Mathematics 38

Southeast Cornerstone School Division # 209

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Introduction: Course Purpose and Description

This course is designed for theme-based instruction, which should enable students to broaden their understanding of mathematics as it is applied in important areas of day-to-day living. There is a need for learning to be meaningful in order to be transferable. Learning mathematics should provide students an opportunity to explore mathematics in their lives.

In this course, emphasis is placed on making informed decisions about finances, home design and maintenance, recreation and personal wellness, and travel and transportation. All mathematics relate to the themes: *Earning and Spending Money, Home, Recreation and Wellness,* and *Travel and Transportation.* Students can draw on their own or others experiences in the workforce to develop and extend their knowledge about earning and spending money. They will also apply mathematics for the purpose of designing, building, and maintaining a home and yard. Students will apply reasoning and problem solving skills to make predictions decisions in recreational and wellness activities. As well, they will investigate and solve problems related to planning a trip.

Broad Areas of Learning

There are three Broad Areas of Learning that reflect Saskatchewan's Goals of Education. K-12 mathematics contributes to the Goals of Education through helping students achieve knowledge, skills, and attitudes related to these Broad Areas of Learning.

Developing Lifelong Learners

Students who are engaged in constructing and applying mathematical knowledge naturally build a positive disposition towards learning. Throughout their study of mathematics, students should be learning the skills (including reasoning strategies) and developing the attitudes that will enable the successful use of mathematics in daily life. Moreover, students should be developing understandings of mathematics that will support their learning of new mathematical concepts and applications that may be encountered within both career and personal interest choices. Students who successfully complete their study of K-12 mathematics should feel confident about their mathematical abilities and have developed the knowledge, understandings, and abilities necessary to make future use and/ or studies of mathematics meaningful and attainable.

In order for mathematics to contribute to this Broad Area of Learning, students must actively learn the mathematical content in the outcomes through using and developing logical thinking, number sense, spatial sense, and understanding of mathematics as a human endeavor (the four goals of K-12 Mathematics). It is crucial that the students discover the mathematics outlined in the curriculum rather than the teacher covering it.

Developing a Sense of Self and Community

To learn mathematics with deep understanding, students not only need to interact with the mathematical content, but with each other as well. Mathematics needs to be taught in a dynamic environment where students work together to share and evaluate strategies and understandings. Students who are involved in a supportive mathematics learning environment that is rich in dialogue are exposed to a wide variety of perspectives and strategies from which to construct a sense of the mathematical content. In such an environment, students also learn and come to value how they, as individuals and as members of a group or community, can contribute to understanding and social well-being through a sense of accomplishment, confidence, and relevance. When encouraged to present ideas representing different perspectives and ways of knowing, students in mathematics classrooms develop a deeper understanding of the mathematics. At the same time, students also learn to respect and value the contributions of others.

Mathematics provides many opportunities for students to enter into communities beyond the classroom by engaging with people in the neighborhood or around the world. By working towards developing a deeper understanding of mathematics and its role in the world, students develop their personal and social identity, and learn healthy and positive ways of interacting and working together with others.

Developing Engaged Citizens

Mathematics brings a unique perspective and way of knowing to the analysis of social impact and interdependence. Doing mathematics requires students to “leave their emotions at the door” and to engage in different situations for the purpose of understanding what is really happening and what can be done. Mathematical analysis of topics that interest students such as trends in climate change, homelessness, health issues (hearing loss, carpal tunnel syndrome, diabetes), and discrimination can be used to engage the students in interacting and contributing positively to their classroom, school, community, and world. With the understandings that students derive through mathematical analysis, they become better informed and have a greater respect for and understanding of differing opinions and possible options. With these understandings, students can make better informed and more personalized decisions regarding roles within, and contributions to, the various communities in which students are members.

Cross-curricular Competencies

The Cross-curricular Competencies are four interrelated areas containing understandings, values, skills, and processes which are considered important for learning in all areas of study. These competencies reflect the Common Essential Learnings and are intended to be addressed in each area of study at each grade level.

Developing Thinking

It is important that, within their study of mathematics, students are engaged in personal construction and understanding of mathematical knowledge. This most effectively occurs through student engagement in inquiry and problem solving when students are challenged to think critically and creatively. Moreover, students need to experience mathematics in a variety of contexts – both real world applications and mathematical contexts – in which students are asked to consider questions such as “What would happen if …”, “Could we find …”, and “What does this tell us?” Students need to be engaged in the social construction of mathematics to develop an understanding and appreciation of mathematics as a tool which can be used to consider different perspectives, connections, and relationships. Mathematics is a subject that depends upon the effective incorporation of independent work and reflection with interactive contemplation, discussion, and resolution.

Developing Identity and Interdependence

Given an appropriate learning environment in mathematics, students can develop both their self-confidence and self-worth. An interactive mathematics classroom in which the ideas, strategies, and abilities of individual students are valued supports the development of personal and mathematical confidence. It can also help students take an active role in defining and maintaining the classroom environment and accept responsibility for the consequences of their choices, decisions, and actions. A positive learning environment combined with strong pedagogical choices that engage students in learning serves to support students in behaving respectfully towards themselves and others.

Developing Literacies

Through their mathematics learning experiences, students should be engaged in developing their understandings of the language of mathematics and their ability to use mathematics as a language and representation system. Students should be regularly engaged in exploring a variety of representations for mathematical concepts and should be expected to communicate in a variety of ways about the mathematics being learned. Important aspects of learning mathematical language is to make sense of mathematics, communicate one’s own understandings, and develop strategies to explore what and how others know about mathematics. The study of mathematics should encourage the appropriate use of technology. Moreover, students should be aware of and able to make the appropriate use of technology in mathematics and mathematics learning. It is important to encourage students to use a variety of forms of representation (concrete manipulatives, physical movement, oral, written, visual, and symbolic) when exploring mathematical ideas, solving problems, and communicating understandings. All too often, it is assumed that symbolic representation is the only way to communicate mathematically. The more flexible students are in using a variety of representations to explain and work with the mathematics being learned, the deeper students’ understanding becomes.

Social Responsibility

As student's progress in their mathematical learning, they need to experience opportunities to share and consider ideas, and resolve conflicts between themselves and others. This requires that the learning environment be constructed by the teacher and students to support respectful, independent, and interdependent behaviors. Every student should feel empowered to help others in developing their understanding, while finding respectful ways to seek help from others. By encouraging students to explore mathematics in social contexts, students can be engaged in understanding the situation, concern, or issue and then in planning for responsible reactions or responses. Mathematics is a subject dependent upon social interaction and, as a result, social construction of ideas. Through the study of mathematics, students learn to become reflective and positively contributing members of their communities. Mathematics also allows for different perspectives and approaches to be considered, assessed for situational validity, and strengthened.

Aims and Goals of K-12 Mathematics

The aim of Saskatchewan's K-12 mathematics program is to help students develop the understandings and abilities necessary to be confident and competent in thinking and working mathematically in their daily activities and ongoing learnings and work experiences. The mathematics program is intended to stimulate the spirit of inquiry within the context of mathematical thinking and reasoning. Defined below are four goals for K-12 mathematics in Saskatchewan. The goals are broad statements that identify the characteristics of thinking and working mathematically.

Goals include:

Logical Thinking

- Through their learning of K-12 mathematics, students will develop and be able to apply mathematical reasoning processes, skills, and strategies to new situations and problems.

Number Sense

- Through their learning of K-12 mathematics, students will develop an understanding of the meaning of, relationships between, properties of, roles of, and representations (including symbolic) of numbers and apply this understanding to new situations and problems.

Spatial Sense

- Through their learning of K-12 mathematics, students will develop an understanding of 2-D shapes and 3-D objects, and the relationships between geometrical shapes and objects and numbers, and apply this understanding to new situations and problems.

Mathematics as a Human Endeavour.

- Through their learning of K-12 mathematics, students will develop an understanding of mathematics as a way of knowing the world that all humans are capable of with respect to their personal experiences and needs.

At every grade level, students' learning should be building towards their attainment of these goals. Within each grade level, outcomes are directly related to the development of one or more of these goals. The instructional approaches used to promote student achievement of the grade level outcomes must, therefore, also promote student achievement with respect to the goals.

Critical Characteristics of Mathematics Education

The following sections highlight some of the different facets for teachers to consider in the process of changing from "covering" to supporting students in "discovering" mathematical concepts. These facets include:

- the seven mathematical processes
- the difference between covering and discovering mathematics
- the development of mathematical terminology
- First Nations and Métis learners and mathematics
- critiquing statements
- the concrete to abstract continuum
- modelling and making connections
- the role of homework
- the importance of ongoing feedback and reflection.

Mathematical Processes

This Mathematics 38 course recognizes seven processes inherent in the teaching, learning, and doing of mathematics. These processes focus on: communicating, making connections, mental mathematics and estimating, problem solving, reasoning, and visualizing, along with using technology to integrate these processes into the mathematics classroom to help students learn mathematics with deeper understanding.

The outcomes in mathematics should be addressed through the appropriate mathematical processes as indicated by the bracketed letters following each outcome. During planning, teachers should carefully consider those processes indicated as being important to supporting student achievement of the respective outcomes.

Communication [C]

Students need opportunities to read about, represent, view, write about, listen to, and discuss mathematical ideas using both personal and mathematical language and symbols. These opportunities allow students to create links among their own language,

ideas, prior knowledge, the formal language and symbols of mathematics, and new learning.

Communication is important in clarifying, reinforcing, and adjusting 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, but only when they have had sufficient experience to develop an understanding of that terminology.

Concrete, pictorial, physical, verbal, written, and mental representations of mathematical ideas should be encouraged and used to help students make connections and strengthen their understandings.

Connections [CN]

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

The brain is constantly looking for and making connections. Learning mathematics within contexts and making connections relevant to learners can validate past experiences and prior knowledge, and increase students' willingness to participate and be actively engaged.

Mental Mathematics and Estimation [ME]

Mental mathematics is a combination of cognitive strategies that enhance flexible thinking and number sense. It is calculating mentally and reasoning about the relative size of quantities without the use of external memory aids. Mental mathematics enables students to determine answers and propose strategies without paper and pencil. It improves computational fluency and problem solving by developing efficiency, accuracy, and flexibility.

Estimation is a strategy for determining approximate values of quantities, usually by referring to benchmarks or using referents, or for determining the reasonableness of calculated values. When estimating, students need to know what strategy to use, when to use it, and how to use it.

Estimation is used to make mathematical judgements and develop 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. When students encounter new situations and respond to questions of the type, “How would you ...?”, “Can you ...?”, or “What if ...?”, the problem solving approach is being modelled. Students develop their own problem-solving strategies by being open to listening, discussing, and trying different strategies.
In order for an activity to be problem-solving based, it must ask students to determine a way to get from what is known to what is sought. If students are given ways to solve the problem, it is not problem solving 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 and creative solutions. Creating an environment where students actively look for and engage in finding a variety of strategies for solving problems empowers students to explore alternatives and develops confidence, reasoning, and mathematical creativity.

Reasoning [R]

Mathematical reasoning helps students think logically and make sense of mathematics. Students need to develop confidence in their abilities to reason and explain their mathematical thinking. Meaningful inquiry challenges students to think and develop a sense of wonder about mathematics.

Mathematical experiences in and out of the classroom should provide opportunities for students to engage in inductive and deductive reasoning. Inductive reasoning occurs when students explore and record results, analyze observations, make generalizations from patterns, and test these generalizations. Deductive reasoning occurs when students reach new conclusions based upon what is already known or assumed to be true.

Visualization [V]

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 sense, spatial sense, and logical thinking. Number visualization occurs when students create mental representations of numbers and visual ways to compare those numbers.

Technology [T]

Technology tools contribute to student achievement of a wider range of mathematics outcomes, and enable students to explore and create patterns, examine relationships, test conjectures, and solve problems. Calculators, computers, and other forms of 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 and test properties
- develop personal procedures for mathematical operations
- create geometric displays
- simulate situations
- develop number sense
- develop spatial sense
- develop and test conjectures.

Technology contributes to a learning environment in which the growing curiosity of students can lead to rich mathematical discoveries at all grade levels. It is important for students to understand and appreciate the appropriate use of technology in a mathematics classroom. It is also important that students learn to distinguish between when technology is being used appropriately and when it is being used inappropriately. Technology should never replace understanding, but should be used to enhance it.

Discovering versus Covering

Teaching mathematics for deep understanding involves two processes: teachers covering content and students discovering content. Knowing what must be covered and what can be discovered is crucial in planning for mathematical instruction and learning. The content that needs to be covered (what the teacher needs to explicitly tell the students) is the social conventions or customs of mathematics. This content includes things such as what the symbol for an operation looks like, mathematical terminology, and conventions regarding recording of symbols and quantities.

The content that can and should be discovered by students is the content that can be constructed by students based on their prior mathematical knowledge. This content includes things such as strategies, processes, and rules, as well as the students' current and intuitive understandings of quantity, patterns, and shapes. Any learning in mathematics that is a consequence of the logical structure of mathematics can and should be constructed by students.

Development of Mathematical Terminology

Part of learning mathematics is learning how to communicate mathematically. Teaching students mathematical terminology when they are learning for deep understanding requires that the students connect the new terminology with their developing mathematical understanding. As a result, it is important that students first linguistically engage with new mathematical concepts using words that are already known or that make sense to students.

First Nations and Métis Learners and Mathematics

Teachers must recognize that First Nations and Métis students, like all students, come to mathematics classes with a wealth of mathematical understanding. Within these mathematics classes, some First Nations and Métis students may develop a negative sense of their ability in mathematics and, in turn, do poorly on mathematics assessments. Such students may become alienated from mathematics because it is not taught in relation to their schema, cultural and environmental context, or real life experiences.

A first step in the actualization of mathematics from First Nations and Métis perspectives is empowering teachers to understand that mathematics is not acultural. As a result, teachers realize that the traditional Western European ways of teaching mathematics also are culturally biased. These understandings will support the teacher in developing First Nations and Métis students' personal mathematical understanding and mathematical self-confidence and ability through a more holistic and constructivist approach to teaching. Teachers need to pay close attention to those factors that impact the success of First Nations and Métis students in mathematics: cultural contexts and pedagogy.

Teachers must recognize the influence of cultural contexts on mathematical learning. Educators need to be sensitive to the cultures of others as well as to how their own cultural background influences their current perspective and practice. Mathematics instruction focuses on the individual parts of the whole understanding, and as a result, the contexts presented tend to be compartmentalized and treated discretely. This focus on parts may be challenging for students who rely on whole contexts to support understanding.

Mathematical ideas are valued, viewed, contextualized, and expressed differently by cultures and communities. Translation of these mathematical ideas among cultural groups cannot be assumed to be a direct link. Teachers need to support students in uncovering these differences in ways of knowing and understanding within the mathematics classroom. Various ways of knowing need to be celebrated to support the learning of all students.

Along with an awareness of students' cultural context, pedagogical practices also influence the success of First Nations and Métis students in the mathematics classroom. Mathematical learning opportunities need to be holistic, occurring within social and cultural interactions through dialogue, language, and the negotiation of meanings. Constructivism, ethnomathematics, and teaching through an inquiry approach are supportive of a holistic perspective to learning. In addition, they also allow students to enter the learning process according to their ways of knowing, prior knowledge, and learning styles. As well, ethnomathematics demonstrates the relationship between mathematics and cultural anthropology.

Individually and as a class, teachers and students need to explore the big ideas that are foundational to this course and investigate how those ideas relate to themselves personally and as a learning community. Mathematics learned within contexts that focus on the day-to-day activities found in students' communities support learning by providing a holistic focus. Mathematics needs to be taught using the expertise of Elders and the local environment as educational resources. The variety of interactions that occur among students, teachers, and the community strengthens the learning experiences for all.

Critiquing Statements

One way to assess students' depth of understanding of an outcome is to have the students critique a general statement which, on first reading, may seem to be true or false. By having students critique such statements, the teacher is able to identify strengths and deficiencies in students' understanding. Some indicators in this course are examples of statements that students can analyze for accuracy.

Critiquing statements is an effective way to assess students individually, as a small group, or as a large group. When engaged as a group, the discussion and strategies that emerge not only inform the teacher, but also engage all of the students in a deeper understanding of the topic.

The Concrete to Abstract Continuum

It is important, in learning mathematics, that students be allowed to explore and develop understandings by moving along a concrete to abstract continuum. As understanding develops, this movement along the continuum is not necessarily linear. Students may at one point be working abstractly but when a new idea or context arises, they need to return to a more concrete starting point. Therefore, teachers must be prepared to engage students at different points along the continuum.

In addition, what is concrete and what is abstract is not always obvious and can vary according to the thinking processes of the individual. As well, teachers need to be aware that different aspects of a task might involve different levels of concreteness or abstractness.

Models and Connections

New mathematics is continuously developed by creating new models as well as combining and expanding existing models. Although the final products of mathematics are most frequently represented by symbolic models, their meaning and purpose is often found in the concrete, physical, pictorial, and oral models and the connections between them.

To develop a deep and meaningful understanding of mathematical concepts, students need to represent their ideas and strategies using a variety of models (concrete,

physical, pictorial, oral, and other symbolic models). In addition, students need to make connections between the different representations. These connections are made by having the students try to move from one type of representation to another (how could you represent what you've done here using mathematical symbols?) or by having students compare their representations with others in the class. In making these connections, students should be asked to reflect upon the mathematical ideas and concepts that are being used in their new models.

Role of Homework

The role of homework in teaching for deep understanding is important. Students should be given unique problems and tasks that help to consolidate new learnings with prior knowledge, explore possible solutions, and apply learning to new situations. Although drill and practice does serve a purpose in learning for deep understanding, the amount and timing of drill will vary among different learners. In addition, when used as homework, drill and practice frequently causes frustration, misconceptions, and boredom to arise in students.

Ongoing Feedback and Reflection

Ongoing feedback and reflection, both for students and teachers, are crucial in classrooms when learning for deep understanding. Deep understanding requires that both the teacher and students need to be aware of their own thinking as well as the thinking of others.

Feedback from peers and the teacher helps students rethink and solidify their understandings. Feedback from students to the teacher gives much needed information to teacher's planning for further and future learnings.

Self-reflection, both shared and private, is foundational to students developing a deep understanding of mathematics. Through reflection tasks, students and teachers come to know what it is that students do and do not know. It is through such reflections that not only can a teacher make better informed instructional decisions, but also that a student can set personal goals and make plans to reach those goals.

Teaching and Learning Guidelines

The teacher of a Mathematics 38 course should:

- Choose themes and topics from the curriculum appropriate to student background, interests, and motivation.
- Individual student ability should be taken into consideration when designing learning programs as often in Alternate Education student learning is individualized to meet individual needs and abilities. Student strengths and needs must be considered when planning.

- Identify the appropriate teaching/learning and assessment/evaluation strategies to help students achieve the outcomes.
- Use resources that best suit students' competencies and interests, and include both print and web-based resources.
- Plan the delivery of the themes, using the support materials as a guideline, to provide students with a variety of learning experiences that focus on active learning, understanding, and engagement.

Students in an Alternate course typically benefit from instruction that:

- Provides students with a clear overview of the course, each unit of study, and expectations.
- Provides students with activities that involve developing critical thinking and decision-making skills.
- Helps students organize new knowledge, understand the relationships among the new knowledge, and connect it to knowledge already learned.
- Helps students understand where they have been, where they are now, and where they are going in the learning process (Lenz, 2000).
- Diagnoses the students' current understanding and skill level.
- Identifies and builds on student's prior knowledge.
- Differentiates what students will learn in order to achieve the outcomes and teaches the prerequisite skills if they are missing.
- Differentiates the instructional approach and instructional groups (alone, pairs, small group, total group).
- Structures individual lessons in a systematic and organized manner, and presents course content in a structured manner.
- Integrates technology and uses a variety of resources.
- Uses current and local information to promote relevance.
- Models and uses scaffolded instructional strategies.
- Teaches students strategies that are specific to particular learning tasks.
- Provides enough guidance and practice so that students can master the strategies.
- Teaches students self-management, self-reflection, and self-regulation strategies to assist students in accomplishing tasks.
- Provides timely and constructive feedback to students.
- Provides assessment criteria for tasks to students.
- Bases students' assessment and evaluation on the knowledge, skills, and strategies that help students achieve the outcomes.
- Uses the information obtained from assessment and evaluation to individualize and inform upcoming instruction.
- Shares assessment and evaluation information (e.g., rubrics, checklists, etc.) with students before those items are used, to help students track personal growth and set learning goalls.

Adaptive Dimension

The Adaptive Dimension refers to the concept of teachers making adjustments to any or all of the following variables: learning environment, instruction, assessment and resources.

Adjustments to learning environments, instruction delivery, and assessment of student learning and use of resources are designed to meet the diverse needs of students. Adaptive dimension emphasises and supports students learning while taking into account their strengths, interests, needs, backgrounds, life, experiences and motivations. While making adaptations curricular outcomes do not change.

Support for teachers utilizing the Adaptive Dimension can be found within the Adaptive Dimension document developed by the Ministry of Education (2017).

Questions for Inquiry

Inquiry learning provides students with opportunities to build knowledge, abilities, and inquiring habits of mind that lead to deeper understanding of their world and human experience. The inquiry process focuses on the development of compelling questions, formulated by teachers and students, to motivate and guide inquiries into topics, problems, and issues related to curriculum content and outcomes.

Inquiry is more than a simple instructional method. It is a philosophical approach to teaching and learning, grounded in constructivist research and methods, which engages students in investigations that lead to disciplinary and transdisciplinary understanding.

Inquiry builds on students' inherent sense of curiosity and wonder, drawing on their diverse backgrounds, interests, and experiences. The process provides opportunities for students to become active participants in a collaborative search for meaning and understanding.

Students who are engaged in inquiry:

- construct deep knowledge and deep understanding rather than passively receiving it
- are directly involved and engaged in the discovery of new knowledge
- encounter alternative perspectives and conflicting ideas that transform prior knowledge and experience into deep understanding
- transfer new knowledge and skills to new circumstances
- take ownership and responsibility for their ongoing learning and mastery of curriculum content and skills.

(Adapted from Kuhlthau & Todd, 2008, p. 1)

Inquiry learning is not a step-by-step process, but rather a cyclical process, with various phases of the process being revisited and rethought as a result of students' discoveries, insights, and construction of new knowledge.

Inquiry prompts and motivates students to investigate topics within meaningful contexts. The inquiry process is not linear or lock- step, but is flexible and recursive. Experienced inquirers move back and forth through the cyclical process as new questions arise and as students become more comfortable with the process.

Well-formulated inquiry questions are broad in scope and rich in possibilities. They encourage students to explore, gather information, plan, analyze, interpret, synthesize, problem solve, take risks, create, conclude, document, reflect on learning, and develop new questions for further inquiry.
In mathematics, inquiry encompasses problem solving. Problem solving includes processes to get from what is known to discover what is unknown. When teachers show students how to solve a problem and then assign additional problems that are similar, the students are not problem solving but practising. Both are necessary in mathematics, but one should not be confused with the other. If the path for getting to the end situation has already been determined, it is no longer problem solving. Students too must understand this difference

Introduction of Outcomes and Indicators

The outcomes in the Mathematics 38 course are based upon the students' prior learning and continue to develop their number sense, spatial sense, logical thinking, and understanding of mathematics as a human endeavour. These learning experiences prepare students to be confident, flexible, and capable with their mathematical knowledge in new contexts.

Outcomes describe the knowledge, skills, and understandings that students are expected to attain by the end of a particular grade. The mathematical knowledge and skills acquired through this course will be useful to students in many applications throughout their lives in both work and non-work settings.

Indicators are included for each of the outcomes in order to clarify the breadth and depth of learning intended by the outcome. New and combined indicators, which remain within the breadth and depth of the outcome, can and should be created by teachers to meet the needs and circumstances of their students and communities.

Mathematical Processes:

- Communication (C)
- Connections (CN)
- Mental Mathematics and Estimation (ME)
- Problem Solving (PS)

- Reasoning (R)
- Visualization (V)
- Technology (T)

Outcomes and Indicators

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.1 Extend understanding of arithmetic operations to rational numbers to solve problems within the home, money, recreation, and travel themes.	a. Compare and order positive and negative numbers, using appropriate tools (e.g., change in temperature using a thermometer).
	b. Apply arithmetic operations to whole numbers, integers, fractions, decimals, and percent.(using calculators, apps, computers etc..)
[C, CN, ME, R, V]	c. Compare and convert among fractions**,** decimals and percent concretely, pictorially, and symbolically.(using calculators, apps, computers etc..)
	d. Determine rounding of decimals to the nearest unit, tenth and hundredth (e.g., calculations with money rounding to 2 decimal places).

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.2 Demonstrate understanding of data collection and analysis within the home, recreation, and	a. Read and interpret graphs (e.g., line graph, broken-line graph, bar graph, histogram, circle graph) obtained from various sources (e.g., newspapers, magazines, Statistics Canada

travel themes. **[C, CN, PS, R, V, T]**	website) and communicate information represented in relation to real life situations (e.g., weight, weight training programs, box scores for sports, nutrition, sleep, physical activity, sporting events, and travel). b. Collect data from primary sources (e.g., surveys, questionnaires, experiments, interviews) or from secondary sources (e.g., Internet databases, newspapers, magazines). c. Represent data using graphs (e.g., line graph, broken-line graph, bar graph, histogram, circle graph) using a variety of tools (e.g., dynamic statistical software, graphing calculator, spreadsheet) and justify the type of graph chosen. d. Describe and analyze situations in which data has been collected. (e.g., target heart rates, weather patterns and predictions, sports scores).

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.3 Demonstrate understanding of measurement in the Système International (metric) and Imperial System within the home and travel themes. **[C, CN, ME, T, V]**	*It is intended that students explore, analyze for patterns, and develop understanding of many units in the systems of measurements. The units used should be those that are appropriate to the context being considered. These units include:* • *metres, grams, litres, and seconds along with appropriate prefixes such as kilo, centi, and milli, and degrees Celsius (SI system).* • *inch, foot, mile, teaspoon, tablespoon, cup, pint, quart, gallon, and degrees Fahrenheit (Imperial system).* a. Determine and explain the lengths of common objects in the metric and imperial systems, using a variety of tools (e.g., measuring tape, metre or yard stick, measuring cups, graduated cylinders, trundle wheel).

b. Develop, explain, and apply strategies to estimate quantities (e.g., books in a shelving unit, time to complete a job, people in a crowd).

c. Determine and explain the mathematics related to time including:
   - converting units of time measure
   - 24-hour clock
   - time zones
   - flight arrival and departure times
   - elapsed time.

d. Convert measures within and between systems (e.g., centimeters and metres, feet and inches, pounds and kilograms, degrees Celsius and degrees Fahrenheit) using a variety of tools (e.g., tables, calculators, online conversion tools) and relate to real life situations.

e. Discuss and approximate measures between systems (e.g., 1 inch is approximately 2.5 cm, 1 kg is a little more than 2 lbs, 1 litre is approximately $\frac{1}{4}$ US gallon).

f. Describe the situations in which SI and/or Imperial units of measurement are used.

g. Estimate, measure, and calculate perimeters, areas of rectangles, triangles, circles, and of related composite shapes (e.g. wall paper borders, fencing, baseboards, wall space to be painted, floors to be covered, square footage of a living space, laying sod, patio slabs, floor tiles, wall paper).

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.4 Demonstrate understanding of angles to solve problems within the home theme. **[C, ME, PS, T, V]**	a. Identify personal references for angles measuring 22.5°, 30°, 45°, 60°, 90°, and 180° and use them to estimate angle measurements (e.g., a corner of a sheet of paper is 90° so ½ of a corner is 45°). b. Explain, using home construction examples (e.g., mitre cuts, framing, window and door casings, trusses, tile installations, crown moulding), how to measure angles in different orientations using a variety of instruments (e.g., protractor, carpenter's square, and dynamic software). c. Explain and illustrate how angles can be replicated and drawn (e.g., Mira, protractor, compass and straightedge, carpenters square and dynamic software). d. Identify, classify, and sketch angles of various measures, including acute, right, straight, obtuse, and reflex angles.

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.5 Demonstrate understanding of the Pythagorean Theorem to solve problems within the home theme.	a. Model, including the use of drawings, concrete materials, and technology, the meaning, role, and use of the Pythagorean Theorem, using examples and non-examples. b. Apply the Pythagorean 3:4:5 ratios to determine if

[C, CN, PS, V, T]

angles are square (right angles) in home construction contexts.

c. Apply the Pythagorean Theorem to solve for a missing side that has an irrational solution

d. Estimate the values of irrational numbers using a table of perfect squares, multiplication chart, or a number line and show appropriate rounding of irrational numbers.

e. Observe and analyze the use of Pythagorean lengths of diagonals of various building structures (e.g., trusses, frames, door jambs, window casings).

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.6 Demonstrate understanding of proportional reasoning within the home, money, recreation, and travel themes. **[CN, ME, PS, R, T]**	a. Explain and apply strategies to solve ratio and rate problems. b. Recognize and represent equivalent rates and ratios. c. Calculate and compare the unit rate of items and the unit cost of items (e.g., heart rates in various situations, walking speed, rate of pay, cost per linear foot). d. Calculate and compare costs of items (e.g., lodgings, transportation, recreation fees, cellular mobile phone plans). e. Estimate and calculate conversions between Canadian and American currency using proportional reasoning. f. Identify and describe applications of proportional reasoning (e.g., applying fertilizers, mixing gasoline and oil for use in small engines, estimating cooking time needed per pound, determining the fiber content of different sizes of food servings, calculating overtime pay).

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.7 Demonstrate understanding of income. **[C, CN, R, T]**	a. Gather, interpret, and describe various remuneration methods of earning income (e.g., hourly rate, overtime rate, job or project rate, commission, salary, gratuities) and remuneration schedules (e.g., weekly, biweekly, semimonthly, monthly). b. Research and record jobs that commonly use different remuneration methods of earning income (e.g., hourly wage, wage and tips, salary, commission, contract, piecework, bonus, and shift premiums). c. Describe the advantages and disadvantages for various remuneration methods of earning income (e.g., hourly wage, tips, piecework, salary, commission, contract work, and self-employment). d. Solve problems and make decisions involving different remuneration methods and schedules. e. Analyze and complete timesheets. f. Explain and assess the information provided on pay stubs. g. Determine gross pay for different situations, including base hourly wage, with and without tips, from given or calculated hours worked base hourly wage, plus overtime (time and a half, double time) from given or calculated hours worked base wage, plus commission, single commission rate and graduated commission. h. Gather, interpret, and describe information about government payroll deductions (e.g., CPP, EI, income tax) and other payroll deductions (e.g., contributions to pension plans other than CPP; union dues; charitable donations; benefit-plan

contributions).

i. Estimate and compare, using current data (e.g., federal tax tables), the percent of total earnings deducted through government payroll deductions for various benchmarks (e.g., $15 000, $20 000, $25 000).

j. Describe the relationship between gross pay, net pay, and payroll deductions (e.g., net pay is gross pay less government payroll deductions and any other payroll deductions), and estimate net pay in various situations.

k. Investigate, with or without technology "what if …" questions related to changes in income. (e.g., "What if there is a change in the rate of pay?" "What if there is a change in the method of earning income?" "What if I can qualify for deductions?" "What if I work 80% time instead of full time?" "What if I am sick for a long period of time?" "What if an athlete earned one million dollars last year, then how many hours would I have to work to earn that much money?").

Goals: Number Sense, Logical Thinking, Spatial Sense, Mathematics as a Human Endeavour

Outcomes	Indicators
M38.8 Demonstrate understanding of responsible spending habits. **[C, CN, ME, PS, R, T]**	a. Identify and justify personal expenses (e.g., mobile phone, vehicle, electronics, recreation, travel, home renovations, and aesthetics). b. Explain considerations made when prioritizing spending money (e.g., recurring expenses and unexpected opportunities). c. Estimate the cost and justify affordability of a desired purchase. d. Determine PST and GST on purchases and discuss exemptions. e. Create a personal spending log over a set period

of time and explain the advantages.

f. Compare and contrast the cost of purchasing items or services at various vendors.

g. Compare various sales incentives (e.g., “Group on”, percent discounts, pre-sale gift with purchase, reward zone points, buy 1, and get 1 . . . (BOGO)) and discuss the value of estimating.

h. Research and report on the estimated costs involved in a large expense (e.g., a trip, home renovation, or an activity or sport).

Resources:

Grade Three Saskatchewan Online Curriculum

Grade Four Saskatchewan Online Curriculum

Grade Five Saskatchewan Online Curriculum

Grade Six Saskatchewan Online Curriculum

Grade Seven Saskatchewan Online Curriculum

Grade Eight Saskatchewan Online Curriculum

Grade Nine Saskatchewan Online Curriculum

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