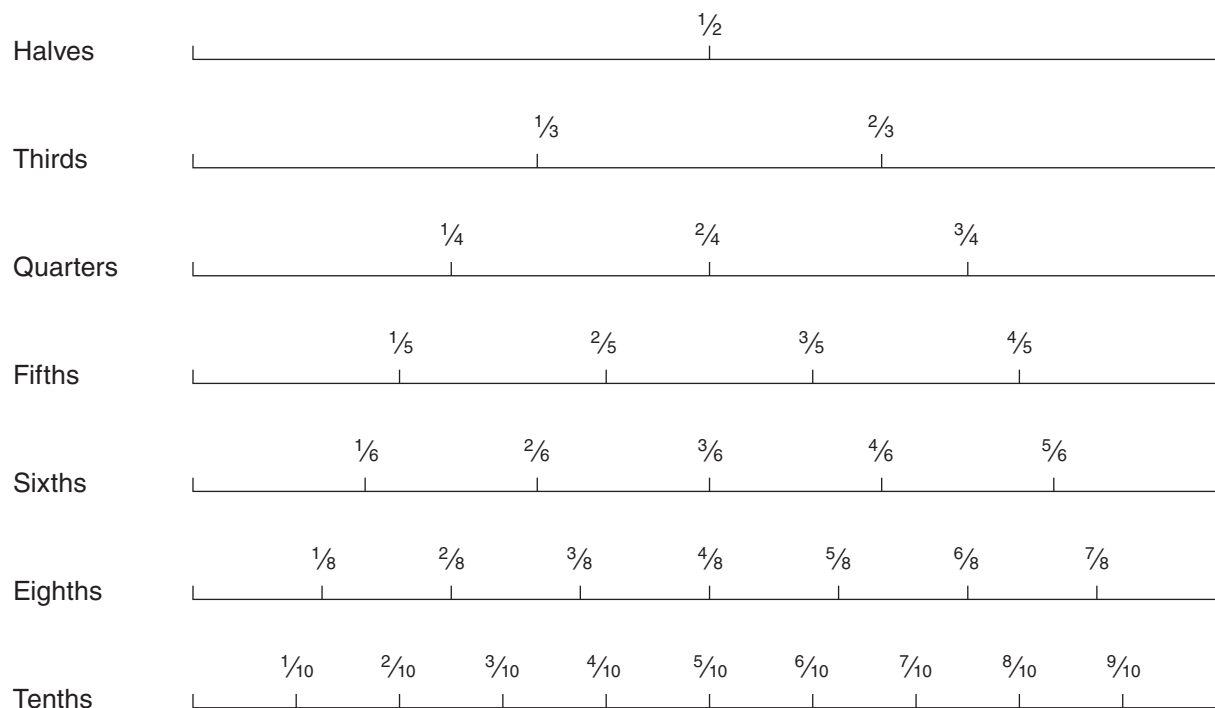
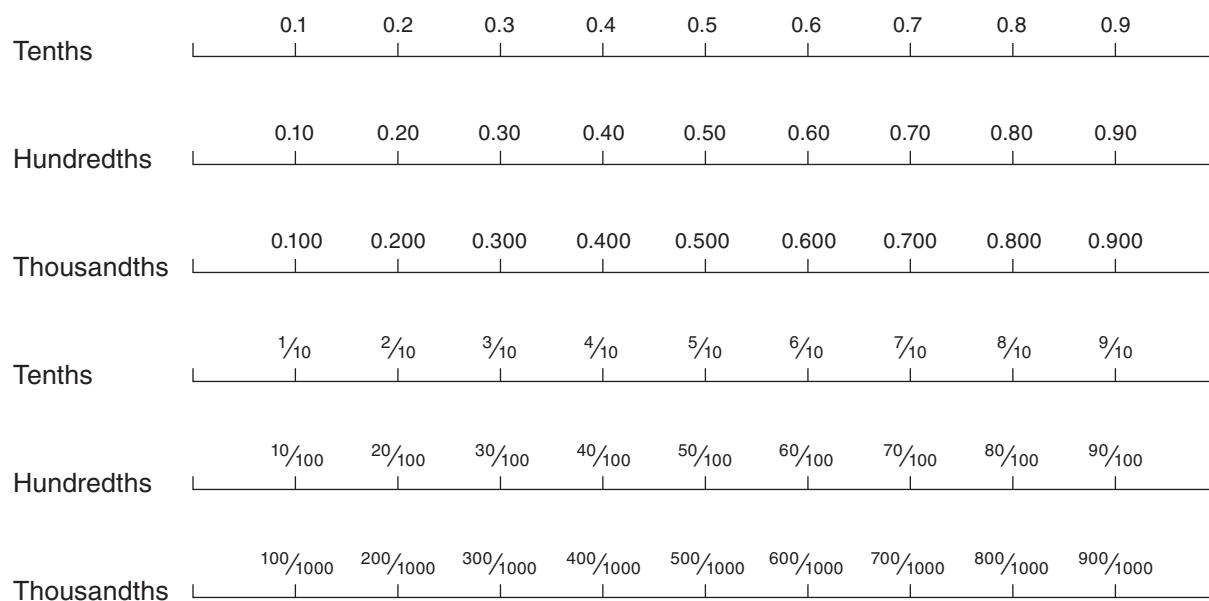| PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students correct a fictitious student's worksheet, supplying written explanations about why a given answer is incorrect. The fictitious worksheet might contain entries such as the following:
 	
(a) $\begin{array}{r} 56 \\ \times 15 \\ \hline 280 \\ +56 \\ \hline \mathbf{336} \end{array}$
 	
(b) $\begin{array}{r} 1.560 \\ 1.23 \\ .18 \\ \hline \mathbf{17.01} \end{array}$
 	
(c) $250 \div 5 = \mathbf{50}$
 	
$\begin{array}{r} 58.4 \\ -1.45 \\ \hline \mathbf{56.95} \end{array}$
 	
(d) $\mathbf{4\,517\,063} = (4 \times 1\,000\,000) + (5 \times 100\,000) + (1 \times 1000) + (7 \times 1000) + (6 \times 10) + (3 \times 1)$
 	
(e) $60\,000 + 7000 + 500 + 2 = \mathbf{67\,502}$
 	
• Have students make up their own version using the sample provided as a template. Students then exchange sheets with a partner and repeat the exercise.
	• When reviewing a student's work, look for evidence of students' understanding of and abilities to
	  – multiplication of 2 digit by 2 digit problems
	  – division (3-digit by 1-digit) with and without remainders
	  – explain why keeping track of place value positions is important when adding and subtracting decimals.
	  – solve a problem that involves addition and subtraction of decimals, limited to thousandths.
	  – represent and describe whole numbers to 1 000 000 by expressing a given numeral in expanded notation; by describing the meaning of each digit in a given numeral, by writing a given numeral represented by expanded notation.
	
	Have students include this working sheet in their math portfolios.

PARTY PLANNING

DOES NOT YET MEET EXPECTATIONS	MINIMALLY MEETS EXPECTATIONS	FULLY MEETS EXPECTATIONS	EXCEEDS EXPECTATIONS
Understanding concepts of data and statistics			
• unable to formulate questions • did not survey students to determine menu and entertainment choices • demonstrates an inability to draw conclusions • conclusions are not supported by the data	• able to formulate some questions • uses some of the survey data for menu and entertainment choices • demonstrates limited ability to draw conclusions • conclusions are partially inconsistent with data	• able to formulate appropriate questions and is able to identify student preferred menus and entertainment • demonstrates the ability to draw conclusions • conclusions are consistent with and fully supported by the data	• able to formulate the most appropriate questions and incorporate student preferences in menus and entertainment choices • demonstrates an ability to draw conclusions, extend conclusions, and make logical predictions based on the data
Applications of mathematical procedures			
• is unable to determine cost per student • is unable to justify costs	• is able to calculate some costs per students • tries to justify cost per student	• calculates cost per students • is able to justify cost per student	• accurately calculates cost per students • justifies cost per student
Communication (Presentation – argument, graphs)			
• describes and explains few justifications in the proposal; advances weak argument • axis, titles, intervals, and data not accurately drawn	• describes and explains some justifications in the proposal; provides very little argument or justification • axis, titles, intervals, and data drawn with some errors	• presents most of their justifications in proposal; justifies argument • axis, titles , intervals, and data accurately drawn with a few errors	• accurately presents all justifications in the proposal; well supported argument • axis, titles, intervals, and data accurately drawn; no errors and/or omissions

GAMEBOARD SAMPLES

SAMPLE 1

Halves — ½

Thirds — ⅓, ⅔

Quarters — ¼, 2/4, ¾

Fifths — ⅕, ⅖, ⅗, ⅘

Sixths — ⅙, 2/6, 3/6, 4/6, ⅚

Eighths — ⅛, 2/8, ⅜, 4/8, ⅝, 6/8, ⅞

Tenths — 1/10, 2/10, 3/10, 4/10, 5/10, 6/10, 7/10, 8/10, 9/10

SAMPLE 2

Tenths — 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9

Hundredths — 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90

Thousandths — 0.100, 0.200, 0.300, 0.400, 0.500, 0.600, 0.700, 0.800, 0.900

Tenths — 1/10, 2/10, 3/10, 4/10, 5/10, 6/10, 7/10, 8/10, 9/10

Hundredths — 10/100, 20/100, 30/100, 40/100, 50/100, 60/100, 70/100, 80/100, 90/100

Thousandths — 100/1000, 200/1000, 300/1000, 400/1000, 500/1000, 600/1000, 700/1000, 800/1000, 900/1000

CLASSROOM ASSESSMENT MODEL
Grade 6

GRADE 6: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Grade 6 Mathematics.

Curriculum Organizers	Suggested Assessment Activities	Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
				K	U&A	HMP
NUMBER	• vocabulary • Frayer model maps • journals • discussions • observation	40-50%	9	2	7	0
	• finding errors • large number graphing • small group work • Venn diagrams					
PATTERNS AND RELATIONS	• posters • discussions • observations	5-15%	4	0	1	3
	• interviews • student demonstrations					
SHAPE AND SPACE	• portfolio • posters • student presentations • observations	30-40%	9	3	4	2
	• artwork • Frayer model maps • problem solving • concrete manipulatives					
STATISTICS AND PROBABILITY	• concrete materials • charts • group work • student work	5-15%	4	0	2	2
	• questionnaires • graphs • technology • observations					
Totals		100%	26	5	14	7

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

GRADE 6

OVERVIEW

Learning at Previous Grades
- whole numbers to 1 000 000
- estimation strategies for calculations and problem solving
- mental mathematics strategies for multiplication facts to 81 and corresponding division facts
- mental mathematics for multiplication
- multiplication for 2-digit by 2-digit and division for 3-digit by 1-digit
- decimal and fraction comparison
- addition and subtraction of decimals to thousandths
- prediction using a pattern rule
- single-variable, one-step equations with whole number coefficients and solutions
- perimeter and area of rectangles
- length, volume and capacity
- parallel, intersecting, perpendicular, vertical and horizontal edges and faces
- quadrilaterals including rectangles, squares, trapezoids, parallelograms and rhombuses
- 2-D shape single transformation
- first-hand and second-hand data
- double bar graphs
- likelihood of a single outcome

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit.

	Order of Operations	Understanding Numbers I	Understanding Numbers II	'L' Pattern	Preservation of Equality	Decimal Error Correct	Geometry Portfolio	Boxes	Unfair Spinner	Survey
Number	X	X	X			X				X
Patterns and Relations *Patterns*				X						
Variables and Equations				X	X			X		
Space and Shape *Measurement*							X	X		
3-D Objects and 2-D Shapes							X			
Transformations				X			X			
Statistics and Probability *Data Analysis*				X						X
Chance and Uncertainty									X	

Order of Operations

Prescribed Learning Outcomes

It is expected that students will:

A9 explain and apply the order of operations, excluding exponents, with and without technology (limited to whole numbers) [CN, ME, PS, T]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students create an order of operations question with a whole number answer. For this process students may use calculators. The criteria for the question is that the question
  − uses each operation at least once
  − uses parentheses in such a way that their removal changes the answer
 Exchange questions with a partner. Have students perform the necessary calculations without a calculator. Check for accuracy.
 	
 Once students have created a question challenge students to create a story which involves the order of operations.
	• Verify that students can explain, using their examples, why there is a need to have a standardized order of operations. Have students explain possible ways in which an incorrect solution may occur. Look for evidence that students can apply the order of operations to solve multi-step problems with and without technology. Discuss the ways that mental mathematics can be used to determine if the solution to the question or story is possible.

Understanding Numbers I

Prescribed Learning Outcomes

It is expected that students will:

A1   demonstrate an understanding of place value for numbers
- greater than one million
- less than one thousandth [C, CN, R, T]

A2   solve problems involving large numbers, using technology [ME, PS, T]

A3   demonstrate an understanding of factors and multiples by
- determining multiples and factors of numbers less than 100
- identifying prime and composite numbers
- solving problems involving multiples [PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Show students how to create a Frayer model: | Definition	Essential Characteristics | (oval) | Examples	Non-examples		• Have students complete a Frayer model in their math journals for each of the following terms: factors, multiples, prime numbers and composite numbers. Verify that students have an accurate understanding of the terms.

• Give students the following tasks:
  − 2 numbers are multiplied to give 36 000 000. What might the 2 numbers be? Answer this question in as many ways as possible.
  − Identify each factor as being a prime number or a composite number.
  − Describe the patterns and/or strategies that helped you find your answers.
	• Observe whether or not students know the patterns of the place value system and are able make use of them when solving the problem. Observe whether students have used multiplication patterns such as the following:
	2 × 18 000 000 9 × 4 000 000
	20 × 1 800 000 90 × 400 000
	200 × 180 000 900 × 40 000
	and can describe their thinking processes.
	
	Can they state why only 3 of the factors (2, 3, 5) are prime?

• Five friends all eat at the same restaurant. Amardeep eats there every day. Becky eats there every second day. Carlos eats there every third day. David eats there every fourth day. Elton eats there every fifth day. If they all eat together on Feb. 1st, when is the next time they will all eat together?	• Encourage students who use a calendar or chart to solve the problem to look for a more efficient method.

Understanding Numbers II

Prescribed Learning Outcomes

It is expected that students will:

A1   demonstrate an understanding of place value for numbers
  – greater than one million
  – less than one thousandth [C, CN, R, T]
A4   relate improper fractions to mixed numbers [CN, ME, R, V]
A6   demonstrate an understanding of percent (limited to whole numbers) concretely, pictorially and symbolically [C, CN, PS, R, V]
A7   demonstrate an understanding of integers, concretely, pictorially and symbolically [C, CN, R, V]

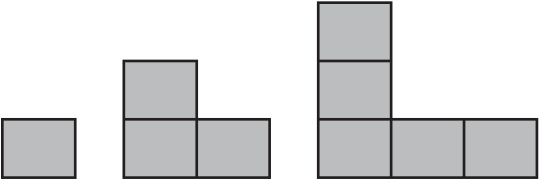| PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students use a graphic organizer such as a Venn diagrams to compare the similarities and differences of the following sets of categories:
  – improper fractions and mixed numbers
  – decimals and mixed numbers
  – fractions, decimals, and percents
  – integers and whole numbers
	• Verify that students have an accurate understanding of the terms and can discuss the similarities and differences.

• Give students a list of proper fractions, improper fractions, and percents and blank mini -hundred squares to represent the whole; students will give an illustration of each number.	• Verify that students can
	  – explain "percent" as "out of 100"
	  – explain percent is a ratio out of 100
	  – represent a given percent pictorially
	  – represent a given improper fraction as being greater than 1

• Give students a list of mixed numbers and improper fraction. Have them change them to the other form and place them on a number line. Number cards could also be used to allow physical placement on the number line.	• Verify that students can
	  – accurately change from one form to the other
	  – explain the strategies they used to determine position on the number line

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• These number line activities can be done with the whole class using number cards and a number line on the floor. It could be also done in small groups, in a Math centre or as an individual task.
 	
• Have students construct a number line and place each number on their number line. Ask students to justify their placement decisions.
 	
$\frac{1}{4}$, $\frac{7}{10}$, 2.6, 40%, $\frac{7}{5}$, 75%, $\frac{247}{100}$, 0.05, $\frac{5000}{10000}$, $\frac{9999}{10000}$.
 	
Have students construct a second number line and place the following integers, again justifying their placement decisions.
–7, 11, –5, –3, 0, 5, –6, –9, 2, 4
 	
Using a number line with positive and negative intervals of one million, have students place these numbers and justify their reasoning:
0
6 456 902
2 989 098
– 4 046 059
728 936
– 3 489 562
– 89 324
2 273 159
– 4 872 396
5 231
	• Monitor students' abilities to
	  − use and/or label benchmarks
	  − use common denominators to compare, where appropriate
	
	Note which students are using a less efficient method to place numbers (e.g., changing all fractions to decimals).
	
	Verify that students can explain how integers are ordered and can compare any 2 integers.

'L' Pattern

Prescribed Learning Outcomes

It is expected that students will:
B1 demonstrate an understanding of the relationships within tables of values to solve problems [C, CN, PS, R]
B2 represent and describe patterns and relationships using graphs and tables [C, CN, ME, PS, R, V]
B3 represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V]
C8 identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs [C, CN, V]
D1 create, label, and interpret line graphs to draw conclusions [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students look at a block pattern such as the following: Have them – draw the next 2 patterns in the sequence – record the data on a table of values – complete the table to pattern 10 – record the data from the table as ordered pairs, then graph the data on coordinate grid paper – extend the line on the graph and predict the number of blocks in pattern 13 – give the rule to solve for any number of patterns (the n rule) Alternately, provide groups of students with different block patterns and have the groups present their findings on a poster.	• Verify that students can – state using mathematical language the relationship in a table of values – predict the value of an unknown term using the relationship in a table of values and verify the prediction – describe the pattern within each column of a table of values – formulate a rule to describe the relationship between 2 columns of numbers in a table of values – translate the pattern to a table of values and graph it – represent the pattern rule using a mathematical expression – label the axis of the first quadrant of a Cartesian plane and identify the origin – plot points in the first quadrant of a Cartesian plane given the ordered pairs
• Students are provided a graph of a linear equation. From this they are to provide the whole number table of values and the ordered pairs. Discuss with a partner and record in their journals the relationship shown by the graph.	• Verify that students can – create a table of values from the given graph – describe using everyday language, orally and in writing, the relationship shown on a graph

Preservation of Equality

Prescribed Learning Outcomes	
It is expected that students will: B4 demonstrate and explain the meaning of preservation of equality concretely, pictorially and symbolically [C, CN, PS, R, V]	
PLANNING FOR ASSESSMENT	**ASSESSMENT STRATEGIES**

• Give students one-step equations such as the following, and have them represented concretely or pictorially, applying the preservation of equality to solve the equations and explaining the process.
 	
$x + 3 = 7$
$a - 3 = 5$
$3c = 12$
$\dfrac{n}{3} = 15$
 	
Interview students and have them demonstrate the process to you.
	• Verify that students can
	  – model the preservation of equality for addition, subtraction, multiplication and division using concrete materials
	  – model the preservation of equality for addition, subtraction, multiplication and division pictorially
	  – explain orally the preservation of equality for addition, subtraction, multiplication and division

Decimal Error Correct

Prescribed Learning Outcomes

It is expected that students will:

A8 demonstrate an understanding of multiplication and division of decimals (1-digit whole number multipliers and 1-digit natural number divisors) [C, CN, ME ,PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Give students problems (such as the following) and have them explain using words and/or pictures why the solutions are incorrect. Have them explain the misunderstandings of the person making these mistakes.
 	
    $1.55 \times 4 = 62$
    $3.4 \div 8 = 4.5$
 	
Ask students to provide examples, such as consumer problems, to demonstrate the meaning of the correct and in correct solution. For example, is it likely that 4 tubes of toothpaste would cost $62 if each tube was $1.55?
 	
When multiplying a decimal number by a whole number, the answer can be either a whole number or a decimal number. Have students explain in pictures, numbers, or words why this it true. Students may use place value blocks to work out the answer, but have them transfer this to written work.
	• Verify that students can
	 − place the decimal point in a product using front end estimation
	 − place the decimal point in a quotient using front end estimation
	 − correct errors of decimal point placement in a given product or quotient without using paper and pencil
	 − justify why a given solution is possible
	 − predict products and quotients of decimals using estimation strategies

Geometry Portfolio

Prescribed Learning Outcomes

It is expected that students will:

C1 demonstrate an understanding of angles by
  − 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 [C, CN, ME, V]

C2 demonstrate that the sum of interior angles is:
  − 180° in a triangle
  − 360° in a quadrilateral [C, R]

C4 construct and compare triangles, including
  − scalene
  − isosceles
  − equilateral
  − right
  − obtuse
  − acute
  in different orientations [C, PS, R, V]

C5 describe and compare the sides and angles of regular and irregular polygons [C, PS, R, V]

C6 perform a combination of translation(s), rotation(s) and/or reflection(s) on a single 2-D shape, with and without technology, and draw and describe the image [C, CN, PS, T, V]

C7 perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations [C, CN, T, V]

C8 identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs [C, CN, V]

C9 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students sketch examples of angles in the environment. Estimate the measure of each angle using referent angles 45°, 90°, and 180°. Classify as acute, right, obtuse, straight, or reflex.	• Verify that students can
	  − provide examples of angles found in the environment
	  − classify them correctly
	  − estimate the measure of an angle using the referents
	Have students create a geometry portfolio to collect their work over the course of this unit. Use criteria such as those outlined in the **Geometry Portfolio** rubric provided at the end of this grade to assess students' portfolios.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Give students worksheets each with a variety of examples of a particular shape including at least one regular shape and, where possible, one with a reflex angle. Polygons to be studied include: triangles, quadrilaterals, pentagons, hexagons, octagons and nonagons. Students measure the sides and angles of each shape. With the information groups of students make a master chart. Headings on the top of the chart are: regular, irregular, sum of angles, anomalies. Headings down the side are the names of the polygons. Students paste an example of a regular shape and an irregular shape on the chart. They report the sum of the interior angles and any anomalies they find on the chart. Each group presents their findings to the class. Discuss the chart and in particular resolve the anomalies found. Have the students create a table of values relating the number of sides of the polygon to the measure of the interior angles.	• Verify that students can − use a ruler and protractor accurately − describe the measure of an angle as the measure of an interior angle of a polygon − explain that within the classes of triangles that the sum of the interior angles is the same − explain that within the classes of quadrilaterals that the sum of the interior angles is the same − sort the set of polygons as regular and irregular and justify their sort − explain 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 − create a table of values to record and reveal a pattern − explain the n rule for any number of sides on a polygon compared to the sum of the interior angles
• Have students construct a triangle comparison sheet. They are to label both the horizontal and vertical axes with the types of triangles (right, acute, obtuse, isosceles, scalene, and equilateral). On this sheet the students will be asked to compare kinds of triangles. Students indicate in each grid box whether or not it is possible for a triangle to meet both definitions. If the combination is possible they are to draw an example. Any 2 comparable drawings must be drawn in different orientations.	• Verify that students can − demonstrate and explain that orientation does not change the characteristics of the triangles. − draw a specified triangle − identify characteristics of a type of triangle
• Have students complete a Frayer model in their math journal for each of the terms, transformations, translation, reflection and rotation.	• Verify that students have an accurate understanding of the terms.
• On 3 separate coordinate grids have students plot these points: A (6,7); B (6,13); C (10,9). Have them draw the triangle and then − rotate the triangle CW 180° around Point F (4,3) and name the new vertices − reflect the triangle over $x = 5$ and name the new vertices − translate the triangle to the right 3 and up 1, then name the new vertices	• Verify that students can − draw a triangle given its vertices − name the vertices on the image − rotate a triangle around a point of rotation that is not a vertex of the triangle

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students draw a scalene triangle on heavy paper to use as a tracing template. Ask them to trace the shape on paper and mark it as the original position. Next, ask them to perform and label the following transformations in successive order:
  – reflection
  – rotation
  – translation
  Students could also create two identical scale triangles of different colours and show the position of the original and its transformed image.
 	
  Have them draw the line of reflection, and mark the centre of rotation.
	• Observe students as they work with reflections, rotations, and translations, and verify that they can draw a triangle and its image given a combination of successive transformations.

• Have students use their templates on another piece of paper to create a design using a combination of transformations. Ask them to explain the transformations they used to create their designs.	• Verify that students can create a design using a triangle and describe the transformations used in the design.

Boxes

Prescribed Learning Outcomes

It is expected that students will:

B3 represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V]

C3 develop and apply a formula for determining the
  − perimeter of polygons
  − area of rectangles
  − volume of right rectangular prisms [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Have students in small groups use a set of 24 square tiles to construct as many rectangles as possible, each with an area of 24 square units. Each group should then − record its differing configurations on centimetre grid paper − determine the perimeters of their rectangles by adding the lengths of the sides − generalize from their findings to create a rule for calculating the perimeters − test their formula for rectangles built using only 20 tiles In a whole-class discussion, challenge students to identify other polygons with which they are familiar (e.g., triangle, pentagon, hexagon) and suggest a procedure and formula for calculating the perimeters of each of those).	• As students carry out the perimeter calculation exercise, monitor their work to ensure that they have − followed the instructions (e.g., used all 24 tiles for each attempt) − identified all the possible rectangles that can be formed (1×24, 2×12, 3×8, 4×6, 6×4, 8×3, 12×2, and 24×1) − correctly calculated perimeters using addition − recognized that there could be more than one way to write a formula for perimeter of a rectangle − derived a reliable formula involving recognition of equal values and multiplication − written their perimeter formulæ appropriately, taking account of the rules for order of operations During the follow-up discussion, monitor students' suggestions to ensure they − recognize the specific characteristics of the polygons they suggest and can distinguish between those whose sides are all of equal length and those that have sides of unequal lengths − are able to extend to other polygons the generalizations involved in creating a formula for determining the perimeter of a rectangle
• Using students' grid paper diagrams of the rectangles created using 24 square tiles as a point of departure, discuss the concept of square units and the relationship between the dimensions of rectangles and their areas.	• Have students use various methods to solve problems that involve calculating the areas of rectangles.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Assume that each area model is the base of a box which will be filled with unit cubes to create 3 or 4 layers. Discuss the following relationships:
  − the area of the base to the volume of the box
  − the dimensions of the box and its volume
 	
Students could examine a variety of traditional Aboriginal storage containers such as cedar baskets, bentwood boxes, and quill baskets and approximate the capacity of these containers.
	• Ask students to use their math journals to reflect on these area-volume relationships. What formula can be derived from the area to determine the volume? Is this the case for all objects?

Unfair Spinner

Prescribed Learning Outcomes

It is expected that students will:

D4 demonstrate an understanding of probability by
   − 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 [C, ME, PS, T]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Give the students a spinner divided into 5 sectors in the following amounts but not labelled: − one sector of $\frac{3}{8}$ − three sectors of $\frac{1}{8}$ − one sector of $\frac{2}{8}$ Have students colour each sector a different colour. For example, colour the large sector red, the medium sector yellow, and each of the small sectors blue, green, and black. Have students identify the outcome they think is most likely, identify all the possible outcomes, conduct the experiment and determine the theoretical probability. Ask students to comment on their findings. Theoretical and experimental probability should be recorded as fractions. Have students keep track of their results to 48 spins. Compare the experimental results with the theoretical. Have groups combine their experimental results and compare them to the theoretical probability.	• Assess students' work to determine the extent to which they are able to − list the probable outcomes of a probability experiment − determine the theoretical probability of an outcome occurring for a probability experiment − conduct a probability experiment and compare the experimental results with 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 can explain the differences

Survey

Prescribed Learning Outcomes

It is expected that students will:

A2 solve problems involving large numbers, using technology [ME, PS, T]

A5 demonstrate an understanding of ratio, concretely, pictorially, and symbolically [C, CN, PS, R, V]

A6 demonstrate an understanding of percent (limited to whole numbers) concretely, pictorially, and symbolically [C, CN, PS, R, V]

D1 create, label, and interpret line graphs to draw conclusions [C, CN, PS, R, V]

D2 select, justify, and use appropriate methods of collecting data, including
  - questionnaires
  - experiments
  - databases
  - electronic media [C, PS, T]

D3 graph collected data and analyze the graph to solve problems [C, CN, PS]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Give students a set of line graphs that represent continuous data such as the following:
  − the distance a bee is from the hive when gathering honey
  − the altitude of an aircraft from take off to landing
  − the filling of a bath tub to taking a bath to emptying the tub
Have the students examine them for common attributes. Have them list other examples of continuous data that could be represented with a line graph. Have students create a line graph from hourly temperature readings for a twelve-hour period.
	• Verify that students can do the following:
	  − explain the difference between continuous data and discrete data
	  − determine whether a given set of data can be represented by a line graph (continuous data) or a series of points (discrete data) and explain why
	  − determine intervals appropriate for the data
	  − interpret line graphs to draw conclusions

• Have students create a question such as: What is your favourite pasta dish (Macaroni and Cheese, Lasagne, Spaghetti, Tortellini, Fettuccine Alfredo or Other)? Students should have 4 to 6 categories on their questionnaire. Each student then collects data by asking at least 25 people. They are to construct an appropriate graph to represent their data. For each category, state their results as a fraction of the whole and a percentage. Additionally some categories should be compared as a ratio.
 	
Students will present their graph, the fractions, percentages, and the original data collection on a poster. Students will present their posters to the class. Included in their presentation will be a recommendation to an interested party. For example, a recommendation could be made to a local restaurant for their weekly pasta special.
	• Verify that students can
	  − design and administer a questionnaire for collecting data to answer a question and record the results
	  − justify their choice of graph when representing data
	  − correctly construct and label their graph
	  − differentiate between fractions of the whole and ratios
	  − interpret their graph to make a recommendation and can justify their reasoning

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Students create a question involving large numbers that must be researched using a database such as those compiled by Statistics Canada. For example, students could examine the change in Aboriginal population using the Aboriginal Peoples Survey. What information is included in this survey and also in the Statistics Canada data? What information is missing? Are there questions for which data from one source would be preferred over the other? Students can choose between a line graph or a bar graph to present their data.	• Verify that students can
	  − select a method for collecting data to answer a question and justify the choice
	  − 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 a databases
	  − determine an appropriate type of graph for displaying a set of data and justify their choice
	  − correctly construct and label their graph
	  − interpret the graph to answer their question

GEOMETRY PORTFOLIO

Not Yet Within Expectations	Minimally Meets Expectations	Fully Meets Expectations	Exceeds Expectations
• The student is unable to meet basic requirements of the task without close, ongoing assistance.	• The work satisfies most basic requirements, but is flawed or incomplete. • Often needs some help.	• The work satisfies basic requirements of the task.	• The work is complete, accurate, and efficient.
• Transformation illustrations are often confusing with key information missing. • There are major errors in performing transformations.	• Transformation illustrations are clear though some information may be missing. • Some features of the transformations are inaccurate or incomplete.	• Transformation illustrations are generally clear and necessary information is included. • Some features of the transformations contain minor errors or flaws (e.g., slight misplacement of ordered pairs).	• Transformation illustrations are clear and all information is included. • The transformations are accurate and complete.

CLASSROOM ASSESSMENT MODEL
Grade 7

GRADE 7: ASSESSMENT OVERVIEW TABLE

The purpose of this table is to provide teachers with suggestions and guidelines for formative and summative classroom-based assessment and grading of Grade 7 Mathematics.

Curriculum Organizers	Suggested Assessment Activities	Suggested Weight for Grading	Number of Outcomes	Number of Outcomes by Domain*		
				K	U&A	HMP
NUMBER	• journals • observations • benchmarks • Venn diagrams • Carroll diagrams • student interviews • error correct • concrete materials • pictorial representations • technology • problem solving	40-50%	7	1	5	1
PATTERNS AND RELATIONS	• journals • Frayer model • sort and classify • interviews • student work • drawing • concrete manipulatives	10-20%	7	2	3	2
SHAPE AND SPACE	• portfolio • Frayer model • journals • charts • geometric constructions • student work • observations	20-30%	5	2	1	2
STATISTICS AND PROBABILITY	• poster • oral report • partner work • observations • constructions • experiments • journals • Frayer model • problem solving	10-20%	6	2	3	1
Totals		100%	25	7	12	6

* The following abbreviations are used to represent the three cognitive levels within the cognitive domain: K = Knowledge; U&A = Understanding and Application; HMP = Higher Mental Processes.

GRADE 7

OVERVIEW

Learning at Previous Grades
- numbers greater than 1 000 000 and smaller than one thousandth
- factors and multiples
- improper fractions and mixed numbers
- ratio and whole number percent
- integers
- multiplication and division of decimals
- order of operations excluding exponents
- patterns and relationships in graphs and tables including a tables of value
- letter variables
- preservation of equality
- angle measure and construction
- sum of interior angles of a triangle and quadrilateral
- formulas for the perimeter of polygons, area of rectangles and volume of right rectangular prisms
- types of triangles
- regular and irregular polygons
- combinations of transformations
- single transformation in the first quadrant of the Cartesian plane
- line graphs
- methods of data collection
- graph data
- experimental and theoretical probability

Curriculum Correlation

The following table shows which curriculum organizers and suborganizers are addressed by each unit in this grade of the Classroom Assessment Model. Note that some curriculum organizers/suborganizers are addressed in more than one unit.

	Geometry Portfolio	Transformations	Bag o' Marbles	Games of Chance	Fun with Statistics	Problems with Percent	Expressions and Equations	Variables and Equations	Decimal Operations	Divisibility	The Terminators	Fractions	Adding and Subtracting Integers	Ordering Numbers
Number			X			X			X	X	X	X	X	X
Patterns and Relations *Patterns*							X							
Variables and Equations							X	X						
Space and Shape *Measurement*	X													
3-D Objects and 2-D Shapes	X													
Transformations		X												
Statistics and Probability *Data Analysis*			X		X									
Chance and Uncertainty			X	X										

Geometry Portfolio

Prescribed Learning Outcomes

It is expected that students will:

C1   demonstrate an understanding of circles by
- describing the relationships among radius, diameter, and circumference of circles
- relating circumference to pi
- 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 [C, CN, R, V]

C2   develop and apply a formula for determining the area of:
- triangles
- parallelograms
- circles [CN, PS, R, V]

C3   perform geometric constructions, including
- perpendicular line segments
- parallel line segments
- perpendicular bisectors
- angle bisectors [CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Show students how to create Frayer models such as the following for geometry terms: | Definition	Essential Characteristics
	| (oval) | Examples	Non-examples
			• Verify that students have a complete, accurate definition for each term. Check for misconceptions (e.g., students should know that the term circle refers to the curve and does not include the area within the curve), and students' ability to justify their entries in the Frayer model.

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Give students 2 or 3 parallelograms drawn on grid paper. For each parallelogram have the students change it into a rectangle of equal area by drawing or by cutting and pasting. Have them calculate the area. Students generalize the rule so they can use it to determine the area of any parallelogram. Repeat the activity using triangles. (Note that it is suggested to not use right triangles because they are an easier case.)	• Collect students' work and note their abilities to
	  − 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
	  − recognize that the height used to calculate the area of a parallelogram must be perpendicular to the base
	  − calculate the area of parallelograms
	  − illustrate and explain how the area of a rectangle or parallelogram can be used to determine the area of a triangle
	  − generalize a rule to create a formula for determining the area of triangle
	  − recognize that the height used to calculate the area of triangle must be perpendicular to the base

• Students will include in their portfolios their best sample of each geometric construction, circles, perpendicular line segments, parallel line segments, perpendicular bisectors and angle bisectors. For perpendicular bisectors and angle bisectors students include 2 different methods of construction.	• Verify that students are able to
	  − identify each construction
	  − explain why 2 line segments are parallel
	  − explain why 2 line segments are perpendicular
	  − 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

• Have students create a chart in which they show for a variety of circles these things: the measurements of the radius, diameter, circumference, the quotient of the circumference divided by the diameter and the quotient of diameter by the radius. Students record their observations concerning the relationships of these measurements.	• Collect students' work and note their abilities to
	  − illustrate and explain that radius is half the diameter and diameter is double the radius
	  − illustrate and explain that the circumference is approximately 3 times the diameter
	  − explain that, for all circles, pi is the ratio of the circumference to the diameter and its value is approximately 3.14

• Give students a circle divided into 8 or more equal sized sectors. Have students cut these apart and paste them to approximate a parallelogram. (The more sectors there are, the more closely it resembles a parallelogram.) Using this, students should be able to derive the formula for area of a circle.	• Verify that students can illustrate and explain how rearranging circle segments can be used to develop the formula for the area of a circle.
• Give students several circles with multiple radii drawn. Have students measure the central angle of each sector and calculate the sum.	• Ask students to explain, using an illustration, that the sum of the central angles is 360°.

PLANNING FOR ASSESSMENT	**ASSESSMENT STRATEGIES**
• Have students include in their portfolios their solutions to problems such as these: 　− draw and label the dimensions for possible triangles and parallelograms that have a total area of 36 square units 　− given a value for the radius of a circle, find the area Have students create problems that involve any of the geometry used in this unit. They are to include the solutions to their problems.	• Assess students abilities to 　− explain that $C = \pi d = 2\pi r$ 　− explain and illustrate that half the circumference is πr 　− explain the difference between r^2 and $2r$ Monitor students work to ensure they can measure accurately using a protractor. Ask students to explain to each other how to use a protractor to measure an angle.

Transformations

Prescribed Learning Outcomes
It is expected that students will:
C4   identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs [C, CN, V]
C5   perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices) [CN, PS, T, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students create and play a version of the game Battleship using coordinate grid paper. (Note that, unlike Battleship, the game will use the intersection of the coordinates rather than the space between the coordinates.) The degree of difficulty may be lessened or increased depending on the spread of the integers on the *x* and *y*-axes.
• Ask students to create a drawing using coordinates and then give the list of coordinates to a partner to recreate the drawing.
	• Collect students' work and note their abilities to
	  – label the axis of a four quadrant Cartesian plane and identify the origin
	  – identify the location of a given point in any quadrant of a Cartesian plane using an integral ordered pair
	  – plot the point corresponding to a given integral ordered pair
	  – are not confusing pairs (e.g., 5,2 with 2,5)

• Students work with points and their knowledge of integers to create rules for determining distance between 2 points that are along vertical or horizontal lines.	• Assess students based on their abilities to
	  – determine the distance between points along horizontal and vertical lines on a Cartesian plane. As an extension they can look for an operational rule.
	  – explain that distance is a positive number

• Have students begin by drawing a scalene triangle on the Cartesian plane, and do the following:
  – identify the vertices of the triangle
  – perform and describe a translation (slide)
  – identify the new vertices
Repeat these last 2 steps for a rotation (turn of 90°, 180°, or 270°) and a reflection (flip) over the *x* or *y*-axis.
 	
    After checking the work, have students exchange the ordered pairs of their original vertices and the descriptions of the transformations. Each student performs the transformations of a classmate.
	• Verify that students can
	  – identify the coordinates of the vertices of a triangle 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 triangle to the corresponding vertices of its image as a result of a transformation
	  – label the axis of a four quadrant Cartesian plane and identify the origin
	  – perform a transformation on a triangle and identify coordinates of the vertices of the image

Bag o' Marbles

Prescribed Learning Outcomes

It is expected that students will:

A3   solve problems involving percents from 1% to 100% [C, CN, PS, R, T]

D3   construct, label, and interpret circle graphs to solve problems [C, CN, PS, R, T, V]

D4   express probabilities as ratios, fractions, and percents [C, CN, R, T, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Give students the following problem to work on: There are four colours of marbles, red, yellow, green, and black in a bag in the following ratios; R:Y is 1:1; G:B is 5:1; G:Y is 5:3. There are at least 20 marbles in the bag. Draw a pictorial representation of the marbles that could be in the bag and justify your decision. Using the contents of your marble bag, write, as both a fraction and a percent, the probability of drawing a red marble from your bag. Repeat for the other 3 colours. Construct an accurate circle spinner representing the probability for each colour.	• Assess students based on their abilities to
	   − identify common attributes of circle graphs
	   − create and label a circle graph, with and without technology, to display a given set of data
	   − when given the ratio G:B = 5:1, can explain that there are 5 green marbles for every 1 black
	   − convert a fractional probability to a percent
	   − calculate the fractional portion of the 360° central angle of the circle
	   − construct angles accurately using a protractor

Games of Chance

Prescribed Learning Outcomes

It is expected that students will:

D5 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]

D6 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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students work with a partner to create a probability experiment involving 2 independent events. Specify one of the events, such as by rolling a regular die, and then ask students to create a second event that has 6 or fewer outcomes (e.g., spinning a spinner, pulling a marble from a bag). Have students determine the theoretical probability for the outcomes using tables, tree diagrams or other graphics. Following this, the pair is to perform the 2 independent events and collect data. (You may wish to have all of the class set up their experiments and allow students to test each other's experiments.) Each pair should then state the results of the experimental data as percents. You may wish to have the students prepare a poster of their work and present their findings to the class.	• Observe student, noting the extent to which they are able to
	  − describe and explain independent events
	  − identify the sample space (all possible outcomes) for each of 2 independent events using a tree diagram, table or another graphic organizer
	  − that theoretical probability is the mathematical model of a problem
	  − determine the theoretical probability of a given outcome involving 2 independent events
	  − conduct a probability experiment involving 2 independent events to compare the experimental probability with the theoretical probability

Fun With Statistics

Prescribed Learning Outcomes

It is expected that students will:

D1 demonstrate an understanding of central tendency and range by
  − 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]
D2 determine the effect on the mean, median, and mode when an outlier is included in a data set [C, CN, PS, R]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Students complete Frayer model in their math journal for the terms mean, median, mode, range, measures of central tendency, and outliers. For mean, median, and mode have the students describe a situation for which each is the most appropriate measure of central tendency. This can be added in the section characteristics. Provide students with problems such as the following, where part of the data set is missing: − The average of 3 numbers is 83. One of the numbers is 107. What might the other numbers be? Explain your choices. − The mean is 7, the median is 5, and the mode is 6. There are 13 scores. What might the numbers be? Explain how you arrived at your numbers. Given a set of data, have students calculate the mean, median, and mode. Have them exchange one of the numbers for a radically different value (an outlier) and explain the effect on the mean, median, and mode.	• Verify that students can − explain the meaning of the terms − 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 most appropriate measure of central tendency to use when reporting findings − solve problems involving the measures of central tendency

Problems with Percent

Prescribed Learning Outcomes
It is expected that students will
A3   solve problems involving percents from 1% to 100% [C, CN, PS, R, T]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Pose these problems for the students:
  – At a minor hockey game one fourth of the people in the stands were children and the rest were parents. If the ratio of dads to moms is 1:4, what percent of the people attending the game were moms?
  – A pair of jeans priced between $50 and $100 was on sale for 25% off. When the original price (a whole dollar amount) was discounted, the sale price was also a whole number of dollars. What are the possible original prices for the jeans?
Have students explain in their math journals their thinking for each question.
	• Collect students' work and note their abilities to
	  – express a percent as a fraction or a decimal
	  – explain and illustrate how fractions relate to percent
	  – explain the difference between ratios and fractions
	  – determine the answer to a percent problem where the answer requires rounding and explain why an approximate answer is needed
	  – organize their data efficiently (e.g., spreadsheets)

Expressions and Equations

Prescribed Learning Outcomes

It is expected that students will:

B1   demonstrate an understanding of oral and written patterns and their equivalent linear relations [C, CN, R]

B2   create a table of values from a linear relation, graph the table of values, and analyze the graph to draw conclusions and solve problems [C, CN, R, V]

B4   explain the difference between an expression and an equation [C, CN]

B5   evaluate an expression given the value of the variable(s) [CN, R]

B6   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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Students complete Frayer models in their math journals for the terms expression, equation, constant, coefficient, and variable. Give students a list of expressions and equations. They sort them into the 2 categories and identify the constants, coefficients, and variables in each set. Assign a value for each variable and have students evaluate the expressions. Students are given 2 linear equations. They create a table of values for each and graph each on the same coordinate graph. Discuss situations each line could represent. Give students problems of the form $x + a = b$, and have students represent the solution process using 2 different methods (concrete models, pictorial representation, or a symbolic representation). This is an excellent opportunity for using an interview with the students. They can demonstrate the process for you and give a verbal explanation of their thinking.	• Assess students based on their abilities to – explain and illustrate the meaning of all terms – create a table of values from a pattern – distinguish between an expression and an equation and compare and contrast them – substitute a value for an unknown into an expression and correctly calculate the answer – plot points on a coordinate graph – represent a given problem with a linear equation and solve the equation using concrete model – draw a visual representation of the steps required to solve a given linear equation

Variables and Equations

Prescribed Learning Outcomes

It is expected that students will:

B3   demonstrate an understanding of preservation of equality by
   − modelling preservation of equality concretely, pictorially, and symbolically
   − applying preservation of equality to solve equations [C, CN, PS, R, V]

B7   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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Represent equations such as the following concretely, pictorially, and symbolically. Have students apply the preservation of equality to solve the equations and explain the process. $2x + 5 = 11$ $x - 3 = 5$ $\frac{x}{3} = 15$	• Collect students' work and note their abilities to − model a given problem with a linear equation and solve the equation using concrete models − draw a visual representation of the steps used to solve a given linear equation − solve a given problem using a linear equation and record the process − verify the solution to a given linear equation using concrete materials and diagrams

Decimal Operations

Prescribed Learning Outcomes
It is expected that students will: A2 demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems [ME, PS, T]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Given a problem such as $4293 \times 23 = 98\ 739$, discuss how and why the answer changes when a decimal (or decimals) is added. Explain, using strategies other than counting decimal places, the placement of the decimal in the answer. Do this kind of problem for each of the operations.
 	
Set rich problems such as the following: At the video rental store you can buy a yearly membership for $30.00. Members can rent movies for $2.45 each while non-members must pay $3.12 each. How many movies would you have to rent that year before you are saving money with an annual membership? Students could also create a spreadsheet to examine "what if" situations.
	• Collect students' work and note their abilities to
	  – solve a given problem involving the addition, subtraction, multiplication and division of decimal numbers
	  – place the decimal in a sum, difference, product or quotient using front-end estimation
	  – check the reasonableness of solutions using estimation
	  – solve problems that involves operations on decimals taking into consideration the order of operations

Divisibility

Prescribed Learning Outcomes

It is expected that students will:

A1   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]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Give students a set of numbers to sort based upon their divisibility. Have students justify their sorting rule. Graphic organizers such as a 2-circle Venn diagram, a 3-circle Venn diagram, or a Carroll diagram may be used. Challenge students to answer the following questions using the number 14 897 2__6, which is missing the 10's place digit: − What digit should be placed in the blank to make the number divisible by 4? by 6? by 8? by 3? by 9? − Explain why the number cannot be divided by 0.	• Assess students based on their abilities to − determine if numbers are divisible by 2, 3, 4, 5, 6, 8, 9, or 10, and explain why − explain, using an example, why a number cannot be divided by 0 − explain how patterns can be used to determine divisibility rules

The Terminators

Prescribed Learning Outcomes

It is expected that students will:

A4 demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions [C, CN, R, T]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Give the students a variety of fractions in lowest terms. Alternately, give the students fractions which must first be put into lowest terms. Have them write the prime factorization of each denominator. Then have them convert each fraction to a decimal. Ask the students to formulate a rule to predict when the fraction will become a terminating decimal and when it will become a repeating decimal. Explain why the rule works with our base-10 system. Have students create fractions they believe will be terminating decimals or repeating decimals. Have them test their predictions. Give students a set of fractions such as $\frac{1}{9}, \frac{2}{9}, \frac{3}{9} \dots$ and have them calculate the decimal representation of the first few and then predict the subsequent decimal representations.	• Look for evidence that students are able to – predict the decimal representation of a given fraction using pattern – sort a set of fractions as repeating or terminating decimals – express a repeating decimal as a fraction – express a terminating decimal as a fraction

Fractions

Prescribed Learning Outcomes

It is expected that students will:

A5   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]

A7   compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using
- benchmarks
- place value
- equivalent fractions and/or decimals [CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Give students a variety of problems involving the addition and subtraction of fractions and mixed numbers. Have students explain the process using concrete materials, pictures, or words. Students should practice explaining the process to each other. Conduct student interviews.
 	
Give the students a selection of problems, some of which have an error in them, such as these:
 	
$12\frac{1}{4} - 9\frac{2}{3} = 3\frac{5}{12}$
 	
$\frac{7}{8} + \frac{1}{3} = \frac{8}{11}$
 	
$2\frac{1}{5} - 1\frac{3}{5} = \frac{8}{5}$
 	
Ask them to find the mistakes and explain the errors in thinking that were made and give the correct solution for each.
	• Verify that students can
	  – model addition and subtraction of a fraction or a mixed number using concrete representations, and record symbolically
	  – solve a problem involving the addition or subtraction of positive fractions or mixed numbers and determine if the solution is reasonable
	  – Look for students who use benchmarks to add and subtract fractions. Students should be able add simple fractions like $\frac{1}{2}$ and $\frac{1}{4}$ in their heads. They should also be able to estimate the answer to addition and subtraction questions and explain their estimation strategies. These strategies may often include the use of benchmarks.
	Notice which students are making errors when regrouping. Are they ignoring the regrouping (i.e., reversing the order of the numbers) or regrouping 10 (as in base 10 regrouping) rather than the equivalent to 1. Note which students are adding and/or subtracting both numerators and denominators.

Adding and Subtracting Integers

Prescribed Learning Outcomes

It is expected that students will:

A6 demonstrate an understanding of addition and subtraction of integers, concretely, pictorially, and symbolically [C, CN, PS, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES
• Give students a variety of problems involving the addition and subtraction of integers. Have students explain the process using concrete materials, pictures, or words. Students should practice explaining the process to each other. Give the students a selection of problems, some of which have an error in them, such as these: $12 - (-5) = 7$ $(-2) + (-9) = 11$ $15 + (-6) = 21$ Ask them to find the mistakes and explain the errors in thinking that were made and give the correct solution for each.	• In interviews, assess students on the basis of their abilities to – explain, using concrete material, that the sum of opposite integers is zero – add or subtract integers using concrete materials or pictorial representations and record the process symbolically

Ordering Numbers

Prescribed Learning Outcomes

It is expected that students will:

A7 compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using
  − benchmarks
  − place value
  − equivalent fractions and/or decimals [CN, R, V]

PLANNING FOR ASSESSMENT	ASSESSMENT STRATEGIES

• Have students choose 2 fractions or 2 decimals that they think are close. Their task is to find five or more fractions or decimals that are between the 2 numbers. Have them explain the strategies they used to determine the new fractions and decimals.	• Verify that students can
	  − order numbers of a given set in ascending or descending order, and verify the result using a variety of strategies
	  − identify a number that would be between 2 given numbers in an ordered sequence
	  − use benchmarks to help place numbers on a number line

• Give students a set of numbers that includes fractions, decimals, and/or integers to place in ascending or descending order, and verify the result using a variety of strategies.	• Notice when students have to change all fractions to common denominators or decimal equivalencies to correctly order the set of numbers.

INTERVIEW OBSERVATION

Name _____ Date _____

Task or Problem _____

The student:	Not Yet at Level	At a Minimal Level	At Expected Level	Beyond Expected Level
Concepts and Procedures				
• understands the math concepts and demonstrates correct procedures				
• selects and carries out appropriate strategies				
Reasoning				
• interprets and evaluates results by looking back at a solution				
• justifies a solution or a decision based on reasons				
Communication				
• expresses thoughts clearly and efficiently				
• uses correct mathematical terminology and in proper context to explain thinking				
• asks and answers questions that go beyond the scope of the original question posed				
Affective Domain				
• stays on task and perseveres				
• demonstrates a willingness to learn				
• confidently takes risks				
• appreciates a challenge				

LEARNING RESOURCES

Mathematics K to 7

This section contains general information on learning resources, and provides a link to the titles, descriptions, and ordering information for the recommended learning resources in the Mathematics K to 7 Grade Collections.

What Are Recommended Learning Resources?

Recommended learning resources are resources that have undergone a provincial evaluation process using teacher evaluators and have Minister's Order granting them provincial recommended status. These resources may include print, video, software and CD-ROMs, games and manipulatives, and other multimedia formats. They are generally materials suitable for student use, but may also include information aimed primarily at teachers.

Information about the recommended resources is organized in the format of a Grade Collection. A Grade Collection can be regarded as a "starter set" of basic resources to deliver the curriculum. In many cases, the Grade Collection provides a choice of more than one resource to support curriculum organizers, enabling teachers to select resources that best suit different teaching and learning styles. Teachers may also wish to supplement Grade Collection resources with locally approved materials.

How Can Teachers Choose Learning Resources to Meet Their Classroom Needs?

Teachers must use either
- provincially recommended resources
  OR
- resources that have been evaluated through a local, board-approved process

Prior to selecting and purchasing new learning resources, an inventory of resources that are already available should be established through consultation with the school and district resource centres. The ministry also works with school districts to negotiate cost-effective access to various learning resources.

What Are the Criteria Used to Evaluate Learning Resources?

The Ministry of Education facilitates the evaluation of learning resources that support BC curricula, and that will be used by teachers and/or students for instructional and assessment purposes. Evaluation criteria focus on content, instructional design, technical considerations, and social considerations.

Additional information concerning the review and selection of learning resources is available from the ministry publication, Evaluating, Selecting and Managing Learning Resources: A Guide (Revised 2002)
www.bced.gov.bc.ca/irp/resdocs/esm_guide.pdf

What Funding is Available for Purchasing Learning Resources?

As part of the selection process, teachers should be aware of school and district funding policies and procedures to determine how much money is available for their needs. Funding for various purposes, including the purchase of learning resources, is provided to school districts. Learning resource selection should be viewed as an ongoing process that requires a determination of needs, as well as long-term planning to co-ordinate individual goals and local priorities.

What Kinds of Resources Are Found in a Grade Collection?

The Grade Collection charts list the recommended learning resources by media format, showing links to the curriculum organizers. Each chart is followed by an annotated bibliography. Teachers should check with suppliers for complete and up-to-date ordering information. Most suppliers maintain web sites that are easy to access.

MATHEMATICS K TO 7 GRADE COLLECTIONS

The Grade Collections for Mathematics K to 7 include newly recommended learning resources as well as relevant resources previously recommended for prior versions of the Mathematics K to 7 curriculum. The ministry updates the Grade Collections on a regular basis as new resources are developed and evaluated.

Please check the following ministry web site for the most current list of recommended learning resources in the Grade Collections for each IRP: www.bced.gov.bc.ca/irp_resources/lr/resource/gradcoll.htm

---

GLOSSARY

Mathematics K to 7

The British Columbia Ministry of Education recognizes the limitation of a glossary available only in print format. An online glossary has been developed by Alberta Education to support the implementation of their revised Kindergarten to Grade 9 Program of Studies. This glossary is based on the WNCP CCF for K-9 Mathematics and therefore also supports the British Columbia Mathematics K to 7 IRP.

This online glossary provides additional supports for teachers indlucing definitions, diagrams, pictures, and interactive applets that cannot be provided through a conventional print glossary. As a result, the Ministry of Education encourages educational stakeholders to access the glossary through a link which is provided on the British Columbia Ministry of Education website.

To access the glossary, follow the links for curriculum support material from the mathematics IRP main page at www.bced.gov.bc.ca/irp/irp_math.htm