Mathematics

Grade 4

Newfoundland Labrador

Government of Newfoundland and Labrador
Department of Education

A Curriculum Guide

2014

Contents

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*, January 2008. These guides incorporate the conceptual framework for Kindergarten to Grade 9 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 Grade 4 Mathematics course was originally implemented in 2008.

Beliefs About Students and Mathematics

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.

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.

GRADE STRAND	K	1	2	3	4	5	6	7	8	9	

Number

Patterns and Relations
- Patterns
- Variables and Equations

Shape and Space
- Measurement
- 3-D Objects and 2-D Shapes
- Transformations

Statistics and Probability
- Data Analysis
- Chance and Uncertainty

GENERAL OUTCOMES, SPECIFIC OUTCOMES AND ACHIEVEMENT INDICATORS

NATURE OF MATHEMATICS

change, constancy, number sense, patterns, relationships, spatial sense, uncertainty

MATHEMATICAL PROCESSES— COMMUNICATION, CONNECTIONS, MENTAL MATHEMATICS AND ESTIMATION, PROBLEM SOLVING, REASONING, TECHNOLOGY, VISUALIZATION

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

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

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

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

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

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

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

Mental Mathematics and Estimation [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*
- *Patterns*
- *Relationships*
- *Spatial Sense*
- *Uncertainty*

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

Change

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

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

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

- the number of a specific colour of beads in each row of a beaded design
- skip counting by 2s, starting from 4
- an arithmetic sequence, with first term 4 and a common difference of 2
- a linear function with a discrete domain.

(Steen, 1990, p. 184).

Constancy

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

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

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

- The sum of the interior angles of any triangle is 180°.

- The theoretical probability of flipping a coin and getting heads is 0.5.

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

Number Sense

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

Number sense, which can be thought of as intuition about numbers, is the most important foundation of numeracy (British Columbia Ministry of Education, 2000, p.146).

A true sense of number goes well beyond the skills of simply counting, memorizing facts and the situational rote use of algorithms. Mastery of number facts is expected to be attained by students as they develop their number sense. This mastery allows for facility with more complex computations but should not be attained at the expense of an understanding of number.

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

Patterns

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

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

Working with patterns enables students to make connections within and beyond mathematics. These skills contribute to students' interaction with, and understanding of, their environment.

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

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

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

Relationships

Mathematics is used to describe and explain relationships.

Mathematics is one way to describe interconnectedness in a holistic world view. Mathematics is used to describe and explain relationships. As part of the study of mathematics, students look for relationships among numbers, sets, shapes, objects and concepts. The search for possible relationships involves collecting and analyzing data and describing relationships visually, symbolically, orally or in written form.

Spatial Sense

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

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

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

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

Uncertainty

Uncertainty is an inherent part of making predictions.

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

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

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

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

Essential Graduation Learnings

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

Aesthetic Expression

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

Citizenship

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

Communication

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

Personal Development

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

Problem Solving

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

Technological Competence

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

Spiritual and Moral Development

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

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

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

Strands

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

The learning outcomes in the mathematics program are organized into four strands across the grades K–9. Some strands are further divided 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 course.

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.

Specific curriculum outcomes represent the means by which students work toward accomplishing the general curriculum outcomes and ultimately, the essential graduation learnings.

Summary

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

ASSESSMENT AND EVALUATION

Purposes of Assessment

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

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

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

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

Assessment has three interrelated purposes:

- assessment *for* learning to guide and inform instruction;

- assessment *as* learning to involve students in self-assessment and setting goals for their own learning; and

- assessment *of* learning to make judgements about student performance in relation to curriculum outcomes.

Assessment *for* Learning

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

Assessment *for* learning:

- requires the collection of data from a range of assessments as investigative tools to find out as much as possible about what students know

- provides descriptive, specific and instructive feedback to students and parents regarding the next stage of learning

- actively engages students in their own learning as they assess themselves and understand how to improve performance.

Assessment *as* Learning

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

Assessment *as* learning:

- supports students in critically analyzing their learning related to learning outcomes

- prompts students to consider how they can continue to improve their learning

- enables students to use information gathered to make adaptations to their learning processes and to develop new understandings.

Assessment *of* Learning

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

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

Assessment *of* learning:

- provides opportunities to report evidence to date of student achievement in relation to learning outcomes, to parents/guardians and other stakeholders

- confirms what students know and can do

- occurs at the end of a learning experience using a variety of tools.

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

Assessment Strategies

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

Observation (formal or informal)

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

Performance

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

Paper and Pencil

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

Journal

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

Interview

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

Presentation

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

Portfolio

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

INSTRUCTIONAL FOCUS

Planning for Instruction

Consider the following when planning for instruction:

- Integration of the mathematical processes within each topic 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 should 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.
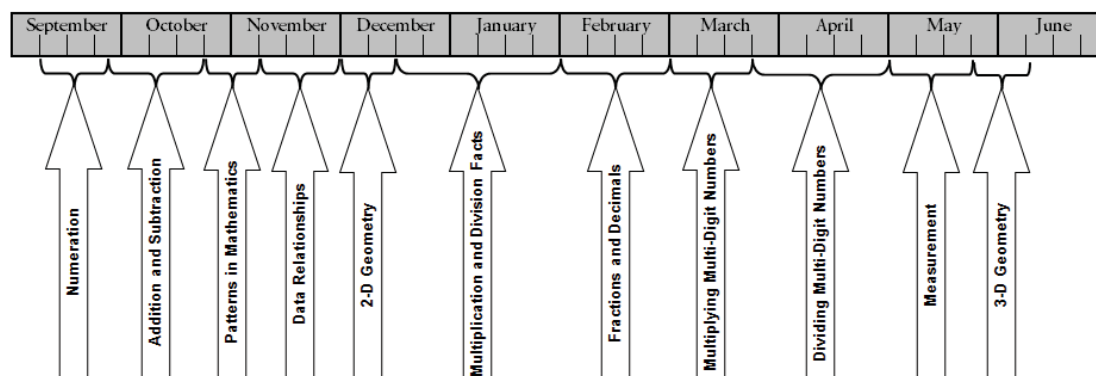
Teaching Sequence

The curriculum guide for Grade 4 Mathematics is organized by units. This is only a suggested teaching order for the course. There are a number of combinations of sequences that would be appropriate.

Each two page spread lists the topic, general outcome, and specific outcome.

Instruction 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. The timelines at the beginning of each unit are provided to assist in planning. The use of these timelines is not mandatory. However, it is mandatory that all outcomes are taught during the school year, so a long term plan is advised. Teaching of the outcomes is ongoing, and may be revisited as necessary.

September	October	November	December	January	February	March	April	May	June

Numeration | Addition and Subtraction | Patterns in Mathematics | Data Relationships | 2-D Geometry | Multiplication and Division Facts | Fractions and Decimals | Multiplying Multi-Digit Numbers | Dividing Multi-Digit Numbers | Measurement | 3-D Geometry

Resources

The authorized resource for Newfoundland and Labrador for students and teachers is *Math Focus 4* (Nelson). Column four of the curriculum guide references *Math Focus 4* for this reason.

Teachers may use any other resource, or combination of resources, to meet the required specific outcomes.
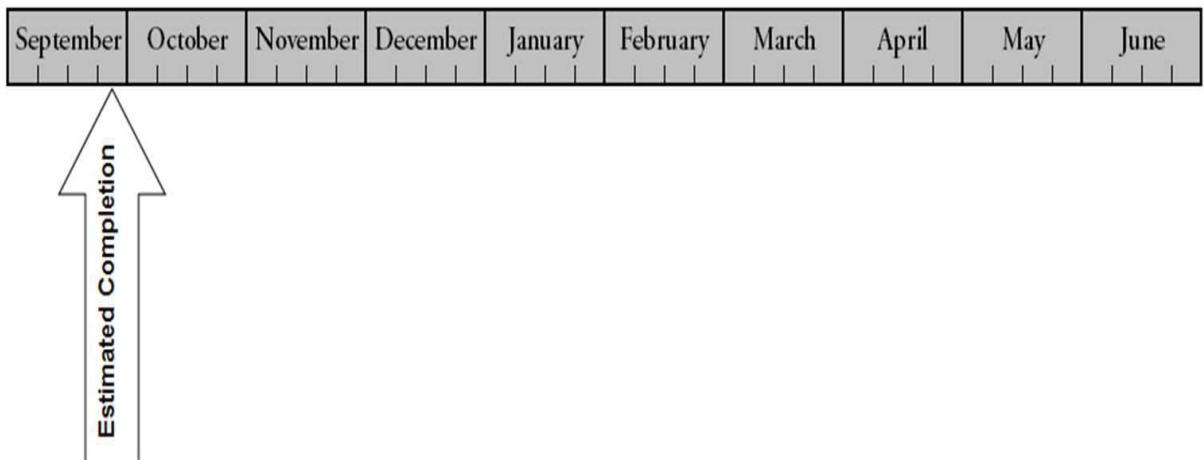
GENERAL AND SPECIFIC OUTCOMES

GENERAL AND SPECIFIC OUTCOMES WITH ACHIEVEMENT INDICATORS (pages 19-238)

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 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. Achievement indicators should also help teachers form a clear picture of the intent and scope of each specific outcome.

Grade 4 Mathematics is organized into eleven units: *Numeration, Addition and Subtraction, Patterns in Mathematics, Data Relationships, 2-D Geometry, Multiplication and Division Facts, Fractions and Decimals, Multiplying Multi-Digit Numbers, Dividing Multi-Digit Numbers, Measurement, and 3-D Geometry.*
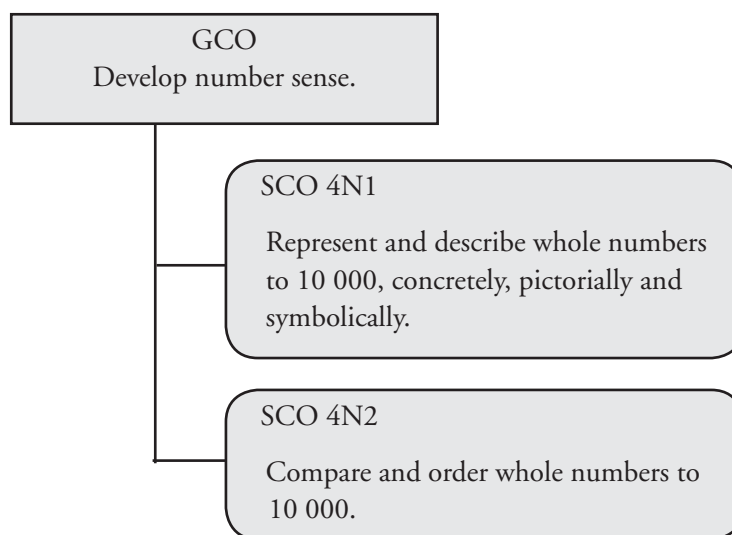
NUMERATION

Suggested Time: 2 Weeks

September	October	November	December	January	February	March	April	May	June

Estimated Completion

Unit Overview

Focus and Context

The focus of instruction in this unit is on the development of flexible thinking with respect to larger whole numbers. Students should gain an understanding of the relative size (magnitude) of numbers through meaningful contexts, such as capacity for local arenas or population of the school/community. Students then begin to use personal referents to think of other large numbers. They will also use benchmarks, such as multiples of 100 and 1 000, as well as 250 and 750, as a reference point to help them develop a conceptual understanding of numbers and their size.

Outcomes Framework

GCO
Develop number sense.

SCO 4N1

Represent and describe whole numbers to 10 000, concretely, pictorially and symbolically.

SCO 4N2

Compare and order whole numbers to 10 000.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
3N2 Represent and describe numbers to 1 000, concretely, pictorially and symbolically. [C, CN, V] 3N3 Compare and order numbers to 1 000. [C, CN, V] 3N4 Estimate quantities less than 1 000, using referents.[ME, PS, R, V] 3N5 Illustrate, concretely and pictorially, the meaning of place value for numerals to 1 000. [C, CN, R, V]	4N1 Represent and describe whole numbers to 10 000, concretely, pictorially and symbolically. [C, CN, V] 4N2 Compare and order whole numbers to 10 000. [C, CN, V]	5N1 Represent and describe whole numbers to 1 000 000. [C, CN, V, T]

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 a graphic as seen above.

In Grade 3, students worked with facts up to 5 × 5. While the focus on multiplication and division facts in Grade 4 does not begin until later, suggestions for reviewing the 5 × 5 facts, as part of a 5-10 minute daily routine, are provided at the beginning of each unit. Refer to *https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit1.html* for strategies for multiplication facts. Work with facts up to 9 × 9 will begin during the Multiplication and Division Facts unit.

Place in a bag all multiplication facts up to 5 × 5. Ask students to draw a grid, 3 blocks by 3 blocks, and record in each block a number representing any product of facts up to 5 × 5. Multiplication facts are drawn from the bag and students with the corresponding product cover the number on their card. Play continues until one student covers three in a row.

10	4	9
12	8	15
20	6	16

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N1 Represent and describe whole numbers to 10 000, concretely, pictorially and symbolically.
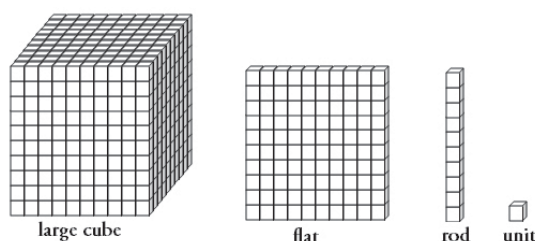[C, CN, V]

Suggestions for Teaching and Learning

In Grade 3, students represented, described, compared and ordered numbers to 1 000. In Grade 4 this will be extended to develop place value concepts for numbers to 10 000. It is important to realize that not all students are ready for numbers up to 10 000 in September. This outcome, therefore, should be ongoing throughout the year.

When using base ten blocks, students should be aware that the blocks can take on different values depending on the context. It is important, therefore, that proper terminology be used when naming the blocks.

The word "block" is a generic term for any of the base ten pieces. Avoid using terms such as "thousands cube/block", "hundreds flat", "tens rod" or "ones" as students will need to be flexible in their thinking of models later. The flat, for example, represents 100 when working with whole numbers. When learning about decimals, the individual blocks will take on different meanings.

large cube   flat   rod   unit

Literature connections with mathematical concepts allow learners to visualize math in the world around them. *How Much, How Many, How Far, How Heavy, How Long, How Tall is 1000?* by Helen Nolan could be used as a pre-assessment of students' number sense. It allows them to think about how the number 1 000 can seem larger or smaller depending on the size, arrangement, and use of the objects being counted. Ask students to give other examples when 1 000 seems like a large number or a small number. The ending provides an opportunity for students to begin thinking about numbers that are greater than 1 000.

# General Outcome: Develop number sense.

Suggested Assessment Strategies

Interview

- To activate students' prior knowledge, ask questions about the reasonableness of numbers. You may first need to discuss what reasonable means in any situation, with or without numbers. Ask:
  (i)   Would it be reasonable for an elementary school to have 9 600 students?
  (ii) Would it be reasonable for an elevator to hold 20 people?
  (iii) Would someone be able to drive 2 600 kilometres in a day?
  (iv) Would it be reasonable to pay $5 000 for a boat? a book? a computer?

  Investigate and discuss possible answers. Ask students to create their own "reasonable" questions about a variety of topics.

  (4N1)

Paper and Pencil

- *Exploding the Number* could be used as a pre-assessment tool to determine students' knowledge of numbers in the thousands. Ask students to write any multi-digit number in the centre of a sheet of paper as shown below. Ask them to 'explode' the number by representing it in as many ways as they can. Students should repeat this task several times throughout the unit as their number sense develops. Begin with a three-digit number at the beginning of the unit and extend to four-digit numbers with additional representations by unit's end (as shown below). Answers will vary.

(4N1)
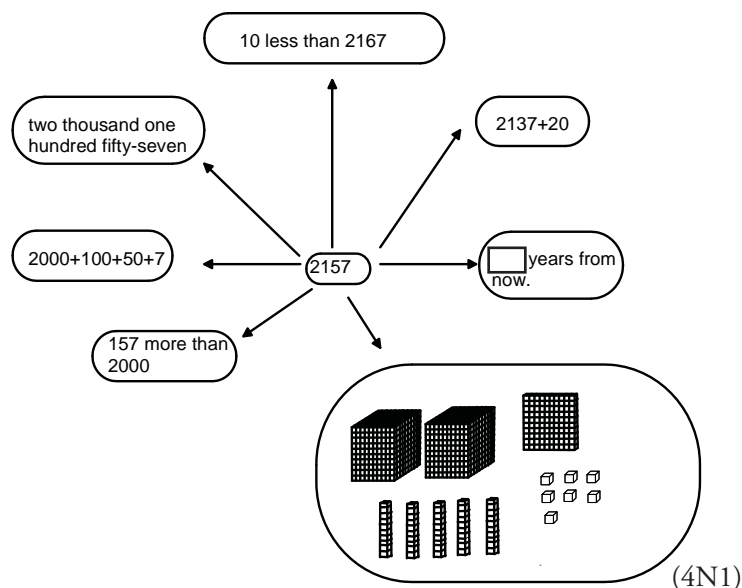
Resources/Notes

Authorized Resource

Math Focus 4
Getting Started:
Modelling Numbers
Teacher Resource (TR): pp. 9-12
Student Book (SB): pp. 34-35

Supplementary Resources

Teaching Student-Centered Mathematics Grades 3-5 – John Van de Walle and LouAnn Lovin

- Support for SCO 4N1 can be found on pp. 45-51

Making Math Meaningful to Canadian Students K - 8 – Marian Small

- Support for SCO 4N1 can be found on pp. 137–148

Suggested Resources

How Much, How Many, How Far, How Heavy, How Long, How Tall is 1000? – Tracy Walker and Helen Nolan

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit1.html

- Enrichment activities

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N1 Continued ...

Achievement Indicators:

4N1.1 Read a given four-digit numeral without using the word 'and'.

4N1.2 Write a given numeral, using proper spacing without commas.

4N1.3 Represent a given numeral using a place value chart or other models.

4N1.4 Explain the meaning of each digit in a given four-digit numeral, including numerals with all digits the same.

Suggestions for Teaching and Learning

In Grade 3, students read a given number in their work with numbers to 1 000. Teachers should model reading whole numbers to remind them that the word 'and' is not used for whole numbers. For example, 5 321 is read as five thousand three hundred twenty-one, NOT five thousand three hundred **and** twenty-one. The word 'and' is reserved for reading decimal numbers to show placement of the decimal. Reading 3.2 as "three **and** two tenths" connects it to the fraction $3\frac{2}{10}$.

It is also worth noting that students will see four-digit numbers written with or without a space between the thousands and hundreds digits (e.g., 4567 or 4 567). For a four-digit number, either is correct. The space is required for numbers greater than four digits (e.g., 10 000).

Students should recognize the value represented by each digit in a number, as well as what the number means as a whole. One model of representation may not meet the needs of all students in the class. Include situations in which students use place value charts, base ten materials, number lines, and money. In Grade 2, students used these models to represent numbers to 100. Similarly, in Grade 3 the models were used to represent numbers to 1 000. To confirm understanding, give some tasks which include the need for regrouping to form, for example, 4 thousands from 40 hundreds or 1 thousand 4 hundred from 14 hundreds. In Grade 3, students represented numbers to 1 000 in different ways. For example, they represented 351 as:

- three 100s, five 10s and one 1
- two 100s, fifteen 10s and one 1
- three 100s, four 10s and eleven 1s

A solid understanding of regrouping is important for work with addition and subtraction.

It is important that students understand the meaning of each digit in a numeral. In 2 222, for example, the first digit represents two thousands, the second digit two hundreds, the third digit two tens and the fourth digit two ones. Students sometimes have difficulty understanding the meaning of 0 when it is a digit in a larger number. Teachers should provide many opportunities for students to model numbers containing zeros. For example, 1 003 means 1 thousand, 3 ones.

Base Ten Blocks

Place Value Chart

Thousands	Hundreds	Tens	Ones
1	0	0	3

The place value chart provides a necessary connection between the base ten models and the written form of the numbers.

General Outcome: Develop number sense.

Suggested Assessment Strategies

*Interview*

- Ask a student to use base ten materials to model 2 046 in three different ways. Ask him/her to explain the models.   (4N1.3)

- Ask students to explain how 1 003 and 103 are different and how they are similar.   (4N1.4)

- Pose a problem for students. For example, if a snowmobile costs $9 130, how many $100 bills would be needed to pay for it? Extend this by asking how many $10 bills would be needed.   (4N1.3)

- Pose a problem such as "Patrick chose 6 base ten blocks. The value of these blocks is more than 4 000 and less than 4 804. Which blocks might Patrick have chosen?" Have the student model and explain. Extension: Challenge students to find all possible numbers and justify their answers.   (4N1.4)

- Ask students to use base ten materials to demonstrate the following:
    (i)   Show what 999 looks like. Show what 1 000 looks like.
    (ii)   What is the total value of ten flats?
    (iii) How would you write a given base ten collection as a numeral?
    (iv)   Model 8 347 in two different ways (e.g., 8 large cubes, 3 flats, 4 rods, 7 units or 83 flats, 4 rods, 7 units).   (4N1.4)

Performance

- Tell students that a number has four-digits. The digit in the thousands place is greater than the digit in the tens place. Ask: What number might this be? Have students share their responses. Ask: What is the greatest number this could be? What is the least number this could be?   (4N1.4)

Paper and Pencil

- Ask students to write a number that has at least 20 tens.   (4N1.3)

- Model a number using base ten materials without saying what the number is. For example, show 4 rods, 2 large cubes, 3 units. (Note: It is not always necessary for the blocks to be presented in the typical order). Ask students to record the number that is represented. Repeat for other numbers.
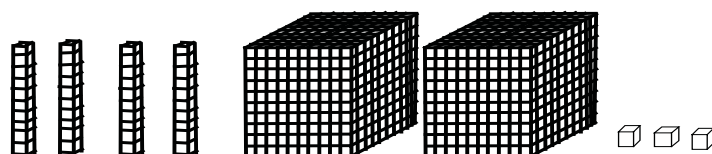
(4N1.2, 4N1.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Modelling Thousands
4N1 (1.1, 1.2)
TR: pp.13-15
SB: pp. 36-37

Lesson 2:
Place Value
4N1 (1.1, 1.2, 1.3, 1.4)
TR: pp. 16-19
SB: pp. 38–41

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N1 Continued ...

Achievement Indicators:

4N1.5 Express a given numeral in expanded notation.

4N1.6 Write the numeral represented by a given expanded notation.

4N1.2 (Continued) Write a given numeral, using proper spacing without commas.

4N1.3 (Continud) Represent a given numeral using a place value chart or other models.

Suggestions for Teaching and Learning

Understanding the meaning of each digit allows students to more easily express the numeral in expanded notation. Provide numbers such as 1 635 and ask:

• Which digit is in the hundreds place?
  Students answer "6".
• What does the 3 represent?
  They answer "30" or "3 tens".

Students should also write numbers in expanded notation (e.g., 1 635 = 1 000 + 600 + 30 + 5).

It is important to include teaching examples such as:

  1 635 = ___hundreds ____ones ___ thousands ____tens

In this example, observe students who tend to put the numbers 1, 6, 3, 5 in the blanks in order without a clear understanding of what each represents.

It is also important to note that the number 4 062 can be expressed as 40 hundreds, even though 0 is in the hundreds place.

Up to this point, students have worked with only four-digit numbers (up to and including 9 999). This is the first time they are formally introduced to the five-digit number, 10 000. Teachers should emphasize that a space is required between the thousands and hundreds place when writing a five-digit number in standard form.

Extending students' conceptual understanding of numbers beyond 1 000 is sometimes difficult to do because physical models for thousands are not commonly available. Through discussion, ask students to think of examples of situations where they can see the number 10 000 (e.g., populations, penny drives, words in a book, the cost of an item). An activity that could be used to help students visualize 10 000 is to show one package of unopened copier paper to the class. Discuss how many sheets are in the package and how many packages would be needed for 10 000 sheets of paper. Following the discussion, build a paper tower. Tasks involving 10 000 will help students develop lasting benchmarks and will provide meaning to large numbers encountered in everyday life. The Internet is a useful tool to help students gain a conceptual understanding of large numbers (e.g., a picture of a baseball park containing 10 000 fans or a field of 10 000 flowers).

General Outcome: Develop number sense.

Suggested Assessment Strategies

Paper and Pencil

- Teachers say a four-digit number. Using base ten blocks, students model that number, sketch their model, and express it in expanded and standard form.   (4N1.2, 4N1.3, 4N1.5)

Performance

- Ask students to create an accordian style paper 'foldable', expressing a four-digit numeral in expanded notation. Students unfold the sections of the foldable and verbally express the numeral represented.

  | 4 135 | 4 000 | + | 100 | + | 30 | + | 5 |
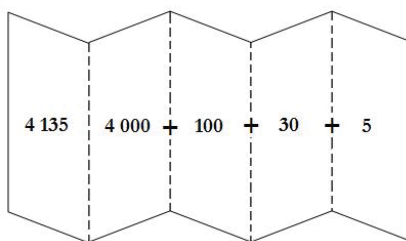
                                                        (4N1.1, 4N1.5)

- Students could play *Find Your Partner*. This card game requires two sets of cards. E.g.,

Set A	Set B
2 332	300 + 2 + 30 + 2 000
223	200 + 20 + 3
2 230	2 000 + 200 + 30
2 032	2 + 30 + 2 000
3 202	three thousand two hundred two

  Set A should include some cards with numbers having "0" as a digit or the same digit repeated. In Set B, cards could include base ten pictures or number lines. Distribute cards, 1 per student, and ask them to circulate around the room to find partners with cards that correspond to their own. As students compare cards, encourage them to discuss why their cards do or do not match. Once students have found their partners, they will read their numbers to the teacher for confirmation. Extension: Sets of cards can include more than two representations of a particular number.   (4N1.5, 4N1.6)

- Ask students to determine whether or not their school sends home 10 000 newsletters in a year and explain their thinking.   (4N1)

- Ask students, as a class, to create a "ten thousands" chart. Small groups could use hundred grids (or other pictorial representations) to create a model to represent 1 000. Combine these models to create a class representation of 10 000.   (4N1.3)

Journal

- Ask students to respond to the following:
  "What does 10 000 mean to you?" Give an example from your own life of where you might use this number.   (4N1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Expanded Form
4N1 (1.1, 1.2, 1.3, 1.4, 1.5, 1.6)
TR pp. 20-23
SB pp. 42-44

Lesson 4:
Describing 10 000
4N1 (1.2, 1.3)
TR: pp. 24-26
SB: p. 45

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit1.html

- Interactive White Board activity to create and represent 3-digit and 4-digit numbers using "Spin the Number"

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4N1 Continued ...** **Achievement Indicator:** *4N1.7 Write a given numeral 0 – 10 000 in words.*	Students should be able to represent, in words, numbers which they see or hear. Although cheque writing is not an outcome, it is a real-life context that provides an opportunity to express a numeral in standard and written form. It is important to provide examples where one or more zeros occur in some of the numbers at various place value positions. Reinforce that the word 'and' should not be included in the written form. Contexts such as the following could also be used: • Teachers could make a collection of possible contexts for four-digit numbers (e.g., the cost of an item, population of a community, flyer clipping, number of people attending an event, Guinness World Records™, dates of historical events). • Say: One thousand nine hundred twenty-two people attend a hockey game. Ask students to write this in words. Teachers could display a four-digit 'Number of the Day" and ask students to choose one or more of the following ways to represent it: • express it orally • write it in words • write it in standard form • write it in expanded form • represent it (sketch, base ten blocks or place value chart)

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Ask students to spin a spinner 3 or 4 times (depending on students' readiness to work with three or four-digit numbers) and write the corresponding number in words.   (4N1.1, 4N1.7)

- Ask students to cut a four-digit number from a newspaper or magazine and paste it on paper. Ask them to write the number in words.   (4N1.1, 4N1.7)

- Ask students to write the current year in words. Students can also write other years such as their birth year, their expected high school graduation year or the year they will turn forty.   (4N1.1, 4N1.7)

- Ask students to create a **Secret Number** poster. Provide materials for the students to create a poster with a door or flap in the middle. Ask each student to think of a secret number and write it behind the flap using numerals and/or words. Next instruct students to write clues around the outside of the door that will assist classmates in identifying the secret number.

Jordan's Secret Number

Greater than 999
Has 4 digits

Less than 2 000

Has repeated digits in the hundreds and thousands place

Multiple of 10

Tens place is 3 less than 7

Display posters and provide students with recording sheets so that they can visit each poster and guess the secret numbers in the display, using words.   (4N1)

- Ask each student to choose any four-digit number and create a rhyme. These rhymes can be combined in a class booklet. Remind students to use words instead of numerals. For example:

    "One thousand four hundred eight
      Too many peas to put on my plate!"

    " Twenty-four hundred seventy-one
      Happy days spent in the sun."   (4N1.1, 4N1.7)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Writing Number Words
4N1 (1.1, 1.2, 1.7)
TR: pp. 30-32
SB: pp. 48-49

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N2 Compare and order whole numbers to 10 000.
[C, CN, V]

Achievement Indicators:

4N2.1 Create and order three different four-digit numerals.

4N2.2 Identify the missing numbers in an ordered sequence or on a number line (vertical or horizontal).
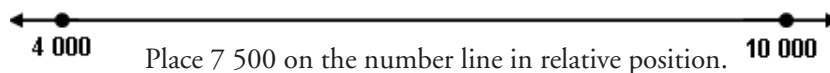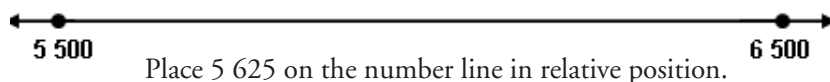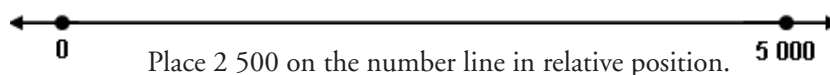
4N2.3 Identify incorrectly placed numbers in an ordered sequence or on a number line (vertical or horizontal).

Suggestions for Teaching and Learning

Comparing and ordering is fundamental to understanding numbers. In Grade 3, students compared and ordered numbers to 1 000 using hundred charts, number lines, and place value.

Students should investigate meaningful contexts to compare and order two or more numbers, both with and without models. They must realize that when comparing two numbers with the same number of digits, the digit in the greatest place value needs to be addressed first. When asked to explain why one number is greater or less than another, for example, they might say that 2 542 < 3 653 because 2 542 is less than 3 thousands while 3 653 is more than 3 thousands. When comparing 6 456 and 6 546, students will begin comparing the thousands and then move to the right until they notice a difference in place value. Teachers should model first and then assign pairs of students the task of making number cards for their classmates to put in order. Teachers should ask students to communicate their thinking frequently.

Number lines are useful tools and should be used with students. It is a good idea to give students a number line with two reference points and ask them to place a given whole number in the correct place on the number line. Remind them that an important feature on a number line is the scale. Remember to include number lines with different starting and ending points (0 to 10 000).

0 ————————————————————— 5 000
Place 2 500 on the number line in relative position.

5 500 ————————————————————— 6 500
Place 5 625 on the number line in relative position.

4 000 ————————————————————— 10 000
Place 7 500 on the number line in relative position.

Students will encounter instances of having to read both vertical and horizontal number lines. Examples include thermometers, measuring cups, distance above/below sea level, growth charts, etc.

Provide opportunites for students to work with blank number lines or number lines that include fewer markings. This will help students draw upon their knowledge of benchmarks and estimation skills to improve accuracy with number placement.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Paper and Pencil

* Ask students to write a number that is about halfway between 9 598 and 10 000. (4N2.1)

Performance

* Provide the following riddle:

  I am thinking of a number. It is between 8 000 and 10 000. All the digits are even and the sum of the digits is 16. What are some possibilities?

  Ask students to place their numbers in relative position on an empty number line. Challenge pairs of students to write similar riddles for one another and to record answers. (4N2.2, 4N2.3)

* Ask two students to hold the ends of a skipping rope which represents a number line. Attach four-digit number cards to the line (using clothespins or fold-over cards). Place several cards out of order. Ask students to identify incorrectly placed numbers and to justify their reasoning. Repeat the activity, having some blank spaces for students to identify the missing four-digit number in the sequence. For example:
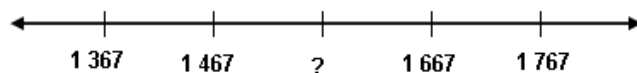
  (4N2.2, 4N2.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Locating Numbers on a Number Line
4N1 (1.1)
4N2 (2.2, 2.3)
TR: pp. 33-36
SB: pp. 50-52

Number

Specific Outcomes

Students will be expected to:
4N2 Continued ...

Achievement Indicators:

4N2.1 (Continued) Create and order three different four-digit numerals.

4N2.4 Order a given set of numbers in ascending or descending order, and explain the order by making references to place value.

Suggestions for Teaching and Learning

Students must recognize that when comparing the size of a number, the 4 in 4 289 has a greater value than the 9 and they should be able to provide an explanation. It is important to encourage students to communicate the process used to compare and order numbers.

Teachers could choose one or more of the following activities to provide students with opportunities to order sets of numbers in ascending or descending order. Although students ordered numbers to 1 000 in Grade 3, it is important to review the meaning of ascending and descending.

- Provide each student with a four-digit number card. E.g.,

| 3 000 | 3 300 | 3 003 | 3 303 | 3 033 |

  Ask students to arrange themselves in ascending order and explain why they positioned themselves in that particular spot. Numbers can vary according to student level. One variation to this activity could be to put the class into teams and use it as a competition with the winning team justifying their positions. This task may be repeated using descending order. Ask students to space themselves with respect to number size (in relative position).

- After working with given four-digit numbers, students should be asked to write a four-digit number on an index card. The teacher collects and shuffles the cards, and tapes one card on each student's back. Ask students to move around the room asking each classmate one question (requiring a 'yes' or 'no' response) to help them identify their number (e.g., Am I greater than 1 000? Am I less than 7 500? Am I an even number? Am I an odd number? Am I a multiple of 10?). Once students have identified their number, have them correctly place it on a class number line. Students should explain their thinking.

- Display a four-digit number and ask students to write on an index card a number which differs from the displayed number by 1 digit. Choose some students to read their number and indicate whether their number is greater or less than the number displayed. As an extension, ask students by how much the two numbers differ.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Students work in pairs for this game with prepared cards marked 0-9 (or a 10-sided die). Students shuffle the cards and select 4 each. Individually they arrange the cards to create the greatest possible number. Students should read and record their numeral. Encourage them to discuss who has the greatest number and tell how they know. The student with the greatest number gets a point. Continue rounds until one player reaches 5 points. This could be repeated for the least number. (4N2.1, 4N2.4)

Paper and Pencil

- Tell students that you are thinking of a four-digit number that has 4 hundreds, a greater number of tens, and an even greater number of ones. Ask them to give three possibilities. (4N2.1)

- Ask students to find 3 ways to fill in the blanks to make the following statement true: __245 > 7__84 (4N2.1)

- Lead students in a discussion. Tell them that Joanne's number has 9 hundreds, Fran's has 6 hundreds and Jessica's has 4 hundreds. Fran's number is greater than Jessica's but less than Joanne's. Explain how this is possible. (4N2.1)

- Ask students which of the numbers below must be greater and have them explain why.

    4 _ _ 2   9 _ 3

(4N2.1, 4N1.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 7 :
Comparing and Ordering Numbers
4N1 (1.3, 1.4)
4N2 (2.1)
TR: pp. 39 – 42
SB: pp. 54 - 56

Math Game:
Target Game
TR: pp. 43 - 44
SB: p. 57

Lesson 8:
Communicating about Ordering Numbers
4N1 (1.4)
4N2 (2.4)
TR: pp. 45-47
SB: pp. 58-59

ADDITION AND SUBTRACTION

Suggested Time: 3 Weeks

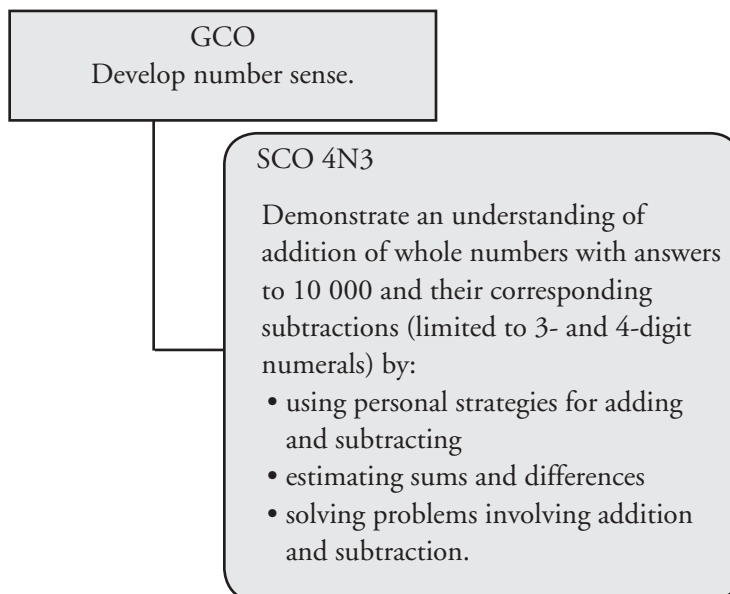| September	October	November	December	January	February	March	April	May	June

Estimated Completion
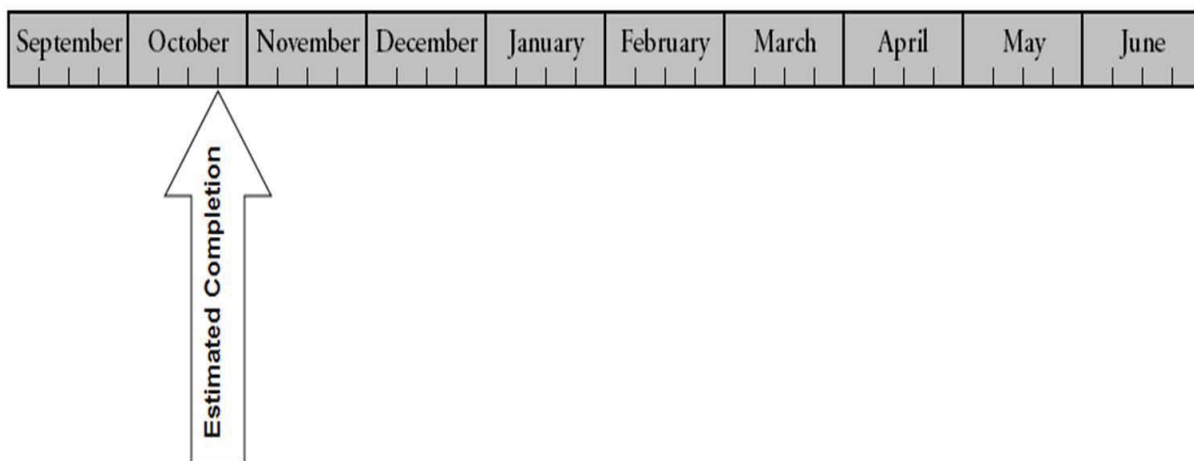
Unit Overview

Focus and Context

This unit focuses on efficiency and flexibility with both traditional algorithms and personal strategies in the addition and subtraction of larger numbers. Students worked with 3-digit addition and subtraction in Grade 3. In Grade 4, the focus will be on addition and subtraction of 4-digit numbers.

Students should begin to recognize that estimation is a useful skill in their lives. To be efficient when estimating sums and differences mentally, students need a variety of strategies from which to choose and must be able to access a strategy quickly. Encourage students to estimate prior to calculating the answer. Use a variety of models, such as base-ten blocks and number lines, to assist in estimation.

Students should have many opportunities to solve and create word problems for the purpose of answering meaningful questions, preferably choosing topics of interest to them.

Outcomes Framework

> **GCO**
> Develop number sense.

> **SCO 4N3**
>
> Demonstrate an understanding of addition of whole numbers with answers to 10 000 and their corresponding subtractions (limited to 3- and 4-digit numerals) by:
> • using personal strategies for adding and subtracting
> • estimating sums and differences
> • solving problems involving addition and subtraction.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
3N6 Describe and apply mental mathematics strategies for adding two 2-digit numerals, such as: • adding from left to right • taking one addend to the nearest multiple of ten and then compensating • using doubles. [C, CN, ME, PS, R, V] 3N7 Describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as: • taking the subtrahend to the nearest multiple of ten and then compensating • think addition • using doubles. [C, CN, ME, PS, R, V] 3N8 Apply estimation strategies to predict sums and differences of two 2-digit numerals in a problem solving context. [C, ME, PS, R] 3N9 Demonstrate an understanding of addition and subtraction of numbers with answers to 1 000 (limited to 1-, 2- and 3-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]	4N3 Demonstrate an understanding of addition of whole numbers with answers to 10 000 and their corresponding subtractions (limited to 3- and 4-digit numerals) by: • using personal strategies for adding and subtracting • estimating sums and differences • solving problems involving addition and subtraction. [C, CN, ME, PS, R]	5N11 Demonstrate an understanding of addition and subtraction of decimals (limited to thousandths). [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

Daily Routine Opportunity

Have fact sheets (up to 5 × 5) ready for students to insert in page protectors. For a short predetermined time, students write the products on the page protector using a dry erase marker. Once the task is completed and answers are checked, they can be erased for repeated use.

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N3 Demonstrate an understanding of addition of whole numbers with answers to 10 000 and their corresponding subtractions (limited to 3- and 4-digit numerals) by:
- **using personal strategies for adding and subtracting**
- **estimating sums and differences**
- **solving problems involving addition and subtraction.**

[C, CN, ME, PS, R]

Achievement Indicators:

4N3.1 Describe a situation in which an estimate rather than an exact answer is sufficient.

4N3.2 Estimate sums and differences, using different strategies.

4N3.3 Refine personal strategies to increase their efficiency.

Suggestions for Teaching and Learning

In this unit, students will investigate a variety of strategies for adding and subtracting. The expectation is that they become proficient in at least one appropriate and efficient strategy that they understand.

In Grade 3, students applied estimation strategies to predict sums and differences of two 2-digit numbers. They added 1-, 2- and 3-digit numbers with answers to 1 000, and then worked with corresponding subtractions. This will now be extended to include 4-digit numbers with answers to 10 000.

Estimating sums and differences is valuable because it helps predict answers and check calculations. Students also need to be aware that an exact answer is not always necessary. Estimating is producing an answer that is "good enough" for the situation and some situations call for more careful estimates than others. Discuss with the class situations in which estimation would be appropriate and instances where it would not. Examples could include ordering pizza for a class, measuring medicine to give a child, or counting the number of people at a crowded restaurant. Ask students questions such as:

- Is it okay to make an estimate?
- What are the benefits of estimating?

In Grade 3, students used front-end estimation and rounding to the nearest ten to estimate sums of 2-digit numbers. As they continue to estimate sums of 3- and 4-digit numbers, provide them with a variety of estimation strategies including, but not limited to:

- Front-end estimation: $138 + 245$ is estimated to be $100 + 200 = 300$. This strategy looks only at the first digit even though the estimate may be low. It is a good beginning strategy for students.
- Rounding: $1\ 439 + 352$ is estimated to be 1 790 ($1\ 440 + 350$) or 1 800 ($1\ 400 + 400$), etc. Rounding is the most familiar form of estimation.
- Benchmarks: $1\ 207 + 126$ would give an answer such as 1 325 (use friendly numbers $1\ 200 + 125$)
- Compensation: $1\ 644 + 548$ would give an answer such as 2 200 ($1\ 600 + 600$). 548 is estimated high to compensate for a low estimate of 1 644.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

*   Give groups of 3 or 4 students familiar situations to discuss whether they should find an estimate or an exact answer. Give groups new situations to discuss after two minutes. As a whole group, discuss various situations.
    <u>Samples</u>:

You have a bag of popcorn to share with your friend. You want to give her half.
Teachers are requesting busses to take students on a field trip. They have to decide how many busses are needed.
You want to buy new shoes and a shirt and you only have $30. Before you get to the checkout, you need to decide if you have enough money.

    (4N3.1)

Interview

*   Ask students to explain how they would estimate the cost of two items (e.g., a $599 item and a $378 item).

    (4N3.2)

Paper and Pencil

*   Ask students to discuss the advantages and disadvantages of the two estimates for the problem:
    Beth went for a run along the Viking Trail. She ran 1 290 m before stopping for a break. Then she ran 1 850 m before she reached the end of the trail. About how far did she run in total?
    Alyssa's estimate: $1\ 000 + 1\ 000 = 2\ 000$
    Victoria's estimate: $1\ 000 + 2\ 000 = 3\ 000$

    (4N3.2)

*   Ask students to use estimation to answer the following:
    You are travelling 1 265 km to visit relatives. If you travel 568 km the first day, will you have to travel more or less than 700 km the next day to reach your destination in two days?

    (4N3.2, 4N3.3)

*   Ask students to complete an exit card such as the one below:

Exact or Estimate?
The teacher has a stack of construction paper in his desk. He wonders how many green, blue, and red sheets he has. Should he make an exact count or an estimate?   Exact ___   Estimate ___   Explain your thinking.   _____   _____   _____

    (4N3.1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Solving Problems by Estimating
4N3 (3.1, 3.2)
TR: pp. 12-15
SB: pp. 68-69

Lesson 2:
Estimating Sums
4N3 (3.2, 3.3)
TR: pp. 16-19
SB: pp. 70-72

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit2.html

*   Enrichment activities

Strand: Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:
4N3 Continued ...
Achievement Indicator:

4N3.4 Determine the sum of two numbers using a personal strategy.

Suggestions for Teaching and Learning

As students add and subtract, it is important to reinforce proper mathematical language. "The terms "regroup", "trade" and "exchange" are used rather than "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).

Students should be provided with more than one strategy to add two numbers. Grid paper may be useful as it allows students to organize digits by place value. Strategies may include:

- Adding from Left to Right

	1	3	2	9
+	2	8	5	4
	3	0	0	0	← add thousands
	1	1	0	0	← add hundreds
			7	0	← add tens
+			1	3	← add ones
	4	1	8	3

This should reinforce students' understanding of adding numbers through place value. By using this method, students get practice grouping by thousands, hundreds, tens and ones.

- Adding from Right to Left

	1		1	
	1	3	2	9
+	2	8	5	4
	4	1	8	3

It is important to model this standard algorithm with base ten materials in the beginning so that students understand they are trading 10 ones for 1 ten and 10 hundreds for 1 thousand.

- Counting On
  $2\ 250 + 1\ 005$
  first think $2\ 250 + 1\ 000 = 3\ 250$
  then count on $3\ 250 + 5 = 3\ 255$
  This strategy should help students recognize when they can 'count on' rather than use either of the previous two methods to determine sums of certain numbers.

- Compensation
  $1\ 328 + 462$ could become $1\ 330 + 460$
  2 is added on to $1\ 328$ and compensated by subtracting 2 from 462 to make an easier computation to find the sum $1\ 790$.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Provide students with concrete or pictorial representations of two numbers. Ask them to use the representation to find the sum and record their thinking symbolically.

  (4N3.4)

Paper and Pencil

- Ask students to use the digits 1, 3, 4, 5, 6 and 7, and the symbols $+, =$ to arrive at a sum of 782 (e.g., $367 + 415 = 782$).

  (4N3.4)

- Ask students to answer the following:
  A concert ran for two consecutive nights. 3 346 people attended on Friday and 3 532 people attended on Saturday.
  (i) Estimate to determine if more than 7 000 people attended.
  (ii) Exactly how many people attended the concert in all?

  (4N3.2, 4N3.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Exploring Addition and Subtraction
4N3 (3.2, 3.4)
TR: pp. 20-22
SB: p. 73

Lesson 4:
Adding from Left to Right
4N3 (3.5, 3.4)
TR: pp. 23-26
SB: pp. 74-76

Math Game:
Race to 1500
4N3
TR: p. 27
SB: p. 77

Lesson 5:
Adding from Right to Left
4N3 (3.4)
TR: pp. 28-31
SB: pp. 78-80

Supplementary Resource

Making Math Meaningful to Canadian Students K - 8 – Marian Small

Strand: Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N3 Continued ...
Achievement Indicators:

4N3.5 Solve problems that involve addition and subtraction of more than two numbers.

4N3.2 (Continued) Estimate sums and differences, using different strategies.

4N3.3 (Continued) Refine personal strategies to increase their efficiency.

Suggestions for Teaching and Learning

Students worked with these strategies when they added numbers with answers to 1 000 in Grade 3. They can also be used when adding more than two numbers. An alternate strategy that could be used to add more than two numbers is clustering. For example, 800 + 625 + 200 can be rearranged so that 800 + 200 is recognized as 1 000, and then 625 is added to get a sum of 1 625. Students need practice recognizing sets of numbers that can combine easily.

Students will encounter many instances in which they will have to solve problems involving the addition of more than two numbers (e.g., shopping lists, collections, total distance travelled, time remaining.) Provide time for them to explore a contextual problem with their own strategies. When sufficient time has been provided for discovery, a discussion should follow, giving students the opportunity to communicate and review each other's solutions. There should also be considerable modeling by the teacher. When teachers "think aloud", for example, they should talk about their reasoning and how to choose and apply strategies to solve a problem.

Remind students that estimation is a useful way to check the reasonableness of their answers. Once they have determined the sum, they should use one of the estimation strategies to judge whether it is reasonable.

At this point in the unit, the focus shifts to estimating differences. In Grade 3, students applied estimation strategies, such as front-end estimation and rounding to the nearest ten, to predict differences of 2-digit numbers. There is no one correct strategy when estimating. Remind students that a good estimate is one that is reasonable and relatively easy to compute.

Revisit the estimation strategies students used for addition. Estimation strategies for subtraction include, but are not limited to:
- Front-end subtraction: 476 – 348 is approximately 100 (400 – 300)
- Rounding: 489 – 52 is approximately 440 (490 – 50)
- Benchmarks: 207 – 126. Students might answer 75 (200 – 125)

As students estimate differences, ask questions such as:
- Is it more or less than the actual amount?
- Is the estimate off by a little or a lot?

Once students see a variety of strategies, give them a subtraction question and let them come up with an estimate that makes sense to them. In groups of three or four, they compare estimates and strategies. This helps in the selection of a strategy, as well as in allowing for a range of answers.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Paper and Pencil

- Pose a problem for students to solve: Megan's family went on a trip. They travelled 654 km on the first day, 856 km on the second day, and 224 km on the third day. Do you think they traveled more than 1 400 km altogether? Why? Exactly how far did they travel?

  (4N3.2, 4N3.4, 4N3.5)

- Ask students to solve: If there are 195 days in a school year and you had perfect attendance since Kindergarten, how many days will you have been in school by the end of this year?

  (4N3.5)

- Ask students to find two numbers with a difference of about 80 and a sum of about 200.

  (4N3.2)

Interview

- Teachers could ask the student to select from the following questions the one he/she thinks is the easiest to calculate and to explain why:
  (i)   600 – 53
  (ii) 143 – 87
  (iii) 264 – 99

  (4N3.3)

- Teachers could pose the following problem:
  Johnny walked 12 km on Monday, 28 km on Tuesday and 32 km on Wednesday. How far did he walk in three days? Ask students what strategy they used to arrive at their answer.

  (4N3.5)

Performance

- Present students with problems and have them decide which problems can be answered with an estimate only and which require calculation. Ask students to solve the problems. Some examples could be:
  (i) A book contains 458 pages and you have read 225 pages the first day and 125 pages the second day. After these two days, how many more pages do you have to read to finish this book?
  (ii) Your three pet rocks weigh a total of 1 625 g. If the first rock weighs 980 g and the second rock weighs 320 g, what is the weight of the third rock?

  (4N3.1, 4N3.2)

- Prepare several cards containing subtraction number sentences. Some should be true and others false. Have students indicate if each is true or false. Ask volunteers to explain how they know.

  (4N3.2, 4N3.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Estimating Differences
4N3 (3.2)
TR: pp. 36-38
SB: p. 83

Curious Math:
Subtracting Another Way
4N3
TR: p. 43
SB: p. 87
Although different from the standard algorithm, this is a valid method and might be the method of choice of some ESL students.

Strand: Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4N3 Continued ...** **Achievement Indicator:** *4N3.6 Determine the difference of two numbers using a personal strategy.*	

Students will now explore strategies for calculating differences. Provide students with a variety of strategies to find differences including, but not limited to:

- Friendly numbers: 1 000 – 299
    $$= 1\ 000 - 300 \text{ (close to 299)}$$
    $$= 700 + 1 \text{ (1 too many was subtracted)}$$
    $$= 701$$

- Break it up: 500 – 125
    $$= 500 - 100 - 25 \text{(break it up so it's easy to subtract)}$$
    $$= 400 - 25 \text{ (quarters should be easy to subtract)}$$
    $$= 375$$

- Counting on: 2 008 − 1 799
    students can first count on from 1 799 to 1 800 (which is + 1), then count on to a friendly number such as 2 000 (which is + 200), then count on again to 2 008 (which is + 8), for a difference of 209. A number line can be used to illustrate this:
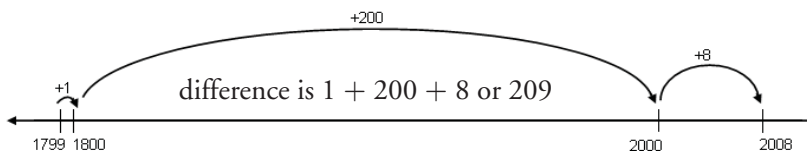
- Regrouping: Students subtract from left to right or from right to left (standard algorithm) using regrouping. Base ten materials are important when illustrating this strategy initially.

- Renaming: 6 000 – 2 249
    $$5\ 999 + 1$$
    $$-\ \underline{2\ 249}$$
    $$3\ 750 + 1 = 3\ 751$$

Students sometimes forget to add on the extra 1 at the end. A variation of this strategy is to decrease both numbers by 1 to produce 5 999 – 2 248. This way the answer requires no adjustment.

This is a strategy that can help students become more efficient with subtraction. It should be introduced, however, after an understanding of regrouping is well established.

These strategies involve taking apart and combining numbers in a variety of ways. This is a significant component of number sense. Students should work with a variety of strategies. The goal, however, is not mastery of every strategy by all students. Rather, they should select strategies they understand and those that are appropriate to the situation.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Paper and Pencil

- Provide two numbers, as shown below. Ask students to determine the difference using a personal strategy and explain their thinking.
  - (i)   3 999 – 246
  - (ii)   4 000 – 499
  - (iii) 4 127 – 238

  (4N3.6)

- Give students a number line with two numbers indicated. Ask students to find the difference.

  (4N3.6)

Performance

- Provide students with base ten materials and ask them to subtract 1 123 – 678.

  (4N3.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 7:
Subtracting Numbers Close to Hundreds or Thousands
4N3 (3.4, 3.6)
TR: pp. 39-42
SB: pp. 84-86

Lesson 8:
Regrouping before Subtracting
4N3 (3.6)
TR: pp. 44-47
SB: pp. 88-90

Math Game:
Target 3500
4N3 (3.2)
TR: p. 91

Lesson 9:
Subtracting by Renaming
4N3 (3.4, 3.6)
TR: pp. 49-51
SB: pp. 92-93

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N3 Continued ...

Achievement Indicators:

4N3.6 (Continued) Determine the difference of two numbers using a personal strategy.

4N3.5 (Continued) Solve problems that involve addition and subtraction of more than two numbers.

Suggestions for Teaching and Learning

To activate prior knowledge, start with subtraction of numbers that do not require regrouping (e.g., 4 563 − 1 252). Using base ten materials as a guide, students should quickly be able to subtract, either from left to right or from right to left.

Next, introduce examples that require regrouping. Using base ten materials, students should see that to calculate 7 364 − 2 751 it is first necessary to trade 1 thousand for 10 hundreds.

	6	13		
	~~7~~	~~3~~	6	4
-	2	7	5	1
	4	6	1	3

When the difference of two numbers is calculated and recorded, students should be able to explain the meaning of all markings at the top in terms of base ten materials.

Students should also complete questions where they have to do more than one trade, including numbers that contain zeros.

Students have had many opportunites to estimate and calculate solutions for various problems involving addition and subtraction. Encourage them to communicate their mathematical thinking with manipulatives, pictures, numbers and words as this helps to show their understanding and provides an opportunity to clarify any misconceptions students might have. Graphic organizers, such as the Four Corner Strategy, help students to organize their thoughts before recording their process. Provide a table with the problem in one corner and ask students to complete the other corners. This could be done in pairs or in small groups to encourage communication.

Problem	Model/Diagram
Peter has saved $510. He received $155 for his birthday. How much money does Peter have altogether?	
Number Sentence	**Strategy**

Success in problem solving depends on a positive climate in which the student can be comfortable in taking risks. Modeling should continue to occur, as necessary.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Teachers could pose the problem for students to solve:

  Aaron decided to clean his backyard fish pond. The pond holds 1 100 L of water. The first day, Aaron removed 250 L of water. The next day he took out 525 L of water. How much water was left to be removed?

  (4N3.5)

Paper and Pencil

- Ask students to solve the following problems:
  - (i) Mike has 348 hockey cards. He gives 196 cards to Sarah and 82 cards to Steve. How many hockey cards does Mike have left? Show your work.
  - (ii) One of Andy's pet rocks weighs 1 418 g. This rock and another pet rock weigh a total of 2 196 g. Estimate the weight of the other pet rock. Show the numbers you used in your estimate. What does the other rock weigh? Show your work.
  - (iii) Natasha jogged for 2 126 m, walked for 1 350 m and biked for 5 250 m. What was her total distance travelled? Show your work.

  (4N3.6, 4N3.3, 4N3.4)

- Ask students to find two numbers with a difference of 150 and a sum of 500.

  (4N3.5, 4N3.6)

- Ask students to create a problem that can be represented by the number sentence: $200 - \underline{\quad} = 79$. They should be able to explain how they know their problem matches the number sentence.

  (4N3.5)

Performance

- Present students with a problem and have them choose which of the number sentences provided could be used to solve the problem. Ask why the number sentences chosen can be used to solve the problem. E.g., Rose exercised for 398 minutes during one week while Selina ran for 176 minutes that week. How much longer did Rose exercise than Selina during that week?

  $176 + 398 = \underline{\quad}$ $\qquad$ $\underline{\quad} = 398 - 176$

  $398 - 176 = \underline{\quad}$ $\qquad$ $176 + \underline{\quad} = 398$

  (4N3.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 10:
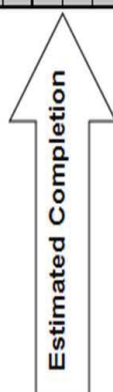Communicating about Number Concepts and Procedures
4N3 (3.4)
TR: pp. 52-54
SB: pp. 94-95

PATTERNS IN MATHEMATICS

Suggested Time: 2 Weeks

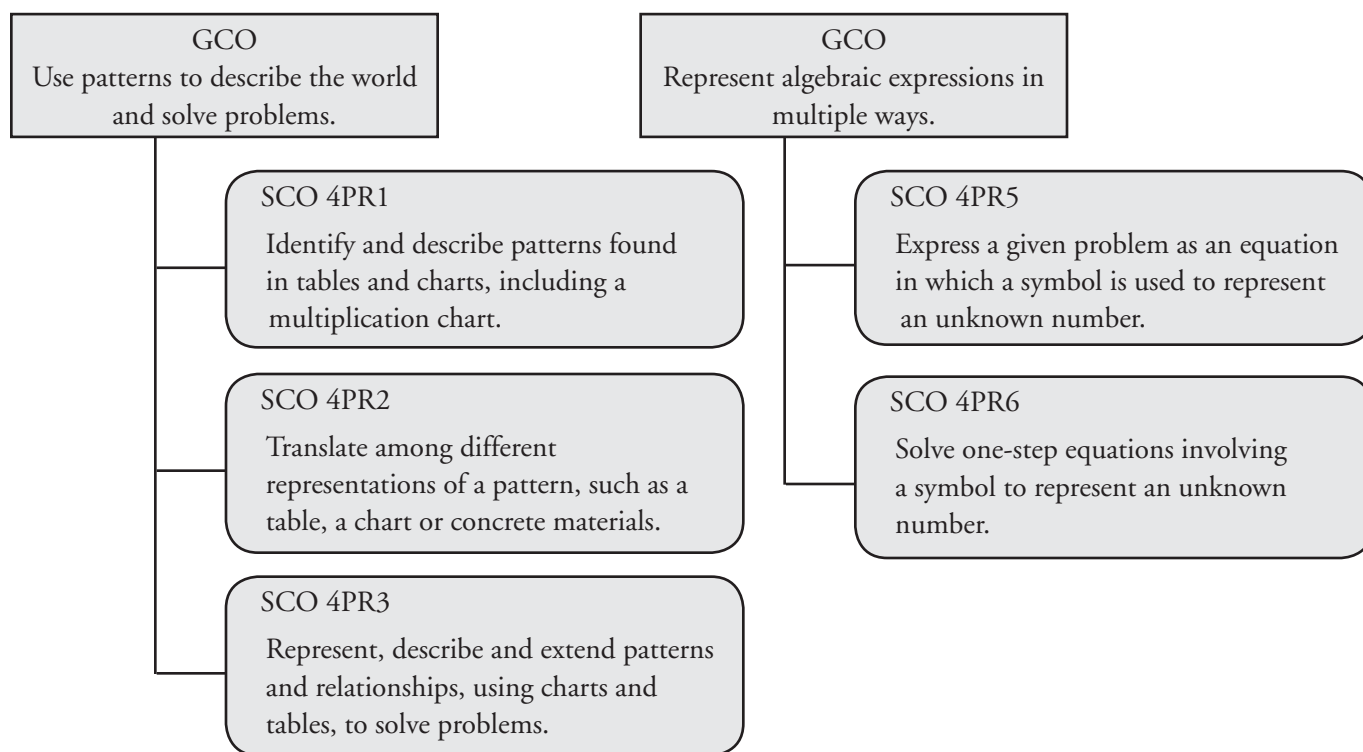| September	October	November	December	January	February	March	April	May	June

Estimated Completion

Unit Overview

Focus and Context

Grade 4 students will extend upon previous knowledge of patterns and relations as they explore the different types of patterns, discover pattern rules, translate between concrete and pictorial representations of patterns and charts or tables, determine equalities, and investigate how patterns using symbols and variables are used mathematically to describe change. The ability to discern and utilize patterns effectively fosters the development of algebraic thinking. Students at the Grade 4 level begin to represent algebraic thinking with algebraic equations.

Outcomes Framework

GCO
Use patterns to describe the world and solve problems.

SCO 4PR1

Identify and describe patterns found in tables and charts, including a multiplication chart.

SCO 4PR2

Translate among different representations of a pattern, such as a table, a chart or concrete materials.

SCO 4PR3

Represent, describe and extend patterns and relationships, using charts and tables, to solve problems.

GCO
Represent algebraic expressions in multiple ways.

SCO 4PR5

Express a given problem as an equation in which a symbol is used to represent an unknown number.

SCO 4PR6

Solve one-step equations involving a symbol to represent an unknown number.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Patterns and Relations (Patterns)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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 1 000). [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]	5PR1 Determine the pattern rule to make predictions about subsequent elements. [C, CN, PS, R, V]
Strand: Patterns and Relations (Variables and Equations)		
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]	5PR2 Solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions. [C, CN, PS, R]

Mathematical Processes

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

Daily Routine Opportunity

Use a small box as an in-out machine. Students choose two cards from numeral cards 0-5 to put in the box and predict what product will come out when the numbers are multiplied.

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

4PR1 Identify and describe patterns found in tables and charts, including a multiplication chart.
[C, CN, PS, V]

Achievement Indicators:

4PR1.1 Describe the pattern found in a given table or chart.

4PR1.2 Determine the missing element(s) in a given table or chart.

4PR1.3 Identify the error(s) in a given table or chart.

Suggestions for Teaching and Learning

In Grade 3, students described, extended, compared, and created increasing and decreasing patterns using numbers to 100. They explored many patterns in the hundred chart. In Grade 4, students will continue to work with patterns in hundred charts as well as various other tables and charts. In this unit, 4PR1 addresses patterns found in hundred charts and in addition tables and will extend to multiplication tables later in the year.

To activate prior knowledge, provide opportunities for students to further explore patterns and determine missing elements on a **hundred chart**.

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

$52 + 43 = 95$

$42 + 53 = 95$

Students may select, for example, four numbers on a hundred chart that form a square. They may discover that when they add the two numbers on both the diagonals, the sums are equal.

Similarly, display an **addition table** for students to explore patterns, such as:
- only even numbers are located on the main diagonal (upper left to lower right), so the sum of a number with itself is always even
- all of the 8s are on one diagonal line, since each time an addend is one greater, the other must be one less
- the diagonals of any four numbers that form a square will have the same sum.

+	1	2	3	4	5
1	2	3	4	5	6
2	3	4	5	6	7
3	4	5	6	7	8
4	5	6	7	8	9
5	6	7	8	9	10

As students explore patterns in tables and charts, ask them to describe their patterns as a confirmation of their understanding. The pattern rule should include vocabulary such as vertical, horizontal, diagonal, row, column, starting number, increasing, decreasing and repeating patterns.

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

Suggested Assessment Strategies

Paper and Pencil

- Using a hundred chart, ask students to colour each number as they skip count by 2s and describe the pattern created. Repeat for 3, 4, 5, 6, 7, 8, and 9. Ask students to describe what changes they notice as the numbers increase. Note to what extent students:
  (i)   identify all, some or none of the multiples of a given number.
  (ii)   are able to predict and extend the pattern.
  (iii) are able to describe the pattern by relating it to similiar designs in the real world (e.g., students may say it looks like a checker board).

(4PR1.1)

- Provide students with a chart with missing numbers and ask them to identify the missing numbers and explain their reasoning.

(4PR1.2)

- Ask students to use a hundred chart to find the missing numbers, explaining the reason for each choice:

  4, 8, ___ , 16, 20, __

  5, ___ , 15, ___ , 25

  3, ___ , ___ , 12, 15

(4PR1.2)

- Ask students to look for, and describe patterns in an addition table or a hundred chart using appropriate mathematical language. Students can record and present to the class.

(4PR1.1)

- Provide students with the pattern below:
  8, 5, 7, 4, 6, 3, 5, ___ , ___, ___
  Ask them to find the missing terms based on this pattern and show their work.

(4PR1.2)

- Provide a chart, such as the following, containing errors:

Number of Tables	Number of Chairs
1	4
2	8
3	12
4	18
5	20
6	24

Ask students to identify and explain where the pattern has errors.

(4PR1.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Patterns in an Addition Table
4PR1 (1.1, 1.2)
TR: pp. 11-14
SB: pp. 4-6

Note

In Getting Started and Lesson One the focus is on patterns in a hundred chart and in an addition table. This material is a review as it was addressed in detail in Grades 2 and 3. It is recommended, therefore, that teachers be very selective with this material.

Math Game:
Patterns in Charts
4PR1 (1.1) 4PR2 (2.1)
TR: pp. 15-16
SB: p. 7

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit3.html

- Enrichment activities

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

4PR2 Translate among different representations of a pattern, such as a table, a chart or concrete materials.
[C, CN, V]

Achievement Indicators:

4PR2.1 Create a concrete representation of a given pattern displayed in a table or chart.

4PR2.2 Create a table or chart from a given concrete representation of a pattern.

Suggestions for Teaching and Learning

As students continue their study of patterns, they need to use manipulatives, charts and diagrams within contexts that are engaging and meaningful to them. They also need ample opportunities to connect patterns to number ideas. When given a pattern displayed in a table or chart, students should reproduce it using concrete materials. Conversely, when given a pattern made with concrete materials, students should create a table or chart. In Grade 4, students will be exposed to patterns involving one operation.

While some students can answer the questions posed without actually representing their solution, it would be advisable that they represent some patterns since the outcome emphasizes translating among different representations.

Once a table or chart is developed, students have two representations of a pattern: the one created with the drawing or materials and the numeric version that is in the table. When looking for relationships, some students focus on the table while others will focus on the physical pattern. It is important for students to see that relationships discovered exist in a variety of forms.

When a relationship is found in a table, challenge students to see how that pattern is represented using concrete materials.

Step	1	2	3	4	5	...	10
# of Squares	2	6	12	20	?	...	?
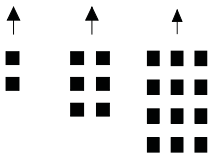
Students should be provided with ample opportunities to construct increasing and decreasing patterns using concrete materials (e.g., toothpicks, pattern blocks, multi-link cubes) and create a table /chart to represent the pattern. Students should be asked to describe what is happening as the pattern increases or decreases. When discussing a pattern, ask students how each step in the pattern differs from the previous one. If each new step can be built by adding on to or changing the previous step, the discussion should include how this can be done.

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

Suggested Assessment Strategies

Performance

- Present students with a geometric design series, such as the one shown below. Ask them to extend the pattern and record it in a T-chart. Ask students what the 10th step would be. What would the 12th step be? What would the 20th step be?

#1	#2	#3	#4

Design #	# of Squares
1	1
2	2
3	3
4	4

(4PR2.2, 4PR3.2)

- Provide a table showing a pattern (involving one operation) such as the one below. Students can complete the table and create a concrete representation using linking cubes or other manipulatives.

Figure	1	2	3	4	5	6	7	8
Number of Cubes	3	6	9	?	?	?	?	?

(4PR2.1, 4PR3.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 2:
Extending Patterns in Tables
4PR1 (1.2, 1.4)
4PR3 (3.1, 3.2)
TR: pp. 17-20
SB: pp. 8-11

Lesson 3:
Representing Patterns
4PR1 (1.3)
4PR2 (2.2)
4PR3 (3.2)
TR: pp. 21-24
SB: pp. 12-14

Curious Math:
Number Chains
4PR1 (1.2, 1.4)
TR: p. 14
SB: p. 15

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

4PR3 Represent, describe and extend patterns and relationships, using charts and tables, to solve problems.
[C, CN, PS, R, V]

Achievement Indicators:

4PR3.1 Translate the information in a given problem into a table or chart.

4PR3.2 Identify and extend the patterns in a table or chart to solve a given problem.

Suggestions for Teaching and Learning

Key to mathematical learning is the ability to represent, describe and extend patterns and to use them to solve problems. This ability leads students to develop algebraic thinking. In Grade 4, students are expected to describe the relationship within the columns of a table of values. In Grade 6, they will use pattern rules that relate one column to the other to describe patterns.

The numeric component of increasing or decreasing patterns can be displayed using a table or T-chart. Provide opportunities for students to complete charts such as the ones below by identifying and extending patterns.

hours	pay
2	4
3	6
4	8
--	--
--	--
--	--

hours	pay
1	7
2	14
3	21
⋮	⋮
⋮	⋮
10	--

hours	pay
1	6
$1\frac{1}{2}$	9
2	12
$2\frac{1}{2}$	--
--	--
--	--

Vary the difficulty and provide concrete materials to help students work with number patterns appropriate for them. Once they become comfortable with identifying a pattern in a table they should then realize that they can extend a pattern without building a model each time. This also leads to predicting what will happen at a particular step.

If no pattern rule is provided or not enough elements have been included, students could extend a pattern in different ways. For example, the pattern 2, 3, 5, 8, … could be extended and described as:
- 13, 21, … each term is the sum of the two preceding terms
- 12, 17, … adding 1 first, then 2, then 3, and so on

Students are also familiar with extending decreasing patterns from Grade 3. Tell them that Alyssa and Ryan are playing a card game in which the object is to be the first player to get rid of all his/her cards. The table below shows their performance in the game. Ask students to decide who will win the game, if the pattern continues:

Alyssa		Ryan	
Turn	# of cards	Turn	# of cards
3	16	3	21
4	14	4	18
5	12	5	15

Students should also describe the patterns. Often they focus on one aspect of the description, but forget another important part of it. For example, if a student describes Ryan's pattern as decreasing by 3 without indicating that it starts at 3, the pattern rule is incomplete.

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

| Suggested Assessment Strategies | Resources/Notes |

Suggested Assessment Strategies

Performance

- Using a hundred chart, place a coloured chip on numbers 21, 28, 36 and 45. Use addition and subtraction to extend this pattern in both directions. Continue using the chips to complete the hundred chart. Explain the pattern using pictures, numbers and words. E.g., +7, +8, +9...

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

(4PR3.2)

- Given the numerical pattern, ask students to extend the pattern and explain how they determined the pattern and its missing elements.

A	B
1	2
2	4
3	
4	8

Ask students to use manipulatives to represent this pattern and describe the relationship between the chart and the concrete representations.

(4PR1.2, 4PR3.1, 4PR3.2)

- Give students two tables with patterns that are related in some way.

Pattern A	
1	5
2	10
3	15
4	20
5	25

Pattern B	
1	2
2	7
3	12
4	17
5	22

Students should first extend each one by three more numbers. Then they should explain how the two patterns are alike and how they are different. Students could make up their own pairs of patterns and challenge other students to discover how they are alike and how they are different.

(4PR3.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 2:
Extending Patterns in Tables
4PR1 (1.2, 1.4)
4PR3 (3.1, 3.2)
TR: pp. 17-20
SB: pp. 8-11

Lesson 3:
Representing Patterns
4PR1 (1.3)
4PR2 (2.2)
4PR3 (3.2)
TR: pp. 21-24
SB: pp. 12-14

Curious Math:
Number Chains
4PR1 (1.2, 1.4)
TR: p. 14
SB: p. 15

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

4PR3 Continued ...

Achievement Indicators:

4PR3.1 (Continued)Translate the information in a given problem into a table or chart.

4PR3.2 (Continued) Identify and extend the patterns in a table or chart to solve a given problem.

Suggestions for Teaching and Learning

Consider using children's literature, such as *Anno's Magic Seeds* by Mitsumasa Anno, as students work with patterns. In the story, Jack is given two magic seeds. He is told to eat one and plant the other. The seed he eats will keep him from hunger for a whole year, and the planted seed will produce two new seeds by the following year. Several years later, Jack decides to plant both seeds rather than eating one. This new pattern continues until he starts to sell seeds. At each stage, there is an opportunity for students to develop a chart and extend the current pattern. Ask questions such as:

- How many seeds would Jack have planted in the fifth year?
- How many seeds would Jack have harvested in the tenth year?

As an extension, ask students to start with a different number and rethink the pattern using the new number.

As students' abilities to recognize and create patterns become more refined, they are better prepared to apply this knowledge. Their ability to solve problems is further developed as they systematically investigate a variety of patterns. Students move from a basic recognition of patterns to a more sophisticated use of patterns as a problem solving strategy.

Meaningful, real-life situations should be provided regularly to ensure that students have sufficient practice to extend patterns found in a table in order to solve a given problem. For example:

Chad was trying out for the swimming team. He had to swim 24 laps by the end of the second week. He was not able to swim on weekends. On the first day he swam 1 lap; on the second day, 4 laps; on the third day, 7 laps; and so on. Was Chad able to swim enough laps at the end of the 2 weeks to make the team?

Students can translate this information into a table as shown below, and then extend the pattern to solve the problem.

Day	Number of Laps
Monday	1
Tuesday	4
Wednesday	7
Thursday	10

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

Suggested Assessment Strategies

Paper and Pencil

- Ask students to solve the problem:
  John was making trains using linking cubes. If he continues to build trains this way, how many blocks will he use in the 7th train?

  Train   Train   Train
  □   □□□□□   □□□□□□□□□

  Ask students to look for a pattern and complete a table to display the information and solve the problem.

Train	Number of Blocks
1	1
2	5
3	9
4	
5	
6	
7	

  (4PR3.1, 4PR3.2)

- Emma agrees to walk Katie's dog for three weeks while Katie is on vacation. Katie is offering to pay her $2.00 per day or $15.00 per week. Ask students, if they were Katie, which offer they would choose and why. Students could complete the table to assist them in reaching a decision.

Day	Total Pay (in Dollars)
1	2
2	4
3	6
4	8
...	...
21	?

  (4PR3.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 4:
Solving Problems using Patterns
4PR1 (1.4)
4PR3 (3.2)
TR: pp. 29-31
SB: pp. 18-19

Suggested Resources

Anno's Magic Seeds – Mitsumasa Anno

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit3.html

- The Interactive White Board activity provides an opportunity for teachers to model how to solve a problem by organizing information and using a hundred chart. Students could then solve the next problem and discuss to communicate their reasoning.

Patterns and Relations (Variables and Equations)

Specific Outcomes

Students will be expected to:

4PR5 Express a given problem as an equation in which a symbol is used to represent an unknown number.
[CN, PS, R]

Achievement Indicators:

4PR5.1 Explain the purpose of the symbol in a given addition, subtraction, multiplication or division equation with one unknown.

4PR5.2 Express a given pictorial or concrete representation of an equation in symbolic form.

Suggestions for Teaching and Learning

Work with patterns leads naturally to algebraic thinking. A pattern can be described algebraically using an equation. The decreasing pattern 80, 75, 70, 65, 60, … could be described, for example, by the equation $80 - \square = 75$.

In Grade 3, students solved one-step addition and subtraction equations, with symbols to represent unknown numbers. Students in Grade 4 will be expected to create and solve equations, with one unknown involving **only one operation**. At this time, students will review solving addition and subtraction equations. In a later unit, students will solve multiplication and division equations.

Students are thinking algebraically when they use open number sentences such as $17 - 8 = \square$, $50 = 20 + \triangle$, or $36 - \bigcirc = 6$, with a symbol representing the unknown. In later grades, they will progress from the use of symbols (e.g., squares, circles, triangles) to letters.

An equation is a mathematical sentence with an equal sign and is used to express relationships between two quantities. For some students, the equal sign poses difficulty. Although they are comfortable with the sentence $4 + 5 = \square$, for example, they interpret the equality 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 might solve $4 + \square = 5$ by adding 4 and 5 to "get the answer". The notion of an equation as an expression of balance may not be apparent to them. It is important for students to understand that an equation is an expression of balance and to view the equal sign as a way to say that the same number has two different names, one on either side of the equal sign.

Provide students with various representations, such as diagrams, number lines and concrete materials, and ask them to write an equation for each. They should include one symbol in each equation.

Example 1:
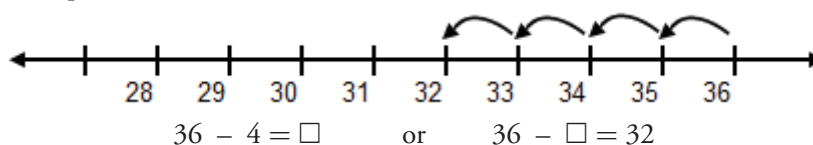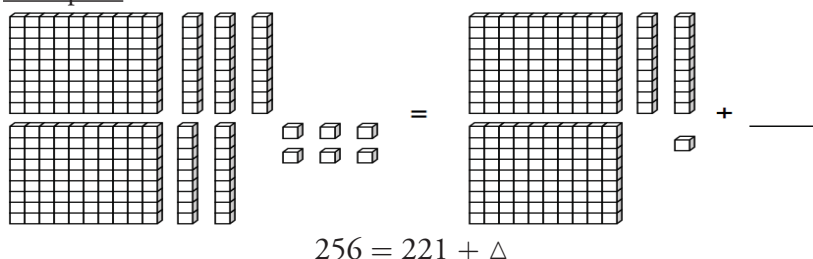
$$36 - 4 = \square \qquad \text{or} \qquad 36 - \square = 32$$

Example 2:

$$256 = 221 + \triangle$$

General Outcome: Represent algebraic expressions in multiple ways.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Ask students to explain the purpose of the box symbol in the following equation:

$$15 - \square = 8$$

(4PR5.1)

Paper and Pencil

- Provide a pictoral representation of the following and ask students to write equations with unknowns for each situation. Students need not solve their equations.

  (i)   The perimeter of a triangle is 12 cm. One side is 3 cm and another side is 4 cm. What is the length of the third side?

  (ii) Susie has three types of stickers. She has 25 stickers, 3 are Barbie™ stickers and 18 are Sponge Bob™ stickers. How many of the third type does she have?

  (iii) Carla's age and her brother's age add up to 18. If Carla is 12, how old is her brother?

(*4PR5.2)*

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Solving Equations
4PR5 (5.2, 5.2)
4PR6 (6.1, 6.2)
TR: pp. 32-35
SB: pp. 20-23

Lesson 6:
Solving Problems with Equations
4PR5 (5.3, 5.4)
4PR6 (6.1, 6.2, 6.3, 6.4)
TR: pp. 36-39
SB: pp. 24-26

Patterns and Relations (Variables and Equations)

Specific Outcomes

Students will be expected to:

4PR6 Solve one-step equations involving a symbol to represent an unknown number.
[C, CN, PS, R, V]
Achievement Indicators:

4PR6.1 Solve a given one-step equation using manipulatives.

4PR6.2 Describe, orally, the meaning of a given one-step equation with one unknown.

4PR6.3 Solve a given equation when the unknown is on the left or right side of the equation.

Suggestions for Teaching and Learning

Once students are familiar with expressing a concrete representation in symbolic form (an equation), they should move to the next step, solving the equation (using one operation).

When an addition or subtraction equation is simple enough, students can use facts they already know to determine the missing value. Balance scales are also a valuable tool to be used when solving equations. The balance scale, with the use of additional manipulatives such as linking cubes, allows the teacher and student to represent the balancing of an equation concretely. For an equation such as $8 + \square = 20$, place 8 blue linking cubes on one side of the scale and 20 red cubes on the other side. Students will see that the scale is unbalanced. Begin adding white cubes to the 8 until the scale balances and equality has been reached. Using different colored cubes allows students to easily see how many were added. The number of white cubes represent the unknown in the equation. Remind students that since the scale is balanced, an equation can be written to represent the situation illustrated.
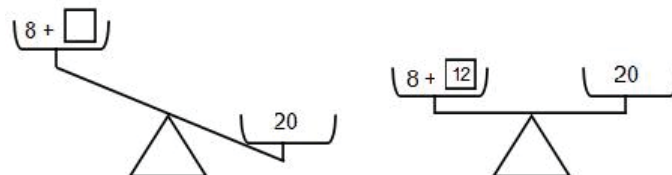
$8 + \square = 20$, so $\square = 12$.

Use contextual situations with addition and subtraction that are meaningful to students. For example:

You have 24 marbles and your friend gives you some more marbles. Now you have 32 marbles in all. How many marbles did your friend give you?

Ask students to:
- model the problem using cubes and balance scales
- write an equation to represent this problem
- solve the problem and explain their thinking

Students develop communication skills in mathematics as they are given opportunities to share their solutions and respond to the solutions of others. For example, in discussing $8 + \square = 20$, a student might say that it means:
- What number do I add to 8 to get 20?
- 8 plus some number equals 20.
- 20 is the total of 8 and some number.

Students should solve equations where the unknown value is in different places (e.g., $15 + \triangle = 27$, $12 + 15 = \bigcirc$).

General Outcome: Represent algebraic expressions in multiple ways.

Suggested Assessment Strategies

Interview

- Ask students to solve the following equations and explain their thinking.
  (i) $\triangle - 13 = 20$
  (ii) $25 + \triangle = 100$

  (4PR6.1, 4PR6.2)

Performance

- Ask students to solve the following using a pan balance:
  (i) $7 + \square = 12$
  (ii) $19 - \square = 11$

  (4PR6.1)

Paper and Pencil

- Ask students to solve the following using base ten materials:
  (i) $109 + \square = 164$
  (ii) $\triangle - 50 = 150$

  (4PR6.3)

- Encourage students to write as many different equations as they can, using symbols. Ask them to trade their equations and solve them. Ensure that a wide variety of equations are included.
  For example:

$15 + \square = 24$	$\diamond + 15 = 24$
$24 = 15 + \triangle$	$24 = \square + 15$
$24 - \triangle = 15$	$24 - 15 = \square$
$15 = 24 - \triangle$	$\square = 24 - 15$

  (4PR6.3, 4PR6.4)

Journal

- Ask students to draw a diagram to represent the equation $\triangle + 23 = 48$. They should then solve the equation.
  After solving this equation, ask students to write in their math journals, using the following prompts:

  I know this is correct because I _____.

  Some strategies I used to solve problems were_____.

  Something I learned was_____.

  Something challenging was _____.

  (4PR6.1, 4PR6.2, 4PR6.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Solving Equations
TR: pp. 32-35
SB: pp. 20-23

Lesson 6:
Solving Problems with Equations
4PR5 (5.3, 5.4)
4PR6 (6.1, 6.2, 6.3, 6.4)
TR: pp. 36-39
SB: pp. 24-26

Patterns and Relations (Variables and Equations)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4PR5, 4PR6 Continued ...

Achievement Indicators:

4PR6.4 Solve a given one-step equation using "guess and test".

Suggestions for Teaching and Learning

Model the use of "guess and test" as another strategy to find the value for the unknown that will balance both sides of the equation. For this strategy, students guess an answer and then test it to see if the guess works. If it doesn't, the guess is revised based on what was learned. This repetitive process continues until the answer is found. Some students are able to think through several guesses at once; others need to go one step at a time. This strategy reinforces the value of taking risks and learning from the information that is found. (Small 2008, p. 44) If students are using this strategy, it is important to listen to their reasoning as they choose numbers to test.

$\square + 17 = 23$		
Guess	Reasoning	Test
$\square = 10$	I'll start with 10 because it's a friendly number to work with	$10 + 17 = 27$ too high
$\square = 5$	My first guess was too high ... I'll try 5	$5 + 17 = 22$ too low
$\square = 6$	My guess of 5 was too low by 1	$6 + 17 = 23$
For the equation $\square + 17 = 23$, $\square = 6$.		

Students often erase their initial guesses because they think of them as "wrong". Highlight the importance of recording all guesses and using each guess to gather information which can lead them closer to the solution.

4PR5.3 Identify the unknown in a problem, represent the problem with an equation, and solve the problem concretely, pictorially or symbolically.

As students become familiar with solving equations, continue to model the connection between the concrete, pictorial and symbolic representations consistently. Provide them with a variety of scenarios and ask them to write and solve appropriate equations to represent the situations. For example:

There are four sandwiches remaining on a tray. If there were 13 to begin with, how many were eaten?

Students should realize that the unknown is the number of sandwiches that were eaten. They can then represent the problem with an equation such as $13 - \square = 4$.

Students could use a model or picture, such as the one shown here, to conclude that 9 sandwiches were eaten. They could also use a balance scale, addition/subtraction facts, or the guess and test strategy to solve the equation.

General Outcome: Represent algebraic expressions in multiple ways.

Suggested Assessment Strategies	Resources/Notes
Performance	**Authorized Resource**

Suggested Assessment Strategies

Performance

- Provide students with linking cubes to model situations. Pose the problem:

  Gregory has 13 red marbles and 22 blue marbles. How many more blue marbles than red marbles does Gregory have?

  Observe how students solve the problem.

  (4PR5.3)

- Ask students to explain what the △ represents in the number sentences shown. Ask them to place numbers in the symbols to make the number sentence true.

$$\triangle - 7 = 6 \qquad\qquad 9 + \triangle = 17$$

  (4PR6.3, 4PR6.4)

Paper and Pencil

- Pose this problem for students to solve:
  You know that $\square + 24 = 35$.
  Could $\square$ represent 10?
  Use words, pictures or symbols to show how you know.

  This is open ended enough that some students could elect to draw a balance scale. Others might draw base ten models. Some might conclude that $10 + 24 = 34$, not 35, and so on.

  (4PR6.3, 4PR6.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Solving Equations
TR: pp. 32-35
SB: pp. 20-23

Lesson 6:
Solving Problems with Equations
4PR5 (5.3, 5.4)
4PR6 (6.1, 6.2, 6.3, 6.4)
TR: pp. 36-39
SB: pp. 24-26

Supplementary Resource

Making Math Meaningful to Canadian Students K - 8 – Marian Small

Patterns and Relations (Variables and Equations)

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:
 	
4PR5, 4PR6 Continued ...
 	
Achievement Indicators:
 	
4PR6.5 Represent and solve a given addition or subtraction problem involving a "part-part-whole" or comparison context, using a symbol to represent the unknown.
	Give students part–part–whole and comparison problems to solve. Ask them to write an equation to represent the problem, using a symbol to represent the unknown value.
	
	Examples of Part–Part–Whole Problems:
	• Whole Unknown
	  Connie has 15 red marbles and 28 blue marbles. How many marbles does she have?
	• Part Unknown
	  Connie has 43 marbles. 15 are red and the rest are blue. How many blue marbles does Connie have?
	
	Examples of Comparison Problems:
	• Difference Unknown
	  Connie has 15 red marbles and 28 blue marbles. How many more blue marbles than red marbles does Connie have?
	• Unknown Big Quantity
	  Connie has 15 red marbles. She has 13 more blue marbles than red ones. How many blue marbles does Connie have?
	• Unknown Small Quantity
	  Connie has 28 blue marbles. She has 13 more blue marbles than red ones. How many red marbles does Connie have?
	
	Teachers should model writing an equation to represent a problem:
	
	Stephen is 15 years old. He has a younger brother. The sum of their ages is 25. Write an equation to help you solve this problem.
	
	Use a "think-aloud" strategy to help students understand how to approach the task. Ask students:
	• What information do we know in this problem? (Stephen is 15, when you add his age to his brother's age you will get 25 as the answer)
	• What information is unknown? (Age of Stephen's brother)
	• What operations can be used to solve this problem?
	Remind students that a symbol takes the place of the unknown number. Display the equation "$15 + \square = 25$" and ask them what $\square$ means in the problem. Have them determine the value of $\square$. Ask students to share their answers and explain their strategies.

4PR5.4 Create a problem for a given equation with one unknown.	Use contexts for problems that students can relate to so that they can translate the meaning of the problem into an appropriate equation. Encourage students to create some problems using addition and others using subtraction.

General Outcome: Represent algebraic expressions in multiple ways.

Suggested Assessment Strategies

Performance

- Ask students to represent and solve these problems:
  (i) Jackie is Sheena's older sister. The difference between their ages is 21 years. Sheena is 37. How old is Jackie?

  (ii) Ms. Jackson allowed 7 students to go to the washroom. There were 15 students left in the room. How many students are in the class?

  (4PR5.3, 4PR6.5)

- Ask students to write as many equations as possible with a solution of $\triangle = 8$ (e.g., $20 - \triangle = 12$, $\triangle + 30 = 38$). In small groups, students take turns reading an equation from their list. All group members who have that equation on their list cross it off. At the end of this activity, students choose an equation remaining on their list and create a problem for that equation.

  Teachers could collect problems and use them as centre activities for the next class or students could exchange problems to solve.

  (4PR5.4)

Paper and Pencil

- Provide an equation such as $14 + \square = 21$ or $25 - \triangle = 18$. Ask students to create a matching story problem and solve it. Observe to what extent students are able to:

  - create a story to match the equation;

  - explain the meaning of the unknown variable; and

  - solve the problem in one or more ways.

  (4PR5.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Solving Problems with Equations
TR: pp. 36-39
SB: pp. 24-26

Lesson 7: Equations in a Story
4PR5 (5.3, 5.4)
4PR6 (6.1, 6.3, 6.4)
TR: pp. 40-42
SB: p. 27

Suggested Resource

My Rows and Piles of Coins – Tololwa M. Mollel

A guide for using this book can be found on pp. 41-42 of the *Math Focus 4* Teacher's Resource.

DATA RELATIONSHIPS

Suggested Time: 3 Weeks

September	October	November	December	January	February	March	April	May	June

Estimated Completion
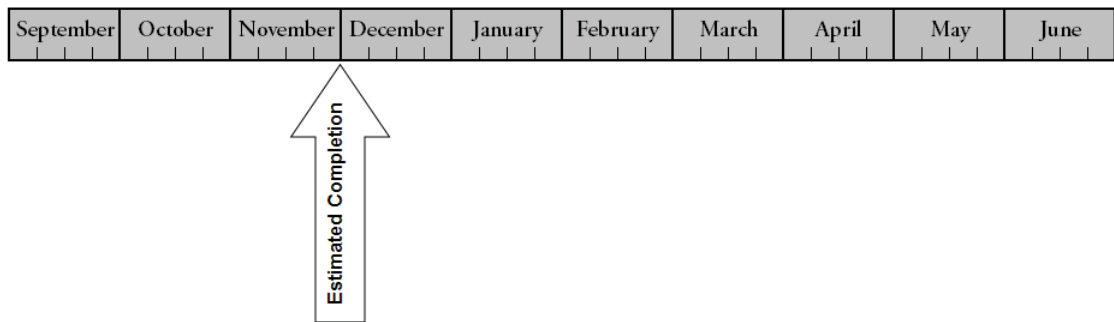
Unit Overview

Focus and Context

Graphing is a way to present data, concisely and visually. In Grade 4, the focus will mainly be on many-to-one correspondence and on interpreting data to see relationships. In preparation for interpreting graphs and using them as a problem-solving tool, students will gather data that is meaningful to them and learn how to construct graphs. Charts, diagrams and graphs are useful as tools to understand mathematical relationships and solve mathematical problems. Examples of such charts covered in this unit include Venn and Carroll diagrams. Although data relationships receive focus in this unit, it is important that students are given opportunities to practice what they have learned, on an ongoing basis throughout the year depending on special occasions and events that naturally occur (e.g., Halloween, sports events, seasons).

Outcomes Framework

> **GCO**
> Collect, display and analyze data to solve problems.

> **SCO 4SP1**
> Demonstrate an understanding of many-to-one correspondence.

> **SCO 4SP2**
> Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions.

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

> **SCO 4PPR4**
> Identify and explain mathematical relationships, using charts and diagrams, to solve problems.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Statistics and Probability (Data Analysis)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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]	5SP1 Differentiate between first-hand and second-hand data. (C, R, T, V) 5SP2 Construct and interpret double bar graphs to draw conclusions. (C, PS, R, T,V)
Strand: Patterns and Relations (Patterns)		
	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

Daily Routine Opportunity

Identify a path of students around the classroom and then practice a rhythm with them (e.g., 2 finger snap followed by two claps, two finger snaps, two claps, and so on). After the pattern is established with the whole class, the teacher states a multiplication fact on the snaps (e.g., 'three fives'). Without disrupting the rhythm, the student thinks during the two claps and on the next two snaps, gives the answer ('fif-teen'). On the next snaps the teacher has another multiplication fact ready to state and a different student is ready to answer. All naming of facts and responses happen during the 'snapping stages' of the rhythm. Try to continue around the class without breaking the rhythmic pattern. Remember to set a slow pace to allow for greater success.

Statistics and Probability (Data Analysis)

Specific Outcomes

Students will be expected to:

4SP1 Demonstrate an understanding of many-to-one correspondence.
[C, R, T, V]

Achievement Indicators:

4SP1.1 Compare graphs in which the same data has been displayed using one-to-one and many-to-one correspondences, and explain how they are the same and different.

4SP1.2 Explain why many-to-one correspondence is sometimes used rather than one-to-one correspondence.

Suggestions for Teaching and Learning

Prior to Grade 4, students have had opportunities to collect data, organize data using tally charts, and display data in pictographs and bar graphs. Teachers may find opportunities in other subject areas, such as Science and Social Studies, for students to collect, display and analyze data to solve problems. As they investigate a wider range of topics, they may discover that the data they collect is too large to display in a graph using a one-to-one correspondence (i.e., having each symbol or number on the bar graph represent one piece of data).

In Grade 2, students constructed and interpreted pictographs, using one-to-one correspondence to display data. They should now be introduced to the concept of using a many-to-one correspondence (or scale) when analyzing graphs that display large amounts of data. Provide students with several pictographs that show the same data using different scales. If two pictographs show a marble collection with 36 blue, 24 red, and 42 clear marbles, one may show a one-to-one correspondance (where each symbol represents one), whereas the other may show a many-to-one correspondance (where each symbol represents 6 marbles). Discuss with students which scale would be more appropriate and why.

In cases where the numbers are all less than 10, it is usually more appropriate to use a one-to-one correspondence. As students begin to work with greater amounts of data, it becomes inconvenient to draw a symbol to represent every piece of data. Using a scale allows a single symbol to represent a number of items, a situation referred to as many-to-one correspondence. For larger numbers it is more appropriate to use intervals (increments) such as 5, 10, 25, 100, or 1 000 based on the data. Students should discuss the data displayed and explain why the scale was chosen and what other correspondence may have been used.

Students would not be expected to use the term 'interval' in their explanations, but may justify their choice by telling how they skip counted.

Deciding what scale to use allows students to apply their knowledge of multiplication. It is very helpful, therefore, for students to have a working knowledge of basic facts learned thus far.

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

Suggested Assessment Strategies

Performance

• The teacher presents two graphs representing the same data, such as in the examples below.

moose	
bear	
rabbit	
fox	

 Represents 10 animals

moose	
bear	
rabbit	...
fox	

 Represents 1 animal

Ask students:
(i)   Do the pictographs show the same data?
(ii) Why do they look different?
(iii) Are they both accurate?
(iv) What inaccurate conclusions might a person make by looking at these graphs?

(4SP1.1, 4SP1.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Interpreting and Comparing Pictographs
4SP1 (1.1, 1.2)
TR: pp. 12-15
SB: pp. 106-109

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/ math/grade-4/links/unit4.html
• Enrichment activities

Statistics and Probability (Data Analysis)

Specific Outcomes

Students will be expected to:

4SP2 Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions.
[C, PS, R, V]

Achievement Indicators:

4SP2.1 Identify an interval and correspondence for displaying a given set of data in a graph, and justify the choice.

4SP2.2 Create and label (with categories, title and legend) a pictograph to display a given set of data, using many-to-one correspondence, and justify the choice of correspondence used.

4SP2.3 Answer a given question using a given graph in which data is displayed using many-to-one correspondence.

Suggestions for Teaching and Learning

When students construct their own graphs, they are invested in the data and learn how a graph conveys information. It is important to discuss what a graph tells people who see it, especially those who didn't construct it. Discussions about graphs of real data that students have themselves been involved in gathering will help them interpret other graphs and charts that they see in newspapers and on TV (Van de Walle and Lovin 2006, p. 329).

When students are creating graphs, it is important to allow opportunities for them to decide which scale to use. By choosing a scale, a correspondence will be identified. The symbol chosen should allow for partial symbols that are easy to interpret. A circle or square is the ideal symbol, as it can be divided into quarter and half symbols which are easy to interpret.

When creating graphs, it is important that students include a title, labels, and a legend (or key). When constructing a pictograph, students need to pay particular attention that the symbols are aligned and are of a consistent size.

Questioning should be ongoing throughout tasks to encourage students to interpret the data presented and to draw inferences. It is important to ask questions that go beyond simplistic reading of a graph. Both literal and inferential questions should be posed. For example:
- How many more/less than….?
- Order from least to greatest / greatest to least…
- What other conclusions can you make?
- Why do you think . . . ?

Some of the following questions could be used for students to gather data or interpret graphs.

Describe or summarize what was learned from a set of data:
- How many glasses of water/milk do you drink in a day/week?
- Which class read the most books last month?

Determine preferences and opinions from a set of data:
- What is your favorite …. (music group)?
- What traits do you value in a friend?

Generalize and make predictions from a set of data:
- What is the typical type of book read by students in the class?
- Can you predict your neck measurement from your wrist measurement?
- Is there a trend between the months of the year and the number of student absences?

(Navigating through Data Analysis and Probability in Grades 3-5)

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

Suggested Assessment Strategies

Performance

- Ask students to collect a set of data from another subject area or related personal interest. Using the data collected, students create a pictograph using a many-to-one correspondence and provide an explanation as to why the particular correspondence was appropriate. Ask students to draw one conclusion based on their graph.

(4SP2.1, 4SP2.2, 4SP2.3)

- Ask students to create a tally chart and use it to construct and label a pictograph with many-to-one correspondence. To gather larger numbers which would be conducive to many-to-one correspondance, data may be collected by surveying other classes.

Favorite Category of Movies

Movie Categories	Number of Students
Adventure	
Comedy	
Drama	
Science Fiction	
Other	

(4SP2.1, 4SP2.2, 4SP2.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 2:
Constructing Pictographs
4SP1 (1.2)
4SP2 (2.1, 2.2, 2.3)
TR: pp. 16-20
SB: pp. 110-113

Note

Creating graphs is time consuming. Be selective with practice.

Supplementary Resource

Teaching Student-Centered Mathematics Grades 3-5 – John Van de Walle and LouAnn Lovin

Suggested Resource

Navigating through Data Analysis and Probability in Grades 3 – 5. NCTM, 2002

Statistics and Probability (Data Analysis)

Specific Outcomes

Students will be expected to:

**4SP2 Continued ...**

Achievement Indicator:

4SP2.4 Create and label (with axes and title) a bar graph to display a given set of data, using many-to-one correspondence, and justify the choice of interval used.

Suggestions for Teaching and Learning

In Grade 3, students constructed and interpreted bar graphs, using one-to-one correspondence to display data. They will now display data using many-to-one correspondence. To activate prior knowledge, teachers should present bar graphs similar to the one below.

Favourite Juice

Number Of Students

Types of Juice
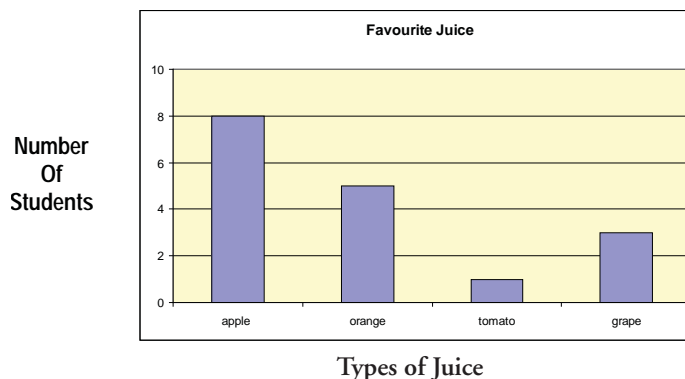
Ask questions such as:

*   What interval is used on the vertical axis? What does it represent?
*   How many people like apple juice?
*   How many more like apple juice than tomato juice?
*   How many students answered the questions about their favourite juice?
*   Why was the interval of 2 chosen?

It is important for students to use a consistent interval in the data display. If a graph has a scale with an interval of 2, for example, all of the numbers, beginning with zero, need to increase by 2 (0, 2, 4, 6, 8, 10, 12 … and not 2, 4, 6, 7, 8, 9, 10, 12…). Depending on the data and the interval chosen, it may become necessary to create bars that fall between numbers. The interval must be clearly shown along a numbered vertical or horizontal axis. Both axes should be labeled and and the graph should include a heading.

Teachers could provide the following: small red cubes, medium blue cubes and large yellow cubes. Ask each student to pick a cube in his/her favourite colour and place it in one of three towers. Ask which colour is the most popular in class. Some students may answer based on the height of the towers without realizing that the size of the cubes may account for the difference in the height. Lead a discussion to illustrate how bar graphs can be misleading if the scale for the bars does not remain constant.
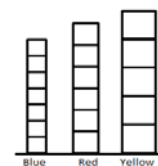
General Outcome: Collect, display, and analyze data to solve problems.

Suggested Assessment Strategies

Paper and Pencil

- The table below represents the genres of books elementary students check out at the library over the period of one week:

Genre of Books	Books Checked Out During One Week
Non-fiction	70
Folk Tales	100
Fantasy	65
Historical Fiction	45

Discuss with students whether one-to-one correspondence or many-to-one correspondence would be most appropriate for this data set. Ask students to construct a bar graph to display the data.

(4SP2.4)

Journal

- Throughout the unit, provide opportunities for students to self-assess their graphs. Suggested prompts include:
  (i) I know I properly constructed a graph because…
  (ii) Some things that are similar between my graph and my classmate's graph are…
  (iii) Some things that are different about my graph and my classmate's graph are…
  (iv) When I make a graph I choose intervals of 1, 2, 5 or 10 when…

(4SP2.4)

Performance

- While on an autumn walk, students collect a variety of leaves. Ask them to classify the leaves according to colour, and display class results on a tally chart. Students then create and label a bar graph using many-to-one correspondence.
  (i) Ask students to interpret graph results by posing questions, such as "Are there less green leaves than the other colours? If so, how many less?".
  (ii) Ask students to create their own questions about the data presented in the graph.

(4SP2.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Interpreting and Comparing Bar Graphs
4SP1 (1.1, 1.2)
4SP2 (2.3)
TR: pp. 21-24
SB: pp. 114-117

Lesson 4:
Constructing Bar Graphs
4SP2 (2.1, 2.3, 2.4)
TR: pp. 25-28
SB: pp. 118-120

Math Game:
Matching Data
4SP1 (1.1)
4SP2
TR: pp. 29
SB: p. 121

Statistics and Probability (Data Analysis)

Specific Outcomes

Students will be expected to:

4SP1 Continued ...
Achievement Indicator:

4SP1.3 Find examples of graphs in which many-to-one correspondence is used in print and electronic media, such as newspapers, magazines and the Internet, and describe the correspondence used.

Suggestions for Teaching and Learning

Students could collect graphs found in newspapers, magazines, books or on the Internet. They should prepare questions that their peers will be able to answer by viewing the graph. In pairs or small groups, students take turns sharing their graphs and asking questions for classmates to respond to using information from the graph. Samples of horizontal and vertical graphs are shown below.
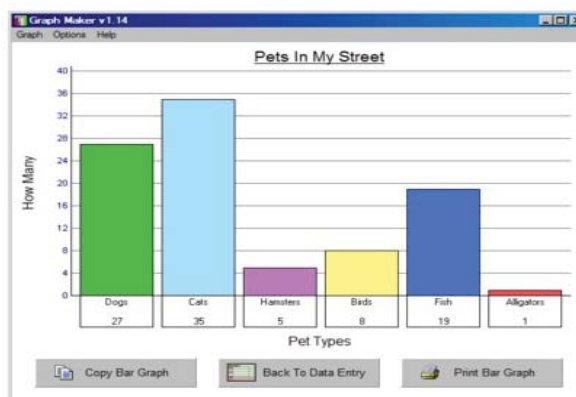
www.greyolltwit.com/graphmaker.html

http://future-edge.com/
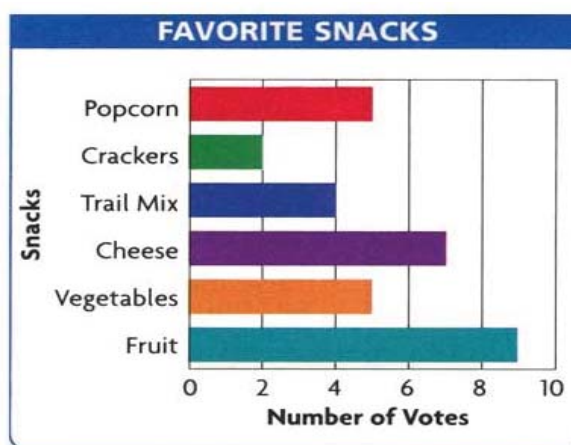
Cloudy with a Chance of Meatballs by Judi Barrett could be used to launch a daily routine activity. The book describes the strange daily weather pattern of a town called Chewandswallow that provides people with all of their required meals by raining food. After reading the book ask students to record weather for a week. Students could display their data and discuss the information that it represents.

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

Suggested Assessment Strategies

Performance

- Ask students to find an example of a graph from either newspapers, magazines, or the Internet to present to classmates. Teachers should pose questions to elicit information about the type of correspondence used in the graph.

  (4SP1.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Graphs in the Media
4SP1 (1.1, 1.2, 1.3)
4SP2 (2.1, 2.3)
TR: pp. 35-37
SB: p. 126

Suggested Resource

Cloudy with a Chance of Meatballs
– Judi Barrett

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

4PR4 Identify and explain mathematical relationships, using charts and diagrams, to solve problems.
[CN, PS, R, V]

Achievement Indicators:

4PR4.1 Identify a sorting rule for a given Venn diagram.

4PR4.2 Describe the relationship shown in a given Venn diagram when the circles intersect, when one circle is contained in the other and when the circles are separate.

4PR4.3 Determine where new elements belong in a given Venn diagram.

Suggestions for Teaching and Learning

Numbers can be grouped according to certain characteristics and shared relationships. Students need to explore these relationships by being involved in experiences where they are expected to recognize, describe and identify relationships and number characteristics. Sorting is the action of grouping (or organizing) objects or data. Classification (or categorization) is the naming of the groups of objects or data. Venn diagrams and Carroll diagrams will be used to identify mathematical relationships.

By Grade 4, students are expected to use more sophisticated sorting tools, such as a Venn diagram. These organizational tools are particularly useful as a form of data display when the categories for the sorting situation overlap.

Students need practice reading and interpreting graphs and diagrams. By recognizing and explaining the relationship between attributes of a given set of data, students are strengthening their reasoning skills.

There are three types of Venn diagrams:
- Two separate circles (when the items being sorted do not share common attributes)
- Overlapping circles (when the items being sorted share common attributes)
- Circle contained within a circle (if the inner circle is a subset of the outer)

The notion of how cross-classification is shown in Venn diagrams could be introduced by using loops of string and a set of number cards in a context such as the one below. Ensure the sorting rules and numbers to be sorted lend themselves to cross-classification. For example:

Kim sorted the number of stickers the students in her class collected:
7, 10, 19, 37, 42, 78, 91, 107, 301, 532, 1233
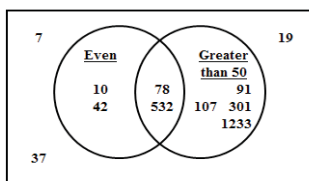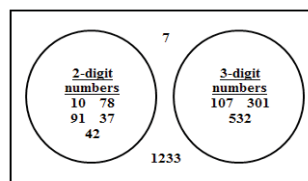
Overlapping Circles   Two Separate Circles
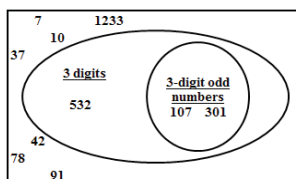
Circle Contained Within a Circle

Teachers should ensure that students include all of the data being considered from their sorting situation. Cards with data not included in the circles may be left outside the loops.

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

Suggested Assessment Strategies

Paper and Pencil

- Provide students with the following data:

  Jennifer listed the numbers for her raffle tickets in the Spring Fair: 723, 694, 496,501, 360, 999, 222

  Ask students to sort these numbers using all three types of Venn diagrams, including labels. Explain the relationships within the three types of diagrams.

  (4PR4.2, 4PR4.3)

- Ask students to create a set of ten 3-digit or 4-digit numbers and sort them in a Venn diagram using two attributes. They should write the sorting rule.

  (4PR4.1, 4PR4.3)

- Ask students to use a Venn diagram to solve the following problem:

  In a class of 22 students, 10 play hockey and 15 play basketball.

  (i) Is it possible that some students play neither sport?
  (ii) What is the greatest possible number of students who do not play either sport?
  (iii) Is it possible that all 22 students are involved in one sport or both?

  They should explain their responses.

  (4PR4.2, 4PR4.3)

Performance

- Provide students with pieces of coloured wool or string and cards displaying various numbers. Ask students to create a Venn diagram using the string. On each turn a student selects six cards, chooses two mystery attributes and sorts them according to their attributes. The other student attempts to guess the sorting rule.

  (4PR4.1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Using Venn Diagrams
4PR4 (4.1, 4.2, 4.3)
TR: pp. 40-43
SB: pp. 128-131

Note

Lessons 6-8 represent content which is new for Grade 4 students and, therefore, will require a greater focus for instruction. Students had experiences with sorting objects in previous grades. The focus here is on sorting numbers, which can be more challenging.

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit4.html

- Interactive White Board activity to assess students' ability to determine where new elements belong in a Venn diagram

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

4PR4 Continued ...

Achievement Indicators:

4PR4.4 Complete a Carroll diagram by entering given data into correct squares to solve a given problem.

4PR4.5 Determine where new elements belong in a given Carroll diagram.

4PR4.6 Solve a given problem using a Carroll diagram.

4PR4.7 Solve a given problem by using a chart or diagram to identify mathematical relationships.

Suggestions for Teaching and Learning

Carroll diagrams are tables used for cross-classification, much like Venn diagrams. Carroll diagrams use two attributes for sorting, focusing on one attribute of each characteristic (Small 2008, p. 521).

The categories of a Carroll diagram should be established to fit a specific context (e.g., even and not even). Numbers or objects are either categorized as having an attribute or not having an attribute.

A table is created with four cells to show the four possible combinations of these two attributes. Either the items themselves, or the count of how many items of each type, will be included in the cells.

Ask students to sort the following numbers in the Carroll diagram provided:

953, 888, 1501, 8000, 201, 2542, 450, 9349

	Odd	Even
< 1000	953 201	888 450
> 1000	1 501 9 349	8 000 2 542

Once students are familiar with various classification methods using a Venn or Carroll diagram, they should be given opportunities to apply these diagrams to problem solving situations. This will help develop their logical reasoning skills. Teachers should discuss with students their choice of diagram.

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

Suggested Assessment Strategies

Resources/Notes

Paper and Pencil

- Ask students to place the numbers 1, 2, 3, 4, 5, 6, 10, 14, 15, 20, 21, 27, 28, 35, 47, 55 appropriately in the Carroll diagram.

Carroll Diagram	Said when you skip count by 5	Not said when you skip count by 5
Even Numbers		
Not Even Numbers		

(4PR4.4, 4PR4.5)

- Ask students to use a Carroll diagram to solve this problem:

  Grant is sorting fifty 2-D and 3-D shapes on a mat. 15 of the 2-D shapes are purple. 18 of the 3-D shapes are yellow. The total number of 3-D shapes is 27. How many 2-D shapes are yellow? Explain your thinking.

  (4PR4.6, 4PR4.7)

Performance

- The teacher provides students with various number cards containing numbers up to 4-digits and asks them to create and complete a Carroll diagram. Using the same number cards, create another Carroll diagram using different sorting rules. Ask students to share the Carroll diagrams they created and explain their sorting rules.

  (4PR4.4, 4PR4.5)

Authorized Resource

Math Focus 4
Lesson 7:
Using Carroll Diagrams
4PR4 (4.4, 4.5)
TR: pp. 44-47
SB: pp. 132-133

Lesson 8:
Solving Problems Using Diagrams
4PR4 (4.3, 4.4, 4.5, 4.6, 4.7)
TR: pp. 48-51
SB: pp. 134-135

Curious Math:
Logic Puzzles
4PR4 (4.7)
TR: pp. 38-39
SB: p.127

2-D GEOMETRY

Suggested Time: 2 Weeks

September	October	November	December	January	February	March	April	May	June

Estimated Completion
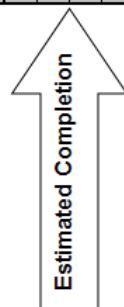
Unit Overview

Focus and Context

This unit introduces students to symmetry and provides them opportunity to explore symmetry and congruency in 2-D shapes. Both of these properties are important and can be linked to the study of fractions and to the area of regular polygons. When children are learning about symmetry, they need to spend a lot of time manipulating the shapes rather than simply looking at them. Taking the time to allow students to fold, draw and work with models to find properties of 2-D shapes is important, as it promotes visualization and is helpful in problem solving. During this unit, prepare an area where children have ongoing opportunities to explore and extend upon their experiences with symmetrical design. Provide geoboards, Miras™, pattern blocks, 2-D shapes, geometric dot paper, Pattern Block grid paper (Masters booklet pp.44-49), fabric, wallpaper, etc. Display symmetrical designs versus non-symmetrical designs as an exhibit in the classrooms or compile digital photographs to make a book or a bulletin board display.

Outcomes Framework

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

> **SCO 4SS5**
> Demonstrate an understanding of congruency, concretely and pictorially.

> **GCO**
> Describe and analyze position and motion of objects and shapes.

> **SCO 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.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Shape and Space (3-D Objects and 2-D Shapes)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
	4SS5 Demonstrate an understanding of congruency, concretely and pictorially. [C, CN, V]	
Strand: Shape and Space (Transformations)		
3SS7 Sort regular and irregular polygons, including: • triangles • quadrilaterals • pentagons • hexagons • octagons according to the number of sides. [C, 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]	5SS5 Describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes that are: • parallel • intersecting • perpendicular • vertical • horizontal. [C,CN, R, T, V] 5SS6 Identify and sort quadrilaterals, including: • rectangles • squares • trapezoids • parallelograms • rhombuses (or rhombi) according to their attributes. [C, 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

Divide the class into two teams. Display several number facts which have one factor missing (e.g., 5 × __ = 20). Each team has a different colour writing tool. The game begins with one of the teams selecting a student to take a turn rolling a number cube (containing numbers 1 - 5 only). The player then fills one cell on the display where the tossed number correctly completes a multiplication fact. If there is no cell for the tossed number to correctly complete the multiplication fact, that team misses a turn. Teams continue to take turns until the display is filled. The team with the most facts completed is the winner.

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

Specific Outcomes

Students will be expected to:

4SS5 Demonstrate an understanding of congruency, concretely and pictorially.
[C, CN, V]

Achievement Indicators:

4SS5.1 Determine if two given 2-D shapes are congruent and explain the strategy used.

4SS5.2 Create a shape that is congruent to a given 2-D shape.

4SS5.3 Identify congruent 2-D shapes from a given set of shapes shown in different orientations.

4SS5.4 Identify corresponding vertices and sides of two given congruent shapes.

Suggestions for Teaching and Learning

Prior to work on symmetry in this unit, teachers should introduce congruency. Knowledge of congruency supports the understanding of symmetry. Congruency is not directly addressed in the authorized resource although it is embedded in the lessons. Given the time frame suggested for this unit, teachers may consider integrating it with the art curriculum.

Two 2-D shapes are **congruent** if they are identical in shape and size – that is, if one is an exact duplicate of the other and can be transformed into the other through a series of reflections, translations and/or rotations. Students sometimes do not understand the difference between the math term 'congruent' and the everyday term 'the same'. It is important to recognize that congruence applies only to size and shape. Thus, figures can be different colours, or oriented in different ways, and they will still be congruent as long as they are the same shape and the same size (Small, 2008). Students sometimes have difficulty recognizing that two shapes are congruent if their orientation is different.

Students should be exposed to the word 'congruent'. They could describe the concept of congruency, however, without always using the explicit term 'congruent'. They may use language such as 'equal parts' or 'same size and shape'.

An appropriate introductory task for congruency would be to ask students to create a square using geoboards or multilink cubes. Tell students that some of these squares are congruent and some are not. Give clues such as *Greg's square is not congruent to Susan's square but it is congruent to Jane's*. Continue giving clues until students discover what congruence means.

Include many hands-on activities to establish the concept of congruence prior to introducing symmetry. Working with a partner, ask one student to create a design using pattern blocks or tiles. The partner then creates a congruent design. Congruent designs may not necessarily use the same pattern blocks. Ask students how they know their two designs are congruent. Possible explanations might include tracing on paper or taping designs together to superimpose them.

Teachers could provide two congruent shapes. Ask students to choose four crayons and to colour the corresponding sides the same colour. Repeat using various shapes or asking students to colour corresponding vertices. A variety of materials, such as tangrams, pattern blocks, attribute blocks, or paper shapes could be used for this activity.

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

Suggested Assessment Strategies

Performance

- Ask students to create a four-compartment foldable to compare congruency of shapes such as the following:

Students cut out the shapes and glue them into the foldable. The final summary is completed in the last compartment.

Congruent with	Congruent with	Congruent with	Summary

(4SS5.1, 4SS5.3)

- The teacher creates a shape on a transparent geoboard and challenges students to create a congruent shape of a different orientation on their geoboards. Students should then test for congruency. To do this, they could place one geoboard on the other.

(4SS5.1, 4SS5.2)

- Ask students to label corresponding vertices and sides of congruent pairs of 2-D shapes. Instead of colour-coding, students may wish to use markings on the sides as shown below.
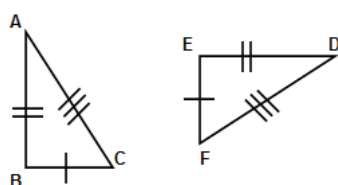
Ask them to justify that they have correctly identified the corresponding sides and vertices by tracing one shape complete with the markings and superimposing it on the congruent shape.

(4SS5.1, 4SS5.3, 4SS5.4)

Resources/Notes

Authorized Resource

Math Focus 4

Note

Outcome 4SS5 is not directly addressed in the student text.

Supplementary Resource

Making Math Meaningful to Canadian Students, K-8 – Marian Small

- Support for SCO 4SS5 can be found on pp. 315-319

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit5.html

- Enrichment activities

Strand: Shape and Space (Transformations)

Specific Outcomes

Students will be expected to:

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]

Achievement Indicators:

4SS6.1 Identify lines of symmetry of a given set of 2-D shapes, and explain why each shape is symmetrical.

4SS6.2 Determine whether or not a given 2-D shape is symmetrical by using an image reflector or by folding and superimposing.

Suggestions for Teaching and Learning

Students should become familiar with the terms symmetry, and lines of symmetry. A 2-D figure has line symmetry when it can be divided or folded so that the two parts match exactly. A fold line is referred to as a line of symmetry. Any given line of symmetry divides a figure into equal halves. It may also be said that each of the halves are mirror images of each other. Some texts may refer to line symmetry as reflective symmetry or mirror symmetry.

Symmetrical tile model

Symmetrical shape on a geoboard
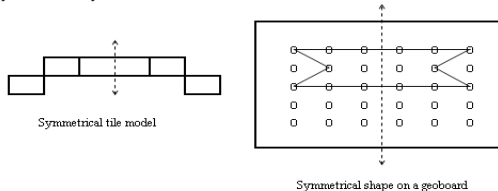
(Small, 2008)

Congruency and symmetry can be used to determine what makes some shapes alike and different. Any symmetrical shape can be divided into two congruent parts along the **line of symmetry**.
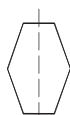
This hexagon is symmetrical. The line of symmetry shown in the diagram divides the hexagon into two congruent pentagons.

Ask students to identify different lines of symmetry in the hexagon.

Students should also explore symmetry in composite shapes. They were introduced to composite 2-D shapes and 3-D objects in Grade 1. Not every composite shape made up of two congruent figures is symmetrical.

This composite shape is made up of two congruent pentagons. It is not symmetrical.

This composite shape is made up of two congruent pentagons. It is symmetrical.

Distribute modelling clay, a variety of large cookie cutters (both symmetrical and not symmetrical), plastic knives and dowels. Ask students to roll modelling clay, press out a shape and explore to see if it is symmetrical. The shape will be symmetrical if the folded parts are congruent.

Transparent mirrors (Mira™) are helpful to students when investigating symmetry. They are useful because they are both transparent and reflective. If a shape is symmetrical along the line where the transparent mirror has been placed, the image on one side of the shape will fall directly on top of the other side of the shape.

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

Suggested Assessment Strategies

Performance

- Ask students to find and group examples of triangles with symmetry and triangles without symmetry. Various organizers, such as a T-chart, a Venn diagram, or a Yes/No chart might be used to record student findings.

    (4SS6.1, 4SS6.2)

- Ask students to draw on squared dot paper different examples of quadrilaterals. They should cut them out and fold them to find the lines of symmetry.

    (4SS6.1, 4SS6.2)

- Display a blank Frayer Model in the classroom. Encourage students to suggest additions to the chart as they discover new information about symmetry.

Definition	Characteristics
Examples	Non-examples

    (4SS6)

- Ask students to create a class "Symme – Tree" (any tree on which shapes can be hung or displayed). The teacher distributes several cut outs, some of which are symmetrical and some of which are not. Ask each student to test shapes for symmetry by folding or using a transparent mirror. Students then place the symmetrical shapes on the class "Symme-tree".

    (4SS6.1, 4SS6.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Lines of Symmetry
4SS6 (6.1, 6.2)
TR: pp. 11-14
SB: pp. 144-146

Note

Lesson 3 is about symmetry in the environment and may be combined with Lesson 1 during the introduction to symmetry.

Supplementary Resource

Making Math Meaningful to Canadian Students, K-8 – Marian Small

- Support for SCO 4SS6 can be found on pp. 298-300

Strand: Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4SS6 Continued ...

Achievement Indicators:

4SS6.3 Complete a symmetrical 2-D shape, given half the shape and its line of symmetry.

4SS6.4 Sort a given set of 2-D shapes as symmetrical and non-symmetrical.

4SS6.5 Provide examples of symmetrical shapes found in the environment, and identify the line(s) of symmetry.

Suggestions for Teaching and Learning

Students should also create their own symmetrical 2-D drawings. Display a simple shape and tell students that this represents half of a symmetrical picture. Ask for suggestions on what the whole shape would look like. The transparent mirror could be used as a tool to complete the symmetrical shape. Give students a transparent mirror and provide them with drawings of half shapes which have a dotted line representing the line of symmetry. They should place the transparent mirror on the dotted line and trace the reflection to complete a symmetrical design. Ask students if there is more than one possibility depending on where the transparent mirror is positioned.

An effective way for students to explore symmetry is through center work. Provide small groups of students with Power Polygons™ or other manipulatives labelled with a letter, as well as transparent mirrors, paper and scissors. Ask students how they could use folding as a strategy when they are trying to determine if hard plastic objects are symmetrical. They should quickly conclude that they could trace and cut the shape from paper so that it is foldable. Using a graphic organizer, ask students to record whether each given shape is symmetrical or not.

Shape	Symmetrical	Strategy (transparent mirror? folding?)
Square (A)	Yes	Folding

Ask various students to choose one shape to present to the class and explain how they know whether or not this shape is symmetrical.

There should be a focus on students observing symmetry in their environment. This may require that students look at the 2-D faces of 3-D objects. Many objects cannot be tested for symmetry by folding or using a transparent mirror. Brainstorm with students other ways that symmetry can be determined. They may suggest visualizing the matching half, taking a photo, or measuring.

Ask students to consider:
* where they can find examples of symmetry in texts or in visual media
* why different shapes have a different number of lines of symmetry
* why some shapes have no line of symmetry
* why a line of symmetry does not divide a 2-D shape into thirds

Opportunities may arise in other subject areas to discuss symmetry. Asymmetrical and symmetrical balance is a powerful concept in visual arts. Scientific observations will also reveal many examples of symmetry.

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

Suggested Assessment Strategies

Performance

- Ask students to use transparent mirrors and look for a simple symmetrical shape which may be found as part of a picture in old magazines or on greeting cards. Students may wish to use their own school photograph. They fold and cut the picture along the line of symmetry. Ask them to glue half of the picture to a piece of paper and draw the missing half. They should display and discuss.

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

- Provide a variety of shapes and ask students to sort them, grouping those with symmetry and those without symmetry. An assortment of shapes for sorting may resemble this set (Van de Walle, John & Lovin LouAnn. *Teaching Student Centered Mathematics (3-5)* (2006), pp. 212 - 213).

  (4SS6.4, 4SS6.5, 4SS6.8)

- Ask students to create a collage using pictures from a print source, digital photos or pictures they draw which show symmetry in their environment.

  (4SS6.5)

Interview

- Ask students to identify and record an object in their environment whose symmetry cannot be determined using folding or a transparent mirror. Students should explain how they know the object is symmetrical.

  (4SS6.5)

Presentation

- Ask students to locate a pine cone, leaf or flower that is symmetrical. They should create a poster explaining the lines of symmetry and where it is located in nature. Ask students to present their findings to the class.

  (4SS6.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 2:
Using a Symmetry Tool
4SS6 (6.1, 6.2, 6.3)
TR: pp. 15-18
SB: pp. 147-150

Supplementary Resource

Teaching Student Centered Mathematics (3-5) – John Van de Walle and LouAnn Lovin

- Support for SCO 4SS6 can be found on pp. 211 - 213

Lesson 3:
Identifying Symmetrical Shapes
4SS6 (6.4, 6.5)
TR: pp. 19-21
SB: p. 151

Note

Lesson 3 may be combined with Lesson 1.

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit5.html

- Interactive White Board activity on symmetry

Strand: Shape and Space (Transformations)

Specific Outcomes

Students will be expected to:

4SS6 Continued ...

Achievement Indicator:

4SS6.6 Sort a given set of 2-D shapes as those that have no lines of symmetry, one line of symmetry or more than one line of symmetry.

Suggestions for Teaching and Learning

Figures may have multiple lines of symmetry which can be vertical, horizontal, or diagonal.
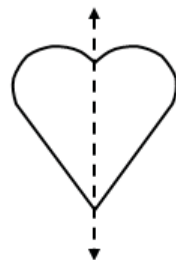
1 line of symmetry
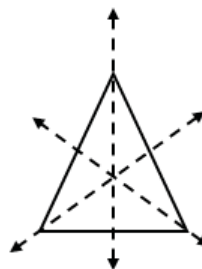
3 lines of symmetry
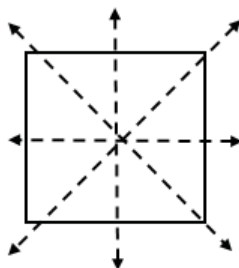
4 lines of symmetry
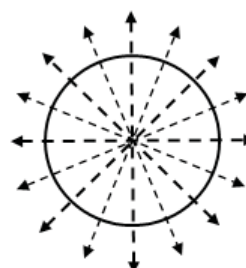
infinite number of lines of symmetry

Teacher Note: A circle has an infinite number of lines of symmetry. The more sides that a regular polygon has, the greater the number of lines of symmetry there are, as the polygon begins to more closely resemble a circle. Students are only expected to identify that a circle has more than one line of symmetry.

Students should be given opportunities to predict and then investigate the number of lines of symmetry of a given figure. Provide examples of 2-D shapes with one line of symmetry, two lines of symmetry and no lines of symmetry. Ask students to draw the lines of symmetry and sort the shapes. Folding cut outs of paper polygons, using transparent mirrors and geoboards, or creating tile models are all possible ways to explore symmetry. Students could be asked to present their findings to the class. This provides an opportunity for teachers to identify any misconceptions that students may have.

Students can use lines of symmetry to define fractions of a 2-D shape, such as halves and fourths. Students may also recognize that there are other fractions of an area that do not identify lines of symmetry (e.g., thirds).

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

Suggested Assessment Strategies

Performance

- Ask students if all triangles have the same number of lines of symmetry. Students should record their answers for reference later. Teachers then provide sets of triangle cut outs for each pair of students (ensure that each set includes examples of equilateral, scalene and isosceles triangles, although students need not know those terms). Allow ample opportunity for students to prove or disprove their predictions by folding, cutting and superimposing.

(4SS6.6)

- Provide students with labelled 2-D shapes similar to these:
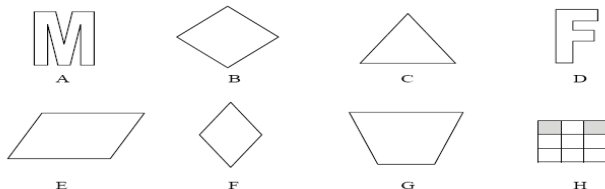
Ask students to indicate which shapes in the set are symmetrical. Instruct them to draw all the lines of symmetry on each symmetrical shape. Students then sort the shapes by the number of lines of symmetry (no lines of symmetry, one line of symmetry, or more than one line of symmetry). They should record answers in a table, as shown below. Invite students to share their ideas about sorting this set of shapes. Students can then be asked to create shapes that have no line, one line and more than one line of symmetry and sort them according to the criteria.

Lines of Symmetry	Letter Names for the Shapes
No lines of symmetry	
One line of symmetry	
More than 1 line of symmetry	

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

Journal

- Ask students to respond to a prompt such as:
  (i) Think about how your life would be different if your face was not symmetrical!
  (ii) How would the playground be different if nothing was symmetrical?

(4SS6.5, 4SS6.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 4:
Counting Lines of Symmetry
4SS6 (6.6)
TR: pp. 25-28
SB: pp. 154-156

Strand: Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 4SS6 Continued ... **Achievement Indicators:** *4SS6.7 Identify the characteristics of given symmetrical and non-symmetrical 2-D shapes and explain the process.*	As students continue to work with symmetrical and non-symmetrical shapes, they should explain how they are determining symmetry. Remind them that symmetrical shapes must have two congruent parts separated by a line of symmetry. It is important for students to be able to access accurate vocabulary as they think mathematically and express their thinking in a coherent way to both their peers and teachers. The teacher is better able to determine understanding if the student is able to communicate effectively orally, in writing, pictorially or through the use of models. Teacher modelling of appropriate mathematical language and explicit instruction about vocabulary will facilitate students' ability to communicate their thinking. Consider creating a word wall where words are posted as a reference. The words associated with communicating symmetry might be grouped together and referred to frequently. These words may also be posted in a personal dictionary or glossary. Activities related to the word wall provide the necessary practice to develop fluency.
4SS6.8 Create a symmetrical shape with and without manipulatives.	Using manipulatives helps students move toward visualizing symmetry. Manipulatives encourage this natural learning process by adding a concrete element to ordinarily abstract concepts. Continued use of manipulatives will eventually enable students to visualize symmetrical objects and shapes, without the use of manipulatives. Symmetry lends itself easily to connections with the art curriculum. Build on students' knowledge of symmetry by using paper folding activities which may be incorporated throughout the year. Ask students to fold a piece of plain paper, draw half of a design along the fold line and cut it out. Students unfold the paper to reveal a shape that is symmetrical because the two halves are mirror images of each other. Students can share their symmetrical 2-D shapes and their designs could be displayed on a bulletin board. Students may create symmetrical designs using a vertical, horizontal or diagonal line of symmetry. The vertical line of symmetry is easiest for students to use in creating symmetrical designs.
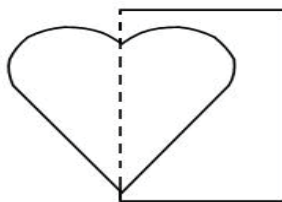
General Outcome: Describe and analyze position and motion of objects and shapes.

Suggested Assessment Strategies

Journal

- Give students a sentence prompt to communicate what they know about symmetry:
  (i)   I know that symmetrical shapes are _____ . . .
  (ii) To check if a shape is symmetrical or not, I could _____ . . .
  (iii) A _____ is symmetrical because _____ . . .

  (4SS6.7)

Performance

- Use a blank Frayer Model to assess student understanding of symmetry. Possible student answers may include those shown below:

(4SS6.1, 4SS6.4, 4SS6.6, 4SS6.7)

- Students work in pairs. Provide them with pattern blocks and isometric dot paper. One student in each pair creates a design using two pattern blocks. The other student then copies the design (reflects the design) to make a composite symmetrical 2-D design. For example:
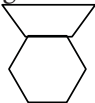
Original Design   Composite Symmetric Shape
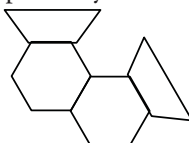
(4SS6.1, 4SS6.3, 4SS6.8)

Paper and Pencil

- Students work in pairs. Using grid paper, each student shades a small design of their own choice in the centre of the page. Students then trade papers and partners use the original figure to create a new symmetrical design. The line of symmetry can be the top or bottom, diagonal, or left or right side.

  (4SS6.3, 4SS6.8)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Communicating about Symmetry
4SS6 (6.7)
TR: pp. 31-34
SB: pp. 158-160

Lesson 6:
Creating Symmetry
4SS6 (6.8)
TR: pp. 35-37
SB: p. 161

Math Game:
Tangram Shapes (optional)
4SS6
TR: pp. 29-30
SB: p. 157

Curious Math:
Folding Paper Shapes
4SS6
TR: p. 38
SB: p. 162

MULTIPLICATION AND DIVISION FACTS

Suggested Time: 3 $\frac{1}{2}$ Weeks

September	October	November	December	January	February	March	April	May	June

Estimated Completion
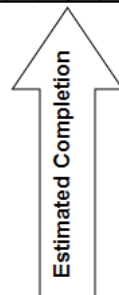
Unit Overview

Focus and Context

In Grade 3, students were introduced to the meaning of multiplication and division with products to 5 × 5. By the end of Grade 4, students will learn to describe and apply efficient mental strategies for multiplication facts to 9 × 9. The meaning of multiplication and division and the connection between the operations is crucial as students develop understanding of the facts. Allow time for both strategy development and practice to ensure that students can demonstrate they know the strategies.

Outcomes Framework

GCO
Use patterns to describe the world and solve problems.

SCO 4PPR1
Identify and describe patterns found in tables and charts, including a multiplication chart.

GCO
Represent algebraic expressions in multiple ways.

SCO 4PPR6
Solve one-step equations involving a symbol to represent an unknown number.

GCO
Develop number sense.

SCO 4N4
Explain and apply the properties of 0 and 1 for multiplication and the property of 1 for division.

SCO 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.

SCO Continuum

Grade 3	Grade 4	Grade 5
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] 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]	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]	5N3 Apply mental mathematics strategies and number properties, such as: • skip counting from a known fact • using doubling or halving • using patterns in the 9s facts • using repeated doubling or halving to determine, with fluency, answers for basic multiplication facts to 81 and related division facts. [C, CN, ME, R, V] 5N4 Apply mental mathematics strategies for multiplication, such as: • annexing then adding zero • halving and doubling • using the distributive property. [C, ME, R] 5N5 Demonstrate, with and without concrete materials, an understanding of multiplication (2 digit by 2-digit) to solve problems. [C, CN, PS, V] 5N6 Demonstrate, with and without concrete materials, an understanding of division (3-digit by 1-digit), and interpret remainders to solve problems. [C, CN, ME, PS, R, V]
Strand: Patterns and Relations (Patterns)		
3PR1 Demonstrate an understanding of increasing patterns by: • describing • extending • comparing • creating numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions. [C, CN, PS, R, V]	4PR1 Identify and describe patterns found in tables and charts, including a multiplication chart. [C, CN, PS, V]	5PR1 Determine the pattern rule to make predictions about subsequent elements. [C, CN, PS, R, V]
Strand: Patterns and Relations (Variables and Equations)		
3PR3 Solve one-step addition and subtraction equations involving a symbol to represent an unknown number. [C, CN, PS, R, V]	4PR6 Solve one-step equations involving a symbol to represent an unknown number. [C, CN, PS, R, V]	5PR2 Solve problems involving single variable, one-step equations with whole number coefficients and whole number solutions. [C, CN, PS, R]

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N4 Explain and apply the properties of 0 and 1 for multiplication and the property of 1 for division.
[C, CN, R]

Achievement Indicators:

4N4.1 Determine the answer to a given question involving the multiplication of a number by 1, and explain the answer.

4N4.2 Determine the answer to a given question involving the multiplication of a number by 0, and explain the answer.

Suggestions for Teaching and Learning

Discovery is the best way for students to understand the properties of 0 and 1 for multiplication. Discussion of their findings will suggest the properties for factors of 0 and 1. Students will learn about the property of one for division later in this unit.

To show the **Property of One** teachers should use number lines (0 – 10) and concrete materials, such as paper plates. For example,
- What would 7 hops of 1 (7 × 1) look like? (land on 7)
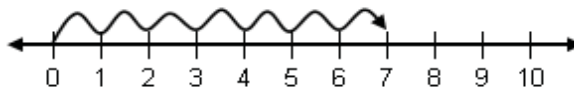
- What would 1 hop of 7 (1 × 7) look like? (land on 7)
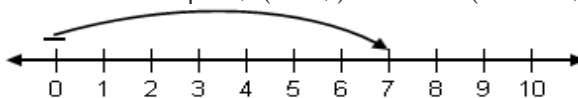
- Show seven plates with one counter on each plate. Ask students, "How any plates?" "How many counters on each plate?" "What are seven groups of one?" Record as a number sentence, 7 × 1 = 7.

Through these discussions, students should discover The Property of One - any number multiplied by 1 remains unchanged.

To show the **Property of Zero**, teachers should also use number lines (0 – 10) and concrete materials, such as paper plates. For example,
- What would 6 hops of 0 (6 × 0) look like? (land on 0 six times).
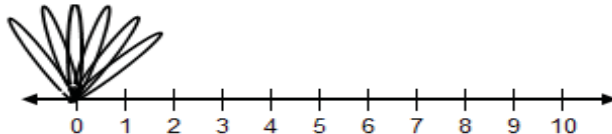
- What would 0 hops of 6 (0 × 6) look like? (stay on 0 – no hops)
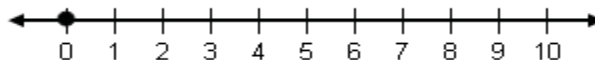
- Show six empty plates. Ask: "How many plates are there?" "How many items are there on each plate?" "Six groups of zero are how many?" Record as a number sentence 6 × 0 = 0.

Through these discussions, students should discover The Property of Zero - any number multiplied by 0 is zero (since many zeros still equal 0).

Calculators could also be used in the exploration of products involving factors of 0 and 1. Instruct students to multiply various large numbers by 0 or by 1 until they identify a pattern (e.g., 654 × 0, 0 × 54, 3 418 × 1, 1 × 26, and 7 854 × 1, etc.).

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to explain what is special about:
    - multiplying by 1?
    - multiplying by 0?

(4N4.1, 4N4.2)

Performance

- Present students with number sentences, one of which matches a given contextual problem. Students select the number sentence that represents the problem and explain their choice.

  E.g., Grandma went Christmas shopping for her 6 grandchildren. She wanted to buy them all a (insert name of popular item)   only to find out that stores were completely sold out.

  Which number sentence represents Grandma's purchase?
  - $1 \times 6 = 6$
  - $6 \times 1 = 6$
  - $0 \times 6 = 0$
  - $6 \times 0 = 0$ (correct answer)

  Discuss with students why the others are incorrect.

(4N4.2)

Resources/Notes

Authorized Resource

Lesson 1:
Multiplying By Skip Counting
4N4 (4.1, 4.2)
TR: pp. 12-15
SB: p. 173 - #8

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

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]

Achievement Indicator:

4N5.1 Provide examples for applying mental mathematics strategies:
- *skip counting from a known fact*
- *doubling*
- *repeated doubling*
- *halving*
- *doubling or halving and adding or subtracting one more group*
- *use ten facts when multiplying by 9*
- *relating division to multiplication.*

Suggestions for Teaching and Learning

By the end of Grade 4, students should:
- *understand and apply strategies for multiplication and related division facts to 9 × 9*
- *recall multiplication and related division facts to 7 × 7*

They have practiced multiplication facts to 5 × 5 and will now build on this knowledge.

The recommended approach for strategy practice and retrieval is to first introduce a strategy, with the use of concrete materials, practice the strategy, and then add/practice new strategies. When students have two or more strategies, it is important to focus on strategy selection. This involves choosing the strategy that will be most useful to determine a particular fact. Students should be exposed to a variety of strategies but mastery of each strategy should not be expected for all students.

One strategy that could be used to determine basic multiplication facts is **skip counting from a known fact**. To determine 3 × 6, for example, students could think: "Since I already know that 3 groups of 5 = 15, I can start at 15 and add one more group of 3." Some possible models for skip counting include hundreds charts, number lines, arrays or pictograph.

Skip counting is practical for some numbers but can be difficult for others. Skip counting by five, for example, may be easier for students than skip counting by eight.

Ask students to solve 9 × 8 = ___ by skip counting from a known fact (such as 2 × 8 = 16). The first student begins the count by saying the known fact (2 × 8 = 16). Another student will say the next fact (3 × 8 = 24). This continues until they reach the answer (9 × 8 = 72). Display a multiplication poster or hundred charts, as some learners may need a visual cue. Repeat for other facts.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Students could use a hundred chart to practice the strategy of skip counting from a known fact. Ask them to solve the equation $7 \times 7 = \underline{\ \ }$ and explain how they arrived at their answer. Students may say, "Since I already know that 5 groups of 7 are 35 (I circled the number 35), I started at 35 and then counted by 7 two more times. I said, "35, 42, 49". They should repeat to determine other multiplication facts.

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

(4N5.1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Multiplying by Skip Counting
4N4 (4.1, 4.2)
4N5 (5.1)
4PR6 (6.1, 6.4)
TR: pp. 12-15
SB: pp. 170-173

Lesson 2:
Building on Multiplication Facts
4N5
TR: pp. 16-18
SB: pp. 174-175

Note

Lessons 1 and 2 may be combined.

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit6.html

- Strategies for multiplication facts

Patterns and Relations (Variables and Equations)

Specific Outcomes

Students will be expected to:

4PR6 Solve one-step equations involving a symbol to represent an unknown number.
[C, CN, PS, R, V]

Achievement Indicators:

4PR6.3 (Continued) Solve a given equation when the unknown is on the left or right side of the equation.

4PR6.6 Represent and solve a given multiplication or division problem involving equal grouping or partitioning (equal sharing), using a symbol to represent the unknown.

Suggestions for Teaching and Learning

Students solved one-step equations involving addition or subtraction in the Patterns in Mathematics unit. They now solve equations involving multiplication.

Students should solve equations where the missing number is in different places. For example:

$$8 \times \square = 40 \qquad \square \times 7 = 28 \qquad 4 \times 9 = \square \qquad \square = 6 \times 8$$

The intent at this point is that they use the multiplication strategies to find the missing values.

Students should also write equations to represent multiplication problems that involve equal grouping. For example:

If 6 people have 3 marbles each, how many marbles are there in total?

Students could represent this with $6 \times 3 = \square$ or $\square = 6 \times 3$. As they solve the equation, encourage them to continue using appropriate strategies for multiplication. They could think "$3 \times 3 = 9$ and 9 doubled is 18". Once students have solved the problem, ask them if there are other equations they could have used to represent it. They might suggest $18 = \square \times 3$ or $6 \times \square = 18$.

General Outcome: Represent algebraic expressions in multiple ways.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to answer the following:

  (i) Sharon invited 24 friends to a movie birthday party. Her mom helped arrange rides for the children. Four passengers could fit in each car. How many cars are needed?

  (4PR6.3, 4PR6.6)

  (ii) Gregory has 35 hockey cards. He shares the cards equally among 7 friends. Each friend needs 6 hockey cards to complete their collection. Does Gregory have enough cards? Explain.

  (4PR6.3, 4PR6.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Multiplying by Skip Counting
4N4 (4.1, 4.2)
4N5 (5.1)
4PR6 (6.1, 6.4)
TR: pp. 12-15
SB: pp. 170-173

Lesson 2:
Building on Multiplication Facts
4N5
TR: pp. 16-18
SB: pp. 174-175

Number

Specific Outcomes

Students will be expected to:

4N5 Continued ...

Achievement Indicator:

4N5.1 (Continued) Provide examples for applying mental mathematics strategies:
- *skip counting from a known fact*
- *doubling*
- *repeated doubling*
- *halving*
- *doubling or halving and adding or subtracting one more group*
- *use ten facts when multiplying by 9*
- *relating division to multiplication.*

Suggestions for Teaching and Learning

In Grade 3, students used doubles to recall basic addition facts. The **doubling strategies** may be used to determine more difficult multiplication facts. Students should explore doubling patterns found on a multiplication chart to discover how the:
- $2\times$ facts can be used to calculate the $4\times$ facts
  E.g., for $4 \times 3 =$ __, think $2 \times 3 = 6$ so $4 \times 3 = 12$ (6 doubled)
- $4\times$ facts can be used to calculate the $8\times$ facts
  E.g., for $8 \times 6 =$ __, think $4 \times 6 = 24$, so $8 \times 6 = 48$ (24 doubled)
- $3\times$ facts can be used to calculate the $6\times$ facts
  E.g., for $6 \times 7 =$ __, think $3 \times 7 = 21$, so $6 \times 7 = 42$ (21 doubled)

Students may also use repeated doubling to multiply by 8. For example, to find $8 \times 6 = \square$, they could:

first think:	$2 \times 6 = 12$
use doubling:	$4 \times 6 = 24$
use doubling again:	$8 \times 6 = 48$

It is important that teachers encourage students to **try** each strategy when it is introduced. It is acceptable, however, for them to use another efficient strategy at other times.

Although the **halving strategy** is used more frequently with larger numbers, it is important that students understand it. If 4×6 is equal to 24, for example, then 2×6 is equal to 12. It will be used here in combination with doubling and adding or subtracting one more group. In Grade 5, students will use the multiplication strategy of doubling one factor and halving the other.

To represent halving / doubling and adding one more group, use manipulatives such as counters. Discuss with students how they can use arrays of smaller facts to determine an unknown product. To solve $7 \times 6 = \square$, for example, students could model:

$3 \times 6 = 18$ (halving)

```
******
******   3 x 6
******
```

double 18 to get 36

```
******
******   3 x 6
******
```

add one more group of 6 to get 42

```
******   1 x 6
```

Some students may also use halving / doubling and subtracting one more group. For example, "I can't recall 7×8, but I know that $4 \times 8 = 32$. To get 8×8, I can double 32 to get 64. To get 7×8, I can subtract one more group of 8 to get the product of 56".

General Outcome: Develop number sense.

| Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Present the following problem to the students:

  Keri puts 1 pencil in each of 3 boxes. Sue puts 2 pencils in each of 3 boxes. Betty puts 4 pencils in each of 3 boxes.
  Explain how to use the answer for the number of pencils Keri has to find:
  (i)   the number of pencils Sue has
  (ii) the number of pencils Betty has

  (4N5.1)

- Ask students to use coloured counters to show how $2 \times 3 = 6$ can help find the answer to 4×3.
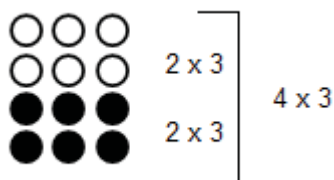
  (4N5.1)

- Ask students to model and solve given multiplication problems, such as the following, using arrays, counters, hundred grids, geoboards, etc.

  Tracy has 4 packages of pencils. There are 4 pencils in each pack. Ask students to model how many pencils Tracy has. Ask students how they could extend this model to determine how many pencils Roxanne has if she has 9 packages of pencils. One possible model could be:
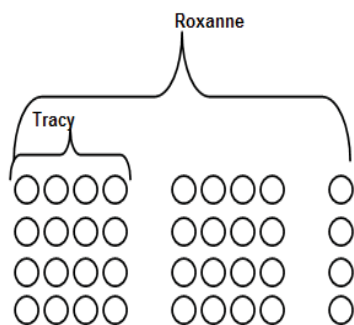
  (4N5.1)

Interview

- Ask the student to explain how knowing 4×5 helps one figure out 8×5. Repeat using other examples.

  (4N5.1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Doubling Multiplication Facts
4N5 (5.1)
4PR1 (1.1, 1.2, 1.4)
TR: pp. 19-22
SB: pp. 176-177

Lesson 4:
Halving and Doubling
Multiplication Facts
4N5 (5.1)
4PR6 (6.1, 6.6)
TR: pp. 23-26
SB: pp. 178-180

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N5 Continued ...

Achievement Indicator:

4N5.1 (Continued) Provide examples for applying mental mathematics strategies:
- *skip counting from a known fact*
- *doubling*
- *repeated doubling*
- *halving*
- *doubling or halving and adding or subtracting one more group*
- ***use ten facts when multiplying by 9***
- *relating division to multiplication.*

Suggestions for Teaching and Learning

In Grade 3, students used skip counting by 10 to say a number sequence forward and backward from 0 to 1 000. This can now be connected to multiplying by 10. Base 10 materials and ten frames are good models to use to focus on the meaning of multiplication. Teachers should refrain from telling students that a 0 is added when multiplying by 10, as this shows little connection to the meaning of multiplication.

After discussing the ten facts, ask students how they can use a ten fact to find the product of a nine fact. When multiplying a factor by 9, the product is always the factor times 10 minus the factor. For 9×7 (9 groups of 7), for example, think 10×7 is 70. Subtract one group of 7 and $9 \times 7 = 63$.

Students will benefit from seeing this modelled on ten frames. They are useful visual models for students when multiplying things that occur in sets close to ten (such as eight or nine). For example, 6×9 can be modelled:
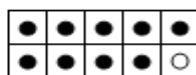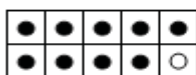
$6 \times 10 - 1$ group of 6
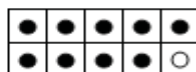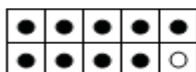
$60 - 1$ group of $6 = 54$
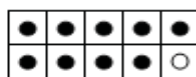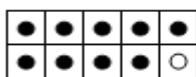
The following activity could also be used to help students discover patterns involving 9 as a factor. Display:

$$9 \times 1 = 9$$
$$9 \times 2 = 18$$
$$9 \times 3 = 27$$
$$9 \times 4 = 36$$
$$9 \times 5 = 45$$
$$9 \times 6 = 54$$
$$9 \times 7 = 63$$
$$9 \times 8 = 72$$
$$9 \times 9 = 81$$

Ask students to find as many patterns as possible in the list of facts. As you listen to responses be sure that these two patterns are found:
- The tens digit of the product is always one less than the second factor (e.g., $9 \times 4 = 36$: 3 is one less than 4)
- The sum of the two digits in the product is always 9

Students may use these two ideas to get any 9 fact quickly. For 7×9, for example, 1 less than 7 is 6, 6 and 3 make 9 so the product is 63.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Play SWAT with students. Write products of 6 and 7 on separate sheets of paper and display them. Divide the class into two teams. Each team may be given a fly swatter. One member from each team is given a multiplication fact. This may be played as a race in which the first team member to "swat" the correct answer gets a point or teams may alternate turns. Teachers may ask students to explain how they arrived at their answers.

(4N5.1)

- Play a 'Loop Game" to reinforce multiplication facts. Prepare a set of cards with various multiplication fact questions and products, such as those below. Distribute to each student at least one card containing a product and a fact. Decide who begins with the fact question (e.g., "Who has 5×9?"). The player who has the card with the correct product responds (e.g., "I have 45") and continues by asking the fact question on his/her card. The cycle continues until the loop has been completed.

1. I have 28, Who has 5 x 9?
2. I have 45, Who has 7 x 8?
3. I have 56, Who has 6 x 5?
4. I have 30, Who has 9 x 8?
5. I have 72, Who has 9 x 9?
6. I have 81, Who has 2 x 7?
7. I have 14, Who has 4 x 6?
8. I have 24, Who has 7 x 6?
9. I have 42, Who has 4 x 9?
10. I have 36, Who has 8 x 8?
11. I have 64, Who has 7 x 5?
12. I have 35, Who has 5 x 5?
13. I have 25, Who has 6 x 8?
14. I have 48, Who has 3 x 7?
15. I have 21, Who has 4 x 5?
16. I have 20, Who has 4 x 3?
17. I have 12, Who has 7 x 7?
18. I have 49, Who has 9 x 7?
19. I have 63, Who has 2 x 9?
20. I have 18, Who has 4 x 4?
21. I have 16, Who has 8 x 4?
22. I have 32, Who has 3 x 5?
23. I have 15, Who has 5 x 8?
24. I have 40, Who has 7 x 4?

Students could be asked to explain which strategy was used.

(4N5.1, 4N5.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5 (optional):
Using 10s to Multiply
4N5 (5.1)

Lesson 6:
Multiplying by 8 and 9
4N5 (5.1)
4PR1 (1.1, 1.2, 1.4)
TR: pp. 30-33
SB: pp. 182-184

Note

Math Focus 4 uses ten facts to multiply by 8. The achievement indicator focuses on using this strategy to multiply by 9.

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4N5 Continued ...** **Achievement Indicators:** *4N5.2 Demonstrate understanding and application of strategies for multiplication and related division facts to 9 × 9.* *4N5.3 Demonstrate recall of multiplication and related division facts to 7 × 7.*	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 reached mastery. After students have worked with a variety of strategies, they should be encouraged to reflect on them and decide which is most efficient in different situations. Being 'efficient' means they can give a quick response without resorting to non-efficient means. Remind students of the various strategies they have worked on. Discuss with them which of the strategies is more efficient for a specific multiplication fact. The use of a graphic organizer such as the one below might help students to organize their thoughts.

Skip Counting	Doubling	Repeated Doubling	Halve/Double and Add or Subtract One More Group	Use Ten Facts
by 2s	4 facts		7 facts	
by 3s	6 facts	8 facts		9 facts
by 5s	8 facts		9 facts	

Students may decide to put some of these multiplication facts under different strategies in their graphic organizers.

This practice in strategy selection should be ongoing so that students do not revert back to counting and ignore more efficient strategies they have learned. The development of multiplication and division fact proficiency in Grade 4 allows students to work more efficiently with equations involving larger multi-digit numbers. If they can recall the facts efficiently, they are more likely to be able to think logically about problem solving without losing their train of thought.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Performance

- Provide pairs of students with counters (a different colour for each player), two paper clips and a 4 by 6 grid showing the products of various multiplication facts (an example is shown below). Below the grid, list 7 factors which correspond with the products on the grid. Player A places a paper clip on one of the factor numbers and Player B then places a paper clip on another factor. Player A multiplies both factors and places his coloured counter over the product on the grid. The game continues as Player B moves one paper clip to another factor. Player B multiplies both factors, finds the product and covers it. The game continues in this manner. The winner is the first person to connect four of their counters in a row, horizontally, vertically or diagonally. As you observe the students playing, ask "What strategies did you use?"

9	15	16	20
21	24	25	27
28	30	32	35
36	40	42	45
48	49	54	56
63	64	72	81

3	4	5	6	7	8	9

(4N5.2)

- Teachers provide pairs of students with two number cubes with the numbers 4, 5, 6, 7, 8, and 9 on each cube, and one game board as shown. A game board contains a separate playing area for each player.

35	49	54	30	25		25	30	54	49	35
64	72	81	28	24		24	28	81	72	64
36	56	45	32	20		20	32	45	56	36
42	48	63	40	16		16	40	63	48	42

Player A rolls the number cubes, multiplies the numbers, and covers the product on the game board. Players alternate turns. When a player does not roll an uncovered product, that player loses a turn. When both players have rolled unsuccessfully, two times in a row, the round ends. The winner is the person who has covered the most numbers. Students play the game for several rounds.

(4N5.2, 4N5.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Multiplying by 8 and 9
4N5 (5.1)
4PR1 (1.1, 1.2, 1.4)
TR: pp. 30-33
SB: pp. 182-184

Curious Math (optional):
Finger Multiplication
4N5 (5.1)
TR: pp. 34-35
SB: p. 185

Strand: Number

Specific Outcomes

Students will be expected to:

4N4, 4N5 Continued ...

Suggestions for Teaching and Learning

In Grade 3, students represented and explained division using equal sharing and equal grouping. They worked with division facts related to multiplication up to 5×5. This will now be extended to division facts related to 9×9 multiplication, while maintaining focus on the understanding and recall of division related to multiplication facts to 7×7 (e.g., $49 \div 7 = 7$). In this unit, students work with division problems without remainders. They will be introduced to division with remainders in the Dividing Multi-Digit Numbers unit.

A book about sharing, such as *The Doorbell Rang* by Pat Hutchins, could be used to activate students' prior knowledge about division. Mom makes cookies for her children and they must share with each other. Each ring of the doorbell brings more friends to share the cookies. Students identify with experiences such as the one this book talks about. They should have many opportunities to solve and create word problems for the purpose of answering contextual questions of personal interest. These opportunities provide students with a chance to practice their computational skills and clarify their mathematical thinking.

Teachers should emphasize the terms divisor, dividend and quotient and model this language during discussions about division. This is a good time to expose students to another symbol for division, $\overline{)}$.

Achievement Indicator:

> *4N4.3 Determine the answer to a given question involving the division of a number by 1, and explain the answer.*

At the beginning of this unit, the properties of 0 and 1 for multiplication were explored. Students will now explore the **Property of One** for division. Using the equal sharing meaning of division, ask students to model dividing 5 into 1 group:

They should conclude that there will be 5 in the group ($5 \div 1 = 5$).

Using equal grouping, ask them to model dividing 5 into groups of 1:



Students should see that this would result in 5 groups.

This should lead them to conclude that when you divide a number by 1 the answer is the number you started with.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Ask students to use a model to explain to a classmate how to share 45 marbles equally among five people. Discuss the different strategies used.

    (4N5.1, 4PR6.6)

- Students could complete a fact family puzzle. Create 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.

7×6 6×7
$42 \div 7$ $42 \div 6$
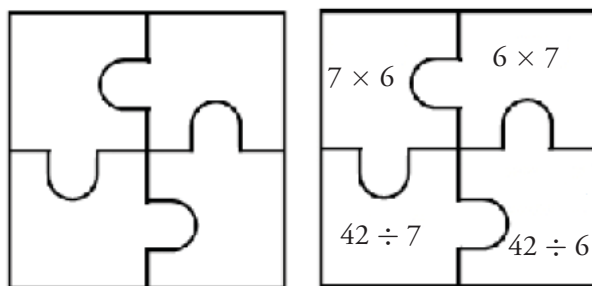
    (4N5.1, 4N5.2)

- As you read *The Doorbell Rang* with students, stop each time a fair share is made in the story and ask students to fairly share food (e.g., cookies, cereal pieces, M&Ms®). To start, have them share 12 cookies between two students. When the doorbell rings, add two students to the group and ask students to rearrange the food for fair shares. You could also ask them to continue to fair share if more children were to show up with only 12 cookies on the table. Students could also count the additional cookies on Grandma's tray and make a new set of fair shares with the larger number.

    (4N5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 7:
Sharing and Grouping
4N7 (7.1, 7.2, 7.3)
TR: pp. 40-43
SB: pp. 188-190

Note

Although *Math Focus 4* does not address the connection between multiplication and division until Lesson 8, teachers may deem it appropriate to make the link in Lesson 7.

Be selective with activities on page 190. Questions 1, 2, 3 and 7 are suggested.

Math Game (Optional):
Comparing Products
4N5(5.1)
TR: pp. 44-45
SB: pp. 191

Lesson 8:
Division and Multiplication
4N4 (4.3)
4N5 (5.1)
4N7 (7.1, 7.2, 7.3)
4PR6 (6.1, 6.2, 6.6)
TR: pp. 46-49
SB: pp. 192-195

Suggested Resource

The Doorbell Rang – Pat Hutchins

Number

Specific Outcomes

Students will be expected to:

4N5, 4PR6 Continued ...

Achievement Indicators:

4N5.1 (Continued) Provide examples for applying mental mathematics strategies:
- *skip counting from a known fact*
- *doubling*
- *repeated doubling*
- *halving*
- *doubling or halving and adding or subtracting one more group*
- *use ten facts when multiplying by 9*
- ***relating division to multiplication***.

4N5.2 (Continued) Demonstrate understanding and application of strategies for multiplication and related division facts to 9 × 9.

4N5.3 (Continued) Demonstrate recall of multiplication and related division facts to 7 × 7.

4PR6.1 Solve a given one-step equation using manipulatives.

4PR6.3 (Continued) Solve a given equation when the unknown is on the left or right side of the equation.

4PR6.6 (Continued) Represent and solve a given multiplication or division problem involving equal grouping or partitioning (equal sharing), using a symbol to represent the unknown.

Suggestions for Teaching and Learning

A strategy for determining a division fact is to think about its **related multiplication fact** (e.g., for $64 \div 8 = \square$, think $8 \times \square = 64$).

Teachers should give students the opportunity to explore and develop an understanding of the relationship between multiplication and division. It is a good idea to discuss 'fact families' with students at this point.

Model an array such as the following, with stars in the array representing chairs that you are setting up in the gym:
Ask students:
- How many rows of chairs are there? (5)
- How many chairs are in each row? (8)
- Write a multiplication equation to show the number of chairs. ($5 \times 8 = 40$)

To relate division to multiplication, ask students:
- How many chairs are there altogether? (40)
- How many chairs are in each row? (8)
- Write a division equation to show how many rows there are. ($40 \div 8 = 5$)

This activity can be repeated with the number of columns of chairs, resulting in $8 \times 5 = 40$ and the related division equation $40 \div 5 = 8$.

The relationship between the four facts should now be discussed:

$8 \times 5 = 40$ $5 \times 8 = 40$ $40 \div 5 = 8$ $40 \div 8 = 5$

Students should represent and solve problems such as:

Mr. Lee wants his Grade 4 class to work in groups of 4 to conduct a science experiment. If there are 24 students in the class, how many groups will there be?

Ask them how this situation could be represented with a division equation, using a symbol to represent the unknown ($24 \div 4 = \square$ or $\square = 24 \div 4$). They could then model the problem using counters. They should conclude that there will be 6 groups. Students could also relate division to multiplication to solve the equation, thinking about the number that multiplies by 4 to result in a product of 24.

It is also important that students solve problems in which the unknown is sometimes the dividend, divisor or the quotient, as in the following examples:

$28 \div 7 = \square$
$28 \div \square = 4$
$\square = 28 \div 4$
$\square \div 7 = 4$

$5\overline{)\square}$ $\square\overline{)20}$ $5\overline{)20}$

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Provide pairs of students with decks of cards, with each card containing a number from 0 - 9. Player A draws two cards, secretly multiplies the two numbers, and tells Player B the product only. Player A hides one card in each hand and asks Player B to choose a hand. Player B is then told that number. Player B now knows only the product and one factor and then figures out the hidden number. If Player B is correct, he/she takes the pair of cards and gives a related division equation. If incorrect, Player A keeps the pair of cards. The person with the most cards at the end of the game wins.

  (4N5.1, 4N5.2, 4N5.3)

- Divide students into groups and distribute 24 pictures of people on paper squares. Ask students to divide their pictures so that there are 8 people on a team. They should record the division equation, and discuss the meaning of each number in the equation. Repeat the activity with 6 on a team and 4 on a team.

  (4N5.1, 4N5.2)

- Provide students with a set of 18 counters or multi-link cubes. Ask them to make an array and record the multiplication and related division equations (e.g., $3 \times 6 = 18$, $6 \times 3 = 18$, $6 = 18 \div 3$, $18 \div 6 = 3$). Some students may be able to rearrange the array to show a different equation. Continue until all possibilities have been discovered.

  (4N5.1, 4N5.2)

- Prepare a deck of cards and a game card containing various division equations. Partners use the same game board but different coloured counters. Player A (red) picks a card from the pile and places it in an appropriate spot to make the equation true. If Player A is correct, he/she places a red counter on the square containing the equation. Player B continues in the same manner. The object of the game is to get three counters in a row (vertically, horizontally or diagonally).

$20 \div 5 = \square$	$12 \div \square = 4$	$5\overline{)10}^{\,\square}$	$\square \div 5 = 3$
$\square\overline{)81}^{\,9}$	$\square \div 2 = 2$	$42 \div \square = 6$	$9\overline{)54}^{\,\square}$
$18 \div 1 = \square$	$72 \div \square = 8$	$\square \div 1 = 8$	$49 \div 7 = \square$
$6\overline{)\square}^{\,6}$	$9\overline{)45}^{\,\square}$	$\square \div 7 = 3$	$9\overline{)\square}^{\,3}$

Deck of Cards:

| 2 | 3 | 4 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 9 | 15 | 18 | 21 | 27 | 36 |

(4PR6.1, 4PR6.3)

Interview

- Ask students to explain how to find the answer for $30 \div 5 = \square$ by relating it to multiplication. (4N5.1, 4N5.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 8:
Division and Multiplication
4N4 (4.3)
4N5 (5.1)
4N7 (7.1, 7.2, 7.3)
4PR6 (6.1, 6.2, 6.6)
TR: pp. 46-49
SB: pp. 192-195

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

4PR1 Identify and describe patterns found in tables and charts, including a multiplication chart.
[C, CN, PS, V]

Achievement Indicators:

4PR1.1 Describe the pattern found in a given table or chart.

4PR1.2 Determine the missing element(s) in a given table or chart.

4PR1.3 Identify the error(s) in a given table or chart.

4PR1.4 Identify and describe a variety of patterns in a multiplication chart.

Suggestions for Teaching and Learning

There are many patterns that occur in a multiplication chart. Students' knowledge of these patterns can help them understand the multiplication facts. It is important that they make connections between these patterns and determining unknown products in a multiplication equation. The chart can also be used to reinforce the relationship between multiplication and division.

Teachers should provide students with opportunities to find missing elements or errors in a chart.

Ask students how many toes 8 people would have, if the pattern shown continues. How many toes would 16 people have? Students should describe the pattern and explain how they arrived at their answers.

	People	Toes
1 x 10	1	10
2 x 10	2	20
4 x 10	4	40
	?	?

A multiplication table can be used to help students see the relationship between multiplication and division. Students have had previous experience finding patterns in a multiplication table. Seeing these patterns helps them become more proficient recalling the facts. Present a multiplication table with missing elements that students can complete together (or provide a completed multiplication table).

X	0	1	2	3	4	5	6	7	8	9
3	0	3	6	9	?	12	18	21	24	27
6			12						48	

Review patterns that students can identify in the table. Teachers can help students see that division is an inverse operation of multiplication and, therefore, they can use the table to help them find answers to division equations. For example, ask students:

- How does this chart help you to calculate 27 ÷ 3?

A student may say, "I looked in the row until I got to 27. Then I looked up the column and found that the quotient is 9."

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to determine missing elements in this multiplication chart.

X	3	4	5	6	7	8	9
4	12	16		24		32	
8		32				64	

(4PR1.2, 4PR1.4)

- The Grade 2 class planted trays of seeds. The table below shows the number of seeds in each tray. Ask students to determine how many seeds would be planted in 6 trays. How many seeds would be planted in 8 trays?

Trays	Number of Seeds
1	6
2	12
3	18
?	?

(4PR1.1)

Interview

- Present a multiplication table with missing elements as shown below. Ask the student to use what they know about patterns in the table to complete the missing elements. Next, present various division equations (e.g., $45 \div 5 = \square$) and ask the student to find the unknown. Vary the unknowns to be divisors, dividends or quotients. Ask the student to explain how he/she used the table to help find the answer.

X	1	2	3	4	5	6	7	8	9
1	1	2	3		5		7	8	
2		4		8		12	14		18
3	3		9	12	15	18		24	27
4	4	8	12			24	28		
5		10	15	20	25		35	40	45
6	6		18		30	36		48	
7		14	21	28	35		49	56	63
8		16		32		48		64	
9	9	18			45		63	72	81

(4PR1.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 9:
Patterns in a Multiplication Table
4N4 (4.1, 4.2, 4.3)
4N5 (5.1)
4PR1 (1.2, 1.4)
TR: pp. 50-52
SB: pp. 196

Math Game:
Matching Pairs
4N5 (5.1)
4PR6 (6.1)
TR: pp. 53-54
SB: pp. 197

Patterns and Relations (Variables and Equations)

Specific Outcomes

Students will be expected to:

4PR6 Solve one-step equations involving a symbol to represent an unknown number.
[C, CN, PS, R, V]

Achievement Indicator:

4PR6.6 (Continued) Represent and solve a given multiplication or division problem involving equal grouping or partitioning (equal sharing), using a symbol to represent the unknown.

Suggestions for Teaching and Learning

Educators have identified several problem solving strategies that prove to be useful in a variety of situations. Each strategy can be discussed with students, preferably after it has arisen naturally and the student has used it. There is some value in naming the strategies so students can easily recall and use them. Throughout the grade levels students have encountered strategies such as:

- Act it out
- Use a model
- Draw a picture
- Guess and Test
- Look for a pattern
- Use an open sentence
- Make chart/table or graph
- Solve a simpler problem
- Make an organized list
- Use logical reasoning

Students should now be introduced to the strategy called working backwards. Sometimes, by starting with the result, students can work backwards to determine information about the original situation. Working Backwards is a more complex problem solving strategy and is covered in this unit but applies to other strands as well. You may need to start with smaller numbers.

Begin with problems that only require the use of multiplication or division. For example:

Ms. Smith's class is going to the school library. She assigns the students into 2 areas: the silent reading area and the computer area. Then she assigns the students in each area into 3 groups of 4 students. How many students are in Ms. Smith's class?

Discuss with students the important information in the problem:
- Number of students in class ÷ 2 = number of students in each area
- Number of students in each area ÷ 3 = 4 students in each group

Students can start with the end result of 4 students in each group and work backwards. This is a good opportunity to reinforce the relationship between multiplication and division.

$4 \times 3 = 12$, or the number of students in each area
$12 \times 2 = 24$, or the number of students in both areas combined.

There are 24 students in Ms. Smith's class.

Students could then use this strategy to solve problems involving addition or subtraction as well.

General Outcome: Represent algebraic expressions in multiple ways.

Suggested Assessment Strategies

Paper and Pencil

- Ask students to solve the following problems:
    (i) There are 6 boxes of chocolate candies. Each box has 2 layers, with 5 candies in each layer. How many candies are there in total?

    (ii) I doubled a number, added 10, divided by 3, and then subtracted 2. The result is 18. What number did I start with?

    (4PR6.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 10:
Solving Problems by Working Backwards
4N5 (5.1)
4N7 (7.1, 7.2, 7.3)
4PR6 (6.4, 6.6)
TR: pp. 55-58
SB: pp. 198-199

Note

Math Focus 4 uses a diagram to represent each step in the process. Some students require this type of visual while others may find it confusing.

FRACTIONS AND DECIMALS

Suggested Time: 4 Weeks

September	October	November	December	January	February	March	April	May	June

Estimated Completion

Unit Overview

Focus and Context

In everyday life, we often have measures that are less than one. In Grade 4, the focus is on students initially developing a firm understanding of these numbers.

At first, students will learn that fractions are one way to represent numbers less than one. They need to understand that a fraction represents one idea although it uses two numbers, with an emphasis on the relationship between these two numbers.

In the second part of this unit, students will use decimals to represent numbers less than one. An introduction to decimals requires familiarity with the concept of fractional tenths. Some students will be comfortable with the concept of tenths and will be ready to move into a study of decimal hundredths fairly quickly. Students will learn that decimals allow for calculations that are consistent with whole number calculations.

Outcomes Framework

> **GCO**
> Develop number sense.

> **SCO 4N4**
> 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.

> **SCO 4N9**
> Represent and describe decimals (tenths and hundredths), concretely, pictorially and symbolically.

> **SCO 4N10**
> Relate decimals to fractions and fractions to decimals (to hundredths).

> **SCO 4N11**
> Demonstrate an understanding of addition and subtraction of decimals (limited to hundredths).

SCO Continuum

Grade 3	Grade 4	Grade 5
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]
		5N7 Demonstrate an understanding of fractions by using concrete, pictorial and symbolic representations to:
		• create sets of equivalent fractions
		• compare fractions with like and unlike denominators.
		  [C, CN, PS, R, V]
		
		5N8 Describe and represent decimals (tenths, hundredths, thousandths), concretely, pictorially and symbolically.
		  [C, CN, R, V]
		
		5N9 Relate decimals to fractions and fractions to decimals (to thousandths).
		  [CN, R, V]
		
		5N10 Compare and order decimals (to thousandths) by using:
		• benchmarks
		• place value
		• equivalent decimals.
		  [C, CN, R, V]
		
		5N11 Demonstrate an understanding of addition and subtraction of decimals (limited to thousandths).
		  [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

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

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]

Achievement Indicators:

4N8.1 Name and record the shaded and non-shaded parts of a given whole.

4N8.2 Represent a given fraction pictorially by shading parts of a given whole.

Suggestions for Teaching and Learning

In Grade 3, students began working with fractions. They were introduced to fractions as parts of a whole. They described situations in which fractions were used and compared fractions of the same whole with like denominators. In Grade 4, students continue to develop the idea of fractional parts of the whole. They also work with fractions that represent parts of a set.

The focus is on students developing a solid understanding of fractions less than or equal to one. Fraction pieces or fraction circles are excellent manipulatives to help students as they learn about fractions. Other appropriate manipulatives include paper (for folding), square tiles, egg cartons, Cuisenaire Rods, counters, money, number lines, geoboards, and grid/dot paper.

Work should begin with fractions that represent parts of a whole. Remind students that the denominator represents the number of equal parts in one whole and the numerator represents the number of equal parts under consideration. To strengthen fraction number sense, the size of the whole should be changed regularly.

Students should develop visual images for fractions and be able to tell about how much a particular fraction represents. Representing a given fraction pictorially or shading parts of a given whole will help conceptualize this understanding. Ask students to name a fraction from a given picture, such as:
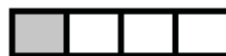
$\frac{3}{4}$ are non-shaded and $\frac{1}{4}$ are shaded

They should also be asked to colour pictures to show a fraction. For a given whole, for example, a student could show $\frac{2}{8}$ is green, $\frac{1}{8}$ is blue, and $\frac{5}{8}$ is red as follows:

G	B	R	R
G	R	R	R

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Use paper-folding to assess student understanding. Give students a rectangular or square piece of paper. Ask them to fold the paper to show $\frac{1}{2}$ and shade that part. Students should then unfold the paper to see $\frac{1}{2}$ of the whole. Repeat for $\frac{1}{4}$ by asking them to fold a paper two times and shading the region. Ask them to label each fractional part.

  (4N8.2)

- Ask students to make several different designs that are $\frac{3}{4}$ red and $\frac{1}{4}$ yellow.

  (4N8.1, 4N8.2)

- Ask students to design flags (with equal parts). For example:
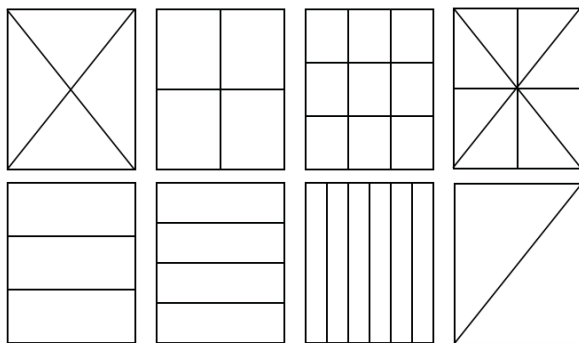
  After flags are designed and coloured, ask students to exchange flags with classmates. Ask them to name the coloured parts of the flags with fractions.

  (4N8.1)

Interview

- Show a strip of 9 squares. Ask students to indicate $\frac{3}{9}$ of the strip and explain how they know what to shade.

  (4N8.1)

Paper and Pencil

- Display the following diagram:
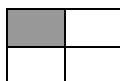
  Ask students to write a fraction representing each:
  (i) the shaded part of the diagram
  (ii) the unshaded part of the diagram

  (4N8.1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1
Fractions of a Whole
4N8 (8.1, 8.2, 8.3, 8.4)
TR: pp. 12–15
SB: pp. 208-211

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit7.html

- Enrichment activities

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N8 Continued ...

Achievement Indicators:

4N8.3 Provide examples of when two identical fractions may not represent the same quantity.

Suggestions for Teaching and Learning

Continue to reinforce that a fraction is a relationship between the part and the whole. It does not give the size of the whole or the size of the parts. This can be confusing for students. To clarify, discuss with students examples of when two identical fractions may not represent the same quantity. Ask them if halves are always the same. Show students an orange and a watermelon and cut them in half. Point out that the halves are different sizes even though they both represent the fraction $\frac{1}{2}$.

Ask students to think about the following situation:

Alex and Jennifer attend a pizza party. When it is time to eat, Alex takes $\frac{1}{4}$ of a pepperoni pizza and Jennifer takes $\frac{1}{4}$ of a veggie pizza. When they meet back at their table, they realize that they do not have the same amount of pizza, but that Jennifer's is larger. Students should discuss how this could happen.

Pepperoni Pizza   Veggie Pizza
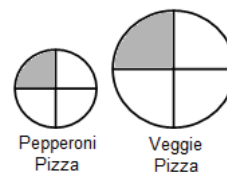
They should realize that Jennifer's slice came from a larger pizza. Van de Walle (2006, p. 267) refers to this as the "pizza fallacy" in that whenever two or more fractions are discussed in the same context, the incorrect assumption is that the fractions are all parts of the same size whole.

By working with everyday contexts in which the whole region varies in size, students should generalize that when comparing fractions, the whole must be the same size for each fraction.

4N8.4 Represent a given fraction, using concrete materials.

4N8.5 Name and record the shaded and non-shaded parts of a given set.

4N8.6 Identify a fraction from its given concrete representation.

4N8.7 Represent a given fraction pictorially by shading parts of a given set.

Using pattern blocks or attribute blocks as concrete representations for either fractions of a whole or fractions of a set can help students make connections between the two models.

Fraction of a Whole:

The shaded triangle is $\frac{1}{3}$ of the trapezoid.

Fraction of a Whole:

The triangle is $\frac{1}{4}$ of this set of 4 blocks.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Paper and Pencil

- Ask students to answer the following:

  (i) Sam ate $\frac{3}{4}$ of his pizza and Sara ate $\frac{3}{4}$ of her pizza. Sam said that he ate more pizza than Sara. Use pictures and words to explain how Sam could be correct.

  (4N8.3)

  (ii) When can $\frac{1}{4}$ give you a bigger piece of something than $\frac{1}{2}$? Draw diagrams to help explain your answer.

  (4N8.3)

Performance

- Using pattern blocks, provide students with a whole and ask them to indicate what fractional part of the whole each shape represents.

One Whole	Shape	Denominator	Numerator	Fraction Representing "Shape"
⬡	◷	2	1	$\dfrac{1}{2}$
⬡	◇	?	?	?

  Possible answers: a trapezoid is $\frac{1}{2}$ of the hexagon, a rhombus is $\frac{1}{3}$ of the hexagon and a triangle is $\frac{1}{6}$ of the hexagon.

  (4N8.6)

- Create fraction cards sets containing fractions of a whole and corresponding fractions of a set. Shuffle the cards, and place them face down. The first player turns over any two cards and checks to see if the cards match. If a match is made, the player must tell his/her opponent what fraction each card represents. If both agree that the answer is correct, the player keeps the cards and takes another turn. Play continues until all possible matches have been made. The player with the most matches wins the game.

  My match represents the fraction $\frac{3}{4}$
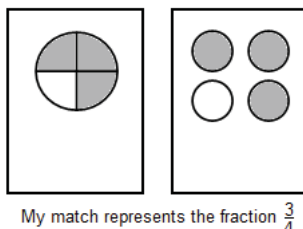
  (4N8.5)

- Provide a variety of coloured paper scoops of ice cream to represent various flavours (e.g., brown for chocolate, green for pistachio, etc.). Ask students to build an ice cream treat and to record the fraction represented by each flavour.

  $\frac{1}{5}$ Blueberry

  $\frac{3}{5}$ Chocolate

  $\frac{1}{5}$ Vanilla

  (4N8.4, 4N8.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Fractions of a Whole
4N8 (8.1, 8.2, 8.3, 8.4)
TR: pp. 12–15
SB: pp. 208-211

Suggested Resource

Teaching Student-Centered Mathematics Grades K-3 – John Van de Walle and LouAnn Lovin

Lesson 2:
Fractions of a Group
4N8 (8.6, 8.7, 8.5, 8.9, 8.8, 8.4)
TR: pp. 16–20
SB: pp. 212-214

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4N8 Continued ...** **Achievement Indicators:** *4N8.8 Provide, from everyday contexts, an example of a fraction that represents part of a set and an example of a fraction that represents part of a whole.*	Encourage students to think about how they use fractions in their everyday lives. Ask them to look in magazines and newspapers for fractions that represent parts of a whole. Examples include: • measuring time • measuring food for recipes • sharing food (dividing pizza into 8 equal pieces) Students should also work with contexts involving fractions that represent part of a set. From a group of 10 students, for example, ask: What fraction of the students are girls? boys? wear glasses? have dark hair? Students should present their findings using pictures (shading parts of a set) and symbols (writing fractions). Alternatively, teachers could draw the shaded and non-shaded parts of the set, ask students to brainstorm real-life situations, and then write the fractions represented by their models.
4N8.9 Order a given set of fractions that have the same denominator, and explain the ordering.	It is important for students to understand that fractions can only be compared if the whole is known in each situation. In Grade 3, models were used to compare fractions with the same denominator. As students begin to order a set of fractions, use concrete representations to reinforce that when fractions have the same denominator, the one with the larger numerator is greater. Ask three students to build the following towers using only red and yellow multi-link cubes: Tower #1- represents $\frac{2}{10}$ yellow cubes Tower #2- represents $\frac{5}{10}$ yellow cubes Tower #3 - represents $\frac{8}{10}$ yellow cubes Stand the towers side by side and ask students to order the fractions from greatest to least. They should notice that all three fractions have the same denominator, and that the tallest tower has the greatest numerator.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Ask students to represent the following:
  (i) $\frac{2}{3}$ of the bananas are ripe
  (ii) $\frac{4}{5}$ of the floor tiles are striped
  (iii) $\frac{1}{3}$ of the balls are basketballs
  (iv) $\frac{4}{9}$ of the fruit are oranges

  (4N8.7)

- This 'Sharing Brownies' activity allows students to demonstrate their understanding of fractions of a set. Provide students with several paper squares to represent fudge brownies. They can experiment by cutting the brownies to solve the following problems:
  (i)   How can 4 people share 3 brownies?
  (ii) How can 3 people share 2 brownies?
  (iii) How can 12 people share 6 brownies?
  (iv) How can 6 people share 4 brownies?

  They should write responses on a recording sheet such as the following:

Draw a picture of the divided brownies.   _____ brownies shared by _____ people.   One person's share is _____ (write the fraction).

  Differentiate the task, using numbers according to individual student ability.

  (4N8.8)

- Divide the class into 3 different sized groups, and ask each group to write a fraction that represents the number of boys and girls in their group. Ask them to present their fractions to the class and tell which fraction is greater. The groups should be able to explain that when the denominators are the same, the numerator determines the larger number.

  (4N8.9)

Interview

- Present pairs of fractions with like denominators. Ask the student to:
  (i)   decide which fraction is greater
  (ii) explain why they think this is so
  (iii) test their choice using any model they wish to use.

  (4N8.8)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 2:
Fractions of a Group
4N8 (8.6, 8.7, 8.5, 8.9, 8.8, 8.4)
TR: pp. 16–20
SB: pp. 212-214

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N8 Continued ...

Achievement Indicator:

4N8.10 Explain how denominators can be used to compare two given unit fractions with numerator 1.

Suggestions for Teaching and Learning

Fraction strips allow students to concretely compare unit fractions, with a numerator of 1. Students could make fraction strips by cutting strips of varied coloured paper and folding them to represent fractions as parts of a whole. These may be used as a manipulative for various tastks involving fractions. Give students the following instructions:

- Label a strip of a particular colour 1, or $\frac{1}{1}$. This strip represents the whole.
- Take a different colour strip of the same length, fold it in half, and label each section $\frac{1}{2}$.
- Next, choose a third strip and fold it into four equal pieces, and label each section $\frac{1}{4}$.
- Continue this process with eighths and sixteenths.

$\frac{1}{1}$							
$\frac{1}{2}$				$\frac{1}{2}$			
$\frac{1}{4}$		$\frac{1}{4}$		$\frac{1}{4}$		$\frac{1}{4}$	
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$							
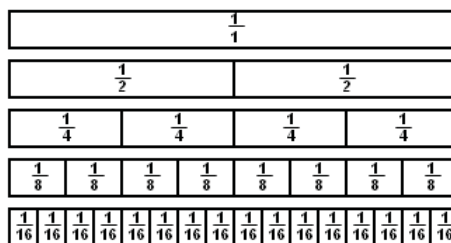
Discuss the meaning of each fraction as students fold the strips. Students should see that: $\frac{1}{8}$ is larger than $\frac{1}{16}$ and that two $\frac{1}{4}$ pieces are equal to a $\frac{1}{2}$ piece.

They should conclude that when comparing unit fractions, the larger the denominator the smaller the fraction. They should then be able to compare fractions in situations such as the following:

Three girls took part in a skip-a-thon. Sydney skipped for $\frac{1}{5}$ of an hour, Paula skipped for $\frac{1}{3}$ of an hour, and Beth skipped for $\frac{1}{2}$ of an hour. Who skipped for the longest period of time? How do you know?

There are several books that teachers may choose to use when teaching about fractions. One example is *Apple Fractions* by Jerry Pallotta. Teachers may ask students to create a foldable book. Teachers read aloud about various fractions, then stop and allow time for students to create a page for the fraction being discussed. Students should be encouraged to use the number representation and draw a model of the fraction. The illustrations in the book will help them with their models and with connecting fractions to the real word.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- The game, 'Cover Up', requires using the cut up fraction pieces from the fraction kit made on the previous page, and involves two or more players. Each player starts with a whole strip from the fraction kit. The goal is to be the first to cover the whole strip completely with the other pieces of the fraction kit. No overlapping pieces are allowed.

  Rules for play:

  1. Students take turns rolling a cube labeled with fractions:

     $$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}$$

  2. The fraction face up on the cube tells what size piece to place on the whole strip.

  3. When the game nears the end and a student needs only a small piece such as $\frac{1}{8}$ or $\frac{1}{16}$, rolling $\frac{1}{2}$ or $\frac{1}{4}$ won't do. The student must must roll exactly what is needed. (Burns, *About Teaching Mathematics*, 2000 p. 227)

  (4N8.5, 4N8.10)

Journal

- Ask students to answer the following:
  (i) Would you rather have $\frac{1}{4}$ of a pizza or $\frac{1}{3}$ of a pizza? Explain the reason for your choice using pictures and words.

  (4N8.10)

  (ii) What possible denominators could be used in the statement below? $\quad \frac{1}{?} \quad < \quad \frac{1}{?}$

  (4N8.10)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Sorting Fractions
4N8 (8.2, 8.6, 8.9)
TR: pp. 21–23
SB: p. 215

Note

Lesson 3 and 4 may be addressed together. Lesson 3 is brief but sets the stage for Lesson 4.

Lesson 4:
Comparing and Ordering
Fractions
4N8 (8.1, 8.2, 8.6, 8.7, 8.8)
TR: pp. 24–28
SB: p. 216-218

Suggested Resources

Apple Fractions – Jerry Pallotta

About Teaching Mathematics – Marilyn Burns

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N8 Continued ...

Achievement Indicator:

4N8.11 Order a given set of fractions that have the same numerator, and explain the ordering.

Suggestions for Teaching and Learning

Many students have a preconceived notion about numbers that may cause them difficulties with the relative size of fractions. In their experience, larger numbers mean "more". A common misconception is for students to transfer previously learned whole number concepts to fractions, thinking seven is more than four, so sevenths should be larger than fourths. The inverse relationship between number of parts and size of parts is better understood by students when they explore and discover this on their own rather than being told.

Provide students with 4 strips of ribbon of equal length. Instruct them to fold and cut the ribbons to represent the fractions below, and then order them from greatest to least or from least to greatest. Keep one strip whole for comparison. Ask students to explain their thinking.

$$\frac{4}{6} \qquad \frac{4}{8} \qquad \frac{4}{10}$$

Lead students into a discussion that fractions with different denominators have the whole divided into different sized parts. If you have the same number of parts (like numerators) in two situations but the parts in one fraction are smaller than the parts in another fraction, then the fraction with the smaller denominator (showing larger parts) is greater. Since sixths are greater than tenths, for example, four-sixths is greater than four-tenths.
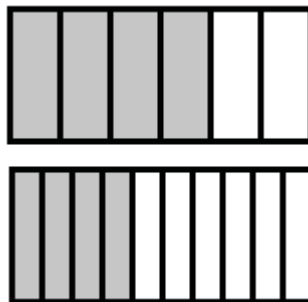
Remind students that the whole must be the same when comparing fractions.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Pose the following problem:
  Matthew, Adam and Peter recorded their batting scores at the batting cage:
    Matthew - $\frac{2}{8}$
    Adam - $\frac{2}{6}$
    Peter - $\frac{2}{5}$
  Matthew put the scores in order from greatest to least, and said that his batting average was the highest, Adam's second, and Peter's third. Was Matthew's ordering correct? Explain your thinking.

  (4N8.11)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Sorting Fractions
4N8 (8.6, 8.9, 8.2)
TR: pp. 21–23
SB: p. 215

Lesson 4:
Comparing and Ordering
Fractions
4N8 (8.6, 8.7, 8.2, 8.10, 8.11)
TR: pp. 24–28
SB: p. 216-218

Curious Math:
TR: p. 29
SB: p. 219

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4N8 Continued ...** **Achievement Indicators:** *4N8.12 Identify which of the benchmarks, 0 , $\frac{1}{2}$ or 1, is closer to a given fraction.* *4N8.13 Name fractions between two given benchmarks on a number line (horizontal and vertical).* *4N8.14 Order a given set of fractions by placing them on a number line (horizontal and vertical) with given benchmarks.*	 The most important reference points, or benchmarks, for fractions are 0, $\frac{1}{2}$ and 1. Understanding why a fraction is close to 0, $\frac{1}{2}$ and 1 is a good beginning for fraction number sense as it helps students understand the relative size of fractions. The following strategies can help students identify which of the benchmarks is closer to a given fraction: • paper fraction strips • comparing the denominator and numerator To place the fractions on a number line using benchmarks of 0, $\frac{1}{2}$ and 1 students must also make estimates of fraction size, in addition to simply ordering the fractions. Ask them to name fractions between two given benchmarks on a number line. When asked to name a fraction between 0 and $\frac{1}{2}$, for example, encourage students to think of as many possibilities as they can, using a set of fractions with like denominators, (e.g., $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$), or unlike denominators (e.g., $\frac{1}{3}$, $\frac{3}{10}$, $\frac{5}{12}$). When ordering fractions, fractions strips can be placed against a number line to help mark the fractions. Students could use fraction strips of fourths, eighths, twelfths, and sixteenths, and ask students to identify the fractions that equal $\frac{1}{2}$. This benchmark is familiar for students as they frequently share things into two equal groups. They can then extend this by ordering other fractions using words such as 'closer to', or 'less than' one half.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Prepare a lunch bag with several fraction cards inside. Divide the class into groups of three and assign each player a benchmark title of 0, $\frac{1}{2}$, or 1. Have players draw a fraction card from the bag and decide which benchmark the fraction is closest to. The player with that benchmark name receives a point. Play continues until a player has reached a predetermined number of points.

  (4N8.12)

- The teacher places fractions on a number line labelled 0, $\frac{1}{2}$ and 1. Some are placed correctly and others incorrectly (e.g., place $\frac{9}{10}$ between 0 and $\frac{1}{2}$). Next, ask students to represent each fraction pictorially or concretely to help them decide whether or not the fraction is placed correctly. Without looking at others, students respond by showing 'thumbs up' to indicate agreement with your placement or 'thumbs down' to show disagreement of the placement of each fraction. Students can then play this game in pairs taking turns placing fractions on the number line and responding.

  (4N8.12, 4N8.13, 4N8.14)

Paper and Pencil

- Ask students to answer the following:
  (i) A mother instructed her two children Gregory and Brandon, to eat all of the broccoli on their dinner plates. Brandon ate 6 out of his 8 pieces of broccoli, and Gregory ate 5 out of his 10 pieces. Which child came closest to following his mother's instructions? Draw pictures to help explain your answer.
  (ii) Michael wanted to run all the way home but only got $\frac{3}{8}$ of the way when he became tired and had no choice but to walk the rest of the way. Did he run greater or less than half the way home? Draw a number line to show your thinking.

  (4N8.12)

- Tell students that a friend placed the following fractions into two groups:

  $$\frac{1}{10} \quad \frac{2}{5} \quad \frac{1}{3} \qquad \frac{3}{4} \quad \frac{6}{10}$$

  Ask them to explain how he/she might have sorted the fractions.

  (4N8.12)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Using Benchmarks to Order Fractions
4N8 (8.12, 8.13, 8.14)
TR: pp. 31-34
SB: pp. 220-222

Math Game:
Pot of Gold
TR: p. 35
SB: p. 223

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit7.html
- Interactive White Board activity for ordering fractions

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4N8 Continued …** **Achievement Indicators:** *4N8.2 (Continued) Represent a given fraction pictorially by shading parts of a given whole.* *4N8.6 (Continued) Identify a fraction from its given concrete representation.* *4N8.7 (Continued) Represent a given fraction pictorially by shading parts of a given set.* *4N8.8 (Continued) Provide, from everyday contexts, an example of a fraction that represents part of a set and an example of a fraction that represents part of a whole.*	Below are three types of problems using fractions of a whole and fractions of a set that can help students develop their understanding of fractional parts. Students should draw diagrams and pictures to help visualize their understanding. Find the Part: • given the whole and the fraction Mr. Hann is building a patio and wants to partition one-fourth of it for a BBQ. If the whole patio looks like this, how big is the space for the BBQ? • given the set and the fraction Michael purchased a package of 12 golf balls and wants to take one-fourth of them to his golf tournament. How many does he take? Find the Whole: • given the part of the whole and the fraction Mr. Hann has finished one-third of his patio. Draw a picture that might be the shape of the finished patio. • given the part of the set and the fraction If these cookies make up $\frac{3}{4}$ of a batch of cookies, how many cookies are in the entire batch? Find the Fraction: • given the whole and the part Shawn ran in a cross-country race. What fraction of the race did he complete? Start Shawn Finish • given the whole of the set and the part Tyler bought a dozen eggs to make omelettes. If the recipe requires 4 eggs, what fraction of the carton will Tyler use?
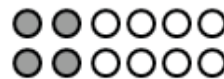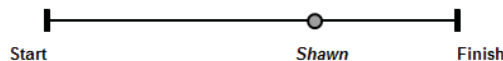
General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to answer the following:
  (i) If adults get the daily recommended 8 hours of sleep per night, what fraction of the day are adults awake? Explain your thinking. Students could also show how much time they spend sleeping or doing other activities.

  (4N8.2, 4N8.6, 4N8.7, 4N8.8)

  (ii) Jane gave $\frac{4}{12}$ of her hockey cards to her brother, and $\frac{3}{12}$ of the cards to her friend. What fraction of the cards did she keep for herself?

  (4N8.2, 4N8.6, 4N8.7, 4N8.8)

  (iii) Twenty students in the class were surveyed on their favourite sport. Basketball was preferred by $\frac{1}{2}$ of the class, $\frac{4}{20}$ of the class preferred soccer, and $\frac{5}{20}$ preferred volleyball. Did all twenty students in the class vote?

  (4N8.2, 4N8.6, 4N8.7, 4N8.8)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Solving Problems by Drawing Diagrams
4N8 (8.7, 8.9, 8.2, 8.4)
TR: pp. 37-40
SB: pp. 224-226

Curious Math:
Drawing With Fractions
4N8 (8.1, 8.2, 8.4)
TR: pp. 41-42
SB: p. 227

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N9 Represent and describe decimals (tenths and hundredths), concretely, pictorially and symbolically.
[C, CN, R, V]

Achievement Indicators:

4N9.1 Write the decimal for a given concrete or pictorial representation of part of a set, part of a region or part of a unit of measure.

4N9.2 Represent a given decimal, using concrete materials or a pictorial representation.

Suggestions for Teaching and Learning

This is students' first introduction to decimals. Previously they learned that fractions are one way to represent measures that are less than one. Students will now be introduced to decimals as another way to represent numbers less than one. They will first work with decimal tenths and will then extend this to include decimal hundredths.

Focus on the need to continue the pattern in our base ten number system, so that the unit (or the whole) is divided into ten equal parts (or tenths) and another place value is included to the right of the ones place, separated by a decimal to show that it is a fractional part. This shows the connection between fractions and decimals, as well as the connection between whole numbers and decimals (e.g., $\frac{2}{10} = 0.2$).

Students will learn about decimals through the use of concrete materials, pictorial representations, and modeling.

- Ten Frames (tenths)
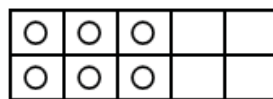
0.6 or "six tenths"

- Number lines (tenths and hundredths)
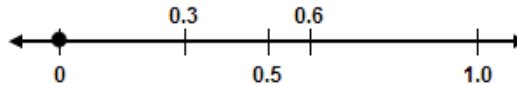
- Place Value Mat (used with money and base ten blocks)
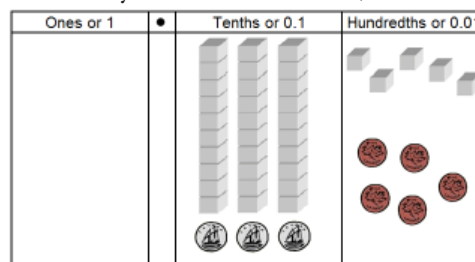
0.35 or "thirty-five hundredths"

 Display a large number line. Place a removable pointer, such as a magnet, clothespin or Post-it® arrow on one of the tenth divisions.
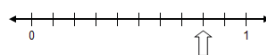
Students write the decimal to represent the place indicated and hold up the answer. Repeat.

4N9.3 Provide examples of everyday contexts in which tenths and hundredths are used.

Teaching decimals through meaningful contexts, such as those below, will strengthen student understanding:
- fingers and toes
- items that are packaged in tens (e.g., pencils, stickers, erasers)
- scores and times for various sporting events (e.g., hundred metre dash was completed in 13.9 seconds).
- gas prices are displayed on signs to the nearest tenth (e.g., 89.9¢/L)

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Make a set of cards showing decimal tenths (for example 0.5 or 0.9) or use decimal squares kit, if available. Have students choose a card and, illustrate the decimal with a picture or show the decimal using concrete materials such as ten frames, number lines, place value mat and money.

  (4N9.2)

- Using a number line from zero to one (interactive white board, paper copy, or clothesline), ask individual students to plot numbers such as 0.5, ten tenths, seven tenths, etc.

  (4N9.2)

- Pair students to work together to locate tenths on a metre stick or measuring tape.

  (4N9.2)

- Brainstorm, with students, various places in their own lives where they see decimal numbers. Working in groups, ask students to collect examples from newspapers, flyers, etc. Students present findings.

  (4N9.3)

- Ask ten volunteers to stand so that the remaining classmates can see them. Ask students to observe certain characteristics (e.g., number of classmates with brown hair, wearing black, wearing glasses or wearing jewelry) and record their results as a fraction and a decimal number.

  (4N9.1, 4N9.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 7:
Decimal Tenths
4N8 (8.5)
4N9 (9.1, 9.2, 9.3)
4N10 (10.1, 10.2, 10.3, 10.4, 10.5)
TR: pp. 46–49
SB: pp. 230-232

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N10 Relate decimals to fractions and fractions to decimals (to hundredths).
[C, CN, R, V]

Achievement Indicators:

4N10.1 Express, orally and in written form, a given fraction with a denominator of 10 or 100 as a decimal.

4N10.2 Read decimals as fractions.

4N10.3 Express, orally and in written form, a given decimal in fraction form.

4N10.4 Express a given pictorial or concrete representation as a fraction or decimal.

4N10.5 Express, orally and in written form, the decimal equivalent for a given fraction.

Suggestions for Teaching and Learning

Children's literature can provide contexts in which decimal tenths may be discussed. For example, *10 for Dinner* by Ellen Bogart provides a context for grouping children who come to a party according to arrival time, outfits, etc. As the teacher reads a page and the groups are discussed, ask students to represent the group by colouring squares in a ten frame or on a tenth grid. From this illustration ask students to represent the group using fractions and decimals.

Students should also be provided with decimals or fractions (tenths only at this time) and asked to shade the appropriate amounts on the hundredth grids. Encourage them to write the decimal and fraction for the unshaded part and compare the numbers they wrote for the shaded and unshaded parts. If 0.4 is shaded, for example, then 0.6 is unshaded. The connection between these two decimals helps provide the foundation for adding and subtracting decimals.

It is important to foster understanding of decimals by ensuring that they can be read correctly. Avoid using the term 'point' when reading a decimal number as it has no mathematical meaning to students. Rather, use the word "and" to represent the decimal when reading a number aloud. For example, 3.4 should be read as '3 and 4 tenths' not '3 point 4' or '3 decimal 4'. Saying decimal numbers correctly will assist students in gaining an understanding of how decimals relate to fractions. Remind students, when writing a decimal less than 1, to use 0 in the ones place to emphasize that the decimal number is less than 1 (e.g., 0.3 rather than .3).

Students should express a given decimal as a fraction and vice versa. Consistently using the correct language when reading decimals and fractions will support students as they convert from one representation to the other.

54 hundredths = $\frac{54}{100}$, or 0.54

2 and 3 tenths = $2\frac{3}{10}$, or 2.3

General Outcome: Develop number sense.

Suggested Assessment Strategies

Interview

- Ask the student to choose a card showing a fraction or a decimal number.

$$\frac{4}{10}$$

  Ask him or her to read the card and represent the number in another way. E.g., Student may say "four tenths" and write 0.4 as another way to represent it.

  (4N10.3)

Paper and Pencil

- Ask students how 0.7 and 0.3 are alike.

  (4N10.4)

- Tell students that Mary painted her nails. She painted 2 nails red, 3 nails blue, 1 nail orange and 4 nails pink. Ask them to complete the chart.

Nail Color	Fraction	Decimal
3 red nails		
2 blue nails		
1 orange nail		
4 pink nails		

  (4N10.5)

- Provide groups of students with counters and egg cartons that have the last two compartments removed to make ten. Instruct students to take turns putting counters into the compartments, and asking classmates "How many?". For example, a student may fill 7 compartments of the carton (0.7). Group members may answer "seven tenths". Supply students with sheets of tenths grids to record numbers created. Students may be instructed to first record the number as a fraction then as a decimal number.

  (4N10.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 7:
Decimal Tenths
4N8 (8.3)
4N9 (9.1, 9.2, 9.3)
4N10 (10.1, 10.2, 10.3, 10.4, 10.5)
TR: pp. 46–49
SB: pp. 230-232

Suggested Resource

10 for Dinner – Ellen Bogart

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

4N9, 4N10 Continued ...

Achievement Indicators:

4N9.1 (Continued) Write the decimal for a given concrete or pictorial representation of part of a set, part of a region or part of a unit of measure.

4N9.2 (Continued) Represent a given decimal, using concrete materials or a pictorial representation.

4N9.3 (Continued) Provide examples of everyday contexts in which tenths and hundredths are used.

4N10.1 (Continued) Express, orally and in written form, a given fraction with a denominator of 10 or 100 as a decimal.

4N10.2 (Continued) Read decimals as fractions.

4N10.3 (Continued) Express, orally and in written form, a given decimal in fraction form.

4N10.4 (Continued) Express a given pictorial or concrete representation as a fraction or decimal.

4N10.5 (Continued) Express, orally and in written form, the decimal equivalent for a given fraction.

Work with tenths will now be extended to include decimal hundredths. In the Numeration Unit, students used base ten materials to represent whole numbers. The flat represented 100, the rod represented 10 and the unit cube represented 1. In this unit, however, the values of the base ten blocks have changed to represent decimal numbers where the flat is 1, the rod is 0.1 and the unit cube is 0.01. Ensure that students do not refer to the flat as '100' but as a 'whole'.

large cube   flat   rod   unit
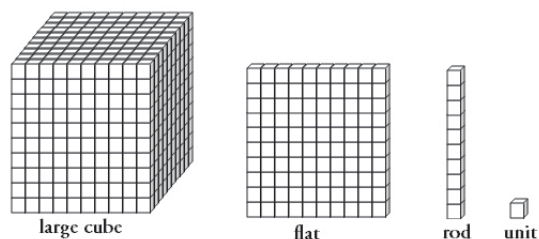
Teachers could relate these base ten blocks to everyday items. A rectangular cake, for example, could represent one whole and the rod could represent a slice that is one tenth of the whole cake. The unit cube would represent a bite of the slice or one hundredth of the whole cake.

Using the same materials to now represent decimals can be challenging for some students. As this different way of thinking about using base ten materials is discussed, teachers could provide students with paper copies of a hundred grid. The cutting of the paper model could better suit various learning styles. Note that the overhead base ten materials (or grids on transparencies) are also useful as a means of showing various base ten representations to the whole class for discussion. Laying one grid over the other helps students see the equivalency between the tenths and hundredths.
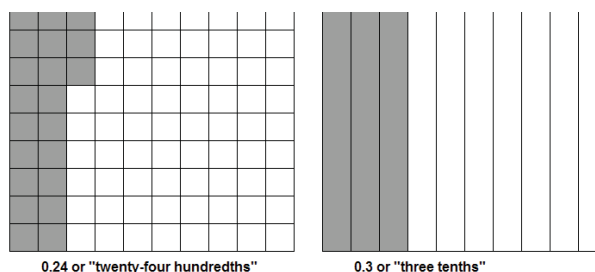
0.24 or "twenty-four hundredths"   0.3 or "three tenths"

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to colour squares on a hundred grid to create an animal or design. Students should write decimal values for each colour used.

  (4N10.4)

- Present the following problem: The record for the 100 metre race at Island Academy is between 12 and 13 seconds. What might the record be? Give at least 15 answers.

  (4N9.1, 4N9.2)

Performance

- Prepare decimal grid cards (10 ×10 paper squares) representing tenths and hundredths. Place the cards in a pile, face down. Taking turns, players select a card from the deck and have their partner try to guess the number of shaded parts on the card. For each guess, the player holding the card must state if the number represented on the card is higher or lower than the guess. If the number is guessed within three tries the player keeps the card. Students count their cards at the end to determine a winner.

  (4N9.1, 4N9.2, 4N9.7)

- The teacher provides sets of fraction badges which consist of a picture, a fraction and a decimal (hundredths). Place all the sets of cards in a bag and students randomly draw a badge to wear and do a buddy search. Groups sit together once all buddies are found.

  (4N10.4, 4N10.5)

Interview

- Ask students why decimals are important. Possible responses could include "Because they indicate part of a whole", "Because they make an answer more exact", etc.

  (4N9.3)

- Tell students that Katie used flats to represent wholes, rods to represent tenths, and units to represent hundredths. Ask them what numbers Katie might have represented using 10 base ten blocks.

  (4N9.1, 4N9.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 8:
Decimal Hundredths
4N8 (8.3)
4N9 (9.1, 9.2, 9.3)
4N10 (10.1, 10.2, 10.3, 10.4, 10.5)
TR: pp. 50-53
SB: pp. 233-235

Math Game:
Race to 1
TR: p. 58
SB: p. 239

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
4N9, 4N10 Continued ...	
Achievement Indicators:	

<table>
<tr><td>

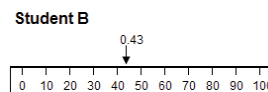*4N9.2 (Continued) Represent a given decimal, using concrete materials or a pictorial representation.*

</td><td>

An activity such as the following could be used to demonstrate that decimal numbers can be represented using a variety of concrete materials.
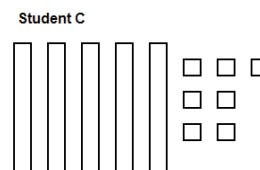
</td></tr>
</table>

4N9.2 (Continued) Represent a given decimal, using concrete materials or a pictorial representation.

4N9.3 (Continued) Provide examples of everyday contexts in which tenths and hundredths are used.

An activity such as the following could be used to demonstrate that decimal numbers can be represented using a variety of concrete materials.

- Student A creates any decimal number using a hundred grid and counters or shading.
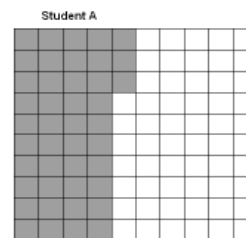
- Student B names the decimal number represented by the covered parts of the hundred grid and then indicates the same number using a metre stick or a number line.

4N10.1 (Continued) Express, orally and in written form, a given fraction with a denominator of 10 or 100 as a decimal.

4N10.2 (Continued) Read decimals as fractions.

- Student C names the decimal number of the uncovered parts of the hundreds grid and is then challenged to show that number using base ten blocks.

4N10.3 (Continued) Express, orally and in written form, a given decimal in fraction form.

4N10.4 (Continued) Express a given pictorial or concrete representation as a fraction or decimal.

Ask each student to then record the 2 decimal numbers as well as the corresponding fractions. $\frac{43}{100}$ **and 0.43**

$\frac{57}{100}$ **and 0.57**

4N10.5 (Continued) Express, orally and in written form, the decimal equivalent for a given fraction.

A good tool in helping students learn about hundredths is the Hundredths Disks (tenths and hundredths) – copy circular discs such as these shown below on two different coloured cards. Each disk is marked with 100 equal intervals around the edge and cut along one radius. The two discs are slipped together and can be used to represent a fraction or a decimal less than 100. *(Source: Van de Walle, Teaching Student Centered Mathematics Grades 3-5. Page 182)*
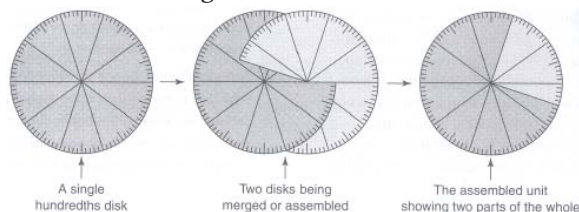
General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Using base ten materials, model and sketch the following decimal numbers:
  (i)   three hundredths
  (ii) three tenths
  (iii) 0.33
  (iv) 0.03

  (4N9.2)

Performance

- Tell students that your Grandmother had a button can containing 100 buttons. 60 of them were buttons with two holes, 5 were buttons with four holes and 35 buttons were one holed buttons. Ask them to write decimal numbers to show:
  (i)   number of buttons with four holes
  (ii) number of buttons with two holes
  (iii) number of buttons with one hole

  Provide students with three hundred grids each. Ask them to shade their grids to match the number of buttons in each group. Alternately, provide one grid per student and ask them to colour each amount of buttons using a different colour for each group of buttons.

  (4N9.1, 4N9.3)

- Using 'Hundredths Disks' as described on the previous page, ask students to turn over the Hundredths Disks to see the back and estimate fractions $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$. Next, they turn over the disks and record how many tenths and how many hundredths were in the section they estimated. Note the colours reverse when the circle is turned over.

  (4N10.4, 4N10.5)

- For this activity, students use hundredths disks (described on the previous page) and Decimal Squares. Prepare a set of large cards showing decimal amounts less than 1 and using both tenths and hundredths, such as 0.7, 0.23, 0.90. 0.4 and 0.65. Pick a card and ask students to manipulate the circles to represent the given decimal. Students display their answer.

  (4N9.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 8:
Decimal Hundredths
4N8 (8.3)
4N9 (9.1, 9.2, 9.3)
4N10 (10.1, 10.2, 10.3, 10.4, 10.5)
TR: pp. 50-53
SB: pp. 233-235

Math Game:
Race to 1
TR: p. 58
SB: p. 239

Supplementary Resource

Teaching Student Centered Mathematics Grades 3-5 – John Van de Walle and LouAnn Lovin

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N9, 4N10 Continued ...

Achievement Indicators:

4N9.4 Explain the meaning of each digit in a given decimal.

4N9.5 Represent a given decimal, using money values (dimes and pennies).

4N9.6 Record a given money value, using decimals.

4N9.7 Model, using manipulatives or pictures, that a given tenth can be expressed as a hundredth.

4N10.4 (Continued) Express a given pictorial or concrete representation as a fraction or decimal.

Suggestions for Teaching and Learning

Provide groups of students with base ten blocks. Show students a decimal number (e.g., 3.45). Instruct them to model it using base ten materials and to explain how much each digit represents. Repeat several times showing different decimal numbers so that each group member has an opportunity to model a number.

Money is a practical way to represent decimals. Take this opportunity to discuss with students the discontinuation of the penny. They should still be aware of the value of the penny. Although it no longer exists in cash transactions, it still plays a role in electronic payments. Students will have seen decimals used in dollar amounts but will likely not have thought about their meaning beyond "how many dollars and how many cents?" It is important that students view a dollar/loonie as a whole with a dime representing 0.1 (one tenth) of a dollar, and a penny representing 0.01 (one hundredth) of a dollar. Referring to a penny as 'one hundredth of a dollar' instead of a 'cent' will help students understand the fractional part of the whole represented by the penny.

To help students understand that decimals represent a fractional part of a whole, ask them to fill a 10 by 10 grid with pennies. They should recognize that dimes are worth 0.1 or $\frac{1}{10}$ of a dollar (one row) and that pennies are worth 0.01 or $\frac{1}{100}$ of a dollar (one grid square is worth a penny). Through discussion and observation, students will also see that 0.20 is equivalent to 0.2 or $\frac{2}{100}$, since 20 pennies (0.20) fill two columns (Small, 2006).

Provide students with sets of play money. Using grocery ads from a newspaper, ask students to show and record at least two ways they could pay for the item. A box of cereal, for example, may cost $3.29 and may be paid for using 3 loonies, 1 quarter and 4 pennies. Another possibility may be 2 loonies, 4 quarters, 2 dimes and 9 pennies. The emphasis in this lesson is on representing parts of a dollar as decimals. Therefore, most of the grocery items students choose should be less than one dollar.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Paper and Pencil

- Using pictures, numbers and words, ask students to show the value of each digit in the number 7.77 (or $7.77).

(4N9.4)

Performance

- Ask students to identify the number in the tenths place (or hundredths place). If you have…
  - (i) $2.38
  - (ii) $92.29
  - (iii) 4 loonies, 5 dimes, 6 nickels and 2 pennies
  - (iv)   2 dimes, 3 nickels and 19 pennies
  - (v)   9 dimes, 1 nickel, and 108 pennies

(4N9.4)

- Provide a 10 × 10 grid and pennies (as described on the opposite page) and pose questions such as:
  - (i)   How much are 3 columns?
  - (ii) If two and a half columns of pennies were removed, how much would be left?
  - (iii) If the first 4 columns were covered and only six blocks were covered in column 5, what would the value be?

  Ask the student to show 0.64 on the grid using any combination of pennies and dimes. Ask if there is a different way to show this amount. (Answers include 6 dimes and 4 pennies or 64 pennies)

(4N9.2, 4N9.5, 4N9.6)

- Ask students to solve this problem: You go to the store to buy sugar and find two different brands. You have to make a decision about which one is the better buy. One package is marked 0.8 kg for $0.78 and the other is marked 0.80 kg for $0.87. Which one is the better buy? Using any manipulatives or pictures, explain how you know.

(4N9.3, 4N9.7)

- Display pictures of items as well as pictures of the money used to pay for those items. Instruct students to record how much each item costs using a decimal number and read the decimal number as a fraction. Likewise, show various decimal values and ask students to model the amount with their play money.

(4N10.2, 4N10.4)

- Place a collection of coins (quarters, dimes, nickels and pennies) in a bag. Ask students to take out four coins and represent the total using decimals and a place value mat.   (4N10.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 9:
Representing Decimals with Coins
4N9 (9.1, 9.2, 9.4, 9.5, 9.6, 9.7)
4N10 (10.2, 10.4)
TR: pp. 54-57
SB: pp. 236-238

Supplementary Resource

Big Ideas from Dr. Small – Marian Small

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N11 Demonstrate an understanding of addition and subtraction of decimals (limited to hundredths).

[C, ME, PS, R, V]

Achievement Indicators:

4N11.1 Predict sums and differences of decimals, using estimation strategies.

4N11.2 Refine personal strategies to increase their efficiency.

4N11.3 Solve problems, including money problems, which involve addition and subtraction of decimals, limited to hundredths.

4N11.4 Determine the approximate solution of a given problem not requiring an exact answer.

4N11.5 Estimate a sum or difference using compatible numbers.

Suggestions for Teaching and Learning

Many students will realize that an exact sum or difference is not always required and an estimate is sometimes sufficient. This is particularly true when adding or subtracting decimal numbers that represent money and distances. When adding and subtracting decimal numbers, students should estimate first as this requires them to focus on the relationships between numbers and the effect of number operations, rather than simply applying a memorized rule to compute. After estimating, students can add or subtract the decimals to get the exact answer and explain the strategy used to the class or to a partner. Base ten blocks should be available to students at all times during addition and subtraction practice to help them arrive at a solution, as well as model how they found their solutions.

Students should understand that estimation is a key component when completing any computation. By providing students with many opportunities to estimate sums and differences in meaningful contexts, students will learn to assess which strategy works best, based on the decimal numbers they are working with. They should also recognize the usefulness of these strategies in everyday life, and in doing so, further develop number sense.

When estimating, students will often use mental computation strategies. A number of these strategies were explored in 4N3 and can also be used in the context of decimals. Students may choose to use strategies such as:

- **compatible numbers**: e.g., 0.72 + 0.23 is close to 0.75 + 0.25

- **front-end addition**: e.g., 32.3 + 24.5 may be thought of as 30 + 20

- **front-end subtraction**: e.g., 4.47 – 3.48 may be thought of as "4 ones subtract 3 ones is 1, for a difference of approximately 1"

- **rounding**: e.g., 4.39 + 5.2 is about 4 + 5 for an estimate of 9

Students could benefit from a class 'store' where they may use play money to make purchases. Students may use pictures from magazines, catalogues, flyers or even real life items to 'sell' (with a price tag attached). Tell students that exact change is not required at this store as long as the clerk and shopper agree on the approximate total price of items purchased. This activity encourages the use of both estimation and mental math strategies.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to create addition or subtraction equations using decimal numbers that would result in an answer close to 50.

  (4N11.1, 4N11.2, 4N11.3)

- Teachers tell students the following:
  (i) Becky earned $127.50 in one week of babysitting and has $248 in the bank. She wants to buy a $400 bicycle. Ask students if they think Becky will have enough money.
  (ii) Jason's favourite comics cost $2.17 on sale. He wants to buy two of them. Ask students to estimate how much they will cost.
  (iii) Beth has $153 in the bank. She has to pay her mom back for a $49.98 pair of sneakers, and wants to buy her brother a $28.38 logo t-shirt for his birthday. She wants to go to Science camp, which will cost $65. Ask students to use estimation to determine if Beth will have enough money.

  (4N11.1, 4N11.2, 4N11.3, 4N11.4)

Interview

- Show students the following: $26.5 + 53.5$
  Ask them: "How can you know that the sum is less than 100 without actually completing the addition?"

- How would you calculate $4.97 + 6.99$ mentally?

  (4N11.1, 4N11.2, 4N11.3, 4N11.4, 4N11.5)

- Tell students that when calculating $9.7 - 8.6$, Bethany thought '$86 + 11 = 97$'. Ask them to try to explain her thinking.

  (4N11.1, 4N11.2, 4N11.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 10:
Estimating Decimal Sums and Differences
4N11 (11.1, 11.3, 11.4, 11.5)
TR: pp. 59-62
SB: pp. 240-242

Lesson 11:
Using Mental Math
4N11 (11.3)
TR: pp. 63-66
SB: pp. 243-245

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N11 Continued ...

Achievement Indicators:

4N11.6 Count back change for a given purchase.

4N11.3 (Continued) Solve problems, including money problems, which involve addition and subtraction of decimals, limited to hundredths.

Suggestions for Teaching and Learning

Focus first on the value of estimating and then on determining how much change one would receive after a purchase.

To find an exact answer, students may choose to "count on" to calculate change and may use a number line to help them record the jumps taken when counting on. The number line in this case will probably not resemble the traditional number line with even intervals. If a student were to use a number line to help calculate change from $20 for a purchase of $18.65, for example, it may look like this:

$ 0.10	$ 0.10	$ 0.10	$ 0.05	$ 1
$18.65	$18.75	$18.85	$18.95 $19.00	$20.00
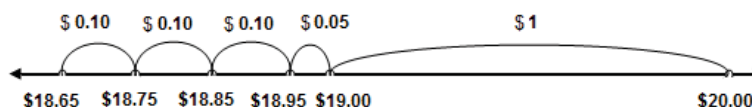
To help students further develop their own personal strategies for calculating change, and to reinforce the strategy of "counting on", teachers could supply groups of students with a catalogue and play money. Ask them to make three separate purchases from the catalogue, pay for each and check that the 'clerk' gave them the correct change, by counting on aloud for group members to hear. Highlight with the class any strategy that may be unfamiliar or different than those the majority would use.

If the class store was established in an earlier lesson, encourage students who visit there to estimate first what their change will be, then calculate the exact amount. The 'clerk' will determine whether or not the change is correct.

It is important that students recognize that the properties and techniques established for the addition and subtraction of whole numbers also apply to decimals. Students should recognize that adding or subtracting tenths (e.g., 3 tenths and 4 tenths are 7 tenths) is similar to adding or subtracting quantities of other items (e.g., 3 apples and four apples are 7 apples). The same is true with hundredths. Rather than simply telling students to line up decimals vertically, or suggesting that they "add zeroes", they should be encouraged to think about what each digit represents and what parts go together. For example, 1.62 + 0.3 may be thought of as 1 whole, 9 (6 + 3) tenths and 2 hundredths, or 1.92. Base ten blocks and hundredths grids continue to be useful models.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to answer the following:

  Tess bought a CD for $22.50. She paid for it with two twenty-dollar bills.

  (i) What was her change? Using models, words and pictures, explain how you solved the problem.

  (ii) What other bills might Tess have used to pay for her purchase? What would her change have been then?

  (4N11.3, 4N11.6)

- Supply groups of students with price tags (cards) showing decimal amounts such as $0.03, $0.40, $1.12, $2.49, $4.99. Cards are placed face down in a pile. The first player turns over a card and uses base ten blocks to build the number shown. Group members discuss what would be added on to get to a loonie, toonie, $5.00, $10.00 and so on, depending on the amount shown on the card. The first member then builds that amount with base ten blocks to show the change one would receive if making a purchase of an item priced like the one on the card. Each group member could then write an equation to represent the round.

  (4N11.6)

Interview

- Ask students to calculate the change from $5.00, if the bill totalled $3.59.

  (4N11.6)

- Show students a short list of grocery items and ask them to answer the following:

  (i) What is an estimate of how much everything on the list will cost in total?

  (ii) What is the total cost? How did you determine the total cost?

  Encourage discussion and explanation of the strategies students used to estimate and to add mentally.

  (iii) If you had $20, would you have enough money to buy all grocery items on the list? How do you know?

  (iv) About how much change would there be from $50? $100? How do you know?

  (4N11.3, 4N11.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 12:
Making Change
4N11 (11.3, 11.6)
TR: pp. 67-70
SB: pp. 246-247

Lesson 13:
Adding and Subtracting Decimals
4N11 (11.3, 11.5)
TR: pp. 71-74
SB: pp. 248-250

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N11 Continued ...

Achievement Indicators:

4N11.3 (Continued) Solve problems, including money problems, which involve addition and subtraction of decimals, limited to hundredths.

4N11.5 (Continued) Estimate a sum or difference using compatible numbers.

Suggestions for Teaching and Learning

Once students recognize these similarities, addition and subtraction equations should be given to students in horizontal form so they can practice aligning the decimals vertically when calculating sums and differences. Before students are introduced to regrouping in addition of decimals, they need to know how to add without regrouping (e.g., 2.5 + 17.36). Grid paper is a good tool to assist students in visualizing lining up place value.

		2	.	5	
+	1	7	.	3	6
	1	9	.	8	6

Then introduce questions that require regrouping.

Continue to encourage students to estimate to determine the reasonableness of their answer:

- using rounding, 2.5 + 17.36 may be thought of as 3 + 17 = 20, so the exact value is a little less than 20
- using front-end estimation, 2.5 + 17.36 may be thought of as 2 + 17 = 19, so the exact value is a little more than 19.

Give students a list of average temperatures for towns/cities they may study as part of Social Studies:

Place	Average temperature (°C) in May
Great Barrier Reef, Australia	25.1
Edmonton, Alberta	10.7
Nairobi, Kenya	19.5
Oslo, Norway	12.3

Ask questions such as:

- In May, how much warmer is it in Australia than in Alberta?
- Would the combined temperatures of Nairobi and Oslo be greater or less than 30? How do you know?
- How much colder is Edmonton than Oslo?

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Tell students that Lucy loves to hike. Her goal is to hike 15 kilometres on a weekend. She keeps track of her weekend hiking distances:

	Saturday	Sunday
First Weekend	4.9 km	3.81 km
Second Weekend	7.19 km	5.8 km
Third Weekend	9.3 km	5.9 km
Third Weekend	8.42 km	6.6 km

  Ask: Did Lucy reach her goal? On which day(s)? Show how you solved the problem.

  (4N11.3, 4N11.5)

- Ask students to make a list of supplies they would need to take on a camping trip. Next, after they research the prices, ask them to estimate and calcuate the total cost.

  (4N11.3, 4N11.5)

- Place a strip of wide masking tape on the floor to represent a number line. With endpoints of 14 and 16, divide the line into tenths. Pose this problem: The city record for the 100-metre run is 15.9 seconds. Robby ran the race in 14.6 seconds. By how much did Robby beat the record?

  (4N11.5)

Paper and Pencil

- Toby's solution to an addition problem is shown below. Ask students to write to Toby and explain the errors and show him through numbers, pictures and words how to solve the problem.

  $$\begin{array}{r} 0.78 \\ +\ \underline{12.3\ } \\ 2.01 \end{array}$$

  (4N11.3, 4N11.5)

- Ask students if the difference between 1.8 and 0.52 is greater than 1 or less than 1. They should how their reasoning.

  (4N11.3, 4N11.5)

Interview

- Ask students how calculating $0.3 + 0.8$ is like calculating $3 + 8$.

  (4N11.3, 4N11.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 13:
Adding and Subtracting Decimals
4N11 (11.3, 11.5)
TR: pp. 71-74
SB: pp. 248-250

MULTIPLYING MULTI-DIGIT NUMBERS

Suggested Time: 2 Weeks

September	October	November	December	January	February	March	April	May	June

Estimated Completion
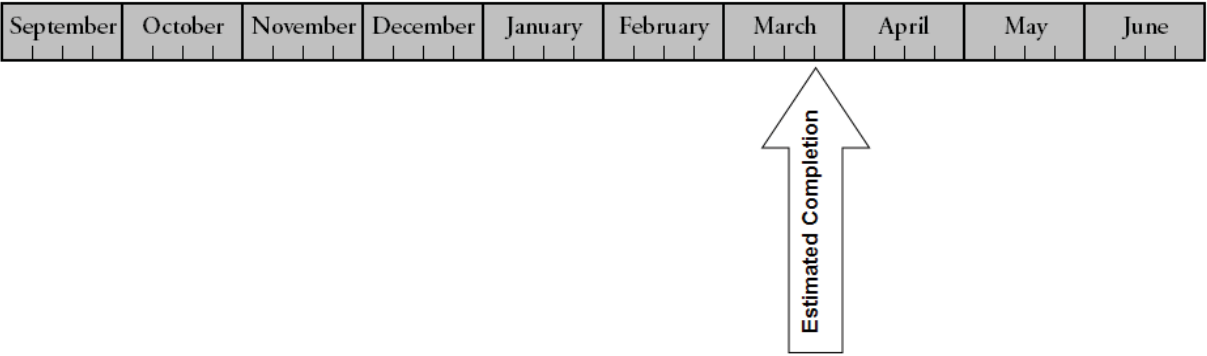
Unit Overview

Focus and Context

Fluency with whole number computations is essential in everyday life. Connecting multiplication and division to measurement, area, money, etc. helps students see the usefulness of multiplication. In this unit students will use their knowledge of basic multiplication facts as well as their understanding of place value to explore patterns when multiplying by 10s and 100s to multiply 2- and 3-digit numbers by a 1-digit number. Students will also build on the strategies they learned when studying multiplication facts to enable them to develop efficient strategies for multiplying larger numbers. As students develop the practice of estimating the product before computing, it enables them to strengthen their number sense. Being able to break apart numbers in flexible ways is important when multiplying numbers. Students will experience greater success applying the strategies to larger numbers if they can automatically recall the multiplication facts. Knowing how to multiply 2- and 3-digit numbers by 1 digit will prepare students for developing an understanding of division and multiplying 2-digit numbers by 2-digit numbers in later grades.

Outcomes Framework

GCO
Develop number sense.

SCO 4N6

Demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by:

- using personal strategies for multiplication with and without concrete materials
- using arrays to represent multiplication
- connecting concrete representations to symbolic representations
- estimating products
- applying the distributive property.

SCO Continuum

Grade 3	Grade 4	Grade 5
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]	4N6 Demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by: • using personal strategies for multiplication with and without concrete materials • using arrays to represent multiplication • connecting concrete representations to symbolic representations • estimating products • applying the distributive property. [C, CN, ME, PS, R, V]	5N4 Apply mental mathematics strategies for multiplication, such as: • annexing then adding zero • halving and doubling • using the distributive property. [C, CN, ME, R, V] 5N5 Demonstrate, with and without concrete materials, an understanding of multiplication (2-digit by 2-digit) to solve problems. [C, CN, PS, V]

Mathematical Processes

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

Number

Specific Outcomes

It is expected that students will:

4N6 Demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by:
- **using personal strategies for multiplication with and without concrete materials**
- **using arrays to represent multiplication**
- **connecting concrete representations to symbolic representations**
- **estimating products**
- **applying the distributive property.**

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

Achievement Indicators:

4N6.1 Use concrete materials, such as base ten blocks or their pictorial representations, to represent multiplication; and record the process symbolically.

4N6.2 Solve a given multiplication problem and record the process.

Suggestions for Teaching and Learning

This unit continues to build on the Multiplication and Division Facts unit. Students will review strategies that they learned earlier and now apply them to multiply two- and three-digit by one-digit numbers. Students will experience greater success with applying these strategies to larger numbers if they can efficiently recall the multiplication facts.

There are many good reasons why students should be encouraged to use personal and varying strategies for multiplication. Sometimes one strategy or algorithm makes more sense to one student than another or works better for a particular set of numbers. Sometimes students may get help from a parent where they expose them to a strategy that is different than those he/she learned at school. It is helpful for students to have exposure to both. Being comfortable with various strategies also allows the student to use one strategy to calculate and another to check the answer.

In this unit, students will investigate a variety of strategies. The expectation is that they become proficient in at least one appropriate and efficient strategy that they understand.

Students should use base ten blocks to help develop their understanding of multiplication when multiplying by 10s and 100s. It is important that teachers avoid telling students to simply add the correct number of zeros without an understanding of why this works. Give students opportunities to discover the pattern created when multiplying by 10s or 100s by using examples, such as the following:

Mrs. Brown has six flower pots. If she puts ten flowers in each pot. How many flowers will Mrs. Brown need to purchase?

Number of Flower Pots	Students Think	Number of Flowers
1	1 group of ten = 1 ten	10
2	2 groups of ten = 2 tens	20
3	3 groups of ten = 3 tens	30
4		40
5		50
⋮	⋮	⋮

When multiplying by 10, students should come to the understanding that there is always a zero in the ones place. When multiplying by 100, there will always be a zero in both the ones place and in the tens place. Discuss with students why this pattern occurs.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Hold a group competition. Divide the class into groups. Prepare a set of cards containing various multiplication problems (using facts to 9 × 9). The cards should be colour coordinated according to various levels of difficulty (e.g., pink cards contain easy problems - value 1 point; yellow cards contain moderate level of difficulty and are valued at 2 points, *etc.*) One person from each group selects a card and returns to the group. The students in each group work collaboratively to solve the problem and show how they got their answer, either on paper or with manipulatives. Once the teacher verifies a correct answer, points are given and the group selects another problem. Continue for a desired time.

- Ask students to use base ten blocks to demonstrate how to multiply 4 by 20 and 4 by 200. They should record the process and explain what they did. (4N6.1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Exploring Multiplication
4N6 (6.1)
TR: pp. 13-15
SB: p. 310

Math Game:
Twenty-Four
4N5
TR: pp. 16-17
SB: p. 311

Note

Lesson 1 is a review of material from the Multiplication and Division Fatcs unit. It can be used to activate students' prior knowledge, using facts to 9 × 9.

Lesson 2:
Multiplying 10s and 100s
4N6 (6.1, 6.3)
TR: pp. 18-21
SB: pp. 312-313

Suggested Resources

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit8.html

- Enrichment activities

- Interactive White Board activity on solving multiplication problems

Number

Specific Outcomes	Suggestions for Teaching and Learning
It is expected that students will: **4N6 Continued ...** **Achievement Indicators:**	

<table>
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4N6.3 Model and solve a given multiplication problem, using an array, and record the process.

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Another strategy students can use is multiplying with arrays. When separating numbers into parts, it is important that students think about number meaning and not 'digits' (e.g., the 1 in 12 actually means 10). It is important to give students time to practice decomposing numbers and to make sense of them.

Students can be taught to multiply by decomposing one of the factors. An array, using grid paper, could be usd to show this. For example, 3×12 can be viewed as 3×10 and 3×2.

3 x 12 = 36

(3×10) + (3×2)

30   +   6

Students could also use other manipulatives, such as square tiles, to form arrays. For example, 6×5 can be represented as $3 \times 5 + 3 \times 5$.

6×5 $3 \times 5 + 3 \times 5$

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<tr>
<td>

4N6.4 Model a given multiplication problem, using the distributive property.

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Decomposing numbers through the use of arrays leads to the distributive property. The distributive property for multiplication is new to students. While students should understand the concept, they are not expected to use this term. This property allows the separation of numbers into parts so that the numbers are easier to work with.

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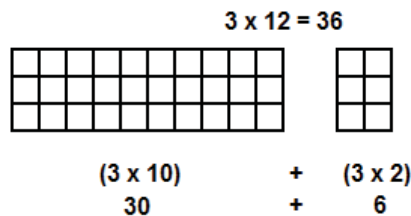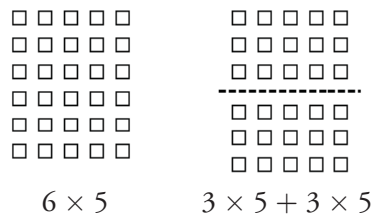
General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- John put 7 hockey cards in his album every day for 14 days. Ask students to use an array to show and then explain how many hockey cards John has altogether.

(4N6.2, 4N6.3)

Paper and Pencil

- Ask students to find the product of $7 \times 12 = $ ___. Provide grid paper and ask them to sketch a 7-by-12 array. Students may use scissors to split the array into smaller arrays or use color to show the separate parts. They should be able to explain how doing this helped them to calculate the product.

(4N6.3, 4N6.4)

- Provide students with the following array showing the separate parts. Ask them to solve the corresponding multiplication equation to find the product.

= ___ + ___
= ___

6 x 17 = ___ x ___ + ___ x ___
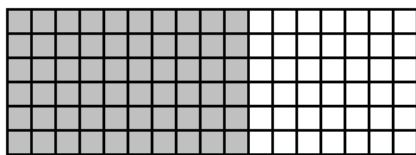
(4N6.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Multiplying Using Arrays
4N6 (6.1, 6.4, 6.5)
TR: pp. 22-25
SB: pp. 314-317

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

It is expected that students will:

4N6 Continued ...

Achievement Indicators:

4N6.1 (Continued) Use concrete materials, such as base ten blocks or their pictorial representations, to represent multiplication; and record the process symbolically.

4N6.2 (Cont'd) Solve a given multiplication problem and record the process.

4N6.3 (Continued) Model and solve a given multiplication problem, using an array, and record the process.

4N6.4 (Continued) Model a given multiplication problem, using the distributive property.

Suggestions for Teaching and Learning

It is important to give students an opportunity to explore multiplication through problem solving. When solving a multiplication problem, teachers could work with the whole group initially, discussing the problem. In order to enhance understanding, invite students to retell the problem in their own words to a partner or a small group. Model strategies to analyze word problems before working on solutions. For example:

3 Read Rule:

1. Read to become familiar
2. Read to look for the math
3. Read to know the question that must be answered

Providing a variety of materials such as base ten materials, counters, chart paper, markers, *etc.*, will also help students with the problem solving process.

Allow plenty of time for students to explore and develop a range of strategies. As students use their invented strategies, encourage movement towards more efficient ones.

Present students with a problem such as the following:

Laura wanted to create invitations for her friends. She has 6 friends and she wanted to use 27 small foam cut-outs to decorate the border on each invitation. How many cut-outs will Laura need to purchase at the craft store?

Graphic organizers help students organize their thoughts. The Four Corner Strategy is one example of a graphic organizer. Provide a table with the problem in one corner and ask students to complete the other corners. This could be done in pairs or in small groups to encourage communication.

Story Problem	Model / Diagrams
Laura wanted to make beaded bracelets for her friends. She has 6 friends and each bracelet will require 27 beads. How many beads will Laura need to purchase at Michael's craft store?	
Number Sentence	**Personal Strategy**

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to create a class picture book, explaining the personal strategies they used to solve a multiplication problem such as:

  How many different single-scoop ice cream cones can be made with 4 different kinds of cones and 28 different flavours of ice cream?

  Students could design a cover for their book indicating a title, authors and illustrators. When reviewing students' pages, teachers should look for evidence that students clearly communicated and understood their personal strategies to solve the multiplication problem.

  (4N6.1, 4N6.2, 4N6.3, 4N6.4)

- Provide students with a multiplication problem and ask them to prepare an infomercial for a fictitious TV show called *Math News*. Students should explain their personal strategies for solving the given multiplication problem. They may use concrete materials or pictures to demonstrate their strategies. Students could then present their infomercial while the teacher looks for evidence that:
  (i)   personal strategies were used effectively
  (ii) students solved the problem accurately
  (iii) students included models, illustrations and symbolic representations in their descriptions of personal strategies.
  These infomercials could be videotaped.

  Students can critique each other's work. The following are some examples of peer assessment statements:

  (i)   The presentation and explanations were clear. I understood what _____ was trying to say.
  (ii) Here is what I think _____ said.
  (iii) This student used graphic representations that were clear and had something important to show.
  (iv) _____'s strategy of _____ solved the problem correctly.
  (v)   _____ used appropriate mathematical vocabulary.
  (vi) Something that _____ did really well was _____.

  (4N6.1, 4N6.2, 4N6.3, 4N6.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Multiplying Using Arrays
4N6 (6.1, 6.3, 6.4, 6.5)
TR: pp. 22-25
SB: pp. 314-317

Number

Specific Outcomes	Suggestions for Teaching and Learning
It is expected that students will: **4N6 Continued ...** **Achievement Indicator:** *4N6.5 Estimate a product, using a personal strategy.*	There are many times when people estimate because an exact answer is not necessary. Sometimes in shopping, people estimate the total cost of their purchases. They may not have access to paper and a pencil or it may be quicker for them to estimate. Students will need to draw upon their knowledge of the multiplication facts and how to multiply with multiples of 10 and 100. Students should be encouraged to use reasoning when estimating products. To demonstrate reasoning, ask students if they have lived closer to 300 or 3000 days and have them explain how they know. Students might think that one year has 365 days, so it can't be 300 days because that would make them less than one year old. Ten years is just a bit less than 10×400 days or 4 000 days, so 3 000 makes the most sense. Numbers that are easier to work with in estimation are sometimes referred to as "friendly numbers". Students should be familiar with this term. To estimate products of two- or three-digit numbers by one-digit numbers, students could: • round one number to the nearest multiple of 10 or 100 E.g., 5×52 is about $5 \times 50 = 250$ • round one factor up and one factor down E.g., 62×9 is about $60 \times 10 = 600$ • use familiar multiplication facts E.g., 4×43 is about $4 \times 50 = 200$ (I know that $4 \times 5 = 20$). The answer is less than 200. • use front-end estimation E.g., 4×457 is about $4 \times 400 = 1\ 600$ (I know that $4 \times 4 = 16$). The answer is more than 1 600. Teachers could present students with the following problem: You have 3 pieces of licorice, each 27 cm long. About how many centimeters of licorice do you have? Ask students to paraphrase the problem, drawing attention to the word *about*, which indicates that an estimated answer is sufficient. They could use the Four Corner Strategy to help them solve the problem. Students should reason that 3×27 is a little more than 3×20, or a little less than 3×30. Discuss with them that 3×30 is the better estimate, since 27 is closer to 30 than it is to 20. They should use a number sentence, $3 \times 30 = 90$, to show the estimated product. Three licorices would be a little less than 90 cm long.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Tell students that Ben estimated 47×7 as 500. Ask the student to explain Ben's thinking, and if he/she would estimate it differently.

  (4N6.5)

Paper and Pencil

- Ask students to give an estimate for each of the following and explain the strategy they chose.
  - (i) $2 \times 243 =$ _____
    (2×243 is close to or a little more than 2×200, or close to or a little less than 2×250).
  - (ii) $79 \times 6 =$
  - (iii) $215 \times 7 =$

    (4N6.5)

- Tell students that Susan travelled 375 km each day for 3 days. Ask them if Susan will reach a cabin that is 1 200 km away by the end of the third day and explain how they know.

  (4N6.5)

- Ask students to explain in writing the estimation strategies for each equation below, and to decide which estimation is closer to the actual product.
  - (i) 79×9 as 80×10 or 80×9
  - (ii) 17×15 as 8×30 or 20×10

    (4N6.2, 4N6.5)

- Ask students to estimate answers to various problems using the Four Corner Strategy. For example:

Story Problem	Model / Diagrams
A skate lace is 176 cm. About how many centimetres are in 4 laces?	
Number Sentence	**Personal Strategy**

  (4N6.1, 4N6.2, 4N6.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Estimating Products
4N6 (6.1, 6.6)
TR: pp. 30-33
SB: pp. 322-324

Math Game:
Greatest Product
4N6
TR: pp. 34-35
SB: p. 325

Note

Math Focus 4 suggests an alternate sequence of lessons for this unit.

Number

Specific Outcomes

It is expected that students will:

4N6 Continued ...

Achievement Indicators:

4N6.1 (Continued) Use concrete materials, such as base ten blocks or their pictorial representations, to represent multiplication; and record the process symbolically.

4N6.2 (Continued) Solve a given multiplication problem and record the process.

4N6.4 (Continued) Model a given multiplication problem, using the distributive property.

4N6.5 (Continued) Estimate a product, using a personal strategy.

Suggestions for Teaching and Learning

During the Numeration unit, students learned that numbers can be represented in expanded form (e.g., $365 = 300 + 60 + 5$). They will now learn to multiply using expanded form by applying the distributive property and their knowledge of multiplying by tens and hundreds. For example:

$$8 \times 365 = (8 \times 300) + (8 \times 60) + (8 \times 5)$$

Using expanded form to multiply allows students to see the value placed on each digit of the number (e.g., the 3 in 365 means 300 instead of 3).

Students should have a good understanding of two-digit by one-digit examples of this strategy before proceeding to three-digit by one-digit examples. Teachers could start with a two-digit by one-digit problem such as:

If there are 52 weeks in one year, how many weeks are there in 3 years?

Step 1: Estimate
3 groups of 52 is about 3 groups of 50 or $3 \times 50 = 150$. The answer will be a little more than 150.

Step 2: Use base ten blocks to represent the problem.

HUNDREDS	TENS	ONES
	□□□□□	□□
	□□□□□	□□
	□□□□□	□□

Step 3: Record and multiply using expanded form

```
  50 + 2          50 + 2
    x 3             x 3
    150               6
  +   6           + 150
    156             156

left-to-right    right-to-left
```

Students could multiply right to left (ones first) or left to right (tens first). They should be exposed to both methods. However, left to right should be encouraged because multiplying the tens first provides useful information for estimation.

Step 4: As students understanding of this multiplication strategy develops there should be a natural progression from use of models to the symbolic representation.

Step 5: Answer: There are 156 weeks in 3 years.

```
     52
    x 3
    150
  +   6
    156
```

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Ask students to explain why the following solution is **incorrect**:
  $6 \times 28 = (6 \times 2) + (6 \times 8) = 12 + 48 = 60$

(4N6.4)

Paper and Pencil

- Ask students to solve 4×36 using expanded form and model using base ten materials. Repeat with other numbers.

(4N6.1, 4N6.4)

- Ask students to solve the problems and record the process:

  (i) Your class is celebrating the end of your Australian unit in Social Studies. If there were 24 people in your class, and each person wanted two Anzac cookies, how many Anzac cookies would you need to make for the celebration? If the Anzac recipe makes 12 cookies, how would you make 48 cookies?

  (ii) Hannah walks her dog for 48 minutes each day. How many minutes does she walk in 3 days?

  (iii) Last year you saved \$32. This year you saved 4 times as much money as last year. How much money did you save this year?

(4N6.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 4:
Multiplying Using Expanded Form
4N6 (6.1, 6.3, 6.4)
TR: pp. 26-29
SB: pp. 318-321

Lesson 7:
Multiplying 3-Digit Numbers
4N6 (6.1, 6.3, 6.4, 6.6, 6.7)
TR: pp. 43-46
SB: pp. 330-332

Number

Specific Outcomes

It is expected that students will:

4N6 Continued ...

Achievement Indicators:

4N6.1 (Continued) Use concrete materials, such as base ten blocks or their pictorial representations, to represent multiplication; and record the process symbolically.

4N6.2 (Continued) Solve a given multiplication problem and record the process.

4N6.4 (Continued) Model a given multiplication problem, using the distributive property.

4N6.5 (Continued) Estimate a product, using a personal strategy.

Suggestions for Teaching and Learning

Moving from multiplying two-digit by one-digit numbers to multiplication of three-digit by one-digit numbers should be a natural progression.

As students begin multiplying three-digit numbers, problems such as the following should be given:
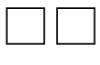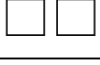
Jack's family is planning a summer vacation. If they are able to save 231 dollars a month, how much money will they save in 3 months?

Teachers should encourage the use of math language to properly describe numbers in their place values when working through operations. For the number 231, 2 is in the hundreds place with a value of 200, 3 is in the tens place wth a value of 30, and 1 is in the ones place.

Step 1: Estimate
3 groups of 231 is about 3 groups of 200 or $3 \times 200 = 600$. The answer will be more than 600. Another estimate could be 3 groups of 250 or $3 \times 250 = 750$. The answer would be less than 750.

Step 2: Use base ten blocks to represent the problem.

Step 3: Record and multiply using expanded form. Students could multiply right-to-left (ones first) or left-to-right (tens first).

```
 200 + 30 + 1          200 + 30 + 1
        x 3                   x 3
        600                     3
         90                    90
       +  3                 + 600
        693                   693
```

Step 4: Symbolic representation

```
     231
     x 3
     600
      90
    +  3
     693
```

Step 5: Answer: Jack's family saved 693 dollars.

It is important that students use appropriate mathematical language as they manipulate the materials and record the corresponding symbols for the product. Ensure that sufficient practice is given and ample opportunities are provided for students to communicate their thinking.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Interview

- Ask students to explain why the following solution is incorrect:

  $3 \times 147 = (3 \times 10) + (3 \times 40) + (3 \times 7)$
  $\qquad\qquad = 30 + 120 + 21$
  $\qquad\qquad = 171$

  (4N6.4)

Paper and Pencil

- Tell students that Josh's pedometer shows that he walked 354 steps in school today. If he walked the same number of steps each day, how many steps will he walk in 5 days? Ask students to model with base ten blocks and represent it by multiplying using expanded form.

  (4N6.1, 4N6.2, 4N6.4)

- Provide students with examples of multiplication using expanded form in which they have to fill in the missing numbers. Observe to see if students show understanding of the value of the digits.

```
    478          2□5          374
  x   3        x   6        x   4
  ----         ----         ----
  1200         1200         ┌────┐
  ┌────┐        240         └────┘
  └────┘         280
  +  24        +  30        +  16
  ----         ----         ----
  1434         1470         14□6
```

  (4N6.4)

Performance

- Ask a student to explain to a classmate how multipying a three-digit number is like multipying a two-digit number. Explain how it is different. Observe.

  (4N6.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 4 (Cont'd):
Multiplying Using Expanded Form
4N6 (6.1, 6.3, 6.4)
TR: pp. 26-29
SB: pp. 318-321

Lesson 7:
Multiplying 3-Digit Numbers
4N6 (6.1, 6.3, 6.4, 6.6, 6.7)
TR: pp. 43-46
SB: pp. 330-332

Curious Math:
Egyptian Multiplication Sum and Product
4N6 (6.1, 6.5)
TR: pp. 47-48
SB: p. 333

Number

Specific Outcomes	Suggestions for Teaching and Learning
It is expected that students will:	
4N6 Continued ...	
Achievement Indicators:	

4N6.1 (Continued) Use concrete materials, such as base ten blocks or their pictorial representations, to represent multiplication; and record the process symbolically.

4N6.2 (Continued) Solve a given multiplication problem and record the process.

4N6.5 (Continued) Estimate a product, using a personal strategy.

Another strategy is the standard algorithm for multiplying two-digit and three-digit numbers by one-digit numbers with regrouping. This method is familiar to students and probably the strategy most frequently used by parents. Students multiply from right-to-left beginning with the ones, then the tens and hundreds. This algorithm is an efficient strategy for multiplying but should only be introduced after students have had the opportunity to explore other strategies. The use of base ten manipulatives will provide students with a visual representation and help establish a link from the concrete representation to the symbolic representation.

Students should practice using correct mathematical language for regrouping. When multiplying 3×27, for example, a student might say "I multiplied 3 groups of 7units which makes 21 units. I regrouped 21 units to make 2 rods and 1 unit."

Continuing to support problems with the use of manipulatives gives meaning to the regrouping which occurs in the symbolic representation of the algorithm. For example:

There are 24 students in each grade 4 class. If there are 4 classes, how many students are there in total?

Encourage students to estimate first to see if the answer they find is reasonable.
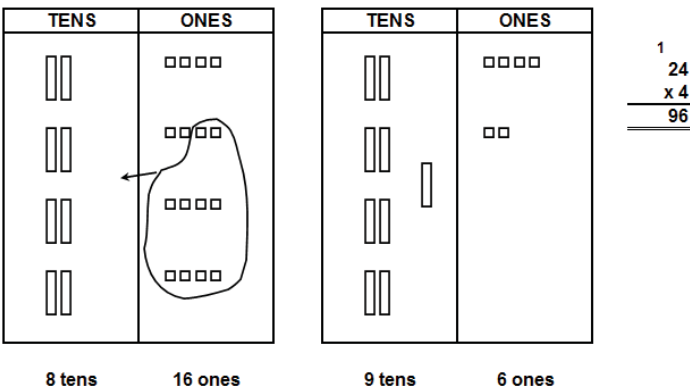
By using a base ten model, students can visualize that the 1 positioned above the tens place in the algorithm above is a result of regrouping 10 ones which created 1 group of ten. In the product, after regrouping, there are 6 ones left over.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to use base ten blocks to model the following problem showing regrouping:

  At the school book fair, the committee offered to donate 3 books to the library, for every one book sold. If 236 books were sold, how many books will be donated to the school library?

  (4N6.1, 4N6.2)

Performance

- Ask students to explain to a new student how they would multiply 278 by 4 using the algorithm with regrouping.

  (4N6.1, 4N6.2)

- Ask students to model the following three-digit by one-digit equation using base ten materials, and explain the procedure to solve the problem.

  104 x 5 =

  (4N6.1, 4N6.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 8:
Multiplying Another Way
4N6 (6.1, 6.4, 6.6, 6.7)
TR: pp. 49-52
SB: pp. 334-337

Number

Specific Outcomes	Suggestions for Teaching and Learning
It is expected that students will: **4N6 Continued ...** **Achievement Indicators:** *4N6.6 Refine personal strategies to increase their efficiency.*	Students have used various multiplication strategies throughout this unit. Brainstorm with them to make a list of the various strategies they have used. It is important that they have a conceptual understanding of multiplication and not be taught to simply follow a given set of steps to obtain a product. Teachers can now challenge students to solve problems using strategies of their choice. It is important to create an atmosphere where students are comfortable sharing their strategies and in which all responses are valued. Students should be reminded when they use a strategy they must be able to explain it.
4N6.2 (Continued) Solve a given multiplication problem and record the process.	Communication is an important part of mathematics learning and should always be encouraged. When students are encouraged to communicate their reasoning to others, they learn to be clear and to make connections. Likewise, as they listen to others, they develop their own understandings.
	In Grade 4, written communication has to be nurtured from pictures to writing words and symbols throughout all mathematics learning. This should become more elaborate with a sense of providing a sequence and some details to the reader. Remind students that when explaining their thinking, whether orally or in writing, they should use words such as *first, then, after, next*, etc.
	Students should also be given time to reflect on their communication, asking questions such as "Did I include enough detail? Did I clearly explain my thinking?" They will require time to further develop their answers. This will allow them an opportunity to create the best possible response.
4N6.7 Create and solve a multiplication problem that is limited to 2- or 3-digits by 1-digit.	Students should have many opportunities to create and solve word problems for the purpose of answering contextual questions, preferably choosing topics of interest to them. These opportunities provide students with a chance to practice their computational skills and clarify their mathematical thinking. Encourage students to use graphic organizers to organize their thinking. Teachers should model this process before asking students to create problems independently.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to communicate their thinking as they solve the following problems in three different ways. They may use base ten blocks, the distributive property, arrays, algorithms, or other personal strategies.

  (i) Tell students that for a school assembly, 9 rows of 38 chairs have been placed in the gym. Ask them if there are enough chairs for 370 students? Ask them to explain their thinking.

  (ii) Julia enjoys writing. She wrote 4 short stories with 289 words in each story. How many words did she write?

  (iii) Tell students that a family has planned a trip to Florida. The last time they went, their son saved $125. This year he saved three times as much money. How much spending money did he save this year?

  <div align="right">(4N6.1, 4N6.2, 4N6.4, 4N6.6)</div>

- Ask students to create and solve a realistic problem that includes the factors 6 and 329.

  <div align="right">(4N6.2, 4N6.7)</div>

Performance

- Provide students with problems such as the following in which they choose a strategy, solve the problem and explain why they chose that particular strategy.

  (i) Patrick made 44 oatmeal cookies from one package of mix. He used 3 packages of mix. How many cookies did Patrick make?

  (ii) Sue needs 25 beads to make a necklace. She wants to give one to 6 of her friends. How many beads does she need?

  (iii) The school had a recycling blitz to raise money for the breakfast club. They collected 6 bags with 134 beverage containers in each. How many containers did they collect in all? If they are given 6 cents for each container, how much money will they raise?

  <div align="right">(4N6.1, 4N6.2, 4N6.6)</div>

Interview

- Conduct interviews with students to determine their abilities to use personal strategies when solving one of the above multiplication problems. During the interview, record observations about how each student applies personal strategies and also their confidence in solving the problem.

  <div align="right">(4N6.6)</div>

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 9:
Choosing a Method for Multiplying
4N6 (6.1, 6.2, 6.3, 6.6)
TR: pp. 53-56
SB: pp. 338-340

Lesson 6:
Communicating About Solving Problems
4N6 (6.1)
TR: pp. 39-42
SB: pp. 328-329

Lesson 10:
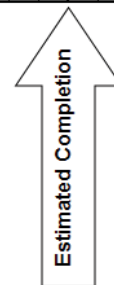Creating Multiplication Problems
4N6 (6.1, 6.7)
TR: pp. 57-59
SB: p. 341

DIVIDING MULTI-DIGIT NUMBERS

Suggested Time: 3 $\frac{1}{2}$ Weeks

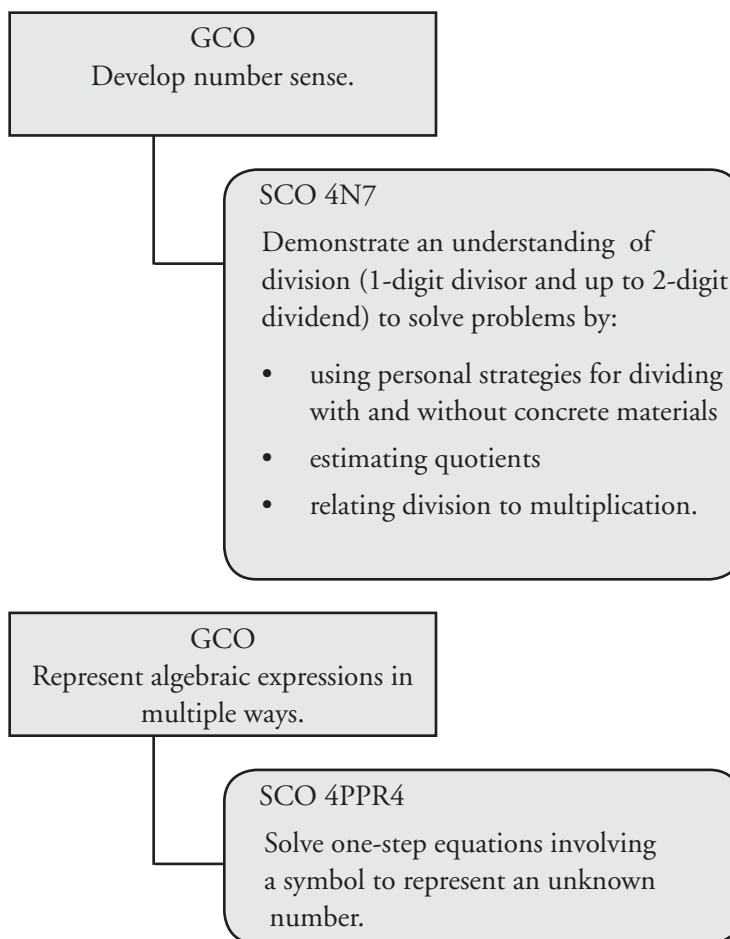| September	October	November	December	January	February	March	April	May	June

Estimated Completion

Unit Overview

Focus and Context

Previously, students developed the concept of division through studying the division facts. In this unit they will continue to develop an understanding of division by finding quotients of 2-digit whole numbers divided by 1-digit numbers. They will also continue to learn the meaning of division and how it relates to multiplication. The two different meanings of division are presented as equal sharing and equal grouping. Focus is on computational fluency with larger numbers so that students learn efficient and accurate methods of computing. This can be developed by solving problems with larger numbers that require calculation and by recording and sharing their strategies with others. Estimation plays an important role in division because it provides a tool for judging the reasonableness of an answer.

Through encounters with various problem situations, students can develop fluency in computing division problems that will be essential in real life situations. When students can create their own division problems based on contextual situations, it strengthens their understanding of the principles of division.

Outcomes Framework

> **GCO**
> Develop number sense.

> **SCO 4N7**
>
> Demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by:
>
> - using personal strategies for dividing with and without concrete materials
> - estimating quotients
> - relating division to multiplication.

> **GCO**
> Represent algebraic expressions in multiple ways.

> **SCO 4PPR4**
>
> Solve one-step equations involving a symbol to represent an unknown number.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Number		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
3N12 Demonstrate an understanding of division by: • representing and explaining division using equal sharing and equal grouping • creating and solving problems in context that involve equal sharing and equal grouping • modeling equal sharing and equal grouping using concrete and visual representations, and recording the process symbolically • relating division to repeated subtraction • relating division to multiplication (limited to division related to multiplication facts up to 5 × 5). 　　[C, CN, PS, R]	4N7 Demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by: • using personal strategies for dividing with and without concrete materials • estimating quotients • relating division to multiplication. 　　[C, CN, ME, PS, R, V]	5N6 Demonstrate, with and without concrete materials, an understanding of division (three-digit by one-digit) and interpret remainders to solve problems. 　　[C, CN, ME, PS, R, V]
Strand: Patterns and Relations (Variables and Equations)		
3PR3 Solve one-step addition and subtraction equations involving a symbol to represent an unknown number. 　　[C, CN, PS, R, V]	4PR6 Solve one-step equations involving a symbol to represent an unknown number. 　　[C, CN, PS, R, V]	5PR2 Solve problems involving single variable, one-step equations with whole number coefficients and whole number solutions. 　　[C, CN, PS, R]

Mathematical Processes

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

Number

Specific Outcomes

Students will be expected to:

4N7 Demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems by:

- **using personal strategies for dividing with and without concrete materials**
- **estimating quotients**
- **relating division to multiplication.**

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

Achievement Indicators:

4N7.1 Solve a given division problem without a remainder, using models, and connect this process to the symbolic representation.

4N7.2 Solve a given division problem with a remainder, using models, and connect this process to the symbolic representation.

4N7.3 Solve a given division problem, using a personal strategy, and record the process.

Suggestions for Teaching and Learning

Earlier this year, students explored and learned strategies to enable them to recall multiplication and related division facts up to 7×7, as well as understand and apply strategies for facts up to 9×9. In this unit, they continue to develop an understanding of division with larger whole numbers through various problem solving situations. They will also continue to learn the meaning of division and how it relates to multiplication.

In this unit, students will investigate a variety of division strategies. The expectation is that they become proficient in at least one appropriate and efficient strategy that they understand.

It is important when introducing division of two-digit dividends by one-digit divisors to use base ten materials, arrays and other concrete materials. The use of models in problem solving situations will help clarify student thinking. Present a problem-solving context, such as sharing items for party loot bags. Provide a container of small manipulatives and give each student a handful. Ask students to discuss and then share the items into the loot bags. In some cases there will be remainders. Teachers may choose to write the equation as the symbolic representation of this process but it is not the focus at this point.

Although remainders are not formally introduced until later, students may experience situations where there are remainders. The teacher may want to introduce the concept when it arises incidentally. Reference to "left-overs" in a given problem is a clue that there could be a remainder in the quotient. In cases where students discover a remainder, they should understand that the remainder must be less than the divisor. It is not intended that remainders be expressed as decimals or fractions, but as whole numbers in problem solving contexts.

Provide time for students to work with strategies to use with division of larger numbers and to use the one that works best for them. Allow them to explore before showing them particular strategies. Teachers should provide opportunities for students to discuss their strategies with classmates. Teachers could help stimulate reasoning and communication skills by asking questions such as the following:

- How did you solve that problem?
- How else could you have solved it?
- What did you like best about your partner's strategy?
- Why did your strategy and your partner's strategy result in the same answer?

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Tell students the following stories. Provide manipulatives and ask students to solve the problem. They should explain their strategies.

  (i) There were two cartons in the refrigerator with a dozen eggs in each, plus three extra eggs in the holders in the fridge door. Mom liked to eat an omelette each day and used two eggs in each omelette. How many days could she make omelettes before she had to buy more eggs?

  (ii) An apple tree owner wanted to give away the apples that fell from his tree. He offered 3 apples to each child who helped collect them. If 50 apples fell to the ground, how many children would get free apples? Will there be any apples left over?

  (4N7.3)

- Ask students to use a model to explain to a classmate how to share 86 marbles among 5 people.

  (4N7.1, 4N7.2)

- Roll two dice to create a two-digit dividend. Arrange the order of the digits so that when divided by 7, it will give you the lowest remainder. Record the remainder after each play, and total the score after 5 plays. Lowest score wins the game.
  (E.g., if you roll a 5 and a 6, decide if the dividend will be 56 or 65. $56 \div 7 = 8$ R0, and $65 \div 7 = 9$ R2, so I'll record 0 as my score.)

  (4N7.2)

Paper and Pencil

- Present the following story to students: Timothy bought a package of 50 dog treats to be shared equally among his 4 Labrador Retrievers. Joey bought a package of 40 treats to be shared among his 3 Dalmatians. Ask students which dogs received the most treats - the Labrador Retrievers or the Dalmatians. Ask them to use square tiles or draw arrays to solve the problem. Ask them if any treats were left over.

  (4N7.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Exploring Division
4N7 (7.1, 7.2, 7.4)
TR: pp. 12-14
SB: p. 350

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit9.html

- Enrichment activities

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

4N7 Continued ...
Achievement Indicators:

4N7.4 Solve a given division problem by relating division to multiplication.

One of the strategies for solving division problems is to use multiplication. Review related facts for multiplication and division. Fact families were discussed in the Multiplication and Division Facts unit. Remind students how they used counters to model division and then related it to multiplication. Students can model 21 divided by 3, for example, by grouping 21 counters into groups of 3. $21 \div 3 = 7$ and the related multiplication fact is $3 \times 7 = 21$. Previous work based on facts up to 9×9 will now be extended as students divide two-digit numbers where quotients can be greater than 9.

To demonstrate to students they can use this relationship to solve division problems with larger numbers involving a one- or two-digit dividend, present the following problem:

Andre collected 57 dollars in 3 days. If he collected the same amount of money each day, how much was his daily collection? Use multiplication to find the answer.

Guide students through a class discussion. First ask them to represent this as a division sentence ($57 \div 3 = \square$) and then a related multiplication sentence ($3 \times \square = 57$). Ask students to think about some multiplication facts they already know and how these facts can help them solve the multiplication sentence. Possible student responses could include:

- I know that $3 \times 10 = 30$. I will double that to get $3 \times 20 = 60$. Because 57 is a little less than 60, my answer should be a little less than 20. I will try 3×19.
- I know $3 \times 10 = 30$ and $3 \times 5 = 15$. Now I have 45. I need 12 more and I know that $3 \times 4 = 12$. So, $10 + 5 + 4 = 19$.
- I know that $3 \times 10 = 30$. That leaves me with 27 and I know $3 \times 9 = 27$. I know $10 + 9 = 19$, so $3 \times 19 = 57$.

4N7.3 (Continued) Solve a given division problem, using a personal strategy, and record the process.

Using subtraction is another strategy to solve division problems. This can be represented on a number line. Students will subtract groups of numbers from the dividend to reach a quotient which may be larger than 9. Ask students to represent the equation $45 \div 3 = 15$ on a number line. Students may begin to use repeated subtraction on a number line as shown below:
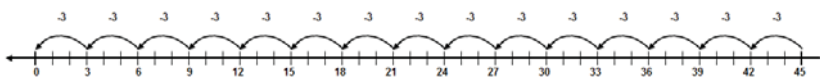
General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to solve the following division problems by using multiplication:
    - (i) You travel 84 km in 3 days. If you travel the same distance each day, how far do you travel each day?

    - (ii) You have 76 flowers to put into bouquets of 8 flowers each. How many bouquets can you make with these flowers?

    - (iii) 60 students were going on a bus to the museum. If 3 students could fit on each seat, how many seats are needed for the whole group?

        (4N7.5)

Interview

- Ask the student to explain how to use multiplication to solve the following: A family of 4 has 60 free text messages each month to share equally. How many text messages would be available to each family member?

    (4N7.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 2:
Relating Division To
Multiplication
4N7 (7.2, 7.5)
TR: pp. 15-17
SB: p. 351

Lesson 3:
Using Subtraction to Divide
4N7 (7.2, 7.3, 7.4)
4PR6 (6.3)
TR: pp. 18-21
SB: pp. 352-355

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N7 Continued ...
Achievement Indicators:

4N7.3 (Continued) Solve a given division problem, using a personal strategy, and record the process.

4N7.1 (Continued) Solve a given division problem without a remainder, using models, and connect this process to the symbolic representation.

4N7.2 (Continued) Solve a given division problem with a remainder, using models, and connect this process to the symbolic representation.

4N7.5 Create and solve a division problem involving a 1- or 2-digit dividend, and record the process.

Suggestions for Teaching and Learning

Students should soon realize that choosing greater numbers to subtract will help them solve the problem more quickly.
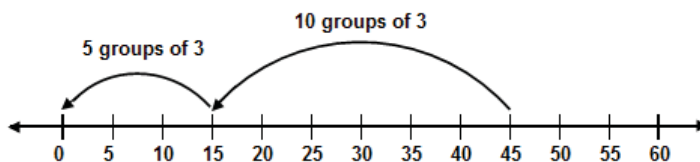
It is important that students represent the division symbolically as they work through the process in this strategy.

Students will encounter situations involving remainders. Explain to them that a remainder is the amount left over after a number is divided into a whole number of equal parts. It is the amount remaining after division when there are not enough to make another group. It is always smaller than the divisor. For example:

57 hula hoops were available for use in a relay race. If they were shared among 4 teams, how many would each team get? How many hula hoops were left over?

$$57 \div 4 = 14 \text{ R1}$$

Students should continue to create and solve problems for the purpose of answering questions related to real-life situations and personal interests. Ask them, individually or in pairs, to create division problems about situations in the classroom. They can post their problems around the room and invite classmates to solve them.

General Outcomes: Develop number sense.

Suggested Assessment Strategies

Interview

- Tell students that (Insert name of your school) has collected 85 "VOCM Coats for Kids" and is packaging 5 coats in each bag. Ask them how many bags will be needed.
  Students should draw a number line showing division involving subtraction. Ask them to justify the size of group they chose to subtract, in order to solve the problem. If smaller groups were chosen, ask them if the problem could have been solved using larger groups, and therefore fewer steps. (4N7.2)

Paper and Pencil

- Ask students to use repeated subtraction to solve the following division problem:

  Melanie has 95 cents in nickels. How many nickels does she have?
  (4N7.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Using Subtraction to Divide
4N7 (7.2, 7.3, 7.4)
4PR6 (6.3)
TR: pp. 18-21
SB: pp. 352-355

Patterns and Relations (Variables and Equations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	

4PR6 Solve one-step equations involving a symbol to represent an unknown number.
[C, CN, PS, R, V]

Teachers should continue to model examples of division equations involving symbols. It is important that students encounter equations with the unknown quotient being on the left or right side of the equation.

Achievement Indicator:

4PR6.3 Solve a given equation when the unknown is on the left or right side of the equation.

Present students with equations that progress in difficulty. For example:

- $20 \div 4 = \square$ or $\square = 20 \div 4$
- $55 \div 8 = \square$ or $\square = 55 \div 8$

Students should also solve problems such as:

5 friends share 64 friendship bands. How many bands does each friend get?

Ask students to represent this problem as an equation with an unknown and then solve the problem. Write all parts of the equation on cards and discuss with students how they can be arranged differently and still be true. This is a good opportunity for teachers to model correct mathematical language (equation, dividend, divisor and quotient).

4N7 Continued ...
Achievement Indicator:

4N7.3 (Continued) Solve a given division problem, using a personal strategy, and record the process.

Another personal strategy that students may choose when dividing larger dividends is 'renaming' the dividend. Students should be encouraged to choose numbers that relate to multiplication and division facts they already know when renaming numbers to solve a division problem. The efficiency of this strategy depends on the students' number sense and may require practice in renaming numbers so that they are easily divided by 1-digit divisors. Modeling this division process using base ten blocks will be important in implementing this strategy. For example:

A bag has 92 jelly beans, and Andrea and her three friends want to share them equally. How many jelly beans will the four girls get?
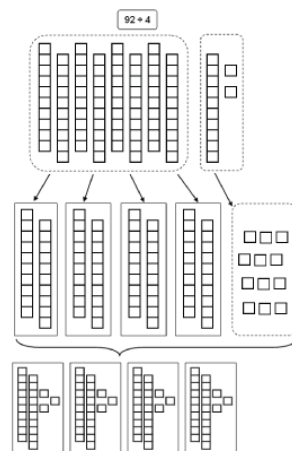
$92 \div 4$
Rename as $(80 + 12) \div 4$

$(80 \div 4) + (12 \div 4)$ The rods are shared among 4 groups. When there are no more rods to share equally, the last rod is regrouped to make 10 units. Next the 12 units are shared equally.

$20 + 3$
23

# General Outcome: Represent algebraic expressions in multiple ways.

Suggested Assessment Strategies

Paper and Pencil

- Ask students to create a problem that can be represented by the number sentence: $\Delta = 64 \div 4$. They should use a number line and repeated subtraction to solve the problem.

  (4N7.3, 4PR6.3)

- Ask students to use two different strategies to calculate $48 \div 4$.

  (4N7.1, 4N7.2)

Performance

- Students could work in pairs, with each pair given a set of 10 cards including various 2-digit dividends, 1-digit divisors, an equal sign, a division sign and a symbol to represent the unknown quotient (as shown below). Distribute cards and ask students to use them to represent a division sentence in two different ways, and solve the equation. Remind students that for this task the unknown will be the quotient. Students should record their answers with the unknown on the left and the right of the equal sign.

  | 4 | 5 | 7 | 42 | 36 |

  | 53 | 92 | = | ÷ | □ |
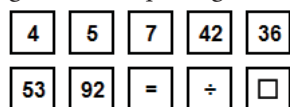
  Ask students to choose one of the equations and create a contextual problem.

  (4PR6.3, 4N7.2, 4N7.3, 4N7.5)

Interview
- Ask students how to use $82 = 40 + 40 + 2$ to calculate $82 \div 4$?

  (4N7.1, 4N7.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Using Subtraction to Divide
4N7 (7.2, 7.3, 7.4)
4PR6 (6.3)
TR: pp. 18-21
SB: pp. 352-355

Lesson 4:
Dividing by Renaming
4N7 (7.1, 7.2, 7.4)
4N6 (6.3, 6.6)
TR: pp. 22-24
SB: pp. 356-357

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit9.html

- Interactive White Board activity for division

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4N7 Continued ...** **Achievement Indicators:** *4N7.2 (Continued) Solve a given division problem with a remainder, using models, and connect this process to the symbolic representation.* *4N7.6 Estimate a quotient, using a personal strategy.*	Students need to make sense of the remainder conceptually, as well as how to account for the remainder symbolically, when using a division algorithm. • Four students wanted to share 46 marbles equally. Students should state the answer as "11 Remainder 2", or record it as $46 \div 4 = 11$ R2, because each person would get 11 marbles and there would be 2 marbles left over. • When dividing 93 by 5, the 93 can be renamed as $45 + 45 + 3$ because we know that 45 is divisible by 5. $$45 \div 5 + 45 \div 5 + 3$$ $$= 9 + 9 \text{ R}3$$ $$= 18 \text{ R}3$$ Students will encounter situations where accuracy is important and other situations where an estimate is preferable. Knowledge of multiplication facts and the use of predicting skills will help students provide a reasonable estimate for a division problem. This will make for closer and more reasonable estimates. Remind students when estimating, they may need to change one or both numbers such that familiar multiplication and division facts can be used. For example: • $43 \div 5$ is about $45 \div 5 = 9$ or $43 \div 5$ is about $40 \div 5 = 8$ • $33 \div 8$ is about $36 \div 9 = 4$ or $33 \div 8$ is about $28 \div 7 = 4$ As students explore estimating divisors and dividends they will observe that they have different effects on the problem's outcome. There may be different answers to the same problem. It is important for teachers to accept student answers if they can justify their strategy. The goal is for students to become comfortable estimating to the point that they automatically estimate in any problem situation. Students should continuously check the reasonableness of their answers as they work through the problem solving process.

General Outcome: Develop number sense.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Group students into pairs to play *Highest Quotient Game*. Provide a deck of division equation cards of varying difficulty. Students:
  (i)   randomly select three division cards each
  (ii)   keep only two of the cards, and return one to a discard pile
  (iii) find the quotient on each fact card
  (iv)   add quotients together (disregard any remainders)

  The player with the highest total receives a point. Play continues until one player receives 10 points. Ask students to choose one turn (showing the three equations) and share strategies used in how they decided which card to place back in the discard pile.

  (4N7.2)

- Provide a list of division questions to pairs of students and ask them to do the following:
  (i)   estimate a quotient
  (ii)   explain their strategy to their partner
  (iii) tell whether or not the estimate is too high or too low, and why.
  (4N7.6)

- Give students various division problem stories. Ask them to estimate and explain their reasoning:

  (i)   Jason rode his bicycle every day for 8 days. He cycled 68 km in total. About how far did he ride each day?

  (ii)   98 parents were expected to attend the school's "Volunteer Appreciation" luncheon. About how many packs of 8 muffins should be purchased to ensure there are enough to serve all of the guests?

  (4N7.6)

Interview

- Ask students to explain:
  (i)   how they know that $89 \div 10$ is about 1 more than $79 \div 10$.
  (ii)   how they know that $79 \div 9$ is about 1 less than $89 \div 9$.

- Ask students to describe a situation in which someone might want to estimate $67 \div 7$.

  (4N7.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 4:
Dividing by Renaming
4N7 (7.1, 7.2, 7.4)
4N6 (6.3, 6.6)
TR: pp. 22-24
SB: pp. 356-357

Lesson 5:
Estimating Quotients
4N7 (7.2, 7.6)
4N6 (6.3, 6.6)
TR pp. 29-32
SB pp. 360-363

Math Game:
3 Card Quotient
4N7
TR: p. 33
SB: p. 363

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4N7 Continued ...

Achievement Indicators:

4N7.1 (Continued) Solve a given division problem without a remainder, using models, and connect this process to the symbolic representation.

4N7.2 (Continued) Solve a given division problem with a remainder, using models, and connect this process to the symbolic representation.

4N7.3 (Continued) Solve a given division problem, using a personal strategy, and record the process.

Suggestions for Teaching and Learning

Previously, students have had experience solving division problems in different ways. Although students will now focus on a method much like the standard algorithm and using base ten blocks to divide, no one method is superior to another. The use of concrete materials will help students visualize what they doing when they divide using the algorithm. Without concrete materials, students often encounter difficulty understanding why the algorithm works and they learn it as a meaningless procedure, often requiring reteaching. Demonstrate division using base ten materials to solve problems with and without remainders. It is essential that students be given ample time to practice this until they develop a clear understanding. For example:

Peter has a bag of 52 jelly beans. He is planning on sharing them equally with his three friends. How many jelly beans will Peter and each of his friends get?

Begin by asking students to estimate and record the number of jelly beans each person will receive. Using base ten blocks to represent 52, the rods are shared equally. When there are not enough rods left to share equally, the one remaining rod is regrouped as 10 units, making a total of 12 units to be shared equally among the 4 children. In total, each child will get 13 jelly beans.
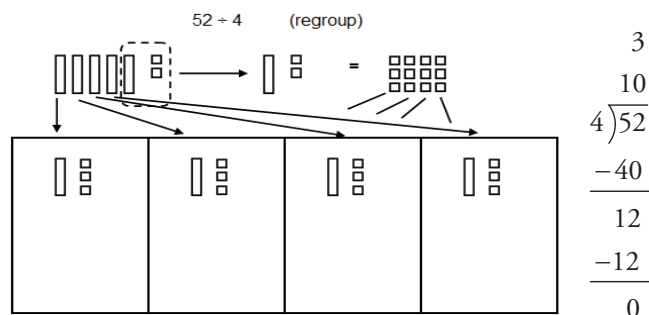
As the teacher demonstrates the dividing by sharing, the process should be recorded symbolically to help students make the connection between the concrete and the symbolic representation. Students should be encouraged to check the answer by comparing it to the estimate made prior to completing the problem. They can also check the answer by multiplying the quotient by the divisor and adding the remainder (if there is one) to arrive at the dividend.

Encourage students to use correct mathematical language when solving division problems (e.g., regroup, trade or exchange, place value terms such as hundreds, tens and ones, product, quotient, remainder, divisor and dividend).

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Ask students to answer the following:

  (i) Andre collected $57 in three days. If he collected the same amount of money each day, how much was his daily collection? Make an estimate. Represent the problem using base ten materials and record the process symbolically.

  (ii) The school custodian needs to place an order for fluorescent light bulbs for his school. If they come in packages of six, how many packages will he need to buy if he needs 89 lights? Will he have any light bulbs left over to go towards his next order? If so, how many? Use base ten blocks to help you solve the problem.

  (iii) You have 98 beads to make four necklaces. If each necklace has the same number of beads, how many beads are on each necklace? Will any beads be left over? If so, how many? Represent the problem using base ten blocks.

  (4N7.1, 4N7.2, 4N7.4)

- Provide a set of base ten blocks. Ask students to model three different division questions and write the division sentence for each.

  (4N7.1, 4N7.2, 4N7.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Dividing by Sharing
4N7 (7.1, 7.2, 7.4, 7.6)
4N6 (6.3, 6.6)
TR: pp. 34-36
SB: pp. 364-366

Note

This lesson shows an algorithm which is very close to the 'traditional algorithm'. Consider extending this to the traditional algorithm since the traditional algorithm for division is typically familiar to parents and allows them to help their children at home.

Curious Math (optional):
Remainder Magic
TR: p. 37
SB: p. 367

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

4N7 Continued ...

Achievement Indicators:

4N7.5 (Continued) Create and solve a division problem involving a 1- or 2- digit dividend, and record the process.

4N7.3 (Continued) Solve a given division problem, using a personal strategy, and record the process.

4N7.7 Refine personal strategies to increase their efficiency.

In a "Guess and Test" strategy, a student guesses an answer to a problem, then tests it to see if the "guess" works. If it doesn't, the student revises the "guess" based on what was learned and tries again. This repetitive process continues until the answer is found. Although we often talk about guessing as bad, this strategy reinforces the value of taking risks and learning from the information that is garnered. (Small , 2008)

Students should be encouraged to use diagrams, counters, multiplication tables, arrays, and base ten blocks to help them work through possible answers. Organized lists also help students to keep track of guesses so they are not repeated.

Present the following problem to students and ask them to read it orally. Base ten materials should be available.

Jerry is given 8 mL of medicine by a doctor. The doctor then gives him a prescription for 76 mL of the same medicine. If Jerry takes 8 mL of medicine each hour, how many hours will pass before all the medicine is gone?

Use the following to guide thinking if necessary:
- State the problem in your own words.
- What do each of the numbers in the problem represent – whole, the number of groups or the quantity in each group?
- What is the unknown in the problem – whole, the number of groups or the quantity in each group?
- What number sentence could you write to show the meaning of the problem?
- About how many hours will pass before the medicine is all gone? Explain your thinking.
- Will any medicine be left over? Explain.
- Use a strategy that makes sense to you to find the answer to the problem. Explain your thinking as you write the numbers.
- Explain how you know your answer makes sense and is reasonable.
- Would you solve the problem another way? Explain your thinking.

General Outcome: Develop number sense.

Suggested Assessment Strategies

Performance

- Tell students that all Grade 4 classes collected the same number of recyclables for the school's Recycling Blitz. Together, they collected 90 recyclables. How many Grade 4 classes could there be in the school? Give 3 possible solutions for your problem.

  (4N7.2)

- Ask students to create a problem that could be solved by guessing and testing. They should solve their problems.

  (4N7.2, 4N7.3)

- Ask students to guess and test to find all possible answers to this problem:

    The same digit is missing for both symbols. What is it?

    $$4\underline{} \div 8 = 5\,R\,\underline{}$$

  (4N7.2)

- Ask students to use guessing and testing to find the answer to this problem: What 2 numbers have a product of 20 and a quotient of 5?

  (4N7.2)

- Tell students that Christopher had between 60 and 70 hockey cards in his collection. He can package them equally in either groups of 2, 4 or 8. How many cards does he have? Use the guess and test strategy to help solve your problem. Explain your solution.

  (4N7.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 7:
Solving Problems by Guessing and Testing
4N7 (7.2, 7.3, 7.6)
TR: pp. 38-39
SB: pp. 368-370

Math Game:
Remainder Hunt
4N7
TR: p. 41
SB: p. 371

MEASUREMENT

Suggested Time: 3 Weeks

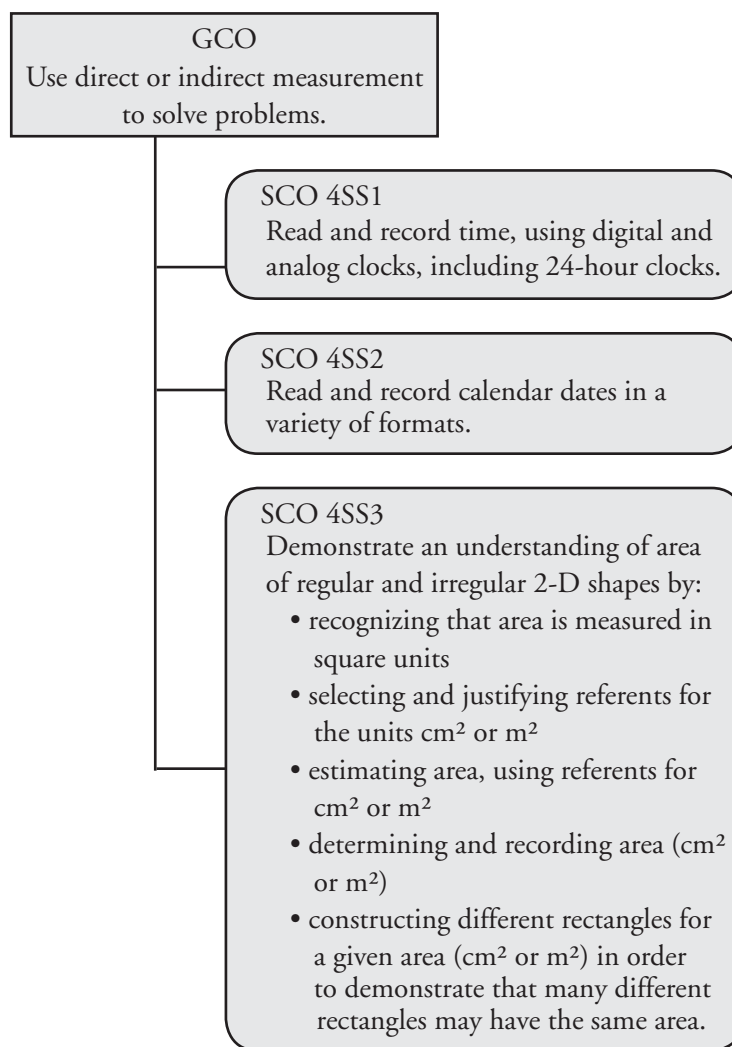| September	October	November	December	January	February	March	April	May	June

Estimated Completion
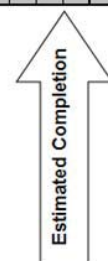
Unit Overview

Focus and Context

Measurement is an essential link to many areas of the mathematics curriculum. Measurement permeates many areas of life including careers and everyday living. In its simplest form it merely attaches a number to some attribute of an object and it increases in it's breadth and depth as students move on through the curriculum. Students must learn proficiency in choosing and using measurement tools. Although measurement is the focus of this unit, it is also relevant in other areas of the mathematics curriculum, as well as everyday experiences.

Outcomes Framework

GCO
Use direct or indirect measurement to solve problems.

SCO 4SS1
Read and record time, using digital and analog clocks, including 24-hour clocks.

SCO 4SS2
Read and record calendar dates in a variety of formats.

SCO 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 cm² or m²
- estimating area, using referents for cm² or m²
- determining and recording area (cm² or m²)
- constructing different rectangles for a given area (cm² or m²) in order to demonstrate that many different rectangles may have the same area.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Shape and Space (Measurement)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**

3SS1 Relate the passage of time to common activities, using nonstandard 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]
 	
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]
	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]
	
	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 cm² or m²
	  • estimating area, using referents for cm² or m²
	  • determining and recording area (cm² or m²)
	  • constructing different rectangles for a given area (cm² or m²) in order to demonstrate that many different rectangles may have the same area.
	    [C, CN, ME, PS, R, V]
		5SS1 Design and construct different rectangles, given either perimeter or area, or both (whole numbers), and make generalizations.
		    [C, CN, PS, R, V]
		
		5SS2 Demonstrate an understanding of measuring length (mm) by:
		  • selecting and justifying referents for the unit mm
		  • modelling and describing the relationship between mm and cm units, and between mm and m units.
		    [C, CN, ME, PS, R, V]
		
		5SS3 Demonstrate an understanding of volume by:
		  • selecting and justifying referents for cm³ or m³ units
		  • estimating volume, using referents for cm³ or m³
		  • measuring and recording volume (cm³ or m³)
		  • constructing right rectangular prisms for a given volume.
		    [C, CN, ME, PS, R, V]
		
		5SS4 Demonstrate an understanding of capacity by:
		  • describing the relationship between mL and L
		  • selecting and justifying referents for mL or L units
		  • estimating capacity, using referents for mL or L
		  • measuring and recording capacity (mL or L).
		    [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

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS1 Read and record time, using digital and analog clocks, including 24-hour clocks.
[C, CN, V]

Achievement Indicators:

4SS1.1 State the number of hours in a day.

4SS1.2 Express time, orally and in writing, from a 12-hour analog clock.
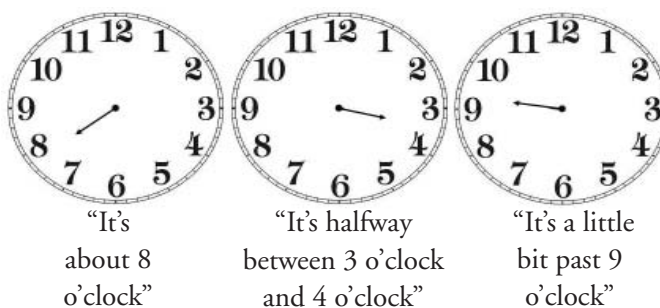
Suggestions for Teaching and Learning

Time can be represented using a linear model such as a timeline. Although time is actually linear because nothing repeats, descriptions of time with words such as days, weeks, months and years describe cycles. A time circle can be used to show the cyclical nature when describing time. Use a digital/analog clock throughout the year to strengthen students' understanding of time.

It is possible that many students have previously been exposed to reading and recording time. This is the first time, however, that students will formally work with analog clocks. Analog clock reading should begin with a focus on hours only.

While time is often described using the 12-hour clock, students should realize that there are 24 hours in a day. Although the world has become increasingly digital, there are still many analog clocks in use. Students should learn to tell time on 12-hour analog and digital clocks. Telling time on 24-hour analog and digital clocks will be discussed later.

To introduce students to the number of hours in a day, teachers could discuss and record events that occur throughout a 24-hour period, from 12:00 midnight until 12:00 midnight. It will be necessary to discuss when a day officially begins and ends as compared to when a student day begins and ends.

Teachers could use a one-handed clock to help students understand and read analog clocks. Remove the long hand from an old clock and set the short hand in varying places as shown below. Use language such as:

"It's about 8 o'clock" "It's halfway between 3 o'clock and 4 o'clock" "It's a little bit past 9 o'clock"

Students need to learn that whether they read the number as an hour or as minutes depends on which hand is pointing to the number. Discuss with them how the hour hand moves over the course of each hour and that the minute hand is at 6 on the half hour mark (__:30) and at 12 on the hour (_:00). They should see that the hour hand moves during the course of the hour, and when it is on the half hour mark it is halfway between two hours. A geared demonstration clock could be used, if one is available.

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

Suggested Assessment Strategies

Performance

- Students use various manipulatives to express time on an analog clock:

  (i) Teachers form a clock on the floor using a large hula hoop or piece of string. Students work in pairs. They use a metre stick for the long hand and a ruler for the short hand. One student places the hands on the clock to display a time of choice. The partner then reads and records the time shown on the clock. Switch roles and repeat. This could also be done using paper plate clocks and popsicle sticks.

  (ii) Ask two students to form a human clock, one student being the minute hand and one being the hour hand. Ask the remaining students to tell the time shown by their classmates.

  (4SS1.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Telling Time to the Hour
4SS1 (1.1, 1.2, 1.3, 1.6)
TR: pp. 12-15
SB: pp. 262-264

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/
math/grade-4/links/unit10.html

- Enrichment activities

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 4SS1 Continued ... **Achievement Indicator:** *4SS1.3 Explain the meaning of a.m. and p.m., and provide an example of an activity that occurs during the a.m., and another that occurs during the p.m.*	Students will encounter other representations of a.m. and p.m., such as AM and PM, or A M and P M [with or without periods/ capitals/lower case]. The terms 'noon' and 'midnight' may help students distinguish between 12:00 a.m. and 12:00 p.m. A good way to investigate a.m. and p.m. is to use a full-day timeline (Small, 2008) as shown below:
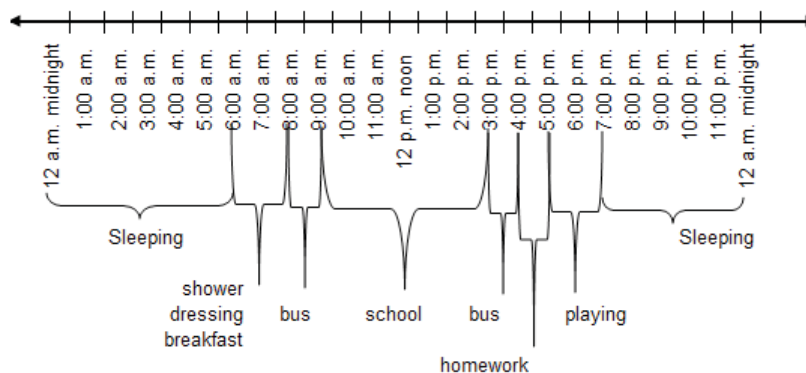
Students would benefit from ongoing practice telling time during morning/daily routines through the use of a demonstration clock. Make an overhead clock by photocopying a clock template and separate hands on transparencies. Cut out the hands and attach them with a fastener so that they are moveable. This could also be demonstrated using computer software or the Internet.

This topic allows for a cross-curricular link with Social Studies. Have a discussion with students on time zones. Ask them to research other places in the world where students could be doing p.m. activities while others are doing a.m. activities, and vice versa.

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

Suggested Assessment Strategies

Interview

- Give the following examples, asking students to indicate a.m. or p.m. for the time the activity would most likely occur.
  - (i) school team soccer practice
  - (ii) eating breakfast
  - (iii) going to a movie
  - (iv) cleaning up supper dishes
  - (v) completing homework
  - (vi) school concert

  Ask students to name an activity they would typically do in the a.m./p.m.

  (4SS1.3)

Paper and Pencil

- Ask students how they sometimes refer to 12:00 p.m. and 12:00 a.m. Ask them to write or tell about what they would usually be doing at these times.

  (4SS1.3)

Performance

- Students could track events throughout a specific day by using a timeline. They should record the time of the activity or event and place it appropriately on the timeline. Encourage them to use different colours for the a.m. and p.m. hours.
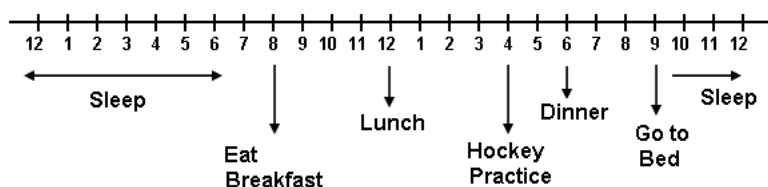
Teachers may repeat this activity by asking students to draw analog clocks, indicating the time of each event.

(4SS1.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Curious Math
4SS1 (1.3)
TR: p. 16
SB: p. 265

Suggested Resource

Making Math Meaningful to Canadian Students K-8 – Marian Small

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS1 Continued ...

Achievement Indicator:

4SS1.4 Express time, orally and in writing, as "minutes to" or "minutes after" the hour.

Suggestions for Teaching and Learning

As students begin telling time to the half hour and quarter hour, teachers could model the clock without numbers (a circle) to review fraction terms such as 'half' and 'quarter'. Add the hour numbers to the clock and introduce the terms "half past", "quarter after" and "quarter to".

Provide an open space for creative movement where children can sit on the floor and then arrange themselves to represent the numbers and hands on a clock. Once they have physically arranged themselves, ask them to show various times on a clock. For a student to relate 8:15 to 'a quarter past 8', they would need to know that 15 minutes is $\frac{1}{4}$ of 60 minutes.

Time after the hour and time before the hour should be addressed. For example, 8:45 might be spoken as "eight forty-five", "forty-five minutes past eight", "quarter to nine", or "fifteen minutes to nine". For times past the half hour mark, however, it is more common to say, "quarter to nine", than "forty-five minutes past eight". As students work in pairs, ask one student to say a time and the other student to make the time on a clock and say it in a different way.

Students will also read and record clock times to the 5-minute marks. Provide a clock that shows the numbers from 1-12 and the minute intervals from 5-55 beside each number. As students establish a comfort level with skip counting by 5, this will enable them to read time to the nearest five minutes. This provides students with an opportunity to relate the numbers on a clock to time. Students may be familiar with the 'clock strategy' as one mental math strategy for learning multiplication of 5× facts.

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

Suggested Assessment Strategies

Paper and Pencil

- Prepare a page of analog clock faces with an hour hand only. Include times that are approximately a quarter past the hour, a quarter to the hour, half past the hour and some that are close to, but not on the hour. Ask students to draw a minute hand on each clock where they think it might be.

(4SS1.2, 4SS1.3)

Interview

- Display a clock as shown and ask students:
    (i)   Where is the hour hand?
    (ii)   What does that tell you?
    (iii) How much after 3:00 is it?
    (iv)   How do you know?

(4SS1.2, 4SS1.4)

Performance

- In pairs, students play 'Clock Bingo'. Each partner has a blank analog clock and a set of game pieces which are placed face down on the table. Player 1 picks a game piece, reads it aloud and glues or places it where he/she thinks it belongs. Player 2 has a turn. If a piece selected is already on the playing board, the player returns it to the table and the next player's turn begins. Continue until one player's clock places are filled. Teacher checks the clock to determine the winner.
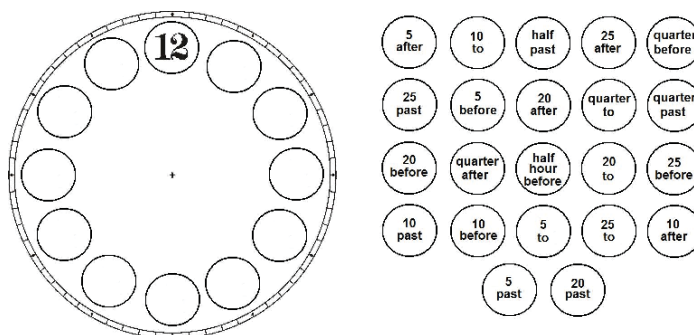
(4SS1.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 2:
Time to the Hour and Quarter Hour
4SS1 (1.2, 1.4, 1.6)
TR: pp. 17-19
SB: pp. 266-267

Lesson 3:
Telling Time to 5 Minutes
4SS1 (1.2, 1.4, 1.6)
TR: pp. 20-22
SB: pp. 268-270

Note

Lessons 2 and 3 may be addressed together.

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

4SS1 Continued ...

Achievement Indicators:

4SS1.4 (Continued) Express time, orally and in writing, as "minutes to" or "minutes after" the hour.

4SS1.5 Express time, orally and in writing, from a 12-hour digital clock.

4SS1.6 Solve problems related to time, including elapsed time.

Teachers can now extend learning beyond the five minute intervals, by introducing students to expressing time to the minute. Using the analog clock, start at 12 and together count each minute around the clock.

Discuss how the long hand on the 2, for example, represents 10 minutes. Therefore, three 1-minute spaces past the 2 is 13 minutes. As students express time, encourage them to first look to the hour hand to predict an approximate time, and then to the minute hand for precision.

Ask students to think about some different kinds of clocks or watches they have seen. Students find it easier to 'read' times from a digital clock but it is important to talk about the meaning of the times they are reading. Using an analog and a digital clock together may help with this. Having a real digital clock available for students to manipulate would be beneficial.

Reading a clock, or 'telling time' is more about reading an instrument. Time as a measurement, however, encompasses duration. For students to make sense of the concept of time, they need to understand that time, as a measurement, is about how long an event takes from beginning to end. This is called *elapsed time*. Elapsed time can be found only by counting the hours and minutes between the start and the end times.

Provide a context, such as a birthday invitation, in which students can discuss elapsed time. Ask students to look at the start and end times. Provide a 4-column chart and model how to use it to record the event - its start and end times and the elapsed time. Extend the chart by brainstorming a list of student activities. Students may wish to refer to a timeline used earlier or clock manipulatives. Invite students to share their charts and then discuss the strategies they used to determine the elapsed time.

 Using an inexpensive wrist watch (digital, analog, or 24-hour), teachers assign each student a day to wear the watch at home. This may be modified by having the student wear it during the school day. Give the student a recording sheet as shown below.

Activity	Start Time	End Time	Elapsed Time
reading	6:00	6:40	40 minutes

During daily routines, the student could present one recorded activity. (e.g., start and end time of reading). Ask students to tell how much time had elapsed and show or tell how they knew.

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

Suggested Assessment Strategies

Paper and Pencil

- Using an index card, ask students to create a word problem involving elapsed time. Then trade their cards with other students to have them solve the problem. (4SS1.6)

Interview

- The teacher shows a time on an analog or digital clock and asks students to express it orally and in writing. For example, 2:10 can be expressed as "two ten" or "ten minutes past two."
  Consider:
  (i) 5:03 might be expressed as "3 minutes after 5"
  (ii) Can students express 7:40 as "twenty minutes to eight"?
  (iii) How would "10 minutes to 8" be written?
  (iv) Would students know that 7:57 means "nearly 8:00?"

  (4SS1.2)

- Using two clocks, one with the minute hand removed leaving only an hour hand and one with two hands, cover the two-handed clock and periodically throughout the day, direct attention to the other one-handed clock. Have students predict where the minute hand should be and then uncover the two-handed clock and check. Ask students what time it might be if:
  (i)   the minute hand is pointed to an area between 4 and 5.
  (ii) the hour hand and minute hand are both pointed directly at a number.

  (4SS1.4)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 4:
Telling Time to 1 Minute
4SS1 (1.2, 1.4, 1.5, 1.6)
TR: pp. 24-27
SB: pp. 272-275

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS1 Continued ...

Achievement Indicator:

4SS1.6 (Continued) Solve problems related to time, including elapsed time.

4SS1.7 Express time, orally and in writing, from a 24-hour analog clock.

4SS1.8 Express time, orally and in writing, from a 24-hour digital clock.

Suggestions for Teaching and Learning

There are many opportunities throughout the school day for students to think about the duration of short and long events that can be measured in minutes and hours. Teachers should refer to the class clock frequently throughout the day and ask questions such as, "What time will it be in 20 minutes?" or "Our math class started at 9:30. How long did it last?"

Display a one-handed or two-handed analog clock or a digital clock. Ask students to read and record the time on an index card or small white board and hold it up for the teacher to see. Teachers may:

- show a one-handed clock and ask students to record approximate time, numerically or in words
- show a digital display and ask students to write the time using words
- show a two-handed analog clock and ask students to write time in words and/or numbers

The 24-hour clock is a system used for telling time in which the day runs from midnight to midnight and is numbered from 0 to 23.

The 24-hour clock eliminates uncertainty as there is only one 11:32, for instance, during the day. Students may have encountered everyday life situations where the 24-hour clock is used if they have traveled on flights and ferries. It is also used in the practice of medicine because it helps prevent confusion about important events in a patient's daily care. This system is sometimes referred to as 'military time'. Ask students why using a 24-hour clock in the military would be important. In the 24-hour notation, a time of day is written in the form hh:mm (e.g., 22:30). Discuss with students why it is necessary to place a zero at the beginning of times less than 10 (e.g., 8:00 is 12-hour and 08:00 is 24-hour).

Teachers could decide to leave work with the 24-hour clock until the end of the unit to ensure students have mastered the 12-hour clock.

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

Suggested Assessment Strategies

Performance

- Make clocks available (students may make their own using a paper plate). At various times during the day, preferably on the hour or half hour, ask questions regarding elapsed time. Students will then simultaneously raise their clocks to show the time. Some examples include:

  (i) 2 hours from now.

  (ii) $4\frac{1}{2}$ hours from now.

  (iii) 12 hours from now.

  (iv) 10 minutes ago.

  (v) 2 hours ago.

  (vi) $1\frac{1}{2}$ hours ago.

  (4SS1.2, 4SS1.4, 4SS1.6)

- Ask the student to move the hands of an analog clock to match the time shown on a digital clock. Ask students to express the time that has been created on a 12-hour analog clock, 24-hour analog clock, and 12-hour digital clock orally and numerically.

  (4SS1.7)

- Ask students to work in pairs to set up a schedule, using the 24-hour clock, in which every student will get 30 minutes computer time, starting at 10:00. Ask:

  (i) Can all students in our class have computer time before noon, and if not, how long will it take to finish after lunch?

  (ii) What time will the last student finish? (Remind them to leave time for recess.)

  (4SS1.6)

Interview

- Discuss when a 24-hour clock would be more appropriate to use than a 12-hour clock.

  (4SS1.5, 4SS1.7, 4SS1.8)

- Ask students what they might be doing when the clock reads 15:00. 02:00?

  (4SS1.8)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 4:
Telling Time to 1 Minute
4SS1 (1.2, 1.4, 1.5, 1.6)
TR: pp. 24-27
SB: pp. 272-275

Suggested Resource

https://www.k12pl.nl.ca/curr/k-6/
math/grade-4/links/unit10.html

- Interactive White Board activity to play a Kooshball game

Lesson 5:
Writing Dates and Times
4SS1 (1.1, 1.3, 1.7, 1.8)
4SS2 (2.1, 2.2, 2.3)
TR: pp. 28-31
SB: pp. 276-278

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **4SS2 Read and record calendar dates in a variety of formats [C, V]** **Achievement Indicators:** *4SS2.1 Write dates in a variety of formats.* *4SS2.2 Relate dates written in the format yyyy/mm/dd to dates on a calendar.* *4SS2.3 Identify possible interpretations of a given date.*	Using a calendar throughout the school year will strengthen students' sense of time. Teachers may send home a calendar of classroom/school events for students to refer to at home. The calendar also provides rich opportunities to explore number sense (4N5) and number patterns (4PR1, 4PR3). Students need to be exposed to a variety of ways dates can be recorded: • *yyyy/mm/dd* • *dd/mm/yyyy* • *dd/mm/yy* • *March 28, 2007* Writing dates in a numeric representation is faster than writing words and is often used today. Consider numeric dates, as they appear in different formats. For example, 06/03/04 could mean the 6th of March 2004 or June 3rd, 2004 or March 4th, 2006. Ask students to discuss situations in which problems could occur using the different formats. Acknowledge examples such as school registration forms, newspapers, receipts and cheques. On an ongoing basis, encourage students to date their work in different formats. Provide opportunities for students to read numeric dates. For example, display 2012/06/23 and ask them to circle the corresponding date on a calendar. Repeat for other dates.

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

Suggested Assessment Strategies

Paper and Pencil

- Provide a chart such as the one shown, with some of the times missing and ask students to fill in the empty spaces.

24 hour clock	12 hour clock
00:00	12:00 a.m. 12 midnight (start of day)
01:00	1:00 a.m.
02:00	2:00 a.m.
03:00	3:00 a.m.
	4:00 a.m.
	5:00 a.m.
06:00	
07:00	
08:00	
	9:00 a.m.
10:00	
11:00	
12:00	
13:00	1:00 p.m.

(4SS1.8)

- Ask students to write about their favourite format for recording a calendar date and explain their choice.

(4SS2.1, 4SS2.2, 4SS2.3)

- Show the student a calendar for the year. Ask him/her to point out the day's date and have them record it using one of the formats.

(4SS2.1, 4SS2.2)

- Ask students to write their birth date using the different formats and then share with classmates.

(4SS2.1)

Performance

- Send students on a scavenger hunt and ask them to bring in different dates from magazines, posters, items printed from the Internet, cheques, and newspapers. Then share, discuss and display the variety of formats as a class.

(4SS2.1)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Writing Dates and Times
4SS1 (1.1, 1.3, 1.7, 1.8)
4SS2 (2.1, 2.2, 2.3)
TR: pp. 28-31
SB: pp. 276-278

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

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 cm² or m²**
- **estimating area, using referents for cm² or m²**
- **determining and recording area (cm² or m²)**
- **constructing different rectangles for a given area (cm² or m²) in order to demonstrate that many different rectangles may have the same area.**

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

Achievement Indicator:

4SS3.1 Describe area as a measure of surface recorded in square units.

Suggestions for Teaching and Learning

This is students' first exposure to area. Therefore, it will be necessary to explore the concept of area using nonstandard units of measure, such as different pattern blocks. Through this exploration, students should realize that area refers to the "measure of space inside a region or how many units it takes to cover a region" Van de Walle & Lovin, 2006 p.234). During introductory work, students can explore measuring area with different types of non-standard units and then transition into using standard units to measure area.

Discuss with students that area measurements are often thought of as being "flat" and at this time, students will mainly investigate area of flat surfaces. Remind students that there are instances in our environment where this might not necessarily be the case (e.g., farm acreage or a golf course which might include hills).

Talk briefly about how area differs from perimeter as students would have already explored perimeter concepts prior to Grade 4. Review, with students, which unit is usually used to measure the perimeter of 2-D shapes. Ask if these units would be useful in measuring the area (or amount of surface covered) of 2-D shapes.

Length is one-dimensional measurement whereas area describes how many units (square units) are required to measure 2-dimensional surfaces. Square units refer to the space inside a region (e.g., the area of a field) or how much it takes to cover a region (e.g., the number of tiles needed to cover a floor). Area is most often expressed in square units, such as square centimetres (cm²) and square metres (m²).

As students explore area concepts, reinforce the importance of naming the measurement unit each time a measurement is said because the units communicate how big the measurement is. Without the unit name, there is no way of knowing what the numbers mean. It is also important that students learn that the units used to measure the area of an object (or to compare the areas of two objects) must be the same size.

As students begin to find the measurements of area they can use sets of a non-standard unit, such as sets of square tiles. Students may use many units or they may *iterate* (move one tile from one location to another). One activity teachers may use involves modeling clay. Ask students to roll out the modelling clay to form a rectangle of any size. Next, students use an interlocking cube to make imprints in the clay and find the area of their rectangle (this makes it easier for students to keep track of the iterations and total number of units). Students may use a square stamp, pad and paper or paper cut-outs to complete the same task.

Although the area formula (length × width) is not expected at this grade level, students will eventually use their knowledge of multiplication to make calculating area easier.

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

Suggested Assessment Strategies

Performance

- Teachers provide students with pattern blocks and a rectangular shape/object to measure. Ask students to use the square pattern block to measure the area. Repeat with a different type of block. Discuss the advantages and/or disadvantages of using each block.

  (4SS3.2)

- Iteration (repeating) with Pattern Blocks - Provide the students with rectangular papers that each measure 10 cm by 13 cm. Ask them to estimate how many copies of each shape of pattern block it would take to cover the rectangle. Then have the students measure the area using each of the shapes in turn.

20 squares

(4SS3.1, 4SS3.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Measuring with Area Units
4SS3 (3.1, 3.2)
TR: pp. 36-39
SB: pp. 283-284

Note

Be sure to include questions #5 and #6 on page 284 of *Math Focus 4* since they are important questions to consider.

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4SS3 Continued ...

Achievement Indicator:

4SS3.2 Identify and explain why the square is the most efficient unit for measuring area.

Suggestions for Teaching and Learning

To help students identify the square as the most efficient unit for measuring area, have them measure a rectangle (such as a Post-it® note) using pennies that obviously do not 'tile' or fit tightly together. When using units such as pennies, students will see that there are spaces not covered and are, therefore, not counted in the measurement. Consequently, they end up with an inaccurate measurement. Students should come to understand that any object that fills a space can be used, but squares are most commonly used because they fit together on any side and because they make rows which are easy to count. It is important to point out, however, that any units that fit together with no spaces in between and are not overlapping can also be used.

There are several pieces of literature that can be used to teach the concept of area. One example is *A Cloak for the Dreamer* by Aileen Friedman. After reading the book to the students ask them to design a cloak on 12″ x 18″ paper. Provide bristol board templates of various shapes (big square, small square, big triangle, small triangle, hexagon, rectangle, circle) and construction paper in different colours. Students should decide on ONE shape for the design (a variety of colours may be used), and then trace and cut out the pieces to cover the cloak. Students are to arrange the pieces so that the sides of the same length match (they must not overlap or have spaces in between).

These are okay:

These are not okay:

Students will present their cloaks designs to their classmates and tell the area and unit they used.

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

Suggested Assessment Strategies

Performance

- Show students a variety of surfaces which have been partially covered with smaller units (e.g., the teacher's desk covered with 3 or 4 adjoining math textbooks). Ask students to estimate the area of the surface, then measure using non-standard units. Ask them to record their findings.

Surface	Estimate	Area
Shelf	*50 sticky notes*	

(4SS3.1)

Interview

- Teachers can use the following questions during the *A Cloak for the Dreamer* activity on the previous page. As the discussion evolves take opportunities to discuss and compare the effectiveness of each area unit. Ask:
  (i)   Which area unit gives a more accurate measure?
  (ii) Which area unit is easier to count?
  (iii) Why would leaving gaps not give an accurate measurement?
  (iv) Why would overlapping not give an accurate measurement?

  Following this activity elicit student responses as to why squares are the most efficient unit for measuring. Answers might include:
  (i)   "squares do not leave gaps"
  (ii) "you can count squares by rows"
  (iii) "squares fit no matter which way they are turned"

(4SS3.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 6:
Measuring with Area Units
4SS3 (3.1, 3.2)
TR: pp. 36-39
SB: pp. 282-284

Curious Math:
Pattern-Block Areas
TR: p. 40
SB: p. 285

Suggested Resource

A Cloak for the Dreamer – Aileen Friedman

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS3 Continued ...

Achievement Indicator:

4SS3.3 Determine the area of an irregular 2-D shape, and explain the strategy.

Suggestions for Teaching and Learning

It is essential to provide students with opportunities to measure irregular shapes, since the real-life applications of area measurement apply to all 2-dimensional shapes or regions, not just regular ones. The measurement of irregular 2-dimensional shapes can be explored using:

- grid paper
- transparent grid overlays
- centimetre dot paper
- geoboards
- pentominoes

    E.g.,
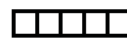
area = 5 square units   area = 5 square units   area = 5 square units

It is important that students apply the same unit of measure when comparing two different areas. Students commonly rely on number alone, without considering the size of the units.

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

Suggested Assessment Strategies

Performance

- Provide students with square grid paper. Instruct them to make a design, using 3 colours. Ask students the following questions:
  (i) What colour in your design has the greatest area?
  (ii) What colour covers the least area?
  (iii) What is the area of each colour?
  (iv) What is the area of your design?

  (4SS3.1, 4SS3.3)

- Teachers should use an even number of triangles to create and display a simple design on the overhead projector or interactive whiteboard (use right isosceles triangles so that by placing two together they form a square). Ask students to estimate and record what they think the area is. As a class discuss how to determine the area of the design in square units. Students may suggest that they reassemble the design into squares in order to count the square units. Invite a student to show this on the projector. Students compare the answer found to their own answer. Repeat with different numbers of triangles and/or squares.

  (4SS3.1, 4SS3.3)

- Divide students into groups and provide each group with a copy of three shapes as shown below, that could represent different garden plots.

  Present the following problem to students:
  Mr. McGregor wants the largest possible garden plot to plant his carrots. Which garden plot should he choose? Estimate and then find the area of each garden plot. Students may cover the surface with objects such as tiles or trace each plot on grid paper. Ask students to share their answers and discuss which method they think is the most accurate in finding the areas.

  (4SS3.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 7:
Counting Square Units
4SS3 (3.1, 3.3)
TR: pp. 41-44
SB: pp. 286-288

Math Game:
Area Logic
TR: pp. 45
SB: pp. 289

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS3 Continued ...

Achievement Indicators:

4SS3.4 Provide a referent for a square centimetre, and explain the choice.

4SS3.5 Estimate the area of a given 2-D shape, using personal referents.

Suggestions for Teaching and Learning

Discuss with students the standard units of measure (centimetre and metre) that are used in linear measurements. In Grade 3, students used these standard units of measure to find perimeter so that the perimeters of shapes could be compared and communicated clearly. Connect the need for standard units in finding perimeter to the need for standard units in finding area. Remind students that measuring with different units makes a difference to the answer. This is a good lead-in as to why we use standard units. Rather than measuring with non-standard units, which can mean different things to different people, we use standard units so that everyone has a common understanding. The first standard unit of area that students encounter is the square centimetre. A square centimetre has a measurement of 1 cm $\times$ 1 cm. Write the symbols and explain that 1 cm² is read as "one square centimetre," not "one centimetre squared." One square centimetre is an area equivalent to the area of a square with the side length of 1 centimetre. It can be a measure for the area of a variety of shapes.

Provide students with centicubes or the units of the base ten materials and centimetre grid paper. They should carefully trace one face of a base ten unit cube and then use their centimetre rulers to measure the side of each square to verify that each square is 1 cm². Ask:

- What are the side lengths of the resulting square?
- How can we tell how much space lies inside the square?

Their responses will give clues to misconceptions. Use their responses to elicit the idea that the area inside the square is represented as 1 cm².

Referents are familiar objects that students can refer to, or visualize, to help them develop a strong understanding of a unit of measurement. Review the referents used for centimetre (e.g., fingernail). Ask students to suggest a suitable referent for 1 cm² and explain why they think it would work. Ask students to use their referent for 1 cm² to estimate the area of a book cover in square centimetres. Students should then check their estimate by finding the area of the book cover by overlaying a transparency with a centimetre grid. Extend this activity by asking what objects around the classroom could be measured using the standard unit of 1 cm². For example, ask if they would try to measure the area of the floor using their personal referent. Why or why not? Use questions such as the following to continue the discussion:

- Using your referent, estimate the area of a napkin/desk top/door/ white board, exercise book, etc. Explain your strategy.
- How many fingernails could cover a crayon box?

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Present the class with a pair of old jeans or t-shirt that has an obvious stain on it. Ask students to estimate the area of a patch that would cover the stain. Next, instruct students to cut a patch from centimeter grid paper to match their estimate. Have students check the effectiveness of their "patch" by using it to cover the stain. Ask:
  - (i) What is the area of the smallest patch that might be used to cover the stain?
  - (ii) Are there any patches of different shapes with the same area?
  - (iii) How could we order our patches according to their area measurement?

  (4SS3.3, 4SS3.4, 4SS3.5)

- Teachers may provide various 2-D shapes, such as those shown below, and ask students to estimate the area using personal referents.
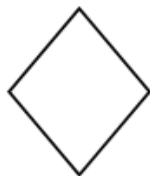
  (4SS3.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 8:
Using Square Centimeters
4SS3 (3.1, 3.3, 3.4, 3.5, 3.6)
TR: pp. 46-49
SB: pp. 290-293

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS3 Continued ...

Achievement Indicators:

4SS3.6 Determine the area of a regular 2-D shape, and explain the strategy.

4SS3.3 (Continued) Determine the area of an irregular 2-D shape, and explain the strategy.

Suggestions for Teaching and Learning

The faces of centimetre cubes (from base ten materials), centimetre grid paper and transparent centimetre grids can be used in the introduction of square centimetres. Both grids and cubes are useful as students transition from non-standard to standard units. They can be used to cover an area and count, even before they are recognized as standard units. It is important that students realize that the squares can be cut and rearranged to form many different shapes. Ask students to make as many different shapes as they can with an area of 5 cm². Share them with the class to emphasize that although they look different they all have an area of 5 square units. For example:
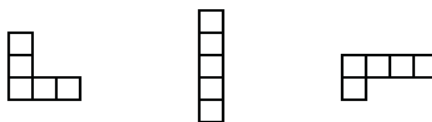
When recording and reporting area measurements in standard units, students should always state the square unit of measure, usually square centimetres or square metres for smaller surfaces. It is recommended that the use of words precede the use of abbreviated form in order to facilitate conceptual understanding.

When determining the area of various surfaces, students should first estimate and then choose a method to calculate the area. When making an estimate, they should have an opportunity to place a square unit on the surface being measured. They should then place multiple square units on the surface area and have an opportunity to adjust their original estimate. For example:
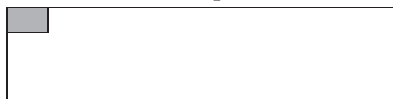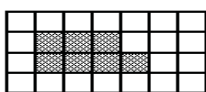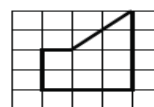

1 Square Unit: Estimate _____
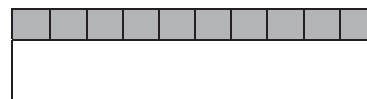
10 Square Units: Adjusted
          Estimate _____

Students should determine the area of both regular and irregular shapes.
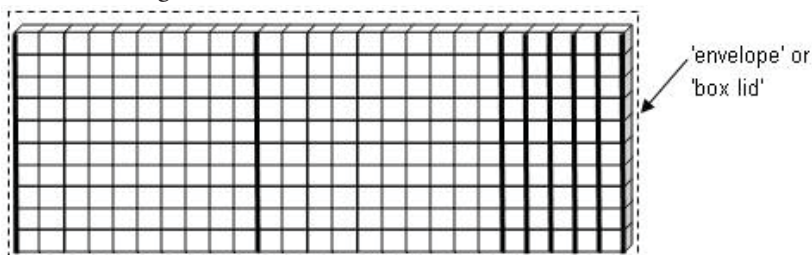

Area = 7 squares (7cm²)

Area = 7 full squares + 2 more
    halves which is 8 squares
    (8 cm²)

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

Suggested Assessment Strategies

Performance

- Provide envelopes or box lids (e.g., shoebox lids) of varying sizes. Ask students to estimate and then use base ten blocks to measure the area of each. E.g.,

'envelope' or 'box lid'

"I used 2 hundred centimetre units and 40 centimetre units to cover the entire envelope, so the area is about 240 square centimetres."

(4SS3.3)

- Provide students with pairs of paper rectangles, such as the following:
  First pair: 1 cm × 9 cm, 3 cm × 6 cm
  Second pair: 1 cm × 10 cm, 3 cm × 5 cm
Provide students with scissors, transparent centimeter grid paper overlays, unit cubes that are each 1 cm² and centimeter rulers. Ask students to decide which rectangle in each pair has the greater area. Encourage students to share their ideas and tell which strategy for finding area works best for them.

(4SS3.3)

- Provide congruent shapes such as those shown below. Ask students to decide if Part R has the same area as Part S and explain your thinking.
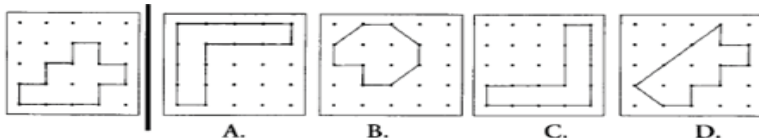

(4SS3.3)

- Make this design on an overhead geoboard and ask a student to explain to the class how to find the area. Ask students to alter the shape on their geoboards to increase the area by 1 cm².

(4SS3.3)

- Ask students to circle the letters of the shapes that have the same area as the one on the left:

A.   B.   C.   D.

(4SS3.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 8:
Using Square Centimetres
4SS3 (3.1, 3.3, 3.4, 3.5, 3.6)
TR: pp. 46-49
SB: pp. 290-293

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS3 Continued ...

Achievement Indicators:

4SS3.7 Provide a referent for a square metre, and explain the choice.

4SS3.8 Determine which standard square unit is represented by a given referent.

4SS3.5 (Continued) Estimate the area of a given 2-D shape, using personal referents.

4SS3.6 (Continued) Determine the area of a regular 2-D shape, and explain the strategy.

4SS3.3 (Continued) Determine the area of an irregular 2-D shape, and explain the strategy.

Suggestions for Teaching and Learning

The ability to visualize standard units in different configurations is useful when estimating area of some objects. For instance, the area of the surface of a shelf or long, narrow countertop would take a long time to estimate in square centimetres. Square metres would give a faster estimate, but the student would first need to understand that an area of 1 m² can take on different shapes.

Discuss with students how to find the area of the whiteboard. Ask if it would be a good idea to find the area using square centimetres.

Review the referents used for a linear metre (e.g., the distance from the teacher's finger tip to his or her opposite shoulder). Using masking tape or other suitable materials, make a square on the floor that is one square metre. Discuss possible personal referents students might have for one square metre. Ask students to use their referents and estimate the area of a large tabletop or a section of the classroom floor. Ask students to use a square piece of paper that is 1 m × 1m to measure the area and check the estimates.

Ask students to use their arms to show you how much area a square metre would cover. Hold up a metre stick and ask how this measuring tool might help determine a more precise representation. Provide four metre sticks and guide students to the discovery that the area inside a square with sides measuring 1 metre represents the standard unit called 1 m².

Provide students with a metre stick, newspaper, gift wrap/paper, scissors and tape. Ask them to make a model of a square metre that can be used as a personal referent during the remainder of the work with area. Teachers could display one in the classroom as visual representation while working on this concept.

Once students have developed personal referents for standard units to measure area, they need ongoing opportunities to apply their understanding to problem solving situations. It is important to allow enough time for students to communicate about their solutions. Encouraging discussion will likely provoke thinking as to how shapes with the same perimeter can have different areas. Students will benefit from sharing strategies with one another. Thinking aloud helps students to clarify their thoughts and sometimes discover their own misconceptions. Listening to the thoughts of others may elicit new ideas or questions in the group.

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

Suggested Assessment Strategies

Performance

- Ask students to estimate the area of different rooms in the school. Students use the square metres that they created.

    (4SS3.5, 4SS3.7)

- Allow students to work in pairs to explore area of objects around the school. Students are likely to come up with differing answers for the same region. Discuss why groups might have different answers and avoid saying that there is one *right* answer. Students should share their strategies so others are exposed to many different strategies.

    (4SS3.6, 4SS3.7)

- Using newspaper, have students make (or use a previously made) area models for one square metre. Ask students to choose a personal referent to estimate the area inside a hula-hoop. Is it greater, less, or about the same as 1 m²?

    (4SS3.5)

- Teachers divide the class in half and ask each group to agree on a group estimate regarding the approximate area of half of the school gymnasium. Students elect someone from their team to record predictions and someone to explain their estimation strategy to the class. Following sharing, have teams each measure the area of one half of the gymnasium using their newsprint models. Record results and compare with predictions. Both groups will come together to share findings. Ask students if the results are similar. Should they be similar?

    (4SS3.5)

- Teachers divide the class into groups and distribute materials to each group. Materials should include 6 m lengths of string, old newspapers, scissors, tape and student-made 1 m² models previously prepared. Tell students that some milk has been spilled on the floor. Instruct students to tie the strings together at both ends and to form the loop of string into an irregular shape on the floor. If the shape inside the string represents how much of the floor needs to be cleaned, ask students to find the area of the floor covered by spilled milk.

    (4SS3.5)

Journal

- Discuss with students personal experiences when the teacher measured an area in cm² or m². Ask students to write about a time when they measured an area in cm² or m².

    (4SS3.3, 4SS3.6)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 9:
Using Square Meters
4SS3 (3.1, 3.3, 3.5, 3.6, 3.7, 3.8)
TR: pp. 50-52
SB: pp. 294-295

Lesson 10:
Estimating Areas
4SS3 (3.3, 3.5, 3.7)
TR: pp. 53-55
SB: pp. 296

Note

Lessons 9 and 10 can be taught together since they both focus on measuring 2-D shapes using square metres.

Curious Math:
Areas on a Board
TR: pp. 56
SB: pp. 297

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

4SS3 Continued ...

Achievement Indicators:

4SS3.9 Construct a rectangle for a given area.

4SS3.10 Demonstrate that many rectangles are possible for a given area by drawing at least two different rectangles for the same given area.

Suggestions for Teaching and Learning

Give groups of students a select number of tiles or geoboards to construct different rectangles and then compare and discuss results. Some students might relate this activity to the construction of arrays used to represent multiplication number sentences in 4N6. They should conclude that objects of different shapes can have the same area. Figures A and B have the same area even though the perimeter of A is greater.

Figure A   Figure B

Provide students with geopaper or squared dot paper to draw the rectangles. Students should record all possible rectangles. Discuss how organized lists can help keep track of information.

Students may not realize that an area, which is rearranged into different shapes, will still have the same area measurement as the original shape. Ask students to make different rectangles with an area of 12 square units. Examine student work to find all of the possibilities. Teachers may notice that some students, through their exploration of tiling and arrays, might discover the multiplication formula for finding area ($l \times w$) on their own. It is important for teachers to realize that this not an expectation for Grade 4 students.

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

Suggested Assessment Strategies

Performance

- Provide students with colour tiles or grid paper to investigate how many different rectangles they can make that measure 8 square centimetres. Students may repeat using different areas such as 9, 12, 15, 16, 18, 21 or 24 cm². Students should record their results and look for patterns.

(4SS3.10)

- Invite students to select 16 pieces of the same pattern block (e.g.,the blue rhombus). Using the rule that at least one side must match up exactly with one side of another block, ask students to make different shapes, all of which have an area of 16 units². Ask them to find, among others, the most compact shape and the longest shape.

(4SS3.10)

- Teachers could divide the class into small groups to participate in *Show My Rectangle* activity. Provide grid paper or a geoboard for each student. One student creates a rectangle which the others cannot see and announces the area of his/her rectangle. The other students then create a rectangle of the same area. All players reveal their rectangles. Ask: What do your responses tell us about area? Can you make any connections or see any patterns that relate to the area of rectangles? Variation: This may be played as a game. Students who match the leader get a point and several rounds are played.

(4SS3.9)

Paper and Pencil

- Tell students that Sammy wants a kennel for his dog. He wants the kennel to have an area of 32 m². Ask students to draw, on centimetre grid paper, all the possible rectangular kennels that have an area of 32 m². The sides of the rectangles must be measured in whole numbers. Students should explain how they knew all the possible rectangular kennels have been drawn and explain which kennel they would advise Sammy to use.

(4SS3.9, 4SS3.10)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 11:
Solving Problems using Organized Lists
4SS3 (3.9, 3.10)
TR: pp. 57-59
SB: pp. 298-299

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 4SS3 Continued ... **Achievement Indicators:** *4SS3.5 (Continued) Estimate the area of a given 2-D shape, using personal referents.* *4SS3.3 (Continued) Determine the area of an irregular 2-D shape, and explain the strategy.*	As students gain experience with area measurement, they should develop more personal referents. The base ten flat, for example, is a good tool to visualize the surface area covered by 100 cm². The largest face of a standard white vinyl eraser may be used as a referent for about 10 cm². Standard unit tools that students may find useful in determining the area of irregular 2-D shapes, such as hand or footprints include, but are not limited to: • transparent centimetre grid paper - can be used to overlay a shape in order to find the area in square centimetres. Laying an acetate or transparent centimetre grid placed on the top of an object provides a pictorial model for measuring area. It allows students to count the number of units that cover or partially cover the shape. • centimetre grid paper - an object is laid on the grid paper and is traced. Area measurement is then determined by counting the squares and part squares. Ask students to estimate and determine the area of familiar objects, such as mittens, leaves, and shaped notepads. Have students explain their chosen strategies. In measuring irregular shapes there may be lots of units that only partially fit. Students will count full units and can visually combine parts of units to count as one. Students may use different coloured marks to represent whole units and ½ units. Involve students in a *Measuring Up* activity. Give students centimeter grid paper and ask them to use centimeters ☐ and half centimeters ◿ to make a design. Ask students to record the area of their design. Assign a letter to each design and display all designs in an area where students have easy access. Ask students to find the area for each shape and write their answers (e.g., A is 21 square centimeters, B is 45 cm²).

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Provide students with equal size pieces of modelling clay. Ask students to roll out the largest surface area they can make (without holes). Have students choose and explain a strategy to determine the area measurement of their clay shape.

  (4SS3.3)

- Ask students to make paint blotches by dropping a spoonful of paint onto centimetre grid paper. Allow to dry. Choose a method to determine the area of blotches and explain procedure used. Display blotches and measurements for comparison purposes.

  (4SS3.3)

Paper and Pencil

- Set up a Graffiti Wall for area with the following headings: Definition, Characteristics, Example, Real Life Problems, Non-Examples. Ask students to write anything they know about area on the wall. Review responses with the class.

  (4SS3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 12:
Estimating Areas on Grids
4SS3 (3.3, 3.5)
TR: pp. 60-62
SB: pp. 300-301

Chapter Task:
Making a Photo Display
TR: pp. 68-69
SB: pp. 305

3-D GEOMETRY

Suggested Time: 2 Weeks

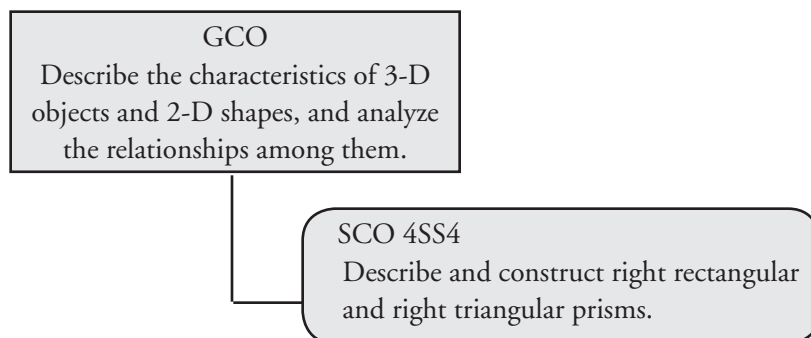| September	October	November	December	January	February	March	April	May	June

Estimated Completion

Unit Overview

Focus and Context

As students develop mathematically and become more familiar with geometric attributes, they are increasingly able to identify and name a shape by examining its properties and using reasoning. Through exploration of three dimensional shapes, students develop awareness that there are certain specific attributes that they can use to classify the shapes. They will also be encouraged to develop and communicate mathematical arguments about geometric relationships.

Outcomes Framework

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

SCO 4SS4
Describe and construct right rectangular and right triangular prisms.

SCO Continuum

Grade 3	Grade 4	Grade 5
Strand: Shape and Space (3-D Objects and 2-D Shapes)		
Specific Outcomes	**Specific Outcomes**	**Specific Outcomes**
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]	5SS5 Describe and provide examples of edges and faces of 3-D objects, and sides of 2-D shapes that are: • parallel • intersecting • perpendicular • vertical • horizontal. 5SS6 Identify and sort quadrilaterals, including: • rectangles • squares • trapezoids • parallelograms • rhombuses (or rhombi) according to their attributes.

Mathematical Processes

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

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

Specific Outcomes

Students will be expected to:

4SS4 Describe and construct right rectangular and right triangular prisms.
[C, CN, R, V]

Suggestions for Teaching and Learning

Students will draw upon their previous knowledge of two dimensional polygons to assist them in their identification and description of prisms. In the earlier grades, students will have classified geometric shapes by general characteristics and will now develop more detailed ways to describe objects. They will identify properties of objects and learn to use proper mathematical vocabulary to describe the objects.

In Grade 4, students work only with right prisms. A prism is 'right' if all faces form a right angle with the bases (i.e., are perpendicular with the bases). Below are examples of prisms illustrating the difference:

Right Rectangular Prism | **Non-Right Prism** | **Right Triangular Prism** | **Non-Right Triangular Prism**

Although the outcome and indicators use the terminology 'right' for purposes of distinguishing between right prisms and other prisms, it is not necessary for students to use the term 'right' in their descriptions. At this level, 'rectangular prism' and 'triangular prism' is sufficient for students.

All prisms have faces, two of which are customarily referred to as bases. These two bases may take the shape of any polygon. Prisms are named according to the shape of the bases (e.g., triangular prism, rectangular prism). Some students may be keen to identify other prisms such as hexagonal prisms or square prisms (square prisms fall into the category of rectangular prisms because a square is a rectangle). In Grade 4, exploration is focused on rectangular prisms and triangular prisms only.

There is a developmental sequence associated with how students think and reason geometrically. Many students in Grade 4 are beginning to develop more sophisticated abilities to identify and name 3-D objects. As levels of geometric thinking develop, students will notice more attributes of three dimensional objects. These attributes are the components that go together to make up the form – edges, vertices and faces, (two of which are the bases).

Achievement Indicators:

4SS4.1 Identify and name common attributes of right rectangular prisms from given sets of right rectangular prisms.

4SS4.2 Identify and name common attributes of right triangular prisms from given sets of right triangular prisms.

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

Suggested Assessment Strategies

Performance

- Display a blank Frayer Model in the classroom to be used for ongoing assessment. Encourage students to share their ideas about prisms and to suggest additions as they discover new information throughout the unit. Observe student contributions and identify any misconceptions which can be used to guide your teaching.
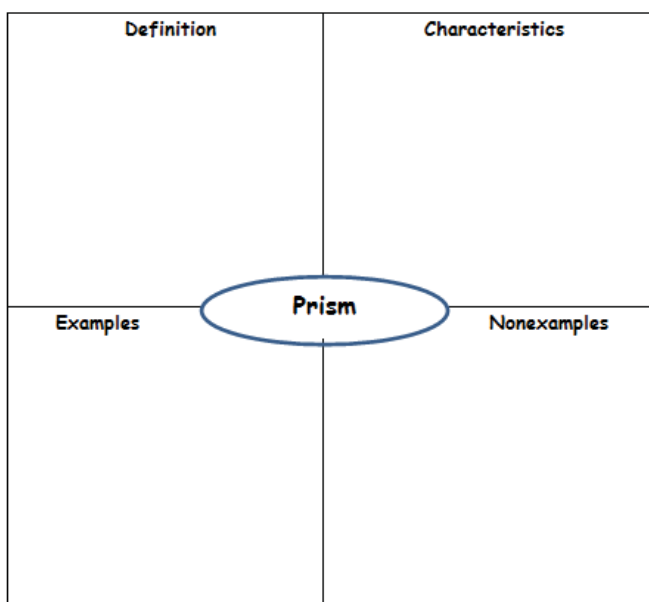
(4SS4.1, 4SS4.2)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Recognizing Rectangular Prisms
4SS4 (4.1, 4.2, 4.3)
TR: pp. 11-13
SB: pp. 380

Curious Math:
TR pp. 14-15
SB p. 381

Lesson 2:
Recognizing Triangular Prisms
4SS4 (4.2)
TR: pp. 16-19
SB: pp. 382-384

Note

Lessons 1 and 2 may be combined or treated separately, depending on teacher preference.

Suggested Resources

https://www.k12pl.nl.ca/curr/k-6/math/grade-4/links/unit11.html

- Enrichment activities

- Interactive White Board activity to compare rectangular and triangular prisms

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

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

4SS4 Continued ...

Achievement Indicators:

4SS4.1 (Continued) Identify and name common attributes of right rectangular prisms from given sets of right rectangular prisms.

4SS4.2 (Continued) Identify and name common attributes of right triangular prisms from given sets of right triangular prisms.
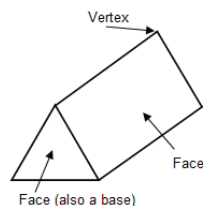
Suggestions for Teaching and Learning

In the process of identifying and naming attributes of prisms, review and encourage students to use appropriate vocabulary such as number of faces, number of edges, number of vertices or shapes of the faces/bases.

- A rectangular prism has 6 faces, 12 edges and 8 vertices.
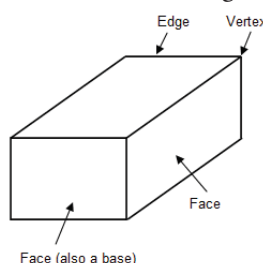
- A triangular prism has 5 faces, 9 edges and 6 vertices.

Allow each student to manipulate concrete models of 3-D shapes so that they are able to touch and count each of the faces, vertices and edges.

One way to familiarize students with rectangular and triangular prisms is to play a guessing game. Distribute several prisms to students. The teacher secretly chooses one prism and provides clues about the attributes of the chosen prism. For example, "The 3-D object I am thinking of has 8 vertices." As clues are given, students will try to determine the correct prism. While some students may be able to think of the prisms visually, the manipulation of the concrete objects will help others.

4SS4.3 Sort a given set of right rectangular and right triangular prisms, using the shape of the base.

Sorting requires students to attend to specific attributes of objects. Give students a variety of 3-D prisms (objects gathered from home or commercially-made models). Ask them to sort the prisms according to the shape of the base. One way for students to display the results of this activity is to attach the objects in the appropriate column of a T-chart.

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

Suggested Assessment Strategies

Performance

- Students work in groups of four or more to play 'My Secret Shape'. One student is designated as leader and chooses a secret geometric object. The other students ask questions to which the leader can only answer "yes" or "no". The group continues to question until they reduce the choices to one object.

(4SS4.1, 4SS4.2, 4SS4.3)

- Provide 3-D objects, gathered from home or commercially-made models, such as spheres, cones, cylinders, pyramids, as well as rectangular prisms and triangular prisms. Students will be familiar with these from Grade 3. Place two hula hoops on the floor to represent a large scale Venn diagram such as the one shown below. Provide labels (triangular prisms, rectangular prisms and other) or ask students to develop their own labels and ask students to sort the objects. Students place their object in the diagram and explain their reasoning to the class.
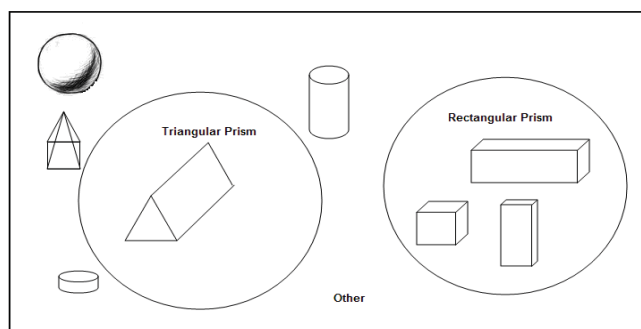
(4SS4.1, 4SS4.2, 4SS4.3)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 1:
Recognizing Rectangular Prisms
4SS4 (4.1, 4.2, 4.3)
TR: pp. 11-13
SB: pp. 380

Curious Math:
TR: pp. 14-15
SB: p. 381

Lesson 2:
Recognizing Triangular Prisms
4SS4 (4.2)
TR: pp. 16-19
SB: pp. 382-384

Note

Lessons 1 and 2 may be combined.

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

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

4SS4 Continued ...

Achievement Indicators:

4SS4.4 Identify examples of rectangular and triangular prisms found in the environment.

Students have been learning about the attributes of rectangular and triangular prisms and how to sort these objects. It is important to provide opportunities for students to connect what they have learned to the real world. One way to explore this connection is to display a set of prisms on a table. Vary the set by including different sizes of triangular and rectangular prisms (including cubes) positioned in different orientations. Ask students to explore the classroom or the school and find objects that match the models displayed. Students could photograph, sketch or list their findings. Encourage them to discuss, using appropriate mathematical language (faces, edges, vertices, etc.), how the objects they found are the same as or different from those displayed. Ask students to consider:

- What might prisms be used for? Answers may include:
    - to put things in, such as a box of cereal
    - to build things, like a house
- Why might prisms have different sizes and shapes? Answers may include:
    - a bigger box is needed to hold more or larger items
    - some prisms might need to be larger to provide strength or support, such as a table leg
   - decorative reasons

4SS4.5 Construct and describe a model of a right rectangular and a right triangular prism, using materials such as pattern blocks or modeling clay.

Have a variety of 3-D objects available to students. Some may need to touch the edges and vertices in order to construct a skeleton. The process of making a skeleton helps students to internalize geometric attributes. The constructions of prisms may take many forms. A good way to explore geometric objects is to use smaller blocks, linking cubes or tiles to construct larger solids. Pattern blocks work well for this. Although pattern blocks are often used as 2-D shapes, they are actually prisms, because they have some thickness. Stacking prisms may help students conceptualize that, regardless of the thickness, a particular prism maintains its attributes (the shape of the base, the number of faces, the number of vertices, the number of edges). Students may also make skeletal models for prisms, using rolled newspapers and tape, modelling clay, straws and string, or toothpicks and miniature marshmallows. For example:
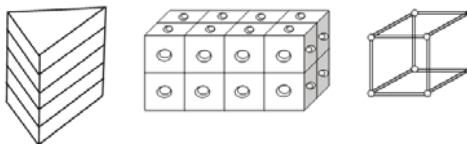
General Outcome: Describe the characteristics of 3-D objects and 2-D shapes and analyze the relationships among them.

Suggested Assessment Strategies

Paper and Pencil

- Ask students to identify one example of a triangular prism and a rectangular prism that might be found at home. Ask students to describe, orally and in writing, how these objects are alike and different, using appropriate mathematical language.   (4SS4.4)

Interview

- Ask students to build skeletal models of two different triangular prisms. Ask students how they are the same/different.   (4SS4.5)

Performance

- Ask students to gather a picture collection of 3-D objects from magazines, newspapers, flyers, catalogues or the Internet. Sort the collection into 2 groups - rectangular and triangular prisms. Ask:
  (i)   What are the attributes of the objects that made them alike?
  (ii)   How are they different?
  (iii) Is a cube a rectangular prism?
  Students could display these pictures in a small group or class collage, according to their classification.
                                              (4SS4.3, 4SS4.4)

- Give students pictures of prisms that are cut in half. Ask them to recreate the missing section.
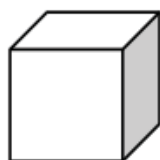
give   (4SS4.5)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 3:
Communication About Prisms
4SS4 (4.4)
TR: pp. 22-25
SB: pp. 386-388

Lesson 4:
Constructing Prisms
4SS4 (4.4, 4.5)
TR: pp. 26-28
SB: p. 389

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

Specific Outcomes

Students will be expected to:

4SS4 Continued ...

Achievement Indicators:

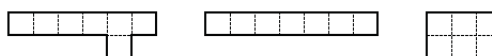*4SS4.6 Construct right triangular prisms from their nets.*

4SS4.7 Construct right rectangular prisms from their nets.

Suggestions for Teaching and Learning

A **net** is a representation of a 3-D object which can be folded to create that solid. Nets represent the faces that make up the surfaces of a 3-D object.
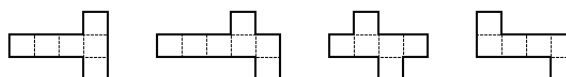
Possible nets for a cube

Not nets for a cube

Students should be exposed to various nets through 'hands on' experience. Ask students to bring in cereal boxes, Toblerone™ bar boxes, etc., to cut and observe the nets. Ask students to cut pieces and discover if they can create a new prism, thus seeing that various nets can make similar prisms. Use commercial net templates for further practice.

Provide students with copies of nets of rectangular and triangular prisms to cut out and fold up. They should be encouraged to unfold them and examine the 2-D shapes that are connected to make each net. An activity such as this should help students to visualize the action of folding and unfolding.

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

Suggested Assessment Strategies

Performance

- Provide the students with a pentomino puzzle piece (a 2-D shape made by joining 5 squares along full sides) that would fold to make a box with no top.
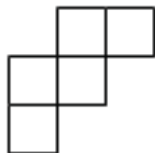
  Ask students to trace this missing piece and then add it as a sixth square for the top of the box. Ask: In how many places can this square be added? Students may wish to use grid paper to facilitate manipulation and checking.

  (4SS4.5, 4SS4.6)

- Explain to students that this diagram is part of a net for a square prism. Ask them to complete the net by drawing the additional faces that would be needed. Cut out and fold to check.
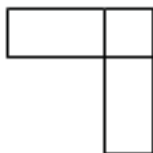
  (4SS4.6)

- Give small groups of students a set of 4 or 5 nets of rectangular or triangular prisms. Each set should consist of one net that can be made into the 3-D object, and 3 or 4 others which cannot be made into the 3-D object. Ask students to analyze the nets, without manipulating them, and to determine which one of the nets in the group could be used to create the 3-D object. Invite them to justify, and then test their predictions.

  (4SS4.6, 4SS4.7)

- Ask students to trace on paper the various faces of different triangular and rectangular prisms to make the nets. The teacher may want to show them how to roll the solid from one face to the other, thereby assuring a continuous pattern. Ask them to cut out the net and fold it up around the solid to see if it works. They could then record the net on grid paper. Instruct students to cut off one of the faces and to investigate the possible places it could be reattached to make a new net. Ask them to record each one on grid paper.

  (4SS4.6, 4SS4.7)

Resources/Notes

Authorized Resource

Math Focus 4
Lesson 5:
Constructing Prisms from Nets
4SS4 (4.5, 4.6, 4.7)
TR: pp. 29-31
SB: p. 390

Appendix:

Outcomes with Achievement Indicators
Organized by Strand
(With Curriculum Guide References)

Strand: Number	General Outcome: Develop number sense.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4N1 Represent and describe whole numbers to 10 000, concretely, pictorially and symbolically. [C, CN, V]	4N1.1 Read a given four-digit numeral without using the word 'and'.	p. 23
	4N1.2 Write a given numeral using proper spacing without commas.	pp. 23-25
	4N1.3 Represent a given numeral using a place value chart or models.	pp. 23-25
	4N1.4 Explain the meaning of each digit in a given four-digit numeral, including numerals with all digits the same.	p. 23
	4N1.5 Express a given numeral in expanded notation.	p. 25
	4N1.6 Write the numeral represented by a given expanded notation.	p. 25
	4N1.7 Write a given numeral 0 - 10 000 in words.	p. 28
4N2 Compare and order whole numbers to 10 000. [C, CN, V]	4N2.1 Create and order three different four-digit numerals.	pp. 30-32
	4N2.2 Identify the missing numbers in an ordered sequence or on a number line (vertical or horizontal).	p. 30
	4N2.3 Identify incorrectly placed numbers in an ordered sequence or on a number line (vertical or horizontal).	p. 30
	4N2.4 Order a given set of numbers in ascending or descending order, and explain the order by making references to place value.	p. 32
4N3 Demonstrate an understanding of addition of whole numbers with answers to 10 000 and their corresponding subtractions (limited to 3- and 4-digit numerals) by: • using personal strategies for adding and subtracting • estimating sums and differences • solving problems involving addition and subtraction. [C, CN, ME, PS, R]	4N3.1 Describe a situation in which an estimate rather than an exact answer is sufficient.	p. 38
	4N3.2 Estimate sums and differences, using different strategies.	p. 38
	4N3.3 Refine personal strategies to increase their efficiency.	pp. 38, 42
	4N3.4 Determine the sum of two numbers using a personal strategy.	pp. 42, 46
	4N3.5 Solve problems that involve addition and subtraction of more than two numbers.	p. 40
	4N3.6 Determine the difference of two numbers using a personal strategy.	pp. 44-46

Strand: Number	General Outcome: Develop number sense.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4N4 Explain and apply the properties of 0 and 1 for multiplication and the property of 1 for division. [C, CN, R]	4N4.1 Determine the answer to a given question involving the multiplication of a number by 1, and explain the answer.	p. 102
	4N4.2 Determine the answer to a given question involving the multiplication of a number by 0, and explain the answer.	p. 102
	4N4.3 Determine the answer to a given question involving the division of a number by 1, and explain the answer.	p. 114
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]	4N5.1 Provide examples for applying mental mathematics strategies: • skip counting from a known fact • doubling • repeated doubling • halving • doubling or halving and adding or subtracting one more group • use ten facts when multiplying by 9 • relating division to multiplication.	pp. 104, 108, 110, 116
	4N5.2 Demonstrate understanding and application of strategies for multiplication and related division facts to 9 × 9.	pp. 112, 116
	4N5.3 Demonstrate recall of multiplication and related division facts to 7 × 7.	pp. 112, 116
4N6 Demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) to solve problems by: • using personal strategies for multiplication with and without concrete materials • using arrays to represent multiplication • connecting concrete representations to symbolic representations • estimating products • applying the distributive property. [C, CN, ME, PS, R, V]	4N6.1 Use concrete materials, such as base ten blocks or their pictorial representations, to represent multiplication; and record the process symbolically.	pp. 160-172
	4N6.2 Solve a given multiplication problem and record the process.	pp. 160-174
	4N6.3 Model and solve a given multiplication problem, using an array, and record the process.	pp. 162, 164
	4N6.4 Model a given multiplication problem, using the distributive property.	pp. 162-170
	4N6.5 Estimate a product, using a personal strategy.	pp. 166-172
	4N6.6 Refine personal strategies to increase their efficiency.	p. 174
	4N6.7 Create and solve a multiplication problem that is limited to 2- or 3-digits by 1-digit.	p. 174

Strand: Number	General Outcome: Develop number sense.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4N7 Demonstrate an understanding of division (1-digit divisor and 2-digit dividend) to solve problems by: • using personal strategies for dividing with and without concrete materials • estimating quotients • relating division to multiplication. [C, CN, ME, PS, R, V]	(It is not intended that remainders be expressed as decimals or fractions.)	
	4N7.1 Solve a given division problem without a remainder, using models, and connect this process to the symbolic representation.	pp. 180, 184, 190
	4N7.2 Solve a given division problem with a remainder, using models, and connect this process to the symbolic representation.	pp. 180, 184, 188, 190
	4N7.3 Solve a given division, using a personal strategy, and record the process.	pp. 180-192
	4N7.4 Solve a given division problem by relating division to multiplication.	p. 182
	4N7.5 Create and solve a division problem involving a 1- or 2-digit dividend, and record the process.	pp. 184, 192
	4N7.6 Estimate a quotient, using a personal strategy.	p. 188
	4N7.7 Refine personal strategies to increase their efficiency.	p. 192

Strand: Number	General Outcome: Develop number sense.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
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]	4N8.1 Name and record the shaded and non-shaded parts of a given whole.	p. 126
	4N8.2 Represent a given fraction pictorially by shading parts of a given whole.	pp. 126, 138
	4N8.3 Provide examples of when two identical fractions may not represent the same quantity.	p. 126
	4N8.4 Represent a given fraction, using concrete materials.	p. 128
	4N8.5 Name and record the shaded and non-shaded parts of a given set.	p. 128
	4N8.6 Identify a fraction from its concrete representation.	pp. 128, 138
	4N8.7 Represent a given fraction pictorially by shading parts of a given set.	pp. 128, 138
	4N8.8 Provide, from everyday contexts, an example of a fraction that represents part of a set and an example of a fraction that represents part of a whole.	pp. 130, 138
	4N8.9 Order a given set of fractions that have the same denominator, and explain the ordering.	p. 130
	4N8.10 Explain how denominators can be used to compare two given unit fractions with numerator 1.	p. 132
	4N8.11 Order a given set of fractions that have the same numerator, and explain the ordering.	p. 134
	4N8.12 Identify which of the benchmarks, 0, ½ or 1, is closer to a given fraction.	p. 136
	4N8.13 Name fractions between two given benchmarks on a number line (horizontal and vertical).	p. 136
	4N8.14 Order a given set of fractions by placing them on a number line (horizontal and vertical) with given benchmarks.	p. 136

Strand: Number	General Outcome: Develop number sense.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4N9 Represent and describe decimals (tenths and hundredths), concretely, pictorially and symbolically. [C, CN, R, V]	4N9.1 Write the decimal for a given concrete or pictorial representation of part of a set, part of a region or part of a unit of measure.	pp. 140, 144
	4N9.2 Represent a given decimal, using concrete materials or a pictorial representation.	pp. 140, 144, 146
	4N9.3 Provide examples of everyday contexts in which tenths and hundredths are used.	pp. 140, 144, 146
	4N9.4 Explain the meaning of each digit in a given decimal.	p. 148
	4N9.5 Represent a given decimal, using money values (dimes and pennies).	p. 148
	4N9.6 Record a given money value, using decimals.	p. 148
	4N9.7 Model, using manipulatives or pictures, that a given tenth can be expressed as a hundredth.	p. 148
4N10 Relate decimals to fractions and fractions to decimals (to hundredths). [C, CN, R, V]	4N10.1 Express, orally and in written form, a given fraction with a denominator of 10 or 100 as a decimal.	pp. 142-146
	4N10.2 Read decimals as fractions.	pp. 142-146
	4N10.3 Express, orally and in written form, a given decimal in fraction form.	pp. 142-146
	4N10.4 Express a given pictorial or concrete representation as a fraction or decimal.	pp. 142-148
	4N10.5 Express, orally and in written form, the decimal equivalent for a given fraction.	pp. 142-146
4N11 Demonstrate an understanding of addition and subtraction of decimals (limited to hundredths). [C, ME, PS, R, V]	4N11.1 Predict sums and differences of decimals, using estimation strategies.	p. 150
	4N11.2 Refine personal strategies to increase their efficiency.	p. 150
	4N11.3 Solve problems, including money problems, which involve addition and subtraction of decimals, limited to hundredths.	pp. 150-154
	4N11.4 Determine the approximate solution of a given problem not requiring an exact answer.	p. 150
	4N11.5 Estimate a sum or difference using compatible numbers.	pp. 150, 154
	4N11.6 Count back change for a given purchase.	p. 152

Strand: Patterns and Relations (Patterns)	General Outcome: Use patterns to describe the world and to solve problems.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4PR1 Identify and describe patterns found in tables and charts, including a multiplication chart. [C, CN, PS, V]	4PR1.1 Describe the pattern found in a given table or chart.	pp. 52, 118
	4PR1.2 Determine the missing element(s) in a given table or chart.	pp. 52, 118
	4PR1.3 Identify the error(s) in a given table or chart.	pp. 52, 118
	4PR1.4 Identify and describe a variety of patterns in a multiplication chart.	p. 118
4PR2 Translate among different representations of a pattern, such as a table, a chart or concrete materials. [C, CN, V]	4PR2.1 Create a concrete representation of a given pattern displayed in a table or chart.	p. 54
	4PR2.2 Create a table or chart from a given concrete representation of a pattern.	p. 54
4PR3 Represent, describe and extend patterns and relationships, using charts and tables, to solve problems. [C, CN, PS, R, V]	4PR3.1 Translate the information in a given problem into a table or chart.	pp. 56-58
	4PR3.2 Identify and extend the patterns in a table or chart to solve a given problem.	pp. 56-58
4PR4 Identify and explain mathematical relationships, using charts and diagrams, to solve problems.	4PR4.1 Identify a sorting rule for a given Venn diagram.	p. 80
	4PR4.2 Describe the relationship shown in a given Venn diagram when the circles intersect, when one circle is contained in the other, and when the circles are separate.	p. 80
	4PR4.3 Determine where new elements belong in a given Venn diagram.	p. 80
	4PR4.4 Complete a Carroll diagram by entering given data into correct squares to solve a given problem.	p. 82
	4PR4.5 Determine where new elements belong in a given Carroll diagram.	p. 82
	4PR4.6 Solve a given problem using a Carroll diagram.	p. 82
	4PR4.7 Solve a given problem by using a chart or diagram to identify mathematical relationships.	p. 82

Strand: Patterns and Relations (Variables and Equations)	General Outcome: Represent algebraic expressions in multiple ways.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4PR5 Express a given problem as an equation in which a symbol is used to represent an unknown number. [CN, PS, R]	4PR5.1 Explain the purpose of the symbol in a given addition, subtraction, multiplication or division equation with one unknown.	p. 60
	4PR5.2 Express a given pictorial or concrete representation of an equation in symbolic form.	p. 60
	4PR5.3 Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.	p. 64
	4PR5.4 Create a problem for a given equation with one unknown.	p. 66
4PR6 Solve one-step equations involving a symbol to represent an unknown number. [C, CN, PS, R, V]	4PR6.1 Solve a given one-step equation using manipulatives.	pp. 62, 116
	4PR6.2 Describe, orally, the meaning of a given one-step equation with one unknown.	p. 62
	4PR6.3 Solve a given equation when the unknown is on the left or right side of the equation.	pp. 62, 106, 116, 186
	4PR6.4 Solve a given one-step equation, using guess and test.	p. 64
	4PR6.5 Represent and solve a given addition or subtraction problem involving a "part-part-whole" or comparison context, using a symbol to represent the unknown.	p. 66
	4PR6.6 Represent and solve a given multiplication or division problem involving equal grouping or partitioning (equal sharing), using a symbol to represent the unknown.	pp. 106, 116, 120

Strand: Shape and Space (Measurement)	General Outcome: Use direct and indirect measurement to solve problems.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4SS1 Read and record time, using digital and analog clocks, including 24-hour clocks. [C, CN, V]	4SS1.1 State the number of hours in a day.	p. 198
	4SS1.2 Express time, orally and in writing, form a 12-hour analog clock.	p. 198
	4SS1.3 Explain the meaning of a.m. and p.m., and provide an example of an activity that occurs during the a.m., and another that occurs during the p.m.	p. 200
	4SS1.4 Express time, orally and in writing, as "minutes to" or "minutes after" the hour.	pp. 202, 204
	4SS1.5 Express time, orally and in writing, from a 12-hour digital clock.	p. 204
	4SS1.6 Solve problems related to time, including elapsed time.	pp. 204, 206
	4SS1.7 Express time, orally and in writing, from a 24-hour analog clock.	p. 206
	4SS1.8 Express time, orally and in writing, from a 24-hour digital clock.	p. 206
4SS2 Read and record calendar dates in a variety of formats. [C, V]	4SS2.1 Write dates in a variety of forms.	p. 208
	4SS2.2 Relate dates written in the format yyyy/mm/dd to dates on a calendar.	p. 208
	4SS2.3 Identify possible interpretations of a given date.	p. 208

Strand: Shape and Space (Measurement)	General Outcome: Use direct and indirect measurement to solve problems.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
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]	4SS3.1 Describe area as the measure of surface recorded in square units.	p. 210
	4SS3.2 Identify and explain why the square is the most efficient unit for measuring area.	p. 212
	4SS3.3 Determine the area of an irregular 2-D shape, and explain the strategy.	pp. 214, 218, 220, 224
	4SS3.4 Provide a referent for a square centimetre, and explain the choice.	p. 216
	4SS3.5 Estimate the area of a given 2-D shape, using personal referents.	pp. 216, 220, 224
	4SS3.6 Determine the area of a regular 2-D shape, and explain the strategy.	pp. 218, 220
	4SS3.7 Provide a referent for a square metre, and explain the choice.	p. 220
	4SS3.8 Determine which standard square unit is represented by a given referent.	p. 220
	4SS3.9 Construct a rectangle for a given area.	p. 222
	4SS3.10 Demonstrate that many rectangles are possible for a given area by drawing at least two different rectangles for the same given area.	p. 222
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.	
4SS4 Describe and construct right rectangular and right triangular prisms. [C, CN, R, V]	4SS4.1 Identify and name common attributes of right rectangular prisms from given sets of right rectangular prisms.	pp. 230, 232
	4SS4.2 Identify and name common attributes of right triangular prisms from given sets of right triangular prisms.	pp. 230, 232
	4SS4.3 Sort a given set of right rectangular and right triangular prisms, using the shape of the base.	p. 232
	4SS4.4 Identify examples of rectangular and triangular prisms found in the environment.	p. 234
	4SS4.5 Construct and describe a model of a right rectangular and a right triangular prism, using materials such as pattern blocks or modelling clay.	p. 234
	4SS4.6 Construct right triangular prisms from their nets.	p. 236
	4SS4.7 Construct right rectangular prisms from their nets.	p. 236

Strand: Shape and Space (Transformations)	General Outcome: Describe and analyze position and motion of objects and shapes.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4SS5 Demonstrate an understanding of congruency, concretely and pictorially. [CN, R, V]	4SS5.1 Determine if two given 2-D shapes congruent and explain the strategy used.	p. 88
	4SS5.2 Create a shape that is congruent to a given 2-D shape.	p. 88
	4SS5.3 Identify congruent 2-D shapes from a given set of shapes shown in different orientations.	p. 88
	4SS5.4 Identify corresponding vertices and sides of two given congruent shapes.	p. 88
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]	4SS6.1 Identify lines of symmetry of a given set of 2-D shapes, and explain why each shape is symmetrical.	p. 90
	4SS6.2 Determine whether or not a given 2-D shape is symmetrical by using an image reflector or by folding and superimposing.	p. 90
	4SS6.3 Complete a symmetrical 2-D shape, given half the shape and its line symmetry.	p. 92
	4SS6.4 Sort a given set of 2-D shapes as symmetrical and non-symmetrical.	p. 92
	4SS6.5 Provide examples of symmetrical shapes found in the environment, and identify the line(s) of symmetry.	p. 92
	4SS6.6 Sort a given set of 2-D shapes as those that have no lines of symmetry, one line of symmetry, or more than one line of symmetry.	p. 94
	4SS6.7 Identify the characteristics of given symmetrical and non-symmetrical 2-D shapes and explain the process.	p. 96
	4SS6.8 Create a symmetrical shape with and without manipulatives.	p. 96

Strand: Statistics and Probability (Data Analysis)	**General Outcome:** Collect, display and analyze data to solve problems.	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following sets of indicators help determine whether students have met the corresponding specific outcome*	**Page Reference**
4SP1 Demonstrate an understanding of many-to-one correspondence. [C, R, T, V]	4SP1.1 Compare graphs in which the same data has been displayed using one-to-one and many-to-one correspondences, and explain how they are the same and different.	p. 72
	4SP1.2 Explain why many-to-one correspondence is sometimes used rather than one-to-one correspondence.	p. 72
	4SP1.3 Find examples of graphs in which many-to-one correspondence is used in print and electronic media, such as newspapers, magazines and the Internet, and describe the correspondence used.	p. 78
4SP2 Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions. [C, PS, R, V]	4SP2.1 Identify an interval and correspondence for displaying a given set of data in a graph, and justify the choice.	p. 74
	4SP2.2 Create and label (with categories, title and legend) a pictograph to display a given set of data, using many-to-one correspondence, and justify the choice of correspondence used.	p. 74
	4SP2.3 Answer a given question using a given graph in which data is displayed using many-to-one correspondence.	p. 74
	4SP2.4 Create and label (with axes and title) a bar graph to display a given set of data, using many-to-one correspondence, and justify the choice of interval used.	p. 76

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