Mathematics 3

Curriculum Guide 2017

Newfoundland Labrador

Education and Early Childhood Development

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Acknowledgements

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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 3 course was originally implemented in 2010.

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:

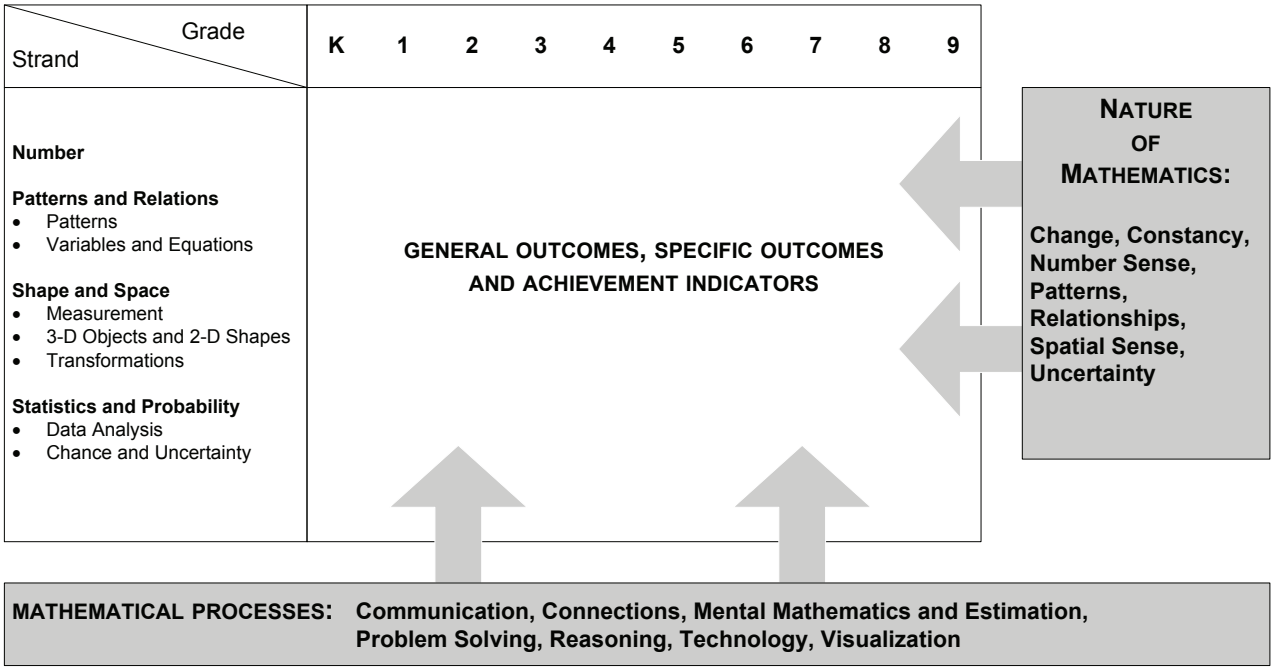
- use mathematics confidently to solve problems
- communicate and reason mathematically
- appreciate and value mathematics
- make connections between mathematics and its applications
- commit themselves to lifelong learning
- become mathematically literate adults, using mathematics to contribute to society.

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

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.

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

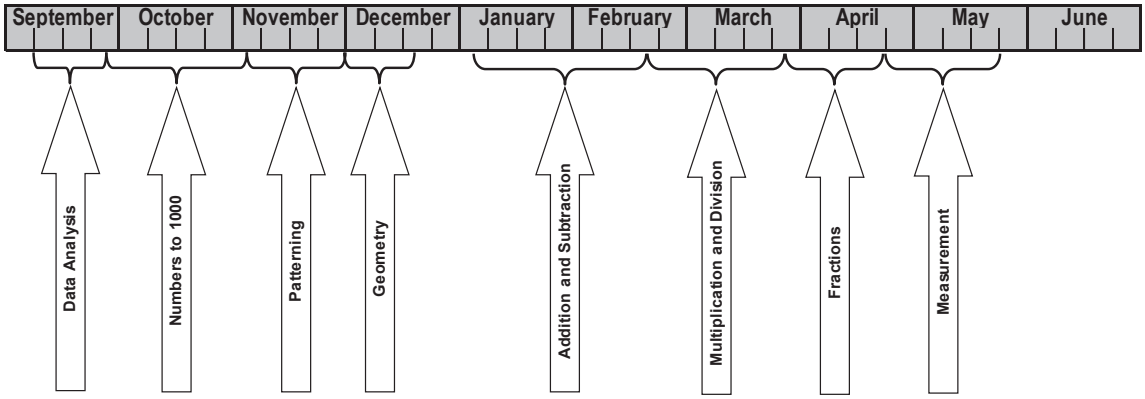
Planning for Instruction

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 Three 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 3* (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 3* 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

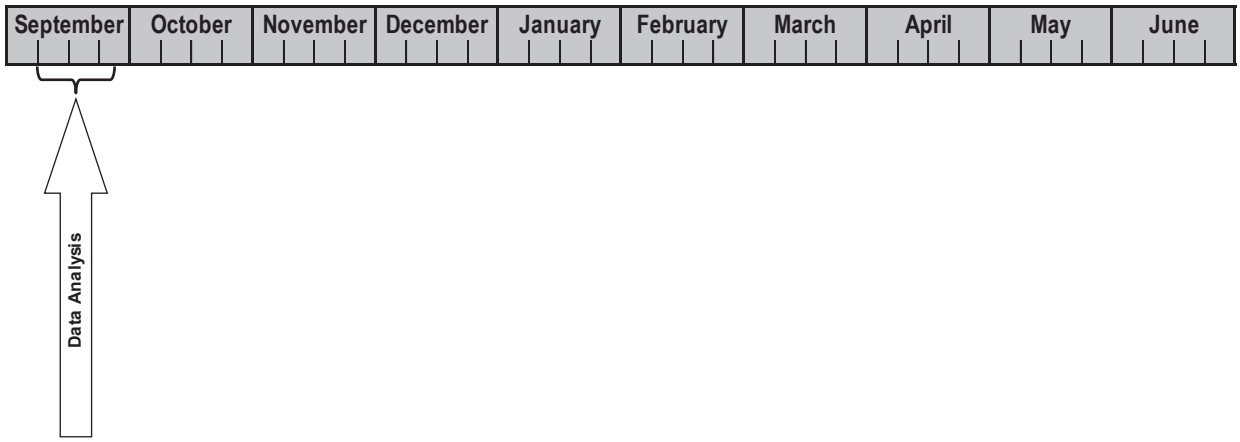
GENERAL AND SPECIFIC OUTCOMES WITH ACHIEVEMENT INDICATORS (pp. 19 - 252)

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 3 is organized into eight units: *Data Analysis, Numbers to 1000*, *Patterning*, *Geometry, Addition and Subtraction, Multiplication and Division, Fractions,* and *Measurement*.

Data Analysis

Suggested Time: 2½ Weeks

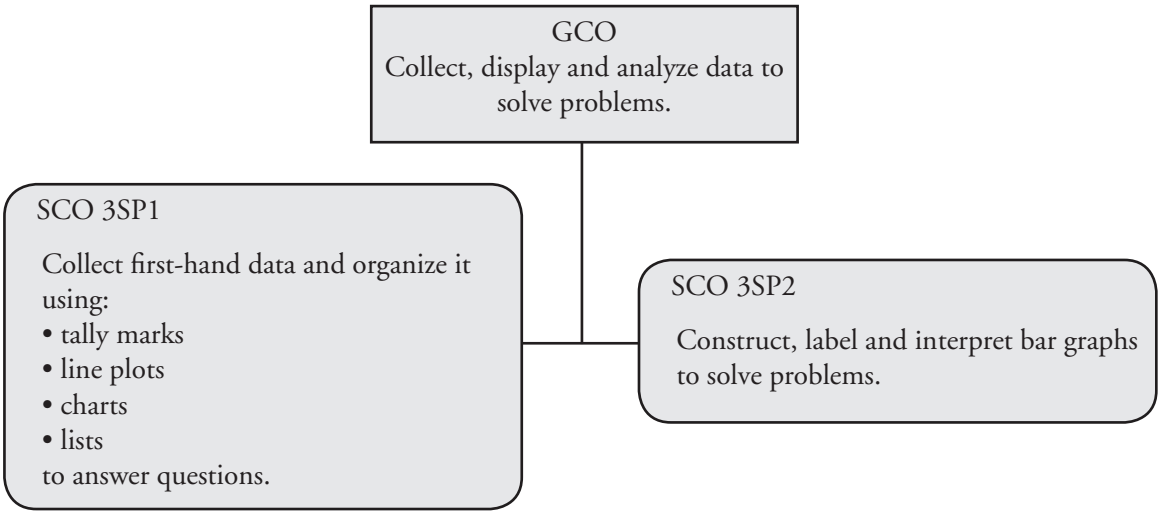


Unit Overview

Focus and Context

Students live in an increasingly complex world of information in which they need to learn how to make sense of the data that surrounds them. Students will be given opportunities to collect, organize, display, and interpret data to answer questions and solve problems. Previously, students have constructed and interpreted concrete graphs and pictographs to solve problems. In Grade Three, students will use tally marks, lists, charts, line plots, and bar graphs to organize data and interpret information relevant to their everyday life. Use the natural curiosity of students to incorporate data analysis as opportunities arise throughout the year, e.g. putting students' names on a birthday graph to display in the classroom, deciding on a lunchtime activity, or comparing bedtimes, etc. When working with data, students discover not only answers to questions, but meaningful information that can evoke change in their world.

Outcomes Framework



SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Statistics and Probability (Data Analysis)		
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]	4SP1. Demonstrate an understanding of many-to-one correspondence. [C, R, T, V] 4SP2. Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions. [C, PS, 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: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

3SP1 Collect first-hand data and organize it using:

- **tally marks**
- **line plots**
- **charts**
- **lists**

to answer questions.

[C, CN, PS, V]

Achievement Indicators:

3SP1.1 Record the number of objects in a given set, using tally marks.

3SP1.2 Answer questions using collected data.

Elaborations—Strategies for Learning and Teaching

Grade Three students have previous knowledge with organizing data using tally marks, charts, pictographs and lists, (2SP1, 2SP2) but this will be their first introduction to line plots.

The key goal in the collection of data is to present information in a form that enables clear analysis and provides answers to otherwise obscure questions. Students have a natural tendency to ask questions and are keenly aware of the interests of their peers. Help students develop this interest through various forms of data collection and organization such as surveys, tallies, and graphical representations. It is important that data collection be relevant to their world, e.g., favourite season, shoe size, bedtimes, etc. Learning how to make inferences, develop and answer questions, and draw conclusions based on organized data, is integral to this strand of mathematics. These early skills provide students with a foundation for future critical viewing of various forms of informational and visual texts.

Gathering data requires an organized system of collecting the information. Using tally marks is a simple way for students to keep track of information as they collect it. Tally marks are most effective when recorded in an organized column chart like the one below. Grouping the tally marks in 5s makes it easier for students to total the numbers in each category by skip counting. Remind students to keep their bundles of five separate from each other. Tally charts should always be given a title to inform the reader about the meaning of the data.

Our Favourite Sports		
Sport	Tally	Number of Students
Hockey	𝍸 |	6
Soccer	𝍸	5
Basketball	||||	4
Gymnastics	||	2

A good graph should communicate some overall impressions of the data to a reader "at a glance". It is important that the graph accurately represents the data and includes clear labelling and a title.

"Once a graph is constructed, the most important activity is discussing what it tells the people who see it, especially those who were not involved in making the graph" (Van de Walle and Lovin, 2006, p. 318).

General Outcome: Collect, Display and Analyze Data to Solve Problems

Suggested Assessment Strategies

Interview

- Ask students why it is easier to count responses when they are shown like this, 𝍸 𝍸 , rather than like this, 𝍸 𝍸 𝍸 𝍸 𝍸 .

(3SP1.1)

Portfolio

-
Ask students to keep track of weather conditions over the period of one month and to design a method to present the information in an organized way. Ask students to provide three conclusions about their data.

(3SP1.2, 3SP1.5)

Paper and Pencil

- Using a template such as the one below, provide students with an opportunity to create a list. Ask them to give the list a title and two categories for surveying the class. Students can list classmates' names underneath their selected choice. Ask students, for example, to answer the following questions about their data: Do more students prefer white or chocolate milk? How many more/less prefer white/ chocolate milk? How many students drink milk in all?

Favourite Milk	
Chocolate	White
Anna	Derek
Jamal	Paul
Shanice	Taylor B.
Taylor M.	

(3SP1.2, 3SP1.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch: At the Vet

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 238 - 239

Lesson 1: Collecting and Organizing Data

TR: pp. 4 - 7

SB: pp. 240 - 243

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Suggested Resources

Children's Literature

- *Tally O'Malley* by Stuart J. Murphy
- *Zoo Animals* by Eliza Collins

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

3SP1 Continued

Achievement Indicators:

3SP1.3 Organize a given set of data, using tally marks, line plots, charts or lists.

3SP1.4 Determine the common attributes of line plots by comparing line plots in a given set.

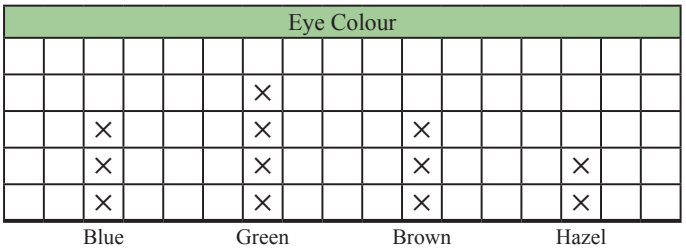
3SP1.5 Collect and organize data, using tally marks, line plots, charts and lists.

3SP1.6 Answer questions arising from a given line plot, chart or list.

Elaborations—Strategies for Learning and Teaching

A useful tool for organizing data is a line plot. It is an easy type of graph for students to make. It displays each piece of data by marking an '✕' above the corresponding choice/value along a horizontal line. A line plot provides a learning 'bridge' from tally charts to bar graphs. Provide students with sets of data and ask them to create their line plots on grid paper, with one '✕' per grid paper square.

Present students with two line plots representing two different sets of data. Have a discussion about the common attributes of the two line plots, e.g., title, labels, horizontal line, ✕s to show the choice selected, and the lines being equally spaced.



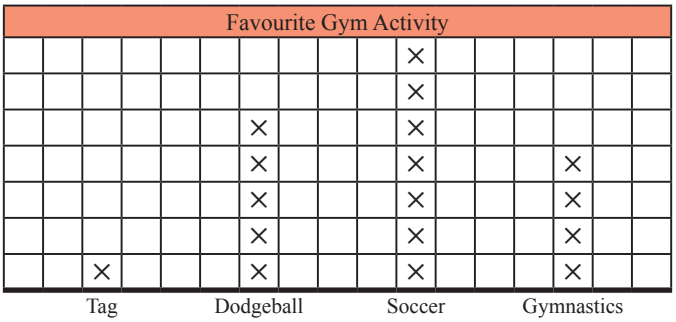
At this level, students should be encouraged to become more independent in the selection of appropriate strategies for collecting and organizing data. Ask students to decide how to collect and to organize data that will show interesting information about classmates. Consider using the book *Chrysanthemum* by Kevin Henkes, for example, to explore the number of letters in names of the students. Using a chart, invite students to place a tally mark next to the number of letters in their names. Use this opportunity to reinforce how to record and count tally marks. Lead a discussion about the information shown by the tally marks and ask students how the data can be organized in another form, i.e. a type of graph. Graph the results together while teaching the steps for formulating a line plot. Discuss the importance of labelling the axes and giving the line plot a title. Ask students to formulate questions that can be answered using the data in the line plot, e.g., "What is the most common number of letters in a name? How many letters does the longest name in the class have? The shortest name?"

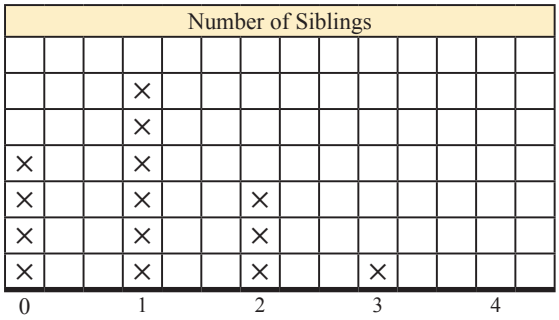
General Outcome: Collect, Display and Analyze Data to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Present students with two different line plots. Ask them to write about how they are similar and how they are different.





(3SP1.4)

Performance

- Ask pairs of students to design a survey and a method of recording data that will show favourite school subjects. (3SP1.3, 3SP1.5)

- Using a die, ask students to roll 20 times, tallying each roll on an organized chart as they go. Ask them to write three questions that could be asked of their data. (3SP1.3, 3SP1.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2: Line Plots

TR: pp. 8 – 11

SB: pp. 244 - 247

Suggested Resources

Children's Literature

- *Chrysanthemum* by Kevin Henkes

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/data-an.html

- eye colour and shoe size line plots
- gym activity and siblings line plots

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

3SP1 Continued

Achievement Indicators:

3SP1.5 (Continued) Collect and organize data, using tally marks, line plots, charts and lists.

3SP1.6 (Continued) Answer questions arising from a given line plot, chart or list.

Elaborations—Strategies for Learning and Teaching

As a class, brainstorm a list of interesting questions for possible surveys. Survey questions may include: What is your favourite TV show, favourite sport, favourite genre of movie, bedtimes, popular cafeteria choices, etc. Students should select a question and a method for collecting data. Allow students, or groups of students, to choose another classroom in which to carry out the survey. Collected data should then be organized and presented to the class. The presentation of the data should include questions formulated and answered by analyzing the data.

General Outcome: Collect, Display and Analyze Data to Solve Problems

Suggested Assessment Strategies

Performance

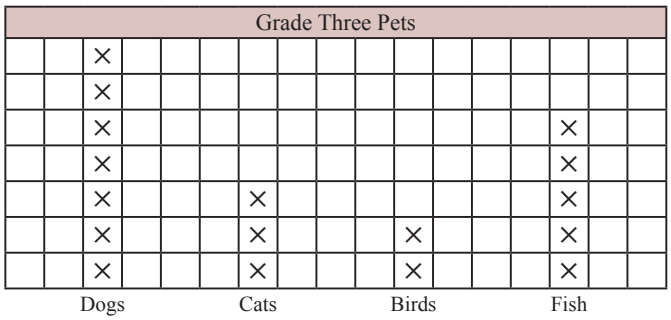
- Provide students with the following chart. Ask students: Were more lunches sold altogether on Monday and Tuesday or on Wednesday and Friday?

  Why were no lunches sold on Thursday?

Lunch Sales for the Week	
Day of the Week	Number of Lunches Sold
Monday	25
Tuesday	63
Wednesday	47
Thursday	0
Friday	46

(3SP1.6)

- Provide students with a line plot such as the one displayed below:



Ask students:

(i) What is the most common type of pet owned by students in Grade Three? What is the least common pet?

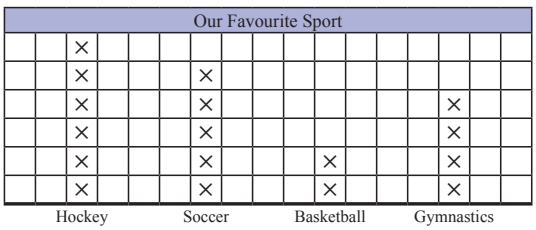
(ii) How many more dogs are there than birds?

(iii) Is it possible to tell, from the graph, how many students have pets?

(3SP1.5, 3SP1.6)

Paper and Pencil

- Provide the following line plot to students. Ask students to generate a question which could be answered from analyzing the data in the graph. Ask students to exchange questions with a classmate and answer their classmate's question.



(3SP1.6)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2: (Continued) Line Plots

TR: pp. 8 - 11

SB: pp. 244 - 247

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/data-an.html

- lunch sales chart
- pets and favourite sports line plots

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

3SP2 Construct, label and interpret bar graphs to solve problems.

[C, PS, R, V]

Achievement Indicators:

3SP2.1 Determine the common attributes, titles and axes of bar graphs by comparing bar graphs in a given set.

3SP2.2 Draw conclusions from a given bar graph to solve problems.

Elaborations—Strategies for Learning and Teaching

In Grade Two, students solved problems by constructing and interpreting concrete graphs and pictographs (2SP2). Grade Three students will be introduced to bar graphs. Initially, students will focus on reading and interpreting given bar graphs, and then move on to constructing bar graphs.

A bar graph is another useful tool for organizing data. Students will explore both vertical and horizontal bar graphs, making the connection that the height or length of the bars represents a number. Ensure that all graphing activities are based on one-to-one correspondence. Many-to-one correspondence will be introduced in Grade Four (4SP1, 4SP2). Bars on a bar graph should not touch each other. When reading a bar graph, teach students to use a ruler, index card, or finger to find the number on the axis that aligns with each bar.

Using multi-link cubes is an effective way to use a concrete graph to model a bar graph before students create their own, on paper. Remind students of the book, *Chrysanthemum*, for example. Create a bar of 13 multi-link cubes with one block representing each letter of Chrysanthemum's name. Provide multi-link cubes for each student to make a bar to represent his/her own name. In groups of four or five, ask students to arrange their 'bars' in a horizontal or vertical bar graph. Ask them what they notice about the information represented in their multi-link bar graphs. Ask each group to share their findings, using appropriate mathematical language such as "more than", "less than" or "fewest" instead of "taller", "smaller" and "shortest". You may extend this activity and ask students to create a name graph, with multi-links, for the whole class. Keep the multi-link bars together and after students have had some experience with constructing bar graphs, you may ask them to transfer the information to paper. Brainstorm an appropriate title for the graph and how to label the axes.

Present students with vertical and horizontal bar graphs that represent two different sets of data. Discuss what common attributes the two bar graphs have, e.g., title, axes, labels for the axes, numerical scale, and bars. Discuss how the two bar graphs are different, e.g., the titles of the graphs, labels for the axes, lengths of the bars, and how some graphs have horizontal bars and others have vertical bars.

General Outcome: Collect, Display and Analyze Data to Solve Problems

Suggested Assessment Strategies

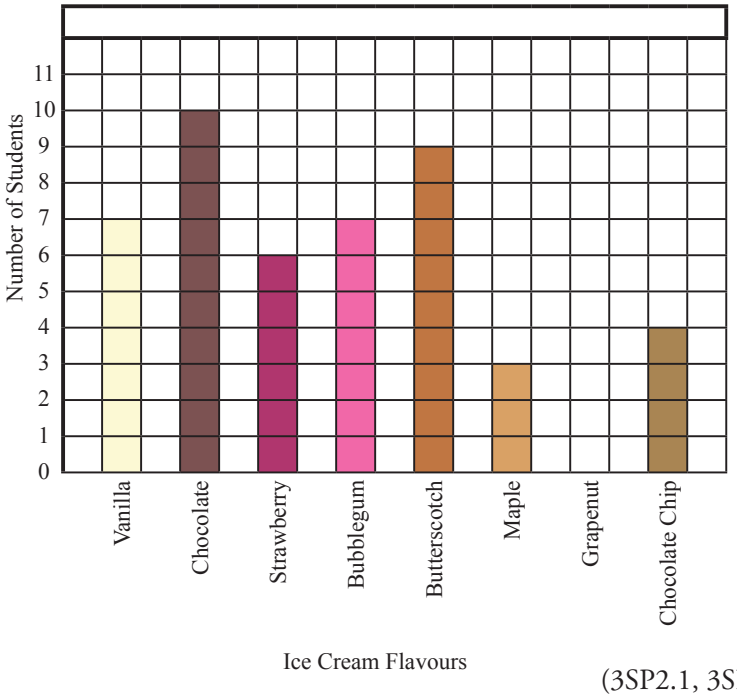
Journal

- Ask students to respond to the following prompt: What would happen if the bars in a graph got rearranged? Would the graph still give you the same information? Explain.

(3SP2.2)

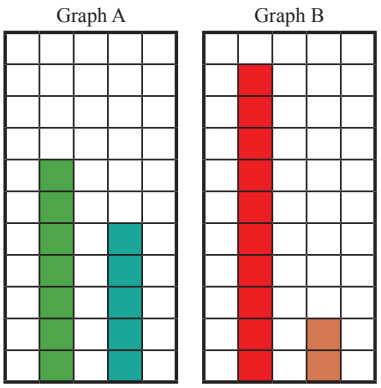
Interview

- Ask students to look at the following bar graph and suggest a reasonable title based on the data presented. Ask for three conclusions that can be drawn from the data.



(3SP2.1, 3SP2.2)

- Provide students with two bar graphs that have no titles or labels. Ask students to think about what the graphs might be representing and to explain their thinking. Ask: Which graph might compare the number of children on a team to coaches? Which graph might compare the number of 8-year-olds to 9-year-olds on a team? Together, decide on appropriate titles and labels for the graphs.



(3SP2.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: Reading Bar Graphs

TR: pp. 12 - 15

SB: pp. 248 - 251

Supplementary Resource

- *Making Math Meaningful to Canadian Students, K – 8.* (2008) by Marian Small

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/data-an.html

- ice cream bar graph
- Graphs A and B

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

3SP2 Continued

Achievement Indicators:

3SP2.3 Create a bar graph, labelling the title and axes, to represent a given set of data.

3SP2.4 Solve problems by constructing and interpreting a bar graph.

Elaborations—Strategies for Learning and Teaching

Children's literature is often a valuable resource for conveying mathematical ideas to students. *The Great Graph Contest* by Loreen Leedy, for example, can be used to demonstrate how data can be represented in different and creative ways. As a whole class activity, use a tally chart to collect data about "Favourite Cookie" choices of the class. On chart paper demonstrate how to transfer the tally marks into a bar graph representation in a creative and colourful way. Explicitly teach the terms "axis" (singular) and "axes" (plural) and discuss the importance of labelling them. During this activity, discuss why equal intervals are used and why the number axis starts from zero, not one. Be sure to give the graph a title, explaining that this helps the reader to understand the graph. Discuss what information the graph represents.

The following activity may be done using any small manipulatives (e.g., beads, buttons, blocks, marbles, etc.).

- Ask students to work in groups. Provide each group with a box of beads.
- Ask them to sort and tally the beads according to colour.
- They will then use this data to create a bar graph, with the bars corresponding to the colours of the beads.
- Students may be provided with 1cm or 2 cm grid paper and a half sheet of bristol board to create a large version of their bar graph for display in the classroom.

This activity will provide a valuable opportunity to analyze and discuss the similarities and differences seen in the various graphs. Some questions which may be posed and answered are:

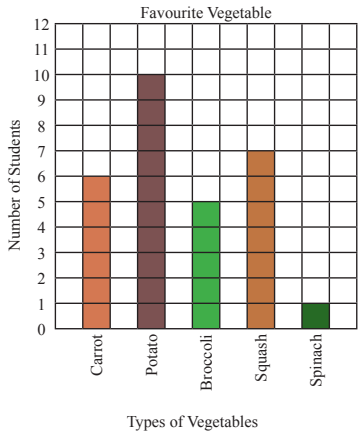
- What is the most common colour of bead?
- How many more red beads are there in one graph compared to another?
- Were all the groups given the same number of beads?

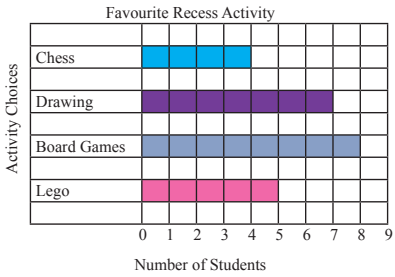
General Outcome: Collect, Display and Analyze Data to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

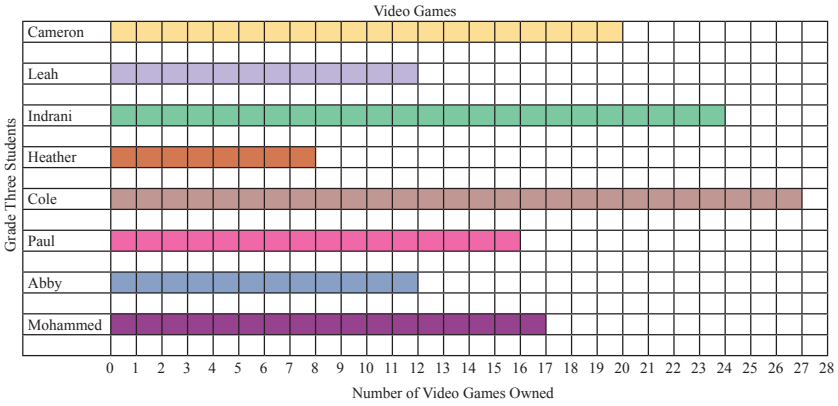
- Ask students to compare and contrast two different bar graphs.





(3SP2.1)

- Provide students with a bar graph and questions such as the ones seen below. Ask them to solve the problems based on the data presented in the graph.



(i) Which students own at least 16 video games?
(ii) If Indrani gave Paul 10 video games, how many games would she have left?
(iii) How many more video games does Cameron own than Abby?
(iv) If Mohammed, Leah and Cole combined their video games, how many would they have in total?
(v) What is the total number of video games owned by all of the students?

(3SP2.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: Reading Bar Graphs

TR: pp. 12 - 15

SB: pp. 248 - 251

Lesson 4: Drawing Bar Graphs

TR: pp. 16 - 19

SB: pp. 252 - 255

Note:

Activity 5 on TR p.19 deals with body lengths using the standard unit metre. Please note that the measurement strand is not developed until later in the year.

Suggested Resources

Children's Literature

- *The Great Graph Contest* by Loreen Leedy.

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/data-an.html

- favourite vegetable and favourite recess activity bar graphs
- video games bar graph
- 1 cm and 2 cm grid paper

Strand: Statistics and Probability (Data Analysis)

Outcomes

Students will be expected to

3SP2 *Continued*

Achievement Indicators:

3SP2.2 (Continued) Draw conclusions from a given bar graph to solve problems.

3SP2.3 (Continued) Create a bar graph, labelling the title and axes, to represent a given set of data.

3SP2.4 (Continued) Solve problems by constructing and interpreting a bar graph.

Elaborations—Strategies for Learning and Teaching

Although students may be able to create bar graphs, some may experience difficulty with interpreting them correctly. As much as possible, ensure that there are reasons for collecting data. Data may be collected to answer questions, to discover something of interest, or most importantly, to solve a problem such as any of the following:

- What should students be allowed to do during the lunch break on inside days?
- What foods should be available on the cafeteria menu? What foods should be removed from the cafeteria menu?
- What activities would you like to do in the gym?

As a class, develop a survey that can be conducted school wide, primary/elementary level, grade level, or in the class. Carry out the survey using a tally chart. Once the data has been collected, combine and total the data for organizing into a bar graph. Analyze the data and present findings to the school principal, another class, or at grade level.

General Outcome: Collect, Display and Analyze Data to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Present the following situation to students:

  Luke asked his teammates what day they would like to practice hockey. Their answers were: Monday, Monday, Tuesday, Wednesday, Saturday, Saturday, Friday, Tuesday, Friday, Sunday, Tuesday, Wednesday, Saturday, Saturday and Friday. Luke preferred Saturday. Ask students to create a bar graph to display this data. Ask the following questions: Which day of the week was the most popular choice? Which day of the week was least popular? How many children are on the team?

  (3SP2.4)

- Using the book, *The Three Silly Billies* by Margie Palatini, chart the various money contributions of the characters in the story. Provide students with 1cm grid paper and ask them to use the data to create a bar graph. Remind them to include a title and label the axes.

  (3SP2.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 5: Using Graphs to Solve Problems

TR: pp. 20 - 22

SB: pp. 256 - 258

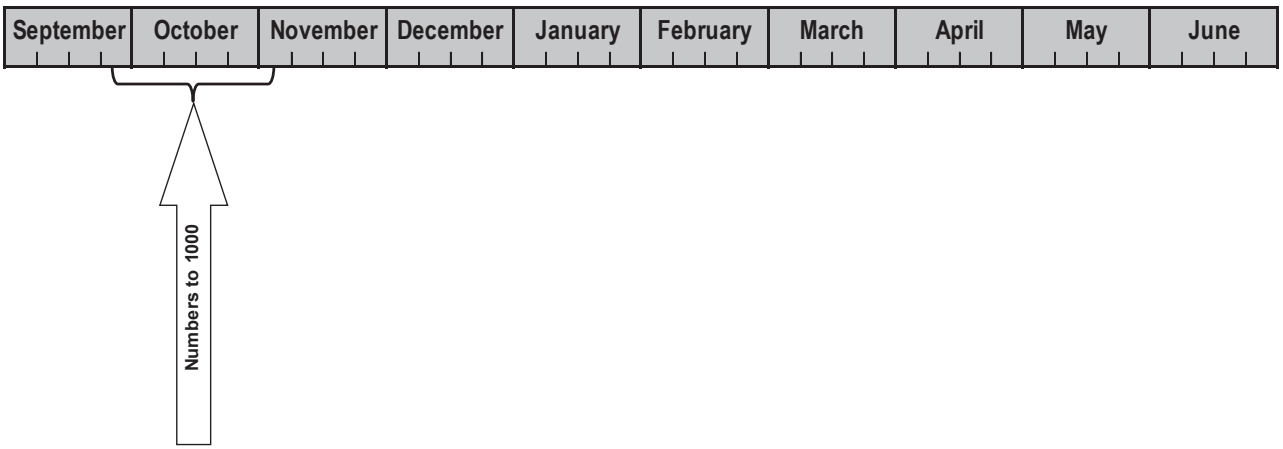
Supplementary Resource

Children's Literature

- *The Three Silly Billies* by Margie Palantini

Numbers to 1000

Suggested Time: 5 Weeks



Unit Overview

Focus and Context

Number permeates through all areas of mathematics in both content standards and process standards. Number sense slowly grows and develops over time, which is why it needs to be a natural part of daily mathematics class. Students with a good sense of number will decompose number, solve problems using number, understand the relationships between numbers and represent numbers in a variety of ways.

In Grade Three, students will build on their experiences with numbers to 100 while investigating the characteristics of numbers 0 – 1000. An active mathematics class enables students to construct meaning in problems while interacting with other students. Through this interaction, students will have a variety of opportunities to extend, reflect and communicate their mathematical knowledge. In addition to group work with problem solving, number sense can be developed in the context of a variety of classroom activities such as use of graphic representations, daily routines, and games explored throughout the curriculum.

Outcomes Framework

GCO
Develop number sense.

SCO 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.

SCO 3N2

Represent and describe numbers to 1000, concretely, pictorially and symbolically.

SCO 3N3

Compare and order numbers to 1000.

SCO 3N4

Estimate quantities less than 1000, using referents.

SCO 3N5

Illustrate, concretely and pictorially, the meaning of place value for numerals to 1000.

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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] 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]	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] 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]	4N1. Represent and describe whole numbers to 10 000, pictorially and symbolically. [C, CN, V] 4N2. Compare and order numbers to 10 000. [C, CN, 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

3N2 Represent and describe numbers to 1000, concretely, pictorially and symbolically.

[C, CN, V]

Elaborations—Strategies for Learning and Teaching

In Grade Two, students represented and described numbers to 100 concretely, pictorially and symbolically (2N4). Grade Three students will build on these skills with numbers to 1000. Building larger numbers with concrete materials helps students develop a better sense of those numbers. It is important that students have many and varied purposeful experiences with materials that they can count and group in a variety of ways. Consistent use of daily routines is an engaging way for students to strengthen and demonstrate their understanding of representing and describing numbers to 1000.

Connections to real life contexts and to literature are very important to young students. Consider using the book *How Much, How Far, How Heavy, How Long, How Tall is 1000?* by Helen Nolan and Tracy Walker as an introduction to exploring numbers to 1000. It is important that students see the number 1000 in different ways in order to realize that 1000 can cover a big area or a small area, depending on the size of the items being counted.

Achievement Indicator:

3N2.1 Represent a given number pictorially.

Provide opportunities for students to use hundreds charts and collections of materials such as straws, buttons, counters, kidney beans, pennies or paper clips to represent given numbers over 100. Students should decide on various ways to count the objects, perhaps grouping them in tens and/or hundreds. Students should then draw their representations. They will require numerous opportunities to group and count objects, in a variety of ways, for given numbers.

325 represented pictorially with buttons

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Provide students with place value mats, a deck of three-digit number cards and counters, popsicle sticks, beans, buttons or small cubes. Ask students to pick a three-digit number from the deck of number cards and represent the number using the objects. Small baggies and containers can be used to help students organize groupings. Ask students to record their groups pictorially.

(3N2.1)

Portfolio

- Present students with a number such as 290 (or the number of days that has passed in the current year). Ask students to create a picture representing the number.

  E.g., a flower box containing 14 flowers (each with 20 petals) and 1 flower (with 10 petals).

(3N2.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch:

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 36 - 37

Lesson 1: Counting Large Collections

TR: pp. 4 - 7

SB: pp. 38 - 41

Supplementary Resource

Children's Literature

- *How Much, How Far, How Heavy, How Long, How Tall is 1000?* by Helen Nolan and Tracy Walker.

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- numeration activities

Strand: Number

Outcomes

Students will be expected to

3N5 Illustrate, concretely and pictorially, the meaning of place value for numerals to 1000.

[C, CN, R, V]

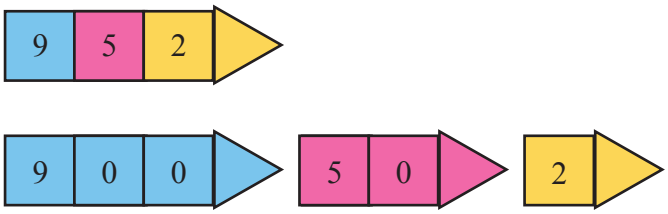
Achievement Indicator:

3N5.1 Explain and show, with counters, the meaning of each digit for a given three-digit numeral with all digits the same; E.g., for the numeral 222, the first digit represents two hundreds (two hundred counters) the second digit represents two tens (twenty counters) and the third digit represents two ones (two counters).

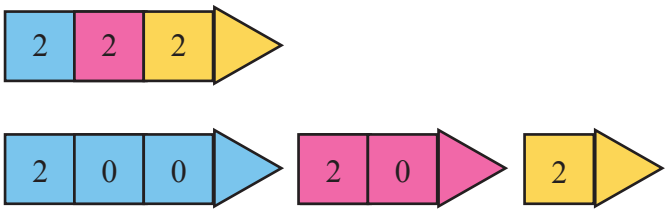
Elaborations—Strategies for Learning and Teaching

In Grade Two, students illustrated, concretely and pictorially, the meaning of place value for numerals to 100 (2N7). Grade Three students will expand these skills to include numbers to 1000.

Provide opportunities for students to show each digit in a three-digit number, using concrete materials, explaining the value of each digit. Provide students, for example, with a set of "Arrow Cards" as shown below. "Arrow Cards" can be used to build numbers. Note that each group of arrow cards are a different colour and can be placed one on top of the other (e.g., "hundreds" cards are blue, "tens" cards are pink and "ones" cards are yellow). Present a multi-digit number, such as 952, to students. Students use arrow cards to build the number. Ask students to discuss the meaning of the digits, (i.e., 9 is 900, 5 is 50, 2 is 2).



Similarly, students could use the arrow cards to represent 222.



General Outcome: Develop Number Sense

Suggested Assessment Strategies

Interview

- Use the number 111. Ask students to use manipulatives such as beans, counters, blocks, etc. to explain and show the meaning of each digit. Ask guiding questions such as:
  (i) How many beans will you need to show the meaning of the 1 in the tens place? How many beans to show the meaning of the 1 in the hundreds place?

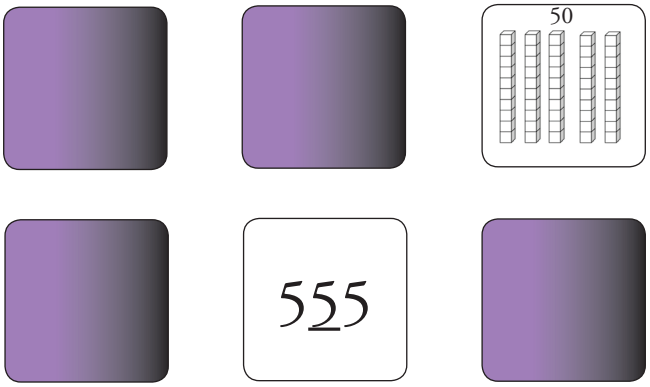
(3N5.1)

Performance

- Provide students with a set of cards containing three-digit numbers, with all digits the same. Ask students to represent the value of one of the digits with base ten materials. Students may use 4 rods, or 40 units, to show the value of the indicated digit in this example:

(3N5.1)

- Invite students to play "Place Value Concentration". Provide a deck of 12 to 16 cards. Half of the cards should contain three-digit numbers with one of the digits underlined. The other half of the cards should contain the value of the underlined digit represented with base ten blocks and the value written in standard form. Have players put all the cards face down. Player 1 turns over two cards, reading the number card and telling the meaning of the underlined digit. Then the student checks to see if a match has been made between the underlined digit and the base ten representation. If a match is made, Player 1 keeps the cards and takes another turn. If no match is made, Player 1 replaces the cards face down and Player 2 takes a turn. Play continues until all the cards are used. The winner is the player with the greatest number of cards at the end.



(3N5.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Counting Large Collections

TR: pp. 4 - 7

SB: pp. 38 - 41

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- Place Value Concentration

Strand: Number

Outcomes

Students will be expected to

3N2 Continued

Elaborations—Strategies for Learning and Teaching

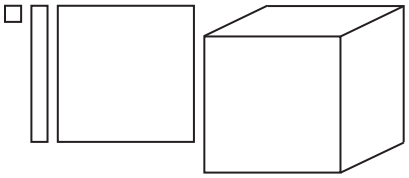
Students need a variety of experiences using pre-grouped materials such as base ten blocks. It is very important that consistent mathematical language is used when referencing the base ten materials. Students need to know and use appropriate terminology.

Students will continue to benefit from many experiences using groupable models since there is potential for some students to misunderstand the ten to one relationship.

Mathematical Name	Picture
unit	
rod	
flat	
cube	

Students may tend to look at numerals alone. For 15, for example, they may simply see a 1 and 5 rather than 1 ten and 5 ones.

When students are drawing base ten blocks, it is not essential that they represent them exactly. They do not need to draw every line on the rod, flat, or cube. What is necessary is that the relative sizes are represented.



Achievement Indicators:

3N2.2 Read a given number word (0 to 1000).

3N2.3 Read a given three-digit numeral without using the word "and".

It is important to model reading numbers correctly, without using "and". 143 should be read as "one hundred forty three" not as "one hundred and forty three". Next year in Mathematics 4, students will learn that the word "and" is used when reading decimals, i.e., 19.24 would be read as "nineteen and twenty-four hundredths (4N10). Students should be provided with a variety of opportunities to read number words, such as using games, activities and centres.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Invite students to play "Number Concentration". Arrange students in groups of two to four players. Students use a set of number cards from 0 to 1000 and a set of matching cards with numbers written in words (approximately 12 of each). Direct students to shuffle the two sets of cards together and place the cards face down. Player 1 turns over two cards and reads the cards aloud. If the number card matches the word card they keep the cards and play again. If the cards do not match, the cards are placed back on the table and the next player takes a turn. Player 2 proceeds to turn over two cards, reading the cards and looking for a match. Repeat until all cards are matched. The winner is the student with the most cards. Observe students as they read numbers and number words to 1000.

  (3N2.2)

- Invite students to play "Number Bang". Place number words in a paper bag along with a card marked "BANG". Ask a student to pick a card from the bag without looking. If the student can read the card properly, he/she can keep it. If not, the card goes back in the bag and the bag is passed to the next player. If a "BANG" card is drawn, that player must put all his/her cards back in the bag and loses all cards. Consider keeping the "BANG" card out once it is drawn from the bag. Play continues until the bag is empty. The player with the most cards is the winner. This game can be modified to use only certain numbers from 0 to 1000, e.g., use only numbers in the 400s, or numbers ending in zero.

  (3N2.2, 3N2.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2: Modelling 3–Digit Numbers

TR: pp. 8 - 10

SB: pp. 42 - 44

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- Base ten blocks poster

Strand: Number

Outcomes

Students will be expected to

3N2 Continued

Achievement Indicator:

3N2.4 Represent a given number as an expression; e.g., 300 – 44 for 256 or 20 + 236.

Elaborations—Strategies for Learning and Teaching

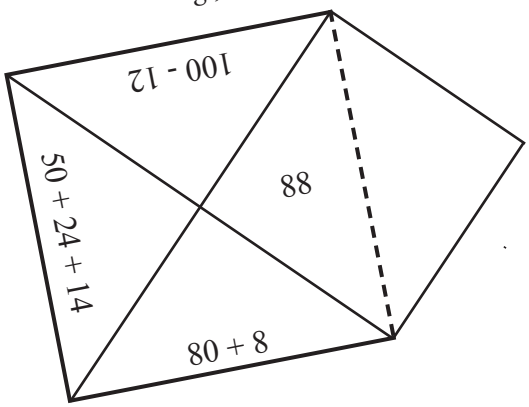
Another important way of representing number is to create different decompositions of the same quantity and record the decompositions as symbolic expressions. It is reasonable that students could possibly express a number in many different ways.

It is important to model the correct use of the term "expression" to students. An expression names a number. Sometimes an expression is a number such as 6. Sometimes an expression shows an arithmetic operation, such as 6 + *n*. An equation contains an equal sign. Students are not expected to understand the difference between an expression and an equation at this grade level, but it is important that they hear the correct terminology being modelled.

A.K.A (Also Known As) - Provide a bag of two- and/or three-digit numbers. Each day a number is picked from the bag and students write as many expressions as they can for that number, recording each one. Compile a large list of number expressions from the whole class and display around the classroom. It is advisable to start this routine using only two-digit numbers, with three-digit numbers being introduced as students become more efficient writing expressions.

Number of the Day - Students represent the number of the day using as many different expressions as they can on a "foldable"as shown below. This foldable is a square sheet of paper with the four corners folded to meet in the center to make four flaps.

E.g.,



General Outcome: Develop Number Sense

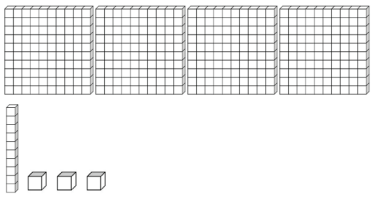
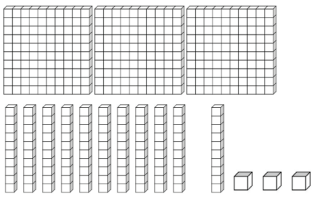
Suggested Assessment Strategies

Paper and Pencil

- Ask students to complete a "Number of the Day" sheet. Provide concrete materials such as coins and base ten blocks and have access to visuals such as hundreds charts, place value mats, calendars and number lines. It is recommended that tallies of 100 be available as stickers.

  E.g., The number of the day is 413

Number of the Day

Standard Form	Number in Words
413	Four hundred thirteen
Is the number odd or even?	Represent the number with tallies
It is odd!	
Base Ten Representation 1	Base Ten Representation 2
	
Represent with Money	Write three number expressions
	400 + 13 200 + 105 + 108 600 - 187
Expanded Form	Place Value Chart
400 + 10 + 3	Hundreds: 4; Tens: 1; Ones: 3

(3N2.1, 3N2.4, 3N2.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2 (Continued): Modelling 3–Digit Numbers

TR: pp. 8 - 10

SB: pp. 42 - 44

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- Number of the Day template
- printable tallies to 100

Strand: Number

Outcomes

Students will be expected to

3N2 Continued
3N5 Continued

Achievement Indicators:

3N2.5 Represent a given number, using manipulatives such as base ten materials.

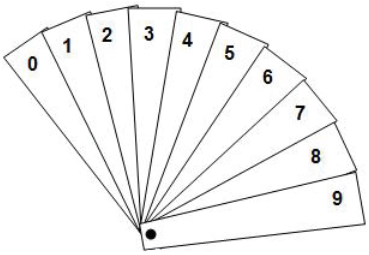
3N5.2 Explain, using concrete materials, the meaning of zero as a place holder in a given number.

Elaborations—Strategies for Learning and Teaching

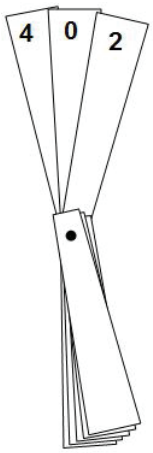
Students need many experiences building number using base-ten materials, and illustrating pictorially and concretely, their models of numbers to 1000. It is important that students realize a number can be expressed in different ways. 234, for example, can mean 2 hundreds, 3 tens and four ones; 23 tens and 4 ones; or 234 ones.

It is important to spend time developing a good understanding of the meaning of zero in numbers. For some students, the number "302", for example, looks like "thirty two". Students need many experiences using base-ten materials to model numbers with zeros as digits.

Consider using the book *Counting on Zero* by Highfield Junior School. Before reading the book, ask students to record their thoughts about zero in their math journal. After reading the book ask students to reread their journal entry and have them record if their opinions have changed. If so how? Why or why not?



Provide a numeral wand for each student. Numeral wands can be made using card stock and paper fasteners and provide a fun way for students to show what they know.



Say a number to the class and ask students to make it on the numeral wand. Ensure some of the numbers contain zeros. Ask students, for example, to make "four hundred two", They would manipulate the wand to show a 4, a 0 and a 2 as shown.

Observe that students demonstrate their understanding of the use of zero as place holders. Discuss the place value that a zero holds depending on where it is placed in a number.

Numeral wands may also be used for several different purposes throughout the year:

- students show a number that comes after/before a number
- students make the greatest number using three given digits
- students show 100 more or 100 less than a given number.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

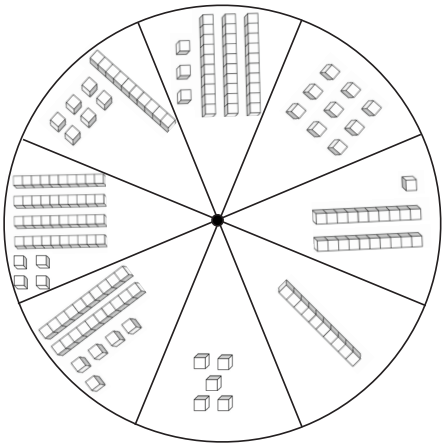
Performance

- Ask students to represent numbers with base ten materials in three different ways. Students should record each representation.

346			
241			
101			

(3N2.1, 3N2.5, 3N5.2)

- Invite students to play "Base Ten Exchange". This is a game for two to four players. Each player will need a place value mat, a set of base ten blocks, and a spinner. Students take turns. The first player spins the spinner, chooses the base ten materials indicated and places them in the appropriate columns of the place value mat. As play continues, students add their next spin to their individual place value mats making all possible exchanges. The first player to get two flats wins. Variation 1: Players start with two flats and remove the indicated amount. The player to clear his/her place value mat first is declared the winner. Variation 2: Start with 1000. Students spin and subtract until someone reaches zero.



Hundreds	Tens	Units

(3N2.5)

Interview

- Ask students to choose any three digit number and tell everything they know about that number. (3N2.1, 3N2.5)
- Give students a three digit number and ask them to represent it with base ten materials. Ask students to explain their representation. Ask if the number can be represented another way. (3N2.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2 (Continued): Modelling 3–Digit Numbers

TR: pp. 8 - 10

SB: pp. 42 - 44

Suggested Resources

Children's Literature

- *Counting on Zero* by Highfield Junior School

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- Base Ten Exchange

Strand: Number

Outcomes

Students will be expected to

3N5 Continued

Achievement Indicators:

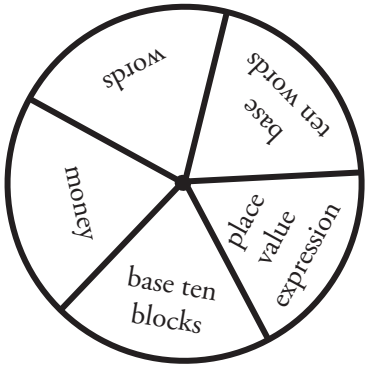
3N5.3 *Record, in more than one way, the number represented by given proportional materials (e.g., base ten materials) and non-proportional materials (e.g., money).*

Elaborations—Strategies for Learning and Teaching

When provided with a model representation, students need to be able to record numbers in more than one way for the given model. Numbers can be recorded in standard form, base ten words, place value expression or words. 234, for example, can be recorded as:

- 2 hundreds, 3 tens, 4 ones
- 200 + 30 + 4
- Two hundred thirty-four

Pair students and provide number cards suitable for the level of the students playing, base ten blocks, money, counters, a spinner and a recording sheet as shown below:



Number	Form	Representation
234	words	two hundred thirty-four
406	money	

One student chooses a number card to find out the number they will be representing and the partner spins the spinner to find out how they will represent the number. They proceed to build the number out of proportional materials (base ten) or non-proportional materials (money) and to record what they built on the recording sheet. Players switch roles and play again. Observe if students are able to represent numbers in different ways.

3N5.4 Represent a given number in different ways, using proportional and non-proportional materials, and explain how the representations are equivalent; E.g., 351 can be represented as three 100s, five 10s and one 1; or two 100s, fifteen 10s and one 1; or three 100s, four 10s and eleven 1s.

Proportional materials such as base ten blocks are an efficient and valuable model, as they are proportional in size. The rod is ten times as big as the unit cube, and the flat is ten times as big as the rod and one hundred times as big as the unit cube. The large cube is a thousand times bigger than the unit cube, etc. This helps with developing number sense, as a number like 100 is ten times bigger than ten.

Money is an example of non-proportional materials. The size of a coin does not reflect its value. A dime, for example, is smaller than a penny, however a dime is worth ten times more.

Students should be able to represent numbers, in different ways, using the base ten blocks or using non-proportional objects.

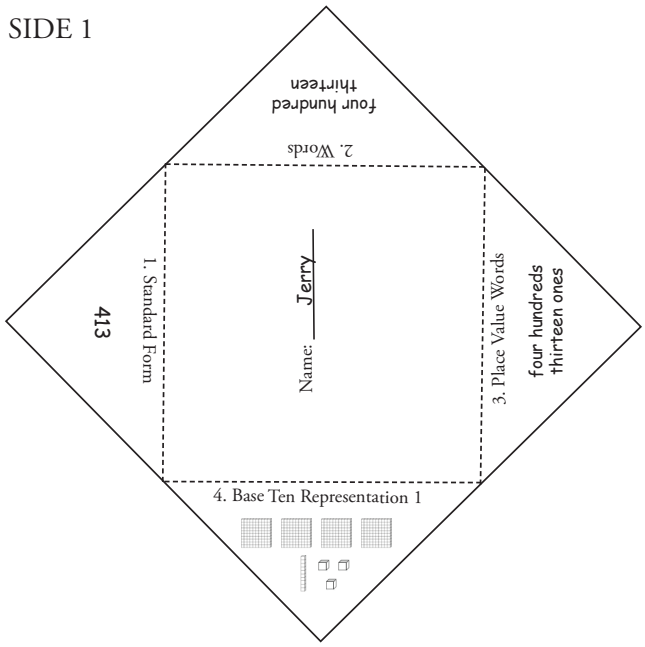
General Outcome: Develop Number Sense

Suggested Assessment Strategies

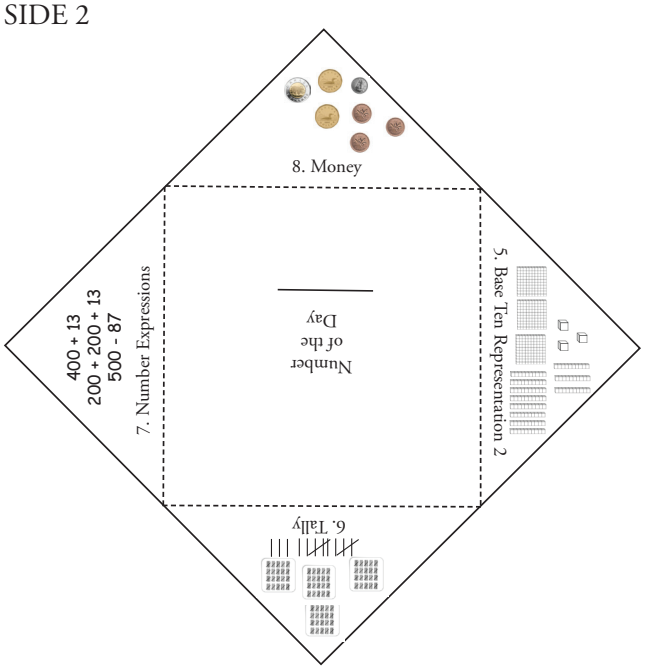
Presentation

- Ask students to represent the number of the day in various ways as requested. Ask students to present their foldable, chart or table to the whole class, small group, or to a partner. E.g.,

SIDE 1



SIDE 2



(3N5.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: Showing Numbers in Many Ways

TR: pp. 11 – 13

SB: pp. 45 - 47

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- representing number activity
- Number of the Day foldable

Strand: Number

Outcomes

Students will be expected to

3N2 Continued

Achievement Indicators:

3N2.6 Write number words for given multiples of ten to 90.

3N2.7 Write number words for given multiples of a hundred to 900.

Elaborations—Strategies for Learning and Teaching

The use of word walls and math dictionaries are important for students to model appropriate math language. Provide ample opportunities for students to write number words for multiples of ten to 90 and for multiples of one hundred to 900 when involved in writing tasks both in mathematics and other subject areas.

Prepare number cards by writing number words for given multiples of a hundred to 900. Provide each student with a number card and tools for recording such as a white board and dry erase marker. When the activity begins, students move around the room and find a partner. Partner A tells Partner B his/her number without showing the card and Partner B writes the number on the white board. When finished, the card is revealed and both check to see if it is correct. The process is then repeated for Partner B. When both students have completed the task, they switch cards and look for new partners. This continues until students have had practice writing several words for multiples of ten to 90 or multiples of a hundred to 900.

General Outcome: Develop Number Sense

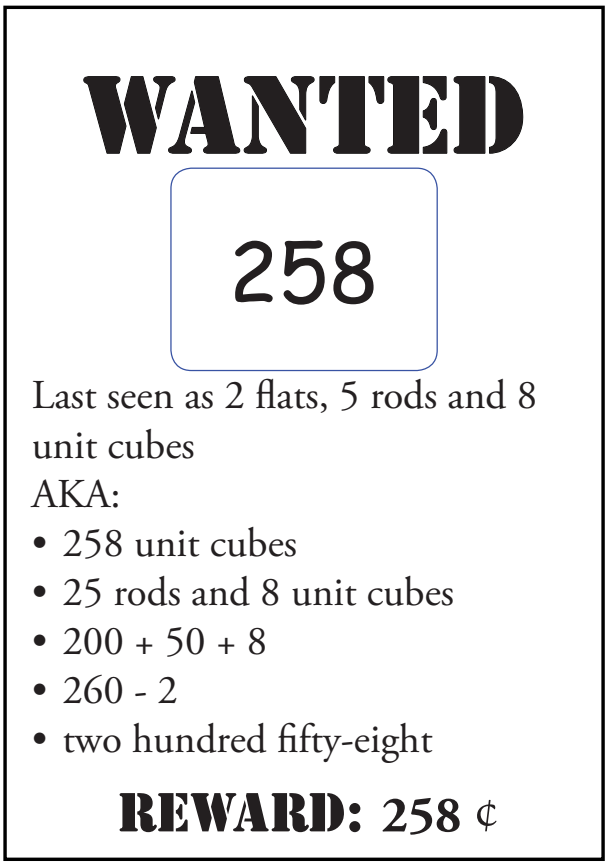
Suggested Assessment Strategies

Performance

- Present students with a number representation. This may be standard form, expanded form, or a model and ask students to record the number in words. (3N2.6, 3N2.7)

Portfolio

- Challenge students to create a wanted poster for a number. Students may be creative about decorating their chosen number. E.g.,



(3N5.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: (Continued) Showing Numbers in Many Ways

TR: pp. 11 - 13

SB: pp. 45 - 47

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- "Wanted" poster

Strand: Number

Outcomes

Students will be expected to

3N3 Compare and order numbers to 1000.

[C, CN, R, V]

Achievement Indicators:

3N3.1 Place a given set of numbers in ascending or descending order, and verify the result by using a hundred chart (e.g., a one hundred chart, a two hundreds chart, a three hundreds chart), a number line or by making references to place value.

3N3.2 Create as many different three-digit numerals as possible, given three different digits. Place the numbers in ascending or descending order.

3N3.3 Identify and explain errors in a given ordered sequence to 1000.

3N3.4 Identify missing numbers in parts of a given hundreds sequence to 1000.

Elaborations—Strategies for Learning and Teaching

Previously, students compared and ordered numbers to 100 (2N5). This year, students will compare and order numbers to 1000.

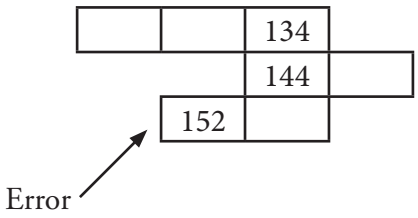
When numbers are represented in their standard or symbolic form, students can use the number of digits to get a sense of their size in order to compare them. Three-digit whole numbers are less than a 1000 but greater than any two digit whole number. Students need to be shown how to use symbols > and < to compare numbers. They should be able to name numbers greater than, less than, or between given numbers.

Students need opportunities to practice using greater than and less than symbols appropriately. Make a set of number cards containing various numbers to 1000. Ask students to pick two number cards, compare the cards and use the greater than or less than symbols to show their relationship.

Place a variety of three-digit number cards in a bag. One student chooses three or four number cards from the bag and places them in ascending order. With a partner, the order is checked using a hundreds chart or a number line. The cards are placed back in the bag and the other partner chooses three or four cards. This activity should also include students placing the numbers in descending order.

Give students a set of cards containing 0 – 9. Students should choose three cards and make as many three-digit numbers as possible. Ask students to record the numbers from greatest to least or from least to greatest.

When presented with pieces of a hundred chart, two hundreds chart, three hundreds chart, etc., students should be able to identify the missing or incorrect numbers.



General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Human Number Line – Provide cards showing various numbers to 1000. Choose two students one for each end of the number line who will represent 0 and 1000. Give students a number card each and have them place themselves on the number line. Ask students to explain their thinking. This activity can be used to teach benchmarks and midpoints.

(3N3.1)

- Ask students to do research to find the average weights of various animals or give them the following information:

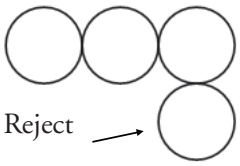
Newfoundland Dog	65 kg
Caribou	180 kg
Lynx	11 kg
Polar Bear	450 kg
Moose	690 kg
Labrador Retriever	36 kg

Order the animals by weight from least to greatest. Ask students to choose one of the numbers above and represent it in three ways using base ten blocks.

(3N3.1, 3N5.4)

Performance

- Invite students to play "Spin to Win". The goal of the game is to form the largest three-digit number possible. Ask students to draw the following diagram on their paper. Designate a person to spin a spinner four times, stating the number aloud for the students to place in any empty circle they wish. They may reject one number by putting it in the "Reject" circle. Once a number has been marked it cannot be erased. Have a student read a large number and display it. Ask: Who has a number that is larger? Compare the numbers. Ask: How do we know it is larger? Is it possible to make a larger number? How? Create a human number line with the students. (Adapted from NCTM Navigation Series *Navigating through Number and Operations in Grade 3-5*) (3N3.2)



Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 5: Comparing and Ordering Numbers

TR: pp. 16 - 19

SB: pp. 50 - 53

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- animal information
- Spin to Win template

Strand: Number

Outcomes

Students will be expected to

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]

Achievement Indicators:

3N1.1 Extend a given skip counting sequence by 5s, 10s or 100s, forward and backward, using a given starting point.

3N1.2 Extend a given skip counting sequence by 25s, forward and backward, starting at a given multiple of 25.

3N1.3 Identify and correct errors and omissions in a given skip counting sequence.

3N1.4 Identify and explain the skip counting pattern for a given number sequence.

Elaborations—Strategies for Learning and Teaching

A solid understanding of the nature of place value patterns and partitioning is fundamental to our base-ten number system. In Grade Two, students learned to skip count forward and backward by 2s, 5s, and 10s using starting points that were multiples of 2, 5, or 10 (2N1). Now, students will skip count by 5s, 10s, or 100s using any starting point and by 25s using starting points that are multiples of 25. Counting by 3s and 4s will be addressed later in this unit.

When learning about place value, students benefit from many opportunities to group concrete materials into tens and hundreds. Students should notice how much easier it is to count large groups of objects when they are grouped in 5s, 10s, 25s, or 100s. Help students to see the patterns inherent in the number system and recognize the patterns that occur in their environment. These patterns can be taught through activities in a morning routine using calendars, number lines and hundreds charts. The teaching and learning of patterning outcomes 3PR1 and 3PR2 is embedded throughout the curriculum developed on number sense.

Provide students with a number line, a mixture of one-, two-, and three-digit numbers and small sticky notes. Students choose a number and write it on the number line. They flag the next five numbers in a given skip counting pattern with their sticky notes. This can be done forwards or backwards. Students can take turns using different colour sticky notes for different patterns. The number line can then be displayed on a wall for classmates to see the patterns. This may be a good opportunity to informally introduce the terms “increasing” and “decreasing” as they relate to moving forwards or backwards. These terms will be formally introduced in the Patterning unit.

As an introductory activity, students can use a calculator to see the counting sequence by 25s. Instruct students to enter 0 + 25 = on a calculator. Use the equal sign repeatedly to generate multiples of 25. Students should be asked to start this activity with various numbers that are multiples of 25.

Students will have had prior experiences identifying patterns. Many students will be able to identify errors and omissions in skip counting forward and backward. Using number lines and hundreds charts are effective visuals to demonstrate this concept.

Students should be able to identify and explain skip counting patterns for a given number sequence. Give a student a skip counting rule and a starting number. The student must generate at least five numbers in the skip counting pattern before passing the list to another student who has to guess the rule. Repeat this activity with the students switching roles.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

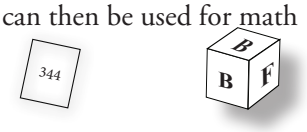
Performance

- Present students with a number sequence such as:
  (i) 107, 102, 97 . . .
  (ii) 298, 398,498 . . .
  (iii) 75, 100, 125 . . .

  Ask the students to give the next four numbers in the sequence. After completing this task, students may create their own pattern, record it, and explain their pattern.

  (3N1.1, 3N1.2)

- Provide students with number lines, hundreds charts to 1000, colour pencils, highlighters or crayons, a deck of three-digit numbers, forward/backward dice and recording strips. A forward/backward die may be made by writing B and F on stickers or labels and covering the pips on a regular die. Ask students to choose how they wish to count, by 5s, 10s, 25s, or 100s, and then roll the forward/backward die. Next each student picks a three-digit number from the deck of cards to get their starting point. The students continue their patterns forward to 1000 or backwards to 0, using a number line or colouring hundred charts. Students record their patterns on the recording strips adding strips as they are needed. Note: The strips can be kept and then examined by the students in later sessions to look for the patterns in the ones place, tens place, or hundreds place as the skip counting continues to 1000. These strips can then be used for math journal writing, describing increasing/decreasing patterns. E.g., a student chooses to count by 10s, rolls "B" (indicating he/she will count backwards), and selects 344 as their starting point.



Pattern Strip									
344	**334**	**324**							

  (3N1.1, 3N1.2)

- Display a set of numbers in any given skip count sequence that includes errors. Ask students to identify the errors and explain their thinking.

  (3N1.3)

Journal

- Ask students to write about how many ways they can count to 200.

  (3N1.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 6: Counting by 5s, 10s, 25s and 100s

TR: pp. 20 - 23

SB: pp. 54 - 57

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- pattern strip template

Strand: Number

Outcomes

Students will be expected to

3N1 Continued

3N5 Continued

Achievement Indicators:

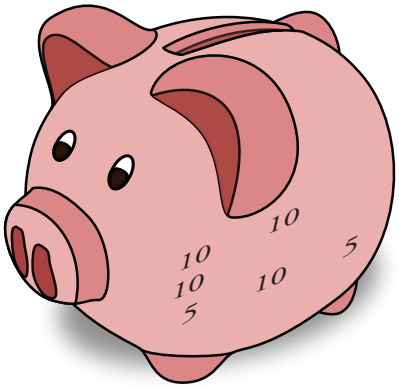
3N1.5 Determine the value of a given set of coins (nickels, dimes, quarters, loonies) by using skip counting.

3N5.4 (Continued) Represent a given number in different ways, using proportional and non-proportional materials, and explain how the representations are equivalent; E.g., 351 can be represented as three 100s, five 10s and one 1; or two 100s, fifteen 10s and one 1; or three 100s, four 10s and eleven 1s.

Elaborations—Strategies for Learning and Teaching

Students need to recognize how to count coins (e.g., 3 loonies, 2 quarters, 1 dime and 4 nickels - $1.00, $2.00, $3.00, $3.25, $3.50, $3.60, $3.65, $3.70, $3.75, $3.80). Before students are able to do this, they require many opportunities to practice counting loonies, quarters, dimes and nickels separately. It is through a wide range of activities, presented regularly throughout the school year, that students often come to recognize that to find the total for a collection of coins, sorting them and counting the larger coins first is easiest.

Provide "piggy bank" cards, coins and a recording sheet. Students should choose a card and place the correct coin on each number shown. Next, students count the coins and record the amount of money in the piggy bank. Continue with other cards.



Choose a quantity of money in coins and write the total on the board for the students to see. Slowly drop the coins, one at a time, in a tin bank so the class can hear the coins drop and count how many coins make up the total. Ensure students can not see the coins, and can only hear them drop. Students should problem solve to decide the different coin combinations that are possible.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Prepare bags of coin with varying amounts. Ask students to choose a bag of coins to count and to then record the total in the bag. Observe how students count money in games and activities, e.g., are they counting the coins with the greatest value first, are they sorting the coins before they count, etc?

(3N1.5)

Interview

- Give the student a variety of coins, or have him/her take a handful. Ask the student to explain how he/she will find the total amount.

(3N1.5)

Performance

- Provide play money and a recording sheet for students to problem solve:

  Sarah has $3.51 in her piggy bank. What are the possible combinations of coins she could have?

(3N5.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 7: Skip Counting with Coins

TR: pp. 24 - 27

SB: pp. 58 - 61

Lesson 8: Representing Numbers with Coins

TR: pp. 28 - 30

SB: pp. 62 - 64

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- piggy bank cards

Strand: Number

Outcomes

Students will be expected to

3N1 Continued

Achievement Indicators:

3N1.6 Extend a given skip counting sequence by 3s, forward and backward, starting at a given multiple of 3.

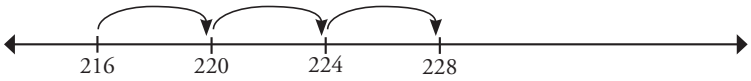
3N1.7 Extend a given skip counting sequence by 4s, forward and backward, starting at a given multiple of 4.

Elaborations—Strategies for Learning and Teaching

Skip counting by 5s, 10s, 25s, and 100s was addressed earlier in this unit. At this time students work with skip counting by 3s and 4s.

Students could visually represent skip counting sequences on a hundred chart. Ask them to use a hundred chart and colour the number they land on as they skip count forwards/backwards by 3s or 4s, starting at different multiples of three or four respectively. Similarly, students could use number lines to skip count forwards/ backwards by 3s or 4s starting at different multiples of three or four. Ask them to record their jumps on the number line.

401	402	403	404	405	406	407	408	409	410
411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430
431	432	433	434	435	436	437	438	439	440
441	442	443	444	445	446	447	448	449	450
451	452	453	454	455	456	457	458	459	460
461	462	463	464	465	466	467	468	469	470
471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490
491	492	493	494	495	496	497	498	499	500



General Outcome: Develop Number Sense

Suggested Assessment Strategies

Interview

- Choose a starting number and for every frog that you show, students need to skip count by three or four, as per your instructions. In the example below, the starting number is 60 and every frog represents a multiple of 4.

(3N1.6, 3N1.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 9: Counting by 3s and 4s

TR: pp. 31 - 33

SB: pp. 65 - 67

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- shaded four hundreds chart
- frog cards

Strand: Number

Outcomes

Students will be expected to

3N4 Estimate quantities less than 1000, using referents.

[ME, PS, R, V]

Achievement Indicators:

3N4.1 Estimate the number of groups of ten in a given quantity, using 10 as a referent (known quantity).

3N4.2 Estimate the number of groups of a hundred in a given quantity, using 100 as a referent.

3N4.3 Estimate a given quantity by comparing it to a referent.

3N4.4 Select an estimate for a given quantity by choosing among three possible choices.

3N4.5 Select and justify a referent for determining an estimate for a given quantity.

Elaborations—Strategies for Learning and Teaching

A referent, or known quantity, is useful as a benchmark or an anchor to acquire a reasonable estimate. In Grade Two, students estimated quantities to 100, using referents (2N6). This year, students will use referents to estimate to quantities up to 1000.

Referents are used as a strategy to improve estimates. If the quantity of objects in a smaller group is known, then that knowledge can be used to estimate the number of objects in a larger group.

The children's literature selection *Betcha! Estimation* by Stuart J. Murphy or *Great Estimations* and/or *Greater Estimations* by Bruce Goldstone can be used as an introduction to estimation using ten or 100 as a referent, or to supplement a lesson.

Show students two jars of objects, one jar with ten items and one with 90 items. Use the jar with ten items as a referent. Guide students' thinking in estimating by asking, "About how many groups of ten are there?" "About how many items are there in total?" Provide similar estimation opportunities using 100 as a referent.

Prepare a centre called the "Estimation Station", where students can visit each day. Place two different groups or piles of objects, one of which would be the referent, at the station. Ask students to use the referent to estimate the quantity. Students should also have the opportunity, in this centre, to examine a quantity of an object, (e.g., beans, popsicle sticks, etc.) and to choose an estimate from three possible choices. The estimation station can also be used to provide opportunities for students to select referents for a given pile and communicate their reasoning.

A common student misconception is that "correct" estimates must be numbers which end in 0 or 5. Students should be encouraged to use their referents to make estimates ending in any digit.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

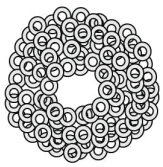
Journal

- Display a clear jar with pennies in it and a clear bag containing 10 or 100 pennies to use as a referent depending on the amount in the jar. Ask students to record their estimate in their journal and then write about how they arrived at their estimate.

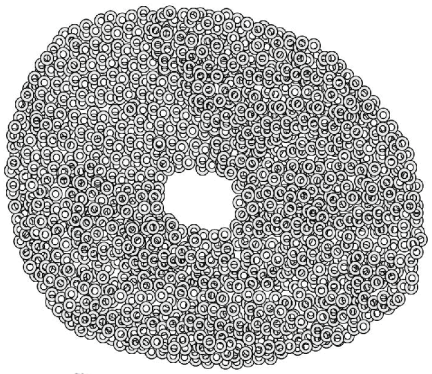
(3N4.1, 3N4.2, 3N4.3)

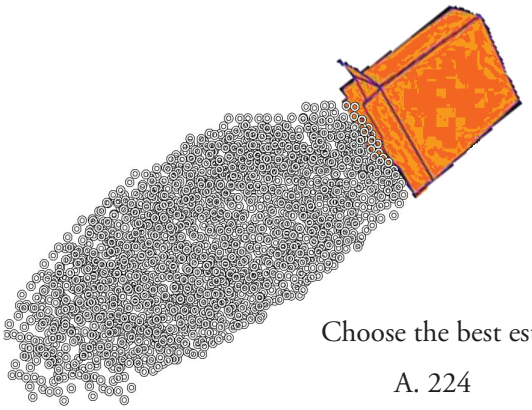
- Show students groups or pictures of objects and give students three possible estimates, for example: (based on book, *Greater Estimations* by Bruce Goldstone)

If 100 Cereal-Os look like this:



and 1000 Cereal-Os look like this





Choose the best estimate for the last picture.

A. 224

B. 482

C. 699

Explain your choice. (3N4.4)

Journal

- Display a quantity of an item such as a bag of marshmallows, pretzels, goldfish crackers, raisins, etc. Ask students to choose a referent to estimate the quantity and explain their choice.

(3N4.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 10: Estimating to 1000

TR: pp. 34 - 37

SB: pp. 68 - 71

Supplementary Resource

Children's Literature

- *Greater Estimations* by Bruce Goldstone

Suggested Resources

Children's Literature

- *Betcha! Estimation* by Stuart J. Murphy

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/num-1000.html

- Cereal-Os activity

Strand: Number

Outcomes

Students will be expected to

3N2 Continued

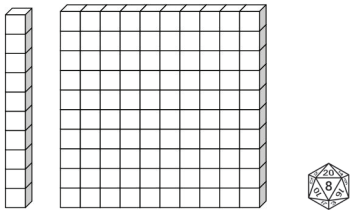
Achievement Indicator:

3N2.5 (Continued) Represent a given number, using manipulatives such as base ten materials.

Elaborations—Strategies for Learning and Teaching

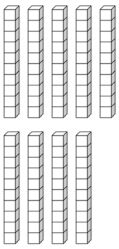
Although some students will have a clear understanding of the base ten pattern of our place value system, many will still be in the early stages of development. It is important that students be provided with regular opportunities to represent numbers concretely, pictorially and symbolically to strengthen their knowledge. Students should recognize that 1000 is just another expression for ten hundreds.

Provide pairs of students with a place value mat, base ten materials (19 rods, nine flats and a large cube), a recording sheet and a 20-sided die.



Number Rolled	Total
9	90

Place value mat if 9 was rolled:

Thousands	Hundreds	Tens	Ones
			

Student 1 should roll the number cube, use the rods to build the number, and record the number on the recording sheet. Student 2 should repeat the process. The pair should quickly realize that they do not have enough rods and will have to "trade" for a flat in order for the activity to continue. A running total is kept on the recording sheet. Students continue to take turns rolling and trading until they have made 1000 (large cube).

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Ask students to make any three-digit number using base ten blocks. Ask students to write down the number and read it. Students can then use a different combination of base ten blocks to make the same number and/or use coins to represent the number. After completing this activity, ask students to choose one of the representations and explain how it shows the number.

(3N2.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

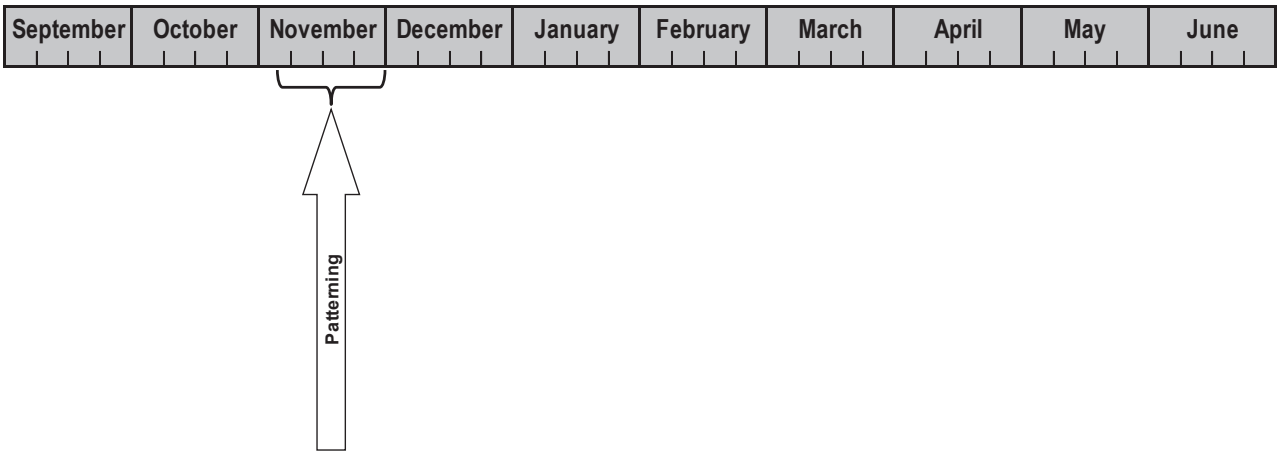
Lesson 11: How Much is 1000?

TR: pp. 38 - 40

SB: pp. 72 - 74

Patterning

Suggested Time: 3½ Weeks



Unit Overview

Focus and Context

In Grade Three, students continue working with increasing patterns. They build on what they have learned in Grade Two by communicating their understanding of increasing patterns and by representing increasing patterns in a variety of ways: concretely, pictorially and symbolically. Students verbalize and communicate rules to help them understand the predictability of a pattern. A large focus in Grade Three is the introduction and development of decreasing patterns. Students use their knowledge of increasing patterns to make connections to the concept of decreasing patterns, since similar understandings are developed. These patterning concepts are the basis for further algebraic thinking and will be extended in later grades.

Outcomes Framework

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

SCO 3PR1

Demonstrate an understanding of increasing patterns by:
- describing
- extending
- comparing
- creating

patterns using manipulatives, diagrams, sounds and actions (numbers to 1000).

SCO 3PR2

Demonstrate an understanding of decreasing patterns by:
- describing
- extending
- comparing
- creating

patterns using manipulatives, diagrams, sounds and actions (numbers to 1000).

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Patterns and Relations (Patterns)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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 patterns using manipulatives, diagrams, sounds and actions (numbers to 100). [C, CN, PS, R, V]	3PR1. Demonstrate an understanding of increasing patterns by: • describing • extending • comparing • creating patterns using manipulatives, diagrams, sounds and actions (numbers to 1000). [C, CN, PS, R, V] 3PR2. Demonstrate an understanding of decreasing patterns by: • describing • extending • comparing • creating patterns using manipulatives, diagrams, sounds and actions (numbers to 1000). [C, CN, PS, R, V]	4PR1. Identify and describe patterns found in tables and charts, including a multiplication chart. [C, CN, PS, V] 4PR2. Translate among different representations of a pattern, such as a table, a chart or concrete materials. [C, CN, V] 4PR3. Represent, describe and extend patterns and relationships, using charts and tables, to solve problems. [C, CN, PS, R, V] 4PR4. Identify and explain mathematical relationships, using charts and diagrams, to solve problems. [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 Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Demonstrate an understanding of increasing patterns by:

- **describing**
- **extending**
- **comparing**
- **creating**

patterns using manipulatives, diagrams, sounds and actions and numbers to 1000.

[C, CN, PS, R, V]

Elaborations—Strategies for Learning and Teaching

In Grade Two, students described, extended, compared and created repeating patterns and increasing patterns (2PR1, 2PR2). Grade Three students will review and learn more about increasing patterns, as well as explore decreasing patterns. Increasing patterns are sometimes referred to as "growing patterns" – a pattern where the size of the elements increase in a predictable way. An element is any single item or step of a pattern. E.g.

- 28, 31, 34, 37,... - the pattern begins at 28 and increases by 3. Each number in the pattern is an element.
-  - in this example, each figure (group of triangles) is an element

It is common for students to confuse a repeating pattern with an increasing or decreasing pattern. Increasing and decreasing patterns do not have a core. Students will be familiar with the mathematical term "core" from working with repeating patterns in Grade Two. Ask students to look for a "core" first. The core is the shortest part of the pattern that repeats. If they cannot find a core, then the pattern is not a repeating pattern and it must be an increasing or decreasing pattern.

Students need sufficient time to explore increasing patterns through various manipulatives, such as Link-Its™, counters, pattern blocks, base ten blocks, stickers, buttons, etc., to realize they increase or decrease in a predictable way. Later, students will connect patterns to numbers, and work with patterns found in the hundreds charts.

Achievement Indicator:

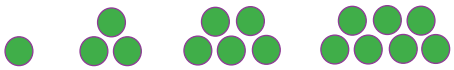
3PR1.1 Describe a given increasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues; e.g., for 42, 44, 46 … the pattern rule is start at 42 and add 2 each time.

A pattern rule tells how to make the pattern and can be used to extend an increasing or decreasing pattern.

Both increasing and decreasing pattern rules have starting points and changes that happens each time.

Give students the first three or four elements of an increasing pattern. Ask them to determine the pattern rule and explain how the pattern continues.

Start with one ⬡ and add one more each time.



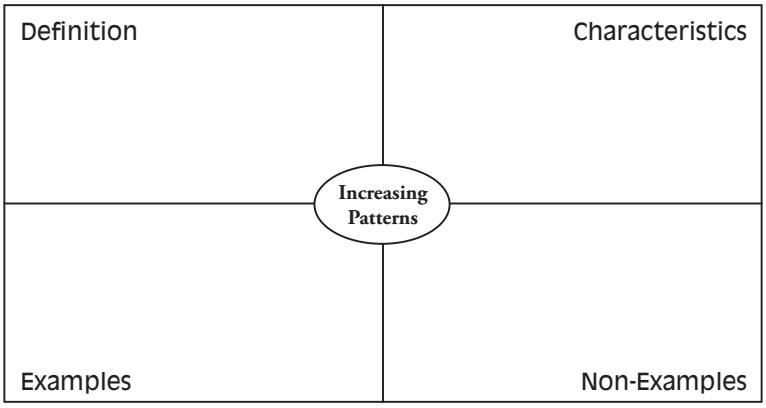
Start with one circle and add two circles each time.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Portfolio

- Ask students to complete a Frayer model concept map. Use it to inform instruction by determining what students already know about increasing patterns. Note any misconceptions to clarify throughout the unit.



Ask students to place the concept map in a portfolio. After further instruction, ask students to complete another allowing them the opportunity to compare it to the first. This allows students to assess their own development. This strategy can also be used to determine their growth and understanding of other concepts.

(3PR1.1)

Performance

- In Grade Three, students can benefit from experiences working with calculators and examining patterns. Ask students press 0 on a calculator. Ask them to select a number from 1 to 9. E.g., 3. Press + followed by 3, then press =. The calculator will add 3 to the previous sum. Record the number displayed. Press = again. Record the new number. Continue pressing = and recording the new number displayed. After several entries, ask the students to predict the next few numbers. Ask: What are some other numbers that are and are not part of the "Add 3" pattern? Is there a rule we can use to predict the numbers? If so, give the rule. Ask students to explore several different numbers from 1 to 9 and see what happens if they start with 0 and then continue to add the chosen number. (*Navigating through Algebra in Grades 3-5*, 2001, p. 15)

(3PR1.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch: It's a Pattern Party!

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 4 - 5

Lesson 1: Exploring Increasing Patterns

TR: pp. 4 - 6

SB: pp. 6 - 8

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- Frayer model template

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

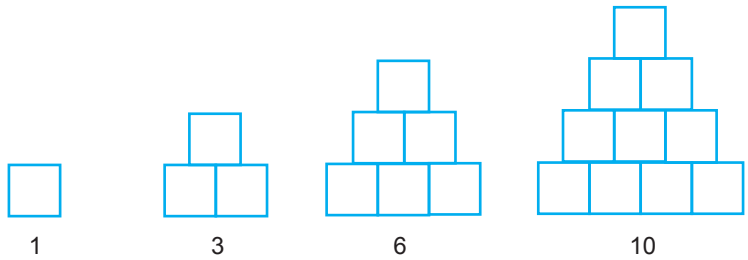
3PR1 Continued

Achievement Indicator:

3PR1.1 (Continued) Describe a given increasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues; e.g., for 42, 44, 46 … the pattern rule is start at 42 and add 2 each time.

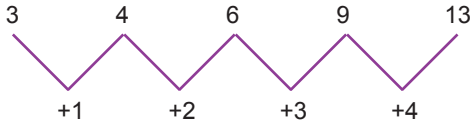
Elaborations—Strategies for Learning and Teaching

As students describe increasing shape patterns, help them recognize that each element has a numeric value. E.g.



Other numeric patterns include:

- 2, 4, 8, 16, … The pattern rule is: Start at 2. Double each time.
- 3, 4, 6, 9, 13, … The pattern rule is: Start at 3. Add 1 and increase the number added by 1 each time.



- 103, 108, 113, 118, 123, … The pattern rule is: Start at 103. Add 5 each time.

A pattern rule must have a starting point. If, for example, a student describes the pattern 3, 7, 11, 15, … as "an add four pattern" without indicating that it starts at 3, the pattern rule is incomplete.

Tell students the following story: On Earth Day, Mr. Harpur and his students planted a vegetable garden in the school yard. He put two plants in the first section, four in the second section and six in the third section. Ask students to:

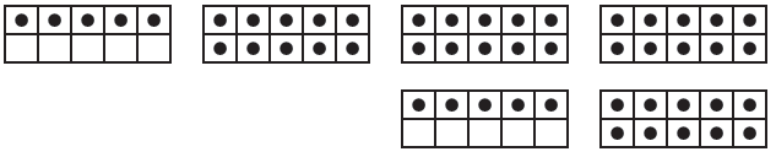
- create the pattern with blocks
- describe the rule
- predict what comes next
- extend the pattern. E.g., How many plants will they put in the tenth section?

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Performance

- Build an increasing pattern by placing counters on the ten-frame and ask students to identify how the pattern is growing. These ten-frames, for example, show that the numbers increase by 5 because another full row of 5 is filled each time.



(3PR1.1)

- Invite students to play "Guess my Pattern". Students play in pairs. One player will wear a headband with a number pattern strip picked from a bag. The player wearing the headband cannot see the number pattern but must figure out the pattern by asking his/her partner questions. He/she must ask questions to find out the starting number, the pattern rule, and a missing term or three additional terms. Examples of questions students might ask their partners:
  - (i) Does the pattern start with an even or odd number?
  - (ii) Is it a multiple of 10?
  - (iii) Does it have one digit, two digits, three digits?
  - (iv) Is it greater than 10?
  - (v) Is the pattern increasing or decreasing?
  - (vi) Is the rule add (or subtract) 2, 5, 6, etc.
  - (vii) Does the pattern increase by 5s?
  - (viii) Does it increase by more (or less) than 5?

(3PR1.1)

Paper and Pencil

- Give students a number pattern and ask them to write the pattern rule. Check that students have included a starting point and how the pattern continues. (3PR1.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Exploring Increasing Patterns

TR: pp. 4 - 6

SB: pp. 6 - 8

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

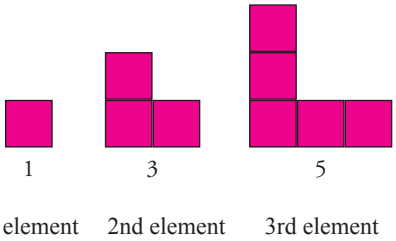
3PR1 Continued

Achievement Indicator:

3PR1.2 Identify the pattern rule of a given increasing pattern, and extend the pattern for the next three elements.

Elaborations—Strategies for Learning and Teaching

Students should be given at least three elements of the beginning of a pattern then asked to extend the pattern by three more elements. They should be reminded to refer to the beginning of the pattern to see that their idea works for the rest of their pattern.

- 

- 50, 100, 150, 200, …
- 6, 13, 20, 27, …
- 5, 8, 12, 17, …
- 2, 2, 4, 4, 4, 4, 6, 6, 6, 6, 6, 6, …

Ask students to work on word problems in pairs:

- Ms. Mercer's class planted a special seed. On Monday the plant is 2 cm high. On Tuesday the plant has doubled its height and is 4 cm high. Each day the plant doubles its height from the day before. How high will the plant be on Friday? Students can make a table showing each day of the week and how tall the plant is on each day. They can also use manipulatives to make the pattern.
- Lily's new puppy, Pokey, is growing fast. When Lily first got Pokey he weighed only 1 kg. After 1 month Pokey weighed 7 kg. After 2 months, Pokey weighed 12 kg. After 3 months Pokey weighed 16 kg. Lily saw a pattern. Find a pattern to tell how much Pokey weighed after 5 months. Ask students to complete a table like the one below: (Pattern rule: Start at 1 kg. Add 6 kg and then add 1 kg less each time.)

	Months					
	At First	1	2	3	4	5
Pokey's Weight	1 kg	7 kg	12 kg			
Weight Gained		6 kg				

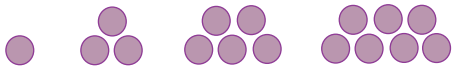
Teachers are cautioned that students sometimes find it difficult to extend patterns requiring them to draw. Patterns should be presented both concretely and pictorially when possible.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Journal

- Provide students with a choice of three increasing patterns. Ask students to choose one pattern to extend for the next three elements and explain the rule.
  Sample shape pattern:



  Sample number pattern:

  1, 2, 4, 8, ...

(3PR1.2)

Paper and Pencil

- Ask students to complete a chart similar to the one below:

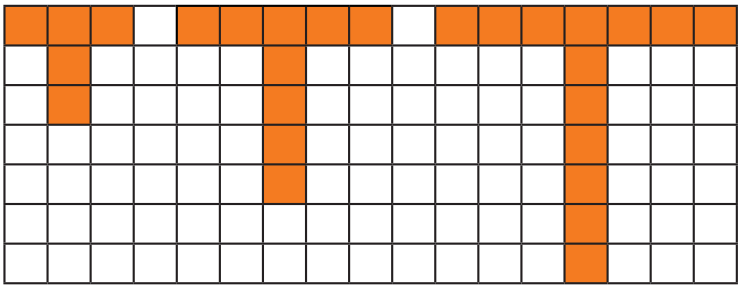
1	2	3	4	5	6
×	× × × ×	× × × × × × × × ×			
♥	♥♥	♥♥ ♥♥			
○	○○ ○	○○○ ○○			
☺ ☺ ☺	☺ ☺ ☺ ☺ ☺ ☺	☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺			

  Ask them to extend each pattern for the next three elements and record each number pattern.

(3PR1.2)

Portfolio

- Provide 1 cm grid paper for the students. Present a pattern such as the one below. Ask students to use coloured pencils to continue the pattern. Next, ask the students to create their own increasing patterns.



(3PR1.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Exploring Increasing Patterns

TR: pp. 4 - 6

SB: pp. 6 - 8

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- Lily's puppy problem
- increasing pattern chart
- T pattern template

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicator:

3PR1.3 Identify and explain errors in a given increasing pattern.

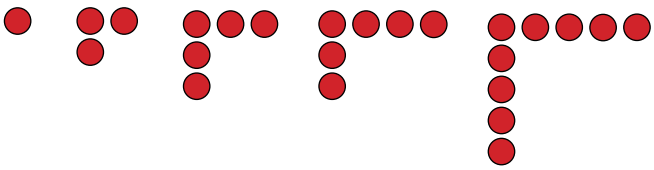
Elaborations—Strategies for Learning and Teaching

Students should be provided with a variety of increasing patterns which contain errors. Students should determine what the pattern is and then explain the error(s).

- 3, 7, 11, 15, 19, 23, 26, 31, 35, 39. The pattern rule is: Start at 3. Add 4 each time. Therefore, 26 is an error since it is only adding on 3 not 4 and 31 is a second error since it is adding 5 and not 4.To help students visualize this pattern they can shade numbers on a hundreds chart and look for the mistake.

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

- The pattern rule is: Start with 1 counter. Add 1 to each row and column each time. Therefore the fourth element is a error. There should be 4 counters in the column not 3.



General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

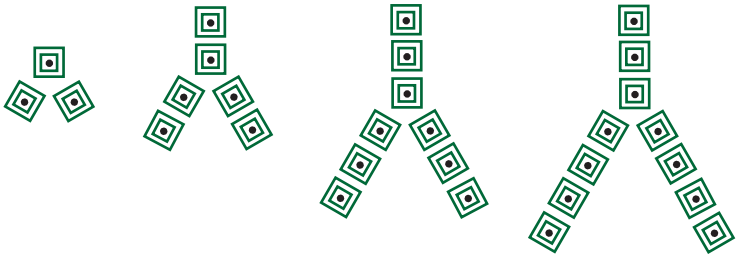
Paper and Pencil

- Give students number patterns such as those below and ask them to find and circle the error.
  - (i) 475, 575, 685, 775
  - (ii) 233, 243, 253, 262
  - (iii) 25, 28, 32, 34
  - (iv) 7, 12, 15, 19

(3PR1.3)

Journal

- Present students with the following increasing pattern. Ask them to find the error and explain how they know.



(3PR1.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Exploring Increasing Patterns

TR: pp. 4 - 6

SB: pp. 6 - 8

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- patterns with errors

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicator:

3PR1.4 Identify and apply a pattern rule to determine missing elements for a given pattern.

Elaborations—Strategies for Learning and Teaching

Since patterns increase in a predictable way, to determine a missing step students should look at the pattern that comes before and after. They must identify the pattern rule.

- 

  Start with a ■. Add a row each time and add one more ■ to each row.
- 15, 26, 37, 48, ___, 70, 8,... Start at 15. Add 11 each time.
- 5, 6, 8, 11, ___, 20, 26, 33, 41,... Start at 5. Add 1, and then increase the number added by 1 more each time.
- 13, 26, ___, 52, 65, 78, 91,... Start at 13. Add 13 each time.

Ask students to practice finding missing elements by making patterns, covering a step, and asking a partner "What's missing?"

Read, for example, *Skip Count Cheerleaders* chants from *Riddle-iculous MATH* by Joan Holub. Ask students to fill in the missing element as they chant:

2, 4, 6, 8,

Who do we appreciate?

8, 10, 12, ___

Our soccer coach, Ms. Morteen.

5, 10, 15, 20,

Who do we all like, and plenty?

20, 25, 30, ___

Our lunch lady, Mrs. Dive.

20, 30, 40, 50,

Who do we all think is nifty?

50, 60, 70, ___

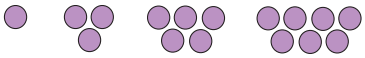
Our principal, Mr. Grady.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Performance

- Invite groups of students to play "Pattern BANG!" Have a variety of cards in a paper bag, such as the examples below:

 What is the pattern rule?	3, 6, 9, ___, 15, 18 What is the missing term?
25, 50, 75, ___, ___, ___ Extend the pattern.	4, 8, 11, 16, 20 What is the error in this pattern?
18, 21, 24, 27, ___ Which number comes next?	 What is the missing element?
BANG!	**BANG!**

Include one BANG card for every four or five question cards. Give each small group a bag. Students take turns drawing a card out and answering the question. If the student answers correctly, he/she gets to keep the card. Group members may help each other with the answer. The bag is then passed to the next player. If a student pulls out a BANG card, he/she must put all of his/her cards back into the bag, leaving the BANG card out. They continue playing until there are no cards left in the bag and whoever has the most cards wins. This activity can be adapted later in the unit to include decreasing patterns.

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

- Ask each student to make an increasing pattern using manipulatives. Next he/she covers one element of the pattern. A classmate will then recreate the pattern putting in the missing element. The initial pattern is uncovered and the two patterns compared.

(3PR1.4, 3PR1.8)

Paper and Pencil

- Ask students to work in pairs to make up their own chants and riddles which involve including a missing element. The finished chants and riddles could be put into a class *Riddle-iculous MATH* book.

(3PR1.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Exploring Increasing Patterns

TR: pp. 4 - 6

SB: pp. 6 - 8

Suggested Resource

Children's Literature

- *Riddle-iculous Math* by Joan Holub

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- Pattern BANG game

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicator:

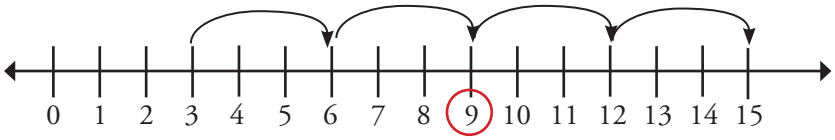
3PR1.5 Describe the strategy used to determine missing elements in a given increasing pattern.

Elaborations—Strategies for Learning and Teaching

Students should identify the pattern rule and then describe how they discovered that rule. E.g., 3, 6, ___, 12, 15,... - the rule is: Start at 3. Add 3 each time.

Possible strategies to determine missing elements include:

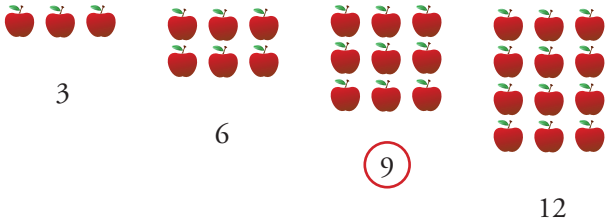
- Number lines



- Hundred chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

- Pictures



- Manipulatives
- Skip counting

It is important to accept other appropriate strategies that students use and to discuss them.

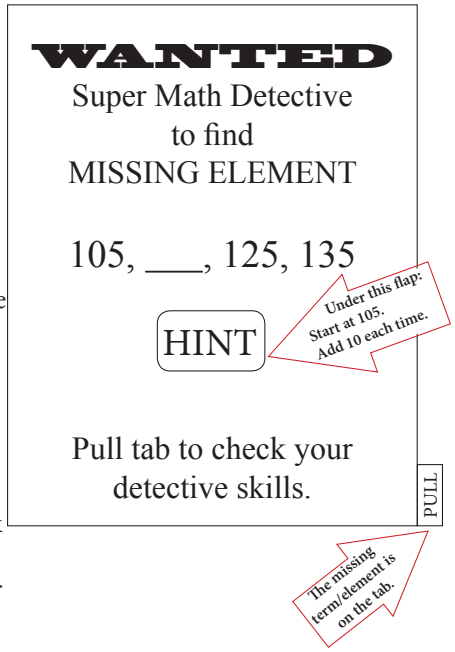
General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Portfolio

- Ask students to make "Wanted" posters, asking readers to find the missing element of an increasing pattern.

  Students create a number or shape pattern, leaving one element out. They will include a hint flap, which tells the pattern rule for those who need to use it. Also, they will create a pull tab, which will give the missing element so that the "detectives" can check to see if they are correct. To make the pull tab, tape half of an envelope to the back of the poster for sliding the tab card in and out. Be sure the tab is longer than the envelope. This activity may be adapted later in the unit to include decreasing patterns.



(3PR1.4, 3PR1.5)

Performance

-
  Invite students to uncover where the party is each day. Present students with a pattern of numbers on a display of houses. Add at least three extra houses without numbers. Choosing a number from the extended pattern, tell students that the party will be at a certain house. Ask students to pick out the location of the house and describe the strategy (pattern rule) they used. Examples of streets could be:

  (i) House# 170, 180, 190, House 4, House 5, House 6. Rule: Start at 170. Go up by 10 each time. The party is at house number 200.

  (ii) House# 31, 36, 41, House 4, House 5, etc. Rule: Start at 31. Increase by 5 each time. We are looking for the house which would have the street number 61

  (iii) House# 101, 104, 107, House 4, House 5, etc. Rule: Start at 101. Increase by 3 each time. The party is at house number 116.

(3PR1.1, 3PR1.5, 3PR1.9)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Exploring Increasing Patterns

TR: pp. 4 - 6

SB: pp. 6 - 8

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicators:

3PR1.6 Create a concrete, pictorial or symbolic representation of an increasing pattern for a given pattern rule.

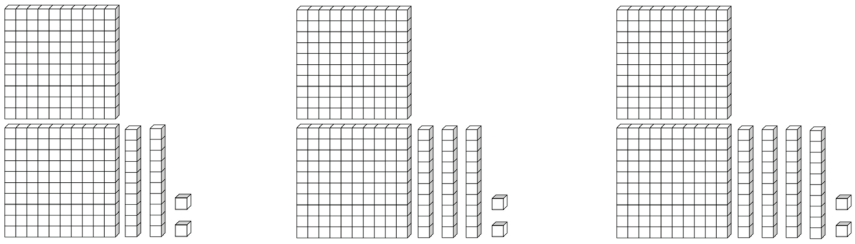
Elaborations—Strategies for Learning and Teaching

Give students various pattern rules to create their own model, picture or number representation. To represent patterns concretely they can choose from a variety of manipulatives (such as pattern blocks, coins or buttons) or they may choose to draw a picture or use numbers.

- 2, 4, 8, 16, … Start at 2 and double each time
- 1, 2, 2, 3, 3, 3, … Each digit repeats according to its value
- 2, 4, 6, 8, 10, … Even numbers – skip counting by 2
- 2, 5, 11, 23, … Double the previous number and add 1
- 1, 2, 4, 7, 11, 16, ... Successively add 1, then 2, then 3, and so on
- 2, 2, 4, 6, 10, 16, … Add the preceding two numbers

3PR1.7 Create a concrete, pictorial or symbolic increasing pattern; and describe the relationship, using a pattern rule.

Students may use base ten blocks to concretely create an increasing pattern with larger numbers. For example,



222 232 242

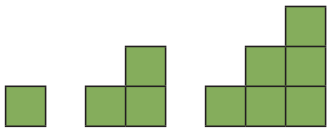
The pattern rule would be: Start at 222. Add 10 each time.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Performance

- Give students the first three elements of a staircase pattern. Ask students to predict what each element will look like before they build it. Ask them to use square tiles, pattern blocks, base ten units, or multi-link cubes to build the next three elements of the staircase pattern.



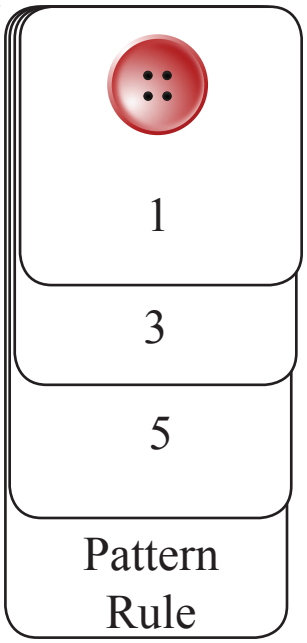
An increasing pattern can be recorded in a table. This allows students to see the relationship between a concrete/pictorial pattern and the corresponding number pattern. Ask students to make a table and record the number of elements, the number of squares added each time and the total number of squares in each element.

Element #	Number of Squares added	Number of Squares in Total
1	1	1
2	2	3
3	3	6

(3PR1.6, 3PR1.7)

Paper and Pencil

- Ask students to build a concrete pattern of their choice using objects such as pattern blocks, square tiles, base ten blocks, buttons, coins, etc. Ask students to create a flip book (also called a step book) by drawing the increasing pattern on the top of each page and labelling the bottom of each page with the correct numeric value. When the book is closed the number pattern will be visible and as they open each page the picture will be revealed. The last page of the book should reveal the pattern rule. Extend this activity by having students exchange their flip book with a partner. Each student will then use manipulatives to concretely create the number pattern represented. Then ask students to describe to their partner the pattern rule before checking the last page. Observe students' concrete representations and ability to describe the pattern rule to each other.



(3PR1.7, 3PR1.8)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2: Creating Increasing Patterns

TR: pp. 7 - 9

SB: pp. 9 - 11

Suggested Resources

Children's Literature

- *The Doorbell Rang* by Pat Hutchins
- *Anno's Magic Seeds* by Anno Mitsumasa
- *Ten Black Dots* by Donald Crews
- *Two of Everything* by Lily Toy Hong

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- how to make a step/flip book

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicator:

3PR1.8 Solve a given problem, using increasing patterns.

Elaborations—Strategies for Learning and Teaching

Students should have frequent experiences with solving real-world problems that interest and challenge them. Ask students to solve the following problems:

- Carrie buys Yummy cat food for her cat, Cleo. One can of Yummy costs 15¢. How many cans can she buy for 90¢? Complete a table

Cans of food	1	2	3			
Cost	15¢	30¢	45¢			

- Robert decided to count the pennies in his piggy bank. After he counted them, he made a pattern. His pattern looked like this:

How many pennies will he need for the 5th element in his pattern? (Charles and Lester, 1985, p.52)

- Sarah wants to make an increasing pattern out of 25 stickers. How many different ways can Sarah make an increasing pattern? She does not have to use all of her stickers.

- Give students the task of discovering how many triangles can make a five-day-old caterpillar. Ask them to use pattern block triangles to construct the following:

They will need to continue the pattern to determine how many blocks a five-day-old caterpillar will have. They can use a T-chart to show the relationship between the age of the caterpillar, in days, and the number of triangles in its body.

Caterpillar Age (days)	Number of Triangles
1	2
2	4
3	6

General Outcome: Use Patterns to Describe the World and to Solve Problems

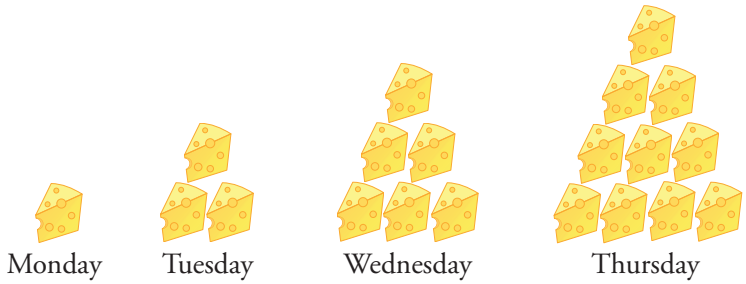
Suggested Assessment Strategies

Paper and Pencil

- Tell students that tickets for the school concert cost $3 for every couple. If 10 people go to the concert, ask students how much will they pay for tickets in total?

(3PR1.8, 3PR1.9)

- Present students with the following problem: Mice have been taking chunks of cheese from the captain's kitchen. They keep stacking the chunks in their den. Each day their stack gets bigger.



If the mice keep using the same pattern, what will the stack look like on Sunday? Students may use cubes to figure out the pattern. (*Get Your Hands on Problem Solving Grade 3*, 1998, p.2)

(3PR1.2, 3PR1.9)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2 (Continued): Creating Increasing Patterns

TR: pp. 7 - 9

SB: pp. 9 - 11

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

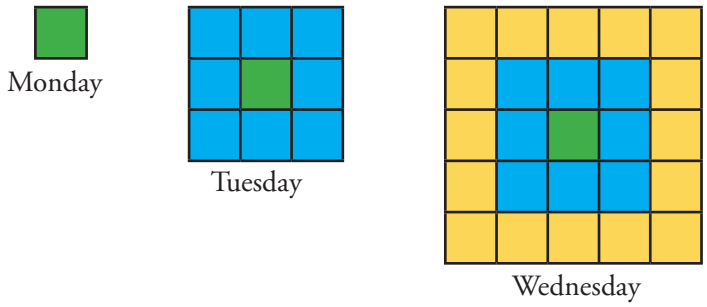
Achievement Indicators:

3PR1.8 (Continued) Solve a given problem, using increasing patterns.

Elaborations—Strategies for Learning and Teaching

The *Quiltmaker's Gift* by Jeff Brumbeau, provides opportunities to engage students in exploring geometric patterns and principles in a real-world context of quilting. After reading the book students can work on the following quilt problem:

Lillith is making a quilt with blocks. She adds a border each day as seen below.



Use grid paper to draw the pattern she will make on Thursday. How many blocks will she have to add on Friday? On what day will she have added 48 blocks?

Another literature connection is *Minnie's Diner* by Dayle Dodds. After reading and discussing the book, ask: If each special cost $4.00, how much money did it cost each brother? How much did it cost for the whole McFay family?

Number of Specials	Cost
Will - 1 Special	$4.00
Bill - 2 Specials	$ 8. 00

3PR1.9 Identify and describe increasing patterns in the environment.

Patterns are found in everyday life. Students need opportunities to recognize patterns in their world. Use the outdoors to extend students' learning about patterns.

- Hometown: house numbers, post office boxes, fences, flower gardens, etc.
- School: calendar, books, lockers, number lines, classroom doors, stairs, etc.
- Nature : gardens, pine cones, ferns, etc.

Following the exploration, students should discuss the patterns they observed.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Journal

- Ask students to pretend they are grocery store workers and they have to restack the soup cans before going home. In the first minute they stack one can; in the second minute they stack three cans; and in the third minute they stack six cans. Continuing the shape pattern below, how many cans will be stacked in the sixth minute?

  Students can model this problem concretely and then explain their findings in their journals using pictures, numbers and words.

1st minute 2nd minute 3rd minute

(3PR1.8)

Paper and Pencil

- Pose the following problems to students:

  (i) A fern has just begun to grow. On day one it had one leaf, on day two it had three leaves, on day four it had seven leaves. How many leaves will the fern have on day eight?

  (ii) One year in a human's life is equivalent to seven years of a dog's life. If you were three years old when you got your puppy and now you are eight, how old is your dog now, in dog years? Use a table to organize your data.

(3PR1.8, 3PR1.9)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2 (Continued): Creating Increasing Patterns

TR: pp. 7 - 9

SB: pp. 9 - 11

Supplementary Resources

Children's Literature

- *Minnie's Diner* by Dayle Dodds
- *The Quiltmaker's Gift* by Jeff Brumbeau

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- Lillith's Quilt

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicator:

3PR1.10 Compare numeric patterns of counting by 2s, 5s, 10s, 25s and 100s.

Elaborations—Strategies for Learning and Teaching

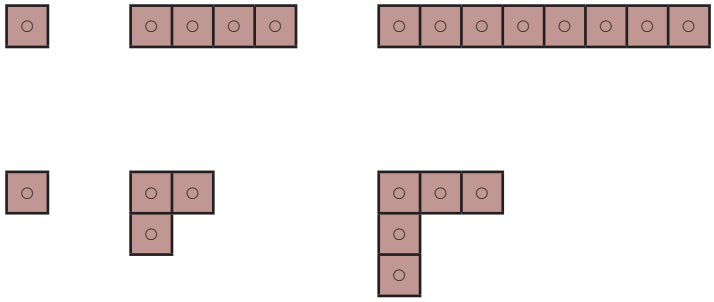
Many everyday situations provide opportunities for students to compare number patterns. When comparing increasing patterns, compare the starting point and the change that occurs each time.

Ask students, for example, to clap two more times than the student before them. Afterwards, change the pattern rule from: "Start with two claps and add two claps each time", to: "Start with two claps and add three claps each time." Discuss and compare the two pattern rules.

As a class, compare the patterns in each set:

- Start at two. Add five each time.

  Start at two. Double each time.

- 

- Start with three blocks. Add two each time.

  Start with four blocks. Add two each time.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Performance

- Have a variety of cards with a number or shape on them, to represent start points of increasing patterns. Ask students to choose a card and then to create four different increasing patterns from this starting point. They may put each pattern on a piece of paper folded into four strips or use a sheet similar to the one below.

Pattern Strips

Name:_____ Date:_____

1. _____

2. _____

3. _____

4. _____

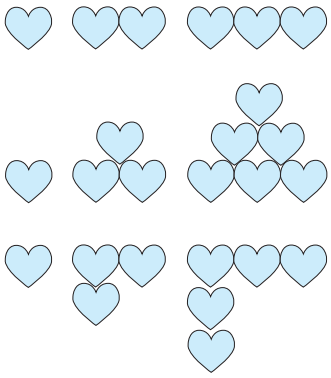
If, for example, a student chooses a card with 5 on it, some possible patterns he/she could create are:

5, 7, 9, 11,…

5, 10, 20, 40,…

5, 6, 8, 11, 14,…

If, for example, a student chooses a card with a heart on it, some possible patterns he/she could create are:



(3PR1.6, 3PR1.10, 3PR1.11)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2 (Continued): Creating Increasing Patterns

TR: pp. 7 - 9

SB: pp. 9 - 11

Lesson 3: Comparing Increasing Patterns

TR: pp. 10 - 12

SB: pp. 12 - 14

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicator:

3PR1.11 Locate and describe various increasing patterns found on a hundred chart, such as horizontal, vertical and diagonal patterns.

Elaborations—Strategies for Learning and Teaching

Using a large hundred chart, show a pattern rule such as skip counting by three. When skip counting by three, use only starting points that are multiples of three.

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

Duplicate small copies of hundred charts. Ask students to shade in their own patterns that show multiples of two and multiples of four, starting only at numbers that are multiples of two when counting by two and only numbers that are multiples of four when counting by four. Students should write a description of their pattern. Repeat the activity starting with five and shading multiples of five. The pattern is two vertical columns, with numbers ending in the digits 5 or 0. Discuss the pattern rules created by going horizontally, vertically or diagonally.

Give students a pattern rule such as, “Start at 4. Add 5 each time.” They should shade this pattern on their individual hundred charts and discuss.

Ask students to think of a number pattern for a hundred chart. They must keep it secret and colour the first ten numbers in their pattern on a hundred chart. Next, they trade patterns with a partner and describe the patterns in their partner’s chart. They should write the numbers in the pattern and extend the pattern.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Interview

- Show students a hundred chart with the first few numbers of a pattern coloured. Ask them to tell you what pattern is represented and what would come next in the pattern.

(3PR1.1, 3PR1.2, 3PR1.10)

Paper and Pencil

- Give students a five-wide hundred chart. Ask students to count by 2s and shade these numbers with one colour. Then count by 5s and shade these numbers with a different colour. Also, start at eight and count on by 10s. Shade these numbers with a third colour. Next use a 10-wide hundred chart and repeat the number patterns from the previous chart. Ask students: How are the patterns in the two charts the same? How are the patterns different?

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

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

(3PR1.5, 3PR1.6, 3PR1.10, 3PR1.11)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4: Increasing Number Patterns

TR: pp. 13 - 15

SB: pp. 15 - 17

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- five wide hundred chart
- hundred charts
- hundred chart with skip counting by 3s

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR1 Continued

Achievement Indicators:

3PR1.10 (Continued) Compare numeric patterns of counting by 2s, 5s, 10s, 25s and 100s.

3PR1.11 (Continued) Locate and describe various increasing patterns found on a hundred chart, such as horizontal, vertical and diagonal patterns.

Elaborations—Strategies for Learning and Teaching

Students need opportunities to compare numeric patterns, discussing how they are the same and how they are different.

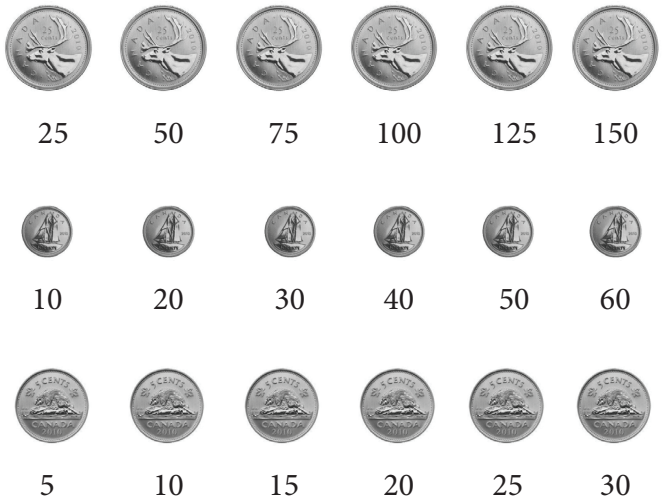
Students should choose one of the following, for example, to shade on a hundred chart and then describe the patterns they see:

- Numbers with a two in the tens place.
- Numbers with a four in the ones place.
- Numbers that are a multiples of three.
- Numbers that are multiples of 5.
- Numbers with a 0 in them.
- Numbers having both digits the same.
- Numbers that are multiples of both 2 and 3.
- Numbers whose digits add to 9.

Students should compare their shaded chart with those of their classmates.

Similarly, give students a page with four small hundred charts. Ask them to skip count and shade one chart by 2s, one chart by 5s, one chart by 10s and one chart by 25s. Then discuss the pattern rule in each chart including similarities and differences among the charts.

Make an array of coins with six quarters in the first row, six dimes in the second row and six nickels in the third row. In the first row write the money amount under each quarter adding the money as you go. Ask students to do the same for other two rows. Discuss and compare the pattern rule for each row.



General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Performance

- As the class counts aloud by 2s, place a counter over each number on a hundred chart transparency or interactive website. Discuss the pattern. Ask students to look away while one or several of the counters are removed. Observe if students are able to tell you which numbers need to be covered to complete the pattern. Repeat for multiples of three, four and five. Then distribute copies of the hundred chart and counters and ask students to repeat the activity working in small groups.

  (*Hands-on Math Grades 2-3*, 1995, p. 32)

  (3PR1.4, 3PR1.6, 3PR1.10)

Journal

- Ask students to look for numeric patterns in books and, using manipulatives, model the patterns. Next, they can represent the patterns in their journal pictorially, with a stated pattern rule.

  (3PR1.1, 3PR1.6, 3PR1.7, 3PR1.10)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4 (Continued): Increasing Number Patterns

TR: pp. 13 – 15

SB: pp. 15 - 17

Suggested Resources

Children's Literature

- *The King's Commissioners* by Aileen Friedman

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- array of coins

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR2 Demonstrate an understanding of decreasing patterns by:

- **describing**
- **extending**
- **comparing**
- **creating**

patterns using manipulatives, diagrams, sounds and actions and numbers to 1000.

[C, CN, PS, R, V]

Achievement Indicator:

3PR2.1 Describe a given decreasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues.

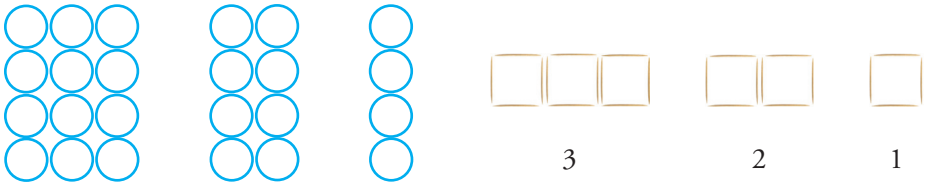
Elaborations—Strategies for Learning and Teaching

Decreasing patterns is a new concept for Grade Three students. A decreasing pattern is a "shrinking" pattern.

Show students a decreasing pattern, by starting with a large number or shape pattern, then taking away a number or shapes repeatedly. Students will begin with building decreasing patterns and talking about how to extend them in a logical step by step process. Building decreasing patterns with concrete materials such as tiles, cubes, counters, etc. gives students opportunity to try the next step and change it if necessary. Sometimes students are more comfortable during the exploration stage if they can experiment first, using manipulatives, and then commit answers to paper. Several of the same tasks that were suggested with work on increasing patterns can be used with modifications to represent decreasing patterns.

As students begin to investigate patterns, they sometimes confuse repeating patterns with decreasing patterns. Remind them to look for a core first. If they cannot find a core, then the pattern is not a repeating pattern.

Give students the first three or four elements of a decreasing pattern, ask them to determine the pattern rule, and explain how the pattern continues. Earlier in this unit, students became familiar with assigning a numeric value to each element in an increasing pattern. This also applies to decreasing patterns.



12 8 4

Other numeric patterns include:

- 42, 37, 32, 27, ... The pattern rule is: Start at 42. Count back by five each time.
- 160, 150, 140, 130,… The pattern rule is: Start at 160. Subtract 10 each time.
- 108, 105, 102, 99 ... The pattern rule is: Start at 108. Decrease by three each time.

Remind students that a pattern rule must have a starting point or the pattern rule is incomplete. If, for example, a student describes the pattern 16, 12, 8, 4, ... as "a decrease by four pattern" without indicating that it starts at 16, the pattern rule is incomplete.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Interview

- Ask students to press 100 on their calculator. Ask students to select a number from 1 to 9, e.g., 3. Press the subtract button followed by 3, then press =. The calculator will subtract 3 from the previous number. Record the number displayed. Press = again. Record the new number. Continue pressing = and recording the new number displayed. After several entries, ask the students to predict the next few numbers. Ask:

  (i) What are some other numbers that are and are not part of the "decrease by 3" pattern?

  (ii) Is there a rule we can use to predict the numbers and if so, what is the rule?

  Ask students to explore several different numbers from 1 to 9 and see what happens if they start with 100 and then continue to subtract the chosen number. Ask:

  (iii) What happens when you start with 100 and subtract the chosen number? Will you reach 0?

  (iv) What numbers could you start with in order to reach 0 using your chosen number?

  (Adapted from *Navigating through Algebra in Grades 3-5*, 2001, p. 15)

  (3PR2.1)

Paper and Pencil

- Ask students to individually create a decreasing pattern pictorially or by using manipulatives. Provide students with a class list. Ask students to move around the room, writing the pattern rule to describe each decreasing pattern they see, next to the name of the student who created it. Ask students to present their own decreasing patterns and say the pattern rule so their classmates can check their answers. Encourage discussion. Remind students to include a starting point and a description of how the pattern continues.

  (3PR2.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 6: Exploring Decreasing Patterns

TR: pp. 19 - 22

SB: pp. 21 - 24

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

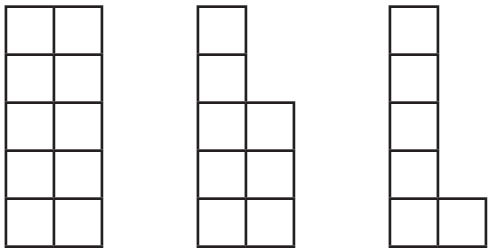
3PR2 Continued

Achievement Indicators:

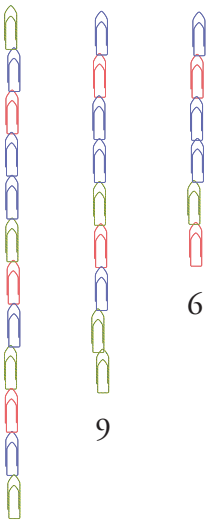
3PR2.2 Identify the pattern rule of a given decreasing pattern, and extend the pattern for the next three elements.

Elaborations—Strategies for Learning and Teaching

Display decreasing patterns and ask students to identify the pattern rules and extend the patterns.

- 

  10 8 6

- 

  12 9 6

Teachers are cautioned that students sometimes find it difficult to extend patterns requiring them to draw. Patterns should be presented both concretely and pictorially when possible.

3PR2.3 Solve a given problem, using decreasing patterns.

Provide students, for example, with the following problem: A monarch caterpillar discovers a milkweed plant that has 24 leaves. It eats two leaves each day. If it begins eating on Monday, on what day will all the leaves be eaten?

Ask students to use pattern block triangles to first model the subtraction of milkweed leaves and then use a T-chart to record the number of leaves that are left at the end of each day.

Days	Number of Leaves Left at the End of the Day
1	22
2	20
3	18

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Performance

- Ask students to solve using manipulatives, pictures or numbers:

  Grandma baked 25 chocolate chip cookies. She put them on a tray to cool. Her dog smelled the cookies and ate five of them. He went back a second time and ate five more. If he continues this pattern, how many times will he be able to return and eat cookies until there are none left?

(3PR2.2, 3PR2.3)

Paper and Pencil

- The O'Riley family went on a trip to visit relatives. They recorded the kilometres they drove and the amount of gas they had left at that time:

Distance Driven (Km)	Gas Left (Litres)
0	14
50	12
100	10

Ask students:

(i) What patterns do you see?

(ii) What rule could you use to describe the number of litres of gas left as the kilometres travelled increased?

(iii) Complete the chart to find out how many kilometres they will travel before running out of gas.

(Adapted from *Navigating through Algebra in Grades 3-5*, 2001, p. 28)

(3PR2.1, 3PR2.2, 3PR2.3, 3PR2.11)

Performance

- After exploring the decreasing patterns in books, for example *Five Little Monkeys Jumping on the Bed* and *There Were Ten in the Bed*, ask students to create their own decreasing pattern stories with a partner. Encourage them to be creative with their stories; possible ideas include using: six headed monsters, butterflies with spots, insects, flower petals, etc. Afterwards, students may role play their stories and discuss their various pattern rules.

(3PR2.1, 3PR2.3, 3PR2.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 6 (Continued): Exploring Decreasing Patterns

TR: pp. 19 - 22

SB: pp. 21 - 24

Suggested Resources

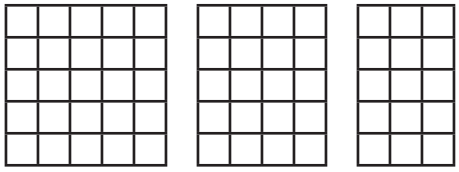
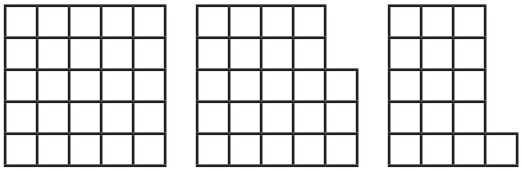
Children's Literature

- *Five Little Monkeys Jumping on the Bed* by Eileen Christelow
- *There Were Ten in the Bed* by Pam Adam

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- decreasing patterns
- O'Riley family trip

Strand: Patterns and Relations (Patterns)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **3PR2 Continued** **Achievement Indicators:**	
3PR2.4 Identify and describe decreasing patterns in the environment.	Over a period of four days, ask students to be a "Pattern Detective". Prepare recording sheets containing a large magnifying glass in which students draw, or glue photos, of decreasing patterns they have seen in their environment. Brainstorm, with students, some places that patterns might occur, for example, tile borders in a bathroom, tiles on a kitchen floor, in quilts, jewellery, etc. Post students' work on a bulletin board or create a class book.
3PR2.5 Compare decreasing numeric patterns of counting backwards by 2s, 5s, 10s, 25s, and 100s.	When comparing decreasing patterns, compare the starting point and the change that occurs each time. • Ask a class, for example, do one set of 12 jumping jacks (or squats, lunges, twists or any simple exercises). Then do 2 less repetitions for each successive set. Repeat the activity using different exercises and decreasing the number of exercises differently each time. • Discuss why Pattern B has 1 block left over and Pattern A has none left: Pattern A  Pattern Rule: Start with 25 blocks. Remove 1 column of blocks each time. Pattern B  Pattern Rule: Start with 25 blocks. Decrease by 2 blocks each time. • Pattern C: Start with 12 blocks. Decrease by 2 each time. Pattern D: Start with 10 blocks. Decrease by 5 each time. • Pattern E: Start at 20. Subtract 5 each time. Pattern F: Start at 20. Subtract 2 each time.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Journal

- Give students the following problems involving decreasing patterns in the environment, and ask them to solve:
  - (i) Jane is running for class president. Beginning at locker number 212, she puts a poster on every third locker going down the hall. What are the next five locker numbers she puts posters on?
  - (ii) Harrison is given $15.00 for his weekly allowance. He spends $3.00 each day on recess. Use a T-chart to determine how much money he has left at the end of the week.

(3PR2.1, 3PR2.3, 3PR2.4, 3PR2.11)

Performance

-

  As part of the morning routine, ask questions such as:
  - (i) What is the date today?
  - (ii) What was the date last Friday?
  - (iii) What was the date two Fridays ago?
  - (iv) Do you see a pattern? Is it increasing or decreasing?

(3PR2.1, 3PR2.3, 3PR2.4, 3PR2.11)

Paper and Pencil

- Ask students to solve the following problem: Adam and Tammy each bring 30 stickers to school on Monday. Every morning Adam gives away five stickers and Tammy gives away three. How many stickers will Adam and Tammy each have at the end of the day on Friday? Ask students to complete a table to find the answer.

	Mon	Tues	Wed	Thurs	Fri
Adam	30	25			
Tammy	30	27			

(3PR2.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 6 (Continued): Exploring Decreasing Patterns

TR: pp. 19 - 22

SB: pp. 21 - 24

Lesson 7: Creating and Comparing Decreasing Patterns

TR: pp. 23 - 25

SB: pp. 25 - 27

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- Patterns A and B

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR2 Continued

Achievement Indicators:

3PR2.6 Create a concrete, pictorial or symbolic decreasing pattern for a given pattern rule.

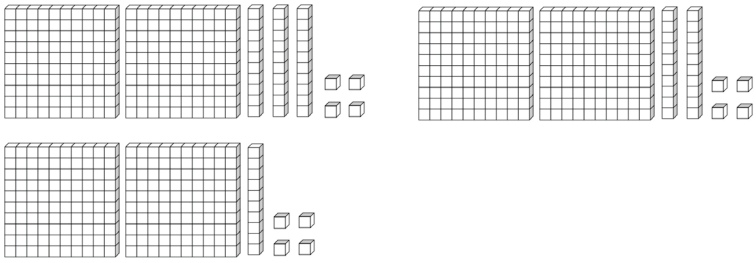
3PR2.7 Create a concrete, pictorial or symbolic decreasing pattern; and describe the relationship, using a pattern rule.

Elaborations—Strategies for Learning and Teaching

Students should be able to create a pattern concretely by using a variety of manipulatives, pictorially by drawing a picture, or symbolically using numbers.

- Start at 32. Decrease by 4 each time.
- Start at 5. Repeat digits according to their value (5, 5, 5, 5, 5, 4, 4, 4, 4, 3, 3, 3, ...)
- Start at 14 and decrease using all the even numbers.
- Start at 16 and take half the previous number.

Students should be given many opportunities to create decreasing patterns using manipulatives, pictures and numbers and then explaining their pattern rule. They may, for example, use base ten blocks to create the following pattern:



The pattern rule is: Start at 234. Subtract 10 each time.

Provide each group with a number belonging to a pattern, e.g., 8, 4, 6, 2, 10. A member from each group will display their number (in the correct order) to form the pattern. The class will come up with the pattern and provide two or three additional numbers in extending the pattern. As well, a question mark can replace one element or term so students can guess the missing step.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Performance

- Have a variety of cards with a number or shapes on them, to be the start points of decreasing patterns. Ask students to choose a card and then to create four different decreasing patterns from this starting point.

  If, for example, a student chooses a card with 40, some possible patterns they could create are:

  40, 35, 30, 25, …

  40, 37, 34, 31, 28, …

  40, 20, 10, 5

  40, 39, 37, 34, 30, …

  (3PR2.5, 3PR2.8)

- Ask students to work in pairs using pattern blocks or other manipulatives. Create a visual barrier between the students' work areas. One student will create a pattern and then verbally give the pattern rule to the other student, who will try to recreate the pattern. Then the students will remove the barrier and compare their patterns.

  (3PR2.6)

- Tell students that the students in the class next door are having a class party. They want to help their teacher keep the classroom clean. As each student finishes their meal, he/she removes his/her plate and cutlery. There are 16 students and only one cleans up at a time. Ask students to:

  (i) create a table to show the pattern of plates and cutlery left.

  Cleaning Up

Plates	16	15	14										
Cutlery (knife and fork)	32	30	28										

  (ii) describe the pattern of the number of plates and cutlery students leave.

  Students may use counters and toothpicks to represent plates and cutlery.

  (3PR2.5, 3PR2.6, 3PR2.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 7 (Continued): Creating and Comparing Decreasing Patterns

TR: pp. 23 - 25

SB: pp. 25 - 27

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/pat.html

- Cleaning Up template

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR2 Continued

Achievement Indicator:

3PR2.8 Identify and describe various decreasing patterns found on a hundred chart, such as horizontal, vertical and diagonal patterns.

Elaborations—Strategies for Learning and Teaching

Many of the tasks mentioned earlier for increasing patterns (3PR1.11) are repeated here with modifications for decreasing patterns.

Model, on a large hundred chart, a decreasing pattern rule. For example, "Start at 99. Subtract multiples of 3."

Provide copies of hundred charts. Ask students to pick a number from two to 10. They should begin with 100 and skip count using their chosen number, shading in the appropriate numbers all the way to 1. Then they should write a description of their pattern. If, for example, they chose five, the pattern is two vertical columns, with numbers ending in five or zero.

Ask students to decide on a decreasing number pattern for a hundred chart. They must keep it secret and colour the first ten numbers in their pattern on the hundred chart. Next they trade patterns with a partner and describe the patterns in their partner's chart. They should then write the numbers in the pattern and extend the pattern.

Give students a page with four small hundred charts. Ask them to skip count backwards, starting at 100, and shade each chart by 2s, 5s, 10s and 25s respectively. Discuss the pattern rules with students, including similarities and differences among the charts.

Use either nickels, dimes, quarters or toonies to represent $2 or loonies to represent 100 cents. Students should take a handful of the same coin and count the amount they have by skip counting. Next they should remove one coin at a time, counting backwards. This gives them the opportunity to count backwards by 2, 5, 10, 25 and 100.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

Interview

- Show students a hundred chart with the first few numbers of a decreasing pattern coloured. Ask them to tell you what pattern is represented and what would come next in the pattern.

(3PR2.8)

Performance

- As the class counts backwards aloud by 2s, place a counter over each number on a hundred chart transparency or interactive website. Discuss the pattern. Ask students to look away while one or several of the counters are removed. Observe if students are able to tell you which numbers need to be covered to complete the pattern. Repeat for multiples of three, four and five. Then distribute copies of the hundred chart and counters and ask students to repeat the activity working in small groups.

  (*Hands-on Math Grades 2-3*, 1995, p. 32)

(3PR2.8)

Journal

- Ask students to create their own decreasing number and/or shape pattern and explain the pattern rule.

(3PR2.8)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 8: Decreasing Number Patterns

TR: pp. 26 - 29

SB: pp. 28 - 31

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR2 Continued

Achievement Indicators:

3PR2.9 Identify and explain errors in a given decreasing pattern.

Elaborations—Strategies for Learning and Teaching

Students should be provided with a variety of decreasing patterns which contain errors. Students first need to determine what the pattern is and then explain the error. For example, 89, 86, 83, 80, 77, 75, 71. The pattern rule is: Start at 89. Subtract three each time. Therefore, 75 is an error since it is only subtracting two, not three. Likewise, 71 is also an error as four has been subtracted.

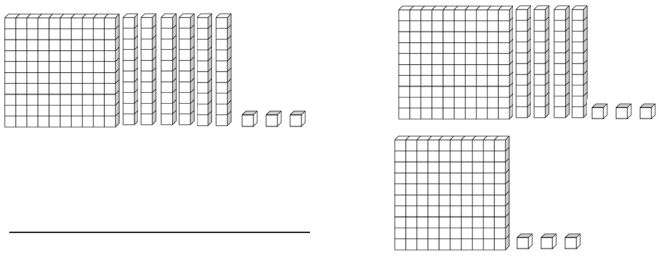
To help students visualize this pattern they can shade numbers on a hundred chart and look for the mistake. This will allow them to see that there are fewer than three numbers between 77 and 75 and more than three between 75 and 71.

Use counters to make the following pattern. Ask students to identify and explain the error in the decreasing pattern.

This shape pattern rule is: Start with 15 counters. Subtract two from each row and column each time. In this example, the third element is a mistake. There should be four counters in the row, not three.

3PR2.10 Identify and apply a pattern rule to determine missing elements for a given pattern.

Since patterns decrease in a predictable way, to determine a missing step students will look at the pattern that comes before and after. They must identify the pattern rule.

- 

  _____

- 150, 125, 100, 75, ___,... 25 Start at 150. Subtract 25 each time.
- 555, 550, 545, 540, ___, 530, 525, 520, 515,... Start at 555. Subtract 5 each time.

Students practice finding missing elements by making decreasing patterns, covering a step and asking a partner "What's missing?" This activity can be done with the whole class using an interactive white board.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies

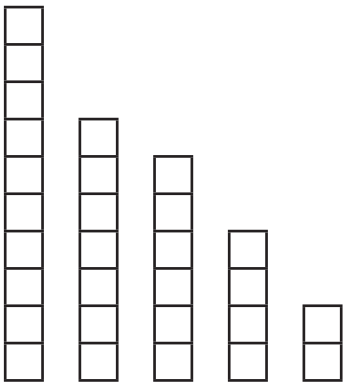
Paper and Pencil

- Give students number patterns such as those below and ask them to find and circle the error.
  - (i) 955, 855, 745, 655
  - (ii) 675, 650, 625, 605
  - (iii) 89, 86, 83, 81, 77
  - (iv) 36, 35, 33, 31, 29

(3PR2.9)

Interview

- Present students with the following decreasing pattern:



Ask them to find the error and explain how they know.

(3PR2.9)

Performance

- Each student makes a decreasing pattern using manipulatives. Next they cover one element of their pattern and have a partner guess and recreate the missing element. Uncover to check accuracy.

(3PR2.7, 3PR2.10)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 8 (Continued): Decreasing Number Patterns

TR: pp. 26 - 29

SB: pp. 28 - 31

Strand: Patterns and Relations (Patterns)

Outcomes

Students will be expected to

3PR2 Continued

Achievement Indicator:

3PR2.11 Describe the strategy used to determine missing elements in a given decreasing pattern.

Elaborations—Strategies for Learning and Teaching

Students should identify the pattern rule and then describe the strategy they used to determine the rule. E.g., 47, 43, 39, ___, 31, 27,... - the rule is: Start at 47. Subtract 4 each time.

Possible strategies to determine missing elements include:

- Number lines
- Hundred chart
- Drawing a picture
- Building with manipulatives
- Skip counting

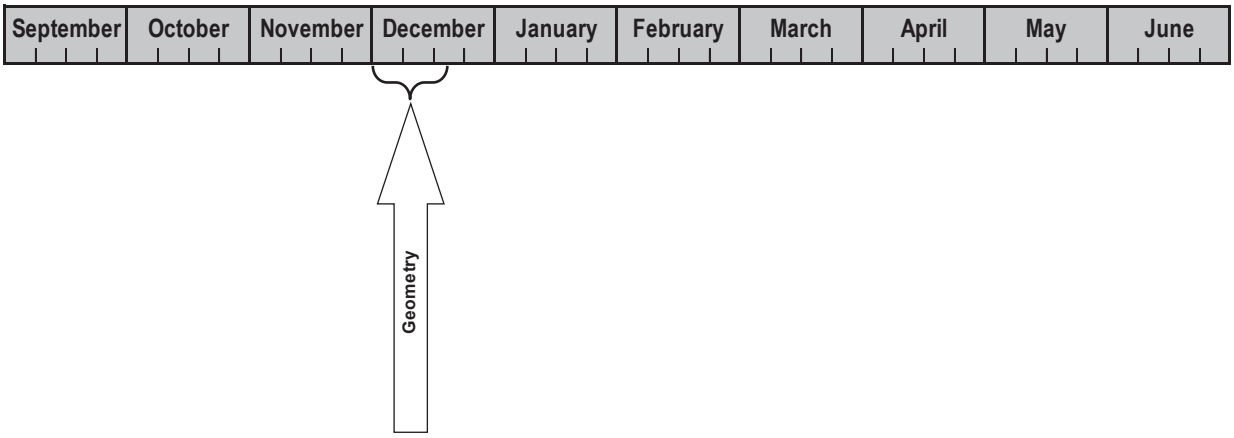
Discuss and accept other appropriate strategies that students use.

General Outcome: Use Patterns to Describe the World and to Solve Problems

Suggested Assessment Strategies	Resources/Notes
Journal • Present students with a decreasing pattern that includes a missing element, for example, 225, 215, ___, 195, 185. Ask them to find the missing element and explain how they know. (3PR2.11)	**Authorized Resource** *Math Makes Sense 3* **Lesson 8 (Continued): Decreasing Number Patterns** TR: pp. 26 - 29 SB: pp. 28 - 31

Geometry

Suggested Time: 2½ Weeks



Unit Overview

Focus and Context

At a very young age, children are engaged in the study of geometry. "When building with blocks, they discover how two-dimensional shapes tile a plane and how three-dimensional forms fill up space, how they stack, and how they fit together. As children work with blocks of various kinds, they examine and analyze them and become more and more discriminating. They learn to identify and sort by knowing attributes of shapes." (*Mathematics Assessment Sampler*, NCTM. 2005. p. 75) Preschool children already possess their own concepts of shape and space, a geometric foundation on which they continue to build throughout their school years. In Grade Two, students have been introduced to identifying, sorting, comparing, describing and constructing 2-D shapes and 3-D objects. In Grade Three, students will continue to develop their knowledge of two and three dimensional shapes by examining their attributes and analyzing the relationships among them. They will "use more formal language to describe and analyze shapes as, for example, specific polygons based on their number of sides and vertices. Any formal discussion of the classification of geometric shapes typically begins with a discussion of polygons. Many of the shapes that students have previously encountered are polygons, but in Grade Three, they learn to use the word polygon to describe any closed figure with straight sides that intersect only at their endpoints." *Focus in Grade 3, Teaching With Curriculum Focal Points*, NCTM (2009) p. 55.

Students will explore more attributes and become more familiar with both regular and irregular polygons. An attribute is defined as a property that applies to all the shapes of a certain class. A triangle, for example, is a 3-sided shape made up of 3 straight line segments. It is essential that teachers provide hands-on experiences with manipulatives such as pattern blocks, power polygons, toothpicks, twist ties, pipe cleaners, modeling clay, geoboards, technology, tangram pieces, etc., to sort, classify and construct various 2-D shapes and 3-D objects. These experiences provide students with informal analyses that make expressing their ideas about geometric shapes and solids, either orally or written, much easier.

Outcomes Framework

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

SCO 3SS6

Describe 3-D objects according to the shape of the faces and the number of edges and vertices.

SCO 3SS7

Sort regular and irregular polygons, including:
- triangles
- quadrilaterals
- pentagons
- hexagons
- octagons

according to the number of sides.

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Shape and Space (3-D Objects and 2-D Shapes)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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]	4SS4. Describe and construct right rectangular and right triangular prisms. [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

3SS7 Sort regular and irregular polygons, including:

- **triangles**
- **quadrilaterals**
- **pentagons**
- **hexagons**
- **octagons**

according to the number of sides.

[C, CN, R, V]

Achievement Indicator:

3SS7.1 Identify given regular and irregular polygons that have different dimensions.

Elaborations—Strategies for Learning and Teaching

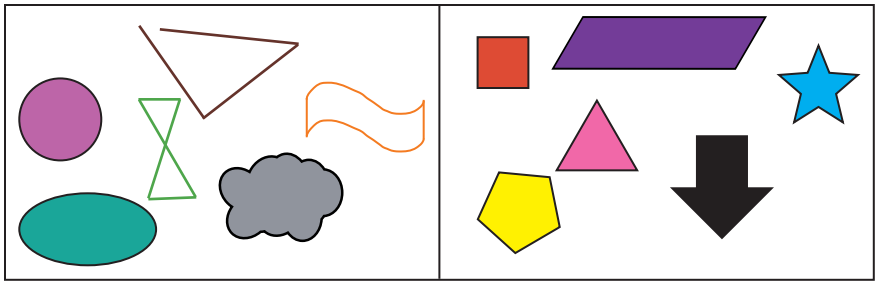
Geometry is an important branch of mathematics that involves shapes, spatial sense, symmetry and proportion. In Grade Two, students described, compared, and constructed 2-D shapes and 3-D objects (2SS7, 2SS8). Grade Three students will review these concepts and learn more about sorting, including both regular and irregular shapes and objects.

A polygon:

- is a closed, 2-D, plane figure
- has three or more straight line segments which only meet at corners
- has the same number of sides as corners
- can be identified by its number of sides

When introducing polygons, ensure students understand the term refers to a closed, plane shape bound by three or more straight line segments. The term "plane" is new to students and they may need help connecting the term "plane" to meaning "flat". Measurements of 2-D shapes include only width and length, whereas 3-D objects include width, length and depth (height).

Ask students to work in groups of four to physically create various polygons. Create figures by using their bodies on the floor. Ask students what polygons they could form if two of the groups were combined and then let the students demonstrate. Also, ask students to physically form a triangle by placing their hands on their hips and tracing the triangle inside their arms.



Not polygons | Polygons

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Many geometric tasks can be incorporated into daily routines to revisit concepts throughout the year.

  (i) Ask students to find various polygons in their environment and explain why each is a polygon.

  (ii) Make a polygon on a geoboard. Ask students to replicate this polygon on their own geoboards in different dimensions. A geoboard for an overhead projector or for an interactive whiteboard is useful for this task.

  (iii) Place a polygon in a bag. Ask students to feel the 2-D shape and describe it according to the number of sides.

(3SS7.1, 3SS7.2, 3SS7.3)

Portfolio

- Using a variety of magazines, newspapers, pictures, etc., ask students to create a poster of a 2-D object of their choice that includes a variety of dimensions.

(3SS 7.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch: Under Construction

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 206 - 207

Lesson 1: Naming Polygons

TR: pp. 4 - 7

SB: pp. 208 - 211

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Suggested Resources

Children's Literature

- *If You Were a Polygon* by Marcie Aboff
- *If You Were a Triangle* by Marcie Aboff
- *If You Were a Quadrilateral* by Molly Blaisdell

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- examples of polygons

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

Outcomes

Students will be expected to

3SS7 Continued

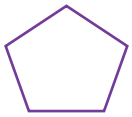
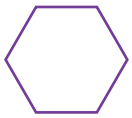
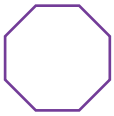
Achievement Indicator:

3SS7.1 (Continued) Identify given regular and irregular polygons that have different dimensions.

Elaborations—Strategies for Learning and Teaching

A regular polygon is a polygon with all sides the same length and all angles the same measure. An irregular polygon is a polygon with all the sides not having the same length.

The word "regular" sometimes creates confusion for students, since they may think of something "regular" as something that is "ordinary." From that perspective, students may view common shapes such as circles or rectangles as "regular" but this is not the mathematical definition. (Small, 2008, p. 296)

Number of Sides	Regular Polygon	Irregular Polygon
3 triangle		
4 quadrilateral		
5 pentagon		
6 hexagon		
8 octagon		

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 use pattern block shapes to represent their family members. Give students the following directions:
  (i) You are the square. If you are a girl, add one blue rhombus to the square. If you are a boy, add one tan rhombus to the square.
  (ii) Represent each adult with a yellow hexagon. The adults can be parents, grandparents, parents' partners, etc.
  (iii) Represent each of your siblings with a trapezoid.
  (iv) Represent each pet with a triangle.
  (v) Use all of the shapes to create a polygon, making sure that your blocks are connected along matching sides.

  Give students paper pattern blocks and ask them to recreate their polygon and glue it to a sheet of paper. Students may use the back of their papers to write additional family details. Display the finished polygons.
  (Adapted from *Teaching Children Mathematics*, 2008, p. 33)

(3SS7.1, 3SS7.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Naming Polygons

TR: pp. 4 - 7

SB: pp. 208 - 211

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- regular vs. irregular polygons
- pattern block template

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

Outcomes

Students will be expected to

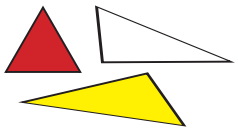
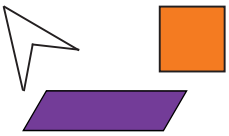
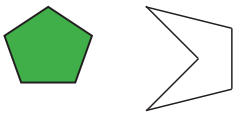
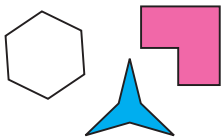
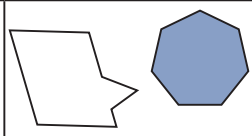
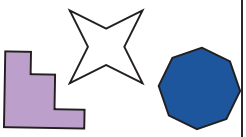
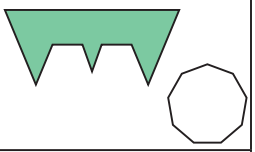
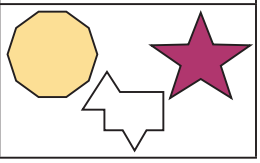
3SS7 Continued

Achievement Indicator:

3SS7.1 (Continued) Identify given regular and irregular polygons that have different dimensions.

Elaborations—Strategies for Learning and Teaching

Together, brainstorm the names of various polygons. Create an organized table similar to the one below as a visual aid. While it is natural for students to be curious about the names of other polygons and it is appropriate to expose them to correct mathematical terminology for other polygons, naming specific polygons is limited to triangle, quadrilateral, pentagon, hexagon and octagon in this outcome.

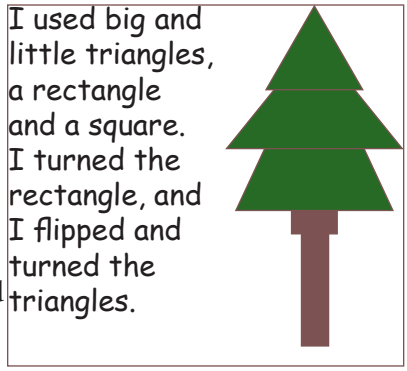
Number of Sides	Name	Sample Polygons
3	triangle	
4	quadrilateral	
5	pentagon	
6	hexagon	
7	heptagon	
8	octagon	
9	nonagon	
10	decagon	

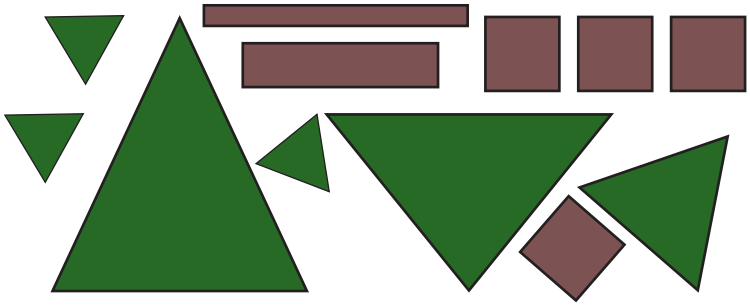
General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Journal

- Provide students with a shape template as shown below. Ask them to cut out the pieces to flip and turn as needed to create a pine tree. It is not necessary to use all of the pieces. After the tree is created, glue pieces to a sheet of white construction paper. Students may create a background scene for their tree using crayons and various craft materials. Ask students to include a brief description of the shapes they used next to their tree. Encourage the use of geometric terms such as triangle, quadrilateral, slide, flip and turn.





(3SS7.1, 3SS7.2)

Performance

- Provide students with two of each of the six pattern blocks. Ask them to investigate how many new polygons can be made by using two of the same block and matching equal sides. Ask students to trace around the blocks to record the different polygons. Observe that the students recognize the same shape in different positions or orientations.

(3SS7.1, 3SS7.2)

Portfolio

- Read *The Quiltmaker's Gift* by Jeff Brumbeau. Look at and discuss the patterns on the inside cover and throughout the book. Discuss the shape and orientation of the different polygons in the quilt squares. Give each child a blank quilt square template and ask them to create their own quilt square using pattern blocks, tangrams, attribute blocks or pentominoes. Ask students to trace and colour the designs and put all the squares together to create a class quilt.

(3SS7.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Naming Polygons

TR: pp. 4 - 7

SB: pp. 208 - 211

Supplementary Resource

Children's Literature

- *The Quiltmaker's Gift* by Jeff Brumbeau

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- table of sample polygons
- shapes for tree activity

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

Outcomes

Students will be expected to

3SS7 Continued

Achievement Indicator:

3SS7.2 Identify given regular and irregular polygons that have different orientations.

Elaborations—Strategies for Learning and Teaching

"Through many experiences with identifying shapes in a variety of orientations, students begin to realize that shapes can be the same, regardless of their position." (*Focus in Grade Three, Teaching With Curriculum Focal Points*, NCTM, 2009, p. 51) Realizing that orientation has no effect on the type of shape is crucial in later grades when working with transformations and congruency.

A quadrilateral in different orientations

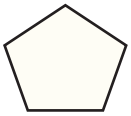
When introducing orientation, provide students with a 2-D shape to trace as they experiment with different orientations by turning (rotating), flipping (reflection) and sliding (translations). This type of "early geometric exploration is valuable in developing their spatial reasoning and again solidifies their understanding of the concept that orientation does not change the basic characteristics of a shape." (*Focus in Grade Three, Teaching With Curriculum Focal Points*, NCTM, 2009, p. 54)

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 design a stained glass window for a church or other building in the community. Ask them to draw many different geometric shapes (trapezoid, kite, triangle, square, rectangle, rhombus, hexagon, etc.) within the window frame provided and colour the shapes with various colours. Students may trace pattern blocks for this activity. If there are any spaces left between shapes, students may colour these spaces grey.



(3SS7.2)

Paper and Pencil

- Provide students with a green triangle, a blue rhombus and a red trapezoid from the pattern blocks. Ask students to:
  - (i) create a parallelogram using all three blocks, and trace the parallelogram in their journals.
  - (ii) create a pentagon using all three blocks, and trace the pentagon in their journals.
  - (iii) create a polygon of their own choice using the pattern blocks, and trace it in their journals.

(3SS7.2)

Interview

- Show students two groups of sorted polygons. Ask, "What might the sorting rule have been?" This allows students to recognize properties of shapes. Some examples of groupings could be regular/irregular polygons, four-sided/three-sided, quadrilaterals/polygons that are not quadrilaterals, etc.

(3SS7.3)

Performance

- Ask students to create a polygon where the number of yellow pattern blocks used is one-half the number of red pattern blocks.

(3SS7.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Naming Polygons

TR: pp. 4 - 7

SB: pp. 208 - 211

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- stained glass template

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

Outcomes

Students will be expected to

3SS7 Continued

Achievement Indicators:

3SS7.2 (Continued) Identify given regular and irregular polygons that have different orientations.

3SS7.3 Classify a given set of regular and irregular polygons according to the number of sides.

Elaborations—Strategies for Learning and Teaching

Ask students to find examples of polygons in the world around them, perhaps even collect as many types of a shape as they can find. Sort them according to the number of sides. Help students recognize that shapes such as the one below is a hexagon (i.e., a six-sided polygon).

Example of a hexagon

Encourage students to build different basic shapes from two triangles of the same size and to paste the new shapes on a sheet of paper. Label each new shape by the number of sides. Students might build a square, parallelogram, or a bigger triangle. Then ask students to build new shapes, but this time with three or more triangles.

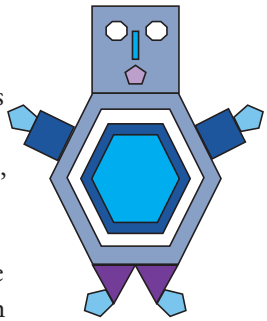
Provide students with a long rope. Tie the ends of the rope together. Ask students to form geometric shapes with the rope. To make a square, for example, ask students to stand equal distances apart forming right angles at each corner. Ask them to change the shape into a triangle, rectangle, etc. Students should note the number of sides for each shape.

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

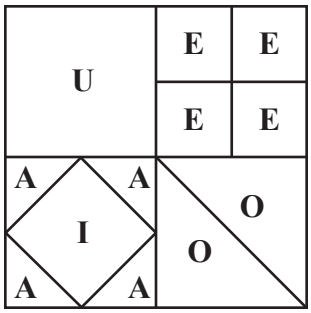
- Ask students to draw an imaginary geometric animal and, using some of the geometry terms from a given list (polygon, quadrilateral, square, rectangle, hexagon, octagon, pentagon, triangle, etc.), describe the animal on a separate sheet of paper. Ask them to include its appearance, behaviour and habitat and give their polygon animal a name. Encourage them to be creative! Display all animals on a class gallery wall.



Hexaseal

(3SS7.1, 3SS7.2)

- Provide a copy of the template below to each student or pairs of students to cut apart. Ask students to use the shapes to solve the following puzzles:
  - (i) Use all the pieces to make a large square
  - (ii) Use two As to make a triangle.
  - (iii) Use two As to make a square.
  - (iv) Use two As to make a four-sided figure that is not a square.
  - (v) Use four of one kind of shape and one of another kind of shape to make a rectangle.
  - (vi) Use two of one kind of shape, two of another shape and one of another to make a rectangle.
  - (vii) Use only As. If each A costs 1¢ make a four-sided figure that costs 3¢.
  - (viii) Use only As. If each A costs 1¢ make a three-sided figure that costs 4¢.
  - (ix) Use only As. If each A costs 1¢ make a five-sided figure that costs 3¢.
  - (x) Use only As. If each A costs 1¢ make a six-sided figure that costs 4¢.
  - (xi) Use only As and the I to make a square.
  - (xii) Use only Os, the U and any other two shapes to make a quadrilateral that is not a rectangle.



(3SS7.1, 3SS7.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Naming Polygons

TR: pp. 4 - 7

SB: pp. 208 - 211

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- Hexaseal
- AEIOU activity

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

Outcomes

Students will be expected to

3SS6 Describe 3-D objects according to the shape of the faces and the number of edges and vertices.

[C, CN, PS, R, V]

Achievement Indicators:

3SS6.1 Identify the faces, edges and vertices of given 3-D objects, including cubes, spheres, cones, cylinders, pyramids and prisms.

3SS6.2 Identify the shape of the faces of a given 3-D object.

3SS6.3 Identify 3-D objects as cubes, spheres, cones, cylinders, square pyramids, triangular pyramids, rectangular prisms, or triangular prisms.

Elaborations—Strategies for Learning and Teaching

In Grade Two, students had experiences with describing, comparing, and constructing 3-D objects (2SS7). Students have also identified 2-D shapes as parts of 3-D objects in the environment (2SS9).

Use *The Greedy Triangle* by Marilyn Burns, for example, to help students make the connection between 2-D shapes and 3-D objects. In this story, the triangle becomes dissatisfied with its shape and continuously makes trips to the "shapeshifter" to add angles and lines. Finally, it can hardly recognize itself and realizes it was happier in its original form.

Give each student a geoboard and geodot paper. Ask students to make a triangle on the geoboard and record it on their geodot paper. As the story unfolds, ask students to predict what will happen to the triangle before the "shapeshifter" makes the requested change. Ask students to make the predicted shape on their geoboards and use geodot paper to draw the predicted shape.

Following the story, have a "shape hunt" in the classroom, looking for the different shapes mentioned in the book. Ask students to sort the plane shapes and solid objects into two categories.

Consider having students use mini-marshmallows or play dough and toothpicks to form the plane (2-D) shapes or solid geometric (3-D) objects from the story.

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Invite students to play "I Spy". Ask students to take turns identifying objects by listening to clues, such as, "I spy with my little eye something that has four rectangular faces and two square faces." Ask the student who guessed correctly to explain how he/she knew what object was spied. That student then takes a turn.

(3SS6.1, 3SS6.2, 3SS6.3)

- Engage students in a headband game of "Guess My Solid". Put students in pairs or small groups. Choose one member of the group to wear a headband. Have another person put a picture of a solid on the headband without the person wearing the headband seeing the solid. The person with the headband can ask questions to the other members of the group to figure out what 3-D object he/she is wearing. Some of the questions may include:
  - (i) Is my solid a prism?
  - (ii) Does my solid have 1 vertex?
  - (iii) Does my solid have 12 edges?
  - (iv) Are all faces of my solid squares?

(3SS6.1, 3SS6.2, 3SS6.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Naming Polygons

TR: pp. 4 - 7

SB: pp. 208 - 211

Supplementary Resources

Children's Literature

- *The Greedy Triangle* by Marilyn Burns
- *Grandfather Tang's Story* by Ann Tompert

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- Guess My Solid template

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

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicators:

3SS6.1 (Continued) Identify the faces, edges and vertices of given 3-D objects, including cubes, spheres, cones, cylinders, pyramids and prisms.

3SS6.2 (Continued) Identify the shape of the faces of a given 3-D object.

3SS6.3 (Continued) Identify 3-D objects as cubes, spheres, cones, cylinders, square pyramids, triangular pyramids, rectangular prisms, or triangular prisms.

Elaborations—Strategies for Learning and Teaching

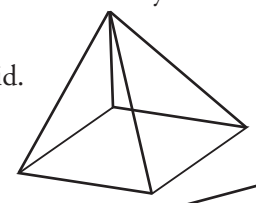
For now, students will work with pyramids and prisms including cubes. Work with spheres, cones, and cylinders will occur later.

Show students models and real-life objects that represent various pyramids and prisms. Show students the faces, edges and vertices of each solid. Brainstorm what each term means.

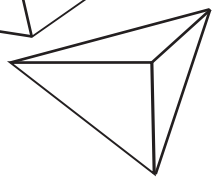
- A face is a flat surface on a geometric object.
- An edge is the line where two faces, or a face and a curved surface, meet.
- A vertex is a point where three or more edges meet or, on a cone, a vertex is the highest point above the base and may also be called the apex.

A pyramid has one base. The base is a special face that determines the name of the pyramid. The remaining faces in a pyramid are always triangles that meet at one point or vertex.

- A pyramid with a square base is a square pyramid.

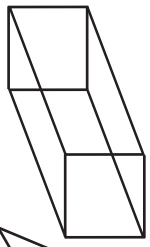


- A pyramid with a triangular base is a triangular pyramid.

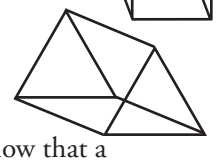


A prism has two bases that are matching polygons. The two bases are special faces that determine the name of the prism.

- A prism with two rectangular bases is a rectangular prism.



- A prism with two triangular bases is a triangular prism.



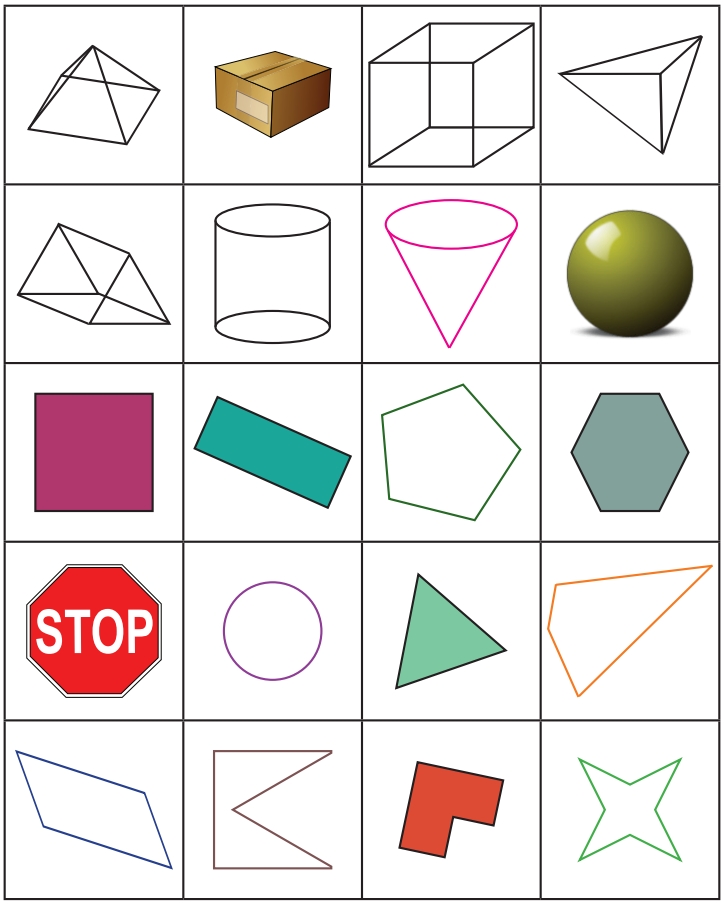
The other faces of prisms are rectangles. Ensure students know that a cube is a special rectangular prism just like a square is a special rectangle. Pyramids and prisms are named according to their bases.

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Invite students to play "3-D Bingo" Provide students with a copy of a handout similar to the one shown below and an empty bingo gameboard. Ask students to cut out the objects and randomly glue them to their own bingo gameboard. Describe a solid, or an attribute of a solid, and have each student place a counter on any one box that fits the description. The first student with four counters in a row, column, or diagonal, wins.



(3SS6.1, 3SS6.2, 3SS6.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2: Sorting Polygons

TR: pp. 8 - 11

SB: pp. 212 - 215

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- 3-D Bingo template

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

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicators:

3SS6.1 (Continued) Identify the faces, edges and vertices of given 3-D objects, including cubes, spheres, cones, cylinders, pyramids and prisms.

3SS6.2 (Continued) Identify the shape of the faces of a given 3-D object.

3SS6.3 (Continued) Identify 3-D objects as cubes, spheres, cones, cylinders, square pyramids, triangular pyramids, rectangular prisms, or triangular prisms.

3SS6.4 Determine the number of faces, curved surfaces, edges and vertices of a given 3-D object.

Elaborations—Strategies for Learning and Teaching

Show the class a model or real-life example of a prism or a pyramid. Give any two attributes and challenge students to decide if the combination is possible or impossible. Hold up a square pyramid, for example, and say, "I can stack. I have five faces." Ask students to give a thumbs-up signal if the combination is possible, or a thumbs-down signal if it is impossible. Later in the unit, modify this activity by adding examples of cones, cylinders and spheres. Show a cylinder and say, for example, "I can stack. I have two faces."

Place a 3-D object, hidden from view of the class, on an overhead projector. Looking only at the shadow on the screen, ask volunteers to guess the name of the 3-D object and give reasons for their choice. A student response might be, for example, "I think the object is a cube because the shape has a square face and I know a cube has all square faces." If the class needs another hint, turn the object to show the shadow of another face.

Show students models and real-life objects of cylinders, cones and spheres. Ask students what the difference is between these solids and the prisms and pyramids already studied. Show students the faces, curved surfaces, edges and vertices of each solid. Brainstorm, with the students, what each term means.

Name	# of faces	# of edges	# of curved surfaces	# of vertices
cube/ rectangular prism	6	12	0	8
triangular prism	5	9	0	6
square pyramid	5	8	0	5
triangular pyramid	4	6	0	4
cone	1	1	1	1 (apex)
cylinder	2	2	1	0
sphere	0	0	1	0

General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Place a variety of 3-D objects in a bag. Ask students to feel the objects in the bag and describe them; have other students try to name them.

(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.4)

- Place a hexagonal prism and hexagonal pyramid, for example, beside one another. Ask the students to name them. Ask them to tell you some things that are the same about them; some things that are different.

(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.4)

Interview

- Ask students the following questions:
  - (i) I have an object that is able to roll. What might it be?
  - (ii) I can see a rectangular prism in this room. What object can I see?
  - (iii) We stacked some objects to make a wall. What objects might we have used?
  - (iv) In a bag I can feel that an object has flat faces, sharp vertices and eight straight edges. What might this object be?
  - (v) I traced around one of the faces of an object. The shape I drew was a circle. What might the object have been?

(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2: Sorting Polygons

TR: pp. 8 - 11

SB: pp. 212 - 215

Lesson 4: Describing Prisms and Pyramids

TR: pp. 14 - 17

SB: pp. 218 - 221

Lesson 5: Describing Cylinders, Cones and Spheres

TR: pp. 18 - 20

SB: pp. 222 - 224

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

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicators:

3SS6.2 (Continued) Identify the shape of the faces of a given 3-D object.

3SS6.5 Sort a given set of 3-D objects according to the number of faces, curved surfaces, edges or vertices.

Elaborations—Strategies for Learning and Teaching

While students are not expected to match nets to a 3-D object, they could explore nets to identify the shape of the faces of 3-D objects. A net can be described as a "jacket" for a geometric solid that can be folded to cover or create the surface of the solid. A net is a two-dimensional shape with indicated lines for folding to create a three-dimensional object.

Provide students with a variety of nets for 3-D objects. Ask students to cut and fold to make a model of these 3-D objects. Using these manipulatives, ask students to play a "Show Me" game to familiarize them with the correct geometric terms for the solids. For example, the teacher says, "Show me a cylinder." Wait for all students to hold up their cylinders. Continue with various other solids. Explain to students that they have various prisms and pyramids. Some models, for example, may be a square pyramid or a triangular pyramid, or students may have a triangular prism or a rectangular prism.

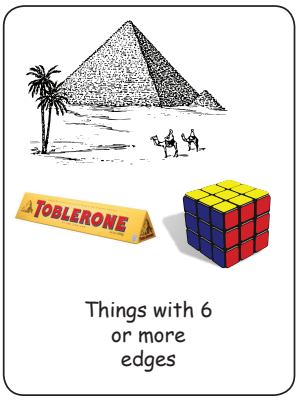
Name a 2-D shape and ask students to take part in a scavenger hunt in which they have to locate 3-D objects in the classroom that have a face with the named shape. Similarly, name a number of faces, curved surfaces, edges or vertices and ask students to locate 3-D objects with that specific attribute. Ask students to list their findings on a sheet of paper.

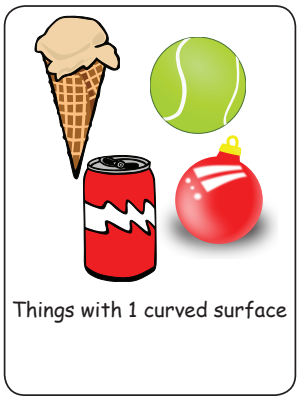
General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Portfolio

- Ask students to look through various catalogues, magazines and books to find pictures of 3-D objects. Ask them to sort the objects in groups according to the number of faces, curved surfaces, edges or vertices. Ensure that students label their groups. The groups of pictures can then be glued to poster board.





(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.4, 3SS6.5)

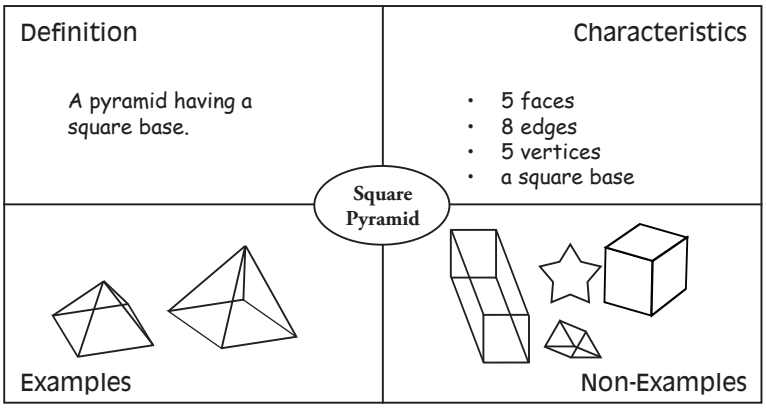
Performance

- Ask students to place a barrier between them and a partner. Ask one student to choose a 3-D object and pretend they are speaking with their classmate on the telephone. They are not allowed to use the name of the object but they must describe it to help the other person guess what 3-D object they are holding.

(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.4)

Portfolio

Ask students to create Frayer models for a given 3-D solid.



(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.4, 3SS6.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4 (Continued): Describing Prisms and Pyramids

TR: pp. 14 - 17

SB: pp. 218 - 221

Lesson 5 (Continued): Describing Cylinders, Cones and Spheres

TR: pp. 18 - 20

SB: pp. 222 - 224

Lesson 6: Sorting Objects

TR: pp. 21 - 24

SB: pp. 225 - 228

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- Frayer model template

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

Outcomes

Students will be expected to

3SS6 Continued

Achievement Indicator:

3SS6.6 Construct a skeleton of a given 3-D object, and describe how the skeleton relates to the 3-D object.

Elaborations—Strategies for Learning and Teaching

A skeleton is the frame of an object. It shows the edges and vertices of 3-D objects.

Gather construction tools such as coffee stir sticks, twist ties, straws, pipe cleaners, toothpicks, gumdrops, play dough, etc. Students should construct one or more of the geometric solids.

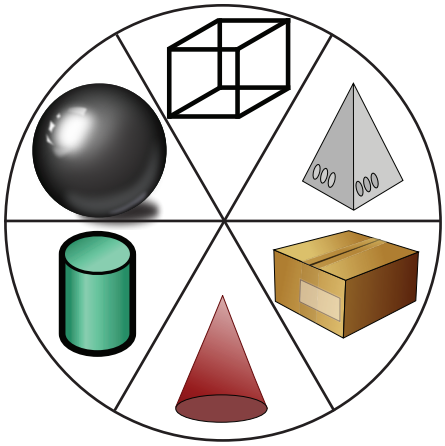
General Outcome: Describe the Characteristic of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies

Performance

- Provide small groups of students with 3-D objects and a spinner as shown below. Students take turns spinning the spinner 6 times and select the 3-D solids that the pointer lands on. Have each group work together to build a robot, from these solids, that lies flat on the table.

  Modify this activity by removing sphere, cone and cylinder from the spinner and inviting students to make a robot as described above. When the robot is complete, challenge students to make the skeleton of their robot.



(3SS6.1, 3SS6.2, 3SS6.3, 3SS6.4, 3SS6.6)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 7: Constructing Skeletons

TR: pp. 25 - 27

SB: pp. 229 - 231

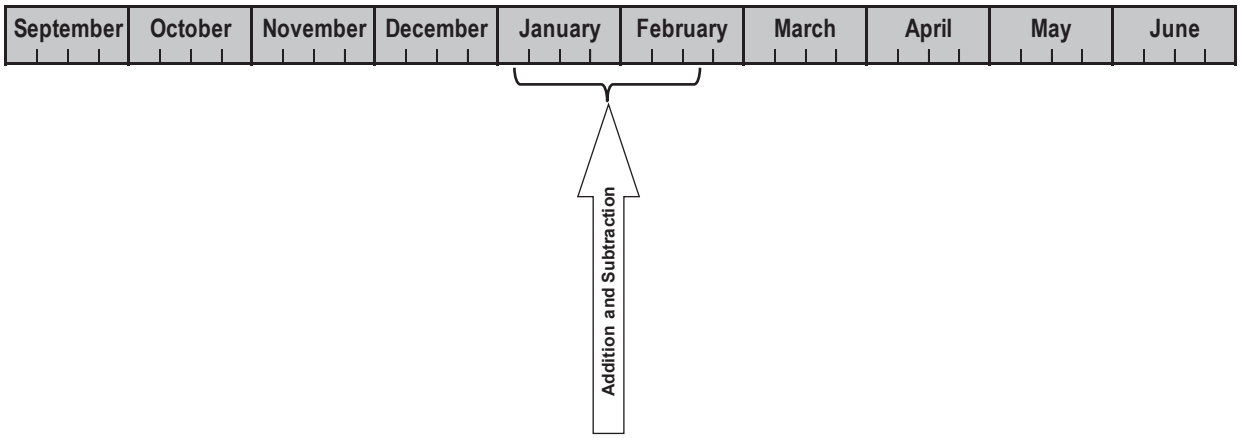
Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/geo.html

- 3-D Object spinner

Addition and Subtraction

Suggested Time: 6 Weeks



Unit Overview

Focus and Context

Prior to Grade Three, students explored addition and subtraction situations with one and two digit numbers with and without re-grouping. In Grade Three the focus will be on combining and separating numbers to 1000. Students will develop a deeper understanding of situations involving addition and subtraction by creating, using and refining personal strategies. It is important that students be given many opportunities to share their thinking with classmates so that a bank of strategies for problem solving situations is explored. Through exploration of their personal strategies students should come to use the most effective strategies that work for them to solve problems.

"Developing fluency requires a balance and connection between conceptual understanding and computational proficiency. On the one hand computational methods that are over practiced without understanding are often forgotten or remembered incorrectly. On the other hand understanding without fluency can inhibit the problem solving process." (Thornton 1990 and Hiebert 1999; Kamii, Lewis, and Livingston 1993; Hiebert and Lindquist 1990 in *Principles for School Mathematics (2000)* p. 35.

Outcomes Framework

GCO
Develop number sense.

SCO 3N6
Describe and apply mental mathematics strategies for adding two two-digit numerals.

SCO 3N7
Describe and apply mental mathematics strategies for subtracting two two-digit numerals.

SCO 3N8
Apply estimation strategies to predict sums and differences of two two-digit numerals in a problem-solving context.

SCO 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.

SCO 3N10
Apply mental mathematics strategies and number properties, in order to understand and recall basic addition facts and related subtraction facts to 18.

Outcomes Framework

GCO
Represent algebraic expressions in multiple ways.

SCO 3PR3.

Solve one-step addition and subtraction equations involving symbols representing an unknown number.

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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]	4N3. Demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to three- and four-digit numerals) by: • using personal strategies for adding and subtracting • estimating sums and differences • solving problems involving addition and subtraction. [C, CN, ME, PS, R]

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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 2	Grade 3	Grade 4
Strand: Patterns and Relations (Variables and equations)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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]	3PR3. Solve one-step addition and subtraction equations involving symbols representing an unknown number. [C, CN, PS, R, V]	4PR5. Express a given problem as an equation in which a symbol is used to represent an unknown number. [CN, PS, R] 4PR6. Solve one-step equations involving a symbol to represent 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

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]

Elaborations—Strategies for Learning and Teaching

By the end of Grade Three, 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 9 + 9 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.

In Grade Two, students applied mental mathematics strategies for basic addition facts and related subtraction facts up to and including 9 + 9 (2N10). They recalled addition facts up to and including 5 + 5 and related subtraction facts. Now the focus will be on using the strategies to efficiently recall the facts up to and including 9 + 9.

The mental mathematics strategies presented in this outcome are not new. Through this outcome, students have the opportunity to maintain and refine previously learned addition and subtraction number facts

Efficient strategies are ones that can be done mentally and quickly. Some students will automatically develop strategies, while others will need direct teaching and practice. Strategy practice must directly relate to one or more number relationships. These strategies should be explicitly taught through demonstrations, think-a-louds, and modelling. It is important to note that the most useful strategy for a student is the one that they understand and are most confident to use. It is personal and they are able to connect it to concepts they already know.

In Grade Three, students use their increasing mathematical vocabulary along with everyday language. Students should be encouraged to use mathematical vocabulary in discussions and in their writing. The use of correct mathematical language should be modelled repeatedly and consistently throughout the curriculum. It is important to note that a student's knowledge about mathematical ideas and the use of mathematical language are connected.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Ask students to complete the following problem:
  Which of the following means the same as 2 + 3 = 5? Use pictures, numbers or words to explain how you know.
  A. 3 + 2 = 5
  B. 5 - 2 = 3
  C. 2 + 3 + 2 = 7
  D. 5 - 3 = 2

(3N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch: Plants in Our National Parks

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 80 - 81

Lesson 1: Strategies for Addition Facts

TR: pp. 4 - 7

SB: pp. 82 - 85

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Strand: Number

Outcomes

Students will be expected to

3N10 Continued

Achievement Indicator:

3N10.1 Explain or demonstrate the mental mathematics strategy that could be used to determine a basic fact, such as:

- *using doubles; e.g., for 6 + 8, think 7 + 7*
- *using doubles plus one, plus two; e.g., for 6 + 7, think 6 + 6 + 1*
- *using doubles subtract one, subtract two; e.g., for 6 + 7, think 7 + 7 – 1*
- *making 10; e.g., for 6 + 8, think 6 + 4 + 4 or 8 + 2 + 4*
- *using addition to subtract; e.g., for 13 – 7, think 7 + ? = 13.*
- *using commutative property; e.g., for 3 + 9, think 9 + 3*
- *provide a rule for determining answers when adding and subtracting zero. When you add or subtract 0 to or from a number, the answer is the number you started with.*

Elaborations—Strategies for Learning and Teaching

Students need opportunities to discuss and share the strategies they are using to determine the facts. Tasks such as the "Quiz-Quiz-Trade" can be used as a way for students to practice a strategy. Provide index cards with addition and subtraction facts pertaining to a strategy. E.g., doubles strategy:

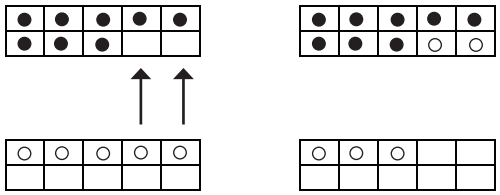
1 + 1 = 2 – 1 =

2 + 2 = 4 - 2 =

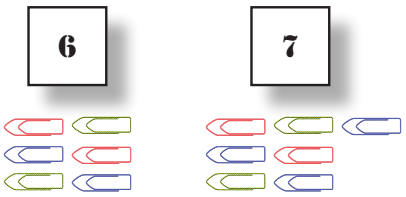
9 + 9 = 18 – 9 =

Put students in pairs and give each student a card. Next, each student quizzes their partner with the fact on his/her card. They switch cards and repeat, then look for a new partner.

Students can practice the "making ten" strategy with a double ten-frame and two-sided counters. Give students a fact, for example, 8 + 5. Students will represent the number eight on one ten-frame and five on the other ten-frame. Students will move counters from the ten-frame with five to complete the ten-frame representing 8.



Students then verbalize what they did, "I took two from the five and put it with the eight to make ten. Then, I added the three left over from the five to the ten and that was 13 so 8 + 5 = 13".



To practice the "using addition to subtract" strategy, provide objects for counting, an opaque container, and number cards 0 to 9. Pick two number cards out of the bag, for example, 6 and 7. Take the number of objects for each card and find the total. Record the number sentence: 6 + 7 = 13

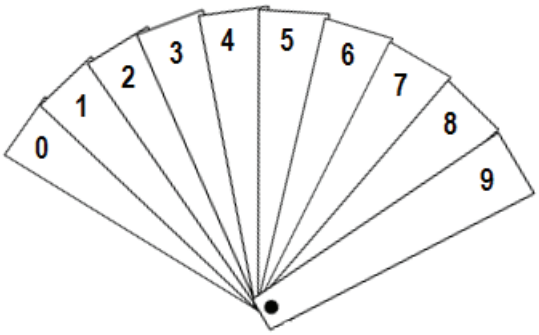
Hide, under the container, one of the groups of objects that match one of the number cards, for example, hide six. Record the subtraction sentence 13 - ? = 7. This activity can also be modelled using an overhead projector or interactive whiteboard.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Present students with "Numeral Wands" and call out a variety of addition/ subtraction facts including zero facts.



(3N10.1)

- Say or display a variety of "doubles"facts to 18, one at a time, and ask students to record the sums/differences and reveal their answers.

(3N10.2)

Journal

- Prompt students with: Imagine that you are helping someone that is just learning to add and subtract. How would you explain addition and subtraction to him/her? Write down what you would say and do to tell someone how to complete the number sentences below:

4 + 5 = __ 9 - 5 = __ (3N10.1)

Interview

- Ask students: Do you find it easy to add zero to, or subtract zero from, a number? If yes, why? If no, why not?

(3N10.1)

- Post the following headings: Near Doubles, Doubles, Make Ten, Property of Zero and Think Addition. Ask students to place a given fact card under one of the headings and justify their placement. Some sample cards are:

5 + 6	18 - 9	7 + 7	15 - 7	6 + 3

(3N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Strategies for Addition Facts

TR: pp. 4 - 7

SB: pp. 82 - 85

Suggested Resources

Children's Literature

- *The Subtraction Book* by Jerry Pallotta

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- fact cards

Strand: Number

Outcomes

Students will be expected to

3N10 Continued

Achievement Indicators:

3N10.1 (Continued) Explain or demonstrate the mental mathematics strategy that could be used to determine a basic fact, such as:

- *using doubles; e.g., for 6 + 8, think 7 + 7*
- *using doubles plus one, plus two; e.g., for 6 + 7, think 6 + 6 + 1*
- *using doubles subtract one, subtract two; e.g., for 6 + 7, think 7 + 7 – 1*
- *making 10; e.g., for 6 + 8, think 6 + 4 + 4 or 8 + 2 + 4*
- *using addition to subtract; e.g., for 13 – 7, think 7 + ? = 13.*
- *using commutative property; e.g., for 3 + 9, think 9 + 3*
- *provide a rule for determining answers when adding and subtracting zero. When you add or subtract 0 to or from a number, the answer is the number you started with.*

3N10.2 Recall doubles to 18 and related subtraction facts.

3N10.3 Recall compatible number pairs for 5 and 10.

Elaborations—Strategies for Learning and Teaching

Students have had experience with adding and subtracting zero (2N8). When discussing the concepts of "adding zero to" and "subtracting zero from" a number, the property of zero should be emphasized. Using the part-part-whole concept with the use of manipulatives, it may be helpful to show two parts with one part being empty. Simple, real life story problems would be good tools to illustrate the effect of adding or subtracting zero from a number.

Whole	
Part	Part

Sometimes students may think that when you add a number the sum must change and when subtracting a number, the difference must be less. Display several zero facts, some with the zero as the first addend, some with the zero as the second addend. Ask students how these facts are alike. Ask if there are differences. Some students may need counters to visually represent the facts.

Van de Walle (2008) suggests using "think-addition", (using addition to subtract), as a powerful strategy for developing fluency with subtraction facts. An example of the "think-addition" strategy is when solving 12 - 5, think "five and what makes 12?" Model the "think addition strategy" by talking about what you are thinking so that students can see the strategy in use and hear what the strategy sounds like.

In "doubles equations", one number is added to itself, for example, 3 + 3 or 4 + 4. Students can often recall these addition facts quickly. These equations can then be used in subtraction. If, for example, a student knows that 7 + 7 = 14, he/she can use this doubles fact to know the answer to 14 – 7.

Ten-frames are useful for developing the part-whole relationship for five and ten. It is important for students to be able to easily recall the number combinations for five and for ten. Working with five and ten lays the foundation for the addition/subtraction of larger numbers.

Frequent opportunities for students to practice number bonds to five and ten during math warm-ups or morning routines are helpful.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Using two number cubes, (one labelled 0, 2, 4, 6, 8, 10 and one labelled 0, 1, 3, 5, 7, 9) counters, and the game board below, ask students to play a game to reinforce that zero, when added to or subtracted from a number, has no effect on the answer. Players take turns rolling the number cubes, and adding or subtracting the numbers. If the answer is on the board the player gets to cover the number with a counter. Play continues until one player gets all four of their counters on the board.

4	7	11	10	2
11	9	1	0	13
6	13	7	5	15
19	3	9	17	8

(3N10.1)

- Prepare two dice, one with numerals from one to nine, and one with +1, +2, −1, −2 stickers on it. Ask students to roll the number cube and double the number. Next, the student rolls the other cube and performs the operation.

(3N10.1)

- Observe students as they are shown number pairs for five and ten. Are students able to recall number pairs mentally or are they using manipulatives?

(3N10.3)

Interview

- Show cards representing a variety of missing addend number sentences. Ask students to chant, or record on their whiteboard, the missing addend. E.g., 6 + __ = 13. Ask students to explain how they figured out the missing addend. Possible responses might include: "I used addition", "I counted up" or "I used doubles plus one."

(3N10.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Strategies for Addition Facts

TR: pp. 4 - 7

SB: pp. 82 - 85

Suggested Resources

Children's Literature

- *Counting on Zero* by Highfield Junior School

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- game board to reinforce adding and subtracting zero

Strand: Number

Outcomes

Students will be expected to

3N10 Continued

Achievement Indicators:

3N10.3 (Continued) Recall compatible number pairs for 5 and 10.

3N10.4 Recall basic addition facts to 18 and related subtraction facts to solve problems.

Elaborations—Strategies for Learning and Teaching

Chants can be fun ways to practice some strategies during morning/daily routines. For the "make ten" strategy, for example,

Say: 9!

Students respond: 1!

Repeat for all combinations of ten. A variation is to say a number and the students clap, stomp or tap the number needed to make ten.

To encourage students to articulate their mathematical thinking while participating in tasks, ask questions such as:

- What strategy did you use?
- How did you figure it out?

"Fluency might be manifested in using a combination of mental strategies and jottings on paper or using an algorithm with paper and pencil, particularly when the numbers are large, to produce accurate results quickly. Regardless of the particular method used, students should be able to explain their method, understand that many methods exist, and see the usefulness of methods that are efficient, accurate, and general" (NCTM, 2000, p 32).

Pose the following task to the class: If you did not know the answer to 8 + 5, what are some really good strategies you can use to get the answer? Explain that "really good" means that you do not have to count and you can do it in your head. Encourage students to come up with more than one strategy. (Van de Walle, *Teaching Student-Centered Mathematics Grades K-3*, p. 104)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Invite students to play "Three in a Row". Provide pairs of students with two blank 3 × 3 grids and a deck of 20 cards containing numbers 0 – 9. Ask each student to create their own game board by writing numbers from 0 to 18 into their blank 3 × 3 grid. Each student may use each number once. Place the deck of cards between the two players. Each partner draws a card and places it face up on the table. The students will use both cards to form an addition or subtraction problem that will give them either a sum or difference on their card. If the sum and difference can be formed from the two cards, students may mark an X on the numbers on their "Three in a Row" Game Board. The winner is the student who gets three in a row first, vertically, diagonally or horizontally.

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

- Domino Group Work - Present each group of four students with dominoes and one index card. Ask the first student to write down an addition fact that goes with the domino and pass the card to the right. The next student writes another addition fact and passes it on. Repeat for two subtraction facts. When the group has completed their fact families they choose another domino and another student goes first. Observe whether students are recognizing that doubles have only two facts.

  (3N10.4)

Interview

- Quickly show a ten-frame card and ask students to communicate how many more are needed to make ten. Students should show their answers to check accuracy.

  (3N10.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Strategies for Addition Facts

TR: pp. 4 - 7

SB: pp. 82 - 85

Lesson 2: Relating Addition and Subtraction

TR: pp. 8 - 10

SB: pp. 86 - 88

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- Three in a Row

Strand: Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to

3PR3 Solve one-step addition and subtraction equations involving a symbol to represent an unknown number.

[C, CN, PS, R, V]

Achievement Indicator:

3PR3.1 Explain the purpose of the symbol in a given addition or subtraction equation with one unknown.

Elaborations—Strategies for Learning and Teaching

In Grade Two, students demonstrated and explained the meaning of equality and inequality by using manipulatives and diagrams (2PR3). Grade Three students are expected to solve one-step addition and subtraction equations involving symbols representing an unknown number.

An equation is a mathematical sentence with an equal sign. The amount on one side of the equal sign has the same value as the amount on the other side. For some students the equal sign poses a difficulty. Although they are comfortable with 4 + 5 = $\square$, they interpret the equal sign to mean "find the answer". Therefore when students see the sentence $\square$ – 4 = 5, they may not be sure what to do as they think the answer is already there. Similarly, students may solve 4 + $\square$ = 5 by adding 4 and 5 to "get the answer". The notion of an equation as an expression of balance is not apparent to them. It is important for students to recognize that the equal sign is viewed as a way to say that the same amount has two different names, one on either side of the equal sign. The term "equation" can be added to word walls and/or dictionaries and should be pointed out often.

The focus of this outcome is to ask students to develop strategies to help them solve equations when there is a symbol representing an unknown number, for basic addition facts to 9 + 9 and related subtraction facts. E.g.,

$$9 + \triangle = 16$$

$$16 - \triangle = 9$$

It is also very important to read and interpret equations in a meaningful way. 9 + $\triangle$ = 16 may be interpreted as, "What do I need to add to nine to get 16 ? or "If 16 is made up of two parts, and one part is nine, how many are in the other part?"

The book *Equal Shmequal* by Virginia Kroll, for example, would be useful in teaching this concept. Before reading the book, ask students to brainstorm the meaning of "equal". Encourage symbols or examples as suggested by the students. Read the story aloud. Model, using counters on a balance scale, each animal – the bee = 1, mouse = 2, etc. Demonstrate a balance of the animals, like a see-saw. Ask students to explore the concept, preferably on their own balances or working in pairs, and continue to link the animals to the story. Challenging students, for example, to balance a bear or two rabbits. Use language such as "balance, equal, equality, sum", etc., as number sentences are written to match the balances.

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies

Performance

- Using a balance scale, ask students to demonstrate how to find the unknown numbers of the following equations:
  - (i) $15 = 18 - \triangle$
  - (ii) $\triangle + 4 = 12$
  - (iii) $16 - \triangle = 9$
  - (iv) $11 = \triangle + 5$

(3PR3.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: Addition and Subtraction Equations

TR: pp. 11 - 14

SB: pp. 89 - 92

Suggested Resources

Children's Literature

- *Equal Shmequal* by Virginia Kroll
- *Subtraction Action* by Loreen Leedy

Strand: Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to

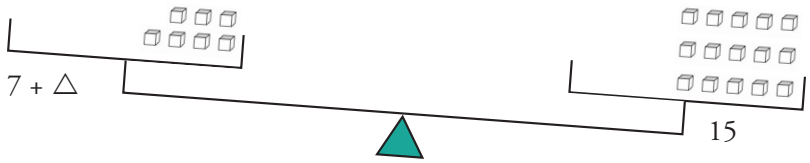
3PR3 Continued

Achievement Indicators:

3PR3.1 (Continued) Explain the purpose of the symbol in a given addition or subtraction equation with one unknown.

Elaborations—Strategies for Learning and Teaching

Using a balance scale, counters, or other stacking manipulatives, and a recording sheet, ask students to place counters on the balance scale to represent the equation 7 + △ = 15 by placing seven counters in the left pan and 15 counters in the right pan.



Ask students to predict how many more counters are needed in the left pan to balance the scale. Record their predictions on a recording sheet. Students add counters to the left pan to see if their predictions are correct and to determine the missing addend. Next, they complete the recording sheet.

Equation with unknown numbers	Predictions for unknown numbers	Actual unknown numbers
7 + △ = 15	△ 6, △ 8, △ 7, △ 9	7 + △ 8 = 15

Ask them to repeat this task using other equations with one unknown number. Through this investigation and discussion, students should see that the symbol △ representing the unknown number must be a number that will balance the equation.

3PR3.2 Create an addition or subtraction equation with one unknown to represent a given combining or separating action.

Prepare a deck of number cards, a card with an equal sign, and an "operations" die. Have a student choose two cards from the deck and roll the die to find the operation (e.g., 8, 3, −). Ask the student to place one of the numbers first, then the operation card and finally the second number after the equal sign. The student should record the equation on a recording sheet using a symbol to represent the unknown number. Ask the student to determine the missing number and explain how he/she arrived at the answer.

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies

Paper and Pencil

- Ask students to create addition and subtraction equations with unknowns whereby the "Number of the Day" is the only number on one side of the equation. If, for example, the number of the day is 16, possible equations with an unknown could include:

  16 = 8 + △ □ + 6 = 16 18 − ○ = 16

  (3PR3.2, 3PR3.3)

- Ask students to create their own addition and subtraction equations with an unknown number. Encourage them to create different symbols to represent the unknown numbers. Play music and ask students to walk around the room. When the music stops, students give their equation to a classmate standing near them. They then take the equation card to their desks to find the unknown and explain to the student, who created the problem, how they arrived at the answer.

  (3PR3.2, 3PR3.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3 (Continued): Addition and Subtraction Equations

TR: pp. 11 - 14

SB: pp. 89 - 92

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- table for equation predictions
- adding and subtracting activity

Strand: Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to

3PR3 Continued

Achievement Indicators:

3PR3.3 Provide an alternative symbol for the unknown in a given addition or subtraction equation.

3PR3.4 Solve a given addition or subtraction equation with one unknown that represents combining or separating actions, using manipulatives.

3PR3.5 Solve a given addition or subtraction equation with one unknown, using a variety of strategies, including guess and check.

Elaborations—Strategies for Learning and Teaching

Explain to students that a symbol should not be a complex picture, but a simple representation.

Students should be exposed to using varying symbols to represent the unknown (e.g., a triangle, square or circle).

6 + △ = 18 6 + □ = 18 6 + ○ = 18

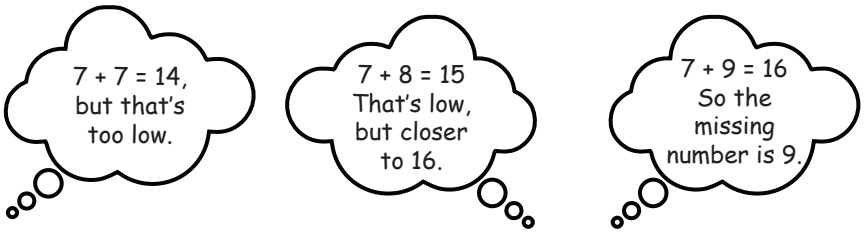
To solve addition or subtraction equations with one unknown, students need to explore different strategies. Students can use manipulatives to solve some problems, for example,

- Ms. Best needs 18 pieces of construction paper for art class. She has 7 pieces, how many more pieces of construction paper does she need?

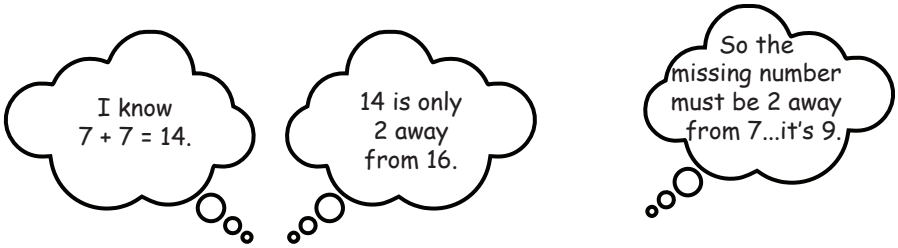
Observe to see if students start with 18 and separate 7 from the group to find the unknown or if they start with 7 and add up to 18.

Other examples of strategies students may use include, but are not limited to, the following:

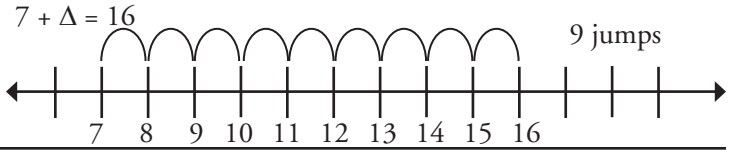
- Guess and Check - This strategy is based on trying different numbers. The key is to think after each try and change or revise the guess when necessary. E.g., 7+ △ =16



- Mental Math - E.g., 7+ Δ = 16



- Number Line - Create a number line with the start point being seven. Then count up to 16, keeping track by using the number line. E.g., 7 + Δ = 16



General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies

Performance

- Present students with an equation where there is an unknown and ask them to model, with manipulatives, how to find the missing number.

(3PR3.4)

Portfolio

- Present students with equations, involving addition and subtraction, where there is one unknown number on either side of the equal sign.

  Examples include:

  $15 - \triangle = 9$

  $\triangle + 8 = 13$

  $17 = \bigcirc + 11$,

  $7 = \bigcirc - 4$

  $15 + 3 = \triangle$

  Ask students to solve the equations and then choose one and explain their strategy.

(3PR3.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3 (Continued): Addition and Subtraction Equations

TR: pp. 11 - 14

SB: pp. 89 - 92

Strand: Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to

3PR3 Continued

Achievement Indicators:

3PR3.6 Solve a given addition or subtraction equation when the unknown is on the left or the right side of the equation.

3PR3.7 Explain why the unknown in a given addition or subtraction equation has only one value.

Elaborations—Strategies for Learning and Teaching

It is important that students read and solve equations when the unknown number is on either the left of the equal sign or the right of the equal sign.

Example of unknown on the left: $12 + \triangle = 18$

Example of unknown on the right: $14 = \triangle - 4$

Present students with an equation such as:

$17 = 8 + \triangle$

Demonstrate, using manipulatives, how to find the unknown number. Begin with 17 counters. Secretly place eight under a cup. Ask students to tell how many are under the cup by viewing what is left. Ask other guiding questions:

- Could the number be anything else?
- Can you explain what you are thinking?

After demonstrating this process to students, ask students to use manipulatives to find missing numbers in various equations.

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies

Performance

- Present student with two numbers and ask them to create and solve equations where one of the numbers is unknown. For 14 and 6, for example, possible equations could be:

  $14 - \triangle = 6$ $\quad$ $6 + \bigcirc = 14$ $\quad$ $14 = 6 + \triangle$

  (3PR3.6)

Journal

- Ask students to respond to the following:
  - (i) Sean says if he makes 16 cupcakes and only puts icing on 7, there will be 9 without icing. Do you agree or disagree?
  - (ii) Sara saw $14 = 6 + \triangle$. She said that the $\triangle$ represents 10. Is she correct? Explain using pictures, numbers and words.

  (3PR3.6, 3PR3.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3 (Continued): Addition and Subtraction Equations

TR: pp. 11 - 14

SB: pp. 89 - 92

Strand: Number

Outcomes

Students will be expected to

3N8 Apply estimation strategies to predict sums and differences of two two-digit numerals in a problem solving context.

[C, ME, PS, R]

Achievement Indicator:

3N8.1 Estimate the solution for a given problem involving the sum of two two-digit numerals; e.g., to estimate the sum of 43 + 56, use 40 + 50 (the sum is close to 90).

Elaborations—Strategies for Learning and Teaching

Estimation is a mental "process of producing an answer that is sufficiently close to allow decisions to be made" (Reys 1986, p. 22). "Students should be encouraged to explain their thinking, frequently, as they estimate. As with exact computation, sharing estimation strategies allows students access to others' thinking and provides many opportunities for rich class discussions." (*Principles and Standards for School Mathematics*, 2000, p. 156)

When students estimate first and then calculate, they refine their estimation strategies. When estimating, the context will determine if an exact answer or an estimate is appropriate and whether a high estimate or a low estimate is more appropriate. In discussing estimating sums, give students the following problem:

Karen is taking piano lessons and her piano teacher asked her approximately how much time she practiced on Saturday and Sunday. Karen knew she practiced 43 minutes on Saturday and 56 minutes on Sunday. To find an estimate for 43 + 56, Karen may use one of the strategies below:

- Front-end Strategy - The front-end strategy is a method of estimating computations by keeping the first digit in each of the numbers and changing all the other digits to zeros. This strategy can be used to estimate sums and differences. Note that the front-end strategy always gives an underestimate for sums. Change each number to the number of tens: 43 becomes 40 and 56 becomes 50.
  40 + 50 = 90. Karen could say she practiced about 90 minutes.
- Round to Ten Strategy - Round each number to the nearest multiple of 10. 43 can be rounded to 40 and 56 can be rounded to 60. Then 40 + 60 = 100. Karen could say she practiced about 100 minutes.

Estimating differences occurs later in this unit.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Ask students to use pictures, numbers and words to explain the following: Matthew has 95¢. He wants to buy a pack of gum that costs 50¢ and a bottle of water that costs 35¢. He estimates that he does not have enough money to buy both. Is he correct? Use pictures, numbers and words to explain.

(3N8.1)

Journal

- Ask students to respond to the following:
  - (i) Ryan estimated that 35 + 46 would be about 70. Explain how he made that estimate.
  - (ii) Julia needs 24 popsicle sticks for her art project. She has 15 collected. She estimates that she will need about 10 more to make 24. Is her estimate reasonable? Use pictures, numbers and words to explain.

(3N8.1)

Performance

- Invite students to play "Estimating Sums". Students play in pairs. Students take turns choosing two numbers from the game board and circling them. Next they add the two numbers using an estimation strategy. Students record points according to the chart below and keep playing until all the numbers on the board are used up.

Estimating Sums				
23	29	68	19	74
5	11	18	21	49
60	13	33	27	15
12	36	35	55	8
15	39	17	46	44

Estimated Total	0 to 20	20 to 40	40 to 60	60 to 80	80 to 100	Over 100
Points	1	2	3	3	2	1

The player with the highest score is the winner. After giving the students several opportunities to play this estimating game, ask students: How did estimating help you get more points? Explain your estimation strategy.

(3N8.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4: Estimating Sums

TR: pp. 15 - 17

SB: pp. 93 - 95

Supplementary Resource

Children's Literature

- *Greater Estimations* by Bruce Goldstone

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- Estimating Sums game board

Strand: Number

Outcomes

Students will be expected to

3N6 Describe and apply mental mathematics strategies for adding two two-digit numerals.

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

Achievement Indicators:

3N6.1 Add two given two-digit numerals, using a mental mathematics strategy, and explain or illustrate the strategy.

3N6.2 Explain how to use the "adding from left to right" strategy; e.g., to determine the sum of 23 + 46, think 20 + 40 and 3 + 6.

3N6.3 Explain how to use the "taking one addend to the nearest multiple of ten and then compensating" strategy; e.g., to determine the sum of 28 + 47, think 30 + 47 – 2 or 50 + 28 – 3.

3N6.4 Explain how to use the "using doubles" strategy; e.g., to determine the sum of 24 + 26, think 25 + 25; to determine the sum of 25 + 26, think 25 + 25 + 1 or doubles plus 1.

3N6.5 Apply a mental mathematics strategy for adding two given two-digit numerals.

Elaborations—Strategies for Learning and Teaching

Students encounter many strategies over time, but will eventually settle on two or three that are most efficient for them. Record students' thinking on the board for all students to see as this will help other students try the strategies as well. Hearing others explain their reasoning helps students develop mathematical language as well as written communication about their mental math strategies.

The two parts that make up the whole are the addends. In 23 + 46 = 69, for example, the "23" and "46" are the addends. It is not necessary to expect students to use these terms. However, it is good to model this language as it gives students a name for these particular numbers.

Some mental mathematics strategies for adding are:

Strategy	Elaboration	Example
Adding left to right	Add the tens and add the ones and then combine them together	46 + 12 = __ 40 + 10 = 50 and 6 + 2 = 8. Then, adding those two sums together, 50 + 8 = 58 So 46 + 12 = 58
Using multiples of ten and compensating	Taking one addend to the nearest multiple of ten and then compensating	69 + 28 = __ 69 is close to 70 70 + 28 = 98 and 69 is one less than 70, so 69 + 28 is 1 less than 98. So 69 + 28 = 97
Using doubles	Use a doubles fact you know to help find the sum	32 + 30 = __ 30 + 30 = 60 and 32 + 30 is 2 more So 32 + 30 = 62

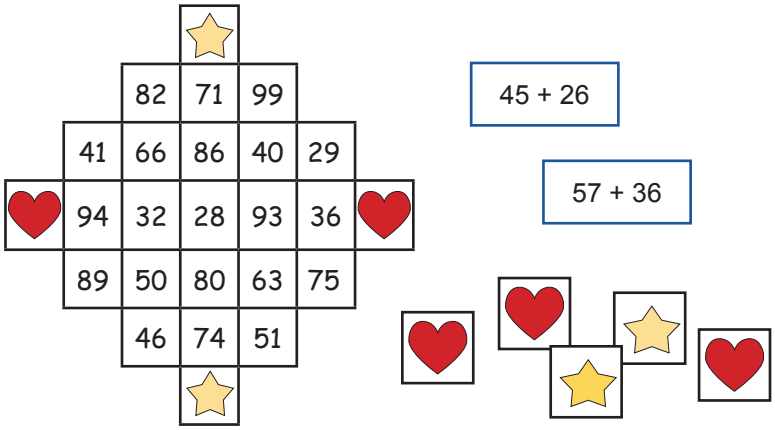
Morning routine is an excellent time to apply and reinforce mental math strategies. Ask, for example, "If it is the 16th of the month, what will the date be in two weeks?" Ask a student to share with the class which strategy he/she used to arrive at an answer.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Invite students to play "Stars and Hearts". Present students with a deck of two-digit addition equations whose sums are on the game board illustrated below. The "star" and "heart" spaces on the game board are like "Free" squares in Bingo. Students shuffle the cards. Player 1 picks a card, solves the equation and explains the strategy to his/her partner. If the sum is on the game board he/she may cover the number with a star card or a heart card. Player 2 then chooses a card from the deck and repeats the process. Player 2 covers their sum with the other shape card. The winner is the first player to cover three numbers in a row on the board.



(3N6.1, 3N6.5)

Interview

- In a conversation with a student ask:
  - (i) What is the sum of 25 + 28? Which strategy did you use?
  - (ii) What is the sum of 39 + 28? Which strategy did you use?
  - (iii) What is the sum of 64 + 33? Which strategy did you use?

(3N6.2, 3N6.3, 3N6.4, 3N6.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 6: Using Mental Math to Add

TR: pp. 22 - 23

SB: pp. 100 - 101

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- Stars and Hearts template

Strand: Number

Outcomes

Students will be expected to

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]

Achievement Indicator:

3N9.1 Model the addition of two or more given numbers, using concrete or visual representations, and record the process symbolically.

Elaborations—Strategies for Learning and Teaching

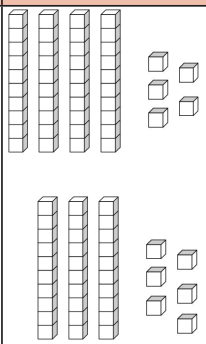
Research has shown that students will create different strategies for adding and subtracting. A classroom climate that fosters communication and sharing of personal strategies will allow for many methods to be explored. Students will choose strategies that make sense to them.

The focus will now be on adding two-digit numbers followed by the introduction of three-digit addition. Later, the same order will be followed for subtraction, first working with two-digits, then working with three-digits. Students have had experience with adding and subtracting two-digit numbers in Grade Two (2N9).

Visual representations may include, but are not limited to, hundreds charts, number lines, place value mats and base ten materials.

Students should investigate a variety of strategies, including standard/traditional algorithms, to become proficient in at least one appropriate and efficient strategy which they understand.

Provide an empty basket, base ten materials (rods and units) and recording sheets. Students work in pairs. Player A chooses a handful of base ten rods and units to represent a two-digit number. Both players record the number on their recording sheets. Player A puts his base ten materials into the empty basket. Player B repeats the process. Both players write an addition problem to represent the joining of the base ten materials that were selected. After both partners figure out the total, they count the value of the base ten materials in the basket and check to confirm their answers.

Numbers	Base Ten Blocks	Addition Problem	Explain Using Words
45 36		40 + 30 = 70 5 + 6 = 11 70 + 11 = 81	I know the answer is 81 because I added the tens 40 + 30 and I got 70. Then I added the ones 5 + 6 and got 11. Then 70 + 11 = 81. So the answer is 81.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Present students with a story problem such as:

  Eric has 27 hockey cards, Shania has 42 hockey cards, and Jenna has 29 hockey cards. If the children combined their collections, how many hockey cards would they have all together?

  Ask students to model the addition problem with base ten blocks and record in their math journal.

(3N9.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 5: Adding 2-Digit Numbers

TR: pp. 18 - 21

SB: pp. 96 - 99

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- table for explaining addition

Strand: Number

Outcomes

Students will be expected to

3N9 Continued

Achievement Indicators:

3N9.1 (Continued) Model the addition of two or more given numbers, using concrete or visual representations, and record the process symbolically.

3N9.2 Create an addition or subtraction story problem for a given solution.

3N9.3 Determine the sum of two given numbers, using a personal strategy; e.g., for 326 + 48, record 300 + 60 + 14.

Elaborations—Strategies for Learning and Teaching

Give students a deck of number cards. Ask students to choose two or more cards from the deck. Write the addition equation and then find the sum using a hundred chart or number line. Observe the students as they are solving the equation.

- Ask students to explain their solution.
- Which number are they starting with?
- What strategies are they using for adding on the hundred chart?

For example,
29 + 36 = ○.

A student explanation may be: "I started with 36 because it's the largest number. I moved down 3 rows on the hundred chart which is 30, which is 1 more than 29 so then I moved back one space. So 29 + 36 = 65.

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

When tasks involving computation are rooted in problems, students see the purpose in using computation. Take advantage of problems that arise daily to create story problems, for example, giving back change from a recess order, ordering books for a book order, etc. The "Number of the Day" can be given as a solution, and students asked to create an addition or subtraction story for the solution.

Prepare a bag of two-digit numeral cards and a recording sheet. For this task, students work in pairs. Ask students to choose two cards. They find the sum, using any strategy they want. After five draws, students choose one of their addition problems and explain their strategy. Later in the unit, this activity may be extended to include some three-digit number cards.

Numbers	How I found the sum
26 + 48	20 + 40 = 60 6 + 8 = 14 60 + 10 + 4 = 74

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Give students one-, two-, or three-digit numbers, and an "exit card". Before the class/day ends, ask students to create a story problem using the given numbers and then solve it using pictures, numbers and words. Students pass in their exit cards as they leave the class. This type of assessment can be repeated often throughout the year. A helpful strategy for creating story problems is "3IQ". "3IQ" is a mnemonic device for students, reminding them to create story problems with four pieces: *I*ntroduction, *I*nformation, *I*nformation, *Q*uestion". For example: I went for a walk in the park. I saw 20 kids playing soccer. I also saw 12 kids in the playground. How many kids did I see in the park?

(3N9.2)

Journal

- Ask students to respond to the following:

  How would you find the sum of 322 and 86? Explain your strategy.

(3N9.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 5 (Continued): Adding 2-Digit Numbers

TR: pp. 18 - 21

SB: pp. 96 - 99

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- table for explaining how to find the sum

Strand: Number

Outcomes

Students will be expected to

3N9 Continued

Elaborations—Strategies for Learning and Teaching

In Grade Two, students added one- and two-digit numerals with answers to 100, and worked with the corresponding subtractions (2N9). In Grade Three, students continue to work on combining and separating larger numbers in a variety of ways as they solve two- and three-digit addition and subtraction problems. Earlier in this unit, students worked with adding two-digit numbers. Now the focus will include three-digit numbers as well.

Strategies invented by classmates should be discussed, shared and explored by others. This allows for exposure to a variety of strategies so that students can choose those that make sense to them. Personal strategies are generally faster than the traditional algorithm and make sense to the person using them.

It is important to reinforce proper mathematics vocabulary. "The terms "regroup", "trade" and "exchange" are used rather than the terms "carry" or "borrow". This is because carrying and borrowing have no real meaning with respect to the operation being performed, but the term "regroup" suitably describes the action the student must take" (Small, 2008, p.170).

Achievement Indicator:

3N9.1 (Continued) Model the addition of two or more given numbers, using concrete or visual representations, and record the process symbolically.

Having students use models is vital for understanding the relationship between the physical action of joining and/or separating two groups and the symbolic representation. Students should use base ten materials to concretely represent the joining and separating of groups. Hundreds charts can also be used. Students have been introduced to the standard/traditional algorithm in Grade Two and may use it as an addition or subtraction strategy.

Questions involving adding three digit numbers should start with adding multiples of 100, for example, 326 + 100 or 326 + 300. Then adding multiples of 100 and of ten, for example, 256 + 120. Next, questions involving adding a three-digit number to another three-digit without regrouping should be solved. Finally, regrouping questions should be introduced.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Tell students that two schools are joining together to raise money to contribute to a children's hospital. One school raised $121.00 and the other school raised $193.00. Ask students to model the addition of the two numbers (i.e. 121 and 193) using base ten materials. Ask students to record their work pictorially and symbolically to show how they solved the equation. Discuss with the students if this strategy worked well for them or if they have another strategy that they would prefer to use.

(3N9.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 7: Adding 3-Digit Numbers

TR: pp. 24 - 27

SB: pp. 102 - 105

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- table for explaining addition

Strand: Number

Outcomes

Students will be expected to

3N9 Continued

Achievement Indicators:

3N9.1 (Continued) Model the addition of two or more given numbers, using concrete or visual representations, and record the process symbolically.

3N9.2 (Continued) Create an addition or subtraction story problem for a given solution.

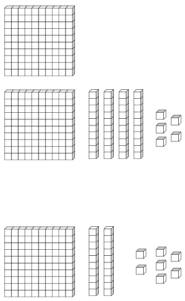
3N9.3 (Continued) Determine the sum of two given numbers, using a personal strategy; e.g., for 326 + 48, record 300 + 60 + 14.

3N9.4 Refine personal strategies to increase their efficiency.

3N9.5 Solve a given problem involving the sum or difference of two given numbers.

Elaborations—Strategies for Learning and Teaching

As a class, use a spinner or a deck of number cards to generate two three-digit numbers. Create an addition number sentence and have students explain the strategy they used to solve the problem. Then students should use base ten materials to show their workings concretely and visually.

Numbers	Base Ten Blocks	Addition Problem	Explain Using Words
245 127		245 + 127= ___ 200 + 100 = 300 40 + 20 = 60 5 + 7 = 12 300 + 60 =360 360 + 10 + 2 = 372	I know the answer is 372 because I added the hundreds 200 + 100 and I got 300. Then I added the tens 40 + 20 and I got 60. Then I added the ones 5 + 7 and got 12. So 300 + 60 = 360 and then I added on 12 more, so 360 + 12 = 372. So 245 + 127 = 372.

It is important that students be involved in solving meaningful and worthwhile addition and subtraction tasks that connect to everyday life. Model the creation of stories in mathematics routines by using the date or number of days in school as a given solution. Students can use games, scores, money and other relevant experiences to help create their own stories for any number. Students will model their answers using pictures, numbers and words.

Provide students with two decks of number cards: Deck A of three-digit numbers, and Deck B of two-digit numbers. Students choose a card from each deck and find the sum using their personal strategy. Ask students to record their work. After completing this three or four times, ask students to identify their largest sum and place the number on a class number line.

Through various experiences working individually or with a group, students will have opportunities to discover their own personal strategies for computation.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Portfolio

- Ask students to create and write an addition and/or subtraction story problem for a given solution. If, for example, the answer is 121, what could the problem be? Ask students to write the corresponding number sentence and then solve the problem using pictures, numbers, and words. This assessment lends itself well to being part of a mathematics routine and should be repeated throughout the year using a variety of one-, two-, and three- digit numerals. Students may need to use the 3IQ strategy when creating story problems.

(3N9.2)

Interview

- Provide students with two numbers. Ask students to find the sum and explain the strategy they have used. Students may use base ten blocks or other manipulatives to aid in their explanation. Observe students for correct use of math language and depth of understanding.

(3N9.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 7 (Continued): Adding 3-Digit Numbers

TR: pp. 24 - 27

SB: pp. 102 - 105

Strand: Number

Outcomes

Students will be expected to

3N8 Apply estimation strategies to predict sums and differences of two two-digit numerals in a problem solving context.

[C, ME, PS, R]

Achievement Indicator:

3N8.2 Estimate the solution for a given problem involving the difference of two two-digit numerals; e.g., to estimate the difference of 56 – 23, use 50 – 20 (the difference is close to 30).

Elaborations—Strategies for Learning and Teaching

Estimating sums and differences is valuable because it helps predict an answer and check a calculation. As with estimating sums, when using estimation in a problem solving context with a difference, there are important things to keep in mind. What is best, an exact answer or an estimate? How important is it for the estimate to be close to the exact value? Is it better to have a low or high estimate?

The following are some strategies to explore:

- Front-end Strategy – The front-end strategy is a method of estimating computations by keeping the first digit in each of the numbers and changing all the other digits to zeros. When estimating 77 - 24, write each number to the number of tens. 77 becomes 70 and 24 becomes 20. Subtract: 70 − 20 = 50
- Round to Ten Strategy - Round each number to the nearest multiple of 10. When estimating 77 - 24 , 77 rounds to 80 and 24 rounds to 20. Subtract: 80 - 20 = 60

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Ask students to respond to the following:
  - (i) There are 68 pencils left in the Grade Three classroom supplies. There are 24 students and each child gets a new pencil. About how many pencils are left in the classroom supplies?
    Lisa estimated about 40 pencils are left and Yolanda estimated about 50 pencils are left. The class agrees with both estimates. Using pictures, numbers or words, explain how this is possible.
  - (ii) Erin has 83 coloured beads to make necklaces for her friends. She uses 37 beads to make a necklace for Julia. About how many beads does Erin have left?

(3N8.2)

Paper and Pencil

- Write two numbers on the board, for example, 28 ↔ 38. Ask students to find combinations of numbers that, when added or subtracted, fall within the range of the given numbers. For example, 40 − 4 falls within the range of 28 and 38, as does 15 + 17.

(3N8.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 8: Estimating Differences

TR: pp. 29 - 31

SB: pp. 107 - 109

Strand: Number

Outcomes

Students will be expected to

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]

Achievement Indicators:

3N9.2 (Continued) Create an addition or subtraction story problem for a given solution.

3N9.6 Model the subtraction of two given numbers, using concrete or visual representations, and record the process symbolically.

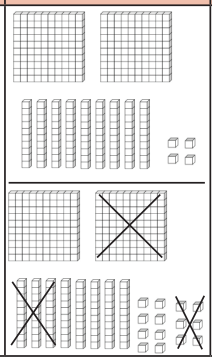
3N9.7 Determine the difference of two given numbers, using a personal strategy; e.g., for

127 – 38, record 38 + 2 + 80 + 7 or 127 – 20 – 10 – 8.

Elaborations—Strategies for Learning and Teaching

Subtracting two-digit numbers should be reviewed prior to starting work with subtracting three-digit numbers. Again, students should start with concrete materials and pictures, and then move to representing subtraction symbolically. To consolidate understanding of "regrouping", students need continuous experiences modelling with concrete materials such as base ten materials. Students need to make the connection between the operation and what it physically looks like. "The literature has been clear, as has conventional practice, that you move students from the concrete to the symbolic. Teachers know that students learn through all of their senses, so the use of concrete materials, or manipulatives, makes sense from this perspective alone. However, what makes the use of manipulatives even more critical in mathematics is that most mathematical ideas are abstractions, not tangibles." (Small, 2008. *Making Math Meaningful to Canadian Students K-8*, p. 639)

To practice representing with concrete materials and visuals, ask students to choose two number cards (one-, two- or three-digit numbers). Together, create a story problem and number sentence. Ask students to use base ten materials to model how to solve the problem. Students should represent their model with pictures.

Numbers	Base Ten Blocks	Subtraction Sentence	Explain Using Words
294 136		294 - 136 = ___	I know that 294 - 136 = 158 because I tried to subtract the ones but I had to regroup a 10. So 14 - 6 = 8. Next I subtracted the tens 8 - 3 = 5 tens or 50. Last I subtracted the hundreds 2 - 1 = 1 hundred. 100 + 50 + 8 = 158.

When subtracting from a "double zero" number, students can use their experience with representing numbers in different ways to regroup. When subtracting 500 - 163, for example, students may represent the question symbolically like this:

$$\begin{array}{r} 5\ 0\ 0 \\ -\ 1\ 6\ 3 \\ \hline \\ \hline \end{array}$$

Knowing that 500 can be represented as 499 + 1, students can rewrite the question like this and subtract:

$$\begin{array}{r} 4\ \ 9\ \ 9 + 1 \\ \cancel{5}\ \cancel{0}\ \cancel{0} \\ -\ 1\ 6\ 3 \\ \hline 3\ \ 3\ \ 6 + 1 \\ \hline \end{array}$$

So, 500 - 163 = 337.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Portfolio

- Present students with two multi-digit numbers. Ask students to find the difference and model their thinking using one of the following: base ten blocks, hundreds chart, number line, money, etc.

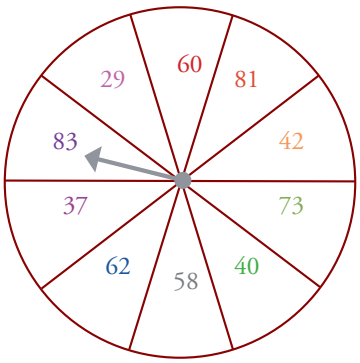
(3N9.6)

- Present students with a two- or three-digit number. Ask them to create a subtraction story for the given number where the number is the solution. Ask students to write the number sentence for the story and to solve the problem using concrete or visual representations. Ask students to record their representation.

(3N9.2, 3N9.6)

Paper and Pencil

- Ask students to spin the spinner twice and record the numbers. Write the subtraction problem. Ask students to use base ten materials to represent the minuend concretely and pictorially. Subtract the other number from the base-ten materials, making all necessary trades and recording the changes on the recording sheet.



(3N9.6)

- Present students with a subtraction problem, for example, "Cameron has 73 toy cars. He shares 47 of them with his brother, Jacob. How many does Cameron have now?" Ask students to solve the problem and explain their strategy.

(3N9.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 9: Subtracting 2-Digit Numbers

TR: pp. 32 - 35

SB: pp. 110 -113

Suggested Resources

Children's Literature

- *Shark Swimathon* by Stuart J. Murphy

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- table for explaining subtraction
- two-digit spinner

Strand: Number

Outcomes

Students will be expected to

3N9 Continued

Achievement Indicator:

3N9.7 (Continued) Determine the difference of two given numbers, using a personal strategy; e.g., for 127 – 38, record 38 + 2 + 80 + 7 or 127 – 20 – 10 – 8.

Elaborations—Strategies for Learning and Teaching

For further practice of subtracting, engage students in a game of "Connect Three". Player 1 chooses two numbers from the cards and subtracts the two numbers. If the difference is on the grid, he/she may place a counter on that square. Player 2 repeats the process using a different coloured counter. Once a number is covered it cannot be covered again. The winner is the person to get three counters in a row, horizontally, vertically or diagonally.

Observe students as they play the game. Question students about the strategies they are using to find the difference. It is important to note whether they are subtracting the smaller number from the larger number.

60 82 41 79 35 56 27

Connect Three				
52	12	41	38	23
19	3	21	25	47
15	26	14	6	33
4	55	44	29	8

136 305 523 708 664 419 251

Connect Three				
169	387	572	528	283
115	218	403	359	114
54	185	141	104	272
44	289	457	245	168

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Present students with two numbers, for example, 266 and 39. Ask students to demonstrate with base ten blocks how to subtract 39 from 266. Ask students to explain their models.

(3N9.6)

- Invite students to play "Subtraction Connect Four". Player 1 chooses a number from Group A and one from Group B. He/she works out the difference between the two numbers. If the answer appears on the grid, Player 1 places the counter on the number. If the number is not there or is already covered, Player 1 misses his/her turn. Player 2 repeats the process. The winner is the first player to have four counters in a row in any direction. This game can be used as a centre where the teacher may observe and question students' thinking about strategies they use to find the differences. Observe if students are making reasonable choices from Group A and Group B to get the differences they need to "connect four".

SUBTRACTION CONNECT FOUR					
24	11	34	153	42	3
116	81	1	32	146	51
28	70	92	52	35	91
115	61	25	147	30	73
3	80	71	65	55	6
70	10	101	9	122	63

GROUP A		
116	198	54
197	85	152

GROUP B		
82	117	127
146	207	51

(3N9.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 11: Subtracting 3-Digit Numbers

TR: pp. 38 - 41

SB: pp. 116 - 119

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- Connect Three
- Subtraction Connect Four

Strand: Number

Outcomes

Students will be expected to

3N9 Continued

Achievement Indicators:

3N9.4 (Continued) Refine personal strategies to increase their efficiency.

3N9.5 (Continued) Solve a given problem involving the sum or difference of two given numbers.

Elaborations—Strategies for Learning and Teaching

When students are involved in creating and solving problems they are more engaged. Problems, in context, help students understand the purpose of using the operations and help them make mathematical connections to the real world. Put numbers into a context as much as possible so that students are more interested and motivated to find an answer.

Students have had experience solving addition and subtraction using personal strategies. As students begin to take more risks with personal strategies, encourage them to make connections between known and new strategies, as well as between their personal strategies and the strategies of their classmates. Plenty of opportunities need to be provided for students to share their thinking and their strategies with peers.

Tasks such as "Problem of the Day" provide students with opportunities to think about what the problem is asking, what operation they need to use and what strategies they will use to solve the problem. Also, students should create their own problems involving addition and subtraction and these problems can be added to the problem bank for "Problem of the Day".

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Present students with a problem such as:

  Mr. Lush is taking the primary and elementary students skating. There are 213 primary students and 198 elementary students. How many students will be going skating?

  Observe to see if the correct operation is being used and ask students to explain their strategy. (3N9.5)

Paper and Pencil

- Ask students to create their own addition and subtraction story problems using one-, two- or three-digit numbers. Students can share their problems for others to solve.

  (3N9.2, 3N9.5)

Journal

- Ask students:

  Leida's best score on her video game yesterday was 43. Her best score today is 95. How many more points did Leida earn today than yesterday? Ask students to explain their thinking.

  (3N9.4, 3N9.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 12: Solving Addition and Subtraction Problems

TR: pp. 42 - 45

SB: pp. 120 - 123

Strand: Number

Outcomes

Students will be expected to

3N7 Describe and apply mental mathematics strategies for subtracting two two-digit numerals.

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

Achievement Indicators:

3N7.1 Subtract two given two-digit numerals, using a mental mathematics strategy, and explain or model the strategy used.

3N7.2 Explain how to use the "taking the subtrahend to the nearest multiple of ten and then compensating" strategy; e.g., to determine the difference of 48 – 19, think 48 – 20 + 1.

3N7.3 Explain how to use the "think addition" strategy; e.g., to determine the difference of 62 – 45, think 45 + 5, then 50 + 12 and then 5 + 12.

3N7.4 Explain how to use the "using doubles" strategy; e.g., to determine the difference of 24 – 12, think 12 + 12 = 24.

3N7.5 Apply a mental mathematics strategy for subtracting two given two-digit numerals.

Elaborations—Strategies for Learning and Teaching

In subtraction, the minuend is the whole, the number on the top in the vertical form or the first number in the horizontal form. For example, in 12 – 10 = 2, 12 is the minuend. The subtrahend is 10 and the difference is 2. It is not necessary to expect students to use these terms. However, it is good to expose them to the language.

Games, centres and class discussions provide opportunities to observe and question the mental math strategies that students are using to find the difference between two two-digit numbers.

Strategy	Elaboration	Example
Think addition	Add up from the smaller number to reach the larger number	62 – 45 = __ 45 + 5 = 50 and 50 + 10 = 60 and 60 + 2 = 62. So 5 + 10 + 2 was added to get to 62, and 5 + 10 + 2 = 17 so 62 – 45 = 17
Using multiples of ten and compensating	Taking the subtrahend to the nearest multiple of ten and then compensating	69 – 28 = __ 28 is close to 30 69 – 30 = 39 and 30 is two more than 28, so 39 + 2 = 41 So 69 – 28 = 41
Using doubles	Use a known doubles fact to help find the difference	62 - 30 = __ 60 = 30 + 30 so 62 = 30 + 30 + 2 So 62 – 30 = 32

It is important that strategies be discussed, shared and explored as a class. This exposure to a variety of strategies allows students to choose ones that make sense to them. A good place to reinforce mental math strategies would be during a morning routine.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Invite students to play "I Have...Who Has...?" Distribute cards to the students. Choose a student to start by reading the question on his/her card. The student with the answer to the question responds and then asks his/her question. Play continues until every student has both asked and answered a question. Sample cards are:

I have 10. Who has 40 − 10?	I have 30. Who has 22 − 14?

(3N7.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 10: Mental Math to Subtract

TR: pp. 36 - 37

SB: pp. 114 - 115

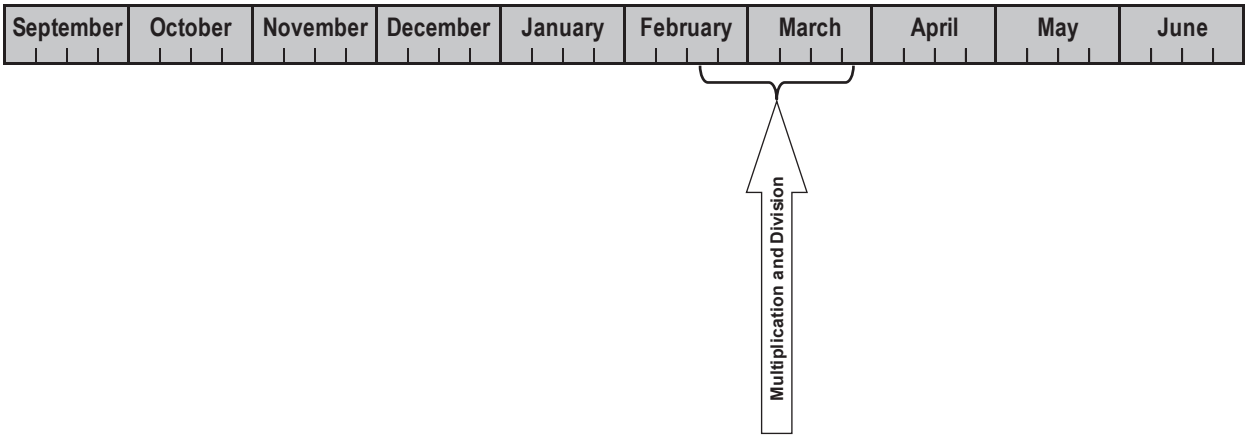
Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/addsub.html

- I Have...Who Has game

Multiplication and Division

Suggested Time: 5 Weeks



Unit Overview

Focus and Context

The focus of this unit is to set the stage for the rest of the year with respect to multiplication to 5 × 5 and its related division. This is the first explicit focus on multiplication and division in the primary grades, but as with other outcomes, it is ongoing throughout the year. In Grade Two, students had many opportunities to use mental mathematics strategies for addition such as using doubles, turn-arounds, and using addition to subtract. This knowledge will provide a fundamental basis on which to build, when multiplication is introduced. In Grade Three, the emphasis is on beginning to build students' conceptual understanding of the multiplication operation. Students should focus on the meanings of, and relationship between, multiplication and division. Students should think about multiplication numerically as repeated addition of the same quantities or equal groups, and geometrically as rows and columns in rectangular arrays. Likewise, students should think about division numerically as repeated subtraction, equal sharing, and equal grouping.

Strategies for multiplication facts are a focus in Grade Four and should not be the emphasis in Grade Three. The focus here is on understanding the meaning of multiplication and division and one to the other. "Modeling multiplication problems with pictures, diagrams or concrete materials helps students learn what the factors and their product represent in various contexts." (*Principles and Standards for School Mathematics* NCTM, p. 151)

Outcomes Framework

GCO
Develop number sense.

SCO 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.

SCO 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.

Daily Routine Opportunity

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

SCO Continuum

Grade 2	Grade 3	Grade 4
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]	4N4. Explain and apply the properties of 0 and 1 for multiplication and the property of 1 for division. [C, CN, R] 4N5. Describe and apply mental mathematics strategies, such as: • skip counting from a known fact • using doubling or halving • using doubling or halving and adding or subtracting one more group • using patterns in the 9s facts •using repeated doubling to determine basic multiplication facts to 9 × 9 and related division facts. [C, CN, ME, R] 4N6. Demonstrate an understanding of multiplication (two- or three-digit by one-digit) to solve problems by: • using personal strategies for multiplication with and without concrete materials • using arrays to represent multiplication • connecting concrete representations to symbolic representations • estimating products • applying the distributive property. [C, CN, ME, PS, R, V]

SCO Continuum

Grade 2	Grade 3	Grade 4
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]	4N7. Demonstrate an understanding of division (one-digit divisor and up to two-digit dividend) to solve problems by: • using personal strategies for dividing with and without concrete materials • estimating quotients • relating division to multiplication. [C, CN, ME, PS, R, V]

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

3N11 Demonstrate an understanding of multiplication to 5 x 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]

Elaborations—Strategies for Learning and Teaching

By the end of Grade Three, students should:

- ***understand and apply strategies for multiplication facts up to and including 5 × 5.***

Prior to this unit, students have worked extensively with the various meanings and principles of addition and subtraction, place value and patterning. This knowledge helps provide the basis for development of multiplication and division.

It is important for students to think about multiplication, numerically, as repeated addition of the same quantities or equal groups, and, geometrically, as rows and columns in rectangular arrays. The numbers being multiplied are the factors and the answer is the product.

Students need conceptual understanding of the multiplication operation rather than simply following a procedure to obtain the product. **Please note, since this is students' first introduction to multiplication, it is not expected that students achieve instant recall of the basic facts, but rather that they relate repeated addition to multiplication to determine the products up to 5 × 5.** Recall will be expected by the end of Grade Four.

Students need to be able to interpret a variety of language patterns representing multiplication experiences. Sometimes students learn multiplication facts with little understanding of what they are memorizing. Initially, students need to understand that multiplication is the process of counting objects by equal groups rather than as single objects. Help students recognize equal groups and help them develop the language of multiplication experiences. Through a variety of teacher-modelled activities, demonstrate to students how multiplication can represent equal groups that can be displayed as "rows of...", "stacks of...", "piles of...", etc. It is important not to begin by using the term "times" and the corresponding symbol because this may interfere with their understanding of the multiplication situation. It is important for students to understand the following meanings of multiplication:

- repeated addition
- equal groups or sets
- an array

Manipulatives such as buttons, counters, number lines, beans, popsicle sticks, straws, snap cubes, Link-its™, cookies, etc. should be used to model various multiplication meanings.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

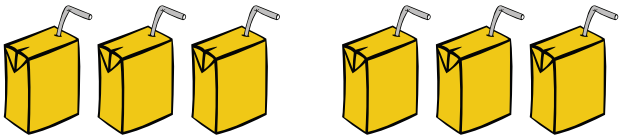
Interview

- Present a contextual multiplication problem to students and ask students to explain how they solved the problem. Ask, for example, "How many fingers are on four hands?" or "How many legs on three chairs?"

(3N11.1, 3N11.3)

Performance

- Provide various magazines, grocery flyers or books for students to collect pictures of items that are displayed in equal groups. Ask students to explain how multiplication can be used to find the total number of items.



3 + 3 = 6
2 x 3 = 6
2 groups of 3 juice boxes equals 6 juice boxes

(3N11.1, 3N11.5, 3N11.6)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch: Sports Day

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 266 - 267

Lesson 1: Investigating Equal Groups

TR: pp. 4 - 7

SB: pp. 268 - 271

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Suggested Resource

Children's Literature

- *What Comes in 2s, 3s and 4s?* by Suzanne Aker and Bernie Karlin

Strand: Number

Outcomes

Students will be expected to

3N11 Continued

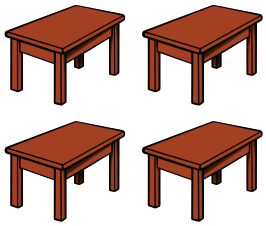
Achievement Indicators:

3N11.1 Identify events from experience that can be described as multiplication.

Elaborations—Strategies for Learning and Teaching

Challenge students to think of real life objects that come in equal groups, such as wheels on bicycles/tricycles, legs on chairs, legs on stools, three-leaf clovers, animal legs, pairs of shoes, cookies on a tray, people's eyes, or fingers on hands.

Provide a real life multiplication problem for students to solve. Ask students to find out, for example, how many eyes there are in the classroom or how many legs four tables have. When students have an answer, ask them if there is a faster way to solve the problem besides adding them up. Record all suggestions and introduce multiplication as a faster way of adding equal groups.



4 + 4 + 4 + 4 = 16 legs
4 × 4 = 16
4 legs on 4 tables equals 16 legs

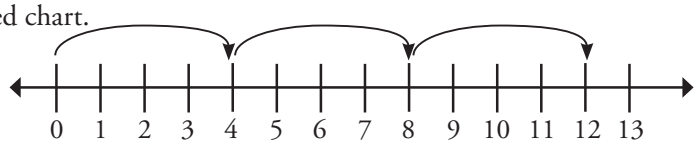
3N11.2 Represent a given story problem, using manipulatives or diagrams, and record the problem in a number sentence.

When students solve simple multiplication story problems before learning about multiplication symbolism, they will most likely write repeated-addition equations. This is an opportunity to introduce the multiplication sign and explain what the two factors mean.

One of the most meaningful ways to apply and practice multiplication is in a problem solving context. Solving real life problems is a means to help deepen students' understanding of number sense.

It is essential to provide students with visual representations such as manipulatives, pictures, diagrams and storyboards when representing and solving multiplication problems. Hundred charts and number lines should be readily available to help students visualize the connection between repeated addition and multiplication. Students have used these manipulatives to skip-count in Grade Two, and earlier in this course. When students skip count, they are saying multiples of a number. It is important for students to have a conceptual understanding of the meaning of multiples. Using language such as "one group of three is three", or "two groups of three is six", and "three groups of three is nine" helps students develop this understanding that multiples of a number are the products of that number.

To find three multiples of four, students can use a number line or a hundred chart.



They should connect this to multiplication and conclude that $3 \times 4 = 12$.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Tell a multiplication story problem that students can act out, either with classroom objects or with counters on a storyboard. E.g.,

  Claire stacks books into two piles. She put four books in each pile.

  As students are acting out the problem, encourage them to use the language patterns representing the multiplication experience. E.g.,

  (i) How many stacks is Claire making? (2 stacks)

  (ii) How many books are in each pile? (2 stacks of 4 books in each pile)

  (iii) How many books all together? (2 stacks of 4 books is 8 books)

  (3N11.2, 3N11.5, 3N11.6)

Paper and Pencil

- Provide students with a variety of personal story problems, including student names, interests, hobbies, etc. Ask them to represent the problem using manipulatives, numbers, pictures, and words.

  (i) Sophie has a collection of hockey cards. She has five pages with four hockey cards on each page. How many hockey cards does Sophie have in all?

  (ii) Evan loves to bake cookies. Each baking pan can hold four rows with three cookies in each row. How many cookies are on each pan?

  (3N11.2, 3N11.6, 3N11.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Investigating Equal Groups

TR: pp. 4 - 7

SB: pp. 268 - 271

Strand: Number

Outcomes

Students will be expected to

3N11 Continued

Achievement Indicator:

3N11.2 (Continued) Represent a given story problem, using manipulatives or diagrams, and record the problem in a number sentence.

Elaborations—Strategies for Learning and Teaching

In this hundred chart, some multiples of four are shaded.

The first three multiples of four are 4, 8 and 12. Ask students to continue shading the remaining multiples.

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

Integrate physical activities into your daily routines to reinforce math concepts such as skip counting and finding multiples of a number:

- Ask students to count by 2s, 3s, 4s or 5s when they are doing activities such as jumping jacks or toe touches.
- Ball Toss: Ask students to toss a ball to each other. Child A starts with 4, and throws the ball to Child B. Child B says 8 and throws the ball to Child C. Child C says 12 and throws the ball to Child D; and so on.

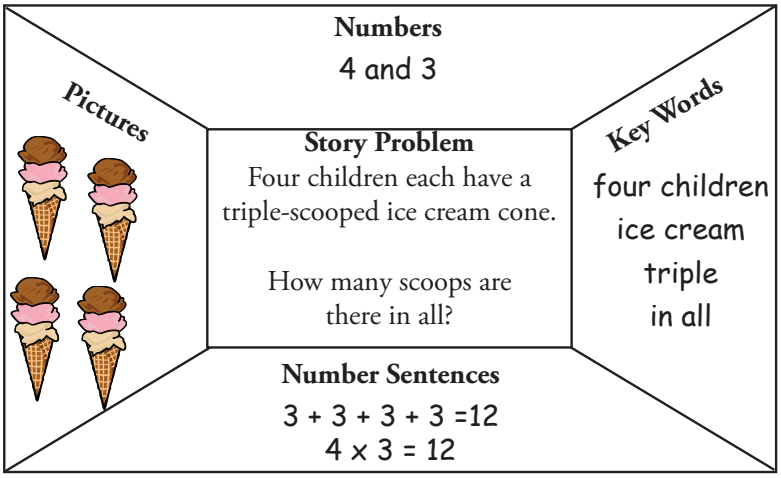
Prepare, in baggies or jars, equal groups of buttons, sorting bears, pattern blocks, snap cubes, etc. Give pairs of students sets of jars. Have the students count and record a description of their set using repeated addition and then multiplication.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Presentation

- Designate a special chair as the "Mathematician's Chair". Ask students to create and solve their own multiplication problem. Provide a graphic organizer, such as the one below, to assist students in solving their problem. Ask individual students to sit in the "Mathematician's Chair" to share their problem and how they solved it.



(3N11.2, 3N11.3, 3N11.4, 3N11.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Investigating Equal Groups

TR: pp. 4 - 7

SB: pp. 268 - 271

Supplementary Resource

Children's Literature

- *One Potato, Two Potato* by Cynthia Defelice

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- Magician's Chair template

Strand: Number

Outcomes

Students will be expected to

3N11 Continued

Achievement Indicators:

3N11.3 Solve a given multiplication problem.

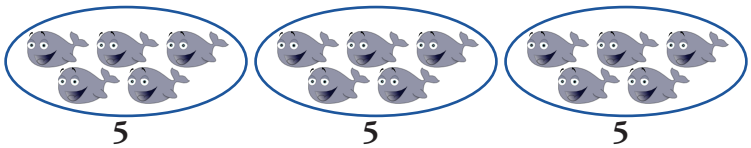
3N11.4 Create and illustrate a story problem for a given number sentence.

3N11.5 Represent, concretely or pictorially, equal groups for a given number sentence.

Elaborations—Strategies for Learning and Teaching

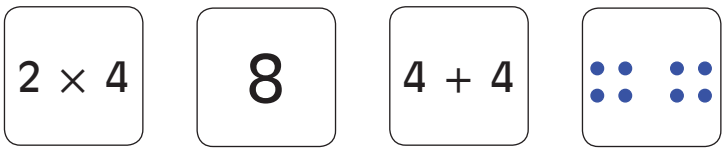
Present a multiplication sentence and ask students to represent a story problem to match, on a storyboard. Ask students to share their stories.

Provide cards that display collective nouns (e.g., school of fish, pod of whales or any picture with a group of items). Print multiplication sentences on the back of each card up to a product of 5 × 5. Ask students to use these cards to create their own word problem. For example, "There are 3 pods of whales and 5 whales in each pod. How many whales in all?"



3 x 5 =15

Provide pairs of students with five multiplication expressions on index cards such as, 5 × 1, 2 × 4, 3 × 3, 0 × 2 and 5 × 5. Ask students to use separate index cards to represent each expression pictorially as equal groups or as an array; as a repeated addition; and to represent the product symbolically. For 2 × 4, for example, the cards will be



Shuffle the cards and place them face down. Ask students to take turns choosing a pair of cards to try and find a match. When a match is found, the student keeps the pair and takes another turn. Continue until all matches are found. The player with the most cards is declared the winner.

Use everyday situations to present multiplication problems to students. Say, for example, "We used four boxes of granola bars for our breakfast program this morning. Each box had five bars. How many students were served if each student received 1 bar?"

Display various riddles from *The Best of Times* by Greg Tang, for example, as lesson starters. Using the riddle clues and the visuals, give students time to mentally solve the problem. Discuss individual problem solving strategies used by students.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Students can create picture books to illustrate multiplication facts. Have each student choose a multiplication sentence and draw a picture to match. Record the multiplication sentence below each picture. Collect all pages and assemble into a class book.

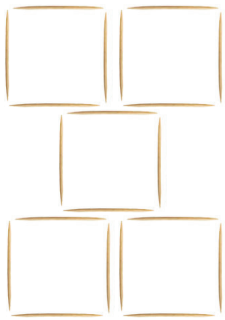
(3N11.3, 3N11.5, 3N11.8)

Journal

- Provide students with toothpicks. Ask them to use the toothpicks to make five squares. Ask students to glue or to draw the arrangement in their journals and label the arrangement in three different ways, as shown.

  Ask students to explain in words the meaning of 5 × 4 = 20 in their journals.

  If necessary, repeat the activity and use a different set of objects each time.



5 equal group of 4
4 + 4 + 4 + 4 +4
5 × 4

(3N11.3, 3N11.4, 3N11.5)

Performance

- Create centres using manipulatives and number cubes (0 - 5) to find "How many groups of...". At each center, students will roll the number cube to determine how many groups to make. Roll the number cubes again to determine how many will be in each group. Make those groups. The student then determines how many altogether and records the information on a recording sheet.

How many groups?	How many in each group?	How many all together?

(3N11.5)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1 (Continued): Investigating Equal Groups

TR: pp. 4 - 7

SB: pp. 268 - 271

Suggested Resources

Children's Literature

- *The Best of Times* by Greg Tang

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- table for How Many...

Strand: Number

Outcomes

Students will be expected to

3N11 Continued

Achievement Indicators:

3N11.6 Represent a given multiplication expression as repeated addition.

3N11.7 Represent a given repeated addition as multiplication.

3N11.8 Represent a given multiplication expression, using an array.

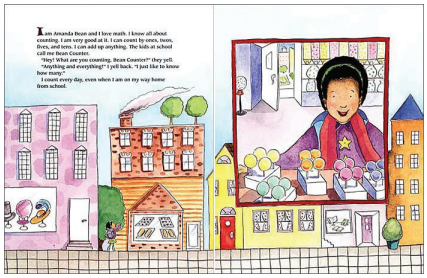
Elaborations—Strategies for Learning and Teaching

It is essential that students view multiplication as an alternate and more efficient form of repeated addition. Students should recognize that addition and multiplication describe how many there are in all when combining groups of objects. For addition, combined groups do not have to be equal. For multiplication, combined groups must be equal.

Engage the students in creating, then playing, a multiplication bingo game. As a class, create a list of repeated addition expressions and fill in bingo style cards with the related multiplication expressions. Call out repeated addition expressions from the list. Ask students to use counters to cover the matching multiplication expression on their individual game boards. The first player to cover a row, column or diagonal wins. This game can also be modified to match the products to the multiplication sentences.

When multiplying, students can think in two ways, numerically as repeated addition of the same amounts, and geometrically in rectangular arrays as rows and columns. An array is an arrangement of objects in equal rows.

Use the book *Amanda Bean's Amazing Dream*, by Cindy Neuschwander as a springboard for connecting multiplication to real life situations and showing the difference between organizing items in equal groups and arrays. Ask students, for example, to look at the second page of the book and observe the six pane windows on the building on the far right. Ask, "What do you notice about the windows?" Bring attention to the panes. Draw a window with three rows of two panes. Ask students, how they could find out how many panes there are on the window without counting. Ask how they could figure this out through multiplication. Introduce students to "rows" and "columns". Rows are horizontal (across the page) and columns are vertical (up and down the page). While it is not necessary for students to know "horizontal" and "vertical" at this time, the terms may be introduced.



From *Amanda Bean's Amazing Dream* by Cindy Neuschwander ©1998

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Create repeated addition sentence cards with the corresponding multiplication sentence cards to match, for example, 3 + 3 = 6 matches 2 × 3 = 6. Shuffle the cards, pass out to students and ask them to circulate to find their matching partner.

(3N11.6, 3N11.7)

Interview

- After reading the book, *Amanda Bean's Amazing Dream* by Cindy Neuschwander, use illustrations in the book that show equal groups. Ask questions such as:
  - (i) How many cookies are on each tray in the bakery window?
  - (ii) How many lollipops are stuck in each block?
  - (iii) How many lollipops are there altogether?
  - (iv) How many stripes are there in a loaf of bread?
  - (v) How many bushes are in the rectangle in the centre of the park?

(3N11.7, 3N11.8)

Journal

- After reading the book, *Amanda Bean's Amazing Dream* by Cindy Neuschwander, ask students to respond to the following prompts in their journals:

  (i) What is the difference between multiplying as repeated addition (such as the groups of lollipops) and using arrays (such as the cookies on the tray)?

  (ii) When would it be difficult to use repeated addition?

(3N11.7, 3N11.8)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2: Relating Multiplication and Repeated Addition

TR: pp. 9 - 11

SB: pp. 273 - 275

Lesson 3: Arrays to Multiply

TR: pp. 12 - 15

SB: pp. 276 - 279

Supplementary Resource

Children's Literature

- *Amanda Bean's Amazing Dream* by Cindy Neuschwander

Suggested Resources

Children's Literature

- *If You Were a Times Sign* by Trisha Speed Shaskan

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- blank BINGO card

Strand: Number

Outcomes

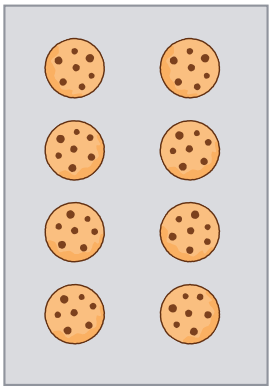
Students will be expected to

3N11 Continued
Achievement Indicator:

3N11.8 (Continued) Represent a given multiplication expression, using an array.

Elaborations—Strategies for Learning and Teaching

Give each student a sheet of paper representing a cookie tray. Ask them to choose a multiplication sentence written on an index card. Have the students arrange counters in an array to match the multiplication sentence they chose. Choose a new card and repeat. Students may also draw, cut out, and glue cookies to their "cookie trays".



$4 \times 2 = 8$

Ask students to create their own game to play with a partner called, "Which Has More?" Students create question cards such as, "Which has more: four rows with four doughnuts in each row, or three rows of five doughnuts?" Pairs of students challenge each other then move to form different pairs.

The book *Minnie's Diner* by Dayle Dodds is an excellent resource for exploring multiplication patterns. The story says repeatedly that the Mcfay brothers "ordered twice as much as the brother before." Ask students:

- Try changing the word "twice" to "three times more". How would that change the multiplication pattern?
- How many of each item would Papa receive?

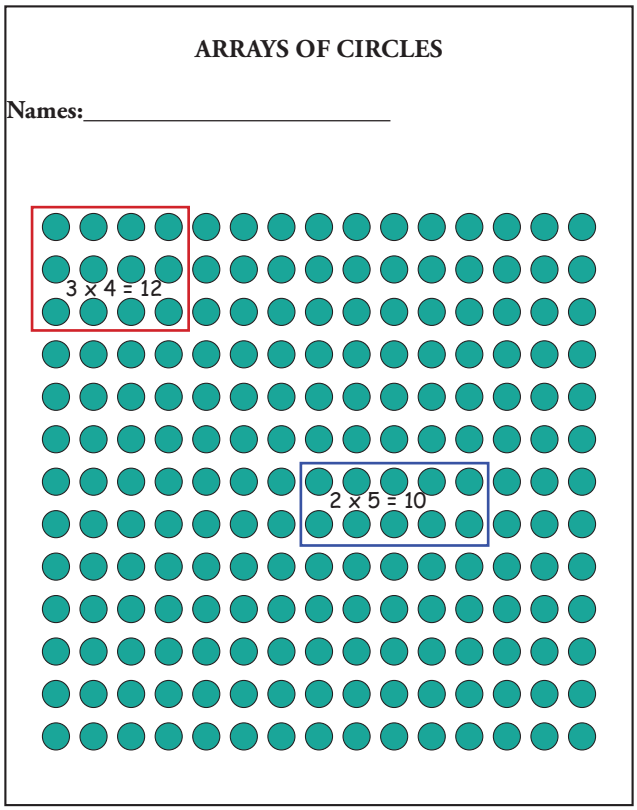
General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Provide students with a circular array recording sheet as shown below, two 0-5 number cubes, and two different coloured pencils. With a partner, ask students to take turns rolling the cubes and outline an array on the recording sheet. Use the two numbers for the dimension of the array. Record the multiplication equation inside the outline.

  E.g., write 3 × 4 =12 and say, "Three rows of 4 is 12." Once a circle has been used in an array, it cannot be used again. There cannot be overlapping. A player loses a turn if the array will not fit in the area remaining on the recording sheet. After six rounds, add for each of the two colours, the products of each rectangle outlined. The player with the greater total wins.



(3N11.8)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3 (Continued): Arrays to Multiply

TR: pp. 12 - 15

SB: pp. 276 - 279

Supplementary Resource

Children's Literature

- *Minnie's Diner* by Dayle Dodd

Suggested Resources

Children's Literature

- *The Visit* by Helen Chapman
- *One Hundred Hungry Ants* by Elinor J. Pinczes

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- array of circles

Strand: Number

Outcomes

Students will be expected to

3N11 Continued
Achievement Indicator:

3N11.9 Create an array to model the commutative property of multiplication.

Elaborations—Strategies for Learning and Teaching

Referring to the book by Cindy Neuschwander, *Amanda Bean's Amazing Dream*, draw a window to show three rows of two panes (3 × 2). Then turn the drawing to show two rows of three panes (2 × 3). Ask, "Does turning the picture change the number of panes? Why or why not?" In pairs ask students to use grid paper to make their own window panes. Switch with a partner to write two multiplication sentences for each window.

Students may like to play the "Connect Four Multiplication Game". Each pair of students will need two paper clips and 16 - 20 counters of two different colours. The player that starts places the paper clips on two numbers on the strip of factors below the game board. That player then uses one of his/her coloured counters to cover the product of those two numbers on one square of the game board. The second player moves exactly one of the paper clips to make a second product. The second player then places his/her counter on the product of those two factors. Play alternates until one player connects four of his/her own colour either horizontally, vertically or diagonally. Players will want to block each other, and this will require that they practice strategies that they have learned.

0	12	6	20	2
10	4	0	1	3
8	9	15	5	9
12	2	6	25	10
6	20	16	3	0
4	3	5	15	8

Strip of Factors					
0	1	2	3	4	5

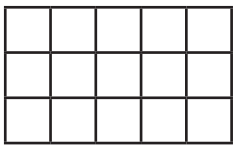
For all multiplication activities, students should have access to number lines, hundred charts, and grid paper for drawing arrays.

General Outcome: Develop Number Sense

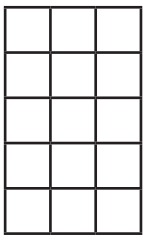
Suggested Assessment Strategies

Journal

- Ask students to use graph paper to cut out two arrays (window panes) of equal size. Then ask them to glue the arrays in their journals showing the "turn-around" or commutative property of multiplication. Label each array with the matching multiplication sentence. Ask students to write their observations, for example, turning the array does not change the product.



3 × 5 = 15



5 × 3 = 15

(3N11.9)

Paper and Pencil

- Using an exit card, ask students to draw two arrays to represent six and label each array with the matching multiplication sentences.

(3N11.9)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3 (Continued): Arrays to Multiply

TR: pp. 12 - 15

SB: pp. 276 - 279

Lesson 4: Relating Multiplication Sentences

TR: pp. 16 - 18

SB: pp. 280 -282

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- Connect Four Multiplication Game

Strand: Number

Outcomes

Students will be expected to

3N12 Demonstrate an understanding of division (limited to division related to multiplication facts up to 5 x 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]

Elaborations—Strategies for Learning and Teaching

Traditionally, multiplication and division were taught separately. It is important, however, to combine multiplication and division shortly after multiplication has been introduced. "Multiplication and division "undo" each other. They are related inverse operations. For example, if 12÷3=4, then 3 × 4=12." (*Making Math Meaningful*, Small, 2008, p. 123)

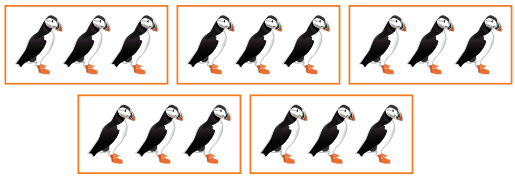
When one number is divided by another, the number being divided is the dividend. The other number is the divisor. The result is the quotient.

It is important for students to understand the three meanings of division:

- Division as Equal Sharing - In a sharing situation, some known quantity (amount) is shared equally among a known number of entities (people, boxes, packages, etc.). What is not known in a sharing situation is the amount of the given quantity per share. The quotient in this situation represents the amount per share, the size of each share or the unit rate.

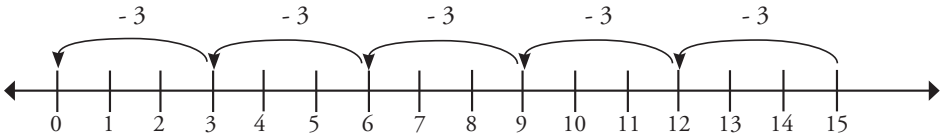
Equal Sharing
15 ÷ 3 = 5
5 is the number of items in each group if 15 items are shared equally among 3 groups.

- Division as Equal Grouping – In a grouping situation, the unknown is the number of groups of a given size that can be made from a given quantity (amount). The quotient in this situation tells how many groups of the specified size can be made from the given quantity.



Equal Grouping
15 ÷ 3 = 5
5 is the number of equal groups of 3 you can make with 15 items.

- Division as Repeated Subtraction – To divide using repeated subtraction, subtract equal groups from the total until you reach 0. Division is a shortcut for repeated subtraction.



Repeated Subtraction
15 ÷ 3 = 5
5 is the number of times you can subtract 3 from 15 before you get to 0. 15 - 3 - 3 - 3 - 3 - 3 = 0

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- To find out about students' prior knowledge of division, ask them to write a response to, "What is division?" What does it mean and what kinds of things can be divided? The focus is to find out what they understand about division and the mathematical notation used, equal grouping and equal sharing. Take note of student misconceptions.

(3N12.1)

Performance

- Tell a division story problem that students can act out, either with actual classroom objects or with counters on a story board. E.g., There are 8 bottles of glue. Each table of students will get two of those bottles. How many tables will get glue?

(3N12.2)

- Using story boards, ask students to create story problems for division. Ask students to use manipulatives to represent their story problem and write the corresponding number sentence.

(3N12.1, 3N12.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 5: Division as Grouping

TR: pp. 19 - 22

SB: pp. 283 -286

Supplementary Resource

- *Making Math Meaningful to Canadian Students, K – 8.* (2008) by Marian Small

Suggested Resources

Children's Literature

- *Dazzling Division* by Jenny Feely
- *Fair Share* by Jenny Feely
- *If You Were a Divided-By Sign* by Trisha Speed Shaskan

Strand: Number

Outcomes

Students will be expected to

3N12 Continued

Achievement Indicators:

3N12.1 Identify events from experience that can be described as equal grouping.

3N12.2 Illustrate, with counters or a diagram, a given story problem, presented orally, that involves equal grouping; and solve the problem.

3N12.3 Listen to a story problem; represent the numbers, using manipulatives or a sketch; and record the problem with a number sentence.

3N12.4 Create and illustrate, with counters, a story problem for a given number sentence; e.g., 6 ÷ 3 = 2.

Elaborations—Strategies for Learning and Teaching

Ask students to brainstorm real-life situations where equal groups are necessary. Remind students that each group has the same number of items (e.g., counters in baggies, cookies on trays, tennis balls in packages).

Place 20 counters on an overhead projector or interactive whiteboard. Ask, "How many groups of four counters can we make if we have 20 to work with?" Most students will be able to solve the problem mentally. After receiving several answers, ask a student to demonstrate how to verify the answer of five groups of four. Ask, "What number sentence could we write for the groups formed?" Possible number sentences include: $4 + 4 + 4 + 4 + 4 = 20$, $5 \times 4 = 20$.

This is a good opportunity to introduce the division symbol and the corresponding number sentence. Say, "20 divided by four is five." and write the division sentence $20 \div 4 = 5$.

Although this outcome does not deal specifically with remainders, sometimes when dividing, students will discover that there will be remainders.

A Remainder of One by Elinor J. Pinczes could be used, for example, to engage students in a discussion about remainders. This book reviews the relationship between multiplication and division while realizing, at times, there may be a remainder when putting objects into equal groups or sets.

Read the story and stop at the sentence "The troop had divided by two for the show". Ask students to predict how many bugs would be in each line. Would there be any bugs left out? How many? Why? Stop throughout the story and make predictions as above. Ask students what they think, for example, when oddball bug Joe is thinking throughout the night that a fourth bug line would work out. Would a fourth line solve the problem? How do you know?

Using this book as a springboard, have pairs of students create their own division problem for other pairs to solve later. Problems may or may not contain a remainder.

It is also important for students to act out story problems using classroom objects that involve remainders. Remainders are a natural part of division and students should deal with them as they begin to learn how to divide. Allow students to deal with the concept of "leftovers" or remainders, beginning with these very first experiences.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Interview

- Ask students to use counters to act out story division problems with and without remainders. Provide opportunity for students to discuss how they solved the problems.
  - (i) Theresa has twenty-five pieces of paper to hand out for booklet covers. Each student needs two pieces of paper to make a cover. How many students can have two pieces?
  - (ii) Craig collects stamps. He has twenty-two stamps. Four stamps fit on each page of his stamp collection book. How many pages can he fill?

(3N12.1)

- Present a division sentence and ask students to represent a story problem to match, on a story board. Ask students to share their stories.

(3N12.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 5 (Continued): Division as Grouping

TR: pp. 19 - 22

SB: pp. 283 -286

Supplementary Resource

Children's Literature

- *Amanda Bean's Amazing Dream* by Cindy Neuschwander

Suggested Resource

Children's Literature

- *A Remainder of One* by Elinor J. Pinczes

Strand: Number

Outcomes

Students will be expected to

3N12 Continued

Achievement Indicators:

3N12.5 Solve a given problem involving division.

3N12.6 Identify events from experience that can be described as equal sharing.

3N12.7 Illustrate, with counters or a diagram, a given story problem, presented orally, that involves equal sharing; and solve the problem.

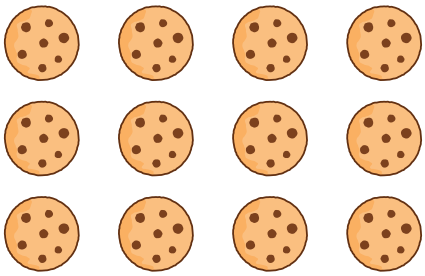
Elaborations—Strategies for Learning and Teaching

Brainstorm real life situations where equal sharing is necessary, for example, balloons in loot bags, money, cards in a game, a box of chocolates, a carton of strawberries, etc. Have volunteers model the following problems:

- There are 24 strawberries in the carton. Share the strawberries equally among 6 students. How many strawberries will each student get? Use real or playdough strawberries, and plates or sheets of paper. Discuss the results.
- The Grade Three class has 20 fish. Susan must put 4 in each bowl to go home for the summer vacation. How many bowls will she need?

The book *The Doorbell Rang*, by Pat Hutchins could be used to engage the students in a discussion about what "equal" or "fair shares" mean. Read the story, but stop at the sentence ,"Share them between yourselves." and insert the word "equally" each time. Ask students to predict how many cookies the two children will have, the four children, the six children, and so on. Ask students to work in pairs and give each pair a sheet of paper cookies as shown below. Reread the story but stop each time the cookies must be shared and ask students to use their paper cookies to chart the various arrangements.

Choose 12 students to play the part of the children. Also, choose students for the mother, grandmother, doorbell and narrator. Role play the story using real or paper cookies.



General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

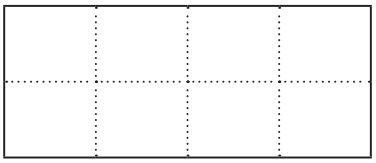
- Have pairs of students choose a mystery object and make up a riddle about it using a division sentence as a clue. For example, "I am thinking of something in this room that shows 20 ÷ 4 = 5." Twenty chairs in the room with four chairs per table will be five tables or groups. Students should share their riddles with the class.

(3N12.2, 3N12.5)

- Ask students to remove their shoes and place all of them in a pile. Provide 5 large boxes and ask students to equally share the shoes among the boxes. Should there be leftovers, or remainders, observe how students deal with them. As a class, record the results using pictures, numbers and words.

(3N12.3, 3N12.5, 3N12.7)

- After reading *The Doorbell Rang* by Pat Hutchins, show students how to fold a sheet of paper into eight sections as shown below.



Ask students to write, in the first box, "The Doorbell Rang" and their own name. Ask students to retell the story in the next five boxes, by writing five mathematical sentences that are presented in the story. In the last two boxes students can make up their own final parts of the story.

(3N12.3, 3N12.5, 3N12.7)

Paper and Pencil

- Arrange students into groups. Provide each student with a loot bag and each group with a number of stickers. Ensure that the total number of stickers can be divided equally among the members of the group. Ask students to share the stickers equally within the group. Ask students, "How many stickers will be in each loot bag?" On chart paper ask students to record the results pictorially and symbolically using number sentences. Encourage students to use pictures, numbers and words to explain their thinking. Allow time for groups to compare results.

(3N12.3, 3N12.5, 3N12.6, 3N12.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 5: Division as Grouping

TR: pp. 19 - 22

SB: pp. 283 - 286

Lesson 6: Division as Sharing

TR: pp. 23 - 25

SB: pp. 287 - 289

Suggested Resources

Children's Literature

- *The Doorbell Rang* by Pat Hutchins

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- cookies

Strand: Number

Outcomes

Students will be expected to

3N12 Continued

Achievement Indicators:

3N12.8 Represent a given division expression as repeated subtraction.

Elaborations—Strategies for Learning and Teaching

Ask students to start with 25 and repeatedly subtract five. Counters, a number line, or a hundred chart may be used. Ask students to record these subtractions on paper until they reach 0. Ask them to explain the results, encouraging correct mathematical vocabulary to explain division as repeated subtraction.

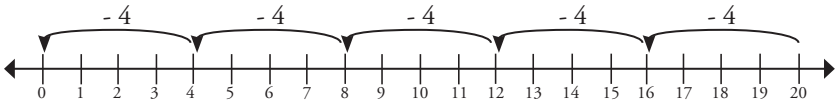
Have pairs of students link together five different coloured groups of four snap cubes. Write on the board the repeated subtraction sentence 20 – 4 – 4 – 4 – 4 – 4 = 0. Then, ask students to role play this with their partner until each coloured group is removed. Ask students to record their findings using a picture, the repeated subtraction sentence and the division sentence.

20 - 4 - 4 - 4 - 4 - 4 = 0

20 ÷ 4 = 5

3N12.9 Represent a given repeated subtraction as a division expression.

Use a number line to show repeated subtraction.



The repeated subtraction sentence, 20 – 4 – 4 – 4 – 4 – 4 = 0 , can be written as 20 ÷ 4 = 5.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Invite students to play "I Have...Who Has...?" Distribute cards to the students. Choose a student to start by reading the question on his/her card. The student with the answer to the question responds and then asks his/her question. Play continues until every student has both asked and answered a question. Sample cards are:

I have 16. Who has 3 × 3?	I have 9. Who has two equal groups of 4?	I have 8. Who has the repeated addition sentence for 4 × 5?

(3N11.2, 3N11.7, 3N12.8, 3N12.9)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 6 (Continued): Division as Sharing

TR: pp. 23 - 25

SB: pp. 287 - 289

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- I Have...Who Has...? game

Strand: Number

Outcomes

Students will be expected to

3N11 Continued
3N12 Continued

Achievement Indicators:

3N11.10 Relate multiplication to division by using arrays and writing related number sentences.

3N12.10 Relate division to multiplication by using arrays and writing related number sentences.

Elaborations—Strategies for Learning and Teaching

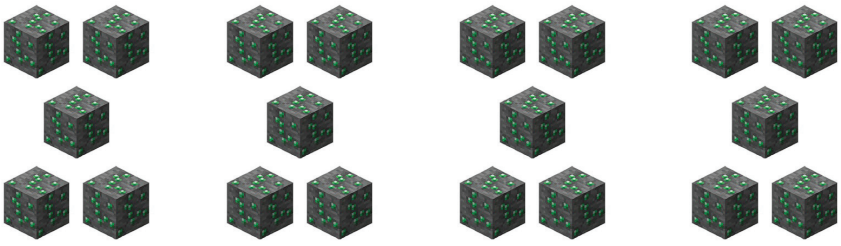
Understanding the meaning of multiplication and division, and the connection between the operations, is crucial as students develop their multiplication and division facts. Students will discover that division is the inverse of multiplication, just as subtraction is the inverse of addition. "Multiplication problems arise from joining equal groups of objects; division problems arise from separating a set of objects into equal groups. Students develop an understanding of division as the inverse of multiplication by separating a whole into equal groups." (NCTM, 2009, pp. 16-17)

Introduce relating multiplication and division with a situation such as:

- Susan bought a pack of 20 Minecraft™ stickers. She wanted to give each of her four friends the same number of stickers. How many stickers will Susan give to each friend?

Ask students, "What operation can you use to find the answer to this problem?" Remind students that if they understand multiplication, they will already know the answer because, just like addition and subtraction are related, multiplication and division are also related (i.e., $4 \times 5 = 20$ so $20 \div 4 = 5$).

Put students in pairs. Ask them to draw a picture to illustrate the sharing of 20 stickers equally among four friends, write a division sentence, and explain how they know using words. Monitor pairs and reinforce that division separates the whole into groups with the same number in each group.



I know because when 20 is shared into 4 equal groups, there are 5 stickers in each group.
$20 \div 4 = 5$.

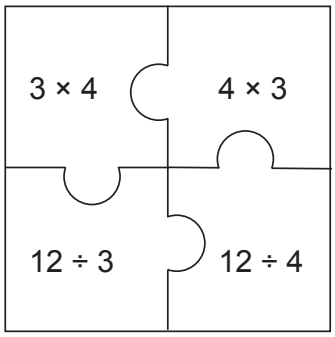
Ask students to write both a division and a multiplication sentence that describes the problem they pictured. ($20 \div 4 = 5$; $4 \times 5 = 20$) Ensure that students can explain 20 means the total number of stickers, four means the number of friends (the number of groups) and five means the number of stickers for each friend (the number in each group).

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Invite students to play with "Fact Family Puzzles". Use a template for a four piece puzzle. Write the related multiplication and division facts on the puzzle pieces. Cut apart the puzzles and ask students to assemble the fact family puzzles.



(3N11.10, 3N12.10)

- Provide students with two 0 - 5 number cubes. They can record each roll in a chart. Player 1 rolls both number cubes. Each player writes down the numbers and uses the two numbers to make both a multiplication and division sentence. Repeat with Player 2 in the same manner. Each player receives a point for every correctly written number sentence.

Cube A	Cube B	Multiplication Sentence	Division Sentence
3	5	3 × 5 = 15	15 ÷ 3 = 5

(3N11.10, 3N12.10)

- Engage students in a "Circles and Stars" activity. Roll a number cube (0 - 5) and ask students to draw that number of circles. Roll the number cube again and ask students to draw that number of stars in each circle. Write the multiplication sentence that describes the drawing. Ask students to write a related division sentence that would describe their drawing.

3 × 2 = 6

6 ÷ 3 = 2

(3N12.10)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 8: Relating Multiplication and Division Using Arrays

TR: pp. 30 - 32

SB: pp. 294 - 296

Lesson 9: Relating Multiplication and Division Using Groups

TR: pp. 33 - 36

SB: pp. 297 - 299

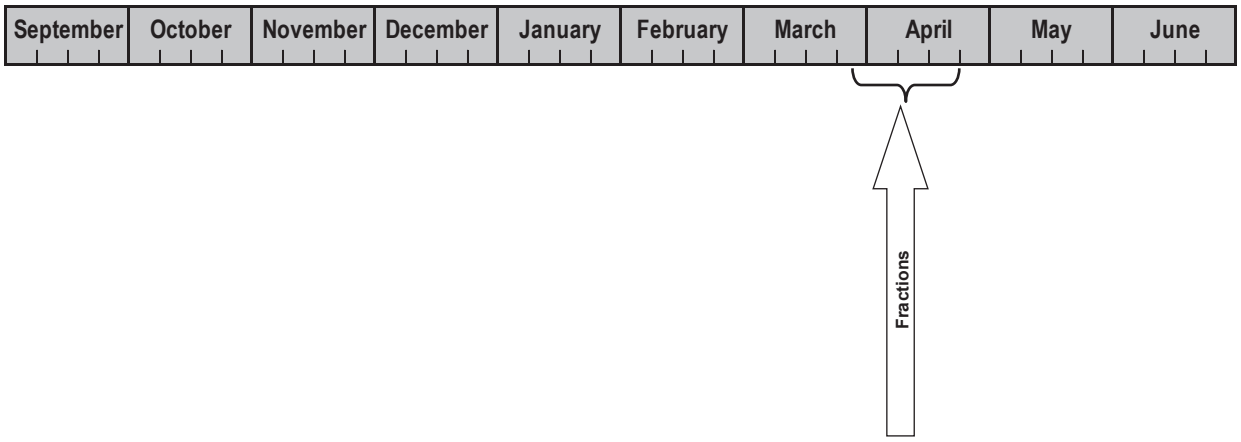
Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/multdiv.html

- Minecraft™ blocks
- Fact Family Puzzle template
- Cubes A and B activity

Fractions

Suggested Time: 3½ Weeks



Unit Overview

Focus and Context

Grade Three will be students' first formal encounter with fractions. Although students come to school with an informal awareness and exposure to fractions, their understanding is often incomplete. You may, for example, hear a child express, "You got the bigger half." Fractions are used to represent parts of a whole, parts of a length, and parts of a set. In Grade Three, students will be introduced to, and explore, the parts of a whole which result when the whole has been divided into equal sized portions or "fair shares". It is important to use the terms whole, one whole, or simply one, to ensure that students have a common language to use regardless of the model used. Initially, students explore the fractions of $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{3}$, before moving onto other proper fractions such as $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{8}$, and so on. Beginning with fractional terms such as halves, thirds, fourths, etc. and their pictorial representations, provides a bridge to the more challenging concept of the symbolic representations of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{3}{4}$, etc. Students will then be able to put a mathematical label on prior conceptions of fractions.

Outcomes Framework

GCO
Develop number sense.

SCO 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.

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
	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]	4N8. Demonstrate an understanding of fractions less than or equal to one by using concrete, pictorial and symbolic representations to: • name and record fractions for the parts of a whole or a set • compare and order fractions • model and explain that for different wholes, two identical fractions may not represent the same quantity • provide examples of where fractions are used. [C, CN, PS, R, V] 4N9. Represent and describe decimals (tenths and hundredths), concretely, pictorially and symbolically. [C, CN, R, V] 4N10. Relate decimals to fractions and fractions to decimals (to hundredths). [C, CN, R, V] 4N11. Demonstrate an understanding of addition and subtraction of decimals (limited to hundredths). [C, ME, 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

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 that have like denominators.**

[C, CN, ME, R, V]

Achievement Indicator:

3N13.1 Describe everyday situations where fractions are used.

Elaborations—Strategies for Learning and Teaching

"A fraction is a number that describes a relationship between a part (represented by the numerator) and a whole (represented by the denominator). Although you see two numbers, you have to think of one idea, the relationship." (Small, 2010, p. 196). Prior to Grade Three, students have only worked with whole numbers and concepts of quantity. Students are now introduced, for the first time, to fractional parts. Students need to see and explore a variety of models of fractions with a key focus on halves, thirds, fourths, fifths, sixths, eighths, and tenths.

Pattern blocks are very useful manipulatives when teaching fractional parts. Larger pattern blocks can be used to represent whole units and smaller pattern blocks to demonstrate the equal parts that can make up the whole, for example, six green triangles make one yellow hexagon. The names of fractional parts are determined by the number of equal parts that make up the whole, for example, six equal parts = sixths. This concrete representation of equal parts will ease the connection to the symbolic representation of $\frac{1}{6}$. From this point students can see that one green triangle is equal to one sixth of the whole, two triangles are two sixths, three triangles are three sixths, etc. With the use of concrete materials students will gain an understanding of how to identify shaded equal portions of a whole. It will be natural also, when examining a situation involving a fraction such as $\frac{1}{4}$, to show the related fraction of $\frac{3}{4}$. Always use a horizontal bar when writing fractions. It may be useful to post fractional terms, symbols, and representations on a math word wall to help students with communication and reasoning.

Students will likely have an awareness of the fraction $\frac{1}{2}$ and possibly others such as $\frac{3}{4}$ and $\frac{1}{3}$. Discuss, with students, their prior knowledge of these familiar fractions and brainstorm where they may occur in everyday life, e.g., moon, pizza, chocolate bars, sharing with a sibling, cake, gas tanks, etc.

The book *Fraction Fun* by David Adler, for example, can be used as an introduction to fractions. This book provides situations where fractions are used in everyday life and teaches the concepts of numerator and denominator through "pizza math".

Ask students to work in groups to brainstorm examples of everyday situations where fractions are used. Set a time limit, then come together as a class and have groups take turns offering examples to be recorded for a master class list of everyday fractional situations.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Provide students with the following prompt:

  Write about and draw something from your daily life that you divide into equal parts.

(3N13.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch: At the Pizza Shop

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 180 - 181

Lesson 1: Exploring Equal Parts

TR: pp. 4 - 6

SB: pp. 182 - 184

Lesson 2: Equal Parts of a Whole

TR: pp. 7 - 10

SB: pp. 185 - 188

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Suggested Resource

Children's Literature

- *Fraction Fun* by David Adler

Strand: Number

Outcomes

Students will be expected to

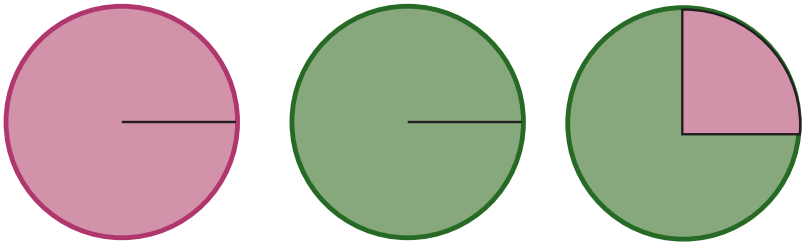
3N13 Continued

Achievement Indicators:

3N13.1 (Continued) Describe everyday situations where fractions are used.

Elaborations—Strategies for Learning and Teaching

Provide students with two circle templates of different colours that have a marked line for cutting to the middle on each. Fit circles together using the slits to create a sliding circle wheel that can form different fractions. Students can display fractions of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, and $\frac{3}{4}$ on their own circle wheel representations.



3N13.2 Cut or fold a whole into equal parts, or draw a whole in equal parts; demonstrate that the parts are equal; and name the parts.

Provide students with pre-cut paper strips. Begin by asking them to demonstrate a $\frac{1}{2}$ fold and to mark the sections identifying the fractional parts using the fractional term "half" and $\frac{1}{2}$. Using a new strip, ask them to repeat that step but to also fold a second time to create $\frac{1}{4}$ and label the new strip. Repeat this activity for $\frac{1}{3}$ and $\frac{1}{8}$, be sure to label the parts and reinforce that the folds are always equal in size.

3N13.3 Sort a given set of shaded regions into those that represent equal parts and those that do not, and explain the sorting.

Invite students to view a display of items, or pictures of items, which have been shared equally or unequally. Such items could include, but are not limited to, fruits, crackers, gum, cut-outs of shapes, packages of items such as pencils, crayons, etc. Ask students to indicate if each item has been shared equally or unequally. Teachers may wish to provide students with a recording chart for their responses.

Fair Shares		
Items	Equal Parts	Unequal Parts
cookie		✓
markers	✓	
gum	✓	
pencils		✓
apple		✓
triangle		✓
rectangle	✓	

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Interview

- Ask the student:
  - (i) What fraction would suggest a "fair share" if four children are sharing an apple. What if three children are sharing an apple?
  - (ii) Is a half a lot or a little? Explain.
  - (iii) If you are really hungry and want a large piece of cake, would you cut the cake into thirds, fourths, or tenths?

(3N13.2)

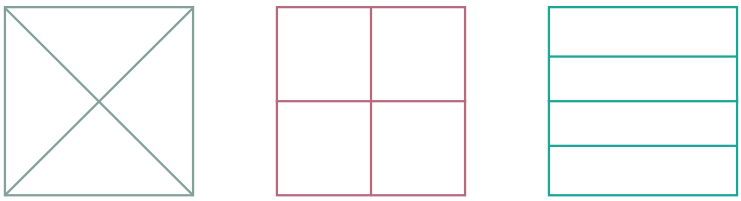
Journal

- Provide students with the following prompts: Why does it not make sense to say the "bigger half"? When might you hear someone talk about one half?

(3N13.2)

Performance

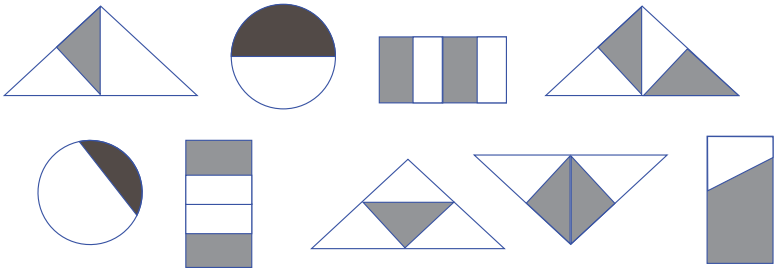
- Give students a square piece of paper and ask them to show fourths by folding. Have the students compare their fourths. Ask: Are they the same shape? Are they all really fourths?



(3N13.2)

Paper and Pencil

- Ask students to sort various shapes that show equal and unequal shaded parts. Ask students to explain in writing how they sorted the shapes.



(3N13.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 1: (Continued) Exploring Equal Parts

TR: pp. 4 - 6

SB: pp. 182 - 184

Lesson 2: (Continued) Equal Parts of a Whole

TR: pp. 7 - 10

SB: pp. 185 - 188

Suggested Resources

Children's Literature

- *Fair Shares* by Jenny Freely

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/frac.html

- sliding circles template
- Fair Shares table
- shaded shapes

Strand: Number

Outcomes

Students will be expected to

3N13 Continued

Achievement Indicator:

3N13.4 Represent a given fraction concretely or pictorially.

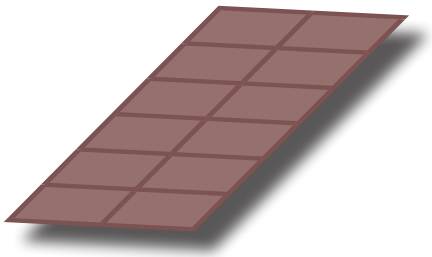
Elaborations—Strategies for Learning and Teaching

Ask students to use their pattern blocks to represent fractions they have been shown. Reinforce, for example, the concept that one blue rhombus shows $\frac{1}{3}$ of the yellow hexagon because it takes 3 of these pattern blocks to cover one of the yellow hexagons, so one blue rhombus covers $\frac{1}{3}$. You may also wish to discuss how the remaining fraction represents the rest of the whole. E.g., the remaining two blue rhombi represent $\frac{2}{3}$ of the yellow hexagon.

Invite students to find another example of the blocks that show $\frac{1}{3}$, for example, the green triangle is $\frac{1}{3}$ of the red trapezoid. Discuss with students that it is possible that both the blue and green blocks can represent $\frac{1}{3}$ since the block that is the whole is different for each.

Provide many opportunities to explore and discuss fractions orally before the symbols are introduced. Continue to use, for example, the "one of three equal parts" language and help students connect the language with its symbol. This is the first time that fractions are presented symbolically. Fractions such as $\frac{1}{3}$, $\frac{2}{5}$, and $\frac{4}{10}$, are relatively easy for students to read since familiar ordinal language is used for the denominator of each – third, fifth, and tenth. Point out to students, however, that $\frac{1}{2}$ is read one "half", not one "second", and that $\frac{1}{4}$ may be read as either "one fourth" or "one quarter". The money application of "four quarters make a whole dollar" can be conveniently presented in this connection.

The Hershey's Milk Chocolate Fractions Book by Jerry Pallotta, for example, may be used to provide a connection between the visual, the word, and the symbolic representation of some fractions. Provide a template of a chocolate bar to each student. As you read, ask students to follow the directions given in the book such as breaking (i.e., cutting) the bar into twelve equal sections. As each new fraction is introduced, students could demonstrate it with their chocolate bar and record the fraction. Another book by Jerry Pallotta, *Apple Fractions,* may also be used to help create connections.

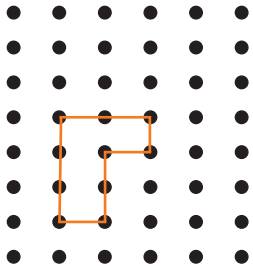


General Outcome: Develop Number Sense

Suggested Assessment Strategies

Presentation

- Provide pairs of students with the following design on dot paper. Tell them that this shape is $\frac{1}{2}$ of a whole shape. What could the whole shape look like? How many different possibilities can you find? Ask students to present their findings to the class. Invite them to create similar problems to challenge other groups, using geoboards.



(3N13.4)

Paper and Pencil

- Prior to this activity, you may wish to read *Pizza Pizzazz* by Carol A. Losi. Ask students to work in pairs or individually. Provide them the following pizza template and directions:

  You are making a pizza for yourself and seven friends. You have a choice of four toppings: pepperoni (P), mushrooms (M), olives (O), and cheese (C). Your friends choose the following toppings:

  Alice: cheese

  Shawn: pepperoni, cheese

  Sarah: pepperoni, mushrooms, cheese

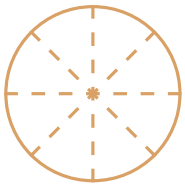
  Tim: mushrooms, olives

  Muhammad: olives, cheese

  Rebecca: cheese, pepperoni

  Jonathan : cheese, pepperoni, mushrooms

  Your choice: _____



  Use a ruler to divide the pizza into eight equal parts. Use the letter symbols to represent the different topping choices of your friends. Ask students the following questions:

  (i) What fraction will have only cheese?

  (ii) What fraction of the pizza will have olives? What fraction will not have olives?

  (iii) Write three fraction questions about your pizza. Exchange your pizza and questions with another student/group.

  This activity can be modified by reducing the number of friends to three or four and the pizza fraction to thirds or fourths respectively.

(3N13.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: Fractions of a Whole

TR: pp. 11 - 14

SB: pp. 189 - 192

Suggested Resources

Children's Literature

- *Pizza Pizzazz* by Carol A. Losi
- *The Hershey's Milk Chocolate Fractions Book* by Jerry Pallotta
- *Apple Fractions by* Jerry Pallotta

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/frac.html

- dots and shape template
- pizza party template

Strand: Number

Outcomes

Students will be expected to

3N13 Continued
Achievement Indicators:

3N13.5 Identify common characteristics of a given set of fractions.

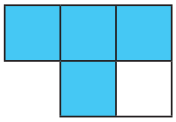
3N13.6 Name and record the fraction represented by the shaded and non-shaded parts of a given region.

3N13.7 Identify the numerator and denominator for a given fraction.

3N13.8 Model and explain the meaning of numerator and denominator.

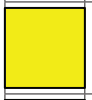
Elaborations—Strategies for Learning and Teaching

Ask students to use grid paper to represent a fraction. Ask them to name the fraction, and identify and explain the meaning of numerator and denominator. In the picture below, for example, the fraction represented is $\frac{4}{5}$. The 4 is the numerator because it tells how many parts of the shape are coloured. The 5 is the denominator because it tells how many equal parts the whole shape is divided into.

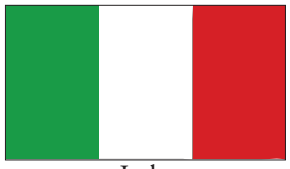


$\frac{4}{5}$

Provide students with a chart of flags, as shown. Ask them to identify the fraction represented by the shaded and non-shaded regions of the flags.

Fraction Flags		
Flag	Shaded Part	Non-Shaded Part
		
		
		
		
		
		

Working in small groups, ask students to look up internationally recognized flags in atlases or online. Ask them to find at least three flags that are divided into fractional parts, or fair shares. Provide them with index cards to reproduce the flags and ask them to write some facts about the flags origin or history. They will also identify a fraction represented by the flag. Ask them to present their findings to their classmates.



Italy

Ukraine

Russia

Indonesia

LGBTQ Pride

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Group fractions in sets that have common characteristics. Using the terms numerator and denominator, ask students to tell how fractions are alike. For these fractions, for example,

  $\frac{1}{3}, \frac{2}{5}, \frac{3}{5}, \frac{1}{8}, \frac{4}{10}, \frac{3}{8}, \frac{4}{5}, \frac{1}{2}$

  some possible students responses are:

  $\frac{1}{3}$, $\frac{1}{8}$, and $\frac{1}{2}$ all have the same numerator.

  $\frac{2}{5}$, $\frac{3}{5}$, and $\frac{4}{5}$ all have the same denominator.

  $\frac{1}{8}$ and $\frac{3}{8}$ have the same denominator.

  $\frac{3}{5}$ and $\frac{3}{8}$ have the same numerator.

  (3N13.5, 3N13.7)

Interview

- Ask the student to tell why, whenever you see a representation of $\frac{1}{3}$, there is always a $\frac{2}{3}$ associated with it.

  (3N13.5)

Performance

- Ask students to create their own fraction flag on an index card. Remind them to be aware of using equal shares when designing their flag and to use rulers. They will decide what colours to use for the design of the flag. Ask them to give their flag a name (e.g., "Flag of Fifths") and identify the fraction represented by each colour on the back of the index card. Students can tape their flags to a wooden stick or straw and display them on their desks using small lumps of play dough as the base.

  (3N13.6)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4: Naming and Writing Fractions

TR: pp. 15 - 17

SB: pp. 193 - 195

Suggested Resources

Children's Literature

- *The Hershey's Milk Chocolate Fractions Book* by Jerry Pallotta
- *Apple Fractions* by Jerry Pallotta

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/frac.html

- Fraction Flags table
- variety of flags

Strand: Number

Outcomes

Students will be expected to

3N13 Continued

Achievement Indicators:

3N13.6 (Continued) Name and record the fraction represented by the shaded and non-shaded parts of a given region.

3N13.7 (Continued) Identify the numerator and denominator for a given fraction.

3N13.8 (Continued) Model and explain the meaning of numerator and denominator.

Elaborations—Strategies for Learning and Teaching

When discussing the symbolic form of fractions, explain that the top number (i.e. numerator) tells how many shares or equal parts we have. The bottom number, (i.e., denominator) tells into how many equal parts the whole has been divided. That is, if the denominator is a four, for example, it means the whole is divided into four equal parts. To assist with the clarity of meaning, always write fractions with a horizontal bar.

$\frac{1}{3}$ ✓

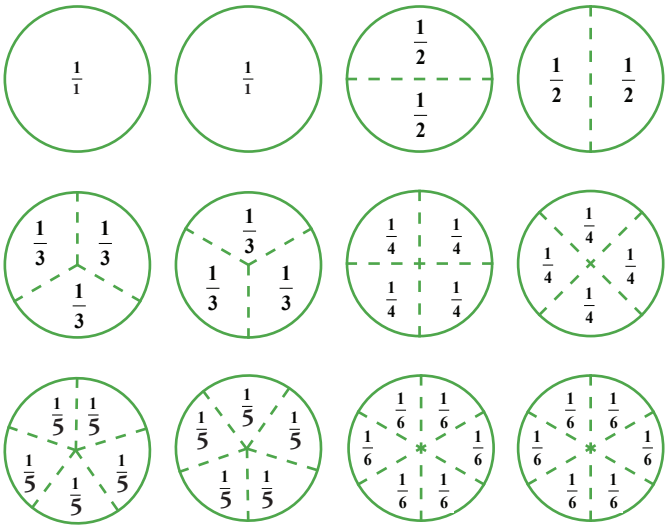
1/3 ✗

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Invite students to play "Roll a Fraction". Provide students with two dice and game boards that displays fraction pies, as seen below.



Students take turns rolling the dice and making fractions from the two numbers. Remind students to place the smaller number as the numerator. If, for example, a 3 and a 4 are rolled, the fraction is $\frac{3}{4}$.

Based on that fraction, students colour pie slices on their game boards. For $\frac{3}{4}$, students would colour in three slices of a pie that is cut in fourths. The first player to colour in all of the slices on all of their pies, wins!

(3N13.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4: (Continued) Naming and Writing Fractions

TR: pp. 15 - 17

SB: pp. 193 - 195

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/frac.html

- Roll a Fraction template

Strand: Number

Outcomes

Students will be expected to

3N13 Continued

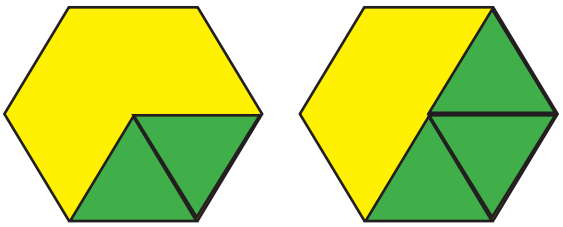
Achievement Indicator:

3N13.9 Compare given fractions with the same denominator, using models.

Elaborations—Strategies for Learning and Teaching

Discuss with students that if two fractions have the same denominator, the fraction with the greater numerator represents the larger piece of the whole. Students will be familiar with the symbols for greater than and less than (< and >) and will now use these symbols when comparing fractions with the same denominator.

Pattern blocks can be used to demonstrate this concept. The yellow hexagon, for example, can be used to represent a pizza and the small green triangles to represent the slices. Ask the students: If John ate $\frac{2}{6}$ of the pizza and Gina ate $\frac{3}{6}$ of the pizza, who ate the most pizza? Ask students to model their answers using the pattern blocks and record the fraction symbols showing which is greater than and less than. Discuss with students how they know.



$\frac{2}{6} < \frac{3}{6}$

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Interview

- Ask the student to give an example of how one fourth of something could mean getting a lot, and how one fourth of something could mean getting a very small amount.

(3N13.9)

Journal

- Provide students with the following situation:

  A giant cookie is a dessert choice on a restaurant menu. Would you rather have $\frac{4}{5}$ of the cookie for your dessert, or $\frac{2}{5}$?
  Using pictures, numbers, and words, explain your thinking.

(3N13.9)

Resources/Notes

Authorized Resource

Math Makes Sense 3

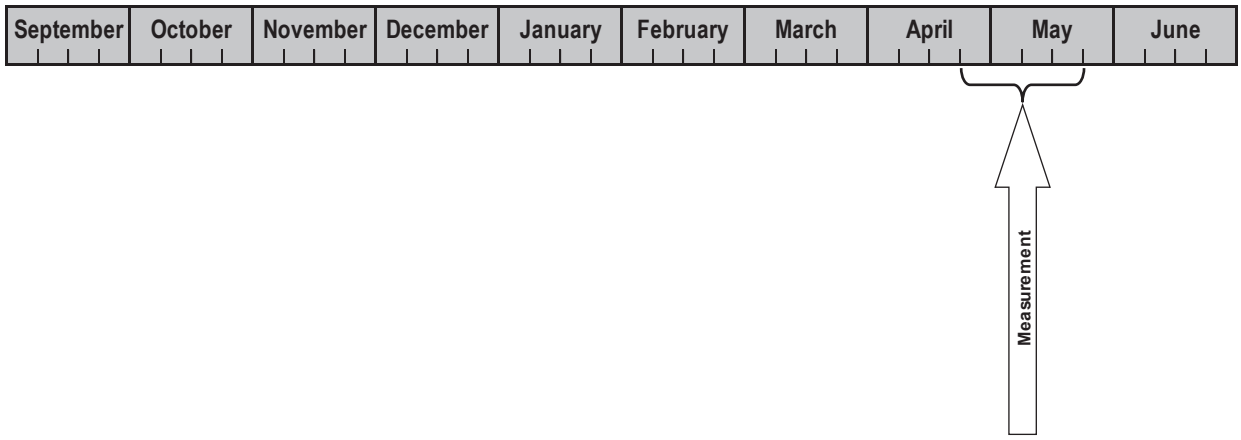
Lesson 5: Comparing Fractions

TR: pp. 19 – 21

SB: pp. 197 - 199

Measurement

Suggested Time: 4 Weeks



Unit Overview

Focus and Context

Students are given the opportunity to work with units of time (seconds, minutes, hours, days, weeks, months, years) in a problem solving context. Students will move from previous work relating the number of days to a week and months to a year, to also include seconds to a minute, minutes to an hour, and days to a month. In Grade Three, students explore the passage of time using both standard and non-standard units in relation to everyday activities. They also learn about measuring and recording length, width, height, and perimeter of 2-D shapes and 3-D objects using personal referents and the standard units of centimetre and metre. Students are introduced to measuring and recording mass in the standard units of gram and kilogram using balance scales. Through investigations, students discover the relationship between centimetre and metre, and gram and kilogram. Students will estimate, measure, compare, and order objects using both non-standard and standard units. It is important that students are familiar with and understand the actual attribute they are using to compare a measure. In Grade Three, students will develop an understanding of personal referents and their value for estimation in everyday life.

Outcomes Framework

GCO
Use direct or indirect measurement to solve problems.

SCO 3SS1

Relate the passage of time to common activities, using non-standard and standard units (minutes, hours, days, weeks, months, years).

SCO 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.

SCO 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.

Outcomes Framework

GCO
Use direct or indirect measurement to solve problems.

SCO 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

SCO 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.

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Shape and Space (Measurement)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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] 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]	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] 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]	4SS1. Read and record time, using digital and analog clocks, including 24-hour clocks. [C, CN, V] 4SS2. Read and record calendar dates in a variety of formats. [C, V]

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Shape and Space (Measurement)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
2SS5. Demonstrate that changing the orientation of an object does not alter the measurements of its attributes. [C, 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]	4SS3. Demonstrate an understanding of area of regular and irregular 2-D shapes by: • recognizing that area is measured in square units • selecting and justifying referents for the units cm^2 or m^2 • estimating area, using referents for cm^2 or m^2 • determining and recording area (cm^2 or m^2) • constructing different rectangles for a given area (cm^2 or m^2) in order to demonstrate that many different rectangles may have the same area. [C, CN, ME, PS, R, V]

SCO Continuum

Grade 2	Grade 3	Grade 4
Strand: Shape and Space (Transformations)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
		4SS5. Demonstrate an understanding of congruency, concretely and pictorially. [CN, R, V] 4SS6. Demonstrate an understanding of line symmetry by: • identifying symmetrical 2 D shapes • creating symmetrical 2-D shapes • drawing one or more lines of symmetry in a 2-D shape. [C, CN, V]

Mathematical Processes

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

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

3SS1 Relate the passage of time to common activities, using non-standard and standard units (minutes, hours, days, weeks, months, years).

[CN, ME, R]

Elaborations—Strategies for Learning and Teaching

Time, as a unit of measurement, presents a unique challenge to students in that it cannot be seen. Grade Three students need the opportunity to explore and discuss daily activities that involve the passage of time and to make connections to their real world experiences. Through the use of non-standard units (e.g., pendulum swings, TV shows, sand-timers, recesses) or the standard units (seconds, minutes, hours, days, weeks, months and years) students will understand that time, as a measurement, is about the duration of an event from beginning to end. The book *A Second is a Hiccup* by Hazel Hutchins, for example, could be used as an introduction to this unit. The book provides real world connections to the passage of time.

Achievement Indicators:

3SS1.1 Select and use a non-standard unit of measure, such as television shows or pendulum swings, to measure the passage of time, and explain the choice.

Prior to the introduction of standard units it is essential that students choose non-standard units that measure the passage of time in a uniform and appropriate manner (e.g., hand claps do not ensure uniformity of time from person to person). Students could be asked to select an appropriate non-standard unit to estimate how long it would take them to do activities such as walking down the hall and back or going to a movie. Ask students to give reasons for their choice.

3SS1.2 Identify activities that can or cannot be accomplished in minutes, hours, days, weeks, months and years.

It is useful to note the duration of long and short events throughout the day to develop a sense of the various standard units of time. Do this by engaging students in daily conversations whereby they need to select an appropriate unit of measurement for activities such as brushing teeth, riding to school, reading a story, extracurricular activities, sleeping, summer vacation, building a highway. Some questions that could be asked of students are:

- Would it take hours or minutes to tie your shoes?
- Can a house be built in days, weeks, or months?
- Do we measure the growth of trees by days or years?

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Journal

- Ask students to describe something they do that takes a second, a minute, an hour, a day, a week, a month, or a year.

(3SS1.2)

Performance

- Ask students to work in pairs. Provide students with a stopwatch or other device for accurately measuring time, e.g., class timer, online stopwatch, timer on an iPad, etc. Students select an activity from the estimating time sheet and estimate how long it will take in seconds or minutes to complete the activity. Ask them to write their estimate on the sheet. They will then have their partner time how long it takes them to complete the activity and record the actual time in seconds or minutes. They continue to take turns making estimates and measuring the time.

Names:_____

Estimating Time

Activity	My estimate	Actual Time
Tie my shoe		
Write my full name		
Do 10 sit-ups		

(3SS1.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Launch: Eat Your Veggies

Teacher Resource (TR): pp. 2 - 3

Student Book (SB): pp. 132 - 133

Lesson 1: Measuring the Passage of Time

TR: pp. 4 - 6

SB: pp. 134 - 136

Lesson 2: Exploring Units of Time

TR: pp. 7 - 10

SB: pp. 137 - 140

Refer to Appendix B (pp. 269 - 273) for problem solving strategies and ideas.

Suggested Resources

Children's Literature

- *A Second is a Hiccup* by Hazel Hutchins
- *If You Were a Minute* by Trisha Speed Shaskan

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/meas.html

- Estimating Time template

Strand: Shape and Space (Measurement)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **3SS1 Continued** **Achievement Indicator:** *3SS1.3 Provide personal referents for minutes and hours.*	The following activities could enable students to get a sense for the length of a minute: • How many times can you write your name in a minute? • How high can you count in a minute? • How many hand claps can you do in a minute? To further develop the sense of a minute, ask students to relate the above activities to two minutes, five minutes, or ten minutes. A referent is an object or standard that can be used to help estimate a measurement. Brainstorm, with students, activities that students engage in for about an hour to help them establish their personal referent for one hour (e.g., math class, lunchtime, television shows, and extracurricular activities).
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] **Achievement Indicator:** *3SS2.1 Determine the number of days in any given month, using a calendar.*	In Grade Two, students were introduced to the number of days in a week and months in a year (2SS1). In Grade Three, students will engage in activities that further develop the relationship between the units of time measurement prior to learning to tell time on a digital or analog clock in Grade Four (4SS1).. Using a calendar throughout the school year strengthens the students' sense of time. It is worthwhile for students to be exposed to the following chant as some may find it easy to remember: *Thirty days hath September, April, June and November. All the rest have 31, ...* Students might also enjoy the "Knuckle Method" for remembering the number of days in each month: Make a fist showing four knuckles; start by pointing to the first knuckle and saying, "January." The space between knuckles is February; the second knuckle is March, and so on. After saying, "July," go back to the beginning making August land on the first knuckle and continue until year end. The months that land on the knuckles each have 31 days.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Interview

- Show the student a calendar for the year and ask them to identify ways in which months are the same and ways in which they differ.

(3SS2.1)

Performance

- Ask pairs of students to predict how many weeks there are in a year. Ask them to use a calendar for the year to check their prediction.

(3SS2.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 2 (Continued): Exploring Units of Time

TR: pp. 7 - 10

SB: pp. 137 - 140

Lesson 3: Exploring the Calendar

TR: pp. 11 - 14

SB: pp. 141 - 144

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

3SS2 Continued

Achievement Indicator:

3SS2.1 (Continued) Determine the number of days in any given month, using a calendar.

Elaborations—Strategies for Learning and Teaching

It might be helpful to have a full calendar that shows all twelve months on display in the classroom. Students should explore the calendar. Guide their exploration with questions such as:

- Are there months that need only four lines?
- Does every month have the same number of Mondays?

Students may be interested to know that a year is a little more than 365 days. To make up for this lost time, every four years there is a leap year which has 366 days. This extra day is added in February which then has 29 days.

At the end of each month, cut around the calendar outline of a commercial calendar making sure to cut out all the empty boxes. Place that month's piece so it fits like puzzle pieces with the previous month's piece. This helps students make the connection between months and why different months start on different days.

September							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	1	2	3	4	5	6
October	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
November	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	

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Ask students to work in pairs. Tell them that Stacey was born February 29, 1992. Ask the students to determine how many birthdays Stacey has had. When would she celebrate her birthday? Ask them to write a letter outlining how unfair it is to be born on February 29th, and what they might suggest be done to change the situation.

(3SS2.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: (Continued) Exploring the Calendar

TR: pp. 11 - 14

SB: pp. 141 - 144

Suggested Resource

Children's Literature

- *The Rabbit Problem* by Emily Gravett

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

3SS2 Continued

Achievement Indicators:

3SS2.2 Solve a given problem involving the number of seconds in a minute, minutes in an hour or days in a given month.

3SS2.3 Create a calendar that includes days of the week, dates and personal events.

Elaborations—Strategies for Learning and Teaching

Before engaging in problem solving activities, students need to consolidate their understanding of the number of seconds in a minute, and the number of minutes in an hour.

Direct students' attention to the clock. ask students "How many big numbers are on the clock?" Ask students to point to the hour hand, and tell them that when the hour hand moves from one number to the next, one hour has passed, or sixty minutes. Ask students to point to the minute hand and tell them that when the minute hand moves from one tick mark to the next, one minute has passed, or sixty seconds.

Count the seconds it takes for the minute hand to do one complete revolution around an analog clock. Challenge students to guess how long one minute is by having them place their heads on their desks. When they think one minute is up, they should raise their hand without looking up. At the end of one minute identify those students who raised their hands closest to the sixty-second mark.

The following problem solving activities would allow students to use their knowledge of standard time units:

- It took John 100 seconds to brush his teeth. Is this greater or less than 2 minutes? How do you know?
- If it takes 185 minutes to drive to your grandparents' house, about how many hours will it take to get there? How do you know?
- Suzy read a chapter book beginning the first day of February and ending on the last day of March. How many days did it take her to read the book? Show your thinking in pictures, numbers or words.

Give each student a copy of a blank calendar. Model how to fill in the month, year, days of the week, and dates. Include important events that are happening in school for that month. Ask students to glue the calendar on construction paper and decorate it with illustrations pertaining to that month. Students could take their calendar home for scheduling personal activities.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Portfolio

- Provide a calendar for the year. Ask students questions such as:
  (i) How many school days are there in each month?
  (ii) How many Friday the 13^{ths} will there be in the year?
  (iii) On what days do the birthdays of friends and family fall?
  Ask students to write about their findings for their portfolios.

(3SS2.2)

Interview

- Show the student a calendar for the year. Ask them to point out today's date and to find out what will the date be in six weeks.

(3SS2.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 3: (Continued) Exploring the Calendar

TR: pp. 11 - 14

SB: pp. 141 - 144

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

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]

Achievement Indicators:

3SS3.1 Provide a personal referent for one centimetre, and explain the choice.

3SS3.2 Estimate the length of an object, using personal referents.

3SS3.3 Draw a line segment of a given length, using a ruler.

3SS3.4 Sketch a line segment of a given length without using a ruler.

Elaborations—Strategies for Learning and Teaching

In Grade Two, students learned to compare and order objects by length, height, distance around, and mass, using non-standard units (2SS2, 2SS3, 2SS4). Working with standard units is integral to students' understanding of a measurement system. Students start using standard units to measure length as they realize that non-standard units mean different things to different people. They need to develop a familiarity with standard units and explore the relationship between them.

According to Van de Walle (2006), estimation activities help students focus on the attribute being measured, provide intrinsic motivation, and help develop familiarity with the measuring unit.

The book *Measuring Penny* by Loreen Leedy can be used to bridge the gap between the use of non-standard and standard units of measure. This book uses Imperial measurements. This would be a great opportunity to discuss with your students that two different measurement systems exist. Before reading, ask students, "What is measurement? How do we measure things? How would you measure if you didn't have a ruler?" After reading, ask students, "What are some forms of measurement (i.e., height, length, time, mass, etc.) What are two parts of any measurement (i.e., a number and a unit of measure, e.g., 12 cm, 26 g, 4 min., etc.)". Brainstorm examples of non-standard and standard units.

Brainstorm a list of items found in the classroom that students believe to be one centimetre. Using the small cube from your base-ten materials, determine which items on the list are closest to 1 cm. Invite students to think about how they could tell if something is about 1 cm long if they did not have a ruler. Ask them to look at their hands to see if they notice anything that is close to 1cm. Identify that the width of their finger is a personal referent for 1 cm.

Working in pairs, ask students to take part in a centimetre scavenger hunt. Using their personal referent as a measurement, ask them to find items in the room that are close to a list of given centimetre lengths.

Provide opportunities for students to use their rulers in a free-draw activity prior to giving specific lengths. Ask them to draw a triangle, rectangle, house, etc. using straight lines. Once they establish comfort with the ruler, ask for lines of given lengths.

Using a ruler, ask students to draw a line segment of a given length, e.g., 3 cm. Then without using their ruler, ask them to sketch a line segment of the same length. Ask them to attempt a line segment of 6 cm, 10 cm, 20 cm, etc. Discuss how the use of their personal referent could help them with this activity.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Ask students to write or draw something that would explain when a sneaker is not a good referent for measuring length.

(3SS3.2)

Journal

- Ask students:

  Why is it important to learn about standard forms of measurement as well as non-standard forms of measurement? Write about a time when you used each.

(3SS3.1, 3SS3.2)

Paper and Pencil

- Ask students to:
  (i) use a ruler to draw a line segment 10 cm long.
  (ii) use a ruler to draw a line segment 15 cm long.
  (iii) sketch, without a ruler, a line segment about 12 cm long.

(3SS3.3, 3SS3.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4: Using a Ruler

TR: pp. 15 - 18

SB: pp. 145 - 148

Supplementary Resource

Children's Literature

- *Measuring Penny* by Loreen Leedy
  Note: This book uses Imperial measurements on some pages. This presents an opportunity to discuss the two measurement systems.

Lesson 5: Estimating and Measuring with Centimetres

TR: pp. 19 - 22

SB: pp. 149 - 152

Strand: Shape and Space (Measurement)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **3SS3 Continued** **Achievement Indicators:**	
3SS3.5 Provide a personal referent for one metre, and explain the choice.	Brainstorm a list of items found in the classroom that students believe to be one metre. Using a metre stick, determine which items on the list are closest to 1 m. Invite students to think about how they could tell if something is about 1 m long if they did not have a metre stick. Ask them to look around to see if they notice anything that is close to 1 m. Identify that the height of a doorknob from the floor can be a personal referent for 1 m.
3SS3.6 Match a given standard unit to a given referent.	Using objects from the classroom as referents, ask students to identify whether the object is an appropriate referent for centimetre or metre (e.g., pencil, garbage can, teacher desk, glue stick, etc.).
3SS3.7 Show that 100 cm is equivalent to 1 m by using concrete materials.	Working in groups with base ten materials, ask students to explore how many small cubes would line up along a rod. Next, ask students to explore how many small cubes would line up along a metre stick. Finally, ask them to explore how many rods would line up along a metre stick. Groups should record and present their findings to the class. Discuss as a whole group to consolidate their understanding of the equivalence of 100 cm to 1 m.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Ask students to find a referent for one metre. Using that referent, students should find items in the room which measure between 1 m and 5 m.

(3SS3.6)

Presentation

- Read the book *Long Jump* by Bernadette Kelly. Ask small groups of students to estimate the length of each person's stride. Measure the stride of each person in the group using a meter stick or measuring tape. Ask students to record their estimates and actual measures on a table. Using the results of the stride activity, ask students to predict who will have the longest jump and give reasons why on the recording sheet. Ask students to estimate the length of each person's long jump. Students will measure the actual long jump distances and record them on the table. Groups may present the results.

	Stride and Jump			
	Stride		Jump	
Name	Estimate	Actual	Estimate	Actual

(3SS3.2, 3SS3.6)

Interview

- Ask the student to show, without using a ruler, how he/she could find out which is wider, the door or the window.

(3SS3.5)

- Tell the student that a bald eagle was measured to be 109 cm long from beak to tail. Ask him/her to estimate and show how long that would be. He/she can then check the estimate by measuring.

(3SS3.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 6: Estimating and Measuring with Metres

TR: pp. 24 - 27

SB: pp. 154 - 157

Suggested Resources

Children's Literature

- *Long Jump* by Bernadette Kelly

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/meas.html

- Stride and Jump template

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

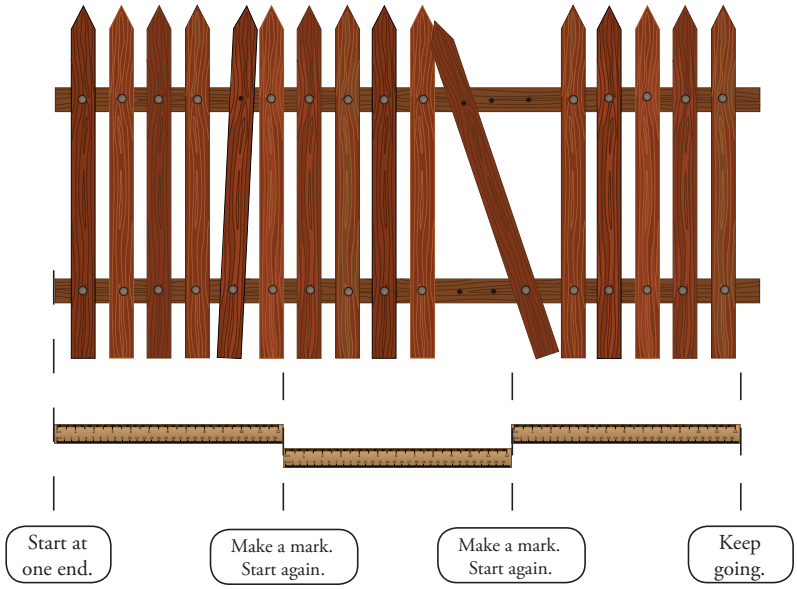
3SS3 Continued

Elaborations—Strategies for Learning and Teaching

It is important to begin measuring with tools that are clear and those that will not confuse students. It can be helpful to ask students to use rulers that show only numbered centimetres and not millimetres. Lining up small cubes from your base ten materials along the ruler will demonstrate that the stripes or numbers on the ruler correspond to the number of small cubes.

When introducing the ruler, it is important for students to line up the 0 mark with the end of the object being measured.

It is important to observe how students use a ruler to measure an object that is longer than the ruler. Show students how to measure something that is longer than a ruler by marking, recording, and starting again.



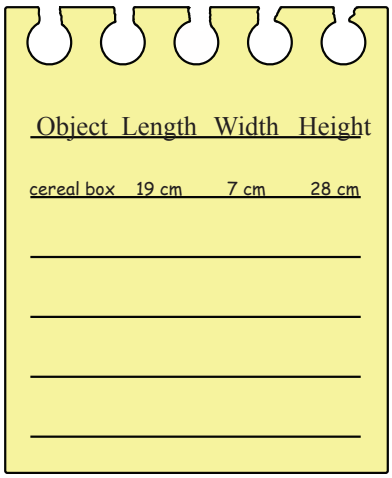
Adapted from *Math to Know: A Mathematics Handbook*, 2003, p. 353.

Achievement Indicators:

3SS3.8 Determine and record the length and width of a given 2-D shape.

3SS3.9 Determine and record the length, width or height of a given 3-D object.

Using a centimetre ruler, first ask students to measure the lengths and widths of given 2-D shapes. Once students are adept at working with 2-D shapes, ask them to measure the length, width or height of some objects in the classroom (e.g., a lunch box, desk, cereal box, etc.). Students can record their measurements on a chart. Emphasize that a measurement is both the number and the measurement unit, e.g., 3 cm or 3 centimetres.



Object	Length	Width	Height
cereal box	19 cm	7 cm	28 cm

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Interview

- Using a standard 30 cm ruler, ask the student to measure a common object that is shorter than the ruler such as a pencil, glue stick, eraser, etc.

(3SS3.8)

- Using a standard 30 cm ruler, ask the student to determine the measurement of something that is longer than the ruler such as a desktop, chart paper, width of a door, bookcase, etc.

(3SS3.8)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 4: (Continued) Using a Ruler

TR: pp. 15 - 18

SB: pp. 145 - 148

Note:

Questions 6 and 7 make reference to students measuring objects starting at places other than 0. This goes beyond the Grade Three curriculum outcome for measurement.

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

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]

Achievement Indicator:

3SS5.1 Measure and record the perimeter of a given regular shape, and explain the strategy used.

Elaborations—Strategies for Learning and Teaching

An understanding that perimeter is not distinct from linear measurement will be key to students' success when exploring perimeter. Students will need to understand that perimeter is the same as measuring linear distance that is not in a straight line. The elaboration for this outcome starts with a focus on centimetres. Later, perimeter will be measured in metres.

Mathematically, the term "regular" refers to a shape with equal sides and equal angles. However, for the purposes of measurement practice, the term "regular" will refer to familiar shapes and objects.

Using any familiar shapes or objects such as a picture frame, a book, or a sheet of paper, ask students how they might determine the total "distance around" the given object.

After discussion of student suggestions, model how you could find perimeter using a piece of string by fitting it tightly around the object, cutting it, then determining its length using a ruler or meter stick. Demonstrate how to record the perimeter using the number and standard unit of measure, e.g., 36 cm.

Provide students with various familiar polygons such as squares, rectangles and triangles, and some string. Invite them to determine and record the perimeter of the given shape using the string and their rulers.

Once students are comfortable finding "distance around" using a piece of string, demonstrate how each side of a given shape or object can be measured and recorded individually using a centimetre ruler. Show how adding the recorded measurements will give you the perimeter of the given shape.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Performance

- Invite students to play "Rolling for Rectangles". Students roll a pair of dice, using one number for the length, and the other for the width, of a rectangle. Next, they form the rectangle on cm grid paper to find and record the perimeter of the rectangle. They score 1 point for each centimetre of perimeter. If, for example, the perimeter is 24 cm, the score is 24 points. Students record the score and then total the points on the chart. They continue taking turns. The winner is the first player to have more than 100 points.

Rolling for Rectangles		
Perimeter	Score	Total
6 + 6 + 6 + 6	24	24
3 + 5 + 3 + 5	16	24 + 16 = 40
1 + 3 + 1 + 3	8	40 + 8 = 48

(3SS5.1)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 8: Measuring Perimeter in Centimetres

TR: pp. 30 - 33

SB: pp. 160 - 163

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/meas.html

- Rolling for Rectangles template

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

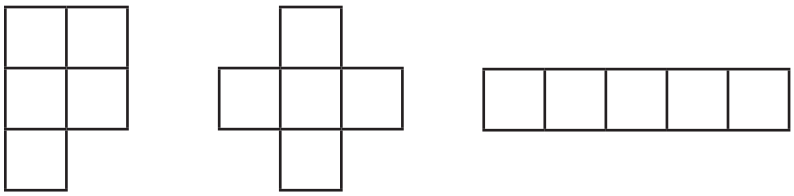
3SS5 Continued

Achievement Indicators:

3SS5.2 Measure and record the perimeter of a given irregular shape, and explain the strategy used.

Elaborations—Strategies for Learning and Teaching

Pentominoes may be used to illustrate this concept. Pentominoes are shapes each made up of five squares, all of which must have at least one side matching up with the side of another.



perimeter is 10 units | perimeter is 12 units | perimeter is 12 units

In addition to irregular shaped objects with straight sides, it is important to expose students to other irregular shapes such as their handprint. Working with a partner, ask students to trace their handprint with fingers touching. Using string they can outline their handprint, then cut the string to determine the perimeter of their handprint by measuring it with their ruler. Challenge students to find someone with a handprint of the same perimeter.

3SS5.3 Construct more than one shape for a given perimeter (cm, m).

Using cm grid paper, ask students to create a shape of a given perimeter. Discuss with students that when constructing shapes for perimeter, they must remember that their shapes should have all square corners and be completely enclosed. Demonstrate how this would be done using only horizontal and vertical lines; students are not to make diagonal lines through the grid squares. By comparing their diagrams, students should realize that there is more than one shape possible for the given perimeter.

3SS5.4 Estimate the perimeter of a given shape (cm, m), using personal referents.

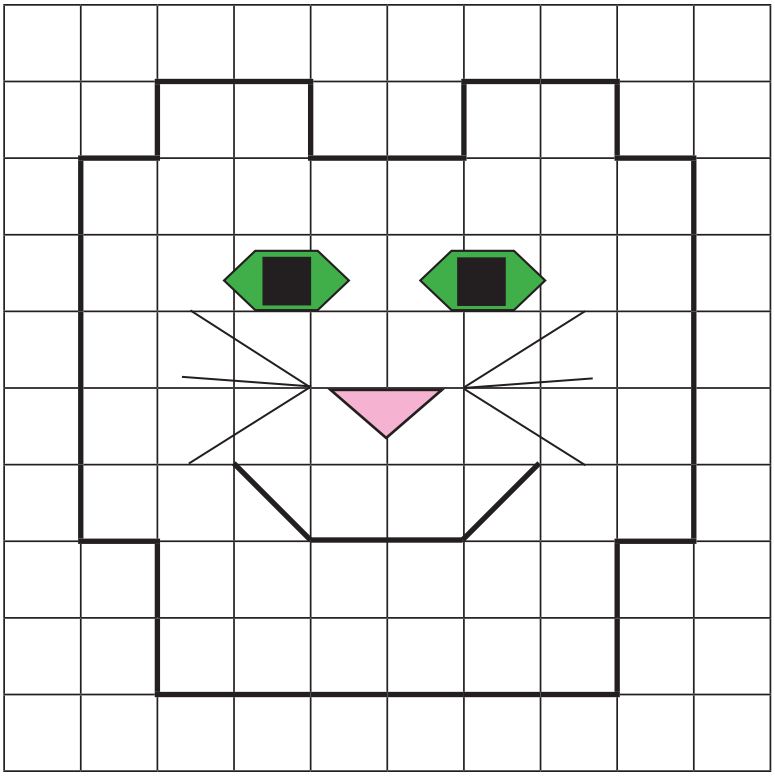
Provide students with a playing card and ask them how they could find the card's perimeter using the width of their finger. Invite students to estimate the card's perimeter. Then, ask students to use a ruler to find the actual perimeter and compare it to their estimates.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Ask students to determine the perimeter of a picture drawn on centimetre grid paper such as the one seen here.



(3SS5.2)

Performance

- Using centimetre grid paper, ask students to create three different shapes for a given perimeter. They must follow three rules:
  - (i) Stay on the lines when drawing.
  - (ii) You must be able to cut your shape out and have it all in one piece.
  - (iii) Each shape must have a perimeter of the given length, e.g., 30 cm.

  Record the perimeter on each shape.

(3SS5.3)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 8: Measuring Perimeter in Centimetres

TR: pp. 30 - 33

SB: pp. 160 - 163

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/meas.html

- cat face

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

3SS5 Continued

Achievement Indicators:

3SS5.1 (Continued) Measure and record the perimeter of a given regular shape, and explain the strategy used.

3SS5.2 (Continued) Measure and record the perimeter of a given irregular shape, and explain the strategy used.

3SS5.3 (Continued) Construct more than one shape for a given perimeter (cm, m).

3SS5.4 (Continued) Estimate the perimeter of a given shape (cm, m), using personal referents.

Elaborations—Strategies for Learning and Teaching

Once students have had experiences measuring using centimetres, metres should then be included.

Metres are used to determine the perimeter of large shapes or regions such as a window, door, or room.

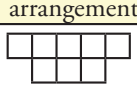
Discuss with students possible strategies for determining the perimeter of the classroom. Using a metre stick and/or measuring tape demonstrate how to measure the length of each side of the room. Record the measurements as you go. Ask students what number sentence could be used to find the perimeter.

Large irregular shapes can be represented using a scale on centimetre grid paper (1 cm = 1 m). Prior to the use of the scale for determining perimeter in metres, tape may be used to outline a large irregular shape, with square corners, on the classroom floor. As a group, determine the shape's perimeter in meters. This activity could also be used in a measurement center.

Using the 1 cm = 1 m scale and cm grid paper, ask students to design two different floor plans for their new bedroom with a perimeter of 26 m. Remind them that their bedrooms must have square corners.

Brainstorm a list of possible referents for a meter. If students experience difficulty with this, you may suggest that a wrapping paper roll, or their arm span, is approximately 1 meter. Invite students to select a referent from the list to estimate the perimeter of a given shape such as a bulletin board, a bookshelf, or a table.

The book *Spaghetti and Meatballs for All* by Marilyn Burns, for example, presents a practical perimeter problem. Ask students to make various table arrangements with manipulatives - eight square tiles to represent the tables, and 32 small cubes to represent chair. Tell students that at least one side of each tile must touch another tile. Ask them to draw their arrangements on a recording sheet such as the one below. With each arrangement, students must record the number of guests seated, and the perimeter. Challenge students to find the arrangements that can seat the greatest and least amount of guests. The scale and unit of measurement for recording perimeter in this activity is 1 tile side = 1 metre.

Number of guests seated	Table arrangement	Perimeter
14		14 m
12		12 m

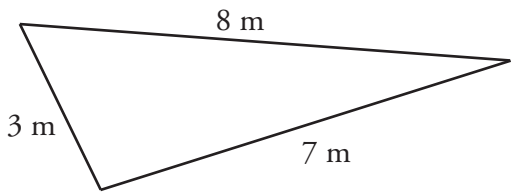
General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Performance

- Sam and Judy were at the beach and each decided to make a shape in the sand. They measured the side lengths of each shape, and printed the lengths in the sand.

  Sam drew this triangle.



  Judy drew a square with each side 4 m long.

  Ask students, "Whose drawing has the greatest perimeter?" Encourage students to use pictures, words and numbers to explain.

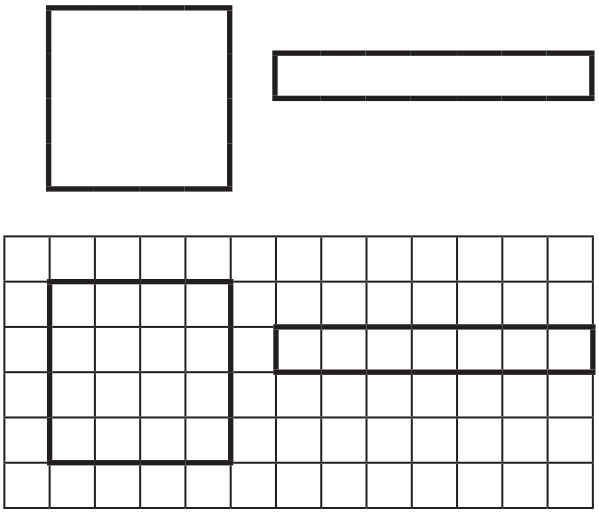
  (3SS5.1)

- Ask students to use a geoboard to create a rectangle with a perimeter of 14 units. Ask them to create a second rectangle with a perimeter of 14 units but in a different shape.

  (3SS5.3)

Interview

- Present the student with two diagrams, one a long, skinny rectangle, the other a square. Ask the question: Do you think it is possible for these two shapes to have the same perimeter? Ask them to explain their response. If necessary, present the diagrams on grid paper.



(3SS5.3, 3SS5.4)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 9: Measuring Perimeter in Metres

TR: pp. 34 - 36

SB: pp. 164 - 166

Lesson 10: Exploring Shapes with Equal Perimeters

TR: pp. 37 - 38

SB: pp. 167 - 168

Suggested Resources

Children's Literature

- *Spaghetti and Meatballs for All* by Marilyn Burns

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/meas.html

- tables and chairs template
- rectangles for comparing perimeters

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

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]

Achievement Indicators:

3SS4.1 Provide a personal referent for one kilogram, and explain the choice.

3SS4.2 Estimate the mass of a given object, using personal referents.

Elaborations—Strategies for Learning and Teaching

Mass measures the amount of matter contained in an object. When introducing the 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". Gravity influences "weight" but not "mass". If you were on another planet, your weight would change but not your mass.

As with all measurement units, it is important that students have a personal reference for gram and kilogram.

Students should recognize which mass unit (gram or kilogram) is appropriate for measuring the mass of a specific item. It is helpful for students to investigate how everyday items are measured, e.g., food items. Include items which are small and dense (e.g., a can of tuna) as well as those which are large and porous (e.g., a baggie of popcorn).

It would be beneficial for students to have an opportunity to make a kilogram mass of their own. Provide students with materials (e.g., sand, pennies, flour, rice, sugar, small cubes from base ten materials, etc.) to fill a container until it exactly balances with a 1 kg mass on a balance scale. Using this kilogram container they can now compare its mass to items in the classroom to help them find a personal referent for 1 kg.

The most conceptual way for students to compare the mass of two objects is to hold one in each hand, extend their arms, and experience the relative downward pull on each, effectively communicating to the student which object is closest to 1 kg.

Once students have established personal referents for 1 kg, they can now use their referents to estimate whether an object is heavier or lighter than 1 kg.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Ask students to list five items they believe to be heavier than 2 kg but lighter than 10 kg.

  (3SS4.1, 3SS4.2)

- Ask students to draw a picture of an object that they believe to have a mass of about 5 kg.

  (3SS4.2)

- Ask students to list five items that would be measured in grams rather than kilograms.

  (3SS4.1, 3SS4.2, 3SS4.3)

Interview

- Ask the student which seems like a more reasonable estimate for the mass of a cat, 6 kg or 6 g? Ask them to explain their choice.

  (3SS4.2)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 11: Exploring Mass: The Kilogram

TR: pp. 39 - 40

SB: pp. 169 - 170

Strand: Shape and Space (Measurement)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **3SS4 Continued** **Achievement Indicators:**	
3SS4.3 Provide a personal referent for one gram, and explain the choice.	Using their understanding of kilogram, ask students to brainstorm items that may have a mass of 1 gram by using the small cube as a reference. You may wish to provide students with an item such as a raisin, jelly bean, paper clip, etc., to conceptualize the sense of how a gram feels. Once students have established a personal referent for 1 g, they can now use their referent to estimate the mass of common objects such as an eraser, an apple, a juice box, a novel, etc.
3SS4.4 Match a given standard unit to a given referent.	Using objects from the classroom as referents, ask students to identify whether the object is an appropriate reference for grams or kilograms (e.g. a counter, a raisin, a paper clip, a textbook, a sneaker, a lunch box, etc.)
3SS4.5 Explain the relationship between 1000 g and 1 kg, using a model.	Using items of various benchmark masses (e.g., two bags of 500 g, four boxes of 250 g, or a pre-counted bag of 1000 one gram items) model how 1000 g is equal to 1 kg using a balance scale.
3SS4.6 Measure, using a scale, and record, using the units g and kg, the mass of given everyday objects.	Model how a balance scale and standard masses can be used to determine the mass of everyday objects. Provide a variety of objects for students to use as they explore measuring mass.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Journal

- Provide students with the following prompts:
  - (i) Could you eat 1 kg of cantaloupe? 1 kg of popcorn? Explain your thinking.
  - (ii) If sliced meat sells for $3.50/g, is it expensive? Explain your thinking.

(3SS4.4)

Performance

- Invite students to create a "Grocery Flyer Collage". Using grocery store flyers, ask students to cut, paste, and sort items that are sold in grams and kilograms onto construction paper or bristol board creating a collage of the items chosen.

(3SS4.4)

- Using grocery flyers, ask students to select at least three items totalling as close to 1000 g or 1 kg as possible. They can cut and paste their selected items on a paper bag. Ask students to record their thinking on the other side of the bag.

(3SS4.4)

- Ask students to choose five objects of varying masses. Ask them to use their best estimate to draw the objects in order from lightest to heaviest on a chart as seen below. Students use a balance scale and standard masses of g and kg, to determine the actual mass of all five objects. They then write the actual mass of each object and draw them again in the correct order from lightest to heaviest on the chart.

Lightest →					Heaviest
My estimate					
Actual mass					

(3SS4.6, 3SS4.7)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 12: Exploring Mass: The Gram

TR: pp. 41 - 43

SB: pp. 171 - 173

Suggested Resource

Resource Link: www.k12pl.nl.ca/curr/k-6/math/grade3/resource-links/meas.html

- Lightest to Heaviest template

Strand: Shape and Space (Measurement)

Outcomes

Students will be expected to

3SS4 Continued
Achievement Indicators:

3SS4.7 Provide examples of 3-D objects that have a mass of approximately 1 g, 100 g and 1 kg.

3SS4.8 Determine the mass of two given similar objects with different masses, and explain the results.

3SS4.9 Determine the mass of an object, change its shape, re-measure its mass, and explain the results.

Elaborations—Strategies for Learning and Teaching

With the mass of a gram being so small, it is important to provide students with opportunities to work with masses of varying benchmark sizes in an effort to develop a conceptual understanding for working with grams and kilograms. A shoelace, for example, has a mass of 1 g; a nickel has a mass of about 5 g; a rod has a mass of about 10 g; or 10 rods could be used to show 100 g, etc.

Determine and record the mass of two similar items such as a ping pong ball and a golf ball. Ask students to explain why two objects that appear to be so similar can have different masses. Lead the discussion to include that a ping pong ball is made of lighter material, is hollow, and intended to move short distances, whereas a golf ball is made of heavier material, is solid, and intended to travel long distances.

Using manipulatives such as modelling clay or multi-link cubes, ask students to create shapes and then measure their mass. Then ask them to change the shape of their creation using the exact same material and measure its mass again.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Interview

- Display a set of five objects of similar size, and a sixth target object. Ask students to sort them into groups with masses less than and greater than the target. This assessment may also be done with a pan balance.

(3SS4.8)

- Ask students to explain why the mass of an object does not change if you change its shape.

(3SS4.9)

- Ask students to find a small but heavy item. Then ask them to find a large but lighter item. Ask them to use a pan balance to check to see if the small object is heavier than the large object.

(3SS4.8)

Journal

- Provide students with the following prompt: Given two objects, why can you not tell which is heavier only by looking at it? Give an example of objects to support your answer.

(3SS4.8)

- Provide students with the following prompt: Do bigger objects always have greater mass than smaller objects? Explain your thinking. E.g., a balloon and a full can of vegetables.

(3SS4.8)

Resources/Notes

Authorized Resource

Math Makes Sense 3

Lesson 12: (Continued) Exploring Mass: The Gram

TR: pp. 41 - 43

SB: pp. 171 - 173

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
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]	3N1.1 Extend a given skip counting sequence by 5s, 10s or 100s, forward and backward, using a given starting point.	p. 54
	3N1.2 Extend a given skip counting sequence by 25s, forward and backward, starting at a given multiple of 25.	p. 54
	3N1.3 Identify and correct errors and omissions in a given skip counting sequence.	p. 54
	3N1.4 Identify and explain the skip counting pattern for a given number sequence.	p. 54
	3N1.5 Determine the value of a given set of coins (nickels, dimes, quarters, loonies) by using skip counting.	p. 56
	3N1.6 Extend a given skip counting sequence by 3s, forward and backward, starting at a given multiple of 3.	p. 58
	3N1.7 Extend a given skip counting sequence by 4s, forward and backward, starting at a given multiple of 4.	p. 58
3N2 Represent and describe numbers to 1000, concretely, pictorially and symbolically. [C, CN, V]	3N2.1 Represent a given number pictorially.	p. 38
	3N2.2 Read a given number word (0 to 1000).	p. 42
	3N2.3 Read a given three-digit numeral without using the word "and".	p. 42
	3N2.4 Represent a given number as an expression; e.g., 300 – 44 for 256 or 20 + 236.	p. 44
	3N2.5 Represent a given number, using manipulatives such as base ten materials.	pp. 46, 62
	3N2.6 Write number words for given multiples of ten to 90.	p. 50
	3N2.7 Write number words for given multiples of a hundred to 900.	p. 50

[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
3N3 Compare and order numbers to 1000. [C, CN, R, V]	3N3.1 Place a given set of numbers in ascending or descending order, and verify the result by using a hundred chart (e.g., a one hundred chart, a two hundred chart, a three hundred chart), a number line or by making references to place value.	p. 52
	3N3.2 Create as many different three-digit numerals as possible, given three different digits. Place the numbers in ascending or descending order.	p. 52
	3N3.3 Identify and explain errors in a given ordered sequence to 1000.	p. 52
	3N3.4 Identify missing numbers in parts of a given hundred sequence to 1000.	p. 52
3N4 Estimate quantities less than 1000, using referents. [ME, PS, R, V]	3N4.1 Estimate the number of groups of ten in a given quantity, using 10 as a referent (known quantity).	p. 60
	3N4.2 Estimate the number of groups of a hundred in a given quantity, using 100 as a referent.	p. 60
	3N4.3 Estimate a given quantity by comparing it to a referent.	p. 60
	3N4.4 Select an estimate for a given quantity by choosing among three possible choices.	p. 66
	3N4.5 Select and justify a referent for determining an estimate for a given quantity.	p. 60
3N5 Illustrate, concretely and pictorially, the meaning of place value for numerals to 1000. [C, CN, R, V]	3N5.1 Explain and show, with counters, the meaning of each digit for a given three-digit numeral with all digits the same; e.g., for the numeral 222, the first digit represents two hundreds (two hundred counters) the second digit represents two tens (twenty counters) and the third digit represents two ones (two counters).	p. 40
	3N5.2 Explain, using concrete materials, the meaning of zero as a place holder in a given number.	p. 46
	3N5.3 Record, in more than one way, the number represented by given proportional materials (e.g., base-ten materials) and non-proportional materials (e.g., money).	p. 48
	3N5.4 Represent a given number in different ways, using proportional and non-proportional materials, and explain how the representations are equivalent; e.g., 351 can be represented as three 100s, five 10s and one 1; or two 100s, fifteen 10s and one 1; or three 100s, four 10s and eleven 1s.	pp. 48, 56

[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
3N6 Describe and apply mental mathematics strategies for adding two two-digit numerals. [C, CN, ME, PS, R, V]	3N6.1 Add two given two-digit numerals, using a mental mathematics strategy, and explain or illustrate the strategy.	p. 154
	3N6.2 Explain how to use the "adding from left to right" strategy; e.g., to determine the sum of 23 + 46, think 20 + 40 and 3 + 6.	p. 154
	3N6.3 Explain how to use the "taking one addend to the nearest multiple of ten and then compensating" strategy; e.g., to determine the sum of 28 + 47, think 30 + 47 – 2 or 50 + 28 – 3.	p. 154
	3N6.4 Explain how to use the "using doubles" strategy; e.g., to determine the sum of 24 + 26, think 25 + 25; to determine the sum of 25 + 26, think 25 + 25 + 1 or doubles plus 1.	p. 154
	3N6.5 Apply a mental mathematics strategy for adding two given two-digit numerals.	p. 154
3N7 Describe and apply mental mathematics strategies for subtracting two two-digit numerals. [C, CN, ME, PS, R, V]	3N7.1 Subtract two given two-digit numerals, using a mental mathematics strategy, and explain or model the strategy used.	p. 172
	3N7.2 Explain how to use the "taking the subtrahend to the nearest multiple of ten and then compensating" strategy; e.g., to determine the difference of 48 – 19, think 48 – 20 + 1.	p. 172
	3N7.3 Explain how to use the "think addition" strategy; e.g., to determine the difference of 62 – 45, think 45 + 5, then 50 + 12 and then 5 + 12.	p. 172
	3N7.4 Explain how to use the "using doubles" strategy; e.g., to determine the difference of 24 – 12, think 12 + 12 = 24.	p. 172
	3N7.5 Apply a mental mathematics strategy for subtracting two given two-digit numerals.	p. 172
3N8 Apply estimation strategies to predict sums and differences of two two-digit numerals in a problem solving context. [C, ME, PS, R]	3N8.1Estimate the solution for a given problem involving the sum of two two-digit numerals; e.g., to estimate the sum of 43 + 56, use 40 + 50 (the sum is close to 90).	p. 152
	3N8.2 Estimate the solution for a given problem involving the difference of two two-digit numerals; e.g., to estimate the difference of 56 – 23, use 50 – 20 (the difference is close to 30).	p. 164

[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
3N9 Demonstrate an understanding of addition and subtraction of numbers with answers to 1000 (limited to one-, two- and three-digit numerals), 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]	3N9.1 Model the addition of two or more given numbers, using concrete or visual representations, and record the process symbolically.	pp. 156 - 162
	3N9.2 Create an addition or subtraction story problem for a given solution.	pp. 158, 162, 166
	3N9.3 Determine the sum of two given numbers, using a personal strategy; e.g., for 326 + 48, record 300 + 60 + 14.	pp. 158, 162
	3N9.4 Refine personal strategies to increase their efficiency.	pp. 162, 170
	3N9.5 Solve a given problem involving the sum or difference of two given numbers.	pp. 162, 170
	3N9.6 Model the subtraction of two given numbers, using concrete or visual representations, and record the process symbolically.	p. 166
	3N9.7 Determine the difference of two given numbers, using a personal strategy; e.g., for 127 – 38, record 38 + 2 + 80 + 7 or 127 – 20 – 10 – 8.	pp. 166 - 168
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]	3N10.1 Explain or demonstrate the mental mathematics strategy that could be used to determine a basic fact, such as: • using doubles; e.g., for 6 + 8, think 7 + 7 • using doubles plus one, plus two; e.g., for 6 + 7, think 6 + 6 + 1 • using doubles subtract one, subtract two; e.g., for 6 + 7, think 7 + 7 – 1 • making 10; e.g., for 6 + 8, think 6 + 4 + 4 or 8 + 2 + 4 • using addition to subtract; e.g., for 13 – 7, think 7 + ? = 13. • using commutative property; e.g., for 3 + 9, think 9 + 3 • provide a rule for determining answers when adding and subtracting zero. When you add or subtract 0 to or from a number, the answer is the number you started with.	pp. 138 - 140
	3N10.2 Recall doubles to 18 and related subtraction facts.	p. 140
	3N10.3 Recall compatible number pairs for 5 and 10.	pp. 140 - 142
	3N10.4 Recall basic addition facts to 18 and related subtraction facts to solve problems.	p. 142

[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
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]	It is not expected that students achieve instant recall of the basic facts.	
	3N11.1 Identify events from experience that can be described as multiplication.	p. 182
	3N11.2 Represent a given story problem, using manipulatives or diagrams, and record the problem in a number sentence.	pp. 182 - 184
	3N11.3 Solve a given multiplication problem.	p. 186
	3N11.4 Create and illustrate a story problem for a given number sentence	p. 186
	3N11.5 Represent, concretely or pictorially, equal groups for a given number sentence.	p. 186
	3N11.6 Represent a given multiplication expression as repeated addition.	p. 188
	3N11.7 Represent a given repeated addition as multiplication.	p. 188
	3N11.8 Represent a given multiplication expression, using an array.	pp. 188 - 190
	3N11.9 Create an array to model the commutative property of multiplication.	p. 192
	3N11.10 Relate multiplication to division by using arrays and writing related number sentences.	p. 202

[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
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]	3N12.1 Identify events from experience that can be described as equal grouping.	p. 196
	3N12.2 Illustrate, with counters or a diagram, a given story problem, presented orally, that involves equal grouping; and solve the problem.	p. 196
	3N12.3 Listen to a story problem; represent the numbers, using manipulatives or a drawing; and record the problem with a number sentence.	p. 196
	3N12.4 Create and illustrate, with counters, a story problem for a given number sentence; e.g., 6 ÷ 3 = 2.	p. 196
	3N12.5 Solve a given problem involving division.	p. 198
	3N12.6 Identify events from experience that can be described as equal sharing.	p. 198
	3N12.7 Illustrate, with counters or a diagram, a given story problem, presented orally, that involves equal sharing; and solve the problem.	p. 198
	3N12.8 Represent a given division expression as repeated subtraction.	p. 200
	3N12.9 Represent a given repeated subtraction as a division expression.	p. 200
	3N12.10 Relate division to multiplication by using arrays and writing related number sentences.	p. 202

[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
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 that have like denominators. [C, CN, ME, R, V]	3N13.1 Describe everyday situations where fractions are used.	pp. 208 - 210
	3N13.2 Cut or fold a whole into equal parts, or draw a whole in equal parts; demonstrate that the parts are equal; and name the parts.	p. 210
	3N13.3 Sort a given set of shaded regions into those that represent equal parts and those that do not, and explain the sorting.	p. 210
	3N13.4 Represent a given fraction concretely or pictorially.	p. 212
	3N13.5 Identify common characteristics of a given set of fractions.	p. 212
	3N13.6 Name and record the fraction represented by the shaded and non-shaded parts of a given region.	pp. 212 - 216
	3N13.7 Identify the numerator and denominator for a given fraction.	pp. 212 - 216
	3N13.8 Model and explain the meaning of numerator and denominator.	pp. 212 - 216
	3N13.9 Compare given fractions with the same denominator, using models.	p. 218

[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
3PR1 Demonstrate an understanding of increasing patterns by: • describing • extending • comparing • creating patterns using manipulatives, diagrams, sounds and actions (numbers to 1000). [C, CN, PS, R, V]	3PR1.1 Describe a given increasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues; e.g., for 42, 44, 46 … the pattern rule is start at 42 and add 2 each time.	pp. 68 - 70
	3PR1.2 Identify the pattern rule of a given increasing pattern, and extend the pattern for the next three elements.	p. 72
	3PR1.3 Identify and explain errors in a given increasing pattern.	p. 74
	3PR1.4 Identify and apply a pattern rule to determine missing elements for a given pattern.	p. 76
	3PR1.5 Describe the strategy used to determine missing elements in a given increasing pattern.	p. 78
	3PR1.6 Create a concrete, pictorial or symbolic representation of an increasing pattern for a given pattern rule.	p. 80
	3PR1.7 Create a concrete, pictorial or symbolic increasing pattern; and describe the relationship, using a pattern rule.	p. 80
	3PR1.8 Solve a given problem, using increasing patterns.	pp. 82 - 84
	3PR1.9 Identify and describe increasing patterns in the environment.	p. 84
	3PR1.10 Compare numeric patterns of counting by 2s, 5s, 10s, 25s and 100s.	pp. 86, 90
	3PR1.11 Locate and describe various increasing patterns found on a hundred chart, such as horizontal, vertical and diagonal patterns.	pp. 88 - 90

[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
3PR2 Demonstrate an understanding of decreasing patterns by: • describing • extending • comparing • creating patterns using manipulatives, diagrams, sounds and actions (numbers to 1000).. [C, CN, PS, R, V]	3PR2.1 Describe a given decreasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues.	p. 92
	3PR2.2 Identify the pattern rule of a given decreasing pattern, and extend the pattern for the next three elements.	p. 94
	3PR2.3 Solve a given problem, using decreasing patterns.	p. 94
	3PR2.4 Identify and describe decreasing patterns in the environment.	p. 96
	3PR2.5 Compare decreasing numeric patterns of counting backward by 2s, 5s, 10s, 25s and 100s.	p. 96
	3PR2.6 Create a concrete, pictorial or symbolic decreasing pattern for a given pattern rule.	p. 98
	3PR2.7 Create a concrete, pictorial or symbolic decreasing pattern; and describe the relationship, using a pattern rule.	p. 98
	3PR2.8 Identify and describe various decreasing patterns found on a hundred chart, such as horizontal, vertical and diagonal patterns.	p. 100
	3PR2.9 Identify and explain errors in a given decreasing pattern.	p. 102
	3PR2.10 Identify and apply a pattern rule to determine missing elements for a given pattern.	p. 102
	3PR2.11 Describe the strategy used to determine missing elements in a given decreasing pattern.	p. 104

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

Strand: Patterns and Relations (Variables and Equations)	**General Outcome:** Represent algebraic expressions in multiple ways.	
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
3PR3 Solve one-step addition and subtraction equations involving a symbol to represent an unknown number. [C, CN, PS, R, V]	3PR3.1 Explain the purpose of the symbol in a given addition or subtraction equation with one unknown.	pp. 144 - 146
	3PR3.2 Create an addition or subtraction equation with one unknown to represent a given combining or separating action.	p. 146
	3PR3.3 Provide an alternative symbol for the unknown in a given addition or subtraction equation.	p. 148
	3PR3.4 Solve a given addition or subtraction equation with one unknown that represents combining or separating actions, using manipulatives.	p. 148
	3PR3.5 Solve a given addition or subtraction equation with one unknown, using a variety of strategies, including guess and check.	p. 148
	3PR3.6 Solve a given addition or subtraction equation when the unknown is on the left or the right side of the equation.	p. 150
	3PR3.7 Explain why the unknown in a given addition or subtraction equation has only one value.	p. 150

[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
3SS1 Relate the passage of time to common activities, using non-standard and standard units (minutes, hours, days, weeks, months, years). [CN, ME, R]	3SS1.1 Select and use a non-standard unit of measure, such as television shows or pendulum swings, to measure the passage of time, and explain the choice. 3SS1.2 Identify activities that can or cannot be accomplished in minutes, hours, days, weeks, months and years. 3SS1.3 Provide personal referents for minutes and hours.	p. 226 p. 226 p. 228
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]	3SS2.1 Determine the number of days in any given month, using a calendar. 3SS2.2 Solve a given problem involving the number of seconds in a minute, minutes in an hour or days in a given month. 3SS2.3 Create a calendar that includes days of the week, dates and personal events.	pp. 228 - 230 p. 232 p. 232
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]	3SS3.1 Provide a personal referent for one centimetre, and explain the choice. 3SS3.2 Estimate the length of an object, using personal referents. 3SS3.3 Draw a line segment of a given length, using a ruler. 3SS3.4 Sketch a line segment of a given length without using a ruler. 3SS3.5 Provide a personal referent for one metre, and explain the choice. 3SS3.6 Match a given standard unit to a given referent. 3SS3.7 Show that 100 cm is equivalent to 1 m by using concrete materials. 3SS3.8 Determine and record the length and width of a given 2-D shape. 3SS3.9 Determine and record the length, width or height of a given 3-D object.	p. 234 p. 234 p. 234 p. 234 p. 234 p. 234 p. 234 p. 238 p. 238

[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
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]	3SS4.1 Provide a personal referent for one kilogram, and explain the choice. 3SS4.2 Estimate the mass of a given object, using personal referents. 3SS4.3 Provide a personal referent for one gram, and explain the choice. 3SS4.4 Match a given standard unit to a given referent. 3SS4.5 Explain the relationship between 1000 g and 1 kg, using a model. 3SS4.6 Measure, using a scale, and record, using the units g and kg, the mass of given everyday objects. 3SS4.7 Provide examples of 3-D objects that have a mass of approximately 1 g, 100 g and 1 kg. 3SS4.8 Determine the mass of two given similar objects with different masses, and explain the results. 3SS4.9 Determine the mass of an object, change its shape, re-measure its mass, and explain the results.	p. 246 p. 246 p. 248 p. 248 p. 248 p. 248 p. 250 p. 250 p. 250
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]	3SS5.1 Measure and record the perimeter of a given regular shape, and explain the strategy used. 3SS5.2 Measure and record the perimeter of a given irregular shape, and explain the strategy used. 3SS5.3 Construct more than one shape for a given perimeter (cm, m). 3SS5.4 Estimate the perimeter of a given shape (cm, m), using personal referents.	pp. 240, 244 pp. 242 - 244 pp. 242 - 244 pp. 242 - 244

[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
3SS6 Describe 3-D objects according to the shape of the faces and the number of edges and vertices. [C, CN, PS, R, V]	3SS6.1 Identify the faces, edges and vertices of given 3-D objects, including cubes, spheres, cones, cylinders, pyramids and prisms.	pp. 120, - 124
	3SS6.2 Identify the shape of the faces of a given 3-D object.	pp. 120 - 126
	3SS6.3 Identify 3-D objects as cubes, spheres, cones, cylinders, square pyramids, triangular pyramids, rectangular prisms, or triangular prisms.	pp. 120 - 124
	3SS6.4 Determine the number of faces, curved surfaces, edges and vertices of a given 3-D object.	p. 124
	3SS6.5 Sort a given set of 3-D objects according to the number of faces, curved surfaces, edges or vertices.	p. 126
	3SS6.6 Construct a skeleton of a given 3-D object, and describe how the skeleton relates to the 3-D object.	p. 128
3SS7 Sort regular and irregular polygons, including: • triangles • quadrilaterals • pentagons • hexagons • octagons according to the number of sides. [C, CN, R, V]	3SS7.1 Identify given regular and irregular polygons that have different dimensions.	pp. 110 - 114
	3SS7.2 Identify given regular and irregular polygons that have different orientations.	pp. 116 - 118
	3SS7.3 Classify a given set of regular and irregular polygons according to the number of sides.	p. 118

[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
3SP1 Collect first-hand data and organize it using: • tally marks • line plots • charts • lists to answer questions. [C, CN, PS, V]	3SP1.1Record the number of objects in a given set, using tally marks.	p. 22
	3SP1.2 Answer questions using collected data.	p. 22
	3SP1.3 Organize a given set of data, using tally marks, line plots, charts or lists.	p. 24
	3SP1.4 Determine the common attributes of line plots by comparing line plots in a given set.	p. 24
	3SP1.5 Collect and organize data, using tally marks, line plots, charts and lists.	pp. 24 - 26
	3SP1.6 Answer questions arising from a given line plot, chart or list.	pp. 24 - 26
3SP2 Construct, label and interpret bar graphs to solve problems. [C, PS, R, V]	3SP2.1 Determine the common attributes, titles and axes of bar graphs by comparing bar graphs in a given set.	p. 28
	3SP2.2 Draw conclusions from a given bar graph to solve problems.	pp. 28, 32
	3SP2.3 Create a bar graph, labelling the title and axes, to represent a given set of data.	pp. 30 - 32
	3SP2.4 Solve problems by constructing and interpreting a bar graph.	pp. 30 -32

Appendix B
Problem Solving Strategies and Ideas

Outcomes *Students will be expected to*	Elaborations—Strategies for Learning and Teaching
Problem Solving	Problem solving strategies introduced in previous grades should be reviewed and extended. 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 these different strategies in your classroom as they are taught. 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.

Suggested Assessment Strategies

Performance

- Ask students to solve the following problems:
  - Kids were lining up to buy Nalini's cheese pizza. Nalini and her friend Kris sold 1 slice in the first minute, and 6 slices in the second minute. They sold 11 slices in the third minute, and 16 slices in fourth minute. If the pattern continued, how many slices did they sell in the fifth minute? If Nalini started out with 80 slices of pizza, when did she sell her last slice?
    (Adapted from *Get Your Hands on Problem Solving Grade 3*,1998, p. 5)
  - Mrs. Piercey bought five flags of different Canadian Provinces, to use in a Social Studies class activity. She added them to the flags she already had in the classroom. She borrowed two more flags. In the end ten flags were used in the activity. How many flags were there in the classroom already?
  - Mandy, Shamir, and Andrea have some crayons. Mandy has 12 crayons. She has 2 more crayons than Shamir and 1 less crayon than Andrea. How many crayons do they have altogether? Encourage students to begin to solve this problem by identifying what they know, and then organizing the information in a chart.
  - Give students a deck of digit cards 0 – 9 and a recording sheet. Present the following problem to students:
    A house number has three different digits.
    The sum of the three digits is 8
    The number does not begin with 0.
    What could the house number be? List all possible numbers.
  - Rachel walked 74 m to the park and realized that she forgot her gloves. She returned to her house to get her gloves and then decided to go to her friend's house which was only 32 m away. After playing with her friend for 45 minutes, Rachel went home. How many metres did Rachel walk altogether?
  - Travis baked blueberry muffins over the weekend. Each day during the week he took four muffins to school to share with his friends. On Saturday when he counted there were 18 left. How many had he baked?

Resources/Notes

Authorized Resource

Math Makes Sense 3

Patterning

Lesson 5: Strategies Toolkit

TR: pp. 16 – 17

SB: pp. 18 - 19

Numbers to 1000

Lesson 4: Strategies Toolkit

TR: pp. 14 - 15

SB: pp. 48 - 49

Addition and Subtraction

Lesson 13: Strategies Toolkit

TR: pp. 46 - 47

SB: pp. 124 - 125

Measurement

Lesson 7: Strategies Toolkit

TR: pp. 28 - 29

SB: 158 - 159

Suggested Resources

- *Math Curse* by Jon Scieszka
- *Math Appeal* by Greg Tang
- *Daily Word Problems, Grade 3* by Evan-Moor

Outcomes

Students will be expected to

Problem Solving (Continued):

Elaborations—Strategies for Learning and Teaching

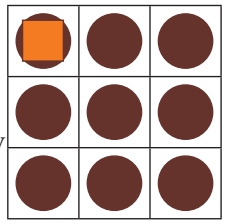
Here are the suggested problem solving strategies. While many of these were addressed in previous grades, students may need a reminder of each.

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/Chart	Students create and interpret a graph to find the solution to a problem.
Make an Organized List	Students realize that there are many possible correct answers. By being systematic and making a list, students are less likely to leave something out. Students must learn to check the list for redundancies.
Solve a Simpler Problem	Students first solve a simpler or more familiar part of the problem. Then they use the information to solve the bigger problem.
Work Backward	Students start with the end result and reverse the steps to determine the information about the original situation.

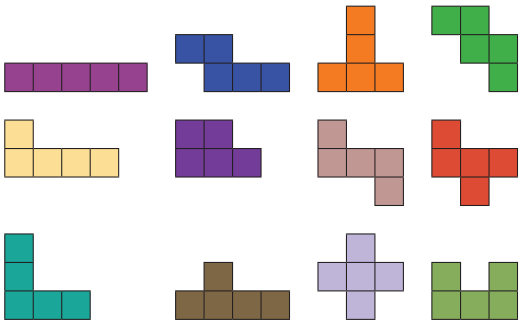
Suggested Assessment Strategies

Performance

- Ask students to solve the following problems:
  - Amayah, Benjamin, and John are each writing a list of numbers from 1 through 50. Amayah is counting by twos, Benjamin is counting by fives, and John is counting by tens. What are the numbers that all three of them will write? Show how you know.
  - There are 9 hamburgers on a grill. One hamburger has cheese on it. Put cheese on 5 more hamburgers on the grill, but be sure to leave 1 hamburger without cheese in each row and in each column. Which hamburgers can you put cheese on?



  - Jamila folded her t-shirts and put them in two stacks in her drawer. She put the brown shirt under the blue shirt. She put the red shirt on the right side of the brown shirt. She put the orange shirt on top of the blue shirt. Finally, Jamila put the pink shirt between the red and the yellow shirt. Where did Jamila put each t-shirt in her drawer? Use multi-link cubes to solve the problem and represent the solution using a coloured illustration.
  - How many different ways can you arrange 5 squares in a single shape so that at least 1 full side of a square touches another full side?



  - The caterpillar is trying to crawl up a tree. It takes 2 minutes to climb one meter but it falls back 25 cm each time it reaches one meter. How long will it take the caterpillar to crawl to the top of a 3 m tree? Students may need a number line for this problem.
  - A large rectangular circus tent has 7 poles from one end to the other end. The poles are 25 m apart. How long is the tent?

Resources/Notes

Authorized Resource

Math Makes Sense 3

Fractions

Lesson 6: Strategies Toolkit

TR: pp. 22 - 23

SB: pp. 200 - 201

Geometry

Lesson 3: Strategies Toolkit

TR: pp. 12 - 13

SB: pp. 216 - 217

Data Analysis

Lesson 6: Strategies Toolkit

TR: pp. 24 - 25

SB: pp. 260 - 261

Multiplication and Division

Lesson 10: Strategies Toolkit

TR: pp. 36 - 37

SB: pp. 300 - 301

Suggested Resource

- *Making Math Meaningful to Canadian Students, K – 8.* (2008) by Marian Small

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