Literacy Enrichment and Academic Readiness for Newcomers (LEARN)

CURRICULUM GUIDE
LEARN-2 Mathematics

Newfoundland Labrador
Education

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Acknowledgements

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Acronyms

ELD	English Literacy Development: An ELD student is one who, due to limited prior schooling, has an achievement gap in literacy and numeracy skills. The student is developing the skills needed to integrate into an age-appropriate grade. Most of these students will be ESL students but some may speak a variety of English as their first language.
ESL	English as a Second Language: An ESL student is one whose mother tongue is not English. The student is learning English to live in an English environment.
L1	First Language or Primary Language
L2	Second Language or Secondary Language
LEARN	Literacy Enrichment and Academic Readiness for Newcomers

Introduction

In recent years Canada has accepted a number of Government Assisted Refugees, many of whom have major gaps in formal education. This mathematics curriculum has been designed for a specific student population – immigrant students who have entered our public school system from other countries and have gaps in their education which prevent them from succeeding in an age-appropriate grade level math program.

LEARN-2 Mathematics is a component of the Literacy Enrichment and Academic Readiness for Newcomers (LEARN) Program. The course is intended to prepare newcomers with the skills and strategies necessary for success in high school mathematics. The curriculum is intended to prepare these students to enter the high school mathematics programs in any of our schools.

The course may be offered at the intermediate or senior high school. LEARN-2 Mathematics is designed to permit entry and exit based solely on the student's skill levels, **not** on chronological age or grade placement in our school system. The course is appropriate for a student who has achieved at least a grade 5 math level by provincial standards or has successfully completed LEARN-1 Mathematics.

The course is designed to be delivered in 110 hours. Depending on a student's assessed needs, all or some of the outcomes may be covered.

The LEARN Program Components

The LEARN Program is developed to meet the academic needs of immigrant students with major gaps in literacy and numeracy achievement. These gaps are generally due to a lack of formal schooling.

LEARN-1 consists of two courses, LEARN-1 Language Arts: Basic Literacy and LEARN-1 Mathematics. There is no time frame for these courses but it is recommended that a student enrolled in LEARN-1 should spend at least one hour per day on each of these subjects. At this rate the beginner ESL student, functioning at a K-1 level on entry into the program, should complete LEARN-1 in two academic years. The course descriptions are as follows:

- LEARN-1 Language Arts: Basic Literacy: a non-credit basic literacy course aiming to bring the student to a transitional reading level. Emphasis is on both academic and life skills reading and writing.
- LEARN-1 Mathematics: a non-credit course aimed to bring a student up to a grade 6 math level. Emphasis is on both academic and practical life skills mathematics.

LEARN-2 consists of four high school academic enabling courses:

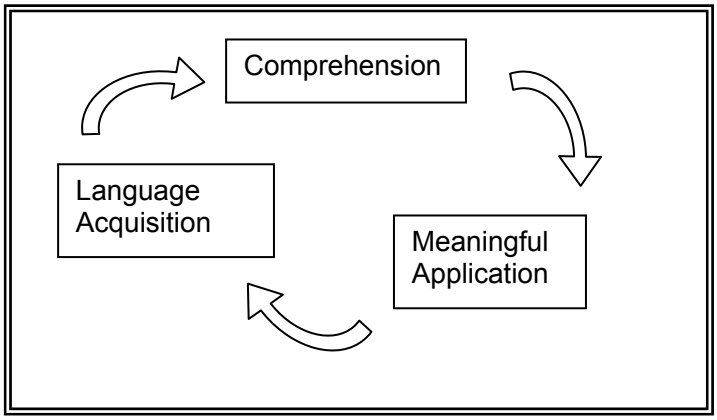
- LEARN-2 Language Arts 701270: a 110 hour academic enabling course that builds skills and strategies for further high school studies in literature and language arts.
- LEARN-2 Mathematics: a non-credit course that covers intermediate outcomes and prepares students for high school mathematics.
- LEARN-2 Social Studies 701172: a 110 hour academic enabling course for further high school social studies. This course focuses on development of literacy skills and strategies within the context of Canadian social studies.
- LEARN-2 Science 701177: a 110 hour academic enabling course for further high school studies in science. This course focuses on the development of science literacy, skills and strategies within the context of earth science, life science and physical science.

Sheltered Instruction

ESL students and students with low literacy levels benefit from being taught in a sheltered environment with a teacher who considers the unique numeracy, literacy and language needs of these students as well as the content area needs. The aim of sheltered instruction (SI) is to help students develop literacy and content skills simultaneously. Sheltered instruction draws largely on good teaching practices and includes specific techniques and strategies to meet the needs of newcomers. It offers a non-threatening learning environment and provides various ways for students to demonstrate knowledge.

Research suggests that students learn a second language best when they are presented with meaningful and relevant comprehensible input. Children learn a first language (L1) through being immersed in that language, regardless of direct instruction. The same is true of young children immersed in a second language. Adolescents and adults can also acquire a language through exposure; however, to reach a high level of academic competency, they need specific techniques, tasks and materials that scaffold language skills and guide language development in an incremental way.

Sheltered instruction combines what we know about natural language acquisition with what we know about developing academic language, skills and knowledge necessary for school success. In SI classes, teachers place equal value on developing both the content area knowledge and the language skills. This follows naturally from approaches to simultaneous language and content development which integrate skills in thematic units. The thematic approach works well with ESL and literacy students as language is recycled and strengthened through different genres and applications.



SI teachers use techniques and resources that make content comprehensible; this is the key to both understanding of the content and development of language.

Many of the techniques used in SI content courses are the same as would be used in any high-quality mainstream classroom: presenting information in a variety of forms, encouraging students to explore and discover, acknowledging different learning styles, strengths and needs, pre-teaching, teaching, follow-up activities for application, review and assessment. Like all students, ESL and literacy students need opportunities to reiterate and strengthen comprehension through discussion and writing activities.

Sheltered classes differ from mainstream classes in the emphasis on language and explicit techniques used to develop language in sheltered classes. Language development techniques can be divided into two related categories: 1) techniques to ensure that input is comprehensible and 2) techniques to ensure that students are developing the four interrelated language skills, reading, writing, listening and speaking.

Making content comprehensible entails that the teacher prepare lessons keeping in mind that the students have a relatively low level of English language and/or English literacy. SI relies less on long, information packed lectures and more on short, plain language explanations coupled with numerous opportunities for students to read and view texts to discover content and language

themselves. Mini-lectures help develop listening skills and present content; however, students also need to develop reading, viewing, speaking, writing and representing skills; thus, they need opportunities to use these in class to access and apply content knowledge. SI avoids the use of dense textbooks and provides texts and materials which present content through simple sentence structures, shorter texts, graphic organizers and visuals.

Sheltered instruction focuses on language needs for classroom and academic success. This means teaching not only the subject specific vocabulary, but also teaching language needed to function in the subject area classroom and to understand academic texts; for example, ESL and literacy students need to learn appropriate language for questioning, confirming and disagreeing. They need language for reporting, describing, writing about processes, following instructions, comparing and contrasting, etc. While much of this is explicitly taught in ESL courses, teachers of sheltered instruction must ensure that students are able to use these language skills in context.

Lesson Plans

Lesson planning for ESL and literacy students requires more focus on language and techniques to make content accessible than would normally be required in the mainstream. Lessons must also provide opportunity for ongoing collection of data about students and their progress.

Sheltered Instruction requires that each lesson have both content and language outcomes. These outcomes should be reached in an integrated fashion. The most convenient approach for a sheltered content area course is to set the content outcomes first and then determine the language outcomes that need to be met for success in the content area or can be met through the lesson. The learning of new vocabulary is an ongoing outcome; however, the content area teaching will also lend itself to reaching other language outcomes.

EXAMPLE of Math Lesson Outcomes:

Content Outcome	Language, Literacy and Numeracy Outcome (embedded in Content)
N13 Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.	Understand vocabulary related to addition and subtraction: *up, down, rise/rose, fall/fell, earn/earned, lose/lost, forwards, backwards, ascend, descend, gain, drop.* Activity: Students work in groups to find the words [MMS7, pp. 56-65] and then list them under two heading: ADD and SUBTRACT.

Sheltered Instruction makes content accessible. Hands-on demonstrations and interactive activities are built into every lesson. For example, when teaching a lesson about forces and motion, be prepared to demonstrate what *force* means by pushing or pulling a book, a chair, etc. to demonstrate how the amount of force needed to move something varies. Students may try pulling and pushing different items and telling which require more force.

Give students ample opportunity to participate in active learning around the content, through group and pair work, as well as through reading and working independently. This approach not only creates autonomous and active learners but offers opportunities for the teacher to assess student learning.

Sheltered Instruction requires ongoing collection of data on the students and assessment of their progress; ways to collect this data and information need to be built into every lesson plan. The students come from various educational, language and cultural backgrounds and bring a wide range of experiences and knowledge to the classroom. Provide opportunities for students to tell or demonstrate what they know and to relate it to their own personal experiences wherever appropriate.

Strategies for Working with ESL Students

Like learning a first language (L1), learning a second language (L2) is a developmental process, usually beginning with a silent period, during which time learners are building receptive language before they are ready to speak. Research has found evidence that the sequence of learning an L2 is very similar to the sequence of learning an L1. For example, people normally begin to acquire present tense forms before past tense forms, statement forms before question forms and, generally speaking, words that hold the most meaning, such as nouns and verbs, before articles and prepositions.

Language development follows a continuum and the key is to expose students to the language that they are ready to absorb. When we speak to beginning language learners we should speak in complete, simple sentences, not mimicking “broken” English. ESL students need to hear clear, standard language that they can understand and gradually acquire.

While a student may acquire day-to-day conversational English relatively quickly, it takes several years and structured ESL focus for students to acquire the level of language needed to reach their potential in academic studies. Acquisition of English may be influenced by the student’s L1. Some students tend to pick up English sounds, grammar and sentence structures more quickly than others. The challenges vary from student to student depending on the L1 and other factors such as age, motivation, confidence and attitude. A student who is literate in another language will benefit from transference of literacy skills; however, students in the LEARN program have limited literacy skills in any language. They will need time and guidance to develop both content and literacy skills.

All students can learn an additional language. This happens best in a non-threatening, comfortable environment where risk-taking is encouraged and emphasis is primarily placed on communication and secondarily on language form.

ESL students will learn English in much the same way that they learned their first language, over time, through exposure to comprehensible input, through meaningful interaction with people who speak the language and as they need it. The teacher’s guidance along the way will help students to reach their potential both in content area understanding and in language development.

The following strategies are suggested:

Classroom Routines

- Gradually introduce and reinforce classroom routines and appropriate school behaviour.
- Print and explain homework assignments clearly and consider the time and resources needed to complete the assigned work; it may take ESL learners much longer to complete certain tasks and/or language tasks may need to be simplified.
- Allow the student a silent period, a period of up to several months to listen and build receptive vocabulary before being expected to speak. Give time for the student to build confidence and familiarity with the sounds of English.
- When the student does speak, use diplomacy in understanding what was said. Do not correct pronunciation or ask for restatement unless you cannot understand what was said. Focus on meaning, not pronunciation or grammar, in spoken language.

- Allow wait time for the student to formulate responses.
- Keep in mind that functioning all day in a second language can be tiring. Give breaks and extended time for completion of work.

Making language and content comprehensible and accessible

- At the beginning of each lesson, provide a clear overview of what will be covered and the expected outcomes or assignments.
- Relate content to the student's background knowledge and personal experience when possible, but tread lightly around sensitive issues.
- Print keywords, page numbers and other important information on the board.
- Print clearly rather than use cursive writing.
- Incorporate demonstrations, models and visuals, such as gestures, props, graphic organizers and charts, to explain or reinforce key ideas.
- Provide models of homework assignments, projects, presentations, test items.
- Monitor teacher talk–avoid slang and colloquial expressions or introduce them gradually in context; speak clearly in simple, plain language, using a normal tone and rate of speed or slightly slower. Enunciate clearly.
- Focus on vocabulary. Consider directing students to new vocabulary and asking them to try to figure out meanings in context before direct teaching or providing a definition.
- Recycle new words and key words. Be sure to repeat the words in several contexts.
- Provide meaningful hands-on activities in class to integrate lesson content.
- Provide meaningful exercises or activities that explicitly teach or reinforce the key vocabulary.
- Check for comprehension–use questions that require one word answers, props and gestures. Encourage students to ask teachers or other students for clarification. Beware; the question, "Do you understand?" is often not answered accurately.
- Allow frequent opportunity for interaction and explanation. If the ESL student has a classmate with the same L1, allow them to discuss and help each other understand the content, using the L1 if they choose.
- Be available for extra support.

Peer Support

- Assign peers who have good communication skills to work with the student.
- Have a classmate ensure that the beginner ESL student is following instructions.

Self-Help and Autonomous Learning

- Encourage student self-assessment; for example, editing written work, correcting errors and highlighting suspected errors.
- Correct errors in grammar and spelling sparingly. Circle errors that you think the student can self-correct and check to ensure that the self-corrections are done.
- Encourage the student to use strategies for language learning, such as noting new words in a text and guessing meaning before checking a dictionary.[1]
- Encourage students to take ownership of their studies; for example, when they have finished an assigned task they should review their work, continue to the next task or read silently. Ensure that appropriate reading materials and activities are available.
- Set up a computer centre with appropriate software or websites bookmarked.
- Set up a listening centre with books and audio recordings.
- Provide simple resources that the student can read independently and that address topics studied in the content areas.

[1] Seek more tips on language learning strategies from an ESL teacher.

Program Design

Learning and Teaching Mathematics

The unifying ideas of the mathematics curriculum suggest quite clearly that the mathematics classroom needs to be one in which students are actively engaged each day in the doing of mathematics. No longer is it sufficient or proper to view mathematics as a set of concepts and algorithms for the teacher to transmit to students. Instead, students must come to see mathematics as a vibrant and useful tool for helping them understand their world and as a discipline which lends itself to multiple strategies, student innovation and, quite often, multiple solutions.

The learning environment will be one in which students and teachers make regular use of manipulative materials and technology and actively participate in discourse and conjecture, verify reasoning and share solutions. This environment will be one in which respect is given to all ideas in which reasoning and sense making are valued above "getting the right answer." Students will have access to a variety of learning resources, will balance the acquisition of procedural skills with attaining conceptual understanding, will estimate routinely to verify the reasonableness of their work, will compute in a variety of ways while continuing to place emphasis on basic mental computation skills and will engage in homework as a useful extension of their classroom experiences.

Meeting the Needs of All Learners

The curriculum stresses the need to deal successfully with a wide variety of equity and diversity issues. Not only must teachers be aware of and adapt instruction to account for differences in student readiness as they enter LEARN-2 Mathematics and as they progress, but they must also remain aware of avoiding gender and cultural biases in their teaching. Ideally, every student should find his/her learning opportunities maximized in the mathematics classroom.

The reality of individual student differences must not be ignored when making instructional decisions. While this curriculum guide presents specific curriculum outcomes for each grade level, it must be acknowledged that all students will not progress at the same pace and will not be equally positioned with respect to attaining any given outcome at any given time.

As well, teachers must understand and design instruction to accommodate differences in student learning styles. Different instructional modes are clearly appropriate, for example, for those students who are primarily visual learners versus those who learn best by doing. Further, the practice of designing classroom activities to support a variety of learning styles must be extended to the assessment realm; such an extension implies the use of a wide variety of assessment techniques.

Connections across the Curriculum

The teacher should take advantage of the various opportunities available to integrate mathematics and other subjects. This integration not only serves to show students how mathematics is used in daily life, but it helps strengthen the students' understanding of mathematical concepts and provides them with opportunities to practice mathematical skills. There are many possibilities for integrating learning experiences—through learning centers, teacher-directed activities, group or independent exploration and other opportune learning

situations. However, it should be remembered that certain aspects of mathematics are sequential and need to be developed in the context of structured learning experiences.

The concepts and skills developed in mathematics are applied in many other disciplines. These include science, social studies, music, technology education, art, physical education and home economics. Efforts should be made to make connections and use examples which apply across a variety of discipline areas. In science, the concepts and skills of measurement are applied in the context of scientific investigations. Likewise, statistical concepts and skills are applied as students collect, present and analyze data. In social studies, measurement is used to read scale on a map, to measure land areas and in various measures related to climatic conditions. As well, students read, interpret and construct tables, charts and graphs in a variety of contexts such as demography. In addition, there are many opportunities to reinforce fraction concepts and operations in music, as well as opportunities to connect concepts such as symmetry and perspective drawings of art to aspects of 2-D and 3-D geometry.

Designing an Instructional Plan

It is important to design an instructional plan for the school year. This plan should reflect the fact that specific curriculum outcomes falling under any given general curriculum outcome should not be taught in isolation. There are many opportunities for connections and integration across the various strands of the mathematics curriculum.

It is often advisable to use pre-testing to determine what students have retained from previous studies relative to a given set of outcomes. In some cases, pre-testing may also identify students who have already acquired skills relevant to the current grade level.

Many topics in mathematics are also addressed in other disciplines, even though the nature and focus of the desired outcome is different. Whenever possible, it is valuable to connect the related outcomes of various disciplines. This can result in an overall savings in time for both disciplines. The most obvious of these connections relate to the use of measurement in science and the use of a variety of data displays in social studies.

Using Calculators

The use of calculators is not recommended when students are learning to apply the basic math operations to new number systems.

Calculators are recommended when patterns are used to develop math concepts and when students are applying learned math concepts in problem solving.

Curriculum Outcomes

Essential Graduation Learnings

Graduates from the public schools of Atlantic Canada are expected to demonstrate knowledge, skills and attitudes in the following Essential Graduation Learnings:

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 as well as 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, mathematical and scientific concepts.

Technical 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 demonstrate understanding and appreciation for the place of belief systems in shaping the development of moral values and ethical conduct.

General Curriculum Outcomes

Strand	General Curriculum Outcome(s)
Numeracy	• Develop number sense.
Patterns and Relations	• Use patterns to describe the world and solve problems. • Represent algebraic expressions in multiple ways.
Shape and Space	• Use direct or indirect measurement to solve problems. • Describe the characteristics of 3-D objects and 2-D shapes and analyze the relationships among them. • Describe and analyze position and motion of objects and shapes.
Statistics and Probability	• Collect, display and analyze data to solve problems. • Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Specific Curriculum Outcomes

Abbreviations used to denote the mathematics strands in this curriculum guide are indicated below.

Number **[N]**

Patterns and Relations **[PR]**
- (i) Patterns **[PR(p)]**
- (ii) Variables and Equations **[PR(v&e)]**

Shape and Space **[SS]**
- (i) Measurement **[SS(m)]**
- (ii) 3-D Objects and 2-D shapes **[SS(3-D,2-D)]**
- (iii) Transformations **[SS(t)]**

Statistics and Probability **[SP]**
- (i) Data Analysis **[SP(da)]**
- (ii) Chance and Uncertainty **[SP(c&u)]**

The following abbreviations are added below each outcome in this curriculum guide to indicate skills a teacher and student will use to master the outcome.

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

The Specific Curriculum Outcomes are cross-referenced with the current (2010) provincial curriculum outcomes. For further elaboration and suggestions for teaching, refer to the provincial mathematics curriculum guides. The code at the end of each specific outcome indicates the grade level, strand and outcome number in the provincial prescribed curriculum.

Reference to Grade 5 and 6 has been included at times to ensure that the student is familiar with the topic that is being developed.

Program Order
This program has been set out by strand to cover the entire intermediate program and although it is important to begin with the Numeracy Strand one would not expect the student to complete the entire Numeracy strand before working on and in some cases completing other strands.

Resources

Teacher and Student resources required for this Mathematics Curriculum

Abbreviations used in the resources column are indicated below.

Pearson	Math Makes Sense 7 – Pro Guide including a DVD and CD. [MMS7PG]
Pearson	Math Makes Sense 7-Student Text [MMS7ST]
Pearson	Math Makes Sense 8 – Pro Guide including a DVD and CD. [MMS8PG]
Pearson	Math Makes Sense 8-Student Text [MMS8ST]
Pearson	Math Makes Sense 9 – Pro Guide including a DVD and CD. [MMS9PG]
Pearson	Math Makes Sense 9-Student Text [MMS9ST]
Saddleback	Math Standards Review 1 (Teacher resource-Black line masters) [MSR1]
Saddleback	Math Standards Review 2 (Teacher resource-Black line masters) [MSR2]

www.sdlback.com

Manipulatives
Manipulative kits authorized for the Grade 7, 8 and 9 prescribed mathematics curriculums.

Websites for teachers and students
www.mathfrog.ca

http://www.statcan.ca/english/edu/teachers.htm

http://www.amathsdictionaryforkids.com/

http://illuminations.nctm.org/ActivitySEarch.aspx

http://www.math-drills.com/

Strand: Numeracy

General Outcome: Develop number sense

Specific Outcome	*Achievement Indicators*
Note: Operations with whole numbers and decimal numbers covered in LEARN-1 N1 [6N9] Explain and apply order of operations, excluding exponents, with and without technology. (whole numbers and decimals) [CN, ME, PS, T]	• Demonstrate and explain with examples why there is a need to have a standardized order of operations. • Apply order of operations to solve multi-step problems with or without technology, e.g., computer, calculator.
Note: These next 6 outcomes will cover operations with positive fractions. N2 [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 involving multiples [PS, R, V]	• Provide an example of a prime number and explain why it is a prime number. • Provide an example of a composite number and explain why it is a composite number. • Sort a given set of prime and composite numbers • Solve a given problem involving factors or multiples.
N3 [7N1] Determine and explain why a number is divisible by 2, 3, 4, 5, 6, 8, 9 or 10 and why a number cannot be divided by 0. [C, R]	• Sort a given set of numbers based on divisibility rules. • Explain using an example why a number cannot be divided by zero.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
N1 [6N6]	*Technology* www.mathfrog.ca for Order of Operations with whole numbers. Grade 6 level [MSR1] page 17 [MM7ST] Sec 3.6 page(s) 108-09
N2 [6N3]	[MSR1] page(s) 22-28
N3 [7N1]	[MM7ST] Sec1.1,1.2 page(s) 6-13

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	***Achievement Indicators***
N4 [5N7] Demonstrate and understanding of fractions by: • Creating sets of equivalent fractions • Comparing fractions with like and unlike denominators [C, CN, PS, R, V]	• Model and explain that equivalent fractions represent the same quantity. • Model simplifying fractions using GCF. • Identify equivalent fractions for a given fraction. • Compare two given fractions with unlike denominators by creating equivalent fractions. • Position a given set of fractions with like and unlike denominators on a number line and explain strategies used to determine the order.
N5 [6N4] Relate improper fractions to mixed numbers. [CN, ME, R, V]	• Demonstrate using models that a given improper fraction represents a number greater than 1. • Express improper fractions as mixed numbers. • Express mixed numbers as improper fractions. • Place a given set of fractions, including mixed numbers and improper fractions, on a number line and explain strategies used to determine position.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
N4 [5N7]	[MMS7ST] Sec 5.2 page(s) 181- 185 Addition operation covered in next outcome. [MSR1] pages59-60
N5 [6N4]	[MMS7ST] Sec 5.3 page(s) 186- 189 Addition operation covered in next outcome. [MSR1] page(s) 60-61

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	***Achievement Indicators***
N6 [7N5] Demonstrate an understanding of adding and subtracting positive fractions and mixed numbers, with like and unlike denominators, concretely, pictorially and symbolically. [C, CN, ME, PS, R, V]	• Determine the sum of two given positive fractions or mixed numbers with like denominators • Determine the difference of two given positive fractions or mixed numbers with like denominators • Determine a common denominator for a given set of positive fractions or mixed numbers. • Determine the sum of two given positive fractions or mixed numbers with unlike denominators. • Determine the difference of two given positive fractions or mixed numbers with unlike denominators. • Simplify the solution to a given problem involving the sum or difference of two positive fractions or mixed numbers. • Solve a given problem involving the sum or difference of two positive fractions or mixed numbers and determine if the answer is reasonable.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
N6 [7N5]	[MMS7ST] Sec 5.2 page(s) 181- 185 [MMS7ST] Sec 5.3 page(s) 186- 189 [MMS7ST] Sec 5.4 page(s) 191- 194 [MMS7ST] Sec 5.5 page(s) 195- 198 [MMS7ST] Sec 5.6 page(s) 199-203 [MMS7ST] Sec 5.7 page(s) 204-208

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	***Achievement Indicators***
N7 [8N6] Demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially and symbolically. [C, CN, ME, PS]	• Model multiplication of a positive fraction by a whole number concretely or pictorially and record the process. • Model multiplication of a positive fraction by a positive fraction concretely or pictorially and record the process. • Model division of a positive fraction by a whole number concretely or pictorially and record the process. • Model division of a positive fraction by a positive fraction concretely or pictorially and record the process. • Generalize and apply rules for multiplying and dividing positive fractions, including mixed numbers. • Solve a given problem involving positive fractions taking into consideration order of operations (limited to problems with positive solutions at this point.)

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
N7 [8N6]	[MMS8ST] Unit 3-Operations with Fractions page(s)103-163

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	*Achievement Indicators*
Note: Next 2 outcomes work on Percent N8 [6N6] Demonstrate an understanding of percent. [C, CN, PS, R, V]	• Explain that "percent" means "out of 100" • Explain that percent is a ratio out of 100. • Express a given percent as a fraction or decimal and visa versa. • Identify and describe percents from real life contexts and record them symbolically.
N9 [7N3] Solve problems involving percents from 1% to 100%. [C, CN, PS, R, T]	• Solve a given problem that involves finding the percent of a number. (e.g. finding tax on an item.) • Determine the answer to a given percent problem where the answer requires rounding and explain why an approximate answer is needed. (e.g. money would be rounded to the hundredths place.)
Note: Next 2 outcomes work on ratio, rate and proportional thinking. N10 [8N4] Demonstrate an understanding of ratio and rate [C, CN, V]	• Express a two-term ratio from a given context in the forms 3:5 or 3 to 5. • Express a part to part ratio as part of a whole fraction, e.g. frozen juice to water: 1 can concentrate to 4 cans of water can be represented as $\frac{1}{5}$, which is the ratio of concentrate to solution, or $\frac{4}{5}$, which is the ratio of water to solution. • Identify and describe ratios and rates from real-life examples and record them symbolically. • Express a given rate using words or symbols, e.g., 20L per 100km or 20L/km. • Express a given ratio as a percent and explain why a rate cannot be expressed as a percent.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
N8 [6N6]	[MSR1] page(s) 82-86
N9 [7N3]	[MMS7ST] Sec 3.8 page(s) 114-116
N10 [8N4]	[MMS8ST] Sec 5.5 page(s) 264-268 Sec 5.6 page(s) 269-273 Sec 5.7 page(s) 279-283 Sec 5.9 page(s) 294-297

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	***Achievement Indicators***
N11 [8N5] Solve problems that involve rates, ratios and proportional thinking. [C, CN, PS, R]	• Explain the meaning of $\frac{a}{b}$ within a given context. • Provide a context in which $\frac{a}{b}$ represents a: Fraction Rate Ratio Quotient Probability (covered later) • Solve a given problem involving rate, ratio or proportional thinking.
Note: These next 3 outcomes will cover operations with integers. N12 [6N7] Demonstrate and understanding of integers, concretely, pictorially and symbolically. [C,CN, R, V]	• Place integers on an extension of a whole number, number line. • Describe contexts in which integers are used, e.g. thermometer, deposits and withdrawals, etc. • Compare two integers using symbols >, <, =, and verify using a number line. • Order a set of integers.
N13 [7N6] Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically. [C, CN, PS, R, V]	• Explain, using concrete models such as integer tiles, that the sum of opposite integers is zero. • Use integer tiles or a number line to add two integers and record the problem and result symbolically. • Use integer tiles or a number line to subtract two integers and record the problem and result symbolically. • Solve a given problem involving the addition and subtraction of integers.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
N11 [8N5]	[MMS8ST] Sec.5.8 page(s) 287-293 Sec 5.10 page(s) 300-306
N12 [6N7]	[MSR1] page(s) 48-49 [MMS7ST] Sec 2.1 page(s) 52-55
N13 [7N6]	[MMS7ST] Sec 2.2 page(s)56-59 [MMS7ST] Sec 2.3 page(s)60-64 [MMS7ST] Sec 2.4 page(s)66-70 [MMS7ST] Sec 2.5 page(s)71-75

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	*Achievement Indicators*
N14 [8N7] Demonstrate an understanding of multiplication and division of integers, concretely, pictorially and symbolically. [C, CN, PS, R, V]	• Model the process of multiplying two integers using concrete materials, patterns or pictorial representations and record the process. • Model the process of dividing two integers using concrete materials, patterns or pictorial representations and record the process. • Solve a given problem involving the division of integers (2-digit by 1-digit) without the use of technology. • Solve a given problem involving the division of integers (2-digit by 2-digit) with the use of technology. • Generalize and apply a rule for determining the sign of the product and quotient of integers. • Solve a given problem involving integers taking into consideration order of operations.
Note: The next 6 outcomes deal with squares, square roots, powers and integral exponent laws. N15 [8N1] Demonstrate an understanding of perfect squares and square roots, concretely, pictorially and symbolically. [C, CN, R, V]	• Represent a perfect square as a square region using materials such as grid paper or square shapes. • Determine the factors of a given perfect square and explain why one of the factors is the square root and the others are not. • Determine the square root of a given perfect square and record it symbolically. • Determine the square of a given number.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
N14 [8N7]	[MMS8ST] Unit 2-Integers. This chapter covers the operations of multiplication and division.
N15 [8N1]	[MMS8ST] Sec 1.1 page(s) 6-10 Sec 1.2 page(s) 11-16 Sec 1.3 page(s) 17-21

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	***Achievement Indicators***
N16 [8N2] Determine the approximate square root of numbers that are not perfect squares(limited to whole numbers) [C,CN,ME, R, T]	• Estimate the square root of a given number that is not a perfect square using the roots of perfect squares as benchmarks. • Approximate the square root of a number using technology.(calculator)
N17 [9N5] Determine the square root of positive rational numbers that are perfect squares. [C, CN, PS, R, T]	• Determine the square root of a given positive rational number and record it symbolically. • Determine a positive rational number given the square root of that positive rational number.
N18 [9N6] Determine the square root of positive rational numbers that are non-perfect squares. [C, CN, PS, R, T]	• Estimate the square root of a given rational number that is not a perfect square using the roots of perfect squares as benchmarks. • Approximate the square root of a given rational number using technology.(calculator)
N19 [9N1] Demonstrate an understanding of powers with integral bases(excluding base 0) and whole number exponents by: • Representing repeated multiplication using powers • Solving problems involving powers. [C, CN, PS, R, T]	• Demonstrate the differences between the exponent and the base by building models of a given power such as 2^3 and 3^2. • Express a given power as a repeated multiplication. • Express a given repeated multiplication as a power. • Explain the role of parentheses in powers by evaluating a given set of powers, e.g. $-2^3, (-2)^3, -2^4$ and $(-2)^4$. • Evaluate powers with integral bases (excluding base 0) and whole number exponents.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
N16 [8N2]	[MMS8ST] Sec 1.4 page(s) 22-27 [MMS8ST] Page 29-Investigating Square Roots with a Calculator
N17 [9N5] This outcome just extends the grade 8 level outcome to rational numbers. The mathematics skills required to complete the outcome are the same. Grade 8 $\sqrt{25} = 5$ $\sqrt{9} = 3$ Grade 9 $\sqrt{\frac{25}{9}} = \frac{5}{3}$	[MMS9ST] Sec 1.1 page(s) 6-13
N18 [9N6] This outcome just extends the grade 8 level outcome to rational numbers. The mathematics skills required to complete the outcome are the same. Grade 8 $\sqrt{21} \doteq 4.6$ because $\sqrt{16} = 4$ and $\sqrt{25} = 5$ Grade 9 $\sqrt{19.7} \doteq 4.6$	[MMS9ST] Sec 1.2 page(s) 14-20
N19 [9N1]	[MMS9ST] Sec 2.1 page(s) 52-57 [MMS9ST] Sec 2.2 page(s) 58-62 [MMS9ST] Sec 2.3 page(s) 63-68

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	***Achievement Indicators***
N20 [9N2] Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents. [C, CN, PS, R, T]	• Explain, using examples, the exponent laws of powers with integral bases(excluding base 0) and whole number exponents: $(a)^0 = 1$ $(a^m)(a)^n = a^{m+n}$ $a^m \div a^n = a^{m-n}, m > n$ $(a^m)^n = a^{mn}$ $(ab)^m = a^m b^m$ $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0$ • Evaluate a given expression by applying the exponent laws.
N21 [9N3] Demonstrate an understanding of rational numbers by: • Comparing and ordering rational numbers • Solving problems that involve arithmetic operations with rational numbers [C, CN, PS, R, T, V]	• Order a given set on rational numbers in decimal and fractional form on a number line. • Solve a given problem involving rational numbers in decimal and fractional form.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
N20 [9N2]	[MMS9ST] Sec 2.4 page(s) 73-78 [MMS9ST] Sec 2.5 page(s) 79-85
N21 [9N3] Using a number line in the classroom where you vary the benchmarks used to order and compare different number sets is an excellent way to develop actual number sense. (A skipping rope attached to the wall works well.) e.g. Given a number line with benchmarks -2, -1, 0, 1, 2 have the students properly place: $\frac{5}{5}, \frac{1}{6}, -\sqrt{4}, 1\frac{3}{4}, -2, 1.75, \frac{7}{4}$, etc.	[MMS9ST] Sec 3.1 page(s) 94-103 [MMS9ST] Sec 3.2 page(s) 106-113 [MMS9ST] Sec 3.3 page(s) 114-121 [MMS9ST] Sec 3.4 page(s) 123-129 [MMS9ST] Sec 3.5 page(s) 130-136

Strand: Numeracy
General Outcome: Develop number sense (cont'd)

Specific Outcome	***Achievement Indicators***
N22 [9N4] Explain and apply order of operations, including exponents, with and without technology. [PS, T] **Note: Students should now be able to apply order of operations to:** • **Whole numbers** • **Decimal numbers** • **Fractions** • **Integers** • **Rational number problems**	Note: First look at order of operations involving exponents. • Solve a problem by applying order of operations without the use of technology. • Solve a problem by applying order of operations with the use of technology.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
N22 [9N4]	[MMS9ST] Sec 3.6 page(s) 137-142

Strand: Patterns and Relations: Patterns

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

Specific Outcome	***Achievement Indicator***
PR(p)1 [7PR1] Demonstrate an understanding of oral and written patterns and their equivalent linear relations. [C, CN, R]	• Formulate a linear relation to represent the relationship in a given oral or written pattern. • Provide a context for a given linear relation that represents a pattern.
PR(p)2 [7PR2] Create a table of values from a linear relation, graph the table of values and analyze the graph to draw conclusions and solve problems. [C, CN, R, V]	• Create a table of values for a given linear relation by substituting values for the variable and graph the result. • Match a given set of linear relations to a given set of graphs. • Match a given set of graphs to a given set of linear relations.
PR(p)3 [8PR1] Graph and analyze two-variable linear relations. [C, ME, PS, R, T, V]	• Construct a graph from the equation of a given linear relation. (Limited to discrete data.) • Describe the relationship between the variables of a given graph.
PR(p)4 [9PR2] Graph linear relations, analyze the graph and interpolate or extrapolate to solve problems. [C, CN, PS, R, T, V]	• Describe the pattern found in a given graph. • Graph a linear relation including horizontal and vertical lines. • Extend a given graph (extrapolate) to determine the value of an unknown element. • Interpolate the approximate value of one variable from a given graph given the value of the other variable.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
PR(p)1[7PR1]	[MMS7ST] Sec 1.4 page(s) 20-24
PR(p)2 [7PR2]	[MMS7ST] Sec 1.5 page(s) 25-28 [MMS7ST] Sec 1.6 page(s) 30-34 [MMS8ST] Sec 6.6 page(s) 351-358
PR(p)3 [8PR1]	[MMS8ST] Sec 6.7 page(s) 359-365
PR(p)4 [9PR2]	[MMS9ST] Sec 4.2 page(s) 164-173 [MMS9ST] Sec 4.3 page(s) 174-180 [MMS9ST] Sec 4.4 page(s) 183-190 [MMS9ST] Sec 4.5 page(s) 191-198

Strand: Patterns and Relations: Variables and Equations

General Outcome: Represent algebraic expressions in multiple ways.

Specific Outcome	***Achievement Indicator***
PR(v&e)1 [7PR4] Explain the difference between an expression and an equation. [C, CN]	• Identify and provide an example of a constant term, a numerical coefficient and a variable in an expression and an equation. • Provide an example of an expression and an equation and explain how they are similar and different.
PR(v&e)2 [7PR5] Evaluate an expression give the value of the variable(s) [CN, R]	• Substitute a value for an unknown in a given expression and evaluate the expression.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
PR(v&e)1 [7PR4]	[MMS7ST] Sec 1.3 page(s) 16-19 [MMS7ST] Sec 1.7 page(s) 35-37
PR(v&e)2 [7PR5]	[MMS7ST] Sec 1.3 page(s) 16-19

Strand: Patterns and Relations: Variables and Equations (cont'd)
General Outcome: Represent algebraic expressions in multiple ways.

Specific Outcome	***Achievement Indicator***
PR(v&e)3 [7PR6] Model and solve problems that can be represented by one-step linear equations of the form $x + a = b,$ concretely, pictorially and symbolically. [CN,PS,R,V]	• Represent a given problem with a linear equation and solve the equation using concrete models, e.g., counters, integer tiles. • Draw a visual representation of the steps required to solve a given linear equation. • Verify the solution to a given linear equation using concrete models and diagrams. • Substitute a possible solution for a variable in a given linear equation into the original linear equation to verify the equality.
PR(v&e)4 [9PR3] Solve problems using linear equations of the form: • $ax = b$ • $\frac{x}{a} = b, a \neq 0$ • $ax + b = c$ • $\frac{x}{a} + b = c, a \neq o$ • $ax = b = cx$ • $a(x + b) = c$ • $ax + b = cx + d$ • $a(bx + c) = d(ex + f)$ • $\frac{a}{x} = b, x \neq 0$ where a, b, c, d, e and f are rational numbers. [C,CN,PS,V]	• Solve a given linear equation symbolically. • Represent a given problem using a linear equation. • Solve a given problem using a linear equation and record the process.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
PR(v&e)3 [7PR6]	[MMS7ST] Sec 1.8 page(s) 38-42
PR(v&e)4 [9PR3]	[MMS7ST] Chapter 6 Equations [MMS8ST] Chapter 6 Sec 6-1 to Sec 6.5 [MMS9ST] Sec 6.1 page(s) 266-274 [MMS9ST] Sec 6.2 page(s) 275-283

Strand: Patterns and Relations: Variables and Equations (cont'd)
General Outcome: Represent algebraic expressions in multiple ways.

Specific Outcome	***Achievement Indicator***
PR(v&e)5 [9PR4] Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem solving context. [C,CN,PS,R,V]	• Translate a given problem into a single variable linear inequality by using the symbols $\geq, >, <, \leq$. • Generalize and apply a rule for multiplying or dividing by a negative number to determine the solution of a given linear inequality. • Graph the solution of a given linear inequality on a number line. • Solve a given problem involving a single variable linear inequality and graph the solution.
PR(v&e)6 [9PR5] Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2). [C,CN,R.V]	• Create a concrete model or pictorial representation for a given polynomial expression. • Identify the variables, degree and number of terms and coefficients, including the constant term, of a given simplified polynomial expression.
PR(v&e)7 [9PR6] Model, record and explain operations of addition and subtraction of polynomial expressions, concretely, pictorially and symbolically (limited to polynomials of degree less than or equal to 2). [C,CN, PS, R,V]	• Model addition of two given polynomial expressions concretely or pictorially and record the process symbolically. • Model subtraction of two given polynomial expressions concretely or pictorially and record the process symbolically.

<table>
<tr><th>Elaboration- Instructional Strategies/Assessment Ideas</th><th>Suggested Resources</th></tr>
<tr><td>PR(v&e)5 [9PR4]</td><td>[MMS9ST] Sec 6.3 page(s) 288-293
[MMS9ST] Sec 6.4 page(s) 294-299
[MMS9ST] Sec 6.5 page(s) 300-306</td></tr>
<tr><td>PR(v&e)6 [9PR5]
Students will use Algebra-tiles to model algebraic expressions and they must be familiar with algebra terminology.

Term e.g. $2a$
2 is the numerical coefficient.
a is the literal coefficient.
In algebra this term $2a$ is called a monomial.

Polynomial – an algebraic expression made up of terms.
<table>
<tr><td>Polynomial</td><td># of terms</td><td>Example</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Monomial</td><td>1</td><td>$2a$</td></tr>
<tr><td>Binomial</td><td>2</td><td>$2a+2b$</td></tr>
<tr><td>Trinomial</td><td>3</td><td>$2a^2-2a+6$</td></tr>
</table>
</td><td>[MMS9ST] Sec 5.1 page(s) 210-216
[MMS9ST] Sec 5.2 page(s) 217-224</td></tr>
<tr><td>PR(v&e)7 [9PR6]</td><td>[MMS9ST] Sec 5.3 page(s) 225-230
[MMS9ST] Sec 5.4 page(s) 231-236</td></tr>
</table>

Strand: Patterns and Relations: Variables and Equations (cont'd)
General Outcome: Represent algebraic expressions in multiple ways.

Specific Outcome	*Achievement Indicator*
PR(v&e)8 [9PR7] Model, record and explain operations of multiplication and division of polynomial expressions, concretely, pictorially and symbolically (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically [C,CN, R,V]	• Model multiplication of a given polynomial expression by a given monomial concretely or pictorially and record the process symbolically. • Model division of a given polynomial expression by a given monomial concretely or pictorially and record the process symbolically.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
PR(v&e)8 [9PR7]	[MMS9ST] Sec 5.5 page(s) 241-248 [MMS9ST] Sec 5.6 page(s) 249-257

Strand: Space and Shape: Measurement

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

Specific Outcome	***Achievement Indicator***
SS(m)1 [6SS1] Demonstrate an understanding of angles by: • identifying angles in the environment • classifying angles according to their measure • estimating the measures of angles using 45^0, 90^0 and 180^0 as reference angles • drawing and labeling angles when the measure is specified. [C,CN,ME,V]	• Classify a given set of angles according to their measure, e.g., acute, right, obtuse, straight, reflex. • Draw and label a specified angle in various orientations using a protractor.
SS(m)2 [6SS2] Demonstrate that the sum of interior angles is: • 180^0 in a triangle • 360^0 in a rectangle [C,R]	• Explain using models that the sum of the interior angles of a triangle is 180^0 and that it is the same for all triangles. • Explain using models that the sum of the interior angles of a quadrilateral is 360^0 and that it is the same for all quadrilaterals.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SS(m)1 [6SS1] Classification of angles Name | Definition acute | $0^0 < \text{angle} < 90^0$ obtuse | $90^0 < \text{angle} < 180^0$ straight | $\text{angle} = 180^0$ right | $\text{angle} = 90^0$ reflex | $180^0 < \text{angle} < 360^0$	[MSR2] page 19
SS(m)2 [6SS2] Hands on Activity Have each student use a ruler to construct a triangle. Do not indicate size or type. Ask students to measure the interior angles of their triangle and then find the sum of the three interior angles. Have students compare their results with others. They should conclude that: The sum of the three interior angles in any triangle is 180^0 This activity can also be used for rectangles. The sum of the four interior angles of any rectangle is 360^0	[MSR2] page 23

Strand: Space and Shape: Measurement (cont'd)
General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome	***Achievement Indicator***
SS(m)3 [6SS1] [7SS1] [8SS3] Develop and apply a formula for determining the: • perimeter of polygons	• Explain using models how the perimeter of any polygon can be found. • Generalize a rule (formula) for finding the perimeter of any polygon. • Generalize a rule (formula) for finding the perimeter of any regular polygon.
	• Explain using models how the area of any rectangle, parallelogram and triangle can be found.
• area of rectangles, parallelograms and triangles	• Generalize a rule (formula) for finding the area of any rectangle, parallelogram and triangle.
	• Explain, using examples, the relationship between the area of 2-D shapes and the surface area of a given 3-D shape.
• surface area of right rectangular prisms and right triangular prisms to solve problems [C,CN,PS,R,V]	• Identify all the faces of a given prism, including right rectangular and right triangular prisms.
	• Describe and apply strategies for determining the surface area of a given right rectangular or right triangular prism
	• Solve a given problem involving perimeter, area or surface area of the shapes identified above

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SS(m)3 [6SS1]	[MST2] page(s) 35-38
SS(m)3 [7SS2]	[MMS7ST] Sec 4.3 page(s) 139-142
SS(m)3 [8SS3]	[MMS7ST] Sec 4.4 page(s) 143-147
	[MMS8ST] Sec 4.3 page(s) 183-187
	[MMS8ST] Sec 4.4 page(s) 188-193

Strand: Space and Shape: Measurement (cont'd)
General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome	***Achievement Indicator***
SS(m)4 [7SS1] Demonstrate an understanding of circles by: • describing the relationships among radius, diameter and circumference of circles • relating circumference to pi • determining the sum of the central angles • solve problems involving the radii, diameters and circumferences of circles. [C,CN,R,V]	• Illustrate and explain that the diameter is twice the radius in a given circle. • Illustrate and explain that the circumference is approximately three times the diameter in a given circle. • Explain that, for all circles, pi is the ratio of the circumference to the diameter $\left(\frac{C}{d}\right)$, and its value is approximately 3.14. • Solve a given contextual problem involving circles.
SS(m)5 [9SS1] Solve problems and justify the solution strategy using the following circle properties: • the perpendicular from the center of a circle to a chord bisects the chord • the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc • the inscribed angles subtended by the same arc are congruent • a tangent to a circle is perpendicular to the radius at the point of tangency. [C,CN,PS,R,T,V]	• Solve a given problem involving application of one or more of the circle properties.
SS(m)6 [7SS2] Develop and apply the formula for determining the area of a circle. [CN,PS,R,V]	• Illustrate and explain how to estimate the area of a circle without using a formula. • Apply a formula for determining the area of a given circle. • Solve a contextual problem involving the area of a circle.
SS(m)7 [8SS3] Determine the surface area of right cylinders to solve problems. [C,CN, PS, R, V]	• Describe and apply strategies for determining the surface area of a right cylinder. • Solve a given problem involving surface area of a right cylinder.
SS(m)8 [8SS4] Develop and apply formulas for determining the volume of right prisms and right cylinders. [C, CN, PS, R, V]	• Determine that the general formula for finding the volume of right prisms and right cylinders is: $V = B \times h$ where B represents the area of the base of the 3-D shape and h represents the height of the 3-D figure. • Apply a formula to solve a given problem involving the volume of a right prism or a right cylinder.

Elaboration- Instructional Strategies/Assessment ideas	***Suggested Resources***
SS(m)4 [7SS1]	[MMS7ST] Sec 4.1 page(s) 130-132 Sec 4.2 page(s) 133-137
SS(m)5 [9SS1]	[MMS9ST] Sec 8.1 page(s) 384-391 [MMS9ST] Sec 8.2 page(s) 392-399 [MMS9ST] Sec 8.3 page(s) 404-412
SS(m)6 [7SS2]	[MMS7ST] Sec 4.5 page(s) 148-152
SS(m)7 [8SS3]	[MMS8ST] Sec 4.7 page(s) 209-214
SS(m)8 [8SS4]	[MMS8ST] Sec 4.5 page(s) 195-200 [MMS8ST] Sec 4.6 page(s) 202-208 [MMS8ST] Sec 4.8 page(s) 215-219

Strand: Space and Shape: Measurement (cont'd)
General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome	***Achievement Indicator***
SS(m)8 [8SS1] Develop and apply the Pythagorean theorem to solve problems. [CN, PS, R, T, V]	• Model and explain the Pythagorean Theorem concretely, pictorially or using technology. • Determine the measure of the third side of a right triangle, given the measures of the other two sides, to solve a problem.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SS(m)8 [8SS1]	[MMS8ST] Sec 1.5 page(s) 31-36 [MMS8ST] Sec 1.6 page(s) 39-45 [MMS8ST] Sec 1.7 page(s) 46-51

Strand: Space and Shape: 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 Outcome	***Achievement Indicator***
SS(3-D,2-D)1 [6SS4] Compare triangles, including: • scalene • isosceles • equilateral • right • obtuse • acute in different orientations. [C, PS, R, V]	• Identify the characteristics of a given set of triangles according to their sides and/or their interior angles. • Replicate a given triangle in a different orientation and show that the two are congruent.
SS(3-D,2-D)2 [5SS3] Identify and recognize parallel lines, perpendicular lines and line segments [CN, R, V]	• Describe examples of parallel line segments, perpendicular line segments, perpendicular bisectors and angle bisectors in the environment.
USEFUL BUT NON-ESSENTIAL: SS(3-D,2-D)3 [6SS5] Describe and compare the sides and angles of regular and irregular polygons. [C, PS, R, V]	• Demonstrate that the sides of a regular polygon are the same length and that the angles of a regular polygon are the same measure. • Sort a given set of polygons as regular or irregular and justify the sorting.

<table>
<tr><th>Elaboration- Instructional Strategies/Assessment Ideas</th><th>Suggested Resources</th></tr>
<tr><td>SS(3-D,2-D)1[6SS4]
Classification of triangles(based on angle measure)
<table><tr><td>Name</td><td>Definition</td></tr><tr><td>acute</td><td>All angles acute</td></tr><tr><td>obtuse</td><td>One angle obtuse</td></tr><tr><td>right</td><td>One angle 90^0</td></tr><tr><td>equiangular</td><td>All three angles 60^0</td></tr></table>
Classification of triangles(based on side length)
<table><tr><td>Name</td><td>Definition</td></tr><tr><td>isosceles</td><td>Two sides equal</td></tr><tr><td>scalene</td><td>All sides different</td></tr><tr><td>equilateral</td><td>All sides equal</td></tr></table></td><td>[MSR2] page 22, page 26.</td></tr>
<tr><td>SS(3-D,2-D)2 [5SS3]</td><td>Only an explanation using models or visuals is necessary.</td></tr>
<tr><td>SS(3-D,2-D)3 [6SS5]
Give students a set of polygons and have them sort them into regular (all sides and interior angles congruent) and irregular groups.
Use triangles as a simple example:
Equilateral triangle-regular polygon
Scalene and isosceles triangles-irregular polygons.</td><td>Only an explanation using models or visuals is necessary.</td></tr>
</table>

Strand: Space and Shape: 3-D Objects and 2-D Shapes (cont'd)
General Outcome: Describe the characteristics of 3-D objects and 2-D shapes and analyze the relationships among them.

Specific Outcome	Achievement Indicator
SS(3-D,2-D)4 [9SS3] Demonstrate an understanding of similarity of polygons. [C,CN,PS,R,V]	• Determine if the polygons of a given set are similar and explain the reasoning. • Solve a given problem that involves a scale diagram by applying the properties of similar triangles.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SS(3-D,2-D)4 [9SS3]	[MMS9ST] Sec 7.3 page(s) 334-342 [MMS9ST] Sec 7.4 page(s) 343-352

Strand: Space and Shape: Transformations

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

Specific Outcome	***Achievement Indicator***
SS(t)1 [7SS4] Identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs. [C, CN, V]	• Label the axes of a four quadrant Cartesian plane and identify the origin. • Draw shapes and designs, using given integral ordered pairs, in a Cartesian plane.
USEFUL BUT NON-ESSENTIAL: SS(t)2 [7SS5] Perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral vertices). [C, CN, PS, T, V]	• Identify the coordinates of the vertices of a given 2-D shape on a Cartesian plane. • Describe the positional change of the vertices of a 2-D shape to the corresponding vertices of its image as a result of a transformation or a combination of successive transformations. • Describe the image resulting from the transformation of a given 2-D shape on a Cartesian plane by identifying the coordinates of the vertices of the image.
SS(t)3 [9SS4] Draw and interpret scale diagrams of 2-D shapes. [CN,R,T,V]	• Draw a diagram to scale that represents an enlargement or reduction of a given 2-D shape. • Determine the scale factor for a given diagram drawn to scale. • Determine if a given diagram is proportional to the original 2-D shape and if it is, state the scale factor.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SS(t)1 [7SS4]	[MMS8ST] Sec 8.5 page(s) 315-319
SS(t)2 [7SS5]	[MMS8ST] Sec 8.6 page(s) 320-324 [MMS8ST] Sec 8.7 page(s) 325-329
SS(t)3 [9SS4]	[MMS9ST] Sec 7.1 page(s) 318-324 [MMS9ST] Sec 7.2 page(s) 325-331

Strand: Statistics and Probability: Data Analysis

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

Specific Outcome	***Achievement Indicator***
SP(da)1 [6SP1] Create, label and interpret line graphs to draw conclusions. [C, CN, PS, R, V]	• Identify common attributes of line graphs (axes, intervals, title.) • Determine whether a given set of data can be represented by a line graph (continuous data) or a series of points (discrete data) and explain why. • Create a line graph from a given table of values or set of data using appropriate scales on the axes.
SP(da)2 [7SP3] Construct, label and interpret circle graphs to solve problems. [C, CN, PS, R, T, V]	• Identify common attributes of circle graphs (title, legend and data as percent with a sum 100%) • Create a display data in a circle graph with and without technology, to display a set of data. Translate percentages displayed in circle graphs into quantities to solve problems.
SP(da)3 [6SP2] Select, justify and use appropriate methods of collecting data including: • questionnaires • experiments • databases • electronic media. [C, PS, T]	• Given a question to answer, determine the best method for collecting the data by determining the pros and cons of each method of data collection.
SP(da)4[9SP1] Describe the effect of: • bias • use of language • ethics • cost • time and timing • privacy • cultural sensitivity on the collection of data. [C, CN, R, T]	• Provide examples to illustrate how bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity may influence data.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SP(da)1 [6SP1] **Discrete data** has only a finite or limited number of possible values. e.g. If you were to graph a pattern of tables and chairs the data would be discrete as values representing half a table or chair would not make sense in the context of the pattern. For discrete data the points on a graph would not be connected. **Continuous data** can have an infinite number of possible values within a given range. e.g. Showing change in water temperature as it is heated would be an example of continuous data. For continuous data points on a graph would be connected.	[MSR2] page(s) 80-81
SP(da)2 [7SP3]	[MMS7ST] Sec 4.6 page(s) 156-160 [MMS7ST] Sec 4.7 page(s) 161-164
SP(da)3 [6SP2] Have students come up with various questions that can be answered by collecting data and have them decide on the best method for collecting the data by weighing the pros and cons of each.	Only discussion on pros and cons of each method is necessary
SP(da)4(9SP1) [9SP1] Using the same questions students came up with in the outcome above (SP(da)3(6) discuss the effects of bias, language etc. on the collection of data.	[MMS9ST] Sec 9.1 page(s) 424-429 [MMS9ST] Sec 9.2 page(s) 431-436

Strand: Statistics and Probability: Data Analysis (cont'd)
General Outcome: Collect, display and analyze data to solve problems.

Specific Outcome	***Achievement Indicator***
SP(da)5 [9SP2] Select and defend the choice of using either a population or a sample of a population to answer a question. [C, CN, PS, R]	• Identify whether a given situation represents the use of a sample or a population. • Decide whether a given situation requires the use of a sample or a population.
SP(da)6 [6SP3] Graph collected data and analyze the graph to solve problems. [C, CN, PS]	• Determine an appropriate type of graph for displaying a set of collected data based of the question being answered. • Solve a given problem by graphing data and interpreting the resulting graph.
SP(da)7 [7SP1] Demonstrate and understanding of central tendency and range by: • determining the measures of central tendency (mean, median, mode) and range • determining the most appropriate measures of central tendency to report findings. [C, PS, R, T]	• Determine the mean, median and mode for a given set of data and explain why these values may be the same or different. • Determine the range of a given set of data. • Given a contextual problem determine which measure of central tendency best represents the solution to the problem.
SP(da)8 [7SP2] Determine the effect on the mean, median and mode when an outlier is included in a data set. [C, CN, PS, R]	• Analyze a set of data to identify any outliers. • Explain the effect of outliers on the measures of central tendency in a given set of data.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SP(da)5 [9SP2] **Population** refers to an entire set of individuals, items or data from which a statistical result is drawn. **Sample** refers to a portion of the population being studied. **Note:** Recognize that students often think that a population only refers to a group of people.	Explain the terms, give examples and then ask for situations that would require only a sample or definitely a population. [MMS9ST] Sec 9.3 page(s) 437-441
SP(da)6 [6SP3] An excellent way to connect math to the real world is to have students complete the **Statistics Canada-Census at School Survey**. Once completed the results can be printed, graphed and interpreted.	http://www.statcan.ca/english/edu/teachers.htm Have students suggest a question, collect the data, graph appropriately and interpret.
SP(da)7 [7SP1]	[MMS7ST] Sec 7.1 page(s) 258-261 [MMS7ST] Sec 7.2 page(s) 262-266
SP(da)8 [7SP2]	[MMS7ST] Sec 7.3 page(s) 267-270 [MMS7ST] Sec 7.4 page(s) 271-275

Strand: Statistics and Probability: Chance and Uncertainty

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

Specific Outcome	***Achievement Indicator***
SP(c&u)1 [6SP4] Demonstrate an understanding of probability by: • identifying all possible outcomes in a probability experiment • differentiating between experimental and theoretical probability • determining the theoretical probability of outcomes in a probability experiment • determining the experimental probability of outcomes in a probability experiment • comparing experimental results with theoretical probability for an experiment. [C, ME, PS, T]	• List the possible outcomes for a probability experiment such as, tossing a coin, rolling a fair die with a given number of faces. • Explain the difference between theoretical and experimental probability. • Demonstrate with a probability experiment that increasing the number of trials in an experiment will give an experimental probability closer to the theoretical probability.
SP(c&u)2 [7SP4] Express probabilities as ratios, fractions and percents. [C, CN, R, T, V]	• Recognize that probability results can be written in words, as ratios, fractions and percents.

Elaboration- Instructional Strategies/Assessment Ideas	***Suggested Resources***
SP(c&u)1 [6SP4]	[MMS7ST] Sec 7.5 page(s) 279-283 [MMS7ST] Sec 7.6 page(s) 284-288
SP(c&u)2 [7SP4]	[MMS7ST] Sec 7.5 page(s) 279-283

Strand: Statistics and Probability: Chance and Uncertainty
General Outcome: use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Specific Outcome	***Achievement Indicator***
SP(c&u)3 [7SP5] Identify the sample space (where the combined sample space has 36 or fewer elements) for a probability experiment involving two independent events. [C, ME, PS]	• Provide an example of two independent events such as tossing a coin and rolling a die and explain why they are independent. • Determine the sample space for two independent events.
SP(c&u)4 [7SP6] Conduct a probability experiment to compare the theoretical probability (determined using a tree diagram, table or other graphic organizer) and experimental probability of two independent events. [C, PS, R, T]	• Determine the theoretical probability of two independent events. • Conduct a probability experiment to determine the outcomes of two independent events and compare the experimental probability to the theoretical probability.
SP(c&u)5 [8SP2] Solve problems involving the probability of two independent events. [C, CN, PS, T]	• Determine the probability of two independent events and generalize a rule for determining the probability of two independent events.

Elaboration- Instructional Strategies/Assessment Idea	***Suggested Resources***
SP(c&u)3 [7SP5]	[MMS7ST] Sec 7.6 page(s) 284-288
SP(c&u)4 [7SP6]	[MMS7ST] Sec 7.6 page(s) 284-288
SP(c&u)5 [8SP2]	[MMS8ST] Sec 7.3 page(s) 407-413 [MMS8ST] Sec 7.4 page(s) 417-422

References

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