Mathematics 2

Curriculum Guide 2017

Newfoundland Labrador

Education and Early Childhood Development

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INTRODUCTION

Background

The curriculum guide communicates high expectations for students.

The Mathematics curriculum guides for Newfoundland and Labrador have been derived from *The Common Curriculum Framework for K-9 Mathematics: Western and Northern Canadian Protocol*, 2006. These guides incorporate the conceptual framework for Grades Kindergarten to Grade Nine Mathematics and the general outcomes, specific outcomes and achievement indicators established in the common curriculum framework. They also include suggestions for teaching and learning, suggested assessment strategies, and an identification of the associated resource match between the curriculum and authorized, as well as recommended, resource materials. This Mathematics 2 course was originally implemented in 2009.

Beliefs About Students and Mathematics Learning

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

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

Students learn by attaching meaning to what they do, and they 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. Through the use of manipulatives and a variety of pedagogical approaches, teachers can address the diverse learning styles, cultural backgrounds and developmental stages of students, and enhance within them the formation of sound, transferable mathematical understandings. Students at all levels benefit from working with a variety of materials, tools and contexts when constructing meaning about new mathematical ideas. Meaningful student discussions provide essential links among concrete, pictorial and symbolic representations of mathematical concepts.

The learning environment should value and respect the diversity of students' experiences and ways of thinking, so that students feel 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. They must come to understand that it is acceptable to solve problems in a variety of ways and that a variety of solutions may be acceptable.

Program Design and Components

Affective Domain

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

A positive attitude is an important aspect of the affective domain and has a profound impact on learning. Environments that create a sense of belonging, encourage risk taking and provide opportunities for success help develop and maintain positive attitudes and self-confidence within students. 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.

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 learn to set achievable goals and assess themselves as they work toward these goals.

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

Goals For Students

Mathematics education must prepare students to use mathematics confidently to solve problems.

The main goals of mathematics education are to prepare students to:

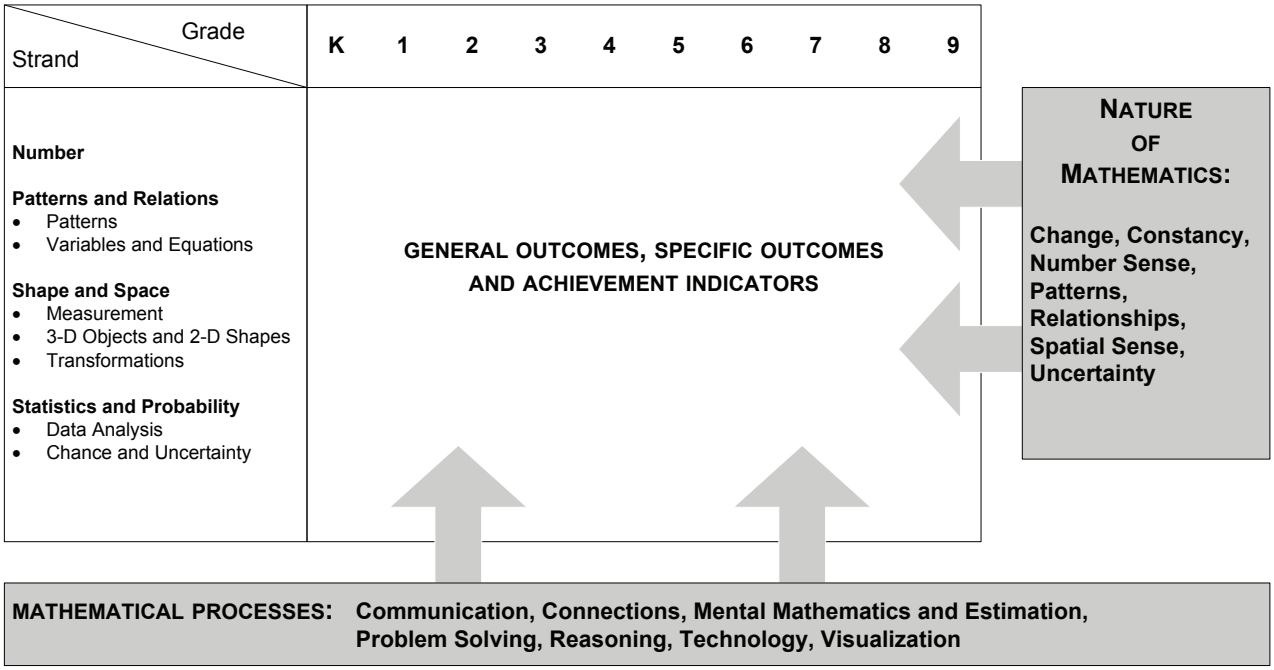
- use mathematics confidently to solve problems
- communicate and reason mathematically
- appreciate and value mathematics
- make connections between mathematics and its applications
- commit themselves to lifelong learning
- become mathematically literate adults, using mathematics to contribute to society.

Students who have met these goals will:

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

CONCEPTUAL FRAMEWORK FOR K - 9 MATHEMATICS

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



Mathematical Processes

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

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and embrace 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 for solving problems
- develop visualization skills to assist in processing information, making connections and solving problems.

This curriculum guide incorporates these seven interrelated mathematical processes that are intended to permeate teaching and learning.

Communication [C]

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

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

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

Communication helps students make connections among concrete, pictorial, symbolic, oral, 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 begin to view mathematics as useful, relevant and integrated.

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

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

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

Mental Mathematics and Estimation [ME]

Mental mathematics and estimation are fundamental components of number sense.

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

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 math" (National Council of Teachers of Mathematics, 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, p. 442).

Mental mathematics "... provides the cornerstone for all estimation processes, offering a variety of alternative algorithms and nonstandard techniques for finding answers" (Hope, 1988, p. v).

Estimation is used for determining approximate values or quantities or for determining the reasonableness of calculated values. It often uses benchmarks or referents. Students need to know when to estimate, how to estimate and what strategy to use.

Estimation assists individuals in making mathematical judgements and in developing useful, efficient strategies for dealing with situations in daily life.

Problem Solving [PS]

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

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

A problem-solving activity requires students to determine a way to get from what is known to what is unknown. If students have already been given steps to solve the problem, it is not a problem, but practice. A true problem requires students to use prior learning 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 seek and engage in 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.

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 students to develop their ability to reason. Students can explore and record results, analyze observations, make and test generalizations from patterns, and reach new conclusions by building upon what is already known or assumed to be true.

Reasoning skills allow students to use a logical process to analyze a problem, reach a conclusion and justify or defend that conclusion.

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.

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Technology 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
- develop personal procedures for mathematical operations
- create geometric patterns
- 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.

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 opportunities to understand mathematical concepts and make connections among them.

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

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

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

Measurement visualization goes beyond the acquisition of specific measurement skills. Measurement sense includes the ability to determine when to measure, when to estimate and which estimation strategies to use (Shaw and Cliatt, 1989).

Nature of Mathematics

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

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

Change

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

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:

- the number of a specific colour of beads in each row of a beaded design
- 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

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

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 following:

- The ratio of the circumference of a teepee to its diameter is the same regardless of the length of the teepee poles.
- 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

An intuition about number is the most important foundation of a numerate child.

Number sense, which can be thought of as intuition about numbers, is the most important foundation of numeracy (British Columbia Ministry of Education, 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. Mastery of number facts is expected to be attained by students as they develop their number sense. This mastery allows for facility with more complex computations but should not be attained at the expense of an understanding of number.

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

Patterns

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

Mathematics is about recognizing, describing and working with numerical and non-numerical patterns. Patterns exist in all strands of mathematics.

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 students develop algebraic thinking, which is foundational for working with more abstract mathematics.

Relationships

Mathematics is used to describe and explain relationships.

Mathematics is one way to describe interconnectedness in a holistic world view. 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 collecting and analyzing data and describing relationships visually, symbolically, orally or in written form.

Spatial Sense

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

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

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 and 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 shapes and objects. Spatial sense allows students to make predictions about the results of changing these dimensions; e.g., doubling the length of the side of a square increases the area by a factor of four. Ultimately, spatial sense enables students to communicate about shapes and objects and to create their own representations.

Uncertainty

Uncertainty is an inherent part of making predictions.

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.

Essential Graduation Learnings

Essential graduation learnings are statements describing the knowledge, skills and attitudes expected of all students who graduate from high school. Essential graduation learnings are cross-curricular in nature and comprise different areas of learning: *aesthetic expression, citizenship, communication, personal development, problem solving, technological competence* and *spiritual and moral development*.

Aesthetic Expression

Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Citizenship

Graduates will be able to assess social, cultural, economic and environmental interdependence in a local and global context.

Communication

Graduates will be able to use the listening, viewing, speaking, reading and writing modes of language(s) and mathematical and scientific concepts and symbols to think, learn and communicate effectively.

Personal Development

Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Problem Solving

Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language and mathematical and scientific concepts.

Technological Competence

Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

Spiritual and Moral Development

Graduates will be able to demonstrate an understanding and appreciation for the place of belief systems in shaping the development of moral values and ethical conduct.

See *Foundations for the Atlantic Canada Mathematics Curriculum*, pages 4-6.

The mathematics curriculum is designed to make a significant contribution towards students' meeting each of the essential graduation learnings (EGLs), with the communication, problem-solving and technological competence EGLs relating particularly well to the mathematical processes.

Program Organization

The learning outcomes in the mathematics program are organized into four strands across the grades K–9. Some strands are subdivided into substrands. There is one general outcome per substrand across the grades K–9.

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

Number

Number

- Develop number sense.

Patterns and Relations

Patterns

- Use patterns to describe the world and to solve problems.

Variables and Equations

- Represent algebraic expressions in multiple ways.

Shape and Space

Measurement

- Use direct and indirect measurement to solve problems.

3-D Objects and 2-D Shapes

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

Transformations

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

Statistics and Probability

Data Analysis

- Collect, display and analyze data to solve problems.

Chance and Uncertainty

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

Outcomes and Achievement Indicators

The curriculum is stated in terms of general outcomes, specific outcomes and achievement indicators.

General Outcomes

General outcomes are overarching statements about what students are expected to learn in each course.

Specific Outcomes

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

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

Achievement Indicators

Achievement indicators are samples of how students may demonstrate their achievement of the goals of a specific outcome. The range of samples provided is meant to reflect the scope of the specific outcome.

The list of indicators contained in this section is not intended to be exhaustive but rather to provide teachers with examples of evidence of understanding that may be used to determine whether or not students have achieved a given specific outcome. Teachers may use any number of these indicators or choose to use other indicators as evidence that the desired learning has been achieved.

Summary

The conceptual framework for K - Grade 9 Mathematics (p. 3) describes the nature of mathematics, mathematical processes and the mathematical concepts to be addressed. The components are not meant to stand alone. Activities that take place in the mathematics classroom should result from a problem-solving approach, be based on mathematical processes and lead students to an understanding of the nature of mathematics through specific knowledge, skills and attitudes among and between topics.

ASSESSMENT AND EVALUATION

Purposes of Assessment

What learning is assessed and evaluated, how it is assessed and evaluated, and how results are communicated send clear messages to students and others about what is really valued.

Assessment techniques are used to gather information for evaluation. Information gathered through assessment helps teachers determine students' strengths and needs in their achievement of mathematics and guides future instructional approaches.

Teachers are encouraged to be flexible in assessing the learning success of all students and to seek diverse ways in which students might demonstrate what they know and are able to do.

Evaluation involves the weighing of the assessment information against a standard in order to make an evaluation or judgment about student achievement.

Assessment has three interrelated purposes:

- assessment *for* learning to guide and inform instruction;
- assessment *as* learning to involve students in self-assessment and setting goals for their own learning; and
- assessment *of* learning to make judgements about student performance in relation to curriculum outcomes.

Assessment *for* Learning

Assessment *for* learning involves frequent, interactive assessments designed to make student understanding visible. This enables teachers to identify learning needs and adjust teaching accordingly. It is an ongoing process of teaching and learning.

Assessment *for* learning:

- requires the collection of data from a range of assessments as investigative tools to find out as much as possible about what students know
- provides descriptive, specific and instructive feedback to students and parents regarding the next stage of learning
- actively engages students in their own learning as they assess themselves and understand how to improve performance.

Assessment *as* Learning

Assessment *as* learning actively involves students' reflection on their learning and monitoring of their own progress. It focuses on the role of the student as the critical connector between assessment and learning, thereby developing and supporting metacognition in students.

Assessment *as* learning:

- supports students in critically analyzing their learning related to learning outcomes
- prompts students to consider how they can continue to improve their learning
- enables students to use information gathered to make adaptations to their learning processes and to develop new understandings.

Assessment *of* Learning

Assessment *of* learning involves strategies to confirm what students know, demonstrate whether or not they have met curriculum outcomes, or to certify proficiency and make decisions about students' future learning needs. Assessment *of* learning occurs at the end of a learning experience that contributes directly to reported results.

Traditionally, teachers relied on this type of assessment to make judgments about student performance by measuring learning after the fact and then reporting it to others. Used in conjunction with the other assessment processes previously outlined, however, assessment *of* learning is strengthened.

Assessment *of* learning:

- provides opportunities to report evidence to date of student achievement in relation to learning outcomes, to parents/guardians and other stakeholders
- confirms what students know and can do
- occurs at the end of a learning experience using a variety of tools.

Because the consequences of assessment *of* learning are often far-reaching, teachers have the responsibility of reporting student learning accurately and fairly, based on evidence obtained from a variety of contexts and applications.

Assessment Strategies

Assessment techniques should match the style of learning and instruction employed. Several options are suggested in this curriculum guide from which teachers may choose, depending on the curriculum outcomes, the class and school/district policies.

Observation (formal or informal)

This technique provides a way of gathering information fairly quickly while a lesson is in progress. When used formally, the student(s) would be aware of the observation and the criteria being assessed. Informally, it could be a frequent, but brief, check on a given criterion. Observation may offer information about the participation level of a student for a given task, use of a concrete model or application of a given process. The results may be recorded in the form of checklists, rating scales or brief written notes. It is important to plan in order that specific criteria are identified, suitable recording forms are ready, and all students are observed within a reasonable period of time.

Performance

This curriculum encourages learning through active participation. Many of the curriculum outcomes promote skills and their applications. In order for students to appreciate the importance of skill development, it is important that assessment provide feedback on the various skills. These may be the correct manner in which to use a manipulative, the ability to interpret and follow instructions, or to research, organize and present information. Assessing performance is most often achieved through observing the process.

Paper and Pencil

These techniques can be formative or summative. Whether as part of learning, or a final statement, students should know the expectations for the exercise and how it will be assessed. Written assignments and tests can be used to assess knowledge, understanding and application of concepts. They are less successful at assessing processes and attitudes. The purpose of the assessment should determine what form of paper and pencil exercise is used.

Journal

Journals provide an opportunity for students to express thoughts and ideas in a reflective way. By recording feelings, perceptions of success, and responses to new concepts, a student may be helped to identify his or her most effective learning style. Knowing how to learn in an effective way is powerful information. Journal entries also give indicators of developing attitudes to mathematical concepts, processes and skills, and how these may be applied in the context of society. Self-assessment, through a journal, permits a student to consider strengths and weaknesses, attitudes, interests and new ideas. Developing patterns may help in career decisions and choices of further study.

Interview

This curriculum promotes understanding and applying mathematics concepts. Interviewing a student allows the teacher to confirm that learning has taken place beyond simple factual recall. Discussion allows a student to display an ability to use information and clarify understanding. Interviews may be a brief discussion between teacher and student or they may be more extensive. Such conferences allow students to be proactive in displaying understanding. It is helpful for students to know which criteria will be used to assess formal interviews. This assessment technique provides an opportunity to students whose verbal presentation skills are stronger than their written skills.

Presentation

The curriculum includes outcomes that require students to analyze and interpret information, to be able to work in teams, and to communicate information. These activities are best displayed and assessed through presentations. These can be given orally, in written/pictorial form, by project summary, or by using electronic systems such as video or computer software. Whatever the level of complexity, or format used, it is important to consider the curriculum outcomes as a guide to assessing the presentation. The outcomes indicate the process, concepts and context for which a presentation is made.

Portfolio

Portfolios offer another option for assessing student progress in meeting curriculum outcomes over a more extended period of time. This form of assessment allows the student to be central to the process. There are decisions about the portfolio, and its contents, which can be made by the student. What is placed in the portfolio, the criteria for selection, how the portfolio is used, how and where it is stored, and how it is evaluated are some of the questions to consider when planning to collect and display student work in this way. The portfolio should provide a long-term record of growth in learning and skills. This record of growth is important for individual reflection and self-assessment, but it is also important to share with others. For all students, it is exciting to review a portfolio and see the record of development over time.

INSTRUCTIONAL FOCUS

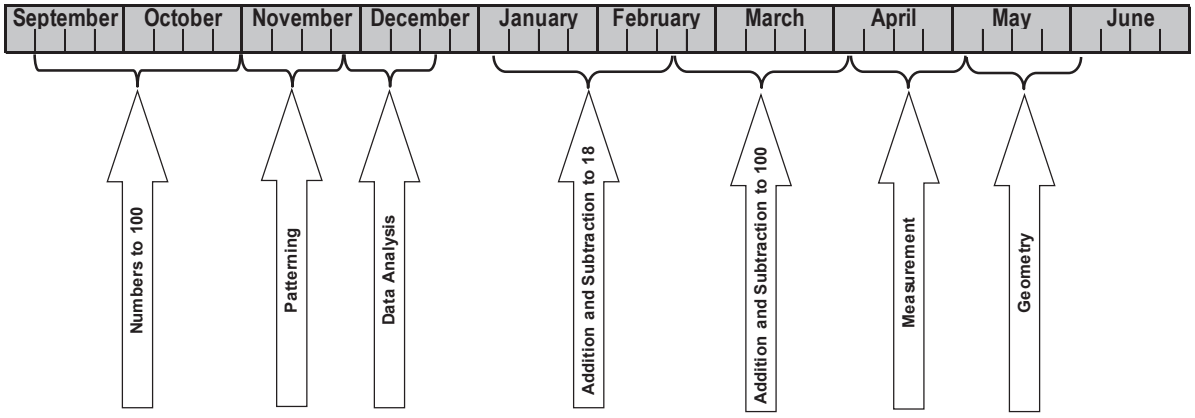
Planning for Instruction

Consider the following when planning for instruction:

- Integration of the mathematical processes within each strand is expected.
- By decreasing emphasis on rote calculation, drill and practice, and the size of numbers used in paper and pencil calculations, more time is available for concept development.
- Problem solving, reasoning and connections are vital to increasing mathematical fluency and must be integrated throughout the program.
- There is to be a balance among mental mathematics and estimation, paper and pencil exercises, and the use of technology, including calculators and computers. Concepts should be introduced using manipulatives and be developed concretely, pictorially and symbolically.
- Students bring a diversity of learning styles and cultural backgrounds to the classroom. They will be at varying developmental stages.

Teaching Sequence

The curriculum guide for Grade Two is organized by units. A timeline has been provided to assist in planning. The use of this timeline is not mandatory; however, it is mandatory that all outcomes are taught during the school year so a long term plan is advised. There are a number of combinations of sequences that would be appropriate for teaching this course. The arrow showing 'estimated focus' does not mean the outcomes are never addressed again. The teaching of the outcomes is ongoing and may be revisited as necessary.



Instructional Time per Unit

The suggested number of weeks of instruction per unit is listed in the guide at the beginning of each unit. The number of suggested weeks includes time for completing assessment activities, reviewing and evaluating.

Resources

The authorized resource for Newfoundland and Labrador for students and teachers is *Math Makes Sense 2* (Pearson). Schools and teachers have this as their primary resource offered by the Department of Education and Early Childhood Development. Column Four of the curriculum guide references *Math Makes Sense 2* for this reason.

Teachers may use any resource or combination of resources to meet the required specific outcomes listed in Column One of the curriculum guide.

General and Specific Outcomes

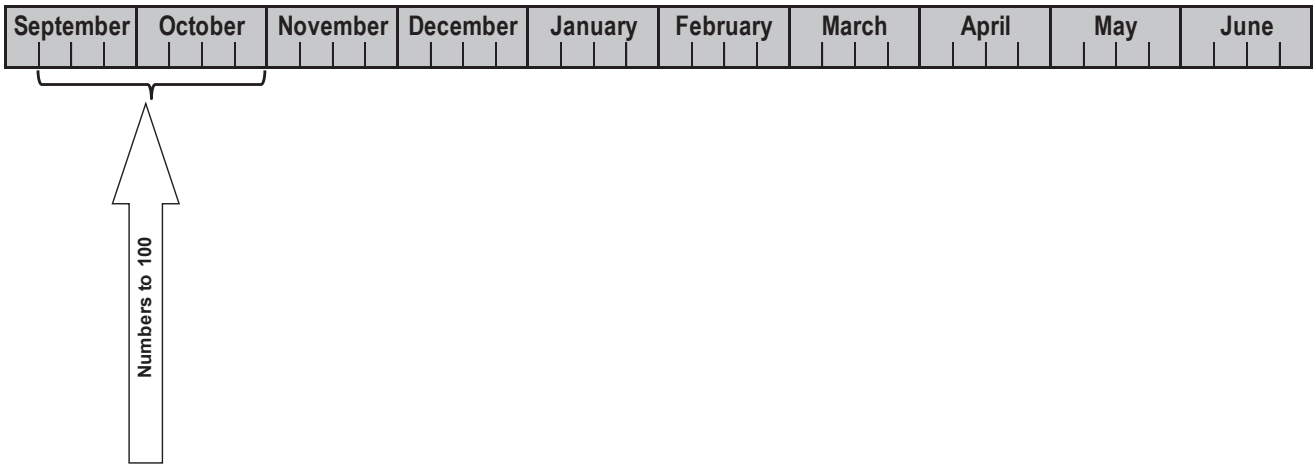
GENERAL AND SPECIFIC OUTCOMES WITH ACHIEVEMENT INDICATORS (pp. 19 - 216)

This section presents general and specific outcomes with corresponding achievement indicators and is organized by unit. The list of indicators contained in this section is not intended to be exhaustive but rather to provide teachers with examples of evidence of understanding to be used to determine whether or not students have achieved a given specific outcome. Teachers should use these indicators but other indicators may be added as evidence that the desired learning has been achieved. Achievement indicators should also help teachers form a clear picture of the intent and scope of each specific outcome.

Mathematics 2 is organized into seven units: *Numbers to 100*, *Patterning*, *Data Analysis, Addition and Subtraction to 18*, *Addition and Subtraction to 100*, *Measurement,* and *Geometry*.

Numbers to 100

Suggested Time: 6 - 7 Weeks



Unit Overview

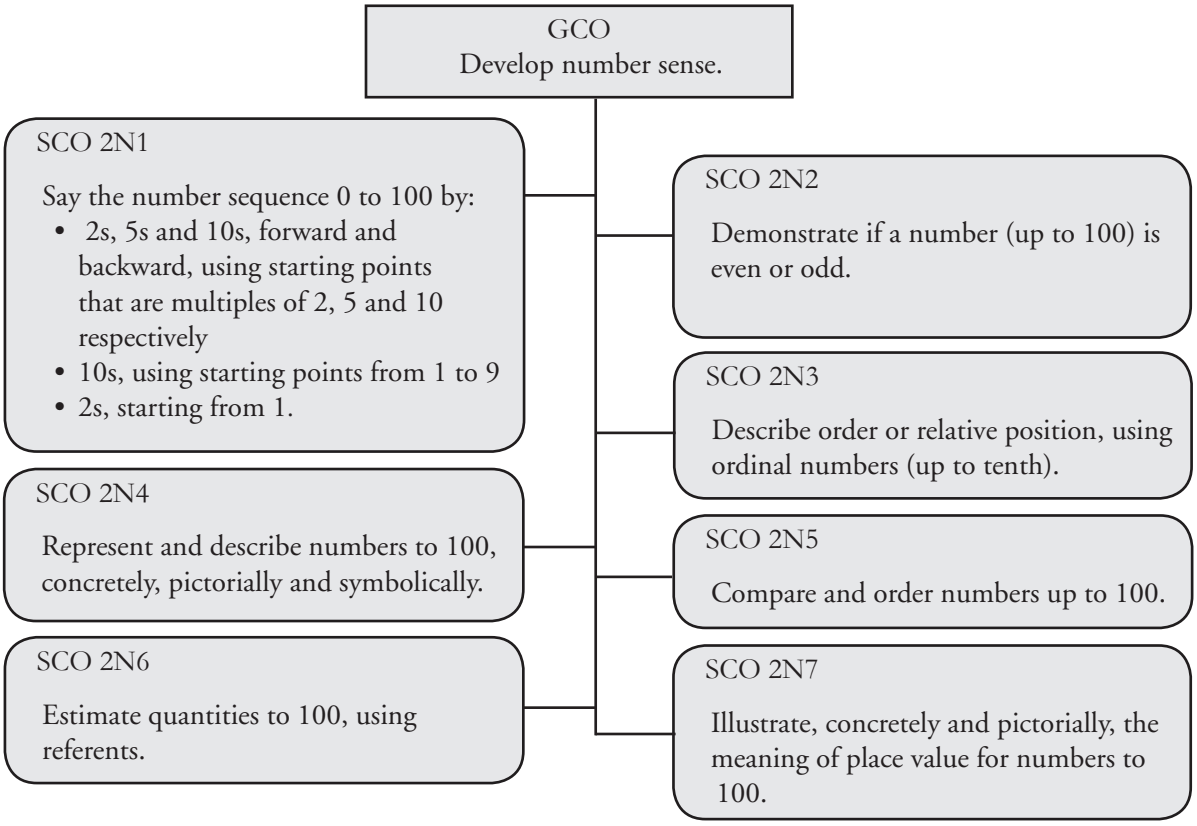
Focus and Context

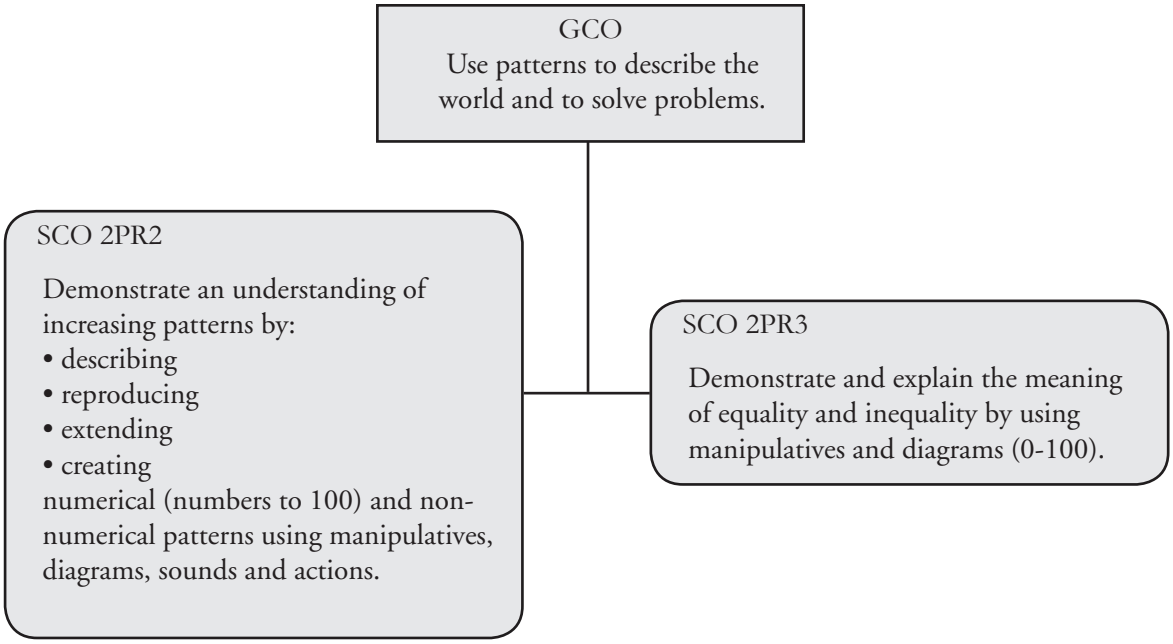
Prior to Grade Two these number concepts have been explored using numbers 0-20. Students will continue to learn and practice approaches to counting, estimating, and grouping objects into sets. Equality and inequality will be explored using balance scales to consider and manipulate sets.

Students will extend their sense of the number 10 as they explore place value for tens and ones. It is important for students to have many experiences using a variety of manipulatives in order to develop a solid understanding of place value that can be expanded in later years.

Students participate actively in mathematics as they continue to further develop these number concepts. They will need to communicate their thinking to demonstrate their level of understanding.

Outcomes Framework





SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1N1. Say the number sequence 0 to 100 by: • 1s forward between any two given numbers • 1s backward from 20 to 0 • 2s forward from 0 to 20 • 5s and 10s forward from 0 to 100. [C, CN, ME, V] 1N2. Subitize (recognize at a glance) and name familiar arrangements of 1 to 10 objects or dots. [C, CN, ME, V]	2N1. 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] 2N2. Demonstrate if a number (up to 100) is even or odd. [C, CN, PS, R] 2N3. Describe order or relative position, using ordinal numbers (up to tenth). [C, CN, R]	3N1. Say the number sequence 0 to 1000 forward and backward 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] 3N2. Represent and describe numbers to 1000, concretely, pictorially and symbolically. [C, CN, V] 3N3. Compare and order numbers to 1000. [C, CN, R, V]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1N3. 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] 1N4. Represent and describe numbers to 20, concretely, pictorially and symbolically. [C, CN, V] 1N5. Compare and order sets containing up to 20 elements to solve problems, using: • referents (known quantities) • one-to-one correspondence. [C, CN, ME, PS, R, V] 1N6. Estimate quantities to 20 by using referents. [C, CN, ME, PS, R, V]	2N4. Represent and describe numbers to 100, concretely, pictorially and symbolically. [C, CN, V] 2N5. Compare and order numbers up to 100. [C, CN, ME, R, V] 2N6. Estimate quantities to 100, using referents. [C, ME, PS, R] 2N7. Illustrate, concretely and pictorially, the meaning of place value for numerals to 100. [C, CN, R, V]	3N4. Estimate quantities less than 1000, using referents. [ME, PS, R, V] 3N5. Illustrate, concretely and pictorially, the meaning of place value for numerals to 1000. [C, CN, R, V]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Patterns and Relations (Variables and Equations)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1PR3. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20). [C, CN, R, V]	2PR3. Demonstrate and explain the meaning of equality and inequality, concretely and pictorially (0-100). [C, CN, R, V]	

Mathematical Processes

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

Daily Routine Opportunity

This curriculum guide contains suggestions for daily routines. They will be indicated with the graphic seen here.

Strand: Number

Outcomes

Students will be expected to

2N1 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]

Achievement Indicators:

2N1.1 Extend a given skip counting sequence (by 2s, 5s or 10s) forward and backward.

2N1.2 Skip count by 10s given any number from 1 to 9 as a starting point.

2N1.3 Count by 2s starting from 1 or from any odd number.

Elaborations—Strategies for Learning and Teaching

In Grade Two, students will be building on their previous understanding of number sense. This understanding about numbers will continue to be developed throughout the school year and will serve as a foundation for further studies in Mathematics.

Daily routines are an effective, on-going way to reinforce number sense to 100 throughout the year. Consider using some of the following on a daily basis: calendar math, ten-frame flashcards (representing numbers to 100), number lines, hundred charts, money, and base ten materials. Anecdotal records of students' responses and participation in these routines are an important part of individual assessment.

Throughout this unit, centres or individual math baggies may be used to allow for further investigation, discovery and practice. Hands-on, concrete, self-directed learning is a natural way for students to make discoveries and connections about mathematics and their world around them. Each centre or baggie could include: counters, hundred chart, number-lines, ten-frames, dice, sticky notes, a variety of small manipulatives, coins, pencil and crayons, as well as a prompt for learning.

Providing a mathematics word wall is one way to build number vocabulary. Words can be added as they occur in classroom activities. Consider using a simple graphic with each word to provide additional support. If a word wall is added to your classroom, have students interact with it frequently to reinforce concepts.

A hundred chart is a valuable tool for students as they skip count and should be readily available to each student for exploration. Students have used hundred charts in Grade One and should be familiar with them.

Students should visually represent skip counting on a hundred chart. Ask them to colour each number that they land on as they count by intervals of 2s, 5s and 10s. Every skip count produces an interesting pattern on the chart. Being able to skip count with ease is an important building block for students. As they move into higher grades, skip counting will help them recall the multiplication facts more readily.

Throughout the day, at appropriate times, call out a number from one to nine and ask for a volunteer to count forwards and then backwards by 10s.

Counting by 2s is not only a representation of even numbers. Students also need to know that skip counting by 2s can begin at any number and can produce odd numbers, e.g., 5, 7, 9, 11...

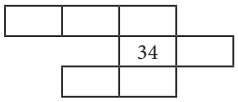
General Outcome: Develop number sense

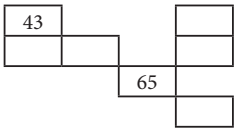
Suggested Assessment Strategies

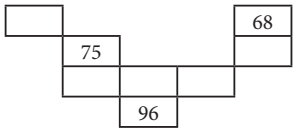
Performance

- Give students a number line and pose a story problem for the students to solve, using a skip counting rule. Place a house, for example, on a given point of the number line and a store on another given point. Ask students,"Flippy the Frog has to go to the store from his house. If each hop covers two spaces, how many hops will he make to get to the store?" (2N1.1)

- Fractured Hundred Chart Pieces - Distribute blank hundred charts and ask students to cut out a random section containing 7-10 squares. Students should print a numeral somewhere on their section such that all other squares can be filled in according to their placement on the hundred chart. Collect and redistribute randomly for students to complete with the appropriate numerals. Some students may need to refer to a hundred chart to complete this activity. Collect students' completed fractured chart pieces and ask them to explain how they concluded which numbers went in the empty squares.







(2N1.1, 2N1.2, 2N5.3)

- Prepare cards labeled "forward 2", "forward 5", "forward 10", "backward 2", "backward 5", "backward 10" and place in a bag. Provide a pompom or cotton ball, a hundred chart and recording sheet as shown. Ask each student to remove a card from the bag and print the rule on their recording sheets. Then ask the student to drop the pompom on the hundred chart to determine the starting number. Next to the rule he/she writes the starting number and extends the number pattern forward or backward as determined by the rule. He/she returns the card to the bag and repeats with a new pattern rule card.

Name:									
Rule	Number Pattern								
backward 5	44	39	34	29	24	19	14	9	4
forward 10	29	39	49	59	69	79	88	99	

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28		30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

(2N1.1, 2N1.2, 2N1.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Launch

Teacher Resource (TR): p. 15

Student Book (SB): pp. 29 - 31

Lesson 1: Counting on a Number Line

TR: pp. 16 - 18

SB: pp. 32 - 33

Audio CD 1:

Selections: 10 - 18

Lesson 2: Counting on a 100-Chart

TR: pp. 19 - 23

SB: pp. 34 - 35

Audio CD 1:

Selections: 19, 20

Audio CD 2:

Selection: 1

Refer to Appendix B (pp. 227 - 231) for problem solving strategies and ideas.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/num-to-100.html

- number sense activities
- word wall ideas
- fractured hundred chart pieces

Strand: Number

Outcomes

Students will be expected to

2N1 Continued

2N2 Demonstrate if a number (up to 100) is even or odd.

[C, CN, PS, R]

Achievement Indicators:

2N1.4 Identify and correct errors and omissions in a given skip counting sequence.

2N2.1 Determine if a given number is even or odd by using concrete materials or pictorial representations.

2N2.2 Identify even and odd numbers in a given sequence, such as in a hundred chart.

2N2.3 Sort a given set of numbers into even and odd.

Elaborations—Strategies for Learning and Teaching

During daily routines, randomly begin counting aloud forward or backward according to a "secret" pattern rule. Have students raise their hand when they figure out your pattern rule. Extend on this game by making a mistake in your pattern. Have students indicate when they recognize an error. Students can make corrections as needed. As the year progresses, the activity should be done repeatedly with more complex patterns.

Engage students in a game of "Skip Counting I Spy". Say, for example, "I spy a number that is ten more than 3". Students may refer to a hundred chart to guess what number you are spying. When the correct number is identified, students should continue the skip counting pattern. As this activity is repeated throughout the year, have students take turns "spying" a number that is two, five or ten more than a number of their choice.

The concept of "evenness" can be shown using manipulatives. If the counters, blocks, shells, etc., can be paired up, the number is even; if they cannot be paired up, then the number is odd.

Provide concrete materials such as counters, Cheerios, macaroni, stickers, etc. Have students select a number card and the corresponding number of items. Students then line up the items in pairs. If all items have a partner, i.e., a rectangle is formed, then the number is even. If each item does not have a partner, the number is odd. Students can paste their "even rectangles" of materials onto construction paper to show how an even number of items will form a rectangle. They can display their work in the classroom under headings of "Even" or "Odd", according to the number they have shown.

Students can also determine if a number is even or odd by trying to share that number of counters fairly between two students. Even numbers can be shared equally between two students, while odd numbers are not "fair" because there is always one extra counter left over.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Calculator Skip Counting - Show students how to make calculators skip count by 2s to represent odd and even number patterns. Ask students to press 1 + 2 =,=,= to show an odd number pattern. Encourage them to start with a greater odd number, e.g., 27 + 2 =,=,=. This same activity can be used with even numbers. As an added challenge, have students work in pairs to guess what the next number will be in the pattern before the equal sign is pressed. (Note: Grade Two students are not expected to have their own calculators.)

  (2N1.3)

- Ask students to work in pairs. They decide that one student is ODD and the other is EVEN. Use a T-chart to record results. Each student puts one hand behind his/her back and when one of the students says GO they each bring that hand to the front, with any number of fingers held up. The students add/combine the two numbers and if the sum is even, the student who is EVEN scores a point. If the number if odd, the student who is ODD scores a point. The first to score 10 points wins. Extension: Both students use both hands. This will allow the sum to go to 20. Teachers should observe and note: Are the students able to make quick decisions on whether a number is odd or even? How are the students combining the two numbers? Are they, for example, counting all seven fingers to know that 4 and 3 make 7? Are they counting on from the larger number to get the sum? Are they able to look at 4 and 3 and immediately say 7?

  (2N2.1, 2N2.3)

- In a centre, present a hundred chart and some manipulatives and provide the following provocations for students:

  (i) I wonder how I can show that two numbers, one right after the other, cannot both be even.

  (ii) I wonder if I choose a column of numbers on the hundred chart, will they all be odd or will they all be even?

  (2N2.1, 2N2.2, 2N2.3)

- Scatter some numbers from one to twenty on the floor, and invite students to dance or move around the room as music is played. Ask students to stand on one foot if they are on an odd number when the music stops. Observe students and identify those who are having difficulty classifying numbers as odd. Offer support as necessary. Repeat the activity using even numbers. As students become more proficient at identifying odd and even numbers, gradually increase the highest number from 20 until 100 is reached.

  (2N2.2, 2N2.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3: Odd and Even Numbers

TR: pp. 24 - 29

SB: p. 36

Lesson 4: Counting with Money

TR: pp. 30 - 34

SB: p. 37

Audio CD 2:

Selection: 2

Note:
It is necessary to use pennies when representing numbers.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/num-to-100.html

- interactive hundred chart

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

2N1 Continued

Achievement Indicators:

2N1.5 Count a given sum of money with pennies, nickels or dimes (to 100 cents).

2N1.6 Count quantity, using groups of 2s, 5s or 10s and counting on.

Elaborations—Strategies for Learning and Teaching

This is the students' first formal introduction to money as part of the mathematics curriculum. Students may need to be made aware of the value of each coin (pennies, nickels, dimes). Pennies, while no longer in circulation, are still legal tender and should be included. Pennies are also necessary for representing numbers using coins.

Students need many opportunities presented regularly throughout the school year to count large quantities of objects. Counting in a variety of ways (1s, 2s, 5s, 10s), will further develop counting efficiency.

"As students get older, the numbers they deal with in their everyday lives become more complex. Students need strategies for representing and making sense of these greater numbers. Although it is possible to count, say, 87 items individually, it is not practical. When items are grouped, counting is made easier and probably more accurate." (Small, 2008, p. 138)

The foundation for the later development of place value is built through working with grouping activities. While place value focuses on groupings of ten, students should also have experiences with different sized groupings, i.e., 2s, 5s, and 10s.

Use a hundred chart to help students count coins. Given 3 dimes and 1 nickel for example, students would place dimes on 10, 20, 30 and the nickel on 35. The placement of the last coin tells students how much money they have altogether. This method is effective for having students figure out the total value of a set of coins.

1	2	3	4	5	6	7	8	9	
11	12	13	14	15	16	17	18	19	
21	22	23	24	25	26	27	28	29	
31	32	33	34		36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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

Suggested Assessment Strategies

Interview

- Say "5, 10, 15, 16, 17." Ask students: What coins am I counting? Repeat for different coins.

(2N1.5)

Performance

- Play "What's in the Can?" Tell the students that you are going to drop nickels (or pennies, or dimes) into a can. Ask the students to listen as the coins drop and to skip count to find the total amount of money. As an extension, tell the students that there is, for example, 45 cents in the can. Tell them that you are going to add dimes (or nickels or pennies) and ask them to keep track to find the total.

(2N1.5)

- Ask eight students to stand in a line. Ask them to count the number of fingers they have, in all, by putting up both hands and saying 10, 20, 30, ... as they move along the line. Repeat the same activity but this time count the number of elbows in all, by saying 2, 4, 6, ... Repeat the activity but this time ask each student to hold up only their left hand. Ask them to count the number of fingers in the left hand for all eight students by saying 5, 10, 15, ...

(2N1.6)

- In a centre, present a variety of coins (pennies, nickels and dimes) and provide the following provocations for students:
  - (i) I wonder if I can make 20¢ using exactly 4 coins?
  - (ii) I wonder if I can make 20¢ using exactly 8 coins?
  - (iii) I wonder if I can make 20¢ using exactly 10 coins?
  - (iv) I wonder what is the highest amount I can get using exactly 6 coins, if only one of them can be a dime?
  - (iv) I wonder what is the lowest amount I can get using exactly 6 coins, if only one of them can be a penny?

(2N1.5)

Observation

- Provide a variety of small objects and ask students to count the objects by 2s, 5s and 10s. Observe and record the students' strategies and accuracy (i.e., do they separate the objects they've counted from the ones they haven't; are they able to count 29 objects by starting with 5s and finishing by 1s).

(2N1.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 4 (Continued): Counting with Money

TR: pp. 30 - 34

SB: p. 37

Audio CD 2:

Selection: 2

Lesson 8: Using 10s and 1s

TR: pp. 49 - 52

SB: pp. 43 - 44

Unit Centres:

TR: p. 13

- What's My Number?
- Show the Number

Lesson 9: Place Value: Tens and Ones

TR: pp. 53 - 58

SB: pp. 45 - 46

Lesson 10: Representing and Describing Numbers

TR: pp. 59 - 64

SB: p. 47

Strand: Number

Outcomes

Students will be expected to

2N3 Describe order or relative position using ordinal numbers (up to tenth).

[C, CN, R]

Achievement Indicators:

2N3.1 Indicate a position of a specific object in a sequence by using ordinal numbers up to tenth.

2N3.2 Compare the ordinal position of a specific object in two different given sequences.

Elaborations—Strategies for Learning and Teaching

An ordinal number tells the position of something in a sequence (i.e., first, second, third.) To compare the ordinal positions of objects, ask students to build a train using ten Link-its™, snap cubes, beads, etc. They can only use one yellow. Ask each student to use the ordinal numbers to tell the position of his/her yellow object, and the position of a classmate's yellow object.

Another way to have students compare ordinal positions is play "Shoe Line-up". Have ten students remove their shoes to make two rows, Row A and Row B. Each student should place one shoe in each row, and in a different ordinal position. Students can tell about the position of their shoes, e.g., "In Row A, my shoe is in the 4th position. In Row B, my shoe is in the 8th position." For smaller class sizes, students may gather a collection of shoes, crayons, lunch bags, etc. to create two rows of ten objects. Students can then say, e.g., "In Row A, my backpack is in the first position, and in Row B, my lunch bag is in the eight position."

There are many opportunities throughout the day to reinforce ordinal number and relative position:

- Discussing the calendar: e.g., 4th day of the week, 3rd Wednesday of the month, etc.
- Line students up to go to the gym, music, etc. according to given ordinal positions.
- Use ordinal language when giving instructions/directions or retelling the events of the day.

General Outcome: Develop number sense

Suggested Assessment Strategies

Interview

- Display a row of up to ten items. Ask the student to point to the 4th (or 2nd, or 8th, etc.) item. Conversely, describe an object in the row and ask the student to tell you its position, for example, "Tell me the position of the yellow Link-it™."

(2N3.1)

Journal

- After completing the train activity as described on the previous page, ask students to draw their train, and write about the ordinal position of the yellow object. (2N3.1)

- After completing the "Shoe Line-Up" activity described on the previous page, ask students to draw and write about what they learned. Provide two blank ten-frames joined together as a template for drawing their line-ups. (2N3.1, 2N3.2)

Performance

- Read *There was An Old Lady Who Swallowed a Desk* by Lucille Colandro. Invite students to extend the story by including other items from the classroom that the old lady could swallow. Ask students to arrange pictures of the items using the ordinal numbers up to tenth.

(2N3.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5: Ordinal Numbers

TR: pp. 35 - 39

SB: p. 38

Audio CD 2:

Selection: 3

Suggested Resources

Children's Literature

- *There Was An Old Lady Who Swallowed A Desk* by Lucille Colandro

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/num-to-100.html

- pictures to use with *There Was An Old Lady Who Swallowed A Desk*

Strand: Number

Outcomes

Students will be expected to

2N4 Represent and describe numbers to 100, concretely, pictorially and symbolically.

[C, CN, V]

Achievement Indicators:

2N4.1 Represent a given number, using concrete materials such as ten-frames and base ten materials.

2N4.2 Represent a given number using tallies.

2N4.3 Represent a given number pictorially and symbolically.

2N4.4 Read a given number (0-100) in symbolic or word form.

2N4.5 Record a given number (0-20) in words.

Elaborations—Strategies for Learning and Teaching

The morning routine is an excellent opportunity to continually build students' understanding of how numbers are represented. Add a popsicle stick, for example, to a jar each morning. Count the popsicle sticks together. As it becomes increasingly time-consuming to count by 1s, ask the students to suggest ways to make the counting easier. Guide the discussion such that the decision is made to group the sticks in bundles of ten with an elastic band.

Using the bundles of popsicle sticks from the morning routine, have students show other ways of representing the "number of the day". This is an excellent opportunity to show the students the connection to base ten materials, i.e., each bundle of popsicle sticks can be represented by a rod, while the extra sticks are represented by units. Students can also represent the "number of the day" using ten-frames.

When exploring various ways to represent a number, the goal is for students to realize that they can create some representations more efficiently than others. Thirty-two, for example, can be represented by 32 units, or by a rod and 22 units, or by two rods and 12 units, or by three rods and two units. The last representation is the most efficient and students should be guided towards thinking about the most efficient way to represent numbers.

Morning routines also provide opportunities for using tallies. These may include counting the weather days in the month, i.e., sunny, cloudy, rainy, etc. Tallies will be used in the Data Analysis unit later in this course. This is a good opportunity to introduce the topic.

To have students represent a given number, play "What's My Number?" Provide baskets of rods and units. Have students secretly choose a number less than 100 to build with their manipulatives. Teachers should label each student representation with a letter card, A, B, C, etc. Students will then label their math journals with the letters A, B, C, etc. They will then circulate around the classroom, looking at each representation, and record symbolically the secret number represented.

Students should be given lots of exposure to the written form of numerals. This may be in the form of written instructions on how to complete tasks, charts displayed in the classroom with pictorial and symbolic representations, or as entries in a personal math dictionary or on a classroom math word wall. Provide ample opportunities for students to record number words. Number words are often used in writing about concepts in other subject areas. Teachers should take every opportunity to write numbers in the contexts of language arts, science, etc.

General Outcome: Develop number sense

Suggested Assessment Strategies

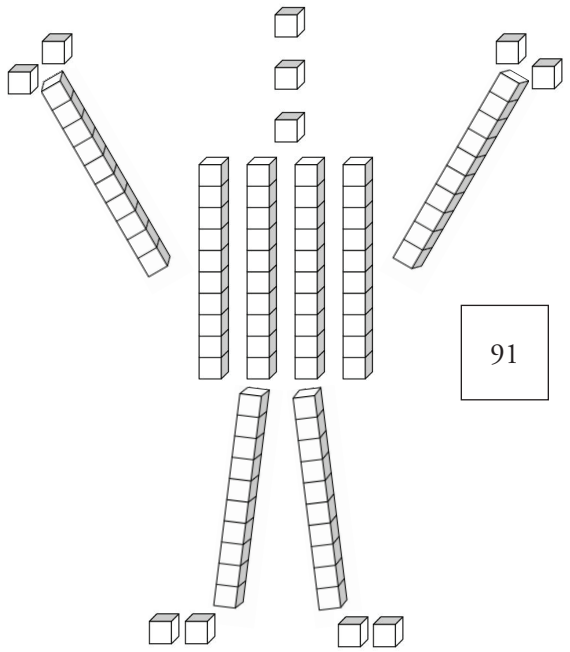
Performance

- Ask students to use base ten materials to represent a number in three different ways. Forty-eight, for example, could be represented with 4 rods and 8 units; 3 rods and 18 units; or 48 units. Then ask them which representation they would prefer and why.

(2N4.1)

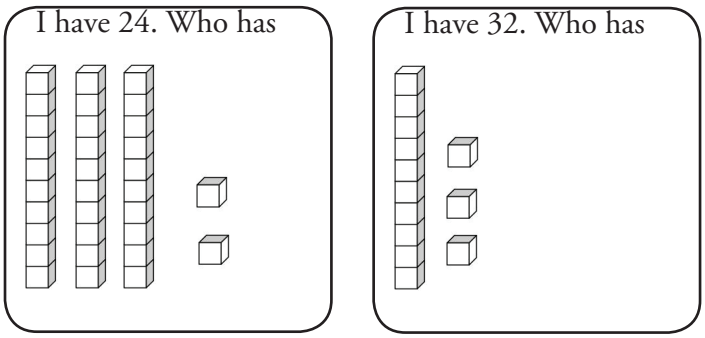
Performance

- Invite students to make a robot with base ten blocks and record its value. E.g.,



(2N4.1, 2N4.3)

- Ask students to play a "looping game" such as "I have...Who has...?". Sample cards are:



(2N4.1, 2N4.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 6: Estimating and Counting to 50

TR: pp. 40 - 43

SB: pp. 39 - 40

Lesson 7: Estimating and Counting to 100

TR: pp. 44 - 48

SB: pp. 41 - 42

Audio CD 2:

Selections: 4, 5, 6

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/num-to-100.html

- I have...Who has cards

Strand: Number

Outcomes

Students will be expected to

2N4 Continued

Achievement Indicators:

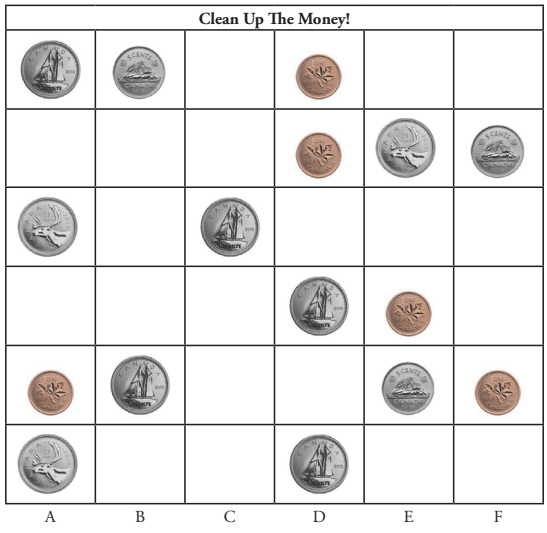
2N4.1 (Continued) Represent a given number, using concrete materials such as ten-frames and base ten materials.

2N4.6 Represent a given number using coins (pennies, nickels, dimes and quarters).

Elaborations—Strategies for Learning and Teaching

Students have used pennies, nickels, and dimes to count by ones, fives and two. Coins can also be used to represent numbers concretely. Pennies, nickels, dimes, and quarters are useful for representing numbers to 100. Students may not be aware of the value of a quarter and may need to be introduced to the concept of a quarter equaling 25 cents.

To represent given numbers using coins, play the game "Clean Up the Money". Play begins with students alternating placing a variety of quarters, dimes, nickels and pennies on the gameboard. Students use two dice, a regular die and a special die labelled (A-B-C-D-E-F). Players take turns tossing the dice and removing the coin from that space on the game board, if a coin is still there. After each turn, the student records the value of his/her coins on a recording sheet. The winner of the game is the student with the greatest value of coins when all coins have been removed from the game board.



Recording Sheet

	Player 1	Player 2	
	25	10	
	35	20	
	45	21	
	46		

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Invite students to help create a memory game for their class. Distribute two blank index cards per student, and assign a two-digit number to each student. Use rubber stamps or pictures of base ten materials and ten-frames. Ask each student to make "matching" cards – a number card showing their assigned number, and a picture card representing their number. Combine sets of cards to make a "memory game" for the class.

  (2N4.1, 2N4.3)

- Give students a collection of coins. Name a number such as 31. Ask students to find at least three different ways to represent 31 using coins. Ask them to discuss how to find all the possibilities. Making a table would help students organize their information.

Quarters	Dimes	Nickels	Pennies
			31
		1	26
	3		1

(2N1.5, 2N4.6)

- Invite pairs of students to play a barrier game. One student selects some coins. He/she tells his/her partner the number of coins they have, and the total amount of money, e.g., "I have three coins and 60¢ all together." The partner has to replicate the coins on their side of the barrier. (2N4.6)

- Ask students to find a way to represent 81 cents using:

  (i). exactly 5 coins

  (ii). exactly 11 coins

  (2N1.5, 2N4.6)

Interview

- Ask a student how many ten-frames he/she would need to represent the number 23. Ask questions such as: How many full frames will you have? Will there be any counters left over that would not fit on those frames? Continue the interview asking about other numbers.

  (2N4.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 8: Using 10s and 1s

TR: pp. 49 - 52

SB: pp. 43 - 44

Unit Centres:

TR: p. 13

- What's My Number?
- Show the Number

Lesson 9: Place Value: Tens and Ones

TR: pp. 53 - 58

SB: pp: 45 - 46

Lesson 10: Representing and Describing Numbers

TR: pp. 59 - 64

SB: p. 47

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/num-to-100.html

- "Clean Up the Money" template

Strand: Number

Outcomes

Students will be expected to

2N6 Estimate quantities to 100, using referents.

[C, ME, PS, R]

Achievement Indicators:

2N6.1 Estimate a given quantity by comparing it to a referent (known quantity).

2N6.2 Estimate the number of groups of ten in a given quantity, using 10 as a referent.

2N6.3 Select between two possible estimates for a given quantity, and explain the choice.

Elaborations—Strategies for Learning and Teaching

The ability to estimate, a key reasoning skill in mathematics, should develop with regular practice over the course of the year. In Grade One, students estimated quantities to 20, using referents (1N6). This year, they will extend their estimation skills to 100.

To develop estimation skills, students should be provided with collections of objects and asked to estimate the size of the group, using a referent. A referent, or known quantity, is useful as a benchmark or anchor in the development of estimation skills.

One strategy for using referents to improve an estimate is to know the quantity in a smaller group, and then use that knowledge to estimate the number of objects in a larger group. To estimate quantities to 100, for example, 10 is a useful referent.

Show students up to 50 items (e.g., beans, counters). Count ten of the items as a referent. Guide students' thinking in estimating by asking them, "About how many groups of ten are there? About how many beans are there?" Record student estimates. Count the total amount and determine which estimates were most reasonable. Ask students whose estimates were closest to the actual count to share how they arrived at their estimates. Lead a discussion about what makes an estimate "reasonable". Repeat this activity several times throughout the year using a variety of objects representing quantities up to 100.

Students will need to be provided with lots of opportunities to practice estimating throughout the year.

Teachers could establish an "Estimation Station". Fill a jar with items (less than 100) to display. Students make estimates throughout the week and record them. As the process continues, a known referent (another identical jar with a known quantity of the same objects) should be placed next to the jar. Encourage students to refine their estimate throughout the week using the "referent" as a guide. At the end of the week the student with the closest estimate refills the jar for the following week.

General Outcome: Develop number sense

Suggested Assessment Strategies

Journal

- Using the "Estimation Station" format, display two possible estimates for a jar full of items. Ask students to choose which estimate is most reasonable and explain their choice.

(2N6.1, 2N6.2, 2N6.3)

- In a centre, present a jar of small items, up to 100, and the following provocations:
  (i) I wonder about how many items are in the jar?
  (ii) I wonder, if I count out 10 of the items and use them as a referent, would my estimate be closer to the actual amount?
  (iii) I think it is less than (or more than) 50 because....

(2N6.1, 2N6.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 6: Estimating and Counting to 50

TR: pp. 40 - 43

SB: pp. 39 - 40

Little Book: *Jelly Bean Contest*

Lesson 7: Estimating and Counting to 100

TR: pp. 44 - 48

SB: pp. 41 - 42

Strand: Number

Outcomes

Students will be expected to

2N7 Illustrate, concretely and pictorially, the meaning of place value for numbers to 100.

[C, CN, R, V]

Elaborations—Strategies for Learning and Teaching

The early work on place-value must focus on the development of an understanding of base ten groupings and a knowledge of how these groupings are recorded. Students should notice how much easier it is to count when the numbers are grouped. As with many topics presented at this level, it is important that this development not be rushed. A later lack of understanding related to numbers can often be traced back to an improper introduction to this concept.

Base ten blocks are an efficient and valuable model, as they are proportional in size. The rod, for example, is ten times as big as the unit, and the flat is ten times as big as the rod, and one hundred times as big as the unit. This helps with developing number sense as a number such as 80 is physically ten times as big as the number 8. While the flat has been introduced, the focus here is numbers up to and including 100, but not greater than 100.

As students begin to represent larger numbers concretely and pictorially, it is important to model the correct representation of flats, rods, and units. Students may have difficulty with accurate proportions and shapes. They may use five rods, for example, to represent the number five, instead of using five units.

When working with numbers, students should always have base ten blocks and ten-frames available and be encouraged to use them to support their thinking. This consistent use of manipulatives solidifies their understanding of number.

Achievement Indicators:

2N7.1 Explain and show with counters the meaning of each digit for a given two-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).

While working with two-digit numbers, it is important to point out the difference of the values of digits in a two-digit number when the digits are the same. In the number 22, for example, the first 2 means two tens and has a value of 20. The second 2 represents two ones, and has a value of two. To reinforce this concept, use an overhead or interactive spinner labeled 11, 22, 33, ….99. Spin the spinner and ask the students to represent the number with counters, beans, macaroni, ten-frames, base ten blocks, etc. Then point to one of the digits and ask for volunteers to explain the meaning/value of that digit.

2N7.2 Count the number of objects in a given set using groups of 10s and 1s, and record the result as a two-digit numeral under the headings 10s and 1s.

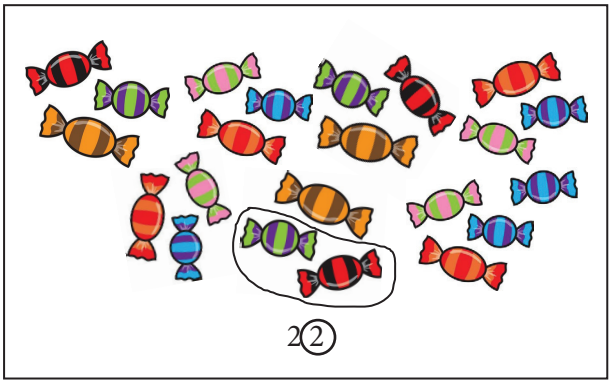
Provide place value mats, a variety of small objects for students to count, (e.g., popsicle sticks, buttons, beans), and a method of grouping the items (e.g., elastic bands, small baggies, cups). As students count ten objects, they group them as a ten using a band, baggie or cup, and move each group to the tens column on the mat. When they can no longer make a group of ten, they should record the total as a two-digit numeral under the headings 10s and 1s.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Display 22 (or 33, 44, 55, etc.) candies. Print the number below the candies. Circle one of the digits, and ask the students to circle the correct number of candies that is represented by that digit. Do the same for the other digit, and ask students to explain their thinking.



Observe students as they represent two-digit numbers, and engage them in a discussion about their responses.

(2N7.1, 2N7.2, 2N7.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 8 (Continued): Using 10s and 1s

TR: pp. 49 - 52

SB: pp. 43 - 44

Unit Centres:

TR: p. 13

- What's My Number?
- Show the Number

Lesson 9 (Continued): Place Value: Tens and Ones

TR: pp. 53 - 58

SB: pp. 45 - 46

Lesson 10 (Continued): Representing and Describing Numbers

TR: pp. 59 - 64

SB: p. 47

Strand: Number

Outcomes

Students will be expected to

2N7 Continued

Achievement Indicators:

2N7.3 Describe a given two-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.

2N7.4 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.

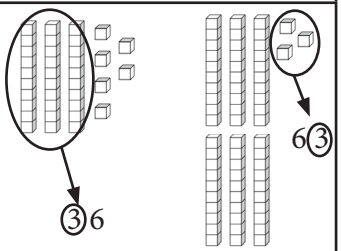
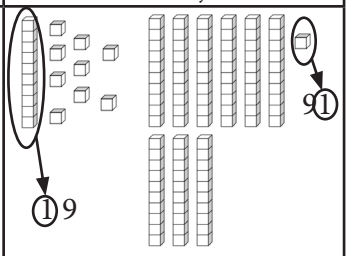
2N7.5 Illustrate, using base ten materials, that a given numeral consists of a certain number of tens and a certain number of ones.

2N7.6 Explain why the value of a digit depends on its placement within a numeral.

Elaborations—Strategies for Learning and Teaching

Ask students to find out how many ways he/she can make a given number using base ten materials. This activity is useful with respect to the regrouping in the subtraction algorithm which students will learn later in the course. Students should record their models in a journal.

Students should also be able to represent any two-digit number using ten-frames, or diagrams illustrating groups of ten. Give each student a set of number cards, 0 - 9. Each student chooses two cards and proceeds to make the smallest two-digit number, and the largest two-digit number possible. They should then explain their reasoning, and represent their numbers with ten-frames, diagrams illustrating groups of ten, or base ten blocks. To extend this activity, students should explain why the value of one of their digits depends on its placement.

Numbers	Smallest two-digit number	Largest two-digit number	My thinking!
3 and 6	36	63	 Here the 3 means 30, but over here the 3 means just 3.
1 and 9	19	91	 Here the 1 is a ten. Here the 1 is a unit.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

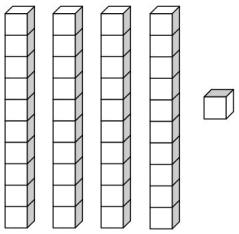
- Ask students to play "Race For a Ten". They roll a die and count out the number of unit cubes. When they get exactly ten, they trade them in for a rod. Play "Race For a Fifty"or "Race For a Hundred," using the same rules. Observe students as they play. Question them to assess their understanding of the "trading" concept.

  (2N7.3, 2N7.5)

- To play "Race for Zero", give each student five rods and one die. Students take turns rolling the die and taking away the amount shown on the die, trading blocks as necessary, until someone reaches 0. Variation: Start with a flat and use two dice to race for zero.

  (2N7.3, 2N7.5)

- Show a student:



  Ask him/her to show at least one other way of representing the same number with base ten materials.

  (2N7.3, 2N7.5)

- Give a student a number of counters. Ask him/her to make groupings of ten counters and to represent the number both symbolically and with base ten materials.

  (2N7.5)

- In a centre, present a place value mat and some base ten blocks and the following provocation:

  I wonder what I can show with these?

  (2N7.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 8 (Continued): Using 10s and 1s

TR: pp. 49 - 52

SB: pp. 43 - 44

Unit Centres:

TR: p. 13

- What's My Number?
- Show the Number

Lesson 9 (Continued): Place Value: Tens and Ones

TR: pp. 53 - 58

SB: pp. 45 - 46

Lesson 10 (Continued): Representing and Describing Numbers

TR: pp. 59 - 64

SB: p. 47

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/num-to-100.html

- template for making the smallest and largest two-digit numbers

Strand: Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to

2PR3 Demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0-100).

[C, CN, R, V]

Achievement Indicators:

2PR3.1 Determine whether two given quantities of the same object (same shape and mass) are equal by using a balance scale.

2PR3.2 Construct and draw two unequal sets, using the same object (same shape and mass), and explain the reasoning.

2PR3.3 Demonstrate how to change two given sets, equal in number, to create inequality.

2PR3.4 Choose from three or more given sets the one that does not have a quantity equal to the others, and explain why.

Elaborations—Strategies for Learning and Teaching

Balance activities form a basis for understanding equality. By working with balance scale problems, students build the foundation for further study in the area of algebra and solving equations. In Grade One, students worked with equalities and inequalities from zero to 20 (1PR3). This work will now be extended to 100.

Using concrete materials, students can examine how a balance operates like the seesaw on a playground. Place an equal sign between the two arms on the scale. This will help students begin to make the connection between the relationship of the quantities on each side of the scale and the equal sign.

This is a good time to point out that the equal sign means that what is on one side is the same, or balances, with what is on the other side. In this case, the equal sign means the same quantity is on both sides and as a result both sides have the same mass. A clear understanding of the equal sign is critical to the students' ability to solve for variables in future work. Many students incorrectly deduce that the equal sign means that the answer comes next or that they need to do something. As a result of these misconceptions, they are not able to solve for variables when the variable is placed on either side of the equal sign.

Using a balance scale, place an equal number of snap cubes on both sides. Ask students, "Is the number of cubes on each side the same?" "How do you know?" How would you know if the number of cubes on each side was not the same?" Then place an unequal number of cubes on each side of the scale and discuss how they know that the sets are unequal.

Provide students with a variety of small objects and balance scales and give them the opportunity to explore equal and unequal sets. Ask students to balance the scale in a situation where there is an unequal number on each side. Ask them how they were able to determine the answer.

General Outcome: Represent algebraic equations in multiple ways

Suggested Assessment Strategies

Journal

- Ask students to show two equal or unequal sets using counters. Ask them to draw a picture of the sets and explain how they know if they are equal or unequal.

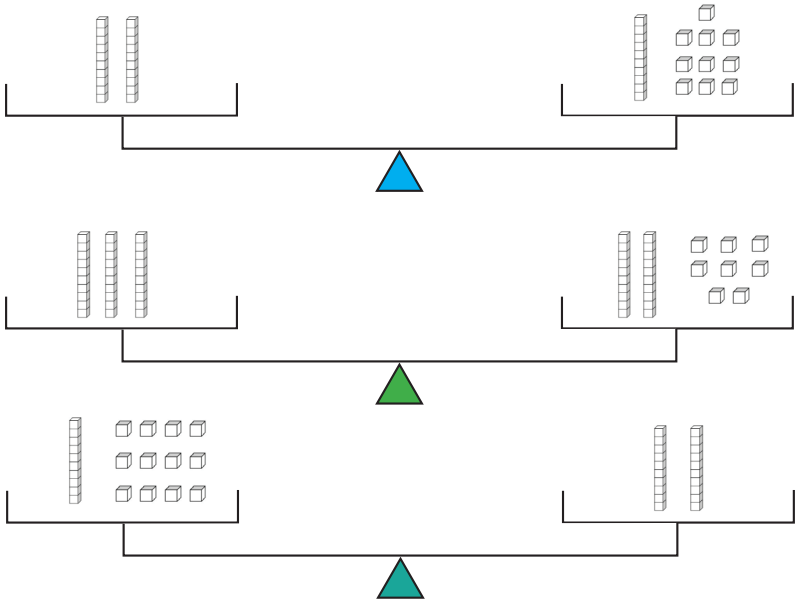
(2PR3.2)

Performance

- Using balance scales and manipulatives such as snap cubes, show the student three sets, two of which are equal and one which is not. Ask them to pick out the one that is unequal and explain why.

(2PR3.4)

- Ask students if the situations presented below are balanced and how they know. This can be done pictorially or with concrete materials. If the situation is not balanced, ask them to re-draw the balance scale the way it should look (i.e., with one side higher than the other).



(2PR3.1, 2PR3.4)

- In a centre, present a balance scale and some base ten blocks and the following provocations:
  - (i) I wonder if I can use different blocks on each side and still balance the scale?
  - (ii) I wonder if I can balance the scales using only 11 blocks?

(2PR3.1, 2PR3.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 12: Equal and Unequal Sets

TR: pp. 68 - 72

SB: pp. 50 - 52

Audio CD 2:

Selection: 8

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/num-to-100.html

- balance scales template

Strand: Number

Outcomes

Students will be expected to

2N5 Compare and order numbers up to 100.

[C, CN, ME, R, V]

Achievement Indicators:

2N5.1 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.

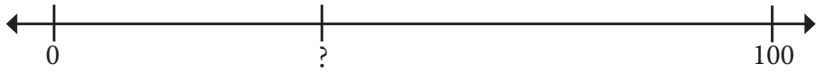
2N5.2 Identify and explain errors in a given ordered sequence.

2N5.3 Identify missing numbers in a given hundred chart.

2N5.4 Identify errors in a given hundred chart.

Elaborations—Strategies for Learning and Teaching

Students have compared and ordered numbers up to 20 (KN5, 1N5). To extend this knowledge up to 100, use a number line labeled 0 and 100 at opposite ends. Mark a point with a question mark that corresponds to a secret number. Have students estimate what number they think the question mark represents. After several guesses, guide students in folding the line in half to mark the 50 point. Fold again to mark 25 and 75. Students can use this information to modify their guesses.



Given a set of numbers to arrange in ascending order, students should be guided to consider the values of the tens place digits first, then the values of the ones place digits. Hundred charts are a familiar visual aid and should be available for students when ordering numbers,

It is important that students be able to identify and explain errors in a given number sequence. Show a number line with some numbers placed incorrectly. Have students identify the errors, explain their reasoning, and place the numbers correctly.

Randomly pull several numbers from the hundred chart, leaving gaps. Have students come up one at a time and identify a missing number. Ask "How do you know?" The student can explain their reasoning, then choose the correct number card, and return it to its correct place on the hundred chart.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Using base ten materials, ask students to show why, for example, 43 is less than 67, and to explain their reasoning.

(2N5.1)

- Provide a blank number line with endpoints 0 and 100. Give students a variety of number cards (0-100) and have them compare and order the numbers from least to greatest. Students can then use sticky notes to place the numbers on the number line. They should explain their reasoning. If any errors are made, students should discuss how they knew there was an error, and what they should do to fix it. This activity also works well with a clothes line in the classroom, and clothes pins to be used for the number cards.

(2N5.1, 2N5.2)

- In a centre, provide a walk on number line made from masking tape and a stack of sticky notes, and some pencils. Mark 0 and 100 on the number line. Provide the following provocations:
  - (i) 75 is missing. I wonder where it should be on the number line?
  - (ii) 20 is missing. I wonder where it should be on the number line?
  - (iii) 63 is missing. I wonder where it should be on the number line?

(2N5.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 13: Comparing Numbers

TR: pp. 73 - 76

SB: pp. 53 - 54

Little Book: *Numbers in Line*

Unit Centre

TR: p. 13

- Spinning Numbers

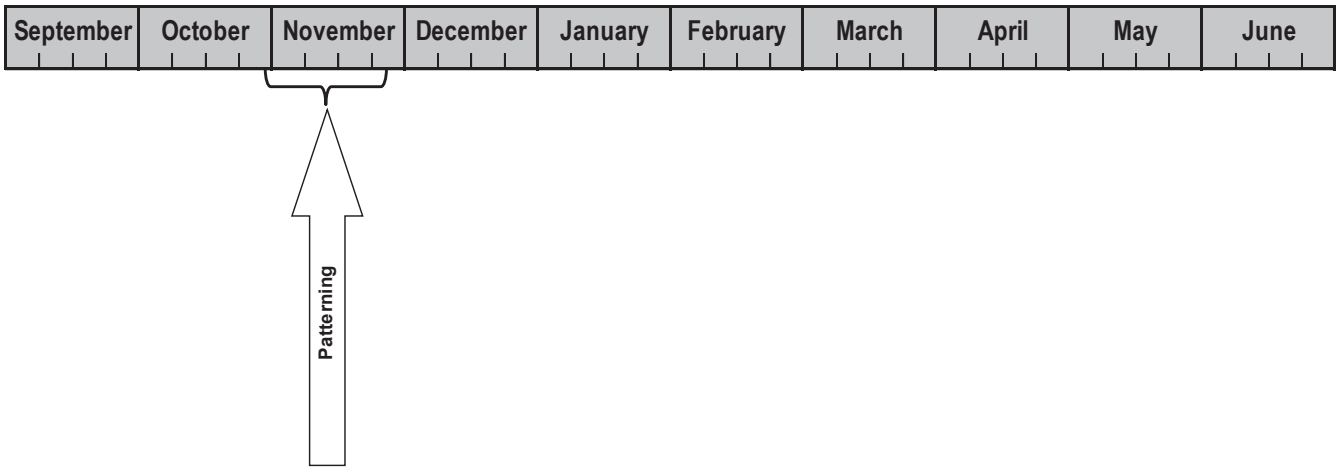
Lesson 14: Ordering Numbers

TR: pp. 77 - 81

SB: pp. 55 - 56

Patterning

Suggested Time: 3 - 3½ Weeks

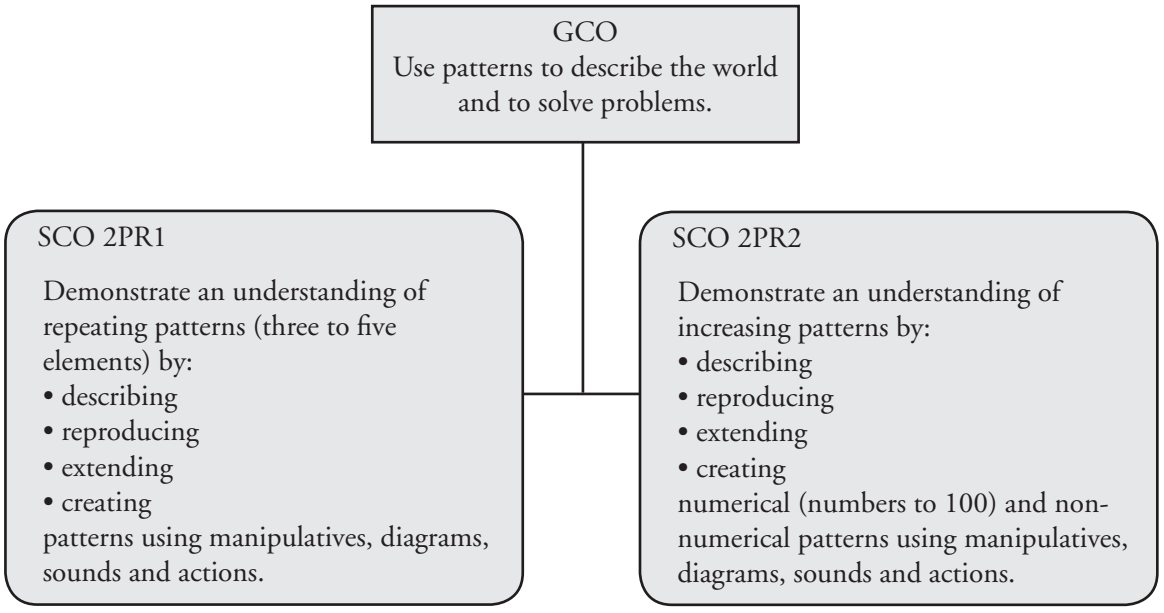


Unit Overview

Focus and Context

In Grade Two, students are formally introduced to increasing patterns. They learn that increasing patterns can be represented in a variety of ways using a variety of materials, sounds, movements or visuals. Students verbalize and communicate rules to help them understand the predictability of a pattern. As students have more experiences with this, they will begin to understand that patterns exist all around us and can be used to solve a variety of everyday problems. In Grade One, students were exposed to repeating patterns of two to four elements. This patterning concept is essential to help students understand repeating patterns as they continue to study patterning up to five elements and work with double attributes in Grade Two. Students will continue working with increasing patterns in Grade Three, but will also extend this knowledge and explore decreasing patterns as well.

Outcomes Framework



SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Patterns and Relations (Patterns)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1PR1. 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] 1PR2. Translate repeating patterns from one representation to another. [C, CN, R, V]	2PR1. 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] 2PR2. Demonstrate an understanding of increasing patterns by: • describing • reproducing • extending • creating numerical (numbers to 100) and non-numerical patterns using manipulatives, diagrams, sounds and actions. [C, CN, PS, R, V]	3PR1. Demonstrate an understanding of increasing patterns by: • describing • extending • comparing • creating numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions. [C, CN, PS, R, V] 3PR2. Demonstrate an understanding of decreasing patterns by: • describing • extending • comparing • creating numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions. [C, CN, PS, R, V]

Mathematical Processes

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

Strand: Patterns and Relationships

Outcomes

Students will be expected to

2PR1 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]

Achievement Indicator:

2PR1.1 Identify the core of a given repeating pattern.

Elaborations—Strategies for Learning and Teaching

Students have had experiences with patterns (KPR1, 1PR1). They worked with repeating patterns with two to four elements. The patterns they work with now should have three to five elements. Begin by reviewing repeating patterns, using a variety of manipulatives in a variety of ways. This may come in the form of teacher-directed, partner and independent activities. Some suggested manipulatives for creating patterns include:

- Collections of small items
- Colour tiles
- Counters
- Link-Its™
- Pattern blocks
- Rubber stamps
- Snap cubes
- Stickers

In Grade One, students transferred patterns to other modes, such as letters (1PR2). The pattern, for example, red, blue, green, red, blue, green, could be also written as ABCABC. Students in Grade Two will continue using different modes to transfer patterns, including using letters. Students may need to be reminded that the first element is always A, and the rest of the elements follow in alphabetical order unless an element is repeated, in which case the letter is repeated.
Teachers should use different strategies to activate students' prior knowledge about patterning, such as asking them to identify different patterns in their home or classroom environment.

As students identify the core of a pattern in activities throughout this unit, appropriate patterning vocabulary needs to be modelled for students, such as core (the repeating part of the pattern), and elements (the actual objects used in the pattern). These words can be added to a math word wall for easy reference. It is important to create patterns that have the core repeating at least three times, for example,

The core of this pattern is – circle, square, triangle. These are the three elements in this pattern.

The pattern below is also a three element pattern:

The core of this three element pattern is – heart (1st element), heart (2nd element), star (3rd element).

To help students identify the pattern core, they should highlight or circle the core each time it repeats. It is also important to encourage students to make predictions and extend their patterns to confirm their predictions.

Try incorporating patterning as part of morning or daily routines or as a "Problem of the Day". Use visual, auditory and kinesthetic patterns to accommodate diverse learning styles.

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

Suggested Assessment Strategies

Performance

- Ask students to play "Pattern Whackers". Display several different repeating patterns around the room or on the board. Divide the class into two teams, giving each team a fly swatter. Ask students questions based on the displayed patterns. The first team to swat the correct pattern gets one point.

(2PR1.1)

Interview

- Ask students to listen to you clap, stamp, snap, play, etc. a pattern. Ask them to identify the core and then repeat the pattern by extending it.

(2PR1.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Launch

Teacher Resource (TR): p. 19

Student Book (SB): pp. 13 - 15

Lesson 1: Describing and Extending Repeating Patterns

TR: pp. 20 - 24

SB: pp. 16 - 17

Audio CD 1:

Selections: 3 - 6

Refer to Appendix B (pp. 227 - 231) for problem solving strategies and ideas.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/pat.html

- patterning activities
- word wall ideas

Strand: Patterns and Relationships

Outcomes

Students will be expected to

2PR1 Continued

Achievement Indicators:

2PR1.2 Describe and extend a given double attribute pattern.

2PR1.3 Explain the rule used to create a given repeating non-numerical pattern.

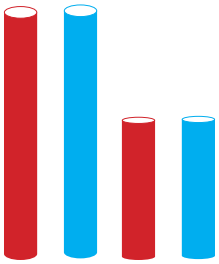
Elaborations—Strategies for Learning and Teaching

Although students have had experiences with repeating patterns in earlier grades, it is important to provide them with more challenging repeating patterns at this level.

A double attribute, or two attribute, pattern is a pattern that consists of like objects with two different attributes, such as colour and size, or shape and position. An example of like objects (2-D shapes) with two different attributes (size and shape) is:

To describe this pattern regarding size, it is an ABB pattern - small, big, big. To describe it according to shape, it is an ABCABC pattern - square, circle, triangle, square, circle, triangle.

Another example of a double attribute pattern with like objects (straws) having two different attributes (colour and length) is seen here:



Teachers could introduce double attribute patterns by using student attributes as the elements of the pattern. Students with blonde, brown and black hair, as well as, students with glasses and no glasses could be used to create a pattern. Ask students to describe the pattern and invite them to choose a classmate to extend the pattern.

Explaining is a key component of mathematical understanding. Explanations may take the form of a written, verbal or kinesthetic response. This is particularly important for students with diverse needs.

Students should be encouraged to explain their reasoning in activities by increasingly incorporating appropriate mathematical language (e.g., core and element). Keep in mind that students may explain their thinking in a variety of ways. Students should explain how the pattern is repeating by identifying the core of the pattern and the particular way the pattern repeats. To help students identify the pattern, ask students questions such as, “What comes first in your pattern?” and “What comes next?”.

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

Suggested Assessment Strategies

Performance

- As an ongoing unit activity, ask students to create a pattern booklet. Students can make a pattern booklet that includes double attribute patterns, repeating patterns, non-numerical repeating patterns, and increasing patterns. Students may leave their booklets at a math center where other students can identify the patterns.

  (2PR1, 2PR2)

- Ask students to create two different repeating patterns with between three and five elements using pattern blocks, focusing on using two attributes of the blocks.

  (2PR1.2)

Journal

- Show students a double attribute pattern. Ask students to identify the two attributes in the pattern and extend it, repeating the core at least two more times. (2PR1.1, 2PR1.2)

Paper and Pencil

- Draw a repeating pattern with three to five elements in the core. Ask students to identify the rule used to create this repeating pattern.

  (2PR1.3, 2PR1.5)

Portfolio

- Ask students to collect pictures and drawings that show repeating patterns. Students should identify the pattern and explain why it is a repeating pattern.

  (2PR1.1, 2PR1.3)

- In a centre, create a double attribute pattern and provide the following provocations:

  (i) I wonder what the next three elements would be.
  (ii) I wonder what the pattern rule is.

  (2PR1.2, 2PR1.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Describing and Extending Repeating Patterns

TR: pp. 20 - 24

SB: pp. 16 - 17

Lesson 2: Creating Repeating Patterns

TR: pp. 25 - 29

SB: pp. 18 - 19

Audio CD 1:

Selections: 7, 8

Suggested Resource

Children's Literature

- *Twizzler's Shapes and Patterns* by Jerry Pallotta

Strand: Patterns and Relationships

Outcomes

Students will be expected to

2PR1 Continued

Achievement Indicators:

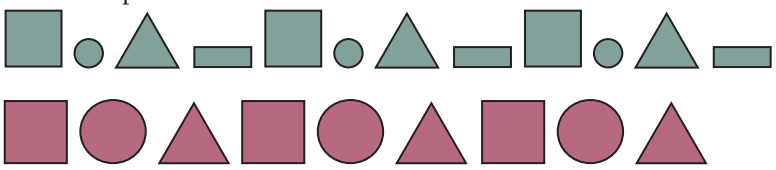
2PR1.4 Compare two given repeating patterns, and describe how they are alike/different.

2PR1.5 Create a repeating pattern where the core has three to five elements.

Elaborations—Strategies for Learning and Teaching

When comparing patterns, students should describe the similarities and differences among the

- number of elements,
- attributes of the elements, and
- core of the pattern.



Students might say that the similarities between the two patterns above are that they both have squares, circles and triangles, and they both have big squares and big triangles.

The differences between the two patterns would be the first pattern has four elements in the core and the second pattern has three elements. The first pattern also has rectangles, and big and small shapes. The second pattern does not have rectangles, and the shapes are all big.

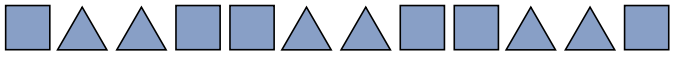
It is suggested that students first be engaged in several sessions of guided practice comparing patterns, where you model and verbalize the comparison. This can then be extended to partner work and independent work, where students are asked to communicate similarities and differences in a variety of ways.

Students should be involved in creating many forms of repeating patterns. Examples of patterns students should describe, extend, compare and create include:

- Sound Patterns

  clap, snap, tap, clap, snap, tap, clap, snap, tap
- Action Patterns

  Sit, sit, stand, hop, sit, sit, stand, hop, sit, sit, stand, hop
- Diagrams



- Manipulatives (blocks, cubes, beads, etc.)

  Red, red, yellow, blue, green, red, red, yellow, blue, green, red, red, yellow, blue, green
  This pattern is an example of a five element pattern even though red is repeated in the core.

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

Suggested Assessment Strategies

Journal

- Ask students to create two different repeating patterns. Ask them to find at least two ways in which the patterns are alike and different.

(2PR1.1, 2PR1.3, 2PR1.4, 2PR1.5)

Performance

- Provide students with the beginning of a repeating pattern. Ask them to identify the core, extend the pattern at least two more times, and create the same pattern using different manipulatives.

(2PR1.1, 2PR1.5)

- Record an auditory pattern and have students reproduce the patterns in the same or different mode, for example,

  Recorded pattern: clap, clap, snap

  Students: clap, clap, snap OR tap, tap, clap (different mode)

(2PR1.1, 2PR1.5)

- Place the following items in a zippered bag: an index card identifying a pattern core and the materials required to complete three or more repetitions of the pattern. Students are required to use the entire contents of the bag to complete the pattern.

(2PR1.5)

- Ask students to create a chant or rap with a repeating pattern. Students can use different percussion instruments to aid them.

(2PR1.5)

- In a centre, create a pattern, and provide manipulatives and the following provocations:

  (i) I wonder if I can make a pattern that is almost the same, but just a little different.
  (ii) I wonder if I can use all the same elements, but make a completely different pattern.

(2PR1.4, 2PR1.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2 (Continued): Creating Repeating Patterns

TR: pp. 25 - 29

SB: pp. 18 - 19

Strand: Patterns and Relationships

Outcomes

Students will be expected to

2PR1 Continued

Achievement Indicators:

2PR1.5 (Continued) Create a repeating pattern where the core has three to five elements.

2PR1.6 Predict an element in a given repeating pattern, using a variety of strategies.

2PR1.7 Predict an element of a given repeating pattern, and extend the pattern to verify the prediction.

Elaborations—Strategies for Learning and Teaching

Students could create a repeating pattern in an art activity, or view art where a repeating pattern is present. They could write about what they see and create. As students line up for recess, gym, etc., ask them create a repeating pattern using their own attributes.

Using the board, interactive whiteboard or overhead projector, show several examples of repeating patterns and demonstrate how to use the A, B, C method to read these patterns. Ask half of the class to close their eyes while the other half auditorily represents the pattern, (e.g., clap, stamp, snap, ...). The students with their eyes closed will then open their eyes and examine the patterns on the board or screen and decide which pattern was demonstrated.

Some of the strategies students should be encouraged to use to predict an element of a given pattern are:

- Build the pattern with manipulatives
- Identify the core of the pattern before they predict the element
- Say the pattern aloud
- Act out the pattern (if applicable)

  This can be done through teacher modelling so that students can see and hear the core.

Students should have experiences predicting missing elements within a given repeating pattern as well as at the end of the repeating pattern. It is important, however, that students practice predicting the next element in the pattern before they begin to identify the missing elements within the pattern.

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

Suggested Assessment Strategies

Presentation

- Ask students to create and design a poster/visual or a frame/border that has repeating patterns within it. This could be part of cross-curricular activity with art, social studies, or science.

(2PR1.5)

Performance

- Show students a repeating snap cube pattern with one or more elements missing. Ask them to predict the missing elements and explain their thinking. They should then create the snap cube pattern to verify their predictions.

(2PR1.5)

- Ask students to create a repeating pattern where the fifth element is a large blue square.

(2PR1.6)

- Put students in groups of four. Provide paper for recording and a collection of manipulatives, such as pattern blocks, a variety of counters, stickers or Link-its™. Ask each student to create a pattern of three to five elements using any of the materials provided. Students will record their pattern and describe their pattern rule on the back of their recording sheet or under their pattern.

  Ask students to find a pattern, similar to theirs, that another student created. Ask students: How are the patterns similar? When comparing patterns, students should describe the similarities and differences between number of elements, attributes of the elements and the core of the pattern.

  Next, ask students to find a pattern that another student created that is different from theirs. Ask students: How are the patterns different? Finally, have students choose another student's pattern and extend it by adding the next five elements. Observe and note how students explain the similarities and differences, the mathematical language used when describing patterns, and the strategies used to extend the pattern.

(2PR1.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2 (Continued): Creating Repeating Patterns

TR: pp. 25 - 29

SB: pp. 18 - 19

Unit Centre:

TR: p. 9

- Stamp It Out?

Lesson 3: Predicting Elements of a Repeating Pattern

TR: pp. 30 - 35

SB: p. 20

Unit Centre:

TR: p. 9

- Action Patterns

Strand: Patterns and Relationships

Outcomes

Students will be expected to

2PR2 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]

Achievement Indicator:

2PR2.1 Identify and describe increasing patterns in a variety of given contexts; e.g., hundred chart, number line, addition table, calendar, tiling pattern or drawings.

Elaborations—Strategies for Learning and Teaching

Increasing patterns is a new concept to Grade Two students. An increasing pattern is a "growing" pattern where each element is increasing by a specific quantity. a growing pattern involving numbers should not exceed 100. The following pattern is increasing by one each time:

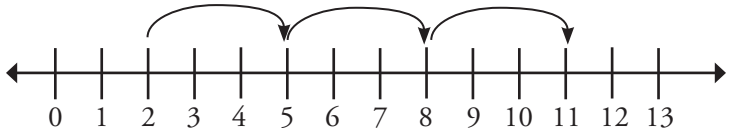
Show students how an increasing pattern is different from a repeating pattern by providing several examples and discussing each. It is common for students to sometimes be confused when the word element is used. In repeating patterns, such as AABBCAABBC each letter is an element of the pattern and the core of the pattern is AABBC. In increasing patterns, there are differing quantities within each element.

For example, F FFF FFFFF FFFFFFF

Here the pattern grows as 1, 3, 5, 7, F's in succession. F is the first element of the pattern and FFF is the second element of the pattern and FFFFF is the third element. Expose students to language that they may use when describing a pattern or pattern rule, for example, "increase", "element", "grow", "pattern". These words could be added to the math word wall. It is more important, however, to focus on students' understanding rather than on their recollection of vocabulary.

There are a variety of contexts in which increasing patterns can be demonstrated:

- *On a number line*: identify a start number and a jump number. The start number could be 2, for example, and the jump number could be 3. Students would mark the start number on the number line and then jump three places marking the number they land on each time.



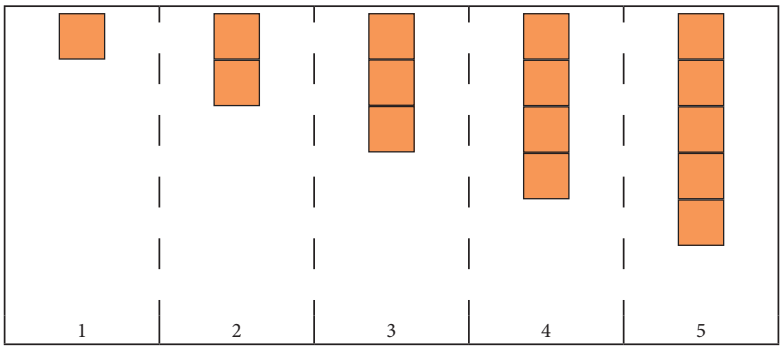
Students should be encouraged to look for the increasing pattern in these numbers.

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

Suggested Assessment Strategies

Performance

- Ask students to build a concrete increasing pattern using simple shapes and objects such as pattern blocks, coins or buttons. Next, instruct students to fold a piece of paper length wise at least 4 times to make sections for drawing. Then ask students to draw the increasing pattern in each section as shown below:



(2PR2.1)

- Ask students to form groups so that the first group has only one member, the second group has three members and the third group has five members. Students can come to the front of the class to form these groups. Have the remaining students decide how many should come up and form the fourth group so that it extends this pattern. This may require some discussion from the whole class. Ask students what would be the number of students in the fifth group. Form this group if there are enough students in the class. Ask students to return to their seats to draw a picture of the pattern they just created and record this pattern using numbers. Ask them to describe how the pattern grows. Ask students to select a manipulative and use it to replicate this pattern. Ask them to extend this pattern to the tenth element to determine how many students in all would be required. Are there enough students in your school to extend this pattern to the tenth element? How many classes of students do you think it would take to create the pattern to the tenth element? Observe and note: Are the students recognizing the pattern? Are they able to extend the pattern? Are they able to represent the pattern using pictures and numbers? Are they able to describe how the pattern grows? Are they able to replicate this pattern using other materials?

(2PR2.1, 2PR2.4)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5: Describing and Extending Increasing Patterns

TR: pp. 39 - 43

SB: p. 23

Audio CD 1:

Selection: 9

Strand: Patterns and Relationships

Outcomes

Students will be expected to

2PR2 Continued

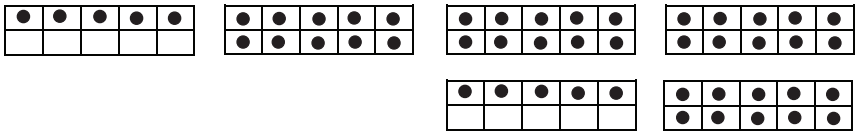
Achievement Indicators:

2PR2.1 (Continued) Identify and describe increasing patterns in a variety of given contexts; e.g., hundred chart, number line, addition table, calendar, tiling pattern or drawings.

Elaborations—Strategies for Learning and Teaching

- *On a hundred chart*: students could colour start-and-jump sequences, making a visual pattern. Students should be encouraged to investigate how patterns change when only the start number changes, or which skip counts make diagonal patterns and/or column patterns.

- *On the ten-frame*: build an increasing pattern by placing counters on the ten-frame and have students identify how the pattern is growing.



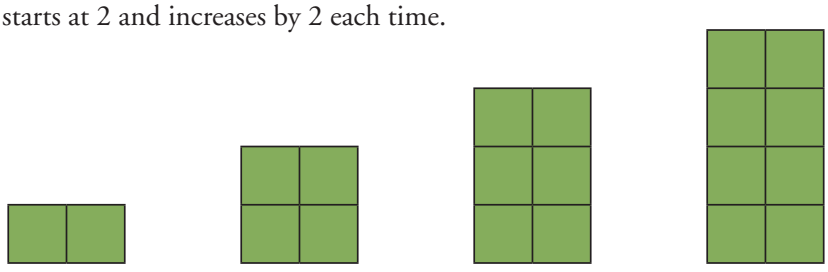
E.g., Pattern - 5, 10, 15, 20...

These ten-frames show that the numbers increase by 5 because another full row of 5 is filled each time.

- *On a calendar*: students can be shown how the days of the week form an increasing pattern of 1, by looking at the rows, and an increasing pattern of 7 by looking at the columns.

2PR2.2 Explain the rule used to create a given increasing pattern.

When describing the rule of a given increasing pattern, students should identify the starting number and how it is increasing. Without indicating this, the pattern rule is incomplete. Students should learn that a pattern rule must describe how each and every element of the pattern is increasing. The rule for the following block pattern, for example, is it starts at 2 and increases by 2 each time.



2 4 6 8

Students should be given many opportunities to explain the rules of increasing patterns.

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

Suggested Assessment Strategies

Performance

- Using a hundred chart, ask students to colour all numbers that have five. Have them describe the patterns they see. Encourage students to find other increasing patterns on the hundred chart.

  (2PR2.2)

- Using a hundred chart and counters, ask one student to cover an increasing pattern. The other students must identify what numbers are covered and then predict which number would come next. They then state the pattern rule, and record the pattern and pattern rule.

  (2PR2.2)

- In a centre, provide manipulatives, a hundred chart, paper and pencils and the following provocations:

  (i) I wonder if I can create an increasing pattern that starts with 1.

  (ii) I wonder what the pattern rule would be for my pattern.

  (iii) I wonder if I can create an increasing pattern that grows by 3 each time.

  (iv) I wonder if I can make up a pattern rule and then make a pattern that matches.

  (2PR2.1, 2PR2.2)

Journal

- Provide students with a choice of three increasing patterns. Ask students to choose a pattern and explain the rule used to create it.

  (2PR2.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5 (Continued): Describing and Extending Increasing Patterns

TR: pp. 39 - 43

SB: p. 23

Strand: Patterns and Relationships

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **2PR2 Continued** **Achievement Indicators:**	
2PR2.3 Identify and describe increasing patterns in the environment; e.g., house/room numbers, book pages, calendar, pine cones, leap years.	Patterns occur in everyday life. Give students opportunities to recognize naturally occurring patterns in their world. Throughout this unit, students should be made aware of patterns in their environment. Consider taking students on a pattern scavenger hunt around the school. Invite them to be pattern detectives, observing and recording patterns that they find. Discuss how leap years only occur every four years and predict when the next leap year will happen. Have students look for increasing patterns using the page numbers in their math books. Ask: "What do you notice about the page numbers on the left side of the book? On the right side?" Record their observations. Ask: "How is this an increasing pattern?"
2PR2.4 Determine missing elements in a given concrete, pictorial or symbolic increasing pattern, and explain the reasoning.	To help students determine missing elements of an increasing pattern, encourage students to • find the pattern rule, • find how much the number grows each time, and • make sure each element grows by the same number each time. Students can practice finding missing elements by making patterns, covering a step and asking a partner, "What's missing?". This type of activity can also be done as a whole class activity using an overhead projector or an interactive whiteboard.

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

Suggested Assessment Strategies

Portfolio

- Ask students to collect pictures or drawings of patterns, increasing and repeating, in their environment. Students may document the patterns using a digital camera. They may present their patterns with an explanation about what makes them patterns.

(2PR2.1)

Presentation

- Take students on a nature walk. Ask students to look for increasing patterns in nature. A digital camera may be used to take pictures of patterns seen, or students may draw a picture of the patterns they see. They may collect items such as leaves, pebbles, twigs, etc., and make a pattern collage with a nature theme.

(2PR2.3)

Performance

- Model a series of cube towers that demonstrate an increasing pattern. Ask students to close their eyes as one element of the pattern is removed. Students must then identify which element is missing and explain how they know that they have identified the correct tower.

(2PR2.4)

- Show students an increasing pattern that contains an error. Ask students to identify the error and explain their reasoning. Students should then recreate the pattern correctly to confirm their prediction.

(2PR2.4)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5 (Continued): Describing and Extending Increasing Patterns

TR: pp. 39 - 43

SB: p. 23

Strand: Patterns and Relationships

Outcomes

Students will be expected to

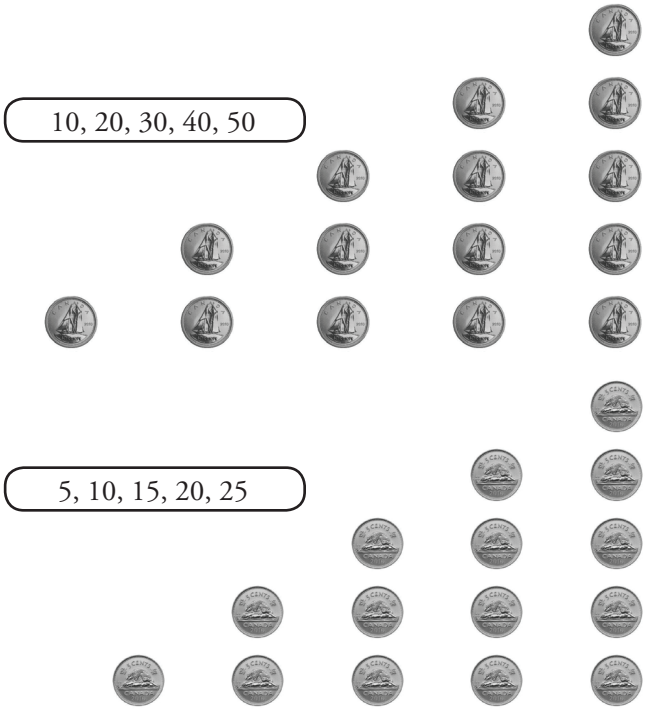
2PR2 Continued

Achievement Indicator:

2PR2.5 Represent a given increasing pattern, concretely and pictorially.

Elaborations—Strategies for Learning and Teaching

Provide task cards with increasing number patterns and have students use coins (pennies, dimes, nickels) to represent the pattern.



"As students get older, the numbers they deal with in their everyday lives become more complex. Students need strategies for representing and making sense of these greater numbers. Although it is possible to count, say, 87 items individually, it is not practical. When items are grouped, counting is made easier and probably more accurate." (Small, 2008, p. 138)

Students need many opportunities presented regularly throughout the school year to count large quantities of objects. Counting in a variety of ways (1s, 2s, 5s, 10s), as in the following activity, will further develop counting efficiency.

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

Suggested Assessment Strategies

performance

- In a centre, present a pattern using manipulatives, numbers or diagrams and provide the following provocations for students:
  (i) I wonder what the pattern rule is?
  (ii) I wonder what the next three elements would look like?
  (iii) I wonder if the same pattern could be made using something different? (The idea here is to have students transfer the pattern to a different medium. A pattern of blocks, for example, could be represented by numbers, or a pattern of numbers could be represented using coins.

(2PR2.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 4 (Continued): Counting with Money

TR: pp. 30 - 34

SB: p. 37

Strand: Patterns and Relationships

Outcomes

Students will be expected to

2PR2 Continued

Achievement Indicators:

2PR2.5 (Continued) Represent a given increasing pattern, concretely and pictorially.

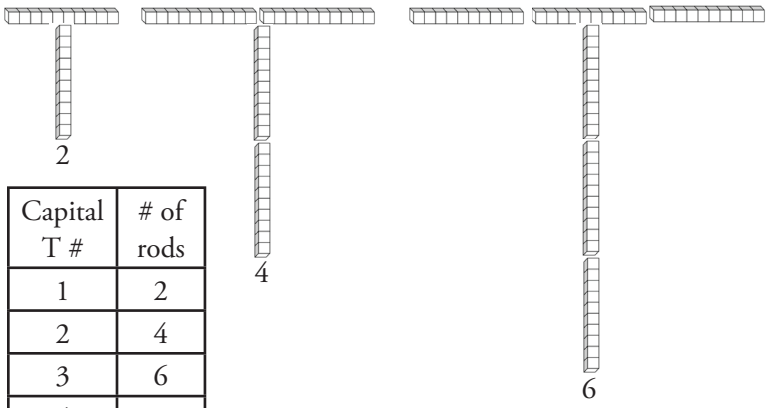
2PR2.6 Create an increasing pattern, and explain the pattern rule.

2PR2.7 Represent a given increasing pattern, using another mode; e.g., colour to shape.

Elaborations—Strategies for Learning and Teaching

Students will need many concrete experiences representing increasing patterns before they begin to represent them pictorially (using pictures, numbers and words on paper). It is suggested that teachers first create patterns as a whole class and model how to pictorially represent the given pattern.

Provide students with base ten rods. Have students make the capital letter T with two rods. Challenge them to make their letter grow bigger by using more base ten rods. Students can add one more rod to the top of the T and one to the bottom.



Capital T #	# of rods
1	2
2	4
3	6
4	
5	
6	
7	

Make it grow again by adding one more rod to the top and one more to the bottom. Ask, "How is this pattern increasing?". Have students record the numbers in a chart to show how the pattern increases. Have them make a prediction as to how big the seventh T will be if it increases by 2 each time. Challenge students by asking them to find other letters or numbers they could use to create an increasing pattern.

Students may find it easier to begin creating increasing patterns using small increments of one or two. Encourage students to first build their pattern and then record. When explaining the rule, remind students the pattern rule should state the start number and by what amount the pattern increases.

Students need to see that they are able to recreate patterns using different materials, and in different ways (modes). A student could, for example, make an increasing pattern using numbers and then show this pattern using hand clapping. 1, 3, 5

One clap, three claps, five claps …

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

Suggested Assessment Strategies

Performance

- Using pattern blocks, ask students to create and record an increasing pattern. Have them explain the rule used to create their pattern. (2PR2.6)

- Provide green pattern blocks to students working in pairs. Ask them to work together to produce an increasing pattern of triangles. (2PR2.6)

- Create a Lego design, such as a town, that includes increasing patterns. This may include things such as buildings of increasing height, cars and trucks of increasing sizes, etc.. (2PR2.1, 2PR2.5, 2PR2.8)

- Using base ten blocks, ask students to make a model of a bug. Tell them their bug comes from a family of four and each bug in the family is a "ten" bigger than the one before. Make the whole family and record how much the bug family grows each time. (2PR2.7)

- Provide the start of an increasing pattern. Ask students to continue the pattern and to describe the pattern rule. Ask students to then represent this pattern in another way, using a different mode. (2PR2.7)

- In pairs, ask students to play a barrier game where one student will clap, snap, chant, or play a pattern (increasing or repeating) and the other student has to reproduce this pattern using concrete objects. Students will then remove the barrier to check for accuracy. (2PR2.7)

- Ask students to use a given pattern in the hundred chart and represent it using a different mode, i.e., base ten blocks, snap cubes, etc. (2PR2.7)

- Ask one student to make an increasing pattern with one set of materials. Ask another student to make the same pattern using a different material. (2PR2.7)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 6: Creating Increasing Patterns

TR: pp. 44 - 49

SB: p. 24

Unit Centres:

TR: p. 9

- Extending Patterns
- Making Patterns in Different Ways

Strand: Patterns and Relationships

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **2PR2 Continued** **Achievement Indicators:**	
2PR2.8 Solve a given problem, using increasing patterns.	Give students many opportunities to solve problems using increasing patterns. For some students, this real world connection of solving problems using increasing patterns may help them to better understand this concept.
2PR2.9 Identify errors in a given increasing pattern.	Encourage students to identify the pattern rule, or state how the pattern is increasing to help identify errors in the pattern. Students can then go back to ensure each element is increasing by the stated rule. Having students identify the error is a good way to assess understanding of the pattern.

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

Suggested Assessment Strategies

Paper and Pencil

- Ask students to solve the following problem: Katie wants to make an increasing pattern out of her 20 pencils. How many different ways can Katie make an increasing pattern out of her 20 pencils? She does not have to use all of her pencils.

  (2PR2.6, 2PR2.8)

- Tell students that the first two numbers in a pattern are 5 and 10. Ask for two different ways in which the increasing pattern might be continued.

  (2PR2.6)

- Ask students to create an increasing pattern where the fourth element is 12.

  (2PR2.6)

- Ask students to create a pattern that increases, but not by the same amount each time.

  (2PR2.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

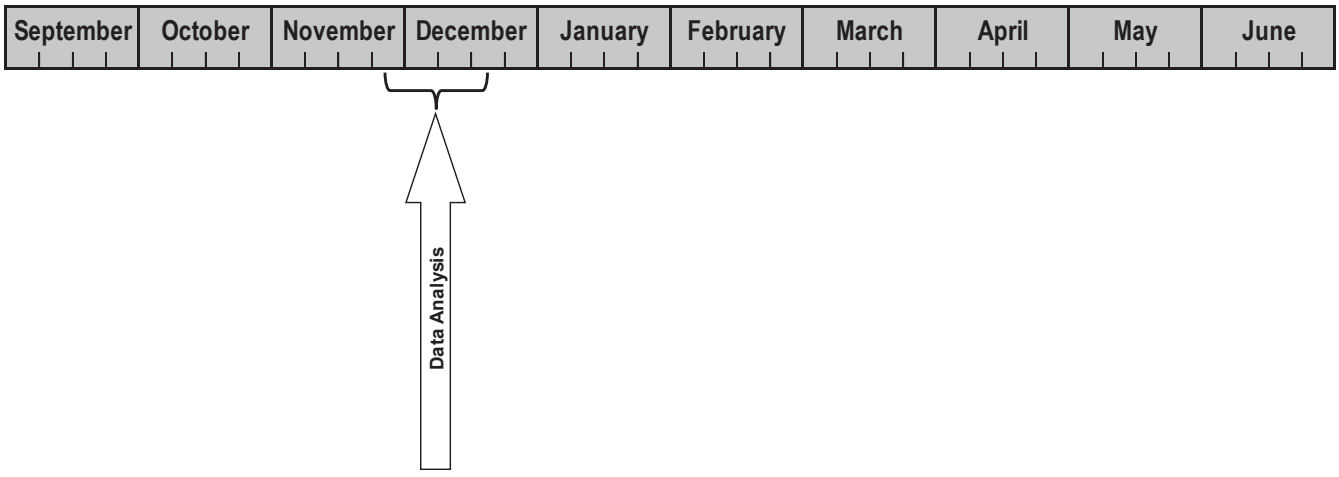
Lesson 7: Solving Problems using Increasing Patterns

TR: pp. 50 - 55

SB: pp. 25 - 26

Data Analysis

Suggested Time: 3 Weeks



Unit Overview

Focus and Context

Students should be given various opportunities throughout the year to practice their skills in data analysis. Naturally occurring seasonal changes provide many ideal opportunities (Back to School, Halloween, Christmas, etc). Data analysis can also be integrated across several curriculum areas (e.g., What activity would you prefer to play during recess today? Skipping? Freeze Tag? Soccer?). Graphing the day's weather is an effective, on-going way to reinforce data analysis skills throughout the year.

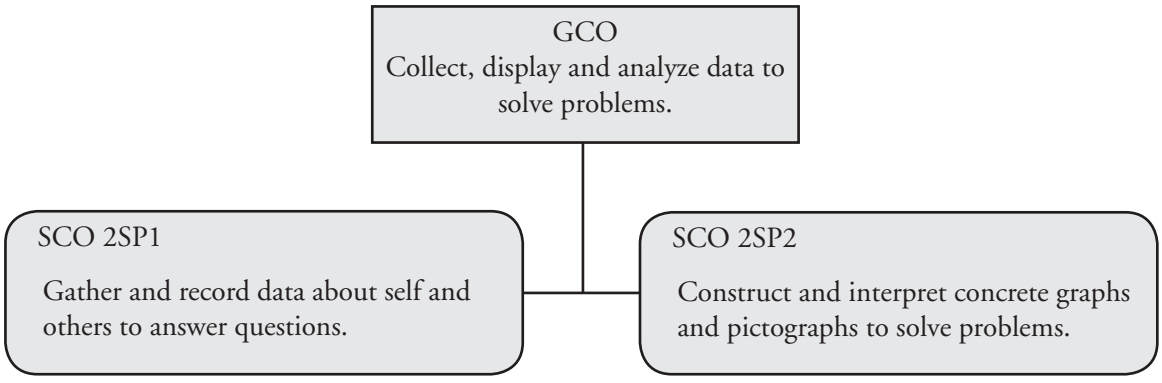
Throughout this unit, centres may be set up to allow for further investigation, discovery and practice. Hands-on, concrete, self-directed learning is a natural way for students to make discoveries about their world around them.

It would be useful to have individual math baggies accessible at all times during this unit. Each baggie could include: counters, graphing mats (horizontal and vertical), sticky notes for labelling, a variety of small manipulatives, and pencil and crayons. Students should feel free to use these materials for free exploration.

Providing a mathematics word wall is a good way to build graphing vocabulary. Words can be added as they occur in classroom activities. Consider using a simple graphic with each word to provide additional support. Use word walls frequently to reinforce concepts.

Data collection is meant to be used as a tool to answer questions or solve problems, rather than an end in itself.

Outcomes Framework



SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Statistics and Probability		
Specific Outcomes	Specific Outcomes	Specific Outcomes
	2SP1. Gather and record data about self and others to answer questions. [C, CN, PS, V] 2SP2. Construct and interpret concrete graphs and pictographs to solve problems. [C, CN, PS, R, V]	3SP1. Collect first-hand data and organize it using: • tally marks • line plots • charts • lists to answer questions. [C, CN, PS, V] 3SP2. Construct, label and interpret bar graphs to solve problems. [C, PS, R, V]

Mathematical Processes

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

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

2SP1 Gather and record data about self and others to answer questions.

[C, CN, PS, V]

Achievement Indicators:

2SP1.1 Formulate a question that can be answered by gathering information about self and others.

2SP1.2 Organize data as it is collected, using concrete objects, tallies, check marks, charts or lists.

2SP1.3 Answer questions, using collected data.

Elaborations—Strategies for Learning and Teaching

This is students' first exposure to data analysis in Math. A journal activity could be used to assess students' background knowledge of data analysis. This can guide your instruction throughout this unit. Ask, for example," What do you know about graphs?" "When do we use graphs?" "Why do we use graphs?" "What does a graph look like?" "Draw a graph and tell about it."

When students formulate questions of interest to themselves, the data they gather will be more meaningful. Encourage students to start with questions that require a yes/no answer as this data is much easier to collect and organize, for example, "Do you have a pet?"

Graphs using real objects to represent the data are called concrete graphs. Students should first be introduced to graphs that are arrangements of the actual objects being sorted. Later, other concrete materials can be used to represent the real objects. Representational objects such as clothes pins or cubes can be used to answer the question. Ask for example, "What colour are your eyes?" Have students show the data in a concrete way using representational objects, such as clothes pins attached to brown, blue, and green ribbon, or brown, blue or green cubes stacked on a table.

It is suggested to go beyond classroom limits when formulating questions and gathering data. When appropriate, surveying neighbouring classes, parents, and siblings can be a great source of information.

When meaningful questions are generated, and data is collected, students' organization of the data will be more purpose-driven. The method of data collection and organization should suit the question Before students start to collect their data, they should be aware of the importance of giving their data an appropriate title and using appropriate labels. The titles and labels should then be used when creating graphs.

At this point, questions should be geared towards data collected in concrete form. This understanding will form the foundation for further investigation using concrete graphs and pictographs.

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

Suggested Assessment Strategies

Performance

- Using a large floor graph, ask students to stand on the floor graph labeled "long sleeves" and "short sleeves" to answer a simple question about themselves: Are you wearing long sleeves or short sleeves? A masking tape grid or marked lines on a solid colour shower curtain or sheet of plastic make good floor graphs.

(2SP1.1)

- Sometimes previously collected data can answer new questions. Encourage students to generate other questions they could answer if they knew, for example:
  - The number of students in the class, and the number of girls in the class;
  - The number of students who bought milk for recess, and the number of boys who bought milk for recess;
  - The number of students in the class, and the number of students who have a pet. Discuss why this information may not be used to determine the number of pets owned by students in the class.

(2SP1.1)

Observation

- Listen to students as they discuss each other's graphs. Make note of the types of questions they ask, and the similarities and differences that they discover.

(2SP1.1, 2SP1.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Launch

Teacher Resource (TR): p. 11

Student Book (SB): pp. 189 - 191

Lesson 1: Exploring Concrete Graphs

TR: pp. 12 - 15

SB: p. 192

Lesson 2: Creating and Interpreting Concrete Graphs

TR: pp. 16 - 20

SB: p. 193

Refer to Appendix B (pp. 227 - 231) for problem solving strategies and ideas.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/data-an.html

- suggestions for data collection
- word wall ideas

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

2SP2 Construct and interpret concrete graphs and pictographs to solve problems.

[C, CN, PS, R, V]

Achievement Indicators:

2SP2.1 Determine the common attributes of concrete graphs by comparing a given set of concrete graphs.

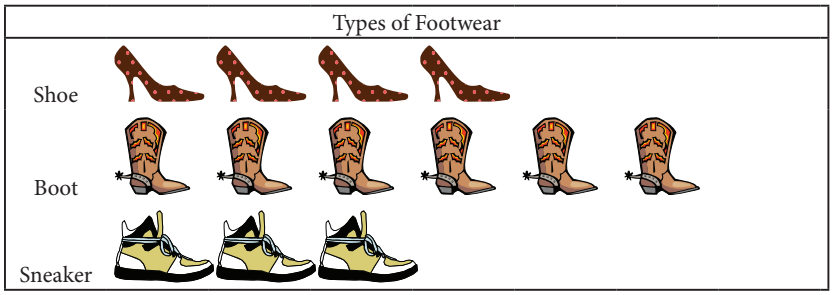
2SP2.2 Answer questions pertaining to a given concrete graph or pictograph.

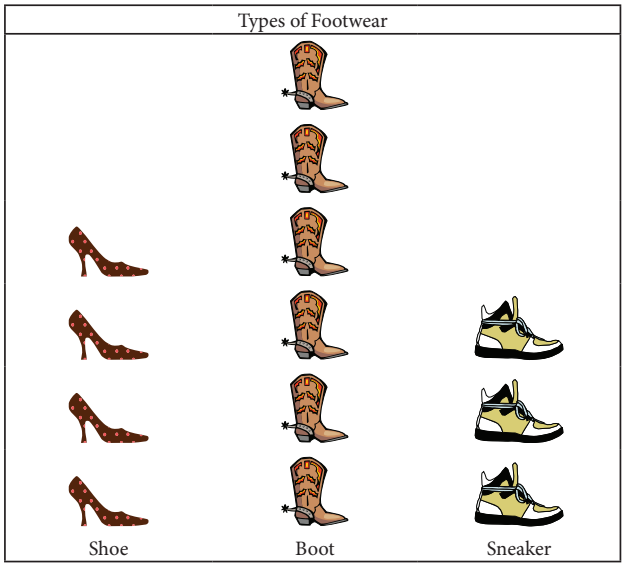
Elaborations—Strategies for Learning and Teaching

When constructing concrete graphs and pictographs, model and discuss the importance of aligning objects accurately.

When interpreting concrete graphs and pictographs, model good questions that require students to think on both a literal level, "How many people prefer sneakers? How many people prefer boots?" and on an interpretive/evaluative levels, "How many more boots than shoes are there?" and "Three more people bought footwear. Now there are the same number of shoes and sneakers. How many people bought sneakers?" When answering questions about data, encourage students to provide support for their answers by referring to the data, e.g., "I know... because... ."

It is important to draw students' attention to the different layouts or formats of graphs. Some graphs are horizontal, others are vertical. It would be helpful to show the same data in two different formats.





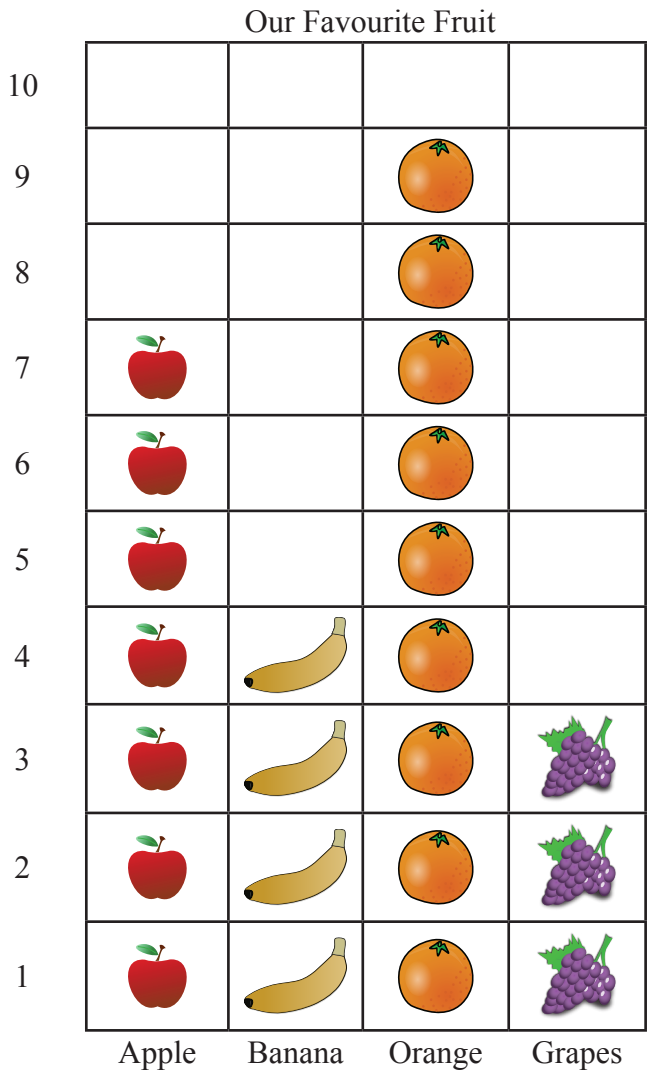
Encourage students to discuss the similarities and differences that they can see between the graphs.

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

Suggested Assessment Strategies

Paper and Pencil

- Provide students with the following completed pictograph:



Use the graph Our Favourite Fruit. Ask students to write all the questions they can about the data displayed on the graph. As a class, answer the questions generated.

(2SP2.2, 2SP2.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Exploring Concrete Graphs

TR: pp. 12 - 15

SB: p. 192

Lesson 2 (Continued): Creating and Interpreting Concrete Graphs

TR: pp. 16 - 20

SB: p. 193

Suggested Resources

Children's Literature

- *The Great Graph Contest* by Loreen Leedy

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/data-an.html

- sample pictographs
- template for "Our Favourite Fruit"

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

2SP2 Continued

Achievement Indicators:

2SP2.3 Determine the common attributes of pictographs by comparing a given set of pictographs.

2SP2.4 Create a concrete graph to display a given set of data, and draw conclusions.

2SP2.5 Create a pictograph to represent a given set of data, using one-to-one correspondence.

Elaborations—Strategies for Learning and Teaching

Students relate best to hands-on, concrete activities. It is strongly suggested that initial concrete graphing experiences be as physically engaging as possible. If classroom space does not permit, an alternative would be to use the gymnasium space for whole-group graphing.

Have the students arrange themselves on a floor graph according to shoes with laces or Velcro shoes. Take a photo of the graph created by the students. Display the photo allowing students to see themselves from a different viewpoint. It is often difficult for students to see the whole picture when they are standing in the middle of the graph. Viewing a photo will give a deeper understanding of the graph they created.

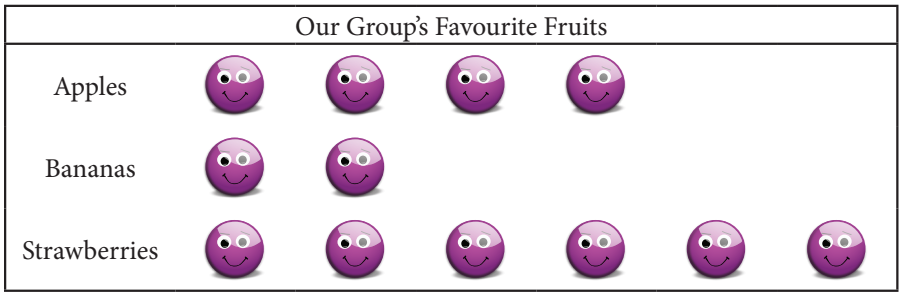
Graphs using pictures or symbols to represent the data are called pictographs. Sometimes the same symbol can be used throughout to represent the data. Other times, different symbols can be used to represent different elements of the data.

There are many ways to create pictographs. As an introduction to this type of graph, some suggestions are

- magnetic board and pictures,
- felt board and pictures,
- cutting pictures out of magazines, and
- using students' photos.

Give students a set of pictographs and encourage them to discuss the similarities and differences that they can see among the graphs.

Students enjoy making a pictograph using photographs of themselves to represent the data. A pictograph can also be created using the same symbol, for example a happy face, to represent the data.



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

Suggested Assessment Strategies

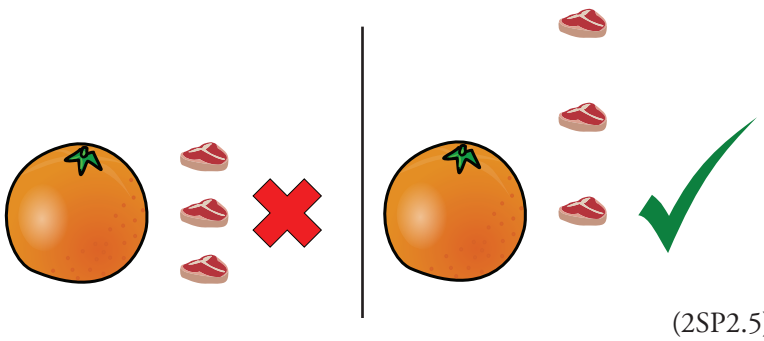
Performance

- Read a book about sisters and brothers, such as *A Very Special Sister* by Dorothy Hoffman Levi. Ask students to construct a pictograph to show how many sisters each student in the class has. Provide students with a variety of materials for collection and recording of data (i.e., blank paper, graph paper, sticky notes, linking cubes, chain links, or crayons). Students should decide individually how best to collect the data, and be given ample time to do so. Have class lists available so that the students can keep track of their classmates who have been surveyed. After the students have collected their data, let them decide how best to record and present their data. Encourage students to ask questions such as, "What does this graph show?", "Which graph best shows how many sisters each of us has?" Which graph do you think is easiest to read?" These questions are not intended to imply that one display is best. Rather, the questions help the students realize that different graphs have different advantages. Encourage students to justify their choices by explaining why they chose a particular graph.

  This activity could be repeated to find out how many brothers each student has, and extended to find out the number of siblings each student has. If no student suggests combining the two sets of data, prompt them by asking questions such as, "Could our data collected in our previous two graphs help us to answer this question?"

  (2SP2.4, 2SP2.5)

- Using grocery store flyers, ask students to create graphs of food groups. Ask students to cut out pictures of meats, fruits, vegetables, etc., and graph them according to category. This is an excellent opportunity to discuss why objects need to be aligned correctly on a pictograph. A large picture of an orange, for example, should not look equal to three smaller pictures of meat.



(2SP2.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Exploring Concrete Graphs

TR: pp. 12 - 15

SB: p. 192

Lesson 2 (Continued): Creating and Interpreting Concrete Graphs

TR: pp. 16 - 20

SB: p. 193

Unit Centres:

TR: p. 9

- Our Concrete Graphs
- Sort and Graph

Lesson 3: Interpreting Pictographs

TR: pp. 21 - 23

SB: pp. 194 - 195

Little Book: *Zoo Animals*

Lesson 4: Creating and Comparing Pictographs

TR: pp. 24 - 28

SB: p. 196

Suggested Resource

Children's Literature

- *A Very Special Sister* by Dorothy Hoffman Levi

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

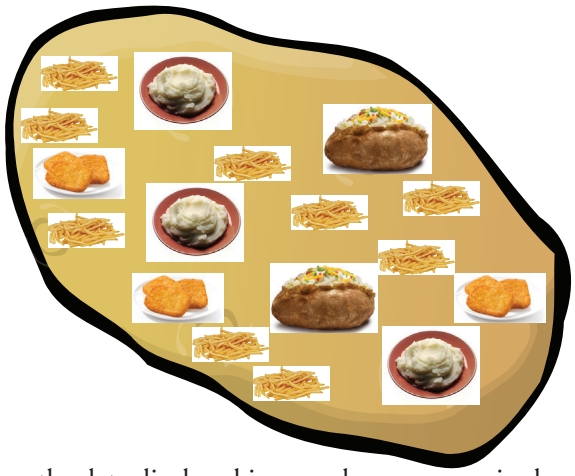
2SP2 Continued

Achievement Indicator:

2SP2.6 Solve a given problem by constructing and interpreting a concrete graph or pictograph.

Elaborations—Strategies for Learning and Teaching

Bring a potato in a paper bag, and ask students to try to identify this mystery object by asking you yes/no questions about its attributes. Once the students have guessed the mystery item, brainstorm a list of ways that potatoes can be prepared. Choose three or four of these suggestions and have students choose their favourite type of prepared potato (mashed, fries, baked, hash browns). Give students a sticky note to draw a picture to represent their choice. Have students stick their picture on a large, prepared potato made from butcher paper.



Discuss the data displayed in a random, unorganized manner. This discussion should lead students to suggest organizing the data more clearly. Suggestions may include

- displaying data on a chart with headings,
- groups of ten circled on a chart,
- horizontal pictograph with data shown on sticky notes,
- vertical graph using cubes to represent the data,
- vertical object graph with clothespins to represent the data, or
- tally chart.

Students should further organize this data by constructing their own pictographs. In their journals, students could write all that they know about the graph they constructed using prompts such as the following:

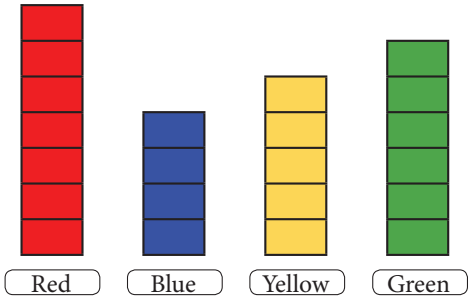
- ____ was the most/least popular.
- ____ had the most/least votes.
- Students liked _____ more than ____.

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

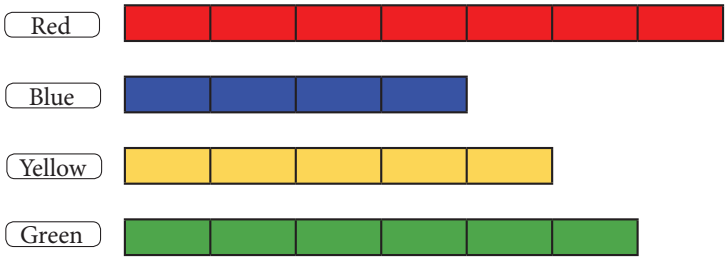
Suggested Assessment Strategies

Performance

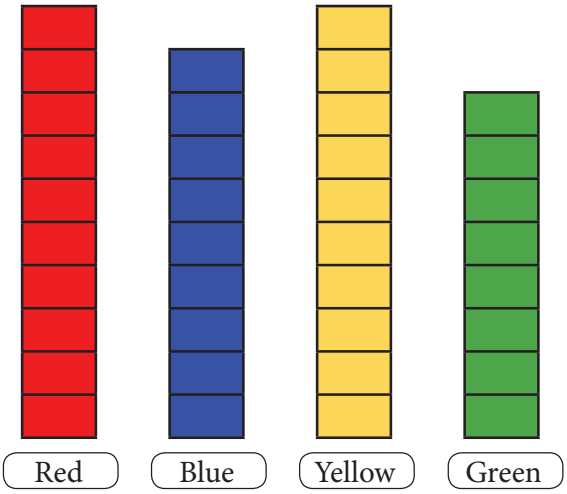
- Divide students into groups of three or four. Provide about 40 multi-link cubes of four colours mixed together in one tub. Ask students to take a large handful of blocks and organize their blocks next to the appropriate colour card, as shown:



It would be beneficial to engage students in a discussion about displaying data both horizontally and vertically. Ask students to also create a horizontal concrete graph using the same data, as indicated:



Each group will combine their data to create a large pictograph to display the class' combined data.



Ask students to pose questions about the pictograph and answer the questions as a class.

(2SP1.1, 2SP1.2, 2SP1.3, 2SP2.2, 2SP2.4, 2SP2.5, 2SP2.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3 (Continued): Interpreting Pictographs

TR: pp. 21 - 23

SB: pp. 194 - 195

Lesson 4 (Continued): Creating and Comparing Pictographs

TR: pp. 24 - 28

SB: p. 196

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

2SP2 Continued

Achievement Indicator:

2SP1.2 (Continued) Organize data as it is collected, using concrete objects, tallies, check marks, charts or lists.

Elaborations—Strategies for Learning and Teaching

When creating charts and lists, it is important to provide tables to ensure proper alignment of data. This will guard against misrepresentation of data caused by varying penmanship and sizes of students' printing.

Provide chart paper with the words to the song "Row, Row, Row Your Boat". Below the words, make a separate vertical chart listing each word that occurs in the song:

Row, row, row your boat Gently down the stream. Merrily, merrily, merrily merrily, Life is but a dream.			
row	|||	merrily	
your	|	life	
boat	|	is	
gently		but	
down		a	
the		dream	
stream			

After singing the song a couple of times as a group, engage the students in creating a tally to represent how often each word occurs in the song. Ask students what questions can be answered from the data collected. This activity can be repeated throughout the year using any poem or song. Ask students to create a similar chart to reinforce this outcome on a regular basis.

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

Suggested Assessment Strategies

Journal

- The following self-assessment chart could be used as a component of overall student assessment.

Put a checkmark (√) in the box that describes your work.			
	Yes, on my own.	Yes, with help.	Not yet.
1. I can make a concrete graph.			
2. I can make a pictograph.			
3. I can answer questions about a graph.			
4. I can make a tally chart.			
5. I can solve a problem by making a graph.			
6. I can make up questions for a survey and show what people answer.			

(2SP1.1, 2SP1.2, 2SP1.3, 2SP2.2, 2SP2.4, 2SP2.5, 2SP2.6)

Performance

- What difference does a day make? Create a pictograph to answer a question such as "What colour socks are you wearing today?" After completing the graph and discussing the data, ask students: "Would this graph stay the same tomorrow? Why or why not?" Discuss graphs that would remain the same such as, Our Class Pets, Hair Colour, Eye Colour, Birthday Month, etc.

(2SP2.6)

- Display a variety of concrete graphs and pictographs around the classroom. Invite students to go on a gallery walk with you. Have students choose a graph to stand by. Taking turns, each student gives one piece of data represented by the graph they have chosen. The data can be a direct statement, e.g., "This graph shows four people like bananas.", or the data can be a comparison statement, e.g., "This graph shows that more people like oranges than apples.".

(2SP2.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3 (Continued): Interpreting Pictographs

TR: pp. 21 - 23

SB: pp. 194 - 195

Lesson 4 (Continued): Creating and Comparing Pictographs

TR: pp. 24 - 28

SB: p. 196

Lesson 6: Exploring Collecting Data

TR: pp. 32 - 35

SB: pp. 199 - 200

Unit Centre:

TR: p. 9

- Using Tallies

Lesson 7: Collecting Data Using Charts and Lists

TR: pp. 36 - 41

SB: pp. 201 - 202

Unit Centre:

TR: p.9

- My Question Is…

Investigation 4: Turtle Tank

TR: pp. 45 - 49

SB: pp. 205 - 216

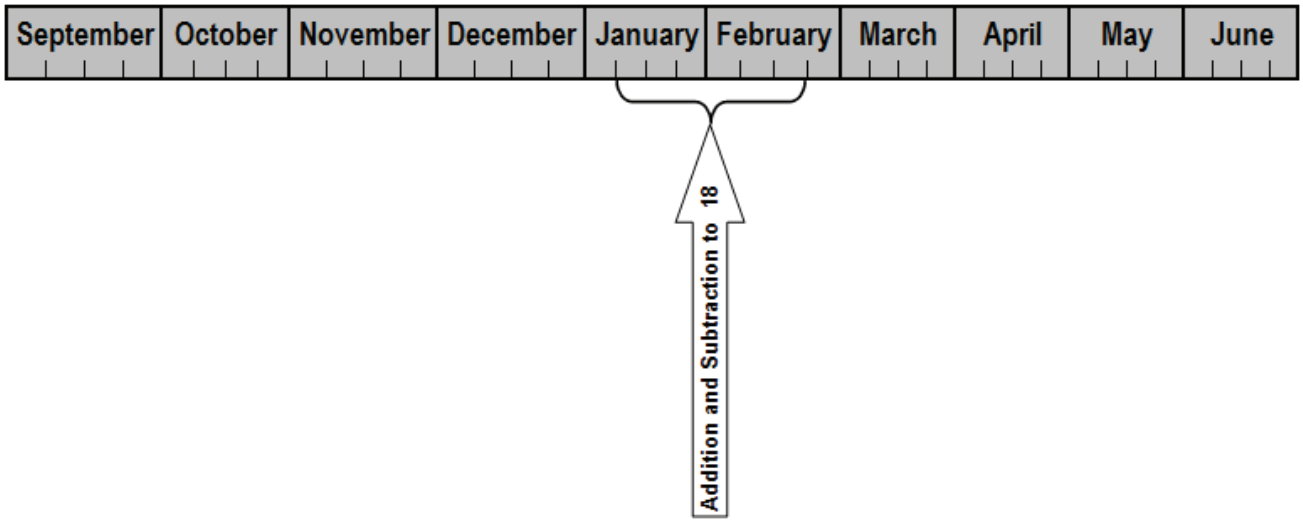
Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/data-an.html

- template for self-assessment

Addition and Subtraction to 18

Suggested Time: 6 Weeks

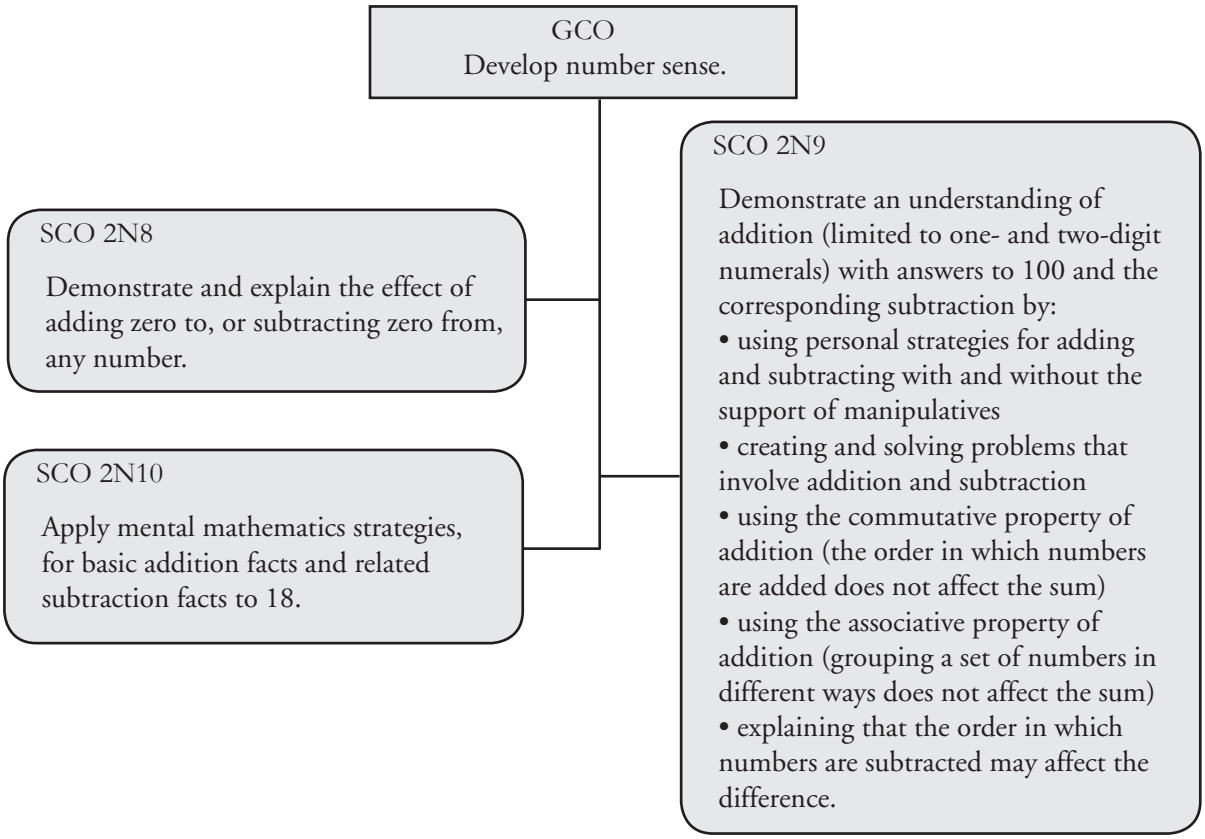


Unit Overview

Focus and Context

In Grade One, students had many opportunities to develop a strong sense of numbers to 20. A good understanding of number provides a foundation for learning to compute. Students have had experience composing and decomposing numbers and started to develop their own personal strategies for addition and subtraction. This work continues in Grade Two, as students first work on addition and subtraction to 18 and then go on to work with adding and subtracting numbers to 100 where they apply mental math strategies they are developing. They will use a variety of models and manipulatives such as number lines, ten-frames and base ten blocks to model part-part-whole relationships, adding to, taking away from, and comparing inequality situations. Students will develop understandings of the meanings of addition and subtraction and strategies to solve such problems. Having students explore a variety of strategies to add and subtract before introducing them to standard algorithms will enable them to meaningfully construct a strong sense of number. While students' strategies may very closely resemble the standard algorithms, this beginning work sets the stage for learning and understanding these more traditional ways of computing.

Outcomes Framework



GCO
Use patterns to describe the world and to solve problems.

SCO 2PR4

Record equalities and inequalities symbolically, using the equal symbol or the not equal symbol.

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1N7. Identify the number, up to 20, that is: • one more • two more • one less • two less than a given number. [C, CN, ME, R, V]	2N8. Demonstrate and explain the effect of adding zero to, or subtracting zero from, any number. [C, R]	3N6. Describe and apply mental mathematics strategies for adding two two-digit numerals. [C, CN, ME, PS, R, V] 3N7. Describe and apply mental mathematics strategies for subtracting two two-digit numerals. [C, CN, ME, PS, R, V]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1N8. Demonstrate an understanding of addition of numbers with answers to 20 and their corresponding subtraction facts, concretely, pictorially and symbolically, by: • using familiar 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] 1N9. Describe and use mental mathematics strategies for basic addition facts and related subtraction facts to 18. [C, CN, ME, PS, R, V]	2N9. Demonstrate an understanding of addition (limited to one- and two-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 • using the commutative property of addition (the order in which numbers are added does not affect the sum) • using the associative property of addition (grouping a set of numbers in different ways does not affect the sum) • explaining that the order in which numbers are subtracted may affect the difference. [C, CN, ME, PS, R, V] 2N10. Apply mental mathematics strategies for basic addition facts and related subtraction facts to 18. [C, CN, ME, PS, R, V]	3N8. Apply estimation strategies to predict sums and differences of two two-digit numerals in a problem-solving context. [C, ME, PS, R] 3N9. Demonstrate an understanding of addition (limited to one-, two- and three-digit numerals) with answers to 1000, and the corresponding subtraction, concretely, pictorially and symbolically, by: • using personal strategies for adding and subtracting with and without the support of manipulatives • creating and solving problems in context that involve addition and subtraction of numbers. [C, CN, ME, PS, R, V] 3N10. Apply mental mathematics strategies and number properties, in order to understand and recall basic addition facts and related subtraction facts to 18. [C, CN, ME, PS, R, V]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
		3N11. 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]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
		3N12. Demonstrate an understanding of division (limited to division related to multiplication facts up to 5 × 5) 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. [C, CN, PS, R] 3N13. 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]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Patterns and Relations (Variables and Equations)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1PR4. Record equalities using the equal symbol (0 to 20). [C, CN, PS, V	2PR4. Record equalities and inequalities symbolically, using the equal symbol or the not equal symbol. [C, CN, R, V]	3PR4. Solve one-step addition and subtraction equations involving symbols representing an unknown number. [C, CN, PS, R, V]

Mathematical Processes

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

Strand: Number

Outcomes

Students will be expected to

2N9 Demonstrate an understanding of addition (limited to one- and two-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 (commutative property)**
- **explaining that the order in which numbers are subtracted may affect the difference.**

[C, CN, ME, PS, R, V]

Achievement Indicator:

2N9.1 Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.

Elaborations—Strategies for Learning and Teaching

In Grade One, students learned to add and subtract, with answers to 20, concretely, pictorially and symbolically (1N8). In Grade Two, students first review addition and the corresponding subtraction of one-digit and two-digit numbers with answers to 18. Addition with answers to 100 and the corresponding subtraction will be covered in the next unit.

To help students develop a mastery of addition and subtraction of numbers to 18, students should be involved in activities where they are modelling, acting out, building, drawing, and hearing appropriate math language while they are engaged in creating and solving number stories and sentences. New vocabulary words can be added to the math word wall to reinforce the use of appropriate terminology, which may include: together, part, sum, difference, add, subtract, take away, addend, minuend, subtrahend.

When possible, use children's literature to create addition and subtraction problems. Alternately, have students use their favourite stories to create problems. They may be given time to dramatize the books and the addition/subtraction situation. Their presentations can involve problems for their classmates to solve.

As students create their own number stories they may use different materials, such as snap cubes, ten-frames, Link-its™, toys, other students, etc., to model the situation. As they begin to develop a concrete understanding of the concept of addition and subtraction, using these concrete materials may help students to more successfully record the process symbolically.

Story boards may also be one way to help students model addition and subtraction situations using materials as they create their own number stories and related sentences. From the book, *Perfect Snow* by Barbara Reid, for example, students can create their own number stories and related number sentences based on the illustrations.

From *Perfect Snow* by Barbara Reid © 2009

General Outcome: Develop number sense

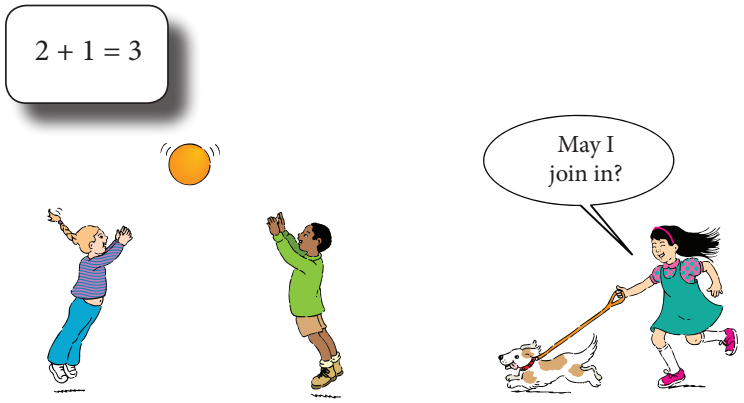
Suggested Assessment Strategies

Performance

- Show students a story board that depicts an addition or subtraction situation. Ask them to create, model and record a number story and sentence that reflects the visual.

(2N9.1)

- Present groups of students with cards stating number sentences. Give students some time to plan, then act out, a short story that could be represented by their number sentence.



(2N9.1)

Journal

- Show students a simple addition or subtraction sentence either in vertical or horizontal forms. Ask them to draw a picture to represent this addition/subtraction sentence. Students may also wish to write/talk about how their picture represents the number sentence.

(2N9.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Launch:

Teacher Resource (TR): p. 19

Student Book (SB): pp. 59 - 61

Lesson 1: Creating and Solving Number Problems

TR: pp. 20 - 23

SB: pp. 62 - 63

Refer to Appendix B (pp. 227 - 231) for problem solving strategies and ideas.

Suggested Resource

Other curriculum resources

- *Perfect Snow* by Barbara Reid (Science 2)

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/add-sub-18.html

- videos and songs
- addition and subtraction games
- word wall ideas

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

2N8 Demonstrate and explain the effect of adding zero to, or subtracting zero from, any number.

[C, R]

Achievement Indicators:

2N9.2 Solve a given problem, using horizontal and vertical forms.

2N8.1 Add zero to a given number, and explain why the sum is the same as the addend.

2N8.2 Subtract zero from a given number, and explain why the difference is the same as the given number.

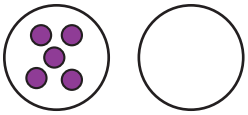
Elaborations—Strategies for Learning and Teaching

As students become more comfortable creating their own number stories and solving others, they begin to record the related number sentences. It is strongly encouraged that students be exposed to, and use, both horizontal and vertical forms of recording number sentences.

Students may begin using zero in their number stories and sentences at the beginning of this unit of work. Although this concept reappears in later work in the unit, it may be necessary to discuss with students the effect of adding and subtracting zero at this time. Students should recognize that zero has a value, but when added to or subtracted from a number, there is no effect.

When discussing the concept of adding zero to and subtracting zero from a number, the value of zero should be emphasized. Using manipulatives and the part-part-whole concept, it may be helpful to show two parts with one part being empty. Simple real life story problems would be a good tool to illustrate the effect of adding or subtracting zero from a number. Sometimes students may think that when you add a number the sum must change and when subtracting a number, the difference must be less.

Using dot plates, show students a plate representing 5. Show students other plates with different numbers and have them name the number. Show them a plate with no dots, zero, where they will see that zero is a number but it means there are no dots on the plate.



5 0

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance:

- Prepare a die by covering one side with a label and marking it with "0". Invite students to play a game involving rolling a die to determine how many spaces to move. When zero is rolled, their game piece will have to stay in the same space. Discuss with students why zero means not moving on the game board.

(2N8.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Creating and Solving Number Problems

TR: pp. 20 - 23

SB: pp. 62 - 63

Audio CD 2:

Selection: 9

Unit Centre:

TR: p. 17

- Creating Number Problems

Activity Bank:

TR: p. 29

- Storyteller
- Cross the River

Lesson 2: Relating Addition and Subtraction

TR: pp. 24 - 27

SB: pp. 64 - 66

Strand: Number

Outcomes

Students will be expected to

2N8 Continued

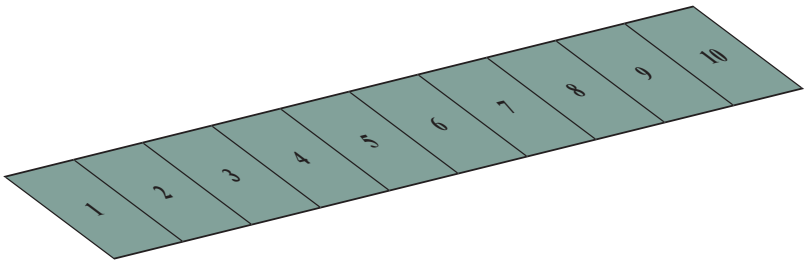
Achievement Indicators:

2N8.1 (Continued) Add zero to a given number, and explain why the sum is the same as the addend.

2N8.2 (Continued) Subtract zero from a given number, and explain why the difference is the same as the given number.

Elaborations—Strategies for Learning and Teaching

When zero is added to a number, the number does not change. A useful model to reinforce this concept is to use a "walk on" number line. You can make a walk on number line using a shower curtain and a permanent marker or masking tape on the floor.



Have students perform the operations as you call out number sentences. For example, say: 3 + 1. The student starts on the 3 and steps 1 space forward to end up on 4. Then, give another student one that includes a zero such as 4 + 0. This means start at 4 and step 0 spaces forward, staying at 4.

Through practice and modelling with manipulatives, students can be shown, for example, the sum of 12 + 0. Using "part-part-whole mats" students will see that there are 12 blocks in one part with no blocks in the second part. Students will eventually realize that when you are adding or subtracting with zero, the number in the addend and minuend remains the same.

In subtraction, the minuend is the whole, the number on the top in the vertical form or the first number in the horizontal form. The subtrahend is the part that is being "taken away". It is the number on the bottom in the vertical form, or the second number in the horizontal form.

- 10 - 3 = 7 The *minuend* is 10, the *subtrahend* is 3 and the *difference* is 7.

In addition, the two parts that make up the whole are the addends.

- 4 + 6 = 10 The 4 and 6 are the *addends*, and 10 is the *sum*.

While students are not expected to use these terms, it is recommended that teachers introduce this language as it gives students a name for these particular numbers.

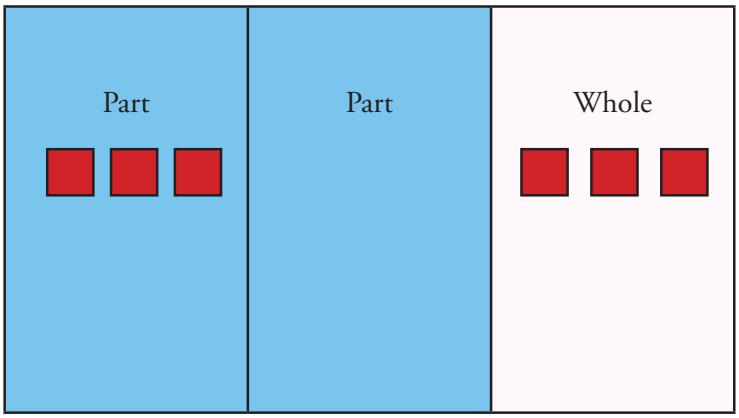
As students continue working on addition and subtraction concepts, they may discover that it makes no difference in which order two numbers are added. There is value in spending time helping students see this relationship as it is useful in mastering basic facts, mental mathematics and problem solving.

General Outcome: Develop number sense

Suggested Assessment Strategies

Journal

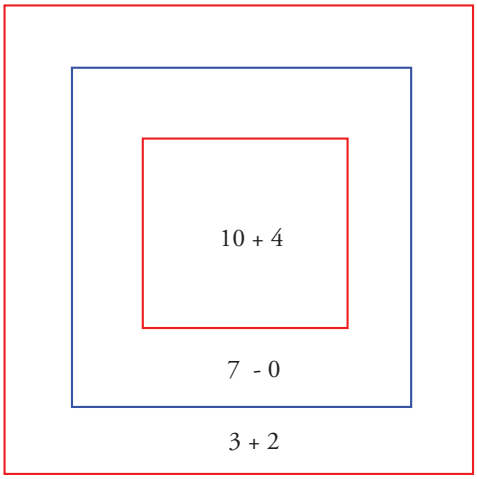
- Write zero facts on the board, some with zero first and some with zero second. Discuss how all the facts are alike. Ask students to use counters and part-part-whole mats to model the facts, for example, 3 + 0 = 3. Ask students to create a problem that involves adding or subtracting a zero to show what they understand about this concept. Part-part-whole mats can be made and laminated using two different colours of construction paper:



(2N8.1, 2N8.2)

Performance

- Invite students to play addition/subtraction curling. Using masking tape on the floor, create different sized squares nested inside each other. Students, in teams, would slide a bean bag into different sections of the squares where each section would have a particular number sentence for them to solve. If they solve it correctly, they get that many points, if not, they lose their turn. The middle square would have a greater value and the outside squares would have lesser values.



(2N8.1, 2N8.2, 2N9.2, 2N10.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2 (Continued): Relating Addition and Subtraction

TR: pp. 24 - 29

SB: pp. 64 - 66

Suggested Resources

Children's Literature

- *The Hershey's Kisses Addition Book* by Jerry Pallotta
- *The Heshey's Kisses Subtraction Book* by Jerry Pallotta
- *The Mission of Addition* by Brian P. Cleary
- *The Action of Subtraction* by Brian P. Cleary
- *Mission Addition* by Loreen Leedy
- *Subtraction Action* by Loreen Leedy
- *Zero the Hero* by Joan Holub
- *Zero, Zilch, Nada: Counting to None* by Wendy Ulmer
- *Zero* by Kathryn Otoshi

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicator:

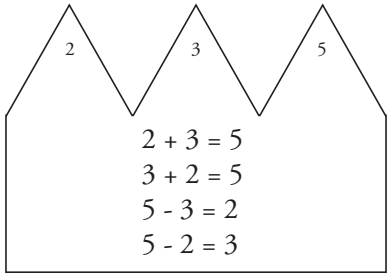
2N9.3 Add a given set of numbers in two different ways and explain why the sum is the same; e.g., 2+5+3+8 = (2+3) +5+8 or 5+3+(8+2).

Elaborations—Strategies for Learning and Teaching

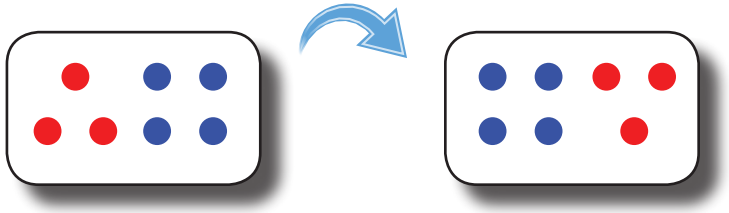
The focus at this point is on the commutative property of addition by presenting problems that have the same two addends but can be added in different orders. Note at this point, only two addends are used. Later in this unit students will use the commutative property for adding three or four addends.

As students begin to understand the commutative property, they are ultimately beginning work on fact families. Knowing the fact family is one way to remember addition facts which can help a student solve a subtraction problem.

A fact family is a list of related facts, such as:



To help students understand that order in addition does not effect the sum (the commutative property) use dot cards/plates that shows two addends in different colours. A dot plate or card, for example, may show 3 red dots and 4 blue dots. Show students this card or plate and have them say or record the number sentence. Then turn the plate or card upside down where the second addend is now the first. If, for example, the plate or card showed 3 red dots first and the 4 blue dots second, when the plate or card is turned, the 4 blue dots would be first and the 3 red dots, second. Students may then see that the sum does not change.



(3 + 4 = 7) (4 + 3 = 7)

Students will need to understand that the commutative property is applicable to addition but not to subtraction.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Provide students with a number expression such as 7 + 5. Ask pairs of students to act out a situation that would give a sum of 12. Students should be encouraged to use a variety of situations that are meaningful to their own experiences.

(2N9.1, 2N9.4, 2N10.2)

- Place a pre-determined number of two-coloured counters in paper cups. Students will shake and spill the counters on their desk. Ask students to record two addition sentences and the two related subtraction sentences.

3 + 5 = 8

5 + 3 = 8

8 - 3 = 5

8 - 5 = 3

(2N9.1, 2N9.2, 2N10.2)

- Invite students to form two equal groups to play a circle game. Each student receives a popsicle stick with a number from zero to nine written on it. Have the groups of students form two circles, one inside the other. Play some music and have the circles rotate. As the outer circle moves clockwise, the inner circle should move counter-clockwise. When the music stops, each pair of students facing each other should add their numbers together. This game can be extended to practice subtraction facts by using popsicle sticks numbered from zero to eighteen.

(2N8.1, 2N8.2, 2N9.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2 (Continued): Relating Addition and Subtraction

TR: pp. 24 - 29

SB: pp. 64 - 66

Little Book: *Turn-Arounds*

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/add-sub-18.html

- fact family house template
- cards for commutative property

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicator:

2N9.3 (Continued) 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).

Elaborations—Strategies for Learning and Teaching

Divide the class in half and give students examples of real life situations in which addition is required. Have the two groups add the numbers in different orders and report their answer. Discuss why the answers are the same and guide students to discover the commutative property. It is not necessary that students use the vocabulary "commutative property". Ask if anyone notices how these problems are alike. Students should conclude that in addition, the addends can be added in any order and the result will be the same:

- Tom has 3 dollars in his piggy bank. His mom made a deal with him. She said she would give him 13 more dollars at the end of the week, if he made his bed every day. Assuming Tom makes his bed every day, how much money will he have in his piggy bank at the end of the week? (3 + 13 = 16 and 13 + 3 = 16)
- The cafeteria delivered 12 cartons of milk for recess. At lunch time 5 more cartons of milk were delivered from the cafeteria to the classroom. How many cartons of milk did the students in that class drink that day? (12 + 5 = 17 and 5 + 12 = 17)

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Ask students to shake and spill a specified number of two-coloured counters on a paper plate. For each spill, students will record and draw two addition sentences. If, for example, there are two red counters and five white counters, the student would draw what they see and record the number sentences of 2 + 5 = 7 and 5 + 2 = 7.

(2N9.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 4: Order in Addition

TR: pp. 34 - 38

SB: pp. 68 - 69

Activity Bank:

TR: p. 38

- Secret Cups
- Cube Trains

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.1 (Continued) Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.

2N9.4 Create an addition or a subtraction number sentence and a story problem for a given solution.

Elaborations—Strategies for Learning and Teaching

When modelling addition and subtraction, it is important to give students time to construct their own understanding. Students should be provided with a variety of manipulatives (i.e., counters, snap cubes, pompoms, etc.) to discover approaches to solving addition and subtraction problems. The use of manipulatives will help them visually represent their work and lead to the recording of the process symbolically.

Provide opportunities where students can use manipulatives to illustrate a number sentence and provide a story problem for a given solution. A "given" solution means a student is provided with a sum or difference and they are asked to create a problem or number sentence that would make it true. This can be done through games, small group/whole group activities and discussions.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Ask students to play "Connect Four". Create a 4 x 4 game board with different numbers inside each block. In teams, students take turns creating a number sentence that would produce a particular sum on the board. If the team calls out a correct number sentence, they cover the block that has the corresponding sum. The first team to get four blocks in a row, wins.

9	17	11	12
5	1	6	3
7	8	7	4
13	15	2	14

(2N8.1, 2N8.2, 2N9.2, 2N10.3)

- Give students a specific number of counters, snap cubes, Link-its™, etc. Ask students to create as many number sentences as possible using this number. Then ask students to choose one of their own number sentences to create a story problem, and illustrate, build, create, or act it out.

(2N8.1, 2N8.2, 2N9.1, 2N9.2, 2N9.4, 2N10.2, 2N10.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2 (Continued): Relating Addition and Subtraction

TR: pp. 24 - 29

SB: pp. 64 - 66

Little Book: *Pia's Birthday Surprise*

Activity Bank:

TR: p. 29

- Toss It
- Pattern Block Pictures

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/add-sub-18.html

- "Connect Four" template

Strand: Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to

2PR4 Record equalities and inequalities symbolically, using the equal symbol or the not equal symbol.

[C, CN, R, V]

Achievement Indicators:

2PR4.1 Determine whether two sides of a given number sentence are equal (=) or not equal (≠). Write the appropriate symbol and justify the answer.

2PR4.2 Model equalities, using a variety of concrete representations, and record the equality symbolically.

2PR4.3 Model inequalities, using a variety of concrete representations, and record the inequality symbolically.

Elaborations—Strategies for Learning and Teaching

In Grade One, students learned to record equalities to 20 using the equal symbol (1PR4). They also learned to describe equalities as a balance and inequalities as an imbalance, concretely and pictorially (1PR3).

The focus of this outcome is to have students interpret the equal sign as a point of balance. It is recommended that teachers balance one addition (or subtraction) sentence first, such as $10 + 4 = 14$, (or $12 – 7 \neq 3$) and then move on to balancing sentences with two additions or two subtractions, for example, $2 + 6 = 7 + 1$, (or $5 – 2 = 6 – 3$ and $5 + 5 \neq 3 + 4$). Finally, students may be ready to deal with combining addition and subtraction sentences, for example, $3 + 9 = 12 – 0$.

At the beginning of this topic, you may wish to write a number sentence on the board that contains an inequality, for example, $2 + 4 = 5$. Have students work with a partner to confirm or reject the number sentence. Using manipulatives, have them demonstrate their thinking as they explain how they know this solution is correct or incorrect. After students have a chance to disprove this number sentence, it may be a good time to introduce the "not equal" phrase and symbol. During this discussion, you could rewrite the number sentence as $2 + 4 \neq 5$ and write the words "two plus four is not equal to five".

Model other number sentences using the equal and not equal symbols, allowing students to confirm each sentence. Have students show if the number sentences are equal or unequal by, for example, raising their hands in the air for equal number sentences, and touching their toes for unequal sentences.

Manipulatives such as ten-frames, snap cubes, balance scales, marbles, etc., can all be used to help students develop an understanding of equal and unequal number sentences. Allowing students to model number sentences and situations using manipulatives, gives them a visual to see whether or not the two sides of the number sentence are equal. Show students, for example, a balance scale with three marbles on the right side, and four on the left. Discuss that the scale is not balanced. Then add two marbles to the right side and one marble to the left side. Show students that the balance scale can be represented by the number sentence $3 + 2 = 4 + 1$. Similarly, starting with three marbles on one side and one marble on the other, show that $3 + 1 \neq 1 + 2$.

General Outcome: Represent algebraic expressions in multiple ways

Suggested Assessment Strategies

Performance

- Invite students work in pairs. Give each pair a deck of numbered cards. Ask one student to deal six cards each and place the remaining deck between the game boards. The object of the game is to create sets. For example, if one player has an 8, 3, 4, 2, 6 in his/her hand, the player could use the 4 and 2 together to add to 6. These three cards could then be placed on the desk. Students can only play one set of cards per turn. Once a set of cards have been played, the play goes to the other player. If this player does not have a pre-existing set in his/her hand, he/she can choose to either pick from the deck or to ask the opposing player for a particular card. If no matches are possible, the player loses his/her turn. The player who gets rid of all his/her cards first, wins.

  (2N8.1, 2N8.2, 2N9.2, 2N9.9, 2N10.2)

- Invite students to play a game of "Concentration". Provide 18 cards with nine different sums, two different facts for each sum, which have to be matched. For example, 9 + 5 and 7 + 7. Students turn over cards to find matches.

  (2N8.1, 2N8.2, 2N9.2, 2N9.9, 2N10.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3: Equality and Inequality

TR: pp. 30 - 33

SB: p. 67

Audio CD 2:

Selection: 10

Suggested Resources

Children's Literature

- *Equal Shmequal* by Virginia L. Kroll

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/add-sub-18.html

- "Concentration" game

Strand: Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to

2PR4 Continued

Achievement Indicators:

2PR4.1 (Continued) Determine whether two sides of a given number sentence are equal (=) or not equal (≠). Write the appropriate symbol and justify the answer.

2PR4.2 (Continued) Model equalities, using a variety of concrete representations, and record the equality symbolically.

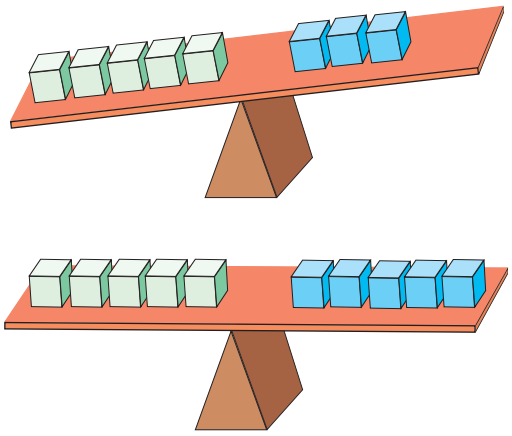
2PR4.3 (Continued) Model inequalities, using a variety of concrete representations, and record the inequality symbolically.

Elaborations—Strategies for Learning and Teaching

Give students one snap cube each. Show them two different bags, one marked with the word "yes" and one with "no". Ask the whole class a question that would elicit a response of either yes or no, such as "Do you have a pet?" Have students place their cube in the appropriate bag. Once all students have had a chance to place their cubes, take one bag and snap all of the cubes together to create a train. Count the number of cubes and then have students decide how many cubes must be in the other bag. If, for example, there are 6 cubes in the "no" bag, and there are 14 students in class, then how many cubes must be in the "yes" bag? Once students determine this, confirm their answer by snapping the second group of cubes together and counting. Stand each train up on its end, giving students a concrete visual to compare. Ask students various questions about these two towers such as:

- What can you tell me about these two stacks of cubes?
- How can we use these two stacks of cubes to tell how many students are in the class?
- What can we say about the number of students with pets and those without?
- How many more students have pets than no pets?

Record the equality or inequality symbolically.



General Outcome: Represent algebraic expressions in multiple ways

Suggested Assessment Strategies

Performance

- Use snap cubes to model an equality or inequality sentence. Ask students to record the number sentence on individual whiteboards. Engage the class in a discussion of their number sentences.

(2PR4.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3 (Continued): Equality and Inequality

TR: pp. 30 - 33

SB: p. 67

Activity Bank:

TR: p. 38

- Equal Romp
- Make it Equal

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.5 Solve a given problem involving a missing addend, and describe the strategy used.

2N9.6 Match a number sentence to a given missing addend problem.

Elaborations—Strategies for Learning and Teaching

It is important to have students work with numbers with which they are most comfortable in order to find the missing part of the whole. Using manipulatives will give students an opportunity to make this abstract concept more concrete. They should have a lot of practice constructing and deconstructing different numbers and in different ways. This part-part-whole relationship, where students see all the parts combined, is instrumental in developing the concept of missing addends.

Providing students with opportunities to see real world examples of finding a missing addend will help make this concept more relevant. Say, for example, "If you know you have invited 10 people to your birthday party and there are 5 people already there, you will know that there are 5 more people left to come because 5 + 5 = 10, or 10 -5 = 5." Or, "If you have 10 cents and a candy costs 12 cents, then you would need 2 more cents to buy the candy."

This concept will also help students understand how addition is related to subtraction, as some may see how using subtraction helps in finding the missing addend.

Place a "magic" number on the board, for example, 7. Using a coffee or soup can, drop a specific number of marbles into the can so the students can hear the number of marbles dropped. Drop a number less than your magic number, in this example, drop 6. Have students tell you how many more marbles need to be dropped in the can to reach the magic number.

Ask students various questions where they can use different strategies and manipulatives to solve the problem. Ask students, for example, to find the number of books Mary read if Bill read 11 and altogether they read 16. Tools such as ten-frames, snap cubes, number lines, pictures, or the actual objects in the problem, could all be used to help students solve the problem. Have students present their solutions to explain how they were able to come up with their answers.

Ask students to create a number sentence with a missing addend and create stories to solve them, either by acting them out or modelling with manipulatives. Students should show how they were able to solve the missing addend. To begin this activity, story boards may be used to help students become more familiar with thinking about and writing the number sentences.

General Outcome: Develop number sense

Suggested Assessment Strategies

Interview

- Using dot plates, ten-frames, or counters, begin with a number with which the student is comfortable, for example, 9. Show the student the 9 on the dot plate, ten-frame or counters and then hide one part of the whole. Ask the student to tell you how many are hidden. Repeat with different amounts hidden. If the student responds quickly and correctly and is clearly not counting in any way, call that a mastered number. When a number is mastered, move on to a higher number.

(2N9.5, 2N9.9, 2N10.2, 2N10.3)

Performance

- Ask students to use manipulatives to answer the question:

  Brett has 17 erasers. Suzelle gave him seven of those erasers. How many did he have to start? Ask students to "think out loud" as they solve the problem. Observe and note the strategies the students are using.

(2N9.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5: Missing Parts – Addition

TR: pp. 39 - 41

SB: pp. 70 - 71

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.4 (Continued) Create an addition or a subtraction number sentence and a story problem for a given solution.

2N9.5 (Continued) Solve a given problem involving a missing addend, and describe the strategy used.

2N9.6 (Continued) Match a number sentence to a given missing addend problem.

Elaborations—Strategies for Learning and Teaching

Provide students with opportunities to practice solving different types of problems involving missing addends.

The two types of addition problems that have missing addends are:

• Change Unknown:

David had 11 elastic bands. Sonya gave him some more. Now David has 17 elastic bands. How many did Sonya give him?

11 + ___ = 17

• Initial Number Unknown:

David had some elastic bands. Sonya gave him 6 more. Now David has 17 elastic bands. How many elastic bands did David have to begin with?

___ + 6 = 17

(Adapted from Van de Walle and Lovin, 2006, pp. 67 - 69)

As a part of morning routine activities, display five or six number sentences on the board, interactive whiteboard, or on chart paper. Tell students a story problem that includes a missing addend and have them match the appropriate number sentence with the problem. Encourage students to discuss their strategies to solve the problem.

Write on the board, for example,

9 + 3 = 12

6 + 3 = 9

3 + 3 = 6

9 + 6 =15.

Then present a story problem:

There were 9 students that drank milk during recess. If 3 students drank white milk, how many had chocolate milk?

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Share the following story with the students: "Billy wanted to play his favourite math game. When he set up the addition game, he quickly realized that some of his game cards had gotten wet and the ink had disappeared. Please help Billy fill in the missing numbers."

5 + ___ = 10	___ + 3 = 17	10 + ___ = 15
7 + 8 = ___	9 + 3 = ___	___ + 4 = 13

(2N9.4, 2N9.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5 (Continued): Missing Parts – Addition

TR: pp. 39 - 41

SB: pp. 70 - 71

Unit Centre:

TR: p. 17

- Cover Up!

Activity Bank:

TR: p. 46

- The Missing Piece
- Quick Glance
- Hoop to Hoop

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/add-sub-18.html

- Billy's game cards

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.4 (Continued) Create an addition or a subtraction number sentence and a story problem for a given solution.

2N9.7 Solve a given problem involving a missing minuend or subtrahend, and describe the strategy used.

Elaborations—Strategies for Learning and Teaching

In a part-part-whole model, when the whole and one of the parts are known, subtraction names the other part. This definition is in agreement with the drastically over used language of "take away". (Van de Walle, 2006, p. 73)

Subtraction is a more complex operation than addition. Most simply, it is the opposite of addition, but there are many nuances. (Small, 2009, p.105). Before students can fully develop an understanding to find missing parts of subtraction sentences, they need to understand what subtraction is. There are three different meanings of subtraction.

- Taking away - separating situation. I have 12 cookies and I eat 7 which leaves 5 cookies. 12 – 7 = 5.
- Comparing – comparing two quantities involves subtracting one from the other. For example, 12 is 5 more than 7.
- Missing Addend – involves finding out how much or how many to add. For example, you have 12 eggs in a carton and you used some to bake brownies. There are now 7 eggs in the carton. How many did you use? 12 - ? = 7.

It is important for students to realize that the varying meanings for subtraction are related. It would make sense to apply the same operation, subtraction, in each situation. Therefore, connections must be explored, and opportunities for presenting various types of meaningful problems be used, to help construct a firm understanding of subtraction.

It is important for students to decode and interpret number stories and not just rely on looking for clue words, such as "altogether", "left", "in all", etc., to decide what operation to perform.

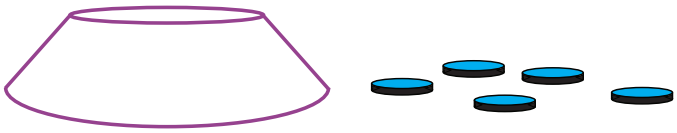
As students work through finding the missing minuend or subtrahend, it is important to give them a context for these problems. Rather than writing a number sentence on the board such as 16 - ? = 5, for example, it may be more effective to provide students with a context for this problem. Asking students to use manipulatives to model, or to act out the problem as it is presented, may help to develop a good understanding of the part-part-whole relationship. Say, for example, "You started with 16 crayons at the beginning of the year, and now there are 5 left in your crayon box. Find out how many crayons were lost during the year."

General Outcome: Develop number sense

Suggested Assessment Strategies

Interview

- Barrier game - Sit facing the student for this task. Select an appropriate number of counters and show them to the student. After the student is satisfied that he/she knows the number of counters in total, erect a barrier so that the student cannot see the counters. Place some of the counters under a container and leave some in view. Remove the barrier and ask the student to determine how many counters are under the container.



(2N9.1, 2N9.7, 2N9.9, 2N10.2, 2N10.3)

- Tell students a story: "You are having a family birthday party for your grandmother and you have 18 aunts, uncles and cousins coming to your house. Your grandmother loves the colour purple so you want to have purple party hats for everyone to wear to surprise her! You have a pack with 5 purple hats in it but you really wish you had 18 purple hats." Ask students to tell you how many more you need to make up the 18. This number can change each time.

(2N9.1, 2N9.7, 2N9.9, 2N10.2, 2N10.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 6: Missing Parts – Subtraction

TR: pp. 42 - 46

SB: pp. 72 - 74

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.8 Match a number sentence to a given missing subtrahend or minuend problem.

Elaborations—Strategies for Learning and Teaching

Students can be shown different subtraction sentences and then be asked to listen to a problem or a story that can be represented by one of the subtraction sentences. Students can then be asked to tell which of the subtraction sentences it is and explain their choice.

Create a class book that shows different number problems where there is a missing part in the sentence. Have students come up with their own page where they will create and illustrate a number problem and write the related number sentence. This completed book can be put in the class library where students can read it and solve each others' problems. The problems can also be used for a "problem of the day".

2N9.1 (Continued) Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.

Subtraction is different than addition in that the order of the minuend and subtrahend does matter. Students need to realize that in subtraction the minuend names the whole, the combination of the two parts. It is important to try and guide students to talk about problems, using natural language, to focus on what makes sense and what does not make sense. Say, for example, "I can't take away 4 pencils from my pencil case when there are only 2 pencils in it." Putting subtraction number sentences in context may help students understand why the whole, or the greater number, is presented first in the number sentence.

As students play with the idea that you can not subtract a greater number from a number that is smaller, 5 – 7, for example, it will be important to have students frequently use manipulatives. Also, through the use of the appropriate language when modelling these subtraction stories, students begin to see why you cannot take 7 away from 5. Model these stories in a variety of ways, including the use of manipulatives and drawing pictures.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Difference War - Gather a pile of about 50 counters and halve a pack of number cards between each pair of students. Together, students will turn over one card from the top of their deck. The player with the greater number on the card gets to take as many counters from the pile as the difference between the two cards. If player one, for example, turns up an 8 and player two turns up a 6, then player one will receive 2 counters. Play continues until all the counters are gone. The player with the most counters at the end of the game, wins.

(2N9.1, 2N9.2, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 6 (Continued): Missing Parts – Subtraction

TR: pp. 42 - 45

SB: pp. 72 - 74

Activity Bank:

TR: p. 46

- Undercover

Lesson 7: Order in Subtraction

TR: pp. 47 - 49

SB: p. 75

Activity Bank:

TR: p. 54

- Reverse It!
- Number Line Hop

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicator:

2N9.1 (Continued) Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.

Elaborations—Strategies for Learning and Teaching

Subtracting using the comparison model is having students find the difference between two set quantities. This is a very difficult idea to show students if they are not given opportunities to construct the idea themselves. It is not immediately clear how you would associate either the addition or subtraction operations with a comparison situation. Again, language use is very important in helping to construct these ideas. The word difference is already familiar to students as the answer to a subtraction sentence. When talking about comparing two set quantities, students will now be asked to find the difference between the two sets, or to find how many more or less one set is than another.

Give students a situation such as:

John has 15 coins and Bill has 7 coins.

Show students the different questions, based on this situation, that leads to subtraction:

- What is the difference between the amount John has and the amount Bill has?
- How many more coins does John have than Bill?
- How many less coins does Bill have than John?

Have students make two towers of different heights. Discuss the difference in height between the two towers to help reinforce the idea that when comparing two numbers you are really finding the difference. If, for example, a student makes a tower of height 13 and a tower of height 7, then the difference is 6. Ask students to think about what number sentences they could write to illustrate this difference.

Provide students with various problems and situations involving comparison of two sets. Have them use concrete materials, such as snap cubes, number lines, ten-frames, etc., to represent the two quantities. Through the use of these materials, students should see that one set is greater than the other. Students then have something concrete to write about when recording the number sentences.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Invite students to play "Store". Label items in the store with different prices, not exceeding 18 cents/dollars. Ask students to choose two items and find the difference in price.

  (2N9.1, 2N9.2, 2N9.9, 2N10.2)

- Put 15 beans in a jar and 8 in another. Ask students to predict which jar has the most/least. Have students count out the contents of each jar and find out how much more/less the other jar contains. Ask students to record the process symbolically.

  (2N9.1, 2N9.2, 2N9.9, 2N10.2)

- Ask students to compare the number of letters in their names. Decide which student has the most letters, vowels, consonants and so on. Students can then decide how many more letters the longest name has than the shortest name.

  (2N9.1, 2N9.2, 2N9.9, 2N10.2)

Journal

- Together with the students, find two different objects to measure using a maximum of 18 snap cubes. Measure each item and build a tower out of the snap cubes (to represent the item's height), or a snake (to represent the item's length). Ask students to compare each measure by looking at the difference in height or length of the connected snap cubes. Have students write about what they found out in their journal.

  (2N9.1, 2N9.2, 2N9.9, 2N10.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 8: Subtracting to Compare

TR: pp. 50 - 54

SB: pp. 76 - 77

Audio CD 2:

Selection: 11

Activity Bank:

TR: p. 54

- Eggs by the Dozen
- Teacher, Teacher

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicator:

2N9.9 Refine personal strategies to increase their efficiency.

Elaborations—Strategies for Learning and Teaching

Previously in this unit, students worked through addition and subtraction sentences and problems. At this point, students may be already starting to refine their strategies. As students begin to take more risks with different strategies, encourage them to compare their known strategies with the new ones, asking which they think is better and why. A discussion about using strategies that help students find the sums and differences quickly may be needed. Provide plenty of opportunities for students to share their thinking and their strategies with their classmates.

The calculator can be an exciting tool to practice the relationships of more than, two more than, one less than, and two less than. (Note: Grade Two students are not expected to have their own calculators.) One way to model this concept could be to play a game such as "A Calculator Two-More-Than Machine" Students could be taught how to make a calculator into a two-more-than machine. Press 0 + 2 = . This makes the calculator a two-more-than machine. Now press any number, for example, 5. Students hold their finger over the = and predict the number that is two more than 5. Then they press = to confirm. If they do not press any of the operation keys (+, -, x, ÷) the "machine" will continue to perform in this way. (Van de Walle, 2006, page 41)

General Outcome: Develop number sense

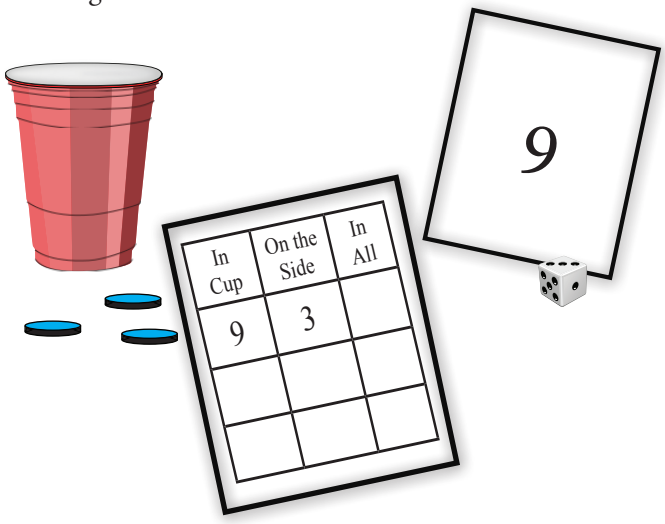
Suggested Assessment Strategies

Performance

- Make a Two-More-Than Set - Provide students with about six dot cards. Ask students to construct a set of counters that is two more than the set shown on each card. Similarly, spread out eight to ten dot cards, and ask students to find another card for each that is two less than the card shown. This activity can be modified to make a one-more-than set. (Van de Walle, 2006, p. 45)

(2N9.1, 2N9.2, 2N10.1)

- Invite students to play "Real Counting On". This game for two students requires a deck of cards with numbers 7 to 12, a die, a paper cup, and some counters. The first player turns over the top number card and places the indicated number of counters in the cup. The card is placed next to the cup as a reminder of how many are there. The second student rolls the die and places that many counters next to the cup. Together, they decide how many counters in all by using the counting on strategy. Have students record their turns on a recording sheet.



Observe how students determine the total amounts in this activity. Students who are not yet counting on may want to count the counters from the cup or will count up from 1 without dumping the counters. Permit these strategies. As students continue to play they will eventually count on as that strategy becomes meaningful and efficient. (Van de Walle, 2006, p. 41)

(2N9.1, 2N9.2, 2N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 9: Mental Math: 1 More, 2 More

TR: pp. 55 - 57

SB: p. 78

Strand: Number

Outcomes

Students will be expected to

2N10 Apply mental mathematics strategies for the basic addition and related subtraction facts to 18.

[C, CN, ME, PS, R, V]

Achievement Indicator:

2N10.1 Explain or demonstrate the mental math strategy that could be used to determine the basic fact, such as:

- *using one more, two more; e.g. for 6 + 2 start at 6 and count on 2, so 6, 7, 8.*
- *using one less, two less; e.g., for 6 – 2, start at 6 and count back 2, so 6, 5, 4*
- *making 10; e.g., for 7 + 5, think 7 + 3 + 2*
- *using doubles; e.g., 4 + 6, think 5 + 5*
- *using doubles plus one, plus two; e.g., 4 + 5, think 4 + 4 + 1*
- *using doubles subtract one, subtract two; e.g., for 4 + 5, think 5 + 5 – 1*
- *using addition to subtract; e.g., for 7 – 3, think 3 + ? = 7.*

Elaborations—Strategies for Learning and Teaching

By the end of Grade Two, students should:

- ***understand and apply strategies for addition facts up to and including 9 + 9 and related subtraction facts***
- ***recall addition facts up to and including 5 + 5 and related subtraction facts.***

Students are expected to master their number facts. Mastery occurs when they both understand and recall number facts. Recall of number facts is when students commit them to memory and retrieve them when needed. Students who simply recall facts without understanding have not achieved mastery. Similarly, students who understand the facts but are unable to recall them have not achieved mastery.

The focus of the work in addition and subtraction is to engage students in experiences where they are beginning to create and use their own strategies. Grade Two students have already been exposed to some mental math strategies in Grade One (1N9). Work here will be focused on helping students build upon these strategies. Some students may already be comfortable with using certain mental math strategies. Now the focus is on refining these strategies and looking for more efficient ways to add and subtract.

Students will need ample opportunity to make a strategy become their own. Some students may not be ready to use an idea when it is first introduced but after some reflection, they will make connections and the strategy will become their own.

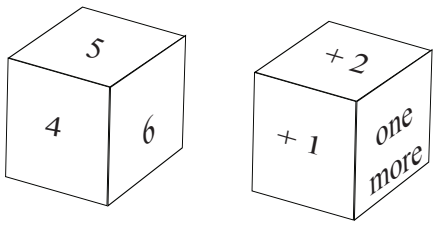
In order to achieve success with mental math strategies, practice should be meaningful. This practice is important to develop fluency in basic number operations and strategies. Provide activities that involve both mental math and pencil and paper tasks using manipulatives. Practice should be purposeful and focused on the development of thinking strategies and the knowledge of number relationships.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

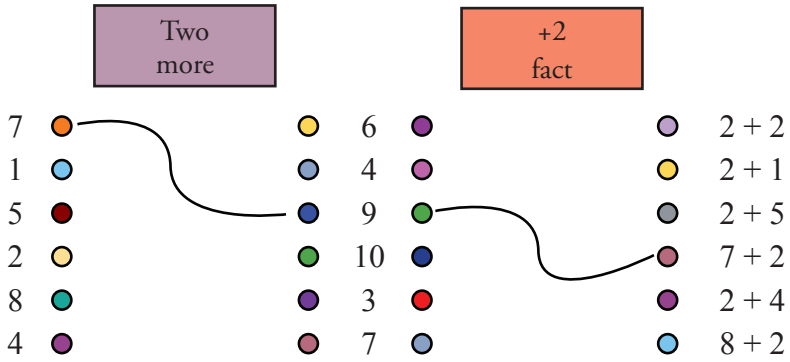
- One/Two More Than Dice - Make a die labelled +1, +2, +1, +2, "one more" and "two more". Use with another die labelled 4, 5, 6, 7, 8, 9.



Ask students to roll the dice and say the complete fact, for example, "Four and two is six." (Van de Walle, 2006, p. 100)

(2N9.1, 2N9.2, 2N10.1)

- One/Two More Than Match - In this matching activity, ask students to begin with a number, match that with the one that is two more, and then connect that with the corresponding basic fact. (Van de Wall, 2006, p. 100)



(2N9.1, 2N9.2, 2N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 9 (Continued): Mental Math: 1 More, 2 More

TR: pp. 55 - 57

SB: p. 78

Activity Bank:

TR: p. 62

- Getting to 12

Strand: Number

Outcomes

Students will be expected to

2N10 Continued

Achievement Indicators:

2N10.1 (Continued) Explain or demonstrate the mental math strategy that could be used to determine the basic fact, such as:

- *using one more, two more; e.g. for 6 + 2 start at 6 and count on 2, so 6, 7, 8.*
- *using one less, two less; e.g., for 6 – 2, start at 6 and count back 2, so 6, 5, 4*
- *making 10; e.g., for 7 + 5, think 7 + 3 + 2*
- *using doubles; e.g., 4 + 6, think 5 + 5*
- *using doubles plus one, plus two; e.g., 4 + 5, think 4 + 4 + 1*
- *using doubles subtract one, subtract two; e.g., for 4 + 5, think 5 + 5 – 1*
- *using addition to subtract; e.g., for 7 – 3, think 3 + ? = 7.*

2N10.2 Use and describe a mental mathematics strategy for determining a sum to 18 and the corresponding subtraction.

Elaborations—Strategies for Learning and Teaching

Addition Strategy	Explanation and Example
Counting on	This strategy is used for adding one or two to a given number. 7 + 2 = __ think 7... 8, 9.
Making ten	When presented with a more difficult equation, 8 + 4 = __ , think 8 + 2 is 10 and 2 more is 12.
Using doubles	Add two of the same number together 7 + 7 = 14.
Using doubles plus one	Find the double and add one more 7 + 8 = __, think 7 + 7 + 1 = 15.
Using doubles plus two	Find the double and add two more 6 + 8 = __, think 6 + 6 + 2 = 14.
Using doubles subtract one	To add 9 + 8, think 9 + 9 = 18 and 18 - 1 = 17
Commutative property sometimes referred to as "turn-arounds"	To add 3 + 11, think 11 + 3

Subtraction Strategy	Explanation and Example
Counting on	Start with the number you are subtracting and count on to the other number: 11 - 8 __ think 8... 9, 10, 11. The answer would be 3 because we counted 3 numbers.
Counting back	Start with the minuend (larger number) and count back: 8 - 2 think 8... 7, 6. The answer is 6.
Using doubles	We have 12 - 6 = __ . Think 6 + 6.
Using addition to subtract	We see 7 - 5 = __ . Think of the related addition fact 5 + 2 = 7 so 7 - 5 = 2.

Students in Grade Two should have had many opportunities counting on and counting back. The strategies of using doubles plus/subtract one or two are an extension on counting on and counting back. "Walk on" number lines and hundred charts are great resources to help students make these strategies their own. Providing a lot of practice and modelling of all strategies is suggested to help students make these strategies more automatic.

General Outcome: Develop number sense

Suggested Assessment Strategies

Portfolio

- Ask students to create a "Wanted" poster. Students should choose a number that has "disappeared". The poster would describe the number using everything the student can say about the number. When constructing a poster for the number five, for example, a student may say things such as:
  - Last seen one step ahead of 4
  - Two steps behind 7
  - It looks the same as the number of fingers on one hand
  - It is half of 10
  - It can take the form of a nickel
  - It can be found on the clock and on my hockey jersey
  - It is a part of my phone number …..

(2N9.1, 2N9.2, 2N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 10: Mental Math: 1 Less, 2 Less

TR: pp. 58 - 62

SB: p. 79

Strand: Number

Outcomes

Students will be expected to

2N10 Continued

Achievement Indicators:

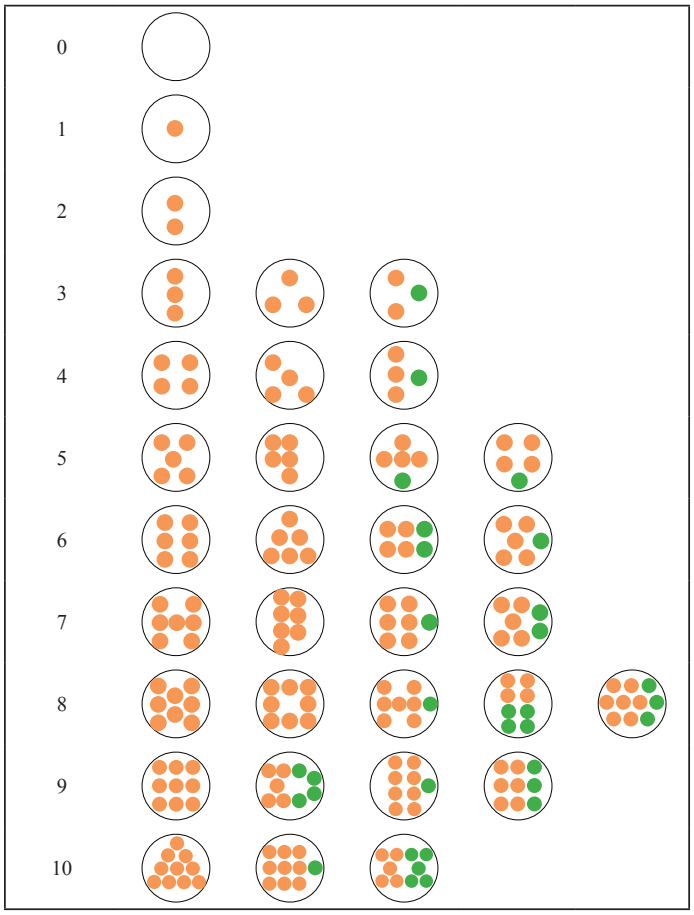
2N10.1 (Continued) Explain or demonstrate the mental math strategy that could be used to determine the basic fact, such as:

- *using one more, two more; e.g. for 6 + 2 start at 6 and count on 2, so 6, 7, 8.*
- *using one less, two less; e.g., for 6 – 2, start at 6 and count back 2, so 6, 5, 4*
- *making 10; e.g., for 7 + 5, think 7 + 3 + 2*
- *using doubles; e.g., 4 + 6, think 5 + 5*
- *using doubles plus one, plus two; e.g., 4 + 5, think 4 + 4 + 1*
- *using doubles subtract one, subtract two; e.g., for 4 + 5, think 5 + 5 – 1*
- *using addition to subtract; e.g., for 7 – 3, think 3 + ? = 7.*

2N10.2 (Continued) Use and describe a mental mathematics strategy for determining a sum to 18 and the corresponding subtraction.

Elaborations—Strategies for Learning and Teaching

One way to help students build their skills and confidence in counting and developing number relationships is to play a game using dot plates. Dot plates can be created by dotting paper plates using bingo markers or circular stickers of different colours.



(Modified from Van de Walle and Lovin, 2006, p.44.) Briefly hold up a dot plate. Ask students to look at the plate, think about what they see, and then say how many dots are on the plate. Then, ask students to describe what was seen and how this helped them to know how many dots were there. You may use two different colours of dots. A student may see, for example, 4 orange dots and 1 green dot. They would say "I see 4 dots plus/and 1 dot, I see 5".

This game can be adapted to demonstrate and practice the counting on and counting back strategy as students can be asked to give a number that is one more or one less than the number of dots they see on the plate.

General Outcome: Develop number sense

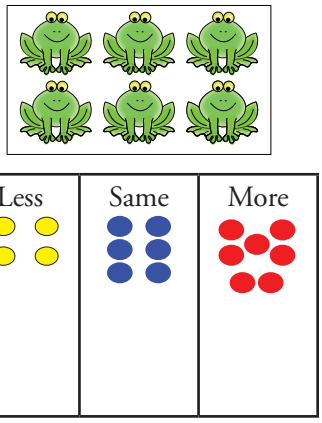
Suggested Assessment Strategies

Performance

- Ask students to play "One-Less-Than" Dominoes. Use the dot pattern dominoes, or a standard set, to play. Play in the usual way, but instead of matching ends, a new domino can be added if it has an end that is one less than the end on the board. A similar game can be played for two less, one more or two more. (Van de Walle and Lovin, 2006, p. 44)

(2N9.1, 2N10.1)

- At a table, provide about 9 cards with sets of 4 to 12 objects, a set of small counters or blocks, and some word cards labelled "more", "less" and "same". Ask students to choose a card and make three collections of counters; a set that is more, one that is less and one that is the same. Have them place the appropriate labels next to the sets. (Van de Walle and Lovin, 2006, p. 38)



(2N9.1, 2N9.2, 2N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 10 (Continued): Mental Math: 1 Less, 2 Less

TR: pp. 58 - 62

SB: p. 79

Activity Bank:

TR: p. 62

- Cover the Numbers
- Down from 11
- Transforming Dominoes

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/add-sub-18.html

- template for less, same, more activity

Strand: Number

Outcomes

Students will be expected to

2N10 Continued

Achievement Indicators:

2N10.1 (Continued) Explain or demonstrate the mental math strategy that could be used to determine the basic fact, such as:

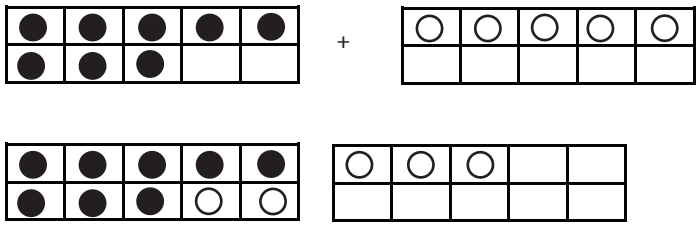
- *using one more, two more; e.g. for 6 + 2 start at 6 and count on 2, so 6, 7, 8.*
- *using one less, two less; e.g., for 6 – 2, start at 6 and count back 2, so 6, 5, 4*
- *making 10; e.g., for 7 + 5, think 7 + 3 + 2*
- *using doubles; e.g., 4 + 6, think 5 + 5*
- *using doubles plus one, plus two; e.g., 4 + 5, think 4 + 4 + 1*
- *using doubles subtract one, subtract two; e.g., for 4 + 5, think 5 + 5 – 1*
- *using addition to subtract; e.g., for 7 – 3, think 3 + ? = 7.*

2N10.2 (Continued) Use and describe a mental mathematics strategy for determining a sum to 18 and the corresponding subtraction.

Elaborations—Strategies for Learning and Teaching

The "make ten" strategy is based on students already having a good understanding of using ten as an anchor or benchmark. Students have seen this strategy in Grade One (1N9). Students should be able to look at 7 + 6, for example, and quickly recall that it is 13 by adding 7 + 3 + 3. To be successful in applying this strategy, it is helpful for students to be very familiar with facts that make 10, i.e., to be able to recognize that 8 + 2, 5 + 5, 3 + 7, 4 + 6, 9 + 1 all equal 10.

The use of a ten-frame becomes instrumental in helping students understand how this strategy works. One way to aid in this development is to present a number sentence such as 8 + 5. Using the ten-frame, students would place eight counters on one ten-frame and five more counters on a second. To "make ten" students will use the counters on the partially filled frames to create a full frame, or make ten. Through modelling and practice, students may come to realize that it is more efficient to take two counters from the five and add it to the eight to make 10. They will see that 8 + 5 can be thought of as 10 + 3 which is 13.



Students benefit from a lot of practice with manipulatives before applying this strategy mentally to solve addition problems. Some students, at this time, may not be ready to move on to applying this strategy without the use of manipulatives.

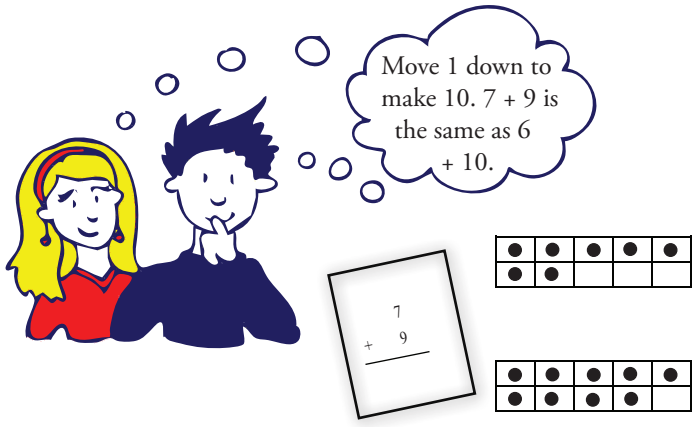
Engage students in activities that will strengthen their computational skills of making ten. Having students decompose the number ten to find all the sums of ten could be one way to do this. Students could also be shown, or flashed, various configurations of ten-frames with already placed counters or dots where they would then tell how many more counters would be needed to fill the ten-frame, or make ten. Incorporate into daily routines such as lining up to go to Phys. Ed. class.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Make 10 on the Ten-Frame - Give students two ten-frames. Flash cards are placed next to the ten-frames, or a fact can be given orally, for example, 7 + 9. Ask students to first model each number in the two ten-frames and then decide on the easiest way to show (without counting) what the total is. The obvious, but not the only, choice is to move one counter into the frame showing nine. Ask students to explain what they did. Focus especially on the idea that one can be taken from the other number and put with the nine to make ten. Then you have ten and whatever is left. (Modified from Van de Walle and Lovin, 2006. p. 103)



(2N9.1, 2N9.9, 2N10.1)

- Hold up a ten-frame card, and ask students to say the "ten fact". For a card with seven dots, for example, the response is "seven and three is ten". Later with a blank ten-frame drawn on the board, say a number less than ten. Ask students to start with that number and complete the "ten fact".

(2N9.1, 2N9.9, 2N10.1)

- On the whiteboard or interactive whiteboard, draw a ten-frame with nine dots. Discuss how you could build numbers between 11 and 18, starting with nine in the ten-frame. Stress the idea of one more to get to ten and then the rest of the number. Repeat for a ten-frame showing eight.

(2N9.1, 2N9.9, 2N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 11: Mental Math: Make 10

TR: pp. 63 - 65

SB: p. 80

Activity Bank:

TR: p. 76

- Target Number

Strand: Number

Outcomes

Students will be expected to

2N10 Continued

Achievement Indicators:

2N10.1 (Continued) Explain or demonstrate the mental math strategy that could be used to determine the basic fact, such as:

- *using one more, two more; e.g. for 6 + 2 start at 6 and count on 2, so 6, 7, 8.*
- *using one less, two less; e.g., for 6 – 2, start at 6 and count back 2, so 6, 5, 4*
- *making 10; e.g., for 7 + 5, think 7 + 3 + 2*
- *using doubles; e.g., 4 + 6, think 5 + 5*
- *using doubles plus one, plus two; e.g., 4 + 5, think 4 + 4 + 1*
- *using doubles subtract one, subtract two; e.g., for 4 + 5, think 5 + 5 – 1*
- *using addition to subtract; e.g., for 7 – 3, think 3 + ? = 7.*

2N10.2 (Continued) Use and describe a mental mathematics strategy for determining a sum to 18 and the corresponding subtraction.

2N10.3 Refine mental mathematics strategies to increase their efficiency

Elaborations—Strategies for Learning and Teaching

While students have been exposed to this strategy in Grade One (1N9), they may need to be reminded of what a "double" is. One way to help students understand doubles is to connect it to visual ideas:

- Double 1 is the eye double: one eye on each side
- Double 2 is the car double: two wheels on each side
- Double 3 is the bug double: three legs on each side
- Double 4 is the spider double: four legs on each side
- Double 5 is the hand double: five fingers on each hand
- Double 6 is the egg carton double: six egg in each row
- Double 7 is the two-week double: seven days in each week
- Double 8 is the crayon double: eight crayons in each row of a box
- Double 9 is the 18-wheeler double: nine wheels on each side of the truck. (Modified from Van de Walle, 2006, p. 56).

Students can draw pictures or make posters that illustrate the double for a given number. The images do not have to be restricted to the ideas presented here.

When there is a difference of two between addends such as 6 + 8, students could be encouraged to go to the middle number and double it. This is often referred to as using "almost neighbours".

As students become comfortable with using the doubles strategy, others, such as double plus one, plus two, subtract one, subtract two can be introduced. Students should be given problems to solve that would have them use these strategies.

As students gain proficiency using these strategies, students could engage in daily oral tasks where a number is said and students tell what the double is. A student could be asked, for example, "What is ten?" Students respond, "Double five". When students can do this well, use numbers up to 18. Students could also be asked how to make a number that cannot be made from a double. Ask, for example, "What is 17?" Students could respond with "Double eight and add one more, or double nine and subtract one."

It is important to monitor the type of strategies that students are using. While you should be accepting of students' choice of strategies, if those strategies are inefficient, facilitate the students' transition to more efficient strategies. These efficient strategies serve them better as they move to more complex situations.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Encourage students to use different visuals and/or manipulatives, to create models to represent double facts. They could, for example, use snap cubes to represent double five by connecting five cubes in one tower and five cubes in another to show that they are the same height and the total is ten. Similarly, a number line can be used to show, for example, double four where a spider could jump four places starting at zero and then jump four more places landing on eight.

  (2N9.1, 2N9.2, 2N9.9, 2N10.1)

- Ask students to locate, talk about, and draw other natural doubles that occur in their world. For example, four legs on a chair (two on each side), 13 letters on each side of the word wall (26 letters altogether).

  (2N9.1, 2N9.2, 2N10.1)

- Ask students to think about how to find the sum of 8 + 6 if they did not already know the answer. Encourage students to come up with different ways of using doubles to figure out this sum. For example, use double eight then subtract two, use double six and add two, use double seven, taking one from the eight and adding it to the six.

  (2N9.1, 2N9.2, 2N10.1)

- Invite students to play "Doubles +/– 1". Create a 4 x 4 game board with different doubles plus/subtract 1 answers on it. Players take turns rolling a die, doubling and adding/subtracting one. If the answer is on the board, the player can use a counter to cover it up. The first player to get four counters on the board, wins. This activity can also be adapted for doubles plus/subtract two.

9	7	11	1
5	1	14	3
7	3	9	11
13	11	7	5

(2N9.1, 2N9.2, 2N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 12: Mental Math: Doubles and Near Doubles

TR: pp. 66 - 69

SB: pp. 81 - 82

Audio CD 2:

Selection: 12

Unit Centre:

TR: p. 17

- Quick Subtraction

Activity Bank:

TR: p. 76

- Doubles Monster

Note:

This lesson uses the term "near doubles" which is the same as the doubles plus one, plus two, subtract one and subtract two strategies.

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicator:

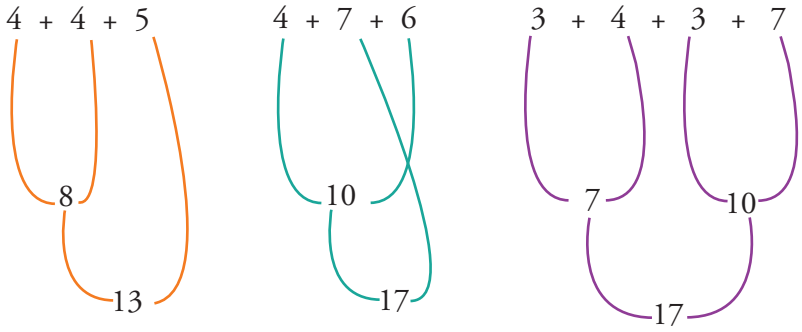
2N9.3 (Continued) Add a given set of numbers in two different ways and explain why the sum is the same; e.g., 2+5+3+8=(2+3) +5+8 or 5+3+(8+2).

Elaborations—Strategies for Learning and Teaching

Students already had experience adding, in different orders, numbers with two addends. The focus now is finding the sum of addition sentences that contain more than two addends and to explore adding them in different ways, for example, 3 + 4 + 7 or 2 + 5 + 3 + 1.

At this point, students have been given many opportunities to learn, develop, and apply addition strategies that are meaningful and relevant to them. When students have to add numbers that have more than two addends, they will need to learn how to adjust and apply their own strategies to fit the numbers in a given addition sentence. It is important to reinforce with Grade Two students that a good strategy is one that helps to make the thinking easier; if it does not, then it is not a good strategy for them to use. Using Doubles and Making Ten are two addition strategies that students may find useful in solving problems involving more than two addends. When students are able to adjust a strategy to solve a number problem, they are on the road to computational fluency.

Give students six sums to find involving 3 or 4 addends. Prepare these on one page divided into six sections so that there is space to write beneath each sum. Within each, include at least one pair with a sum of ten or perhaps a double; e.g. 4 + 7 + 6, or 3 + 4 + 3 + 7. Students should show how they added the numbers. Allow students to find the sums without any other directions. (Adapted from Van de Walle, 2006, p. 76)



As students share their solutions, it will become apparent that some students will have added the numbers in different orders but reached the same sum thus reinforcing the commutative property of addition. Finding combinations of ten or using doubles to help find the answer are both efficient ways of applying learned strategies and ones which should be encouraged and modelled. As these strategies are learned and applied, students will begin to look for compatible or friendly numbers when grouping for addition.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Divide students into groups, present the groups with a problem, and ask each group to write an addition sentence and the sum. Allow each group to present their addition sentence. Students will see that although some groups added the numbers in different orders, the sum was the same. For example,

  (i) Ms. Jones asked students to bring in reusable beverage containers to use in a math center. 4 students brought in pop bottles, 1 brought orange juice containers, 6 brought apple juice containers and 9 brought in fruit punch containers. Some possible number sentences include :

  $6 + 9 + 4 + 1 = 17$

  $6 + 4 + 9 + 5 = 17$

  $9 + 1 + 4 + 6 = 17$

  (ii) The cafeteria sent up 4 cartons of milk for the breakfast club, 13 cartons of milk for recess and at lunch time, 3 more cartons were delivered. The students drank all of the milk. How many cartons of milk did the students drink that day?

  (2N9.3)

- Earlier in this unit, students were invited to shake and spill a specified number of two-sided counters on a paper plate. For each spill, the student recorded and drew two addition sentences. For example, if there were two red counters and five white, the student would have drawn what they saw and recorded the number sentences of $2 + 5 = 7$ and $5 + 2 = 7$. This task may now be extended to 3 and 4 addends by using coloured cubes instead of two sided counters.

  (2N9.3)

- Show each student four coloured links and have them pick their favorite of the four colours. Next sort the students into groups by colours. List the number of students in each group and have students choose to add the numbers in any order. Students then report their sentence to the rest of the class. This is also a good opportunity to practice adding zero. If the groups are sorted, for example, into green, red, blue and yellow, ask how many students are in the orange group. Encourage students to write their addition sentences including the zero.

  (2N8.1, 2N9.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 14: Different Ways to Add the Same Number

TR: pp. 72 - 76

SB: p. 85

Audio CD 2:

Selections: 13, 14

Unit Centre:

TR: p. 17

- Hit the Target

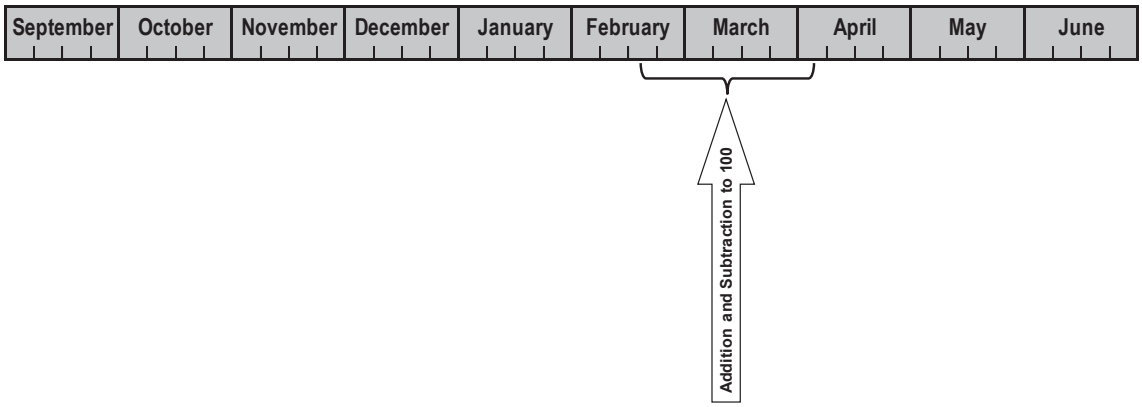
Activity Bank:

TR: p. 76

- Toothpick Creations
- Dazzling Dots

Addition and Subtraction to 100

Suggested Time: 5 Weeks



Unit Overview

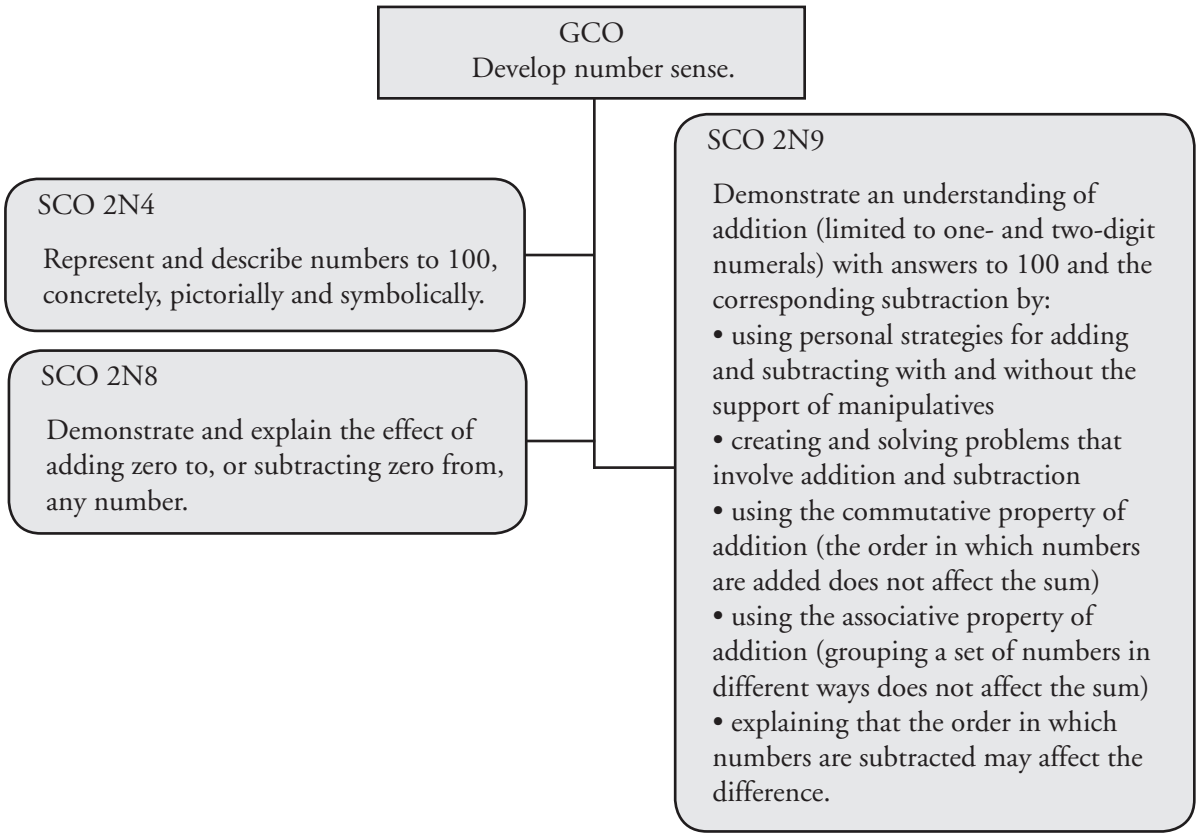
Focus and Context

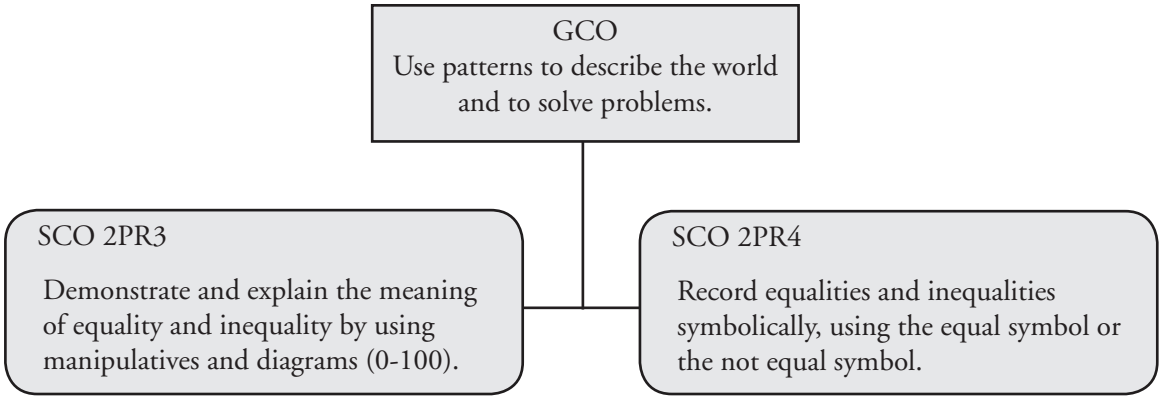
Earlier work in Grade Two focused on addition and subtraction situations with one and two-digit numbers with answers to 18 and on learning how to represent numbers to 100. Through this early work, students have been given opportunities to develop basic concepts needed to begin the study of addition and subtraction to 100.

Students will use their previous experiences to add and subtract one-digit and two-digit numbers, investigate/create story problems and develop/ refine personal strategies.

As students continue to work with numbers, they will be given opportunities to gain a better understanding of the base ten numeration system. This understanding is encouraged through the work with concrete materials, such as base ten blocks, ten-frames, number lines, linking cubes, etc. It is important that the manipulatives are available to students. They will be encouraged to group and regroup units and rods. They also learn to interpret and explain numbers and understand various ways to write a number symbolically. Throughout the unit, estimation and experiences checking for reasonableness of an answer will be modelled.

Outcomes Framework





SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1N4. Represent and describe numbers to 20, concretely, pictorially and symbolically. [C, CN, V] 1N7. Identify the number, up to 20, that is: • one more • two more • one less • two less than a given number. [C, CN, ME, R, V]	2N4. Represent and describe numbers to 100, concretely, pictorially and symbolically. [C, CN, V] 2N8. Demonstrate and explain the effect of adding zero to, or subtracting zero from, any number. [C, R]	3N2. Represent and describe numbers to 1000, concretely, pictorially and symbolically. [C, CN, V] 3N6. Describe and apply mental mathematics strategies for adding two two-digit numerals. [C, CN, ME, PS, R, V] 3N7. Describe and apply mental mathematics strategies for subtracting two two-digit numerals. [C, CN, ME, PS, R, V]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1N8. Demonstrate an understanding of addition of numbers with answers to 20 and their corresponding subtraction facts, concretely, pictorially and symbolically, by: • using familiar 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]	2N9. Demonstrate an understanding of addition (limited to one- and two-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 • using the commutative property of addition (the order in which numbers are added does not affect the sum) • using the associative property of addition (grouping a set of numbers in different ways does not affect the sum) • explaining that the order in which numbers are subtracted may affect the difference. [C, CN, ME, PS, R, V]	3N8. Apply estimation strategies to predict sums and differences of two two-digit numerals in a problem-solving context. [C, ME, PS, R] 3N9. Demonstrate an understanding of addition (limited to one-, two- and three-digit numerals) with answers to 1000, and the corresponding subtraction, concretely, pictorially and symbolically, by: • using personal strategies for adding and subtracting with and without the support of manipulatives • creating and solving problems in context that involve addition and subtraction of numbers. [C, CN, ME, PS, R, V]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Patterns and Relations (Variables and Equations)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1PR3. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20). [C, CN, R, V] 1PR4. Record equalities using the equal symbol (0 to 20). [C, CN, PS, V	2PR3. Demonstrate and explain the meaning of equality and inequality, concretely and pictorially (0-100). [C, CN, R, V] 2PR4. Record equalities and inequalities symbolically, using the equal symbol or the not equal symbol. [C, CN, R, V]	3PR4. Solve one-step addition and subtraction equations involving symbols representing an unknown number. [C, CN, PS, R, V]

Mathematical Processes

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

Strand: Number

Outcomes

Students will be expected to

2N9 Demonstrate an understanding of addition (limited to one-and two-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 the numbers are added does not affect the sum (commutative property).**
- **Explaining the order in which numbers are subtracted may affect the difference.**

(C, CN, ME, PS, R, V)

Achievement Indicator:

2N9.1 Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.

Elaborations—Strategies for Learning and Teaching

In Grade One, students demonstrated an understanding of the addition of numbers to 20 and their corresponding subtraction facts (1N8). This was revisited in the Addition and Subtraction to 18 unit (2N9). Earlier in Grade Two, students also represented and described numbers to 100 (2N4). Now students begin to work at combining and separating numbers in a wide variety of ways as they solve two-digit addition and subtraction problems. Students should investigate a variety of strategies, including standard algorithms, to become proficient in at least one appropriate and efficient strategy that they understand.

Using models is essential in helping students to relate the physical action of joining and/or separating two groups. Base ten blocks are a great way to do this. In previous work, students have had many opportunities to practice representing numbers using base ten blocks and joining or separating them. Give students many opportunities to model addition and subtraction using concrete materials. This can extend to representing pictorially and symbolically.

Use a hundred chart and indicate a "Number of the Day". Use this number to pose questions such as:

- What is 10 more than this number? What is 20 more?
- What is 10 less?
- Is there a number that is 50 less?

Present the base ten model of the number and then physically show how to add 10 more, 20 more etc., as you engage students in a conversation about the process. Through this daily practice, students should come to realize that only the tens place is changing, when adding or subtracting ten, whereas the ones place is remaining the same.

General Outcome: Develop number sense

Suggested Assessment Strategies

Journal

- Ask students to choose a number from the hundred chart and record it. Ask students to show what happens to when you add 10 to, or subtract 10 from, the number. Repeat with multiples of 10. Ensure manipulatives are available to students as they complete this problem.

  (2N9.1, 2N9.9)

- Using individual hundred charts, ask students to choose a number less than 20. For example, someone chooses the number 6.

  Then ask students to add 10 to 6 and colour the sum on their hundred chart.

  Ask students to add 40 to 6 and colour the sum.

  Ask students to add 20 to 6 and colour the sum.

  Ask students to colour the sum of other multiples of 10.

  Ask students to write about the patterns they see in their coloured hundred charts. Observe students' conceptual understanding of adding 10.

  (2N9.1, 2N9.4, 2N9.9)

Performance

- Ask students to represent a given number using base ten blocks. Ask students to show what happens when you add 10 or multiples of 10 to the number. Have them symbolically record the number sentences showing the sum.

  (2N9.1, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Launch:

Teacher Resource (TR): p. 17

Student Book (SB): pp. 125 - 127

Unit Centre:

TR: p. 15

- My Number Is

Lesson 1: Adding 10's

TR: p. 18

SB: pp. 128 - 129

Audio CD 3:

Selection: 1

Little Book: *Birthday Countdown*

Refer to Appendix B (pp. 227 - 231) for problem solving strategies and ideas.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/add-sub-100.html

- interactive number chart
- addition and subtraction games
- word wall ideas

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.1 (Continued) Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.

2N9.9 Refine personal strategies to increase their efficiency.

Elaborations—Strategies for Learning and Teaching

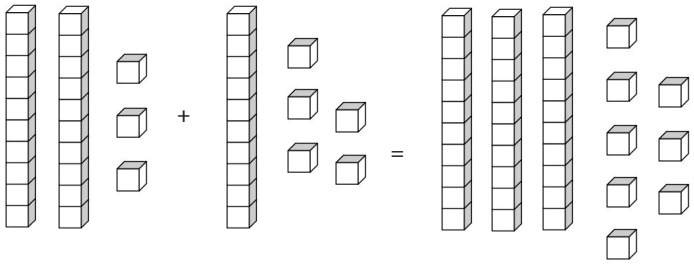
Adding 10s is a good place to reinforce money concepts formally introduced in previous units. Students can practice adding or subtracting 10s using dimes.

To allow for differentiation in student learning, provide choice within tasks that will accommodate all levels of ability. Choosing different numbers in a question for students to add, subtract, or represent may allow all students the ability to access the problem and challenge them.

Two-Digit Addition Strategies

The strategies illustrated all show 23 + 15 = 38.

- Base ten blocks

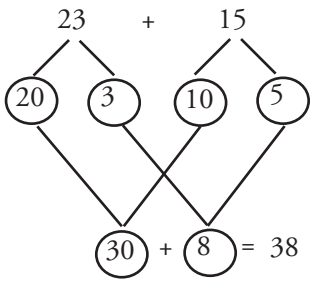


- Hundred chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Start at the first number. When adding ten, use a vertical arrow to move down one row. When adding five, use a horizontal arrow to move five spaces to the right.

- Place value



General Outcome: Develop number sense

Suggested Assessment Strategies

Portfolio

- Collect samples of student work throughout the unit. Note whether students have refined their strategies to include more efficient methods.

(2N9.9)

Performance

- In a centre, set up two sets of base ten blocks and the following provocations:
  - (i) I wonder what number I would create if I put all these blocks together?
  - (ii) I wonder if there is another way to use base ten blocks to represent these numbers?

(2N9.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Adding 10's

TR: pp. 18 - 20

SB: pp. 128 - 129

Activity Bank:

TR: p. 26

- Tens Attack!
- Add a Ten

Lesson 2: Adding 1-Digit and 2-Digit Numbers

TR: pp. 21 - 25

SB: pp. 130 - 131

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

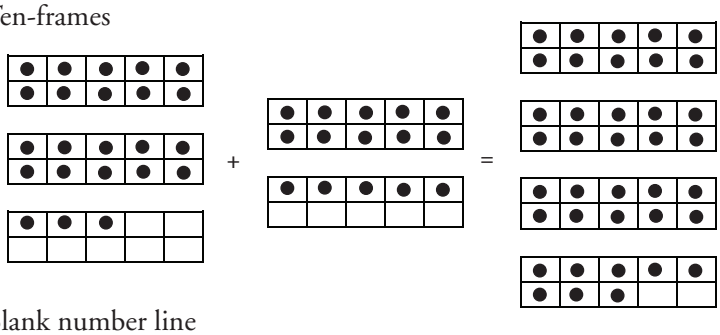
Achievement Indicators:

2N9.1 (Continued) Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.

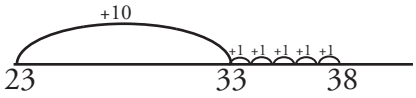
2N9.9 (Continued) Refine personal strategies to increase their efficiency.

Elaborations—Strategies for Learning and Teaching

- Ten-frames



- Blank number line



Draw a line. Place the largest number at the beginning of the line. Make a big jump for each ten being added and smaller hops for each one.

- Standard algorithm

$$\begin{array}{r} 2\ 3 \\ +\ 1\ 5 \\ \hline 3\ 8 \end{array}$$

Research has shown that students gain a greater understanding of concepts if they have been given "hands on" opportunities to develop strategies. Talking and discussing are important aspects in refining a student's personal strategy to solving problems. As students talk about their thinking, or engage in partner and small group discussions, they are able to organize their thoughts, and also hear how others are making sense of the task. This sharing of ideas helps to solidify understanding for some students, and for others, helps them to think about the problem in a new way. This helps them to refine their own personal strategies. To help facilitate discussions, prompt students with:

- "Tell me what you were thinking when you did that."
- "Why or how does that work?"
- "What would happen if…?"
- "What else can you tell me about...?"

It is important to monitor the type of strategy students are using as they solve problems. Be accepting of students' personal strategies and give them sufficient time to work with their strategy. When strategies are inefficient, however, and students are given time to realize why they are inefficient, they can be guided to find more efficient ways to solve the problem. More efficient strategies serve students better as they move to more complex situations.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Write a variety of two-digit numbers on small pieces of paper, and place them in a paper bag. Invite students to draw two pieces of paper, record the appropriate addition sentence horizontally and/or vertically, and use personal strategies to solve their problem. Ensure that students are using both horizontal and vertical forms.

  (2N9.1, 2N9.2, 2N9.9)

- Using a walk-on hundred chart, present students with various addition sentences, including some with zero. Students move appropriately along the hundred chart to represent the problem. A walk-on hundred chart can be made by using a vinyl tablecloth or shower curtain and a permanent marker.

  (2N8.1, 2N9.1, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2 (Continued): Adding 1-Digit and 2-Digit Numbers

TR: pp. 21 - 25

SB: pp. 130 - 131

Activity Bank:
TR: p. 26
- Square Sums
- Number Match

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.2 Solve a given problem, using horizontal and vertical forms.

2N9.3 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).

Elaborations—Strategies for Learning and Teaching

Use what students already know about strategies to help them create other personal strategies. Encourage them to use previously learned strategies to add and subtract one and two-digit numbers, such as doubles and doubles plus one. Students should be able to recall addition facts up to and including 5 + 5 and related subtraction facts. At this point, it may be important that the "counting-on"strategy be brought forward as an efficient way of adding a small one-digit number to a two-digit number. As students work through solving addition and subtraction problems, present problems using both horizontal and vertical forms. Vertical forms emphasize place value, while horizontal forms support the idea of what addition is – that of joining.

The associative property tells us that to add three numbers, you can add the first two numbers and then add the last number to the sum. Or, you can add the last two numbers and then add the first number to the sum. To add 15 +14 +13, for example, you can add 15 +14 to get 29 and then add 13, or you can add 14 +13 to get 27 and then add 15 to get your answer.

Provide an example such as 14 + 38 + 6. Ask students which two numbers would they add together first to make adding on the third number easier? Students should be encouraged to explain their choices.

General Outcome: Develop number sense

Suggested Assessment Strategies

Journal

- Ask students to grab two handfuls of counters, count the counters in each group and create and solve a number sentence to represent the quantity of counters. Have students record their thinking as they solve their problem.

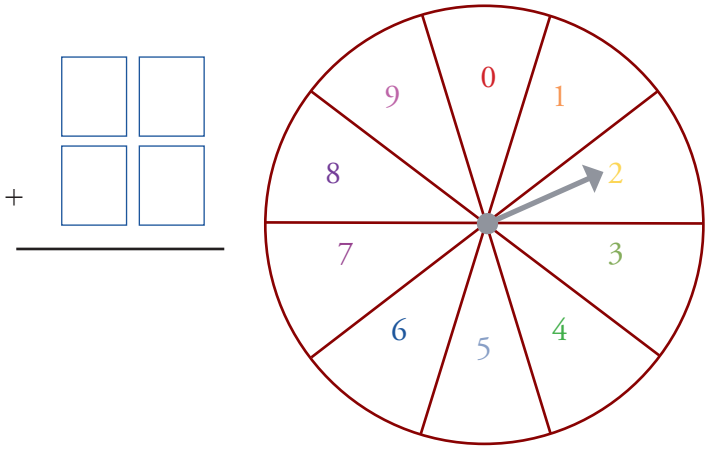
(2N9.1)

- Ask students to create a real-world story problem using groups of counters. They should then solve their problem, and record their thinking. They may also exchange problems with a classmate to solve.

(2N9.1, 2N9.2, 2N9.4, 2N9.9)

Performance

- Invite students to play the "Spin and Solve Game". A student spins a spinner and writes the number he/she spins as a digit in his/her first problem. Alternating with a partner, they repeat this eight times to complete both two-digit addends. They each solve their addition problems to find the sums. The player with the greatest sum is the winner of that round. Continue the game in this manner while keeping a tally of rounds won. Students with strong mathematical thinking will quickly discover the value of placing greater numbers in the tens place, and lesser numbers in the ones place to produce a greater sum. Ask the student with the largest sum to explain his/her strategy.



(2N9.1, 2N9.2, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3: Adding 2-Digit Numbers Using Personal Strategies.

TR: pp. 27 - 30

SB: pp. 132 - 133

Audio CD 3:

Selection: 2

Unit Centre:
TR: p. 15
- Store Front

Activity Bank:
TR: p. 38
- Reach 100

Lesson 4: Adding More than 2 Numbers

TR: pp. 31 - 38

SB: p. 134

Audio CD 3:

Selection: 3

Activity Bank:

TR: p. 38

- Reach 100
- Pick up Sticks

Strand: Number

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **2N9 Continued** **Achievement Indicators:**	
2N9.4 Create an addition or subtraction number sentence and a story problem for a given solution.	It is important that students be involved in solving meaningful and worthwhile addition and subtraction tasks that are engaging and interesting. Creating activities that are relevant and personal, such as using student names within questions, interesting facts about people, world records, playing games, etc., are examples of how to make classroom work more meaningful.
2N9.5 Solve a given problem involving a missing addend, and describe the strategy used.	The concept of finding the missing addend has already been introduced this year, but students may need some review. Addition and subtraction problems can be categorized based on the kinds of relationships they represent. It is important that different categories of problems be presented and that these are derived from students' experiences. These categories include: • Join Problems: result unknown, change unknown, initial unknown • Separate Problems: result unknown, change unknown, initial unknown • Part-Part-Whole Problems: whole unknown, part unknown • Compare Problems: difference unknown, larger unknown, smaller unknown (Van de Walle and Lovin, 2006, pp. 67 - 69) When students see addition and subtraction as simply "put together" and "take-away", they often have difficulty with more complex structures. Students should be presented with a variety of problems in which they are working with these different structures.

General Outcome: Develop number sense

Suggested Assessment Strategies

Journal

- Provide students with a complete addition or subtraction sentence and ask them to create a real-world problem.

(2N9.4, 2N9.9)

- Ask students to work with a partner to choose two two-digit numbers from a hundred chart. One student writes an addition sentence, while the other student writes the corresponding "turn-around". Students then solve their problem individually and compare answers.

(2N9.1, 2N9.2, 2N9.3, 2N9.9)

- Arrange students in groups of three. Ask each student to measure his/her foot from heel to toe in blocks, cubes, etc. Students then record the three measurements and create and solve a number sentence to find the total length of their three feet.

(2N9.1, 2N9.2, 2N9.3, 2N9.4, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5: Creating and Solving Addition Problems

TR: pp. 34 - 37

SB: pp. 135 - 136

Activity Bank:

TR: p. 26

- Square Sums
- Number Match

TR: p. 38

- Adding Money

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

Achievement Indicators:

2N9.6 Match a number sentence to a given missing addend problem.

2N9.7 Solve a given problem involving a missing minuend or subtrahend and describe the strategy used.

2N9.9 (Continued) Refine personal strategies to increase their efficiency.

Elaborations—Strategies for Learning and Teaching

The hundred chart and arrows was introduced as an effective way to teach addition and subtraction of one and two-digit numbers. Choose a starting number and an ending number. Together, write a number sentence that is represented, for example, 23 + ☐ = 69. Engage the students in a discussion about how a vertical arrow means adding/subtracting ten, while a horizontal arrow means adding/subtracting one.

It is important for students to think of subtracting tens as the inverse or opposite of adding tens, rather than as a separate idea.

Be cautious when teaching subtraction strategies. Traditionally, students were taught to subtract two-digit numbers solely by using a vertical algorithm. This rote method often lacked deep understanding. Always ensure that manipulatives are readily available for students to use. After students have had opportunity to explore and discover their own strategies for solving subtraction problems, have one student share his/her thinking to solve a problem. As a class, discuss how this thinking can be recorded. Repeat this procedure for other students with different strategies. The efficiency of the strategies should be discussed.

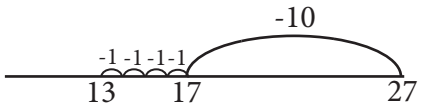
Students must have a firm understanding of the part-part-whole concept in order to have success. Continued practice with combining and separating wholes is encouraged throughout this unit using concrete experiences. Students should be able to describe that when the whole group is missing, you can determine what it is by adding the parts. When one part is missing, you can either add on to the part you know to get the whole, or subtract the part from the whole.

While it is not necessary for students to use the terms minuend and subtrahend, they can be exposed to the terminology.

Two-Digit Subtraction Strategies

The strategies illustrated all show 27 - 14 = 13.

- Blank number line



Draw a line. Place the largest number at the end of the line. Make a big jump for each ten being subtracted and smaller hops for each one.

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Present addition and subtraction stories for each of the four categories. Ask students to create and represent the problems concretely (using manipulatives), pictorially (using sketches), and/or symbolically (recording number sentences). The following examples may be used:

  Join Problems

  Result Unknown - Sarah placed 24 pencils on the table. Steven placed 37 more pencils on the table. How many pencils are on the table altogether?

  Change Unknown - Sarah placed 24 pencils on the table. Steven placed some pencils on the table. There are 61 pencils altogether. How many pencils did Steven place on the table?

  Initial Unknown - Sarah placed some pencils on the table. Steven placed 31 more pencils on the table. There are 61 pencils altogether. How many pencils did Sarah place on the table?

  Separate Problems

  Result Unknown - 35 children are playing soccer on the field. 12 children went home. How many children are still on the field?

  Change Unknown - 35 children are playing soccer on the field. Some went home. There are 23 children left on the field. How many children went home?

  Initial Unknown - Some children are playing soccer on the field. 12 children went home. There are 23 children left. How many children were playing soccer in the beginning?

  Part-Part-Whole Problems

  Whole Unknown - Mark has 14 purple balloons and 28 yellow balloons. How many balloons does he have altogether?

  Part Unknown - Mark has 42 balloons. 14 of his balloons are purple and the rest are yellow. How many yellow balloons does Mark have?

  Compare Problems

  Difference Unknown - Mark has 42 stickers. Julia has 28 stickers. How many more stickers does Mark have than Julia?

  Larger Unknown - Mark has 14 more stickers than Julia. Mark has 42 stickers. How many stickers does Julia have?

  Smaller Unknown - Mark has 14 more stickers than Julia. Julia has 28 stickers. How many stickers does Mark have?

(2N9.1, 2N9.2, 2N9.4, 2N9.5, 2N9.7, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 6: Subtracting 10's

TR: pp. 39 - 41

SB: pp. 137 - 138

Audio CD 3:

Selection: 4

Activity Bank:

TR: p. 47

- 10s
- Arrow Paths

Lesson 7: Subtracting a 1-Digit Number from a 2-Digit Number.

TR: pp. 42 - 46

SB: pp. 139 - 140

Activity Bank:

TR: p. 47

- Reach One
- X-Ray Vision

Strand: Number

Outcomes

Students will be expected to

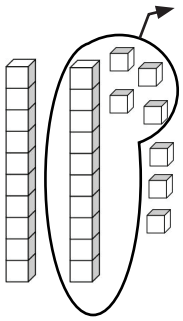
2N9 Continued

Achievement Indicator:

2N9.9 (Continued) Refine personal strategies to increase their efficiency.

Elaborations—Strategies for Learning and Teaching

- Base ten blocks



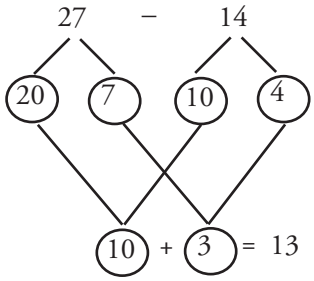
Use base ten blocks to show 27. Remove blocks to represent 14. 13 base ten blocks are left.

- Hundred chart

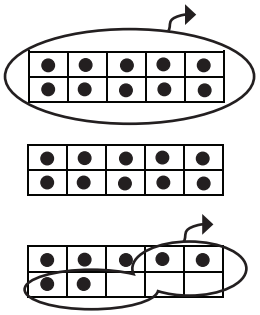
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Start at the first number. When subtracting ten, use a vertical arrow to move up one row. When subtracting four, use a horizontal arrow to move four spaces to the left.

- Place value



- Ten-frame



Use ten-frames to model 27. Subtract ten, (one full ten-frame) and four ones.

General Outcome: Develop number sense

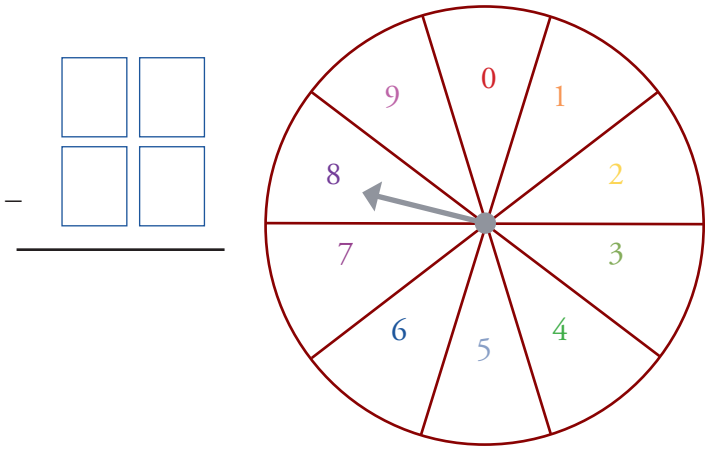
Suggested Assessment Strategies

Performance

- Invite pairs of students to play the "Toss It!" Game. Ask a student to toss two counters into a box lid which has been prepared with a grid with numbers less than 100. He/she records the numbers the counters land on as a subtraction problem. The other student in the pair then does the same. The student with the greatest answer is the winner for that round. Students keep a tally of how many rounds they win. The first person to win ten rounds is the overall winner.

(2N9.1, 2N9.2, 2N9.9)

- Invite students to play the "Spin and Solve Game". A student spins a spinner and writes the number he/she spins as a digit in his/her first problem. Alternating with a partner, they repeat this eight times to complete both two-digit numbers. They each solve their subtraction problem to find the difference. The player with the greatest difference is the winner of that round. Continue the game in this manner while keeping a tally of rounds won. If students arrange the digits such that the problem cannot be solved, their turn is "busted"! For example, 53 - 80 cannot be solved at the Grade Two level. Students with strong mathematical thinking will quickly discover the value of placing greater numbers in the minuend, and lesser numbers in the subtrahend to produce a greater difference. If students do not discover this, a guided discussion may be necessary.



(2N9.1, 2N9.2, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 8: Subtracting 2-Digit Numbers Using Personal Strategies

TR: pp. 48 - 51

SB: pp. 141 - 143

Unit Centre:

TR: p. 15

- Greatest Difference

Activity Bank:

TR: p. 56

- Scrambled Letters
- Snakes and Ladders My Way

Lesson 9: Creating and Solving Subtraction Problems

TR: pp. 52 - 55

SB: pp. 144 - 145

Unit Centre:

TR: p. 15

- Build It

Activity Bank:

TR: p. 56

- Storyteller

Strand: Number

Outcomes

Students will be expected to

2N9 Continued

2N4 Represent and describe numbers to 100, concretely, pictorially and symbolically.

[C, CN, V]

Achievement Indicators:

2N9.9 (Continued) Refine personal strategies to increase their efficiency.

2N9.8 Match a number sentence to a given missing subtrahend or minuend problem.

2N4.3 Represent a given number pictorially and symbolically.

2N4.7 Represent a given number, using expressions ; e.g., 24 + 6, 15 + 15, 40 – 10.

Elaborations—Strategies for Learning and Teaching

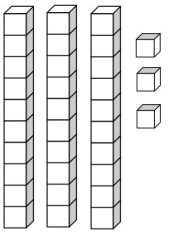
- Standard algorithm

$$\begin{array}{r} 2\ 7 \\ -\ 1\ 4 \\ \hline 1\ 3 \end{array}$$

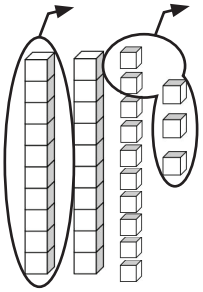
Students should also work with subtraction that requires regrouping.

- Base ten blocks (with regrouping)

This example illustrates 33 - 15 = 18



5 units cannot be taken from 3 units. Regrouping is necessary. Change one rod into 10 units. Subtract one ten and five units. The answer is 18.



- Standard algorithm (with regrouping)

$$\begin{array}{r} {}^{2}\not{3}\ {}^{1}3 \\ -\ 1\ 5 \\ \hline 1\ 8 \end{array}$$

Subtraction as "think-addition" is a key component for mastering subtraction facts. Because the unknown part is left hidden, when students do these activities they are encouraged to think about the hidden part. "What goes with the part I see to make the whole?" If, for example, the total or whole number of counters is 23, and 14 are removed, the student is likely to think of "14 and what makes 23?" or "What goes with 14 to make 23?" This mental activity is "think-addition" instead of a "count what's left" approach.

At this point in the year, students will be becoming more proficient at drawing various representations of a given number using manipulatives such as base ten blocks, ten-frames, popsicle sticks (in groups of ten), etc.

This would be a good opportunity to reinforce the concept of money. 43, for example, can be represented in various ways including:

- 10¢ + 10¢ + 10¢ + 10¢ + 1¢ + 1¢ + 1¢
- 5¢ + 5¢ + 5¢ + 5¢ + 5¢ + 5¢ + 5¢ + 5¢ + 1¢ + 1¢ + 1¢
- 25¢ + 10¢ + 5¢ + 1¢ + 1¢ + 1¢

General Outcome: Develop number sense

Suggested Assessment Strategies

Performance

- Ask students to work in pairs. One student represents a number using rods and units. The other student looks at the number and then closes his/her eyes. The student who made the number removes part of the number. The other student must then determine what part of the number is missing. To extend this activity, ask students to record these number sentences.

(2N9.1, 2N9.2, 2N9.7, 2N9.8, 2N9.9)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 10: Missing Numbers in Addition

TR: pp. 57 - 59

SB: p. 146

Lesson 11: Missing Number in Subtraction

TR: pp. 60 - 62

SB: pp. 147 - 148

Audio CD 3:

Selection: 3

Activity Bank:

TR: p. 68

- Transformers
- Coupon Savings

Lesson 12: Expressing Numbers Different Ways

TR: pp. 63 - 67

Activity Bank:

TR: p. 68

- Target Number
- Match Up

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

2PR3 Demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0-100).

[C, CN, R, V]

2PR4 Record equalities and inequalities symbolically, using the equal symbol or the not equal symbol.

[C, CN, R, V]

2N8 Demonstrate and explain the effect of adding zero to, or subtracting zero from, any number.

[C, R]

Achievement Indicators:

2PR3.1 Determine whether two given quantities of the same object (same shape and mass) are equal by using a balance scale.

2PR4.1 Determine whether two sides of a given number sentence are equal (=) or not equal (≠). Write the appropriate symbol and justify the answer.

2PR4.2 Model equalities, using a variety of concrete representations, and record the equality symbolically.

2N8.1 Add zero to a given number, and explain why the sum is the same as the addend.

2N8.2 Subtract zero from a given number, and explain why the difference is the same as the given number.

Elaborations—Strategies for Learning and Teaching

The concepts of equality and inequality were introduced and explored in previous units. Similarly, students have worked with computations involving zero already this year. The intent here is to revisit these ideas working with sums to 100 and their related differences.

Use the pan-balance scale to show equality and inequality. Place 24 counters, for example, on the left side of the balance, and 30 counters on the right side. The scale will not be balanced (i.e., 24 ≠ 30). Discuss how many counters will need to be removed from the right side, or added to the left side, to make the pans balance. This example can be represented as 24 = 30 - 6 or as 30 = 24 + 6.

Students should complete number sentences using = or ≠.

- 55 + 21 ☐ 76
- 32 + 63 ☐ 98
- 64 ☐ 98 − 44
- 24 + 52 + 0 ☐ 44 − 0 + 32

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

Suggested Assessment Strategies

Performance

- In a centre, provide a balance scale with 35 counters on one side and 19 counters on the other, and the following provocations:
  (i) Balance me by subtracting.
  (ii) Unbalance me by adding.
  (iii) Write the number sentences.

(2PR3.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

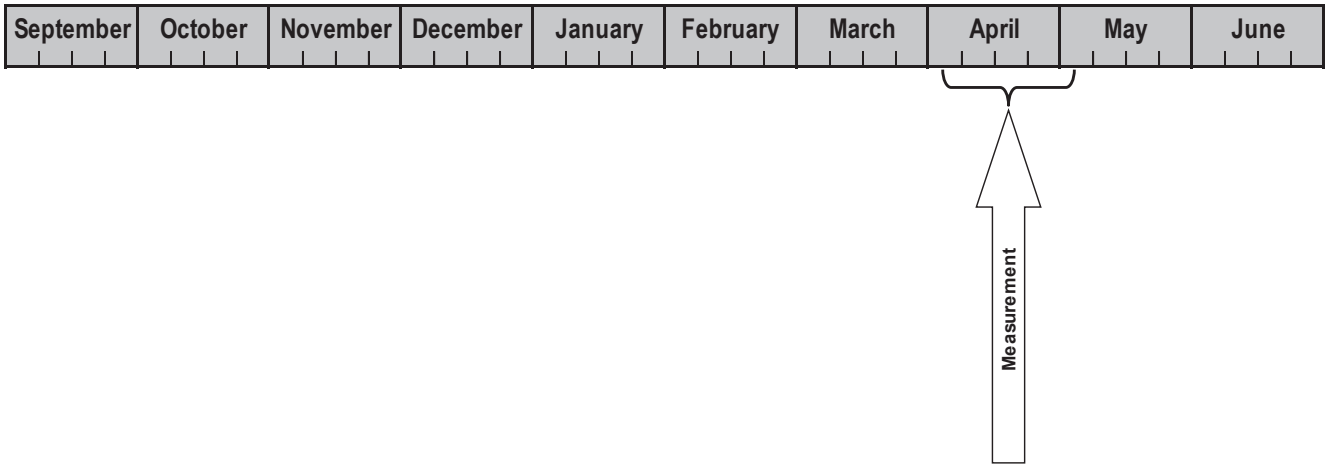
Lesson 12 (Continued): Expressing Numbers Different Ways

TR: pp. 63 - 67

SB: p. 149

Measurement

Suggested Time: 4 Weeks



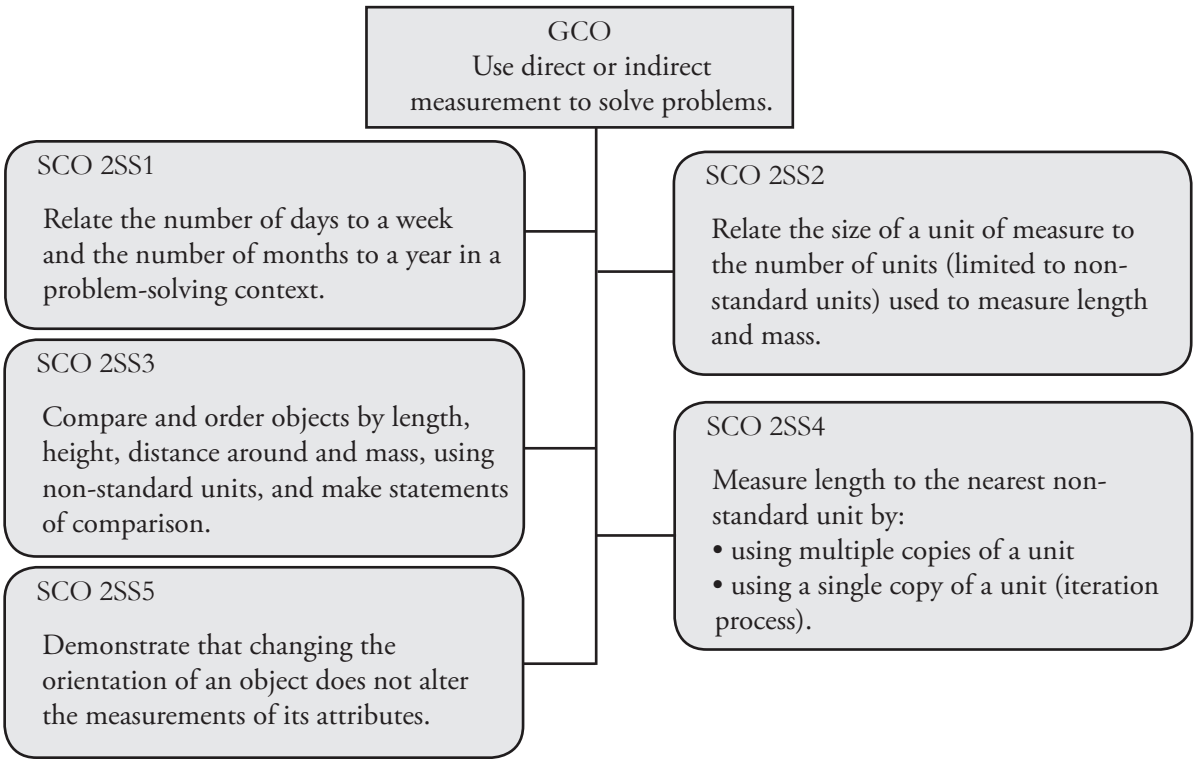
Unit Overview

Focus and Context

Students are given the opportunity to work with units of time, (days, weeks and months). They also learn about measuring length, height, distance around and mass using non-standard units such as snap cubes, paper clips, parts of the body, etc. Students will move from previous work where they have engaged in identifying days of the week and seasons of the year as repeating events, to reading dates on a calendar and solving problems related to the calendar. In Grade One, students compared lengths, areas, capacities and masses by matching, covering and filling. In Grade Two students will estimate, measure, compare and order objects using a variety of non-standard units. It is important that students be familiar with and understand the actual attribute they are using to compare and measure.

Estimation in measurement is a skill that is worked on throughout this unit. Estimation activities should focus on helping students come to a realization that different non-standard units will have different measurements depending on the size of the unit. A desk, for example, could be two math books wide or 50 paper clips wide. Students need to have a lot of practice using non-standard units to come to this realization. Engage students in careful observation and comparison of objects, and develop appropriate questioning and predicting skills as they estimate how big, how tall, how heavy an object is.

Outcomes Framework



GCO
Use patterns to describe the world and to solve problems.

SCO 2PR2

Demonstrate an understanding of increasing patterns by:
• describing
• reproducing
• extending
• creating
numerical (numbers to 100) and non-numerical patterns using manipulatives, diagrams, sounds and actions.

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Shape and Space (Measurement)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1SS1. 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]	2SS1. 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] 2SS2. Relate the size of a unit of measure to the number of units (limited to non-standard units) used to measure length and mass . [C, CN, ME, R, V] 2SS3. Compare and order objects by length, height, distance around and mass, using non-standard units, and make statements of comparison. [C, CN, ME, R, V]	3SS1. Relate the passage of time to common activities, using non-standard and standard units (minutes, hours, days, weeks, months, years). [CN, ME, R] 3SS2. 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]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Shape and Space (Measurement)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
	2SS4. 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] 2SS5. Demonstrate that changing the orientation of an object does not alter the measurements of its attributes. [C, R, V]	3SS3. 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] 3SS4. 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] 3SS5. Demonstrate an understanding of perimeter of regular and irregular shapes by: • estimating perimeter, using referents for cm or m • 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]

SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Patterns and Relations (Patterns)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1PR1. 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] 1PR2. Translate repeating patterns from one representation to another. [C, CN, R, V]	2PR2. Demonstrate an understanding of increasing patterns by: • describing • reproducing • extending • creating numerical (numbers to 100) and non-numerical patterns using manipulatives, diagrams, sounds and actions. [C, CN, PS, R, V]	3PR1. Demonstrate an understanding of increasing patterns by: • describing • extending • comparing • creating numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions. [C, CN, PS, R, V] 3PR2. Demonstrate an understanding of decreasing patterns by: • describing • extending • comparing • creating numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions. [C, CN, PS, R, V]

Mathematical Processes

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

Strand: Shape and Space

Outcomes

Students will be expected to

2SS1 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]

Achievement Indicators:

2SS1.1 Read a date on a calendar.

2SS1.2 Name and order the days of the week.

2SS1.3 Identify the day of the week and the month of the year for an identified calendar date.

2SS1.4 Communicate that there are seven days in a week and twelve months in a year.

2SS1.5 Determine whether a given set of days is more or less than a week.

2SS1.6 Identify yesterday's/ tomorrow's date.

2SS1.7 Identify the month that comes before and the month that comes after a given month.

2SS1.8 Name and order the months of the year.

Elaborations—Strategies for Learning and Teaching

It is important to involve students in daily problem solving activities with the calendar in order to help them gain a deeper understanding of how the days of the week and months of the year are organized. These problem solving activities should allow students to see, more clearly, patterns that exist in the calendar and how these patterns can help them read the calendar more effectively.

The calendar is one of the first places where students are exposed to a ready made pattern (i.e., the days of the week form a seven element repeating pattern, and the months of the year is the core of a 12 element repeating pattern). Working with the calendar is a good opportunity for students to experience patterns. Learning the days of the week and months of the year can be taught simultaneously and not as separate entities. It is also important for students to see the relevance of calendar activities in their personal and daily lives by tracking important dates, such as holidays and birthdays.

Teachers could move beyond identifying just the day by engaging students in problem solving activities involving the calendar. Question students about the various patterns that are found within the calendar, for example, "If today is the 15th of April, what would the date be a week from now? Two weeks from now?"

These types of problem solving activities help make deeper connections between the calendar, patterning, and their own life.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance

- Ask students to play in pairs using a die and a one-month or two-month calendar as a game board. Students take turns rolling the die and moving forward on the gameboard to see who reaches the end of the board first. Student A rolls the die and counts from May 1. Student B continues in the same manner. Apply some rules such as the following:

  If you land on a Wednesday, jump ahead one week.
  If you land on a Sunday, go back three spaces.
  If you land on a Friday, skip the weekend and go to the next Monday.

May / June 2018						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

(2SS1.1, 2SS1.2, 2SS1.3)

- Invite students to play with the "Calendar Mystery Box". Provide cards with the days of the week and the months of the year printed on them. Ask one student, to choose a card to put in the mystery box. The rest of the class have to ask questions to determine which card is in the box. E.g.,

  (i) Is it a month?

  (ii) What month comes after it?

  This game can be extended by adding cards with the numbers 1 - 31 on them. Then a student can put a month and a date in the mystery box. Some questions the rest of the class might ask are:

  (i) Is it an even number date?

  (ii) Is it more than 15?

(2SS1.2, 2SS1.7, 2SS1.8)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Launch

Teacher Resource (TR): p. 15

Student Book (SB): pp. 105 - 107

Lesson 1: Days of the Week

TR: pp. 16 - 20

SB: pp. 108 - 110

Lesson 2: Months of the Year

TR: pp. 21 - 25

SB: p. 111

Little Book: *Birthday Countdown*

Audio CD 2:

Selection: 17

Refer to Appendix B (pp. 227 - 231) for problem solving strategies and ideas.

Strand: Shape and Space

Outcomes

Students will be expected to

2SS1 Continued

Achievement Indicators:

2SS1.1 (Continued) Read a date on a calendar.

2SS1.2 (Continued) Name and order the days of the week.

2SS1.3 (Continued) Identify the day of the week and the month of the year for an identified calendar date.

2SS1.4 (Continued) Communicate that there are seven days in a week and twelve months in a year.

2SS1.5 (Continued) Determine whether a given set of days is more or less than a week.

2SS1.6 (Continued) Identify yesterday's/tomorrow's date.

2SS1.7 (Continued) Identify the month that comes before and the month that comes after a given month.

2SS1.8 (Continued) Name and order the months of the year.

Elaborations—Strategies for Learning and Teaching

Some students will have some previous knowledge as many Kindergarten and Grade One teachers do calendar activities as part of their morning routines. A useful activity is having a "Question of the Day" where class helpers pick from a bank of calendar questions to ask the class:

- What will be the date a week from today?
- How many days before Saturday?
- What day will it be three days from today?
- If Christmas vacation begins on December 19th and ends on January 5th, how many weeks will you be on vacation?
- If Easter vacation begins on April 14th and ends on April 23rd, how many weeks/days will you be on vacation?
- If you went to the cottage with your family on Wednesday and arrived back home on the following Tuesday, would that be more or less than a week?

At the beginning of the month, engage students in a teacher directed activity where students build and create their own monthly calendars. They will need to write the days of the week in order, number the days, and fill in any special dates for that month.

Chants, songs, poetry and literature are good methods to teach students the days of the week and the months of the year in order. For example, chant:

Apples, oranges, peaches, plums,
Jump right up when your birthday comes.
January, February, March, April, May, June,
July, August, September, October, November, December.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance

- Invite students to play "I Spy" using the class calendar. This can be a whole group activity or the class can be divided into "teams". Give five clues such as "The date I see is an odd number. It is a two digit number. It is three more than twenty." Then ask: "What date do you spy"?
  (2SS1.1, 2SS1.2, 2SS1.3, 2SS1.4, 2SS1.5, 2SS1.6, 2SS1.7, 2SS1.8)

- Make a "Step Book" to show the activities a student does during a week, month, or year.
  E.g., "On Monday I…", "In October I…"
  (2SS1.1, 2SS1.2, 2SS1.3, 2SS1.4, 2SS1.5, 2SS1.6, 2SS1.7, 2SS1.8)

Journal

- Ask students to complete a journal entry based on one of the following:
  (i) Write what you know about days of the week.
  (ii) How many weeks are in a year? How did you get your answer?
  (iii) If today is Tuesday, what day of the week will it be in seven days?
  (iv) Today is (Friday, February 6th), what date will it be 10 days from today?
  (v) How might you use a calendar to subtract 14 from a number?
  (2SS1.1, 2SS1.2, 2SS1.3, 2SS1.4, 2SS1.5, 2SS1.6, 2SS1.7, 2SS1.8)

- Using student agendas or personal calendars, have students view a calendar and identify any special days within the month. Ask students to identify the day and write why the day is special.
  (2SS1.1, 2SS1.2, 2SS1.3, 2SS1.4, 2SS1.5, 2SS1.6, 2SS1.7, 2SS1.8)

Presentation

- Ask students to work in pairs. Ask them do a collage/storyboard on the days of the week or months of the year. They can use old magazines, the internet, and catalogues for images that represent things they would do during these time periods.
  (2SS1.1, 2SS1.2, 2SS1.3, 2SS1.4, 2SS1.5, 2SS1.6, 2SS1.7, 2SS1.8)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Days of the Week

TR: pp. 16 - 20

SB: pp. 108 - 110

Lesson 2 (Continued): Months of the Year

TR: pp. 21 - 25

SB: p. 111

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/meas.html

- how to make a "step book"
- word wall ideas

Strand: Shape and Space

Outcomes

Students will be expected to

2SS1 Continued

Achievement Indicator:

2SS1.9 Solve a given problem involving time that is limited to the number of days in a week and the number of months in a year.

Elaborations—Strategies for Learning and Teaching

The following problem solving situations would allow students to see patterns that exist in the calendar and how these patterns can help them read the calendar more effectively. Questions such as the following could be asked:

- Mikayla has been gone on vacation for 14 days. How many weeks is that?
- Johnny was in hospital for three weeks. How many days was he there?
- There are three months until the end of the school year. About how many days are left until summer vacation?
- It is the 80th day of the school year. What month will we celebrate the 100th day?
- If today is Wednesday, March 3rd, what day will it be in three weeks? What will the date be?
- You are invited to Joshua's birthday party 10 days from today. What date is Joshua's birthday?

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance

- Create a set of "Who has?"cards, using calendar type questions. One card may say, for example, "I have September, who has the month after July?" or "I have Friday, who has the day before Tuesday?" Give each student a card from the deck. The starting student would read his/her statement and question. The student who has the answer to the question would read the answer and pose the new question. The game continues until all students have had a chance to read their cards.

(2SS1.2, 2SS1.3, 2SS1.7, 2SS1.8)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Days of the Week

TR: pp. 16 - 20

SB: pp. 108 - 110

Lesson 2 (Continued): Months of the Year

TR: pp. 21 - 25

SB: p. 111

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/meas.html

- I have...Who has...? template

Strand: Patterns and Relations

Outcomes

Students will be expected to

2PR2 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]

Achievement Indicators:

2PR2.1 Identify and describe increasing patterns in a variety of given contexts; e.g., hundred chart, number line, addition tables, calendar, tiling pattern or drawings.

2PR2.3 Identify and describe increasing patterns in the environment; e.g., house/room numbers, book pages, calendar, pine cones, leap years

Elaborations—Strategies for Learning and Teaching

The calendar can be used to find number patterns such as repeating numbers, skip counting, and patterns in rows, columns and diagonals. While this outcome has already been addressed in the Patterning unit, this would be a good time to revisit and further reinforce patterning skills using the calendar.

Calendar patterns that your students might discover:

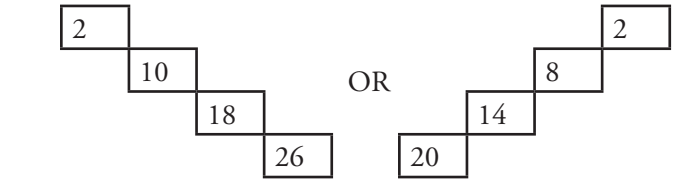
- Months of the Year:
  January, February, March, April, May, June, July, August, September, October, November, December is the core of a 12 element repeating pattern of months. Students are not expected to use 12 element patterns in Grade Two. However, it can be pointed out in this instance.
- Days of the Week:
  The days of the week form a seven element repeating pattern with a core of Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday.
- Row Patterns - always add 1 when going across a row

11	12	13	14	15	16	17

- Days-of-the-Week Pattern - add 7 when going down a column

9
16
23
30

- Diagonal Patterns such as



Add 8 going down Add 6 going down

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

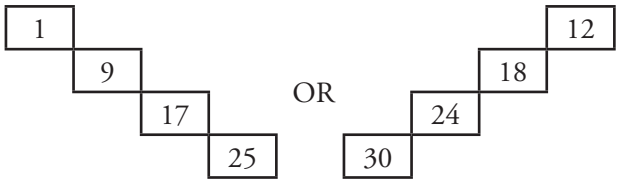
Suggested Assessment Strategies

Performance

- Each day a student selects the number card for the day's date and posts it on the calendar. Alternatively, the student may write the number on a post-it note to add to a blank calendar. Coloured "post-its" may be used to continue pattern work. Students have to identify both the number and the colour to complete the pattern. The student completes the activity by leading the class in reading the complete date for the day, "Today is _____[day of week/month/day/year].

(2PR2.1, 2PR2.3)

- Give students diagonal cut-outs from a simple calendar.



Ask: "What pattern do you see? Explain why this pattern occurs."

Student might say:

a) the diagonal shows dates which are one week and one day apart so that's why they are eight days apart.

b) the diagonals shows dates which are one week subtract one day apart so they are six days apart.

(2PR2.1, 2PR2.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Days of the Week

TR: pp. 16 - 20

SB: pp. 108 - 110

Lesson 2 (Continued): Months of the Year

TR: pp. 21 - 25

SB: p. 111

Unit Centre:

TR: p. 13

- Calendar Creations

Strand: Shape and Space

Outcomes

Students will be expected to

2SS3 Compare and order objects by length, height, distance around and mass, using non-standard units, and make statements of comparison.

[C, CN, ME, R, V]

Elaborations—Strategies for Learning and Teaching

In Mathematics One, students demonstrated their understanding of measurement by making comparisons and using terms such as longest, shortest, heaviest, most, least, etc. (1SS1) It is necessary that Grade Two students be given the opportunity to compare and order objects by length, height, distance around and mass. These attributes can be measured using non-standard units. Students need to recognize that the length and height of an object is consistent whether an object is standing or lying down (changing orientation). Students are encouraged to compare and order the length and height using appropriate mathematical vocabulary (length, height, longer than, shorter than, number of units, etc.). Students also need to relate their knowledge of measurement to real world experiences. Using non-standard units will be followed in Grade Three by students using standard units.

Estimation should be incorporated in all measurement activities. The concept of estimation was introduced earlier in the course, and should be continually used through this unit. If , for example, when measuring a book with cubes the students use 17 cubes and still have a small length (less than a cube's length) remaining, it is acceptable to estimate the length of the book as "about 17 cubes", "a little more than 17 cubes", or "a little less than 18 cubes".

Achievement Indicators:

2SS3.1 Estimate, measure and record the length, height, distance around, or mass of a given object, using non-standard units.

2SS3.2 Compare and order the measure of two or more objects in ascending or descending order, and explain the method of ordering.

Students should use everyday classroom items (e.g., paper clips, crayons, pencils) to compare and order objects by length and height. Exposure to measuring larger objects in the classroom (e.g., doors, windows, white boards) can also be used to help students further visualize and compare length and height attributes.

Students will measure length and height using non-standardized units. Measure, with a non-standard unit, objects that show large differences, moving then towards measuring objects similar in length or height. Use, for example, linking cubes to measure both a pencil and a desk. Then, use the cubes to measure a pencil and a straw.

Students should be given opportunities to rank measurements from smallest to biggest and biggest to smallest. They should be able to explain why and how they have ordered the measurements.

Consider making a "sorting-by-length" station or centre where students can estimate, sort, compare and order objects by length. Provide students with some non-standard units of measure or have them choose their own. They can confirm their predictions by measuring the objects.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance

- Measurement Search - Give students strips of scrap paper, construction paper or string cut to a particular length to use as a non-standard unit. Have students find objects in the classroom to measure. Ask students to estimate the length of the objects and check their estimation by measuring using the non-standard unit. Students should record their estimates and measurements of the objects.

  (2SS3.1)

- Ask students to each make a "worm" from plasticine. Divide the students into groups of four and ask them to arrange their worms from shortest to longest. Ask each student to then make a new worm using a different colour of plasticine. Adjust the new worms' lengths until each of the new worms fits between the old ones to make a two-colour pattern. Arrange from shortest to longest, alternating colours.

  (2SS3.2)

- Cut straws in a variety of lengths, with no two straws being the same length. Ask students to each choose a straw and to then arrange themselves from longest straw to shortest straw, or vice versa.

  (2SS3.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3: Measuring and Comparing Lengths

TR: pp. 26 - 29

SB: p. 112

Little Books: *Long Jump* and *My Lemonade Stand*

Strand: Shape and Space

Outcomes

Students will be expected to

2SS4 Measure length to the nearest non-standard unit by:

• using multiple copies of a unit

• using a single copy of a unit (iteration process).

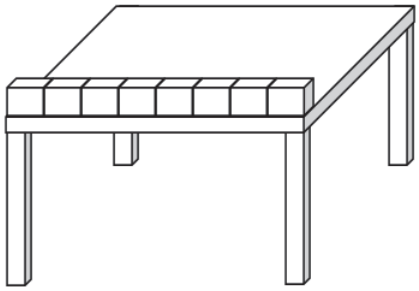
[C, ME, R, V]

Achievement Indicator:

2SS4.1 Explain why overlapping or leaving gaps does not result in accurate measures.

Elaborations—Strategies for Learning and Teaching

When using non-standard units to measure, students should first be provided with multiple copies of a non-standardized unit before using a single copy of that unit. Below, a student has placed cubes along the edge of the table to determine that the table is 8 cubes long.

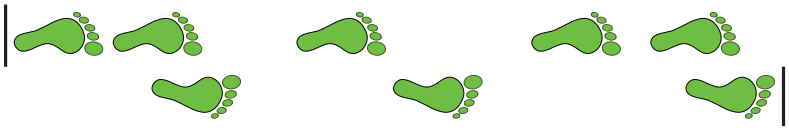


Explain and model how to place a single unit against the object to be measured, ensuring students understand why, in order to get an accurate measurement, there cannot be gaps and/or overlaps of the unit.

Activities should be provided where students are shown measurements where obvious gaps and/or overlapping occur. The arrangements of footprints below, for example, could be left on the floor of the class to allow students to discover for themselves which would give an accurate measurement. Discuss with students what is needed for accurate measures, and what mistakes lead to inaccurate measures.

Accurate measure: 9

Inaccurate measure;
contains spaces



Inaccurate measure; contains
spaces and overlaps

Show students an example of measuring an object with the unit of measure overlapping or there are gaps in the measurement. Tell students that the measure of this object is, for example, 15 snap cubes. Ask them to explain how they know this answer is correct or incorrect. Then have students show how they would appropriately measure the object.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance

- Ask students to create their own questions regarding measuring objects. Students will then find a partner to pose their question to and have the other student answer the question. A student may ask, for example, "How many pencils long is the teacher's desk?" The other student would then measure the desk with a pencil while their partner checks for overlapping and gaps.

  (2SS4.1)

- In a centre, provide some non-standard measurement items (e.g., blocks, unsharpened pencils, cut-outs of footprints, etc.), a stack of identical textbooks, and the following provocations:

  (i) I wonder how long the window ledge is?

  (ii) I wonder how tall this stack of books is?

  (iii) I wonder if I can measure the length of the window ledge with books?

  (2SS4.1, 2SS2.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3 (Continued): Measuring and Comparing Lengths.

TR: pp. 26 - 29

SB: p. 112

Unit Centres:

TR: p. 13

- The Three Bears
- Estimation Station!

Activity Bank:

TR: p. 35

- Scavenger Hunt
- Measuring Sticks

Strand: Shape and Space

Outcomes

Students will be expected to

2SS2 Relate the size of a unit of measure to the number of units (limited to non-standard units) used to measure length and mass.

[C, CN, ME, R, V]

Achievement Indicators:

2SS2.1 Explain why one of two given non-standard units may be a better choice for measuring the length of an object.

2SS2.2 Select a non-standard unit for measuring the length or mass of an object, and explain why it was chosen.

2SS2.3 Estimate the number of non-standard units needed for a given measurement task.

2SS2.4 Explain why the number of units of a measurement will vary depending upon the unit of measure used.

Elaborations—Strategies for Learning and Teaching

Students need to understand that the size of the non-standard unit used to measure an object's length will affect the results of the measurement. To demonstrate this idea, ask each student to measure the top of his/her desk using two different non-standard units (e.g., paper clips and straws). Students will discover that more paper clips were used than straws because straws are a larger unit. Repeat with other classroom objects and with other different sized units.

Provide a selection of non-standard measuring tools for students to explore. Have them work in pairs to choose appropriate non-standard units to measure various objects found in their environment. Ask students to present their findings to their classmates, telling what was measured, the non-standard unit used and whether it was an appropriate unit to use.

Students could also identify a non-standard unit they used to measure a secret object. They should tell the measurement, but keep the object that was measured a secret. For example:
I measured something in my classroom.

It is 10 pencils long.

What did I measure?

In measurement, we often use approximations. There is always value in using estimation when teaching measurement. There are times when an estimate is all you need, whereas other times it is a useful check on the reasonableness of a more precise answer. When talking to students, teachers should use phrases such as, "The desk is about three unsharpened pencils long.", or, "The tile is a little less than two unsharpened pencils long.". Estimation is an effective way to get students to focus on the attribute being measured.

Ask students to work in pairs to measure a book. One student measures using pennies or nickels and the other measures the same book using toothpicks. Have them record their answers on paper and compare the numbers. The number of units used will be different. Have students discuss why that might have happened (the smaller the unit the larger the quantity, the bigger the unit the smaller the quantity).

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Journal

- Engage students in a jumping contest in the class. Discuss what non-standard units can be used to measure the jumping distance. Then ask students to measure the distance jumped using these units of measure. Students can complete a journal entry to discuss what they found. Look for ideas such as "the longer the unit was, the easier it was to measure the jump". (2SS2.1)

Performance

- Have students make a class measurement riddle book. Students secretly measure an object of choice within the classroom with a non-standard unit. They would then individually write a riddle that could take on the following form:
  I measured _____.

  It is _____ units long.

  What unit did I use? (2SS2.2)

- Ask students:
  (i) Would it take more paper clips or popsicle sticks to measure the length of your arm?
  (ii) Would it take more popsicle sticks to measure the width of your desk, the width of the door or the height of the door knob?

  Ask students to explain their reasoning. (2SS2.1)

- Ask students to partially measure the length, height, distance around, or mass, of an object and then estimate the full measurement. (2SS2.3, 2SS3.1)

- Give each student two types of non-standard units of measurement which clearly differ in size such as straws and mini marshmallows. Ask students to measure the length of their desk using both units of measurement and record their answers. Discuss what students discovered during this activity. (2SS2.4)

Interview

- Ask students to measure the length of a side on a cereal box using a non-standard measure, such as a snap cube. Ask them to explain why, when using a popsicle stick, they would need less popsicle sticks to measure the side of the box. (2SS2.4)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 4: Estimating Length and Choosing Units

TR: pp. 32 - 35

SB: p. 113

Audio CD 2:

Selections: 18, 19

Activity Bank:

TR: p. 35

- Measures from the Past

Little Books: *Bradley's Backpack* and *Long Jump*

Strand: Shape and Space

Outcomes

Students will be expected to

2SS4 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]

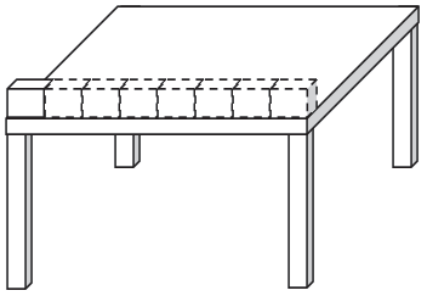
Achievement Indicators:

2SS4.2 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.

2SS4.3 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.

Elaborations—Strategies for Learning and Teaching

Earlier students used multiple copies of a unit to measure length of an object. Now they will use one unit but use it repeatedly as illustrated below:



To introduce the process of iteration (repetition), give students one toothpick and ask them to measure the length of their desktop (assuming all desktops are the same size). Encourage them to independently explore how to accurately complete this task. At this stage, do not emphasize the importance of the toothpick starting where the previous one ended as they move it along the length of the desktop. Display a class chart and as students complete the task, have them record their results. Most likely, they will see that there are a variety of answers. Use the chart as a springboard for discussion about the importance of not overlapping or leaving gaps in order to get a more accurate answer. Students should be given many opportunities to use non-standard units with the iteration process.

When measuring objects, counting with one-to-one correspondence will be necessary for accuracy. Give students modelling clay, one paper clip, one toothpick, and one Link-It™. Instruct them to measure two objects of varying lengths one at a time. Using their modelling clay, have students make "snakes" the same length as the objects to be measured. Using one of their non-standard units, have them make an impression in the snake each time they use that unit. Students can draw the object and record the length in their journals.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance

- Ask students to measure an object with a single copy of a non-standard unit of their choice. Note if the student is correctly placing the unit each time during the measurement process.

(2SS4.2)

- Trace, with help, and then cut out, an outline of yourself or another adult on butcher paper. Ask students to choose a non-standardized unit of measure to measure the grown-up. Measure using multiple copies of the chosen unit. Then, remeasure using a single copy of the unit. Compare and discuss the measurements.

(2SS4.1, 2SS4.2, 2SS4.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5: Using One Copy of a Unit

TR: pp. 36 - 39

SB: pp. 114 - 115

Strand: Shape and Space

Outcomes

Students will be expected to

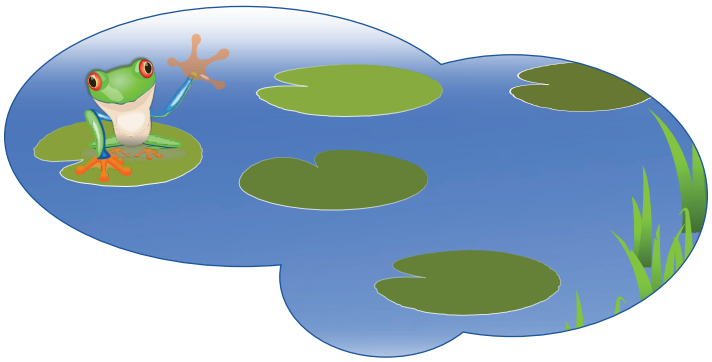
2SS4 Continued

Achievement Indicator:

2SS4.4 Estimate and measure, using non-standard units, a given length that is not a straight line.

Elaborations—Strategies for Learning and Teaching

Give students common objects found in the classroom that can be bent easily into curvy lines, (e.g., pipe cleaners, modelling clay, wool). Ask students to first estimate, then measure, objects which are not straight. The distance around a coffee can, for example, can be measured as two pipe cleaners long. The distance around a pond on a map, for instance, should first be estimated, then measured using wool, string, etc. This type of measuring will have to be modelled for students, and is further elaborated on later in this unit.



Ask students to place a sticker in the top left corner of their paper and another sticker in the bottom right corner. Each student then draws a zigzag path between the two stickers, making sure that the path has at least three parts. Using non-standard units, guide students to estimate and then measure the length of each line. Results should be recorded and discussed.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance

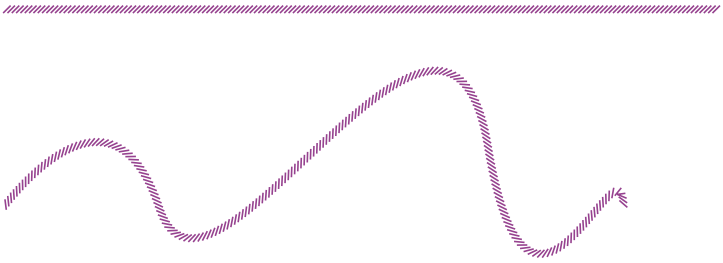
- Group students in pairs. Give them counters and paper. Ask students to draw a curvy line on their paper without crossing over their line. Students can then estimate how many counters it would take to cover the entire line. Students take turns placing counters along the line. They should then compare their estimate and their measurement.

  (2SS4.4)

- Draw three curvy lines on a page each with the same starting point. Ask students to estimate and then measure using non-standard units to see which line is longest.

  (2SS4.4)

- Show a straight piece of yarn, and a curved piece that appears shorter, but would be longer when straightened. E.g.



  Ask students which piece of yarn is longer and why. Ask them how could they find out which is longer?

  (2SS4.2, 2SS4.4)

- In a centre, put paper, pencils, yarn, cubes, and other non-standard units and the following provocation:

  I wonder how far it is from one side of my wrist, around my fingers, to the other side of my wrist?

  (2SS4.2, 2SS4.4)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5 (Continued): Using One Copy of a Unit

TR: pp. 36 - 39

SB: pp. 114 - 115

Strand: Shape and Space

Outcomes

Students will be expected to

2SS5 Demonstrate that changing the orientation of an object does not alter the measurements of its attributes.

[C, R, V]

2SS3 Continued

Achievement Indicators:

2SS5.1 Measure a given object, change the orientation, re-measure, and explain the results.

2SS3.1 Estimate, measure and record the length, height, distance around, or mass of a given object using non-standard units.

2SS3.2 Compare and order the measure of two or more objects in ascending or descending order, and explain the method of ordering.

Elaborations—Strategies for Learning and Teaching

It is important to provide many opportunities for students to play with and measure different objects in different orientations (position and direction). By providing students with this type of practice, they will have the opportunity to conclude that orientation does not change the measurement of the object.

Students could work in pairs to measure each other. First students measure each other lying on the floor in different directions and record the measurements. Next have them measure each other standing up. They will see that the height of each student stays the same even though their orientation is different.

Distance around refers to perimeter and circumference. "Distance around" is a term that Grade Two students may be more comfortable using instead of the formal terminology.

Initially, students will learn to measure the perimeter of a shape, such as their desk, by fitting a string around the desk and cutting the string to that length. Once students are comfortable measuring the distance around a linear object (i.e., one that has straight edges) students are more capable of understanding the notion of measuring around curves. When measuring round or curvy objects is first introduced, students should use string, ribbon, wool, etc.

Provide students with various round objects. Ask them to estimate and predict the order from smallest distance around to the largest distance around. Students should measure each object, recording each measure and then confirm their predictions, altering the order if necessary. Have them explain why they needed to change the order, if they did.

Provide students with some round objects. Using non-standard units, create a non-standard ruler (e.g., 6 blocks, 4 paper clips, 7 counters, 3 footprints, etc.). Have students use an equivalent length of wool or string to measure the distance around each round object. Students should create a T-chart with the headings "Longer" and "Shorter". Under each heading ask students to record what objects are longer around or shorter around than the non-standard ruler.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Journal

- Ask students to explain, using pictures, numbers and/or words, what they would discover if they measured a pencil while it was flat on a desk and then measured it while it was being held straight up.

(2SS5.1)

Performance

- Ask students to choose two different objects, one with straight edges and one that is round or with curvy edges. Ask students to predict which of the two objects has the greatest distance around and explain their prediction. They can then measure the distance around each object to confirm their predications.

(2SS3.1)

- Ask students to estimate how long a string would be necessary to fit around the widest part of a globe or some other round object. Cut the string and test their prediction. Encourage students to make statements of comparison by asking, "Was your string too long, too short, or just right?"

(2SS3.1)

- Invite students to play "Closest Estimate" in groups of four. Ask students to bring a variety of round objects from home. Place a number of the objects at each table. Instruct Student A to select an object and place it at the center of the table. All four students estimate the distance around the object by cutting a piece of yarn to show their estimate. Student A then measures the distance around the object. All students compare their estimate with the actual measure by placing the pieces of yarn side-by-side on a table. The person with the closest estimate, scores a point. They continue until all objects on the table have been used. The student scoring the most points wins the title, "Best Estimator for Today!"

(2SS3.1)

- Ask students to choose two or more objects in the classroom. Ask them to estimate and record how many non-standard units will the length (height, distance around) be. Students should measure, and then record and compare the measurements.

(2SS3.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5 (Continued): Using One Copy of a Unit

TR: pp. 36 - 39

SB: pp. 114 - 115

Activity Bank:

TR: p. 45

- Wacky Units
- Beads, Beads, Beads

Lesson 6: Distance Around

TR: pp. 40 - 44

SB: p. 116

Unit Centres:

TR: p. 13

- The Three Bears
- Estimation Station!

Activity Bank:

TR: p. 45

- How Far Around?
- Measuring Ribbons

Strand: Shape and Space

Outcomes

Students will be expected to

2SS2 Continued

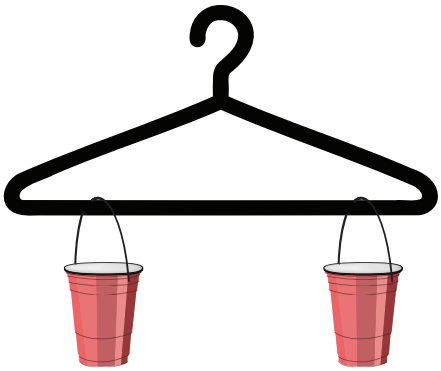
Elaborations—Strategies for Learning and Teaching

In Kindergarten, students used direct comparison to compare the masses of objects (KSS1). In Grade One, students compared and ordered objects according to mass (1SS1).

When introducing this concept, note that the terms "mass" and "weight" are similar, but they are not the same. "Weight" measures how heavy an object is (measured with a scale), while "mass" measures the amount of matter in an object (measured with a balance). Students should be exposed to the correct term "mass".

The most conceptual way for students to compare the masses of two objects is to hold one in each hand, extend their arms, and experience the relative downward pull on each. This will help them understand what the term "heavier" means.

To help students conceptualize "mass", have them create their own simple balance scale using a coat hanger, string and two cups. This is one way to introduce a balance scale but may lack accuracy so cannot be used for more advanced work. Students can then use this balance to compare masses of objects.



Students should be familiar with how a balance scale works and be able to identify that the object with the greater mass is on the side of the balance that is pulled down more. Describe a balance scale as being like a teeter-totter (see-saw) at the playground.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance:

- Read a book about ladybugs, such as *Ladybug on the Move* by Richard Fowler . Provide students with cut-outs of a ladybug. Ask students: "A ladybug flew into our classroom and landed on an object. The object was 15 ladybugs long, what could the object be? If the object was 25 ladybugs long, what do you think it could be?"

  (2SS3.1)

- Mystery Object - Have a collection of objects available for exploration and several "clue cards", for example, "This object is longer than 5 cubes but shorter than 10 cubes" and "It is heavier than the class stapler", etc. Ask students to measure to determine the object after reading the clues.

  (2SS3.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 8: Measuring Mass

TR: pp. 48 - 50

SB: pp. 117 - 118

Unit Centres:

TR: p. 13

- The Three Bears
- Estimation Station!
- Co-operative Balance Building

Activity Bank:

TR: p. 55

- Search and Find

Suggested Resources

Children's Literature

- *Ladybug on the Move* by Richard Fowler
- *Tall* by Jez Alborough

Strand: Shape and Space

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **2SS2, 2SS5 Continued** **Achievement Indicators:**	
2SS2.5 Explain why one of two given non-standard units may be a better choice for measuring the mass of an object.	Students need to see the relationship between the mass of the object that is being measured and the mass of the non-standard measuring unit. If a student, for example, wants to find the mass of their pet rock, they must first understand their rock is a heavy object and it would be best to choose a non-standard unit that is also relatively heavy, such as a marble as opposed to a toothpick.
2SS2.2 (Continued) Select a non-standard unit for measuring the length or mass of an object, and explain why it was chosen.	Provide students with an opportunity to discover why certain non-standard units may be more efficient and accurate in measuring the mass of an object. Through guided instruction and exploration, students can further develop their thinking about choosing appropriate non-standard units of measure. Give groups of students two types of non-standard units of measurement which clearly differ in size, such as toothpicks and blocks. They could measure the mass of their eraser using both and record their answers. Discuss what students discovered during this activity. Ask, "If you wanted to know the mass of your shoe, would it be best to use toothpicks or blocks, and why?"
2SS5.1 (Continued) Measure a given object, change the orientation, re-measure, and explain the results.	Students need to recognize that whether an object is standing up, lying flat, or tilted, the mass of the object will remain the same. Share some play dough, or snap cubes, equally among all students. Call upon pairs of students to weigh their portions on the balance scale to ensure each group has the same amount by mass. Invite all students to create something interesting using their materials. After five minutes, bring students together to share their creations. Ask students to tell which creation has a greater mass than another. Have them explain their reasoning and check on the balance scale to confirm their thinking.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Journal

- Invite students to make a "fish" by putting crumpled scrap paper as well as a variety of other objects with different masses, into a sock. Tie the end of the sock. Have students work in pairs to take turns weighing their fish, using non-standard unit, on a balance scale. First ask them to use smaller units such a toothpicks and then bigger units such as blocks. Students should observe that it takes more toothpicks than blocks to balance the scale. Children's literature can be used to support this activity such as *Fishy Scales*, written by Calvin Irons. Encourage students to write a journal entry explaining why blocks, or the heavier non-standard unit, were a better choice for measuring the mass of their "fish".

(2SS2.2, 2SS2.5)

Performance

- Provide a selection of non-standard measuring tools for students to explore. Ask them work in pairs to choose non-standard units to measure various objects found in the classroom environment. Ask students to present their findings to their classmates, telling what was measured, the non-standard unit used and whether it was an appropriate unit to use.

(2SS2.3, 2SS2.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 8 (Continued): Measuring Mass

TR: pp. 48 - 50

SB: pp. 119 - 120

Suggested Resource

Children's Literature

- *Fishy Scales* by Calvin J. Irons

Strand: Shape and Space

Outcomes

Students will be expected to

2SS3 Continued

Achievement Indicators:

2SS3.1 (Continued) Estimate, measure and record the length, height, distance around, or mass of a given object, using non-standard units.

2SS3.2 (Continued) Compare and order the measure of two or more objects in ascending or descending order, and explain the method of ordering.

Elaborations—Strategies for Learning and Teaching

In measurement, approximations are important. When talking to students try to use sentences such as, "The eraser's mass is about three blocks." Students need to be given ample opportunity to measure with non-standard units before estimating using non-standard units. When students have a good grasp of estimation, they will be better focused on measuring and recording certain attributes.

As a whole class, choose objects that have obvious differences in mass. Students should be given opportunities to rank the objects by mass from heaviest to lightest and lightest to heaviest. They should be able to explain why and how they have ordered the objects. Teachers should use vocabulary such as "lighter than", "heavier than", "second heaviest", etc., to model how to describe and compare masses.

General Outcome: Use direct or indirect measurement to solve problems

Suggested Assessment Strategies

Performance.

- Bring in a schoolbag or container filled with different items. Ask students to compare the mass of each item. Record the results and choose a way to rank them (e.g., heaviest to lightest, lightest to heaviest).

(2SS3.1, 2SS3.2)

- Sports is an interest of many students. Discuss various sports and types of equipment used. Ask students to compare the masses of different types of balls, such as soft balls, ping pong balls, footballs, etc. Ask students: Are the sport balls that are bigger, usually heavier?

(2SS3.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 9: Comparing by Mass

TR: pp. 51 - 55

SB: p. 121

Audio CD 2:

Selection: 20

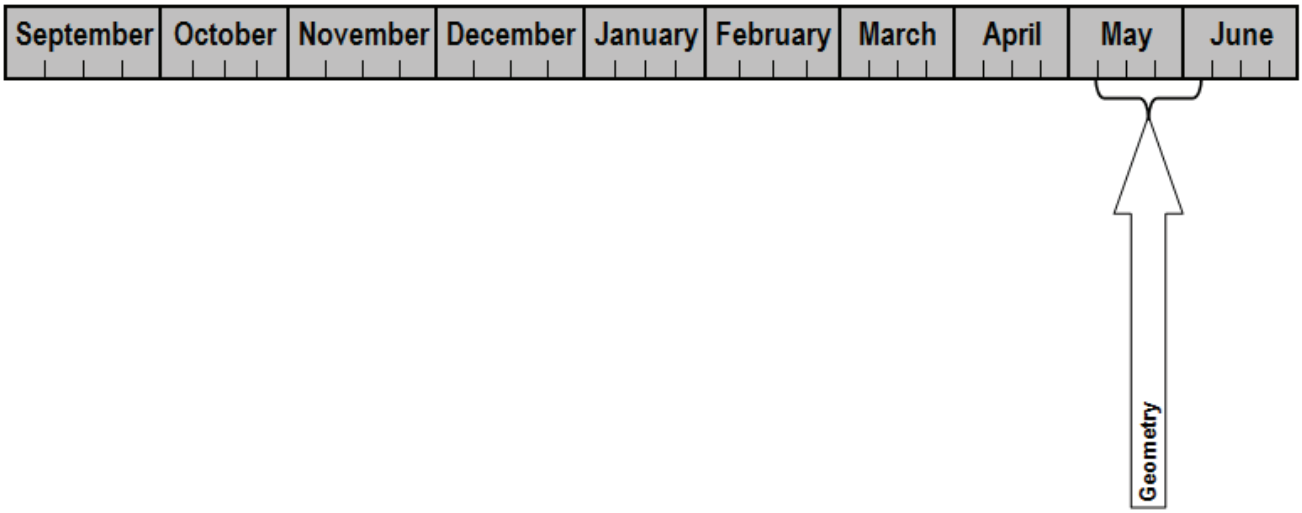
Activity Bank:

TR: p. 55

- Play Ball!
- Riddle Me, Riddle Me

Geometry

Suggested Time: 4 Weeks

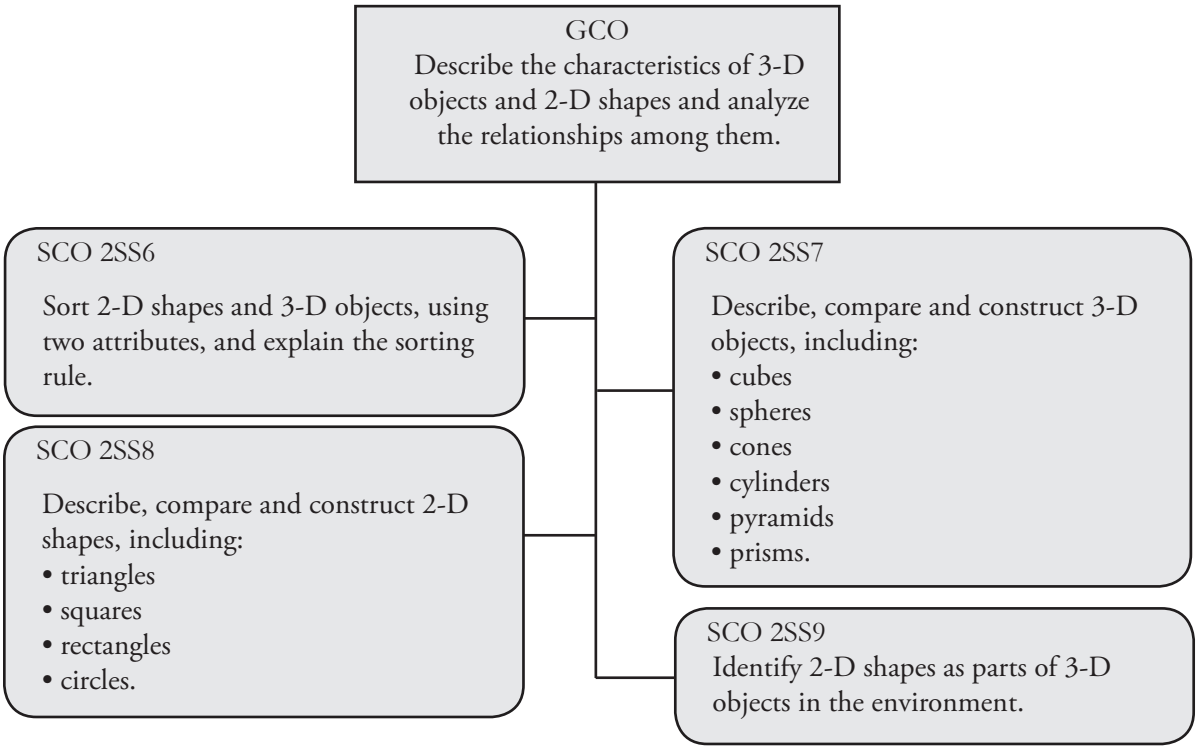


Unit Overview

Focus and Context

This unit provides students with experiences sorting, comparing, describing, constructing and representing 2-D shapes and 3-D objects. In Grade One, students compared two objects using only one attribute whereas in this unit, students will use two attributes when comparing shapes. As students use mathematical language such as cube, sphere, cone and faces to describe the various shapes in their many hands-on experiences, they will move from using informal language such as box to the more formal language. The focus is not on identifying 2-D shapes and 3-D objects, but on using the attributes such as the number of faces or vertices to compare the various shapes and objects. It is beneficial to have students compare 2-D shapes to other 2-D shapes, 3-D objects to other 3-D objects as well as 2-D shapes to 3-D objects to see similarities and differences which will enable students to classify shapes and objects in later grades.

Outcomes Framework



SCO Continuum

Grade 1	Grade 2	Grade 3
Strand: Shape and Space (3-D Objects and 2-D Shapes)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
1SS2. Sort 3-D objects and 2-D shapes, using one attribute, and explain the sorting rule. [C, CN, R, V] 1SS3. Replicate composite 2-D shapes and 3-D objects. [CN, PS, V] 1SS4. Compare 2-D shapes to parts of 3-D objects in the environment. [C, CN, V]	2SS6. Sort 2-D shapes and 3-D objects, using two attributes, and explain the sorting rule. [C, CN, R, V] 2SS7. Describe, compare and construct 3-D objects, including: • cubes • spheres • cones • cylinders • pyramids • prisms. [C, CN, R, V] 2SS8. Describe, compare and construct 2-D shapes, including: • triangles • squares • rectangles • circles. [C, CN, R, V] 2SS9. Identify 2-D shapes as parts of 3-D objects in the environment. [C, CN, R, V]	3SS6. Describe 3-D objects according to the shape of the faces and the number of edges and vertices. [C, CN, PS, R, V] 3SS7. Sort regular and irregular polygons, including: • triangles • quadrilaterals • pentagons • hexagons • octagons according to the number of sides. [C, CN, R, V]

Mathematical Processes

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

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

Outcomes

Students will be expected to

2SS8 Describe, compare and construct 2-D shapes, including:

- **triangles**
- **squares**
- **rectangles**
- **circles.**

[C, CN, R, V]

Elaborations—Strategies for Learning and Teaching

A student's ability to conceptualize shape develops gradually. Initially, younger students identify and name shapes on an intuitive level. They know, for example, that something is a "ball" or a "box" as opposed to a sphere or a rectangular prism. As students develop mathematically, they are able to name shapes according to properties and use higher levels of reasoning.

When comparing and constructing 2-D shapes, it is important for students to first have many opportunities to engage in hands-on activities with a variety of manipulatives. Using geoboards and elastics, construction paper cut-outs and everyday objects that can be found at home or school are good ways of engaging students in thinking about geometric shapes. Expressing their ideas orally in small groups or with partners, makes writing or describing their ideas much easier.

Achievement Indicator:

2SS8.1 Identify common attributes of triangles, squares, rectangles and circles from given sets of the same 2-D shapes.

An attribute is defined as a property that applies to all the shapes of a certain class. A square, for example, is a four-sided shape made up of four straight line segments which are equal in length. The three attributes that make up 2-D shapes are straight sides, curves and angles. It is the recognition of attributes of shapes and the implications of those attributes that help students more effectively use shapes in their lives.

When students are identifying attributes, accept the language they use. Be prepared for students to notice features that may not be traditionally thought of as attributes of a shape. Students may, for example, call something "curvy" or "pointy". This is a good time to model the proper geometric terms. Say "Yes, that shape is pointy. This point is called a corner." Through this modelling of proper geometric language, students are learning and hearing the appropriate mathematical language. Listening to the language that students use when they describe shapes is a good indication of their level of thinking.

Sorting activities are a way to focus students' attention on geometric attributes. Give students a collection of reproduced circles, squares, triangles and rectangles. Instruct them to sort the shapes into groups and describe their sorting rule. Some students will sort shapes based on straight lines and curved lines. Others will sort the shapes based on number of sides in a shape. From this activity, a classroom attribute chart can be developed and displayed.

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

Suggested Assessment Strategies

Journal

- Ask students to participate in a "Shape Walk". Working independently, students locate examples of triangles, squares, rectangles and circles in the classroom and/or school. Students draw the shape they have found, identify it and then describe it (writing about the attributes of the shape).

(2SS8.1)

Interview

- Give the student pre-sorted shapes of triangles, circles, rectangles and squares. Ask the student to identify common attributes of the given sets.

(2SS8.1)

Performance

- Give students a number of 2-D shapes and ask them to complete the chart:

	Triangles	Squares	Rectangles	Circles
straight sides or curved sides	straight			
# of straight sides	3			
# of corners (vertices)	3			

(2SS8.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Launch

Teacher Resource (TR): p. 11

Student Book (SB): pp. 171 - 173

Lesson 1: Describing 2-D Shapes

TR: pp. 13 - 17

SB: p. 174

Audio CD 3:

Selections: 7, 8, 9, 10

Little Book: *Shaping Up*

Refer to Appendix B (pp. 227 - 231) for problem solving strategies and ideas.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/geo.html

- geometric songs
- word wall ideas

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

Outcomes

Students will be expected to

2SS8 Continued

Achievement Indicators:

2SS8.1 (Continued) Identify common attributes of triangles, squares, rectangles and circles from given sets of the same 2-D shapes.

2SS8.2 Identify given 2-D shapes with different dimensions.

Elaborations—Strategies for Learning and Teaching

Engaging students in an activity using "Secret Shape" folders may be a motivating activity to identify common attributes of 2-D shapes. Inside a file folder, glue a variety of similar shapes (e.g., all triangles or all rectangles). One student is designated as the holder of the secret shape folder. Other students have to guess the mystery shape by asking questions which can only have a "yes" or "no" answer. Using their own copies of the possible shapes, the guessing group can eliminate those that do not fit the responses to their questions. Students continue to ask questions until they guess the correct shape.

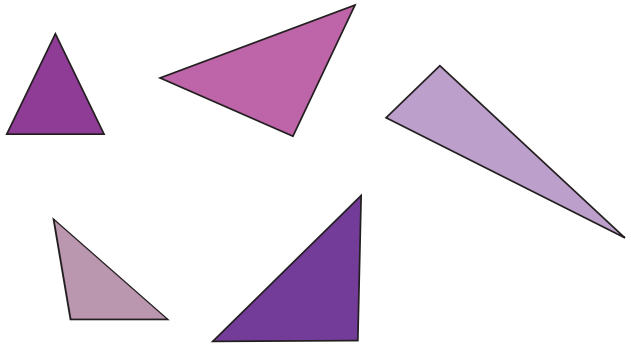
Students could create a class or personal 2-D Shape Riddle Book. Using the attribute chart generated and displayed in the classroom, students write their own riddles using the attributes as clues to the answer. An example of such a riddle might be:

What am I?

- I have curved sides.
- I have no straight edges or points.
- Sometimes I can be found at home or at school.
- I am the same shape as the wheel on your bike.

It is important that students be able to identify two shapes as the same but having different dimensions (size).

As students grow in their ability to identify shapes and recognize them in their environment, they should realize that shapes can appear in many different sizes and orientations, and sometimes differ in appearance. This knowledge is acquired through repeated practice and exposure to identifying attributes of 2-D shapes. A rectangle, for example, is a four-sided, straight lined shape. It may be large or small. However, a triangle has three sides composed of straight lines but it can have sides of different lengths and appear to look different.



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

Suggested Assessment Strategies

Journal

- Pose these questions and ask students to respond in their journals:
  (i) What makes a circle a circle? Draw two circles that look different.
  (ii) What makes a triangle a triangle? Draw two triangles that look different.
  (iii) What makes a square a square? Draw two squares that look different.
  (iv) What makes a rectangle a rectangle? Draw two rectangles that look different.
  (v) What makes a square different from a rectangle?

(2SS8.1, 2SS8.2)

Performance

- Read *The Greedy Triangle* by Marilyn Burns. Encourage students to identify the various shapes into which the "shapeshifter" changes the triangle.

(2SS8.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Describing 2-D Shapes

TR: pp. 13 - 17

SB: p. 174

Suggested Resource

Children's Literature

- *Twizzler's Shapes and Patterns* by Jerry Pallotta
- *The Greedy Triangle* by Marilyn Burns

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

Outcomes

Students will be expected to

2SS8 Continued

Achievement Indicators:

2SS8.2 (Continued) Identify given 2-D shapes with different dimensions.

2SS8.3 Identify given 2-D shapes with different orientations.

Elaborations—Strategies for Learning and Teaching

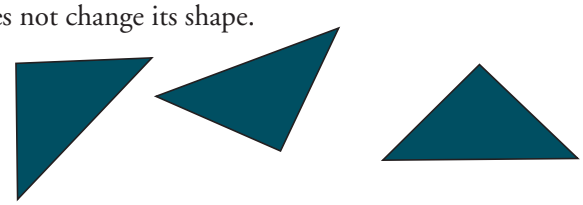
Students could create a triangle on their geoboard. Once completed, ask students to find a partner whose triangle appears to be different from the one they have constructed. These students should then discuss how their triangles are alike and different.

Ask:

- How are these two triangles different? (Students may notice lengths of sides, number of pegs per side, the "pointiness" of the vertices (i.e., the angle)
- Are they both still triangles?
- How do you know?

It is important to be aware of how shapes are presented to students. Most times they are represented in stereotypical ways. A triangle, for example, almost always looks like a witch's hat and squares are usually presented as boxes rather than as diamonds. After repeated exposure to the same representations, students come to see these common shapes as the only visual prototypes. By presenting shapes in various orientations, students will develop deeper geometric understandings as they attend to the attributes of the shapes.

Working with concrete models like pattern blocks or attribute blocks helps students see that although shapes can be oriented in different ways they still maintain the properties of that shape. Flipping or turning a triangle does not change its shape.



Students often think that the way a shape is oriented is part of what defines it. Distribute a variety of attribute blocks. Have students choose one shape (triangle, circle, square or rectangle) and ask them to trace the shape onto their paper in as many different ways as they can. Engage the class in a discussion about whether their shapes have changed.

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

Suggested Assessment Strategies

Portfolio

- Ask students to create a "Shape Collage" using their favorite shape. Students would be required to represent their collage using a variety of materials, sizes and orientations.

(2SS8.3)

Performance

- Ask students to create a robot using squares, circles, triangles and rectangles. Encourage them to use a variety of sizes and orientations. On an index card, ask students to identify the total number of each shape used in the creation of their illustration. Keep the index cards separate from the robots. Display the robots on the bulletin board and each day pick an index card, and ask students to identify the robot described.

(2SS8.3)

- In a centre, provide containers of attribute or pattern blocks, and the following provocations:
  - (i) I wonder what picture I could make using three triangles, four squares and two circles?
  - (ii) I wonder what picture I could make if I used only squares and triangles?
  - (iii) I wonder what picture I could make if I used only equal numbers of squares and circles?
  - (iv) I wonder what picture I could make if I used an even number of circles and an odd number of triangles?

(2SS8.3, 2N2.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 1 (Continued): Describing 2-D Shapes

TR: pp. 13 - 17

SB: p. 174

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

Outcomes

Students will be expected to

2SS6 Sort 2-D shapes and 3-D objects, using two attributes, and explain the sorting rule.

[C, CN, R, V]

Achievement Indicator:

2SS6.1 Determine the differences between two given pre-sorted sets, and explain the sorting rule.

Elaborations—Strategies for Learning and Teaching

In both Kindergarten and Grade One, students have sorted 3-D objects using a single attribute, and have explained the sorting rule (KSS2, 1SS2). In Grade One, students also sorted 2-D shapes using one attribute (1SS2).

It is important for students to realize that every 2-D shape has many attributes. These may include straight sides, curved sides, number of corners, and length of sides. Representing shapes, taking them apart, and putting them together are ways to encourage students to explore more carefully the attributes of those shapes.

Sorting rules for 2-D shapes should have an emphasis on geometric attributes such as:

- straight sides/curved sides
- large shapes /small shapes
- shapes with/without points or corners
- four sided shapes/three sided shapes

To help focus attention on these attributes, careful consideration should be given to the materials that are used in creating a pre-sorted set. For instance, if a set were comprised of two-dimensional attribute blocks, students might automatically focus on colour as an attribute as opposed to observing the sides or corners of the shape. Using paper cut-outs, all of the same colour, would take the focus away from colour as an attribute.

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

Suggested Assessment Strategies

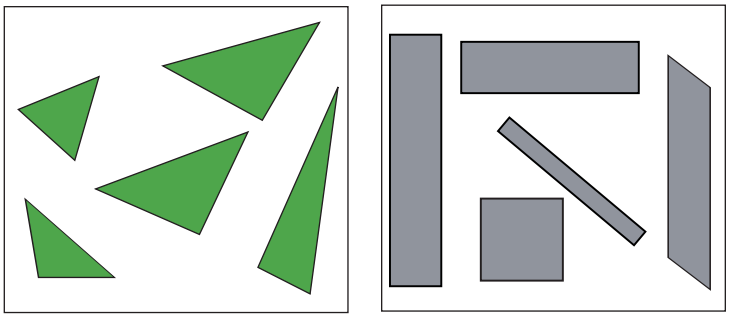
Performance

- Play "Shape Relay" - This game is ideally played in the gymnasium. Prepare a variety of pre-sorted shape cards that are large enough to display on a wall. Divide the class into two teams and have them sit in two straight lines on the floor. Each team is given a folder with a variety of pre-cut shapes. At the start of the game, the first student in each team randomly draws a shape from their folder and must race to the wall to place the shape in the appropriate group. That student then tags the next student on their team and goes to the end of the line. Play continues until the entire contents of the shape folder is sorted and the team is seated. As students gain mastery with this concept, the folders could include a variety of shapes that may not fit the pre-sorted groups. In this case, the game would have a discard pile.

(2SS6.1, 2SS6.2, 2SS6.3)

Interview

- Display a set of pre-sorted shapes. Have the student explain the sorting rule.



(2SS6.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2: Comparing and Sorting 2-D Shapes

TR: pp.18 - 22

SB: p. 175

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

Outcomes

Students will be expected to

2SS6 Continued

Achievement Indicators:

2SS6.2 Identify and name two common attributes of items within a given sorted group.

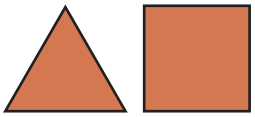
2SS6.3 Sort a given set of 2-D shapes (regular and irregular), according to two attributes, and explain the sorting rule.

Elaborations—Strategies for Learning and Teaching

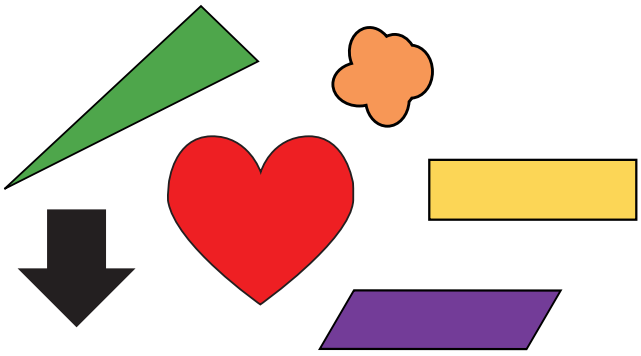
On a geoboard, instruct students to make a triangle, square or rectangle using one rubber band. When completed, invite 8-12 students to place their geoboards in an area for all to see (for example, the ledge of the whiteboard). Students should then attempt to sort the shapes into two groups. Once the shapes have been sorted, students should identify two common attributes of each group. Students can then be challenged to sort the same set of geoboards in another way, possibly identifying different attributes for each group. A modification of this activity is to have groups of students swap geoboards.

A more challenging activity would be to have partners play "One of These Shapes is Not Like the Other." One student creates a set based on two common attributes and then adds one other shape that does not fit the sorting rule. The other student must identify the two common attributes that were used to complete the sort, and also identify which shape does not belong and tell why.

A regular 2-D shape refers to a shape with all sides the same length and all angles the same measure. A square would be a regular shape as would an equilateral triangle.



An irregular 2-D shape is one whose sides are not all the same length.



Students are not expected to know the definitions of regular and irregular shapes but should be exposed to sorting and identifying attributes of these shapes.

Students have already had many experiences with sorting shapes and naming common attributes. They are now ready to further explore sorting shapes using more irregular patterns. To further solidify their conceptual understanding of sorting and naming common attributes, it is important to include other shapes such as hearts, arrows, stars, etc.

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

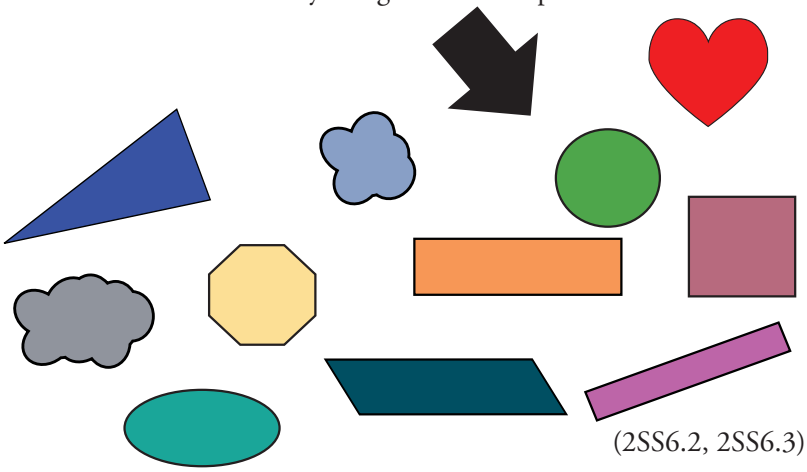
Suggested Assessment Strategies

Performance

- Ask students to identify two common attributes for shapes and then create a set that would fit the description. For instance, a student may like to create a set of objects that have straight sides and vertices. They would include shapes such as squares, triangles and rectangles.

(2SS6.2, 2SS6.3)

- Draw a variety of regular and irregular shapes. Ask students to identify two common attributes shared amongst some of the shapes. Invite students to identify which shapes fit the sorting rule by having them place an R on those that fit the rule and an X on those that do not. Continue this activity using different shapes.



(2SS6.2, 2SS6.3)

- Ask students to create a picture/design using regular and irregular shapes. The students should choose their shapes according to a two attribute rule which they identify themselves. As an extension to this activity, digital photos may be taken of each design to be displayed in a class book. Students could write about their photographed design including information about the shapes and attributes used.

(2SS6.2, 2SS6.3)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 2 (Continued): Comparing and Sorting 2-D Shapes

TR: pp.18 - 22

SB: p. 175

Note:
Irregular shapes are not addressed in the resource. Supplementing will be necessary.

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

Outcomes

Students will be expected to

2SS8 Continued

Achievement Indicators:

2SS8.4 Create a model to represent a given 2-D shape.

2SS8.5 Create a pictorial representation of a given 2-D shape.

Elaborations—Strategies for Learning and Teaching

Describing, comparing and constructing skeletons of 2-D shapes helps students to see familiar shapes in a different way. Through the process of constructing, they can look at and touch the sides and the corners of a shape. This helps to develop a stronger focus and understanding of the attributes which assists students with describing and visualizing the shapes.

Students may use a variety of media to create models of 2-D shapes. Suggested materials include yarn, fabric, pipe cleaners, stir sticks, tooth picks, straws, play dough, Wikki Stix™, etc. Give students many opportunities to create various 2-D shapes using different materials. This may be completed as centre activities or as partner work.

A concrete way for students to explore the attributes of 2-D shapes is to form the corners of the shapes with their bodies. Provide a group of students with a large piece of yarn or string. Ask four students to hold the yarn and tell what shape they have made. Have them move along the yarn to create a different shape, (e.g., changing from a square to a rectangle). Ask one student to leave the group. Ask the group, "What shape can be made now?" Have the group explore different kinds of triangles by moving their bodies in different positions along the yarn.

Ask students to look at pieces of art created by various artists. Engage students in a discussion about the shapes that they see:

- How are the shapes that you see alike?
- How are they different?

Ask students to:

- draw two different triangles
- cut one rectangle and one square from construction paper
- cut a square from construction paper; cut a larger square from construction paper; cut a smaller square from construction paper. Ask: How do you know they are still square?

Ask students to share and discuss their drawings/cutouts.

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

Suggested Assessment Strategies

Journal

- Draw a triangle, circle, square or rectangle on the whiteboard. Instruct students to copy the shape into their Math Journals. Tell them to now draw a shape that is different from the copied shape in one way, but the same in another way. Have students write how the shapes are different and how they are alike.

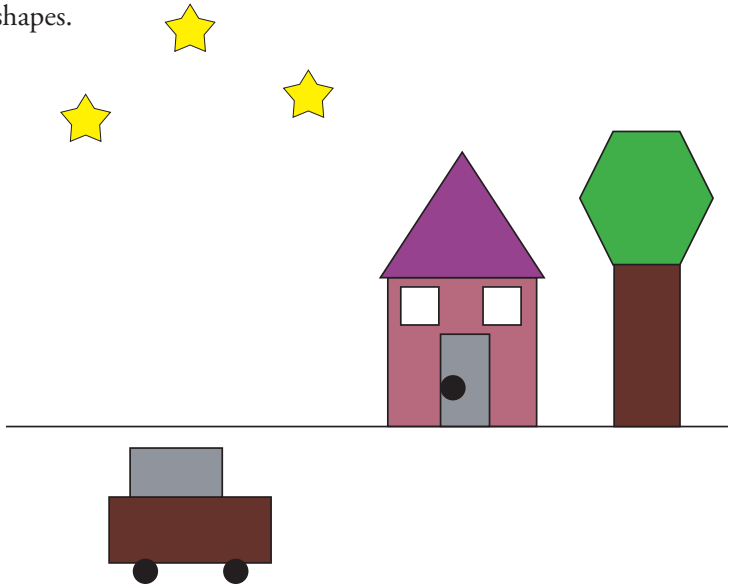
(2SS8.4, 2SS8.5)

Performance

- As a cross-curricular activity that integrates Language Arts, Art and Mathematics, invite students to create "I Spy" group books. Divide students into groups of four or five and identify a specified shape for each group (i.e., I Spy Squares, I Spy Circles, I Spy Triangles or I Spy Rectangles). Challenge students to create pages for their group book by hiding their shapes inside a drawn and coloured picture. As an extension, students can share their books with younger students.

(2SS8.4, 2SS8.5)

- Ask students to create their own artwork using only a certain set of shapes.



Students may base their own creations on artwork they have observed. Ask students to count how many of each shape they have used in their picture.

(2SS8.5)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 3: Constructing 2-D Shapes

TR: pp. 23 - 26

SB: p. 176

Audio CD 3:

Selection: 9

Unit Centres:

TR: p. 9

- What Is My Shape?
- Stamp a Pattern

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

Outcomes

Students will be expected to

2SS7 Describe, compare and construct 3-D objects, including:

- **cubes**
- **spheres**
- **cones**
- **cylinders**
- **pyramids**
- **prisms.**

[C, CN, R, V]

Achievement Indicator:

2SS7.1 Sort a given set of 3-D objects, and explain the sorting rule.

Elaborations—Strategies for Learning and Teaching

In Kindergarten, students built and described 3-D objects (KSS3). In Grade One, students replicated composite 3-D objects (1SS3). This year, in order to describe, compare and construct 3-D objects, students must first have multiple opportunities to explore concrete models of cubes, spheres, cones, cylinders, pyramids and prisms. As part of the exploration process, students will need to be able to touch, feel, build, and observe a wide variety of geometric solids in the classroom as well as familiar 3-D objects in their home and school environment.

3-D objects are objects that have length, width and depth. Through exploration, students should come to understand that the faces of a 3-D object are made up of two-dimensional shapes. When discussing three dimensional objects with students it is important to refer to them as simply "objects" or "solid figures". This will assist students in differentiating between 2-D shapes and 3-D objects. Through hands-on exploration, students will discover the various components used to classify 3-D solids. These components would include faces, curved surfaces, edges and vertices.

- A face is a flat surface on a geometric object.
- An edge is the line where two faces, or a face and a curved surface, meet.
- A vertex is a point where three or more edges meet or, on a cone, a vertex is the highest point above the base and may also be called the apex.

While it is important to accept the language that students use to describe these components, you should consistently model the appropriate mathematical terminology and display these words in the classroom environment (e.g., math wall, bulletin board, etc.).

In any sorting activity students should decide how to sort the objects as opposed to the teacher making this decision. This allows students to use their own ideas and understandings about the properties of 3-D objects. Listening to the language used is a valuable assessment tool as it gives insight into how the student thinks and what they know about 3-D objects.

Provide students with a set of 3-D geometric solids. This could be the suggested math manipulatives traditionally found in classrooms and/or a set of 3-D objects such as cups, balls, tissue boxes, ice cream cones, paper towel rolls, etc. that are found in the students' environment. Real world examples of pyramids are difficult to find and so may need to be constructed out of paper or clay for the students. Provide students with opportunities to work with a partner or in small groups to sort the objects into sets and discuss their sorting rules.

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

Suggested Assessment Strategies

Observation

- Ask students to work with partners, or in small groups, to sort objects and discuss sorting rules. Make direct observations of how students sort their sets, the kind of language that students use to describe their sets, and the level of confidence that is demonstrated in working with the concept.

(2SS7.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 4: Describing 3-D Objects

TR: pp. 27 – 31

SB: pp. 177 - 178

Audio CD 3:

Selection: 7, 8

Little Book: *What Am I?*

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

Outcomes

Students will be expected to

2SS7 Continued

Achievement Indicators:

2SS7.2 Identify common attributes of cubes, spheres, cones, cylinders, pyramids, and prisms from given sets of the same 3-D objects.

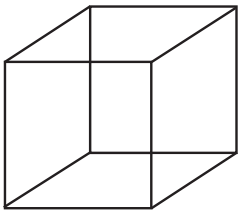
Elaborations—Strategies for Learning and Teaching

Many of the attributes that apply to 2-D shapes also apply to 3-D objects. Attributes that students may observe in 3-D objects are:

- shape of the faces (square, circular, rectangular, or triangular)
- number of faces or edges
- identical or congruent faces
- number of vertices
- faces or curved surfaces
- more vertices than faces
- able to slide/roll/stack

Engage students in creating individual 3-D dictionaries. As students continue to sort and work on identifying objects, they can illustrate and write a detailed description of the attributes that describe each solid.

It has 6 faces.
It has 8 vertices.
It has 12 edges.
It can slide.
It looks like a box.



Cube

Pictures of each solid can be provided for students who are not proficient at drawing 3-D solids.

2SS7.3 Identify and describe given 3-D objects with different dimensions.

Dimensions refers to the lengths of the sides of a geometric figure and the number of ways a figure can be measured. It is not necessary to engage students in physically measuring the lengths of the sides. Students are only visually comparing similar solids.

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

Suggested Assessment Strategies

Performance

- Provide brown lunch bags with a geometric solid in each bag. Randomly distribute the bags to students. Ask each student to look into the bag to see the solid and to describe it, in writing, in riddle form. Ask students to exchange and read the riddles, write his/her answer and check inside the bag to confirm.

(2SS7.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 4 (Continued): Describing 3-D Objects

TR: pp. 27 – 31

SB: pp. 177 - 178

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

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **2SS7 Continued** **Achievement Indicators:**	
2SS7.4 Identify and describe given 3-D objects with different orientations.	In class discussion, present students with a wide variety of 3-D objects that vary in size and orientation. This could include the class set of geometric solids as well as objects from the classroom environment. Ask students to identify, for example, all of the cylinders or cones. Have them tell you what makes these objects the same. Students can participate in a barrier game. Pairs of students would sit opposite each other with a barrier between them (i.e., book open and standing). Each student would have an identical collection of solids. The starting student would choose one object, put it on his/her side of the barrier, and then provide clues to their partner regarding the attributes of that object, as well as the orientation of that object on the desk. If a student, for example, has chosen a cylinder as his mystery object, he may tell his partner: • My object has two faces. • My object is placed so that it cannot roll. The barrier is then removed and the students check for accuracy. This game could be played in a variety of ways. Students could draw pictures using 2-D shapes as opposed to 3-D solids. The basic understanding that students need to have is that the dimensions and orientation of a solid do not change its name or its attributes. A bead and a basketball, for example, are both spheres even though they are different sizes. A tire and a paper towel roll are both cylinders even though they are oriented differently.
2SS7.5 Identify examples of cubes, spheres, cones, cylinders and pyramids found in the environment.	As students are engaged in observing the objects in their environment, they begin to see that much of what surrounds them is actually three dimensional. Visualization is a skill that is developed over time and assists students in helping them to understand their physical world. Take students on a "Solid Walk" around the school and school grounds using a paper towel roll as a spy glass. A leader would record any examples of cubes, spheres, cones, cylinders, pyramids and prisms that they "spy" on their walk. A digital camera could be used to capture "evidence" of their findings. Upon returning to the classroom, students should share their findings and create a bulletin board entitled "I Spy Solids".

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

Suggested Assessment Strategies

Performance

- Using a variety of magazines, newspapers, pictures, etc., ask students to create a poster featuring a 3-D object of their choice.

(2SS7.3)

- Make a cube and label each side with "cube", "sphere", "cone", "cylinder", "pyramid" and "prism". Ask students to roll the cube and find, in a catalogue or in the environment, an example of something that is the solid shown on the cube.

(2SS7.5)

Journal

- Present students with pictures of, for example, an ice-cream cone and a party hat. Ask them to identify the solid and describe the similarities and differences between the two pictures.

(2SS7.4)

Presentation

- Ask students to use a digital camera to take photos of 3-D objects in their environment. Print the photos. Each student will use their pictures to create a page called 3-D Objects In _____'s environment. All pages can be compiled into a class book or displayed on a bulletin board.

(2SS7.4)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 4 (Continued): Describing 3-D Objects

TR: pp. 27 – 31

SB: pp. 177 - 178

Unit Centre:

TR: p. 9

- Who Am I?

Little Book: *A Bird's Eye View*

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

Outcomes

Students will be expected to

2SS6 Sort 2-D shapes and 3-D objects, using two attributes, and explain the sorting rule.

[C, CN, R, V]

2SS7 Continued

Achievement Indicators:

2SS6.4 Sort a given set of 3-D objects, according to two attributes, and explain the sorting rule.

2SS7.6 Create and describe a representation of a given 3-D object, using materials such as modelling clay.

Elaborations—Strategies for Learning and Teaching

When engaging students in sorting 3-D objects with two attributes, it is possible to go beyond the physical characteristics of the solid (faces, curved surfaces, edges and vertices). Encourage students to consider how the solid moves (slide or roll) and if it can be stacked.

When presented with a set of 3-D objects, students should be challenged to identify different sorting rules for the same set of objects. The sorting rule, for example, for a set of spheres and cylinders could be things that roll and have curved surfaces; or the sorting rule could be things that do not stack (if the cylinders are placed on their curved surfaces) and have no vertex.

By making models of 3-D objects, students focus on the shape attributes of different solids.

Describing objects allows students to focus on their basic characteristics. Use questioning to focus student thinking:

- What other shapes are similar to this one? In what way are they alike?
- What does this object look like?
- Does your object have vertices?
- Does the object have flat or curved surfaces, or both?
- Pick two of the shapes and tell how they are alike and how they differ.

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

Suggested Assessment Strategies

Paper and Pencil

- Present a reproduced copy of a set of 3-D objects. Ask students to choose two attributes and write a sorting rule for the objects. Students should then circle all the objects in the set which have the two attributes identified.

(2SS6.4)

Performance

- Provide students with various building materials such as modelling clay, pipe cleaners, foam blocks, Unifix™ cubes, toothpicks, straws, paper, cardboard, etc., and ask them to build 3-D objects.

  Ensure models are available so that students have a model to follow if necessary.

  Ask students to present their object to a partner explaining how they made it, how it is the same as the solid their partner made, or how it is different.

(2SS7.6)

- Place three 3-D objects in a bag, two of which are the same and one that is different. Invite students to feel the shapes inside the bag, and without looking, to identify the odd one and to tell how it is different from the others. Ask, "How are the shapes alike and how do they differ?"

(2SS7.6)

Interview

- Ask a student to choose a 3-D object and tell how he/she would describe the solid to someone who does not know what it is.

(2SS7.6)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 5: Comparing and Sorting 3-D Objects

TR: pp. 32 - 36

SB: pp. 179 - 180

Lesson 6: Constructing 3-D Objects

TR: pp 37 - 40

SB: p. 181

Unit Centre:

TR: p. 9

- Creating Creatures

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

Outcomes

Students will be expected to

2SS9 Identify 2-D shapes as parts of 3-D objects in the environment.

[C, CN, R, V]

Achievement Indicator:

2SS9.1 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.

Elaborations—Strategies for Learning and Teaching

In earlier grades, students will have had opportunities to explore shapes through sorting, patterning, and building activities (KSS2, KSS3,1SS2, 1SS3). Considering the attributes of various 2-D shapes and 3-D objects allows students to identify, compare, and sort them, using different criteria. Students in the early grades need many varied opportunities to manipulate both 2-D shapes and 3-D objects. This enables them to make connections to objects in their environment. When a student sees a transport truck, for example, they will identify the shape of the box as a rectangle.

Many of the 3-D objects students see or explore have flat faces (pyramids, prisms, and cubes), but others have curved surfaces (cylinders, spheres, and cones). Students should begin to relate the description of a 3-D object to a description of the curved surfaces and faces that compose it. A cylinder, for example, has two flat faces and a curved surface, and a sphere has one curved surface.

Place a number of different 3-D objects such as a small juice can, tennis ball, die, etc. in a bag. Show, or have a student name, a particular 2-D shape and ask another student to find a 3-D object with the corresponding shape by feeling the objects within the bag.

Present drawings or pictures of a variety of 3-D objects from the environment. Ask students to match 2-D shapes to the faces of the 3-D objects.

Place a 3-D object on an overhead projector and ask students to predict what shape they will see when the projector is turned on. Students might project onto paper and trace around the image. This will enable students to see the relationship between the 2-D shape and the 3-D object.

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

Suggested Assessment Strategies

Performance

- Ask students to work in small groups to make class books shaped like a triangle, a square and a circle. Ask them to fill each book with cut out or drawn pictures of objects from the environment that have faces that are the same shape as the book.

(2SS9.1)

- Provide drawings of a variety of 3-D objects. Ask the students to match these with the actual solid models.

(2SS9.1)

Interview

- Use a variety of picture books that include illustrations of objects shaped like cubes, cones, pyramids, cylinders, spheres and prisms to allow students to see how the illustrators depict 3-D objects in the real world. Ask students to find 2-D shapes represented in the illustrations.

(2SS9.1)

Journal

- Have students cut out a picture of a 3-D object from a magazine, paste it in their journal and describe it using mathematical language such as curved surfaces, flat faces, names of shapes, etc.

(2SS9.1)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 7: Identifying 2-D Shapes in 3-D Objects

TR: pp. 41 - 45

SB: pp. 182 - 183

Little Book: *What Animal is That?*

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

Outcomes

Students will be expected to

2SS9 Continued

Achievement Indicator:

2SS9.2 Name the 2-D faces of a given 3-D object.

Elaborations—Strategies for Learning and Teaching

Working with 3-D objects and 2-D shapes enables students to understand that most 3-D objects are made up of 2-D faces.

Engage students in a game of "What Am I?" Choose a 3-D object and describe it to the class using clues such as:

- "My solid has all flat faces. What am I?"
- "My solid has one square face. What Am I?"

After modelling this game, students can play the game in small groups.

Place three 3-D objects in a bag, two of which are the same and one that is different. Invite students to feel the objects inside the bag to identify the odd one and to tell how it is different by discussing the faces of the objects.

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

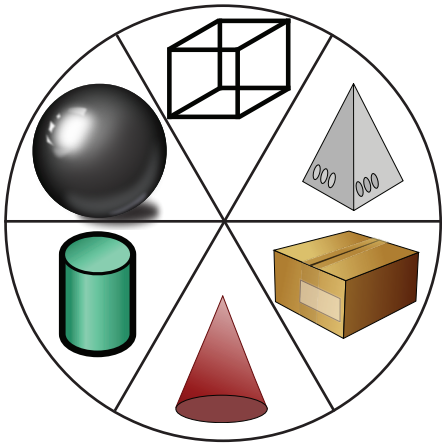
Suggested Assessment Strategies

Performance

- Provide students with different solids that have at least one flat face and have students trace the faces. Students then give their drawing to a partner to guess which solid they traced.

(2SS9.2)

- Provide students with a spinner containing pictures of the geometric solids. Ask students to take turns spinning and describing the faces/ curved surfaces of the solid on which they landed.

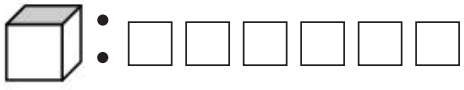


(2SS9.2)

Journal

- Provide playdough or clay. Ask students to flatten the clay. Ask each student to choose a solid, and press it into the clay to make a print of the figure's faces. In his/her journal, the student draws the figure labeling it with its name and then draws and lists the names of the faces.

  A cube has 6 square faces.



(2SS9.2)

Interview

- Show students a picture of a 2-D shape (circle, square, rectangle or triangle). Make several 3-D objects available and ask the student to choose one or more, that has a face that matches the picture.

(2SS9.2)

- Provide a cylinder and a cone. Ask the student to describe how they are alike and how they differ.

(2SS9.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Lesson 7: Identifying 2-D Shapes in 3-D Objects

TR: pp. 41 - 45

SB: pp. 182 - 183

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/gr2/links/geo.html

- template for spinner with 3-D objects

Appendix A
Outcomes by Strand
(with page references)

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

Strand: Number	**General Outcome:** Develop number sense.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2N1 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]	2N1.1 Extend a given skip counting sequence (by 2s, 5s or 10s) forward and backward.	p. 24
	2N1.2 Skip count by 10s given any number from 1 to 9 as a starting point.	p. 24
	2N1.3 Count by 2s starting from 1 or from any odd number.	p. 24
	2N1.4 Identify and correct errors and omissions in a given skip counting sequence.	p. 26
	2N1.5 Count a given sum of money with pennies, nickels or dimes (to 100 cents).	p. 28
	2N1.6 Count quantity, using groups of 2s, 5s or 10s and counting on.	p. 28
2N2 Demonstrate if a number (up to 100) is even or odd. [C, CN, PS, R]	2N2.1 Determine if a given number is even or odd by using concrete materials or pictorial representations.	p. 26
	2N2.2 Identify even and odd numbers in a given sequence, such as in a hundred chart.	p. 26
	2N2.3 Sort a given set of numbers into even and odd.	p. 26
2N3 Describe order or relative position, using ordinal numbers (up to tenth). [C, CN, R]	2N3.1 Indicate a position of a specific object in a sequence by using ordinal numbers up to tenth.	p. 30
	2N3.2 Compare the ordinal position of a specific object in two different given sequences.	p. 30
2N4 Represent and describe numbers to 100, concretely, pictorially and symbolically. [C, CN, V]	2N4.1 Represent a given number, using concrete materials such as ten-frames and base ten materials.	pp. 32-34
	2N4.2 Represent a given number, using tallies.	p. 32
	2N4.3 Represent a given number pictorially and symbolically.	pp. 32, 152
	2N4.4 Read a given number (0 –100) in symbolic or word form.	p. 32
	2N4.5 Record a given number (0 – 20) in words.	p. 32
	2N4.6 Represent a given number, using coins (pennies, nickels, dimes and quarters).	p. 34
	2N4.7 Represent a given number, using expressions; e.g., 24 + 6, 15 + 15, 40 – 10.	p. 152
2N5 Compare and order numbers up to 100. [C, CN, ME, R, V]	2N5.1Order 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.	p. 44
	2N5.2 Identify and explain errors in a given ordered sequence.	p. 44
	2N5.3 Identify missing numbers in a given hundred chart.	p. 44
	2N5.4 Identify errors in a given hundred chart.	p. 44

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

Strand: Number (Continued)	**General Outcome:** Develop number sense.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2N6 Estimate quantities to 100, using referents. [C, ME, PS, R]	2N6.1 Estimate a given quantity by comparing it to a referent (known quantity).	p. 36
	2N6.2 Estimate the number of groups of ten in a given quantity, using 10 as a referent.	p. 36
	2N6.3 Select between two possible estimates for a given quantity, and explain the choice.	p. 36
2N7 Illustrate, concretely and pictorially, the meaning of place value for numbers to 100. [C, CN, R, V]	2N7.1 Explain and show with counters the meaning of each digit for a given two-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).	p. 38
	2N7.2 Count the number of objects in a given set, using groups of 10s and 1s, and record the result as a two-digit numeral under the headings 10s and 1s.	p. 38
	2N7.3 Describe a given two-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.	p. 40
	2N7.4 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.	p. 40
	2N7.5 Illustrate, using base ten materials, that a given numeral consists of a certain number of tens and a certain number of ones.	p. 40
	2N7.6 Explain why the value of a digit depends on its placement within a numeral.	p. 40
2N8 Demonstrate and explain the effect of adding zero to, or subtracting zero from, any number. [C, R]	2N8.1 Add zero to a given number, and explain why the sum is the same as the addend.	pp. 94-96, 154
	2N8.2 Subtract zero from a given number, and explain why the difference is the same as the given number.	pp. 94-96 154

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

Strand: Number (Continued)	**General Outcome:** Develop number sense.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2N9 Demonstrate an understanding of addition (limited to one- and two-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 (commutative property) • explaining that the order in which numbers are subtracted may affect the difference. [C, CN, ME, PS, R, V]	2N9.1 Model addition and subtraction, using concrete materials or visual representations, and record the process symbolically.	pp. 92, 102, 114-116, 138-142
	2N9.2 Solve a given problem, using horizontal and vertical forms.	pp. 94, 144
	2N9.3 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).	pp. 98-100, 130, 144
	2N9.4 Create an addition or a subtraction number sentence and a story problem for a given solution.	pp. 102, 110 -112, 146
	2N9.5 Solve a given problem involving a missing addend, and describe the strategy used.	pp. 108-110, 146
	2N9.6 Match a number sentence to a given missing addend problem.	pp. 108-110, 148
	2N9.7 Solve a given problem involving a missing minuend or subtrahend, and describe the strategy used.	pp. 112, 148
	2N9.8 Match a number sentence to a given missing subtrahend or minuend problem.	pp. 114, 152
	2N9.9 Refine personal strategies to increase their efficiency.	pp. 118, 140-142, 148-152
2N10 Apply mental mathematics strategies for the basic addition and related subtraction facts to 18. [C, CN, ME, PS, R, V]	2N10.1 Explain or demonstrate the mental mathematics strategy that could be used to determine a basic fact, such as: • Using one more, two more; e.g. for 6 + 2 start at 6 and count on 2, so 6, 7, 8. • Using one less, two less; e.g., for 6 – 2, start at 6 and count back 2, so 6, 5, 4 • Making 10; e.g., for 7 + 5, think 7 + 3 + 2 • Using doubles; e.g., 4 + 6, think 5 + 5 • Using doubles plus one, plus two; e.g., 4 + 5, think 4 + 4 + 1 • Using doubles subtract one, subtract two; e.g., for 4 + 5, think 5 + 5 – 1 • Using addition to subtract; e.g., for 7 – 3, think 3 + ? = 7	pp. 120-128
	2N10.2 Use and describe a mental mathematics strategy for determining a sum to 18 and the corresponding subtraction.	pp. 122-128
	2N10.3 Refine mental math strategies to increase their efficiency.	pp. 128-132

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

Strand: Patterns and Relations (Patterns)	**General Outcome:** Use patterns to describe the world and to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2PR1 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]	2PR1.1 Identify the core of a given repeating pattern.	p. 50
	2PR1.2 Describe and extend a given double attribute pattern.	p. 52
	2PR1.3 Explain the rule used to create a given repeating non-numerical pattern.	p. 52
	2PR1.4 Compare two given repeating patterns, and describe how they are alike/different.	p. 54
	2PR1.5 Create a repeating pattern where the core has three to five elements.	pp. 54-56
	2PR1.6 Predict an element in a given repeating pattern, using a variety of strategies.	p. 56
	2PR1.7 Predict an element of a given repeating pattern, and extend the pattern to verify the prediction.	p. 56
2PR2 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]	2PR2.1 Identify and describe increasing patterns in a variety of given contexts; e.g., hundred chart, number line, addition tables, calendar, tiling pattern or drawings.	pp. 58-60, 168
	2PR2.2 Explain the rule used to create a given increasing pattern.	p. 60
	2PR2.3 Identify and describe increasing patterns in the environment; e.g., house/room numbers, book pages, calendar, pine cones, leap years.	pp. 62, 168
	2PR2.4 Determine missing elements in a given concrete, pictorial or symbolic increasing pattern, and explain the reasoning.	p. 62
	2PR2.5 Represent a given increasing pattern, concretely and pictorially.	pp. 64-66
	2PR2.6 Create an increasing pattern, and explain the pattern rule.	p. 66
	2PR2.7 Represent a given increasing pattern, using another mode; e.g., colour to shape.	p. 66
	2PR2.8 Solve a given problem, using increasing patterns.	p. 68
	2PR2.9 Identify errors in a given increasing pattern.	p. 68

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

Strand: Patterns and Relations (Patterns)	**General Outcome:** Use patterns to describe the world and to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2PR3 Demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0-100). [C, CN, R, V]	2PR3.1 Determine whether two given quantities of the same object (same shape and mass) are equal by using a balance scale.	pp. 42, 154
	2PR3.2 Construct and draw two unequal sets, using the same object (same shape and mass), and explain the reasoning.	p. 42
	2PR3.3 Demonstrate how to change two given sets, equal in number, to create inequality.	p. 42
	2PR3.4 Choose from three or more given sets the one that does not have a quantity equal to the others, and explain why.	p. 42
2PR4 Record equalities and inequalities symbolically, using the equal symbol or the not equal symbol. [C, CN, R, V]	2PR4.1 Determine whether two sides of a given number sentence are equal (=) or not equal (≠). Write the appropriate symbol and justify the answer.	pp. 104-106, 154
	2PR4.2 Model equalities, using a variety of concrete representations, and record the equality symbolically.	pp. 104-106, 154
	2PR4.3 Model inequalities, using a variety of concrete representations, and record the inequality symbolically.	pp. 104-106

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

Strand: Shape and Space (Measurement)	**General Outcome:** Use direct or indirect measurement to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2SS1 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]	2SS1.1 Read a date on a calendar.	pp. 162-164
	2SS1.2 Name and order the days of the week.	pp. 162-164
	2SS1.3 Identify the day of the week and the month of the year for an identified calendar date.	pp. 162-164
	2SS1.4 Communicate that there are seven days in a week and twelve months in a year.	pp. 162-164
	2SS1.5 Determine whether a given set of days is more or less than a week.	pp. 162-164
	2SS1.6 Identify yesterday's/tomorrow's date.	pp. 162-164
	2SS1.7 Identify the month that comes before and the month that comes after a given month.	pp. 162-164
	2SS1.8 Name and order the months of the year.	pp. 162-164
	2SS1.9 Solve a given problem involving time that is limited to the number of days in a week and the number of months in a year.	p. 166
2SS2 Relate the size of a unit of measure to the number of units (limited to non-standard units) used to measure length and mass. [C, CN, ME, R, V]	2SS2.1 Explain why one of two given non-standard units may be a better choice for measuring the length of an object.	p. 174
	2SS2.2 Select a non-standard unit for measuring the length or mass of an object, and explain why it was chosen.	pp. 174, 184
	2SS2.3 Estimate the number of non-standard units needed for a given measurement task.	p. 174
	2SS2.4 Explain why the number of units of a measurement will vary depending upon the unit of measure used.	p. 174
	2SS2.5 Explain why one of two given non-standard units may be a better choice for measuring the mass of an object.	p. 184
2SS3 Compare and order objects by length, height, distance around and mass, using non-standard units, and make statements of comparison. [C, CN, ME, R, V]	2SS3.1 Estimate, measure and record the length, height, distance around, or mass of a given object, using non-standard units.	pp. 170, 180, 186
	2SS3.2 Compare and order the measure of two or more objects in ascending or descending order, and explain the method of ordering.	pp. 170, 180, 186

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

Strand: Shape and Space (Measurement)	**General Outcome:** Use direct or indirect measurement to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2SS4 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]	2SS4.1 Explain why overlapping or leaving gaps does not result in accurate measures.	p. 172
	2SS4.2 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.	p. 176
	2SS4.3 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.	p. 176
	2SS4.4 Estimate and measure, using non-standard units, a given length that is not a straight line.	p. 178
2SS5 Demonstrate that changing the orientation of an object does not alter the measurements of its attributes. [C, R, V]	2SS5.1 Measure a given object, change the orientation, re-measure, and explain the results.	pp. 180, 184

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

Strand: Shape and Space (3-D Objects and 2-D Shapes)	**General Outcome:** Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2SS6 Sort 2-D shapes and 3-D objects, using two attributes, and explain the sorting rule. [C, CN, R, V]	2SS6.1 Determine the differences between two given pre-sorted sets, and explain the sorting rule.	p. 198
	2SS6.2 Identify and name two common attributes of items within a given sorted group.	p. 200
	2SS6.3 Sort a given set of 2-D shapes (regular and irregular), according to two attributes, and explain the sorting rule.	p. 200
	2SS6.4 Sort a given set of 3-D objects, according to two attributes, and explain the sorting rule.	p. 210
2SS7 Describe, compare and construct 3-D objects, including: • cubes • spheres • cones • cylinders • pyramids • prisms. [C, CN, R, V]	2SS7.1 Sort a given set of 3-D objects, and explain the sorting rule.	p. 204
	2SS7.2 Identify common attributes of cubes, spheres, cones, cylinders, pyramids, and prisms from given sets of the same 3-D objects.	p. 206
	2SS7.3 Identify and describe given 3-D objects with different dimensions.	p. 206
	2SS7.4 Identify and describe given 3-D objects with different orientations.	p. 208
	2SS7.5 Identify examples of cubes, spheres, cones, cylinders and pyramids found in the environment.	p. 208
	2SS7.6 Create and describe a representation of a given 3-D object, using materials such as modelling clay.	p. 210
2SS8 Describe, compare and construct 2-D shapes, including: • triangles • squares • rectangles • circles. [C, CN, R, V]	2SS8.1 Identify common attributes of triangles, squares, rectangles and circles from given sets of the same 2-D shapes.	pp. 192-194
	2SS8.2 Identify given 2-D shapes with different dimensions.	pp. 194-196
	2SS8.3 Identify given 2-D shapes with different orientations.	p. 196
	2SS8.4 Create a model to represent a given 2-D shape.	p. 202
	2SS8.5 Create a pictorial representation of a given 2-D shape.	p. 202
2SS9 Identify 2-D shapes as parts of 3-D objects in the environment. [C, CN, R, V]	2SS9.1 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.	p. 212
	2SS9.2 Name the 2-D faces of a given 3-D object.	p. 214

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

Strand: Statistics and Probability (Data Analysis)	General Outcome: Collect, display and analyze data to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
2SP1 Gather and record data about self and others to answer questions. [C, CN, PS, V]	2SP1.1 Formulate a question that can be answered by gathering information about self and others.	p. 74
	2SP1.2 Organize data as it is collected, using concrete objects, tallies, check marks, charts or lists.	pp. 74, 82
	2SP1.3 Answer questions, using collected data.	p. 74
2SP2 Construct and interpret concrete graphs and pictographs to solve problems. [C, CN, PS, R, V]	2SP2.1 Determine the common attributes of concrete graphs by comparing a given set of concrete graphs.	p. 76
	2SP2.2 Answer questions pertaining to a given concrete graph or pictograph.	p. 76
	2SP2.3 Determine the common attributes of pictographs by comparing a given set of pictographs.	p. 78
	2SP2.4 Create a concrete graph to display a given set of data, and draw conclusions.	p. 78
	2SP2.5 Create a pictograph to represent a given set of data, using one-to-one correspondence.	p. 78
	2SP2.6 Solve a given problem by constructing and interpreting a concrete graph or pictograph.	p. 80

Appendix B
Problem Solving Strategies and Ideas

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
Problem Solving	A student's earliest experience with mathematics is through solving problems. NCTM (2000) states that "problem solving means engaging in a task for which the solution method is not known in advance" (p. 52). To find solutions, students must draw on knowledge, and through this process they will often develop new mathematical understandings. By engaging in problem solving tasks, students will acquire ways of thinking, perseverance, curiosity and confidence with unfamiliar situations. Good problem solvers are able to tackle everyday situations effectively. An effective problem solving activity asks 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. Good mathematical problems should arise from daily routine, as well as non-routine, tasks. Engaging students in rich problem solving tasks gives them the opportunity to solidify and extend upon what they already know, thus stimulating their mathematical learning. Setting up an environment where activities are built around problems and exploration is essential in providing students with these opportunities. Problems can be presented orally, visually or by a written-and-oral approach. Choose worthwhile problems that are meaningful to the students, and provide an environment that encourages risk-taking and persistence. Communication should be intertwined with problem solving throughout all areas of mathematics. Invite students to talk about their work as they investigate the process of how to find solutions to problems. As students reflect on, explain, and justify their reasoning, they may revise their answers, thus leading to and confirming their own understanding. This allows opportunities for meaningful assessment. Problems can be powerful tools for engaging young students in mathematics and many students enjoy making sense of them. Honoring students' problem solving approaches is important. Capitalize on opportunities that come from rich problem solving experiences by talking with the students and observing, listening and questioning them. Allow ample time for students to wrestle with a challenging problem over a few days. These opportunities encourage an attitude of persistence. As students move through the problem solving process, it should be an experience that "stretches" the students' thinking. Support and challenge the students' thinking before giving the correct answer. It is important to explicitly discuss problem solving strategies with students, preferably as they come up naturally in classroom activities and discussions. There is value in naming the strategies so that students can discuss and recall them readily. Consider posting the different strategies in your classroom as they are taught.

Suggested Assessment Strategies

Resources/Notes

Performance

- Create a number line on the floor using masking tape or rope. The distance between the numbers should be large enough for students to jump from one number to the next. Engage students in a variety of activities whereby they are kangaroos or rabbits and have them skip count and jump along the number line, creating patterns as they go. Students may jump from various starting points skipping by one's, two's or three's. Pose problems such as the following:

  Fuzzy Bunny lives in Garden number 3. She wants to visit her friend at Garden number 21. If Fuzzy Bunny skips 2 Gardens at a time, how many hops will Fuzzy Bunny need to jump to reach her friend's Garden?
  (Adapted from NCTM Navigation Series – Navigating through Algebra Pre-K to 2.)

  (2N1.1, 2N1.2, 2N1.3)

Authorized Resource

Math Makes Sense 2

Numbers to 100

Lesson 11: Strategies Toolkit

TR: pp. 65 - 67

SB: pp. 48 - 49

- Use a T-chart to engage students in solving these problems:
  (i) How many ears are on ten dogs?
  (ii) How many legs are on five cats?
  (iii) How many ears and noses do eight students have?
  (iv) How many legs are on four spiders?

  (2PR2.1)

Patterning

Lesson 4: Strategies Toolkit

TR: pp. 36 - 38

SB: pp. 21 - 22

- Ask students to work in pairs to create "Mystery Graphs". Students will need to decide on a question that can be answered by collecting data within the classroom, for example, "Are there more windows than plants in our classroom?" They will then collect the necessary data by making tallies, and record the data in the form of a pictograph. There will not be any words or numbers recorded as this is a "mystery graph". On a separate sheet of paper students will write the title of their graph. Collect the titles and graphs and display them separately. Allow ample time for the students to analyze the graphs and make connections to appropriate titles. Encourage students to discuss their reasoning. As a group, match the titles with the correct graph, making note of students' reasoning and mathematical vocabulary.

  (2SP1.2)

Data Analysis

Lesson 5: Strategies Toolkit

TR: pp. 29 - 31

SB: pp. 197 - 198

Outcomes

Students will be expected to

Problem Solving (Continued):

Elaborations—Strategies for Learning and Teaching

Here are the suggested problem solving strategies. While many of these were addressed in Grade One, students may need a reminder of each.

Strategy	Description
Act it Out	Students physically act out the problem to find the solution.
Make a Model	Students use a variety of materials or manipulatives to represent the elements in the problem.
Look for a Pattern	Students' surroundings contain many patterns such as in their clothing, in structures and buildings, and in the classroom. Students can look for patterns to help them solve problems.
Draw a Picture	Students draw a picture of the problem before attempting to solve it. This can be beneficial to visual learners. Although students may think that drawing a picture to solve a problem is easy, the thought that goes into creating the picture is important to the success of the investigation and is helpful in presenting the solution.
Guess and Check	Students make a guess and then check to see if they are correct. If their guess does not work they revise their initial guess based on what was tried and learned. This continues until the correct answer is found.
Use an Object	Students use simple objects such as string, paper clips, snap cubes or any non-standard measuring tool to solve the problem.
Make a Graph	Students create and interpret a graph to find the solution to a problem.

Suggested Assessment Strategies

Performance

- Tell students that you plan to plant 15 young trees in your new backyard. You planted 7 of them along the back. The rest will be planted on the two sides. Ask students to draw a picture to help you find how many were planted on the sides.

(2N9.7)

- "What's in My Bag?" - Say to the students, "I have 73 cents in my bag. What coins might I have?" Encourage students to represent as many different possible coin combinations that they can think of. Reveal the coins in your bag.

(2N9.1, 2N9.2, 2N9.4, 2N9.9)

- Ask students, "Can something that is small be heavier than something that is large?" Ask students to find two objects and use a balance scale to demonstrate their thinking. A golf ball, an inflated balloon, and a ping pong ball are all good to use in this activity.

(2SS3.2)

Interview

- Present students with a sample of each of the 3-D geometric solids (i.e., cube, sphere, cone, cylinder, pyramid and prism). Ask:
  - (i) How is a cube like/different from a sphere?
  - (ii) How is a pyramid like/different from a cone?

  For students who may struggle with open-ended questions, start by asking more direct questions such as:
  - (i) How many faces/edges/vertices are on a cone?
  - (ii) Which objects slide/stack/roll?

(2SS7.2)

Resources/Notes

Authorized Resource

Math Makes Sense 2

Addition and Subtraction to 18

Lesson 13: Strategies Toolkit.

TR: pp. 70 - 71

SB: pp. 83 - 84

Addition and Subtraction to 100

Lesson 13: Strategies Toolkit

TR: pp. 69 - 70

SB: pp. 150 - 151

Measurement

Lesson 7: Strategies Toolkit

TR: pp. 46 - 50

SB: 117 - 118

Geometry

Lesson 8: Strategies Toolkit

TR: pp. 46 - 47

SB: pp. 184 - 185

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