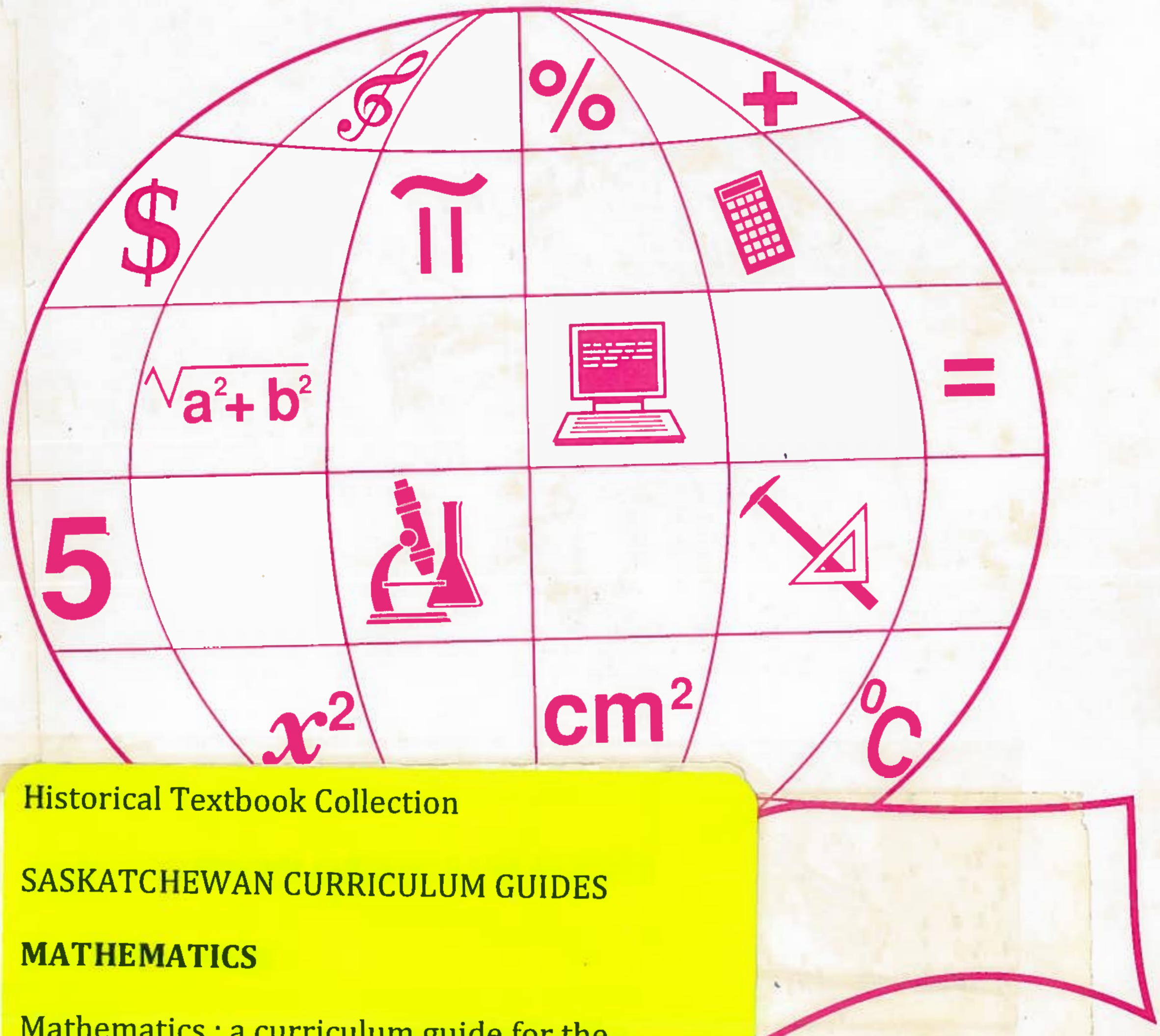
Saskatchewan
Education,
Training and
Employment

Mathematics
A Curriculum Guide for the Elementary Level



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Saskatchewan Education
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Acknowledgements

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Table of Contents

Organization of the Guide

The Elementary Mathematics Curriculum Guide is to be used by teachers of grades 1-5 in Saskatchewan. It presents a relatively detailed plan to direct and assist the teaching of Elementary Mathematics. Kindergarten teachers are also encouraged to refer to this curriculum in order to understand the important concepts, processes, and approaches in mathematics, and to integrate them, as appropriate, when planning their kindergarten programs.

This Guide is divided into seven sections.

The **Introduction to the Curriculum** contains statements about the important initiatives surrounding the teaching of Elementary Mathematics.

The second section, **Evaluation**, is a summary of the types, phases, principles, and focuses of evaluation, and presents an assortment of student assessment instruments.

Section three contains the **Scope and Sequence**. Here the student learning objectives for grades (K)1-5 are listed and coded.

In **Strand Overviews**, the fourth section, student learning objectives are presented by grade level and for easy cross reference, are identically coded to those in the Scope and Sequence. Examples or activities are given for each objective together with suggested manipulatives and resources, and corresponding instructional notes.

Section five outlines suggestions for **Planning Units** and includes a sample **Model Unit** for each grade level.

Projects which can challenge students individually, in groups, or as a whole class are suggested in section six.

Lastly, the **Glossary** defines the mathematical terminology used in this Guide.

Introduction to the Curriculum

"Learning is limitless for learners who can solve problems."

- Shirley M. Frye, Past President
National Council of Teachers of Mathematics

Mathematics Program Philosophy, Aim, and Goals (K-12)

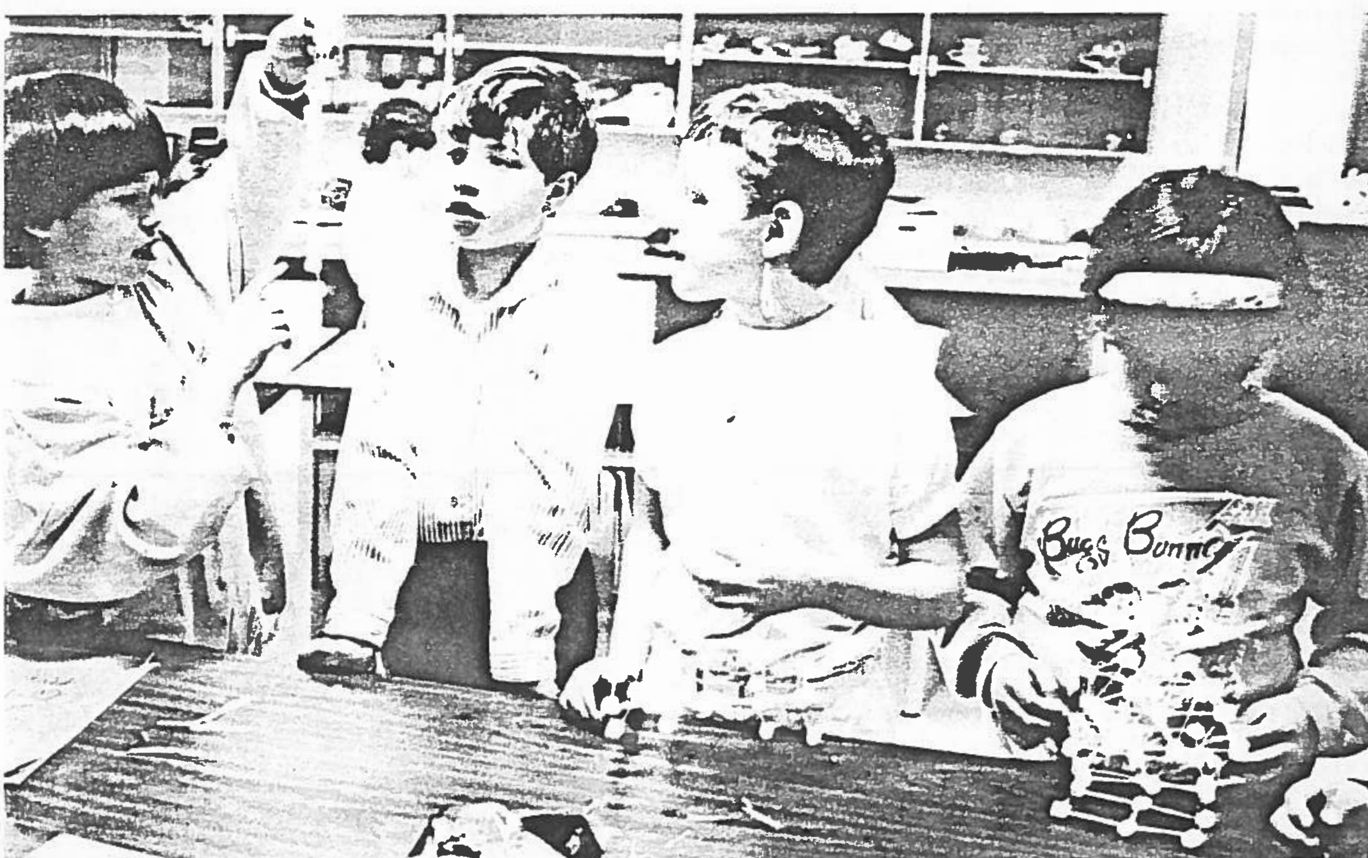
The philosophy of mathematics education in Saskatchewan is reflected in the program aim and goals and is closely related to the concept of Core Curriculum based on the philosophy of *Directions* (Saskatchewan Education, 1984).

The main aim of the mathematics program is to prepare numerate individuals who value mathematics and appreciate its role in society. Students must be able to cope confidently and competently with everyday situations that demand the use of mathematical concepts; specifically, this means interpreting quantitative information, estimating, performing calculations mentally, and developing an intuitive knowledge of measurement and spatial relationships. The mathematics program is intended to stimulate the spirit of inquiry by developing a variety of problem solving skills and abilities. There is a need to make effective use of technology where it is most appropriate (Hope, 1990).

The curriculum goals are intended to provide students with the mathematical preparation essential to:

- function as consumers and workers, that is, to develop the skills and knowledge of concepts necessary to meet the needs of the average worker and consumer;
- function as informed responsible citizens, that is, to develop the ability to analyze and interpret quantitative information;
- obtain a liberal education, that is, to develop logical thinking skills, effective work habits, and an appreciation of mathematics;
- become capable problem solvers, that is, to develop the desire, confidence, and ability to solve problems;
- communicate mathematically; and,
- pursue further study in mathematics and mathematically related areas (Hope, 1990).

Emphasis is placed on **how** to compute, measure, estimate, and interpret mathematical data, **when** to apply these same skills and techniques, and understanding **why** these processes apply. The intention is to develop self-reliant, self-motivated, confident life-long learners.



The Strands

The Elementary Mathematics objectives, for reasons of clarity and emphasis, are divided into five strands. These strands are: problem solving, data management and analysis, numbers and operations, geometry, and measurement. Many research studies indicate that instruction in mathematics should regularly demonstrate its applicability to real life. Therefore, even though the student learning objectives are detailed in separate strands, they are intended to be taught in an integrated fashion.

Problem Solving

Mathematics should revolve around problems, questions or concerns that students view as pertinent to their present world and that of the future. Problem solving is the avenue that generates excitement, challenge, and meaningfulness in mathematics. Many of the skills and strategies of problem solving should be individually explored and then applied to assist in the solving of a variety of problems.

Data Management and Analysis

The collection, display, and analysis of data is a process used to solve many problems. Graphs, charts, and lists relaying numbers and statistics are a part of our daily lives. At an early age, students should begin to learn the processes of data management. Many activities and instructional ideas to support this rationalization are suggested in this guide.

Numbers and Operations

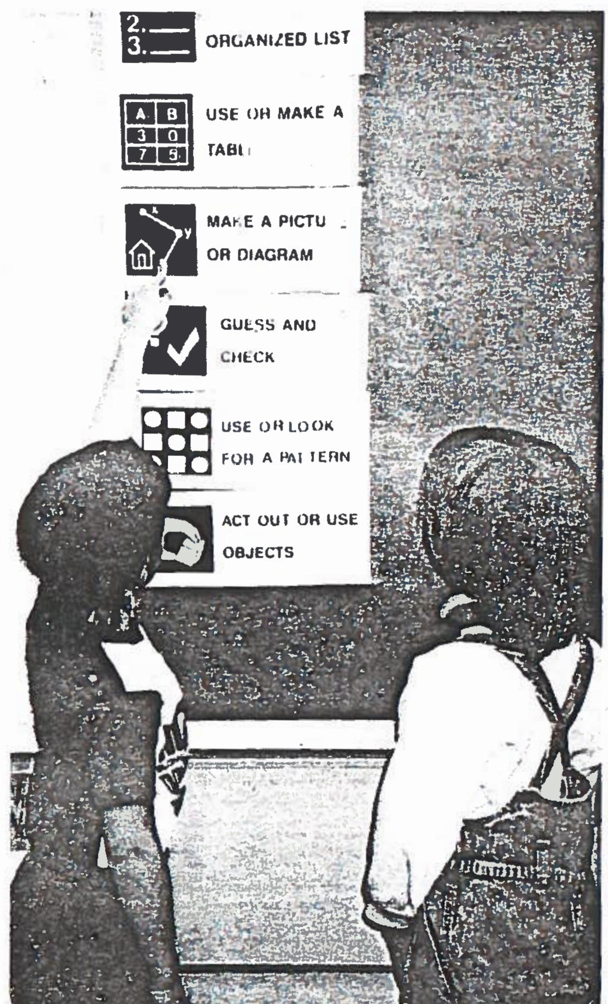
In this strand the emphasis is on students developing "number sense". The curriculum advocates that this is best accomplished by students searching for and understanding the many patterns and relationships among numbers. Being able to use mental calculation and estimation strategies is paramount. Critical is the understanding of the concepts of whole and rational numbers, and when to apply basic operations. At the Elementary Level, more complex computational procedures can be reserved for the calculator.

Geometry

The development of geometrical concepts and the cultivation of spatial awareness is best accomplished through the continuous integration of geometry in the curriculum. Students learn these concepts by actively manipulating, drawing, constructing and creating geometric shapes and objects, and making connections to the real world. Geometry should be experiential and reflected in the students environment as an exciting and applicable ingredient of mathematics.

Measurement

Emphasis is on the development of "measurement sense" when students are actively engaged in the processes of comparing, estimating, and measuring. Regular integration with other Required Areas of Study such as Science, Physical Education, and Social Studies readily makes this strand one in which applicability can be easily demonstrated.



Areas of Increased Emphasis in the Teaching and Learning of Elementary Mathematics

The belief that "learning is limitless for learners who can solve problems", supports the initiative to have problem solving as a central focus for the curriculum. It is through problem solving that Mathematics can be presented in a meaningful, applicable, constructive manner for students.

Problem solving, by its very nature, does not necessarily follow a sequential pattern. Students must analyze the problem and combine prior knowledge and experiences into a procedure that will yield success in arriving at a solution.

To establish a problem-solving environment in which students feel motivated and confident, a classroom teacher may consider a number of practices:

- collecting a good supply of a variety of quality problems;
- presenting problems orally, visually, and in written form;
- using a variety of instructional approaches and student groupings;
- making manipulatives available for students to use to assist in solving problems;
- integrating problem solving with other topics and subject areas;
- discussing various ways to solve a problem and accepting alternate solutions where applicable;
- reinforcing positive attitudes and perseverance; and,
- providing sufficient time - it is better to solve fewer problems and fully explore other possible processes, solutions, and related problems.

Students need to recognize the applicability of mathematics. **Problem solving is the link between mathematics in the classroom and the real world.**

There are many strategies, processes, concepts, and skills that students should learn and be able to apply in order to become successful, life-long mathematical problem solvers. **The following areas of increased emphasis in the teaching and learning of Mathematics are critical to the overall development of problem solvers who are confident and competent.**

Activity-Based Classroom

It is crucial that students develop a positive attitude towards mathematics. Without this positive attitude they will not realize their full potential. They must view mathematics as more than paper-and-pencil assignments with the primary goal of producing correct answers. They must see mathematics as a means to solving a variety of challenging problems. This involves manipulating concrete materials, using pictures and diagrams, collecting and analyzing data, and sharing their mathematical experiences.

Activity-based classrooms usually have:

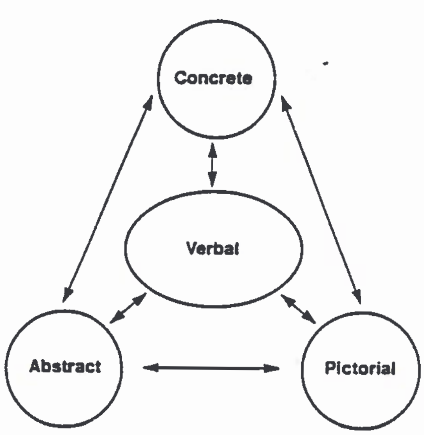
- an assortment of manipulatives, stored so that they are readily available to both students and teacher;
- a mathematics centre or area where problems, activity cards, manipulatives, displays, and games are kept;
- areas (floor and tables) where students can work cooperatively; and,
- adaptability, to accommodate the various tasks in which students actively participate.

Manipulative Materials

Students at the elementary level best learn mathematical concepts through the manipulation of concrete materials because it assists them in building a mental representation of the concept. Manipulatives provide concrete introductions to abstract ideas. Each student should have an opportunity to have adequate "hands on" experiences with appropriate manipulatives before engaging in paper-and-pencil activities. All print resources, including textbooks and workbooks, offer only the pictorial and symbolic representations of mathematical concepts. Therefore, it is highly recommended that every classroom have an assortment of manipulatives (purchased, constructed, collected) that are accessible to students at all times.

Students need time for free exploration when each type of manipulative is first introduced. They must have the opportunity to play, experiment, and observe characteristics of the concrete materials. Students should talk to classmates and their teacher (using appropriate mathematical terminology) about their experiences.

As objects are manipulated and new concepts introduced, teachers must help students make the connections between their actions and the concepts. A gradual transition to pictorial representations and when appropriate to symbolic representations is made. During this process the appropriate verbal representation is incorporated. Students must eventually understand the relationship between the physical manipulation of materials and the concepts. The way students record their results of manipulative activities often affects their bridging of the gap between the concrete and the abstract.



Although not all objectives need to be introduced using manipulatives, most students will benefit enormously if given the opportunity to proceed from concrete to pictorial to abstract when learning the majority of new concepts.

It is extremely beneficial for students to use a **variety of manipulatives** when learning a major mathematical concept. This will help to assure that students do not develop a narrow view of the concept.

Many manipulatives can be collected (odds and ends, counters) and/or constructed (10-frames, geoboards) by teachers, students, and parents. Others, (linking cubes, Mira) are best purchased. The storage and distribution of manipulatives is an important consideration for the classroom teacher and many excellent suggestions can be found in various teacher resources.

Mental Calculation

Mental calculation is a life skill that assists in solving many mathematically related problems. For elementary students, developing the ability to calculate mentally helps with understanding basic number concepts and relationships. It improves students' paper and pencil calculations and eliminates many common errors produced on electronic calculators. Mental calculation is also the cornerstone to all estimation. This mental ability develops the confidence that assures students that they have the skills to quickly solve basic mathematical problems.

The following instructional ideas are suggested to promote development of student mental calculation abilities:

- use mental calculation whenever possible in all areas of study;
- teach a variety of mental calculation strategies as students do not always learn these on their own;
- allow student choice, as a strategy that is preferred by one student may not be the best for another student;
- encourage students to develop, use, and explain their own strategies; and,
- practice in a meaningful setting - present real-life problems, activities, and games in which mental calculations must be used.

Students involved in repetitive paper and pencil exercises often become accustomed to following with minimum thought, pre-determined steps. Mental calculation forces students to think about numbers and number relationships.

Estimation

Mathematics is a discipline that we often characterize by its precision in common usage. However, we do not always need, nor are we sometimes able, to attain a high degree of accuracy in our calculations. Approximate numbers are often easier to comprehend and they can also help to develop consistency. When counting, measuring, or calculating it is often advantageous to estimate prior to finding a more exact solution. Development of the concept and skills of estimation helps students to adapt mathematics in a variety of situations.

The increased emphasis of estimation in the curriculum corresponds with the important role estimation assumes in daily life.

Integration

Mathematics should be applicable and meaningful for all students. Students must understand the need for them to learn the concepts and skills of mathematics. This is best accomplished by teaching a topic or theme that is relevant to the students' lives and that offers many and varied opportunities for mathematical applications. When choosing and planning appropriate topics/themes (e.g., bicycles), teachers should attempt to meet objectives from all five strands. This gives them the opportunity to create problems that require students to collect and analyze data, learn geometrical concepts, incorporate measurement understandings and skills, apply concepts and skills of numbers and operations, as well as develop problem-solving abilities.

Teachers may also wish to integrate across subject areas by developing a single theme (e.g., animals) within their classroom. This allows for a more focused planning of units and further demonstrates to students the use of mathematics in daily life.

Calculators

Calculators should be an important contributing factor in students' number development. Quality designed calculator activities and problems enhance the growth and formation of students' understanding of mathematical patterns and relationships. The concepts of computation are usually understood in advance of the mastery of the algorithms. Therefore, with a calculator, more complex calculations can be performed and problems solved. This can eliminate the drudgery and frustration that may hinder rather than enhance mathematical thinking and creativity when students are expected to use and master algorithms they are not developmentally ready to comprehend.

All elementary students should have regular access to calculators. The calculator should be used as a tool to:

- formulate generalizations from patterns of displayed numbers e.g., counting, place value;
- assist in the learning of basic number concepts and mental calculation strategies;
- enhance understanding of number order and magnitude;
- assist with solving problems and therefore promote independence; and,
- encourage experimentation with mathematical ideas.

Calculators do not replace the need for the acquisition of basic number facts. Since there is an increasing need to be able to calculate mentally, estimate, and determine the reasonableness of answers to computed problems, students need to learn strategies that assist them with number fact recall.

Students must use calculators regularly if they are to learn how, when, and why they are effective.

Microcomputers

The microcomputer has many beneficial applications in mathematics. It has been identified as a tool for students to use to explore and discover concepts by assisting with the transition from concrete representation to the more abstract mathematical stages of learning. Appropriate computer software can be the link between concrete manipulatives and the symbolic representation. Using a combination of manipulatives and corresponding computer software supports the constructivist perspective that learning is a process of constructing, building and fitting ideas, and making connections. By giving students the opportunity to experiment with various representations, we are offering more models with which to make these connections.

Computer hardware and software is continuing to become increasingly sophisticated in design in areas such as problem solving, manipulating, creative programming, games, tutorials, drill and practise, and managing. **Within these applications it is crucial that software correlates with the curriculum and the ability levels of the students.**

The microcomputer also has tremendous potential to help students with special needs. Students with learning difficulties, those who require enrichment activities, and students in multi-graded classrooms can all benefit from the individual assistance a computer can offer.

Assignments

Assignments, intended to be completed in class or at home, enhance students' understanding, skills, and proficiency in mathematics. But, care must be taken to assure that assignments are meaningful extensions of the concepts taught in class. Repetitive computation or other similar homework assignments can often inhibit a student's creativity, love of mathematics, and desire to independently extend their learning. Assignments should develop students' higher levels of thinking by being structured in a problem solving mode so that students have the opportunity to apply the mathematical ideas learned.

Parents/caregivers can be significant contributors of this learning process. Opportunities for parents/caregivers to be involved in the data collection and problem solving processes allows them to display their interest in the child's work. It also offers them the opportunity to become familiar with the student's program.

Overview and Estimated Time Allotments

The Student Learning Objectives in Elementary Mathematics are divided into five strands. Each strand is further divided into topics and sub-topics.
The time allocation for Mathematics at the Elementary Level is 210 minutes per week.
The percentage of time indicated to be spent on each strand is approximate, because when integrating, overlapping will occur.

	Grade				
	1	2	3	4	5
	Approximate Time Allotted (Percent)				
Problem Solving .... ♦ Understanding ♦ Planning and Executing ♦ Reflecting	15	15	15	15	15
Data Management and Analysis .... ♦ Collecting ♦ Organizing and Displaying ♦ Summarizing and Interpreting	10	10	10	10	10
Number and Operations .... ♦ Whole Numbers • Foundations • Counting • Place Value • Addition • Subtraction • Multiplication • Division ♦ Rational Numbers • Common Fractions • Decimal Fractions	50	50	50	50	50
Geometry .... ♦ Space (three-dimensional) ♦ Plane (two-dimensional)	10	10	10	10	10
Measurement .... ♦ Length ♦ Area ♦ Capacity ♦ Volume ♦ Mass ♦ Time ♦ Temperature ♦ Money ♦ Angles	15	15	15	15	15

Components of Core Curriculum

Core Curriculum: Plans for Implementation (Saskatchewan Education, 1987) defines the Core Curriculum as including the seven Required Areas of Study, the six Common Essential Learnings, the Adaptive Dimension, and Locally-Determined Options. Mathematics is one of the Required Areas of Study.

The following foundational documents are supportive of the philosophy of Core Curriculum.

Understanding the Common Essential Learnings: A Handbook for Teachers (Saskatchewan Education, 1988) as a foundation document for Saskatchewan Education, defines and expands on an understanding of these essential learnings.

Instructional Approaches: A Framework for Professional Practice (Saskatchewan Education, 1991), is intended to generate discussion and promote reflective thinking about instructional practices and to act as a catalyst for further professional development.

The Adaptive Dimension in Core Curriculum (Saskatchewan Education, 1992), establishes the rationale for the Adaptive Dimension as an integral part of Core Curriculum and outlines a process for adjusting program to meet diverse student needs.

Student Evaluation: A Teacher Handbook (Saskatchewan Education, 1991) is intended to provide teachers with information in support of appropriate student evaluation, including: a process for taking stock of current personal evaluation practices; suggestions for enhancing student evaluation programs; descriptions and examples of specific assessment techniques; and the connections between learning objectives, instructional strategies, and assessment techniques.

Common Essential Learnings

Mathematics offers many opportunities for incorporating the Common Essential Learnings (C.E.L.s) into instruction. The purpose of this incorporation is to help students better understand the subject matter under study and to better prepare students for their future learning both in and outside of the K-12 educational system. The decision to focus on a particular C.E.L. or C.E.L.s within a lesson is guided by the needs and abilities of individual students and by the particular demands of the subject area. Throughout a unit, it is intended that each Common Essential Learning will have been developed to the fullest extent possible.

It is important to incorporate C.E.L.s in an appropriate manner. For example, some areas of mathematics may offer many opportunities to develop the understandings, values, skills and processes related to a number of Common Essential Learnings. The development of a particular C.E.L., however, may be limited by the nature of the subject matter under study.

It is intended that Common Essential Learnings be developed and evaluated within subject areas. Therefore, Foundational Objectives for the C.E.L.s are included together with the Foundational Objectives for Mathematics at the beginning of each grade overview in this guide. Since Common Essential Learnings are not necessarily separate and discrete categories, it is anticipated that working toward the achievement of one foundational objective may contribute to the development of others. For example, many of the processes, skills, understandings and abilities required for the C.E.L.s of Communication, Numeracy and Critical and Creative Thinking are also needed for the development of Technological Literacy.

Incorporating Common Essential Learnings into instruction has implications for the assessment of student learning. A unit which has focused on developing the C.E.L.s of Communication and Critical and Creative Thinking should also reflect this focus when assessing student learning. Assessment should allow students to demonstrate their understanding of the important concepts in the unit and how these concepts are related to each other or to previous learning. Questions can be structured so that evidence or reasons must accompany student explanations. If students are encouraged to think critically and creatively throughout a unit, then the assessment for the unit should also require students to think critically and creatively.

It is anticipated that teachers will build from the suggestions in this curriculum guide and from their personal reflections in order to better incorporate Common Essential Learnings into Mathematics.

Adaptive Dimension

The Adaptive Dimension is an essential part of all educational programs. Like the Common Essential Learnings, the Adaptive Dimension is a component of Core Curriculum and permeates all curriculum and instruction. The Adaptive Dimension is defined as:

> "the concept of making adjustments in approved educational programs to accommodate diversity in student learning needs. It includes those practices the teacher undertakes to make curriculum, instruction, and the learning environment meaningful and appropriate for each student."

The essence of the Adaptive Dimension rests in the phrase "seeking other ways". Offering students alternative access to, and expression of knowledge, facilitates their participation in learning. Just as physical environments can be made more accessible through modifications such as ramps or wider doorways, learning environments can be made more accessible through a modification of setting, method or material. The Adaptive Dimension is used to:

- maximize student independence;
- maximize generalization and transfer;
- lessen discrepancies between achievement and ability;
- promote a love of learning;
- promote a positive self-image and feeling of belonging;
- promote confidence;
- promote a willingness to become involved in learning; and,
- facilitate integration.

These purposes address a primary function of the school, that of helping students to maximize their potentials as independent learners.

Students may find learning to be difficult or not to be challenging but with varying adaptations of teaching methodologies, curriculum organization, timetabling, or with the assistance of appropriate technologies they can be active participants in their learning. Some general guidelines for adaptation follow:

- alter the method of instruction to meet the needs of individuals;
- alter the pace of the lesson to ensure that students understand the concept being presented or are being challenged by the presentation. One of the most basic adaptations that can be made to assist students is to give them sufficient time to explore, create, question, and experience as they learn;
- allow more than one way to accomplish a task;
- monitor the use of vocabulary. It is possible to use advanced and simple vocabulary in the same lesson by incorporating both levels in a sentence: "Show me the spheres or ball-shaped solids." This helps to satisfy the requirements of some students, expand the vocabulary of others, and make the lesson meaningful to others;
- alter the manner in which the student is required to respond to the teacher and/or to the instructional approach;
- alter the setting so that the student may benefit more fully from the instruction;
- accommodate a variety of learning modes (visual, auditory, kinesthetic);
- use resources that maximize learning;
- expect an increase in speed only after the student has achieved a high level of accuracy;
- have advanced or challenging tasks available for students who have become proficient;
- use interactive techniques that allow for close observation of the student's progress;
- involve students in decisions regarding their own learning; and,

- use assessment techniques that are matched to the instructional adaptations that have been made for the students.

The Adaptive Dimension includes all practices the teacher employs to make learning meaningful and appropriate for each student. Because the Adaptive Dimension permeates all teaching practice, professional decision becomes the critical factor. This curriculum guide encourages such flexibility and decision-making.

Supporting Initiatives

In addition to the main components of Core Curriculum, Saskatchewan Education emphasizes other important initiatives. These include **Resource-Based Learning, Gender Equity, and Indian and Metis Perspectives.** These initiatives can be viewed as principles which guide the development of curricula as well as instruction in the classroom.

Resource-Based Learning

Resource-based teaching and learning is a means by which teachers can greatly assist the development of attitudes and abilities for independent life-long learning. Resource-based learning is student-centered. It offers children opportunities to choose, to explore, and to discover. Students who are encouraged to think critically in an environment rich in resources are well on their way to becoming autonomous learners.

The mathematics teacher cooperates with library staff to integrate non-print, human, and print resources with classroom assignments. The teacher plans in advance with library staff, and respects the library resource centre as a place for active learning and an extension of the classroom. The teacher contributes to collection development by suggesting items for purchase. The teacher-librarian, if available, assists with planning assignments, integrating appropriate resources, and teaching students the processes needed to find, use, and present information.

The library resource centre staff may support the mathematics curriculum by:

- displaying a positive and welcoming attitude. The effective teacher-librarian models and supports curiosity, open-ended investigation, and problem-solving approaches;
- organizing and circulating print and non-print resources which support the mathematics curriculum. Resources might include manipulatives, commercial games, records and tapes of counting songs and rhymes, videos, filmstrips and films, software, newspapers and magazines, counting books, material on spatial objects and geometric forms, reference books containing statistics and other numerical data including postal code and telephone directories, maps and globes, scale drawings, measuring instruments;
- maintaining a resource file of speakers and presenters in the community who can show how mathematics is used in daily life;
- assisting the mathematics teacher prepare learning stations in the classroom or library which use library resources;
- cooperating with the mathematics teacher to teach children methods of library organization including computerized systems, and practical uses of indexing of all kinds;
- providing resources for students at all levels of ability including exceptional children;
- maintaining a collection of professional materials on subjects of interest to mathematics teachers;
- providing a link to information and materials from other libraries, the central board office, universities, museums, governments, industry;
- providing enrichment materials which anticipate students' interests such as books of puzzles, mathematical games, material on crafts and hobbies using mathematical principles, magazines which deal with mathematics/science, sports records; and,
- providing interdisciplinary experiences to help students comprehend and anticipate the links between mathematics and other disciplines and areas of study.

Gender Equity

Saskatchewan Education is committed to providing quality education for all students in the K to 12 system. It is recognized that expectations, based primarily on gender, limit students' ability to develop to their fullest potential. While some stereotypical views and practices have disappeared, others remain. Where schools have endeavoured to provide equal opportunity, continued efforts are required so that equality of benefit or outcome may be achieved. It is the responsibility of schools to decrease sex-role expectations and attitudes in an effort to create an educational environment free of gender bias. This can be facilitated by increased understanding and use of gender balanced material and strategies, and further efforts to analyze current practice. Both girls and boys need encouragement to explore non-traditional as well as traditional options.

In order to meet the goal of gender equity in the K to 12 system, Saskatchewan Education is committed to efforts to bring about the reduction of gender bias which restricts the participation and choices of students. It is important that the Saskatchewan curriculum reflects the variety of roles and the wide range of behaviours and attitudes available to all members of our society. This curriculum strives to provide gender balanced content, activities and teaching strategies described in inclusionary language. These actions will assist teachers to create an environment free of bias and enable all students to share in experiences and opportunities which develop their abilities and talents to the fullest.

The role of the elementary mathematics teacher is critical in addressing the principle of gender equity in the new curriculum. Research shows that few, if any, gender differences exist in mathematical ability, but because of different earlier experiences with mathematics, the eventual achievement of girls may not reach that of boys. Elementary mathematics teachers can influence the level of success achieved by all students by becoming aware of their own attitudes. Teachers must understand that both girls and boys can perform well in mathematics at all grade levels. Teachers should also become aware of the attitudes displayed by their students and help them to view themselves as being capable in mathematics. It is important in showing students the relevance of mathematics to their lives, that we choose examples which come from the experiences of all students. From an early age students need to be made aware that daily living and most careers require a knowledge and understanding of mathematics. Teachers need to be sensitive to their interactions with students and ensure that everyone takes an active part in classroom activities. Being aware of interactions between students which may reinforce negative behaviour or attitudes, and taking opportunities to discuss them, will help students develop a broader understanding of their distinct abilities and their potential. All of these actions will support and reinforce the principle of gender equity in a mathematical context and move toward improved teaching practice.

Indian and Métis Curriculum Perspectives

The integration of Indian and Métis content into the Kindergarten to Grade 12 curriculum fulfils a central recommendation of *Directions. The Five Year Action Plan for Native Curriculum Development* further articulates the commitment and process. In addition, the *1989 Indian and Métis Education Policy from Kindergarten to Grade 12* makes the statement:

> *Saskatchewan Education recognizes that the Indian and Métis peoples of the province are historically unique peoples and occupy a unique and rightful place in society today. Saskatchewan Education recognizes that education programs must meet the needs of Indian and Métis peoples, and that changes to existing programs are also necessary to benefit all students.* (p.6)

It is recognized that, in a pluralistic society, affirmation of culture benefits everyone. Its representation in all aspects of the school environment enables children to acquire a positive group identity. Instructional resources which reflect Indian and Métis cultures similarly provide meaningful and relevant experiences for children of Indian and Métis ancestry and promote the development of positive attitudes in all students towards Indian and Métis peoples. Awareness of one's own culture, and the cultures of others, forms the basis for positive self-concept. Understanding other cultures enhances learning and enriches individual growth. It also promotes an appreciation of the pluralistic nature of Canadian society.

Indian and Métis students in Saskatchewan have varied cultural backgrounds and come from geographic areas encompassing northern, rural, and urban environments. Teachers must be given support that enables them to create instructional plans relevant to meeting diverse needs. Varied social, cultural, and linguistic backgrounds of Indian and Métis students imply a range of strengths and learning opportunities for teachers to draw upon. Explicit guidance, however, is needed to assist teachers in meeting the challenge by enabling them to make appropriate choices in broad areas of curriculum support. Theoretical concepts in anti-bias curricula, cross-cultural education, applied socio-linguistic, first and second language acquisition, and standard and non-standard usage of language are becoming increasingly important to classroom instruction. Care must be taken to ensure teachers utilize a variety of teaching methods that build upon the knowledge, cultures, and learning styles students possess. All curricula including mathematics require adaptations to the content, instructional practices, and learning environment that reflect the needs of the students.

The final responsibility for accurate and appropriate inclusion of Indian and Métis content in instruction rests on teachers. They have the responsibility of evaluating resources for bias, and teaching students to recognize bias. The focus of the new Elementary Mathematics Curriculum provides teachers with opportunities to begin these integration and evaluation processes. The document *Diverse Voices: Selecting Equitable Resources for Indian and Métis Education* (Saskatchewan Education, 1992) provides support for teachers in evaluating resources for bias.

The Elementary Mathematics Curriculum supports the expectations of Indian and Métis content and perspectives by:

- encouraging teachers to design problems related to the students' environment;
- reminding teachers to encourage students to design their own problems based on topics of interest to them and their world;
- utilizing an activity-based, hands-on approach which promotes success and the development of a positive self image;
- utilizing materials, both concrete and pictorial, with which the student is familiar and comfortable;
- incorporating student-focused projects and the collection of data;
- demonstrating the applicability of mathematics through integration with other areas of study and daily life;
- suggesting students work together in cooperative groups of varying sizes;
- encouraging communication of mathematical ideas in all four modes; and,
- incorporating mathematical ideas associated with the traditional Indian and Métis cultures.

Evaluation

Introduction

Evaluation is an important component of the teaching-learning process, and its main purposes are to facilitate student learning and to improve instruction. Teachers make decisions about student progress based on information gathered through a variety of assessment techniques. This information assists teachers in planning or modifying their instructional programs, which in turn helps students to learn more effectively. Evaluations are also used for reporting progress to students and their parents/caregivers, and for making decisions related to promotion in Mathematics.

Core Curriculum is designed to provide students with the knowledge, skills, and abilities needed for further education, work life, and daily living. It requires changes in the ways children have traditionally been taught and evaluated. Formerly, evaluation of student learning focused on factual content, and student progress was assessed by using traditional strategies such as paper-and-pencil tests. However, to evaluate students' growth and development as critical and creative thinkers or independent learners through assessing their progress within mathematics and other areas of study, nontraditional strategies are required. More often than before, teachers will rely on strategies such as observation, conferencing, oral and written assignments, and performance assessment to gather information about student progress.

Although the responsibility to establish student evaluation and reporting procedures resides with the school principal and the teaching staff, the classroom teacher has the daily responsibility for student evaluation. The teacher is at the forefront in determining student progress using evaluative practices which include careful planning, appropriate assessment strategies, and, most importantly, sound professional decisions.

Clarification of Terms

To enhance understanding of the evaluation process it is useful to distinguish between the terms "**assessment**" and "**evaluation**". These terms are often used interchangeably which causes some confusion. **Assessment** is a preliminary phase in the evaluation process. In this phase, various techniques are used to gather information about student progress. **Evaluation** is the weighing of assessment information against some standard (such as a curriculum learning objective) in order to make a decision. This decision may lead to action by the teacher, student, or parent/caregiver.

There are three main types of student evaluation: **formative, summative**, and **diagnostic evaluation**. Assessment techniques are used to gather information for each type of evaluation.

Formative evaluation is an ongoing classroom process that keeps students and educators informed of students' progress towards program learning objectives. The main purpose of formative evaluation is to improve instruction and student learning. It provides teachers with valuable information for instructional modifications. This type of evaluation helps teachers understand the degree to which students are learning the course material and the extent to which their knowledge, understandings, skills, and attitudes are developing. Students are provided direction for future learning and are encouraged to take responsibility for their progress.

Summative evaluation is designed to be used at the end of instruction. Its primary purpose is to determine what has been learned over a period of time, and, to summarize and report to students, parents/caregivers, and educators on student progress relative to curriculum objectives.

Seldom are evaluations strictly formative or strictly summative. For example, summative evaluation can be used formatively to assist teachers in making decisions about changes to instructional strategies or other aspects of students' learning programs. Similarly, formative evaluation may be used to assist teachers in making summative decisions about student progress. However, it is important that teachers make clear to students the purpose of assessments and whether they will later be used summatively.

Diagnostic evaluation usually occurs at the beginning of the school year or before a unit of instruction. Its main purposes are to identify students who lack prerequisite knowledge, understanding, or skills, so that remedial help can be arranged; to identify gifted learners to ensure they are being sufficiently challenged; and to identify student interests. Diagnostic evaluation provides information essential to teachers in designing appropriate programs for students.

Teachers conduct all three types of evaluation during the course of the school year.

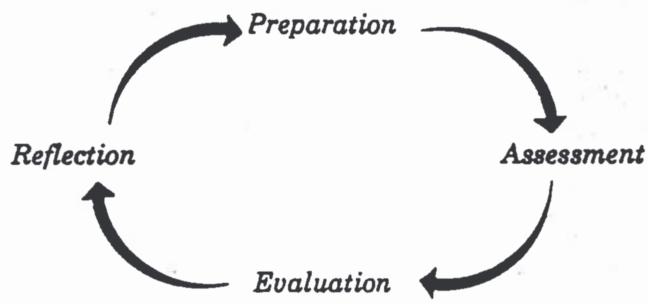
Phases of the Evaluation Process

Although evaluation is not strictly sequential, it can be viewed as a cyclical process including four phases: **preparation, assessment, evaluation,** and **reflection.** The evaluation process involves the teacher as a decision maker throughout all four phases.

- In the **preparation phase,** decisions by students and teachers are made which identify what is to be evaluated, the type of evaluation (formative, summative, or diagnostic) to be used, the criteria against which student learning outcomes will be assessed, and the most appropriate assessment techniques with which to gather information on student progress. The teacher's decisions in this phase form the basis for the remaining phases.
- During the **assessment phase**, the teacher identifies information-gathering strategies, constructs or selects instruments, administers them to the student, and collects the information on student learning progress. The teacher continues to make decisions in this phase. The identification and elimination of bias (such as gender, culture, and language) from the assessment techniques and instruments, and determining where, when, and how assessments will be conducted are examples of important considerations for the teacher in this phase of evaluation.
- During the **evaluation phase**, the teacher interprets the assessment information and makes decisions about student progress. Based on evaluations, teachers make decisions about student learning programs and report on progress to students, parents/caregivers, and appropriate school personnel.
- The **reflection phase** allows the teacher to consider the extent to which the previous phases in the evaluation process have been successful. Specifically, the teacher evaluates the utility and appropriateness of the assessment techniques used, and such reflection assists the teacher in making decisions concerning improvements or modifications to subsequent teaching and evaluation.

All four phases are included in formative, diagnostic, and summative evaluation processes. They are represented in Figure 1.

Figure 1. Process of Student Evaluation



Guiding Principles

Nine guiding principles are presented in the report ***Evaluation in Education*** (Saskatchewan Education, 1989). The purpose of these principles is to provide guidance on educational evaluation in several areas. One of these areas is student evaluation. The evaluation of student progress has a strong influence on both teaching and learning. If used appropriately, evaluation can promote learning, build confidence, and develop students' understanding of themselves.

Recognizing the importance of evaluation as an integral part of the curriculum, Saskatchewan Education has developed five general guiding principles which are closely linked to the ***Evaluation in Education*** report, and provide a framework to assist teachers in planning for student evaluation:

1. Evaluation is an essential part of the teaching-learning process. It should be a planned, continuous activity which is closely linked to both curriculum and instruction.

2. Evaluation should be guided by the intended learning outcomes of the curriculum, and a variety of assessment techniques should be used.

3. Evaluation plans should be communicated in advance. Students should have opportunities for input to the evaluation process.

free of bias. Students should be given opportunities to demonstrate the extent of their knowledge, understandings, skills, and attitudes in their first language.

5. Evaluation should help students. It should provide positive feedback and encourage students to actively participate in their learning.

Focuses of Evaluation

Evaluations may focus on progress in student learning (**student evaluation**), the effectiveness of school programs (**program evaluation**), and the effectiveness of the curriculum (**curriculum evaluation**). Teachers also reflect on the effectiveness of their instruction (**teacher self-evaluation**).

Student Evaluation

Specific assessment techniques are selected or devised to gather information related to how well students are achieving the learning objectives of the curriculum. The assessment techniques used at any given time will depend on several factors such as the type of learning outcomes (knowledge, understanding, skill, attitude, value, or process), the subject content, the instructional strategies used, the student's level of development, and the specific purpose of the evaluation.

There are various assessment techniques that teachers may use to gather information on student learning. These techniques have been categorized for ease of use. Each assessment technique is letter-coded to simplify referencing. For explanation of these techniques refer to ***Student Evaluation: A Teacher Handbook*** (Saskatchewan Education, 1991).

Methods of Organization

These methods refer to the broad organizational structure of the assessment techniques a teacher may decide to use. They enable a teacher to make assessment decisions as to how the assessment will be done.

- Assessment Stations **AS**
- Individual Assessments **IA**
- Group Assessments **GA**
- Learning Contracts **LC**
- Peer- and Self-Assessment **P/SA**
- Portfolios **P**

Methods of Data Recording

These methods may be used within the structure of any of the methods of organization and with any of the ongoing student activities, as well as quizzes and tests.

- Anecdotal Records **AR**
- Observation Checklists **OC**
- Rating Scales **RS**

Ongoing Student Activities

These techniques are those a teacher would use throughout the course of a regular school day when students are engaged in their usual learning activities.

- Written Assignments **WA**
- Presentations **PR**
- Performance Assessment **PA**
- Homework **H**

Quizzes and Tests

This category of assessment techniques may be used in situations that are structured to allow students to demonstrate what they know.

- Oral Assessment **O-T**
- Performance Tests **P-T**
- Extended Open-Response **OR-T**
- Short-Answer Items **SA-T**
- Matching Items **M-T**
- Multiple-Choice Items **MC-T**
- True/False Items **T/F-T**

Note: Photocopy the right hand column of this page and use as a book mark for quick reference.

Selected techniques are listed after each student learning objective in this curriculum guide. The assessment techniques are not prescribed; rather, they are meant to serve as suggestions. It would be inappropriate for curriculum guides to give teachers specific formulas for assessing students. Planning for assessment and evaluation must take into account unique circumstances and purposes.

Common Essential Learnings (C.E.L.s) are incorporated in the foundational and learning objectives of Mathematics. As the objectives are assessed and decisions made, the C.E.L.s will form an integral part of the evaluation process. For example, in a unit of instruction, some learning objectives will identify expected learning outcomes associated with C.E.L.s, but they will be imbedded in the Mathematics content. Assessment techniques will be used to gather student progress information on C.E.L.s through assessment in the Mathematics. When all assessment information has been gathered, it will form the basis for an evaluation. **It is inappropriate to evaluate student progress in the Common Essential Learnings independent of Mathematics.**

Program Evaluation

Program evaluation is a systematic process of gathering and analyzing information about some aspect of a school program in order to make a decision, or to communicate to others involved in the decision-making process. Program evaluation can be conducted at two levels, relatively informally at the classroom level, or more formally at the classroom, school, or school division levels.

At the classroom level, program evaluation is used to determine whether the program being presented to the students is meeting both their needs and the objectives prescribed by the curriculum. Program evaluation is an ongoing process. For example, if particular lessons appear to be poorly received by students, or if they do not seem to demonstrate the intended learnings from a unit of study, the problem should be investigated and changes made. By evaluating programs at the classroom level, teachers become reflective practitioners. The information gathered through program evaluation can assist teachers in program planning and in making decisions for improvement. Most program evaluations at the classroom level are relatively informal, but they should be done systematically. Such evaluations should include identification of the area of concern, collection and analysis of information, and decision making.

Formal program evaluation projects use a step-by-step problem-solving approach to identify the purpose of the evaluation, draft a proposal, collect and analyze information, and report the evaluation results. The initiative to conduct a formal program evaluation may originate from an individual teacher, a group of teachers, the principal, a staff committee, an entire staff, or central office. Evaluations are usually done by a team, so that a variety of skills are available and the work can be distributed. Formal program evaluations should be undertaken regularly to ensure programs are current.

To support formal school-based program evaluation activities, Saskatchewan Education has developed the ***Saskatchewan School-Based Program Evaluation Resource Book*** (1989) to be used in conjunction with an inservice package. Further information on these support services is available from the Evaluation and Student Services Division, Saskatchewan Education.

Curriculum Evaluation

During the decade of the 1990s, new curricula will be developed and implemented in Saskatchewan. Consequently, there will be a need to know whether these new curricula are being effectively implemented and whether they are meeting the needs of students. Curriculum evaluation, at the provincial level, involves making decisions about the effectiveness of provincially authorized curricula.

Curriculum evaluation involves gathering information (assessment phase) and making decisions based on the information collected (the evaluation phase), to determine how well the curriculum is performing. The principal reason for curriculum evaluation is to plan improvements to the curriculum. Such improvements might involve changes to the curriculum document and/or the provision of resources or inservice to teachers.

It is intended that curriculum evaluation be a shared, collaborative effort involving all of the major education partners in the province.

Although Saskatchewan Education is responsible for conducting curriculum evaluations, various agencies and educational groups will be involved. For instance, contractors may be hired to design assessment instruments; teachers will be involved in instrument development, validation, field testing, scoring, and data interpretation; and the cooperation of school divisions and school boards will be necessary for the successful operation of the program.

In the assessment phase, information will be gathered from students, teachers, and administrators. The information obtained will indicate the degree to which the curriculum is being implemented, the strengths and weaknesses of the curriculum, and the problems encountered in teaching it. The information from students will indicate how well they are achieving the intended learning outcomes and will provide indications about their attitudes toward the curriculum.

Student information will be gathered through the use of a variety of strategies including observations, performance tests (hands-on), paper-and-pencil tests (objective and open-response), interviews, and surveys.

As part of the evaluation phase, assessment information will be interpreted by representatives of all major education partners including the Curriculum and Evaluation Divisions of Saskatchewan Education and classroom teachers. The information collected during the assessment phase will be examined, and recommendations, generated by an interpretation panel, will address areas in which improvements can be made. These recommendations will be forwarded to the appropriate groups such as the Curriculum and Instruction Division, school divisions and schools, universities, and educational organizations in the province.

Curriculum evaluation is described in greater detail in the document ***Curriculum Evaluation in Saskatchewan*** (Saskatchewan Education, 1990).

Teacher Self-Evaluation

There are two levels of teacher self-evaluation: reflection on day-to-day classroom instruction, and professional self-evaluation.

Teachers refine their skills through reflecting upon elements of their instruction which includes evaluation. The following questions may assist teachers in reflecting on their evaluations of student progress:

- Was there sufficient probing of student knowledge, understanding, skills, attitudes, and processes?
- Were the assessment techniques appropriate for the student information required?
- Were the assessment conditions conducive to the best possible student performance?
- Were the assessment techniques fair/appropriate for the levels of student abilities? Consider gender, culture and language aspects.
- Was the range of information collected from students sufficient to make interpretations and evaluate progress?
- Were the results of the evaluation meaningfully reported to students, parents/caregivers, and other educators as appropriate?

Through reflection on questions like those above, teachers are able to improve their strategies for student evaluation. It is important for teachers, as professionals, to engage in self-evaluation. Teachers should take stock of their professional capabilities, set improvement targets, and participate in professional development activities. Some ways teachers can address their professional growth are by: reflecting on their teaching; reading professional documents (e.g. articles, journals and books); attending workshops, conferences, and courses; and developing networks with other professionals in their fields.

Information Gathering and Record Keeping

Having summarized the various types of assessment and evaluation, it is obvious that large amounts of data are gathered by teachers, schools and school divisions, and Saskatchewan Education. It is important that teachers maintain appropriate records to ensure data are organized and accessible for making decisions. Records can be kept in a variety of ways; however, it is recommended that teachers keep separate files on student progress (student portfolios), teachers' self-evaluations (professional files), and program evaluation.

Conclusion

Evaluation is the reflective link between what ought to be and what is, and therefore, it is an essential part of the educational process. The main purposes for evaluating are to facilitate student learning and to improve instruction. By continuously evaluating student progress, school programs, curriculum, and the effectiveness of instruction and evaluation, these purposes will be realized.

Assessment of Student Progress

Measuring student progress in the learning objectives described within the curriculum, requires a variety of assessment techniques. The purpose for which a teacher will be assessing will determine which technique(s) will be chosen in order to collect student information. Beneath each learning objective in the Strand Overviews are listed suggested assessment techniques. Teachers may supplement the list with other techniques.

Teachers should remember that it is a valuable process to assess students' mathematics abilities and understandings when learning in other areas of study and when engaged in play.

The assessment techniques listed within the curriculum are written in abbreviated form. Letter codes indicate which techniques are suggested for each learning objective as appropriate methods of collecting a range of student information. For instance, Observation Checklists are indicated by OC; Contracts are coded as C. Any items which are in the form of tests are designated by a T after the letter code, as in Multiple Choice Test items being MC-T. A full reference of the techniques and the codes are listed on page 19.

All assessment techniques correspond with those found in the document ***Student Evaluation: A Teacher Handbook*** (Saskatchewan Education, 1991). Should teachers wish more detailed descriptions of the purposes of the various techniques as well as how to construct and use them, such information is found in the handbook in a complete and easily referenced form. Examples of specific assessment techniques and blank templates which may be helpful to teachers are included in this section.

Mathematics

Grade:

Key

1 - Unable
2 - Guidance Usually
3 - Guidance Periodically
4 - Independent

Grade:	Problem Solving				Data				Numbers and Operations									Geom etry		Measurement											
Name	Understanding	Plan & Execute	Reflect	Processes	Collect	Organize & Display	Summarize & Interpret	Processes	Foundations	Counting	Place Value	Addition	Subtraction	Multiplication	Division	Fractions	Decimals	Space	Plane	Length	Area	Capacity	Volume	Mass	Time	Temperature	Money	Angles			

Mathematics

Grade: One — **Problem Solving**

Key

F - Fair
G - Good
V - Very Good
E - Excellent

Name	Understanding				Plan & Execute					Reflecting				Processes																	
	Use Manipulatives	Act Out	Interpret Pictures	Ask Questions	Use Manipulatives	Act Out	Counting Strategies	Data	Types	Explain - Orally	Create Problem	Similar Problems		Suitable Solution	Demonstrates Confidence	Systematic Approaches	Mathematical Language														

Grade: Four **Topic: Geometry** **Date:**

Key:

A - Able
U - Unable

Name	Space						Plane							
	Properties	Construct	Identify Faces	Congruency	Symmetry	Recall Objects	Identify Shapes	Combine Shapes	Lines	Congruency	Transformations	Symmetry	Tessellations	Terms

Observation Checklist - ability to solve problems					
Date: ________ Group: ________________					
Context:					
	Students				
Criteria					
Student understands the problem.					
Student plans and solves the problem.					
Student explains how the solution was obtained.					
Student demonstrates confidence/perseverance.					
Student properly displays the results.					
Student creates similar problems.					

Checklist/Anecdotal Records – Construction of 3-D Objects

Name: ______________________

Date: ______________________

Check (✓) Criteria Met

A. Process:

1. Student uses appropriate terminology (faces, corners, edges, rectangles, etc.). ______
2. Student follows instructions. ______
3. Student realizes that a 3-D object is constructed using 2-D shapes. ______
4. Student constructs a 3-D object. ______

B. Cooperative Group Work

1. Student participates in discussion and/or task. ______
2. Student asks group for assistance when necessary. ______
3. Student helps and encourages others. ______
4. Student understands the process. ______

Anecdotal Comment:

Grade : **Three**
Topic: **Volume**
Date:

Key: **1 - Fair**
2 - Good
3 - Very Good
4 - Excellent

Student	Rating	Comments
Jack Jones	2	Understands the concept of volume but has difficulty estimating and comparing volumes.
Sally Smith	4	Understands all concepts. Can estimate, compare and measure using non-standard units.

Grade :
Topic:
Date:

Key: 1 -
2 -
3 -
4 -

Student	Rating	Comments

Cooperative Rating Scale
Group Work
Topic:

	Seldom			Always
1. We stayed with our group	1	2	3	4
2. We moved without noise	1	2	3	4
3. We listened carefully	1	2	3	4
4. We used "quiet voices"	1	2	3	4
5. Everyone contributed	1	2	3	4
6. We used "put-ups"	1	2	3	4
7. We helped each other out	1	2	3	4
8. Everyone in our group understood	1	2	3	4
9. We made decisions together	1	2	3	4
10. We finished our work	1	2	3	4

The best thing about our group:

Next time I would change:

	Seldom			Always
1. ______	1	2	3	4
2. ______	1	2	3	4
3. ______	1	2	3	4
4. ______	1	2	3	4
5. ______	1	2	3	4
6. ______	1	2	3	4
7. ______	1	2	3	4
8. ______	1	2	3	4
9. ______	1	2	3	4
10. ______	1	2	3	4

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Scope and Sequence

Using the Scope and Sequence

All student learning objectives as listed in the Scope and Sequence are correlated to the appropriate grade level. These learning objectives are arranged in logical order but do not necessarily follow a set teaching sequence. A code (e.g., P-5 - meaning the fifth objective in the strand Problem Solving) is given to each objective. Using the code assigned to each objective, the teacher can refer back and forth between the grade specific Strand Overviews and the Scope and Sequence.

As you plan, you will discover that some objectives will be covered in more than one unit. You may also find that not all objectives indicated in a topic or subtopic will be covered in a single unit of study. They will have to be included in subsequent units.

The following coding is used for the five strands:

- (P) Problem Solving
- (D) Data Management and Analysis
- (N) Numbers and Operations
- (G) Geometry
- (M) Measurement

Key:

- **A blank space before an asterisk** indicates that no formal instruction should occur although informal instruction or readiness activities could take place.
- **An Asterisk (*)** indicates the grade level(s) at which the objective should be formally taught and evaluated.
- **An arrow (→) following the asterisk** means that review or reinforcement should occur when necessary.

  The objectives indicated by an arrow are not included in the grade specific Strand Overviews, but it is important to assure that students understand these concepts and have acquired these skills.

Strand: Problem Solving
Topic: Understanding

Learning Objectives	K	1	2	3	4	5
The student should be able to:						
P-1 establish and/or demonstrate an understanding of a problem by						
a) using manipulatives	*	*	*	→	→	→
b) acting out the problem	*	*	*	→	→	→
c) interpreting pictures	*	*	*	→	→	→
d) asking questions	*	*	*	→	→	→
e) drawing diagrams			*	*	*	→
f) interpreting tables, charts, graphs			*	*	*	*
g) using number sentences			*	*	*	*
h) rephrasing the problem			*	*	*	*
i) identifying missing or extraneous information				*	*	*
j) determining reasonableness of given information					*	*
k) recognizing subproblems						*
l) recognizing hidden information						*

Strand: Problem Solving
Topic: Planning and Executing

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
P-2 design a plan and solve problems using one or more of the following strategies						
a) use manipulatives	*	*	*	→	→	→
b) act out the plan	*	*	*	→	→	→
c) use counting strategies		*	*	→	→	→
d) collect, organize, and interpret data		*	*	*	*	→
e) choose an operation			*	*	*	→
f) use patterns			*	*	*	→
g) draw a diagram			*	*	*	→
h) use a number sentence			*	*	*	*
i) guess and check				*	*	*
j) work backwards				*	*	*
k) make a systematic list					*	*
l) use a simpler related problem					*	*
m) make a chart or table					*	*
n) select and use appropriate information						*
o) eliminate possibilities						*
P-3 apply estimation strategies to a problem			*	*	*	*
P-4 solve a variety of types of problems including						
a) translation problems		*	*	*	*	*
b) process problems		*	*	*	*	*
c) realistic problems		*	*	*	*	*

Strand: Problem Solving
Topic: Reflecting

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
P-5 explain how the solution was obtained	*	*	*	*	*	*
P-6 judge the reasonableness of the results by						
a) reviewing the problem and process used				*	*	*
b) comparing to similar problems				*	*	*
c) comparing to the estimate				*	*	*
P-7 create a word problem given specific information						
a) orally		*	*	→	→	→
b) in written form				*	*	→
P-8 create problems similar to those solved		*	*	*	*	*
P-9 recognize similarities to other problems					*	*
P-10 apply alternate problem-solving strategies					*	*
P-11 properly display the results			*	*	*	*

Strand: Data Management and Analysis
Topic: Collecting

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
D-1 acquire data through						
a) counting	*	*	*	→	→	→
b) surveys	*	*	*	*	*	*
c) measuring	*	*	*	*	*	*
d) simple experiments			*	*	*	*
e) published information				*	*	*
D-2 recognize that the data collected are affected by						
a) the nature of the sample					*	*
b) the method of collection						*
c) the sample size						*
D-3 discuss factors that may distort the results of data collected, e. g., gender, ethnic, socio/economic		*	*	*	*	*

Strand: Data Management and Analysis
Topic: Organizing and Displaying

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
D-4 design classifications and sort data using						
a) objects	*	*	→	→	→	→
b) pictures	*	*	*	→	→	→
D-5 design classifications for data collected				*	*	*
D-6 display data using						
a) object graphs	*	*	*	→	→	→
b) picture graphs	*	*	*	→	→	→
c) tables and lists			*	*	→	→
d) tally methods			*	*	→	→
e) symbolic graphs				*	*	→
f) bar graphs				*	*	*
g) timelines and timetables				*	*	*
h) line graphs (broken)					*	*
i) histograms						*
D-7 discuss and determine the most suitable method(s) to display data				*	*	*

Strand: Data Management and Analysis
Topic: Summarizing and Interpreting

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
D-8 discuss, interpret, and ascribe meaning to the organized data by						
a) examining the shape	*	*	*	*	→	→
b) questioning		*	*	*	*	*
c) conjecturing					*	*
d) seeing relationships					*	*
e) reviewing before concluding						*
f) building theories						*
g) finding averages						*
D-9 solve problems involving data management	*	*	*	*	*	*
D-10 understand the concepts of probability (chance) by						
a) using the terms sometimes, never, always, maybe, likely		*	*			
b) predicting	*	*	*	*	*	*
c) identifying events				*	*	*

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Foundations

Learning Objectives	K	1	2	3	4	5
The student should be able to:						
N-1 recognize that all whole number quantities are compositions of other smaller quantities		*	→			
N-2 recognize that adding one quantity to another increases the total		*	→			
N-3 recognize that subtracting one quantity from another decreases the total		*	→			
N-4 recognize that partitioning a quantity does not change the total quantity		*	*			
N-5 recognize that one and only one number can be assigned to represent a quantity		*	→			
N-6 recognize that not all numerals represent quantities		*	*	→		
N-7 recognize that two quantities can be made equal by						
a) adding or subtracting a quantity		*	→			
b) adjusting both quantities			*	→		
N-8 recognize that the number representing a quantity is independent of the characteristics of the objects or the configuration of the quantity		*	→			
N-9 recognize that quantities can be ordered according to the numbers assigned to represent each quantity		*	*	→		

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Foundations

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
N-10 recognize that if a quantity is partitioned into two then either sub-quantity can be determined given the other and the total quantity		*	*	→	→	
N-11 recognize, demonstrate, and explain patterning of numbers, objects, and events		*	*	→	→	→
N-12 identify one or more characteristics of an object or an event	*	*	*	*	*	→
N-13 demonstrate and explain classification (sorting) of data, objects, or events by						
a) finding all which correspond to a single specified property		*	→			
b) arranging all into groups of different properties		*	*	→		
c) arranging them in different ways	*	*	*	*	→	→
d) using set intersection				*	*	→
N-14 demonstrate and explain seriation (ordering) of objects or events by using commonly seen attributes	*	*	*	*	*	→
N-15 demonstrate and explain correspondence (matching) by using						
a) one to one matching	*	*	→			
b) one to many correspondence		*	*	→		
c) many to many correspondence				*	*	→
N-16 compare sets using the phrases "more than", "less than", "equal to"		*	*	→		

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Counting

Learning Objectives	Grade K	1	2	3	4	5
The student should be able to:						
N-17 recognize that the last counted number represents the quantity		*	→			
N-18 recognize the purposes of counting	*	*	*	→		
N-19 count forward and backward by ones using any starting or ending point up to						
a) 100		*	→			
b) 1000			*	→		
N-20 skip count forward and backward by						
a) 2's, 5's, and 10's to 100		*	→	→		
b) 3's, 4's, 25's, 100's			*	→	→	→
c) 6's, 9's				*	→	→
d) 7's, 8's					*	→
N-21 use ordinals to describe and order an arrangement		*	*	*	→	→
N-22 understand and use the terms "the number before", "the number after", "the number between", "odd", and "even"		*	*	→		
N-23 recognize quantities up to 5 by visual inspection (not counting)		*	→			
N-24 gain an understanding of the role of approximate numbers		*	*	*	*	→
N-25 use the terms "about", "near", "close" to compare numbers		*	→			
N-26 estimate an amount by						
a) using referents or benchmarks		*	*	→	→	→
b) focusing on more than one attribute			*	*	→	→
c) partitioning into equal parts			*	*	→	→

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Place Value

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
N-27 understand that the digits 0-9 are used to form all other numbers		*	*	→		
N-28 group by						
a) 10's and 1's		*				
b) 100's, 10's, and 1's			*			
c) 1000's, 100's, 10's, and 1's				*		
d) 10 000's, 1000's, 100's, 10's, and 1's					*	
N-29 read, write the symbols for, and express orally, numerals less than						
a) 100		*				
b) 1000			*			
c) 10 000				*		
d) 100 000					*	
e) 1 000 000						*
N-30 read words for numerals						
a) to 10		*				
b) to 20			*			
c) to 100				*		
d) to 1000					*	→
e) beyond 1000						*
N-31 write the numerals for a given model/picture and make a model/picture for a given numeral less than						
a) 100		*				
b) 1000			*			
c) 10 000				*		
N-32 understand the place value positions as increasing powers of ten to						
a) 3 digits			*			
b) 4 digits				*		
c) 5 digits					*	
d) 6 digits						*

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Place Value

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
N-33 understand that each digit of a number represents the product of the digit and the appropriate power of ten to						
a) 3 digits			*			
b) 4 digits				*		
c) 5 digits					*	
d) 6 digits						*
N-34 understand that the quantity represented by a multi-digit numeral is the sum of the quantities represented by each digit to						
a) 2 digits		*				
b) 3 digits			*			
c) 4 digits				*		
d) 5 digits					*	
e) 6 digits						*
N-35 compare and/or order numbers by						
a) using a number line		*	*	→		
b) using place value		*	*	*	*	*
c) using the symbols						
i) =		*	→	→		
ii) <, >				*	→	→
N-36 understand that large numbers are arranged into groups of three digits when written and expressed verbally					*	*
N-37 understand that a decimal point is placed between the units digit and the tenths digit and uses the term "and' when read					*	*
N-38 write equivalent expressions for a number			*	*	*	*

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Addition

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
N-39 recognize and solve a variety of problems involving addition		*	*	*	*	*
N-40 demonstrate addition by joining sets using manipulatives		*	*			
N-41 reason out sums and solve problems by applying the following mental calculation strategies						
a) counting on from the larger addend		*	*	→	→	→
b) recalling a doubles combination		*	*	→	→	→
c) counting on in steps larger than a unit		*	*	*	→	→
d) building on a known double		*	*	*	→	→
e) using addition tables		*	*	*	→	→
f) using properties						
- zero, commutative, associative		*	*	*	→	→
g) counting on from a known sum			*	*	→	→
h) making tens			*	*	*	*
i) building on a known sum of ten				*	*	*
j) making fives				*	*	*
k) annexing zeros				*	*	*
l) recalling neighbouring numbers					*	*
m) using left to right					*	*
n) adding 8's and 9's						*
o) compensating						*
N-42 read, write, and solve open number sentences using +, =, and __		*	*	*	*	*
N-43 understand and use the terms						
a) add, plus		*	→			
b) sum, total			*	→	→	
c) addend				*	→	→

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Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Addition

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
N-44 use manipulatives, pictures, or a number line to calculate sums		*	*	→		
N-45 demonstrate and record various compositions of a given number		*	*	→	→	
N-46 perform addition displayed in horizontal and vertical format		*	*	→	→	→
N-47 calculate sums by using addition algorithms with						
a) addends containing 2 digits			*			
b) addends containing 3 digits				*		
c) addends containing 4 digits					*	→
N-48 estimate a sum by						
a) adding front end digits			*	*	*	*
b) compensating					*	*
c) using compatible numbers					*	*
d) using special numbers						*
e) clustering						*
f) rounding						*
N-49 determine and use the most appropriate method(s) to find sums in problem solving situations						
a) computational estimation			*	*	*	*
b) standard algorithms			*	*	*	*
c) mental computation			*	*	*	*
d) calculator				*	*	*
N-50 use subtotals to calculate a sum				*	*	*

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Subtraction

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
N-51 recognize and solve a variety of problems involving subtraction		*	*	*	*	*
N-52 demonstrate subtraction by						
a) removing objects		*	→			
b) comparing the number of objects			*	→		
c) partitioning objects			*	→		
N-53 reason out differences and solve problems by applying the following mental calculation strategies						
a) counting back from the minuend the size of the subtrahend		*	*	→		
b) counting back from the minuend to the subtrahend		*	*	→		
c) counting up from the subtrahend		*	*	→		
d) counting back in steps larger than a unit			*	*	*	*
e) figuring from a known difference			*	*	*	*
f) applying addition to subtraction			*	*	*	*
g) complementary method of subtraction				*	*	*
h) annexing zeros				*	*	*
i) using doubles					*	*
j) using left to right					*	*
k) subtracting 8's and 9's						*
l) compensating						*
N-54 read, write, and solve open number sentences using -, =, and __		*	*	*	*	*
N-55 understand and use the terms						
a) take away, subtract		*	→			
b) minus, difference			*	→	→	
c) minuend, subtrahend						*
N-56 use manipulatives, pictures, or a number line to calculate differences		*	*	*	→	

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Subtraction

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
N-57 understand that subtraction is the inverse of addition . . .		*	*	→		
N-58 perform subtraction displayed in horizontal and vertical format		*	*	*	→	→
N-59 calculate differences by using subtraction algorithms with						
a) subtrahends containing 2 digits			*			
b) subtrahends containing 3 digits				*		
c) subtrahends containing 4 digits					*	→
N-60 estimate differences by						
a) using front end digits			*	*	*	*
b) compensating					*	*
c) using special numbers						*
d) rounding						*
N-61 determine the accuracy of subtraction by using addition . .				*	*	*
N-62 determine and use the most appropriate method(s) to find differences in problem solving situations						
a) computational estimation			*	*	*	*
b) standard algorithms			*	*	*	*
c) mental computation			*	*	*	*
d) calculator				*	*	*

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Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Multiplication

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
N-63 recognize and solve a variety of problems involving multiplication			*	*	*	*
N-64 demonstrate multiplication by using manipulatives, pictures, and repeated addition			*	→	→	
N-65 reason out products and solve problems by applying the following mental calculation strategies						
a) skip counting				*	*	→
b) multiplication tables and patterns				*	*	→
c) properties - of 1 and 0				*	*	→
- commutative				*	*	→
- associative					*	*
d) annexing zeros					*	*
e) additive distribution					*	*
f) subtractive distribution					*	*
g) factoring one factor						*
h) repeated doubling						*
i) using left to right						*
j) halving and doubling						*
N-66 understand and use the terms						
a) groups of			*	→		
b) times, multiply				*	→	
c) product, factor					*	→
d) multiplier, multiplicand						*
e) multiples						*
N-67 find products by using arrays and number lines			*	*	→	→
N-68 read, write, and solve open number sentences using x, =, and __				*	*	*

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Multiplication

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
N-69 mentally find products using as a factor						
a) 10, 100, 1000					*	→
b) multiples of 10, 100, and 1000						*
N-70 estimate a product by						
a) multiplying front end digits				*	*	*
b) compensating					*	*
c) using special numbers					*	*
d) rounding						*
N-71 use multiplication algorithms, involving a single digit multiplier, to find products					*	*
N-72 calculate the product by using more than two factors						*
N-73 express for a given number						
a) multiples					*	*
b) all the factors						*
N-74 determine and use the most appropriate method(s) to find products in problem solving situations						
a) computational estimation					*	*
b) standard algorithms					*	*
c) mental computation					*	*
d) calculator					*	*

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Division

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
N-75 recognize and solve a variety of problems involving division				*	*	*
N-76 demonstrate division as						
a) sharing			*	*	→	
b) forming equal groups				*	*	→
N-77 reason out quotients and solve problems by applying the following mental calculation strategies						
a) repeated subtraction				*	→	
b) applying multiplication to division					*	*
c) annexing zeros					*	*
d) divisive distribution						*
e) halving						*
N-78 understand and use the terms						
a) divide, left over, remainder				*	→	→
b) divisor, dividend, quotient						*
N-79 find quotients by using manipulatives, pictures, and a number line				*	*	*
N-80 estimate a quotient by						
a) using the front end digits					*	*
b) compensating						*
c) using special numbers						*
d) using compatible numbers						*
e) rounding						*
N-81 use division algorithms, involving a single digit divisor, to find quotients						*

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Division

Learning Objectives	K	1	2	3	4	5
The student should be able to:						
N-82 verify a quotient by using						
a) repeated subtraction					*	
b) multiplication						*
N-83 write related multiplication and division sentences					*	*
N-84 read, write, and solve open number sentences using /, ÷, =, and __					*	*
N-85 use mental calculation to find quotients using as a divisor						
a) 10					*	→
b) 100, 1000						*
N-86 determine and use the most appropriate method(s) to find quotients in problem solving situations						
a) computational estimation					*	*
b) standard algorithms						*
c) mental computation					*	*
d) calculator					*	*

Strand: Numbers and Operations
Topic: Rational Numbers
Sub-Topic: Common Fractions

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
N-87 compare the size of fractions by using a variety of manipulatives and materials		*	*	*	→	→
N-88 use manipulatives, when sharing, to develop the concept of fraction		*	*	→	→	
N-89 demonstrate by using manipulatives and pictures, the concept of fraction as						
a) part of a shape or solid						
- halves, thirds, fourths		*	→			
- tenths			*	→		
- n/d; $n \le 10$, $d \le 10$				*	→	→
b) part of a group of objects						
- halves, thirds, fourths			*	→		
- tenths				*	→	
- n/d; $n \le 10$, $d \le 10$					*	→
c) a point on a number line				*	*	*
N-90 demonstrate by using correct symbols, the concept of fraction for						
a) halves, thirds, fourths				*		
b) n/d; $n \le 10$, $d \le 10$					*	→
N-91 understand that fractions represent partitioning into equal-sized parts of the whole		*	*	*	*	→
N-92 demonstrate equivalent fractions by						
a) using manipulatives and pictures				*	*	→
b) multiplying/dividing						*
c) expressing a fraction in simplest terms						*

Strand: Numbers and Operations
Topic: Rational Numbers
Sub-Topic: Common Fractions

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
N-93 understand the relationships between the concrete, pictorial, verbal, and symbolic representations of						
a) fractions				*	*	→
b) mixed numbers					*	*
N-94 use manipulatives, pictures, and symbols to order fractions						
a) having like denominators				*	*	→
b) having like numerators					*	*
c) having the same number of pieces less or more than a unit						*
d) by comparing to one-half or a unit						*
N-95 understand and use the terms						
a) numerator, denominator, equivalent fractions					*	*
b) simplified fractions						*
N-96 convert to a decimal fraction (vice versa), a common fraction with a denominator of						
a) 2, 10					*	
b) factors of 100						*
c) non-factors of 100 (approximation)						*
N-97 use manipulatives and pictures to solve problems involving addition and subtraction of fractions with						
a) like denominators					*	→
b) compatible unlike denominators						*

Strand: Numbers and Operations
Topic: Rational Numbers
Sub-Topic: Decimal Fractions

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
N-98 recognize and solve problems involving addition and subtraction of decimal fractions					*	*
N-99 determine the size of a decimal fraction by comparing it to a benchmark					*	*
N-100 understand the relationship of common fractions to decimal fractions for						
a) 10ths					*	→
b) 100ths						*
N-101 illustrate decimal fractions by using models and diagrams						
a) 10ths					*	→
b) 100ths						*
N-102 order decimal fractions by using						
a) manipulatives or pictures					*	*
b) position of the digit						*
N-103 generate patterns using decimal fractions						
a) 10ths					*	→
b) 100ths					*	*
N-104 express decimal fractions in words and numerals						
a) 10ths					*	→
b) 100ths						*

Strand: Numbers and Operations
Topic: Rational Numbers
Sub-Topic: Decimal Fractions

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
N-105 compare any two decimal numbers greater than or less than one using						
a) 10ths					*	→
b) 100ths						*
N-106 use manipulatives and pictures to illustrate addition and subtraction of decimal fractions						
a) 10ths					*	→
b) 100ths						*
N-107 use mental calculation strategies to estimate sums and differences of decimal fractions					*	*
N-108 add and subtract decimal fractions by aligning similar place value columns						
a) 10ths					*	
b) 100ths						*
N-109 recognize and solve problems involving the multiplication of a decimal fraction						*
N-110 use models and diagrams to illustrate multiplication of decimal fractions by a single digit whole number						*
N-111 use mental calculation strategies to estimate the product of a decimal fraction and a single digit whole number						*

Strand: Numbers and Operations
Topic: Rational Numbers
Sub-Topic: Decimal Fractions

Learning Objectives	Grade K	1	2	3	4	5
The student should be able to:						
N-112 multiply a decimal fraction by a single digit whole number						*
N-113 use estimates when multiplying to place the decimal point						*
N-114 recognize and solve problems involving the division of a decimal fraction						*
N-115 use manipulatives and pictures to illustrate division of a decimal fraction by a single digit whole number						*
N-116 use mental calculation strategies to estimate the quotient when dividing a decimal fraction by a single digit whole number						*
N-117 divide a decimal fraction by a single digit whole number						*
N-118 determine and use the most appropriate method(s) to find answers to problems involving decimal fractions						
a) computational estimation					*	*
b) standard algorithms					*	*
c) mental computation					*	*
d) calculator					*	*

Strand: Geometry
Topic: Space

Learning Objectives	K	1	2	3	4	5
	Grade					
The student should be able to:						
G-1 design classifications and sort three-dimensional objects according to various characteristics	*	*	*	*	→	→
G-2 describe and demonstrate the relative position of an object as over, under, above, below, in front of, behind, inside, outside, beside, between, along, and through	*	*	→			
G-3 identify and name examples from the environment of						
a) sphere, cube, cone		*	*	→	→	→
b) cylinder, rectangular solid			*	*	→	→
c) pyramid				*	→	→
G-4 identify the properties (faces, corners, and edges) and compare three-dimensional objects		*	*	*	*	→
G-5 construct three-dimensional objects			*	*	*	*
G-6 identify the shape of the faces of three-dimensional objects				*	*	*
G-7 make congruent three-dimensional objects				*	*	*
G-8 identify and name examples of congruent three-dimensional objects in the environment					*	*
G-9 locate planes of symmetry of three-dimensional objects				*	*	*
G-10 draw three-dimensional shapes						*
G-11 recall objects no longer in view	*	*	*	*	*	*

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Strand: Geometry
Topic: Plane

Learning Objectives	Grade K	1	2	3	4	5
The student should be able to:						
G-12 design classifications and sort two-dimensional shapes according to various characteristics	*	*	*	*	→	→
G-13 name, illustrate, and identify examples from the environment of						
a) square, rectangle, circle, triangle		*	*	→	→	→
b) hexagon, octagon, oval				*	*	→
c) parallelogram, pentagon					*	*
d) trapezoid, rhombus						*
G-14 trace and draw two-dimensional figures		*	*	*	→	
G-15 differentiate between figure and background		*	*	→		
G-16 combine two-dimensional geometric figures to make other figures		*	*	*	*	*
G-17 recognize, draw, and name						
a) point, line, line segment				*	*	→
b) parallel, intersecting, and perpendicular lines					*	*
G-18 match congruent (same size, same shape) two-dimensional figures			*	*	→	→
G-19 make congruent two-dimensional figures			*	*	*	*
G-20 identify and name examples of congruent two-dimensional figures in the environment					*	*

Strand: Geometry
Topic: Plane

Learning Objectives	Grade K	1	2	3	4	5
The student should be able to:						
G-21 enlarge and reduce figures						*
G-22 identify and draw using simple figures						
a) translations (slides)					*	→
b) reflections (flips), rotations (turns)						*
G-23 create symmetrical shapes and determine lines of symmetry				*	*	*
G-24 identify and name examples of symmetry in the environment (reflection or rotation)				*	*	*
G-25 cover a surface by using one or more shapes		*	*	*	*	*
G-26 cover a surface by using one or more tessellating shapes				*	*	*
G-27 recognize tessellations in the environment					*	*
G-28 create shapes that tessellate						*
G-29 understand and use the terms						
a) symmetry				*	*	→
b) congruent, tessellate					*	*
G-30 locate and plot ordered number pairs in the first quadrant						*

Strand: Measurement
Topic: Length

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
M-1 solve a variety of problems involving length		*	*	*	*	*
M-2 compare lengths using "longer", "wider", "thicker", "taller", "shorter", "deeper", "thinner"		*	→			
M-3 estimate and then measure the length of or distance around objects by using non-standard units		*	→			
M-4 read measuring devices to measure length/distances in						
a) centimetres		*	→	→	→	→
b) metres			*	*	→	→
c) millimetres					*	→
d) kilometres						*
M-5 compare, estimate, then measure and record lengths/distances by using						
a) centimetres (cm)		*	→	→	→	→
b) metres (m)			*	*	→	→
c) millimetres (mm)					*	→
d) kilometres (km)						*
M-6 recognize and use the appropriate unit to measure length or distance given a real world measurement situation			*	*	*	*
M-7 understand the relationship between						
a) cm - m			*	*	→	→
b) mm - cm					*	→
c) mm - m, m - km						*

Strand: Measurement
Topic: Length

Learning Objectives	Grade K	1	2	3	4	5
The student should be able to:						
M-8 identify, estimate, measure, and calculate the perimeter of plane figures by adding all sides					*	*
M-9 identify examples in the environment involving linear measurement using						
a) centimetres		*	→	→	→	→
b) metres			*	*	→	→
c) millimetres					*	→
d) kilometres						*
M-10 find the circumference of a curved object by measuring			*	*	*	→
M-11 find the diameter of a circle by measuring						*
M-12 understand the relationship between the radius and diameter of a circle						*

Strand: Measurement
Topic: Area

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
M-13 solve a variety of problems involving area				*	*	*
M-14 explore the concept of area using manipulatives	*	*	*	→		
M-15 estimate and measure the area of a surface using non-standard units			*	→		
M-16 estimate the area of a region by comparing it with another area				*	*	→
M-17 compare the area of two regions as larger or smaller by						
a) superimposing surfaces				*	→	
b) cutting and rearranging superimposed surfaces					*	→
M-18 identify the square as the standard shape for measuring the area of a surface					*	→
M-19 compare, estimate, and then measure the area of regions using						
a) square centimetres (cm^2)					*	*
b) square metres (m^2)						*
M-20 recognize and discuss the relationships between the dimensions of a rectangle and its area (including squares)					*	*
M-21 determine various dimensions of rectangles when the area is known						*
M-22 identify regions in the environment which are measured using						
a) square centimetres					*	*
b) square metres						*

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Strand: Measurement
Topic: Capacity

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
M-23 solve a variety of problems involving capacity		*	*	*	*	*
M-24 understand that capacity is the amount a container holds		*	*	→		
M-25 compare visually, the capacity of two containers as more, less, or equal		*	→	→	→	→
M-26 estimate and then measure the capacity of a container using non-standard units		*	*	→		
M-27 estimate, measure, and compare the capacity of two or more containers using non-standard units		*	*	→		
M-28 compare, estimate, and then measure the capacity of containers using standard units						
a) litre (L)			*	*	→	→
b) millilitre (mL)					*	*
M-29 identify, in the environment, containers which are measured using						
a) litres			*	*	→	→
b) millilitres					*	*
M-30 recognize the relationship between litres and millilitres . .					*	*

Strand: Measurement
Topic: Volume

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
M-31 solve a variety of problems involving volume					*	*
M-32 understand that volume involves the measure of space ...				*	*	→
M-33 compare visually, the volume of two objects as more, less, or equal				*	→	
M-34 understand that the cube is the standard shape for measuring volume				*	→	
M-35 estimate and then measure the volume of an object using stackable, non-standard units				*	*	→
M-36 compare and measure the volume of two objects using non-standard units					*	→
M-37 compare, estimate, and then measure the volume of objects using standard units						
a) cubic centimetre (cm^3)					*	*
b) cubic metre (m^3)						*
M-38 recognize and discuss the relationships between length, width, height, area, and volume					*	*
M-39 identify objects in the environment which are measured using						
a) cubic centimetres					*	*
b) cubic metres						*

Strand: Measurement
Topic: Mass

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
M-40 solve a variety of problems involving mass			*	*	*	*
M-41 compare by lifting, the masses of two objects as heavier or lighter	*	*	→	→		
M-42 recognize that the size and shape of an object does not necessarily depict its mass		*	*	→		
M-43 compare, estimate, and then measure the masses of objects using non-standard units		*	*	→		
M-44 compare, estimate, and then measure the masses of objects using standard units						
a) kilogram (kg)			*	*	→	→
b) gram (g)					*	*
M-45 identify objects in the environment which are measured using						
a) kilograms				*	→	→
b) grams					*	→
M-46 explain the relationship between						
a) kg and g					*	→
b) 1 kg and 1 L of water						*

Strand: Measurement
Topic: Time

Learning Objectives	Grade K	1	2	3	4	5
The student should be able to:						
M-47 solve a variety of problems involving time		*	*	*	*	*
M-48 identify longer and shorter time periods using non-standard units		*	→			
M-49 determine the length of time (non-standard units) using a variety of simple "clocks"		*	→			
M-50 understand the concept of time by using a						
a) digital clock						
- hour		*	→			
- minute			*	→		
- second					*	→
b) 12 hour clock						
- hour, half hour		*	→			
- quarter hour, five minute			*	→		
- minute				*	→	
- second				*	→	→
- A.M./P.M.					*	→
c) 24 hour clock						*
M-51 estimate elapsed time in						
a) minutes				*	→	→
b) seconds					*	→
M-52 order events according to time		*	*	*	*	*
M-53 understand and explain						
a) 24 hours = 1 day		*	→	→		
b) 7 days = 1 week		*	→	→		
c) 30 days ≈ 1 month		*	*	→		
d) 12 months = 1 year		*	*	→		
e) 60 minutes = 1 hour			*	→		
f) 60 seconds = 1 minute				*	→	
g) 365 days ≈ 1 year				*	→	

Strand: Measurement
Topic: Temperature

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
M-54 solve a variety of problems involving temperature		*	*	*	*	*
M-55 compare temperatures using terms such as "hotter", "colder", "warmer", "cooler"		*	*	→		
M-56 compare and estimate, then read a thermometer and record in degrees Celsius			*	*	*	*
M-57 use environmental signs to estimate temperature				*	→	→
M-58 recall in degrees Celsius						
a) comfortable room temperature, average seasonal temperatures					*	→
b) freezing and boiling point of water, average body temperature						*

Strand: Measurement
Topic: Money

Learning Objectives	Grade					
	K	1	2	3	4	5
The student should be able to:						
M-59 solve a variety of problems relating to money		*	*	*	*	*
M-60 identify coins/bills up to						
a) one dollar		*	→			
b) ten dollars			*	→		
c) one hundred dollars				*	→	
M-61 understand the relationships between						
a) pennies, nickels, dimes		*	→			
b) quarters, dollars			*	→		
M-62 count with						
a) pennies, nickels, dimes		*	→	→		
b) quarters, dollars			*	→	→	
c) two dollars, five dollars, ten dollars				*	→	→
M-63 use strategies to make change for given values to						
a) one dollar			*			
b) five dollars				*		
c) ten dollars					*	
d) one hundred dollars						*
M-64 add and subtract amounts of money using correct symbols						
a) cents or dollars			*			
b) dollars and cents				*	*	→
M-65 multiply/divide amounts of money (single digit multiplier/divisor)						
a) multiply					*	→
b) divide						*

Strand: Measurement
Topic: Angles

Learning Objectives	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
The student should be able to:						
M-66 recognize that an angle is a measurement of change of direction or the amount of turn			*	*	*	*
M-67 compare angles by						
a) superimposing			*	→		
b) using benchmarks						
- corner or right angles				*	→	
- straight angles					*	*
M-68 identify and compare sizes of angles in the environment as seen in a variety of orientations and line segment lengths			*	*	*	*

Strand Overviews

Using the Strand Overviews

The Strand Overviews are organized by grade. At the beginning of each grade overview the foundational objectives are presented. The first five foundational objectives are representative of the five strands in this Mathematics Curriculum. The following five foundational objectives are supportive of each Common Essential Learning excluding numeracy. These foundational objectives are expected to be applied at the appropriate level as supported by the detailed listing of the student learning objectives.

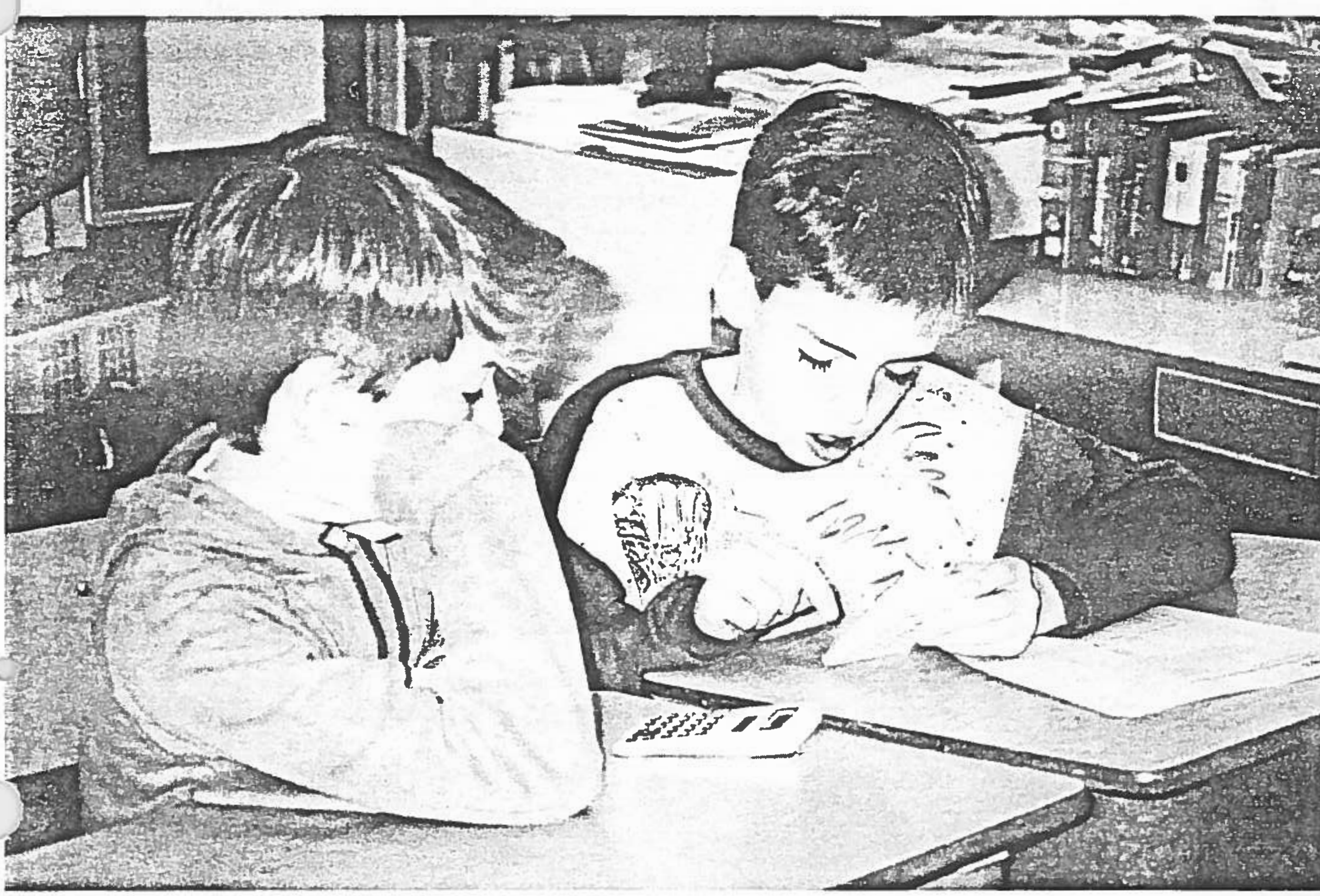
For each **learning objective** to be formally taught at each grade, a corresponding **example or activity** is given to help explain the objective and present a suggested level of difficulty. These examples may be used verbatim or adapted to suit a unit plan.

The facing page contains a column of **manipulatives and resources** that may be used to develop the corresponding objectives, and a column of **instructional notes** from which the teacher may acquire many ideas to use within each topic or subtopic.

A space is allotted for **teacher notes** where additional examples, activities, manipulatives, resources, and instructional notes can be written.

Various student **assessment techniques** are suggested for each learning objective. These are written in abbreviated form under each objective. e.g., (Assess: AR, OC) - indicates anecdotal records and/or observation checklist could be used for assessment purposes.
For further reference to these techniques see page 19.

Note: **Teachers are encouraged to use and adapt ideas from the strand overviews, model units, and projects other than the grade level(s) they are teaching.**



Guidelines for Kindergarten

Foundational understandings from the Required Areas of Study are best developed with young children when presented as contextualized, integrated experiences in an interactive environment, rather than when organized into subject specific learnings. Therefore, foundational understandings or objectives related to mathematics are to be integrated into developmentally appropriate activities for kindergarten students. Mathematical activities and experiences in the kindergarten program should contribute to the development of each child's:

- confidence, desire and ability to solve a variety of mathematically related problems;
- knowledge and understanding of how to collect, organize and interpret numerical data;
- understanding of numbers, number patterns, counting and estimation;
- sense of spatial awareness through active involvement in working with two- and three-dimensional shapes; and,
- understanding of the basic concepts of measurement.

It is important to develop these understandings through the use of manipulatives and through the active involvement of students in classroom, field and outdoor experiences. Some general guidelines and specific examples relevant to the development of the foundational objectives for kindergarten mathematics follow.

General Guidelines

At the kindergarten level, developing each students' understanding of mathematical concepts, processes and abilities emphasizes the following:

1. Student Purpose

   This refers to the student's need to know, to understand, to find out. The desire to know comes from viewing the world as meaningful in some way. Teachers can facilitate students' search for meaning by providing materials which allow students to discover relationships upon which they can then build further discoveries. Students' backgrounds and experiences provide a framework which helps them to make sense of their discoveries.

   Providing students with relevant choices which allow them to explore areas in which they are interested also leads to students developing a sense of purpose for learning. This presupposes that teachers have already thought through the big ideas to be explored and have asked themselves the important question: "Why is this worth learning?"

2. Use of Manipulative Materials

   This guideline follows naturally from the supposition that the younger the child, the more context-embedded the experience should be. Kindergarten children learn through handling and experimenting with concrete materials. Such materials and equipment should provide for multicultural, anti-racist and non-sexist experiences.

It is important to provide a variety of manipulatives when exploring any concept. For example, students may initially explore the concept of capacity at the water table with different sizes of plastic beakers, containers and cups. Further play and exploration can be encouraged through the use of other "pourable" substances such as grains, lentils, sand, coloured water, marbles, pebbles, buttons, paper clips, macaroni or rubber bands.

3. Hands-on, Experiential Play

It is through play that young children come to know and understand the world around them. The physical, social, emotional and intellectual development of children is dependent upon activity. Therefore, the kindergarten program uses child-initiated, child-directed, teacher-supported play as an essential part of the educational process.

It is important that children have time for free exploration, experimentation and observation of materials and activities, particularly when concepts, materials or activities are new or unknown to the students.

4. Student Observation, Language and Reflection

One of the purposes of having students touch, handle, manipulate or experiment with materials is that it allows them to discuss their observations from an experiential point of view. Much of the development in these early years focuses on strengthening students' perceptual abilities through concrete experiences. Observations, manipulations and experiences with objects, visual images, sounds, music and movement contribute to the development of students' perceptual abilities.

The use of language also facilitates perceptual development. Young children learn through communicating with others both verbally and non-verbally in a positive, supportive learning climate. As children share their observations, and their ideas around these observations, they come to understand what it is they are thinking and learning about. Through expressing themselves, children frequently find out what they think and know, and so inform themselves. Classroom situations which invite students to use language to question or to explore, nurture a natural curiosity about the world. Such situations encourage the continued use of language for the purpose of inquiry. Sometimes adults are needed to provide a model for language use or to link ideas together.

Asking children to reflect upon their observations leads to the development of perceptual, procedural, conceptual and personal understanding. Children can be helped to broaden and deepen their understanding beyond these observations through teacher support.

5. Teacher Support

Teachers can support the continuous growth and learning of young children through:

- encouraging children to make choices and decisions based upon the available materials, activities and time. This involvement in designing and managing their own learning contributes to the development of a sense of purpose for learning and to the development of independent learners;
- accepting and respecting children and their ideas. Questioning should be open-ended and intended to encourage students to give information which the teacher does not have. The emphasis here is not on soliciting singular responses, or right or wrong answers. Rather, the teacher seriously considers the children's points of view and is interested in finding out how they reach their conclusions;
- encouraging children to learn about themselves and their world through the various senses. This develops students' observation and perceptual abilities and contributes to their procedural, conceptual and personal understandings;
- offering specific informative comments rather than rewards or general feedback. Material or social rewards can negatively affect student interest, motivation, and creativity and may even distract the child from experiencing personal satisfaction;
- enhancing incidental learnings; and,
- observing students.

Specific Examples

Some examples of developmentally appropriate activities which work toward the development of mathematical understandings related to the five strands in this Elementary Curriculum Guide follow.

1. **Problem Solving**

This strand emphasizes the understanding of problems, the planning and execution of solutions, and reflection. For kindergarten students, daily problem solving can be encouraged in the classroom and on the playground. Such problem solving should focus on:

- real life situations
- careful observation and discussion with others
- students generating alternatives
- students choosing alternatives
- students reflecting on choices

In addition to developing intellectual, mathematical understanding, this strand contributes to students' social development. An important question for teachers to ask themselves is:

"What is the child learning from this intervention/process/experience?"

2. **Data Management and Analysis**

This strand emphasizes the collection, organization, and interpretation of data. For kindergarten students, a variety of objects, events and activities can be provided for observing, discussing, sorting, labelling and display. Such experiences should focus on:

- real life situations
- careful observation and discussion with others
- noting similarities of objects or experiences
- collecting or organizing according to their own criterion
- sorting, classifying and reclassifying

Important questions for teachers to ask include:

"Can you tell me about the materials you chose?"
"What kinds of groups did you make?"
"How did you get that idea?"
"What other kinds of groups could you make?"

3. **Numbers and Operations**

This strand emphasizes the understanding of numbers, number patterns, counting, and estimation. Such understanding is best developed through purposeful, concrete experiences and through using manipulatives. The following example demonstrates the integration of this strand with the previous strand.

Two kindergarten children were observed playing at a block centre with eight plastic models of dinosaurs. The children first arranged the dinosaurs in a line according to size and counted them one, two....eight. Then they decided to arrange them in order of meanness. After deciding that the ones with the biggest teeth were the meanest, they again lined up the dinosaurs and again counted them. They both expressed considerable surprise when they found that there were still eight dinosaurs.

In another part of the classroom, the kindergarten teacher observes four children in the imaginative play area and joins their play in the "restaurant":

"May I join you?"
"Is there another chair for me to use?"
"Do you have enough?"
"Tell me about the "special" of the day..."

There are many opportunities for children to learn about numbers through play. They need many concrete experiences with different sets of objects in different situations before their understanding of number is firmly established.

4. **Geometry**

This strand emphasizes the development of students' spatial awareness through active involvement in working with two- and three-dimensional shapes. Such development is most successfully promoted through using manipulative materials and through hands-on, experiential play. The emphasis is on:

- handling and exploring with varied materials
- careful observation and discussion with others
- noting similarities and differences

- organizing according to their own criterion
- sorting, classifying, reclassifying

Many of the objectives which kindergarten teachers can work toward developing through appropriate materials, activities and experiences overlap with objectives related to other strands. An example follows.

Providing students with cardboard shapes of different sizes and colours, attribute blocks, paper, scissors and crayons and allowing time for exploration through observing, handling, tracing, sorting, comparing and reclassifying will contribute to students' understanding in the strand. Questions which could guide students' discoveries include:

"How are these shapes alike? Different?"
"If you close your eyes, which shape are you able to find? What is it about this shape that helps you to find it?"
"What other things in the room/gym/playground have the same shape?"

5. **Measurement**

This strand emphasizes the exploration of concepts such as length, area, capacity, mass, time, and temperature. The facilitation of this exploration is accomplished through:

- using manipulatives
- involvement in practical classroom and outdoor experiences
- making careful observations and discussing these with others

For example, students' sense of time can be developed by emphasizing tasks and completion of activities:

"Tell me about your picture/construction/ experiment. Where did you get your ideas? If you were to change anything, what would it be? How will you know when your project is finished?"

or

"You've been working at this painting/castle/ water wheel for a while. Why?"

When exploring the concept of capacity with pourable substances, questions which could guide students' observations and experimentations include:

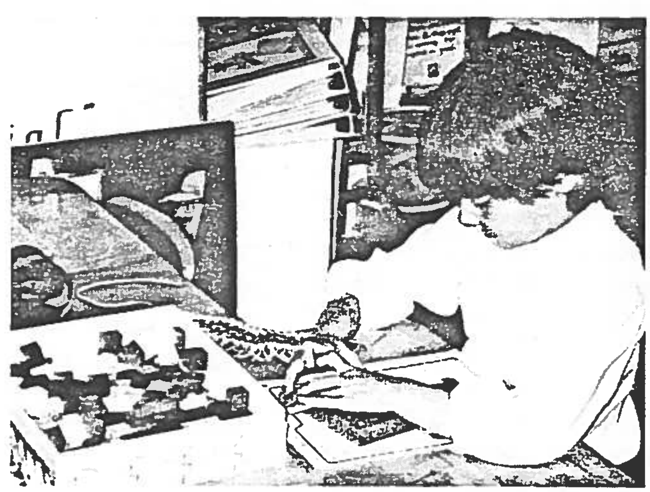
"How can you tell which container holds more water? Less water? The same amount?"

Questions to facilitate the exploration of the concept of area with manipulatives could include:

"How many pennies/hands/buttons do you think it will take to cover the circle? How could you check?"

Objectives which kindergarten teachers can work toward developing through appropriate materials, activities and experiences are outlined in the Scope and Sequence which precedes this section. This scope and sequence of specific learning objectives at the Kindergarten level is not intended to be complete, final or prescriptive. Rather, it provides a source of items from which teachers can generate additional learning objectives that work toward the development of mathematical understandings in the kindergarten program.

It is not necessary to design a "math" center in the kindergarten classroom. Mathematical understandings can be developed through materials and activities at the block center, water table, sand table, imaginative play area, discovery table, library corner, cooking center, carpentry area or through other centres, experiences and projects. Centres, activities or projects devoted to a particular area of study are not the critical component. It is the learnings that children acquire through these varied experiences that are important.



Grade One

Grade One

Foundational Objectives

The Student should:

- demonstrate confidence, desire, and an ability to solve a variety of mathematically related problems;

- demonstrate knowledge and understanding of why, when, and how to collect, organize, and interpret numerical data;

- demonstrate an understanding of numbers, patterns, counting, operations, and estimation;

- demonstrate a sense of spatial awareness and familiarity with two- and three-dimensional shapes and recognize relationships between geometry and the environment; and,

- demonstrate an ability to measure and use appropriate measurement techniques and to apply measurement to real life.

Working toward the achievement of the above foundational objectives contributes to the development of the C.E.L. of Numeracy and to the following foundational objectives for the Common Essential Learnings. Other C.E.L. foundational objectives should be used in addition to those given below.

Students should develop their abilities to:

- discuss their ideas using their own language and using the vocabulary and forms of expression of mathematics (C);

- generate alternative solutions and share how they arrived at these solutions (CCT);

- work cooperatively and contribute positively in group learning activities (PSVS);

- participate in experiences which lead to independent exploration (IL); and,

- understand the benefits and limitations of measuring tools and calculating devices (TL).

Strand: Problem Solving
Topic: Understanding

Learning Objectives	Example/Activity
P-1 establish and/or demonstrate an understanding of a problem by	
a) using manipulatives (Assess: AR, OC, P-T, O-T, AS)	Have students examine attribute/logic blocks and ask them to explain the various characteristics. Use the blocks to make a train so that each connecting car has one and only one different characteristic (colour, shape, thickness, or size).
b) acting out the problem (Assess: AR, OC, RS, P-T)	Demonstrate understanding by acting out the following problem. If it takes 10 handclaps to run around the circle once, how many handclaps does it take to run around the circle twice?
c) interpreting pictures (Assess: AR, OC, RS, O-T)	Demonstrate how examining a picture may help to understand the following problem. Sue, Bill and Laurie each have their own cat. Laurie has the largest cat. Sue's cat is smaller than Bill's cat. Who has the smallest cat?
d) asking questions (Assess: AR, OC, RS, O-T)	Bradley and Jennifer each have a wagon. How many wheels are there altogether on both wagons? Demonstrate how students may analyze a problem by asking questions. e.g., Who has wagons? How many wagons does each have? How many wheels are there on one wagon? What do we have to find out?

Manipulatives/Resources

A variety of appropriate manipulatives should be available to assist students in understanding a problem, including:

- counters
- attribute/logic blocks
- base ten material
- measuring devices
- geometry shapes
- linking cubes
- odds and ends
- felt boards
- objects in the classroom
- students
- other items of interest e.g., cartoon characters

An assortment of many good problems is necessary. These may be chosen from:

- real-life experiences
- problem solving publications
- teacher guides
- student resources
- magazines

Variations to an original problem can be produced by students and the teacher by:

- changing the context
- changing the size of numbers
- reversing the given and wanted information
- personalizing the problems
- using a combination of the above

Teacher Notes:

Instructional Notes

- Understanding the problem is a major hurdle for young problem solvers. Students must become part of the problem by analyzing the information given, the ideas related to information which may have to be collected, and the question(s) posed. Once understanding is thought to be achieved, students move instinctively into the planning and solving of the problem.

- Problems should be presented visually and/or orally to the students. The teacher should model the process of gaining understanding of the problem. The students will then become aware of the questions they may ask themselves and strategies they may apply each time they are challenged with a problem. But be careful not to over explain the problem so as to undermine students' confidence and ability.

- Each strategy developed for understanding a problem should be individually taught and demonstrated.

- Children often use the most probable approach but should receive positive feedback when using a different or multiple approaches.
  Ask probing questions as to how students arrived at their understanding of the problem thus allowing others to see their way of thinking.
  Allow students time to think and explore on their own.

- Children often have difficulty interpreting both oral and pictorial presentations. Therefore, teachers should be sure that students fully understand the problem.
  Encourage hands-on activities.

- Many mathematical skills and concepts can be developed through children's literature. For example:
  - use stories which display mathematical concepts and/or skills as outlined in one or more of the five strands;
  - develop mathematics related problems to correspond with the story;
  - have students use various strategies;
  - have students create their own related problems or stories; and,
  - use cooperative groups to solve problems.

- In situations where the language of instruction is other than the student's mother tongue, understanding the problem to solve may be an area of difficulty. Allow as much time as needed before proceeding to planning and executing.

Strand: Problem Solving
Topic: Planning and Executing

Learning Objectives	Example/Activity
P-2 design a plan and solve problems using one or more of the following strategies	
a) use manipulatives (Assess: AR, OC, AS, PA, P-T)	Make a garden using four squares. At least one side must be fully connected to the adjoining square. How many different gardens can you make? Trace them. Sascha rode her bike to the store to buy stickers. She bought 3 "feeling good" stickers and 6 "happy face" stickers. How many stickers did she buy altogether? Did she buy enough for herself and seven friends?
b) act out the plan (Assess: AR, OC, RS)	In a game, to travel from one station to another, we can either first take a step or a skip followed by a hop or a jump. There are four different ways that you could travel through this section. What are they? e.g., step, hop, step, hop ... step, jump, step, jump ...
c) use counting strategies (Assess: AS, AR, OC, O-T)	Mae invited nine friends to her birthday party. Three could not be there. How many came? (see N-53)
d) collect, organize, and interpret data (Assess: AR, OC, PA)	What is the length of your shoe in linking cubes. How many other classmates have shoes the same length as yours? How many have different lengths? Display the data.
P-4 solve a variety of types of problems including	
a) translation problems (Assess: AR, OC, O-T)	At the school carnival Joey knocked over four cans with his first throw and three cans with his second throw. What was his total? e.g., four cans plus three cans is seven cans.
b) process problems (Assess: AR, OC, AS, O-T)	Jamie can buy one small bead for two cents and one large bead for five cents. What sized beads can be bought for twenty cents? (use manipulatives or pictures to help find the answer)
c) realistic problems (Assess: AR, OC, AS, O-T)	How can you find out about how much taller you will probably grow this year?

Manipulatives/Resources

A variety of manipulatives should always be available for students to use when planning and executing the plan.

- counters
- base ten blocks
- linking cubes
- geoboards and elastics
- odds and ends
- blocks
- money
- classroom objects
- students
- other items of interest

Teacher Notes:

Instructional Notes

- Each strategy developed for executing the problem should be individually taught and demonstrated.
  This should occur several times with opportunity to practise.

- Depending on the type of problem, have students work individually, in pairs or small groups. Working cooperatively promotes confidence and development of interpersonal skills and contributes to success.

- Problems can be divided into three types:
  Translation
  - Problems that precisely provide the information needed to solve.
  - Problems that usually have only one acceptable answer.
  - Problems that are expected to be solved using some previously taught rule or algorithm.

  Process
  - Emphasis is more on the process of solving the problem.
  - The solution usually involves the application of a special problem solving strategy or heuristic.
  - Problems that encourage multiple and creative methods of solution.

  Realistic
  - Problems that are often not well defined.
  - Problems that often have multiple solutions.
  - Problems that often require the collection of information.
  - Problems that often involve collaboration with other people.
  - Problems that usually cannot be solved in a few minutes.

  Many problems may appear to fit into more than one category. When attempting to classify problems into the above types, their placement often depends on the level of difficulty for the student and on how the problem is to be solved.

Strand: Problem Solving
Topic: Reflecting

Learning Objectives	Example/Activity
P-5 explain how the solution was obtained (Assess: O-T, P-T, AR, OC)	Demonstrate and explain orally how you arrived at your answer. Billie and Sarah wanted to make sixteen playdough cookies. They made nine before dad called them for supper. How many do they have to make after supper?
P-7 create a word problem given specific information a) orally (Assess: AR, O-T)	Create your own problems using the information given in the picture.

Learning Objectives	Example/Activity
P-8 create problems similar to those solved (Assess AR, O-T)	As a class create new problems by altering the original problem. e.g, Which weighs more (less) - a scoop of sand or a scoop of blocks? - a handful of sand or a handful of pebbles? - a container of beans or a container of sunflower seeds? - one teacher or two students? - a pail of water or a pail of snow?

Manipulatives/Resources

Students should have access to manipulatives to assist in their explanations of the process they used to solve the problem.

Use appropriate problems that students and teacher have created and collected.

Teacher Notes:

Instructional Notes

- An important part of problem solving is to begin to have students reflect on the understanding they have of the problem and the processes they have used to solve the problem.
- Encourage students to describe to others how they interpret the problem and the strategies they used to arrive at an answer.
- Ask students to name the strategies used.
  e.g., to act out the problem, to use manipulatives, to count.
- Discuss any unique features the problem or solution may have.
- Observe students and question them individually, or as a group, about their work. Focus on the process. Offer hints when necessary. Encourage children to use or attempt to use alternative strategies.

Strand: Data Management and Analysis
Topic: Collecting

Learning Objectives	Example/Activity
D-1 acquire data through a) counting (Assess: AR, OC, RS, P-T)	Count the number of shoes that have laces and the number of shoes that have no laces. Count the number of people in your class with buttons on their shirts and the number of people with no buttons on their shirts. How many drops of water fit on a penny? A dime? How many water droplets can you put on wax paper and move around with a toothpick before the collection of droplets becomes too large to move?
b) surveys (Assess: AR, OC, RS)	Students line up in the classroom thereby creating a "real-life" graph. They then count the number in each line. Which students travelled to school by walking? Which students travelled to school in a vehicle? Choose your favourite - either a sugar or a sugar-free gum.
c) measuring (Assess: AR, OC, P-T)	How many linking cubes long is your foot? How many small containers does it take to fill the large container?
D-3 discuss factors that may distort the results of data collected e.g., gender, ethnic, socio-economic (Assess: AR)	Did we survey about the same number of girls as boys? Have the boys (girls) generally answered one way?

Manipulatives/Resources

An assortment of real-life problems for which data must be collected is necessary.
These may be divided into three types:

1. Your choice
   - favourite ice cream
   - prefer singing or dancing
2. The way the world is
   - objects that are hard or soft
   - objects that float or sink
3. Changing data
   - total number of buttons worn each day by students
   - total number of shirts of one colour compared to another colour
   - weather e.g., rainy, snowy, sunny, cloudy, cold, warm, hot

Teacher Notes:

Instructional Notes

- Data collected should be meaningful and involve information with which the students are familiar.
  e.g., school, family
- Data management and analysis at this grade should usually be done as a whole class or learning centre activity.
- Data management and analysis is a problem solving skill and should be taught in a systematic manner.
- Discuss with students the data needed and how to collect it.
- Collection should initially involve only two categories.
  e.g., soft/hard
  old/new
- Data becomes more meaningful if it is collected by the students.
- Skills for the collection of data should be applied through integration within the strands of mathematics and across the subject areas.
- Collecting data from various sources (e.g., books, T.V.) can be an excellent opportunity to introduce evaluating materials for bias.
- Collecting data at home can be an assignment to encourage family member involvement.
  e.g.,
  - eye colour of family members
  - favourite songs
  - favourite snacks

Strand: Data Management and Analysis
Topic: Organizing and Displaying

Learning Objectives	Example/Activity
D-4 design classifications and sort data using	
a) objects (Assess: P-T, AR, OC)	Sort a collection of objects. e.g., buttons, pasta, stones Explain how the objects were grouped. Re-sort the same collection. Explain.
b) pictures (Assess: P-T, AR, OC)	Sort a collection of pictures. Explain how the pictures were grouped. Re-group the same collection. Explain.
D-6 display data using	
a) object graphs (Assess: AR, OC)	After students have created a graph using themselves as the objects, indicating those wearing shoes with laces and those wearing shoes with no laces, they could then place the actual object in the appropriate column on the large floor graph. Place your shoe in the correct column.

Laces	No Laces

Learning Objectives	Example/Activity
b) picture graphs (Assess: AR, OC)	Attach to the graph in the correct column, a picture of running shoes if you prefer running or a picture of skates if you prefer skating. How many people live in your home? Draw the people in your home and glue by the corresponding number on the graph.

Manipulatives/Resources

sorting or graphing devices
- sorting mats
- floor graphing mats
- large laminated wall graphs
- trays
- egg cartons
- boxes
- plastic containers

pattern blocks
attribute blocks
odds and ends
playing cards
buttons
stones
sticks
feathers
beads
bottle caps
pasta
toys
paper clips
clothes pins (with and without student names)

actual objects which students can use to make their graph
- themselves
- shoes
- mukluks
- mitts
- hats
- food items
- books
- pencils

pictures of objects
- cut from magazines,etc.
- drawn by students
- duplicated by the teacher

Teacher Notes:

Instructional Notes

- The main objective for organizing and displaying data is to be able to better understand the information gathered.

- Instruction should be sequential, beginning with the concrete representation (using objects) and progressing to the pictorial representation (using pictures)
It is not advised to progress beyond the pictorial stage at this level.

- Students should experience data being represented in many ways using a variety of media. They should also be aware that data management activities do not end with the collection and display of data. The interpretation of the data, so as to come to some conclusion about the problem, is necessary.
e.g., Which category has more?
Which category has less?
How much more/less?
Which category has the same?
Why?

Strand: Data Management and Analysis
Topic: Summarizing and Interpreting

Learning Objectives	Example/Activity
D-8 discuss, interpret, and ascribe meaning to the organized data by	
a) examining the shape (Assess: O-T, AR, OC, RS)	Where are most of the items clumped? Are there places with few or no items?
b) questioning (Assess: AR, OC, RS, O-T)	Which category has more items? Which item is more popular? Does our graph make sense? What do you think would happen if we asked different people?
D-9 solve problems involving data management (Assess: PR, WA, O-T, AS)	Collect, display and interpret data to solve problems such as: Which of two television shows do you like best? Do most of us have pets? Will we have more sunny days or more cloudy days this month?
D-10 understand the concepts of probability (chance) by	
a) using the terms sometimes, never, always, maybe, likely (Assess: AR, OC)	Does it always, never or sometimes rain?
b) predicting (Assess: AR, AS, O-T)	How many times do you think heads will land facing up if we flip a coin ten times? Which letter(s) are used most often as a first letter of a name? Graph the first letter of your name. Graph for each member of your class. Which letter is used most often? Least often? The same as another?

Manipulatives/Resources

Try to represent the data in various ways using a variety of media. Using various methods can sometimes give a different view or message of the results.

Teacher Notes:

Instructional Notes

- Students should be encouraged to talk about their data - how they collected, displayed and interpreted the information.
- Attempt to generate new questions from the collected data. What are the times of the most popular T.V. shows? What advertisements are included?
- Data are often collected and displayed as a single culminating exercise to answer a question.
  e.g., What are the most popular T.V. shows?
  Attempt to use this data to raise and answer other questions.
  e.g., What makes them the most popular?
- At this level, probability is a very intuitive concept. Concentrate on using the terms related to probability and on predicting using small numbers and real life situations.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Foundations

Learning Objectives	Example/Activity
N-1 recognize that all whole number quantities are compositions of other smaller quantities (Assess: AR, O-T, P-T)	In pairs and using a part-part-whole mat, have students arrange counters in a composition that represents a given number e.g., "6" - read and explain the composition and then rearrange using a different composition. Students use six double-sided counters and turn one over at a time to discover all combinations.
N-2 recognize that adding one quantity to another increases the total (Assess: AR, O-T, P-T)	Students form a set of 3 objects, add 2 more and recount.
N-3 recognize that subtracting one quantity from another decreases the total (Assess: AR, O-T, OC)	Students form a set of 5 objects, remove 2 objects and recount the resultant set.
N-4 recognize that partitioning a quantity does not change the total quantity (Assess: AR, P-T, OC)	Form a set of 6 objects, divide them into groups and recount.
N-5 recognize that one and only one number can be assigned to represent a quantity (Assess: O-T, P-T, OC, RS)	As an independent activity or in pairs, have students use ten frames to show a certain amount. In groups students can use a large blank number strip on which to place objects and corresponding symbols.
N-6 recognize that not all numerals represent quantities (Assess: AR, OC)	Students should realize that numbers are also used to order, label, or identify things. e.g., athlete's number license plate house address numbers telephone numbers Go on a neighbourhood walk and record or take photographs of where numbers are used to signify situations other than amounts.

Manipulatives/Resources

counters
- buttons
- bottle caps
- pasta pieces
- dried beans
- bread bag fasteners
- beads
- large seeds
- paper clips
- pebbles
- bingo chips
- double-sided counters

small toys
odds and ends
linking cubes
unit cubes (base ten)
ten frames
part-part-whole mat
bead boxes
athletic sweater
license plate
pictures of numbers not
representing quantities

Teacher Notes:

Instructional Notes

♦ Students' understanding of number and quantity, and development of a keen number sense is critical to their understanding of mathematics.

♦ Development of the concept of number is dependent on the development of many number relations:
1. Relation in patterned arrangements.
e.g.,

```
"4" -   * *     *       *       *
        * *    * *      * *     *      ****
                *       *       *
                                *
```

2. Relation between two or more parts of the number.
   6 is...5 and 1, 4 and 2, 3 and 3.
3. Relation to other numbers.
   - one more or less
   - two more or less
   - special numbers
     (multiples of 5 and 10)

♦ It is important that students recognize common number relationships and patterns.
e.g., 8 is less than 9
6 is between 5 and 7
10 is the same as two 5's

♦ Conservation of number is developed when students are involved in partitioning quantities.

♦ Equal partitioning is the beginning of the development of fraction concepts.
Students should be involved in partitioning quantities using concrete objects and in forming their own partitions.
e.g., Equally divide 9 stickers between three students.
Equally divide a square cake between four students.

♦ Students often associate numbers only with quantities. Create a collage which demonstrates numbers used in non-quantity situations. Students may search through magazines or bring pictures from home.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Foundations

Learning Objectives	Example/Activity
N-7 recognize that two quantities can be made equal by a) adding or subtracting a quantity (Assess: SA-T, AR, P-T)	Make equal sets from a set of 4 objects and a set of 6 objects by either adding 2 objects to the smaller set, or taking 2 objects from the larger set. A student may wish to combine both sets and then divide them in half. This is a more cumbersome but acceptable strategy.
N-8 recognize that the number representing a quantity is independent of the characteristics of the objects or the configuration of the quantity (Assess: AR, P-T, OC, AS)	2 buttons + 2 blocks = _ objects
N-9 recognize that quantities can be ordered according to the numbers assigned to represent each quantity (Assess: P-T, SA-T, OC)	Order from smallest to largest: xxxx x xxx xxxx x xxx 8 2 6 _, _, _.
N-10 recognize that if a quantity is partitioned into two then either sub-quantity can be determined given the other and the total quantity (Assess: AR, P-T, OC)	Use a part-part-whole mat to demonstrate: 3 objects + __ objects = 5 objects __ objects + 1 object = 3 objects
N-11 recognize, demonstrate, and explain patterning of numbers, objects, and events (Assess: AR, O-T, RS)	Build a pattern using logic/attribute blocks. Continue the pattern. Give to a partner to continue. Ask them to explain.

Manipulatives/Resources

counters
- buttons
- bottle caps
- bread bag tags
- large seeds
- blocks

odds & ends
digit cards
linking cubes
part-part-whole mats
double-sided counters
attribute/logic blocks

Teacher Notes:

Instructional Notes

♦ Students may tend to associate quantity with size or configuration of objects. This can be overcome by using a variety of objects in various configurations.

♦ The concept of number can be developed with whole class or small group activities. Design various patterns of dots (e.g., representing the number 8) on paper plates, transparencies, or using objects on the overhead projector.

♦ Whenever students work in **cooperative groups** they should practise:
- taking turns (Circle of Knowledge Strategy)
- talking with "inside or quiet" voices
- staying with the group
- encouraging others - giving "put-ups"
- listening carefully to others
- sharing
- helping each other
- being cooperative

Focus on developing one or two of these skills at a time. Print the responsibilities on a wall chart for continuous viewing and add picture drawings and examples to help describe.

♦ Using manipulatives (counters and digits), students should discover that quantities do not have to be recounted each time they are ordered or used. Numbers representing the quantity can be assigned and used.

♦ When a quantity is partitioned, the concept of **conservation of number** is developed. In order for students to successfully find one of the parts of a total they must understand that partitioning a quantity does not change the total quantity.
This understanding develops slowly in some children.

♦ Model the appropriate vocabulary for your students so they hear the language of mathematics.
Always consider the students' language background. Encourage them to communicate with one another and share their observations and thinking as they participate in activities.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Foundations

Learning Objectives	Example/activity
N-12 identify one or more characteristics of an object or an event (Assess: AR, OC, RS)	Point to the yellow objects. Is this object thick or thin? Which objects are round and red? Identify patterns in music or art.
N-13 demonstrate and explain classification (sorting) of data, objects, or events by	
a) finding all which correspond to a single specified property (Assess: AS, AR, OC, RS)	Find all objects that are soft. Choose all the events which occur in the morning: walk home after school, eat breakfast, eat supper, brush your teeth, get dressed.
b) arranging all into groups of different properties (Assess: AR, SA-T, RS, OC)	Sort these objects into groups so that each group has different characteristics.
c) arranging them in different ways (Assess: AS, AR, OC, SA-T)	Look at the objects in the group. Sort them according to their colour. Now sort them according to another characteristic.
N-14 demonstrate and explain seriation (ordering) of objects or events by using commonly seen attributes (Assess: AR, OC, AS)	Arrange these articles in order from smallest to largest. Arrange all of the objects in order from heaviest to lightest. Arrange the objects in a way you choose. Explain.
N-15 demonstrate and explain correspondence (matching) by using	
a) one to one matching (Assess: P-T, AS, AR, OC)	Match children and hoops. Match children and pencils. Draw a bird to go with each tree.
b) one to many correspondence (Assess: P-T, AS, OC, AR)	Make a set of pennies to match the value of a nickel.
N-16 compare sets using the phrases "more than", "less than", "equal to" (Assess: SA-T, P-T, AS)	How many letters are in your first name? How many letters are in your last name? Compare the number of letters in each name. How does the length of your names compare? How does the length of your names compare to those of your classmates?

Manipulatives/Resources

odds and ends
students
bean bags
hoops
balls
shells
keys
buttons
nuts and bolts
nails
toys
pasta
marbles
small stones
plasticine
Big books
art supplies
pictures
attribute blocks
sorting mats
sorting trays
boxes
plastic containers
egg cartons
clothing items
money
number stories
number rhymes
number songs

Teacher Notes:

Instructional Notes

- Before students can be expected to sort, order, or match objects or events, they must be able to identify certain characteristics (e.g., colour, size, shape, texture, function, type).

- A focus for a Mathematics Centre could be "classification". Using sorting mats and a variety of materials, students can sort and re-sort objects.
  They may also sort materials that have been mixed up through activity, sort a collection following a field trip, or find examples of objects that have been sorted.

- Activities which develop an understanding of ordering can be organized to be included in work centres or activity centres. Order according to size, mass, capacity, time, length, or amount.

- One-to-one correspondence is a very critical concept for students to understand. Students should begin matching with the manipulation of concrete objects. At this grade level begin by matching items which are related e.g., students and chairs.

- Playing "trading games" and using manipulatives, students can discover examples of real-life one to many correspondence.
  e.g.,
  - 2 loonies for a $2 bill
  - 3 wheels for every tricycle
  - 10 pennies for a dime

- Have students compare sets using identical objects in similar configurations and progressing to using a variety of objects in different configurations.

- It is also important that students become familiar with the language used in comparing.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Counting

Learning Objectives	Example/Activity
N-17 recognize that the last counted number represents the quantity (Assess: P-T, O-T, AR, OC)	Students should count the amount in a group and emphasize the last counted number.
N-18 recognize the purposes of counting (Assess: AR, OC, O-T)	Counting can be used to solve simple problems. Count the number of beads in the package. 2 counters and 3 more counters = __ counters Do we have enough cupcakes for everyone in the classroom?
N-19 count forward and backward by ones using any starting or ending point up to a) 100 (Assess: O-T, P-T, SA-T, OC, RS)	Count forward from 1 to 19. Count forward from 12 to 21. Count backward from 60 to 48. Use a hundred chart or a number line to count.
N-20 skip count forward and backward by a) 2's, 5's, and 10's to 100 (Assess: P-T, AS, OC, RS, SA-T, AR)	Use a hundred chart to discover patterns. Use a calculator (2 + = = =). Make big books (counting). Beginning with number one, record on a long strip of paper (adding machine paper) each day of school.e.g., 1 2 3 4 5 6 ... Circle and box the 2's, 5's, 10's, and 25's on the paper roll using a different colour for each. Count forward and backward.
N-21 use ordinals to describe and order an arrangement (Assess: OC, RS, O-T, P-T)	Count from first to tenth. Show the sixth day of the month. Emphasize the position of an object and not the object itself by changing the order of the objects. Students line up first, second, etc.
N-22 understand and use the terms "the number before", "the number after", "the number between", "odd", and "even" (Assess: SA-T, MC-T, T/F-T, M-T)	What number is between 6 and 8? What number comes before 4? What number comes after 9? Use a hundred chart or number line. Introduce even and odd numbers through activities involving equal sharing of objects.

Manipulatives/Resources

counters
- beans
- bottle caps
- buttons
- bread bag tags
- large seeds
- paper clips
- pebbles
- pasta
- double sided counters
- blocks
- cereal
- popcorn

linking cubes
hundred chart
number line
calculator
adding machine paper
variety of objects
Big books
calendars
students

Teacher Notes:

Instructional Notes

- Use various objects from the student's environment to count.
  Make sure that the students move the objects as they count. If counting pictures, they should keep track by touching them, crossing them out, or placing a counter on them as they count. Use the statement, "count to find how many".
- Counting forward and backward should be practised at every opportunity since counting is crucial to the development of computational strategies.
- Skip counting is useful for counting larger quantities, counting out money, and as prerequisite to understanding multiplication.
  Use songs and rhymes that contain skip counting.
- Students should be encouraged to discover patterns when counting. Difficulty is often experienced with the numerals 11-19, or at the beginning of a decade (29-30).
- The ordinal aspect of number is as important as the cardinal aspect of number. Ordinality is used regularly in our daily lives to indicate many different arrangements such as time and dates, page numbers, and street numbers.
- Use real-life examples and concrete materials to develop the concept of ordinality. A variety of materials should be used and their order changed to emphasize that ordinality relates to the position of an object, event, or number.
- Number sense is developed by encouraging students to recognize and explain relationships between numbers.
  Try to demonstrate and encourage students to show how numbers are related to one another.
  Play a game of "before, after or in between".
  e.g., Is 14 before, after, or in between 8 and 10?

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Counting

Learning Objectives	Example/Activity
N-23 recognize quantities up to 5 by visual inspection (not counting) (Assess: OC, RS, P/SA)	Use "flash math". Flash, on an overhead for 1-2 seconds, varying numbers of objects of different sizes and shapes (up to 5) in varying configurations. Students indicate the number of objects.
N-24 gain an understanding of the role of approximate numbers (Assess: O-T, AR)	Discuss with students situations where approximate numbers are used (students on the playground) and where exact numbers are used (students in our class).
N-25 use the terms "about", "near", "close" to compare numbers (Assess: AR, OC, P/SA)	Play "about how many" by asking the students to close their eyes, think about how many and write down their answer. e.g., About how many books on the teacher's desk? About how many steps to the hallway?
N-26 estimate an amount by a) using referents or benchmarks (Assess: AR, O-T, AS, P/SA, RS)	Students should estimate amounts by comparing to recently measured amounts. e.g., a cluster of ten stickers, the length of their shoes. Students can manipulate smaller amounts and later use flash math activities. Pairs or small groups of students may work independently by placing objects under a shoe box lid which is removed for 1 or 2 seconds. Students write down the estimate and then count the objects to check for the accuracy of their estimate. Encourage students to use this experience as a guide to estimate other amounts.

Manipulatives/Resources

counters
- beans
- bottle caps
- buttons
- bread bag tags
- large seeds
- paper clips
- pebbles
- pasta
- double sided counters
- blocks
- cereal
- popcorn

linking cubes
overhead projector
variety of objects
- different sizes
- different shapes

shoe box lids

Teacher Notes:

Instructional Notes

- Students should develop sight recognition of smaller amounts without counting. This is beneficial later for partitioning and counting larger amounts.

- First develop the notion of "about" by having students estimate smaller amounts.

- Students must understand the exact answer to a problem is not always required. This can be reinforced by asking students to estimate answers where approximations are best suited.
  e.g., fish in the aquarium, pictures on the bulletin board, leaves on the plant.

- You may find that using a multiple choice approach for answers until students feel comfortable with estimating larger amounts is the preferable progression.
  e.g., About how many counters are on the overhead projector? 5, 15, 50
  Vary the size and type of objects used as counters.

- Students need benchmarks with which to compare an amount or measure before they are able to estimate accurately.

- Plan an estimation activity each day. Always keep a few handy so that they can be used as "fillers".

- Individual small chalkboards may be used by students in recording answers for "flash math" or other activities. Teachers can check at a glance on the progress of students.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Place Value

Learning Objectives	Example/Activity
N-27 understand that the digits 0-9 are used to form all other numbers (Assess: SA-T, AS, AR)	What numerals can you make with any two of the digits 0-9? Use digit cards to form numbers. Read and then write the numbers on paper.
N-28 group by a) 10's and 1's (Assess: RS, OC, P/SA)	See how many sets of ten your group can make out of the objects you have. How many are left over?
N-29 read, write the symbols for, and express orally, numerals less than a) 100 (Assess: SA-T, AR)	36 dogs are in the park. Read aloud the above sentence.
N-30 read words for numerals a) to 10 (Assess: WA, AS, AR)	Read Aloud, "Eight friends are having fun."
N-31 write the numerals for a given model/picture and make a model/picture for a given numeral less than a) 100 (Assess: SA-T, MC-T, OC)	Use a 10-frame or base ten blocks to show 23. Use base ten stamps to show 57.
N-34 understand that the quantity represented by a multi-digit numeral is the sum of the quantities represented by each digit to a) 2 digits (Assess: OC, SA-T, O-T, AS)	If there are 2 groups of ten bottle caps and 4 extra left over, how many do you have altogether?
N-35 compare and/or order numbers by a) using a number line (Assess: SA-T, OC, RS)	Using digit cards students fill in the numbers that are missing on the number line.
b) using place value (Assess: P/SA, OC, RS, SA-T)	In pairs and using base ten materials show the value of various numbers. Students can then compare amounts and arrange in order.
c) using the symbols i) = (Assess: P-T, P/SA, OC, RS, AS)	Put equal sign cards between the numbers and the groups of objects that are equal.

Manipulatives/Resources

counters
- beans
- bottle caps
- buttons
- bread bag tags
- large seeds
- paper clips
- pebbles
- pasta
- cereal
- popcorn
- blocks

cups/containers
linking cubes
units and longs (from base ten materials)
bean sticks (10 beans glued on a tongue depressor)
digit cards (0-9)
base ten mats
base ten stamps
abacus
10-frames
straws
plasticine
money
number lines
giant number lines
popsicle sticks
elastics

Teacher Notes:

Instructional Notes

- Ample time must be taken to develop the relatively complex concept of place value.
  Supply teams of students with counters. Ask them to separate the counters into equal groups e.g., 13 = 2 groups of five with 3 left over. Gradually progress to groups of ten. Grouping is an important prerequisite for base ten work.
- Next, using containers with ten counters in each, relate decade names to familiar names - twenty (two), thirty - (three), forty - (four), etc. Clarify differences between sounds such as "thirty", "thirteen" and "three".
  With popsicle sticks, students make groups of ten and attach these groups with elastics in order to count all the popsicle sticks.
- Using laminated digit cards (0-9), students should indicate a given number of concrete objects or base ten materials.
- Any student demonstrating difficulty in linking number symbols to the number name likely requires more time with manipulatives.
- Supply small groups of students with a base ten mat, sufficient base ten materials and 2 sets of digit cards. Beginning with "1", display materials on the mat, show the corresponding digit cards and write the numeral for any number 1-99.
- Create a "cheerio abacus" with cheerios and small sticks or drinking straws cut in half and pushed into plasticine. Students either record the number modeled, or make the model.
- Understanding place value is essential to understanding our numeration system. By allowing students ample opportunities to group and regroup concrete materials and link numeral symbols and oral names to the sets of materials, they will acquire the insight necessary for the initial understanding of place value.
- Provide students with many opportunities to count sets of objects. They may first count them by ones and later by grouping them into tens. Students will soon discover the efficiency of grouping when counting large numbers.
- Emphasize the concept of number not the characteristics of the objects.
  Emphasize relationships between numbers.
  e.g., On a number line demonstrate that fourteen is a little less than half way between ten and twenty.
- Use concrete objects to show that a 2-digit number can be represented using a number of tens and a number of ones. Encourage students to talk about their experiences as they work with various materials and numbers.
- Use a variety of base ten material so students do not associate concepts with one manipulative only.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Addition

Learning Objectives	Example/Activity
N-39 recognize and solve a variety of problems involving addition (Assess: SA-T, AS, AR)	For lunch, Mr. J's class ordered 13 hot dogs and Mrs. B's class ordered 7 hot dogs. How many hot dogs need to be made?
N-40 demonstrate addition by joining sets using manipulatives (Assess: P-T, AS, AR, O-T, S/P-A)	What is the total number of toques worn by girls and boys in our class today? May the total change next week? Why?
N-41 reason out sums and solve problems by applying the following mental calculation strategies	
a) counting on from the larger addend (Assess: SA-T, P-T, AS, OC)	Sue has 8 books. The teacher gives her 3 more. How many books does she now have? Think ... 8 plus 1 plus 1 plus 1 = _
b) recalling a doubles combination (Assess: O-T, S/P-A, OC, RS, AR)	Students should learn the sums of doubles by using referents such as: - 1 + 1 eyes, hands, arms. - 2 + 2 table legs, wagon wheels. - 3 + 3 pop cases, insect legs. - 4 + 4 fingers, spider legs. - 5 + 5 toes, two nickels. - 6 + 6 egg carton, muffin tray. - 7 + 7 two weeks. - 8 + 8 crayons in a box. - 9 + 9 two baseball teams. Verify doubles using a calculator.
c) counting on in steps larger than a unit (Assess: OC, P-T, O-T, SA-T, RS)	To fill the pail, Rachel put in 6 cups of sand and Jason put in 4 cups of sand. How many cups of sand does the pail hold? Think ... 6 plus 2 plus 2 =
d) building on a known double (Assess: SA-T, MC-T, O-T, P/SA)	If 5 + 5 = 10, then 5 cookies plus 4 cookies = _ cookies.
e) using addition tables (Assess: SA-T, OC, P/SA)	Use an addition table to add 9 and 6.
f) using properties - zero - commutative - associative (Assess: AS, OC, O-T, SA-T)	 Any number plus 0 = itself. 4 bags + 2 bags = 2 bags + _ bags. 3 + 4 + 6 = ___ Think ... 3 + 4 = 7, 7 + 6 = 13 or 4 + 6 = 10, 10 + 3 = 13 Addition can be performed in any order or grouping.

Manipulatives/Resources

counters
- beans
- bottle caps
- buttons
- bread bag tags
- large seeds
- paper clips
- pebbles
- pasta
- double-sided counters
- blocks
- cereal
- popcorn

linking cubes
items of clothing
odds and ends
number lines
number charts
hundred charts
money
pictures/objects
- table
- wagon
- pop case
- insects
- spider
- money
- egg carton
- muffin tray
- calendars
- crayons
- baseball field

calculators
addition tables

Teacher Notes:

Instructional Notes

- The concept of addition should be introduced, practised, and reinforced through real-life problems with which the students can easily identify and which reflect the environment in which they live.
- Using manipulatives, students should spend ample time in joining sets in as many different ways as possible. In pairs or small groups students can demonstrate their actions and describe their thoughts orally to one another as to how they arrived at the total.
- Development of addition facts begins at this grade level. Recognizing various patterns and using basic strategies to add assists with number fact recollection.
- Counting on from the larger addend is best used when the addends differ greatly in size. e.g., 7 shoes and 2 shoes. To be successful students need to recognize the larger addend, be able to count on from a number, keep track of the count and realize that they do not have to recount all the objects. Begin by using recognizable quantities for the larger addend such as adding pennies to a dime instead of pennies to pennies.
- Using larger counting units or steps can speed up the process. e.g., 6 + 4 is counted as 6, 8, 10. Encourage students to use number charts displaying the multiples until they become confident and skilled counting in steps. Use a calculator. Record each step on a paper in order to visualize the steps.
- As these strategies and calculations are performed repeatedly, recall should be encouraged. Do not expect recall until students can mentally perform these strategies that assist them with addition.
- Once students can understand the process of addition and can demonstrate the use of manipulatives and pictures and can make the transition to a number sentence, they should be allowed to use manipulatives until recall becomes more automatic. (Do not use tables at the expense of reasoning strategies.)
- Manipulatives should be used first to demonstrate and work with mathematical properties. This understanding assists with addition (reduces the number of facts to be known), grouping and general "number sense". Formal language such as commutative and associative should not be used at this level.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Addition

Learning Objectives	Example/Activity
N-42 read, write and solve open number sentences using +, = and __ (Assess: SA-T, AR, OC)	Write a number sentence: 11 girls and 7 boys are going to the swimming party. How many treats are needed if each person receives one treat?
N-43 understand and use the terms a) add, plus (Assess: O-T, OC)	6 buttons plus 7 buttons equals how many buttons?
N-44 use manipulatives, pictures, or a number line to calculate sums (Assess: P-T, OC, RS, AS)	8 robins plus 7 swallows = _ birds Use manipulatives or draw a picture to illustrate the above problem. Ask students to use a number line (e.g., ruler) to help solve.
N-45 demonstrate and record various compositions of a given number (Assess: SA-T, P-T, AS, AR)	Find different ways to add numbers to make a total of seven. 7 = 7 + 0 7 = 6 + 1 7 = 5 + 2 7 = 4 + 3 7 = 3 + 3 + 1 You may ask students to do some mentally and some using a calculator.
N-46 perform addition displayed in horizontal and vertical format (Assess: OC, AR, SA-T)	Encourage students to display addition in both formats. e.g., 8 + 5 = $\begin{array}{r} 8 \\ +\underline{5} \end{array}$

Manipulatives/Resources

linking cubes
odds and ends
number lines
rulers
counters
• beans
• bottle caps
• buttons
• bread bag tags
• large seeds
• paper clips
• pebbles
• pasta
• double-sided counters
• blocks

Teacher Notes:

Instructional Notes

- Symbols that can be manipulated e.g., +, =, __, should be used prior to any written symbolic work. Students should feel comfortable setting up number sentences that they can manipulate before proceeding to written number sentences.

- Expect students to use correct mathematical terminology. Encourage them to share their thoughts.

- Manipulatives themselves do not teach concepts. There must be a slow progressive transition to the abstract. Work with manipulatives until students have a firm understanding of a particular strategy.
  Then a transition to the pictorial (pictures of the manipulatives) is gradually made.
  When appropriate, numbers are substituted for the pictures.
  Through this progression students gradually learn to perform these calculations mentally.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Subtraction

Learning Objectives	Example/Activity
N-51 recognize and solve a variety of problems involving subtraction (Assess: SA-T, AS, P/SA, OC)	If there are 15 oranges in the box and you and 5 friends each took one orange, how many would be left in the box?
N-52 demonstrate subtraction by a) removing objects (Assess: P-T, SA-T, P/SA, AR)	Using manipulatives, demonstrate the problem above .
N-53 reason out differences and solve problems by applying the following mental calculation strategies a) counting back from the minuend the size of the subtrahend (Assess: O-T, AR, OC, RS)	8 - 3 is reasoned by counting back 3 from 8. Think ... 7, 6, 5.
b) counting back from the minuend to the subtrahend (Assess: O-T, AR, OC, RS)	8 - 6 is reasoned by counting back from 8 until 6 is reached. Think ... 7, 6, so 2 is the answer
c) counting up from the subtrahend (Assess: O-T, AR, OC, RS)	Find the difference between 10 and 6. Think ... 7, 8, 9, 10, so 4 is the answer
N-54 read, write, and solve open number sentences using -, =, and _. (Assess: AS, RS, OC, WA)	Write a number sentence: Jan gives 5 of her 10 beads to Sam. How many does she have left? e.g., 10 - 5 = __
N-55 understand and use the terms a) take away, subtract (Assess: O-T, AR, OC)	Subtract 6 pieces from 11 pieces.
N-56 use manipulatives, pictures, or a number line to calculate differences (Assess: P-T, SA-T, OC)	Sandy had 15 marbles. She lost 9 marbles in a game. Did she lose more than one-half the marbles?
N-57 understand that subtraction is the inverse of addition (Assess: O-T, AR, OC)	If 2 plus 3 equals 5, then 5 take away 3 equals _. Use part-part-whole boards to assist.
N-58 perform subtraction displayed in horizontal and vertical format (Assess: AR, OC, SA-T)	10 rabbits - 4 rabbits = __ rabbits 9 books <u>- 3 books</u>

Manipulatives/Resources

counters
- beans
- bottle caps
- buttons
- bread bag tags
- large seeds
- paper clips
- pebbles
- pasta
- double sided counters
- blocks
- marbles

ruler
number lines
hundred charts
linking cubes
part-part-whole boards

Teacher Notes:

Instructional Notes

- The concept of subtraction should be introduced, practised, and reinforced through real-life problems with which students can easily identify and which reflect the environment in which they live.

- The "removal" or "take away" model of subtraction should be emphasized at this grade level.
  Play "Penny Subtraction". With a partner, begin with a total of 13 pennies. Taking turns each may remove 1, 2, or 3 pennies. The player who takes the last penny gets a point.
  Students may develop strategies to win. Change the rules by beginning with a different amount or taking only 1 or 2 pennies each time.

- With the assistance of number lines and hundred charts, encourage recognition of number patterns.
  You may teach subtraction strategies using direct instruction while simultaneously having students work with manipulatives.
  Progress to pictures and then to symbols encouraging development of mental calculations.

- Counting and recognizing patterns can be greatly enhanced through the use of a **calculator**.

- Always encourage students to use appropriate mathematical terminology.

- Manipulatives should be used for students to discover the relationship existing between addition and subtraction.
  A "take away"/"add to" process using the same number of objects leads to this understanding. Proceed to the use of symbols once students understand this relationship through the use of concrete objects.

Strand: Numbers and Operations
Topic: Rational Numbers
Sub-Topic: Common Fractions

Learning Objectives	Example/Activity
N-87 compare the size of fractions by using a variety of manipulatives and materials (Assess: AR, OC)	Use paper folding, fraction pie plates, geoboards, linking cubes, and pattern blocks to assist students with demonstrating halves, thirds, and quarters. Fold a fraction strip into two equal parts. Colour one part. Show one-half on your fraction pie plate. How are they the same? Show one-quarter in the same way. How is one-quarter different from one-half?
N-88 use manipulatives, when sharing, to develop the concept of fraction (Assess: P/SA, SA-T, OC, RS, AR)	Ask students to discuss in groups of four how they would share an eight section chocolate bar (or similar treat).
N-89 demonstrate by using manipulatives and pictures, the concept of fraction as a) part of a shape or solid - halves, thirds, fourths (Assess: AR, OC, RS, AS)	Using fraction pie plates, ask students to estimate and show one-half, one-third and three-quarters. Later, use geoboards.
N-91 understand that fractions represent partitioning into equal-sized parts of the whole (Assess: AR, OC)	Students divide and/or share various items. Are the items divided equally? Is the appropriate terminology used?

Manipulatives/Resources

paper fraction strips
fraction pie plates
geoboards
linking cubes
pattern blocks
items that can be divided
- chocolate bars
- oranges
- cookies
- crackers
- cakes
- pizzas

flannelboard pieces
measuring devices
- cups
- plastic containers

Teacher Notes:

Instructional Notes

- The concept of fraction as part of a whole is introduced at this grade level.
- Demonstrate and emphasize that the whole is divided into equal parts.
- Activities in which students must share equally enhances the concept of fraction and the process of partitioning into equal parts.
- **Students at this grade level should not be expected to recognize fraction symbols. Initial work should be exclusively concrete, pictorial and oral.** Students should become very comfortable with the names of fractions (one-third, three-quarters, etc.) before they are introduced to fraction symbols.
- Students should be given the opportunity to make their own partitions. e.g., Supply each group of students (various numbers) with several pictures of a rectangular cake and sticks of different lengths. Using the sticks, ask them to divide the cake so that each group member receives an equal amount. Record the lines. They may devise different ways to divide the cake. Ask each group to display and explain their results.
- If food is used to assist in concept development, use food that is as nutritious as possible. Be aware of allergies or other food related problems.

Strand: Geometry
Topic: Space

Learning Objectives	Example/Activity
G-1 design classifications and sort three-dimensional objects according to various characteristics (Assess: P-T, AR, OC, RS)	Sort objects according to their shape. Design a giant graph according to shapes using 3-D objects. Create a monster, castle, or space ship using boxes, etc. Experiment on an inclined plane (e.g., slide) to discover which shapes will roll. Integrate with an environmental pollution topic and use various shapes to create "munching machines, recycle robots, pollution pests."
G-2 describe and demonstrate the relative position of an object as over, under, above, below, in front of, behind, inside, outside, beside, between, along, and through (Assess: AR, OC, O-T)	Using a flannel board, students place figures in positions indicated by the teacher. Students draw pictures and tell the story, indicating where different features of the story are located. Students arrange themselves or objects in the room according to "Simon Says".... Students work with mazes (computer or paper).
G-3 identify and name examples from the environment of a) sphere, cube, cone (Assess: P-T, AR, OC)	Ask students to find the spheres in a group of assorted objects. Students bring from home an object which demonstrates each shape. They then use this collection for classification purposes.
G-4 identify the properties (faces, corners, and edges) and compare three-dimensional objects (Assess: P-T, OC)	Working in pairs, have students examine the number of faces, corners or edges on each object.
G-11 recall objects no longer in view (Assess: AR, P-T, RS, OC)	Place three objects such as a ball, a can and a box on a table. Students view the objects for a limited amount of time. Cover with a blanket and ask students to recall the objects.

Manipulatives/Resources

cans
balls
cones
rods
marbles
styrofoam shapes
boxes
blocks
geometric solids
sea shells
bottles
sharpened pencils
straws
plasticine
magazines
giant graph

Teacher Notes:

Instructional Notes

- The development of spatial awareness and skills is an important component of mathematics. It can be difficult for young students to develop this "spatial sense" unless they can visually perceive examples and relate them to previous experiences. These abilities grow through regular active involvement in moving and manipulating objects in space.
- When classifying, begin by asking students to sort objects according to one attribute only. They should progress to recognizing two or more characteristics such as size, shape, colour, thickness, and texture of objects.
- Construct a graph of classroom objects.
- Correlate the properties of objects (faces, corners, edges) with stories and poems which emphasize the shapes of objects.
- Students may construct their own 3-D figures out of playdough or other easily moulded substances. Use straws and plasticine to make skeletons of 3-D objects.
- Students can also make booklets or collages with pictures of shapes.
- Have students help collect a variety of 3-D objects for the classroom.
- Many computer games and programs increase students' spatial awareness.

Strand: Geometry
Topic: Plane

Learning Objectives	Example/Activity
G-12 design classifications and sort two-dimensional shapes according to various characteristics (Assess: P-T, AR, OC, RS)	Sort 2-D shapes according to the number of sides. Using geoboards and elastics, ask each student to make a shape. On a giant graph students can then classify the geoboard shapes.
G-13 name, illustrate, and identify examples from the environment of a) square, rectangle, circle, triangle (Assess: WA, AS, RS, OC, AR)	Select a shape and find objects in the classroom that illustrate that shape. Make group booklets with pictures of objects containing these shapes. In small groups use long strings to make 2-D geometric shapes. Working in pairs, students take turns guessing the shape that is drawn on each other's back.
G-14 trace and draw two-dimensional figures (Assess: AR, OC, RS, O-T, P-T)	In groups have each student draw simple geometric figures by tracing lids, coins, birthday cards, pattern blocks, and attribute blocks. They could use these shapes to draw pictures.
G-15 differentiate between figure and background (Assess: AR, P-T)	Ask students to find a figure when it is hidden among other figures. Students make their own pictures, drawing the background first and then adding figures. As a class discuss the figures within various pictures.
G-16 combine two-dimensional geometric figures to make other figures (Assess: OC, P-T)	Design a simple figure using various shapes. Use tangrams (2 pieces, 3 pieces) to create a figure.
G-25 cover a surface by using one or more shapes (Assess: AS, P-T, RS)	Students are given an assortment of circles, squares, rectangles, and triangles to cut out and use to cover a surface. They are encouraged to create a design or pattern. Use pattern blocks, attribute/logic blocks, or handprints to cover the surface.

Manipulatives/Resources

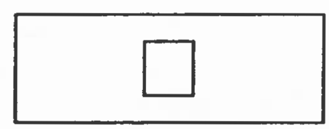
attribute blocks
pattern blocks
lids
cards
coins
2-D shapes from
- paper
- cardboard
- flannel
- plastic
- wood
- metal

geoboards
pegboards
magazines

Teacher Notes:

Instructional Approach

- Sorting and classifying 2-D figures contributes towards the development of logical and critical thinking.
- Activities in which students participate when working with three-dimensional objects will contribute to their understanding of two-dimensional shapes.
- Be sure that students have the opportunity to explain either in groups or with the whole class the reasons for their groupings.
  Initially only one attribute should be used to sort shapes.
- Use geoboards and elastics to make larger and smaller shapes inside and outside each other.
  Pegboards also allow for experimenting in building shapes.
- "Magic Windows" are made from index cards by cutting out various geometric shapes and laminating the cards. The cards can be placed against any coloured surface to change colours or can be used to look through to align with other shapes.
  e.g.,



- Branch into concepts of fractions by using geometric shapes to discover which could be easily folded into 1/2, 1/4.
- Visual imagery can help students' understanding of 2-D geometry.
  e.g., Display a shape on the overhead projector for a few seconds and then students are asked to draw it. As students gain experience the figures may be rotated and/or be formed by other figures.
- As a homework assignment, parent/caregiver and child might be asked to create a new floor covering design by covering a surface with one or more shapes and then colouring.
- "Geometry Fairs" are an interesting way to involve students and community in the study of geometry. Activities could include quizzes, constructions, puzzles.

Strand: Measurement
Topic: Length

Learning Objectives	Example/Activity
M-1 solve a variety of problems involving length (Assess: AR, OC, SA-T, RS, O-T)	How many steps long is the classroom? How many shoe lengths is it from your desk to the teacher's desk? How many body lengths is the gymnasium floor? Estimate and then measure.
M-2 compare lengths using "longer", "wider", "thicker", "taller", "shorter", "deeper", "thinner" (Assess: O-T, AR, OC)	Name three things that are taller than yourself. Arrange straws, sticks, etc. from shortest to longest. Name two objects and identify which is longer/shorter.
M-3 estimate and then measure the length of or distance around objects by using non-standard units (Assess: O-T, AR, OC, SA-T)	Estimate and then measure how many hands wide your desk is. Use an enlarged ruler or measuring tape to measure objects. (non-standard) Each student estimates, using a string, the distance around a sphere. Measure the actual distance using another string. Compare lengths. Use terms - longer, shorter. Attach all strings to a wall chart for display and comparison.
M-4 read measuring devices to measure length/distances in a) centimetres (Assess: O-T, AR, OC, SA-T)	Use a ruler to read centimetres. Grow a gladiola or other plant. Measure and record every day for approximately three weeks. Students could estimate the growth for the fourth week and then measure. Have the students use the term centimetres when measuring and recording. This activity could be integrated with a plant unit in Science.
M-5 compare, estimate, then measure and record lengths/distances by using a) centimetres (cm) (Assess: OC, AR, SA-T, O-T)	Compare and estimate the lengths of two of your pencils. Measure and record the length of each pencil. Design a measurement chart of student growth and measure three times throughout the year.
M-9 identify examples in the environment involving linear measurement using a) centimetres (Assess: AR, AS, OC)	Ask students to find examples of items that they think they could measure using their centimetre tape.

Manipulatives/Resources

various articles for comparing and measuring lengths

straws
toothpicks
stir sticks
popsicle sticks
paper clips
nails
clothespins
centimetre cubes
centimetre strips
metric ruler
metric measuring tape
linking cubes

Teacher Notes:

Instructional Notes

- Measurements of length and distance can be more difficult for young students to comprehend then may first appear. Measurement applications such as lines or objects drawn on paper, straight or curved parts of objects, imaginary lines through the air, irregular paths, imaginary lines through objects, and lines in different orientations (vertical and horizontal) can create confusion for the learner. Care must be taken that students understand why and how these applications occur.

- When calculations are performed outside school they are usually done in relationship to units of measurement. Success in many other disciplines depends on a firm understanding of the measurement process.

- Students should be able to perceive the concept of length and compare objects (longer/shorter) before they measure the actual length.

- Students should begin measuring using non-standard units. e.g, Roll out a length of plasticine and use a paper clip to measure. Estimate first. As you measure lightly press the paper clip into the plasticine. Repeat using a different unit of measure. Compare. Later they are introduced to the centimetre unit.

- Students must realize that length is only one of many measurements by which objects can be compared.

- Students must learn to distinguish between different types of measures. (e.g., length and capacity)

- Students must be involved in active, meaningful measurement activities and the analysis of these measurements.

- Use zucchinis to teach measurement. They are a variety of sizes, are easily handled by students, and are plentiful in the fall. They can be used to teach problem solving, data management, estimation, ordering, patterns, length, capacity, area, and mass.
  See model Unit grade 2 - Pumpkins.

Strand: Measurement
Topic: Area/Capacity

Learning Objectives	Example/Activity
M-14 explore the concept of area using manipulatives (Assess: AR, OC)	Cover the outlined figures with blocks or tiles that are the same size and same shape. Use tiles or other congruent shapes to cover areas. e.g., hands, feet
M-23 solve a variety of problems involving capacity (Assess: O-T, AR, OC, P-T)	Use a scoop to fill each tin can with seeds. If the seeds tasted like candy, which tin can would you like to have?
M-24 understand that capacity is the amount a container holds (Assess: OC, O-T, RS, AR, P-T)	Fill various sized containers with sand, water, seeds, berries, etc.
M-25 compare visually, the capacity of two containers as more, less, or equal (Assess: O-T, AR, OC, P-T)	Fill two containers with sand. Which container do you think holds more? Why? Use containers that are tall and narrow or short and wide. Use the sandtable in the classroom or the sandpit in the school playground.
M-26 estimate and then measure the capacity of a container using non-standard units (Assess: AS, AR, P-T)	How many cups of seeds do you think the jar holds? Measure to find the answer. Was your estimation close to your measurement? Was it more or less?
M-27 estimate, measure, and compare the capacity of two or more containers using non-standard units (Assess: AS, AR, O-T, P-T)	How many small containers of sand do you think it will take to fill the first large container? The second large container? Measure. How many more small containers of sand does it take to fill the larger of the two containers?

Manipulatives/Resources

pattern blocks
tiles
various congruent shapes
finger paints
puzzles
tin cans
plastic containers
milk cartons
small boxes
sand
water
seeds
berries
sand centre
water table
cooking utensils

Teacher Notes:

Instructional Notes

- At this level, the concept of area is explored informally using non-standard units as listed.
  The term "area" should not be expected to be understood.
- Counting and beginning tessellation (tiling) skills can be developed.
- Understanding the difference between capacity and volume can cause confusion. Volume refers to the amount of three-dimensional space something occupies. Capacity is the amount of fluid-like substance a container holds.
- To understand the concept that capacity is the amount a container holds, students should be actively involved in the filling of various sized and shaped containers with fluid-like materials.
- Children at this grade level should be expected to compare capacities as more, less, or about the same.
- Students should understand that capacity is only one of many measurements by which objects can be compared.
- Cooking experiences contribute to the development of students' understanding of capacity. Use them as often as possible.
- Activities can be easily integrated with Science.
  Use snow to fill containers. Melt the snow. Will there be less water than snow? Freeze the water. Will there be the same amount of ice as water?

Strand: Measurement
Topic: Mass

Learning Objectives	Example/Activity
M-41 compare by lifting, the masses of two objects as heavier or lighter (Assess: O-T, OC, AR, AS)	Lift and compare the pairs of objects. Which is lighter or heavier? Without touching the objects, guess which is heavier. Now lift them to check. Close your eyes and lift two different objects. Which one is heavier? Use a balance to verify your choice.
M-42 recognize that the size and shape of an object does not necessarily depict its mass. (Assess: O-T, OC)	Which object is heavier? Use a block of balsam wood and a piece of metal the same size. Does the weight (mass) of objects that are the same size determine if they will float? Develop a sink and float centre. Integrate with Science.
M-43 compare, estimate, and then measure the masses of objects using non-standard units (Assess: AS, P-T, AR)	Which is lighter - your pencil or your book? How many linking cubes do you think each weighs? Measure and compare.

Manipulatives/Resources

books
shoes
pencils
styrofoam
pieces of various metals
pieces of various woods
cork
vegetables
stones
bag of feathers
playdough
plasticine
balances
linking cubes
sorting mats
balance

Teacher Notes:

Instructional Notes

- To understand the concept of mass students should be actively involved with lifting and comparing objects.

- Through appropriate activities and discussion, students learn that the mass of a body remains the same regardless of its form.
  e.g., shape playdough.

- Set up stations for students to compare the masses of various objects. They should indicate which of two objects they think is heavier/lighter, estimate how many non-standard units each weighs, and then find the mass of each using a balance.
  Some students might also be challenged to find which of three objects is heavier or lighter using a balance.

  Note: The terms "weight" and "mass", and "heavier" and "more massive" are used interchangeably although it is recognized that scientific definitions draw a distinction between them.
  The appropriate term is "mass" and rather than weighing an object you "determine its mass".

Strand: Measurement
Topic: Time

Learning Objectives	Example/Activity
M-47 solve a variety of problems involving time (Assess: OC, AR, O-T)	What part of the day do you go to school, eat lunch, go home from school, go to bed? What takes the least/most amount of time? • a walk to the park • a walk to the library • a walk to the gymnasium Discuss.
M-48 identify longer and shorter time periods using non-standard units (Assess: O-T, AR, OC, M-T)	Is morning recess longer or shorter than • a T.V. program? • a radio program? • a song?
M-49 determine the length of time (non-standard units) using a variety of simple "clocks" (Assess: P-T, O-T, AR, OC)	How many handclaps does it take for us to tie a bow? To run once around the playground?
M-50 understand the concept of time by using a a) digital clock - hour (Assess: O-T, AR, OC)	Read the digital clock. • What time is it? • Is that morning, afternoon, or night? • Is that before or after lunch?
b) 12 hour clock - hour, half hour (Assess: O-T, AR, OC)	Read the 12 hour clock face. • What time is it? • What part of the day - morning or afternoon?
M-52 order events according to time (Assess: O-T, AR, OC)	What do you usually do first, second, ...? • eat breakfast • eat lunch • go to school • get dressed Sequence a school day. Use pictures.
M-53 understand and explain a) 24 hours = 1 day	Using a 12 hour clock describe and show the number of hours in one day.
b) 7 days = 1 week	Using a calendar describe and show the days in one week.
c) 30 days ≈ 1 month	Using a calendar describe and show the days in one month.
d) 12 months = 1 year (Assess: O-T, AR, OC)	Using a calendar describe and show the months in a year. Graph student's birthdays. Poems and stories about time should be used.

Manipulatives/Resources

picture cards
Big Books
balls
musical instruments
sand clocks
sun
T.V. programs
digital clocks
12 hour clocks
clock stamps
calendars

Teacher Notes:

Instructional Notes

- Time is perhaps the most abstract measure to comprehend. Therefore connect the concept of time with the child's world and integrate with other areas of study.
- There are two very different concepts of time:
  - the time at which something occurs; and,
  - the time it takes something to happen.
- Measure events that have a clear beginning and ending.
- Students should begin to measure time using "simple clocks".
  e.g., heartbeats, ball bounces, handclaps, musical notes, walk a specified distance, pendulum swings (pendulum of 1 metre length has a period of about one second).
- Use clock stamps and fill in time for various activities.
- Students can make paper clocks that they keep at their desks
  - a digital with windows and a sliding paper strip
  - a 12 hour using brass fasteners.

  These clocks can be used to keep time during the day or to demonstrate answers to questions.
  e.g., Set the clock for the time you get up in the morning. Use a "real clock" with movable hands to assist in demonstrating to the class.
- Use time frequently throughout the day.
  e.g., This morning at 10:00 we will be ....
  Tomorrow is our special day.
- Clock stamps can also be used to make BINGO cards.
  e.g., under the "G" - 3 o'clock. Make "time booklets".
  As a class, collect a variety of clocks and watches and design a classroom display.
  Use pictures or sequencing cards to order events.
- Refer to a calendar each morning and on the chalkboard or chart paper print: Today is ...., Tomorrow will be ...., Yesterday was ....
  or on a laminated chart:
  Today is <u>(month)</u> <u>(day)</u>. It is the <u>(ordinal)</u> day of the week. <u>(day)</u> comes before it. <u>(day)</u> comes after it.
  Students help to complete the sentences.
  Students can take turns leading the calendar activity and if recorded on chart paper, can take it home.
  Other "Secret Messages" can be written on the chart that list the events and times planned for the day.
- At the beginning of each month fill in a large class calendar recognizing special events (holidays, school events, cultural events).
- Humans have constructed two major categories of time - cyclical and linear. Cyclical concepts of time arise through human interactions with the cycles of nature while linear concepts of time develop as a result of industrialization. Each concept of time is valid and of use to humans - cyclical time promotes harmony with the environment; linear time is a measurement which facilitates the organization of the operation of society. One concept of time is not superior to the other. However, this curriculum focuses on the linear concept because of our ability to measure linear time. It is important that teachers recognize that students bring various concepts of time to class.

Strand: Measurement
Topic: Temperature

Learning Objectives	Example/Activity
M-54 solve a variety of problems involving temperature (Assess: OC, AR, O-T)	Compare pictures of scenes depicting various temperatures. Compare the outside temperature today with the outside temperature yesterday. Is it warmer or cooler? As a class organize a summer picnic. Decide on: • menu • clothing • location • activities How would this vary for a winter picnic? Week One - bring something that reminds you of hot. Week Two - bring something that reminds you of cold. Create temperature graphs.
M-55 compare temperatures using terms such as "hotter", "colder", "warmer", "cooler" (Assess: P-T, O-T, OC, AR)	Which bowl of water is colder? Will they stay the same temperature that they are now? Why? After skipping, is Robert's forehead warmer than Kristie's forehead? Why? Compare the temperatures of metal and wood exposed to the summer sun. Sort pictures showing hot, cold, warm, and cool.

Manipulatives/Resources

pictures of:
- seasons
- dress
- activities

non-standard thermometer
dress up clothes
bowls
liquids
skipping rope
metal
wood

Teacher Notes:

Instructional Notes

- Measuring the amount of heat contained in a body is easily sensed by children.
- Students should be actively engaged in testing temperatures and comparing them to one another.
- Students should be given the opportunity to orally explain their experiences.
- Non-standard thermometers indicating familiar graduations allow children to make a more realistic comparison of temperatures. (cold, cool, warm, hot)
- Keep a class weather chart complete with pictures and vocabulary. Each morning and/or afternoon ask students to describe the weather and record.
Discuss the warmest, coldest, most windy day, etc.
Compare to weather in the past.

Strand: Measurement
Topic: Money

Learning Objectives	Example/Activity
M-59 solve a variety of problems relating to money (Assess: O-T, P-T, OC, AR)	Have students earn "play money" throughout the week by doing various tasks. They then use their money to buy things at a class sale. Items to sell may be free time passes, leader tickets, stickers, etc.
M-60 identify coins/bills up to a) one dollar (Assess: O-T, P-T, MC-T, AR)	Identify and give the value of each coin. Make coin rubbings.
M-61 understand the relationships between a) pennies, nickels, dimes (Assess: O-T, OC, P-T)	If you trade one nickel for pennies, how many pennies would you have? Two nickels? Three nickels? What is the pattern?
M-62 count with a) pennies, nickels, dimes (Assess: P-T, O-T, OC, AS)	Using pennies make a value of 10 cents. Suppose that each consonant is worth 1¢ and each vowel is worth 5¢. How much is your name worth? What is the value of other names or words?

Manipulatives/Resources

real coins
play money (coins)
cash register
variety of items (store)
coin stamps
enlarged pictures of money

Teacher Notes:

Instructional Notes

- Students should be able to identify coins and understand their value. At this level they may be able to correctly name the coin but have difficulty understanding its value.
- Actual coins should be used to introduce this topic.
- If students are developmentally ready, use pennies and dimes to teach place value.
- The concept of money should be taught in relation to realistic problem solving.
- Ask the students to help you design and set up a store. They then alternate working in the store.
- You may use the teaching method of concept attainment to develop the concept of amounts that equal a certain value. e.g., 12¢ - give examples of two nickels and two pennies, one nickel and seven pennies, and non-examples of one dime, eight pennies, etc.
  Students should categorize the examples as yes or no and discuss and determine the criteria that supports the concept.
- Students need to experience many and varied activities over a period of time to grasp these concepts. Continually revisit these concepts, spiralling to a more sophisticated level as students demonstrate readiness.
  Integrate these concepts with other areas of study.

Grade Two

Grade Two

Foundational Objectives

The Student should:

- demonstrate confidence, desire, and an ability to solve a variety of mathematically related problems;
- demonstrate knowledge and understanding of why, when, and how to collect, organize, and interpret numerical data;
- demonstrate an understanding of numbers, patterns, counting, operations, and estimation;
- demonstrate a sense of spatial awareness and familiarity with two- and three-dimensional shapes and recognize relationships between geometry and the environment; and,
- demonstrate an ability to measure and use appropriate measurement techniques and apply measurement to real life.

Working toward the achievement of the above foundational objectives contributes to the development of the C.E.L. of Numeracy and to the following foundational objectives for the Common Essential Learnings. Other C.E.L. foundational objectives should be used in addition to those given below.

Students should develop their abilities to:

- discuss their ideas using their own language and using the vocabulary and forms of expression of mathematics (C);
- generate alternative solutions and share how they arrived at these solutions (CCT);
- work cooperatively and contribute positively in group learning activities (PSVS);
- discover meanings and solutions for themselves through active participation in learning activities and through generating questions (IL); and,
- understand the benefits and limitations of measuring tools and calculating devices (TL).

Strand: Problem Solving
Topic: Understanding

Learning Objectives	Example/Activity
P-1 establish and/or demonstrate an understanding of a problem by	
a) using manipulatives (Assess: AR, OC, O-T, P-T)	Show how you would use manipulatives to explain what these problems are saying. How many different ways can you use pennies, nickels, and dimes to show the value of 15¢? Nutri-Bars cost 9¢ each. You would like to buy one for yourself and each of your two friends. Are you able to buy these bars if you have 25¢?
b) acting out the problem (Assess: AR, OC, RS)	Demonstrate understanding by acting out the problem. We have three different coloured hats. How many arrangements can you find for two people to wear the hats?
c) interpreting pictures (Assess: AR, OC, O-T)	Use the picture to find which object each person owns. Cindy's rolls Jack's is tasty Sam's is heavy Gail's floats Sandy's ......
d) asking questions (Assess: AR, OC, RS, O-T)	It takes two minutes for Tracy to run once around the track. If she ran the same speed, how long would it take her to run five laps? Help students to understand a problem by demonstrating how they could ask themselves questions. e.g., Who is running? How many laps are desired? How long to run one lap? How would I find out how long it would take to run five laps? Work with a partner and measure your time to run one lap. Try running more than one lap. Does your time change? Why or why not? Discuss and/or write about your results.

Manipulatives/Resources

A variety of appropriate manipulatives should be available at all times for students to use when analyzing problems including:

- counters
- base ten blocks
- measuring devices
- geometric shapes
- linking cubes
- odds and ends
- classroom objects
- other items of interest

An assortment of many good problems is necessary.
These may be chosen from:

- real-life experiences
- problem solving publications
- teacher guides
- textbooks
- magazines

Problems should be created by students or the teacher.
Use the names of students in the class or others close to them.
Use situations which are relevant to their personal lives.

Teacher Notes:

Instructional Notes

♦ Problem solving is an integral part of the Mathematics curriculum.
Understanding the problem is a major hurdle for young problem solvers. Students must become part of the problem by analyzing the information given, the ideas related to information which may have to be collected, and the question(s) posed. Once understanding is thought to be achieved, students move instinctively into the planning and solving of the problem.

♦ Understanding the problem helps to determine the data that are relevant, the methods used to solve that are appropriate, and the solutions that are possible.

♦ Teach about problem solving.
Each skill or ability developed for understanding a problem should be individually taught and demonstrated several times. Ample opportunity should be given for students to practise.

♦ Introduce concepts and practise strategies through the extensive use of meaningful problems. Don't use problem solving only with the intention of practising computation.

♦ Develop problems centred around children's literature. The following ideas may be initiated:
- use stories which display mathematical concepts and/or skills as outlined in one or more of the five strands;
- develop mathematics related problems to correspond with the story;
- have the students use various strategies to solve the problems;
- use cooperative groups; and,
- students may create their own related problems or stories.

Strand: Problem Solving
Topic: Understanding

Learning Objectives	Example/Activity
e) drawing diagrams (Assess: AR, OC, P-T)	Draw a diagram to demonstrate understanding. You have a special way to solve a difficult problem. You explain it to two of your friends. Each of your two friends explain it to two more of their friends. How many people now know your special way to solve the problem?
f) interpreting tables, charts, graphs (Assess: AR, OC, O-T)	Examine and/or make a tallied chart that indicates how many children prefer each television show or popular song. Use a hundred chart to design and write your own pattern. e.g., Begin at 36, move down two rows and three spaces to the right. Write a number sentence for your path.
g) using number sentences (Assess: AR, RS, OC)	Complete the number sentence. Twelve eggs are in the nest. Four eggs have hatched. How many are not yet hatched? 12 eggs __ 4 eggs = __ eggs
h) rephrasing the problem (Assess: AR, O-T)	Using your own words explain this problem. Cindy had fifteen seeds in one package and six seeds in another package. She planted ten seeds in total. How many of each does she have left if she planted an equal amount if each seed?

Manipulatives/Resources

Variations to an original problem can be produced by students and/or the teacher by:

- changing the context
- changing the size of the numbers
- reversing the given and wanted information
- personalizing the problem
- using a combination of the above

Teacher Notes:

Instructional Notes

- Encourage students to read or examine the problem as many times as necessary to achieve understanding.

- Encourage students to think of other problems they have been challenged with that are similar to the one they are about to solve.

- Students should learn how to work cooperatively to solve problems.
  Focus on one or two interpersonal skills at a time.
  Begin by grouping students in pairs and/or small groups.
  Emphasize listening, taking turns, talking with "inside/quiet" voices, encouraging others, and giving praise.
  It is crucial that students know what each of these skills look and/or sound like.
  The group process is as important as the product.

- In situations where the language of instruction is other than the student's mother tongue, understanding the problem to solve may be an area of difficulty. The teacher should allow as much time as needed before proceeding to planning and executing.

Strand: Problem Solving
Topic: Planning and Executing

Learning Objectives / Example/Activity

P-2
design a plan and solve problems using one or more of the following strategies

a) use manipulatives
(Assess: AR, OC, AS, P-T)

Use manipulatives to help plan and execute these problems:
Use four sets of four counters with each set a different colour. Use the counters to cover a 4 X 4 grid so that four different colours appear in each row and column. Record your solution. Is more than one solution possible?

There were seventeen rabbits in the cage. Twelve rabbits are left after the first day and only eight after the second day. How many ran away altogether?

b) act out the plan
(Assess: AR, OC, RS)

Three of your friends are waiting to receive a treat. How many different ways can they line up?

c) use counting strategies
(Assess: AS, AR, OC, O-T)

There are nine pages in the booklet. We added six more pages. How many pages are now in the booklet?
e.g., count on in steps
Think ... 9 + 3 + 3 = 15

d) collect, organize, and interpret data
(Assess: AR, OC, RS, WA)

What are all the different sizes of shoes worn by students in your grade?
How many students wear shoes of each size?

e) choose an operation
(Assess: SA-T, O-T, AR, OC)

Mike rode his bike around the park fourteen times. His sister Jan rode eight times around the park. How many fewer times did Jan ride around the park than Mike?

f) use patterns
(Assess: SA-T)

If one bicycle has 2 wheels;
And two bicycles have 4 wheels;
And three bicycles have 6 wheels;
Then four bicycles have __ wheels;
And five bicycles have __ wheels.

g) draw a diagram
(Assess: AR, OC, RS)

How many sides are there on three triangles?

h) use a number sentence
(Assess: SA-T, OC)

Write a number sentence to solve:
Riki went skating on the weekend. He skated 14 laps on Saturday and 17 laps on Sunday. What was his total number of laps?

Manipulatives/Resources

A variety of manipulatives should always be available for student use.

- counters
- base ten blocks
- linking blocks
- measuring devices
- geometric shapes
- odds and ends
- classroom objects
- other items of interest
- large beads

Build a collection of problems in which students can use more than one type of strategy to solve a problem.

Teacher Notes:

Instructional Notes

- Each strategy for planning and executing should be individually taught, demonstrated, and practised a sufficient number of times.
- Focus on the processes the students use to solve the problem.
- Encourage students to use alternate strategies and acknowledge their ingenuity and effort when they attempt to use their own methods for solving.
- Use cooperative learning techniques.
- Challenge students with questions that will develop listening, reading and observation skills.
- Encourage interaction among students and between students and teacher.
- Provide sufficient time to review, uncover errors, and attempt alternative strategies.

Strand: Problem Solving
Topic: Planning and Executing

Learning Objectives	Example/Activity
P-3 apply estimation strategies to a problem (Assess: OC, AR, SA-T)	If one friend has 32¢, another friend has 24¢ and you have 41¢, about how much money do you and your two friends have in total? e.g., Think ... Add front end digits. 3 plus 2 plus 4 equals 9 or 90¢
P-4 solve a variety of problems including	
a) translation problems (Assess: AR, OC, O-T)	A classroom is nine metres long and the hallway is seventeen metres long. How much longer is the hallway than the classroom? Measure your hallway and classroom and compare.
b) process problems (Assess: AR, OC, AS, O-T, P-T)	Use a calculator and a hundred chart to find patterns when you count by 2's, 3's, 4's, and 5's. Mark the patterns using different colours. Discuss your results.
c). realistic problems (Assess: OC, AR, P-T, AS)	Decide on a method to find how many radios there are in total in the families of your classmates.

Manipulatives/Resources

A variety of problems including translation, process and realistic is necessary.

Teacher Notes:

Instructional Notes

♦ Encourage students to estimate answers to problems before the more exact solution is obtained.

♦ Problems can be divided into three types:
Translation
- Problems that precisely provide the information needed to solve.
- Problems that usually have only one acceptable answer.
- Problems that are expected to be solved using some previously taught rule or algorithm.

Process
- Emphasis is more on the process of solving the problem.
- The solution usually involves the application of a special problem solving strategy or heuristic.
- Problems that encourage multiple and creative methods of solution.

Realistic
- Problems that are often not well defined.
- Problems that often have multiple solutions.
- Problems that often require the collection of information.
- Problems that often involve collaboration with other people.
- Problems that usually cannot be solved in a few minutes.

Many problems may appear to fit into more than one category. When attempting to classify problems into the above types, their placement often depends on the level of difficulty for the student and on how the problem is to be solved.

Strand: Problem Solving
Topic: Reflecting

Learning Objectives	Example/Activity
P-5 explain how the solution was obtained (Assess: O-T, OC, AR, RS)	Explain and/or demonstrate how you arrived at your answer. At this time last year Carla's puppy was 18 centimetres tall. He is now 32 centimetres tall. How much did he grow in one year? How tall do you think he will be next year at this time?
P-7 create a word problem given specific information a) orally (Assess: O-T, AR, OC, RS)	Design your own problem using the following information 27 - 8 = 19
P-8 create problems similar to those solved (Assess: WA, O-T, RS, OC)	Design, either orally or written, new problems by altering the numbers or the setting in the original problem. e.g., How many different combinations of heads and tails can you get by spilling 4 coins? Record them - 3 heads and 1 tail.... How many different combinations of colours can you get by spilling 8 two-coloured counters? Record them.
P-11 properly display the results (Assess: WA, P-T, AR, OC, RS)	Demonstrate to students how to display answers/solutions in a visually appealing, precise manner. e.g., Use mathematical vocabulary, appropriate units, and complete sentences.

Manipulatives/Resources

Students should have access to manipulatives to assist in their explanation of the process they used to solve the problem.

Use problems that students and teacher have collected, altered, or created.

Teacher Notes:

Instructional Notes

- Encourage students to reflect upon the work they have done.
  e.g., orally explain, demonstrate
- Students should have the opportunity often to describe to others their interpretation of the problem and the process they used to arrive at the solution.
- Ask students to name the strategies used.
  e.g., using patterns, drawing a diagram, counting back in steps, acting it out, using manipulatives
- Discuss how a certain problem may relate to a problem previously solved and any unique features the problem or solution may have.
- Assist the students in moving back and forth across the various steps of problem solving until a satisfactory solution for the problem is found.
- Offer extensions to problems.
  e.g., How many different ways can two students line up at the water slides? Three students? Four students?
- Students' flexibility in using strategies increases as knowledge and experience broadens.
- Many problem solving activities can be integrated across subject areas and can be used to solve real-life problems in the classroom and on the playground. This demonstrates to the students the applicability of mathematics problem solving and gives them opportunity to apply their problem solving abilities.

Strand: Data Management and Analysis
Topic: Collecting

Learning Objectives	Example/Activity
D-1 acquire data through a) counting (Assess: OC, AR, RS, O-T)	How many students are present in each class in our school? How many buttons in total are on the clothes that students in our class are wearing? How many faces, corners and edges are on each of the three-dimensional objects?
b) surveys (Assess: AS, RS, OC)	What is the most popular sport in our school? What is your favourite toy? What is your favourite treat?
c) measuring (Assess: AR, OC, AS, P-T)	What is the outside temperature at noon each weekday for the next two weeks? How much will you grow each month? How many litres of water will fill the pail?
d) simple experiments (Assess: OC, AR, AS, RS)	When rolling two dice, what sums turn up the most often? Least often? What combinations of numbers do you get when you spill 12 two-sided counters?
D-3 discuss factors that may distort the results of data collected e.g., gender, ethnic, socio/economic (Assess: AR)	Did we survey about the same number of girls as boys? Have the girls (boys) generally answered one way?

Manipulatives/Resources

Compile an assortment of problems related to the students' environment and/or interests which challenge them to collect data in order to solve.
These may be divided into three types:

1. Your choice
   - favourite colour
   - favourite toy
2. The way the world is
   - number of letters in your name
   - month in which you were born
3. Changing data
   - growth of a plant
   - temperature each day

measuring instruments
tally sheets
probability devices

- dice
- spinners

Teacher Notes:

Instructional Notes

- Data management problems at this grade may be solved either as a whole class activity, in small groups that can be closely monitored by the teacher or at learning centres.
  If students work cooperatively, allow time for them to reflect on their cooperative behaviours.

- Data management and analysis is a problem solving skill and should be taught in a systematic manner.
  The three areas of data management and analysis (collecting, organizing and displaying, summarizing and interpreting) should be clearly demonstrated.

- Discuss with students what data are needed to solve the problem and brainstorm ways to collect the data.

- Data collected should be meaningful and involve information with which the students can easily identify.
  e.g., school, family, interests

- Collection can involve more than two categories.
  e.g., favourite T.V. shows

- Collection of data by the students should become part of problems encountered in other areas such as Science, Social Studies, Health, and Physical Education.
  e.g.,
  - objects attracted by magnets
  - temperatures at various locations in the classroom
  - snack foods
  - sports and/or hobbies

- Collecting data at home can be an assignment to encourage family member involvement.
  e.g.,
  - number of radios
  - favourite leisure time activity
  - favourite colour

Strand: Data Management and Analysis
Topic: Organizing and Displaying

Learning Objectives	Example/Activity
D-4 design classifications and sort data using b) pictures (Assess: OC, AR, O-T, RS)	Sort a collection of pictures. Explain how the pictures were grouped. Resort the pictures and explain.
D-6 display data using a) object graphs (Assess: AR, RS, OC)	Make a table or floor graph:
b) picture graphs (Assess: RS, OC, AR)	What eye colour is most common? Draw a picture of yourself showing the colour of your eyes and attach to the graph in the correct column.
c) tables and lists (Assess: RS, OC, AR)	Where do various organisms live? Make a list of organisms which live in different environments. e.g., ocean, desert, pond, etc.
d) tally methods (Assess: RS, OC, AR)	Which of the seasons is preferred by students in our school? Which day of the week does each student's birthday fall on this year? Which month has the most student birthdays? What are the most common colours of running shoes?

Floor graph (for D-6 a):

Students With mitts	Students without mitts

Manipulatives/Resources

pictures of objects
- cut from magazines, etc.
- drawn by students
- duplicated by the teacher

large graphing mats
re-usable laminated graphs
tally sheets

Materials and objects which students can use to display their data.
- themselves
- items of clothing
- food
- books
- pictures

Instructional Notes

- Instruction should be sequential. Assure that students recognize the relationship between concrete (using objects) and pictorial (using pictures) representation.
  Do not use symbolic representation. e.g., a circle on a graph to symbolize each student's preference.

- Data management activities should not end with the collection and display of data.
  Interpreting the data so as to come to some conclusion about the problem is the primary reason for engaging in the process.

- Refer to the Elementary Science Curriculum Guide, page 230, for information on the six seasons of the Woodland Cree.

Teacher Notes:

Strand: Data Management and Analysis
Topic: Summarizing and Interpreting

Learning Objectives	Example/Activity
D-8 discuss, interpret, and ascribe meaning to the organized data by	
a) examining the shape (Assess: O-T, RS, OC, AR)	What is the overall shape of the data? Where are the data clumped? Are there holes with little or no data?
b) questioning (Assess: OC, O-T, AR, RS)	Does the display make sense? Is it reasonable? What do you think would happen if we asked different people?
D-9 solve problems involving data management (Assess: WA, AS, AR)	Collect, display, and interpret data related to problems such as: How do weather conditions at a particular time each day vary from day to day? During a walk outdoors, do you think we could observe more living things, non-living things or signs of living things? What are the most common colours of houses in our community?
D-10 understand the concepts of probability (chance) by	
a) using the terms sometimes, never, always, maybe, likely (Assess: AR, OC)	Is it more likely to snow or not to snow today? Do bicycles always, never or sometimes get flat tires?
b) predicting (Assess: AR, AS, O-T)	When two, 2-colour counters (red and yellow) are tossed 20 times, how many times do you think 2 reds, 2 yellows, or 1 red and 1 yellow would appear. Test your prediction.

Manipulatives/Resources

Try to represent the data in various ways using a variety of media. Using various methods of display can sometimes give a different view or message of the results.

Teacher Notes:

Instructional Notes

- As a whole class or in smaller groups students should talk about their data - how they collected, displayed and interpreted the information.

- Data are often collected and displayed as a single culminating exercise to answer a single question. Encourage students to generate new questions from the collected data.
  e.g., What is the most common colour of fences in our community?
  Demonstrate how this data can be used to answer other questions.
  e.g., Why do you think this colour is the most common? Are lighter colours or darker colours more popular?

  During our hike, why did we encounter more non-living things than living things?
  Would we get different results if we hiked in a different area?

- At this level, probability is an intuitive concept. Concentrate on using the terms related to probability, and on predicting using small numbers and real-life situations.

- Follow up predictions with the collection of actual data if possible. It is necessary to stress that predictions are not always reasonable.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Foundations

Learning Objectives	Example/Activity
N-4 recognize that partitioning a quantity does not change the total quantity (Assess: SA-T, OC, AR)	How many different ways can you split a group of eight objects into two groups? Three groups?
N-6 recognize that not all numerals represent quantities (Assess: AR, SA-T, WA, OC)	Numbers are often used to order, label or identify. e.g., phone numbers classroom numbers Ask students, with the assistance of their parents/caregivers, to list situations where numerals do not represent quantities. e.g., home, post office, sports, toy shop
N-7 recognize that two quantities can be made equal by b) adjusting both quantities (Assess: P-T, AR, OC, SA-T)	Using counters students make two different sized sets equal by taking some from the larger set and adding to the smaller set until both sets are equal.
N-9 recognize that quantities can be ordered according to the numbers assigned to represent each quantity (Assess: P-T, AS, OC, AR, RS, SA-T)	Students randomly make groups of objects, count and note the number of each group, and then arrange them in order.

Manipulatives/Resources

counters
- buttons
- bottle caps
- pasta
- dried beans
- bread bag fasteners
- beads
- large seeds
- paper clips
- pebbles
- bingo chips
- double sided counters
- popcorn
- cereal

odds and ends
small toys
linking cubes
unit cubes (base ten)
part-part-whole mat

Teacher Notes:

Instructional Notes

♦ Development of the concept of number is dependent on the development of many number relations.

1. Relation in patterned arrangements

```
"6" -   * *     *        *
        * *     *        * *     ******
        * *     * *      * *
                *        *
                *
```

2. Relation between two or more parts of the number.

   8 is - 7 and 1, 6 and 2, 5 and 3,
   4 and 4, 3 and 3 and 2, etc.

3. Relation to other numbers
   - one more or one less
   - two more or one less
   - special numbers
     (multiples of 5, 10 and 25)

Use concept attainment to develop the concept of a number.
e.g., 10

♦ Partitioning quantities and then reforming the total group develops conservation of number.
Equal partitioning activities help develop fraction concepts. Use concrete objects and pictures and ask students to determine their own equal partitions.

♦ Design activities that demonstrate situations of numbers not representing quantities.
e.g., design a classroom display

♦ In cooperative groups and using concrete objects encourage students to discuss how they would make two different quantities equal. For example a set of 10 and a set of 6 can be made equal by:
- adding or subtracting the difference
  10 - 4 = 6 or 6 + 4 = 10
- combining both sets and dividing
  10 + 6 = 16 divided by 2 = 8
- subtracting from one and adding to the other
  10 - 2 = 8, 6 + 2 =8

♦ Students should be involved in counting quantities and labelling the quantities with corresponding numbers. Then they put in order according to the number assigned to each set.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Foundations

Learning Objectives	Example/Activity
N-10 recognize that if a quantity is partitioned into two then either sub-quantity can be determined given the other and the total quantity (Assess: AR, OC, P-T)	Use a part-part-whole mat to show: _ objects + 13 objects = 19 objects. 40 objects + _ objects = 90 objects.
N-11 recognize, demonstrate, and explain patterning of numbers, objects, and events (Assess: AR, RS, O-T)	What patterns can you find on a hundred chart? Write them on a piece of paper. Build a "Two difference" train using attribute/logic blocks (each block must have 2 different characteristics from the preceeding block).
N-12 identify one or more characteristics of an object or an event (Assess: MC-T, M-T, SA-T, O-T, AR)	Which objects are smooth and will float?
N-13 demonstrate and explain classification (sorting) of data, objects or events by	
b) arranging all into groups of different properties (Assess: O-T, AR, P-T, RS, OC)	Ask students to make groups of objects that belong together. They should be able to explain to other students the reasons for sorting them in the way they did.
c) arranging them in different ways (Assess: AS, AR, P-T)	Sort the same data a different way from that of your partner.
N-14 demonstrate and explain seriation (ordering) of objects or events by using commonly seen attributes (Assess: SA-T, O-T, AR, OC, P/SA)	Do the following events occur before or after those already listed? e.g., Valentine's Day, Christmas Day, cultural days
N-15 demonstrate and explain correspondence (matching) by using	
b) one to many correspondence (Assess: AR, OC, SA-T, O-T)	Make a set of nickels to match the value of a quarter. Demonstrate the number of longs (10's) it takes to make a flat (100's) using base ten blocks.
N-16 compare sets using the phrases "more than", less than," equal to" (Assess: AR, RS, OC, O-T, SA-T)	How many vowels are in your first and last name? Compare to other classmates. How would you gather and display your data? Does your data give you other information?

Manipulatives/Resources

counters
attribute blocks
sorting mats
sorting trays
muffin trays
egg cartons
plastic containers
boxes
hoops
odds and ends
money
baseball cards
hockey cards
pictures - events
part-part-whole mats

Teacher Notes:

Instructional Notes

- When a quantity is partitioned, the concept of conservation of number is developed. For students to successfully find one of the parts of a total, they must understand that partitioning a quantity does not change the total quantity.

- The ability to observe a single characteristic or a combination of more than one characteristic is necessary before students can effectively sort, order, or match.

- Use a sorting mat or containers and a variety of materials for students to sort objects. Sort mixed up materials or different collections from field trips, etc. Students should talk or write about their thinking.
  In a work centre, students cooperatively sort "sports cards" (teams, team colours, position, left or right handed, birth dates, etc.), or sticker collection.

- Use activity cards that ask students to order objects or events. Include them in the Mathematics Centre.

- Match items which are related (tags and toys) as well as items not related (ball and book).
  One-to-one correspondence is an important concept to develop. Find differences by comparing sets of manipulatives using one-to-one correspondence.

- Set up a "money exchange" booth in your class. Students can exchange pennies, nickels, dimes, quarters and dollars. This develops the concept of one-to-many correspondence.

- Compare sets by using a variety of objects or pictures in a variety of configurations. Compare, expecting students to use appropriate terminology.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Counting

Learning Objectives	Example/Activity
N-18 recognize the purposes of counting (Assess: O-T, AR, P/SA, SA-T, OC)	Use various counting strategies to attain answers to problems. e.g., counting on from the larger addend - 5 + 3 = __ Think ... 6, 7, 8 If we read one book a day, will we have enough time to read all our Christmas books before Christmas?
N-19 count forward and backward by ones using any starting or ending point up to b) 1000 (Assess: O-T, OC, AR, RS, SA-T)	Count forward from 350 to 450. Count backward from 450 to 350. Record the time it takes for each. Which is faster? By how much? Why? Use a hundred chart to count.
N-20 skip count forward and backward by b) 3's, 4's, 25's 100's (Assess: SA-T, O-T, AR, RS)	Arrange counters or cut and paste pictures in groups of 3's, 4's, 5's to count and record. Use a hundred chart to discover patterns. Use a calculator (3 + = = = =)
N-21 use ordinals to describe and order an arrangement (Assess: SA-T, O-T, P-T, AS, AR, OC)	Count from April 10th to April 30th. Show the 21st day of the month. Emphasize the position of the object and not the object itself.
N-22 understand and use the terms "the number before", "the number after", the number between", "odd", and "even" (Assess: AR, SA-T, MC-T)	What numbers are between 19 and 22? What number comes before 50? What are the odd numbers between 30 and 40?
N-24 gain an understanding of the role of approximate numbers (Assess: O-T, AR, OC)	Brainstorm with students to make a list of places where approximate numbers are used. Compare to places where exact numbers are needed. Why are there differences?

Manipulatives/Resources

counters
odds and ends
linking cubes
hundred chart
number lines
calculators
calendars

Teacher Notes:

Instructional Notes

- Quick, accurate counting is necessary for many computational strategies.
- If you are asking students to count objects use the statement, "Find how many by counting".
- Individually, in groups, or as a whole class, students should practise counting forward and backward at every opportunity. Emphasize number patterns.
- Play "Calculator 21". Clear your calculator. Take turns with a partner and each may add a 1, 2, or 3. The first to reach exactly 21 receives a point. Can you devise a winning strategy? Change the rules. Play again.
- Skip counting is an economical process to use when counting large quantities. It is a prerequisite for multiplication.
  When students use a calculator to skip count (or find a pattern) make sure they record the number pattern on paper as seen on the calculator.
- To develop the concept of ordinality, use a variety of objects and change their order so that the position of the object is emphasized as the determining factor.
- Students must understand the need for approximate numbers in real life.
  As a whole class discussion or small group activity, ask questions which invite approximate answers.
  e.g., About how many leaves on the plant? About how many metres high is the door?
- Play "Approximately 100". This is a concentration type game using index cards on which numbers less than 100 are written. Players turn two cards over at a time and if the sum is close to 100 (upper 90's or low 100's) the player keeps the cards. If not they are returned.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Counting

Learning Objectives	Example/Activity
N-26 estimate an amount by	
a) using referents or benchmarks (Assess: AR, O-T, OC, SA-T)	Ask students to measure the length of their pencil. Using that information, estimate the length of both shorter and longer objects. Use "flash math" by momentarily exposing various sized, shaped, and amounts of objects on an overhead projector or from under a box lid. Students should learn to use previous experiences to estimate more accurately.
b) focusing on more than one attribute (Assess: AR, O-T, OC)	Using tiny objects (rice) grouped closely together, estimate an amount. Using larger objects (linking cubes) grouped further apart, estimate an amount.
c) partitioning into equal parts (Assess: AR)	Place about 40 small objects on the overhead projector and ask students to explain strategies they would use to estimate the amount. Partially separate the objects into groups of approximately 10 to assist the students with working toward the idea of partitioning.

Manipulatives/Resources

counters
linking cubes
odds and ends
overhead projector

Teacher Notes:

Instructional Notes

- Quick, short activities which develop estimating skills are good "fillers".

- Estimating skills are developed through regular practise and the use of commonly seen benchmarks.
  e.g., a door is about 2 m high, a dime is about 1 mm thick.
  Students need benchmarks with which to compare an amount or measure before they are able to estimate accurately.

- Discuss how size of the objects can give a feeling of more or less.
  Shape, colour, and spacing can also have an effect on our estimation skills.

- Students should learn to estimate a larger amount by mentally combining easily countable smaller groups that make up the larger set.

- Organize counters in nearly equal subsets and using guided discovery ask students if anything helped them with their estimates. Ask students to explain their observations to their group or the entire class.

- For estimating larger amounts, multiple choice questions may be presented until students have developed adequate skill and confidence.
  e.g., About how many birds are in the picture?
  20 50 100

- Plan an estimation activity for each day. Always keep a few activities on hand and ready to use.

Strand: Numbers and Operations
Topic: Whole Numbers
Sub-Topic: Place Value

Learning Objectives

N-27
understand that the digits 0-9 are used to form all other numerals
(Assess: SA-T, OC, AR)

N-28
group by
b) 100's, 10's, and 1's
(Assess: OC, RS, AR, AS, SA-T, P-T)

N-29
read, write the symbols for, and express orally numerals less than
b) 1000
(Assess: SA-T, O-T, OC, AR)

N-30
read words for numerals
b) to 20
(Assess: SA-T, OC, RS, AR)

N-31
write the numerals for a given model/picture and make a model/picture for a given numeral less than
b) 1000
(Assess: SA-T, AR)

Example/Activity

What numerals can you make with any three of the digits 0-9?

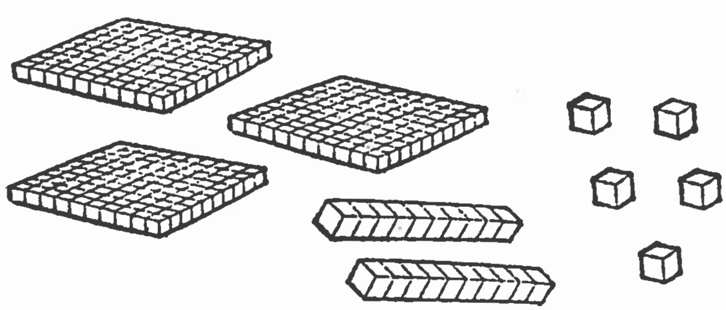
Use a calculator to form numbers. Read the numbers.

Divide the students into groups of three and ask them to find how many groups of 10 can be made out of their bag of objects. How many single objects are left over? How many groups of 100 can be made out of the groups of 10? How many are left over?

318 students attend our school.
Read aloud the above sentence.

Read aloud "sixteen houses are white".

Write the numeral for the picture represented by the base ten blocks.



Using base ten stamps make a picture that shows 367.

Manipulatives/Resources

base ten material
• units, lengths, flats
• beans and bean sticks
• straws & elastics
money
abacus
digit cards (0-9)
counters
base ten stamps
calculators
10-frames
place value mats

Teacher Notes:

Instructional Notes

- Students should discover that counting and grouping objects into sets of 10 and 100 becomes more efficient than counting by ones.
- If students use sets of digit cards (0-9) to indicate amounts, it helps them to realize that all numbers are formed using one or more of the ten digits.
- Always model correct number reading. (e.g., 254 is read two hundred fifty four. "And" is used to describe decimal numbers - 2.5 is read two "and" five tenths.)
  "And" is often use incorrectly.
  e.g., 114 is often **incorrectly** read as one hundred **and** fourteen.
- Write numbers and number names into problems, stories, rhymes, etc.
  Students should create their own problems using numbers.
- A calculator can be used for promoting the reading and saying of numbers. e.g., Dictate numbers and ask students to enter and calculate with them. They should state their answers using correct number words.
- Game situations can be developed by having one student present a numeral and another make a corresponding picture.
- Encourage students to read numbers using correct place value notation rather than reading digit by digit.
  e.g., 371 is read three hundred seventy-one, rather than three-seven-one.