Mathematics 5

Curriculum Guide 2015

Newfoundland Labrador

Education and Early Childhood Development

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Acknowledgements

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 Mathematics 5 course was originally implemented in 2009.

Beliefs About Students and Mathematics Learning

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

Students are curious, active learners with individual interests, abilities and needs. They come to classrooms with varying knowledge, life experiences and backgrounds. A key component in successfully developing numeracy 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. At all levels, students benefit from working with a variety of materials, tools and contexts when constructing meaning about new mathematical ideas. Meaningful student discussions 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 are comfortable taking intellectual risks, asking questions and posing conjectures. Students need to explore problem-solving situations in order to develop personal strategies and become mathematically literate. They must realize 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 be taught 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, asssessing 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 curiousity.

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	NATURE OF MATHEMATICS
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**						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.

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.

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

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.

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 worldview. 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 subdivided into substrands. There is one general outcome per substrand across the grades K–9.

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

Number

Number

- Develop number sense.

Patterns and Relations

Patterns

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

Variables and Equations

- Represent algebraic expressions in multiple ways.

Shape and Space

Measurement

- Use direct and indirect measurement to solve problems.

3-D Objects and 2-D Shapes

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

Transformations

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

Statistics and Probability

Data Analysis

- Collect, display and analyze data to solve problems.

Chance and Uncertainty

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

Outcomes and Achievement Indicators

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

General Outcomes

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

Specific Outcomes

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

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

Achievement Indicators

Achievement indicators are samples of how students may demonstrate their achievement of the goals of a specific outcome. The range of samples provided is meant to reflect the scope of the specific outcome. The list of indicators contained in this section is not intended to be exhaustive but rather to provide teachers with examples of evidence of understanding that may be used to determine whether or not students have achieved a given specific outcome. Teachers may use any number of these indicators or choose to use other indicators as evidence that the desired learning has been achieved.

Summary

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

ASSESSMENT AND EVALUATION

Purposes of Assessment

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

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

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

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

Assessment has three interrelated purposes:

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

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

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

Assessment *for* Learning

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

Assessment *for* learning:

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

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

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

Assessment *as* Learning

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

Assessment *as* learning:

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

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

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

Assessment *of* Learning

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

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

Assessment *of* learning:

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

- confirms what students know and can do

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

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

Assessment Strategies

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

Observation
(formal or informal)

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

Performance

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

Paper and Pencil

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

Journal

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

Interview

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

Presentation

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

Portfolio

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

INSTRUCTIONAL FOCUS

Planning for Instruction

Consider the following when planning for instruction:

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

Teaching Sequence

The curriculum guide for Mathematics 5 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.

Instructional Time per Unit

The suggested number of weeks of instruction per unit is listed in the guide at the beginning of each unit. The number of suggested weeks includes time for completing assessment activities, reviewing and evaluating. The timelines at the beginning of each unit are provided to assist in planning. The use of this timeline is not mandatory. However, it is mandatory that all outcomes are taught during the school year, so a long term plan is advised. Teaching of the outcomes is ongoing, and may be revisited as necessary.

September	October	November	December	January	February	March	April	May	June

- Numeration
- Adding and Subtracting Decimals
- Measurement
- Data Relationships
- Motion Geometry
- Multiplication
- Patterns in Mathematics
- Fractions
- Division
- 2-D and 3-D Geometry
- Probability
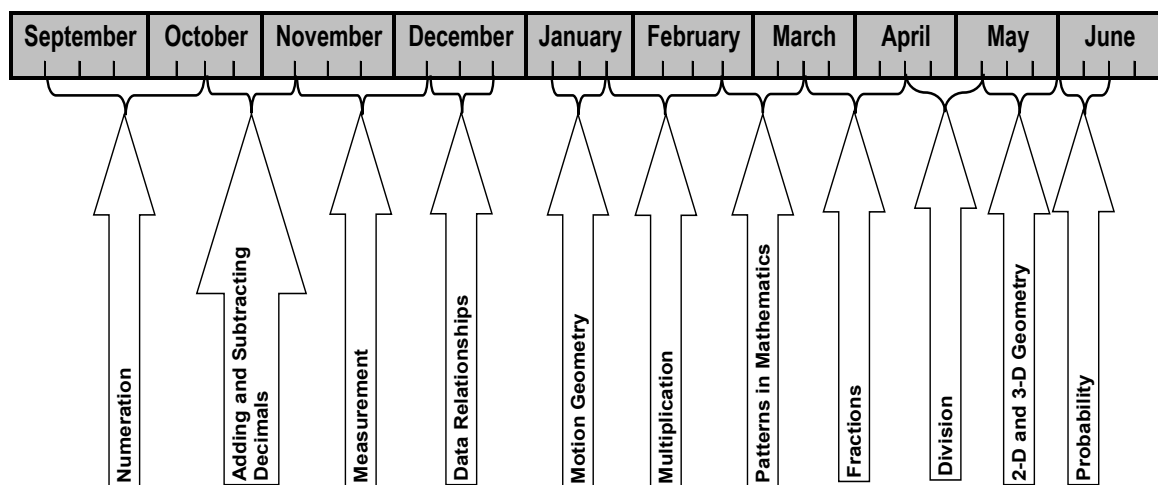
Resources

The authorized resource for Newfoundland and Labrador for students and teachers is *Math Focus 5* (Nelson). Column four of the curriculum guide references *Math Focus 5* 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 19-275)

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.

Mathematics 5 is organized into eleven units: *Numeration, Adding and Subtracting Decimals, Measurement, Data Relationships, Motion Geometry, Multiplication, Patterns in Mathematics, Fractions, Division, 2-D and 3-D Geometry* and *Probability.*

Numeration

Suggested Time: 5 Weeks

September	October	November	December	January	February	March	April	May	June

Numeration
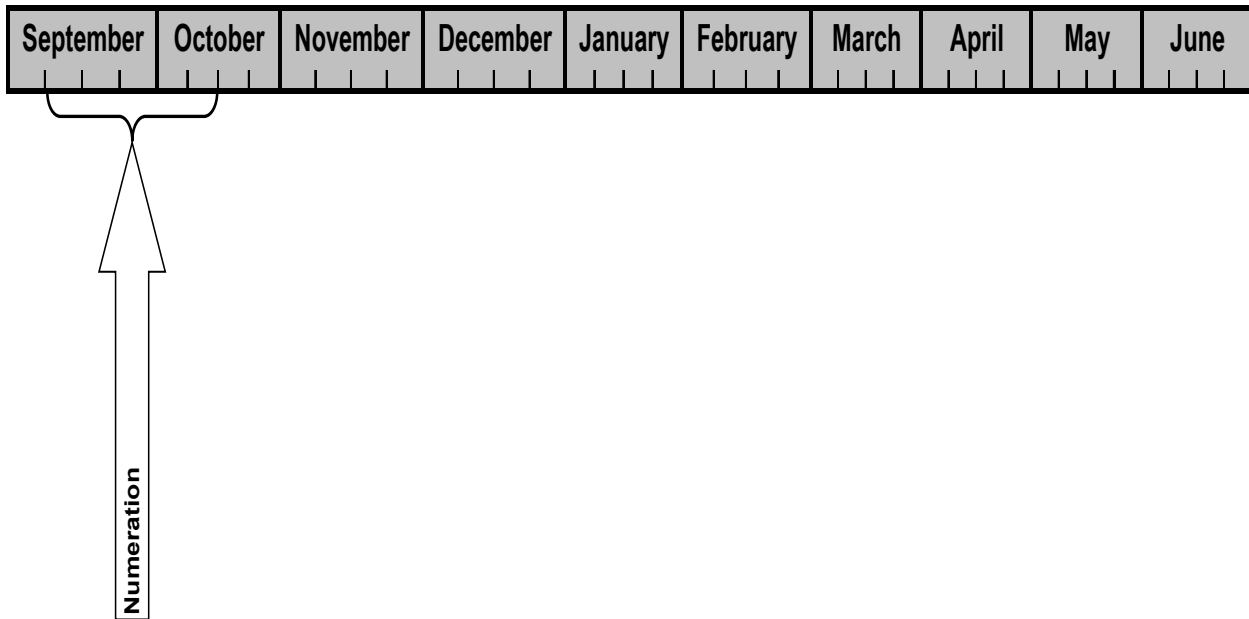
Unit Overview

Focus and Context

Throughout this unit students will extend their understanding of the place value system up to one million and decimal places to thousandths, focusing on the patterns of the base ten system. These numbers will be experienced through base ten materials, grids and number lines. Students will explore estimation of numbers using a variety of strategies including number relations and benchmark numbers. They should gain an understanding of the relative size of numbers (magnitude) through meaningful contexts such as population, measurement, and capacity of venues.

Outcomes Framework

> **GCO**
> Develop number sense.

> **SCO 5N1**
> Represent and describe whole numbers to 1 000 000.

> **SCO 5N8**
> Describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially and symbolically.

> **SCO 5N10**
> Compare and order decimals (to thousandths) by using:
> - benchmarks
> - place value
> - equivalent decimals

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
4N1 Represent and describe whole numbers to 10 000 concretely, pictorially and symbolically. [C, CN, V]	5N1 Represent and describe whole numbers to 1 000 000. [C, CN, V] 5N8 Describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially and symbolically. [C, CN, R, V] 5N10 Compare and order decimals (to thousandths) by using: • benchmarks • place value • equivalent decimals. [C, R, V]	6N1 Demonstrate an understanding of place value, including numbers that are: • greater than one million • less than one thousandth. [C, CN, R, T] 6N2 Solve problems involving whole numbers and decimal numbers. [ME, PS, T] 6N3 Demonstrate an understanding of factors and multiples by: • determining multiples and factors of numbers less than 100 • identifying prime and composite numbers • solving problems using multiples and factors. [CN, PS, R, V] 6N7 Demonstrate an understanding of integers, concretely, pictorially and symbolically. [C, CN, R, V]

Mathematical Processes

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

Daily Routine Opportunity

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

While the focus on multiplication and division begins later in the year, review of the facts up to 7 x 7 from Grade 4 will solidify student recall and allow for extension in Grade 5. Place all facts up to 7 x 7 in a bag. Ask students to draw a 4 x 4 grid and fill the squares with their choice of any products of facts up to 7 x 7. The caller pulls a fact from the bag, reads it aloud, and students with the corresponding product cover the number on their grid. Play continues until one student covers a straight line of 4 (vertical, horizontal or diagonal).

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5N1 Represent and describe whole numbers to 1 000 000. [C, CN, V, T]	In Grade 4, students represented, described, compared and ordered numbers to 10 000. In Grade 5, this will be extended to develop place value concepts for numbers to 1 000 000. The focus is on numbers in the tens and hundreds of thousands. However, students are also expected to develop meaning for "one million".
	As students model numbers, they should also write them in standard form. The modelling should help them see that, in standard form, numbers are written in groups of three digits (periods).
Achievement Indicators:	To effectively read large numbers (i.e., numbers at and above tens of thousands), periods must be separated with a space. It is no longer the convention to separate periods with commas. A four-digit number can correctly be written with or without a space separating the thousands place from the hundreds place. To emphasize the patterns and periodic nature of place value, this document will employ the use of the space for all four-digit numbers. This is consistent with the practice implemented in Grade 4.
5N1.1 Write a given numeral, using proper spacing without commas.	
5N1.2 Write a given numeral to 1 000 000 in words.	Students should represent, in words, numbers which they see or hear. They could practice using meaningful contexts, such as cheque writing, population, event attendance, dates (years), and large numbers quoted in newspapers or sources such as the *Guinness Book of World Records*[TM].
	Reading and writing numbers in words requires students to consider the place value of each digit and solidifies the importance of the periodic structure. Students have experience in writing numbers to 10 000 in words; writing numbers to 1 000 000 is a natural extension. To write 946 219 using words, for example, students should recognize that they start with the largest period and continue with the successive periods. When reading whole numbers, students read the number of hundreds, tens and ones in the period furthest to the left (nine hundred forty-six) and then the name of the period (thousands). This is followed by the number of hundreds, tens and ones in the next period (two hundred nineteen). Remind students that since the ones period is the most common, its name is considered implicit and not usually named aloud. Therefore, 946 219 is correctly named as nine hundred forty-six thousand two hundred nineteen.
	Teachers should model reading whole numbers to remind students that the word "and" is not used. The word "and" is reserved for use with fractional or decimal numbers.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**

Suggested Assessment Strategies

Paper and Pencil

- Given a set of numbers up to 1 000 000 written in words, ask students to write the numbers in standard form using correct spacing and no commas.

  (5N1.1)

- Given a set of number cards (0-9), students could create a six-digit number, rewrite their number using words, and read their number aloud.

  (5N1.2)

- Ask students to scan newspapers and magazines for large numbers and rewrite the headlines/sentences with the numbers in words.

  (5N1.2)

Performance

- Ask students to brainstorm and create headlines that include numbers up to one million using words. They could then create computer generated copies of their headlines with images that might accompany the headlines.

  (5N1.2)

- Students could use an interactive spinner on a white board or roll dice (ten-sided if possible) to create a number up to one million. They should write the number in standard form and in words.

  (5N1.1, 5N1.2)

- Students could create and play a memory game matching numbers in standard form with word form.

  (5N1.2)

- Given a set of number cards (0 - 9), ask students to create and write five different six-digit numbers, with correct spacing and no commas.

  (5N1.1)

Interview

- Orally present a series of numbers up to 1 000 000 and ask students to write the given numbers in standard form.

  (5N1.1)

- Give students a number in standard form and also in words. The word form should be incorrect. Ask students to correct and explain, e.g., 34 360 vs thirty thousand four hundred sixty.

  (5N1.2)

Resources/Notes

Authorized Resource

Math Focus 5

Getting Started:
Teacher Resource (TR): pp. 9-12
Student Book (SB): pp. 38-39

Lesson 1: Representing Numbers

TR: pp. 12-16

SB: pp. 40-43

Note

This is not new for students. 5N1.2 is not covered in *Math Focus 5*. To address this indicator, students must write numbers in standard form as they work through the activities.

Teacher Resource Masters Booklet
Place Value Chart
TR: p. 43

Suggested Resource

- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit1

  -enrichment activities

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N1 Continued...** **Achievement Indicators:** *5N1. 3 Describe the pattern of adjacent places/positions moving from right to left.*	When discussing adjacent place positions and hundreds of thousands, build on students' prior knowledge with tens, hundreds, thousands and ten thousands. Students should be aware that base ten 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 name 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.

When discussing adjacent place positions and hundreds of thousands, build on students' prior knowledge with tens, hundreds, thousands and ten thousands.

Students should be aware that base ten 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 name 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.

large cube   flat   rod   unit

Begin with the unit cube representing one and the ten unit cube making a rod representing ten. Then ask, "What Comes Next?" Ten rods should give a flat, representing one hundred. Continue to one thousand. Continue using large cubes to make a rod representing ten thousand. Continue up to the cubic metre which has one million cubes.

5N1.4 Describe the meaning of each digit in a given numeral.

Some time may be required to review the concept of the "value" of a digit. The "value" of a digit is determined by where it falls in reference to the place value chart. Ask students to describe the meaning of a digit in a given set of numbers, such as 2$\underline{3}$4 561, 10$\underline{8}$ 300, or $\underline{3}$44 901.

Number of the Day

Given a whole number, students express it in various ways such as: words, expanded notation, pictorial form (place value chart, number line, base ten blocks, etc.), sum of other numbers.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to place two zeros anywhere in the number 2 583 to form a new six-digit number. They should write the new number and explain how the value of each digit has changed.

  (5N1.3)

- Provide students with a statement such as: *The digit 3 does not always have a value of 3.* Ask them to explain in writing using examples.

  (5N1.4)

- Ask students to explain how the value represented by the digit 1 varies in each of the following numbers:

  45 213   1 000 000   12 326   987 531   154 605

  (5N1.4)

Performance

- Provide students with a place value chart and counters. Ask them to model a six-digit number that has 9 as two of its digits. Instruct students to add one more counter to a place that has a 9 and write the new number with an explanation as to how they found that number.

  (5N1.3)

- Ask students to model 304 with base ten blocks and explain why rods are not present in the model although there is a digit in the tens place of the number.

  (5N1.4)

- Students choose six cards from a set of number cards with digits 0 to 9. Ask them to find:

    (i) the greatest possible number.
    (ii) the least possible number.
    (iii) a third number with value between the other two but closer in value to the greater than to the lesser.

  (5N1.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Representing Numbers

TR: pp. 12-16

SB: pp. 40-43

Lesson 2: Using Expanded Form

TR: pp. 17–21

SB: pp. 44-47

Supplementary Resource

Teaching Student-Centred Mathematics Grade 3-5 - John Van de Walle and LouAnn Lovin

- Support for SCO 5N1 can be found on pages 48-49.

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N1 Continued...** **Achievement Indicators:** *5N1.5 Express a given numeral in expanded notation.*	Expanded form can be demonstrated in either of the following ways: • 486 123 = (4 x 100 000) + (8 x 10 000) + (6 x 1 000) + (1 x 100) + (2 x 10) + (3 x 1) • 486 123 = 400 000 + 80 000 + 6 000 + 100 + 20 + 3 The first instance makes a smooth transition when it is used in conjunction with students' experiences using base ten blocks or place value charts. It represents the concrete model with the exact number of each type of block or numbers of counters in each place value column. Some students will be able to move quickly to the second version in which the combined value represented by each digit is expressed. Students should be exposed to both forms and practice should include numbers which contain zeros, such as 50 302. Number cards, place value charts, dice, newspaper articles, etc. can be used to create and/or find large numbers which can be represented in expanded form.
5N1.6 Write the numeral represented by a given expanded notation.	Write a large number in expanded form on the whiteboard. Have students write the number in standard form on individual whiteboards and hold up when completed. Expanded form should also be given in various orders such as (4 x 10 000) + (3 x 100 000) + (2 x 100). This requires students to consider the place value represented by each term rather than just taking the beginning digit of each group in order to convert to standard form. What's My Number? Give students a series of clues about a specific number. Based on the clues, they should identify the number. For 10 912, for example, the clues could be: • I have five digits. • My ones digit is 2. • I have four values, not five. • My ten thousands digit and my tens digit are the same. They are each half of my ones digit. • The sum of my digits is 13. • My hundreds digit is greater than 5. What's my number?

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Given a set of counters and a place value chart, ask students to model five different six-digit numbers and write them in expanded form. Some of the numbers should include zeros as digits (e.g., 274 092).

  (5N1.5)

- Students create and share punch cards* which give multiple choice solutions to questions related to naming a number, such as the value represented by a particular digit, or a missing value in expanded notation.

  (5N1.2, 5N1.4, 5N1.5)

* *Punch cards are a type of self-correcting multiple choice questions. On the front of an index card is a question with three possible answers along the bottom. Next to each answer choice, a small hole has been punched. Students put their pencil through the hole which corresponds to the answer they belive to be correct. On the back of the card, the hole corresponding to the correct response has been highlighted. When the student turns the card over, he or she can easily tell if his or her answer is correct.*

- Play a loop game "I Have..., Who has..." for numbers up to one million. Questions could include expanded notation, standard form, particular place values, etc.

  (5N1.2, 5N1.4, 5N1.5, 5N1.6)

Paper and Pencil

- Given a set of numbers in standard form, ask students to write them in expanded form. Be certain to include examples with zeros in some places.

  (5N1.5)

- Students may create *Wanted Posters* for whole numbers up to one million. The posters would list attributes such as standard form, digits in certain place value places, word presentation of its name, base ten or place value mat representations, etc. See *Math Art* by Carolyn Brunetto for details.

  (5N1.1, 5N1.2, 5N1.4, 5N1.5, 5N1.6)

- Given a set of numbers in expanded form, ask students to write them in standard form. Be certain to give some examples which mix the order of the values, e.g., (2 x 100) + (3 x 100 000) + (5 x 1).

  (5N1.6)

- Complete a modified* Frayer model or a web for a six-digit number. Students represent their number in different ways such as word form, expanded notation, pictorial form, etc.

  * instead of using non-examples, include another characteristic.

  (5N1.2, 5N1.4, 5N1.5)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 2: Using Expanded Form

TR: pp. 17–21

SB: pp. 44-47

Note

Lesson 2 does not provide enough work in moving back and forth between standard and expanded form where zeros are concerned.

Lesson 3: Renaming Numbers

TR: pp. 23–24

SB: p. 48

Curious Math:
Keep on Doubling

TR: pp. 25-26

SB: p. 49

Curious Math:

Lots of Money

TR: pp. 27-28

SB: p. 49

Lesson 5: Exploring One Million

TR: pp. 33-35

SB: p. 53

Suggested Resource

- *Math Art* - Carolyn Brunetto

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N1 Continued...
Achievement Indicator:

5N1.7 Provide examples of large numbers used in print or electronic media.

Brainstorm with students where they might see examples of large numbers. Ask them to gather real world examples of large numbers in headlines and stories to bring in and share with the class. Common uses might include population numbers, voting or polling results, event attendance, export numbers, government spending, twitter followers, Internet site hits, high scores in video games, etc.

The book *A Million Dots* by Andrew Clements may help students gain an appreciation for the magnitude of 1 000 000 while introducing a new place value period. Readers are able to visualize one million of something as this book contains one million dots (and 46 amazing facts).

Before reading the book, engage students in a discussion of one million. Ask questions such as:

- If you travelled one million km, where would you end up?

- How long is a million seconds? (about 11 1/2 days)

- How tall is a tower of one million dimes? (about 1.2 km)

Allow students to discuss the magnitude of the large numbers presented throughout the book. Students might attempt to make a small drawing using dots (pointillism) similar to the illustrations in *A Million Dots*. How many dots does it take to draw a heart on an 8 cm square sticky note? How many dots did the whole class use in making these hearts? How close are we to one million?

In pairs, students could time each other to see how high each can count in two minutes. Using this information, students could estimate how high a student could count in one hour, then one day. How long would it take to count to one million?

Have the students investigate other fun facts and relate them to one million.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Provide students with a large number, up to one million, and ask them to describe a situation where they would see that number outside of school.

(5N1.7)

Performance

- Ask students to scan newspapers, magazines, e-news etc. to find examples of large numbers in headlines and stories. They could create a collage using numbers and phrases collected.

(5N1.7)

- Ask students to take part in a thought experiment to discuss how they would go about finding out how far a line of 1 000 000 people standing shoulder to shoulder would reach if the line started in St. John's, Newfoundland and Labrador and moved west. Students would not be able to physically test this probe, but the discussion around how to go about solving it will highlight student understanding of measurement and magnitude of number, problem solving strategies and mathematical ideas.

(5N1.7)

Paper and Pencil

- Students could choose from the options presented in this RAFT chart to write about large numbers and how they might combine to reach one million. This RAFT is designed to be used linearly: i.e., each line taken together rather than a patchwork of any one choice from each column.

Role	Audience	Format	Topic
Milk Salesman	Kindergarten class of 25 students	Advertising - buy milk every school day!	My company is offering a reward for the school when this class buys their one millionth carton of milk (What grade will the class be in?).
Grade 5 Student	Parent/Guardian	Request for increase in allowance	Chocolate bars are about $1.00 each. You need an increase in your allowance in order to be able to eat one million chocolate bars in one year.
Grandma	Banker	Business letter	I have been saving pennies ever since I was a girl. I have 1 000 000 of them. Now that the Bank of Canada no longer uses pennies, I want to trade them in and go to Egypt to see the pyramids. How much money will I get for my pennies?

(5N1.7, 5N1)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 5: Exploring One Million

TR: pp. 33-35

SB: p. 53

Suggested Resource

- *A Million Dots* - Andrew Clements

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	

5N8 Describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially and symbolically.

[C, CN, R, V]

Achievement Indicator:

5N8.1 Express orally and in written form the decimal for a given symbolic, concrete or pictorial representation of a part of a set, part of a region, or part of a unit of measure.

In Grade 4, students represented and described decimals (tenths and hundredths) concretely, pictorially and symbolically. In Grade 5, this is extended to include thousandths.

Through the use of concrete materials, pictorial representations, and modelling, students strengthen the understanding that the use of decimals can extend the place value system to represent parts of a whole or mixed numbers. The decimal point is the symbol that marks the separation of part from whole; it separates the tenths from the ones. The symmetry of the decimal number system occurs around the ones place and the decimal. Teachers should focus on continuing the pattern of the base ten number system so that the unit (or the whole) is divided into ten, a hundred or a thousand equal parts (tenths, hundredths, thousandths).

There are many concrete materials that will aid students in their understanding of decimals:

*   grid paper
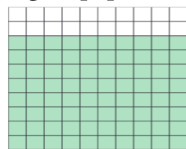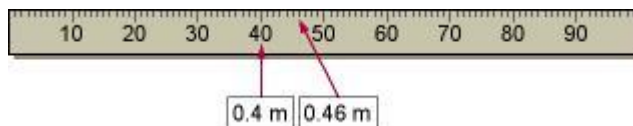

80 hundredths or 0.80

*   base ten blocks

three hundred forty-five thousandths or 0.345

*   number lines (tenths, hundredths, and thousandths)

| 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 |

nine tenths or 0.9

*   metre stick (millimetres are thousandths of a metre)

10   20   30   40   50   60   70   80   90

0.4 m 0.46 m

General Outcome: Develop Number Sense

| Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to identify tenths, hundredths and thousandths of a metre on a metre stick. Students could then measure objects to the nearest tenth (dm), hundredth (cm) and thousandth (mm) of a metre.

  (5N8.1)

- Show a variety of grids representing different decimals and ask students to write the corresponding decimal number in standard form.

  (5N8.1)

- Ask students to create matching cards with decimals in standard form and pictorial, concrete representations or indications of the value of digits. They could use these cards in various ways such as finding partners, concentration or bingo game, or quiz, quiz, trade.

  (5N8.1, 5N8.3)

Interview

- Present students with a base ten model of a decimal number and ask them to represent the model symbolically.
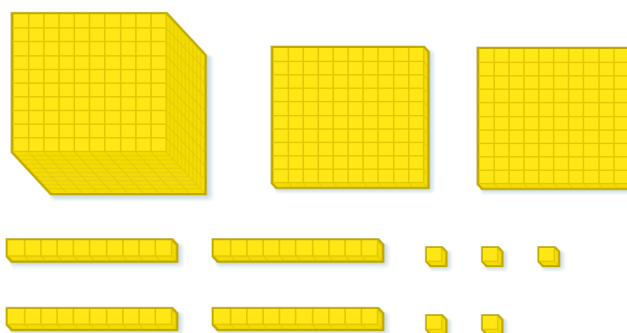
Key:

1	0.1	0.01	0.001

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Decimal Place Value

TR: pp. 39-43

SB: pp. 56-59

Note

The relationship between fractions and decimals is further developed in 5N9 in the Fractions unit.

Number

Outcomes	Suggestions for Teaching and Learning

Students will be expected to:
5N8 Continued...

5N1 Continued...
Achievement Indicators:

5N8.1 (Continued) Express orally and in written form the decimal for a given symbolic, concrete or pictorial representation of a part of a set, part of a region, or part of a unit of measure.

There are often different, but equivalent, representations for a number. Relating fractions to decimals is an example of this concept.

Decimals are introduced as tenths, hundredths or thousandths so students immediately recognize the relationship between decimals and fractions. For example, $\frac{2}{10}$ equals 0.2 , 0.34 is $\frac{34}{100}$ and 0.472 equals $\frac{472}{1\,000}$.

At this point in the year, students are expected to see the parallels in the naming system and be able to express decimals as fractions with denominators of 10, 100, or 1000. The conversion between fractions and decimals will be further developed in their work with fractions.

Students should read the decimal 3.2 as "3 and 2 tenths" not as "3 point 2." "3 and 2 tenths" reveals the important connection between fractions and decimals but the language "3 point 2" is meaningless and should be avoided.

Teachers should reinforce the correct usage of the word "and" to connect the whole number part of a number with the fractional or decimal part.

The following poem may be useful to remind students of how to properly read/name decimal numbers between zero and one:

Reading decimals is easy, you'll see.
They have two names like you and me.
First say the name as if there were no dot,
Then say the name of the last place value spot.

5N1.3 (Continued) Describe the pattern of adjacent place positions moving from right to left.

Using decimals extends the place value system to represent parts of a whole. This principle means that decimals are an extension of whole numbers. Writing the tenths digit after the decimal point is a convention that must be explicitly taught. If you follow the base ten relationship from right to left, a pattern appears.

Each time you move one place to the left, the value of the position increases by a factor of 10. Moving from the tens place to the hundreds place increases the value of the digit ten times; e.g., 900 is ten times larger than 90. The same thing happens with decimal places. 0.01 is ten times larger than 0.001; 0.1 is ten times larger than 0.01 or 100 times larger than 0.001. Using examples that explore money can highlight the similar relationships between pennies, dimes and dollars.
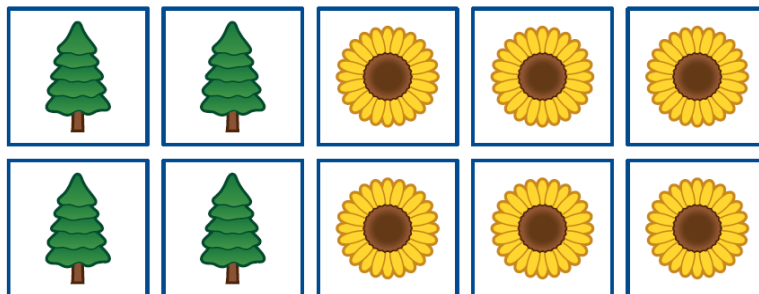
General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Write a decimal and a fraction to show the indicated part of each of the following diagrams.

Number of sunflowers:

Shaded area:
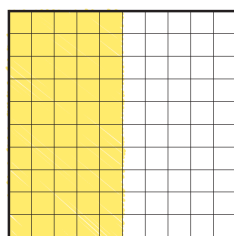
(5N8.1)

- Ask students to write the decimal represented by the shaded section.
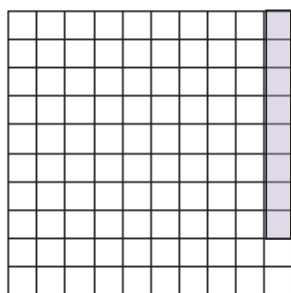
(5N8.1)

- Ask students to write the decimal represented by an identified point on a metre stick.

(5N8.1)

Interview

- Ask the student, "Why are the zeros important in the number 23 006? How would it affect the value of the number if the zeros were removed?"

(5N1.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Decimal Place Value

TR: pp. 39-43

SB: pp. 56-59

Number

Outcomes	Suggestions for Teaching and Learning

Outcomes

Students will be expected to:

5N8 Continued...
Achievement Indicators:

5N8.2 Describe the value of each digit in a given decimal.

5N8.3 Represent a given decimal, using concrete materials, pictorial representation, or a grid.

Suggestions for Teaching and Learning

Students should continue to use concrete materials to represent or model decimals in order to better see the relationship between hundredths and thousandths. Base ten blocks are an effective tool for this. Model decimal numbers to the thousandths using large cubes as ones, flats as tenths, rods as hundredths and unit cubes as thousandths. Using base ten blocks to model 3.231, for example, would look like this:

| 1 | 0.1 | 0.01 | 0.001 |
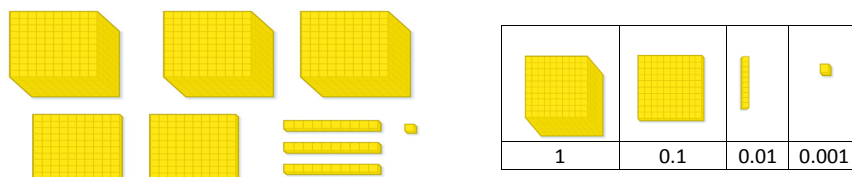
Remind students to draw a key when modelling with base ten blocks.

Number lines can also be used to visually represent decimal numbers.
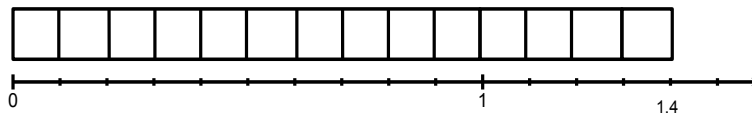
The tenths can be subdivided as needed in order to represent thousandths.
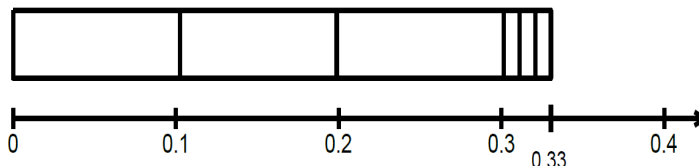
Students may also use thousandth grid paper for modelling decimal numbers to thousandths. Using thousandths grids on an interactive white board, shade a given value, such as 1.453. Discuss the value of each digit and how it is represented on the thousandths grid.

Metre sticks could also be used to represent decimals. Measuring to the nearest millimetre is one thousandth of a metre, centimetres are hundredths of a metre and decimetres are tenths of a metre.

Ask students to write at least one decimal example for each of the following clues:
- the ones digit is 0
- the tenths, hundredths and thousandths digit are all even
- the tenths, hundredths and thousandths digit are all even and are all different
- the tenths digit is less than the hundredths digit

As the students gain facility with decimal place value, more complex criteria or descriptors can be added.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

**Suggested Assessment Strategies**

Performance

- Present students with the following decimal numbers;

  1.105   0.403   2.069

  Ask students to model the decimals using base ten materials, grids, place value chart or number lines. Ask: "How did you choose your materials to model the decimals?"   Students could draw their models and include a key.

  (5N8.3)

- Ask students to do a card sort. Provide a small group of students with a plastic bag containing index cards with various statements about a specified number. Students are to discuss each card and create two rows of cards. Row One is for all cards that are true for the given number. Row Two is for the cards which are not true. Students explain why each card was placed in a particular row. There may be a need for a third row for disputed cards if not all members can agree.

  Sample: For the number 80.367

  A. There is a 6 in the hundredths place   B. There are 803 tenths

  C. There are 67 hundredths   D. There are 80 ones

  (5N8.2)

- Provide the student several sticky notes on which decimal expressions of distance between 0m and 1m have been written (e.g., 0.75 m and 0.265 m). Ask the student to stick the notes appropriately on a metre stick and explain his or her thinking.

  (5N8.3)

Paper and Pencil

- Ask students to work in pairs. One student prepares a list of four different decimal numbers. The other student models these numbers using base ten materials, number lines or grids. Students alternate roles.

  (5N8.3)

- Ask students to write the decimal represented by each of the following:

      4 hundredths   17 thousandths   36 tenths

  (5N8.2)

- Ask students to explain the value of each digit in $9.99.

  (5N8.2)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Decimal Place Value

TR: pp. 39-43

SB: pp. 56-59

Lesson 7: Renaming Decimals

TR: pp. 44–48

SB: pp. 60-63

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N8 Continued...

Achievement Indicators:

5N8.4 Express a given tenth as an equivalent hundredth and thousandth.

5N8.5 Express a given hundredth as an equivalent thousandth.

5N8.6 Represent an equivalent tenth, hundredth or thousandth for a given decimal, using a grid.

Suggestions for Teaching and Learning

In Grade 4, students used money (dimes and pennies) to explore the equivalence of tenths and hundredths. For example, 20 pennies (0.20) was equivalent to 2 dimes (0.2). In Grade 5, equivalence will include tenths, hundredths and thousandths and therefore thousandths grid paper (or decimal squares) will be needed.

Distribute tenths, hundredths and thousandths grids. Ask students to shade three columns on the tenths grid, 30 squares on the hundredths grid and 300 rectangles on the thousandths grid. Use coloured leads or markers in order to outline the subgroups reflected by each decimal number. This helps students see that these decimals are equivalent.

Beat the Teacher Game

Students and teacher each have a piece of paper. The teacher informs the students of the place values of a mystery number up to one million with as many as three decimal places. (Note that students are not responsible for numbers greater than one million.) Students and teacher create the skeleton of the number with segments as shown:

___ ___ ___   ___ ___ ___ . ___ ___ ___

The teacher rolls a number cube and each player decides in which place he or she will place that digit (in the ones, tens, hundreds ... place). Unseen, the teacher and students record the digit. Continue until all places are filled. When all blanks are filled, the teacher shows his or her number and the students each determine whether they have beaten the teacher (i.e., created a number which is greater than the teacher's).

This process may start early in the unit with whole numbers and expand to include decimal places.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

• Ask students to express the decimal represented by this grid in tenths, hundredths and thousandths.
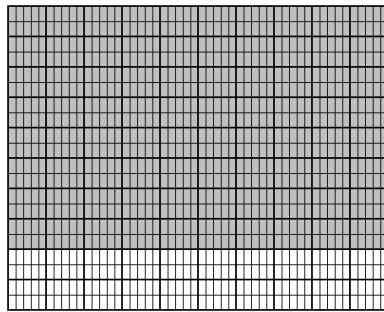
(5N8.1, 5N8.4, 5N8.5)

• Ask students to identify the decimal represented by the hundredths grid and then shade a tenths grid to show an equivalent amount. They could then create a thousandths grid representing the equivalent amount displayed by the tenths and hundredths grids. Ask students to explain how they know the decimals are equivalent.
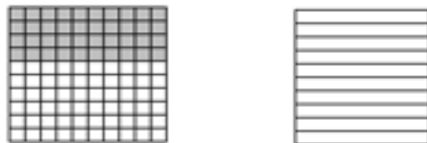
(5N8.4)

• Ask students to identify the decimals represented by the grids below and explain whether or not they are equivalent.
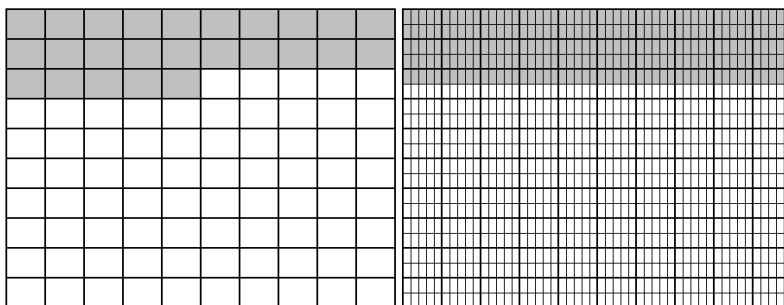
(5N8.1, 5N8.6)

Performance

• Display a series of decimals and ask students to match sets of equivalent decimals.

2.35	**5.4**	**0.7**
5.40	**0.070**	**2.305**
2.350	**0.700**	**2.3**
5.400	**0.70**	**0.540**

(5N8.4, 5N8.5)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 8: Communicating About Equivalent Decimals

TR: pp. 49–52

SB: pp. 64-65

Math Game:

Decimal Snap

TR: p. 57

SB: p. 69

Number

Outcomes	Suggestions for Teaching and Learning

Outcomes

Students will be expected to:

5N10 Compare and order decimals (to thousandths) by using:

- **benchmarks**
- **place value**
- **equivalent decimals.**

[C, CN, V]

Achievement Indicators:

5N10.1 Order a given set of decimals including only tenths, using place value.

5N10.2 Order a given set of decimals including only hundredths, using place value.

5N10.3 Order a given set of decimals including only thousandths, using place value.

5N10.4 Order a given set of decimals by placing them on a number line (vertical or horizontal) that contains the benchmarks 0.0, 0.5 and 1.0.

Suggestions for Teaching and Learning

Strategies for comparing decimals closely relate to strategies for comparing whole numbers. It is important to ensure that the same place values are being compared. Note that with whole numbers, students rely on the number of digits to provide a sense of the relative size of numbers. That is, a three-digit whole number is always greater than a two-digit whole number. Emphasize that this is not the case with decimals. When comparing decimals, the number of digits is irrelevant; it is the place value of the digits that matters. Students can use place value, a number line, or benchmark numbers to help them compare.

Students should be able to determine which of two decimal numbers is greater by comparing the whole number parts first and then the value of each digit to the right of the decimals.

It is important that students understand that decimal numbers do not need the same number of decimal places in order to be compared. One can quickly conclude that 0.8 > 0.423 without converting 0.8 to 0.800. By comparing the largest place value, students can easily see that eight tenths is larger than four tenths.

Some students may use benchmarks for comparison.

Comparing Using A Benchmark Number and/or Number Line
0.15 < 0.7 since 0.15 <0.5 and 0.7 > 0.5

| 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 0.1 |

Using 0.5 as benchmark
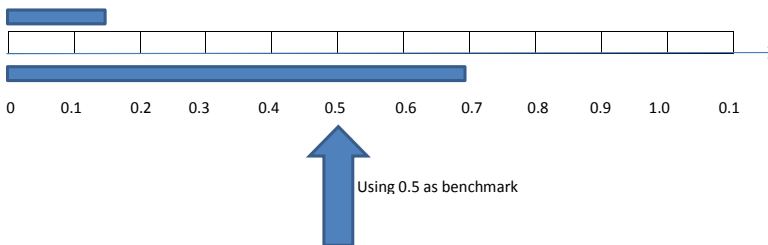
Create a number line on the classroom floor using masking tape. Have several decimal numbers, (less than 1) on flash cards. Show the numbers to the class. Ask students to determine appropriate benchmarks and place them correctly on the number line. Giving students the flash cards, have a class discussion to determine where each decimal should be placed on the number line. As student understanding grows, this activity can be used with varying sets of cards with values of: tenths only, hundredths only, thousandths only, or a mixture of all three.

Students could also use a metre stick when ordering decimals. Metre

General Outcome: Develop Number Sense

| **Suggested Assessment Strategies**	**Resources/Notes**

Suggested Assessment Strategies

Performance

• Give students the following blank game board.

```
☐.☐☐  >  ☐.☐☐
☐☐.☐  >  ☐☐.☐
☐☐.☐  >  ☐.☐☐
```

Roll a die. As the number is called, ask each student to write it in a blank square on his/her board. Roll the die 18 times. The student(s) who create(s) three true sentences wins the round. Repeat the process. Circulate during the play asking questions and noting students' justification of position choice. Students could be asked to write any strategies they used on chart paper and a class discussion could follow.

(5N10.1, 5N10.2)

• Give students eight index cards with a decimal number to tenths on each. Ask them to challenge a partner to order the number cards. Repeat activity using decimal numbers to hundredths and to thousandths.

(5N10.1, 5N10.2, 5N10.3)

• Give students the number cards 0.99, 0.987, 0.9 and 1.001, and ask them which decimal number they think is closest to 1. Have them explain how they made their decision.

(5N10.4)

• Give students the number cards 9.023, 10.9, 9.05, 10.11 and 9.8, and ask them which decimal they think is closest to 10. Have them explain how they made their decisions.

(5N10.4)

Paper and Pencil

• Provide examples of some of the best javelin throw distances that have occurred in past Olympics, e.g.,

1972: 90.48 m   1980: 91.20 m   1988: 84.28 m   1992: 89.66 m

Ask students to arrange the distances in order and determine whether records always improve.

(5N10.2)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 10: Comparing and Ordering Decimals

TR: pp. 59-62

SB: pp. 70-72

Note

Using equivalent decimals to compare is not directly addressed in the text, however, the concept of equivalent decimals has been developed in Lessons 7 and 8.

Number

Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N10 Continued...

Achievement Indicators:

5N10.1 (Continued) Order a given set of decimals including only tenths, using place value.

5N10.2 (Continued) Order a given set of decimals including only hundredths, using place value.

5N10.3 (Continued) Order a given set of decimals including only thousandths, using place value.

5N10.4 (Continued) Order a given set of decimals by placing them on a number line (vertical or horizontal) that contains the benchmarks 0.0, 0.5 and 1.0.

5N10.5 Order a given set of decimals including tenths, hundredths and thousandths, using equivalent decimals.

sticks provide visual representations of tenths (decimeters), hundredths (centimeters) and thousandths (millimetres).

Remind students that it is not the number of decimal places that determines the size of a number. Some students may think 0.101 is larger than 0.11 because 101 is larger that 11; others think it is smaller just because it has thousandths while the other number has only hundredths. Such misconceptions can be corrected by having students make base ten block representations of the numbers being compared.

Many students find it easier to compare (and calculate with) decimals when they have the same number of digits. This is always possible using equivalent decimals.

Comparing Using Equivalent Decimals with the Same Number of Digits
• 0.34 > 0.3 since 0.34 > 0.30 (34 hundredths > 30 hundredths)
• 8.302 < 8.32 since 8.302 < 8.320
(8 and 302 thousandths < 8 and 320 thousandths)

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance
- Divide students into groups of two or three. Ask each student to create a three-digit decimal number, less than two. Next, they could build their number using base ten materials and sketch it in a journal. Place all of the group's numbers on a number line in relative position. Students should compare and check answers with classmates.

(5N10.5)

- Give students cards with various decimal numbers written on them. Ask the students to place the numbers on a number line in appropriate places.

(5N10.5)

- Put students in small groups. Ask each student to write a decimal number, between 0 and 1, on a card. Two or three students can become benchmarks. Each member of the group then places him- or herself, holding the decimal card, in order from least to greatest.

(5N10.4, 5N10.5)

- Ask students to form a large circle. Read a statement aloud. Give 10 seconds of think time. Students who agree with the statement move to the centre of the circle. Students who do not agree stay on the outside of the circle. Students with opposing thoughts may be matched to defend their opinions. When time is called, students return to their original positions for another round.
    Sample questions:
        0.6 is larger than 0.56
        0.33 is the same spot on the number line as 0.330

(5N10.1, 5N10.2, 5N10.3)

Journal
- Ask students to respond to this prompt:

  Michael says 1.406 is bigger than 1.42 because 1.406 has more digits. Is he correct or not correct? Explain using base ten drawings.

(5N10.5)

Paper and Pencil
- Ask students to put 0.24, 0.8, 0.493, 0.024 and 0.08 in order from greatest to least.

(5N10.5)

Interview

- Ask the student to explain why you cannot compare two decimals by simply counting the number of digits after the decimal point in each.

(5N10.5)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 10: Comparing and Ordering Decimals

TR: pp. 59-62

SB: pp. 70-72

Number

Outcomes	Suggestions for Teaching and Learning

Outcomes

Students will be expected to:

5N10 Continued...

Achievement Indicator:

5N10.6 Explain what is the same and what is different about 0.2, 0.20 and 0.200.

Suggestions for Teaching and Learning

The decimal numbers 0.2, 0.20 and 0.200 represent the same amount: $\frac{2}{10}$ is equivalent to $\frac{20}{100}$ which is also equivalent to $\frac{200}{1\,000}$. They are different in their representation and in the number of digits used. Students should realize, though, that using different expressions of this value implies a difference in the precision of measurement used. For example, you cannot equate 3.2 m and 3.20 m. The measurement 3.20 m indicates that the actual length could be anywhere between 3.195 m and 3.204 m (the range of values that could be rounded to 3.20), whereas 3.2 m could be anywhere between 3.15 m and 3.24 m (the range of values that could be rounded to 3.2). This makes 3.2 m less precise than 3.20 m (Big Ideas from Dr. Small, 2009, p. 65).

Students could use an organizer, such as a T-chart, to compare 0.2, 0.20 and 0.200.

Same	Different
• They have 0 and 2 as digits • They are both decimal numbers • The 2 is always in the tenths place • The same point on the number line • The same amount shaded on tenth, hundredth and thousandth grids	• Number of digits after the 0 • Degree of precision shown (3 places after the decimal suggests that the measurement was more precise – to thousandths) • 0.2 represents 2 parts out of 10 • 0.20 represents 20 parts out of 100 • 0.200 represents 200 parts of 1 000

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to demonstrate the equivalency of 0.1, 0.10 and 0.100 using base ten blocks.

(5N10.6)

Journal

- Ask students to repond to the follow question:

    How are 0.3, 0.30 and 0.300 the same? How are they different? Use pictures, words and numbers in your explanation.

(5N10.6)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 10: Comparing and Ordering Decimals

TR: pp. 59 - 62

SB: pp. 70-72

Supplementary Resource

Big Ideas from Dr. Small- Marian Small

Adding and Subtracting Decimals

Suggested Time: 3 weeks

September	October	November	December	January	February	March	April	May	June

Adding and Subtracting Decimals
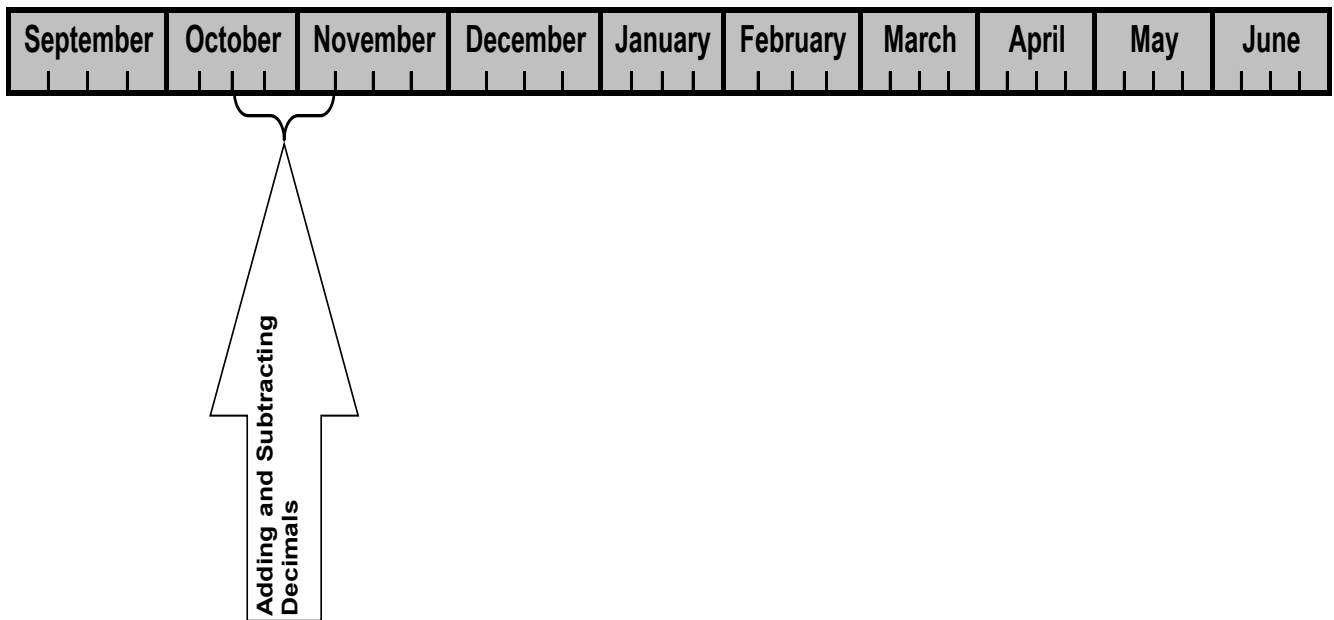
Unit Overview

Focus and Context

In this unit, students will build on their understanding of addition and subtraction of whole numbers and extend to include decimals. The importance of adding the same place values continues; i.e., adding tenths to tenths, hundredths to hundredths and so on. In exploring operations with decimals, estimation plays a large role. Estimation is used in everyday situations because it is sometimes more practical and efficient than the time required to find an exact value. Students will use front-end estimation, compensation, rounding and compatible numbers to estimate a sum or difference and to determine if solutions they compute are reasonable.

Outcomes Framework

GCO

Develop number sense

SCO 5N2

Use estimation strategies, including:

- front-end estimation
- compensation
- compatible numbers
- rounding

in problem-solving contexts.

SCO 5N11

Demonstrate an understanding of addition and subtraction of decimals (limited to thousandths).

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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 two 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]	5N2 Use estimation strategies, including: • front-end estimation • compensation • compatible numbers • rounding in problem-solving contexts. [C, CN, ME, PS, R, V] 5N11 Demonstrate an understanding of addition and subtraction of decimals (limited to thousandths). [C, CN, PS, R, V]	6N2 Solve problems involving whole numbers and decimal numbers. [ME, PS, T]

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:

5N2 Use estimation strategies, including:

- **front-end estimation**
- **compensation**
- **compatible numbers**
- **rounding**

in problem-solving contexts.

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

Suggestions for Teaching and Learning

Estimation is a mental "process of producing an answer that is sufficiently close to allow decisions to be made" (Reys 1986, p. 22). In Grade 4, students used front-end estimation, rounding, compensation, benchmarks and compatible numbers to predict sums and differences of four-digit whole numbers and decimal numbers (limited to hundredths). In Grade 5, students will continue to use these strategies to estimate sums and differences of whole numbers to hundred thousands and decimal numbers to thousandths. As students estimate first and then calculate, they refine their estimation strategies. When estimating, it is important that students focus on the meaning of the numbers and the operations.

Consider the following when teaching estimation:

- Encourage students to take risks as they explore various estimation strategies. They must develop a comfort level in finding approximate answers to computation.

- "Create a classroom environment that encourages student exploration, questioning, verification and sense making" (Reys 1992, p. 5).

- Have students communicate their thinking as they estimate and share their reasoning.

- Capitalize on class sharing by highlighting the estimation strategies that result in close estimates.

- Provide regular reinforcement so that students always estimate before they calculate in order to determine the reasonableness of their calculated answers.

- Provide a variety of problem-solving contexts in which students decide that an estimated answer is adequate and efficient.

- Provide a variety of problem-solving contexts in which students have the opportunity to explore various types of estimation strategies and then choose the strategy that works best for them in a given situation.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Resources/Notes

Authorized Resource
Math Focus 5

Getting Started
Teacher Resource (TR): pp. 8-12
Student Book (SB): pp. 80-81

Lesson 1: Estimating Whole
Number Sums and Differences
TR: pp. 13-17
SB: pp. 82-85

Lesson 2: Communicating About
Estimating and Calculating
TR: pp. 18-21
SB: pp. 86-87

Note
Front-end estimation,
compensation, and compatible
numbers strategies are located in
Math Background in TR: p. 13.

Teachers are encouraged to use
selected parts of these three
opening lessons to reactivate
student knowledge related to
rounding and estimating with
whole numbers before extending
these concepts to include decimal
numbers.

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N2 Continued...

Achievement Indicator:

5N2.1 Round decimals to the nearest whole number, nearest tenth or nearest hundredth.

Suggestions for Teaching and Learning

Providing opportunities for students to round numbers will help them develop skills necessary for using estimation strategies in problem-solving contexts. Students were introduced to rounding in Grade 3. In Grade 5, they will consider to which place numbers should be rounded to give the best approximation, and how the strategy of compensation may influence the direction in which a particular term may be rounded. To get a better estimate when adding 10 956 + 2 852 + 13 650, for example, if the first two addends were rounded up to the nearest thousand, the third could be rounded down to compensate for the high estimate of 10 956 and 2 852.

The following rhyme might be helpful when reviewing the rules for rounding. Students should look at the digit to the right of the place value under consideration (to which they have been asked to round).

5 or more, let it soar; 4 or less, let it rest.

In Grade 4, students rounded numbers with decimals to the nearest whole number. In Grade 5, students should be able to round decimals to fewer places such as 2.9286 to 2.9 or 3. The conventions or rules for rounding decimals are just like the ones for whole numbers. Rounding a number means that you substitute a "friendly" number that is easier to use in order to get an estimated anwer.

Decimal	Nearest Thousandth	Nearest Hundredth	Nearest Tenth	Nearest Whole Number
2.9286	2.929	2.93	2.9	3

Ask students to suggest situations when it might be useful to round decimals. One common example is in describing measurements. A wall that is 2.367 metres long, for example, can be estimated as 2.37 metres or 2.4 m, or as 2 m. Discussion may be warranted regarding instances in which each of these rounding choices may be most appropriate.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Resources/Notes

Performance

- Close Nice Numbers - Display a number with four decimal places, e.g., 3.0917. Starting with whole numbers, ask students, "Is it closer to 3 or 4?" Then go to the tenths: "Is it closer to 3.0 or 3.1?" Repeat with hundredths and thousandths. At each answer, challenge students to defend their choices. (Walle & Lovin, 2006)

(5N2.1)

- Ask students to create a number line using cash register tape and use it to place a given set of decimals. Ask them how they decided where to place the numbers on the number line.

(5N2.1)

Journal
- Jill needs 4.673 m of velvet ribbon and 5.076 m of silk ribbon for costumes for the school play. When she went to the website to order, she found that they only sell ribbon by the tenth of a metre. Ask students how much of each she should order. They should explain their answer.

(5N2.1)

Authorized Resource

Math Focus 5

Chapter 2, Lesson 9: Rounding Decimals
TR: pp. 54-56
SB: pp. 66-68

Suggested Resource
- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit 2 -enrichment activities

Number

Specific Outcomes	**Suggestions for Teaching and Learning**

Students will be expected to:

5N2 Continued...

Achievement Indicator:

5N2.2 Determine the approximate solution to a given problem not requiring an exact answer.

Estimation 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. Some situations call for more careful estimates than others. When providing students with problems or questions, attempt to make the problems as relevant to the students as possible. Discuss situations where estimation is used in real life. Discuss with the class situations in which estimation would be appropriate and instances where it would not. Possible suggestions might include the number of people at a crowded restaurant, the amount of pizza required for a party, measuring medicine to give to a baby, or the number of socks in your drawer. Ask questions such as:

- Is it okay to make an estimate?

- What are the benefits of estimating?

- When might an estimate be the best way to solve a problem?

Students should work with a variety of problems which require determining an approximate solution such as:
A toy store has a sale. The store will pay the tax if your purchase totals $25 or more. Jessica buys a computer game for $14.95 and some batteries for $4.99. About how much more would she need to spend in order to avoid paying tax?
Students may chose the estimation strategy to use in finding approximate solutions to problems. They should realize that some strategies will give closer estimates than others. Student exploration will help refine their choices of estimation method depending on the situation and nature of the problem.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to discuss whether each of the following situations requires an estimate or an exact answer:

  (i)   How many people live in Happy Valley-Goose Bay?
  (ii) How much milk does my family drink each week?
  (iii) Fred has a bag of raisins and wants to share half with his brother.
  (iv) Eric wants to buy two packs of trading cards from the $20 he got for his birthday. If the cards cost $7.95 a pack, does he have enough money?

  (5N2.2)

Paper and Pencil

- Give students an Estimate or Exact exit card:

  The teacher has a bin of crayons on his shelf. He wonders how many red, green and yellow ones he has. Should he estimate or determine the exact number of each colour? Explain your thinking.

  (5N2.2)

- Provide a collection of flyers for big ticket items such as vacations, houses, cars, etc. Ask students to estimate what choices they could make if they won $150 000. Teachers could specify requirements such as including airfare, accommodations, attraction admissions, car insurance or property tax.

  (5N2.2)

- Ask students to create a problem that does not require an exact answer. They could exchange problems with a classmate and solve them by estimating the answer and explaining their thinking.

  (5N2.2)

Journal

- Ask students to respond to the following prompt:

  Beth needs 0.796 of a ball of wool to make a hammock for her bearded dragon. If she also plans to make a hammock for each of her friend's two dragons, how many balls of wool does she need to buy? Explain your answer.

  (5N2.2)

Resources/Notes

Authorized Resource

Math Focus 5

Chapter 2, Lesson 9: Rounding Decimals
TR: pp. 54-55
SB: pp. 66-69

Chapter 3, Lesson 1: Estimating Whole-Number Sums and Differences
TR: pp. 13-17
SB: pp. 82-85

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:
5N2 Continued...
Achievement Indicators:

5N2.3 Estimate a sum, difference or product, using compatible numbers.

Compatible numbers is a method of estimating using "friendly" or "nice" numbers, which can be easily calculated mentally. Students have used this strategy in Grade 4. In this unit, students use compatible numbers in estimating sums and differences of large whole numbers and decimal numbers.

e.g., (a) $109\ 543 - 10\ 257 \approx 109\ 543 - 10\ 243 = 99\ 300$.

(b) $46.093 + 78.92 + 54 \approx (46 + 54) + 79 = 100 + 79 = 179$

Model estimating both sums and differences using compatible numbers.

Suppose Roger has $17 986 in the bank and spends $196 buying new school clothes. In order to determine about how much money he has left his account, students could use compatible numbers.

$17 986 (compatible number $18 000) - $196 (compatible number $200)

So, $18 000- $200= $17 800. Roger has about $17 800 left.

Students should also work with problems involving decimals, such as:

To raise money at school, 24 students each sold 6 chocolate bars at $1.75 each. Estimate how much money the students collected. This problem could be solved using addition while some students may choose to use multiplication. Both strategies are acceptable. Teachers could remind students that multiplication is just repeated addition. A compatible number for $1.75 is $2. The estimate can be found using either $2 + $2 + $2 + $2 + $2 + $2 = $12 or 6 x $2 = $12.

5N2.4 Apply front-end estimation to find:

* *sums*

* *differences*

* *products*

* *quotients*

Teachers should note that the teacher resource for Math Focus 5 refers to front-end rounding. Students have already used this strategy but the terminology used in Grades 3 and 4 has been front-end estimation. Rounding is another related but separate estimation strategy. To combine the terms will be misleading. For clarity of student understanding, teachers should refer to this strategy as front-end estimation.

Front-end estimation is a method of estimating computations by keeping the first digit (i.e., furthest to the left) in each of the numbers and changing all of the other digits to zeros. This strategy can be used to estimate sums and differences. Students should recognize that this strategy always gives an underestimate for sums,

e.g., $189\ 523 + 25\ 812 \rightarrow 100\ 000 + 20\ 000 = 120\ 000$

Students should apply front end estimation to find sums and differences in problems such as: Joshua has a piece of ribbon that is 46.5 cm long and he cuts off a piece 22.7 cm long. About how much ribbon does Joshua have left?
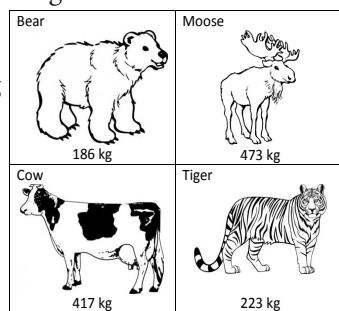
General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Students could estimate to determine which combination of animals can safely cross bridges with the given load limits.

  (a) Bridge A: load limit of 800 kg

  (b) Bridge B: load limit of 1 100 kg

Bear	Moose
186 kg	473 kg
Cow	Tiger
417 kg	223 kg

  (5N2.3, 5N2.4)

- Ask students to estimate the solution to each of the following problems:

  (i)   Mount Everest is 8.850 km high. Mount Logan is 5.959 km high. What is their height difference?

  (ii) Jenny and her 11 friends go out to eat at a restaurant. Each meal costs $9.97 including GST and the tip. Will $100 cover the cost of the meals?

  (iii) During one summer, Marcie travels 7 185 km and Jimmy travels 4 205 km. Estimate how much farther Marcie travels than Jimmy during the summer. Explain your thinking. Do you think your estimate is more or less than the calculated answer? Explain your reasoning.

  (5N2.2, 5N2.3, 5N2.4)

Interview

- Terry-Lynn had $257. She spent $173.75. She estimates that she has less than $100 dollars left. Ask students if her estimate is reasonable. Explain.

  (5N2.3)

Performance

- Place students in groups of two or three. Provide each group with a weekly retail flyer. Ask each group to use front-end estimation to purchase items from the flyer to get a total as close as possible, without going over, a given amount. Have groups share their strategies with the class.

  (5N2.3, 5N2.4)

Resources/Notes

Authorized Resource

Math Focus 5

Chapter 3: Lesson 1: Estimating Whole-Number Sums and Differences
TR: pp. 13-17
SB: pp. 82-85

Chapter 3: Lesson 2: Communicating About Estimating and Calculating
TR: pp. 18-21
SB: pp. 86-87

Note
Math Focus 5 does not reference the estimation strategies of front-end estimation, compensation and compatible numbers in solving problems. Further development of these strategies should use material from this guide.

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N2 Continued...

Achievement Indicator:

5N2.5 Estimate the solution to a given problem, using compensation, and explain the reason for compensation.

Suggestions for Teaching and Learning

Compensation is adjusting a computational estimate to make it closer to the calculated answer.
If asked, for example, to estimate the sum
$\qquad$ 136.2 + 26.2 + 55.2
by rounding or compatible numbers, students might suggest:
$\qquad$ 140 + 30 + 60 = 230
This results in a very high estimate as, according to the rules of rounding, all addends are rounded up. In situations where all addends are rounded in the same direction, students could choose to round one in the opposite direction in order to improve the accuracy of the estimate.

To compensate: 136.2 (↑)+ 26.2 (↑) + 55.2 (↓)
$\qquad$ 140   +   30   + 50   = 220
This results in a better estimate.
Ask students to think of alternative compensation strategies.
(e.g., 130 + 30 + 60, 135 + 25 + 55)

Encourage compensation also when all addends would be rounded down according to rounding guidelines.
144.95 + 34.89 + 84.5 + 73.09

140 (↓) + 30 (↓) + 80 (↓) + 80 (↑) = 330

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Interview

- Ask students to answer the following:

  Tony has 375 baseball cards and 823 hockey cards. He estimates his total collection of sports cards to be 1 100. How could he make his estimate closer to the actual total?

  (5N2.5)

Journal

- The fair visited towns all over Newfoundland and Labrador last summer. The number of tickets sold for each ride is shown in the table below:

Ride	Tickets Sold
Super Slide	45 980
Tilt-A-Whirl	38 678
Scrambler	29 894
Tip Top	42 579
Tornado	18 668
Rock O'Plane	5 509

  Ask students to estimate the total number of tickets sold, using compensation. They should explain their thinking.

  (5N2.5)

Paper and Pencil

- Joshua told his mom that he will make chili for supper. His recipe calls for 0.750 kg of ground beef. All that is left at the supermarket is three packages which have masses of 0.157 kg, 0.279 kg, and 0.381 kg. Ask students to use estimation to determine if he will have enough to make his recipe if he buys the three packs. They should explain their thinking.

  (5N2.5)

Presentation

- Ask students to estimate and explain their strategy for each of these sums.

  (i)   346 + 263

  (ii) 952 + 324 + 147

  (iii) 75 + 514 + 287 + 22

  They could present one of their answers to a group of classmates.

  (5N2.4, 5N2.5))

Resources/Notes

Authorized Resource
Math Focus 5

Chapter 2: Lesson 4: Rounding Numbers

TR: pp. 29-32

SB: p.p. 50-52

Note

This lesson focusses on estimating using rounding of whole numbers. Additional examples will be required to include other methods of estimation and estimating with decimal numbers.

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N11 Demonstrate an understanding of addition and subtraction of decimals (limited to thousandths).

[C, CN, PS, R, V]

Achievement Indicators:

5N11.1 Predict sums and differences of decimals, using estimation strategies.

5N11.2 Place the decimal point in a sum or difference, using estimation.

Students should develop computational fluency with decimal numbers. In the past, decimal computation was dominated by lining up the decimal places. While this is important, for accurate computation a firm understanding of place value is needed.

Students should begin by using estimation to predict sums and differences. The estimation strategies covered in outcome 5N2 will help students determine if their solution is reasonable.

Jack rode his bike 8.5 km on Monday, and 7.3 km on Tuesday. How far did he ride in two days?

Estimates might be similar to:

9 km + 7 km = 16 km (rounding)

8 km + 7 km = 15 km (front-end estimation or compatible numbers)

When students begin to find exact solutions to sums and differences of decimal numbers, they should always be encouraged to compare them to their estimates to determine if the calculated answer is reasonable.

Estimation strategies should also help students determine correct decimal placement in a sum or difference.

Ask students to estimate 4.13 + 5.67

They may respond with 4 + 5 = 9 (using front-end estimation) or

4 + 6 = 10 (using rounding or compatible numbers).

Focus attention on the fact that there are 9 or 10 wholes.

Display the digits of the answer but do not include the decimal:

4.13 + 5.67 = 980

Ask students: Where does the decimal belong?

They should be able to connect this with their estimate and realize that their estimate was nine or ten. Therefore, the decimal must be placed so that the solution has about 9 or 10 wholes. The correct response would be 9.80.

Similarly with subtraction: Ask students to estimate 87.85 - 78.52.

They may suggest 88 - 79 = 9 (or something close depending on the strategy chosen).

The answer without the decimal point is: 87.85-78.52 = 933

Ask students where the decimal goes. According to their estimate the answer has to be about nine, so 9.33 is the correct placement.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Journal

- Ask students to estimate to match each example from the left to the answer on the right and explain their reasoning.

  (i)   0.713 - 0.522   4.48

  (ii) 4.80 - 0.32   0.631

  (iii) 0.229 + 0.402   2.02

  (iv) 2.99 - 0.97   0.191

  (5N11.1)

- Ask students to describe how to use estimation to determine the placement of a decimal in a sum or a difference.

  (5N11.2)

Paper and Pencil

- Ask students to estimate the missing number in each example and explain their thinking.

  (i)   0.099 + 0.280 is about _____

  (ii) 2.948 + 5.799 is about _____

  (iii) 18.97 - 4.77 is about _____

  (5N11.1)

- Jane was running in her school's track and field competition. Her first race time was 4.127 minutes. Her second time for the same distance was 4.091 minutes. Ask students:

  (i)   Estimate her total running time. Explain your thinking.

  (ii) In which race did she perform better?

  (iii) About how much faster was her time for the second race?

  (5N11.1)

Performance

- Provide the students with a selection of addition and subtraction problems using decimals to thousandths. Include the calculated answer without the decimal point. Ask students to decide where the decimal point should be placed in each answer and explain how they know. Encourage the use of a variety of estimation strategies. Students could then share their answers with the whole class and correct any errors in decimal point placements.

  (5N11.2)

Resources/Notes

Authorized Resource
Math Focus 5

Chapter 3: Lesson 3: Estimating Decimal Sums and Differences

TR: pp. 22-25

SB: pp. 88-91

Note

This strategy of estimating to ensure proper placement of the decimal is merely mentioned in *Math Focus* Lesson 5. Teachers should use examples from this guide to help students with this strategy.

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N2 Continued...** **Achievement Indicators:** *5N2.6 Select and use an estimation strategy for a given problem.*	At this point, students should be given problems in which they are expected to use reasoning skills to choose the estimating strategy which makes the most sense such as: According to the *Guinness World Records 2005*[TM], the heaviest head of garlic had a mass of 1.191 kg. The heaviest potato had a mass of 3.487 kg. Estimate the combined mass of these vegetables and explain the estimation strategy used. Encourage students to explain, in their own words, why they chose a particular estimation strategy. Students should also work with contexts which require the addition and subtraction of decimals.
5N2.7 Provide a context for when estimation is used to: • *make predictions* • *check the reasonableness of an answer* • *determine approximate answers*	Estimates will give help students make predictions for planning. Angela is at the store and sees some flowers that would be perfect in her back yard. She knows that the row in her flower bed is 47 cm long. The tag on the plants says to plant them 10 cm apart. How many plants does she need? Think: "47 cm is nearly 50 cm, and 50 divided by 10 is 5, so 5 plants should be enough." Estimates also give students a better sense of the size of answer they should get when they solve a problem. Zora wants to buy five magazines that cost $1.95 each. When she gets to the check out, the amount displayed on the cash register is $12.25. Is that right? Quickly estimating how much she expects to pay, she thinks: "Five at $1.95 each is about 5 x $2, or about $10 so $12.25 seems too much". If a solution differs greatly from the estimate, students should take it as a signal to double check their calculations. If you are adding 109 + 56, and the calculator shows 75, is that right? Think: "109 + 56 is close to 110 + 60, which is 170. Ooops! I must have punched a wrong number." In this manner, estimation helps ascertain if an answer found through computation is reasonable.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview
- Tell students: We are going to put up a new bulletin board in the classroom. The border needed comes in lengths of 113.5 cm. The perimeter of (distance around) the board is 406.9 cm. Is it reasonable to use six lengths of border? Explain.

(5N2.7)

Journal
- Ask students to respond to the following prompts;

  (i) Jimmy is going to buy three packages of gum. Each package of gum costs $1.37. How can he estimate how much money he will need for his purchase?

(5N2.6)

  (ii) Adam was given two Newfoundland puppies for his birthday named Ebony and Ireland. When they were born, Ebony had a mass of 0.775 kg and Ireland had a mass 0.836 kg. Estimate the total mass of Ebony and Ireland and explain your estimation strategy.

(5N2.6)

- Ask students to estimate each of the following differences:

  (i) 685.777 – 217.93   (ii) 685.073 – 274.1

  They should explain the strategy used and identify which estimate is closer to the actual difference.

(5N2.6)

Paper and Pencil
- Ask students to solve this problem:

  Judy used the following strategy to estimate the sum of 365 and 437. Judy's thinking: I used front-end estimation.

  365 is about 300 and 437 is about 400.

  300 + 400 = 700

  My estimate for the sum of 365 and 437 is about 700.

  Ask students how they could help Judy adjust her estimate to make it closer to the calculated sum. They should explain their thinking without doing the actual calculation.

(5N2.6)

Resources/Notes

Authorized Resource
Math Focus 5

Lesson 3: Estimating Decimal Sums and Differences

TR: pp. 22-25

SB: pp. 88-91

Note

Lesson 4 is optional, as there is no direct mention of mental math in the outcomes; however it may be interesting and useful for some students.

Number

Specific Outcomes	**Suggestions for Teaching and Learning**

Students will be expected to:

5N2 Continued...

Achievement Indicator:

5N2.8 Describe contexts in which overestimating is important.

Brainstorm with students to create a list of real life situations in which overestimating is important. When determining if you have enough money for a particular purchase, for example, it may be advisable to overestimate the total of the goods to be purchased to ensure you have enough money.

Ella is at the grocery store with only $20. She needs to buy milk $3.98, bread $2.29, eggs $2.76 and a steak for $8.67. When she gets to the cash register, will she have enough money to buy everything she has selected?

Overestimating is also important in planning a birthday party or similar event to ensure there is enough food for all guests and to accommodate any unexpected people who attend the party.

As students learn to add and subtract decimal numbers, they should connect with what they learned about adding and subtracting whole numbers. In Grade 4, students have added and subtracted tenths and hundredths. In Grade 5, they will expand this to work with thousandths. It is recommended that students revisit adding and subtracting to hundredths before moving forward to examples involving thousandths.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Journal

- Ask students to respond to the following prompts:

  (i) Sophie and her sisters, Ruby and Rhonda, are going to the theatre. They will each need to each purchase a ticket which costs $7.85, and they would each want to purchase a snack pack that costs $8.99. Their parents give them $50. Use estimation to determine if they will have enough money.

  (5N2.8)

  (ii) Describe a situation in which you would round $12.35 to $13 instead of down to $12.

  (5N2.8)

Paper and Pencil

- There are 310 students going to the Arts and Culture Centre to see a musical. Each school bus holds 50 people. Ask students how many school buses should be booked. They should explain their thinking.

  (5N2.8)

- Ask students to solve this problem:

  John wishes to buy a new computer game that costs $109.95 including taxes. He has $43.79 in his wallet and $59.98 in his piggy bank. He estimates his total cash to be over $110, so he can buy his game. Is his estimate reasonable? Explain.

  (5N2.7, 5N2.8)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 3: Estimating Decimal Sums and Differences

TR: pp. 22-25

SB: pp. 88-91

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N11 Continued...
Achievement Indicators:

5N11.3 Explain why keeping track of place value positions is important when adding and subtracting decimals.

5N11.4 Solve a given problem that involves addition and subtraction of decimals, limited to thousandths.

Suggestions for Teaching and Learning

Emphasize that when adding decimals, students must add like place values, i.e., tenths to tenths, hundredths to hundredths, and so on. This is achieved by lining up decimals when adding vertically. One cm grid paper or a place value chart should help students keep track of place value.

4	5	.	7	6	3
	3	.	4	2	
4	9	.	1	8	3

(with a + sign to the left of the second row)

Provide examples of student work for class analysis such as:
Susan added 1.469 + 11.6 and got a result of 13.069.
Ryan added the same numbers and said the answer was 1.585.
(i) Ask students to explain why the answers are different.
(ii) Ask: Who is right? How do you know?

As students learn to add and subtract decimals, emphasize that the properties and techniques established for the addition and subtraction of whole numbers also apply to decimals. In Grade 4, students recognized that tenths are added to tenths, and hundredths to hundredths. This is also true for thousandths. Encourage students to think about what each digit represents. 1.234 + 0.562, for example, would be one whole, seven tenths, nine hundreths and six thousandths. Base ten blocks and place value charts will support this understanding.

In Grade 4, students used base ten blocks, number lines, regrouping, renaming and counting on to add and subtract decimals (to hundredths). They should continue to use and refine these strategies to add and subtract decimals to thousandths.

In Grade 4, students have represented decimals to hundredths using base ten materials where:

= 1 whole $= \frac{1}{10}$ $= \frac{1}{100}$
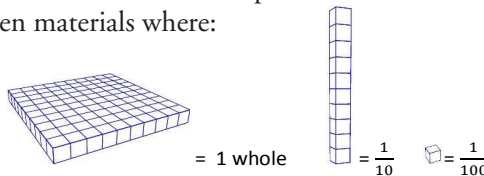
In Grade 5, the base ten materials have to extend to thousandths, and will, therefore, be represented as follows:

= 1 whole $= \frac{1}{10}$ $= \frac{1}{100}$ $= \frac{1}{1\,000}$
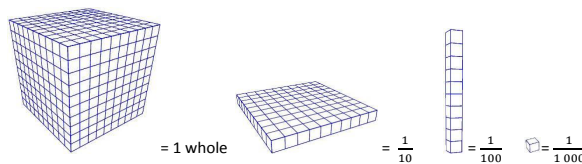
Digital versions of the base ten materials are also available online.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil
- Maria's math book has a mass of 0.573 kg, her social studies book is 0.45 kg, and her science book is 0.108 kg. Ask students to determine the total mass of Maria's books.

(5N11.4)

Performance
- Ask students to use base ten materials to model and solve the following:

(i)   3.2 + 4.51
(ii) 3.21 - 1.41
(iii) 3.234 + 1.123
(iv) 1.562 - 1.238

(5N11.4)

Interview

- Present students with a solution containing an error such as:

Scott wrote 5.23 + 4.232 = 4.755

Ask students to identify the error that occurred and explain to Scott how he could correct the error.

(5N11.3)

Journal

- Ask students to respond to the following prompt:

When adding 24.56 and 1.735, Ariana got a total of 4.191. How can you tell if her answer is reasonable? If it is not, what was her error?

(5N11.3)

Resources/Notes

Authorized Resource
Math Focus 5
Lesson 5: Adding Decimals by Regrouping
TR: pp. 30-34
SB: pp. 94-97

Suggested Resource
- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit2
    -online base 10 blocks

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N11 Continued...

Achievement Indicator:

5N11.4 (Continued) Solve a given problem that involves addition and subtraction of decimals, limited to thousandths.
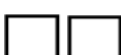
Suggestions for Teaching and Learning

To activate prior knowledge, ask students to model a set of decimals with base ten blocks.

Students should begin by determining a sum that does not require regrouping, such as 1.213 + 1.124.

Number	Ones	Tenths	Hundredths	Thousandths
1.213 + 1.124 = 2.337				

Students should then model a sum that requires regrouping, such as 2.456 + 1.275.

Number	Ones	Tenths	Hundredths	Thousandths
2.456 + 1.275 = 3.731				

Kidspiration® software could also be used to help students visualize and demonstrate their understanding of regrouping.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

• For each pair of students, provide base ten blocks, a set of index cards with different decimal numbers written on them (such as 1.2, 2.05, 1.423, 12.3, 4.223), and recording paper.

Ask students to work with a partner. Each person picks one number card, models the number selected with base ten materials, and sketches the model on a recording sheet. Students should then determine the sum of their numbers. They should compare and check each other's sum and the strategy used.

To further extend this exercise, ask students to:

(i) find the difference between the two original numbers selected

(ii) choose any three cards and add them together

(iii) choose two cards and create a word problem that uses the numbers on both cards. Exchange problems with another pair of students to solve.

1.04	2.05	2.31
2.1	1.34	0.06
1.2	1.9	0.012
0.253	1.3	2.5
0.524	1.07	1.42
1.42	1.1	0.41

(5N11.4)

Observation

• Ask students to model a given sum using base ten blocks. Teachers should observe:

(i) What strategies do students use to make their numbers? How do they decide which block will represent one whole?

(ii) How quickly and confidently do they represent and add decimal numbers? Are they confident in trading/regrouping (particularly when zeros are involved)? How engaged are they in the discussion? What questions do they ask?

(5N11.4)

Resources/Notes

Authorized Resource
Math Focus 5
Lesson 5: Adding Decimals by Regrouping

TR: pp. 30-34
SB: pp. 94-97

Suggested Resource
• Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit2-Kidspiration®

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N11 Continued...** **Achievement Indicator:** *5N11.4 (Continued) Solve a given problem that involves addition and subtraction of decimals, limited to thousandths.*	Students learned in Grade 4 that they can determine a difference using either take away or comparison strategies with base ten blocks. Each summer Sarah and her family pick bakeapples and sell them. On their last outing, Sarah picked 2.75 L. On the way back to the car, she tripped and spilled 0.342 L. How much does she now have in her container? e.g., 2.75 - 0.342 Students should recognize that this problem involves subtraction. Students should model the first number, 2.75, using base ten blocks and should then 'take away' 0.342.
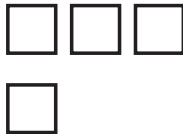
Ones	Tenths	Hundredths	Thousandths

Ones	Tenths	Hundredths	Thousandths

They should conclude that Sarah has 2.408 L of bakeapples left. Using a place value mat, the following base ten blocks would remain.

Ones	Tenths	Hundredths	Thousandths

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Model 2.12 and 1.140 with base ten blocks. Ask students to use the materials to explain how to find the difference between the two numbers.

  (5N11.4)

- Ask students to work in pairs. Each student should measure 10 of their own foot lengths in metres to the nearest millimetre (i.e., thousandth of a metre). They should find the sum of the measures of the two partners and the difference between the two lengths. They could share their results with other groups and repeat the comparisons with another pair of students.

  (5N11.4)

Paper and Pencil

- Jacob has grown two sunflowers. One of the sunflowers is 80.254 cm tall and the other is 86.49 cm tall. What is the difference in the heights of the two sunflowers?

  (5N11.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Exploring Problems that Involve Decimals
TR: pp. 40-42
SB: p. 100

Curious Math:
Subtracting Decimals Using a Whole Number
TR: pp. 43-44
SB: p. 101

Lesson 7: Subtracting Decimals by Regrouping
TR: pp. 45-49
SB: pp. 102-105

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:
5N11 Continued...
Achievement Indicator:

5N11.4 (Continued) Solve a given problem that involves addition and subtraction of decimals, limited to thousandths.

Suggestions for Teaching and Learning

Students could also use the comparison model for subtraction of decimals using base ten materials, where the focus is on finding the difference between the two numbers. In this case, students could model both numbers and compare. The difference between them is the solution.

Ask students to model using their base ten materials and record their solution pictorially and symbolically. Students should continue to use estimation to determine the correct placement of the decimal.

Each summer, Sarah and her family pick bakeapples and sell them. This year, Sarah picked 2.75 L and her brother picked 1.346 L. How much more did Sarah pick than her brother?

When modelling with pictures or diagrams, students could circle what is being traded and cross out what has been subtracted. They may need to be reminded to move over what has been traded by redrawing in the new place value section.

The answer would be the blocks remaining in the top model or 1.404.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Present the following problem to students:

  Mr. Browne takes his three daughters to the playground. The three daughters decide that they want to play on the seesaw with Dad on one end. Dad has a mass of 70 kg, the same as the girls' combined mass. If the oldest daughter is the heaviest and has a mass of 29.5 kg, what are the possible masses of the other two daughters if both of them have masses greater than 15 kg? Find two different possibilities for each of the two daughters.

  Students could work in groups of two or three to determine the solution and present their answers to the class. They could use pictures, numbers and words to explain their answer.

  (5N11.4)

Resources/Notes

Authorized Resource
Math Focus 5

Lesson 7: Subtracting Decimals by Regrouping
TR: pp. 45-49
SB: pp. 102-105

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N11 Continued...
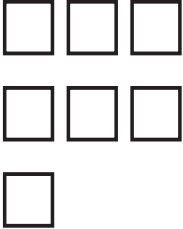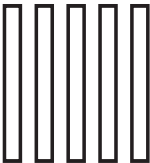
Achievement Indicator:

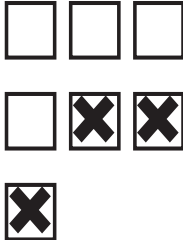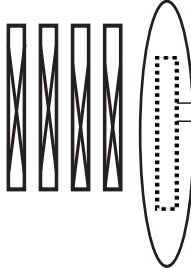*5N11.4 (Continued) Solve a given problem that involves addition and subtraction of decimals, limited to thousandths.*

Suggestions for Teaching and Learning

A number line could also be used to determine a sum or difference. The number line would not resemble the traditional number line with even intervals.

When asked to determine 3.019 + 1.309, for example, students should start with 3.019 and count on. The first jump would be 1 to reach 4.019, the next jump would be three tenths (0.3) to reach 4.319 and the final jump would be nine thousandths (0.009) resulting in 4.328.
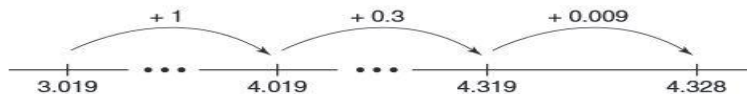
To determine a difference, such as 3.22 - 2.61, students should start at 2.61 and find what the difference is to 3.22 (add on).
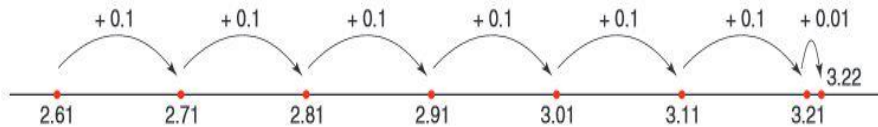
Jumping by 0.1 would reach 2.71, then 2.81, 2.91 and so on up to 3.21. That is 6 jumps of 0.1 for a difference of 0.6 to get to 3.21. A further 0.01 is need to reach 3.22. Altogether, the jumps totalled 0.61, therefore 3.22 - 2.61 = 0.61.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource
Performance	*Math Focus 5*
• Ask students to use base ten materials or number lines to determine the following.	**Note**
(i) 1.24 – 0.13	There are very few examples in *Math Focus 5* of using number lines to represent addition and subtraction of decimals. This strategy will require teacher demonstration.
(ii) 2.42 + 1.35	
(iii) 2.432 – 1.212	
(iv) 3.163 – 2.041	
(v) 3.652 + 0.513	
(vi) 2.322 – 1.424	
(5N11.4)	

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N11 Continued...

Achievement Indicator:

5N11.4 (Continued) Solve a given problem that involves addition and subtraction of decimals, limited to thousandths.

Suggestions for Teaching and Learning

Students should make the transition from concrete and pictorial representations to the symbolic. They should continue to align place values, regrouping when necessary.

$$7.6\overset{1}{2}\overset{10}{1}$$
$$-\ 4.317$$
$$\overline{3.303}$$

Students should apply addition and subtraction strategies for whole numbers to their work with decimal numbers.

The renaming method, which was introduced in Grade 4, may also be used with decimal numbers. This strategy is particularly useful when working with a top number (minuend) which ends in zeros. Using renaming creates numbers which are much easier to work with because there is no need for trading or regrouping. When determining 10 - 6.789, for example, 10 changes to 9.999 to avoid trading and then 0.001 is added to the answer once it is acquired. Students may need to review that 10 = 10.000 (e.g., equivalent decimals).

10.000 (subtract 0.001)	9.999 + 0.001
- 6.789	-6.789
	3.210 + 0.001 = 3.211

A common error occurs when students forget to add on the extra 0.001.

Another renaming method to consider for subtracting 10.000 – 6.789 is to simply decrease both numbers by 0.001 to produce 9.999 – 6.788. This way the answer requires no adjustment.

10.000 (subtract 0.001)	9.999
- 6.789 (subtract 0.001)	-6.788
	3.211

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to answer the following questions:

  (i)   Mary ran 3 km. Sally ran 2.432 km. Mary said she ran 0.567 km further. Is she correct? Explain.

  (5N11.4)

  (ii) Henry received $20 for his allowance. He downloaded an album of music for $14.38. How much money does he have left?

  (5N11.4)

Interview

- Ask students to explain how renaming can help determine the following differences:

  (i)   4 kg – 3.675 kg

  (ii) 25 km – 10.95 km

  (5N11.4)

Journal

- Ask students to respond to the following prompt:

  Subtracting decimals by "renaming" makes subtracting decimals a whole lot easier.
  Do you agree with this statement? Why or why not?

  (5N11.4)

Resources/Notes

Authorized Resource
Math Focus 5

Lesson 8: Subtracting Decimals by Renaming
TR: pp. 50-54
SB: pp. 106-108

Math Game:
Close Call
TB: pp. 55-56
SB: p. 109

Number

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N11 Continued...** **Achievement Indicator:** *5N11.5 Create and solve problems that involve addition and subtractions of decimals, limited to thousandths.*	Requiring students to create their own problems provides opportunities for them to explore operations in depth. It is a more complex skill requiring conceptual understanding and must be part of the student's problem-solving experiences. To help students create problems, teachers could: • provide a diagram or map and ask students to create story problems based on them • provide a number sentence and ask students to create a problem based on the given number sentence • provide a story situation involving numbers and ask students to write questions which can be solved, based on the story. Students could write questions based on a story, such as 'At the Mall!' *At the Mall!* *Today we went to the mall to do some back to school shopping. Mom said we could afford to spend $200 on back to school clothes. It seemed like a lot of money at first until I started looking at the prices. We went to the sports store first to buy running shoes. They ranged from about $49.88 to $199.95. I asked Mom if the $200 we had to spend included tax. She said, "No".* *"Thank goodness!" I thought. I decided that it would be best to buy my running shoes at a discount store where they were less expensive.* *At the mall, I found some nice t-shirts. They were $12.50 each or 3 for $25. Great deal! I bought two pairs of jeans that were originally $49 each but they were ½ price. I needed hoodies as well. I found some that I liked for $39 each and you get a second one for ½ price.* *Mom said that I should remember to buy new underwear. I bought a 6 pack of underwear for $9.99. Another good deal! Then I remembered socks. Luckily, I found a 6 pack of socks for $6.79.* *As soon as we go to the discount store for my running shoes, I'll be all set. I wonder if I can get two pairs!* Teachers could consider using children's literature such as *Math Curse* by Jon Scieszka. Prior to reading the book, brainstorm with students where they have used math today. Encourage students to look for more examples of math inside and outside of their homes. The resulting list might include: clocks, timers, calendars, window panes, TV screen sizes, video game scores, data download allowances, measuring cups, clothing and shoe sizes, calculators, shopping totals, budgets, music practice, sports scores, weekly allowance and many more.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to create a word problem using the numbers 1.37 and 3.701.

  (5N11.5)

- Ask students to create word problems involving addition and subtraction for which the answer is 13.52.

  (5N11.5)

- In pairs, students could create a word problem involving decimals to thousandths. Allow students time to share their problem with other pairs to solve.

  (5N11.5)

- Ask students to create a word problem which could be solved with one of the following:

  (i)   10.00 - 2.25 - 3.80

  (ii) 5.903 + 4.5 - 6.065

  (iii) 0.499 + 1.001 + 0.251 + 0.999

  They could trade their word problem with a classmate and discuss their solutions.

  (5N11.5)

Resources/Notes

Authorized Resource

Note

Math Focus 5 does not address this indicator. Teachers are encouraged to use suggestions from this guide.

Suggested Resources
- *Math Curse* - Jon Scieszka
- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit2 -Glogster

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	

5N11 Continued...
Achievement Indicator:

> *5N11.5 (Continued) Create and solve problems that involve addition and subtractions of decimals, limited to thousandths.*

Share the book *Math Curse* by Jon Scieszka with the class. Add examples of daily experiences of math from the book to the students' brainstormed list.

Students could choose two of the math problems posed in the book to solve, and investigate one reference they did not understand, (Mayan place value, other bases, Fibonacci sequence...). Using some of the information they gathered from their daily experience, they could create a problem from everyday life to pose to a classmate. The class could compile a collection of crazy problems based on everyday events and occurrences. This might take the form of a Glogster poster for each problem.

Students could also time themselves getting ready for school as the book's narrator did on Wednesday morning. They might benefit from an organizer such as:

I get up at _____.

It takes me _____ minutes to get dressed.

It takes me _____ minutes to eat my breakfast.

It takes me _____ minutes to brush my teeth and comb my hair.

It takes me _____ minutes to gather what I need for school (my backpack, my lunch, my homework, my gym shoes, my library book, and my smile!)

I leave home at _____(time).

Encourage them to record the part minutes as decimals. Students could then find their total required preparation time by calculating the minutes including decimals.

> *5N11.6 Correct errors of decimal point placements in sums and differences without using pencil and paper.*

Students should be encouraged to use their estimation skills when checking that the results of their calculations are reasonable. An error involving the placement of the decimal in a given sum or difference can be located and corrected often without recalculating. Consider the following example:

Florence gets to the check out with four bottles of shampoo which are $4.95 each. The cashier asks her for $198. She knows immediately that this is wrong.

What do you think the cashier did to get this total? Correct the error.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance
- Provide students with flyers and newspapers (e.g., sports or business sections). Ask them to create a series of problems based on the information they find using decimal numbers limited to thousandths. Have them present their problems to the class.

(5N11.5)

- Bob and Alex caught three salmon with masses of 0.725 kg, 1.02 kg, and 0.689 kg. Bob bragged that he and Alex had caught 24.34 kg of salmon. Ask students how they could help Alex explain to Bob the correct mass of the salmon they had caught.

(5N11.6)

Portfolio
- Ask students to create money word problems that involve adding or subtracting decimals.

(5N11.5)

Resources/Notes

Authorized Resource Note
Creating and solving problems (5N11.5) is not addressed in the *Math Focus 5* student book.

Measurement

Suggested Time: 4 Weeks

September	October	November	December	January	February	March	April	May	June
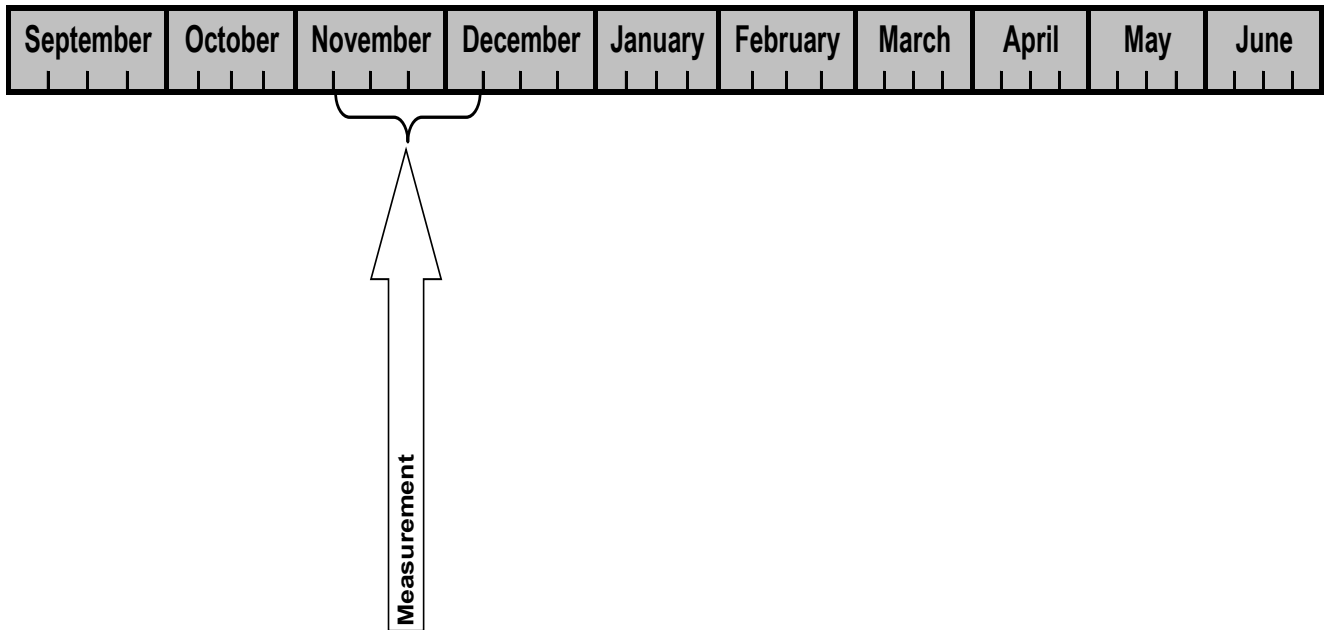
Measurement

Unit Overview

Focus and Context

Measurement is an integral link to many areas of the mathematics curriculum as well as to careers and everyday life. Throughout this unit, students hone their proficiency in choosing and using measurement tools. The students are to demonstrate an understanding of metric linear units, volume, capacity and the construction of rectangles based on a given area or perimeter. Although measurement is the focus for this unit, opportunities to highlight and practice these skills arise in other areas of the mathematics curriculum, as well as in science, art, social studies, physical education and other daily activities.

Outcomes Framework

GCO

Use direct or indirect measurement to solve problems.

SCO 5SS1

Design and construct different rectangles, given either perimeter or area, or both (whole numbers) and make generalizations.

SCO 5SS2

Demonstrate an understanding of measuring length (mm and km) 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
- selecting and justifying referents for the unit km
- modelling and describing the relationship between m and km units

SCO 5SS3

Demonstrate an understanding of volume by:

- selecting and justifying referents for cm^3 and m^3 units
- estimating volume, using referents for cm^3 amd m^3 units
- measuring and recording volume (cm^3 and m^3 units)
- constructing right rectangular prisms for a given volume

SCO 5SS4

Demonstrate an understanding of capacity by:

- describing the relationship between mL and L
- selecting and justifying referents for mL or L
- estimating capacity, using referents for mL or L
- measuring and recording capacity (mL or L)

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Shape and Space (Measurement)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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 • 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 & km) 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 • selecting and justifying referents for the unit km • modelling and describing the relationship between m and km units. [C,CN,ME,PS,R,V] 5SS3 Demonstrate an understanding of volume by: • selecting and justifying referents for cm³ and m³ units • estimating volume, using referents for cm³ and m³ units • measuring and recording volume (cm³ and m³ units) • 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 • estimating capacity, using referents for mL or L • measuring and recording capacity (mL or L). [C,CN,ME,PS,R,V]	6SS3 Develop and apply a formula for determining the: • perimeter of polygons • area of rectangles • volume of right rectangular prisms [C,CN,PS,R,V]

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

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5SS2 Demonstrate an understanding of measuring length (mm and km) 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
- selecting and justifying referents for the unit km
- modelling and describing the relationship between m and km units.

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

Achievement Indicators:

5SS2.1 Show that 10 millimetres is equivalent to 1 centimetre using concrete materials.

5SS2.2 Show that 1 000 millimetres is equivalent to 1 metre using concrete materials.

5SS2.3 Provide examples of when millimetres are used as the unit of measure.

Suggestions for Teaching and Learning

In Grade 3, students measured lengths in cm and m. In Grade 5, students will continue to develop skills with cm and m units, as well as being introduced to mm and km units.

The introduction to millimetres should take place after students have had additional experience using centimetres. A good way to introduce millimetres is to look at objects that are between centimetres; something, that is 25 mm, for example, is between two and three cm.

When discussing centimetres, use an overhead ruler which has only centimetres marked (if possible). Once students work with centimetres, introduce the ruler that includes the markings for centimetres and millimetres.
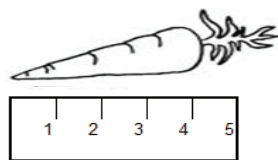
It can easily be shown on a centimetre ruler that 1cm = 10 mm or that 30 mm = 3 cm.

Students will require many experiences comparing one unit of measurement to another. Have students make some curved paths on the floor with masking tape. Use a rope to measure the path, then stretch out the rope and measure it in mm. Ask the students to decide what the measure will be in a different unit such as m or cm.

Possible shapes:

A metre stick is divided into centimetres. Students should analyze a metre stick to see that 100 cm = 1 metre.

Since they know that 1 cm = 10 mm, it follows that 1 metre (100 cm) has 1 000 mm.

Using the metre stick, students can mark off sets of 10 mm (1cm) again realizing that 10 mm x 100 = 1 000 mm.

While discussing a millimetre, students will realize that it is a very tiny linear measurement. Ask students to draw 1 mm on paper using a ruler. They could discover referents by brainstorming objects that would be that tiny. Suggestions might include: thickness of a fingernail, width of an eyelash, head of a straight pin, a fraction of a mosquito leg, the thickness of a credit card or a stack of 10 sheets of paper.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to use their knowledge of these metric units to fill in the blanks.

    30 cm = _____ mm

    2 mm =   _____ cm

    (5SS2.1)

Performance

- Ask students to measure the length of their desk tops in cm. Then ask them to measure in mm. Ask them which way was most appropriate and which markings on their rulers they used. Note any troubles students may have with the actual measuring.

    (5SS2.1)

- Ask students to measure a bookshelf or the teacher's desk with a metre stick. They could then measure it in mm to emphasize that 1 000 mm = 1 m. Some students may find it easier to manipulate a flexible metre measure (a paper strip or a flexible sewing measuring tape) than a rigid stick.

    (5SS2.2)

- Give students photos of objects and ask them to sort into two piles: those best measured using millimetres and those best measured using metres. Ask students to justify their choices.

    (5SS3)

Journal

- Ask students to respond to the following: What would we measure with the millimetre unit and why is this unit useful?

    (5SS2.3)

Resources/Notes

Authorized Resource

Math Focus 5

Getting Started: Planning a Park (optional)

Teacher Resource (TR): pp. 9-11

Student Book (SB): pp. 256-257

Lesson 1: Measuring Length in Millimetres

TR: pp. 12-15

SB: pp. 258-259

Suggested Resource

- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit3

    -enrichment activities

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5SS2 Continued...
Achievement Indicators:

5SS2.4 Provide a referent for one kilometre, and explain the choice.

5SS2.5 Know that 1 000 metres is equivalent to 1 kilometre.

5SS2.6 Provide examples of when kilometres are used as the unit of measure.

5SS2.7 Explore and generalize the measurement relationships between and among millimetres, centimetres, metres and kilometres.

Suggestions for Teaching and Learning

Ask students: What is the distance from the school to various points in the community - the post office, bank, or your home? Some students will already be familiar with the kilometre from their life experiences. Others may refer to these distances in metres. Through conversation, point out that the metre is too small a unit for measurement of longer distances. The unit for measurement of longer distances is the kilometre (km).

As a benchmark, students might relate to the fact that it takes about 15 minutes to walk a kilometre. Consider going on a kilometre walk to give students a feel for how long a kilometre is. Exposure to the kilometre as a unit of measure is important to be able to read map scales. While map scales can be written as a ratio, many are also written as one cm represents 10 km. The latter is more likely to have meaning for Grade 5 students.

Using Google maps to locate local landmarks or nearby communities and noting their distance from the school may also give students an appreciation for how long the kilometre is. It may be opportune to discuss that road distance may be different from a straight line route (usually shorter) possible by another means of transportation such as walking or flying.

Teachers could make a class chart as follows and ask students to put their name under one of the three headings.

Distance from Home to School		
Less than 1 km	About 1 km	More than 1 km

Ask students to discuss, in pairs, how many times they would have to walk around the perimeter of the school yard to walk one kilometre. Ask them to identify and write about the strategy they used to find their answer.

Students should also relate the metre to the kilometre. They should come to realize that if 1 000 metre sticks were lined up end-to-end, they would measure one kilometre.

Students may find it helpful to create a four-door foldable with the sections titled mm, cm, m and km. The inside flaps could contain referents or examples of items that might be measured using that unit. This could be completed as students work through the indicators for 5SS2.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to work in pairs to decide about how many fifth graders lying head to toe it would take to stretch 1 kilometre.

  (5SS2.4)

- Ask the students to use a map to find distances and make a chart of communities in Newfoundland and Labrador and their distance from the student's home town.

Town	Distance from (home town)

  (5SS2.4)

- Ask students which of these they would measure using kilometres:

  (i) the distance from your school to the ocean

  (ii) the distance from your school to a corner store

  (iii) the distance from your school building to the playground

  (iv) the distance from your desk to the whiteboard

  (v) the distance from your nose to your toes

  (vi) the distance from your school to a hospital

  For the examples selected, students could estimate the distance.

  (5SS2.4, 5SS2.5, 5SS2.6, 5SS2.7)

- Ask students to match one of these distances to each of the examples given: 10 cm, 10 km, 10 m, 10 mm

  (i) the length of a transport truck

  (ii) the distance you drove in a car

  (iii) the distance a snail travels in five seconds

  (iv) the length of your hand

  (5SS2.5, 5SS2.7)

Journal

- Ask students to respond to this prompt:

  Suppose there are two stores where you can go to buy treats. One is 500 m away and the other is five km away. To which one would you choose to walk? Explain your choice.

  (5SS2.7)

Resources/Notes

Authorized Resource

Note

Math Focus 5 does not have material to support this indicator. Teachers should use suggestions from this guide.

Suggested Resource

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit3

  -Google maps

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SS2 Continued...** **Achievement Indicators:** *5SS2.7 (Continued) Explore and generalize the measurement relationships between and among millimetres, centimetres, metres and kilometres.*	It is important for students to understand that the unit chosen for measurement affects the numerical value of the measurement. The larger the unit, the smaller the numerical value: 1 m = 100 cm, for example, the larger unit (metres) has the numerical value of 1 but the distance measured in the smaller unit (centimetres) yields the larger numerical value of 100. Working in pairs, have each student trace their partner's body on large sheets of paper. Measure the length of their paper body parts i.e., legs, arms, fingers and total length of body. Students will need to decide which measuring tool would be most appropriate for each measurement - to measure fingers, they would use a cm ruler, to measure the length of body, they would use a metre stick. Ask students to record all measurements in mm, cm and m. Ask why the millimetre measurements have a larger numerical value than the metre measurements.
5SS2.8 Provide a referent for 1 millimetre and explain the choice. *5SS2.9 Provide a referent for 1 centimetre and explain the choice.* *5SS2.10 Provide a referent for 1 metre and explain the choice.*	Ask students to suggest objects that are about 1 mm, 1 cm or 1m. These may serve as referents. Referents are everyday objects of particular lengths that students can use as benchmarks to help them estimate. The use of referents makes the learning more meaningful for students and helps them come up with reasonable estimates. When discussing referents for 1 mm, examples should be given of objects that would be measured in mm: the thickness of a button, a ladybug, thickness of a gold chain. A centimetre is about the length of a staple or the width of a pinkie nail. The metre stick provides an excellent referent for one metre and is a familiar object for students. One metre is about the distance from the floor to a door knob. After tracing or marking out a metre with tape, students could brainstorm ideas for objects that are about a metre or more than one metre; e.g., the long edge of a newspaper, width of a whiteboard, teacher's desk.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource

Suggested Assessment Strategies

Performance

- Ask students to measure the sides of a rectangle and give the results in mm, cm, and m.

(5SS2.7)

- With a partner, students could find objects in the classroom that measure about one metre. Ask: Why did you choose that object? What else would you measure using the metre as a unit of measure? Explain.

(5SS2.10)

- Students could find objects in the classroom that measure about one cm. Ask: Why did you choose that object? Measure the objects to the nearest cm. What are their measurements in mm?

(5SS2.2, 5SS2.7, 5SS2.9)

Journal

- Ask students to look around the classroom, choose one object, and estimate its length and width. Ask what referent they used to determine their estimated measurements.

(5SS2.8, 5SS2.9, 5SS2.10)

- Ask students to respond to this prompt:

    Think of a situation in which you would not be able to use a ruler to find the measurement of an object. Why is it important to have referents?

(5SS2)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 2: Estimating Length

TR: pp. 16-19

SB: pp. 260-262

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5SS1 Design and construct different rectangles given either perimeter or area, or both (whole numbers), and draw conclusions.

[C, CN, PS, R, V]

Achievement Indicator:

5SS1.1 Construct or draw two or more rectangles for a given perimeter in a problem-solving context.

Suggestions for Teaching and Learning

Chart sized grid pads are useful tools for teaching area and perimeter because the linear and square measurement are readily apparent with the grid background.

Students worked with perimeter in Grade 3. They may need to review finding perimeter before they begin constructing rectangles given a specific perimeter. In Grade 4, students worked extensively with finding the area of rectangles and constructing different rectangles for a given area. While investigating the distance around various rectangles, students should, in their own words, explain any generalizations noticed.

Using a formula for perimeter is not required of students. The important thing is that they know that perimeter means distance around. This year the focus will be on working with area and perimeter when constructing rectangles. Students will be required to draw conclusions regarding rectangular shapes that create the greatest and least areas. As they investigate, they should discover the relationship: area of a rectangle = length x width. This investigation should be done using a problem solving approach.

Students should have frequent opportunities to formulate, grapple with and solve complex problems that might require a significant amount of effort and should then be encouraged to reflect on their thinking. The method of solution should not be known in advance.

It is essential that the concepts of area and perimeter be applied to real-life situations. In order to lay floor coverings, paint a wall, or cover a bulletin board, students need knowledge of the area of the floor or wall. Such examples let students see the real world applications of these mathematical concepts.

Geoboards or grid paper can be used to create various rectangles with the same perimeter. A rectangle with a perimeter of 20 units, for example, can have sides that are 9 cm, 9 cm, 1 cm, 1cm; 8 cm, 8 cm, 2 cm, 2 cm; 3 cm, 3 cm, 7 cm, 7cm; or 6 cm, 6 cm, 4 cm, 4 cm. Students are working towards the realization that rectangles of different dimensions can have the same perimeter.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	**Resources/Notes**

Suggested Assessment Strategies

Performance

- Ask students to create different size rectangles on grid paper each having a perimeter of 24 cm.

  (5SS1.1)

- Ask students to create two rectangles on a geoboard, each with a perimeter of 20 cm. They should explain how they decided the dimensions of the rectangles.

  (5SS1.1)

- Distribute 16 colour tiles to each student. Ask students to create two different rectangles which have a perimeter of 16 units and find the area of each rectangle.

  (5SS1.1)

Paper and Pencil

- Ask students:

  Frank is painting the outside lines for the basketball court on the school playground. The principal gave him enough paint to paint 160 metres of lines. What possible sizes can Frank create the court?

  (5SS1.1)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 3: Exploring Perimeter

TR: pp. 20-22

SB: pp. 263

Suggested Resource

Principles and Standards for School Mathematics - NCTM

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SS1 Continued...** **Achievement Indicators:** *5SS1.2 Construct or draw two or more rectangles for a given area in a problem-solving context.* *5SS 1.3 Illustrate that for any given perimeter, the square or shape closest to a square will result in the greatest area.* *5SS1.4 Illustrate that for any given perimeter, the rectangle with the smallest possible width will result in the least area.* *5SS1.5 Provide a real-life context for when it is important to consider the relationship between area and perimeter.*	Teachers could divide the class into groups of two or three. Give each group 30 colour tiles. Ask them to create all possible rectangles with an area of 30 and record the perimeter of each. Students should find a method to keep track of side lengths and width, and sketch the rectangles on grid paper. Word problems could be solved and created based on the area and/or perimeter of these rectangles. Ask: • Do all rectangles with the same area have the same perimeter? • Do all rectangles with the same perimeter have the same area? • Which rectangles have the greatest/least perimeter? • Which rectangles have the greatest/least area? Provide students with grid paper. Ask them to draw a square that has sides each measuring two units. Find its perimeter and area. Share results. Repeat with squares that have other side measurements. Ask if they see a relationship between side length and perimeter; between side length and area. The playground can be a good place for students to investigate perimeter. First, ask students which unit of measurement they should use to measure the playground (mm, cm, m or km). Then, have students estimate the perimeter by estimating the number of steps they would take if they walked around the perimeter. Record the estimates of each child. Using a trundle wheel, find the actual measurement of the perimeter. Creating problems based on children's literature allows a spring board for thinking creatively about concepts like area and perimeter. After reading *Pigs* by Robert Munsch, for example, pose problems related to the construction of a new pen for the pigs such as: The farmer has 24 m of fencing remaining from his last project and four fence posts. What size rectangle should he build the pen so that the pigs have the maximum amount of play area? Students could use square tiles to model different sized pigpens, finding those which can be enclosed with 24 units of fencing and recording the dimensions and area of each. Ask them to look for patterns. Ask: What happens as the length of the rectangle changes? What do you notice about the pigpen that has the largest area? Students could create a commercial jingle or a print ad for a fencing company which guarantees their fences provide the largest area for the amount of fencing used.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Paper and Pencil

- Tell students that Jane has to make a rectangular cabbage patch with an area of 24 m². Ask them to:

  (i)   use grid paper to sketch all the possible rectangles.

  (ii) find and record the side lengths of each rectangle.

  (iii) consider why Jane might want to make the patch with the greatest perimeter.

  (5SS1.2, 5SS1.3)

- Tell students that the area of a rectangular classroom is 600 m² and its perimeter is 100 m. Ask: What are the dimensions of the classroom?

  (5SS1.1, 5SS1.2)

- Joe is staining his patio. His can of stain will cover 36 m² which is just enough for one coat. Ask students to find possible dimensions of his patio.

  (5SS1.2)

- Roger and his neighbour, Jason, decided to build swimming pools in their back yards. They decided on different shapes.
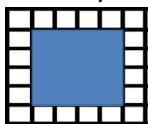
Roger's pool

Jason's pool

  It costs $1 000 for every square metre of pool, plus $200 for every metre of non-slid pool edging for the distance around the outside of the pool. Ask students: Which pool is cheaper to construct? Which pool has more area to swim?

  (5SS1.5)

Journal

- Ask students to respond to the following prompt:

- A farmer has 100 m of fencing to make a pen for his pigs. He decides that a rectangle would be the best shape. What are some possible sizes of pens he could make? How do the areas of the pens compare? What dimensions would you recommend and why? What pen has the greatest area? What is special about this rectangle? Which one encloses the least area? What is special about this rectangle?

  (5SS1.1, 5N1.3, 5N1.4)

Performance

- Give each pair of students a set number of straws or pieces of uncooked spaghetti. Ask each pair to create and sketch as many rectangles as possible that use all of the straws or spaghetti (set perimeter). Ask them to compare the changes in area with each new configuration.

  (5SS1.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Perimeters and Areas of Rectangles

TR: pp. 23-26

SB: pp. 264-266

Curious Math:

Same Area, Greater Perimeter

TR: pp. 27-28

SB: pp. 267

Suggested Resources

- *Pigs* - Robert Munsch
- Resource Links: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit3

  -apps

  -algebra tiles

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	

Specific Outcomes

Students will be expected to:

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 and m³)**

• **constructing right rectangular prisms for a given volume.**

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

Achievement Indicators:

5SS3.1 Identify the cube as the most efficient unit for measuring volume and explain why.

5SS3.2 Determine the volume of a given 3-D object, using manipulatives, and explain the strategy.

Suggestions for Teaching and Learning

Students have not had previous formal experience with volume or capacity.

Volume and capacity are both terms for measures of the 'size' of three-dimensional regions. Volume is the amount of space occupied by a 3-dimensional object and capacity is how much the 3-D shape will hold.

Students explore the idea that one object has more volume than another if it is bigger or takes up more space. In Grade 5, the objects used for all of these explorations will be rectangular prisms.

Standard units of volume are expressed in cubic units: cubic centimetres, cubic metres, etc.

Involving students in a hands-on activity to explore the volume of a given box should help them identify the cube as the most efficient unit for measuring volume. In order to reach this conclusion, they must also be exposed to measuring volume using other objects like marbles or styrofoam peanuts.

Ask groups of two to three students to determine the volume of a given box by first filling it with marbles and recording this number. Then have them fill the box with cubes and record the number. Compare and explain the differences.

After this experience, students should estimate the volume of a variety of different sized boxes. Using cubes to fill the boxes will help students understand why the volume is recorded in cubic units.

Having different groups measure volume using different sized cubes will yield different results. This should lead to a discussion of the importance of using the same unit for measuring. This leads well into the introduction of the cubic centimetre and cubic metre as standard units.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	**Resources/Notes**

Resources/Notes

Journal

- Thinking back to the size of different materials that were used to fill the boxes, ask students to write about:

    I noticed that...

    I learned that ...

    (5SS3.1)

- Ask students to respond to the following:

    How could you figure out the number of cubes that would fit in a box without filling it with your measuring objects (blocks, etc.)?

    (5SS3.2)

Performance

- Give students a number of boxes of varying sizes. Using centimetre cubes, ask students to estimate the volume of each box.

    (5SS3.2)

- Ask students to view the video *Minecraft in Education: Finding Volume by Adding Layers (5th Grade Technology Integration)*. This reviews perimeter and area and introduces how to find volume of a rectangular prism using minecraft blocks. The video then poses some challenges for the students to build their own prisms using layers of different coloured bricks and write a number sentence to express the volume.

    (5SS3.2)

Authorized Resource

Math Focus 5

Lesson 5: Measuring and Comparing Volumes

TR: pp. 33-36

SB: pp. 270-272

Suggested Resource

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit3

    -Minecraft in Education

Shape and Space (Measurement)

Specific Outcomes

Students will be expected to:

5SS3 Continued...

Achievement Indicators:

5SS3.3 Construct a right rectangular prism for a given volume.

5SS3.4 Explain that many right rectangular prisms are possible for a given volume by constructing more than one right rectangular prism for the same given volume.

Suggestions for Teaching and Learning

Ask students to work in pairs. Give each pair five sheets of 1 cm grid paper. Students will need scissors and pencils. Have students trim each grid sheet to 10 squares x 11 squares (20 cm x 22 cm).

Caution students not to cut into squares when trimming. When sheets are all trimmed, have a quick discussion on the dimensions of the grids and ask how many squares each sheet has; work towards realization that the flat paper has no volume because it has no height.

	Length	Width	Height	Volume	Total Number of Unit Squares Cut from Rectangles
Box 1	8	9	1	72 sq units	4
Box 2	6	7	2	84 sq units	16
Box 3					
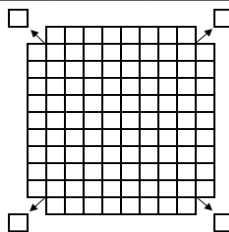
Steps:

1. Take grid sheet and cut one square off of each corner.

2. Fold up the outside row on each side and tape corner to make box. Fill the box using 1 cm cubes (multi link may be used if necessary) and record the total used.

3. Have groups report on findings and discuss strategies in order to lead them to discuss what the length and width were and their relationship to the total number of cubes (the volume).

4. The remaining boxes will be made using the same steps except for step 1 which changes each time as follows:

- box 2: cut a 2 by 2 square from each corner
- box 3: cut a 3 by 3 square from each corner
- box 4: cut a 4 by 4 square from each corner

After students have the understanding that a one cm cube has a volume of 1 cm³, they should build various rectangular prisms and find their volume.

Some students may generalize that volume is

number of columns (length) × number of rows (width) × number of layers (height), but this is not an expectation for Grade 5.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource

Performance

- Ask students to create as many rectangular prisms as possible using 36 provided marshmallows or sugar cubes. They could use a digital camera to take photos and create a visual display of the variety of configurations which have a volume of 36 cubes.

(5SS3.3, 5SS3.4)

- Ask students to create rectangular prisms using specified numbers of 1 cm cubes/centicubes.

(5SS3.3)

- Given 20 centimetre cubes, ask students to create as many right rectangular prisms as possible that use all of the cubes (i.e., have a volume of 20 cm³) and record the dimensions of each.

(5SS3.4)

- Given two boxes of different shape, (e.g., a box of macaroni and cheese dinner and a flat box like a small box from chocolates) ask students to predict which one will have a greater volume. Students can build block models of each using standard or non standard measures to compare their volume.

(5SS3.4)

Resources/Notes column:

Math Focus 5

Lesson 5: Measuring and Comparing Volumes

TR: pp. 33-36

SB: pp. 270-272

Math Game:

Building Boxes

TR: pp. 37-38

SB: p. 27

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SS3 Continued...** **Achievement Indicators:** *5SS3.5 Provide a referent for a cubic centimetre and explain the choice.*	After some investigation with finding volume using non-standard units, teachers should introduce a centimetre cube. A cubic centimetre is 1cm x 1cm x 1cm. Students should develop personal referents for units. The use of personal referents helps students establish the relationships between the units. A good referent for this is the base ten unit cube. Other examples would be a small die or a small sugar cube. 1 cm 1 cm 1 cm
5SS3.6 Provide a referent for a cubic meter and explain the choice.	A good way to model a cubic metre as a personal referent is to take 12 rolls made from a double sheet of newspaper (1 metre long each) and tape them together to form a cube. If the cube were solid it would have a volume of 1 m³. Students will be able to see that the newspaper cube has a height, length and width of one metre each. Ask students to estimate how many cubic metres there are in a telephone booth or an elevator.
5SS3.7 Determine which standard cubic unit is represented by a given referent.	Give students a set of sticky notes with examples or images of common items which have an approximate volume of 1 mm³, 1 cm³, or 1 m³. Have students sort the sticky notes into three groups with headings of 1 mm³, 1 cm³, and 1 m³. Examples might include a grain of salt or sugar, a sugar cube or centicube, something about the size of a small grape, a box from a wall oven, a rectangular prism made up of approximately 26 paper boxes or bankers boxes. Using a series of different 3-D objects (or images of large items), ask students if they would be better measured in cubic centimetres or cubic metres. They should justify their reasoning. Students could vote using personal whiteboards, coloured paddles, Senteo devices, or inside-outside agreement circles.
5SS3.8 Estimate the volume of a given 3-D object using personal referents.	Students should be aware that although a cubic centimetre is a volume equivalent to the space occupied by a cube with a side length of 1 cm, an object which has a volume of 1 cm³ is not necessarily cube shaped. That being said, estimation of the volume of 3-D objects should begin with object which are in the shapes of cubes or right rectangular prisms.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	Resources/Notes

Resources/Notes

Journal

- Ask students to respond to the following prompts:
  - (i) A box has a volume of 10 cm³. What is it most likely to hold?
    a) refrigerator   b) shoes   c) 10 pack of pencils
    Explain your choice.

    (5SS3.8)

  - (ii) Name 3-D objects that could be measured in cubic millimetres, cubic centimetres and cubic metres. Explain why you chose each.

    (5SS3.7)

Performance

- Ask students to sort various containers - or photos of them - (e.g., swimming pool, bus, transport truck, shoe box, match box, pill bottle, milk carton, playpen, the gym) according to the unit they would choose to measure their volume and explain how each was determined. Ask students to estimate the volume of one container in each of their categories.

  (5SS3.8)

- Place rectangular prisms, boxes, etc. in several centres around the classroom. Be sure there is no indication of the volume of each (i.e., label). On a card beside each, write two estimates. Students will record which estimate they think is closer to the actual volume of the container. This may be done with a paper ticklist, using an app, or self checking using QR codes or punch cards.

  Sample: 1 500 cm³ or 5 m³.

27 cm

3 cm

19 cm

(5SS3.8)

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

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 and L

• measuring and recording capacity (mL or L)

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

Suggestions for Teaching and Learning

Capacity units are generally used for measuring liquids or the containers that hold those liquids (mL, L, etc). Students have not had previous experience with volume or capacity. The Système International recognizes the abbreviations of ml and mL to both be acceptable for millilitre. This guide will use mL for the sake of consistency. This is also the form used in the authorized textbook.

Investigation of capacity should begin with non-standard units.

Give students containers of different sizes and shapes and ask them to order these from largest to smallest capacity. Have them provide examples from real life contexts that represent these quantities (e.g., 250 mL contains a little less than the average pop can). The investigation should next move to use of standard measures. Begin with litres because they are a familiar part of everyday life (milk, ice-cream, etc.). Using a variety of litre containers can help students see that the shape of one litre containers can vary but the capacity remains the same. Useful video resources may include *Volume and Capacity Introduction* by Turtlediary and *Metric Measurement: Capacity*. Start the latter video at about 1:00 to get past the American statement that "we commonly use cups and gallons" and get right into the metric section. This has some good illustrations of vessels and consideration of which measure to use: L or mL.

Achievement Indicators:

5SS4.1 Demonstrate that 1 000 millilitres is equivalent to 1 litre by filling a 1 litre container using a combination of smaller containers.

Gather a series of graduated cylinders with varying capacities less than 1 L as well as a 1 L container. Use the smaller containers to fill the one litre container, recording the amounts added until the 1 L container is filled. When students add the amounts which were combined, they should realize it takes 1000 mL to equal 1 L. This activity can also be done in reverse, starting with a filled 1 litre container and measuring what is removed.

5SS4.2 Determine the capacity of a given container using materials that take the shape of the inside of the container and explain the strategy.

Discuss with students their strategies and decisions involving which containers to use. Prompt discussion of strategy and justification for choosing particular labelled containers to estimate the capacity of an unlabeled container. Students could use liquid, sand, rice, beads, etc. Ask: Why did you choose this container to determine that the bowl contains 750 mL? How did you use it? A student might reply "I chose the 250 mL container to determine that the bowl contains 750 mL because I could fit 3 scoops of sand (250 mL each) in the bowl, so its capacity is 750 mL."

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Performance

- Students may be given a variety of containers (scoops, cups, and spoons) and asked to estimate how many of one container it would take to fill another. To determine if their estimation was correct, students would fill the large container from the smaller to check, or empy the larger container by repeatedly removing contents using the smaller container.

(5SS4.1)

- Ask students to estimate the number of pieces of popcorn a 1L container would hold. Fill the container and determine the actual capacity.

(5SS4.2)

Paper and Pencil

- Students could use a Frayer model to consolidate their understanding of capacity. A sample follows:

DEFINITION	REAL-LIFE PROBLEM AND VISUAL REPRESENTATION
Capacity is the amount that a container will hold. **Characteristics** • The amount of liquid, sand or rice remains the same when placed in different shaped containers of the same capacity. • Capacity can be measured in nonstandard or standard units. • The smaller the unit of measure, the greater the number of units needed to measure the capacity of a given container. • When comparing capacities, the same units must be used. • Standard units for capacity include mL and L.	Sarah is filling a 1 L clear plastic bottle with layers of various colours of sand as a decoration for her room. Which of the following containers filled with sand could she use to completely fill her bottle? Container A: 355 mL Container B: 225 mL Container C: 125 mL Container D: 420 mL Container E: 160 mL Sarah could use a variety of ways to completely fill her bottle. Three of the ways include: • Use Container C and fill it 8 times to completely fill the 1L bottle • Use Containers A, B, and D each filled once to completely fill the bottle • Use Container D filled twice and Container E filled once to completely fill the bottle.

Capacity

EXAMPLES	NON EXAMPLES
Capacity is used in the following: • sand in a sandbox • water in a swimming pool • juice in a pitcher • grain in a silo • milk in a glass	Capacity is not used in the following: • fencing around a garden • lace around a tablecloth • painting walls • tiling floors • covering countertops

(5SS4.2)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 8: Exploring Millilitres and Litres

TR: pp. 48-50

SB: p. 281

Suggested Resources

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit3

  -*Volume and Capacity Introduction -*Turtlediary

  -*Metric Measurement: Capacity*

Shape and Space (Measurement)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SS4 Continued...** **Achievement Indicators:** *5SS4.3 Relate mL and L in problem solving situations.*	Solving problems rooted in real life situations by allowing students hands-on experience with capacity will help them realize that 1L = 1 000 mL. Centres are useful for facilitating this type of learning. • Tell students that Jim has to make a recipe in which he has to use two litres of orange juice. He only has a 500 mL container to measure the juice. How could he use the 500 mL container to measure two litres of orange juice? Explain using numbers, pictures and words. • Ask students to draw and label three smaller containers whose capacity, when added together, would equal one L. Ask them to explain their choices. • Ask students to choose, from a series of containers (5 mL, 75 mL, 200 mL, etc.), a combination that will create a total capacity of one litre.
5SS4.4 Provide a referent for a litre and explain the choice. *5SS4.5 Provide a referent for a millilitre and explain the choice.* *5SS4.6 Determine which capacity unit is represented by a given referent.* *5SS4.7 Estimate the capacity of a given container using personal referents.*	Aside from familiar referents such as 1 L milk cartons and water bottles, students should realize that a large base ten cube hollowed out would have the capacity to hold 1 L. A useful referent for a millilitre would be a unit base ten cube. Since the millilitre is so small, students should use referents that represent millilitre units like 5 mL =1 tsp or 15 mL= 1 tbsp. Use a medicine dropper that shows a 1 mL marking. Talk about how small babies often receive medicine in this unit. Also, eye and ear drops are often given in quantities even less than a millilitre. Ask students to bring from home a variety of containers to serve as referents for exploring the concept of capacity, Using a series of different containers, ask students to decide, with justification, whether each would be better measured in mL or L. Examples might include a glass of milk, a container of laundry detergent, etc. Students would estimate the capacity using the units selected and use a litre container to check their estimates. Review the referents for a cm and a metre and ask students to suggest a suitable referent for 1 mL. Ask them to explain why it would be suitable. Students should use their referent to determine the capacity of a small container.

General Outcome: Use Direct or Indirect Measurement to Solve Problems

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to order various containers by capacity based on their estimates. Require them to indicate their referent for each of the different containers (e.g., 250 ml contains less than the average pop can). In their journals, students could illustrate and explain how they know their ordering is correct.

    (5SS4.4, 5SS4.5, 5SS4.6, 5SS4.7)

- Students could play a loop game (I have... Who has...?) using cards which have common containers and estimates for capacity and volume. Sample cards:

    - Who has the capacity of a small milk carton from recess?

    - I have 250 mL. Who has the capacity of a medicine dropper?

    - I have 10 mL. Who has the volume of George's pencil box?

    (5SS3.8, 5SS4.7)

- Place containers in several centres around the classroom. Be sure there is no indication of the capacity of each (i.e., label). On a card beside each, write two estimates. Students will record which estimate they think is closer to the capacity of the container. This may be done with a paper ticklist, using an app, or self checking using QR codes or punch cards.

    Sample: 15 mL or 250 mL

    (5SS4.7)

Journal

- Ask students to respond to the following prompts:

    (i) About how much milk are you likely to drink for lunch?

    a) 25 L   b) 25 mL   c) 250 mL

    Explain your choice.

    (ii) About how much water do you need in your tub to take a bath?

    a) 100 mL   b) 100 L   c) 1 000 mL

    Explain your choice.

    (5SS4.7)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 9: Estimating and Measuring Capacity

TR: pp. 52-55

SB: pp. 282-285

Data Relationships

Suggested Time: 2 Weeks

September	October	November	December	January	February	March	April	May	June

Data Relationships
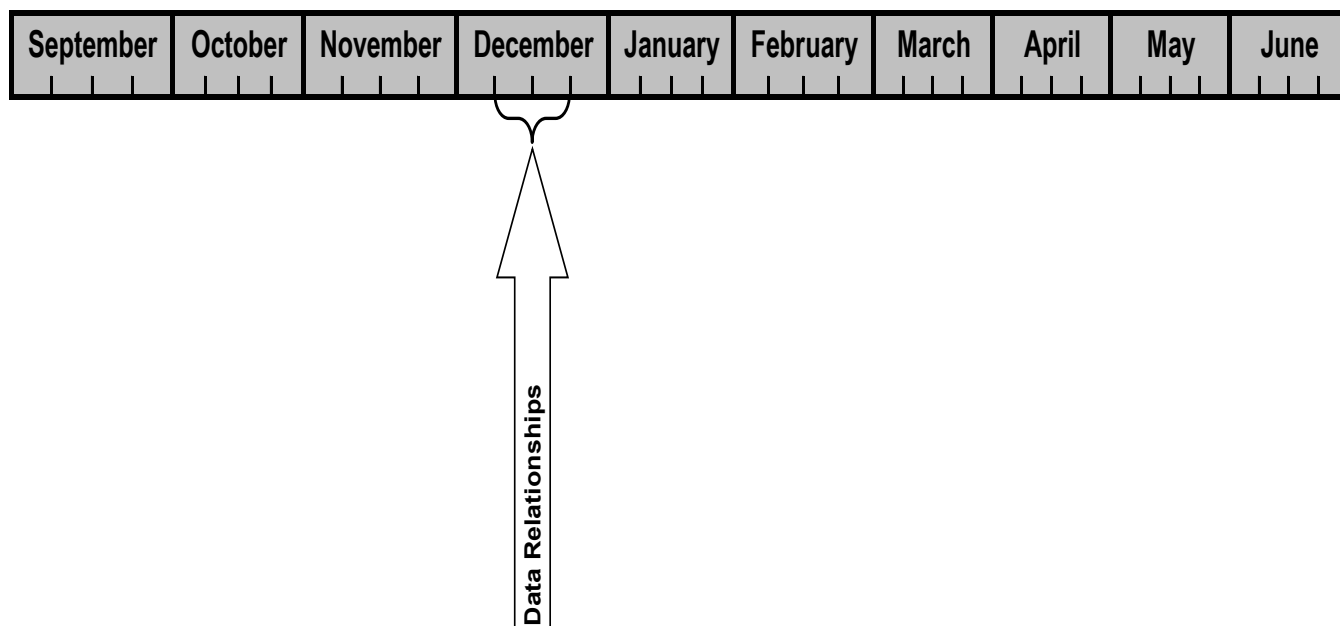
Unit Overview

Focus and Context

A set of data can be collected, organized, and then displayed in a variety of ways, depending on the type of data and the purpose for its collection. Once a set of data is displayed, it can be analyzed to look for patterns, make comparisons, draw inferences, predict, and inform decisions.
The focus of this unit is on data recording and problem solving using first- and second-hand data and double bar graphs. Various sample double bar graphs will be provided for students to explore and interpret. Students will formulate questions to collect first-hand data and display using a double bar graph. They will also create and answer questions regarding second-hand data.

Graphing allows data to be presented concisely and visually. Within all curriculum areas, data can be collected and graphed to help students value the graphing process. This connection to real quantities in a student's environment is an important aspect of graph development; comparisons of graphs will deepen their understanding and such knowledge will transfer and benefit other curriculum areas. Although data relationships is the focus of this unit, it is important that students are given opportunities to practice what they have learned on an ongoing basis throughout the year. This may be easily incorporated with special occasions and events that naturally occur (e.g., Hallowe'en, sports events, consideration of the weather) as well as in other subject areas.

Outcomes Framework

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

> SCO 5SP1
>
> Differentiate between first-hand and second-hand data.

> SCO 5SP2
>
> Construct and interpret double bar graphs to draw conclusions.

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Statistics and Probability (Data Analysis)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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]	6SP1 Create, label and interpret line graphs to draw conclusions. [C, CN, PS, R, V] 6SP2 Select, justify and use appropriate methods of collecting data, including: • questionnaires • experiments • databases • electronic media [C, CN, PS, R, T] 6SP3 Graph collected data, and analyze the graph to solve problems. [C, CN, PS, R, T]

Mathematical Processes

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

Daily Routine Opportunity

Divide the class into two teams and give each team a different colour marker. Display several multiplication sentences with one factor missing (e.g., 6 x ____ = 48). A chosen player from Team 1 rolls a number cube or spins a spinner which is numbered 2 to 7. The player fills in one blank on the display where the rolled number correctly completes the sentence. If there is no blank which can be correctly filled in, the team misses a turn. Teams continue to take turns until all blanks are filled. The team with the most facts correctly completed is the winner.

Statistics and Probability

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	

5SP1 Differentiate between first-hand and second-hand data.

[C, R, T, V]

In Grades 3 and 4, students collected data, kept a tally, and created and interpreted single bar graphs. This will be their first introduction to the terms first- and second-hand data.

Discuss various situations that warrant data collecting. Introduce the key terms first-hand data and second-hand data.

First-hand data is collected by the researcher (in this case, the students) and is best used when looking for answers to questions about people, places or objects found in everyday life. First-hand data is required when this information is not readily available from existing credible sources or when data is limited. It will be necessary to review first-hand data gathering techniques such as surveys, observations, interviews and experiments.

Second-hand data is information that has been collected by someone else. It can be found in print and on the Internet. Some secondary sources include *The World Almanac for Kids*™, *Guinness World Records*™, *The World Almanac &Book of Facts*™ and Statistics Canada. Second-hand data sources also include newspapers and resource books. Curriculum areas such as Science, Health and Social Studies have many opportunities for investigating second-hand data.

Achievement Indicator:

5SP1.1 Explain the difference between first-hand and second-hand data.

Provide students with examples of first- and second-hand data and ask them to identify the type of data provided. Hockey statistics found in the newspaper or the population of Canada found on the Statistics Canada website are both examples of second-hand data. Students are collecting first-hand data when they survey the class on their preference in popcorn seasonings or record how many fish they caught during a weekend at the cabin. Encourage students to reflect on the meaning of first- and second-hand data and record this reflection in their journals.

Have a class discussion on the two types of data. Students could create four shutterfold flash cards and glue them horizontally onto a exercise page to the right of the following questions:

• Who collected the data?

• Where was the data found?

• What is the role of the student?

• What kind of questions are used?

The two covers of each of the shutterfold flashcards would be labelled first-hand data and second-hand data. The flaps underneath would read:

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

Suggested Assessment Strategies	**Resources/Notes**
	Authorized Resource
Performance	*Math Focus 5*
• Ask students to create a collage showcasing various sources of second-hand data such as clippings from newspapers, the Internet and/or magazines.	Getting Started
	Teacher Resource (TR): pp. 9-11
(5SP1.1)	Student Book (SB): pp. 118-119
• Present the whole class with various types of first- and second-hand data. Ask students to respond using personal whiteboards or coloured paddles to indicate whether the sample displayed is first- or second-hand data.	Lesson 1 (optional): Exploring Types of Data
(5SP1.1)	TR: pp. 13-15
• Provide small groups of students with various examples of first-and second-hand data. Students could sort them into two groups: first- or second-hand data, and defend their decisions.	SB: pp. 120-121
	Note
(5SP1.1)	This lesson serves as a beginning discussion on differentiating between first-hand and second hand data. It is not necessary to explore all of the optical illusion examples on page 121 of the student book.
• Give each student a sticky note on which to write examples of data sources. Ask students to stick all of their examples on a wall, white board, etc. Students will then have opportunity to choose any sticky note and move it to the part of the board/wall designated for first- or second-hand data. A gallery walk of the sorted examples will lead to discussion, questioning, and perhaps some clarification or correction.	
(5SP1.1)	**Suggested Resources**
Journal	• Resource Link: https://www k12pl.nl.ca/curr/k-6 math/grade-5/links/unit4
• Ask students to explain the difference between first-hand and second-hand data and give examples.	- enrichment activities
	- shutterfold foldable
(5SP1.1)	
	• *Navigating through Data Analysis and Probability in Grades 3-5 -* Chapin et al., p.11.

Statistics and Probability

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5SP1 Continued...	
Achievement Indicators:	

5SP1.1 (Continued) Explain the difference between first-hand and second-hand data.

First-Hand Data

- data collected by the researcher (in school, this is the student)
- gathered by observations, surveys, experiments
- students consult the primary source (the people questioned, observed or interviewed)
- questions created should help give precise answers

Second-Hand Data
- data collected by others and used for secondary analysis
- found in news, Internet, statistics
- student is not part of data collection or questioning
- questions can be created to interpret data presented

5SP1.2 Formulate a question that can best be answered using first-hand data, and explain why.

The process of data analysis begins with the formulation of questions concerning an issue or topic of interest. Students should be encouraged to formulate questions that address issues in their lives at school, home or within their communities.

Brainstorm questions that could be answered using first-hand data. Some examples are:

- What is the favourite sports team of Grade 5s in our school?

- What is the favourite type of music of students in our class?

As students prepare to collect first-hand data, it is important that they understand what constitutes a good question.

(i) Questions should be clear and direct. There should be no doubt about what is being asked.

(ii) Questions should be manageable in the amount of information they provide. For example, asking Grade 5 students "What is your favourite pop song?" is much more clear, direct and manageable than asking "What music do you like?" The first question is much more precise in asking for a particular song of a particular style (pop) whereas the second has a wide range of interpretation. It could be interpreted as asking what genre of music you like: classical, pop, rap, etc. or instrumental make-up: choral, strings, electric, etc. or even music by a particular artist.

(iii) Questions should ask only one thing. "Which of the tablets you tried boots up fastest?" will result in better data than asking "Which tablet is the fastest, lightest, and most reliable?"

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

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource
Performance	*Math Focus 5*
• Using the exit card strategy, ask students to provide an example of a question that could best be answered using first-hand data. Collected questions could be displayed on a bulletin board or as a collage.	Lesson 2: Using First-Hand Data
	TR: pp. 16-20
	SB: pp. 122-125
(5SP1.2)	
• Using a blogging tool such as Kidblog, ask students to design a question to collect first-hand data from their classmates. Ask students to respond to each other's questions through the blog site. They could reflect on the question they created and whether they received clear answers.	**Suggested Resources**
	• Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit4 -KidBlog
(5SP1.2)	

Statistics and Probability

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SP1 Continued...** **Achievement Indicators:** *5SP1.2 (Continued) Formulate a question that can best be answered using first-hand data, and explain why.* *5SP1.3 Find examples of second - hand data in print and electronic media, such as newspapers, magazines and the Internet.* *5SP1.4 Formulate a question that can best be answered using second-hand data, and explain why.*	Discuss with students the importance of posing specific questions that provide a clear answer, e.g., What is your favourite music ?, is not as specific as What is your favourite type of music? or Who is your favourite pop singer? Compile a list of student-generated questions. Ask students why each of the questions constitutes a good question. The website *Census at School* provides a tool to gather first-hand data from the class in response to a number of questions. It also has a compilation of international data which may be engaging for students when dealing with second-hand data. The Internet provides a wealth of data about sports, world records and Canadian statistics which can be used for secondary analysis. Take advantage of cross-curricular opportunities for students to explore examples of second-hand data using the Internet and informational text. Using second-hand data, and keeping in mind the qualities of good questions, students should pose questions to help in its analysis. Provide students with examples of data from a variety of sources (print or electronic). Ask them to create questions based on the data and then share with their classmates. This could include samples such as weather data from across the province or the country, the amount of Vitamin C in various orange beverages, the highest rated movies in Canada last weekend, or the number of goals scored by rookies in the NHL so far this year.

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

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource
Interview	*Math Focus 5*
• Give students samples of second-hand data and ask them to generate questions. Ask them to discuss whether their questions are precise, direct, and can be clearly understood and answered.	Lesson 3: Using Second-Hand Data
(5SP1.4)	TR: pp. 21-24
	SB: pp. 126-128
Pencil and Paper	
• Give students second-hand data (e.g., a local newspaper clipping) and ask them to generate pertinent questions on the data.	Math Game:
(5SP1.4)	Matching Data
	TR: p. 25
Performance	SB: p. 129
• Use Statistics Canada and/or other sources to provide several examples of data. Remove related titles, information, and questions. Using the data which has been stripped of descriptors, students could work in pairs to generate and record questions that could be answered using this data. They might speculate as to what is being represented by the graph. Gather all questions and sources of data. Student pairs could match the questions of the other groups with the data samples.	**Suggested Resource**
	• Statistics Canada
	• Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit4
(5SP1.4)	- Census at School
• Ask students to collect examples of second-hand data that they encounter in print or multimedia sources and note, print, or clip it to bring to school. Ask shoulder partners to share what they have found and choose one example to highlight in a class discussion or display.	
(5SP1.3)	

Statistics and Probability

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5SP2 Construct and interpret double bar graphs to draw conclusions.

[C, PS, R, T, V]

Achievement Indicators:

5SP2.1 Determine the attributes (title, axes, intervals and legend) of double bar graphs by comparing a given set of double bar graphs.

5SP2.2 Draw conclusions from a given double bar graph to answer questions.

Suggestions for Teaching and Learning

Students worked with bar graphs in Grade 3 and Grade 4. They constructed, labelled and interpreted graphs to solve problems. This will now be extended to include double bar graphs.

A double bar graph is best used to show how two sets of data are different or alike. Using a legend helps the reader interpret the data displayed. Students should analyze double bar graphs on which data is displayed horizontally as well as others on which data is displayed vertically.

Ask students to compare a set of double bar graphs, such as the one below displaying data collected from six students.
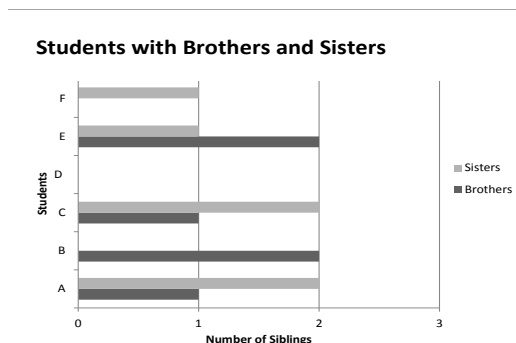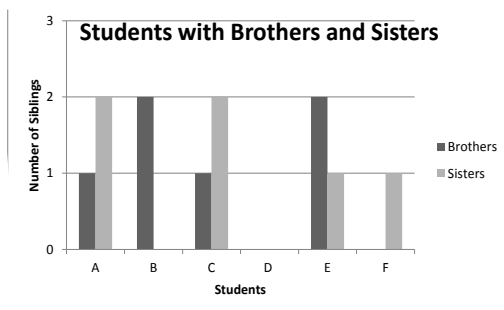
Ask students questions such as:

- Who has the most sisters? brothers? siblings?

- How many more sisters does Student C have than Student E?

- Which students have the same number of brothers?

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

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource

Journal
- Ask students to analyze double bar graphs. They should identify the title, scale, axes, labels and key, and use pictures, numbers and words to explain the purpose for using double bar graphs.

(5SP2.1)

Performance
- Provide each small group of students with a different double bar graph (some vertical, some horizontal in orientation). Ask each group to share an overview of what their graph is communicating.

(5SP2.1, 5SP2.2)

Math Focus 5

Lesson 4: Interpreting Bar Graphs

TR: pp. 30-34

SB: pp. 132-135

Statistics and Probability

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SP2 Continued...** **Achievement Indicators:** *5SP2.1 (Continued) Determine the attributes (title, axes, intervals and legend) of double bar graphs by comparing a given set of double bar graphs.* *5SP2.2 (Continued) Draw conclusions from a given double bar graph to answer questions.* *5SP2.3 Provide examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines and the Internet.*	Remind students that, as with the bar graphs they created in Grade 4, in a double bar graph: • Each set of data must use the same scale. • All graphs must have a title, scale and legend. • The order of colours must remain the same throughout. Provide students with examples of various graphs displaying the above attributes, and ask questions such as: • What message is conveyed in this double bar graph? • Who did the data collection? • For whom was the data collected? • What have you learned from this graph? • What conclusions can be reached based on this data? Ask students to locate examples of double bar graphs found in newspapers, magazines, pamphlets, the Internet, posters or books. Discuss the parts of the graph and different types of information displayed on these graphs.

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Resources/Notes

Authorized Resource

Paper and Pencil

Math Focus 5

- Ask students to label a given double bar graph appropriately using the terms title, axes, and legend.

Lesson 4: Interpreting Double Bar Graphs

(5SP2.1)

TR: pp. 30-34

- Provide small groups of students with different double bar graphs. Ask each group to compile a list of possible questions that could be asked about the graph. Students should answer the questions they created.

SB: pp. 132-135

Supplementary Resource

Nelson Mathematics Handbooks: Math at Hand

(5SP2.2)

- Provide students with a double bar graph and ask them to answer questions such as:

- Support for SCO 5SP2 can be found on pp. 259-265.

   (i)   What information is being relayed?
   (ii) What data was collected?
   (iii) How many subjects were involved?
   (iv)What conclusions can be drawn based on this data?

(5SP2.2)

Presentation

- Ask students to find an example of a double bar graph from newspapers, magazines or the Internet to present to their classmates. They could pose questions to elicit information about the graph.

(5SP2.3, 5SP2.2)

- Ask students to present a selected double bar graph they found, telling about the different attributes found on the graph.

(5SP2.3, 5SP2.2)

Journal

- Throughout the unit, provide opportunities for students to self-assess their graphs. Suggested prompts include:

    (i) I know I constructed a good double bar graph because ...
    (ii) Some things that are similar between my double bar graph
       and my classmate's double bar graph are...
    (iii) Something surprising was...
    (iv) Something challenging was...
    (vi) Something my partner and I did well...
    (vii) Next time I would....   (5SP2)

Statistics and Probability

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SP2 Continued...** **Achievement Indicators:** *5SP2.4 Represent a given set of data by creating a double bar graph, labelling the title and axes, and creating a legend, without the use of technology.*	Model the construction of a double bar graph before students work independently to construct their own. At beginning stages, students could use grid paper to construct bar graphs to ensure that the alignment and scale of the bars are correct. Knowing your students is key to suggesting/modelling graphs which are meaningful to your students. Hockey, soccer, baseball or football scores may connect some students' outside interests to mathematics. Book sales of the latest popular children's author may appeal to others. Still more students may be interested in music downloads or video game information. Allowing students to explore these areas of interest while learning to display the data they collect in a double bar graph makes the experience more authentic and may boost the task committment to what can sometimes be a lengthy process. Students should share their graphs with a partner and discuss such questions as: • How are your graphs different? • What conclusions did you draw? • How might your conclusions have changed if you had surveyed twice as many adults as students?
5SP2.5 Solve a given problem by constructing and interpreting a double bar graph.	"The value of having students actually construct their own graphs is not so much that they learn the techniques, but that they are personally invested in the data and that they learn how a graph conveys information. Once a graph is constructed, the most important activity is discussing what it communicates to others who were not involved in making the graph. Discussions about real data that students have themselves been involved in gathering and graphing will help them interpret other graphs and charts that they see in newspapers and on TV." (Van de Walle and Lovin 2006, p. 329) Brainstorm with students possible questions to use to collect data that could be appropriately displayed on a double bar graph. Suggestions might include: • Does the intersection near the school have more traffic in the morning or at lunch time? • Is cheese or pepperoni pizza ordered more frequently on pizza day? Students should select one of their questions, decide whether to use first- or second-hand data, collect data, construct and interpret a double bar graph to answer their question.

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

Suggested Assessment Strategies

Performance

- Ask students to create a double bar graph to compare two sets of data. Possible suggestions are:

    (i) the number of sisters that classmates have, compared with the number of brothers

    (ii) male and female Olympic track records for particular distances

    (iii) the number of books read per month, by grade level

    (5SP2.4)

Paper and Pencil

- Ask students to survey and then use a double bar graph to compare the numbers of students who regularly ride the bus to school and those who do not.

    (5SP2.4)

- Students could determine and discuss a question which they will pose to another class via Skype, Microsoft LYNC, etc. Survey the virtual class and represent the responses of the two groups with a double bar graph. Reconnect with the virtual class to share and discuss results and findings.

    (5SP2.5)

- Heart Rate Challenge - Ask students to take their "at rest" heart rate and then do various exercises. They record their heart rate after one minute of each exercise. After all exercises are completed, ask students to pair up and compare their data using a double bar graph.

Exercise	My Results	My Partner's Results
At Rest		
Jumping Jacks		
Running in Place		
Burpies		

    (5SP2.5)

Performance

- Students could gather data and construct a double bar graph to assist in solving a given problem. Ask students to draw one conclusion based on their graph. Some suggestions are:

    (i) Which students report enjoying Mathematics more: Grade 5 or Grade 6?

    (ii) Which students watch NHL hockey more frequently on television- those who play in a hockey league or those who do not?

    (5SP2.5)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 5: Constructing Double Bar Graphs

TR: pp. 35-39

SB: pp.136-139

Supplementary Resource

Van de Walle and Lovin 2006, p. 329

Lesson 6: Solving Problems by Creating Diagrams

TR: pp. 40-43

SB: pp. 140-142

Curious Math:

Picture Graphs

TG: pp. 44-45

SB: p. 143

Motion Geometry

Suggested Time: 2 Weeks

September	October	November	December	January	February	March	April	May	June

Motion Geometry
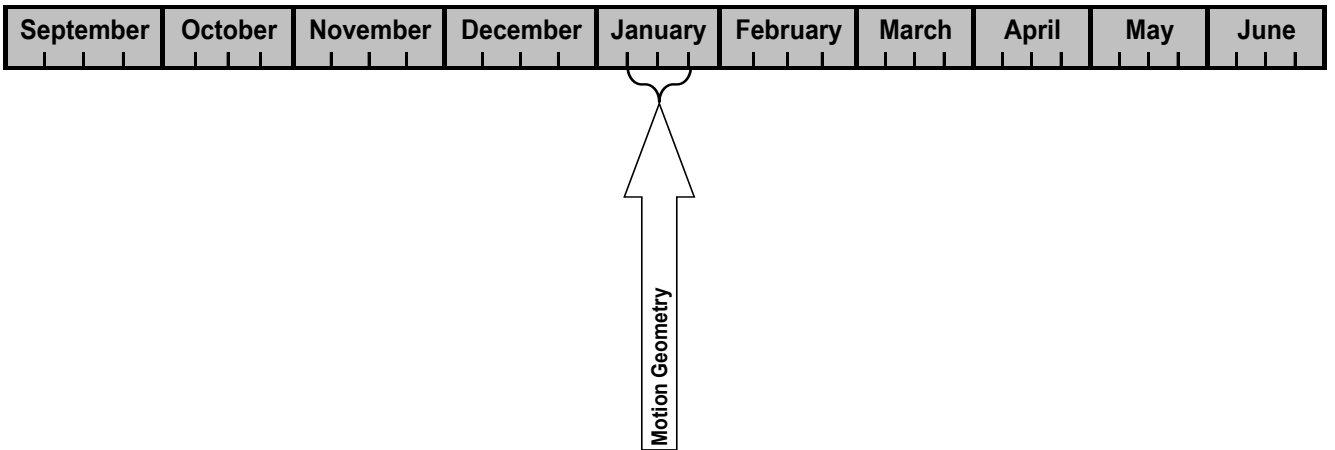
Unit Overview

Focus and Context

In Grade 4, students were introduced to symmetry and congruency in 2-D shapes but transformational geometry is a new concept to Grade 5 students. Using manipulatives such as pattern blocks, geoboards, Miras ™, and grid paper along with various technologies such as interactive whiteboards and websites, will help them visualize various transformations and strengthen their understanding.

The focus of this unit is on being able to visualize, perform and describe reflections (flips), translations (slides) and rotations (turns).

Outcomes Framework

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

> **SCO 5SS7**
> Perform a single transformation (translation, rotation or reflection) of a 2-D shape, and draw and describe the image.

> **SCO 5SS8**
> Identify and describe a single transformation including a translation, rotation and reflection of 2-D shapes.

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Shape and Space (Transformations)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
4SS5 Demonstrate an understanding of congruency, concretely and pictorially. [C, CN, 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]	5SS7 Perform a single transformation (translation, rotation or reflection) of a 2-D shape, and draw and describe the image. [C, CN, T, V] 5SS8 Identify and describe a single transformation, including a translation, rotation, and reflection of 2-D shapes. [C, CN, T, V]	6SS6 Perform a combination of translations, rotations and/or reflections on a single 2-D shape, with and without technology, and draw and describe the image. [C, CN, PS, T, V] 6SS7 Perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations. [C, CN, T, V] 6SS8 Identify and plot points in the first quadrant of a Cartesian plane, using whole number ordered pairs. [C, CN, V] 6SS9 Perform and describe single transformations of a 2-D shape in the first quadrant of a Cartesian plane (limited to whole number vertices). [C, CN, PS, T, V]

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 the students (e.g., two finger snaps followed by two claps, two snaps, two claps, etc.). After the pattern is established with the whole class, the teacher states a multiplication fact on the snaps (e.g., "three fives"). Without disturbing the rhythm, the student thinks during the two claps and gives the answer on the next two snaps ("fif-teen"). On the next two 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. Start with a slow pace to allow for greater success. When starting this activity, students should recall the facts up to 7 x 7 from their work in Grade 4. Throughout the course of Grade 5, this will be expanded to expect recall of facts up to 9 x 9.

Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	

Specific Outcomes

Students will be expected to:

5SS7 Perform a single transformation (translation, rotation or reflection) of a 2-D shape, and draw and describe the image.

[C, CN, T, V]

Achievement Indicators:

5SS7.1 Translate a given 2-D shape horizontally, vertically or diagonally, and describe the position and orientation of the image.

5SS7.2 Draw a 2-D shape, translate the shape, and record the translation by describing the direction and magnitude of the movement.

Suggestions for Teaching and Learning

Translations, reflections and rotations are new topics to Grade 5 students.

It may be helpful for students to create a graphic organizer such as a Venn diagram or a foldable to list the attributes of the three transformations as they are introduced. This may later help them identify the transformation which resulted in a given image. When labelling a 2-D shape and its transformed image, prime notation should be used. If the original shape is labelled ABCD, for example, its image will be A'B'C'D'.

To introduce translations, teachers could draw a 2-D shape using grid paper, replicate it and move it to a new location. Generate a discussion on key words such as horizontal, vertical, diagonal, etc. Note that the terms up, down and across are equally acceptable. Discuss the orientation of the shape after a translation. In a translation the orientation does not change.

Orientation is not the same as direction. This is a common misunderstanding. Orientation is related to the relative position of the vertices of a polygon. When orientation changes, vertices of the shape are in a different order.

Students should then begin performing translations. They could cut a shape out of an index card, label the vertices, and trace it on a sheet of paper to create its original position. It can then be translated to a new location on the paper, traced again and the image labelled. Students should label the vertices of the shape (e.g., A, B, C, D) and the corresponding vertices of the reflected image (e.g., A', B', C', D'). Be sure that they do not flip the card over. It might be useful to have them write TOP on the side of the card that should be visible when tracing around the shape.

Students should recognize that for a translation:

• the 2-D shape and its image are congruent

• the 2-D shape and its image have the same orientation (i.e., if we go around the object ABCD in a clockwise direction, we should be able to also go around its translated image, A'B'C'D', in a clockwise direction).

Teachers could then model drawing 2-D shapes such as squares, rectangles and triangles and translating them to a new location. Students should draw and translate simple 2-D shapes. It might be helpful to ask students to use grid paper for their beginning translations to help them ensure the move is the correct number of units up or down, left or right.

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

Suggested Assessment Strategies	Resources/Notes

Resources/Notes

Authorized Resource

Performance

- Provide a 2-D shape (such as a triangle) on grid paper and ask students to translate the shape according to specific instructions; e.g., translate Δ ABC three units left and two units down. Label its image.

(5SS7.1)

- Provide students with grid paper and ask them to draw a square. Students decide and record their own translation rule (e.g., translate the shape two units right and three units down). Students could create the translation described and then switch with a partner, comparing and discussing the two resulting transformations.

(5SS7.2)

- Using tiles on the floor as the units, ask students to translate themselves (as a point) two units right and four units up. Ask pairs of students to direct the translation of each partner. Students could then represent two different points and find and record the translation required (direction and magnitude) to move from one to another.

(5SS7.1, 5SS8.1))

- Ask students to form groups of six. Three students make themselves the vertices of a triangle. They might hold elastic, string or a skipping rope to create the sides of their polygon. Using floor tiles as the grid and units, the other three students create the image of this triangle translated four units left and six units down (4L, 6D).

(5SS7.1)

Math Focus 5

Getting Started

Teacher Resource (TR): pp. 9-11

Student Book (SB): pp. 150-151

Lesson 1: Performing Translations

TR: pp. 12-16

SB: pp.152-154

Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5SS8 Identify and describe a single transformation, including a translation, rotation and reflection of 2-D shapes.	
[C, CN, T, V]	
Achievement Indicator:	
5SS8.1 Describe a given translation by identifying the direction and magnitude of the movement.	Given a translation, students should describe the direction and magnitude of the movement. They could express a translation of three units left and two units down, for example, as (3L, 2D).
	In counting the magnitude of the translation, a common error is to count the corners of the blocks rather than the blocks themselves. Remind students to look for the number of grid blocks between the vertices of the original shape and its image.

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

Suggested Assessment Strategies

Paper and Pencil

- Provide students with various illustrations such as the following. Ask them to write the translation rule.

(i)

(ii)
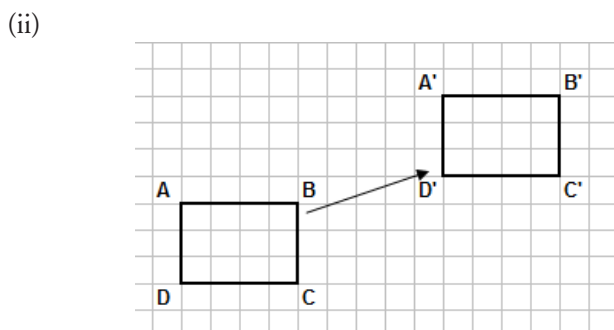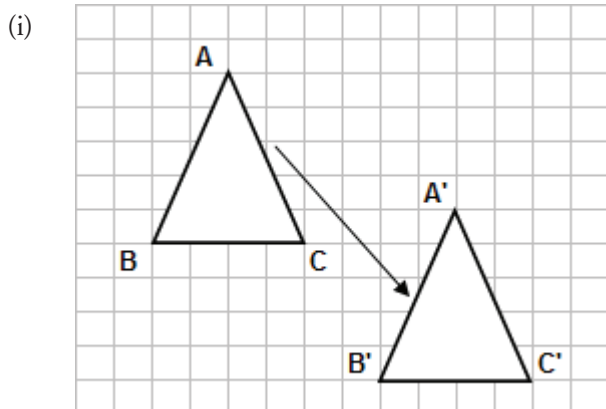
(5SS7.2, 5SS8.1)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Performing Translations

TR: pp. 12-16

SB: pp.152-154

Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 5SS7 Continued... **Achievement Indicators:** *5SS7.3 Reflect a given 2-D shape in a line of reflection, and describe the position and orientation of the image.* *5SS7.4 Draw a 2-D shape, reflect the shape, and identify the line of reflection and the distance of the image from the line of reflection.*	Students should make the connection between symmetry and the line of reflection. The line of reflection creates symmetry between object and image whereas a line of symmetry typically refers to symmetry within a given object.

Review Mira™ use. Students should be familiar with them from their work with symmetry in Grade 4.

The image produced by a Mira™ is considered a reflection. Students could practice drawing/tracing a shape using a Mira™ - noting location of the line of reflection - or use tracing paper to trace a 2-D shape and the image formed by the Mira™. They could place the traced image over the original to reinforce that reflections are congruent images. Remind students that when labeling a 2-D shape and its reflected image, prime notation should be used. For Grade 5, lines of reflection should be limited to vertical and horizontal lines.

Students should note that for reflections:

- a 2-D shape and its image are congruent

- a 2-D shape and its image are of opposite orientation (i.e., if we go around the object ABCD in a clockwise direction, the image A'B'C'D' would require a counter-clockwise direction).

- a 2-D shape and its reflected image are equal distance from the line of reflection.

Encourage students to add this information to their graphic organizer.

Given a shape, such as rectangle ABCD, and a line of reflection, students should reflect the shape, resulting in the image A'B'C'D'.
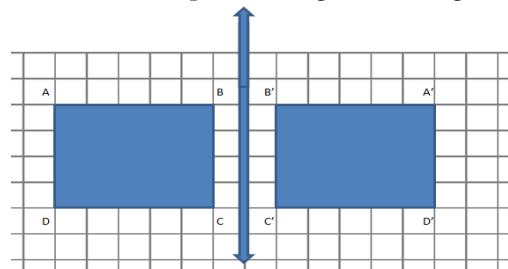
Recognizing that the shape and its image are always equal distance from the line of reflection is key to producing its reflected image.

The direction and magnitude of the move is described by stating the direction of the reflection (e.g., in a horizontal line of reflection) and the distance each vertex is from the line of reflection.

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

Suggested Assessment Strategies

Performance

- 'Reflective Reflections'- Ask students to place three geoboards in a row (see figure below). On the middle geoboard, they could construct and label a quadrilateral. Using the edges of the middle geoboard as lines of reflection, construct the reflected images on the other two geoboards. Ask students to record the figure and the two images on geopaper provided and label all three figures. Ask: What are the similarities between the first shape you created and its reflected images? How are they different? Compare the reflections. What do you notice?
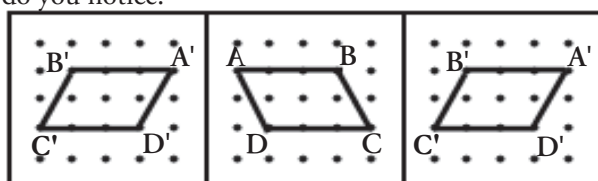
(5SS7.3)

- Ask students to reflect ΔABC using the given line of reflection. Ask them to describe the position and orientation of the reflected image and justify why their drawing is correct.
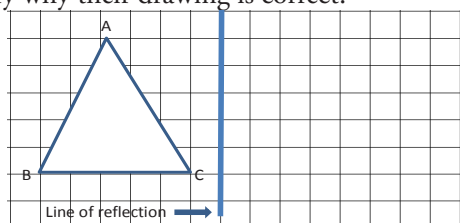
(5SS7.4)

Paper and Pencil

- Triangle Reflection: Ask students to work in pairs to:

    (i)   Draw a triangle

    (ii) Label the triangle Δ ABC

    (iii) Draw a line of reflection

    (iv) Reflect the shape

    (v) Connect the corresponding vertices

    (vi) Label the image

    (vi) Describe the distance of the image from the line of reflection

    (vii) Describe the orientation

(5SS7.4)

Journal

- Provide students with a given shape and a line of reflection. Ask them to draw and label the reflection image and describe the distance each vertex of the original and reflected polygon is from the line of reflection.

(5SS7.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 2: Exploring Reflections using a Mirror

TR: pp. 17-19

SB: p. 155

Note

See p. 46 in Teacher's Guide for a good problem solving example.

Lesson 3: Performing Reflections on a Grid

TR: pp. 20-24

SB: pp. 156-159

Note

The term *Mira* ™can be interchanged with transparent mirror or Reflect View on an interactive white board or Flip on SMART Notebook.

Shape and Space (Transformations)

Specific Outcomes

Students will be expected to:

5SS8 Continued...

Achievement Indicator:

5SS8.2 Describe a given reflection by identifying the line of reflection and the distance of the image from the line of reflection.

Suggestions for Teaching and Learning

Provide sample polygons and their reflections.
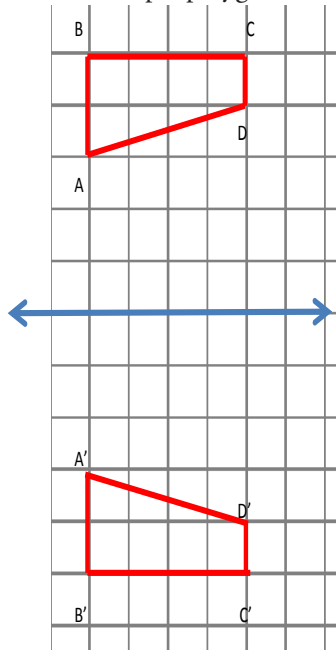
Students should describe the reflection:
- Figure ABCD has been reflected in a horizontal line of reflection.
- The image A'B'C'D' is congruent to the original polygon.
- A' is three units from the line of reflection, B' and C' are five units away from the line of reflection, and D' is four units away from the line of reflection.

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

Suggested Assessment Strategies	**Resources/Notes**

Suggested Assessment Strategies

Performance

- Ask students to match a given set of cards containing pictures of shapes and their reflected images with descriptors of each transformation displayed.

(5SS8.2)

- Explain that these two triangles are reflections of one another. Ask students to use a ruler to find the line of reflection and check the result using a Mira™.
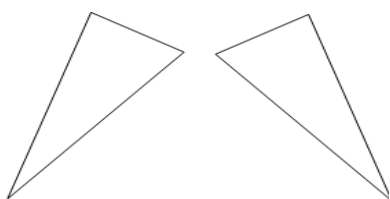
(5SS8.2)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 3: Performing Reflections on a Grid

TR: pp. 20-24

SB: pp. 156-159

Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5SS7 Continued...

Achievement Indicators:

5SS7.5 Rotate a given 2-D shape about a vertex and describe the direction of rotation (clockwise or counterclockwise) and the fraction of the turn (limited to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or full turn).

5SS7.6 Draw a 2-D shape, rotate the shape about a vertex, and describe the direction of the turn (clockwise or counterclockwise), the fraction of the turn (limited to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or full turn) and point of rotation.

Suggestions for Teaching and Learning

Rotations are often the most challenging of the transformations. Students are only expected to perform rotations about a vertex. **They are not expected to rotate around an exterior point.**

A rotation moves shapes in a circular motion. Review the terms 'clockwise' and 'counterclockwise' with students. Model the rotation of several shapes such as squares, rectangles and triangles before students are expected to rotate 2-D polygons independently.

At this grade level, the emphasis is on drawing rotation images and identifying a rotation image with a turn centre on one of the vertices, limited to $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ turns, clockwise or counterclockwise.

Start with a polygon drawn on paper. Using tracing paper, trace the polygon. Using a pencil tip to hold the traced image on the specified vertex, rotate the traced image in the direction and amount specified (e.g., clockwise $\frac{1}{4}$ turn). Draw the image and label it with prime notation.

When students begin working with rotations, they identify them in terms of fractions of a circle: $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ turn. In addition to describing the amount of turn, students should also identify the turn direction (clockwise or counterclockwise). Sometimes clockwise and counterclockwise are abbreviated as cw and ccw.

Many online resources, such as Math 5 Live, address Motion Geometry. Sometimes, however, they use the terminology: slides, flips and turns. Teachers should model use of proper terminology for transformations and encourage students to use the terms translation, reflection, and rotation rather than slides, flips and turns.

Teachers should model various rotations. Demonstrate how to rotate figure ABCD $\frac{1}{4}$ turn clockwise about turn centre (vertex) C.
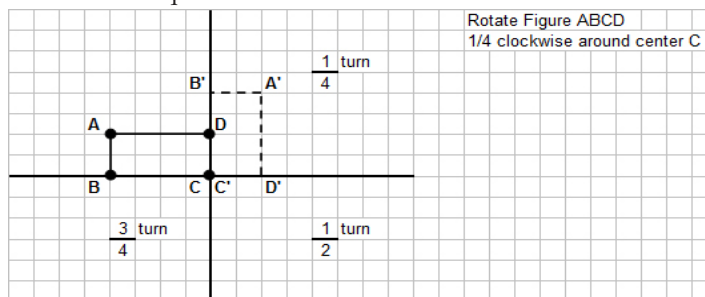
Teachers could then use the same figure but rotate $\frac{1}{2}$ turn or $\frac{3}{4}$ turn. Counterclockwise rotations should also be modelled.

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

Suggested Assessment Strategies	**Resources/Notes**

Suggested Assessment Strategies

Performance

- Make a large plus sign on the floor using masking tape. Ask one student to stand at the intersection of the perpendicular lines, holding rope. Ask a second student to stand along one of the rays, holding the other end of the rope so that it is taut. The second student walks clockwise (keeping the rope taut) stopping when he or she gets to another ray. Ask students: What rotation did the second student just make? Where was the centre of the rotation? Students could discuss the various rotations performed according to directions given.

Active Living: Do the Cha-Cha Slide
This is a party dance by DJ Casper with specified moves which are given in the lyrics. Some of the steps incorporate slides, turns and reverse which can be taught in terms of the transformations explored during this unit.

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Performing Rotations

TR: pp. 25-29

SB: pp. 160-163

Supplementary Resource

Making Math Meaningful - Marian Small

Suggested Resources

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit5

  -Math 5 Live

  -Cha Cha Slide

Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5SS7 Continued...	
Achievement Indicators:	

5SS7.6 (Continued) Draw a 2-D shape, rotate the shape about a vertex, and describe the direction of the turn (clockwise or counterclockwise), the fraction of the turn (limited to $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ or full turn) and point of rotation.

Students should have many opportunities to rotate various figures as they will be required to draw a 2-D shape, rotate the 2-D shape, and describe the turn.

Students could identify the point of rotation, and draw a vertical and horizontal line through the turn centre on the original figure. Then, they could trace the figure and the vertical and horizontal lines on tracing paper. Rotating the tracing paper such that the horizontal line rotates cw or ccw to the vertical line assists students with $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ rotations.

Students should recognize the following about rotations:
- the shape turns around a point in a circle (or part of a circle)
- the image is congruent to the original polygon
- the orientation does not change

Encourage them to add this information to their graphic organizer.

5SS8.3 Describe a given rotation about a vertex by the direction of the turn (clockwise or counterclockwise).

As students explore a variety of rotations about a vertex of a 2-D shape, teachers should model, using mathematical language, how to describe given rotations.

Students should identify the vertex which was used as the turn centre, whether the polygon was rotated clockwise or counterclockwise, and the amount of the turn ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or full turn).

Terminology from Motion Geometry may be incorporated into physical education classes. Possibilities might include:

- turn centre
- $\frac{1}{4}$ turn
- $\frac{1}{2}$ turn
- $\frac{3}{4}$ turn
- clockwise
- counterclockwise

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Show the students the following diagram and ask them to describe the transformation.
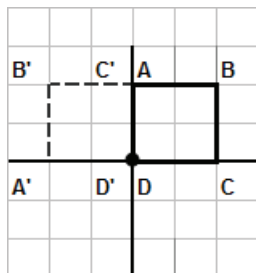
(5SS7.6)

- For the rotation shown, ask students to describe the direction of the turn, the fraction of the turn, and the point of rotation.
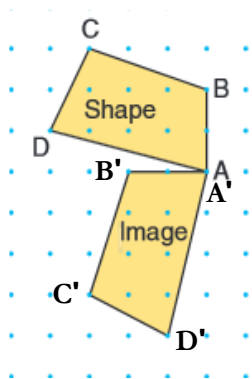
(5SS7.6)

Performance

- Ask students to draw a 2-D shape on grid paper and choose the vertex of rotation. Students describe the direction of the turn, the fraction of the turn and the point of rotation (turn centre).

(5SS7.6)

- Ask students to stand facing a specified wall. They should follow oral directions to turn clockwise or counterclockwise to face another wall ($\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ of a turn). Their feet will be the turn centre as they pivot on that spot.

(5SS7.5)

- Ask students to form pairs. Each student could provide his or her partner with a labelled polygon on grid paper, and specify a turn centre, direction of the turn (clockwise or counterclockwise) and fraction of the turn. Partners draw the rotations and explain their process.

(5SS7.5)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Performing Rotations

TR: pp. 25-29

SB: pp. 160-163

Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5SS7 Continued...	
5SS8 Continued...	
Achievement Indicators:	
5SS7.7 Predict the result of a single transformation of a 2-D shape, and verify the prediction.	Once students have practiced transforming shapes, they should be able to predict the result of a specified move without physically manipulating the original figure. Using the interactive white board, provide various examples of figures on a grid. Invite students to predict the position of the image to be translated, reflected or rotated. They should then verify the prediction by completing the transformation.
5SS8.4 Provide an example of a translation, a rotation and a reflection.	Generate discussion around real life examples of transformations, such as a player pivoting on a basketball court, a spinning fan, a bike wheel, a merry-go-round or Ferris Wheel (rotation), pushing a box across the room, moving furniture around in a room (translation), a kaleidoscope, temporary tattoos, cattle brands (reflection), etc.

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

| Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Journal

- Ask students to respond to the following prompts:

  When do you see or use these transformations in your everyday lives? What transformation do you enjoy the most and the least? Why?

  (5SS7.7)

- Ask students to describe the differences in the three transformations: translation, reflection, and rotation.

  (5SS8.5)

- Ask students to complete a Venn Diagram comparing any two transformations.

  (5SS8.5)

Performance

- Motion Commotion - Provide students with a sheet of 8 1/2 by 14 inch paper to fold and cut according to the diagram below. Ask students to cut each section of the top layer from the edge to the fold so that the top half of the strip has flaps that can be folded over to cover the images. Place one figure in the first (lower left hand) box of the strip. Students should perform a transformation and write on the flap a description of the movement performed. Students should continue performing these transformations until all blocks have been filled.
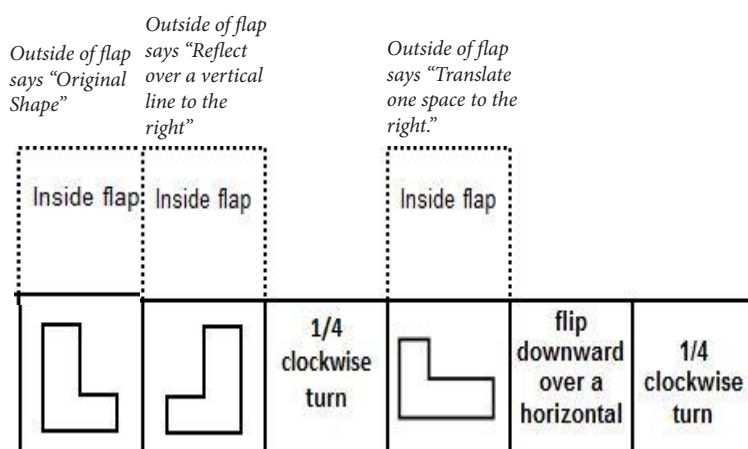
Source: Navigating through Geometry (Grades 3-5)

(5SS8.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Performing Rotations

TR: pp. 25-29

SB: pp. 160-163

Lesson 5: Communicating about Transformations

TR: pp. 30-33

SB: pp. 164-165

Math Game:

Cover Up

TR: pp. 34-35

SB: p. 166

Curious Math:

Fun with Transformations

TG: pp. 36-37

SB: p. 167

Shape and Space (Transformations)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SS8 Continued...** **Achievement Indicator:** *5SS8.5 Identify and describe a given single transformation as a translation, rotation or reflection.*	Give students sets of figures and ask them to identify whether the transformation resulted from a translation, reflection, or rotation and describe the move. The reference material they have compiled in their foldable or Venn diagram should help with this determination. Ask students: • What transformation would move figure ABCDEF to image A'B'C'D'E'F'? Describe the movement. • What transformation would move figure FGHI to image F'G'H'I'? Describe the movement. Students could view *Motion Geometry: Rotations, Reflections and Translations* from Discovery Education. This short video illustrates how animators use transformations to create dragons and dinosaurs in movies. Students could be challenged by compositions (a combination of two or more transformations) or observing tessellations by M.C. Escher to determine how the transformations were effected. This is beyond the expectation of the outcome and would be considered enrichment or extension.
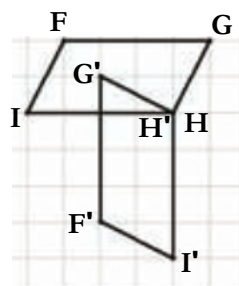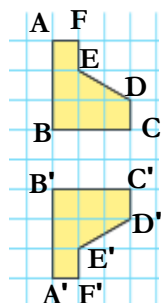
General Outcome: Describe and analyze position and motion of objects and shapes.

Suggested Assessment Strategies

Paper and Pencil

- Ask students to complete a chart similar to the one below. Provide various transformations on individual cards.

Figure	Name of Transformation	Description of Transformation
Card 1	Rotation	$\frac{1}{2}$ turn counter clockwise about vertex Q

Card 1
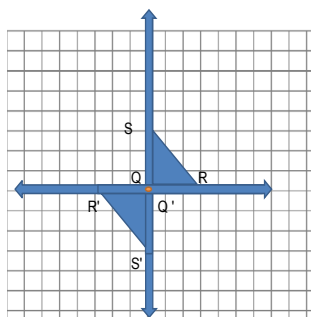
(5SS8.5)

Journal

- Ask students to use the following story starters in a journal, choosing the correct stem for a set of images provided:

  I know this is a reflection because...

  I know this is a translation because...

  I know this is a rotation because...   (5SS8.5)

Interview

- Provide students with a variety of completed transformations. Ask them to identify the type of transformation and explain how they know.

(5SS8.5)

Performance

- Ask students to do a List, Sort and Label. Provide small groups of students with a set of index cards containing images of transformations and key terms from the unit. The small groups are to discuss their LIST and create a method by which to SORT them. Once the cards have been sorted, the group will use blank index cards to create a LABEL for the sub groups they created as criteria for sorting as well as a title for the whole collection of terms. Different groups may devise differing, equally legitimate ways to sort the terms which are equally legitimate. The discussion and justification between group members is more important than a uniform result. For students who struggle, this may be scaffolded by providing suggestions of categories into which the terms may be sorted.

(5SS8.5)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 5: Communicating about Transformations

TR: pp. 30-33

SB: pp. 164-165

Curious Math:

Fun with Transformations

TG: pp. 36-37

SB: p. 167

Suggested Resource

- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit5

  -Motion Geometry: Rotations, Reflections and Translations

Multiplication

Suggested Time: 4 Weeks

September	October	November	December	January	February	March	April	May	June
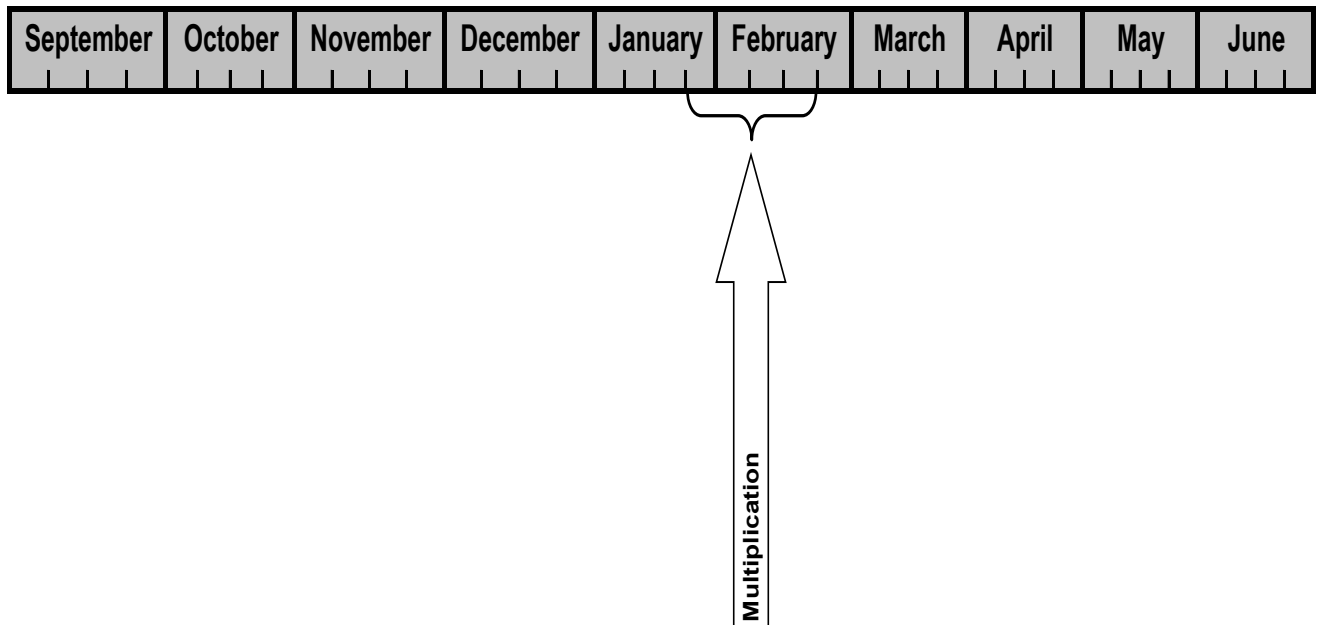
Multiplication

Unit Overview

Focus and Context

During this unit, students will apply what they have previously learned about multiplication to larger numbers and choose the most efficient method or strategy for multiplying numbers. Mental computation and estimation should be integrated throughout the unit as students routinely determine the reasonableness of their computations.

Outcomes Framework

> **GCO**
> Develop number sense.

> **SCO 5N2**
>
> Use estimation strategies, including:
>
> - front-end estimation
> - compensation
> - compatible numbers
> - rounding

> **SCO 5N3**
>
> Apply mental mathematics strategies and number properties, such as:
>
> - skip counting from a known fact
> - using halving and doubling
> - using patterns in the 9s facts
> - using repeated doubling or halving
>
> in order to understand, apply and recall basic multiplication facts to 9 x 9 and related division facts.

> **SCO 5N4**
>
> Apply mental mathematics strategies for multiplication, such as:
>
> - annexing (adding) zero
> - halving and doubling
> - using the distributive property

> **SCO 5N5**
>
> Demonstrate, with and without concrete materials, an understanding of multiplication (two-digit by two-digit) to solve problems.

> **GCO**
> Represent algebraic expressions in multiple ways.

> **SCO 5PR2**
>
> Solve problems involving single variable, one-step equations with whole number coefficients and whole number solutions.

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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 x 9 and related division facts. [C, CN, ME, R] 4N6 Demonstrate an understanding of multiplication (two- or three-digit by one-digit) to solve problems by: • using personal strategies for multiplication with and without concrete materials • using arrays to represent multiplication • connecting concrete representations to symbolic representations • estimating products • applying the distributive property. [C, CN, ME, PS, R, V]	5N2 Use estimation strategies, including: • front-end estimation • compensation • compatible numbers • rounding in problem-solving contexts. [C, CN, ME, PS, R, V] 5N3 Apply mental mathematics strategies and number properties, such as: • skip counting from a known fact • using halving or doubling • using patterns in the 9s facts • using repeated doubling or halving in order to understand, apply and recall basic multiplication facts to 9 x 9 and related division facts. [C, CN, ME, R, V] 5N4 Apply mental mathematics strategies for multiplication, such as: • annexing (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 (two-digit by two-digit) to solve problems. [C, CN, PS, V]	6N8 Demonstrate an understanding of multiplication and division of decimals (one-digit whole number multipliers and one-digit natural number divisors). [C, CN, ME, PS, R, V] 6N9 Explain and apply the order of operations, excluding exponents, with and without technology (limited to whole numbers). [C, CN, ME, PS, T]
Strand: Patterns and Relations (Variables and Equations)		
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	Suggestions for Teaching and Learning

Students will be expected to:

5N3 Apply mental mathematics strategies and number properties, such as:

- **skip counting from a known fact**
- **using double and halving**
- **using patterns in the 9s facts**
- **using repeated doubling or halving**

in order to understand, apply and recall basic multiplication facts to 9 x 9 and related division facts.

[C, CN, ME, R, V]

By the end of Grade 5, students should:
- *understand and apply strategies for multiplication and related division facts to 9 x 9.*
- *recall multiplication and related division facts to 9 x 9*

By the end of Grade 4, students are expected to understand facts to 9×9 and recall facts to 7×7. In Grade 5, students will build on their knowledge and expand their range of recalled facts to 9×9.

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 more strategies. Once 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.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Students could work in pairs. One student represents odd numbers while the other represents even numbers. Students prepare a T-chart to record their scores.

Even	Odd

Both students put both hands behind their backs and one of the players says "go". Both students bring their hands to the front with any number of fingers, of their choice, held up. The students take turns multiplying the numbers. If the product is even, the student representing "even" scores a point. If the product is odd, the student representing "odd" scores a point. The first to score ten points wins the game.

Assessment observations: How are the students multiplying the two numbers? For example, are they applying strategies (efficient or inefficient) to find various products? Are they able to look at 5 and 7 and immediately say 35? Is there an automatic response for some and not for others?

$$8 \quad x \quad 6 \quad = \quad 48$$
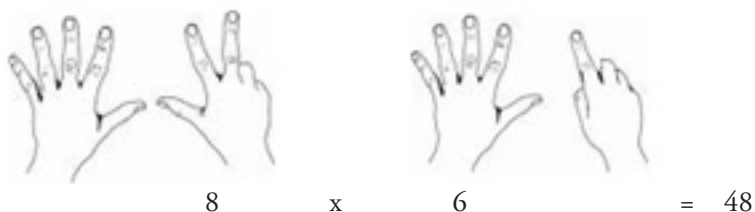
(5N3)

Interview

- Tell students: You know that $3 \times 5 = 15$. Ask: What other multiplications could be easier for you to do because you know this?

(5N3)

Resources/Notes

Authorized Resource

Math Focus 5

Getting Started

Making Dream Catchers

Teacher Resource (TR): pp. 9-11

Student Book (SB): pp. 174-175

Lesson 1: Multiplication Strategies

TR: pp. 12-15

SB: pp. 176-179

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N3 Continued...

Achievement Indicator:

5N3.1 Describe the mental mathematics strategy used to determine a given basic fact, such as:

• skip count up by one or two groups from a known fact

• skip count down by one or two groups from a known fact

• doubling

• patterns when multiplying by 9

• repeated doubling

• repeated halving

Suggestions for Teaching and Learning

In Grade 4, students used these mental mathematics strategies to determine multiplication facts to 9 x 9. A review of the strategies will be important. Examples of each of these strategies follow:

- skip count up by one or two groups from a known fact; e.g., since $5 \times 7 = 35$, then 6×7 is equal to $35 + 7$ (42) and 7×7 is equal to $35 + 7 + 7$ (49)

- skip count down by one or two groups from a known fact; e.g., if $8 \times 8 = 64$, then 7×8 is equal to $64 - 8$ (56) and 6×8 is equal to $64 - 8 - 8$ (48)

- doubling; e.g., for 8×3 think $4 \times 3 = 12$, so $8 \times 3 = 12 + 12$ (24)

- patterns when multiplying by 9; the tens digit of the product is always one less that the other factor, the sum of the two digits in the product is always 9; e.g., for 7×9, think: 1 less than 7 is 6, 6 and 3 make 9, so the answer is 63.

- repeated doubling; e.g., if 2×6 is equal to 12, then 4×6 is equal to 24 and 8×6 is equal to 48.

- repeated halving; e.g., for $60 \div 4$, think $60 \div 2 = 30$ and $30 \div 2 = 15$.

Teachers could read aloud Gregory Tang's *The Best of Times* and encourage students to try out the strategies Tang suggests for any fact families for which they did not have a rule or strategy. Students could add to or revise their own strategy book including creating a cover which illustrates one of the strategies contained inside.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**

Suggested Assessment Strategies

Interview

*   Use some of these questions to discuss with students the strategies they use for multiplication:

    (i) Given the fact that 7 × 8 = 56, explain how you could use this to determine 8 × 8 and 9 × 8. Use words, diagrams and numbers to explain.

    (ii) Bill says that because 7 × 7 = 49, he knows that 6 x 7 = 42. Explain his thinking.

    (iii) Amy knows that 4 x 9 = 36. How can she use this fact to help her determine 8 x 9? Explain.

    (iv) Jack states that 9 x 7 = 64. Jill sees right away that Jack's answer is incorrect because 6 + 4 = 10. What pattern did Jill use?

    (v) Explain how to use the repeated doubling strategy to determine any of the eight times facts.

(5N3.1)

Portfolio

*   After reading and discussing Gregory Tang's *The Best of Times,* ask students to create their own illustrated booklet on multiplication fact strategies.

(5N3.1)

Performance

*   Students could play a loop game (I Have..., Who Has...) to reinforce multiplication facts. Prepare a set of cards with various multiplication fact questions and products (see sample below). Shuffle and distribute. One student starts by reading aloud his or her question (i.e., Who has 9 × 7?). The student with the correct product responds ("I have 63") and continues by asking the question on the bottom of his or her card. The cycle continues until the loop has been completed and the student who began gives his or her answer. To scaffold this for students who are unsure, consider giving pairs of students a card or two cards for each pair. If desired, the questions can be phrased: We have... Who has...? Ask students which strategy they used to determine their answer.

Sample cards:

1. I have 28. Who has 4 x 4?   2. I have 49. Who has 3 x 5?

3. I have 16. Who has 8 x 8?   4. I have 15. Who has 7 x 6?

5. I have 64. Who has 7 x 8?   6. I have 42. Who has 6 x 6?

7. I have 56. Who has 7 x 7?   8. I have 36. Who has 7 x 4?

(5N3.1, 5N3.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Multiplication Strategies

TR: pp. 12-15

SB: pp. 176-179

Note

Repeated halving will be addressed in Chapter 9, Division, Lesson 2.

Suggested Resource

The Best of Times - Gregory Tang

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N3 Continued...

Achievement Indicators:

5N3.2 Explain why multiplying by zero produces a product of zero.

5N3.3 Demonstrate recall of multiplication facts to 9 x 9 and related division facts.

Suggestions for Teaching and Learning

Students worked with the property of zero in Grade 4. To show 5 sets of 0, teachers could use 5 empty baskets and ask, "How many muffins are there in all?" Since there is nothing in any of the baskets, the answer is 0, because 5 groups of 0 is 0. It will not matter how many empty baskets there are, any number of baskets with 0 muffins in them result in 0 muffins altogether.

5 x 0 = 0

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 number facts without understanding have not reached 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. Being able to recall and apply facts efficiently enables students to think logically about problem solving without losing their train of thought in attempting to retrieve basic facts.

It is important for students to recognize facts they know well and facts they need to continue to review for prompt recall. With a blank facts table, help students identify the facts they already know (i.e., 1s, 2s, 3s, 4s, 5s, 6s, 7s). Students often recall the 9s facts with quick finger patterns or digit patterns. Review and discuss rules and strategies for each set of facts. Ask students to fill in the table as the class works through identifying the facts. Students should be encouraged to identify any facts they are struggling with and continue to develop strategies for efficient recall.

This would be a good time to discuss turn around facts (4 × 5 vs 5 × 4). A diagonal line can be drawn to identify turn around facts.

X / ÷	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30				54
7	0	7	14	21	28	35				63
8	0	8	16	24	32	40				72
9	0	9	18	27	36	45	54	63	72	81

Facts that students often need to focus on.

Reinforce with regular class routines.

Shaded area: Turn around facts

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Portfolio

- Have students write a poem, or create a poster with the theme, "I may be Zero, but I am NOT nothing".

(5N3.2)

Performance

- Two Player Game: Race to 1 000. One student rolls a pair of dice and uses the numbers rolled as factors for a product. The student determines the product and the other student verifies the answer using a calculator or a multiplication facts table. When a student gives a correct fact, they keep a running count of the value of the solutions until one student reaches 1000. Students can use manipulatives, place value charts or numbers to keep their tally.

(5N3.3)

- Exit Card Activity: Give each student a 4 x 6 index card. Students must recap strategies learned to complete any set of multiplication facts (e.g., 9s facts). Students then exchange cards with their peers. Have two or three students share their strategies with the class. Lead discussion to include ways to enhance and clarify the strategies.

(5N3.3)

- Students could use the app *NearPod* or *Socratic* for custom formative assessment and immediate feedback on recall of multiplication facts.

(5N3.4)

Paper and Pencil

- Ask students to fill a blank times table chart to determine facts that need to be worked on with appropriate strategies. The chart can be created with the numbers in sequence or with the numbers placed randomly such as:

X	7	3	8	...
2	14	6	16	
5	35	15	40	
9	63	27	72	...

(5N3.3, 5N3.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 2: Special Products

TR: pp. 16-19

SB: pp. 180-182

Note

Related division facts are not addressed in student text but must be addressed as part of the outcome.

Lesson 3: Relating Multiplication Facts (Optional)

TR: pp. 20 -22

SB: p. 183

Suggested Resources

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit6

  -enrichment activities

  -NearPod

  -Socratic

  -Enjoy Learning 9 x 9

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N3 Continued...
Achievement Indicator:

5N3.3 (Continued) Demonstrate recall of multiplication and related division facts to 9 x 9.

The division sign is included on the chart so students can identify related fact families. Students no longer need to concentrate on 100 facts but can now focus on the facts they need to learn while maintaining recall of the facts they already know.

It is important that students recognize that multiplication and division are inverse operations. For each multiplication, or division fact, there is a related fact family. This fact family, for example, shows the relationships between 7, 8 and 56.

$$8 \times 7 = 56$$
$$7 \times 8 = 56$$
$$56 \div 7 = 8$$
$$56 \div 8 = 7$$

5N4 Apply mental mathematics strategies for multiplication, such as:
- **annexing (adding) zero**
- **halving and doubling**
- **using the distributive property.**

[C, CN, ME, R, V]

Proficiency with mental mathematics is a valuable skill for students:
- It can be done quickly using tools which are always readily available.
- It adds efficiency to computations, problem solving work, and to later work with algebra. Without mental math, students have to make too many side-trips in more complex tasks which take them away from the main problem and increase the likelihood of error.

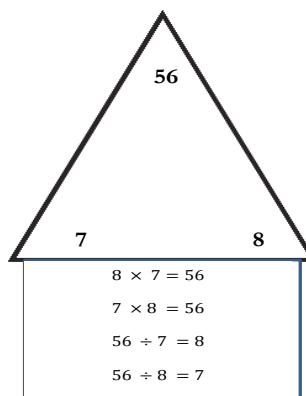**Achievement Indicator:**

5N4.1 Determine the products when one factor is a multiple of 10, 100 or 1000 by annexing (adding) zeros.

Estimation and calculations of multi-digit products are based on knowledge of the multiplication facts and how to multiply with multiples of 10, 100, and 1000. The following models can be used to teach and explain these concepts.
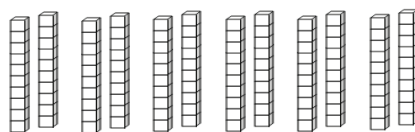
Model 6 x 20 as 6 groups of 20

Regroup 12 tens by trading 10 tens for 1 hundred

6 x 20 = 6 x 2 tens

= 12 tens or 120
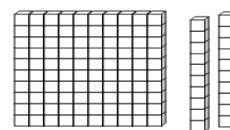
6 x 2 tens = 12 tens

= 1 hundred, 2 tens

= 120

(Big Ideas from Dr. Small, 2009, pp. 32)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- **Facto** - Create Facto cards [4 x 5] with squares containing two factors, one of which is a multiple of 10. Each pair of students is given one grid and a set of product cards with the answers to the problems on the grid. Turn the product cards face down. Students take turns turning over product cards and placing them on the appropriate problem on the Facto card. The first student to achieve a straight line

F	A	C	T	O
39 x 10	4 x 100	10 x 10	14 x 1000	90 x 10
14 x 10	56 x 100	40 x 20	25 x 10	90 x 40
8 x 70	600 x 30	70 x 5	62 x 10	60 x 50
20 x 800	30 x 25	12 x 40	13 x 20	5 x 90

(5N4.1)

Pencil and Paper

- Ask students: What basic fact can be used to find the product 4 x 8 000? What is the product?

(5N4.1)

- Ask students to complete each column and explain the pattern they see.

3 x 7 = ____   4 x 5 = ____

3 x 70 = ____   4 x 50 = ____

3 x 700 = ____   4 x 500 = ____

3 x 7 000 = ____   4 x 5 000 = ____

3 x 70 000 = ____   4 x 50 000 = ____   (5N4.1)

- Ask students to choose two factors from the list for each estimated product. Each number may be used more than once.

Factor List: 309   193   4   3   759   7

Δ x Δ = 2 100   Δ x Δ = 900

Δ x Δ = 1 200   Δ x Δ = 800

Δ x Δ = 24 00   Δ x Δ = 5 600

(5N4.1)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Multiplying by Tens, Hundreds, and Thousands

TR: pp. 23–26

SB: pp. 184-187

Suggested Resource

- *Big Ideas from Dr. Small-Marian Small*

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N4 Continued...** **Achievement Indicators:** *5N4.1 (Continued) Determine the products when one factor is a multiple of 10, 100 or 1000 by annexing (adding) zeros.* *5N4.2 Apply halving and doubling when determining a given product.*	When using powers of 10, students can determine the basic multiplication fact and then annex the correct number of zeros as determined by the power of ten used. For 30 x 400, for example, students could think "ten times one hundred is one thousand, and three times four is twelve, so three tens times four hundreds is twelve thousands or 12 000". The doubling and halving strategy is a specific example of the multiplication principle which states: to multiply two numbers you can divide one factor and multiply the other by the same number without changing the product. Consider eight groups of three (8 x 3). If you combine groups of three, you will have six in each group, (twice as many per group), but only four groups (half as many groups), while the total number of circles remains the same. (8 x 3 = 4 x 6)

<div align="center">

8 groups of 3   4 groups of 6

8 x 3 = 4 x 6 (double and half)
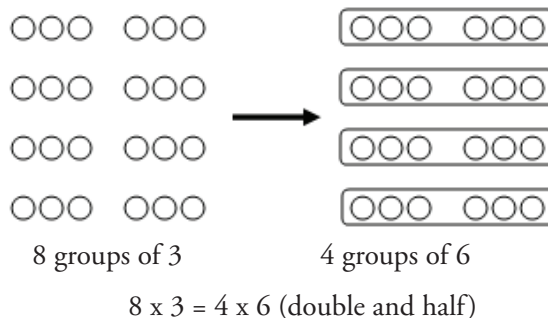
(Big Ideas from Dr. Small, 2009, p 28)
</div>

The halving and doubling strategy works best when one or more of the factors is even, since halving an odd number results in a fraction. This strategy is particularly useful for factors such as 5, 15, 25, etc.

e.g.,   12 x 15   ->   6 x 30   ->   180

25 x 18   ->   50 x 9   ->   450

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Ask students: For which of the following computations would you use the halving and doubling strategy? Explain.

  9 x 7   8 x 13

  50 x 8   51 x 9

  25 x 16   35 x 4

  (5N4.2)

- Given the equation: 57 x 7 = (60 x 7)____ (3 x 7), ask the student to choose which operation should go in the blank and explain why.

  (5N4.3)

Journal

- Ask students to explain how the halving and doubling strategy could be used to solve 5 x 34.

  (5N4.2)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 5: Halving and Doubling to Multiply

TR: pp. 27–30

SB: pp. 188-191

Lesson 6: Multiplying Numbers Close to Ten

TR: pp. 34–37

SB: pp. 194-197

Suggested Resource

- *Big Ideas from Dr. Small-* Marian Small

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:
5N4 Continued...

Achievement Indicator:

5N4.3 Apply the distributive property to determine a given product involving multiplying factors that are close to multiples of 10.

The ability to break numbers apart in flexible ways is even more important in multiplication than in addition or subtraction.

In the Numeration unit, students learned that numbers can be represented in expanded form, such as 365 = 300 + 60 + 5. Students could multiply using this expanded form by applying the distributive property and their knowledge of multiplying by multiples of 10, 100 and 1 000.

7×256, for example, can be multiplied as:

$(7 \times 200) + (7 \times 50) + (7 \times 6)$

   1 400 + 350   + 42 = 1 792

Using expanded form to multiply allows students to see the value placed on each digit of the number; e.g., the 5 in 256 means 50 instead of 5.

Similarly, 98 x 7 = (90 x 7) + (8 x 7)

A discussion could occur around which strategy, or combination of strategies, students find most useful.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Resources/Notes

Authorized Resource

Performance

- Ask students to model the following using base ten blocks.

  $32 \times 4 = (30 \times 4) + (2 \times 4)$.

(5N4.3)

Math Focus 5
Lesson 6: Multiplying Numbers
Close to Ten

TR: pp. 34–37

SB: pp. 194-197

Paper and Pencil

- Ask students to determine 68×7 and explain their method.

(5N4.3)

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N2 Use estimation strategies, including:

- **front-end estimation**
- **compensation**
- **compatible numbers**
- **rounding**

in problem-solving contexts.

Achievement Indicators:

5N2.2 Determine the approximate solution to a given problem not requiring an exact answer.

5N2.3 Estimate a sum or product, using compatible numbers.

5N2.7 Provide a context for when estimation is used to:

- *make predictions*
- *check the reasonableness of an answer*
- *determine approximate answers.*

5N2.8 Describe contexts in which overestimating is important.

5N2.4 Apply front-end estimation to estimate:

- *sums*
- *differences*
- *products*
- *quotients*

Estimation is valuable because it helps judge the reasonableness of an answer acquired using pencil and paper or calculators. It can be done quickly using tools which are always readily available. An estimate is often all that is required to make an important decision. Estimating is producing an answer that is "good enough" for the situation, and some situations call for more accurate estimates than others. Discuss with students situations in which an estimate would be appropriate and instances where it would not.

Provide students with problem-solving contexts requiring the multiplication of two two-digit whole numbers such as:

To raise money at school, 24 students each sold 36 chocolate bars. Estimate how many chocolate bars the students sold.

Through discussion, students should conclude that the operation used in this problem is multiplication. Ask students to estimate the product using front-end estimation or compatible numbers. Remind students that front-end estimation uses only the first digit in each number and replaces the other digits with zeros; therefore, 24 becomes 20 and 36 becomes 30. Review multiplying by 10s and also rewriting each number as a product of 10. If necessary, rewrite 20×30 as $2 \times 3 \times 10 \times 10 = ?$

Students should determine $20 \times 30 = 600$.

Students may refine their estimates using compensation. Explain that the compensation strategy is used to adjust the estimate to make it closer to the actual product. For the example above, ask students whether 600 is more or less than the actual product and why they think so. A sample explanation might be "Since the digits in the ones place were replaced by zeros, then 24 x 36 is greater than 600." Through discussion, students should generalize that front-end estimation of the product of two numbers is always an underestimate.

When an overestimate is required, or the rounded or compatible numbers are not nearby to the originals, students might consider rounding one factor in one direction and the other in the opposite. In this example, to compensate for the low estimate that would be obtained by using front-end estimation, they might instead use 20×40 to get the closer estimate of 800.

Encourage students to calculate the answer to the problem using a personal strategy and then compare their calculated answer to the estimated answer.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Journal

- Ask students to respond to the following:

  Judy's class sold Belgian chocolate as a fund raiser for their school. Her class sold 46 boxes of chocolate at $18.00 a box. Judy estimated that her class raised $920.00. Explain her strategy and tell whether you think her estimate is reasonable or not.

  (5N2.7)

- Find two different ways to use compatible numbers to estimate each product and explain each method you used.

  23 x 8   94 x 5   43 x 54

  (5N2.4)

Interview

- Jane has to purchase hoodies for her team of 30 gymnasts. Each hoodie costs $63.00 and Jane estimates the total by using $60.00 x 30 to get a cost of $1800.00. Ask students whether her estimate is too high or too low. In this case, why is a low estimate a problem?

  (5N2.8)

Paper and Pencil

Ask students to solve the following:

- You have four pieces of chocolate that each weigh 253 g. Estimate whether the total weight of these four pieces of chocolate is more or less than1 kg (1 000g). Explain your thinking.

  (5N2.7)

- In each box, circle all factor pairs whose estimated product is in the center. Explain your choice for any two sets of factors.

2 × 599	6 × 212	3 × 395
4 × 304	**1 200**	2 × 673
3 × 444	4 × 256	6 × 184

6 × 524	4 × 888	9 × 444
4 × 973	**3 600**	6 × 555
9 × 381	6 × 631	4 × 918

(5N2.2, 5N2.3, 5N2.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 7: Estimating Products

TR: pp. 38–41

SB: pp. 198-200

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N2 Continued...

Achievement Indicator:

> *5N2.6 Select and use an estimation strategy for a given problem.*

Suggestions for Teaching and Learning

Students should work with a variety of problems that require them to use estimation strategies such as:

Maren and her friends each read a different story by Hans Christian Andersen. Maren said she had read the most because her story had the most pages. Nicholas pointed out that his story had more lines on a page so he actually read the most. Finally, Brooklyn and Jaxon decided they should all estimate the number of lines in their stories to settle the argument.

Name	Story	Number of Pages	Lines per Page
Maren	*The Ugly Duckling*	29	18
Nicholas	*The Steadfast Tin Soldier*	16	25
Brooklyn	*The Princess and the Pea*	24	17
Jason	*The Fir Tree*	18	19

Ask students to:

(i) Select and use strategies to estimate the number of lines in each story to find out who read the most. Show your thinking.

   Explain which person read the most.

(ii) Explain why you used the estimation strategy or strategies that you chose.

   (Source: www.LearnAlberta.ca Grade 5, Number (SO 2) 2008)

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 7: Estimating Products

TR: pp. 38–41

SB: pp. 198-200

Interview

- Present the following problem to students: Jennifer has 18 pieces of string and each piece is 32 cm in length. Estimate the total length of string.

  Use the following prompts to guide the student's thinking, if necessary:

  - State the problem in your own words.

  - What do each of the numbers in the problem represent?

  - What is the unknown in the problem?

  - What number sentence could you write to show the meaning of the problem?

  - What operation will you use to solve the problem? Explain.

  Use an estimation strategy that makes sense to you to find the answer to the problem. Explain your thinking as you write the numbers. (Hint: provide guidance in using the front-end or compatible numbers strategies, if necessary.)

  Explain how you know your estimate is quite close to the calculated answer. (Hint: have the student use compensation, if appropriate, to refine the estimate.)

  Calculate the answer to the problem using paper and pencil to record your personal strategy.

  Compare your calculated answer with your estimated answer.

  Another prompt for this process may be: There are 52 candies in each of 23 bags. Estimate how many candies there are in total.

  (5N2.6)

- Ask students to create a problem that requires only an estimated answer to solve it. They could then solve the created problem by estimating the answer and explaining their thinking.

  (5N2.3, 5N2.6)

Suggested Resource

- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit6

  -Learn Alberta

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N5 Demonstrate, with and without concrete materials, an understanding of multiplication (two-digit by two-digit) to solve problems.

[C, CN, PS, V]

Achievement Indicators:

5N5.1 Model the steps for multiplying two-digit factors, using an array and base ten blocks, and record the process symbolically.

5N5.2 Describe a solution procedure for determining the product of two given two-digit factors, using a pictorial representation such as an area model.

5N5.3 Solve a given multiplication problem in context, using personal strategies, and record the process.

In Grade 4, students multiplied two- or three-digit numbers by one-digit numbers. The strategies they used can be applied to multiply two-digit numbers by two-digit numbers. There are many good reasons for students to be exposed to various algorithms for multiplication including:

- One algorithm may be more meaningful to a student than another.

- One algorithm may work better for a particular set of numbers.

- Some algorithms lend themselves to mental computations.

- At home, parents may use a different algorithm than one taught at school.

Multiplication of two-digit by two-digit numbers may be concretely modelled using base ten blocks or grids/arrays. These figures both illustrate 31 x 24 and lead students to find the product 744.

$$
\begin{array}{r}
31 \\
\underline{\times\ 24} \\
4 \\
120 \\
20 \\
\underline{+\ 600} \\
744
\end{array}
$$
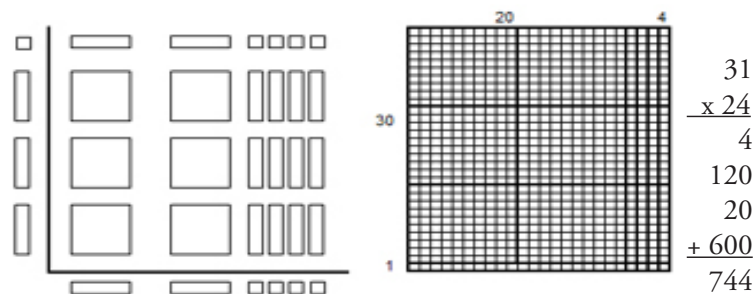
Another pictorial method of representing two-digit by two-digit multiplication is the area method.
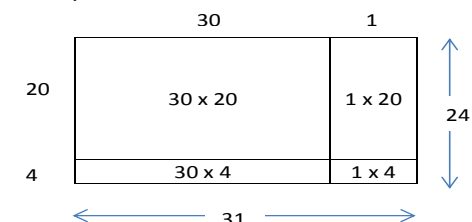
Students should be able to explain any algorithm they choose to use.

It is also important that students explain their reasoning clearly using correct mathematical language. When describing algorithms, terms might include:

- regroup

- trade or exchange

- product

- place value terms such as hundreds, tens and ones.

Effective communication of mathematical thinking uses words, pictures and numbers. These should be logically outlined and clearly presented in students' responses.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to model 54 x 23 using base ten blocks, arrays, or an area model.

(5N5.1, 5N5.2)

Paper and Pencil

- Ask students to find the following products, using base ten blocks if required. Record the process using numbers, words and/or pictures.

  25 x 36   14 x 23

  22 x 32   21 x 17

(5N5.1, 5N1.3)

- Ask students to fill in each of the digits 0-9 in the right spot. Use each digit only once.

3_ × _1 = 16_2
67 × 1_ = 737
_ _ × 8_ = 36_0
1_ × 91 = 1_29

(5N5.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 8: Multiplying Two-Digit Numbers (Optional)

TR: pp. 42–45

SB: p. 201

Lessons 9: Multiplying with Base Ten Blocks

TR: pp. 46-49

SB: pp. 202-205

Lesson 10: Multiplying with Arrays

TR: pp. 50-53

SB: pp. 206-207

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N5 Continued...
Achievement Indicators:

5N5.2(Continued) Describe a solution procedure for determining the product of two given two-digit factors, using a pictorial representation such as an area model.

5N5.3 (Continued) Solve a given multiplication problem in context, using personal strategies, and record the process.
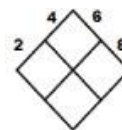
5N5.4 Illustrate partial products in expanded notation for both factors.

5N5.5 Represent both two-digit factors in expanded notation to illustrate the distributive property.

Suggestions for Teaching and Learning

An alternative procedure for two-digit by two-digit multiplication is as follows:

To multiply 24 x 68, make a tilted square as shown:

Drop diagonals vertically as shown to divide each block into two triangles. This divides each block into tens and ones.
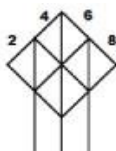
When multiplying 4 x 8 the answer 32 is recorded as shown.
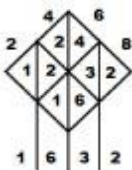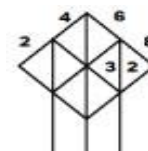
This continues until all triangles are filled.

Add the digits from each column to determine the final answer.

A similar method is shown in the student resource on page 210 (p. 58 in the TR). The lattice method is just the tilted square turned on its side. Some students find this arrangement easier to work with. The final product is found by adding along the diagonals right to left.

The practice of using partial products in expanded notation for both factors can be illustrated using the area model or the distributive property. For 24 x 68, for example,

X	20	4
60	1 200	240
8	160	32

1 200 + 240 + 160 + 32 = 1632

or

24 x 68

(20 + 4) x (60 + 8)

(20 x 60) + (20 x 8) + (4 x 60) + (4 x 8)

1200 + 160 + 240 + 32

1632

As students' understanding of multiplication strategies develops, there should be a natural progression from use of models to symbolic representation.

Another strategy is the standard algorithm for multiplication. This method is familiar to students and probably the strategy most frequently used by parents. Students multiply from right to left. This algorithm should be introduced for two-digit by two-digit multiplication after students have had the opportunity to explore other strategies.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to make their own tilted square and use it to multiply 26 x 43.

(5N5.2, 5N5.3)

- Ask students to use the tilted square to multiply 23 x 45.
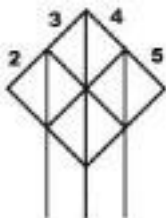
(5N5.2)

- On chart paper with a prepared series of two-digit by two-digit multiplication equations, ask students to fill in missing numbers and provide justification for their choices.

  Example: 45 ×36

  = (40 + 5) × (__ + 6)

  = 40 × 30 + 40 × __ + 5 × __ + 5 × 6

  = 1200 + ____ + 150 + 30 = ____

(5N5.4, 5N5.5)

- Noah planted 15 rows of tulips with 24 tulips in each row. When determining how many tulips he planted, he wrote the following.

  ```
     15
   x  24
     20
     40
     10
   +200
    270
  ```

  Ask students if Noah's answer is correct. They should explain thier answer.

(5N5.4)

- The fish processing plant finished packaging 25 crates of halibut. There were 72 kg of halibut in each crate. Ask students how many kilograms of halibut were packaged altogether. They should use words, numbers and pictures to solve the problem.

(5N5.3)

Performance

- Ask students to use a model to show the amount of money collected for school photos if 43 students each bring in $23.00.

(5N5.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 8: Multiplying Two-Digit Numbers (Optional)

TR: pp. 42–45

SB: p. 201

Lessons 9: Multiplying with Base Ten Blocks

TR: pp. 46-49

SB: pp. 202-205

Lesson 10: Multiplying with Arrays

TR: pp. 50-53

SB: pp. 206-207

Curious Math:

Lattice Multiplication

TG: p. 58

SB: p. 210

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N5 Continued...

Achievement Indicators:

5N5.6 Refine personal strategies to increase their efficiency.

5N5.7 Create and solve a multiplication problem, and record the process.

It is important to monitor the types of strategies that students are using. While personal strategies should be accepted, when those strategies become inefficient, students should transition to more efficient strategies. These more efficient strategies will serve them better as they move to more complex mathematical situations. For example, a student may use repeated addition to calculate 5 x 24 (24 + 24 + 24 + 24 + 24). Although it is an effective strategy, it is not efficient.

Using problem writing can reveal student understanding and misunderstanding in a manner in which traditional assessment cannot. It is possible to see gaps in student understanding that can be used to tailor instruction to individual needs. It also allows opportunity for students to demonstrate mathematical reasoning through the discussion of their problem.

When students are asked to generate and solve their own multiplication problems, they must demonstrate an understanding of real-world, everyday problems that require multiplication and then effectively apply strategies to solve those problems. Students should be encouraged to record their answers and share strategies with the class.

These opportunities for class discussion of the various strategies used in solving the multiplication problems will be a valuable source of learning and ongoing assessment.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Ask students to explain at least two different strategies they would use to solve a given problem. Ask the students which of the strategies they would prefer and why. (Record observation about the efficiency of strategy chosen. This would be an opportunity to discuss the appropriate use of a given strategy with the student.)

(5N5.6)

Paper and Pencil

- Britney is having her 11th birthday party at a movie theatre. The cost is $9.39 per child. She is inviting 12 of her friends. Ask students how her mother should estimate the cost.

(5N5.6)

- Ask students to list five equations which this image might be describing.

450

(5N5.7)

- Given ten number cards (0-9), students could select four cards to create two two-digit numbers and use them as factors in a multiplication problem. Ask students to use the two numbers to create and solve two word problems: one problem with a solution that must be calculated and the other which requires only an estimation. Students explain their choices.

(5N5.7)

Performance

- Students could receive different problems such as " Carrie has to sell 18 boxes of Girl Guide cookies. There are 25 cookies in every box. How many cookies does Carrie have to sell altogether?" Students could use a presentation tool such as Prezi, Keynote, Power Point, Show Me to communicate the strategy they used to solve the problem. Consider various presentation strategies when designing the problems.

(5N5.7)

- Give small groups of students three sets of cards with the digits 0 -9, three multiplication signs and three equals signs. Ask them to create three multiplication sentences using two digit factors. One should have an eight and a nine in the answer, at least one should have a four-digit answer, and one should use no more than one of any digit as factors or product. Students could write problems which could be solved using these created equations.

(5N5.7)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 11: Communicating About Multiplication Methods

TR: pp. 54–57

SB: pp. 208-209

Math Game:

Rolling Products

TR: p. 59

SB: p. 211

Suggested Resources

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit6

  -Prezi Online or app

  -Keynote

  -Power Point

  -Show Me

Patterns in Mathematics

Suggested Time: 3 Weeks

September	October	November	December	January	February	March	April	May	June

Patterns in Mathematics
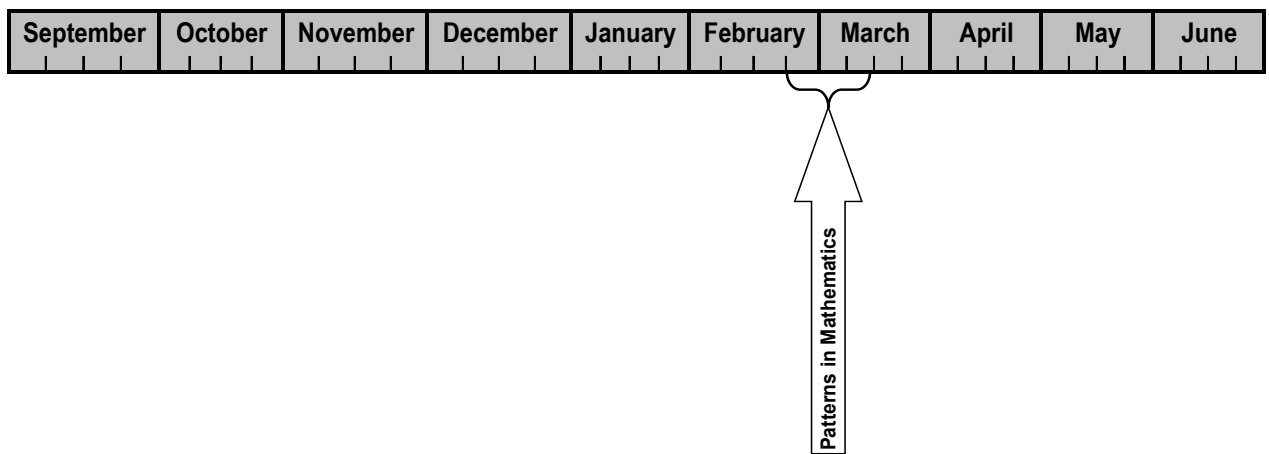
Unit Overview

Focus and Context

Recognizing patterns and making generalizations are necessary skills in mathematics. Patterns are used repeatedly as a means of developing concepts and as a tool for solving problems. Students will represent patterns numerically, pictorially, and symbolically. They will describe pattern rules, use relationships in patterns to predict missing elements and write equations to solve problems.

Students will also be more formally introduced to an algebraic approach in which they first describe the problem using an unknown or variable in an equation and then solve the equation by reasoning. Students are **not expected** to manipulate equations in order to isolate variables, solve for *x*, etc. It will be important to connect concrete, pictorial and symbolic representations as students develop an understanding of equations and continue to build on their understanding of equality as a relationship and not an operation.

Outcomes Framework

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

> **SCO 5PR1**
>
> Determine the pattern rule to make predictions about subsequent elements.

> **GCO**
>
> Represent algebraic expressions in multiple ways.

> **SCO 5PR2**
>
> Solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions.

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Patterns and Relations (Patterns)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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]	6PR1 Demonstrate an understanding of the relationships within tables of values to solve problems. [C, CN, PS, R] 6PR2 Represent and describe patterns and relationships, using graphs and tables. [C, CN, ME, PS, R, V]
Strand: Patterns and Relations (Variables and Equations)		
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]	6PR3 Represent generalizations arising from number relationships, using equations with letter variables. [C, CN, PS, R, V] 6PR4 Demonstrate and explain the meaning of preservation of equality, concretely and pictorially. [C, CN, PS, R, V]

Mathematical Processes

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

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

5PR1 Determine the pattern rule to make predictions about subsequent elements.

[C, CN, PS, R, V]

Achievement Indicator:

5PR1.1 Extend a given pattern with and without concrete materials, and explain how each element differs from the preceding one.

Suggestions for Teaching and Learning

In Grade 4, students identified, described and extended patterns. They concretely reproduced patterns displayed in a table or chart and used tables and charts to record observed patterns. Students also expressed a given problem as an equation and solved one-step equations with symbols representing unknown values.

In Grade 5, students will continue to work with patterns. The focus, however, will be on making and verifying predictions of missing elements in various patterns. Students will use concrete materials and tables to determine pattern rules which will enable them to predict missing elements in a pattern.

Given a number, geometric, pictorial, or situational pattern, students should be able to explain the pattern in spoken and written language. Very often, students will need to extend the pattern to fully understand it.

Skip counting is one way to introduce patterns. Provide students with a hundred chart to help them practice the strategy of skip counting (e.g., counting by 6) to find patterns.

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

The hundreds chart is a tool for exploring number relationships which is the focus of pattern work. *Smart Exchange* is an online source with an interactive 100s grid which may be helpful in exploring skip counting.

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to extend the following patterns and describe how the elements are changing .

  3, 6, 9, 12, _____, _____, _____

  8, 17, 26, 35, _____, _____, _____

  97, 86, 75, 64, _____, _____, _____

  49, 42, 35, 28, _____, _____, _____

  (5PR1.1)

Performance

- Ask students to work with a partner to build a staircase using either connecting cubes or rods from base ten materials.

Step 1   Step 2   Step 3
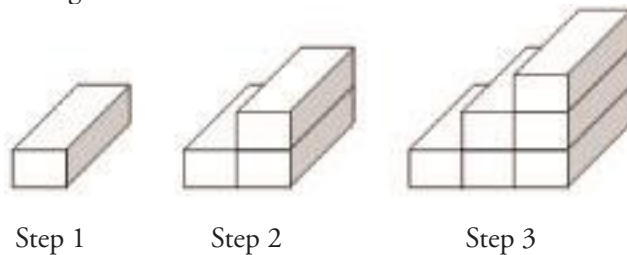
Step	Number of Blocks
1	1
2	3
3	
4	
5	
6	
10	

Ask students to:

(i)   Copy and extend the pattern above to show the next three steps.

(ii) Describe what they notice about the pattern.

(iii) Record the pattern on the chart provided.

(iv) Think about many blocks might be in the tenth step and explain how they made that guess.

(v)   Extend the pattern to the tenth step.

  (5PR1.1)

Resources/Notes

Authorized Resource

Math Focus 5

Getting Started
Collecting Pennies
Teacher Resource (TR): pp. 9-11
Student Book (SB): pp. 2-3

Note

In Getting Started, the focus is on patterns in a hundreds chart. Select only one or two practice exercises or omit completely as it does not reflect patterns at the Grade 5 level.

Lesson 1: Modelling Patterns
TR: pp. 12-15
SB: pp. 4-6

Suggested Resources

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit7

  -enrichment activities

  -Smart Exchange

Patterns and Relations (Patterns)

Specific Outcomes

Students will be expected to:

5PR1 Continued...

Achievement Indicators:

5PR1.2 Describe, orally or in writing, a given pattern, using mathematical language, such as one more, one less, five more.

5PR1.3 Predict subsequent elements in a given pattern.

5PR1.4 Represent a given pattern visually to verify predictions.

Suggestions for Teaching and Learning

Through teacher questioning, students should have ample opportunity to explain orally, prior to writing descriptions, how elements in various patterns change as the patterns are extended. Students should use manipulatives to copy and extend patterns. Ask them to describe how the concrete representation illustrates the pattern.

Provide students with number patterns such as the following:

85, 80, 75 …   8, 15, 22…….

37, 26, 17…..   6, 12, 24……

Students should continue the pattern for the next three numbers and then describe the pattern rule.

When describing a pattern, students should state at what number the pattern starts and how the number changes for each term. In the first pattern above, for example, the pattern rule is: Start at 85 and subtract 5 each time to find each term which follows.

Students could continue to use manipulatives when predicting subsequent elements in a given pattern. They could also construct a table or T-chart to record or represent a pattern.

For example, the diagram below shows a series of triangles built using toothpicks.

Students should continue the pattern above for the next three triangles.

Number of Triangles	Number of Toothpicks
1	3
2	5
3	7
4	
5	
6	

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

Suggested Assessment Strategies

Paper and Pencil

- Ask students: If you keep dividing the square as shown below, how many sections will there be in the fifth picture?
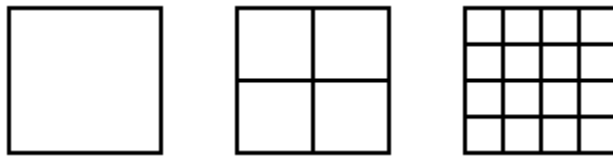
   Explain the pattern using mathematical language.

   (5PR1.2, 5PR1.3)

- Ask students: If you keep building the T shape using square tiles, how many tiles will there be in the sixth picture?

| 1 | 2 | 3 |
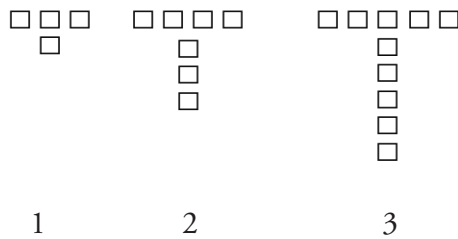
   What pattern rule will you use to determine the number of tiles needed?

   (5PR1.3)

Performance

- Give students this diagram.

   House #1 has two shapes, House #2 has 4 shapes, and House # 3 has 6 shapes. Ask: How many shapes does House #4 have?

   House #8?

   After predicting, students could draw a picture of each of the eight houses to verify their answer.

Journal

- Ask students to respond to the following:

   A certain pattern has the number five in it. What could the pattern be?

   (5PR1.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Modelling Patterns
TR: pp. 12-15
SB: pp. 4-6

Curious Math:
Adding Squares
TR: pp. 16-17
SB: p. 7

Patterns and Relations (Patterns)

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5PR1 Continued...** **Achievement Indicators:** *5PR1.2 (Continued) Describe, orally or in writing, a given pattern, using mathematical language, such as one more, one less, five more.* *5PR1.3 (Continued) Predict subsequent elements in a given pattern.* *5PR1.4 (Continued) Represent a given pattern visually to verify predictions.*	Recording the pattern in a chart should help them describe the pattern. They should find the pattern rule for the number of toothpicks: Start at three and add two for each element. They could also determine the pattern rule for the number of triangles: Start at one and add one each time. In Grade 5, students are not expected to explore the relationship between the two columns. That is, they are not expected to express the result in column two as result of a mathematical computation using the number in column one. Ask students to predict the number of toothpicks needed to construct 10 triangles using the same pattern and explain their prediction. Making a prediction involves using existing information to discover a pattern and to project what values are to follow. Enabling students to validate their predictions of elements further in the pattern often requires completing a table of values or using visual representations. Students should be asked to explain their predictions to clarify their understanding of the pattern, and then verify that their answer is correct. Teachers could create a pattern block train by alternating one red trapezoid with one yellow hexagon. Students should predict which block will be in the 15th place and then extend the train to verify the prediction.

General Outcome: Use Patterns to Describe the World and to Solve Problems
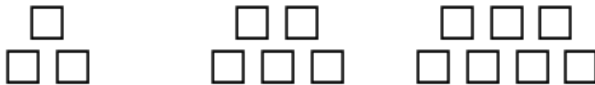
Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to use cubes or square tiles to copy and extend these shapes to the fifth shape in the pattern. They could explain in words how the pattern grows. Ask them to predict what the seventh shape would look like.

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

- Students could fold a piece of paper to create two sections. When they fold the same piece of paper again, the result is four sections. Ask students to investigate the number of sections they would get with three folds and with four folds. Ask them to predict the number of sections with five folds. Students should check their predictions and explain how they could predict the number of sections for eight folds. This provides a good example of why predicting is important. Sometimes it is not realistic to extend models.

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

- Provide students with the first two elements in a pattern and ask them to extend the pattern. Students could work in pairs to create as many different patterns as they can, writing the pattern rule for each.

Some possible beginnings are:

4, 8…..

100, 94, ……

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

Paper and Pencil

- Ask students to use their knowledge of patterns to answer the following:

Sharon delivers pizza. Each day, she earns $20.

(i) How much will she earn at the end of one day?

(ii) How much will she earn at the end of two days?

(iii) How much will she earn at the end of one week?

(iv) How many days will it take Sharon to earn $240?

Ask students to explain how they solved the problems.

(5PR1.1, 5PR1.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 2: Extending Increasing Patterns
TR: pp. 18-22
SB: pp. 8-11

Note

This lesson is closely linked to Lesson Three which focuses on decreasing patterns. They could be treated together.

Lesson 3: Extending Decreasing Patterns
TR: pp. 23-26
SB: pp. 12-14

Patterns and Relations (Patterns)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5PR1 Continued...

Achievement Indicator:

5PR1.5 Solve a given problem by using a pattern rule to determine subsequent elements.

Suggestions for Teaching and Learning

Patterns are used repeatedly as a means of developing concepts and as a tool for solving problems.

Many problems solved through the use of patterns are appropriate for Grade 5 students.

Examples include:

Use the following pattern to figure out what 9 × 999 would be.

$2 \times 999 = 1998$

$3 \times 999 = 2997$

$4 \times 999 = 3996$

$5 \times 999 =$

$6 \times 999 =$

Possible enrichment task: How far can this pattern be extended before it comes to an end?

Find the patterns for increasing this recipe for carmel corn.

# of Batches	Brown Sugar	Popcorn
1	1 scoop	10 scoops
2	2 scoops	20 scoops
3	3 scoops	30 scoops

The pattern rule for brown sugar is to start with one scoop and add one scoop for each additional batch. The pattern rule for popcorn is to start with ten scoops and add ten scoops for every batch. Ask students to use the pattern rule to determine how much popcorn would be needed to make six batches to sell at the soccer team's bake sale.

Students could use techology (iPads, cameras, etc.) to capture examples of patterns in the real world. They could look in magazines, Internet, or around the school and community.

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

Suggested Assessment Strategies

Performance

- Ask students to solve the following problem:

  A particular book in a book order costs $25. How much does it cost to buy two copies of this book? Three copies? Four copies?

  Complete the following table to find the cost.

Number of Books	Cost
1	$25
2	
3	
4	
5	

  Describe the pattern rule.

  How much would it cost to buy nine copies of this book? How do you know?

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

Paper and Pencil

- Ask students to describe the pattern rule for each example and determine the next three elements of each:

  (i) 1, 10, 7, 70, 67, 670, ...

  (ii) 10, 12, 16, 22, 30 ...

  (iii) 50, 48, 47, 45, 44 ...

  (5PR1.2, 5PR1.5)

- Ask students to complete the following table to predict the number of students who will attend the school in 2015-2016 if the population of students continues to decline.

School Year	Number of Students
2006-2007	355
2007-2008	344
2008-2009	332
2009-2010	?
2010-2011	?
2015-2016	?

  (5PR1.1, 5PR1.5)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Describing Number Patterns in Games
TR: pp. 27-29
SB: p. 15

Lesson 5: Solving Problems Using Patterns
TR: pp. 30-33
SB: pp. 16-18

Note

Question number 4 in Lesson 5 may be challenging for students. They may need some guidance.

Patterns and Relations (Patterns)

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:
5PR1 Continued...
Achievement Indicator:

5PR1.6 Determine and explain why a given number is or is not the next element in a pattern.

Suggestions for Teaching and Learning

The challenge with patterning or sequencing of numbers is not only to find and extend the pattern, but to be able to determine if an element is or is not the next one in the pattern. It is important for students to identify errors in patterns to prevent them from continuing to extend a pattern incorrectly.

It is helpful for students to think of a pattern rule and apply it when analyzing tables or charts for errors.

Present the class with the following problem.

Jim was conducting a science experiment on plant growth. The growth occurred based on a pattern. After each week, he recorded the height of his plant in the following chart:

Plant Growth

Week(s)	Height (cm)
1	20
2	40
3	60
4	100
5	120

Ask students to describe the pattern shown in Jim's chart. They should realize that there is an error. Ask them to identify and explain the error and support their findings.

The pattern example with the strawberry seeds in *Math Focus 5* provides a springboard to *The Grapes of Math* by Gregory Tang. In this children's book, Tang suggests ways to use patterns in order to make addition, multiplication and subtraction easier. It asks students to be open-minded in their work with numbers and think strategicially to facilitate easier computation. Students could create their own artwork which presents similar math strategies, post them, and challenge their classmates to find patterns that help solve the questions presented. This might also combine with art techniques and lead to the cross curricular creation of a class book.

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

Suggested Assessment Strategies	Resources/Notes

Resources/Notes

Authorized Resource
Math Focus 5

Lesson 5: Solving Problems Using Patterns
TR: pp. 30-33
SB: pp. 16-18

Suggested Assessment Strategies

Journal

- Ask students to respond to the following prompt:

  Sue filled bags with marbles. She placed two marbles in the first bag, four marbles in the second bag, six marbles in the third bag, eight marbles in the fourth bag and twelve in the fifth bag.

  Her friend Lisa noticed an error in the pattern. Can you identify and describe the error?

  (5PR1.6)

Interview

- Ask students to explain whether 127 would occur in the following patterns:

  4, 8, 12, 16…….

  1, 3, 5, 7……….

  300, 295, 290, 285……..

  Students will show an understanding of this question by ruling out patterns in which 127 cannot occur. For example, 4, 8, 12, 16 (all even numbers) and 300, 295, 290 (all multiples of 5).

  (5PR1.1, 5PR1.6)

Suggested Resource

- *The Grapes of Math* - Greg Tang

Create QR codes that take students to a list of values for which they may be asked to find and write a pattern rule, complete a pattern, determine the 10th term of a pattern, etc.

Patterns and Relations (Patterns)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5PR1 Continued...** **Achievement Indicator:** *5PR1.7 Write a mathematical expression to represent a given pattern.*	In Grade 4, students used symbols in expressions such as $4 + \Delta$. In Grade 5, lower case letters will be used for the variable. It will be necessary for students to see how $4 + \Delta = 7$ means the same as $4 + n = 7$. This will be students' first formal exposure to the use of letters as variables to represent an unknown number. A variable is a letter or symbol used to represent an 'unknown'. Patterns using symbols and variables provide a means of describing change mathematically (e.g., two more than a number ($n + 2$) or six less than a number ($h - 6$)). A number sentence is called an equation. A number sentence with a variable is an algebraic equation. The major difference between an equation and an expression is that an equation is a complete sentence which says two things are equal. It contains the verb 'equals'. For example, $h + 7 = 10$ means a number h added to 7 is equal to 10. Students worked with equations in Grade 4. An expression also contains numbers and variables but there is no 'equals'. For example, $p + 3$ is read as the number p added to three. There is no mention of being equal to something else. In mathematics, variables are typically quantities that change. Students might relate variables to things from their own experiences which change over time, such as their height or hair length. In the early stages of variable usage it may be wise to avoid the use of "*x*" or "*s*" as variables, since students often get "*x*" mixed up with the multiplication symbol and "*s*" can be confused with the number five when written by hand. It is important, when reading aloud to students, to read expressions such as $3 + m$ as "a number m added to 3," or "3 more than m."

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

Suggested Assessment Strategies

Performance

- Ask students to match each situation with the corresponding expression.

Temperature increases 6°	$t + 6$
Henry was 4 levels lower than Mary	$t - 12$
Susan is 2 years older than Leon	$m + 5$
Adele walks 5 km farther than Maria	$l + 2$
Temperature drops 12°	$m - 4$

  (5PR 1.7)

- Ask students to match the pattern to its variable expression

(a) $4 + n$	(i) 4, 7, 10…..
(b) $n + 3$	(ii) 5, 9, 13……
(c) $n - 2$	(iii) 100, 85, 70…..
(d) $n - 15$	(iv) 16, 14, 12 ……

  (5PR1.7)

  Create a class set of mathematical single-variable expressions and corresponding scenarios. Post the expressions around the room and give each student a description of a situation. Have them match their description with the corresponding expression.
  Extension: Students could create a bank of stories and corresponding expressions for classmates to match.

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Describing Relationships using Expressions
TR: pp. 38-42
SB: pp. 22-25

Note

Questions 7 and 8 can be omitted since they go into further depth than is necessary for Grade 5.

Patterns and Relations (Variables and Equations)

Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5PR1 Continued...

Achievement Indicator:

5PR1.8 Describe the relationship in a given table or chart, using a mathematical expression.

Tables are often used to enable students to determine the pattern rule. Tables are used to record the numeric components of patterns, such as the number of blocks used for each step. By using a table, students can see the relationship between the terms as well as between the position of the term and its value.

Using children's literature provides wonderful opportunities for contextualizing mathematics. In *Spaghetti and Meatballs for All!* by Marilyn Burns, Mr. and Mrs. Comfort are having a family reunion. As guests arrive, the seating configurations undergo a number of changes. This book provides opportunity to consider patterns and develop pattern rules regarding the numbers of seats created by consecutively joining tables in varying configurations.

Students could model seating arrangements with paper squares and counters and analyze the various configurations suggested by the relatives to determine how many tables would be required in each in order to accommodate all of the dinner guests. They can then decide which would be the most efficient use of space and resources. A pattern rule can be developed for each configuration and then validated by physically rearranging desks, modelling using square tiles for tables and counters for chairs, or drawing on paper.

Number of Tables	Number of Places
1	4
2	6
3	8

This table has a pattern rule for finding subsequent numbers of places available as tables are added. The rule would start with four places and add two places ($n + 2$) every time another table is put in place. In this expression, n is any number of places at the table.

Increasing recipe amounts as more guests arrive provides another avenue for finding patterns.

Students may expand on the theme of table and chair arrangement to design suggested configurations for their classroom for different activities and situations. Tying the suggestions back to a pattern rule makes this an authentic extension to the patterning outcomes.

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies

Paper and Pencil

- This table shows the pattern of cost of boxed lunches for students on a field trip.

# of Students	1	2	3	4	5	?
Cost of Lunch in Dollars	3	6	9	12	15	90

Ask students to:

(i)   explain the pattern of how the cost of lunches changes as more students go on the trip.

(ii) use the pattern to determine how many students went on the trip if the cost of lunches is $90.

(5PR1.8)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Describing Relationships Using Expressions
TR: pp. 38-42
SB: pp. 22-25

Patterns and Relations (Variables and Equations)

Outcomes

Students will be expected to:

5PR2 Solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions.
[C, CN, PS, R]

Achievement Indicators:

5PR2.1 Express a given problem as an equation where the unknown is represented by a letter variable.

5PR2.2 Solve a given single-variable equation with the unknown in any of the terms; e.g., $n + 2 = 5$, $4 + a = 7$,
$6 = r - 2$, $10 = 2c$.

5PR2.3 Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.

Suggestions for Teaching and Learning

It is important to note the difference between an expression and an equation which was addressed in 5PR1.7.

The focus here is on equations using smaller numbers which can be more easily modelled or solved using concrete materials such as counters, pan balance or pictures. This will enable students to build on their conceptual knowledge of one-step equations.

Students will come to realize that there is more than one possible strategy that can be used to solve equations.

In Grade 4, students solved one-step equations in which the variable was a symbol. They will continue to solve one-step equations, with a letter as the variable. Students will explore preservation of equality in Grade 6, and in Grade 7 they will solve equations by applying preservation of equality.

Balance scales are valuable tools to use when solving equations. The balance scale, with the use of manipulatives such as linking cubes, allows teachers and students to represent the balancing of an equation concretely. For an equation such as $m + 5 = 24$, place five blue linking cubes on one side of the scale and 24 red cubes on the other side. Students should see that the scale is unbalanced. Begin adding white cubes to the five until the scale balances and equality has been reached. Using different colour cubes allows students to readily see how many cubes were added.

Similarly, with a diagram such as this for $n + 5 = 13$, students can remove the same number of circles from each side to find out what number should be inside the box representing *n*. Alternatively, the students can draw additional circles inside the box for *n* until both sides are equal (13 circles on each pan) and count how many were needed for *n* in order to make the scale balance.
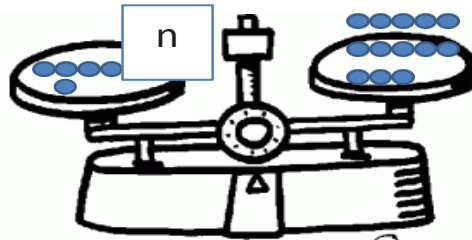
Students may be more familar with equations involving multiplication being written as $2 \times c = 12$. This equation is more commonly written as $2c = 12$. Students need to be aware that $2c$ means two multiplied by *c*.

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

• Students could use concrete materials, such as blocks or counters and the balance scales, to find the value of p in the following equations. If necessary, model the use of guess and test as one strategy. By observing patterns in their results, students become more systematic in the guesses they make.

$3 + p = 11$ $14 - p = 8$ $p - 9 = 16$ $3p = 12$

$p + 5 = 17$ $24 = p + 9$ $25 = 35 - p$

(5PR2.3)

Paper and Pencil

• Ask students to draw a diagram to represent and solve the following equations.

$n + 12 = 19$ $k = 14 - 3$ $9 + d = 16$ $5m = 15$

(5PR2.2)

• Tell students:

There are now 11 muffins on a tray. There were 24 at the start; some have been eaten. How many muffins are missing from the tray?

Ask students to write an equation to represent the problem. Then solve it. Is there another possible equation for the same problem? Explain.

(5PR2.1, 5PR2.2, 5PR2.3)

• Ask students to solve the following equation and explain their thinking.

$c - 12 = 8$

(5PR2.2)

Journal

• Ask students to respond to these prompts:

(i) Explain how you would solve the equation $21 + y = 40$.

(5PR2.2, 5PR2.3)

(ii) Fran is 3 years older than Hannah. Hannah is 21 years old. How old is Fran? Write an equation to solve the problem and then solve the equation. Is it possible to write a different equation for the same problem? Explain.

(5PR2.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 7: Using Equations to Solve Problems
TR: 43-47
SB: pp. 26-29

Suggested Resource

• Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit7

  -Virtual Manipulatives

Patterns and Relations (Variables and Equations)

Outcomes	Suggestions for Teaching and Learning

Outcomes

Students will be expected to:

5PR2 Continued...

Achievement Indicators:

5PR2.2 (Continued) Solve a given single-variable equation with the unknown in any of the terms; e.g., n + 2 = 5, 4 + a = 7, 6 = r – 2, 10 = 2c.

5PR2.3 (Continued) Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.

Suggestions for Teaching and Learning

For a question such as $2q = 8$, students could put one counter into each of the two boxes and repeat until the eight counters have been equally shared.

They should then count how many counters are in box q. That would be the value of the variable.

When the scale is balanced, an equation can be written to describe the pictorial representation.

$m + 5$ 14

To solve $m + 5 = 14$, students could use related facts.

$m + 5 = 14$	I have a missing addend. I know that one addend is 5 and the sum is 14.
$m = 14 - 5$	I have learned that I can find my missing addend by subtracting the one I know from the sum.
$m = 9$	My missing addend is 9.

It is important that students understand why subtracting five is an appropriate strategy.

Students should also write and solve an equation illustrated by:

$2c$ 12

$2c = 12$	I know that $2c$ means two multiplied by c. I have a missing factor. Two times the missing number is 12.
	I know from my multiplication facts that two times six is twelve so the missing factor must
$c = 6$	be six.

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource

Journal
- Ask students to write about this prompt:
  You know that $4 + 3 = f$
  What other equations have to be true if this one is?

(5PR2.2)

Paper and Pencil
- Ask students to do a one minute write. On a blank index card, give students one minute to write an explanation of how they would go about solving a problem with a variable. This would work well as an exit card at the end of a lesson. Teachers could collect them and review to ensure student understanding of process.

(5PR2.3)

Math Focus 5

Lesson 7: Using Equations to Solve Problems
TR: 43-47
SB: pp. 26-29

Patterns and Relations (Variables and Equations)

Outcomes	Suggestions for Teaching and Learning

Outcomes

Students will be expected to:

5PR2 Continued...

Achievement Indicators:

5PR2.2 (Continued) Solve a given single-variable equation with the unknown in any of the terms; e.g., n + 2 = 5, 4 + a = 7, 6 = r − 2, 10 = 2c.

5PR2.3 (Continued) Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.

5PR2.4 Create a problem for a given equation.

Suggestions for Teaching and Learning

Or 2c = 12	I have a missing factor. Two times some number is 12.
$12 \div 2 = c$	I know that I can find a missing factor by dividing the quotient by the other factor.
c = 6	My missing factor is 6.

Use contextual situations that are meaningful to students such as:

Sam has 12 stickers. Meg gave him some more stickers. Sam now has 16 stickers. How many stickers did Meg give Sam?

Students should represent the unknown, or the number of stickers Meg gave Sam, with a variable, *p*, and write the equation $12 + p = 16$. Solving the equation results in:

p = 16 - 12 (subtracting the known addend from the sum)

p = 4	Meg gave Sam four stickers.

Encourage students to create problems using a variety of operations: addition, subtraction, multiplication and division. Teachers should model how to create a problem for a given equation. The following equations could be used to create problems:

- $46 + 12 = h$

Possible problem:

Bob has 46 hockey cards; Harry has 12 more hockey cards than Bob. How many cards does Harry have?

- $15 = n - 9$

Possible problem:

There were 15 students in the classroom after nine students went to choir. How many students are in the full class?

c) $383 + k = 625$

Possible problem:

Sarah, Allan and Kristine decided to combine their individual shell collections. Sarah and Allan together had 383 shells. Kristine also had some to add to the collection. Altogether they had 625 shells. How many shells did Kristina contribute?

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

• Ask students to create a problem for the given equations and then solve the equations.

$12 + p = 16$ $m - 3 = 21$
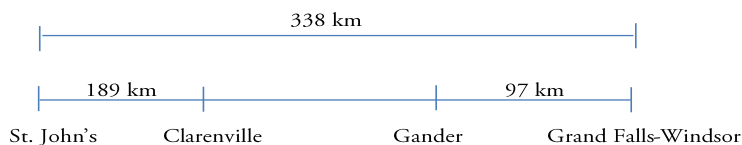
$c + 7 = 19$ $4b = 24$

$p = 24 - 14$

(5PR2.2, 5PR2.3, 5PR2.4)

• Given a diagram such as the one shown below, students could create two problems and write equations to solve the problems. They should solve the problems to find the missing values.

338 km

189 km   97 km

St. John's   Clarenville   Gander   Grand Falls-Windsor

(5PR2.2, 5PR5.4)

Students could use a map to create a similar problem, trade with a partner and solve each other's problem. They could check their partner's solution.

This activity provides an opportunity to make a cross-curricular link to Social Studies. Students could use a kilometre guide on a tourist map or Google Maps.

(5PR2.2, 5PR2.4)

Journal

• Ask students to respond to the following prompt:

The class was given this problem:

Pat walked 14 metres less than Joan. Joan walked 24 metres. How far did Pat walk?

Amy wrote the equation $14 + 24 = p$ and said that Pat walked 38 metres.

Was she correct? Explain.

(5PR2.1, 5PR2.2, 5PR2.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 8: Creating Problems
TR: pp. 48-50
SB: p. 30

Math Game:

TR: pp. 51-52
SB: p. 3
Matching Equations with Solutions

Note

This game would be a good center activity. The Equation Cards are found on TR p. 69.

Patterns and Relations (Variables and Equations)

Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5PR2 Continued...** **Achievement Indicator:**	

5PR2.4 (Continued) Create a problem for a given equation.

d) $2d = 18$

Possible problem:

George filled in for his friend Henry and delivered the newspapers on his route for two days when Henry was sick. He delivered 18 papers in all. How many newspapers are in Henry's paper route?

As this process is being modelled, encourage students to first think about what the variable could represent. They should also choose contexts that are realistic for the numbers given in the equation.

General Outcome: Represent Algebraic Expressions in Multiple Ways

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to describe two different stories that the equation $5 + k = 9$ could represent.

(5PR2.4)

Resources/Notes

Authorized Resource

Math Focus 5
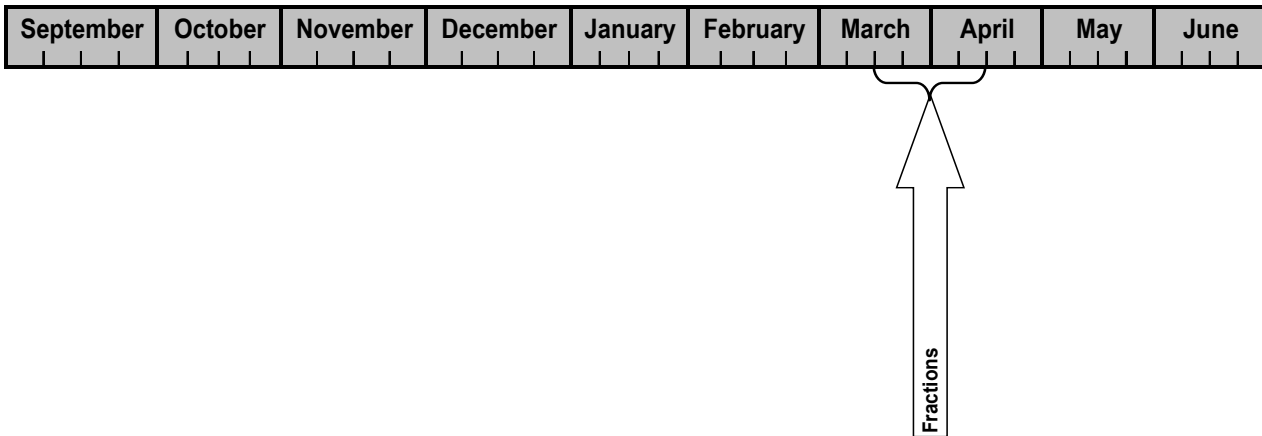
Lesson 8: Creating Problems
TR: pp. 48-50
SB: p. 30

Fractions

Suggested Time: 4 Weeks

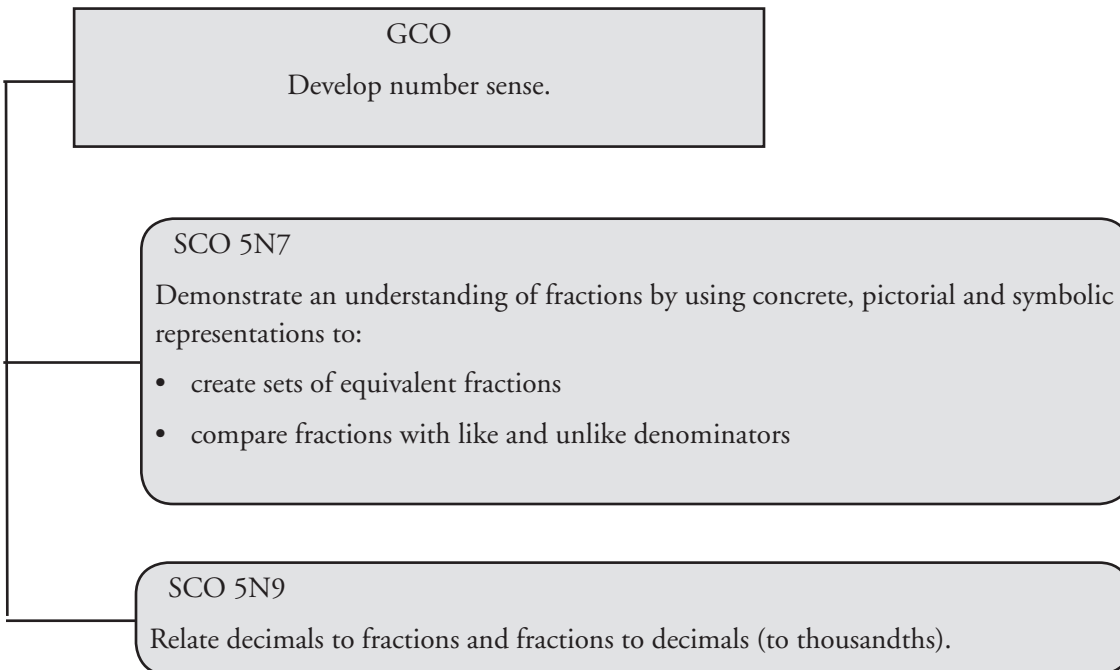| September	October	November	December	January	February	March	April	May	June

Fractions

Unit Overview

Focus and Context

In this unit, students will further their understanding of fractions using concrete, pictorial and symbolic representations to create and compare equivalent fractions. While the goal is to develop symbolic methods, students work from personal strategies to more efficient ones. Fractions with denominators of 10, 100 and 1 000 are connected to decimals. Through thousandths grids and base ten materials, students will express a given pictorial or concrete representation as a fraction or a decimal. They will also write a fraction from a given decimal and vice versa.

When working with fractions and decimals, students should understand that decimals are simply another form of a fraction.

Outcomes Framework

GCO

Develop number sense.

SCO 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

SCO 5N9

Relate decimals to fractions and fractions to decimals (to thousandths).

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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, CN, 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] 5N9 Relate decimals to fractions and fractions to decimals (to thousandths). [C, CN, R, V]	6N4 Relate improper fractions to mixed numbers. [CN, ME, R, V] 6N5 Demonstrate an understanding of ratio, concretely, pictorially and symbolically. [C, CN, PS, R, V] 6N6 Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially and symbolically. [C, CN, PS, R, V]

Mathematical Processes

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

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

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]

Achievement Indicators:

5N7.1 Create a set of equivalent fractions and explain, using concrete materials, why there are many equivalent fractions for any given fraction.

5N7.2 Model and explain that equivalent fractions represent the same quantity.

In Grade 4, students created fractions focusing on parts of a whole and parts of a set. In Grade 5, they will create equivalent fractions between 0 and 1, using concrete, pictorial and symbolic representations.

Teachers could model equivalent fractions by folding a square piece of paper in half, and unfolding to show how one whole piece of paper is equivalent to two halves. Continuing to fold paper to show fourths and eighths should help students visualize equivalences such as $\frac{2}{4}$ equals $\frac{1}{2}$. This can be modelled for thirds and sixths as well.

Students should be given many opportunities to work with various manipulatives and demonstrate equivalent fractions using materials such as:

- pattern blocks
- fraction pieces
- fraction strips
- double-sided counters
- arrays for interactive white boards
- parts of sets of objects such as buttons or counters

Students could use pattern blocks to create equivalent fractions. They should recognize that the trapezoid, for example, is one half the hexagon. Students should use the green triangle to cover the trapezoid. They should conclude that $\frac{1}{2} = \frac{3}{6}$. Similarly, fraction strips, pieces or circles could be used to create equivalent fractions.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to create various sets of equivalent fractions using pattern blocks, such as:

$$\frac{3}{6} = \frac{1}{2}$$

$$\frac{2}{6} = \frac{1}{3}$$

(5N7.1)

- Give students blue and green colour tiles and two cm grid paper. Ask them to mark or cut out a rectangle with 24 squares from the grid paper. Place tiles on the rectangle so that $\frac{1}{3}$ of the rectangle is green and the rest is blue. Ask students to find and record as many ways as possible to write fractions which name the part of the rectangle that is blue. Do the same for the part that is green.

(5N7.1, 5N7.2)

Resources/Notes

Authorized Resource

Math Focus 5

Getting Started

Teacher Resource (TR): pp. 10-11

Student Book (SB): pp. 218-219

Lesson 1: Recognizing and Creating Equivalent Fractions

TR: pp. 12-16

SB: pp. 220-223

Suggested Resource

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit8

    -enrichment activities

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

*Students will be expected to:*

5N7 Continued...

Achievement Indicators:

5N7.1 (Continued) Create a set of equivalent fractions and explain, using concrete materials, why there are many equivalent fractions for any given fraction.

5N7.2 (Continued) Model and explain that equivalent fractions represent the same quantity.

Suggestions for Teaching and Learning

Double-sided counters could also be used to create equivalent fractions.

$\frac{6}{24}$
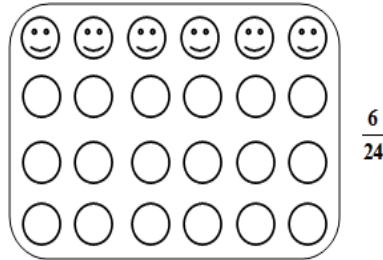
Students should identify other ways to arrange the counters in equal groups.

$\frac{2}{8}$

$\frac{3}{12}$

$\frac{1}{4}$
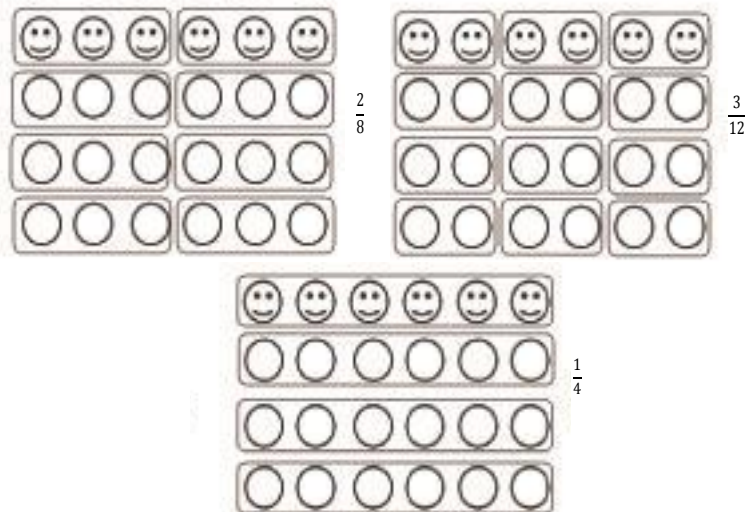
They should conclude that $\frac{6}{24}$ = $\frac{2}{8}$ = $\frac{3}{12}$ = $\frac{1}{4}$.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

• Ask students to create sets of equivalent fractions using double-sided counters.

(5N7.1)

• Ask students to make an array showing $\frac{3}{12}$ using double-sided counters placed on individual whiteboards. Then, using whiteboard markers, they should create sets of equivalent fractions.
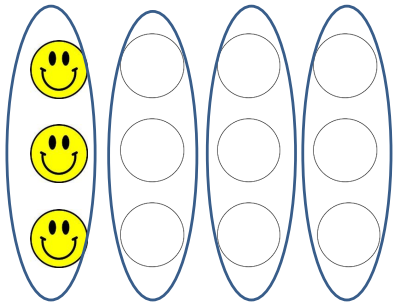
$$\frac{3}{12} = \frac{1}{4}$$

(5N7.1)

Journal

• Ask students to colour and cut out fraction strips to show sets of equivalent fractions. These can be glued into journals. They should explain how they know their sets are equivalent.
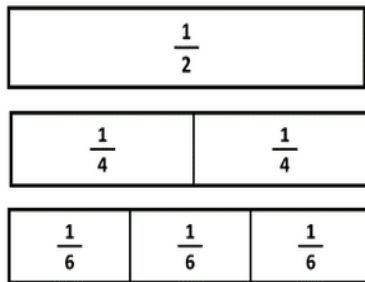
$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6}$$

(5N7.1, 5N7.2)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Recognizing and Creating Equivalent Fractions

TR: pp. 12-16

SB: pp. 220-223

Suggested Resource

• Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit8

   -Math Live

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N7 Continued...

Achievement Indicator:

5N7.3 Determine if two given fractions are equivalent using concrete materials or pictorial representations.

Students should determine whether two given fractions are equivalent by using the manipulatives they have worked with in creating equivalent fractions.

Emphasize that the whole figures or whole sets have to be the same size in order to compare them.

When comparing $\frac{2}{6}$ and $\frac{1}{3}$ of a chocolate bar, for example, the bars must be the same size. One half of a snack size bar is not equivalent to one half of a family size bar. The same is true with the concrete materials or sketches students may use.

Pattern blocks are convenient for comparing some fractions (halves, thirds, sixths) but fractions strips are perhaps a more useful tool and can be used throughout the unit, especially for students who have difficulty drawing bars of equal size and/or appropriate divisions for their fractional parts. They are applicable for a broader range of denominators than pattern blocks can readily accommodate.

When asked if $\frac{2}{3}$ is equivalent to $\frac{3}{5}$, for example, students should model each fraction.

$\frac{2}{3}$

$\frac{3}{5}$
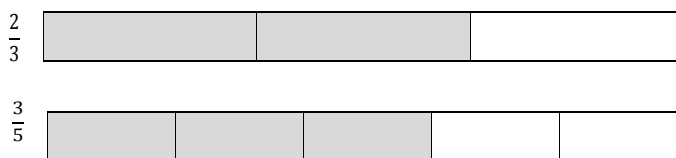
They should recognize that since they do not cover the same area, the two fractions are not equivalent.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- John ate $\frac{4}{8}$ of a medium pizza. Joanne ate $\frac{1}{2}$ of a medium pizza. Ask students: Who ate more pizza? How do you know?

  (5N7.2, 5N7.3)

- Give students sets of fractions. For each set, ask students to identify which ones are equivalent and explain how they know.

  (5N7.3)

Journal

- Ask students to explain why $\frac{2}{4}$ is equivalent to $\frac{1}{2}$. They should use words, pictures and numbers in their answer.

  (5N7.2, 5N7.3)

Performance

- Use counters or sketches to determine which pair of fractions are equivalent:

  (i) $\frac{12}{15}$ and $\frac{3}{5}$

  (ii) $\frac{3}{4}$ and $\frac{6}{16}$

  (5N7.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Recognizing and Creating Equivalent Fractions

TR: pp. 12-16

SB: pp. 220-223

Lesson 2: Using Fractions to Describe Area

TR: pp. 17-20

SB: p. 224

Curious Math:

Fraction Riddles

TR: pp. 21-22

SB: p. 225

Math Game:

Winner Takes All

TR: pp. 32-33

SB: p. 233

Number

Specific Outcomes

Students will be expected to:
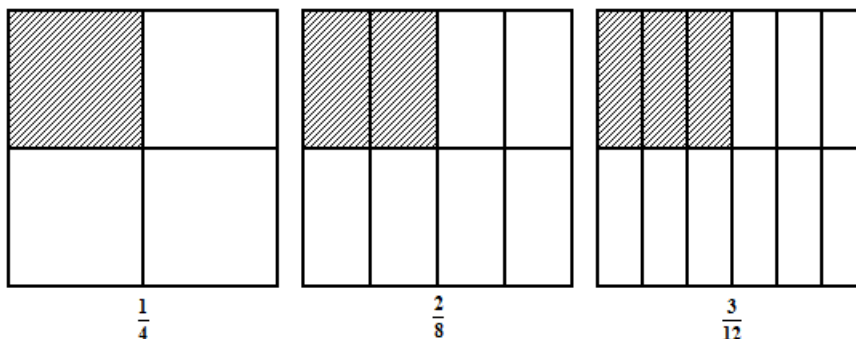
5N7 Continued...
Achievement Indicators:

5N7.4 Identify equivalent fractions for a given fraction.

5N7.5 Formulate and verify a rule for developing a set of equivalent fractions.

Suggestions for Teaching and Learning

Students could be given $\frac{1}{4}$, for example, and asked to create equivalent fractions using the same diagram.

$$\frac{1}{4} \qquad \frac{2}{8} \qquad \frac{3}{12}$$

They could also use counters to identify equivalent fractions.

$\frac{1}{4}$ Students should add another four counters to replicate the set.

$\frac{2}{8}$ Add another four counters to get

$\frac{3}{12}$ and so on.

Students should conclude that

$$\frac{1}{4} = \frac{2}{8} = \frac{3}{12}$$

Students should continue to draw diagrams to help develop more symbolic methods. However, often in real life students will have to extend the size of equivalent fractions beyond what is reasonable to draw. Therefore, they will have to identify a rule for developing equivalent fractions.

Students should analyze the equivalent fractions they have already created such as $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \frac{4}{16}$.
Ask them: What is the relationships between the numerators and denominators?

Emphasize that fractions with the same numerator and denominator have a value of one and that multiplying or dividing any number by one results in the original number.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**

Suggested Assessment Strategies

Paper and Pencil

- Tell students: You ate $\frac{2}{3}$ of the six chocolates in the box. How many chocolates did you eat? Show how you know.

(5N7.4)

- Ask students to determine which of the following fractions are equivalent:

$\frac{2}{3}$, $\frac{4}{20}$, $\frac{6}{8}$, $\frac{3}{15}$ They should explain how they know.

(5N7.4)

Performance

- Students can create Equivalent Fraction Counting Books. Using the fractions: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$ students create a page for each. Each page can be divided into two sections; one with the original fraction and the other side containing the equivalent fraction. Each page should include pictures, words and numbers.

(5N7.5)

- Give each student a set of two number cubes as shown:

Number Cube 1

	1		
2	3	5	4
	6		

Number Cube 2

	1		
2	3	8	4
	10		
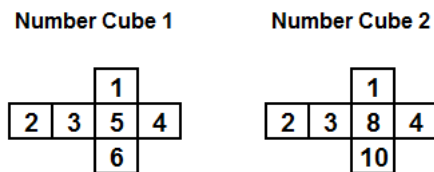
Each student should roll the dice and use the digits to make a proper fraction (less than 1; i.e., the smaller digit on the top). They should write two equivalent fractions. Students could verify their answers with a partner.

(5N7.2, 5N7.4)

Journal

- Ask students to respond to the prompts:

(i) Sally is given the following set of equivalent fractions:

$\frac{1}{3}$, $\frac{2}{6}$, $\frac{4}{12}$ $\frac{8}{24}$, $\frac{16}{48}$.

Help Sally find a pattern to describe this set of equivalent fractions.

(5N7.5)

(ii) Describe $\frac{1}{2}$ as many ways as you can. Include at least five equivalent factions and explain your strategy.

(5N7.5)

Resources/Notes

Authorized Resource
Math Focus 5

Lesson 2: Using Fractions to Describe Area

TR: pp. 17-20

SB: p. 224

Lesson 3: Creating Equivalent Fractions

TR: pp. 23-27

SB: pp. 226-229

Number

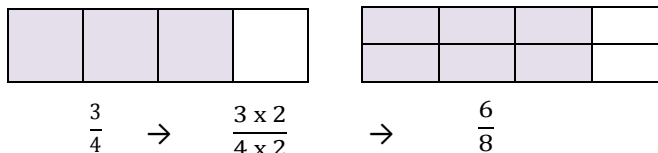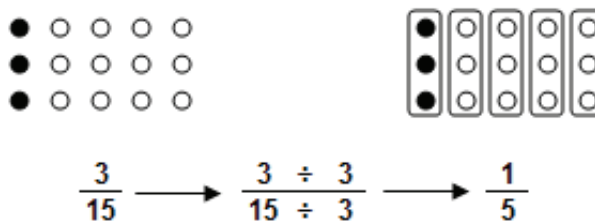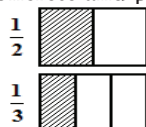| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N7 Continued...** **Achievement Indicators:** *5N7.5 (Continued) Formulate and verify a rule for developing a set of equivalent fractions.*	Multiplication is used to increase both the numerator and denominator by the same number in order to create an equivalent fraction with larger terms. $$\frac{3}{4} \quad \rightarrow \quad \frac{3 \times 2}{4 \times 2} \quad \rightarrow \quad \frac{6}{8}$$ Division is used to reduce both the numerator and denominator to simplify a fraction written in larger terms to a smaller equivalent fraction. $$\frac{3}{15} \longrightarrow \frac{3 \div 3}{15 \div 3} \longrightarrow \frac{1}{5}$$
5N7.6 Compare two given fractions with unlike denominators by creating equivalent fractions.	When comparing fractions. students should use strategies that suit the question. If given $\frac{1}{2}$ and $\frac{1}{3}$, for example, students could continue to use concrete and pictorial representations. $\frac{1}{2}$ $\frac{1}{3}$ They should conclude that $\frac{1}{2}$ is larger than $\frac{1}{3}$ Students could also compare two fractions, such as $\frac{2}{5}$ and $\frac{1}{4}$, by creating equivalent fractions having the same denominator. $$\frac{2}{5} \times \frac{4}{4} = \frac{8}{20} \qquad\qquad \frac{1}{4} \times \frac{5}{5} = \frac{5}{20}$$ They should conclude that $\frac{8}{20} > \frac{5}{20}$ and therefore, $\frac{2}{5} > \frac{1}{4}$ Students should be encouraged to use multiple strategies to compare fractions.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ellen has two birthday cakes that are the same size. One is chocolate and one is vanilla. The boys ate $\frac{2}{3}$ of the chocolate cake. The girls ate $\frac{3}{4}$ of the vanilla cake. Ask students: Which group ate more cake?

(5N7.6)

Journal

- Ask students to respond to the following prompt:

    You are given 10 m of string to fly a kite. Would you prefer to use $\frac{4}{10}$ of the string or $\frac{3}{5}$ of the string to fly your kite? Explain your choice.

(5N7.6)

- Ask students which two fractions they would find easier to compare.

    $$\frac{4}{10} \quad \frac{3}{9} \quad \frac{1}{12} \quad \frac{4}{6} \quad \frac{8}{9}$$

    They should explain their choice.

(5N7.5, 5N7.6)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 3: Creating Equivalent Fractions

TR: pp. 23-27

SB: pp. 226-229

Lesson 5: Comparing Fractions

TR: pp. 34-38

SB: pp. 234-237

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

**5N7 Continued...**

Achievement Indicator:

5N7.7 Position a given set of fractions with like and unlike denominators on a number line (horizontal or vertical), and explain strategies used to determine their order.

Suggestions for Teaching and Learning

In Grade 4, students worked with placing fractions with like denominators on a number line to compare and order them. In Grade 5, they will extend this knowledge to include fractions with unlike denominators.

To activate prior knowledge, teachers could begin with fractions of like denominators and gradually transition to unlike denominators.
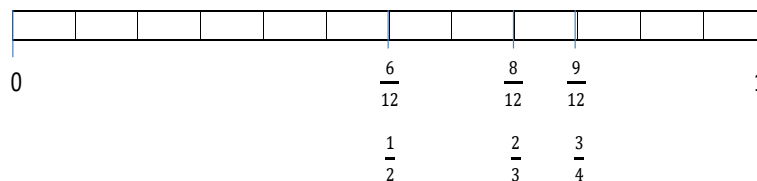
Students should place a given set of fractions with like and unlike denominators on a number line using benchmarks. To compare $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{1}{2}$, for example, students could construct three separate number lines of the same length having endpoints of zero and one. The first line should be divided into three equal sections. Fraction strips can be placed against a number line to help mark the fractions. This process should be repeated so that the second number line is divided into four equal sections, and the third into two equal sections. The fractions to be placed should be shaded on the corresponding number line so that visual comparisons can be made.

$\frac{2}{3}$

$\frac{3}{4}$

$\frac{1}{2}$
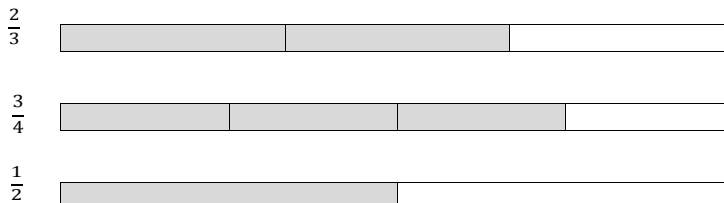
Students could then transfer the placement of these three fractions to a single number line. After having experience placing the benchmarks on separate number lines, students should start to place fractions with unlike denominators on the same line.

Alternatively, students could create equivalent fractions for $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{1}{2}$ such that all denominators are the same. They could then place the fractions on a single number line.

$$\frac{2}{3} = \frac{8}{12} \qquad \frac{3}{4} = \frac{9}{12} \qquad \frac{1}{2} = \frac{6}{12}$$

$$0 \qquad\qquad\qquad \frac{6}{12} \qquad \frac{8}{12} \quad \frac{9}{12} \qquad\qquad 1$$

$$\frac{1}{2} \qquad\qquad \frac{2}{3} \quad \frac{3}{4}$$

Through their work with number lines, equivalent fractions such as $\frac{1}{2} = \frac{2}{4}$ will be reinforced.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	

Paper and Pencil

- Lilly put a set of fractions on a number line. She placed one of the fractions incorrectly. Ask students to identify which fraction is incorrect and explain Lilly's thinking.

0   1

| $\frac{1}{3}$ | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{4}$ |
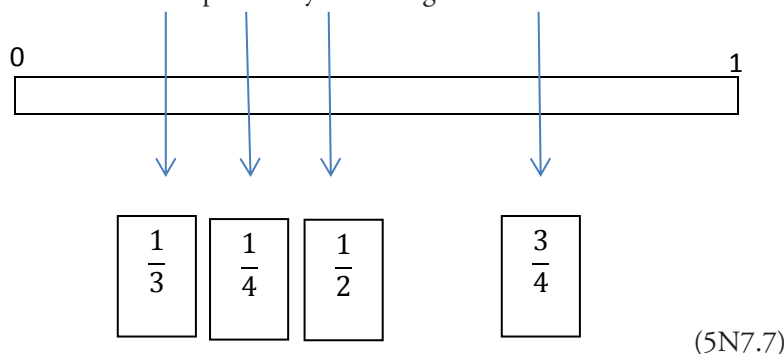
(5N7.7)

Journal

- Ask students to explain to a friend the steps in placing $\frac{2}{3}$, $\frac{1}{5}$ and $\frac{1}{2}$ on a number line. They should use pictures, words and numbers to explain the process.

(5N7.7)

Performance

- Ask students to use an Agreement Circle or True-False and Verify to respond to statements about fractions such as:

  (i) If a shape is divided into 5 parts, each part must be $\frac{1}{5}$.

  (ii) The only fraction between 0 and $\frac{1}{2}$ is $\frac{1}{4}$.

  (iii) 10 hundredths is greater than 10 thousandths.

  (iv) If the denominators are the same, the fraction with the largest numerator is the greatest.

  (v) If the numerators are the same, the fraction with the largest denominator is the greatest.

(5N7.7)

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N9 Relate decimals to fractions (to thousandths)

[CN, R, V]

Achievement Indicators:

5N9.1 Express orally and in written form, a given decimal as a fraction with a denominator of 10, 100 or 1 000.

5N9.2 Express orally and in written form, a given fraction with a denominator of 10, 100 or 1 000 as a decimal.

5N9.3 Express a given pictorial or concrete representation as a fraction or a decimal.

In Grade 4, students related decimals to fractions and fractions to decimals to hundredths. In Grade 5, students continue to work with fractions which are less than one. Students should recognize that 0.341 and $\frac{341}{1\,000}$ both have the same value. They are different but equivalent representations for the same number. Grade 5 students will be relating decimals and fractions with denominators of 10, 100, or 1 000. Improper fractions and mixed numerals will be introduced in Grade 6.

Using proper mathematical language should help students translate between decimals and fractions with denominators of 10, 100, or 1 000. We say 0.385 as three hundred eighty-five thousandths - meaning 385 thousands of a whole or $\frac{385}{1\,000}$. Similarly, reading $\frac{2}{10}$ as two tenths should connect it to 0.2.

Using a place value chart may also help students make the translation between formats. $\frac{650}{1\,000}$ (or six hundred fifty thousandths), for example, would be:

ones	tenths	hundredths	thousandths
0	6	5	0

Students should move between concrete and pictorial representations and the fraction or decimal represented. This demonstrates the students' level of number sense in this area.

Teachers could give students a pictorial representation of 0.036, for example, and ask students to write the decimal and fraction it represents.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Inside-Outside Circle

  Students are each given a fraction, a personal whiteboard and a dry erase marker. Ask each student to write his or her assigned fraction on his or her own whiteboard. The students form two concentric circles with an equal number of members in each; the students in one circle facing the students in the other circle. The inside circle is stationary while the outside circle moves one person to the left with each interaction. As students meet a new partner, each one writes on the partner's white board, without repeating an answer, a decimal or fraction equivalent to the one originally presented. The challenge increases as more moves are made.

  (5N9.1, 5N9.2, 5N7.4)

- Give the student a set of number cards (0-9). Show him or her the fraction $\frac{65}{1\,000}$. Ask the student to place the number cards on a place value mat as a decimal.
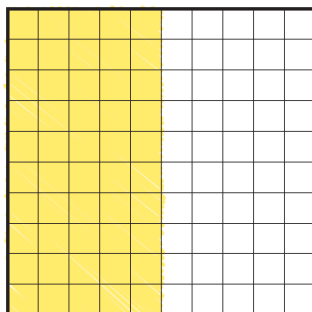
  (5N9.2)

- Students could be given a set of cards containing equivalent decimals and fractions (benchmarks or denominators of 10, 100 or 1 000) and asked to find the pairs.

  (5N9.1, 5N9.2)

Paper and Pencil

- Ask students to write a fraction and a decimal to indicate the portion indicated in of each of the following:

  Shaded portion:

  Trees:

  (5N9.3)

Resources/Notes

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5N9 Continued... **Achievement Indicator:**	
5N9.3 (Continued) Express a given pictorial or concrete representation as a fraction or a decimal.	Reinforce the connection between decimals and fractions by having students write the fraction and decimal for the shaded part of a diagram. Students could also write the decimal and fraction for the unshaded part and compare the pairs of fractions and decimals. If 0.435 is shaded, for example, 0.575 is unshaded.
	They should also be aware of the equivalences of the following benchmarks:
	• 0.5 or 0.50 or 0.500 are all equal to $\frac{1}{2}$.
	• 0.25 or 0.250 both equal $\frac{1}{4}$.
	• 0.75 and 0.750 are equal to $\frac{3}{4}$.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to play Bingo to work with various representations of fractions. Bingo cards can be created using pictures, decimals, and fractions.

The caller will have a set of fraction cards to call.

Samples

| Four Fifths | One Half | Five Sixths |

The caller will select and call a fraction card. Players will cover the matching equivalent representation on their boards.

(5N9.2, 5N9.3)

- Students are given a pictorial representation. Ask them to use individual whiteboards to write the number it represents.

(5N9.3)

Journal

- Ask students to respond to the following prompt:

James is having a party and is ordering a square party pizza to share equally among five friends and himself. Draw a picture showing how you would cut the pizza, and how much of the pizza each person will get. Express your answer as a fraction and decimal.

(5N9.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Using Decimals and Fractions

TR: pp. 43-46

SB: pp. 240-242

Division

Suggested Time: 3 Weeks

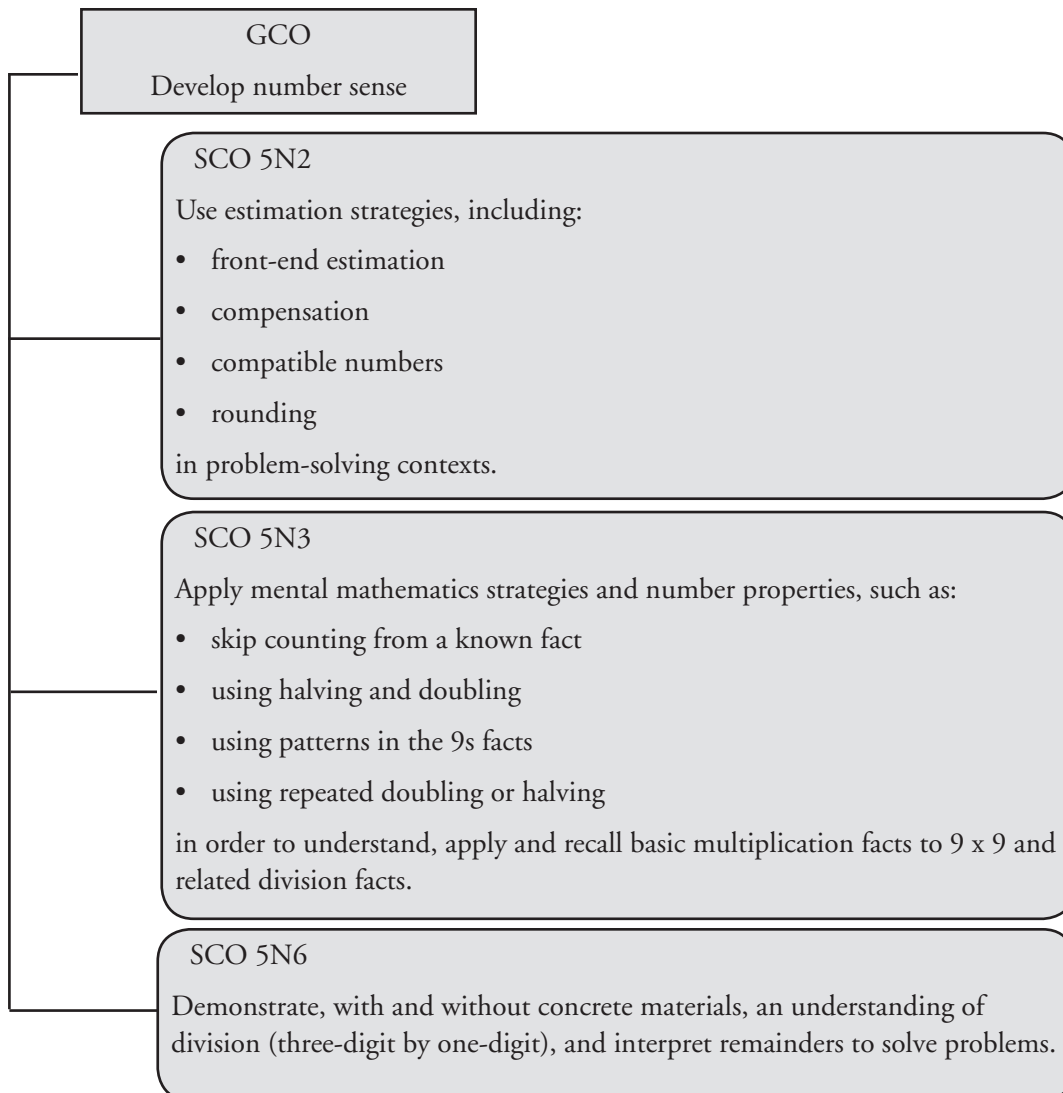| September	October	November	December	January	February	March	April	May	June
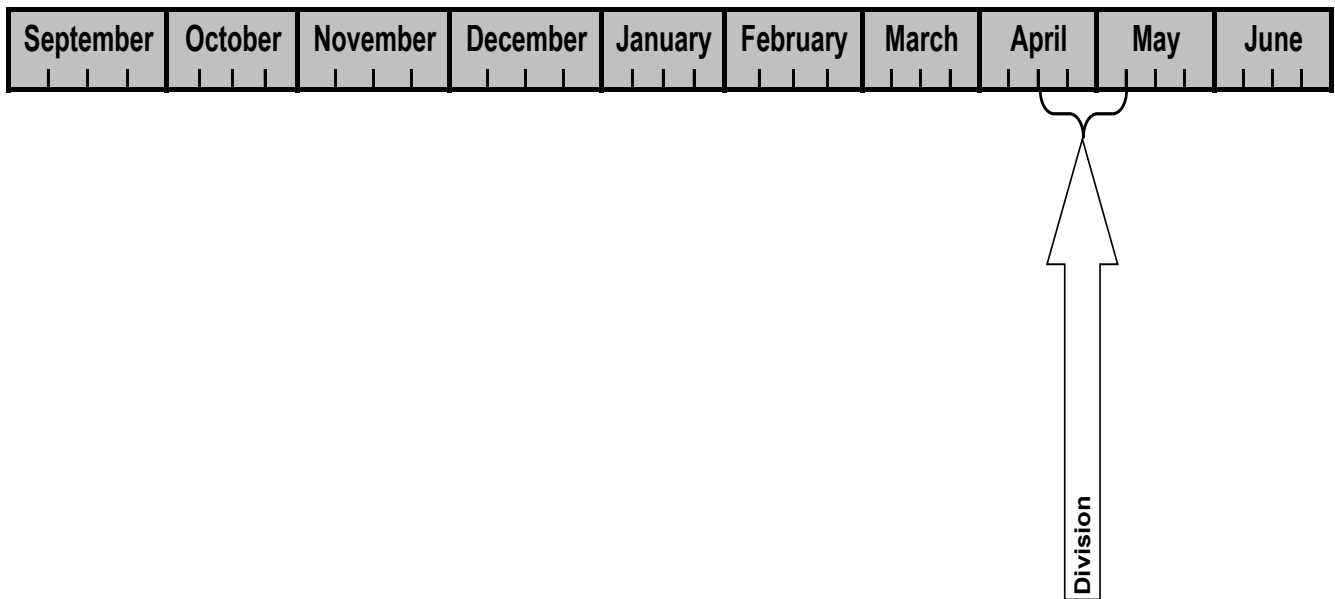
Division

Unit Overview

Focus and Context   An understanding of division has been developed through studying division facts and division of two-digit numbers by one-digit numbers. In this unit, students continue to explore the meaning of division and develop a strong conceptual understanding of this operation. Development of computational fluency should flow from a sound understanding of what division means. Equal sharing (15 ÷ 5 = 3; the number of treats each of 5 people will get if there are 15 treats) and equal grouping (15 ÷ 5 = 3; the number of equal groups of 5 in 15) are two meanings of division that should be presented to students in real world contexts. In this way, division does not become a rote procedure but one that is rooted in a problem situation.

Estimation should be used to determine an approximate solution before computation using a model or an algorithm. Estimation will be used to determine the reasonableness of a solution.

Outcomes Framework

> GCO
>
> Develop number sense

> SCO 5N2
>
> Use estimation strategies, including:
>
> - front-end estimation
> - compensation
> - compatible numbers
> - rounding
>
> in problem-solving contexts.

> SCO 5N3
>
> Apply mental mathematics strategies and number properties, such as:
>
> - skip counting from a known fact
> - using halving and doubling
> - using patterns in the 9s facts
> - using repeated doubling or halving
>
> in order to understand, apply and recall basic multiplication facts to 9 x 9 and related division facts.

> SCO 5N6
>
> Demonstrate, with and without concrete materials, an understanding of division (three-digit by one-digit), and interpret remainders to solve problems.

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Number		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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, V] 4N7 Demonstrate an understanding of division (one-digit divisor and up to two-digit dividend) to solve problems by: - using personal strategies for dividing with and without concrete materials - estimating quotients - relating division to multiplication. [C, CN, ME, PS, R, V]	5N2 Use estimation strategies, including: - front-end estimation - compensation - compatible numbers - rounding in problem-solving contexts. [C, CN, ME, PS, R, V] 5N3 Apply mental mathematics strategies and number properties, such as: - skip counting from a known fact - using halving or doubling - using patterns in the 9s facts - using repeated doubling or halving in order to understand, apply and recall basic multiplication facts to 9 x 9 and related division facts. [C, CN, ME, 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]	6N8 Demonstrate an understanding of multiplication and division of decimals (one-digit whole number multipliers and one-digit natural number divisors). [C, CN, ME, PS, R, V] 6N9 Explain and apply the order of operations, excluding exponents, with and without technology (limited to whole numbers). [C, CN, ME, PS, T]

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:

5N3 Apply mental math strategies and number properties by:
  • **skip counting from a known fact**
  • **using doubling or halving**
  • **using patterns in the 9s facts**
  • **using repeated doubling or halving**
in order to understand, apply and recall basic multiplication facts to 9 x 9 and related division facts.

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

Achievement Indicator:

5N3.1 Describe the mental mathematics strategy used to determine a given basic fact, such as:

• skip count up by one or two groups from a known fact

• skip count down by one or two groups from a known fact

• doubling

• patterns when multiplying by 9

• repeated doubling

• repeated halving

Suggestions for Teaching and Learning

By the end of Grade 5, students should:

• *understand and apply strategies for multiplication and related division facts to 9 × 9*

• *recall multiplication and related divison facts to 9 × 9*

As with multiplication, students should be exposed to a variety of strategies to determine division facts, but mastery of each strategy should not be expected for all students.

In Grade 4, students explored the relationship between multiplication and division. Arrays and sets of objects are important in helping students review and solidify this understanding and the computational procedures for multiplication and division. Coloured tiles are effective when exploring arrays for this purpose.

Using coloured tiles on an interactive white board, have a class discussion to create as many rectangles as possible which use 20 square units. Relate each of the rectangles to multiplication facts, (1 x 20, 2 x 10 and 4 x 5). Next, split each rectangle into equal groups of coloured tiles to review the corresponding division facts. (20 ÷ 1 = 20; 20 ÷ 20 = 1; 20 ÷ 2 = 10; 20 ÷ 10 = 2; 20 ÷ 4 = 5; 20 ÷ 5 = 4) This may also be completed using Kidspiration® software.

Remind students how they have previously used counters to model division and then relate it to multiplication. Previous work on facts up to 9 × 9 will now be extended as students divide two-digit numbers where the quotient can be greater than 9.

Skip counting from a known fact can be used as a tool for division. If the known fact is 40 ÷ 8 = 5, for example, students could use this fact to determine 56 ÷ 8 by skip counting up 2 more groups of 8 to get from 40 → 48 → 56. This shows that 56 ÷ 8 = 5 groups plus 2 more groups, so 7 groups in total. Therefore, 56 ÷ 8 = 7.

Skip counting from a known fact can also work by skipping backward. If the known fact is 80 ÷ 8 = 10, for example, students could use this fact to determine 72 ÷ 8 by skip counting down 1 more group of 8 to get from 80 → 72. There is one less group of 8 so 72 ÷ 8 is one less group of 8 than 80 ÷ 8. Therefore, 72 ÷ 8 = 9.

Another strategy that students could use to determine a quotient is **repeated halving**. For 60 ÷ 4, for example, think 60 ÷ 2 = 30 and 30 ÷ 2 = 15, so 60 ÷ 4 = 15.

There are also apps available which provide fun ways to practice basic division facts.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Alex is stitching together a quilt for the Grade 5 class. The students have prepared 30 squares of material with their own drawings depicting Friendship. Using 30 colored tiles, ask students to model Alex's quilt design to determine all possible layouts. They should show all multiplication and related division facts. Ask them which layout would be the most reasonable for the quilt and why they made that decision.

(5N3.1)

- Students could use an interactive whiteboard or coloured tiles to create a game board which requires 18 squares. Ask them to determine all possible layouts for the game board and show the related multiplication and division facts. Students could share their creations with the class.

(5N3.1)

- Ask students to use a division mat to model various division problems such as $48 \div 8$. Students place the counters that represent the dividend at the bottom of the mat, then model the quotient. Ask students to write the related multiplication fact for each example.

(5N3)

Paper and Pencil

- Ask students to complete the following:
  (i) Use the known fact $56 \div 8 = 7$ to find $64 \div 8$; $72 \div 8$; $80 \div 8$.

(5N3.1)

  (ii) Use the known fact $49 \div 7 = 7$ to find $42 \div 7$, $35 \div 7$ and $28 \div 7$.

(5N3.1)

Interview

- Ask students: How would you use 56 coloured tiles to show that $56 \div 8 = 7$? What other division sentences could you show using the 56 colored tiles?

(5N3.1)

To activate prior knowledge and connect multiplication and division facts, ask students to give the related division facts from flash cards showing different multiplication facts up to 9×9.

Resources/Notes

Authorized Resource

Math Focus 5

Getting Started:
Opening Ceremony
Teacher Resource (TR): pp. 9–11
Student Book (SB): pp. 296-297

Lesson 1: Division Fact Strategies
TR: pp. 13-16
SB: pp. 298-301

Suggested Resources

- division mat

- math tiles

- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit9

  -enrichment activities

  -Kidspiration®

  -Division for Kids

Number

Specific Outcomes

Students will be expected to:

5N3 Continued...

Achievement Indicators:

5N3.4 Explain why division by 0 is not possible or undefined.

Suggestions for Teaching and Learning

"You cannot divide by 0," is a principle of division which may be difficult to explain. The repeated subtraction model may be a useful tool. For example, $20 \div 5 = 4$ because $20 - 5 - 5 - 5 - 5 = 0$. However $5 \div 0$ is undefined because no matter how many times 0 is subtracted from 5, you will never reach 0; i.e., $5 - 0 - 0 - 0 - \dots = 5$, not 0.

Students should understand that you cannot share items among 0 people. Ask them how they could share nine playing cards between 0 people. They should realize that this cannot be done because there is no one to even try to give cards to.

Students are encouraged to check their answer by multiplying the quotient and the divisor. If the product obtained is the dividend, the answer is correct. To check $36 \div 9 = 4$, for example, students should multiply 4×9. Since this results in 36, they know that their answer is correct. However, if they try checking their division with a related multiplication fact, there is no number that can be multiplied by zero that will result in six.

A common error occurs when students conclude that division by zero results in a quotient of zero. Continued exposure to division facts involving zero should help students realize that $8 \div 0$ is not possible but $0 \div 8 = 0$ is possible.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Aaron states that 15 ÷ 0 is not possible. Ask students whether they agree or disagree with Aaron. They should use pictures, numbers and words to explain their thinking.

(5N3.4)

Journal

- Ask students to respond to the following prompt:

  Karen said 10 ÷ 0 and 0 ÷ 10 have the same quotient. Is she correct? Use pictures, numbers and words to explain your thinking.

(5N3.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Division Fact Strategies

TR: pp. 13-16

SB: pp. 298-301

Lesson 2: Dividing by Halving

TR: pp. 17-20

SB: pp. 302-303

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:
5N3 Continued...

Achievement Indicator:

5N3.3 Demonstrate recall of multiplication facts to 9 × 9 and related division facts.

Suggestions for Teaching and Learning

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 number facts without understanding have not reached mastery.

Children's literature can present situations for discussing the use of division in everyday life. *Spaghetti and Meatballs for All!* by Marilyn Burns features preparation for a dinner with 30 guests and the many ways tables can be arranged to accommodate the diners. This gives a realistic example of relating several division sentences with the same dividend - one number can be divided in a variety of ways. It may offer a springboard for other explorations of related multiplication and division situations.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Ask students to state all multiplication and related division facts for each:

  (i) 48   (ii) 36   (iii) 18   (iv) 56

  (5N3.3)

- Students could play Bingo. Student gameboards contain digits from zero to nine. The caller reads a division fact aloud and students cover the correct quotient on their card. The first student with a straight line wins.

  (5N3.3)

- Students could play *Drag Race Division*. This game can have up to four players per online game.

  (5N3.3)

- Ask students to play a Loop Game (I have..., Who has...) using division facts and answers.

  (5N3.3)

- Provide pairs of students with a game board similar to the one below and a die. Player A rolls the die and chooses a division fact from the row corresponding to the number rolled. If the player answers correctly, he or she places a counter on the square. Players alternate turns. The first player to get a straight line in any direction is the winner.

⚀	36 ÷ 4	28 ÷ 4	20 ÷ 4	24 ÷ 4	16 ÷ 4	32 ÷ 4
⚁	25 ÷ 5	45 ÷ 5	35 ÷ 5	40 ÷ 5	20 ÷ 4	30 ÷ 5
⚂	48 ÷ 6	30 ÷ 6	42 ÷ 6	24 ÷ 4	36 ÷ 6	54 ÷ 6
⚃	63 ÷ 7	42 ÷ 7	49 ÷ 7	28 ÷ 7	56 ÷ 7	35 ÷ 7
⚄	48 ÷ 8	64 ÷ 8	40 ÷ 8	72 ÷ 8	32 ÷ 8	56 ÷ 8
⚅	63 ÷ 9	45 ÷ 9	81 ÷ 9	54 ÷ 9	72 ÷ 9	36 ÷ 9

(5N3.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 1: Division Fact Strategies

TR: pp. 13-16

SB: pp. 298-301

Lesson 2: Dividing by Halving

TR: pp. 17-20

SB: pp. 302-303

Suggested Resources:

- *Spaghetti and Meatballs for All!*

  - Marilyn Burns

- Resource Link: https://www.k12pl.nl.ca/curr/k-6/math-5/links/unit9

  -Drag Race Division

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N2 Use estimation strategies, including:

- **front-end estimation**
- **compensation**
- **compatible numbers**
- **rounding**

 in problem-solving contexts.

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

Achievement Indicator:

5N2.6 Select and use an estimation strategy for a given problem.

5N2. 4 Apply front-end estimation to find:

- *sums*
- *differences*
- *products*
- *quotients*

Suggestions for Teaching and Learning

To estimate products and quotients, students should know multiplication and division facts as well as how to multiply and divide with multiples of 10, 100, 1 000…

Ask students:

Why is estimation a valuable skill?

Possible points include:

- Estimation enables us to judge the reasonableness of an answer acquired using pencil and paper or calculators.
- It can be done quickly using tools which are always readily available.
- An estimation is often all that is required to make an important decision.

Using prior knowledge, students can discuss real life situations where they have used (or could use) estimation strategies to find an approximate answer using division.

There is no one correct strategy or answer in estimating.

Some strategies for estimating dividends include:

- Round one or both numbers to the nearest multiple of 10, 100 or 1000, e.g., $829 \div 4 = 800 \div 4 = 200$
- Round numbers so that familiar facts can be used, e.g., $643 \div 8 = 640 \div 8 = 80$
- Round both numbers, e.g., $372 \div 9 = 400 \div 10 = 4$

Focus on helping students see what happens when:

$437 \div 9 \rightarrow 450 \div 9$ [about 50]

$437 \div 9 \rightarrow 500 \div 10$ [about 50]

$437 \div 9 \rightarrow 400 \div 8$ [about 50]

Discuss why each change in the dividend and divisor makes sense. Remind students that when using front-end estimation, only the first digit of the dividend is considered and the rest of the digits become zero.

$476 \div 5$, for example, would be $400 \div 5 = 80$.

Students should remember that with front-end estimation, the estimate will always be less than the actual answer.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Ask students to estimate 375 ÷ 4 using two different strategies and explain their choices.

(5N2.6)

Interview

- Ask students:

  Angela and her three friends went shopping during the weekend. They spent a total of $103.00. If each person spent the same amount, about how much did each person spend? Explain your estimation strategy.

(5N2.6)

Performance

- Bert's class raised $234.00 as a class project. They are going to share that money equally among three different charities. Ask students to estimate how much each charity will receive. Students could record their estimate on paper or individual white boards, and hold them up on cue. Students could share their strategies with the class.

(5N2.6)

Snowball Division

Ask all students to write a divison fact on a piece of paper (e.g., 81 ÷ 9). They should crumple their paper into a ball. Teacher says, "Snowball fight!" and students throw their "snowballs". Students pick up the closest snowball and determine the quotient. Repeat. This can also be done with related multiplication facts, writing a division problem to toss and solve, estimating quotients, etc. Teachers may wish to build in a verification step (tell the answer to your partner, check on a multiplication chart, check on your calculator) to ensure the answers are correct.

Variation: Use a dry erase marker to write math facts on an inflated beach ball. Students toss the balls back and forth with a partner. With each catch, the student is to give the answer to the fact closet to his or her right thumb. The facts can be wiped off and replaced as skill builds or to individualize for (add or decrease challenge) the needs of particular students.

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Estimating Quotients

TR: pp. 27-30

SB: pp. 308-310

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N2 Continued...

Achievement Indicators:

5N2.7 Provide a context for when estimation is used to:

- *make predictions*
- *check the reasonableness of an answer*
- *determine approximate answers.*

5N2.8 Describe contexts in which overestimating is important.

5N2.2 Determine the approximate solution to a given problem not requiring an exact answer.

Students should be encouraged to estimate before calculating quotients to check the reasonableness of their answer.

Present a scenario such as: Brianna has 823 beads and she wants to use them all to make eight friendship bracelets. She determines that she can put 13 beads on each bracelet. Is her answer reasonable? Why or why not?

To determine the reasonableness of the answer, students should be encouraged to round 823 to 800 and then think, "800÷ 8 =100" so an answer of only 13 beads per bracelet would not be reasonable.

The purpose of estimating is to change numbers in a problem to close ones which are easier to calculate mentally, or to find an answer which only needs to be approximate.

Sometimes, when estimating, it is important to overestimate. There are 23 people, for example, and a number of cars which can seat five people each. How many cars are needed? No one should be left behind, so students should round the number of people up or find a compatible number higher than 23 to ensure there are enough cars to take everyone. Using 25 people for estimating will determine that five cars will be needed to take everyone.

Students should discuss other situations where an approximate answer is sufficient. Teachers could present a problem such as the following: Students have seven days to read a novel that is 264 pages long. About how many pages should they read per day? Why is it not necessary to calculate an exact answer?

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Interview

- Ask students:

  (i) There are 336 students traveling to a hockey tournament on buses. There are 6 buses. How many students will be on each bus? Did you overestimate or underestimate? Explain.

  (5N2.8)

  (ii) James estimated 834 ÷ 4 to be 200. Will the actual answer be less than or greater than this estimate? Explain.

  (5N2.4)

Paper and Pencil

- At the annual Spring Fair there were 947 prizes won at the duck pond. If the fair lasted three hours, ask students to estimate how many prizes were won each hour.

  (5N2.4)

- Ask students to create a problem for 579 ÷ 3 and estimate a solution.

  (5N2.4)

- Your school expects 265 children to attend the book fair. Ms Collins purchased packages of erasers with eight erasers in each. Ask students: About how many packages did she purchase so that every student can take home one eraser? Explain your thinking using pictures, numbers and words.

  (5N2.2)

- Share *The Doorbell Rang* by Pat Hutchins. Divide students into groups of three or four. Provide each group with a different division problem or situation (it should include numbers which provide an opportunity to apply estimation strategies). Ask students to create a dramatic presentation of the situation or problem and record the play (iPad, iMovie, etc.). The presentation should demonstrate an understanding of the division required by the problem or situation and an explanation of the estimation strategies used. Movies can be shared with other groups and the estimation strategies discussed.

  (5N2.6, 5N2.7)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Estimating Quotients

TR: pp. 27-30

SB: pp. 308-310

Note

Front-end estimation is not adressed in *Math Focus 5*. The student book concentrates on rounding the dividend to the nearest multiple of 10.

Suggested Resources

- *The Doorbell Rang* -Pat Hutchins

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

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]

Achievement Indicators:

5N6.1 Students investigate a variety of strategies and become proficient in at least one appropriate and efficient division strategy that they understand.

5N6.2 Model the division process as equal sharing, using base ten blocks, and record it symbolically.

Suggestions for Teaching and Learning

In Grade 4, students used base ten blocks to model division (two-digit by one-digit) as equal sharing. They also renamed the dividend in order to get friendly numbers for dividing. 92 ÷ 4, for example, could be renamed as (80 + 12) ÷ 4. In Grade 5, students will build on these strategies and explore several others to divide three-digit by one-digit numbers.

Teachers could begin by asking students to use base ten blocks to model division by equal grouping for 396 ÷ 3.
Ask small groups of students to model 396 using base ten blocks.
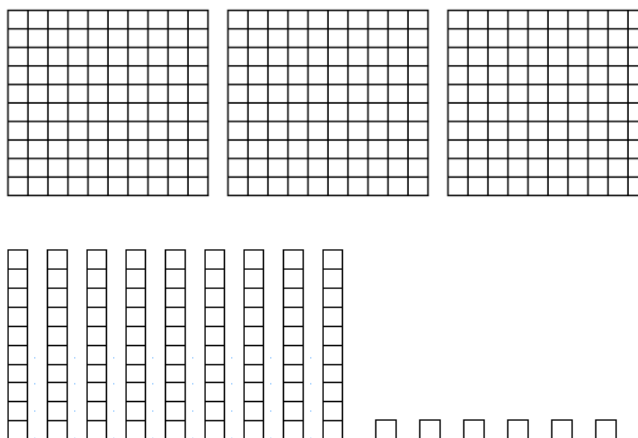
They should then share the blocks equally into three groups to find 396 ÷ 3.
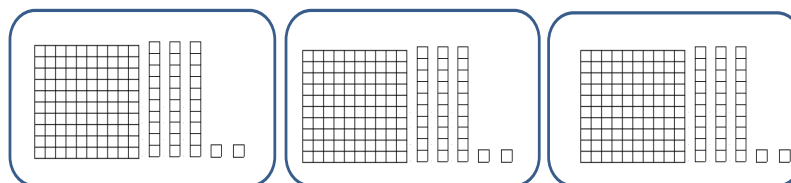
Each of the three equal sets contains 132. Therefore, 396 ÷ 3 = 132.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes
Performance • Ask students to use equal sharing with base ten blocks to determine $804 \div 4$. (5N6.2)	**Authorized Resource** *Math Focus 5* Lesson 3: Dividing Tens and Hundreds TR: pp. 21-24 SB: pp.304-306 Math Game: Choose Four TR: pp. 25-26 SB: p. 307 Lesson 7: Dividing by Sharing TR: pp. 45-49 SB: pp. 318-321

Number

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

5N6 Continued...

Achievement Indicators:

5N6.1 (Continued) Students investigate a variety of strategies and become proficient in at least one appropriate and efficient division strategy that they understand.

5N6.2 (Continued) Model the division process as equal sharing, using base ten blocks, and record it symbolically.

Teachers could model division by equal sharing where the dividend requires renaming. In the Numeration unit, students worked with renaming digits using varying place values. 4 500, for example, can be renamed as 45 hundreds. Students should be able to reflect this understanding in regrouping base ten materials.

Ask students to work in groups of two to determine 320 ÷ 8. Give each group three flats and two rods to represent 320 and ask if they can complete the division with only those base ten blocks. They should realize that regrouping is necessary.

320

Trade the flats for rods. This gives 32 rods of 10.

Since 32 ÷ 8 = 4,

32 rods ÷ 8 groups gives 4 rods in each group

32 tens ÷ 8 = 4 tens.

Therefore,

320 ÷ 8 = 40

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource
Performance	*Math Focus 5*
• Ask students to use base ten blocks to model 252 shared equally among seven groups. They could then represent their answer using labelled diagrams and a number sentence.	Lesson 3: Dividing Tens and Hundreds
	TR: pp. 21-24
(5N6.2)	SB: pp. 304-306
• Students could use Kidspiration® software to model and explore various division questions with virtual base ten manipulatives. The software will allow students to explain their step by step reasoning.	Math Game:
	Choose Four
	TR: pp. 25-26
(5N6.2)	SB: p. 307
• Ask students to use base ten blocks to solve:	
Each trailer can carry 4 horses. If there are 308 horses to be moved, how many trailers would be needed?	Lesson 7: Dividing by Sharing
	TR: pp. 45-49
(5N6.2)	SB: pp. 318-321

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 3: Dividing Tens and Hundreds

TR: pp. 21-24

SB: pp. 304-306

Math Game:

Choose Four

TR: pp. 25-26

SB: p. 307

Lesson 7: Dividing by Sharing

TR: pp. 45-49

SB: pp. 318-321

Suggested Resource

• Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit9

-Kidspiration®

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5N6 Continued...** **Achievement Indicators:** *5N6.3 Explain that the interpretation of a remainder depends on the context:* • *ignore the remainder* • *round up the quotient* • *express remainders as a fraction or decimal* *5N6.1 (Continued) Students investigate a variety of strategies and become proficient in at least one appropriate and efficient division strategy that they understand.* *5N6.2 (Continued) Model the division process as equal sharing, using base ten blocks, and record it symbolically.*	Sometimes a number does not divide evenly into the number of groups specified and there will be a remainder. Students should understand why the number of units left over after the sharing must be less than the divisor. This can be demonstrated using models so that students can realize that if there are more left over than the divisor, there is enough to give each group another equal share; e.g., if there are 6 blocks left over but the divisor is 4, each of the 4 groups can get another block (an equal share) and the actual remainder is 2. Students must understand and be able to express remainders symbolically. There are many ways to interpret remainders. They can be expressed as: • whole numbers where it is ignored - 882 marbles shared among 4 children, $882 \div 4 = 220$ R2, because even if there are 2 marbles left over, each child still gets 220 marbles. Contexts in which you ignore the remainder involve items that cannot be expressed other than as a whole; e.g., marbles, cards, etc. • round up the quotient - 260 children with 7 children per van. How many vans are required? $260 \div 7 = 37$ R1. There are 38 vans needed. • decimals - $19.00 shared equally among 4 people is $19 \div 4 = 4$ R3 which is $4.75 • fractions - 100 oranges shared between 8 people, $100 \div 8 = 12$ R4 which is 12 1/2 oranges each. Contexts in which the remainder is expressed as a fraction involve items that can be expressed as less than a whole; e.g., metres, pizzas, cakes, etc.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- From the RAFT chart below, ask each student to choose a role, an audience, a format and a topic and prepare the product selected. Each product should relate the particular role to the division process. The remainder, for example, could write an email to his friends about feeling left out when all of the other cookies are shared out equally to the children at the birthday party and he is not included because he is the remainder (left over).

  Students should share their product.

R-Role	A- Audience	F-Format	T-Topic
remainder	class	letter	feeling left out
quotient	principal or teacher	song	making friends
divisor	other math friends (product or sum)	email	sharing equally
dividend	your friends	story	being separated from your friends

(5N6)

- Ask students to work in groups of three or four. Give each group a random set of base ten materials. Students should share the materials equally (divide) and then complete a math sentence.

(5N6.1)

- Ask students to use base ten blocks to solve:

  Purity Factories produce Cream Crackers. They prepare gift packs with three boxes of Cream Crackers in each pack. If they have 724 boxes of crackers, how many gift packs can they package?

(5N6.2)

Interview

- Ask students to write the division sentence being modelled below and create a word problem that would apply to the model.
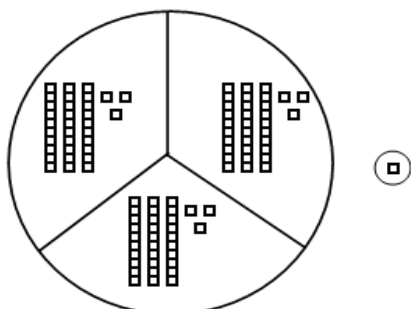
(5N6)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 7: Dividing by Sharing

TR: pp. 45-49

SB: pp. 318-321

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N6 Continued...

Achievement Indicators:

5N6.1 (Continued) Students investigate a variety of strategies and become proficient in at least one appropriate and efficient division strategy that they understand.

5N6.2 (Continued) Model the division process as equal sharing, using base ten blocks, and record it symbolically.

Suggestions for Teaching and Learning

Teachers could present the following problem and model the solution using base ten blocks, renaming and regrouping.

Six friends decide to share a jar of 325 marbles equally. How many marbles will each friend get?

$$325 = 300 + 25$$

Regroup flats as rods and share equally into 6 groups.

Regroup rods and share equally into 6 groups. There is one left over (remaining).

Combine the groupings to get 54 in each set with one left over.

$$325 \div 6 = 54 \text{ R1}$$

Teachers could use base ten materials to show that $120 \div 4$ would be 12 rods shared equally into 4 groups with 3 rods in each group. Since each rod represents 10, the answer is 30.

$1\,200 \div 4$ would be 12 flats shared equally into 4 groups to get 3 flats in each group. Since each flat represents 100, then answer is 300.

From this and other similar examples, discuss the pattern of dividing multiples of 10 and 100. For example, $12 \div 4 = 3$, so $120 \div 4 = 30$ and $1\,200 \div 4 = 300$.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to use base ten materials to solve 320 ÷ 8. Then ask: How could you then use this answer to solve 3 200 ÷ 8?

(5N6.2)

- Ask students: Meredith cut a 42 m bolt of cloth into five equal lengths. How long is each piece? Give your answer as a decimal number of meters.

(5N6.3)

Interview

- Ask students to use play money to model the following:

    Jacob won $83.00. He wanted to share equally among himself and his three friends. How much will each person receive?

- Ask students to discuss the following scenario: (5N6.3)

    Anna solved the following problem: There were 367 fans going to a hockey game. Each SUV can carry 7 fans. How many SUVs are needed? Her answer was 367 ÷ 7 = 52 R3.

    What does the remainder 3 represent? Anna's final answer was 53. Explain.

(5N6.3)

- Explain how the fact that 45 ÷ 5 = 9 would help with 4 500 ÷ 9.

(5N6.3)

Paper and Pencil

- Ask students if, for each of the folllowing, they would: ignore the quotient, round up the quotient, or express it as a fraction or decimal:

    (i)   William has 185 hockey cards that he wants to share equally among his three friends. How many cards will each person receive?

    (ii)   Mrs. Peabody has nine Swiss chocolate bars to share equally among her four nephews. How much chocolate will each nephew receive?

    (iii) Ian can transport three passengers at a time in his canoe. How many trips would it take him to transport 35 people across a river?

    Students should justify each choice.   (5N6.3)

- Ask students to create three problems: one each where the best way to treat the remainders is to:

    (i) ignore the remainder   (ii) express the remainder as a fraction

    (iii) round up the quotient

(5N6.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 8: Describing Remainders as Decimals

TR: pp. 50-52

SB: pp. 322-323

Lesson 9: Interpreting Remainders

TR: pp. 53-56

SB: pp. 324- 326

Math Game:

Two Hundred Plus

TR: pp. 57-58

SB: p. 327

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

*Students will be expected to:*

5N6 Continued...

Achievement Indicator:

5N6.1 (Continued) Students investigate a variety of strategies and become proficient in at least one appropriate and efficient division strategy that they understand.

Suggestions for Teaching and Learning

Multiplication has been identified as repeated addition. Likewise, division is repeated subtraction. A number line is a possible and plausible visual to demonstrate division as repeated subtraction. Erin has 251 hockey cards in her collection, for example. She doesn't want to collect hockey cards anymore so she decides to share them equally among her eight friends.
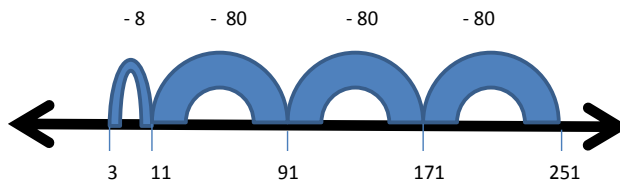
Give 10 cards each → subtract 80 cards

Give 10 more cards each → subtract 80 cards

Give 10 more cards each → subtract 80 cards

Eleven are left. That is one more card each and 3 left over, so each friend gets 31 cards with 3 cards remaining.

This same strategy can also be used symbollically. Students may find this just as meaningful and more efficient.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to solve the following problem:

  Alvin was raising money for his four favourite hockey teams. After many car washes, bake sales, and hat days, he had raised $625. Show how he could share this money with the four teams. How much more money does he need so that each team has the same amount of money?

  (5N6.1)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 6: Using Subtraction to Divide

TR: pp. 39-42

SB: pp. 314-316

Curious Math:

Stubborn Remainders

TR: pp. 43-44

SB: p. 317

Number

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5N6 Continued...

Achievement Indicators:

5N6.1 (Continued) Students investigate a variety of strategies and become proficient in at least one appropriate and efficient division strategy that they understand.

Suggestions for Teaching and Learning

Trial-and-error, or guess-and-check, is sometimes an appropriate strategy for solving division problems which are open-ended such as:

Stephen shared $24.00 evenly among his friends. Each received the same amount in dollars. How many friends did Stephen have?

Students should be able to use their knowledge of division facts and estimation to guess and check possible solutions to this problem. They should share their solutions with the class. Through this sharing, they should recognize that there is more than one solution to the problem.

Base ten blocks are also useful tools for developing understanding of the standard algorithm for division. Students should divide three-digit numbers by one-digit numbers using base ten blocks, recording their calculations symbolically. Through discussion, students should be able to access their prior knowledge of base ten and subtraction to complete this method and make connections between the base ten models and the standard algorithm. Remind students to estimate before they divide, and use this estimate to determine if their answer is reasonable.

```
        141 R.0
   4) 564              Divide
   -  4↓               Multiply
      16               Subtract  - Bring Down
   -  16               Repeat
       04
   -     4
        0
```

5N6.4 Solve a given division problem in context, using personal strategies, and record the process.

Students may select one of many methods to find solutions with division. They should be asked to describe their process. When the method being used is not efficient, the student should be led to try another.

5N6.5 Refine personal strategies to increase their efficiency.

Ask students to discuss how they would solve problems such as:

• 160 treats were sorted into loot bags for Bob's birthday party so that all bags had the same amount. There were fewer than 25 children invited to the party. How many people could have been invited?

• At Salmonier Nature Park, there are 57 animals in seven groups that are mostly equal. How many animals are in most groups?

Ask students to record and explain their strategies.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Ask students to use basic facts to help calculate each of the following:

  2 400 ÷ 8   560 ÷ 7   4 800 ÷ 6

  (5N6.1)

- Ask students to create and solve a problem involving division with a divisor of 6 and a dividend of 252.

  (5N6.4)

- Ask students to solve this problem: Joey's partner worked 147 days this year. If he worked six days a week, how many weeks did he work? If he worked five days a week, how many weeks did he work?

  (5N6.2)

- Jill is a chicken farmer with 816 m of fencing material to build a chicken coop. Jill fences off an area with all sides the same length. Ask students to give three possibilities as to how many sides there are in all.

  (5N6.4)

Interview

- Ask students to discuss the following:

  What basic fact would help you calculate 3 600 ÷ 9? What is 3 600 ÷ 9?

  (5N6.1)

Journal

- Ask students to respond to the following prompts:

  (i) Fred was asked to divide 42 by 7. He started at 42 and skip counted backwards by 7. How many groups did he get? Is this a good strategy for solving division problems? Why or why not?

  (5N6.4)

  (ii) To divide 467 by 3, Amy subtracted one group of three at a time. Using pictures, numbers and words, explain why or why not this is a good division strategy for this problem.

  (5N6.4)

  (iii) A marine biologist discovered a school of translucent sea creatures floating in the coral reef. The total number of tentacles was 96. If each creature had the same number of tentacles, how many creatures were there and how many tentacles were on each? Give three different possibilities. Use words and pictures to explain ONE of your answers.

  (5N6.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 10: Solving Problems by Guessing and Testing

TR: pp. 59-61

SB: pp. 328-329

Lesson 5: Exploring Division with Greater Numbers

TR: pp. 31-34

SB: p. 311

Note

The problem situations in Lesson 10 may be suitable as an enrichment activity or class discussion as both the divisor and dividend are unknown.

Be aware that the food quantities discussed in Lesson 5 are not realistic.

Number

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5N6 Continued...	
Achievement Indicators:	
5N6.6 Create and solve a division problem, and record the process.	Students should 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 or their community. They can post their problems around the room and invite classmates to solve them.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to each create a problem, related to their favourite hobby, which requires division of a three-digit number. They should write the problem on an index card with the solution on the back. Students could trade problems and discuss their method of solving with the creator of the problem.

(5N6.6)

- Ask students to create a problem which could be solved by guessing and checking. They should solve their problems.

(5N6.5, 5N6.6)

Resources/Notes

Authorized Resource

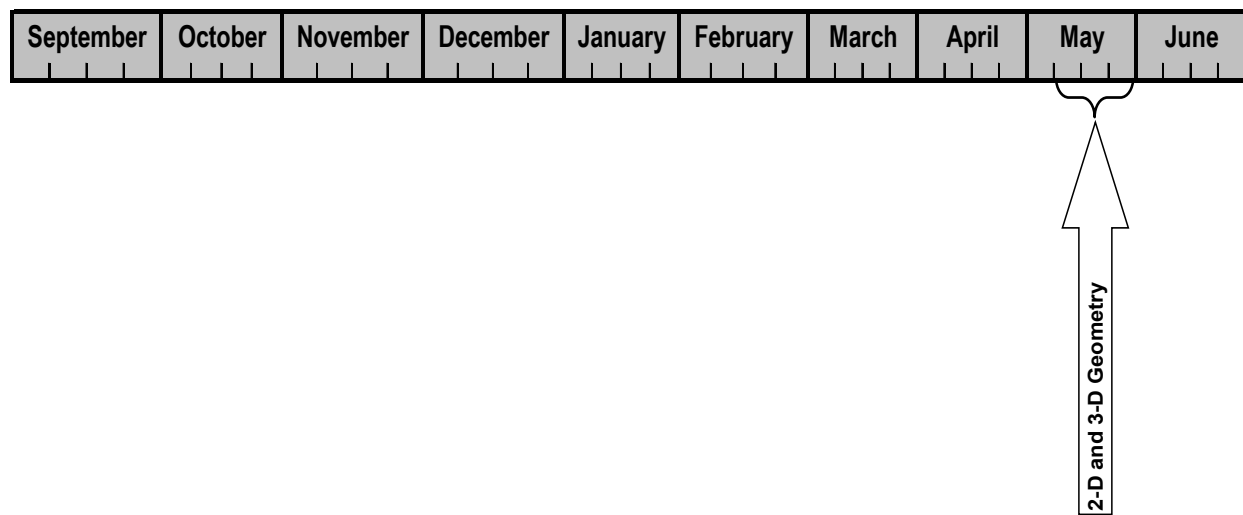*Math Focus 5*

Chapter Task

TR: pp. 67-69

SB: p. 333

Note

This achievement indicator is addressed in Question E of the chapter task but should be extended to allow students to create problems related to an area of interest.

2-D and 3-D Geometry

Suggested Time: 3 Weeks

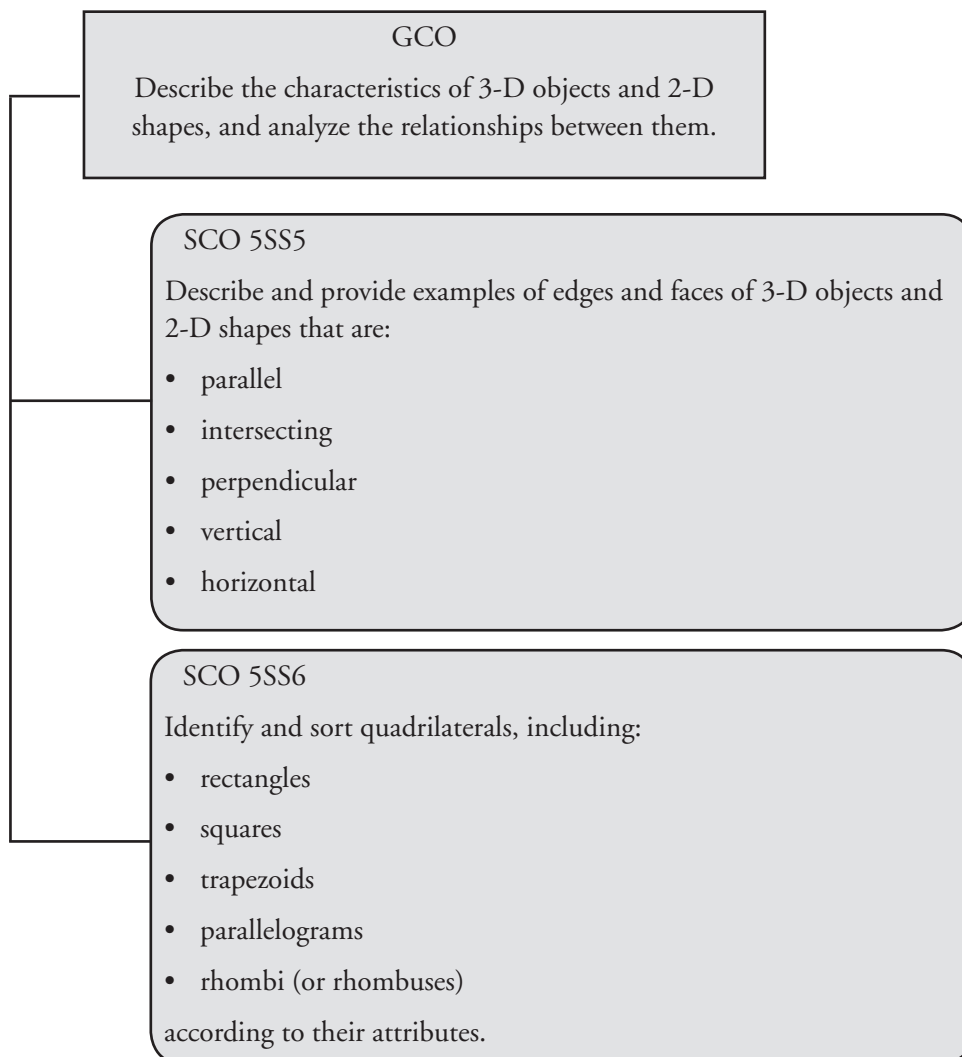| September	October	November	December	January	February	March	April	May	June

2-D and 3-D Geometry

Unit Overview

Focus and Context

Spatial sense is the understanding of shapes and solids and the relationships among them. Developing spatial sense gives students a feeling for the geometric aspects of their surroundings and the shapes of objects in their environment. Appreciation of form in art, nature and architecture is fostered by strong spatial sense. It is developed through rich experiences with shape and spatial relationships, provided consistently over time.

Students study horizontal, vertical, parallel, intersecting and perpendicular lines (edges) and apply these attributes to both 2-D shapes and 3-D objects. Also, students engage in a study of the properties of four-sided 2-D shapes (quadrilaterals) and a variety of 3-D solids. Through this study, students will develop the tools necessary to refine their own spatial awareness.

Outcomes Framework

GCO

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

SCO 5SS5

Describe and provide examples of edges and faces of 3-D objects and 2-D shapes that are:

- parallel
- intersecting
- perpendicular
- vertical
- horizontal

SCO 5SS6

Identify and sort quadrilaterals, including:

- rectangles
- squares
- trapezoids
- parallelograms
- rhombi (or rhombuses)

according to their attributes.

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Statistics and Probability (Data Analysis)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
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 [C, CN, R, T, V] 5SS6 Identify and sort quadrilaterals, including: • rectangles • squares • trapezoids • parallelograms • rhombi (or rhombuses) according to their attributes. [C, R, V]	6SS3 Develop and apply a formula for determining the: • perimeter of polygons • area of rectangles • volume of right rectangular prisms [C, CN, PS, R, V] 6SS4 Construct and compare triangles, including: • scalene • isosceles • equilateral • right • obtuse • acute in different orientations. [C, PS, R, V] 6SS5 Describe and compare the sides and angles of regular and irregular polygons. [C, PS, R, V]

Mathematical Processes

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

Daily Routine Opportunity

Using the interactive whiteboard, have various equivalent decimals and/or fractions (denominators of 10, 100, and 1 000) presented in random order. Students take turns matching the equivalent pairs. They can also practice/review naming these decimals and fractions.

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

Specific Outcomes	Suggestions for Teaching and Learning

Students will be expected to:

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)

Achievement Indicators:

5SS5.1 Identify parallel, intersecting, perpendicular, vertical and horizontal sides on 2-D shapes.

5SS5.2 Identify that perpendicular lines meet to form right angles.

Grades 3 and 4 focussed mainly on classification of 2-D shapes and 3-D objects according to visible properties, such as shape of faces and number of edges and vertices. In Grade 5, the focus is relationships involving edges and faces and how to classify shapes according to these attributes.

Although students did not deal with edges and faces during Grade 4, they were introduced to these concepts in the primary grades. Students should recognize the connections between different shapes, the effects of changing dimensions of shapes, and the distinguishing and similar characteristics of different shapes. These understandings lay a strong foundation for learning a variety of mathematical concepts and spatial awareness.

Teachers could begin by discussing the definitions of the following terms and identifying examples in the classroom.

Lines in the same plane can be parallel or they can intersect. Parallel lines never meet since they remain a constant distance apart. Whenever two lines intersect, they meet at a single point. Perpendicular lines are intersecting lines that meet or cross at a right angle (a square corner). Students have not measured angles in degrees with a protractor. This will be explored in Grade 6. Any use of the terminology of 90 degrees must be tied to "right angle" or "square corner".

To develop the concepts of vertical and horizontal, students could identify examples in- and outside of the classroom. To get started, they could consider the horizon. Which way is the horizon? Up and down or left to right?

Students may need guided exploration to learn about these different lines. To provide examples from the environment that show parallel, intersecting, perpendicular, vertical and horizontal line segments, consider going on a walk to explore the different shapes and lines around the community. Students could record their observations in a sketchbook or using a digital camera.

Students should recognize that the edges of shapes and objects are segments of lines and so terminology which discusses parallel lines or parallel edges should not cause confusion. If two edges are perpendicular, the two lines which contain these segments are also perpendicular. Similarly, if two lines are parallel, segments which are from the same set of lines are also parallel.

Using pattern blocks, ask students to categorize sets of edges as parallel, intersecting, perpendicular, vertical or horizontal.

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Ask students to search through newspapers, magazines, artwork, etc., to find examples of vertical and horizontal lines.

  (5SS5.1)

- Ask students to form groups of four to six. Ask them to create closed shapes using string or elastic for sides and themselves as vertices. Form a shape based on given properties (e.g., four equal sides and all angles are right angles). The first group to correctly form and identify the shape is the winner.

  (5SS5.1)

- Ask students to play Always, Sometimes, or Never True. Students respond to mathematical statements about geometry with one of: always, sometimes or never. This could be done using voting tools (Senteo clickers, apps, voting paddles, or ticking one of three boxes on a printed sheet) or an inside-outside agreement circle (step back from circle for never, stay on circle for sometimes, step into circle for always). Sample statements may include:

  (i)   Perpendicular lines meet at right angles.
  (ii) Parallel lines meet at only one point.
  (iii) The top of the whiteboard is a horizontal line.

  (5SS5.1, 5SS5.2)

Interview

- Provide flash cards of 2-D shapes. Ask students to identify horizontal and vertical edges on each figure displayed as well as parallel, perpendicular and intersecting edges for each flash card as appropriate.

  (5SS5.1)

- Ask students to share examples of each type of line that they may see in their environment.

  (5SS5.2)

- Give students multiple pairs of lines and ask them to indicate which line pairs intersect at right angles.

  (5SS5.2)

Resources/Notes

Authorized Resource

Math Focus 5

Getting started: Matching Nets with 3-D Objects

Teacher Resource (TR): pp. 10-11

Strudent Book (SB): pp. 364-365

Lessons 1: Vertical and Horizontal Lines and Faces.

TR: pp. 13-17

SB: pp. 366-369

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

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 5SS5 Continued... **Achievement Indicators:** *5SS5.3 Describe the sides of a given 2-D shape, using terms such as parallel, intersecting, perpendicular, vertical or horizontal.*	Model with students how to play a barrier game. A physical barrier (e.g., a screen, big book) is placed between two people so that they cannot see what the other is doing. This might also be achieved by having the students sit back to back. There are no visual clues available within the game and the success of the activity relies on good verbal communication. Ask students to work in pairs. Partner A draws a 2-D shape that Partner B cannot see and describes it to Partner B using appropriate vocabulary (parallel, intersecting, perpendicular, horizontal, vertical edges, etc.). Partner B draws a shape with these criteria, asking questions as he or she attempts to draw. When Partner B is finished, he or she will verify the shape with Partner A. Partners switch roles. As students play the game, notice whether students are using appropriate mathematical terminology to describe a shape's attributes and/or interpret the information provided by his or her partner. Students could conduct self-assessment in pairs. Partners reflect on how they did on the task, with reference to questions such as the following: • How well did you work together as a team? • How did you deal with disagreements? • What did you enjoy about this collaborative activity? • What were the challenges faced? Source: BC Math K to 7
5SS5.4 Draw 2-D shapes that have sides that are parallel, intersecting, perpendicular, vertical or horizontal.	To draw a 2-D shape with parallel edges, students can use their rulers to measure equal distances between edges or draw along opposite sides of a ruler. For perpendicular edges, remind students they are drawing a right angle or square corner. An index card can be used to draw perpendicular edges, to compare side lengths, and to draw straight edges (segments). For best results, place pencil first, slide ruler or straight edge into place touching the pencil point, and draw toward the body. Rotate paper or exercise book to allow this position.

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

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource

Suggested Assessment Strategies

Paper and Pencil

- Provide students with a variety of 2-D shapes with different colour edges.

  Ask them to identify the following using colours:

  (i) parallel edges

  (ii) intersecting edges

  (iii) perpendicular edges

  Students should explain their choices and designations.

  Example: Red and blue edges are parallel. So are green and yellow. Edges red and blue are horizontal. Edges green and yellow are vertical.   Red and green, red and yellow, blue and green, and blue and yellow all intersect at right angles and are, therefore, perpendicular.

  (5SS5.1, 5SS5.3)

- Ask students to draw and label separate 2-D figures which demonstrate each of the following:

  (i)   one set of parallel sides

  (ii) two sets of parallel sides

  (iii) no parallel sides

  (iv) adjacent sides (sides that touch each other - share a vertex) which are perpendicular

  (v) vertical and horizontal edges

  (5SS5.4)

Journal

- Ask students to create a "Who Am I?" journal entry. Each student describes the attributes of a particular 2-D shape and challenges other students to identify the shape being described.

  (5SS5.3)

Performance

- Ask students to create two facts and a fib about a particular 2-D shape. Write them on an index card and have a tea party where students circulate and challenge classmates to identify the fib.

  (5SS5.3)

Resources/Notes

Authorized Resource
Math Focus 5

Lessons 1: Vertical and Horizontal Lines and Faces.

TR: pp. 13-17

SB: pp. 363-369

Lesson 2: Parallel, Intersecting, and Perpendicular Lines and Faces

TR: pp. 18-21

SB: pp. 370-373

Suggested Resource

- BC Math K to 7

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

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 5SS5 Continued... **Achievement Indicator:** *5SS5.5 Identify parallel, intersecting, perpendicular, vertical and horizontal edges and faces on 3-D objects.*	

Faces are the flat surfaces of a 3-D object. Edges are where two faces meet or intersect. Adjacent faces of a cube are perpendicular and opposite faces are parallel.

parallel faces

intersecting faces
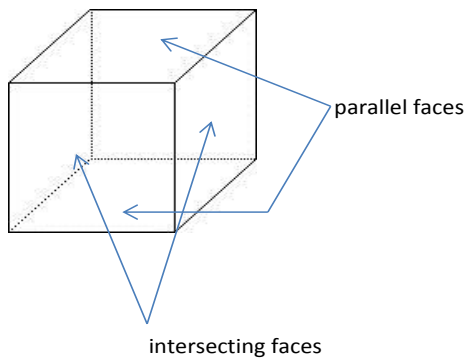
Working in small groups, students could stack pattern blocks to build prisms like the samples below.
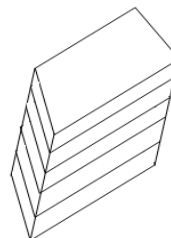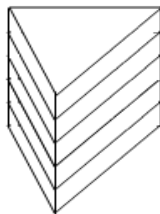
Ask students questions such as:

• Which solid has the most parallel faces?

• Which solid has the least number of edges?

• Which solid has only two parallel faces?

• Which solids have eight intersecting edges?

• Which solid has four sets of parallel faces?

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

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource *Math Focus 5*

Suggested Assessment Strategies

Interview

- Using a variety of geometric solids, ask students to identify parallel, intersecting, and perpendicular edges.

(5SS5.5)

Observation

- While students are performing the stacking activity described on the previous page, circulate and look for evidence that they are able to correctly identify the edges and faces specified.

(5SS5.5)

Performance

- Ask students to construct 3-D shapes using popsicle sticks or nets and use paint or colouring to highlight given properties. This may also be accomplished by using coloured stickers or sticky notes to indicate specific relationships between faces or edges of wooden or plastic models, such as Platonic solids or blocks.

(5SS5.5)

- Ask students to explore the classroom to identify and accurately describe parallel, intersecting, perpendicular, vertical and horizontal edges and faces on 3-D objects. Students may record this information on a 10 flap foldable created by folding a right hand page in their exercise book in half vertically. Cut from the free edge of the page to the fold to make flaps. The outside pieces would be labelled: parallel edges, parallel faces, intersecting edges, intersecting faces, perpendicular edges, perpendicular faces, vertical edges, vertical faces, horizontal edges, horizontal faces. The inside section would contain specific examples of each found in the classroom; e.g., parallel edges - the left and right edges of my math textbook; parallel faces - the top and bottom cover of my science textbook; horizontal edges - the top and bottom edges of the SMART board.

(5SS5.5)

Resources/Notes

Authorized Resource
Math Focus 5

Lessons 1: Vertical and Horizontal Lines and Faces.

TR: pp. 13-17

SB: pp. 366-369

Lesson 2: Parallel, Intersecting, and Perpendicular Lines and Faces

TR: pp. 18-21

SB: pp. 370-373

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

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 5SS5 Continued... **Achievement Indicators:** *5SS5.6 Describe the faces and edges of a given 3-D object, using terms such as parallel, intersecting, perpendicular, vertical or horizontal.*	Teachers could display a cereal box (rectangular prism) and have students identify the faces and edges. It may be helpful to colour code each face of the box. Use a marker to label each edge wth a letter: A, B, C, etc.

Teachers could display a cereal box (rectangular prism) and have students identify the faces and edges. It may be helpful to colour code each face of the box. Use a marker to label each edge wth a letter: A, B, C, etc.
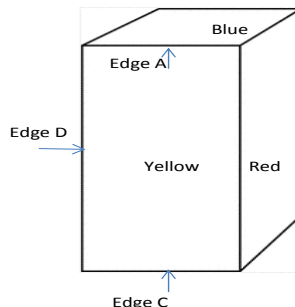
Lead discussion that will encourage students to describe edges and faces of the cereal box in terms of parallel, intersecting, perpendicular, vertical and horizontal; e.g., the red face is parallel to the orange face but perpendicular to the blue face; the yellow and blue face intersect at horizontal edge A.

Ask students to work in pairs. Without identifying his or her choice, one student chooses a geometric solid and describes it according to its attributes. The second student then tries to identify the solid. Once he or she is successful, students switch roles. Having solids visible for student reference may be helpful.

Activities related to 3-D are not limited to rectangular and triangular prisms. Teachers may include pyramids to let students realize that not all solids have parallel sides. This activity can also include other prisms, for example, hexagonal or octagonal.

5SS5.7 Draw 3-D objects that have edges and faces that are parallel, intersecting, perpendicular, vertical or horizontal.

Drawing 3-D shapes is new to students and they may need to practice their drawing.

Draw two congruent polygons slightly staggered vertically.

Join corresponding vertices with parallel lines.

Erase "unseen" lines and replace with dotted lines.

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

- Provide students with a variety of 3-D objects and paper representations todemonstrate their understanding. Using three different prisms or diagrams, ask students to shade:

    (i)   a set of parallel faces

    (ii) a set of perpendicular faces

    (iii) a set of intersecting faces

    In a set of prisms ask students to colour:

    (i)   horizontal edges red

    (ii) vertical edges blue

    (iii) a set of parallel edges yellow

    (iv) a set of intersecting edges green

    (v)   a set of perpendicular edges orange

    Ask student to justify their choices.

    (5SS5.1, 5SS5.6)

Performance

- Ask students to create an illustrated glossary (perhaps in a comic strip or dictionary format) to define these words: parallel, intersecting, perpendicular, vertical, and horizontal in relation to 2-D shapes and 3-D objects. Work with students to establish criteria for a good glossary, such as clear definition using mathematical language, examples from the real world and accurate illustrations.

    (5SS5.9, 5SS5.6, 5SS5.7)

Journal

- Ask students to work in pairs. One student selects a geometric solid. The other student tries to identify the solid by asking questions which can only be answered with "yes" or "no". Once the solid is identified, they switch roles.

    Students could use journals to record their reflections by answering the following guiding questions:

    - How well did you and your partner work together?

    - What did you enjoy about this activity?

    - What were the difficulties?

    - How does working with partners help learning?

    - Were you usually successful in identifying the solid? Why or why not?

    (5SS5.6)

Resources/Notes

Authorized Resource
Math Focus 5

Lessons 1: Vertical and Horizontal Lines and Faces.

TR: pp. 13 - 17

SB: pp. 363-369

Lesson 2: Parallel, Intersecting, and Perpendicular Lines and Faces

TR: pp. 18 - 21

SB: pp. 370-373

Note
Many students will need more practice drawing 3-D objects than *Math Focus 5* provides.

Suggested Resources

- Resource Links: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit10

    -Make Beliefs Comix
    -enrichment activities

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

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: 5SS5 Continued... **Achievement Indicators:** *5SS5.7 (Continued) Draw 3-D objects that have edges and faces that are parallel, intersecting, perpendicular, vertical or horizontal.* *5SS5.8 Provide examples from the environment that show parallel, intersecting, perpendicular, vertical and horizontal line segments.* *5SS5.9 Find examples of edges, faces and sides that are parallel, intersecting, perpendicular, vertical and horizontal in print and electronic media such as newspapers, magazines and the Internet.*	Some students may find it helpful to use triangular grid (isometric) paper to draw 3-D objects. *Illuminations* (by NCTM) also has an online isometric drawing tool for creating 3-D drawings. Students could view the video *3D Drawings; Top/Side/Front Views* for a walk through of how to use isometric paper to draw more complex 3-D objects. The first six minutes are the most pertinent. After that point, the narrator breaks the object into top, front and side views which is beyond Grade 5 expectations. Provide students with magazines, newspapers, photographs, artwork and pre-selected Internet sites and ask them to find parallel, intersecting, perpendicular, and vertical and horizontal lines. Using a chart with each of the concepts as headings may simplify the recording of findings. Teams of students might also take part in a geometry scavenger hunt to find examples of each type of line, segment, or side. This could be a checklist requiring a description, sketch or a digital capture of the situation or object exhibiting the required attribute.

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 prepare a slideshow using labelled or narrated photographs of shapes and lines observed around their community.

  (5SS5.8)

- Students could create a collage of 3-D and 2-D objects with parallel, intersecting, perpendicular, vertical and horizontal edges, faces and sides.
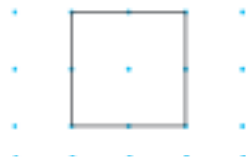
  (5SS5.9)

Journal

- Ask students to write about the topic "Shapes and Lines in My World".

  (5SS5.8)

Paper and Pencil

- Given a face of a specified 3-D object, ask students to complete the drawing of the object.

  (i) cube

  (ii) hexagonal prism

  (5SS5.7)

Provide students with iPads or cameras to go around the school to take pictures of examples of 3-D objects and 2-D shapes that have sides and/or edges which are parallel, intersecting, perpendicular, vertical or horizontal. Alternatively, students could sketch their findings if technology is not available. Make a classroom display either virtually or in print.

Further opportuntities may be offered to seek out and identify quadrilaterals which may then be sorted by the criteria under consideration.

Resources/Notes

Authorized Resource
Math Focus 5

Lesson 3: Finding Lines and Faces in the Media

TR: pp. 22-24

SB: p. 374

Note
Math Focus 5 does not address indicator 5SS5.8.

Math Game

Shape Eliminator

TR: pp. 25 - 26

SB: p. 375

Suggested Resources

- Resource Links: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit10

  -Illuminations

  -Isometric Drawing Grade E Level 5: *3D Drawings; Top/Side/Front Views*

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

Specific Outcomes	Suggestions for Teaching and Learning

Specific Outcomes

Students will be expected to:

5SS6 Identify and sort quadrilaterals, including:

- **rectangles**
- **squares**
- **trapezoids**
- **parallelograms**
- **rhombi (or rhombuses)**
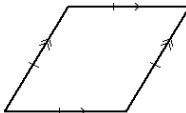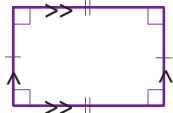
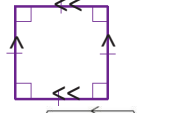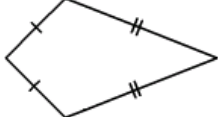**according to their attributes.**

(C, R, V)

5SS6.1 Identify and describe the characteristics of a pre-sorted set of quadrilaterals.

Suggestions for Teaching and Learning

In Grade 3, students sorted regular and irregular polygons, including triangles, quadrilaterals, pentagons, hexagons and octagons, according to their number of sides. Grade 5 students consider the attributes of different types of quadrilaterals. Quadrilaterals are four-sided polygons. Although rectangles are the most common in everyday life, students will work with many classes of quadrilaterals.

The quadrilateral family includes squares, rectangles, rhombi (rhombuses), parallelograms, kites and trapezoids, along with other four-sided regular and non-regular shapes.

QUADRILATERAL   PROPERTIES

Parallelogram — A quadrilateral with two pairs of parallel sides.

Rhombus — A parallelogram with all sides equal in length.

Rectangle — A parallelogram with four right angles.

Square — A rectangle with all sides equal in length.

Trapezoid — A quadrilateral with one pair of parallel sides.

Kite — A quadrilateral with two pairs of equal adjacent sides.

Some quadrilaterals do not fit into any of the above-listed classifications, e.g.:

Some students may enjoy the *Quadrilateral Song* available online. Others may want to create their own version detailing the attributes of the different types of quadrilaterals.

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

Suggested Assessment Strategies

Interview

- Draw various quadrilaterals on sticky notes, one per sheet. Place one label on the back of a student, without letting him or her see the shape. Ask the student to identify the shape on his or her back by asking the teacher four attribute questions about the shape.

  The questions must have a "yes" or "no" answer. If the question is not clear, the teacher may also reply:

  - Please ask that another way.
  - I don't know how to answer that.

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

Performance

- Ask students to create a rap for a quadrilateral that includes its attributes.

  (5SS6.1)

- Ask students to create Bingo cards with quadrilaterals in the grids. The caller calls out attributes of shapes; students identify the quadrilateral being described and cover that block.

  (5SS6.1)

- Ask students to create and complete a quadrilateral trifold with the three sections: picture of shape, written attributes, name of quadrilateral.

  (5SS6.1)

- Ask students to create mystery bags by putting a quadrilateral inside a paper bag. On the outside, they write the attributes for their quadrilateral. Students switch bags with a partner and use the descriptions to identify what is inside. Students open bag to verify their answer.

  (5SS6.1)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Sorting Quadrilaterals

TR: pp. 31-35

SB: pp. 378-381

Attribute Cards and Shape Cards
TR: pp. 62-63

Sorting Quadrilaterals

TR: pp. 66-67

Suggested Resources

- *Teaching Student-Centered Mathematics, Grades 3 - 5 -* John A Van De Walle and Louanne H. Lovin

- Resource Links: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit10

  - Quadrilateral Song

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

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
SS6 Continued...	
Achievement Indicator:	

5SS6.1 (Continued) Identify and describe the characteristics of a pre-sorted set of quadrilaterals.

Van de Walle suggests using the Mystery Definition Approach to distinguishing common attributes of sets of shapes.

Students could be presented with the following diagrams:
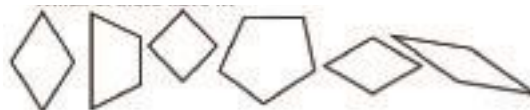
All of these have something in common.

None of these have it.

Which of these have it?

They should identify a property that is a characteristic of all members of the first set, but not characteristic of any members of the second set. In this case, the characteristic is quadrilaterals with four equal length sides. Once they have identified the property, students select shapes from the third set that have that characteristic. Rather than verbalize the choice of shapes in the third set, students should write an explanation for their choice.

Creation of additional examples of mystery definitions may have shapes in line one (*All of these have something in common*) which illustrate a sorting rule using one of the following characteristics:

- all four sides equal
- opposites sides equal
- one pair of opposite sides parallel
- adjacent sides equal
- four right angles
- opposite sides equal

The value of the Mystery Definition Approach is that students develop their own definitions based on their own experiences. The official or formal definition can be presented after students have developed a conceptual understanding of the quadrilateral property(s) being explored.

Students could also play online games related to classifying quadrilaterals.
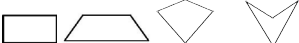
General Outcome: Describe the Characteristics of 3-D Objects and 2-D Shapes and Analyze the Relationships Among Them

Suggested Assessment Strategies	**Resources/Notes**

Suggested Assessment Strategies

Paper and Pencil

- Provide students with a template for a Frayer Model and ask them to fill in the sections to demonstrate their understanding of a geometric shape such a rhombus.

  See the sample below:

DEFINITION		CHARACTERISTICS
A rhombus is a quadrilateral with four congruent sides.		• a polygon: a closed 2-D figure with sides and no curves • a four-sided figure • has four congruent sides • has two lines of symmetry • diagonals may or may not be equal • diagonals bisect each other • diagonals intersect at right angles
	Rhombus	
EXAMPLES		NON EXAMPLES

(5SS6.1)

Performance

- Ask students to play Commit and Toss (Snowball Fight). Given a sheet of paper showing a set of polygons, ask students to find a sorting rule that fits all members. From a second set of possible shapes, each student selects which quadrilaterals would be part of the sorted group. Each student circles his or her selection and writes a justification on the provided piece of paper without including any identifying information. Students then crumple the papers into a ball and toss them. At a given signal, each student opens the one he or she currently has. Students can share and discuss the rules suggested and the shapes which belong to each. This is a great opportuniy to see that different rules may be possible, that different students see things differently and that "wrong" answers can be just as valuable for learning and constructing new ideas as "right" ones.

(5SS6.1, 5SS6.2)

- Ask students to use an agreement circle* to respond to statements such as:

  (i)   All quadrilaterals are trapezoids.
  (ii) All rhombuses are parallelograms.
  (iii) All squares are rectangles.
  (iv) All squares are rhombuses.
  (v)   All parallelograms are rhombuses.
  (vi) All intersecting lines are perpendicular.
  (vii) All perpendicular lines are intersecting.
  (viii)All perpendicular lines have vertical and horizontal lines.

(5SS6.1)

* Students form a circle. Students respond to an oral statement by stepping into the centre to agree, or staying in original circle to disagree.

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Sorting Quadrilaterals

TR: pp. 31-35

SB: pp. 378-381

Math Game:

Shape Eliminator

TR: pp. 25-26

SB: p. 375

Suggested Resources

- *Teaching Student –Centered Mathematics,Grades 3 - 5* - John A Van De Walle; Louanne H. Lovin

- Resource Links: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit10

  - graphic organizers

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

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: SS6 Continued... **Achievement Indicators:** *5SS6.2 Sort a given set of quadrilaterals according to the lengths of the sides.*	Provide students with an assortment of quadrilaterals. Ask them to sort them according to different categories of properties such as: • opposite sides equal • all sides equal • no sides equal Label each group according to the common attributes. This may be best accomplished by using a Venn Diagram. If a student struggles with this, he or she could take one section of the Venn, e.g., *all sides equal,* and fill it with squares and rhombi. Another student may have *no sides equal* and a third, *opposite sides equal.* This is an easier sort because there is only one decision; each shape is either in or out according to the single criteria under consideration. The three students may then discuss how their three sections fit together. Two are mutually exclusive but those with *all sides equal* also fit within the circle which has *opposite sides equal.* Students may choose the appropriate diagram demonstrating this relationship from a bank of graphic organizers.
5SS6.3 Sort a given set of quadrilaterals according to whether or not opposite sides are parallel.	Provide students with an assortment of quadrilaterals, and ask them to sort them according to: • two pairs of opposite sides parallel • one pair of opposite sides parallel • no sides parallel Label each group according to the common attributes. The same scaffolding may be used as required. Placing the blocks or cards into a Venn diagram made from hula hoops may also be helpful for students who prefer to physically manipulate materials. The hoops can then be appropriately labelled to explain the sorting.
5SS6.4 Sort a given set of quadrilaterals, and explain the sorting rule.	Provide students with a set of quadrilaterals. Model by sorting them into groups and describing the sorting rule you followed. Ask students to sort the shapes a different way and describe their sorting rule.

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

Suggested Assessment Strategies

Observation

- Prepare a number of flash cards listing quadrilateral properties. Ask students to identify the quadrilateral given specific properties. Cards could include such things as:

  (i) a 2-D shape with four straight sides of equal length and four right angles.

  (ii) a 2-D shape with four straight sides and four right angles. One pair of sides is longer than the other.

  (iii) a 2-D shape with four straight sides. One pair of sides is parallel with one side longer than the other.
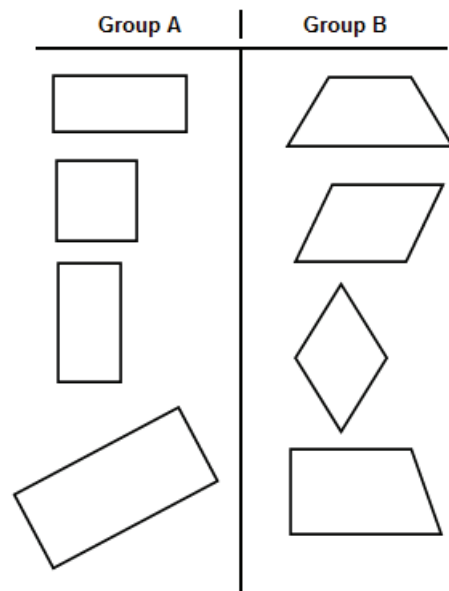
  (5SS6.1)

Performance

- Ask students to play a loop game (I have..., Who has...) using names of quadrilaterals and their characteristics.

  (5SS6.1)

Paper and Pencil

- Ray sorted this set of quadrilaterals into two groups. Ask students what rule he used to sort the shapes.

  (5SS6.1)

Interview

- Have a set of quadrilaterals for students to manipulate. Ask them to sort and to explain the sorting rule they used. They could then repeat the task using the same shapes but a different sorting rule.

  (5SS6.4)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Sorting Quadrilaterals

TR: pp. 31-35

SB: pp. 378-381

Attribute Cards

TR: p. 62

Suggested Resources

- Resource Links: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit10

  -Classifying Quadrilaterals game

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

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **SS6 Continued** **Achievement Indicators:** *5SS 6.2 (Continued) Sort a given set of quadrilaterals according to the lengths of the sides.* *5SS 6.3 (Continued) Sort a given set of quadrilaterals according to whether or not opposite sides are parallel.* *5SS 6.4 (Continued) Sort a given set of quadrilaterals, and explain the sorting rule.*	Tell students that exactly three sides of a quadrilateral are equal in length. What could the shape look like? How do you know? The important part of this activity is the discussion. A similar task would be to ask students to create two different quadrilaterals of different types which each have two sets of parallel sides. Students should tell how else the quadrilaterals are alike and how they are different. The blackline masters which accompany *The Van de Walle Professional Mathematics Series: Teaching Student-Centered Mathematics* include several pages of shapes suitable for sorting quadrilaterals. These masters are available online. Students could repeat the activity from 5SS6.1 when they attempted to identify the quadrilateral portrayed on a sticky note on their back. To extend the game, once students have identified their shapes, ask them to form groups based on student-identified common attributes; e.g., all member shapes have right angles or all members have two sets of parallel sides.

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

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Performance

- Give students the following sets of quadrilaterals:
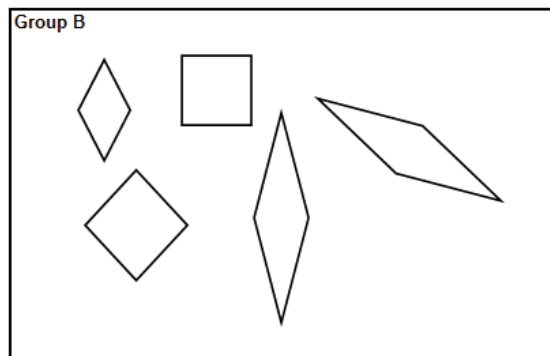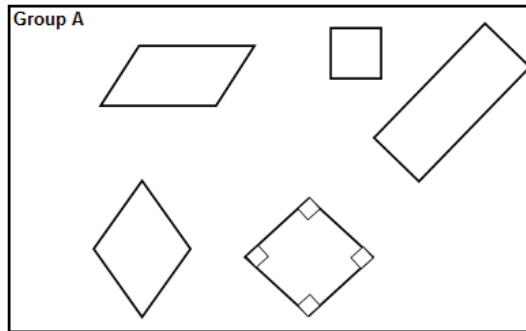
Group A

Group B

Ask them to write a sorting rule for each group based on the lengths of the sides.

(5SS6.2)

- Give students the following sets of quadrilaterals:
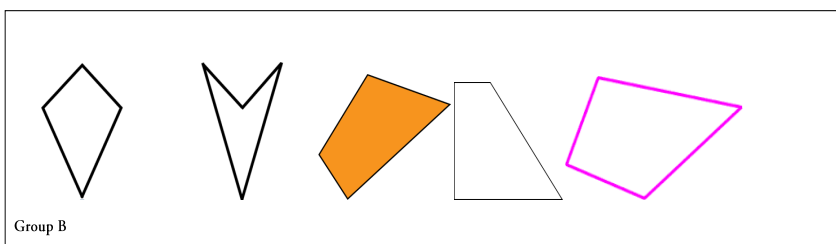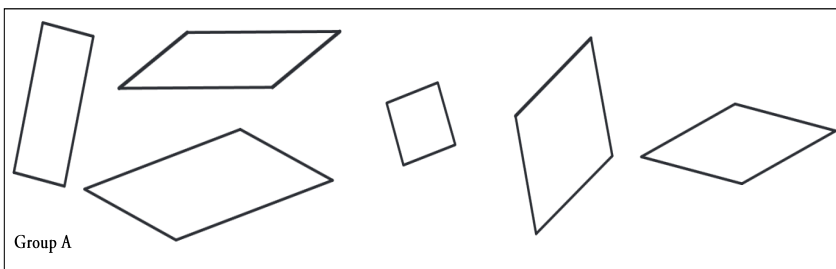
Group A

Group B

Ask students to write a sorting rule for each group based on parallel sides.

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Sorting Quadrilaterals

TR: pp. 31-35

SB: pp. 378-381

Lesson 5: Solving Problems by Drawing Diagrams

TR: pp. 36-37

SB: pp. 382-383

Note

Students will apply the skills and concepts learned in the previous units to solve problems involving quadrilaterals. They are encouraged to draw diagrams to solve the problems.

Suggested Resources

- Resource Links: https://www.k12pl.nl.ca/curr/k-6/math/grade-5/links/unit10

  -graphic organizers

  - *Teaching Student –Centered Mathematics, Grades 3 - 5* blackline masters

Probability

Suggested Time: 2 Weeks

September	October	November	December	January	February	March	April	May	June
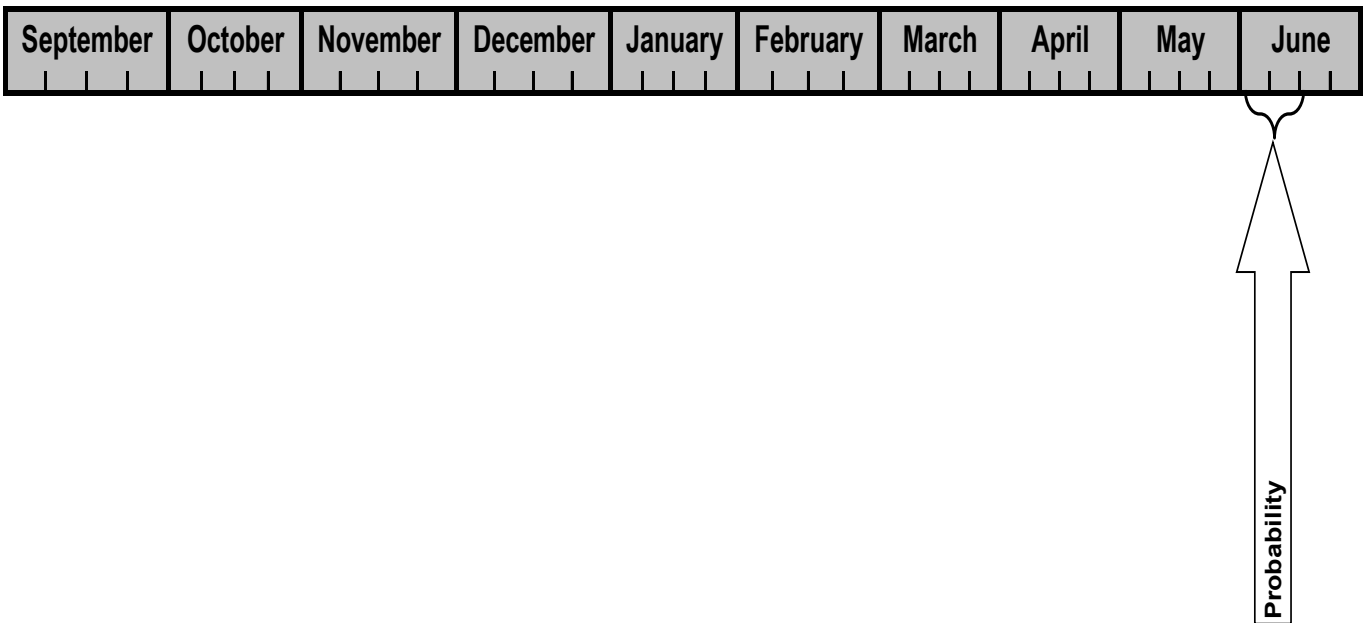
Probability

Unit Overview

Focus and Context

Probability is the study of chance. When discussing the likelihood of an event occurring, we are discussing the probability that an event will occur.

In this unit, students will identify whether the likelihood of a particular single outcome is possible, impossible or certain. They will also consider whether one of two possible outcomes is less likely, equally likely or more likely to occur than the other.

Outcomes Framework

GCO

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

SCO 5SP3

Describe the likelihood of a single outcome occurring, using words such as:

- impossible
- possible
- certain

SCO 5SP4

Compare the likelihood of two possible outcomes occurring, using words such as:

- less likely
- equally likely
- more likely

SCO Continuum

Grade 4	Grade 5	Grade 6
Strand: Statistics and Probability (Data Analysis)		
Specific Outcomes	Specific Outcomes	Specific Outcomes
	5SP3 Describe the likelihood of a single outcome occurring, using words such as: • impossible • possible • certain [C, CN, PS, R] 5SP4 Compare the likelihood of two possible outcomes occurring, using words such as: • less likely • equally likely • more likely [C, CN, PS, R]	6SP4 Demonstrate an understanding of probability by: • identifying all possible outcomes of a probability experiment • differentiating between experimental and theoretical probability • determining the theoretical outcomes in a probability experiment • determining the experimental probability of outcomes in a probability experiment • comparing experimental results with theoretical probability for an experiment. [C, ME, PS, T]

Mathematical Processes

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

Statistics and Probability (Chance and Uncertainty)

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to:	
5SP3 Describe the likelihood of a single outcome occurring, using words such as:	This will be students' first exposure to probability. In order for students to understand the concept of probability, they will require many hands-on experiences with manipulatives such as coins, spinners, cubes and marbles.
• **impossible**	
• **possible**	
• **certain**	
[C, CN, PS, R]	
Achievement Indicator:	
5SP3.1 Provide examples of events from personal contexts that are impossible, possible or certain.	Teachers could use children's literature, such as *It's Probably Penny* by Loreen Leedy, to introduce probability. The examples used by the teacher in the story to introduce the concepts of possible, impossible, certain, equal and unequal chances are very accessible for students. Students can use the guidelines provided to the fictional class to find examples of things in their experience which fit into these categories.

Discuss other words that suggest probability such as: chance, perhaps, likely, unlikely, probably, possible, maybe, could be, cannot

Position the three reference points *impossible*, *possible* and *certain* on a clothesline.
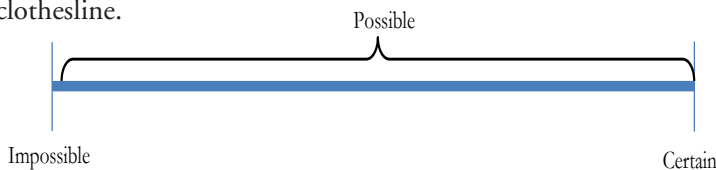
Provide examples of events that would be impossible, possible or certain, such as:

*   The sun will rise and set tomorrow.
*   If Elliott flips a coin, he will get heads or tails.
*   You will roll 1, 2, 3, 4, 5, or 6 if you roll a standard die.
*   Evan will eat cereal for breakfast tomorrow.
*   Laura will go to bed at 9 pm tonight.
*   It will rain tomorrow.
*   A flower will say hello to me.
*   Beth will have two birthdays this year.
*   I will pick a red cube out of a bag containing only green cubes.

Ask students to place these events on the clothesline (probability line) in the appropriate places. Students could also create their own probability events and have other classmates place them on the probability line.

General Outcome: Use Experimental or Theoretical Probabilities to Represent and Solve Problems Involving Uncertainty.

Suggested Assessment Strategies

Journal

- Ask students to write a journal entry outlining events in their everyday lives that are impossible, possible and certain.

(5SP3.1)

Performance

- Students could be given sticky notes on which to write their own probability events and place them on the appropriate surface in the room labelled *Possible, Impossible,* and *Certain.* When all events are posted, students can share their events and the reasoning for their placement. A Gallery Walk will allow students to consider and discuss a wider variety of ideas.

(5SP3.1)

Paper and Pencil

- Ask students to create a three door foldable with outside flaps which read: *Impossible, Possible,* and *Certain.* Ask students to discuss, with their shoulder partners, events which would fit each of these descriptors. Students write and illustrate several of their favourites underneath the appropriate flap of their foldable.

(5SP3.1)

- Provide students with four copies of this graphic.
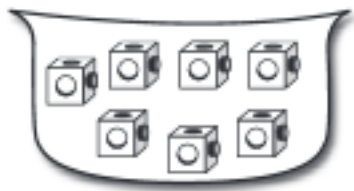
  Ask them to colour the blocks so that with each selection of a single block, it is:

  (i)   equally likely to draw a red block as a green block.

  (ii) more likely to pull a yellow block than a non-green block.

  (iii) less likely to get a blue block than any other colour block.

  (iv) less likely to draw a yellow one than a non-yellow one.

(5SP3.1)

Resources/Notes

Authorized Resource

Math Focus 5

Getting Started: Predicting the Results of an Experiment

Teacher Resource (TR): pp. 8-11

Student Book (SB): pp. 336-337

Lesson 1: Probability Lines

TR: pp. 12-15

SB: pp. 338-339

Suggested Resource

It's Probably Penny - Loreen Leedy

Statistics and Probability (Chance and Uncertainty)

| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SP3 Continued...** **Achievement Indicators:**	

5SP3.1 (Continued) Provide examples of events from personal contexts that are impossible, possible or certain.

Using a diagram to show the relationship between these three cases may be helpful for some students. They should realize that *possible* and *impossible* are mutually exclusive but that *certain* is a subset of *possible*.
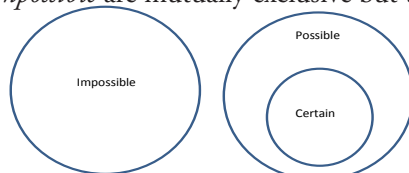
Experimental probability is the probability reached by actually performing an experiment. In theory, for example, if you flip a coin two times you should get one head and one tail. However, after flipping the coin twice you may get two heads. The more you flip the coin, the greater the chance of having equal numbers of heads and tails results.

5SP3.2 Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible or certain.

Using spinners, dice or coloured cubes, ask students to predict whether the outcome will be impossible, possible or certain. Examples include the following:

- From a bag containing red cubes and yellow cubes:

    (i)   What is the likelihood of picking a yellow cube?

    (ii) What is the likelihood of picking a green cube?

    (iii) What is the likelihood of picking a cube which is red or yellow?

- Using the spinner shown:

    (i)   What is the likelihood of the spinner landing on five?

    (ii) What is the likelihood of the spinner landing on one or two?

- When rolling a standard die:

    (i)   What is the likelihood that you will roll a one, two, three, four, five or six?

    (ii) What is the likelihood of rolling a seven?

5SP3.3 Design and conduct a probability experiment in which the likelihood of a single outcome occurring is impossible, possible or certain.

After some experience with probability experiments, students should be able to make a connection between the number of times an event occurs and the representation of that quality in the whole. With a spinner, for example, if most of the area is covered in pink and a small section is blue, it is possible to spin pink or blue. It is impossible to spin yellow.

Tell students that they are going to select 10 blocks to put in each bag. Ask them how many of which colours they would use to create Bag A, B and C.
Bag A - the likelihood of choosing a red cube is certain.
Bag B - the likelihood of choosing a red cube is possible.
Bag C- the likelihood of choosing a red cube is impossible.

General Outcome: Use Experimental or Theoretical Probabilities to Represent and Solve Problems Involving Uncertainty.

Suggested Assessment Strategies

Performance

- Ask students to vote with their feet by moving to a designated corner of the classroom in response to probability statements. The corners are labelled *Possible*, *Impossible*, and *Certain*. When students arrive at the corner of their choice, they discuss with others in that corner the reasons for their choice. A class dialogue could be held with each corner defending why they made their choice, followed by a whole class decision regarding whether one response might be a better choice than the others.

(5SP3.2)

- Ask students to do a probability sort. Supply a set of statements on task cards - perhaps drawn from their personal stories in Achievement Indicator 5SP3.1 - and ask them to sort the events into the categories of Possible, Impossible and Certain.

(5PS3.2)

- Ask students to imagine that a new student is about to join the class. Ask them which of these statements is possible, which is certain, and which is impossible. Students may use an agreement circle or move to designated corners of the classroom to vote on statements such as:

  (i) The student is a girl.

  (ii) The student is the same age as others in the class.

  (iii) The student has a head.

  (iv) The student likes physical education class.

  (v) The student has just moved into the area.

(5SP3.2)

- Give students a paper bag containing 10 coloured tiles; five red, three blue, two yellow. Ask them whether choosing a red tile is certain, impossible, or possible. They explain their response. Ask: How would you change the tiles in the bag so that the likelihood of choosing a non-red tile is (i) certain? (ii) impossible?

(5SP3.3)

Paper and Pencil

- Exit Card: Ask students to summarize, in 30 words or less, what they learned about the likelihood of a particular event happening.

Journal   (5SP3.1)

- Ask students to respond to this prompt: If two standard dice are rolled, what is the likelihood that the numbers rolled have a sum of 14 - certain, possible, or impossible? Why do you think so?

(5SP3.3)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 2: Conducting Spinner Experiments

TR: pp. 16-20

SB: pp. 340-343

Lesson 3: Conducting Experiments with a Die

TR: pp. 21-24

SB: pp. 344-346

Math Game:

Choose Your Spinner

TR: pp. 25-26

SB: p. 347

Statistics and Probability (Chance and Uncertainty)

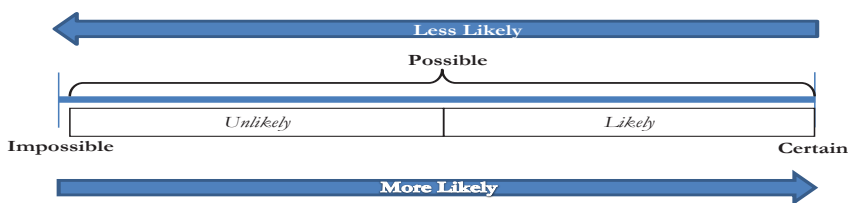| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SP4 Compare the likelihood of two possible outcomes occurring, using words such as:** • **less likely** • **equally likely** • **more likely.** [C, CN, PS, R] **Achievement Indicator:** *5SP4.1 Identify outcomes from a given probability experiment that are less likely, equally likely or more likely to occur than other outcomes.*	To introduce the concepts of less likely, equally likely, and more likely, teachers could return to the previous clothesline activity (probability line). Through discussion, students should decide where on the line to place the new words (less likely and more likely). Students can then be given probability statements to place on the line. For example: • It will snow tomorrow. • I will go to school tomorrow. • I will go to bed by 9 pm tonight. • I will be a teacher when I grow up. • When I flip a coin, I will get heads. A statement placed further to the right than a second statement is more likely to happen. A statement that is placed further to the left than another statement is less likely to occur. Two statements that are located on the same place on the continuum - whether to the right, left, or middle - are equally likely to occur. When students have placed the statements on the clothesline, ask them if it is more likely to snow tomorrow or that they will go to bed before 9 pm tonight? Is it less likely that they will go to school tomorrow or be a teacher when they grow up?

General Outcome: Use Experimental or Theoretical Probabilities to Represent and Solve Problems Involving Uncertainty.

Suggested Assessment Strategies	Resources/Notes

Suggested Assessment Strategies

Paper and Pencil

- Given a paper bag containing 10 coloured tiles (five red, two blue, one yellow, two green), ask students to describe and explain a choice event that is:

  (i) more likely   (ii) equally likely   (iii) less likely to occur

  (5SP4.1)

- Ask students to consider this friendly talk probe:

  Three sisters were walking to school:

  Beth: Mom said she is cleaning out the freezer after school. She said she would give us each an ice cream treat to help make more space. What kind do you think we will get?
  Olivia: She bought a box of treats yesterday that had eight drumsticks and eight polar bars.
  Liza: I saw four empty drumstick wrappers in the garbage can this morning. You know drumsticks are Dad's favourite.
  Olivia: I think it is equally likely that we will get a drumstick or a polar bar because Mom bought eight of both.
  Beth: I think we are more likely to get a polar bar than a drumstick because a lot of the drumsticks are already gone.
  Liza: I think it's less likely that we will get a polar bar or a drumstick than a popsicle. Popsicles are my favourite.

  Which sister do you agree with most? Explain.

  (5SP4.1)

Journal

- Ask students to respond to this prompt: In a bag with 10 red cubes, five green and four yellow, why is it less likely that a yellow cube will be drawn than a red or green one?

  (5SP4.1)

Incorporate probability vocabulary into your classroom. Discuss the likelihood that Sports Day will go ahead as scheduled. Is it likely to rain tomorrow? Is it possible that there will be frost to threaten the school's garden? Build prediction and probablity into the read-aloud being shared with students to discuss how likely it is that particular events will happen.

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 4: Comparing Probabilities

TR: pp. 30-34

SB: pp. 350-353

Suggested Resources

- interactive dice and interactive coin on interactive white board

- Resource Link: https://www. k12pl.nl.ca/curr/k-6/math/ grade-5/links/unit11
  -adjustable spinners
  -Math Five Live

Statistics and Probability (Chance and Uncertainty)

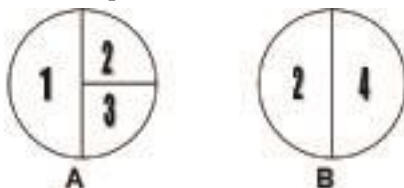| Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SP4 Continued...** **Achievement Indicator:** *5SP4.1 (Continued) Identify outcomes from a given probability experiment that are less likely, equally likely or more likely to occur than other outcomes.*	Provide these spinners. As a class discussion, ask students: • Which spinner is more likely to spin a two? • Which spinner is less likely to spin a two? • Which spinner is equally likely to spin a two or three? Place a variety of coloured multilink cubes in a bag: perhaps 15 red, 10 blue, 5 green and 5 yellow. Students should recognize that each cube in the bag has an equal chance of being picked since they are all the same size and shape. Ask them which colour is more likely to be picked than the other colours. Of the other colours in the bag, which colours are equally likely to be picked? Students sometimes think that the presence of more examples of an item in question means that there is a greater chance of getting that result. Some students think that because there are more stars in Set B than Set A, there is a better chance of selecting one in a random draw. Their hands-on exploration should help them see that the likelihood of getting a star (or a heart) is the same in both cases. Set A Set B *3D Animated Math Probability Spinner Video* could be used to reinforce the possible outcomes of a probability experiment. This short animation features cowboys riding through the desert and coming upon a directional signpost. They have to use their spinner to decide which road to choose. The spinners are examples of likely, less likely, equally likely, impossible and certain.

General Outcome: Use Experimental or Theoretical Probabilities to Represent and Solve Problems Involving Uncertainty.

Suggested Assessment Strategies

Paper and Pencil

- Ask students to choose the best response:

  Two jars hold black and white bubble gum.

  Jar A   Jar B
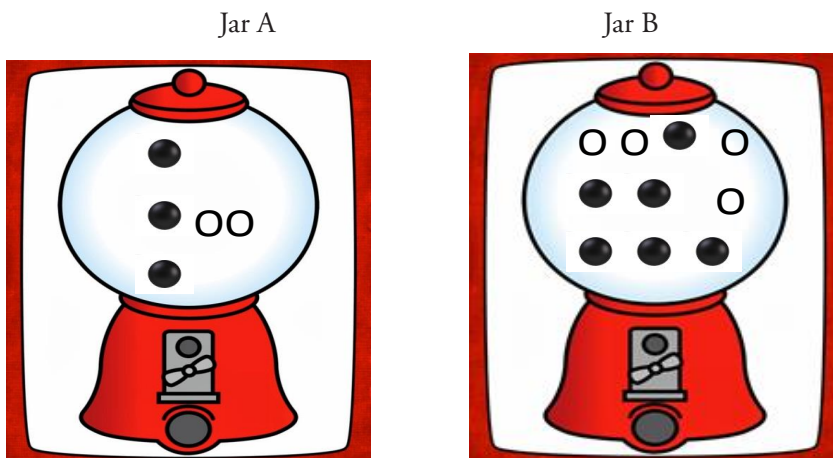
  Which statement best describes the chance of getting a black bubble gum?

  A. You are more likely to get a black bubble gum from Jar A than Jar B.

  B. You are more likely to get a black bubble gum from Jar B than Jar A.

  C. You are equally likely to get a black bubble gum from Jar A as from Jar B.

  (5SP4.1)

Resources/Notes

Authorized Resource

Math Focus 5

Lesson 5: Solving Problems by Conducting Experiments

TR: pp. 35-38

SB: pp. 354-355

Statistics and Probability (Chance and Uncertainty)

Specific Outcomes	Suggestions for Teaching and Learning
Students will be expected to: **5SP4 Continued...** **5SP3 Continued...** **Achievement Indicators:** *5SP3.4 Conduct a given probability experiment a number of times, record the outcomes, and explain the results.*	Students should use manipulatives to try experiments in order to verify their predictions regarding the expected results. Students should discover that the more times they try an experiment, the closer their results will come to what they expected. Flipping a coin twice, for example, may result in two heads. Trying this one hundred times should bring the results closer to equal numbers of heads and tails. Have students predict on which letter a spinner is most likely to land. Hold a paper clip in place with a pencil and spin. Record the letter on which the paperclip lands. Repeat the experiment ten times. Record the results. Try another twenty spins. Discuss results.
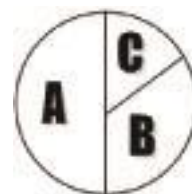
Provide students with blank spinners and have them design an experiment where one event is less likely to occur than others. They could design a spinner that is $\frac{1}{2}$ yellow, $\frac{1}{4}$ red, $\frac{1}{8}$ blue and $\frac{1}{8}$ green. With this design:

- it is less likely that the spinner will land on blue than red.

- it is less likely that it would land on green than yellow.

- it is more likely that the spinner will land on red than green.

- it is equally likely that the spinner will land on blue as green.

 Students should spin this spinner 20 times and record results. They could try another 20 times and analyze the results in order to verify that the design of their spinner is correct.

| Specific Outcomes (continued) |
|---|
| *5SP4.2 Design and conduct a probability experiment in which one outcome is less likely to occur than another outcome.* |
| *5SP4.3 Design and conduct a probability experiment in which one outcome is equally likely to occur as another outcome.* |
| *5SP4.4 Design and conduct a probability experiment in which one outcome is more likely to occur than another outcome.* |

General Outcome: Use Experimental or Theoretical Probabilities to Represent and Solve Problems Involving Uncertainty.

Suggested Assessment Strategies	Resources/Notes
	Authorized Resource *Math Focus 5*
Performance	Lesson 5: Solving Problems by Conducting Experiments
• Ask students to toss a coin and record whether they get heads or tails. Repeat at least twenty times and record results in a chart. They discuss their findings, try flipping the coin another twenty times and discuss the results again.	TR: pp. 35-38 SB: pp. 354-355
(5SP3.4)	
• Ask a student to turn on the classroom radio. Note whether the first voice heard (speaking or singing) is a female or male voice. Change to a different station and record the gender of the first voice you hear. After students have tried five stations, ask them to describe the probability of hearing a male voice on daytime radio.	
(5SP3.4)	
• Ask students to describe the 10 coloured erasers they would put in a pencil box so that the probability of selecting a red one is high but not certain.	Lesson 6: Designing Spinners TR: pp. 41-44 Spinners Blackline Masters pp. 69-70 SB: p. 357
(5SP4.4)	
• Using a bag which contains 20 green cubes and 5 red cubes, ask a student, without looking, to remove one cube from the bag. Record the color, and return it to the bag. Repeat the experiment 20 times. Ask students to indicate the frequency with which a green cube was chosen. Ask them to describe, using the language supplied (less likely, equally likely, more likely), the likelihood that a green cube will be selected rather than a red cube.	Curious Math Did it Really Happen? TR: pp. 39-40 SB: p. 356
(5SP4.4)	
• Give students a paper bag containing 10 coloured tiles: five red, three blue, two yellow. Ask them to determine which probabilities they wish to determine. Ask them to design and conduct an experiment based on their decision.	
(5PS4.2, 5PS4.3, 5PS4.4)	
Interview	
• Ask students to describe an experiment where one outcome is equally likely to occur as another outcome.	
(5SP4.3)	

Appendix:
Outcomes with Achievement Indicators
Organized by Strand
(With Curriculum Guide page references)

Strand: Number	General Outcome: Develop number sense	
Specific Outcomes Students will be expected to:	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
5N1 Represent and describe whole numbers to 1 000 000. [C, CN, V, T]	5N1.1 Write a given numeral, using proper spacing without commas.	p .22
	5N1.2 Write a given numeral to 1 000 000 in words.	p.22
	5N1.3 Describe the pattern of adjacent place positions moving from right to left.	pp.24,32
	5N1.4 Describe the meaning of each digit in a given numeral.	p.24
	5N1.5 Express a given numeral in expanded notation.	p.26
	5N1.6 Write the numeral represented by a given expanded notation.	p.26
	5N1.7 Provide examples of large numbers used in print or electronic media.	p.28
5N2 Use estimation strategies, including: • front-end estimation • compensation • compatible numbers • rounding in problem-solving contexts. [C, CN, ME, PS, R, V]	5N2.1 Round decimals to the nearest whole number, nearest tenth or nearest hundredth.	p.50
	5N2.2 Determine the approximate solution to a given problem not requiring an exact answer.	pp.52,156,224
	5N2.3 Estimate a sum or product, using compatible numbers.	pp.54,156
	5N2.4 Apply front-end rounding to estimate: • sums • differences • products • quotients	pp.54,156,222
	5N2.5 Estimate the solution to a given problem, using compensation, and explain the reason for compensation.	p.56
	5N2.6 Select and use an estimation strategy for a given problem.	pp.60,158,222
	5N2.7 Provide a context for when estimation is used to: • make predictions • check the reasonableness of an answer • determine approximate answers.	pp.60,156,224
	5N2.8 Describe contexts in which overestimating is important.	pp.62,156,224

Strand: Number	General Outcome: Develop number sense	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
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 in order to understand, apply and recall basic multiplication facts to 9 x 9 and related division facts. [C, CN, ME, R, V]	5N3.1 Describe the mental mathematics strategy used to determine a given basic fact, such as: • skip count up by one or two groups from a known fact • skip down down by one or two groups from a known fact • doubling • patterns when multiplying by 9 • repeated doubling • repeated halving 5N3.2 Explain why multiplying by zero produces a product of zero. 5N3.3 Demonstrate recall of multiplication facts to 9 × 9 and related division facts. 5N3.4 Explain why division by zero is not possible or is undefined.	pp.146,216 pp.218 pp.148,150,220 p. 218
5N4 Apply mental mathematics strategies for multiplication, such as: • annexing (adding) zero • halving and doubling • using the distributive property. [C, CN,ME, R]	5N4.1 Determine the products when one factor is a multiple of 10, 100 or 1 000 by annexing (adding) zeros. 5N4.2 Apply halving and doubling when determining a given product 5N4.3 Apply the distributive property to determine a given product involving multiplying factors that are close to multiples of 10.	pp.150,152 p.152 p.154
5N5 Demonstrate, with and without concrete materials, an understanding of multiplication (two-digit by two-digit) to solve problems. [C, CN, PS, V]	5N5.1 Model the steps for multiplying two-digit factors, using an array and base ten blocks, and record the process symbolically. 5N5.2 Describe a solution procedure for determining the product of two given two-digit factors, using a pictorial representation such as an area model. 5N5.3 Solve a given multiplication problem in context, using personal strategies, and record the process. 5N5.4 Illustrate partial products in expanded notation for both factors. 5N5.5 Represent both two-digit factors in expanded notation to illustrate the distributive property. 5N5.6 Refine personal strategies to increase their efficiency. 5N5.7 Create and solve a multiplication problem, and record the process.	p. 160 pp.160,162 p. 160,162 p.162 p.162 p. 164 p.164

Strand: Number	General Outcome: Develop number sense	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
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]	5N6.1 Students investigate a variety of stagies and become proficient in at least one appropriate and efficient strategy that they understand.	pp. 226-236
	5N6.2 Model the division process as equal sharing, using base ten blocks, and record it symbolically.	pp. 226-232
	5N6.3 Explain that the interpretation of a remainder depends on the context: • ignore the remainder • round up the quotient • express remainders as fractions • express remainders as decimals	p. 230
	5N6.4 Solve a given division problem in context, using personal strategies, and record the process.	p.236
	5N6.5 Refine personal strategies to increase their efficiency.	p.236
	5N6.6 Create and solve a division problem, and record the process.	p.238
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]	5N7.1 Create a set of equivalent fractions; and explain, using concrete materials, why there are many equivalent fractions for any given fraction.	pp.196,198
	5N7.2 Model and explain that equivalent fractions represent the same quantity.	pp.196, 198
	5N7.3 Determine if two given fractions are equivalent, using concrete materials or pictorial representations.	p.200
	5N7.4 Identify equivalent fractions for a given fraction.	p. 202
	5N7.5 Formulate and verify a rule for developing a set of equivalent fractions.	pp. 202,204
	5N7.6 Compare two given fractions with unlike denominators by creating equivalent fractions.	p. 204
	5N7.7 Position a given set of fractions with like and unlike denominators on a number line (horizontal or vertical), and explain strategies used to determine the order.	p.206
5N8 Describe and represent decimals (tenths, hundredths, thousandths) concretely, pictorially and symbolically. [C, CN, R, V]	5N8.1 Express orally and in written form the decimal for a given symbolic, concrete or pictorial representation of part of a set, part of a region or part of a unit of measure.	pp.30,32
	5N8.2 Describe the value of each digit in a given decimal.	p.34
	5N8.3 Represent a given decimal, using concrete materials, pictorial representation, or a grid.	p.34
	5N8.4 Express a given tenth as an equivalent hundredth and thousandth.	p.36
	5N8.5 Express a given hundredth as an equivalent thousandth.	p.36
	5N8.6 Represent an equivalent tenth, hundredth or thousandth for a given decimal, using a grid.	p.36

Strand: Number	General Outcome: Develop number sense	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
5N9 Relate decimals to fractions and fractions to decimals (to thousandths). [CN, R, V]	5N9.1 Express orally and in written form, a given decimal as a fraction with a denominator of 10, 100 or 1 000.	p. 208
	5N9.2 Express orally and in written form, a given fraction with a denominator of 10, 100 or 1 000 as a decimal.	p. 208
	5N9.3 Express a given pictorial or concrete representation as a fraction or decimal.	pp. 208,210
5N10 Compare and order decimals (to thousandths) by using: • benchmarks • place value • equivalent decimals. [CN, R, V]	5N10.1 Order a given set of decimals including only tenths, using place value.	pp. 38,40
	5N10.2 Order a given set of decimals including only hundredths, using place value.	pp. 38,40
	5N10.3 Order a given set of decimals including only thousandths, using place value.	pp. 38,40
	5N10.4 Order a given set of decimals by placing them on a number line (vertical or horizontal) that contains the benchmarks 0.0, 0.5 and 1.0.	pp. 38,40
	5N10.5 Order a given set of decimals including tenths, hundredths and thousandths, using equivalent decimals.	pp.40
	5N10.6 Explain what is the same and what is different about 0.2, 0.20 and 0.200.	p. 42
5N11 Demonstrate an understanding of addition and subtraction of decimals (limited to thousandths). [C, CN, PS, R, V]	5N11.1 Predict sums and differences of decimals, using estimation strategies.	p. 58
	5N11.2 Place the decimal point in a sum or difference, using estimation.	p. 58
	5N11.3 Correct errors of decimal point placement in sums and differences without using paper and pencil.	p. 64
	5N11.4 Explain why keeping track of place value positions is important when adding and subtracting decimals.	pp. 64-74
	5N11.5 Create and solve problems that involve addition and subtraction of decimals, limited to thousandths.	pp.76, 78
	5N11.6 Correct errors of decimal point placements in sums and difference without using pencil and paper	p. 78

Strand: Patterns and Relations (Patterns)	**General Outcome:** Use patterns to describe the world and to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
5PR1 Determine the pattern rule to make predictions about subsequent elements. [C, CN, PS, R, V]	5PR1.1 Extend a given pattern with and without concrete materials, and explain how each element differs from the preceding one.	pp. 170
	5PR1.2 Describe, orally or in writing, a given pattern, using mathematical language, such as one more, one less, five more.	p. 172,174
	5PR1.3 Predict subsequent elements in a given pattern.	pp. 172,174
	5PR1.4 Represent a given pattern visually to verify predictions.	pp. 172,174
	5PR1.5 Solve a given problem by using a pattern rule to determine subsequent elements.	p. 176
	5PR1.6 Determine and explain why a given number is or is not the next element in a pattern.	p. 178
	5PR1.7 Write a mathematical expression to represent a given pattern. 5PR1.8 Describe the relationship in a given table or chart, using a mathematical expression.	p.180 p. 182

Strand: Patterns and Relations (Variables and Equations)	General Outcome: Represent algebraic expressions in multiple ways.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
5PR2 Solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions. [C, CN, PS, R]	5PR2.1 Express a given problem as an equation where the unknown is represented by a letter variable.	p. 184
	5PR2.2 Solve a given single-variable equation with the unknown in any of the terms; e.g., $n + 2 = 5$, $4 + a = 7$, $6 = r - 2$, $10 = 2c$.	pp. 184-188
	5PR2.3 Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.	pp. 184-188
	5PR2.4 Create a problem for a given equation.	pp. 188,190

Strand: Shape and Space (Measurement)	General Outcome: Use direct or indirect measurement to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
5SS1 Design and construct different rectangles, given either perimeter or area, or both (whole numbers), and draw conclusions. [C, CN, PS, R, V]	5SS1.1 Construct or draw two or more rectangles for a given perimeter in a problem-solving context.	p. 90
	5SS1.2 Construct or draw two or more rectangles for a given area in a problem-solving context.	p. 92
	5SS1.3 Illustrate that for any given perimeter, the square or shape closest to a square will result in the greatest area.	p. 92
	5SS1.4 Illustrate that for any given perimeter, the rectangle with the smallest possible width will result in the least area.	p. 92
	5SS1.5 Provide a real-life context for when it is important to consider the relationship between area and perimeter.	p. 92
5SS2 Demonstrate an understanding of measuring length (mm and km) 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. • selecting and justifying referents for the unit km. • modelling and describing the relationship between m and km units. [C, CN, ME, PS, R, V]	5SS2.1 Show that 10 millimetres is equivalent to one centimetre, using concrete materials.	p. 84
	5SS2.2 Show that 1 000 millimetres is equivalent to one metre, using concrete materials.	p. 84
	5SS2.3 Provide examples of when millimetres are used as the unit of measure.	p. 84
	5SS2.4 Provide a referent for one kilometre, and explain the choice.	p. 86
	5SS2.5 Know that 1 000 metres is equivalent to one kilometre.	p. 86
	5SS2.6 Provide examples of when kilometres are used as the unit of measure.	
	5SS2.7 Explore and generalize the measurement relationships between and among millimetres, centimetres, metres and kilometres.	pp. 86,88
	5SS2.8 Provide a referent for one millimetre, and explain the choice.	p. 88
	5SS2.9 Provide a referent for one centimetre, and explain the choice.	p. 88
	5SS2.10 Provide a referent for one metre, and explain the choice.	p. 88

Strand: Shape and Space (Measurement)	General Outcome: Use direct or indirect measurement to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
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]	5SS3.1 Identify the cube as the most efficient unit for measuring volume, and explain why.	p. 94
	5SS3.2 Determine the volume of a given 3-D object, using manipulatives, and explain the strategy.	p. 94
	5SS3.3 Construct a right rectangular prism for a given volume.	p. 96
	5SS3.4 Explain that many rectangular prisms are possible for a given volume by constructing more than one right rectangular prism for the same given volume.	p. 96
	5SS3.5 Provide a referent for a cubic centimetre, and explain the choice.	p. 98
	5SS3.6 Provide a referent for a cubic metre, and explain the choice.	p. 98
	5SS3.7 Determine which standard cubic unit is represented by a given referent.	p. 98
	5SS3.8 Estimate the volume of a given 3-D object, using personal referents.	p. 98
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]	5SS4.1 Demonstrate that 1 000 millilitres is equivalent to 1 litre by filling a 1 litre container using a combination of smaller containers.	p. 100
	5SS4.2 Determine the capacity of a given container, using materials that take the shape of the inside of the container, and explain the strategy.	p. 100
	5SS4.3 Relate mL and L in problem solving situations.	
	5SS4.4 Provide a referent for a litre, and explain the choice.	p. 102
	5SS4.5 Provide a referent for a millilitre, and explain the choice.	p. 102 p. 102
	5SS4.6 Determine which capacity unit is represented by a given referent.	p. 102
	5SS4.7 Estimate the capacity of a given container, using personal referents.	p. 102

Strand: Shape and Space (3-D Objects and 2-D Shapes)	**General Outcome:** Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
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]	5SS5.1 Identify parallel, intersecting, perpendicular, vertical and horizontal sides on 2-D shapes.	p. 244
	5SS5.2 Identify that perpendicular lines meet to form right angles.	p. 244
	5SS5.3 Describe the sides of a given 2-D shape, using terms such as parallel, intersecting, perpendicular, vertical or horizontal.	p. 246
	5SS5.4 Draw 2-D shapes that have sides that are parallel, intersecting, perpendicular, vertical or horizontal.	p. 246
	5SS5.5 Identify parallel, intersecting, perpendicular, vertical and horizontal edges and faces on 3-D objects.	p. 248
	5SS5.6 Describe the faces and edges of a given 3-D object, using terms such as parallel, intersecting, perpendicular, vertical or horizontal.	p. 250
	5SS5.7 Draw 3-D objects that have edges and faces that are parallel, intersecting, perpendicular, vertical or horizontal.	pp. 250,252
	5SS5.8 Provide examples from the environment that show parallel, intersecting, perpendicular, vertical and horizontal line segments.	p. 252
	5SS5.9 Find examples of edges, faces and sides that are parallel, intersecting, perpendicular, vertical and horizontal in print and electronic media, such as newspapers, magazines and the Internet.	p. 252
5SS6 Identify and sort quadrilaterals, including: • rectangles • squares • trapezoids • parallelograms • rhombi (or rhombuses) according to their attributes. [C, R, V]	5SS6.1 Identify and describe the characteristics of a pre-sorted set of quadrilaterals.	pp. 254,256
	5SS6.2 Sort a given set of quadrilaterals according to the lengths of the sides.	pp. 258,260
	5SS6.3 Sort a given set of quadrilaterals according to whether or not opposite sides are parallel.	pp. 258,260
	5SS6.4 Sort a given set of quadrilaterals, and explain the sorting rule.	pp. 258,260

Strand: Shape and Space (Transformations)	General Outcome: Describe and analyze position and motion of objects and shapes.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
5SS7 Perform a single transformation (translation, rotation or reflection) of a 2-D shape, and draw and describe the image. [C, CN, T, V]	5SS7.1 Translate a given 2-D shape horizontally, vertically or diagonally, and draw and describe the position and orientation of the image.	p. 124
	5SS7.2 Draw a 2-D shape, translate the shape, and record the translation by describing the direction and magnitude of the movement.	p.124
	5SS7.3 Reflect a given 2-D shape in a line of reflection, and describe the position and orientation of the image.	p. 128
	5SS7.4 Draw a 2-D shape, reflect the shape, and identify the line of reflection and the distance of the image from the line of reflection.	p. 128
	5SS7.5 Rotate a given 2-D shape about a vertex, and describe the direction of rotation (clockwise or counter clockwise) and the fraction of the turn (limited to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or full turn).	p. 132
	5SS7.6 Draw a 2-D shape, rotate the shape about a vertex, and describe the direction of the turn (clockwise or counter clockwise), the fraction of the turn (limited to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or full turn) and point of rotation.	p. 132,134
	5SS7.7 Predict the result of a single transformation of a 2-D shape, and verify the prediction.	p. 136
5SS8 Identify and describe a single transformation, including a translation, rotation and reflection of 2-D shapes. [C, T, V]	5SS8.1 Describe a given translation by identifying the direction and magnitude of the movement.	p. 126
	5SS8.2 Describe a given reflection by identifying the line of reflection and the distance of the image from the line of reflection.	p. 130
	5SS8.3 Describe a given rotation about a vertex by the direction of the turn (clockwise or counter clockwise).	p. 134
	5SS8.4 Provide an example of a translation, a rotation and a reflection.	p. 136
	5SS8.5 Identify a given single transformation as a translation, rotation or reflection.	p. 138

Strand: Statistics and Probability (Data Analysis)	General Outcome: Collect, display and analyze data to solve problems.	
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators help determine whether students have met the corresponding specific outcome:*	Page Reference
5SP1 Differentiate between first-hand and second-hand data. [C, R, T, V]	5SP1.1 Explain the difference between first-hand and second-hand data.	pp. 108,110
	5SP1.2 Formulate a question that can best be answered using first-hand data, and explain why.	pp. 110,112
	5SP1.3 Formulate a question that can best be answered using second-hand data, and explain why.	p. 112
	5SP1.4 Find examples of second-hand data in print and electronic media, such as newspapers, magazines and the Internet.	p. 112
5SP2 Construct and interpret double bar graphs to draw conclusions. [C, PS, R, T, V]	5SP2.1 Determine the attributes (title, axes, intervals and legend) of double bar graphs by comparing a given set of double bar graphs.	pp. 114,116
	5SP2.2 Draw conclusions from a given double bar graph to answer questions.	pp. 114,116
	5SP2.3 Provide examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines and the Internet.	p. 116
	5SP2.4 Represent a given set of data by creating a double bar graph, label the title and axes, and create a legend without the use of technology.	p. 118
	5SP2.5 Solve a given problem by constructing and interpreting a double bar graph.	p. 118
5SP3 Describe the likelihood of a single outcome occurring, using words such as: • impossible • possible • certain. [C, CN, PS, R]	5SP3.1 Provide examples of events, from personal contexts, that are impossible, possible or certain.	pp. 266,268
	5SP3.2 Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible or certain.	p. 268
	5SP3.3 Design and conduct a probability experiment in which the likelihood of a single outcome occurring is impossible, possible or certain.	p. 268
	5SP3.4 Conduct a given probability experiment a number of times, record the outcomes, and explain the results.	p. 274
5SP4 Compare the likelihood of two possible outcomes occurring, using words such as: • less likely • equally likely • more likely. [C, CN, PS, R] *p. 228*	5SP4.1 Identify outcomes from a given probability experiment that are less likely, equally likely or more likely to occur than other outcomes.	pp.270,272
	5SP4.2 Design and conduct a probability experiment in which one outcome is less likely to occur than the other outcome.	p. 274
	5SP4.3 Design and conduct a probability experiment in which one outcome is equally likely to occur as the other outcome.	p. 274
	5SP4.4 Design and conduct a probability experiment in which one outcome is more likely to occur than the other outcome.	p. 274

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