



Prince Edward Island Mathematics Curriculum

Education and Early
Childhood Development
English Programs

Mathematics

Grade 7

CURRICULUM



2009
Prince Edward Island
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Background and Rationale

The development of an effective mathematics curriculum has encompassed a solid research base. Developers have examined the curriculum proposed throughout Canada and secured the latest research in the teaching of mathematics, and the result is a curriculum that should enable students to understand and use mathematics.

The Western and Northern Canadian Protocol (WNCP) *Common Curriculum Framework for K-9 Mathematics* (2006) has been adopted as the basis for a revised mathematics curriculum in Prince Edward Island. The *Common Curriculum Framework* was developed by the seven Canadian western and northern ministries of education (British Columbia, Alberta, Saskatchewan, Manitoba, Yukon Territory, Northwest Territories, and Nunavut) in collaboration with teachers, administrators, parents, business representatives, post-secondary educators, and others. The framework identifies beliefs about mathematics, general and specific student outcomes, and achievement indicators agreed upon by the seven jurisdictions. This document is based on both national and international research by the WNCP, and on the *Principles and Standards for School Mathematics* (2000), published by the National Council of Teachers of Mathematics (NCTM).

➤ Essential Graduation Learnings

Essential graduation learnings (EGLs) are statements describing the knowledge, skills, and attitudes expected of all students who graduate from high school. Achievement of the essential graduation learnings will prepare students to continue to learn throughout their lives. These learnings describe expectations not in terms of individual school subjects but in terms of knowledge, skills, and attitudes developed throughout the curriculum. They confirm that students need to make connections and develop abilities across subject boundaries if they are to be ready to meet the shifting and ongoing demands of life, work, and study today and in the future. Essential graduation learnings are cross curricular, and curriculum in all subject areas is focussed to enable students to achieve these learnings. Essential graduation learnings serve as a framework for the curriculum development process.

Specifically, graduates from the public schools of Prince Edward Island will demonstrate knowledge, skills, and attitudes expressed as essential graduation learnings, and will be expected to

- respond with critical awareness to various forms of the arts, and be able to express themselves through the arts;
- assess social, cultural, economic, and environmental interdependence in a local and global context;
- use the listening, viewing, speaking, and writing modes of language(s), and mathematical and scientific concepts and symbols, to think, learn, and communicate effectively;
- continue to learn and to pursue an active, healthy lifestyle;
- use the strategies and processes needed to solve a wide variety of problems, including those requiring language and mathematical and scientific concepts;
- use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

More specifically, curriculum outcome statements articulate what students are expected to know and be able to do in particular subject areas. Through the achievement of curriculum outcomes, students demonstrate the essential graduation learnings.

➤ **Curriculum Focus**

There is an emphasis in the Prince Edward Island mathematics curriculum on particular key concepts at each grade which will result in greater depth of understanding. There is also more emphasis on number sense and operations in the early grades to ensure students develop a solid foundation in numeracy. The intent of this document is to clearly communicate to all educational partners high expectations for students in mathematics education. Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge (NCTM, *Principles and Standards for School Mathematics*, 2000).

The main goals of mathematics education are to prepare students to

- use mathematics confidently to solve problems;
- communicate and reason mathematically;
- appreciate and value mathematics;
- make connections between mathematics and its applications;
- commit themselves to lifelong learning;
- become mathematically literate adults, using mathematics to contribute to society.

Students who have met these goals will

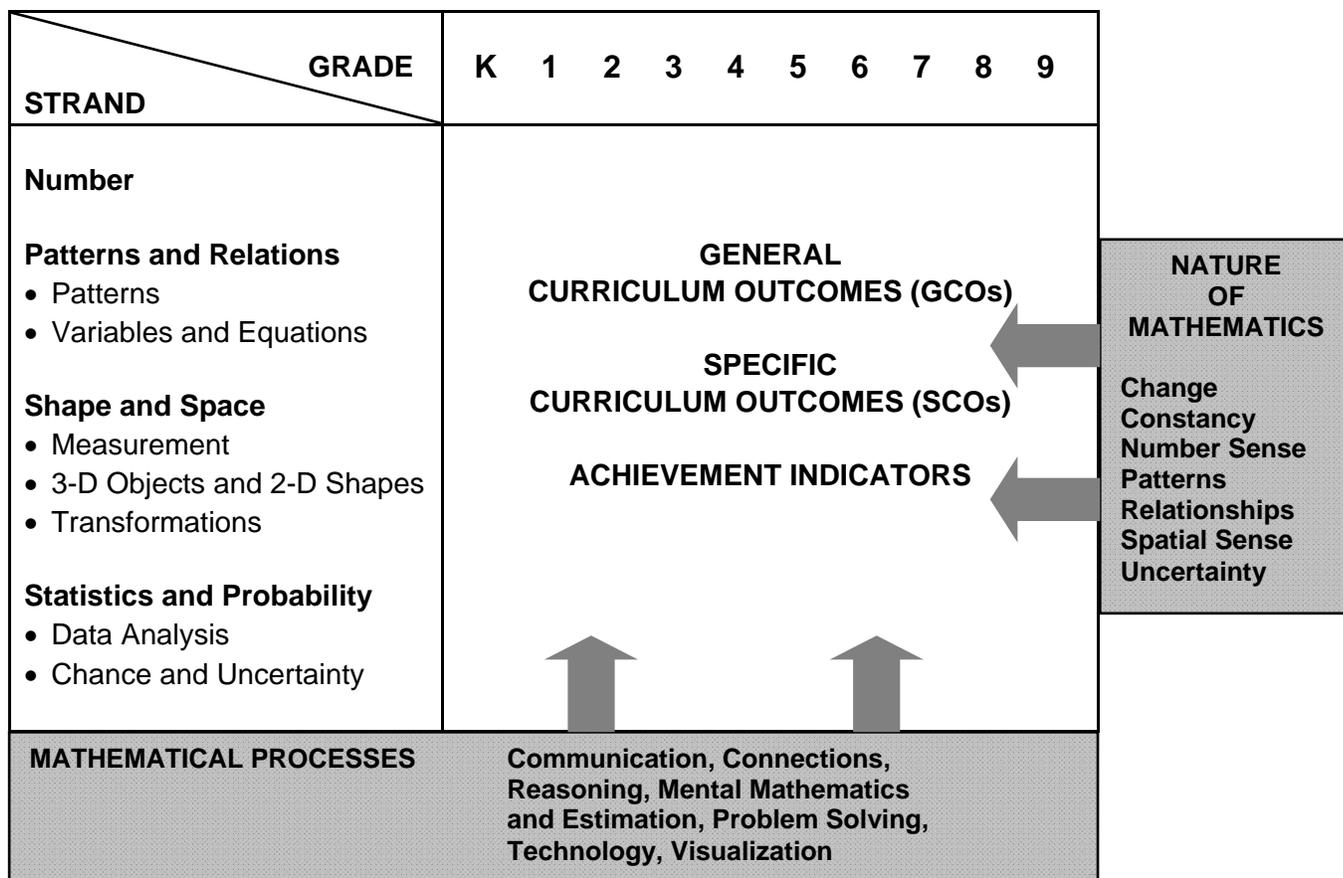
- gain understanding and appreciation of the contributions of mathematics as a science, philosophy, and art;
- exhibit a positive attitude toward mathematics;
- engage and persevere in mathematical tasks and projects;
- contribute to mathematical discussions;
- take risks in performing mathematical tasks;
- exhibit curiosity.

➤ **Connections across the Curriculum**

The teacher should take advantage of the various opportunities available to integrate mathematics and other subjects. This integration not only serves to show students how mathematics is used in daily life, but it helps strengthen the understanding of mathematical concepts by students and provides them with opportunities to practise mathematical skills. There are many possibilities for integrating mathematics in literacy, science, social studies, music, art, physical education, and other subject areas. Efforts should be made to make connections and use examples drawn from a variety of disciplines.

Conceptual Framework for K-9 Mathematics

The chart below provides an overview of how mathematical processes and the nature of mathematics influence learning outcomes.



The mathematics curriculum describes the nature of mathematics, as well as the mathematical processes and the mathematical concepts to be addressed. This curriculum is arranged into four strands, namely Number, Patterns and Relations, Shape and Space, and Statistics and Probability. These strands are not intended to be discrete units of instruction. The integration of outcomes across strands makes mathematical experiences meaningful. Students should make the connections among concepts both within and across strands. Consider the following when planning for instruction:

- Integration of the mathematical processes within each strand is expected.
- Decreasing emphasis on rote calculation, drill, and practice, and the size of numbers used in paper and pencil calculations makes more time available for concept development.
- Problem solving, reasoning, and connections are vital to increasing mathematical fluency, and must be integrated throughout the program.
- There is to be a balance among mental mathematics and estimation, paper and pencil exercises, and the use of technology, including calculators and computers. Concepts should be introduced using models and gradually developed from the concrete to the pictorial to the symbolic.

➤ Mathematical Processes

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and encourage lifelong learning in mathematics. The Prince Edward Island mathematics curriculum incorporates the following seven interrelated mathematical processes that are intended to permeate teaching and learning. These unifying concepts serve to link the content to methodology.

Students are expected to

- communicate in order to learn and express their understanding of mathematics; **[Communications: C]**
- connect mathematical ideas to other concepts in mathematics, to everyday experiences, and to other disciplines; **[Connections: CN]**
- demonstrate fluency with mental mathematics and estimation; **[Mental Mathematics and Estimation: ME]**
- develop and apply new mathematical knowledge through problem solving; **[Problem Solving: PS]**
- develop mathematical reasoning; **[Reasoning: R]**
- select and use technologies as tools for learning and solving problems; **[Technology: T]**
- develop visualization skills to assist in processing information, making connections, and solving problems. **[Visualization: V]**

Communication [C]

Students need opportunities to read about, represent, view, write about, listen to, and discuss mathematical ideas. These opportunities allow students to create links between their own language and ideas and the formal language and symbols of mathematics. Communication is important in clarifying, reinforcing, and modifying ideas, knowledge, attitudes, and beliefs about mathematics. Students should be encouraged to use a variety of forms of communication while learning mathematics. Students also need to communicate their learning using mathematical terminology. Communication can help students make connections among concrete, pictorial, symbolic, verbal, written, and mental representations of mathematical ideas.

Connections [CN]

Contextualization and making connections to the experiences of learners are powerful processes in developing mathematical understanding. When mathematical ideas are connected to each other or to real-world phenomena, students can begin to view mathematics as useful, relevant, and integrated. Learning mathematics within contexts and making connections relevant to learners can validate past experiences and increase student willingness to participate and be actively engaged. The brain is constantly looking for and making connections.

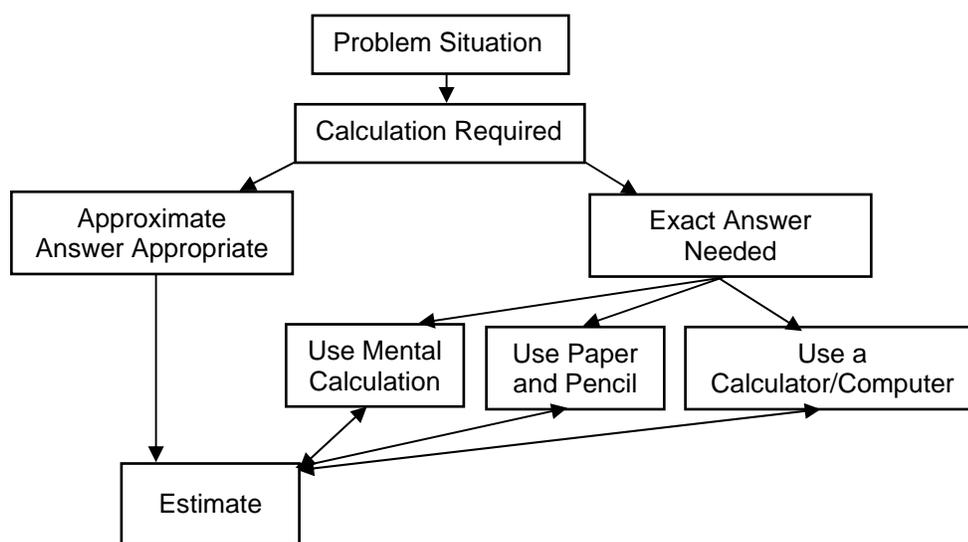
For instance, opportunities should be created frequently to link mathematics and career opportunities. Students need to become aware of the importance of mathematics and the need for mathematics in many career paths. This realization will help maximize the number of students who strive to develop and maintain the mathematical abilities required for success in further areas of study.

Mental Mathematics and Estimation [ME]

Mental mathematics is a combination of cognitive strategies that enhance flexible thinking and number sense. It involves calculation without the use of external memory aids. Mental mathematics enables students to determine answers without paper and pencil. It improves computational fluency by developing efficiency, accuracy, and flexibility. Even more important than performing computational procedures or using calculators is the greater facility that students need - more than ever before - with estimation and mental mathematics (National Council of Teachers of Mathematics, May 2005). Students proficient with mental mathematics “become liberated from calculator dependence, build confidence in doing mathematics, become more flexible thinkers and are more able to use multiple approaches to problem solving” (Rubenstein, 2001). Mental mathematics “provides a cornerstone for all estimation processes offering a variety of alternate algorithms and non-standard techniques for finding answers” (Hope, 1988).

Estimation is a strategy for determining approximate values or quantities, usually by referring to benchmarks or using referents, or for determining the reasonableness of calculated values. Students need to know when to estimate, what strategy to use, and how to use it. Estimation is used to make mathematical judgments and develop useful, efficient strategies for dealing with situations in daily life.

Students need to develop both mental mathematics and estimation skills through context and not in isolation so they are able to apply them to solve problems. Whenever a problem requires a calculation, students should follow the decision-making process described below:



(NCTM)

Problem Solving [PS]

Learning through problem solving should be the focus of mathematics at all grade levels. When students encounter new situations and respond to questions of the type, “How would you. . . ?” or “How could you. . . ?” the problem-solving approach is being modelled. Students develop their own problem-solving strategies by being open to listening, discussing, and trying different strategies.

In order for an activity to be problem-solving based, it must ask students to determine a way to get from what is known to what is sought. If students have already been given ways to solve the problem, it is not

a problem, but practice. A true problem requires students to use prior learning in new ways and contexts. Problem solving requires and builds depth of conceptual understanding and student engagement.

Problem solving is also a powerful teaching tool that fosters multiple, creative, and innovative solutions. Creating an environment where students openly look for and engage in finding a variety of strategies for solving problems empowers students to explore alternatives and develops confident and cognitive mathematical risk takers.

Over time, numerous problem-solving strategies should be modelled for students, and students should be encouraged to employ various strategies in many problem-solving situations. While choices with respect to the timing of the introduction of any given strategy will vary, the following strategies should all become familiar to students:

- using estimation
- guessing and checking
- looking for a pattern
- making an organized list or table
- using a model
- working backwards
- using a formula
- using a graph, diagram, or flow chart
- solving a simpler problem
- using algebra.

Reasoning [R]

Mathematical reasoning helps students think logically and make sense of mathematics. Students need to develop confidence in their abilities to reason and justify their mathematical thinking. High-order questions challenge students to think and develop a sense of wonder about mathematics. Mathematical experiences in and out of the classroom provide opportunities for inductive and deductive reasoning. Inductive reasoning occurs when students explore and record results, analyse observations, make generalizations from patterns, and test these generalizations. Deductive reasoning occurs when students reach new conclusions based upon what is already known or assumed to be true.

Technology [T]

Technology contributes to the learning of a wide range of mathematical outcomes and enables students to explore and create patterns, examine relationships, test conjectures, and solve problems.

Calculators and computers can be used to

- explore and demonstrate mathematical relationships and patterns;
- organize and display data;
- extrapolate and interpolate;
- assist with calculation procedures as part of solving problems;
- decrease the time spent on computations when other mathematical learning is the focus;
- reinforce the learning of basic facts and test properties;
- develop personal procedures for mathematical operations;
- create geometric displays;
- simulate situations;
- develop number sense.

Technology contributes to a learning environment in which the growing curiosity of students can lead to rich mathematical discoveries at all grade levels. While technology can be used in K-3 to enrich learning, it is expected that students will meet all outcomes without the use of technology.

Visualization [V]

Visualization involves thinking in pictures and images, and the ability to perceive, transform, and recreate different aspects of the visual-spatial world. The use of visualization in the study of mathematics provides students with opportunities to understand mathematical concepts and make connections among them. Visual images and visual reasoning are important components of number, spatial, and measurement sense. Number visualization occurs when students create mental representations of numbers.

Being able to create, interpret, and describe a visual representation is part of spatial sense and spatial reasoning. Spatial visualization and reasoning enable students to describe the relationships among and between 3-D objects and 2-D shapes.

Measurement visualization goes beyond the acquisition of specific measurement skills. Measurement sense includes the ability to determine when to measure and when to estimate, and knowledge of several estimation strategies (Shaw & Cliatt, 1989).

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

➤ The Nature of Mathematics

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

Change

It is important for students to understand that mathematics is dynamic and not static. As a result, recognizing change is a key component in understanding and developing mathematics. Within mathematics, students encounter conditions of change and are required to search for explanations of that change. To make predictions, students need to describe and quantify their observations, look for patterns, and describe those quantities that remain fixed and those that change. For example, the sequence 4, 6, 8, 10, 12, ... can be described as

- skip counting by 2s, starting from 4;
- an arithmetic sequence, with first term 4 and a common difference of 2; or
- a linear function with a discrete domain.

Constancy

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

- The area of a rectangular region is the same regardless of the methods used to determine the solution.
- The sum of the interior angles of any triangle is 180° .
- The theoretical probability of flipping a coin and getting heads is 0.5.

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

Number Sense

Number sense, which can be thought of as intuition about numbers, is the most important foundation of numeracy (*The Primary Program*, B.C., 2000, p. 146). A true sense of number goes well beyond the skills of simply counting, memorizing facts, and the situational rote use of algorithms. Number sense develops when students connect numbers to real-life experiences, and use benchmarks and referents. This results in students who are computationally fluent, and flexible and intuitive with numbers. The evolving number sense typically comes as a by-product of learning rather than through direct instruction. However, number sense can be developed by providing rich mathematical tasks that allow students to make connections.

Patterns

Mathematics is about recognizing, describing, and working with numerical and non-numerical patterns. Patterns exist in all strands and it is important that connections are made among strands. Working with patterns enables students to make connections within and beyond mathematics. These skills contribute to students' interaction with and understanding of their environment. Patterns may be represented in concrete, visual, or symbolic form. Students should develop fluency in moving from one representation to another. Students must learn to recognize, extend, create, and use mathematical patterns. Patterns allow students to make predictions and justify their reasoning when solving routine and non-routine problems. Learning to work with patterns in the early grades helps develop students' algebraic thinking that is foundational for working with more abstract mathematics in higher grades.

Relationships

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

Spatial Sense

Spatial sense involves visualization, mental imagery, and spatial reasoning. These skills are central to the understanding of mathematics. Spatial sense enables students to interpret representations of 2-D shapes and 3-D objects, and identify relationships to mathematical strands. Spatial sense is developed through a variety of experiences and interactions within the environment. The development of spatial sense enables students to solve problems involving 2-D shapes and 3-D objects.

Spatial sense offers a way to interpret and reflect on the physical environment and its 3-D or 2-D representations. Some problems involve attaching numerals and appropriate units (measurement) to dimensions of objects. Spatial sense allows students to use dimensions and make predictions about the results of changing dimensions.

- Knowing the dimensions of an object enables students to communicate about the object and create representations.
- The volume of a rectangular solid can be calculated from given dimensions.
- Doubling the length of the side of a square increases the area by a factor of four.

Uncertainty

In mathematics, interpretations of data and the predictions made from data may lack certainty. Events and experiments generate statistical data that can be used to make predictions. It is important to recognize that these predictions (interpolations and extrapolations) are based upon patterns that have a degree of uncertainty. The quality of the interpretation is directly related to the quality of the data. An awareness of uncertainty allows students to assess the reliability of data and data interpretation. Chance addresses the predictability of the occurrence of an outcome. As students develop their understanding of

probability, the language of mathematics becomes more specific and describes the degree of uncertainty more accurately.

Contexts for Learning and Teaching

The Prince Edward Island mathematics curriculum is based upon several key assumptions or beliefs about mathematics learning which have grown out of research and practice:

- Mathematics learning is an active and constructive process.
- Learners are individuals who bring a wide range of prior knowledge and experiences, and who learn via various styles and at different rates.
- Learning is most likely to occur in meaningful contexts and in an environment that supports exploration, risk taking, and critical thinking, and that nurtures positive attitudes and sustained effort.
- Learning is most effective when standards of expectation are made clear with ongoing assessment and feedback.

Students are curious, active learners with individual interests, abilities, and needs. They come to classrooms with varying knowledge, life experiences, and backgrounds. A key component in successfully developing numeracy is making connections to these backgrounds and experiences.

Young children develop a variety of mathematical ideas before they enter school. They make sense of their environment through observations and interactions at home and in the community. Their mathematics learning is embedded in everyday activities, such as playing, reading, storytelling, and helping around the home. Such activities can contribute to the development of number and spatial sense in children. Initial problem solving and reasoning skills are fostered when children are engaged in activities such as comparing quantities, searching for patterns, sorting objects, ordering objects, creating designs, building with blocks, and talking about these activities. Positive early experiences in mathematics are as critical to child development as are early literacy experiences.

Students learn by attaching meaning to what they do, and they need to construct their own meaning of mathematics. This meaning is best developed when learners encounter mathematical experiences that proceed from the simple to the complex and from the concrete to the abstract. The use of models and a variety of pedagogical approaches can address the diversity of learning styles and developmental stages of students, and enhance the formation of sound, transferable, mathematical concepts. At all levels, students benefit from working with a variety of materials, tools, and contexts when constructing meaning about new mathematical ideas. Meaningful discussions can provide essential links among concrete, pictorial, and symbolic representations of mathematics.

The learning environment should value and respect the experiences and ways of thinking of all students, so that learners are comfortable taking intellectual risks, asking questions, and posing conjectures. Students need to explore problem-solving situations in order to develop personal strategies and become mathematically literate. Learners must be encouraged that it is acceptable to solve problems in different ways and realize that solutions may vary.

➤ Homework

Homework is an essential component of the mathematics program, as it extends the opportunity for students to think mathematically and to reflect on ideas explored during class time. The provision of this additional time for reflection and practice plays a valuable role in helping students to consolidate their learning.

Traditionally, homework has meant completing ten to twenty drill and practice questions relating to the procedure taught in a given day. With the increased emphasis on problem solving, conceptual understanding, and mathematical reasoning, however, it is important that homework assignments change accordingly. More assignments involving problem solving, mathematical investigations, written explanations and reflections, and data collection should replace some of the basic practice exercises given in isolation. In fact, a good problem can sometimes accomplish more than many drill-oriented exercises on a topic.

As is the case in designing all types of homework, the needs of the students and the purpose of the assignment will dictate the nature of the questions included. Homework need not be limited to reinforcing learning; it provides an excellent opportunity to revisit topics explored previously and to introduce new topics before teaching them in the classroom. Homework provides an effective way to communicate with parents and provides parents an opportunity to be actively involved in their child's learning. By ensuring that assignments model classroom instruction and sometimes require parental input, a teacher can give a parent clearer understanding of the mathematics curriculum and of the child's progress in relationship to it. As Van de Walle (1994, p. 454) suggests, homework can serve as a parent's window to the classroom.

➤ **Diversity in Student Needs**

Every class has students at many different cognitive levels. Rather than choosing a certain level at which to teach, a teacher is responsible for tailoring instruction to reach as many of these students as possible. In general, this may be accomplished by assigning different tasks to different students or assigning the same open-ended task to most students. Sometimes it is appropriate for a teacher to group students by interest or ability, assigning them different tasks in order to best meet their needs. These groupings may last anywhere from minutes to semesters, but should be designed to help all students (whether strong, weak or average) to reach their highest potential. There are other times when an appropriately open-ended task can be valuable to a broad spectrum of students. For example, asking students to make up an equation for which the answer is 5 allows some students to make up very simple equations while others can design more complex ones. The different equations constructed can become the basis for a very rich lesson from which all students come away with a better understanding of what the solution to an equation really means.

➤ **Gender and Cultural Equity**

The mathematics curriculum and mathematics instruction must be designed to equally empower both male and female students, as well as members of all cultural backgrounds. Ultimately, this should mean not only that enrolments of students of both genders and various cultural backgrounds in public school mathematics courses should reflect numbers in society, but also that representative numbers of both genders and the various cultural backgrounds should move on to successful post-secondary studies and careers in mathematics and mathematics-related areas.

➤ **Mathematics for EAL Learners**

The Prince Edward Island mathematics curriculum is committed to the principle that learners of English as an additional language (EAL) should be full participants in all aspects of mathematics education. English deficiencies and cultural differences must not be barriers to full participation. All students should study a comprehensive mathematics curriculum with high-quality instruction and co-ordinated assessment.

The *Principles and Standards for School Mathematics* (NCTM, 2000) emphasizes communication “as an essential part of mathematics and mathematics education” (p.60). The *Standards* elaborate that all

students, and EAL learners in particular, need to have opportunities and be given encouragement and support for speaking, writing, reading, and listening in mathematics classes. Such efforts have the potential to help EAL learners overcome barriers and will facilitate “communicating to learn mathematics and learning to communicate mathematically” (NCTM, p.60).

To this end,

- schools should provide EAL learners with support in their dominant language and English language while learning mathematics;
- teachers, counsellors, and other professionals should consider the English-language proficiency level of EAL learners as well as their prior course work in mathematics;
- the mathematics proficiency level of EAL learners should be solely based on their prior academic record and not on other factors;
- mathematics teaching, curriculum, and assessment strategies should be based on best practices and build on the prior knowledge and experiences of students and on their cultural heritage;
- the importance of mathematics and the nature of the mathematics program should be communicated with appropriate language support to both students and parents;
- to verify that barriers have been removed, educators should monitor enrolment and achievement data to determine whether EAL learners have gained access to, and are succeeding in, mathematics courses.

➤ **Education for Sustainable Development**

Education for sustainable development (ESD) involves incorporating the key themes of sustainable development - such as poverty alleviation, human rights, health, environmental protection, and climate change - into the education system. ESD is a complex and evolving concept and requires learning about these key themes from a social, cultural, environmental, and economic perspective, and exploring how those factors are interrelated and interdependent.

With this in mind, it is important that all teachers, including mathematics teachers, attempt to incorporate these key themes in their subject areas. One tool that can be used is the searchable on-line database *Resources for Rethinking*, found at <http://r4r.ca/en>. It provides teachers with access to materials that integrate ecological, social, and economic spheres through active, relevant, interdisciplinary learning.

Assessment and Evaluation

Assessment and evaluation are essential components of teaching and learning in mathematics. The basic principles of assessment and evaluation are as follows:

- Effective assessment and evaluation are essential to improving student learning.
- Effective assessment and evaluation are aligned with the curriculum outcomes.
- A variety of tasks in an appropriate balance gives students multiple opportunities to demonstrate their knowledge and skills.
- Effective evaluation requires multiple sources of assessment information to inform judgments and decisions about the quality of student learning.
- Meaningful assessment data can demonstrate student understanding of mathematical ideas, student proficiency in mathematical procedures, and student beliefs and attitudes about mathematics.

Without effective assessment and evaluation it is impossible to know whether students have learned, or teaching has been effective, or how best to address student learning needs. The quality of the assessment and evaluation in the educational process has a profound and well-established link to student performance. Research consistently shows that regular monitoring and feedback are essential to improving student learning. What is assessed and evaluated, how it is assessed and evaluated, and how results are communicated send clear messages to students and others.

➤ **Assessment**

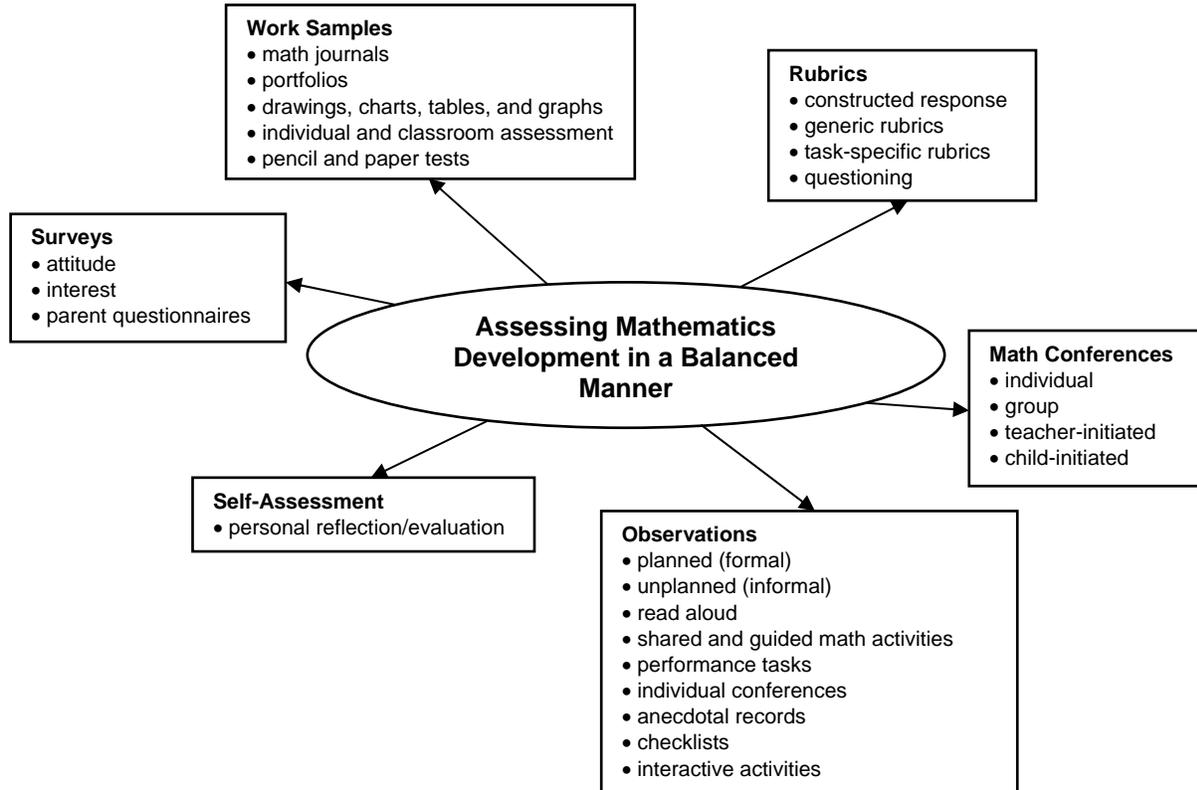
Assessment is the systematic process of gathering information on student learning. To determine how well students are learning, assessment strategies have to be designed to systematically gather information on the achievement of the curriculum outcomes. Teacher-developed assessments have a wide variety of uses, such as

- providing feedback to improve student learning;
- determining if curriculum outcomes have been achieved;
- certifying that students have achieved certain levels of performance;
- setting goals for future student learning;
- communicating with parents about their children's learning;
- providing information to teachers on the effectiveness of their teaching, the program, and the learning environment;
- meeting the needs of guidance and administration.

A broad assessment plan for mathematics ensures a balanced approach to summarizing and reporting. It should consider evidence from a variety of sources, including

- | | |
|------------------------------------|------------------------------|
| • formal and informal observations | • portfolios |
| • work samples | • learning journals |
| • anecdotal records | • questioning |
| • conferences | • performance assessment |
| • teacher-made and other tests | • peer- and self-assessment. |

This balanced approach for assessing mathematics development is illustrated in the diagram on the next page.



There are three interrelated purposes for classroom assessment: assessment *as* learning, assessment *for* learning, and assessment *of* learning. Characteristics of each type of assessment are highlighted below.

Assessment *as* learning is used

- to engage students in their own learning and self-assessment;
- to help students understand what is important in the mathematical concepts and particular tasks they encounter;
- to develop effective habits of metacognition and self-coaching;
- to help students understand themselves as learners - *how* they learn as well as *what* they learn - and to provide strategies for reflecting on and adjusting their learning.

Assessment *for* learning is used

- to gather and use ongoing information in relation to curriculum outcomes in order to adjust instruction and determine next steps for individual learners and groups;
- to identify students who are at risk, and to develop insight into particular needs in order to differentiate learning and provide the scaffolding needed;
- to provide feedback to students about how they are doing and how they might improve;
- to provide feedback to other professionals and to parents about how to support students' learning.

Assessment of learning is used

- to determine the level of proficiency that a student has demonstrated in terms of the designated learning outcomes for a unit or group of units;
- to facilitate reporting;
- to provide the basis for sound decision-making about next steps in a student's learning.

➤ Evaluation

Evaluation is the process of analysing, reflecting upon, and summarizing assessment information, and making judgments or decisions based upon the information gathered. Evaluation involves teachers and others in analysing and reflecting upon information about student learning gathered in a variety of ways.

This process requires

- developing clear criteria and guidelines for assigning marks or grades to student work;
- synthesizing information from multiple sources;
- weighing and balancing all available information;
- using a high level of professional judgment in making decisions based upon that information.

➤ Reporting

Reporting on student learning should focus on the extent to which students have achieved the curriculum outcomes. Reporting involves communicating the summary and interpretation of information about student learning to various audiences who require it. Teachers have a special responsibility to explain accurately what progress students have made in their learning and to respond to parent and student inquiries about learning. Narrative reports on progress and achievement can provide information on student learning which letter or number grades alone cannot. Such reports might, for example, suggest ways in which students can improve their learning and identify ways in which teachers and parents can best provide support. Effective communication with parents regarding their children's progress is essential in fostering successful home-school partnerships. The report card is one means of reporting individual student progress. Other means include the use of conferences, notes, and phone calls.

➤ Guiding Principles

In order to provide accurate, useful information about the achievement and instructional needs of students, certain guiding principles for the development, administration, and use of assessments must be followed. The document *Principles for Fair Student Assessment Practices for Education in Canada* (1993) articulates five fundamental assessment principles, as follows:

- Assessment methods should be appropriate for and compatible with the purpose and context of the assessment.
- Students should be provided with sufficient opportunity to demonstrate the knowledge, skills, attitudes, or behaviours being assessed.
- Procedures for judging or scoring student performance should be appropriate for the assessment method used and be consistently applied and monitored.
- Procedures for summarizing and interpreting assessment results should yield accurate and informative representations of a student's performance in relation to the curriculum outcomes for the reporting period.
- Assessment reports should be clear, accurate, and of practical value to the audience for whom they are intended.

These principles highlight the need for assessment which ensures that

- the best interests of the student are paramount;
- assessment informs teaching and promotes learning;
- assessment is an integral and ongoing part of the learning process and is clearly related to the curriculum outcomes;
- assessment is fair and equitable to all students and involves multiple sources of information.

While assessments may be used for different purposes and audiences, all assessments must give each student optimal opportunity to demonstrate what he/she knows and can do.

Structure and Design of the Curriculum Guide

The learning outcomes in the Prince Edward Island mathematics curriculum are organized into four strands across the grades K-9. They are Number, Patterns and Relations, Shape and Space, and Statistics and Probability. These strands are further subdivided into sub-strands, which are the general curriculum outcomes (GCOs). They are overarching statements about what students are expected to learn in each strand or sub-strand from grades K-9.

| Strand | General Curriculum Outcome (GCO) |
|--|--|
| Number (N) | Number: Develop number sense. |
| Patterns and Relations (PR) | Patterns: Use patterns to describe the world and solve problems. |
| | Variables and Equations: Represent algebraic expressions in multiple ways. |
| Shape and Space (SS) | Measurement: Use direct and indirect measure to solve problems. |
| | 3-D Objects and 2-D Shapes: Describe the characteristics of 3-D objects and 2-D shapes, and analyse the relationships among them. |
| | Transformations: Describe and analyse position and motion of objects and shapes. |
| Statistics and Probability (SP) | Data Analysis: Collect, display, and analyse data to solve problems. |
| | Chance and Uncertainty: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty. |

Each general curriculum outcome is then subdivided into a number of specific curriculum outcomes (SCOs). Specific curriculum outcomes are statements that identify the specific skills, understandings, and knowledge students are required to attain by the end of a given grade.

Finally, each specific curriculum outcome has a list of achievement indicators that are used to determine whether students have met the corresponding specific outcome.

In this curriculum guide, each specific curriculum outcome (SCO) is presented in a two-page format, and includes the following information:

- its corresponding strand and general curriculum outcome;
- the scope and sequence of the specific curriculum outcome(s) from grades six to eight which correspond to this SCO;
- the specific curriculum outcome, with a list of achievement indicators;
- a list of the sections in *MathLinks 7* which address the SCO, with specific achievement indicators highlighted in brackets;
- an elaboration for the SCO.

In the second half of this document, a curriculum guide supplement is presented which follows the primary resource, *MathLinks 7*.

NUMBER

SPECIFIC CURRICULUM OUTCOMES

N1 – Determine and explain why a number is divisible by 2, 3, 4, 5, 6, 8, 9 or 10, and why a number cannot be divided by 0.

N2 – Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems.

N3 – Solve problems involving percents from 1% to 100%.

N4 – Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.

N5 – Demonstrate an understanding of adding and subtracting positive fractions and mixed numbers, with like and unlike denominators, concretely, pictorially and symbolically (limited to positive sums and differences).

N6 – Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.

N7 – Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:

- benchmarks;
- place value;
- equivalent fractions and/or decimals.

Grade 7 – Strand: Number (N)

GCO: Develop number sense.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|---|--|
| <p>N3 Demonstrate an understanding of factors and multiples by:</p> <ul style="list-style-type: none"> • determining multiples and factors of numbers less than 100; • identifying prime and composite numbers; • solving problems involving multiples. | <p>N1 Determine and explain why a number is divisible by 2, 3, 4, 5, 6, 8, 9 or 10, and why a number cannot be divided by 0.</p> | <p>N1 Demonstrate an understanding of perfect square and square root, concretely, pictorially and symbolically (limited to whole numbers).</p> <p>N2 Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers).</p> |

SCO: **N1 – Determine and explain why a number is divisible by 2, 3, 4, 5, 6, 8, 9 or 10, and why a number cannot be divided by 0.** [C, R]

Students who have achieved this outcome should be able to:

- A.** Determine if a given number is divisible by 2, 3, 4, 5, 6, 8, 9 or 10 and explain why.
- B.** Sort a given set of numbers based upon their divisibility using organizers, such as Venn and Carroll diagrams.
- C.** Determine the factors of a given number using the divisibility rules.
- D.** Explain, using an example, why numbers cannot be divided by 0.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

6.1 (A B C D)

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

SCO: N1 – Determine and explain why a number is divisible by 2, 3, 4, 5, 6, 8, 9 or 10, and why a number cannot be divided by 0. [C, R]

Elaboration

Exploration of the divisibility rules serves as an excellent opportunity to extend number sense. Knowledge of the divisibility rules provides a valuable tool for mental arithmetic and general development of operation sense.

Students should be reminded of the divisibility rules for 2, 5 and 10 which most should recall readily. Once students understand divisibility for 2 and 3, they can use this knowledge to develop a means of testing for divisibility by 6. This should be seen as a problem solving opportunity for students. They can also explore whether similar strategies will always work for other numbers such as 8 and 10.

The divisibility rules are given below (this is a suggested order for instruction). A number is divisible by:

- 2 if it is even, that is, it ends in a 0, 2, 4, 6 or 8;
- 5 if it ends in a 0 or a 5;
- 10 if it ends in a 0;
- 3 if the sum of the digits is divisible by 3;
- 6 if the number is divisible by 3 and is even;
- 9 if the sum of the digits is divisible by 9;
- 4 if the number formed by the last two digits is divisible by 4;
- 8 if the number is divisible by 4 and the resulting quotient is even (*e.g.*, for 92, think $92 \div 4 = 23$; since 23 is not even, 92 is not divisible by 8); or if the number represented by the last 3 digits is divisible by 8. This rule can also be thought of as dividing by 2 evenly three times.

To avoid an arbitrary rule for not being able to divide by 0, use a repeated subtraction meaning for division. For example, to explain $20 \div 5$, you can subtract 5 four times from 20 until you get to 0, so $20 \div 5 = 4$. So, for $6 \div 0$, ask how many times can you subtract 0 from 6 before you get to 0. There is no answer, as you will never get to 0 ($6 - 0 - 0 - 0 = 6$).

Grade 7 – Strand: Number (N)

GCO: Develop number sense.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|---------|
| <p>N1 Demonstrate an understanding of place value for numbers:</p> <ul style="list-style-type: none"> • greater than one million; • less than one thousandth. <p>N8 Demonstrate an understanding of multiplication and division of decimals.</p> <p>N9 Explain and apply the order of operations, excluding exponents, with and without technology.</p> | <p>N2 Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems.</p> | |

SCO: **N2 – Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems.** [ME, PS, T]

Students who have achieved this outcome should be able to:

- A.** Solve a given problem involving the addition of two or more decimal numbers.
- B.** Solve a given problem involving the subtraction of decimal numbers.
- C.** Solve a given problem involving the multiplication of decimal numbers.
- D.** Solve a given problem involving the multiplication or division of decimal numbers with 2-digit multipliers or 1-digit divisors (whole numbers or decimals) without the use of technology.
- E.** Solve a given problem involving the multiplication or division of decimal numbers with more than a 2-digit multiplier or a 1-digit divisor (whole number or decimal), with the use of technology.
- F.** Place the decimal in a sum or difference using front-end estimation; e.g., for $4.5 + 0.73 + 256.458$, think $4 + 256$, so the sum is greater than 260.
- G.** Place the decimal in a product using front-end estimation; e.g., for $\$12.33 \times 2.4$, think $\$12 \times 2$, so the product is greater than \$24.
- H.** Place the decimal in a quotient using front-end estimation, e.g., for $51.50 \text{ m} \div 2.1$, think $50 \text{ m} \div 2$, so the quotient is approximately 25 m.
- I.** Check the reasonableness of solutions using estimation.
- J.** Solve a given problem that involves operations on decimals (limited to thousandths) taking into consideration the order of operations.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

2.1 (A B F I)

2.2 (C D E G I)

2.3 (D E H I)

2.4 (J)

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

SCO: N2 – Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems. [ME, PS, T]

Elaboration

Students should know when it is appropriate to use a mental procedure, a paper-and-pencil algorithm or a calculator for the mathematical operations involving whole numbers and/or decimals. They need to understand the relationship between whole number and decimal number operations, including order of operations begun in grade six. Emphasis should be placed on place value and estimation ideas to ensure that instruction does not focus on students simply mastering procedural rules without a conceptual understanding. It is important that a problem solving context is used to help ensure the relevance of the operations.

Addition and subtraction questions should also be presented horizontally, as well as vertically, to encourage alternative computational strategies. Students should be able to use algorithms of choice when they calculate with pencil-and-paper methods. While it is important that the algorithms developed by students are respected, if they are inefficient, they should be guided toward more appropriate strategies. For example, when adding numbers such as 4.2 and 0.23, students should be encouraged to add the whole numbers, tenths and hundredths.

Estimation should be used to develop a sense of the size of the answer for all calculations involving decimals. For example, one might round each of the decimal numbers 2.8×8.3 , for an estimate of 24 (3×8). When estimation is an automatic response students will, when faced with a calculation, not depend on the “counting back decimal places” rule.

Multiplication and division of two numbers will produce the same digits, regardless of the position of the decimal point. As a result, for most practical purposes, there is no reason to develop new rules for decimal multiplication and division. Rather, the computations can be performed as whole numbers with the decimal placed by way of estimation (Van de Walle and Lovin, 2006, p. 107).

Grade 7 – Strand: Number (N)

GCO: Develop number sense.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|--|
| <p>N5 Demonstrate an understanding of ratio, concretely, pictorially and symbolically.</p> <p>N6 Demonstrate an understanding of percent, (limited to whole numbers) concretely, pictorially and symbolically.</p> | <p>N3 Solve problems involving percents from 1% to 100%.</p> | <p>N3 Demonstrate an understanding of percents greater than or equal to 0%.</p> <p>N4 Demonstrate an understanding of ratio and rate.</p> <p>N5 Solve problems that involve rates, ratios and proportional reasoning.</p> |

SCO: **N3 – Solve problems involving percents from 1% to 100%.** [C, CN, PS, R, T]

Students who have achieved this outcome should be able to:

- A.** Express a given percent as a decimal or a fraction.
- B.** Solve a given problem that involves finding a percent.
- C.** Determine the answer to a given percent problem where the answer requires rounding and explain why an approximate answer is needed; *e.g.*, total cost including taxes.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

- 4.1 (B C)**
- 4.2 (B C)**
- 4.3 (A B)**

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

SCO: N3 – Solve problems involving percents from 1% to 100%. [C, CN, PS, R, T]

Elaboration

Percents are simply hundredths and as such are a third way of writing both fractions and decimals. Number sense for percent should be developed through the use of benchmarks:

- 100% is all;
- 50% is half;
- 25% is a quarter;
- 10% is a tenth;
- 1% is one hundredth.

Students should be able to flexibly move between percent, fraction and decimal equivalents in problem solving situations. For example, when finding 25% of a number, it is often much easier to use $\frac{1}{4}$ and then divide by 4 as a means of finding or estimating the percent. Students should make immediate connections between other percentages and their fraction equivalents, such as 50%, 75%, $33\frac{1}{3}\%$, and multiples of 10%, such as 20%, 30% and 40%. Encourage students to recognize that percents such as 51% and 12% are close to benchmarks, which could be used for estimation purposes. Students should be able to calculate 1%, 5% (half of 10%), 10% and 50% mentally using their knowledge of benchmarks. When exact answers are required, students should be able to employ a variety of strategies in calculating the percent of a number. Students should be able to solve problems which involve finding a , b or c in the relationship $a\%$ of $b = c$, using estimation and calculation.

Discussion should also focus on the contexts in which 1% would be considered high and the contexts in which 90% would be considered low. Everything is relative to the size of the whole.

The conceptual understanding developed here should flow from meaningful problem solving contexts.

Grade 7 – Strand: Number (N)

GCO: Develop number sense.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|---|---------|
| <p>N1 Demonstrate an understanding of place value for numbers:</p> <ul style="list-style-type: none"> • greater than one million; • less than one thousandth. <p>N6 Demonstrate an understanding of percent, (limited to whole numbers) concretely, pictorially and symbolically.</p> | <p>N4 Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.</p> | |

SCO: **N4 – Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.** [C, CN, R, T]

Students who have achieved this outcome should be able to:

A. Predict the decimal representation of a given fraction using patterns, e.g., $\frac{1}{11} = 0.\overline{09}$,

$$\frac{2}{11} = 0.\overline{18}, \frac{3}{11} = ?, \dots$$

- B.** Match a given set of fractions to their decimal representations.
- C.** Sort a given set of fractions as repeating or terminating decimals.
- D.** Express a given fraction as a terminating or repeating decimal.
- E.** Express a given repeating decimal as a fraction.
- F.** Express a given terminating decimal as a fraction.
- G.** Provide an example where the decimal representation of a fraction is an approximation of its exact value.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

4.1 (C)

4.2 (A B D E F G)

10.1 (A)

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

SCO: N4 – Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions. [C, CN, R, T]

Elaboration

Decimal numbers are simply another way of writing fractions. Maximum flexibility is gained by understanding how the two systems are related (Van de Walle and Lovin, 2006, p. 107).

Decimals and proper fractions are both parts of wholes. All fractions can be expressed as terminating or repeating decimals and vice versa. A few students will already know the decimal equivalents of some simple fractions (e.g.: $\frac{1}{2} = 0.5$, $\frac{1}{4} = 0.25$, $\frac{1}{5} = 0.2$) as well as any fraction with a denominator of 10, 100, or 1000.

For example, to locate 0.75 on a number line, many students think of 0.75 as being three quarters of the way from 0 to 1. Many students, however, believe that the only fractions which can be described by decimals are those with denominators which are a power of 10 or a factor of a power of 10. By building on the connection between fractions and division, students should be able to represent any fraction in decimal form, using the calculator as an aid.

Many fractional numbers, such as thirds and ninths, will produce decimals that will not terminate, but instead, produce repeating patterns. Students should be introduced to the terminology *repeating* and *period* as well as bar notation when working with repeating decimals. This is demonstrated by drawing a bar over the digits that repeat. The patterns produced by fractions with a variety of denominators should be explored since many have particularly interesting periods.

Students should use calculators, when appropriate, to find the decimal form for some fractions and predict the decimal form for other fractions. Students should also be aware of the effect of calculator rounding (i.e., automatic rounding caused by the limit on the number of digits which the calculator can display). Students should use their knowledge of the patterns explored to determine the fractional form of repeating decimals.

Grade 7 – Strand: Number (N)

GCO: Develop number sense.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|---|
| <p>N3 Demonstrate an understanding of factors and multiples by:</p> <ul style="list-style-type: none"> • determining multiples and factors of numbers less than 100; • identifying prime and composite numbers; • solving problems involving multiples. <p>N4 Relate improper fractions to mixed numbers.</p> | <p>N5 Demonstrate an understanding of adding and subtracting positive fractions and mixed numbers, with like and unlike denominators, concretely, pictorially and symbolically (limited to positive sums and differences).</p> | <p>N6 Demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially and symbolically.</p> |

SCO: **N5 – Demonstrate an understanding of adding and subtracting positive fractions and mixed numbers, with like and unlike denominators, concretely, pictorially and symbolically (limited to positive sums and differences).** [C, CN, ME, PS, R, V]

Students who have achieved this outcome should be able to:

- A. Model addition and subtraction of a given positive fraction or a given mixed number using concrete representations, and record symbolically.
- B. Determine the sum of two given positive fractions or mixed numbers with like denominators.
- C. Determine the difference of two given positive fractions or mixed numbers with like denominators.
- D. Determine a common denominator for a given set of positive fractions or mixed numbers.
- E. Determine the sum of two given positive fractions or mixed numbers with unlike denominators.
- F. Determine the difference of two given positive fractions or mixed numbers with unlike fractions.
- G. Simplify a given positive fraction or mixed number by identifying the common factor between the numerator and denominator.
- H. Simplify the solution to a given problem involving the sum or difference of two positive fractions or mixed numbers.
- I. Solve a given problem involving the addition or subtraction of positive fractions or mixed numbers and determine if the solution is reasonable.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

6.2 (A B G H I)

6.3 (A C G H I)

7.1 (D)

7.2 (A E F G H I)

7.3 (A B D G H I)

7.4 (C D F G H I)

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

SCO: N5 – Demonstrate an understanding of adding and subtracting positive fractions and mixed numbers, with like and unlike denominators, concretely, pictorially and symbolically (limited to positive sums and differences). [C, CN, ME, PS, R, V]

Elaboration

Fractions are an extension of the whole number system used to represent values between the whole numbers. Since fractions include whole numbers, the same properties apply. Students need a solid conceptual foundation in fractions as a prerequisite for fraction computation. They must first understand the meaning of fractions, using different models – region, set and length or measurement. To help students add and subtract fractions correctly and with understanding, teachers must help them develop an understanding of the numerator and denominator, equivalence and the relation between mixed numbers and improper fractions (NCTM, 2000, p. 218).

- The meanings of each operation with fractions are the same as the meanings for the operations on whole numbers. Operations with fractions should begin by applying these same meanings to fractional parts. For addition and subtraction, it is critical to understand that the numerator tells the number of parts and the denominator the type of part.
- The estimation of fraction computations is tied almost entirely to both of the concepts of the operations used and of the fractions. A computation algorithm is not required for making estimates. Estimation should be an integral part of computation development to keep the attention of students on the meanings of the operations and the expected size of the results (Van de Walle and Lovin, 2006, p. 66).

An estimate is sometimes all that is required to satisfy a given situation. At other times, an estimate can be used to determine if an answer, found using an algorithm or a calculator, is reasonable. This skill permits students to make quick and efficient judgments about the reasonableness of answers acquired through algorithms. Developing

benchmarks such as $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 should be a focus of the estimation of sums and differences of fractions. It is

necessary to encourage flexibility in thinking and provide learning opportunities in connecting:

- operations with whole numbers to operations with fractions;
- subtraction of fractions to addition of fractions;
- operations with fractions to real world problems (Alberta Education, 2004).

Grade 7 – Strand: Number (N)

GCO: Develop number sense.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|---|--|
| N7 Demonstrate an understanding of integers, concretely, pictorially and symbolically. | N6 Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically. | N7 Demonstrate an understanding of multiplication and division of integers, concretely, pictorially and symbolically. |

SCO: N6 – Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically. [C, CN, PS, R, V]

Students who have achieved this outcome should be able to:

- A.** Explain, using concrete materials such as integer tiles and diagrams, that the sum of opposite integers is zero.
- B.** Illustrate, using a number line, the results of adding or subtracting negative and positive integers; e.g., a move in one direction followed by a move in the opposite direction results in no net change in position.
- C.** Add two given integers using concrete materials or pictorial representations and record the process symbolically.
- D.** Subtract two given integers using concrete materials or pictorial representations and record the process symbolically.
- E.** Solve a given problem involving the addition and subtraction of integers.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

- 9.1 (A C)**
- 9.2 (B C E)**
- 9.3 (D)**
- 9.4 (B D E)**
- 9.5 (A B C D E)**

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

SCO: N6 – Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically. [C, CN, PS, R, V]

Elaboration

Integers play an important role in the overall understanding of mathematics. Students develop a better understanding of operations with integers when emphasis is placed on the following items:

- **Real World Contexts**

In everyday life there are many uses of integers, so problem solving plays a major role in developing an understanding of integer operations. Students should see a connection between integers and the world around them through the use of problems using real-life contexts such as height above and below sea level, temperature or banking (deposits and withdrawals).

- **Relating Operations with Whole Numbers to Operations with Integers**

The set of integers is an extension of the whole number system to include the opposite of every whole number. Operations with integers build on operations with whole numbers. Since integers include the whole numbers and their opposites it can be said that integers are numbers that deal with opposites (direction) as well as quantity (magnitude).

- **Creating Concrete, Pictorial and Symbolic Representations**

The two models most commonly used for solving addition and subtraction with integers are two coloured counters and number lines. Both models depict the concepts of quantity and opposite and students should be given experiences with each. Quantity is signified by the number of counters or length of the arrows. Opposite is represented as different colours or different directions.

- **The Zero Principle**

Emphasis must be placed on the zero principle and its application in addition and subtraction situations.

- **Connecting Subtraction of Integers to Addition of Integers**

Students should develop an understanding why any subtraction number sentence can be written as an equivalent addition number sentence.

Grade 7 – Strand: Number (N)

GCO: Develop number sense.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|--|---------|
| <p>N1 Demonstrate an understanding of place value for numbers:</p> <ul style="list-style-type: none"> • greater than one million; • less than one thousandth. <p>N4 Relate improper fractions to mixed numbers.</p> | <p>N7 Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:</p> <ul style="list-style-type: none"> • benchmarks; • place value; • equivalent fractions and/or decimals. | |

SCO: **N7 – Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:**

- **benchmarks;**
- **place value;**
- **equivalent fractions and/or decimals.**

[CN, R, V]

Students who have achieved this outcome should be able to:

- A.** Order the numbers of a given set that includes positive fractions, positive decimals and/or whole numbers in ascending or descending order, and verify the result using a number of strategies.
- B.** Identify a number that would be between two given numbers in an ordered sequence or on a number line.
- C.** Identify incorrectly placed numbers in an ordered sequence or on a number line.
- D.** Position fractions with like and unlike denominators from a given set on a number line and explain strategies used to determine order.
- E.** Order the numbers of a given set by placing them on a number line that contains benchmarks, such as 0 and 1 or 0 and 5.
- F.** Position a given set of positive fractions, including mixed numbers and improper fractions, on a number line and explain strategies used to determine position.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

4.1 (A B C D E F)

4.2 (A)

6.2 (A B C)

6.3 (A B C)

7.1 (A B C D)

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

SCO: N7 – Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:

- **benchmarks;**
- **place value;**
- **equivalent fractions and/or decimals.**

[CN, R, V]

Elaboration

Students should continue to use conceptual methods to compare fractions and decimals, such as context problems and models. Students tend to think of fractions as sets or regions whereas they think of decimals as being more like whole numbers. A significant goal of instruction in decimal and fraction numeration should be to help students see that both systems represent the same concepts. For this reason, it is important to use a variety of models and benchmarks. However, while money can be an effective model for decimals, it should not be used exclusively as it only extends to hundredths.

Students need experiences in comparing fractions with the same denominator, with unlike denominators and with the same numerator. Students should develop a variety of strategies to compare fractions in addition to creating equivalent denominators. They should also be able to identify fractions between any two given fractions.

A rich understanding of place value allows students to compare and order decimals using strategies similar to those used with whole numbers. Students should be discouraged from using the strategy of “adding zeros to a number” to create decimals of equal length without having first developed the conceptual understanding of place value as it relates to decimals.

Once students develop a sense of the benchmark fractions $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{3}{4}$, and know the decimal equivalents, they should be able to use them interchangeably as a powerful strategy for comparing and ordering fractions and decimals.

Decimal numbers are simply another way of writing fractions. Both notations have value. Maximum flexibility is gained by understanding how the two symbols are related (Van de Walle and Lovin, 2006, p. 107).

PATTERNS AND RELATIONS

SPECIFIC CURRICULUM OUTCOMES

PR1 – Demonstrate an understanding of oral and written patterns and their equivalent linear relations.

PR2 – Create a table of values from a linear relation, graph the table of values, and analyse the graph to draw conclusions and solve problems.

PR3 – Demonstrate an understanding of the preservation of equality by:

- modelling preservation of equality, concretely, pictorially and symbolically;
- applying preservation of equality to solve equations.

PR4 – Explain the difference between an expression and an equation.

PR5 – Evaluate an expression given the value of the variable(s).

PR6 – Model and solve problems that can be represented by one-step linear equations of the form $x + a = b$, concretely, pictorially and symbolically, where a and b are integers.

PR7 – Model and solve problems that can be represented by linear equations of the form:

- $ax + b = c$;
- $ax = b$;
- $\frac{x}{a} = b, a \neq 0$

concretely, pictorially and symbolically, where a, b and c are whole numbers.

Grade 7 – Strand: Patterns and Relations (PR)

GCO: Use patterns to describe the world and solve problems.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|---|
| PR1 Represent and describe patterns and relationships, using graphs and tables. | PR1 Demonstrate an understanding of oral and written patterns and their equivalent linear relations. | PR1 Graph and analyse two-variable linear relations. |

SCO: PR1 – Demonstrate an understanding of oral and written patterns and their equivalent linear relations. [C, CN, R]

Students who have achieved this outcome should be able to:

- A.** Formulate a linear relation to represent the relationship in a given oral or written pattern.
- B.** Provide a context for the given linear relation that represents a pattern.
- C.** Represent a pattern in the environment using a linear relation.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

- 10.1 (A B)**
- 10.2 (C)**
- 10.4 (B)**

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

SCO: PR1 – Demonstrate an understanding of oral and written patterns and their equivalent linear relations. [C, CN, R]

Elaboration

Mathematics is often referred to as the science of patterns, as they permeate every mathematical concept and are found in everyday contexts. They are usually described as a situation or observed as a pattern, and students have to translate the situation or pattern into an expression or equation.

The various representations of patterns including physical models, tables of values, algebraic expressions, sequences and graphs provide valuable tools in making generalizations of mathematical relationships. Some characteristics of patterns include the following:

- Patterns include repetitive patterns and growth patterns. Growth patterns are evident in a wide variety of contexts, including arithmetic and geometric situations. Arithmetic patterns are formed by adding (or subtracting) the same number each time to the previous term. Geometric patterns are formed by multiplying (or dividing) by the same number each time to the previous term. Patterns using concrete or pictorial representations can be written as number patterns, where numbers represent the quantity in each step of the pattern. An expression that explains what you do to the term number to get the value of the pattern for that term is called a functional relationship and is known as a pattern rule (Van de Walle and Lovin, 2006, p.267-268).
- Patterns are used to generalize relationships. How a pattern changes from one term to the next is called a recursive relationship. It explains what you do to the previous term in the pattern to get the next one. This type of pattern is the first that students will observe.

Grade 7 – Strand: Patterns and Relations (PR)

GCO: Use patterns to describe the world and solve problems.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|--|---|
| PR2 Demonstrate an understanding of the relationships within tables of values to solve problems. | PR2 Create a table of values from a linear relation, graph the table of values, and analyse the graph to draw conclusions and solve problems. | PR1 Graph and analyse two-variable linear relations. |

SCO: **PR2 – Create a table of values from a linear relation, graph the table of values, and analyse the graph to draw conclusions and solve problems.** [C, CN, R, V]

Students who have achieved this outcome should be able to:

- A.** Create a table of values for a given linear relation by substituting values for the variable.
- B.** Create a table of values using a linear relation and graph the table of values (limited to discrete elements).
- C.** Sketch the graph from a table of values created for a given linear relation and describe the patterns found in the graph to draw conclusions, *e.g.*, graph the relationship between n and $2n + 3$.
- D.** Describe the relationship shown on a graph using everyday language in spoken or written form to solve problems.
- E.** Match a given set of linear relations to a given set of graphs.
- F.** Match a given set of graphs to a given set of linear relations.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

10.3 (A)

10.4 (A B C D E F)

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

SCO: PR2 – Create a table of values from a linear relation, graph the table of values, and analyse the graph to draw conclusions and solve problems. [C, CN, R, V]

Elaboration

A linear pattern can be described using a table of values. For example, the number pattern 1, 3, 5, 7, 9, ... has the relationship where the next term is found by adding two to the previous term. The functional relationship for this pattern is $2n - 1$.

| | | | | | |
|---------------------|---|---|---|---|---|
| Term number (n) | 1 | 2 | 3 | 4 | 5 |
| Term ($2n - 1$) | 1 | 3 | 5 | 7 | 9 |

Variables such as n are used to represent an unknown quantity. Students should use tables to organize the information that a pattern provides. When using tables, it is important for students to realize that they are looking for the relationship between two variables (term number and term). These relations should be graphed using the data from a table of values. Students should be given opportunities where appropriate, to interpolate (finding a point between two known points), as well as to extrapolate (finding a point that lies beyond the known data). As an extension, students could explore if an ordered pair satisfies a given equation by plotting the points to see if it follows the pattern, and substituting it into the equation.

Grade 7 – Strand: Patterns and Relations (PR)

GCO: Represent algebraic expressions in multiple ways.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|--|--|
| <p>PR5 Demonstrate and explain the meaning of preservation of equality, concretely and pictorially.</p> | <p>PR3 Demonstrate an understanding of preservation of equality by:</p> <ul style="list-style-type: none"> • modeling preservation of equality, concretely, pictorially and symbolically; • applying preservation of equality to solve equations. | <p>PR2 Model and solve problems using linear equations of the form:</p> <ul style="list-style-type: none"> • $ax = b$; • $\frac{x}{a} = b, a \neq 0$; • $ax + b = c$; • $\frac{x}{a} + b = c, a \neq 0$; • $a(x + b) = c$ <p>concretely, pictorially and symbolically, where a, b and c are integers.</p> |

SCO: **PR3 – Demonstrate an understanding of the preservation of equality by:**

- **modelling preservation of equality, concretely, pictorially and symbolically;**
- **applying preservation of equality to solve equations.**

[C, CN, PS, R, V]

Students who have achieved this outcome should be able to:

- Model the preservation of equality for each of the four operations using concrete materials or using pictorial representations, explain the process orally and record it symbolically.
- Solve a given problem by applying preservation of equality.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

11.2 (A B)

11.3 (A B)

11.4 (A B)

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

- SCO: PR3 – Demonstrate an understanding of the preservation of equality by:**
- **modelling preservation of equality, concretely, pictorially and symbolically;**
 - **applying preservation of equality to solve equations.**
- [C, CN, PS, R, V]

Elaboration

Most students have come to think of the equal sign as a symbol that tells them to find the answer, but they should come to view the equals sign as a symbol of equivalence and balance. While most students have little difficulty with understanding $7 + 2 = \square$, some may struggle with understanding $3 + 5 = 1 + \square$.

To understand equality, one of the first things students must realize is that equality is a relationship, not an operation. Both equality and inequality express relationships between quantities. When the quantities balance, there is equality. The equal sign is a symbol that indicates the quantity on the left side of the sign is the same as the quantity on the right. When there is an imbalance, there is inequality. The expressions on either side of the equality or inequality represent a quantity; *e.g.*, $2 + 3$ and $2n + 4$ are both expressions for some quantity. A number sentence is called an equation. A number sentence with a variable is an algebraic equation.

Equality or inequality between quantities can be considered as:

- whole to whole relationships (five red chips = five blue chips or $5 = 5$);
- part-part to whole relationships ($3 + 5 = 8$);
- whole to part-part relationships ($8 = 3 + 5$);
- part-part to part-part relationships ($4 + 4 = 3 + 5$).

Solving equations requires that the balance of the equation is maintained so that the expressions on either side of the equal sign continue to represent the same quantity. For example, if a quantity is added to one side of the equation then, to maintain equality, the same quantity must be added to the other side of the equation. The equality must be maintained similarly for the other operations.

The most useful models for demonstrating preservation of equality are the balance-scale model and algebra tiles. Students must move from the concrete, to the pictorial, to the symbolic with strong connections made among these representations.

Grade 7 – Strand: Patterns and Relations (PR)

GCO: Represent algebraic expressions in multiple ways.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|--|---------|
| PR3 Represent generalizations arising from number relationships using equations with letter variables. | PR4 Explain the difference between an expression and an equation. | |

SCO: **PR4 – Explain the difference between an expression and an equation.** [C, CN]

Students who have achieved this outcome should be able to:

- A.** Identify and provide an example of a constant term, a numerical coefficient and a variable in an expression and an equation.
- B.** Explain what a variable is and how it is used in a given expression.
- C.** Provide an example of an expression and an equation, and explain how they are similar and different.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

10.2 (A B)

11.1 (A B C)

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

SCO: PR4 – Explain the difference between an expression and an equation. [C, CN]

Elaboration

Previous experience with representing patterns should assist students in understanding the difference between expressions and equations. An expression represents a word statement. An equation is a statement where two quantities are equal. The major difference between an equation and an expression is that an equation is a complete sentence and an expression is only a phrase. For example, $p = 3$ reads “ p is equal to 3,” whereas $p + 3$ reads “ p plus three.” The expression $p + 3$ contains no equal sign and is therefore cannot be an equation. An equation can also be called a number sentence. A number sentence with a variable is an algebraic equation ($3 + y = 7$).

In an expression, such as $2n + 12$, the variable can represent any number. In some equations, such as $2n = 12$, the variable has only one value. It is also important for students to understand that an equation like $x + 6 = 10$ is the same as $10 = x + 6$. Both sides of each equation have the same value.

Equations containing more than one variable such as $b = 2n - 1$ can have a variety of values which make them true. For each value of n , a corresponding value of b can be found. The expression $2n - 1$ behaves in a similar way as the previous equation, whereas $2a - 1 = 7$ is only true for a single value of a .

The equal sign is a symbol that indicates the quantity on the left side of the sign is the same as the quantity on the right.

Grade 7 – Strand: Patterns and Relations (PR)

GCO: Represent algebraic expressions in multiple ways.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|---------|
| PR4 Demonstrate and explain the meaning of preservation of equality concretely, pictorially and symbolically. | PR5 Evaluate an expression given the value of the variable(s). | |

SCO: **PR5 – Evaluate an expression given the value of the variable(s).** [CN, R]

Students who have achieved this outcome should be able to:

- A.** Substitute a value for an unknown in a given expression and evaluate the expression.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

10.3 (A)

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

SCO: PR5 – Evaluate an expression given the value of the variable(s). [CN, R]

Elaboration

We can use symbols to represent a pattern. A variable is a symbol that represents an unknown quantity. Students are familiar with variables in formulas, such as $\text{area} = \text{base} \times \text{height}$ ($A = bh$). Students might relate variables to things which change over time that are part of their own experiences, such as their height. Some letters used as variables may be confusing to students as they have more than one meaning. For example, x may be mixed up with the multiplication symbol or m may be confused with metres. It is important, when reading aloud to students, to read expressions such as $3c$ as “a number multiplied by 3,” or “3 times c .” When evaluating algebraic expressions, ensure that students understand the meaning of such notations. It is also easy for students to confuse the placement of variables when writing expressions or equations; for example, if there are 6 notebooks for each student, they might write $s = 6n$, instead of $n = 6s$.

Grade 7 – Strand: Patterns and Relations (PR)

GCO: Represent algebraic expressions in multiple ways.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|--|
| <p>PR3 Represent generalizations arising from number relationships using equations with letter variables.</p> <p>PR4 Demonstrate and explain the meaning of preservation of equality concretely, pictorially and symbolically.</p> | <p>PR6 Model and solve problems that can be represented by one-step linear equations of the form $x + a = b$, concretely, pictorially and symbolically, where a and b are integers.</p> | <p>PR2 Model and solve problems using linear equations of the form:</p> <ul style="list-style-type: none"> • $ax = b$; • $\frac{x}{a} = b, a \neq 0$; • $ax + b = c$; • $\frac{x}{a} + b = c, a \neq 0$; • $a(x + b) = c$ <p>concretely, pictorially and symbolically, where a, b and c are integers.</p> |

SCO: **PR6 – Model and solve problems that can be represented by one-step linear equations of the form $x + a = b$, concretely, pictorially and symbolically, where a and b are integers.** [CN, PS, R, V]

Students who have achieved this outcome should be able to:

- A.** Represent a given problem with a linear equation and solve the equation using concrete models, e.g., counters, integer tiles.
- B.** Draw a visual representation of the steps required to solve a given linear equation.
- C.** Solve a given problem using a linear equation.
- D.** Verify the solution to a given linear equation using concrete materials and diagrams.
- E.** Substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

11.2 (A B C D E)

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

SCO: PR6 – Model and solve problems that can be represented by one-step linear equations of the form $x + a = b$, concretely, pictorially and symbolically, where a and b are integers. [CN, PS, R, V]

Elaboration

When solving one-step equations in the form of $x + a = b$ in grade seven, a and b may be integers. However, when solving linear equations that require multiplication or division, only whole numbers should be used as these operations with integers will be addressed in grade eight.

There are many methods for solving a one-step linear equation such as inspection, systematic trial (guess and test), rewriting the equation, creating models using algebra tiles and using illustrations of balances to show equality. Students should be encouraged to choose the most appropriate method for solving a given problem. Emphasis at this level should be on solving problems concretely, pictorially and symbolically.

- **Concretely** – Students should be comfortable representing integers with the use of algebra tiles and should continue to do so when modeling an addition or subtraction equation. The zero principle is an important aspect of finding equality between the two sides.
- **Pictorially** – Students need to be encouraged to use concrete models when solving problems and then draw pictures of their models in order to move from the concrete stage to the pictorial.
- **Symbolically** – Students should be made familiar with notions such as adding or subtracting the same value from both sides of an equation and understanding why equality is maintained.

It is valuable to have students be aware of situations in which they will develop and apply problem solving skills. Students should consider in advance what might be a reasonable solution, and be aware that once they acquire a solution, it can be checked for accuracy by substitution into the original equation.

Grade 7 – Strand: Patterns and Relations (PR)

GCO: Represent algebraic expressions in multiple ways.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---------|---|--|
| | <p>PR7 Model and solve problems that can be represented by linear equations of the form:</p> <ul style="list-style-type: none"> • $ax + b = c$; • $ax = b$; • $\frac{x}{a} = b, a \neq 0$ <p>concretely, pictorially and symbolically, where a, b and c are whole numbers.</p> | <p>PR2 Model and solve problems using linear equations of the form:</p> <ul style="list-style-type: none"> • $ax = b$; • $\frac{x}{a} = b, a \neq 0$; • $ax + b = c$; • $\frac{x}{a} + b = c, a \neq 0$; • $a(x + b) = c$ <p>concretely, pictorially and symbolically, where a, b and c are integers.</p> |

SCO: **PR7 – Model and solve problems that can be represented by linear equations of the form:**

- $ax + b = c$;
- $ax = b$;
- $\frac{x}{a} = b, a \neq 0$

concretely, pictorially and symbolically, where a, b and c are whole numbers. [CN, PS, R, V]

Students who have achieved this outcome should be able to:

- A. Model a given problem with a linear equation and solve the equation using concrete models; e.g., counters, integer tiles.
- B. Draw a visual representation of the steps used to solve a given linear equation.
- C. Solve a given problem using a linear equation and record the process.
- D. Verify the solution to a given linear equation using concrete materials and diagrams.
- E. Substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

11.3 (A B C D E)

11.4 (A B C D E)

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

SCO: PR7 – Model and solve problems that can be represented by linear equations of the form:

- $ax + b = c$;
- $ax = b$;
- $\frac{x}{a} = b, a \neq 0$

concretely, pictorially and symbolically, where a, b and c are whole numbers. [CN, PS, R, V]

Elaboration

In order for students to solve linear equations that are in the forms $ax + b = c$, $ax = b$ and $\frac{x}{a} = b$, where $a \neq 0$, they should understand how to work with the idea of “balancing” or “moving from one side to another” by using opposite operations. This, in fact, allows for the preservation of balance and equality in the equation (left side = right side). In the form $ax + b = c$, students need to perform a two-step elimination process to solve for the variable whereas in the other forms listed above, a single-step process is used. The focus in this outcome is with the use of whole numbers only for a, b and c .

Problem solving is an important ability that students should understand and develop. Formulas and equations are seen on a regular basis in our daily lives and it is important for students to understand situations in which they will use, develop and apply such knowledge.

The use of diagrams and concrete materials to demonstrate the idea of solving for x is a natural progression to lead the students to an understanding of the steps needed to isolate the variable. It is after this progression that students will be able to solve for x in a linear equation and record the process.

Students should consider in advance what might be a reasonable solution and be aware that once they acquire a solution, it can be checked for accuracy by substitution into the original equation.

SHAPE AND SPACE

SPECIFIC CURRICULUM OUTCOMES

SS1 – Demonstrate an understanding of circles by:

- describing the relationships among radius, diameter and circumference of circles;
- relating circumference to π ;
- determining the sum of the central angles;
- constructing circles with a given radius or diameter;
- solving problems involving the radii, diameters and circumferences of circles.

SS2 – Develop and apply a formula for determining the area of:

- triangles;
- parallelograms;
- circles.

SS3 – Perform geometric constructions, including:

- perpendicular line segments;
- parallel line segments;
- perpendicular bisectors;
- angle bisectors.

SS4 – Identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs.

SS5 – Perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices).

Grade 7 – Strand: Shape and Space (SS)

GCO: Use direct or indirect measurement to solve problems.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|---|--|
| <p>SS1 Demonstrate an understanding of angles by: identifying examples of angles in the environment; classifying angles according to their measure; estimating the measure of angles, using 45°, 90° and 180° as reference angles; determining angle measures in degrees; drawing and labelling angles when the measure is specified.</p> <p>SS2 Demonstrate that the sum of interior angles is: 180° in a triangle; 360° in a quadrilateral.</p> <p>SS3 Develop and apply a formula for determining the: perimeter of polygons; area of rectangles; volume of right rectangular prisms.</p> | <p>SS1 Demonstrate an understanding of circles by:</p> <ul style="list-style-type: none"> • describing the relationships among radius, diameter and circumference of circles; • relating circumference to π; • determining the sum of the central angles; • constructing circles with a given radius or diameter; • solving problems involving the radii, diameters and circumferences of circles. | <p>SS3 Determine the surface area of:</p> <ul style="list-style-type: none"> • right rectangular prisms; • right triangular prisms; • right cylinders <p>to solve problems.</p> <p>SS4 Develop and apply formulas for determining the volume of right prisms and right cylinders.</p> |

SCO: **SS1 – Demonstrate an understanding of circles by:**

- **describing the relationships among radius, diameter and circumference of circles;**
- **relating circumference to π ;**
- **determining the sum of the central angles;**
- **constructing circles with a given radius or diameter;**
- **solving problems involving the radii, diameters and circumferences of circles.**

[C, CN, R, V]

Students who have achieved this outcome should be able to:

- A. Illustrate and explain that the diameter is twice the radius in a given circle.
- B. Illustrate and explain that the circumference is approximately three times the diameter in a given circle.
- C. Explain that, for all circles, π is the ratio of the circumference to the diameter, $\left(\frac{C}{d}\right)$, and its value is approximately 3.14.
- D. Explain, using an illustration, that the sum of the central angles of a circle is 360° .
- E. Draw a circle with a given radius or diameter with and without a compass.
- F. Solve a given contextual problem involving circles.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

- 8.1 (A E)**
- 8.2 (B C)**
- 8.5 (D F)**

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

SCO: SS1 – Demonstrate an understanding of circles by:

- describing the relationships among radius, diameter and circumference of circles;
- relating circumference to π ;
- determining the sum of the central angles;
- constructing circles with a given radius or diameter;
- solving problems involving the radii, diameters and circumferences of circles.

[C, CN, R, V]

Elaboration

A circle is a plane (2-D) figure that has all its points the same distance from a fixed point called the centre of the circle (Cathcart, 1997, p. 185). The radius is the distance from the centre of the circle to the edge of that circle while the diameter is a line segment passing through the centre of the circle with both endpoints on the circle. The circumference of a circle is the distance around or the perimeter of a circle. Students should understand that the ratio of circumference to diameter, $\frac{C}{d}$, is constant for all circles, and that the Greek letter π (pi) is used to represent the value of this ratio. The symbol π is a decimal number that cannot be expressed exactly as a fraction. Students in grade eight will learn that numbers such as these are called irrational. To thirty decimal places, the approximate value for π is 3.14159 26535 89793 23846 26433 83280. The value of π is often approximated as 3.14 although most scientific calculators have a π button. However, for estimates, students may use 3 as an approximate value for π .

When measuring the circumferences, radii and diameters of circles, length is being measured and appropriate units to measure length include millimetres, centimetres or metres. When finding the sum of the central angles of a circle, angle measure is being used and the appropriate unit to measure angles is the degree.

Grade 7 – Strand: Shape and Space (SS)

GCO: Use direct or indirect measurement to solve problems.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|--|---|
| <p>SS3 Develop and apply a formula for determining the: perimeter of polygons; area of rectangles; volume of right rectangular prisms.</p> | <p>SS2 Develop and apply a formula for determining the area of:</p> <ul style="list-style-type: none"> • triangles; • parallelograms; • circles. | <p>SS1 Develop and apply the Pythagorean theorem to solve problems.</p> <p>SS3 Determine the surface area of:</p> <ul style="list-style-type: none"> • right rectangular prisms; • right triangular prisms; • right cylinders <p>to solve problems.</p> <p>SS4 Develop and apply formulas for determining the volume of right prisms and right cylinders.</p> |

SCO: **SS2 – Develop and apply a formula for determining the area of:**

- triangles;
- parallelograms;
- circles.

[CN, PS, R, V]

Students who have achieved this outcome should be able to:

- A. Illustrate and explain how the area of a rectangle can be used to determine the area of a triangle.
- B. Generalize a rule to create a formula for determining the area of triangles.
- C. Illustrate and explain how the area of a rectangle can be used to determine the area of a parallelogram.
- D. Generalize a rule to create a formula for determining the area of parallelograms.
- E. Illustrate and explain how to estimate the area of a circle without the use of a formula.
- F. Apply a formula for determining the area of a given circle.
- G. Solve a given problem involving the area of triangles, parallelograms and/or circles.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

3.4 (C D G)

3.5 (A B G)

8.3 (E F G)

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

SCO: SS2 – Develop and apply a formula for determining the area of:

- **triangles;**
- **parallelograms;**
- **circles.**

[CN, PS, R, V]

Elaboration

Area can be defined as a measure of the space inside a region or how many square units it takes to cover a region. In using any type of measurement, such as area, it is important to discuss the similarities in developing understanding of the different measures – first identify the attribute to be measured, then choose an appropriate unit and finally compare that unit to the object being measured (NCTM, 2000, p. 171). One of the key ideas in understanding area is the property of conservation – an object retains its size when the orientation is changed or when it is rearranged by subdividing it in any way.

Formulas for finding the area of 2-D shapes provide a method of measuring area by using only measures of length (Van de Walle and Lovin, 2006, p. 230). The areas of rectangles, parallelograms, triangles and circles are related, with the area of rectangles forming the foundation for the areas of the other 2-D shapes.

- **Parallelograms** – Students should recognize that the area of a parallelogram is the same as the area of a related rectangle (one with the same base and height) ($A = bh$). Students should be able to determine the base or height, given the area and the other dimension and recognize that a variety of parallelograms can have the same area.
- **Triangles** – Students should see that the area of a triangle is just one-half of the area of its related parallelogram ($A = \frac{bh}{2}$). They should also be able to connect this idea to the relationship between the formulas of a parallelogram and triangle. Students can use this relationship to find areas of simple triangles. Students should understand that, as long as the base and height are the same, the areas of visually-different triangles are the same.
- **Circles** – Students should develop the formula for the area of a circle through investigations that connect a circle to a parallelogram by cutting it into equal sectors. The exploratory work done by students in estimating the areas of circles, using the square of the radius as a referent, also provides a foundation for developing the formula for the area of a circle ($A = \pi r^2$).

Grade 7 – Strand: Shape and Space (SS)

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

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|---|
| <p>SS4 Construct and compare triangles, including: scalene; isosceles; equilateral; right; obtuse; acute in different orientations.</p> | <p>SS3 Perform geometric constructions, including:</p> <ul style="list-style-type: none"> • perpendicular line segments; • parallel line segments; • perpendicular bisectors; • angle bisectors. | <p>SS5 Draw and interpret top, front and side views of 3-D objects composed of right rectangular prisms.</p> |

SCO: **SS3 – Perform geometric constructions, including:**

- **perpendicular line segments;**
- **parallel line segments;**
- **perpendicular bisectors;**
- **angle bisectors.**

[CN, R, V]

Students who have achieved this outcome should be able to:

- A. Describe examples of parallel line segments, perpendicular line segments, perpendicular bisectors and angle bisectors in the environment.
- B. Identify line segments on a given diagram that are parallel or perpendicular.
- C. Draw a line segment perpendicular to another line segment and explain why they are perpendicular.
- D. Draw a line segment parallel to another line segment and explain why they are parallel.
- E. Draw the bisector of a given angle using more than one method and verify that the resulting angles are equal.
- F. Draw the perpendicular bisector of a line segment using more than one method and verify the construction.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

3.1 (A B C D)

3.2 (F)

3.3 (E)

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

SCO: SS3 – Perform geometric constructions, including:

- **perpendicular line segments;**
- **parallel line segments;**
- **perpendicular bisectors;**
- **angle bisectors.**

[CN, R, V]

Elaboration

“What makes shapes alike and different can be determined by an array of geometric properties. For example, shapes have sides that are parallel, perpendicular, or neither” (Van de Walle and Lovin 2006, p. 179).

Students should be able to identify lines (or line segments) that are parallel or that are perpendicular (meet at right angles) in familiar shapes and in the real world. This might include identifying the parallel sides of squares, rectangles, hexagons, trapezoids, and parallelograms, as well as pairs of adjacent sides that are perpendicular. This can be tied in nicely to the properties of the different polygons.

Students should come to understand the meaning of bisection through reference to familiar words with the same prefix like *bicycle*, *biplane* and *bivalve*. Another focus for students is the construction of both bisectors and perpendicular bisectors of line segments as well as bisectors of angles using a variety of methods. These methods should include paper folding, Miras, and compass and straightedge. Students should be able to describe how each construction was completed and include the notion of how reflection plays a role in constructions using paper folding and Miras.

Students should be able to explain similarities and differences between line bisectors and perpendicular line bisectors. Reference should also be made to the difference between intersect and bisect.

Grade 7 – Strand: Shape and Space (SS)

GCO: Describe and analyse position and motion of objects and shapes.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|--|---|
| SS8 Identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs. | SS4 Identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs. | PR1 Graph and analyse two-variable linear relations. |

SCO: **SS4 – Identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs.**
[C, CN, V]

Students who have achieved this outcome should be able to:

- A.** Label the axes of a four quadrant Cartesian plane and identify the origin.
- B.** Identify the location of a given point in any quadrant of a Cartesian plane using an integral ordered pair.
- C.** Plot the point corresponding to a given integral ordered pair on a Cartesian plane with units of 1, 2, 5 or 10 on its axes.
- D.** Draw shapes and designs, using given integral ordered pairs, in a Cartesian plane.
- E.** Create shapes and designs, and identify the points used to produce the shapes and designs in any quadrant of a Cartesian plane.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

1.1 (A B C)

1.2 (D E)

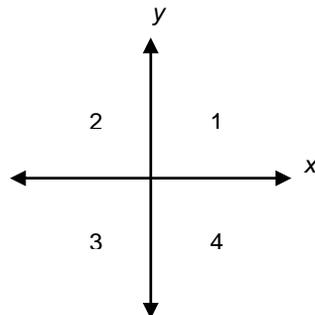
| | | | |
|--------------------------|---|-----------------------------|--------------------------|
| [C] Communication | [ME] Mental Mathematics and Estimation | [PS] Problem Solving | [T] Technology |
| [CN] Connections | | [R] Reasoning | [V] Visualization |

SCO: SS4 – Identify and plot points in the four quadrants of a Cartesian plane using integral ordered pairs.
[C, CN, V]

Elaboration

Students should plot data points in all four quadrants. Ordered pairs of integers can represent position on a four quadrant Cartesian plane. The scale of the axis will need to be determined based on the magnitude of the coordinates. Students should be exposed to a variety of scales including 1, 2, 5 and 10.

The quadrants are labelled counterclockwise, as follows:



Students should recognize that:

- a negative number for the second coordinate indicates that the point is below the horizontal axis;
- the point at which the axes intersect has coordinates (0,0) and is known as the origin;
- the position of a point on a grid can be described by its coordinates where the first number is the horizontal coordinate and the second number is the vertical coordinate of the point.

Situations which might be modeled using 4-quadrant graphs include:

- high vs. low temperatures for different days;
- mathematical relationships (e.g., a number vs. its double);
- locations, such as blocks north, south, east and west from the town centre.

Grade 7 – Strand: Shape and Space (SS)

GCO: Describe and analyse position and motion of objects and shapes.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---|--|---|
| <p>SS6 Perform a combination of translation(s), rotation(s) and/or reflection(s) on a single 2-D shape, with and without technology, and draw and describe the image.</p> <p>SS7 Perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations.</p> <p>SS9 Perform and describe single transformations of a 2-D shape in the first quadrant of a Cartesian plane (limited to whole number vertices).</p> | <p>SS5 Perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices).</p> | <p>SS6 Demonstrate an understanding of tessellation by:</p> <ul style="list-style-type: none"> • explaining the properties of shapes that make tessellating possible; • creating tessellations; • identifying tessellations in the environment. |

SCO: **SS5 – Perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices).** [CN, PS, T, V]

Students who have achieved this outcome should be able to:

- A.** Identify the coordinates of the vertices of a given 2-D shape on a Cartesian plane.
- B.** Describe the horizontal and vertical movement required to move from a given point to another point on a Cartesian plane.
- C.** Describe the positional change of the vertices of a given 2-D shape to the corresponding vertices of its image as a result of a transformation or successive transformations on a Cartesian plane.
- D.** Determine the distance between points along horizontal and vertical lines in a Cartesian plane.
- E.** Perform a transformation or consecutive transformations on a given 2-D shape and identify coordinates of the vertices of the image.
- F.** Describe the positional change of the vertices of a 2-D shape to the corresponding vertices of its image as a result of a transformation or a combination of successive transformations.
- G.** Describe the image resulting from the transformations of a given 2-D shape on a Cartesian plane by identifying the coordinates of the vertices of the image.

Note: It is intended that the original shape and its image have vertices with integral coefficients.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

1.3 (A B C D E)

1.4 (B D F G)

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

SCO: SS5 – Perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices). [CN, PS, T, V]

Elaboration

Students have been exposed to transformational geometry in previous grades. An emphasis at this level should be the use of the formal language of transformations, such as *translation*, *reflection* and *rotation*, instead of *slides*, *flips* and *turns*. Students will be working with transformations and combinations of transformations in all four quadrants of the Cartesian plane.

With respect to describing transformations, students should be able to recognize a given transformation as one of the following: a reflection, a translation, a rotation or some combination of these. In addition, when given an image and its translation image, students should be able to describe:

- a translation, using words and notation describing the translation [e.g., $\Delta A'B'C'$ is the translation image of ΔABC , or $D'(5,8)$ is the translation image of $D(-5,8)$];
- a reflection, by determining the location of the line of reflection;
- a rotation, using degree or fraction-of-turn measures, both clockwise and counterclockwise, and identify the location of the centre of a rotation. A centre of rotation may be located on the shape (such as a vertex of the original image) or off the shape.

When investigating properties of transformations, students should consider the concepts of congruence, which were developed informally in previous grades. In discussing the properties of transformations, students should consider if the transformation of the image:

- has side lengths and angle measures the same as the given image;
- is similar to or congruent to the given image;
- has the same orientation as the given image; or
- appears to have remained stationary with respect to the given image.

STATISTICS AND PROBABILITY

SPECIFIC CURRICULUM OUTCOMES

SP1 – Demonstrate an understanding of central tendency and range by:

- determining the measures of central tendency (mean, median, mode) and range;
- determining the most appropriate measures of central tendency to report findings.

SP2 – Determine the effect on the mean, median and mode when an outlier is included in a data set.

SP3 – Construct, label and interpret circle graphs to solve problems.

SP4 – Express probabilities as ratios, fractions and percents.

SP5 – Identify the sample space (where the combined sample space has 36 or fewer elements) for a probability experiment involving two independent events.

SP6 – Conduct a probability experiment to compare the theoretical probability (determined using a tree diagram, table or another graphic organizer) and experimental probability of two independent events.

Grade 7 – Strand: Statistics and Probability (SP)

GCO: Collect, display and analyse data to solve problems.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---------|--|---|
| | <p>SP1 Demonstrate an understanding of central tendency and range by:</p> <ul style="list-style-type: none"> • determining the measures of central tendency (mean, median, mode) and range; • determining the most appropriate measures of central tendency to report findings. | <p>SP1 Critique ways in which data is presented.</p> |

SCO: **SP1 – Demonstrate an understanding of central tendency and range by:**

- **determining the measures of central tendency (mean, median, mode) and range;**
 - **determining the most appropriate measures of central tendency to report findings.**
- [C, PS, R, T]

Students who have achieved this outcome should be able to:

- A.** Determine mean, median and mode for a given set of data, and explain why these values may be the same or different.
- B.** Determine the range of given sets of data.
- C.** Provide a context in which the mean, median or mode is the most appropriate measure of central tendency to use when reporting findings.
- D.** Solve a given problem involving the measures of central tendency.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

- 12.1 (A)**
- 12.2 (A C D)**
- 12.3 (B)**
- 12.5 (C D)**

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

- SCO: SP1 – Demonstrate an understanding of central tendency and range by:**
- **determining the measures of central tendency (mean, median, mode) and range;**
 - **determining the most appropriate measures of central tendency to report findings.**
- [C, PS, R, T]
-

Elaboration

The phrase central tendency, or average, describes a single number that refers to a middle value or perhaps a typical value for a set of data and is measured using the mean, median or mode. Which one is best depends on the situation and the data set. The range is the difference between the lowest and highest data values in the set.

The mean is simply the sum of the data values divided by the total number of items in the set. You can develop a better conceptual understanding of the mean by, for example, building models of the data values with linking cubes and having the students adjust them so they are all the same size.

The median of a set of values is the middle value when the values are arranged in order from smallest to largest. For an odd number of values the median is easily observable. When there is an even number of values, it is necessary to find the mean of the middle two values.

The mode is the most frequently occurring value in the data set and is often useful when looking at data involving categories (e.g., favourite TV show).

Grade 7 – Strand: Statistics and Probability (SP)

GCO: Collect, display and analyse data to solve problems.

| GRADE 6 | GRADE 7 | GRADE 8 |
|---------|---|--|
| | SP2 Determine the effect on the mean, median and mode when an outlier is included in a data set. | SP1 Critique ways in which data is presented. |

SCO: **SP2 – Determine the effect on the mean, median and mode when an outlier is included in a data set.** [C, CN, PS, R]

Students who have achieved this outcome should be able to:

- A.** Analyse a given set of data to identify any outliers.
- B.** Explain the effect of outliers on the measures of central tendency for a given data set.
- C.** Identify outliers in a given set of data and justify whether or not they are to be included in the reporting of the measures of central tendency.
- D.** Provide examples of situations in which outliers would and would not be used in reporting the measures of central tendency.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

12.3 (A B C D)

12.4 (A B C D)

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

SCO: SP2 – Determine the effect on the mean, median and mode when an outlier is included in a data set. [C, CN, PS, R]

Elaboration

It is important for students to know that because the mean uses the values of all the numbers in the data set it can be affected by outliers. Outliers are data values that are significantly higher or lower than the other values.

The median is not affected by outliers, as it is the middle value of an ordered set of data.

The mode is also not affected by outliers, unless it happens to be an outlier.

Grade 7 – Strand: Statistics and Probability (SP)

GCO: Collect, display and analyse data to solve problems.

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|--|
| <p>SP1 Create, label and interpret line graphs to draw conclusions.</p> <p>SP3 Graph collected data and analyse the graph to solve problems.</p> <p>SS1 Demonstrate an understanding of angles by: identifying examples of angles in the environment; classifying angles according to their measure; estimating the measure of angles using 45°, 90° and 180° as reference angles; determining angle measures in degrees; drawing and labelling angles when the measure is specified.</p> | <p>SP3 Construct, label and interpret circle graphs to solve problems.</p> | <p>N3 Demonstrate an understanding of percents greater than or equal to 0%.</p> <p>SP1 Critique ways in which data is presented.</p> |

SCO: **SP3 – Construct, label and interpret circle graphs to solve problems.** [C, CN, PS, R, T, V]

Students who have achieved this outcome should be able to:

- A.** Identify common attributes of circle graphs, such as:
 - title, label or legend;
 - the sum of the central angles is 360° ;
 - the data is reported as a percent of the total and the sum of the percents is equal to 100%.
- B.** Create and label a circle graph, with and without technology, to display a given set of data.
- C.** Find and compare circle graphs in a variety of print and electronic media, such as newspapers, magazines and the Internet.
- D.** Translate percentages displayed in a circle graph into quantities to solve a given problem.
- E.** Interpret a given circle graph to answer questions.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

8.4 (A B C D E)

8.5 (A B D)

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

SCO: SP3 – Construct, label and interpret circle graphs to solve problems. [C, CN, PS, R, T, V]

Elaboration

Students should realize that a circle graph does not show actual measurements. Circle graphs are used to describe how a whole is distributed into its component parts. Data is partitioned into parts and the circle graph illustrates the ratio of each part to the whole. The sum of the percent of each part will thus always be the whole or 100%. Likewise, the sum of the central angles will always be 360° . You may wish to compare and contrast the difference between a circle graph (part-whole) and bar graph (gives actual measurement). You can compare two wholes, by comparing two circle graphs. For example, one circle graph may display the percentage of people in each age group for a city and the other may show the same information for the province. Since circle graphs display ratios rather than quantities, a small set of data can be compared to a large set of data. That can not be done with bar graphs (Van de Walle and Lovin, 2006, p. 324).

The title, legend and labels are crucial to interpreting circle graphs. Use real data if at all possible when interpreting or drawing circle graphs. When constructing circle graphs, data would typically be given as percents or as raw data to be converted to percents. Before students consider converting percentage to degrees, you may wish to begin by having students draw circle graphs using a hundred disk. Students should also be able to draw circle graphs using technology.

No matter which approach you take when having students construct graphs, it is important to pose situations that include a real context and have students decide what statistics and what graphs would best serve the purpose (Van de Walle and Lovin, 2006, p. 320).

Grade 7 – Strand: Statistics and Probability (SP)

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

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|--|---|
| <p>SP4 Demonstrate an understanding of probability by: identifying all possible outcomes of a probability experiment; differentiating between experimental and theoretical probability; determining the theoretical probability of outcomes in a probability experiment; determining the experimental probability of outcomes in a probability experiment; comparing experimental results with the theoretical probability for an experiment.</p> | <p>SP4 Express probabilities as ratios, fractions and percents.</p> | <p>N4 Demonstrate an understanding of ratio and rate.</p> <p>N5 Solve problems that involve rates, ratios and proportional reasoning.</p> <p>SP2 Solve problems involving the probability of independent events.</p> |

SCO: **SP4 – Express probabilities as ratios, fractions and percents.** [C, CN, R, V, T]

Students who have achieved this outcome should be able to:

- A.** Determine the probability of a given outcome occurring for a given probability experiment, and express it as a ratio, fraction and percent.
- B.** Provide an example of an event with a probability of 0 or 0% (impossible) and an event with a probability of 1 or 100% (certain).

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

5.1 (A B)

5.2 (A B)

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

SCO: SP4 – Express probabilities as ratios, fractions and percents. [C, CN, R, V, T]

Elaboration

Probability is a measure of how likely an event is to occur. Probability is about predictions of events over the long term rather than predictions of individual, isolated events. Theoretical probability can sometimes be obtained by carefully considering the possible outcomes and using the rules of probability. For example, in flipping a coin, there are only two possible outcomes, so the probability of flipping a head is, in theory, $\frac{1}{2}$. Often in real-life situations involving probability, it is not possible to determine theoretical probability. We must rely on observation of several trials (experiments) and a good estimate, which can often be made through a data collection process. This is called experimental probability.

It is important for students to acquire an understanding that probability can be represented in multiple forms. The probability of an event occurring is most often represented by using a fraction, where the numerator represents the number of favourable outcomes and the denominator represents the total possible outcomes:

$$P(E) = \frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}}.$$

This representation has many advantages, since it often maintains the original numbers in simple situations. Probability can similarly be represented as a ratio. However, probability can just as easily and meaningfully be represented in decimal form. Likewise, students will often hear in news or weather reports various probability data presented as percents. For example, the likelihood of rainfall for a given day is almost always provided in percent form. In order for all situations encountered to be meaningful to the student, they should work with all representations of probabilities (fractions, decimals, ratios, percents).

Grade 7 – Strand: Statistics and Probability (SP)

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

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|---|
| <p>SP4 Demonstrate an understanding of probability by: identifying all possible outcomes of a probability experiment; differentiating between experimental and theoretical probability; determining the theoretical probability of outcomes in a probability experiment; determining the experimental probability of outcomes in a probability experiment; comparing experimental results with the theoretical probability for an experiment.</p> | <p>SP5 Identify the sample space (where the combined sample space has 36 or fewer elements) for a probability experiment involving two independent events.</p> | <p>SP2 Solve problems involving the probability of independent events.</p> |

SCO: **SP5 – Identify the sample space (where the combined sample space has 36 or fewer elements) for a probability experiment involving two independent events.** [C, ME, PS]

Students who have achieved this outcome should be able to:

- A.** Provide an example of two independent events, such as:
 - spinning a four-section spinner and an eight-sided die;
 - tossing a coin and rolling a twelve-sided die;
 - tossing two coins;
 - rolling two dice,
 and explain why they are independent.
- B.** Identify the sample space (all possible outcomes) for each of two independent events using a tree diagram, table or another graphic organizer.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

- 5.2 (A B)**
- 5.3 (B)**
- 5.4 (B)**

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

SCO: SP5 – Identify the sample space (where the combined sample space has 36 or fewer elements) for a probability experiment involving two independent events. [C, ME, PS]

Elaboration

An outcome is the result of a single trial of an experiment, whereas an event is one or more outcomes (a set of outcomes) of an experiment. Both an outcome and an event form a subset of the sample space.

The sample space of a probability experiment is the set of all possible outcomes for that experiment. These equally likely possible outcomes can be represented in a tree diagram or table.

Grade 7 – Strand: Statistics and Probability (SP)

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

| GRADE 6 | GRADE 7 | GRADE 8 |
|--|---|---|
| <p>SP4 Demonstrate an understanding of probability by: identifying all possible outcomes of a probability experiment; differentiating between experimental and theoretical probability; determining the theoretical probability of outcomes in a probability experiment; determining the experimental probability of outcomes in a probability experiment; comparing experimental results with the theoretical probability for an experiment.</p> | <p>SP6 Conduct a probability experiment to compare the theoretical probability (determined using a tree diagram, table or another graphic organizer) and experimental probability of two independent events.</p> | <p>SP2 Solve problems involving the probability of independent events.</p> |

SCO: **SP6 – Conduct a probability experiment to compare the theoretical probability (determined using a tree diagram, table or another graphic organizer) and experimental probability of two independent events.** [C, PS, R, T]

Students who have achieved this outcome should be able to:

- A.** Determine the theoretical probability of a given outcome involving two independent events.
- B.** Conduct a probability experiment for an outcome involving two independent events, with and without technology, to compare the experimental probability to the theoretical probability.
- C.** Solve a given probability problem involving two independent events.

Section(s) in MathLinks 7 text that address the specific curriculum outcome with relevant Achievement Indicators in brackets:

5.3 (A C)

5.4 (A C)

5.5 (A B C)

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

SCO: SP6 – Conduct a probability experiment to compare the theoretical probability (determined using a tree diagram, table or another graphic organizer) and experimental probability of two independent events. [C, PS, R, T]

Elaboration

The theoretical probability of an event is the ratio of the number of favourable outcomes in an event to the total number of possible outcomes, when all possible outcomes are equally likely. It can only be used to predict what will happen in the long run, when events represented are equally likely to occur. Students should realize that the probability in many situations cannot be characterized as equally likely, such as tossing a thumb tack to see if it lands with the point up or down, and therefore theoretical probability is more difficult to determine. In such cases, experiments should be limited to determining the relative frequency of a particular event. The theoretical probability of event is:

$$Y = \frac{\text{number of ways that event } Y \text{ can successfully occur}}{\text{sample space (total number of possible outcomes)}}$$

The experimental probability or relative frequency of an event is the ratio of the number of observed successful occurrences of the event to the total number of trials (Van de Walle and Lovin, 2006, p. 334). A probability experiment is a method of exploring so students can isolate the critical factors associated with a problem. The greater the number of trials, the closer the experimental probability approaches the theoretical probability. A single-stage probability experiment is a probability experiment that involves only one action, such as tossing one coin, to determine an outcome. A two-stage probability experiment is a probability experiment that involves two actions, such as tossing two coins, to determine an outcome. Two events are independent if the fact that one event occurs does not affect the probability of the second event occurring. If an experiment is conducted by spinning a spinner twice, then a trial is the result of spinning the spinner twice and the experimental probability or relative frequency of a specific event, which is:

$$Y = \frac{\text{number of observed successful occurrences of event } Y}{\text{sample space (total number of trials in the experiment)}}$$

Before conducting experiments, students should predict the probability whenever possible, and use the experiment to verify or refute the prediction.



Curriculum Guide Supplement

This supplement to the *Prince Edward Island Grade 7 Mathematics Curriculum Guide* is designed to parallel the primary resource, *MathLinks 7*.

For each of the chapters in *MathLinks 7*, an approximate timeframe is suggested to aid teachers with planning. The timeframe is based on a total of 176 classes, each with an average length of 40 minutes:

| CHAPTER | SUGGESTED TIME |
|---|----------------|
| Chapter 1 – Coordinates and Design | 15 classes |
| Chapter 2 – Operations on Decimal Numbers | 15 classes |
| Chapter 3 – Geometry and Measurement | 15 classes |
| Chapter 4 – Fractions, Decimals and Percents | 15 classes |
| Chapter 5 – Probability | 15 classes |
| Chapter 6 – Introduction to Fraction Operations | 13 classes |
| Chapter 7 – Add and Subtract Fractions | 13 classes |
| Chapter 8 – Circles | 17 classes |
| Chapter 9 – Add and Subtract Integers | 12 classes |
| Chapter 10 – Patterns and Expressions | 14 classes |
| Chapter 11 – Solving Equations | 13 classes |
| Chapter 12 – Working with Data | 19 classes |

Each chapter of *MathLinks 7* is divided into a number of sections. In this document, each section is supported by a one-page presentation, which includes the following information:

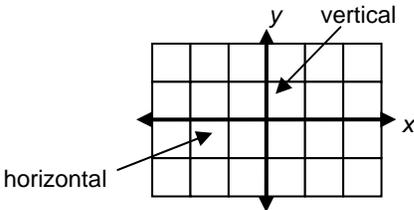
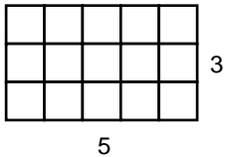
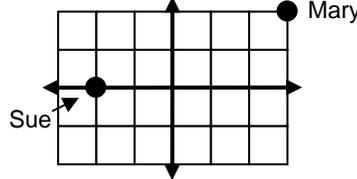
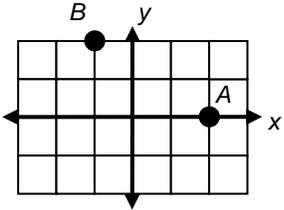
- the name and pages of the section in *MathLinks 7*;
- the specific curriculum outcome(s) and achievement indicator(s) addressed in the section (see the first half of the curriculum guide for an explanation of symbols);
- the student expectations for the section, which are associated with the SCO(s);
- the new concepts introduced in the section;
- literacy links, which reinforce previously learned concepts and highlight the language of mathematics;
- suggested problems in *MathLinks 7*;
- possible instructional and assessment strategies for the section.



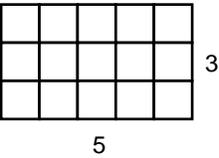
CHAPTER 1
COORDINATES AND DESIGN

SUGGESTED TIME
15 classes

Section 1.1 – The Cartesian Plane (pp. 4-11)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SS4 (A B C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> label the axes and origin of a Cartesian plane identify and plot points on a Cartesian plane <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> Cartesian plane – the plane formed when a horizontal and a vertical number line cross  <ul style="list-style-type: none"> x-axis – the horizontal number line on the coordinate grid y-axis – the vertical number line on the coordinate grid origin – the point where the x-axis and the y-axis cross quadrants – the four regions on the coordinate grid coordinates – the values in an ordered pair (x,y) <p>Literacy Links:</p> <ul style="list-style-type: none"> Roman Numerals – I, II, III and IV are Roman numerals that represent 1, 2, 3 and 4. Reading Coordinates – Read the x-coordinate first, then the y-coordinate. The point (3,-2) is read as “the coordinate pair three, negative two” or “the ordered pair three, negative two.” Area of a Rectangle $\text{Area} = \text{length} \times \text{width}$ $= 5 \times 3 = 15 \text{ units}^2$  <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 8-11: #1-12, 14, 16, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Encourage students to develop a memory device to help them remember that the x-coordinate comes before the y-coordinate. For example, x comes before y in the alphabet. Have students design a class poster showing the coordinate grid with labelled parts. Hang it in the classroom for easy reference. Use four geoboards linked together to represent the four quadrants. Ask students to plot ten points on a Cartesian plane. In pairs, students will take turns trying to find each other's points similar to the game of Battleship. Provide students with a variety of points that may require them to change the scale on the coordinate grid. For example, (-35,40) would require students to scale by 5 or 10 instead of a scale factor of 1. Show a map (graph) like the one below. Ask: How many blocks north of town centre does Mary live? How many blocks east? Write Sue's location as an ordered pair.  <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> State the coordinates of each point on the coordinate grid shown.  <ul style="list-style-type: none"> Plot each of the following points on a Cartesian plane: D(1,-9), O(-8,-4), G(-8,0). Plot ten points in quadrant I for which the difference between the first and second coordinate is 3. This will create a line. Find three coordinates with negative values that are on that line. Determine an appropriate grid scale for plotting the points (-35,30), (15,30), (-20,-20) and (30,-20). Create the grid and plot the points. Explain why you chose that scale. |

Section 1.2 – Create Designs (pp. 12-17)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SS4 (D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • create a design and identify the coordinates used to make the design • identify the coordinates of vertices of a 2-D shape <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • vertex – a point where two sides of a polygon meet; plural is <i>vertices</i> <p>Literacy Links:</p> <ul style="list-style-type: none"> • Plural of Axis – The word <i>axes</i> is used to describe more than one axis. • Perimeter of a Rectangle $\begin{aligned} \text{Perimeter} &= 2l + 2w \\ &= 2(5) + 2(3) \\ &= 10 + 6 \\ &= 16 \text{ units} \end{aligned}$  <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 14-17: #1-8, 10, 11, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Encourage students to develop steps for creating a design. For example: <ul style="list-style-type: none"> ➤ Plot the vertices of the design. ➤ Identify and label the vertices. ➤ Connect the vertices. ➤ Colour the design (if it has colour). You may wish to record these steps on a poster to hang in the classroom. • Have students create drawings using all four quadrants of the coordinate grid. They could then provide other students with a list of vertices, in order, for each drawing created. The other students would subsequently re-create the drawings. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Plot ten points for which the first coordinate is the negative of the second [<i>e.g.</i>, (5,-5)]. Describe the pattern that you see and why you might have expected that pattern. • Plot the following points on a grid: $A(-3,2)$, $B(1,2)$, $C(-3,-2)$. Determine what the coordinates of a fourth point, D, would be in order to create the square $ABCD$ when the four points are connected. |

Section 1.3 – Transformations (pp. 18-29)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SS5 (A B C D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> use a translation, a reflection and a rotation describe the image resulting from a transformation <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> transformation – moves a geometric figure; examples are translations, reflections and rotations translation – a slide along a straight line reflection – a mirror image; a mirror line is called a line of reflection rotation – a turn about a fixed point called the centre of rotation <p>Literacy Links:</p> <ul style="list-style-type: none"> Reading Prime – A' is read “A prime.” It is used to label the point that matches the point A after a transformation. Reading the Translation Arrow – The translation arrow \rightarrow shows the distance and direction a figure has moved. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 24-29: #1-20, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Encourage students to experiment with several objects and a Mira or mirror. Discuss what they notice as they reflect several objects. Spend time making sure students understand the more challenging concept of rotations. Reinforce the vocabulary: <i>centre of rotation</i>, <i>clockwise</i>, <i>counterclockwise</i>, and <i>angle of rotation</i>. Ask students to describe a rotation that results in a pre-image which has the same position as the image. Tell students that an object is reflected and the resulting image appears exactly the same in all aspects as the original object. Ask them under what conditions this would be possible. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Transform this figure according to each transformation described below. <div style="text-align: center;"> </div> <ol style="list-style-type: none"> Translate 1 unit left and 1 unit down. Translate 4 units right and 2 units up. Translate 6 units down. Reflect the figure in the y-axis. Reflect the figure in the x-axis. Rotate the figure 90° counterclockwise about centre of rotation $(1, -1)$. <ul style="list-style-type: none"> Where would each of these points be located following a clockwise half-turn about the origin: $P(-3, -5)$, $Q(3, 6)$, $R(-2, 4)$? a counterclockwise half-turn about the origin? |

Section 1.4 – Horizontal and Vertical Distances (pp. 30-35)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SS5 (B D F G) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> describe the movement of a point on the Cartesian plane, using the terms horizontal and vertical determine the horizontal and vertical distance between two points describe how vertices of a 2-D shape change position when they are transformed one or more times <p>Literacy Link:</p> <ul style="list-style-type: none"> Reading Double Prime – A'' is read “A double prime.” It is used to label the point that matches point A after a second transformation. <div style="text-align: center;"> </div> <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 33-35: #1-9, 11, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> As a class, compose a statement about transformations between two fixed points. For example, “Different transformations may be used to get from one fixed point to another, but the total distance does not change.” Reflect a triangle over two parallel lines and compare the image with the pre-image. Describe one transformation which would move the image back to the pre-image position. Ask students to determine what happens to a plotted shape if all the first coordinates are switched with the corresponding second coordinates [e.g., $A(3,-2)$ becomes $A'(-2,3)$]. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Sketch a quadrilateral on a four-quadrant plane. <ol style="list-style-type: none"> Label and record the coordinates of its vertices. Translate the quadrilateral 3 units right and 2 units upward. Label and record the coordinates of the corresponding vertices of the image. Compare the coordinates of the pre-image with the coordinates of the image and record your observations. Predict the coordinates when the quadrilateral is translated 3 units left and 3 units downward. Plot the points $A(-2,4)$ and $B(3,4)$. Join the points to create line segment AB. What is the distance between A and B? Triangle $\triangle ABC$ has coordinates $A(1,2)$, $B(3,5)$ and $C(4,0)$. <ol style="list-style-type: none"> Reflect the triangle in the horizontal axis and label the coordinates for $\triangle A'B'C'$. Reflect $\triangle A'B'C'$ in the vertical axis and label the coordinates for $\triangle A''B''C''$. Discuss $\triangle A''B''C''$ in relation to the original $\triangle ABC$. Is the transformation of $\triangle ABC$ congruent to $\triangle A''B''C''$? Explain. Has the orientation of the transformation of $\triangle ABC$ changed? Explain. |

CHAPTER 2
OPERATIONS ON DECIMAL NUMBERS

SUGGESTED TIME
15 classes

Section 2.1 – Add and Subtract Decimal Numbers (pp. 44-51)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N2 (A B F I) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • use estimation to check if solutions are reasonable • use front-end estimation to place the decimal point in a sum or difference • solve problems using addition and subtraction of two or more decimal numbers <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • estimate – to approximate an answer • overestimate – estimate that is larger than the actual answer • underestimate – estimate that is smaller than the actual answer <p>Literacy Link:</p> <ul style="list-style-type: none"> • Adding Zeros – Adding zeros after the decimal point does not change the value. $27.83 = 27.830$ <p>When there are no digits for the place values before a number or after a decimal, you can add a zero as a placeholder. $38.73 = 038.73$ <p>This shows there are 0 hundreds in 38.73.</p></p> <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 48-51: #1-13, 15, 16, 18, 19, 23, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Reinforce that students can use any method of estimation that provides a reasonable answer. • Encourage students to use times in their own lives when they use, or have used, estimation. • Encourage students to realize that sometimes it is better to overestimate cost. • Give students a column of numbers and ask them to estimate the sum. Have students exchange their problem with a partner. Ask students to check the estimate of their partner and explain whether or not they feel the estimate of their partner is a reasonable one. Do the same estimation activity, using a long list of numbers and a calculator. Again, ask students to use estimation to check the reasonableness of the results. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Place the decimal point in the correct position in the answer to make a true statement. <ul style="list-style-type: none"> a. $579.6 - 288.5 = 29110$ b. $6.791 + 3.45 + 5.126 = 15367$ • Calculate each of the following. <ul style="list-style-type: none"> a. $9.72 + 4.563$ b. $2.94 - 1.97$ • Use rounding to find an estimate and explain the rounding used for the difference of \$134.63 and \$19.15. • Use the front-end strategy to find an estimate for $\\$14.32 + \\$27.25 + \\$11.13$. • Estimate the answer for the sum of $3456 + 3567 + 3450 + 3300 + 3712 + 3645$. Compare the estimate with the answer, 21,524, to determine reasonableness. Explain your strategy and tell why you feel your answer is reasonable. • Explain why an estimate or an exact answer is required in each of these situations. John's bill for dinner at Pizza Delight is \$36.58. Is an estimate enough when: <ul style="list-style-type: none"> a. the waiter finds the tax? Explain why. b. the waiter finds the total of the bill? Explain why. c. John figures out the tip? Explain why. d. John checks the bill for accuracy? Explain why. • Explain a relatively quick way to find the sum of \$43.52, \$24.31 and \$57.48. • Draw a quadrilateral with a perimeter of 16.3 cm, where no side is a whole number. |

Section 2.2 – Multiply Decimal Numbers (pp. 52-59)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | | | | | | | | | | | | |
|---|--|------|-----|--|---|---|-----|-----|-----|------|---|---|--|---|--|---|--|--|---|--|---|-----|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N2 (C D E G I) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> use estimation to place a decimal point in a product multiply decimal numbers with and without a calculator solve problems using estimation and multiplication of decimal numbers <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 57-59: #1-8, 10, 11, 13, 15, 18, 21, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Have students display the multiplication of two factors using an open array as shown in the example 2.4×3.7 below. To find the overall product, add the partial products in the array. The numbers used on the outside of the array can be partitioned in flexible ways to create “nice” numbers to multiply. <div style="text-align: center;"> <table style="border-collapse: collapse; margin: auto;"> <tr> <td style="padding: 0 10px;">2</td> <td style="padding: 0 10px;">0.4</td> <td></td> </tr> <tr> <td style="padding: 0 10px;">3</td> <td style="border: 1px solid black; padding: 5px;">6</td> <td style="border: 1px solid black; padding: 5px;">1.2</td> </tr> <tr> <td style="padding: 0 10px;">0.7</td> <td style="border: 1px solid black; padding: 5px;">1.4</td> <td style="border: 1px solid black; padding: 5px;">0.28</td> </tr> </table> </div> <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Without calculating the answer, place the decimal point in the correct position. <ul style="list-style-type: none"> a. $4.9 \times 5.9 = 28910$ b. $2.58 \times 0.47 = 12126$ Multiply each of the following. <ul style="list-style-type: none"> a. 56×2.7 b. 54×4.5 Working in pairs, share strategies for estimating in situations such as: <ul style="list-style-type: none"> a. the area of a rectangular plot of land 24.78 m by 9.2 m b. the cost of 9.7 kg of beef at \$4.59/kg Explain a relatively quick way to find the product of: <ul style="list-style-type: none"> a. 24.6 and 20 b. 5 and 144 Describe how to calculate 3×1.25 by thinking of it as money. Find the missing digits: <div style="text-align: center; margin: 10px 0;"> <table style="border-collapse: collapse;"> <tr> <td style="padding: 0 5px;">5</td> <td style="padding: 0 5px;">.</td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="padding: 0 5px;">3</td> </tr> <tr> <td style="padding: 0 5px;"></td> <td style="padding: 0 5px;">×</td> <td style="padding: 0 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> </tr> <tr> <td style="border-top: 1px solid black; padding: 0 5px;">3</td> <td style="border-top: 1px solid black; padding: 0 5px;"></td> <td style="border-top: 1px solid black; padding: 0 5px;">.</td> <td style="border-top: 1px solid black; padding: 0 5px;">5 8</td> </tr> </table> </div> Respond to the following: Jade said, 3.45×4 must be 1.380. There is only digit before the decimal place in 3.45, so there must be one digit before the decimal place in the product. Two decimals are multiplied. The product is 0.48. What might the decimals have been? Give three possible pairs of decimals. | 2 | 0.4 | | 3 | 6 | 1.2 | 0.7 | 1.4 | 0.28 | 5 | . | | 3 | | × | | | 3 | | . | 5 8 |
| 2 | 0.4 | | | | | | | | | | | | | | | | | | | | | |
| 3 | 6 | 1.2 | | | | | | | | | | | | | | | | | | | | |
| 0.7 | 1.4 | 0.28 | | | | | | | | | | | | | | | | | | | | |
| 5 | . | | 3 | | | | | | | | | | | | | | | | | | | |
| | × | | | | | | | | | | | | | | | | | | | | | |
| 3 | | . | 5 8 | | | | | | | | | | | | | | | | | | | |

Section 2.3 – Divide Decimal Numbers (pp. 60-67)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N2 (D E H I) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> use estimation to place a decimal point in a quotient divide decimal numbers with and without a calculator solve problems using estimation and division of decimal numbers <p>Literacy Links:</p> <ul style="list-style-type: none"> Understanding Division – A division statement such as $6 \div 2 = 3$ means that in 6 there are three groups of 2. <p style="text-align: center;">● ● ● ● ● ●</p> <ul style="list-style-type: none"> Reading \approx – The symbol \approx means “is approximately equal to.” <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 65-67: #1-9, 12, 14-17, 20, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Encourage students to consider times in their own lives when they use, or have used, estimation to divide (e.g., sharing a restaurant bill). Focus on strategies such as rounding and front-end estimation. For example, to calculate $789.6 \div 89$, one could think: “90 multiplied by what number would give an answer close to 800?” <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Without calculating the answer, place the decimal point in the correct position. <ul style="list-style-type: none"> a. $20.194 \div 4.6 = 439$ b. $3.5 \div 0.25 = 1400$ Estimate the answer for $81.791 \div 8.9$. Compare the estimate with the answer, 9.19, to determine reasonableness. Explain your strategy and why you feel your answer is reasonable. Describe this situation by referring to money: $2.40 \div 0.1 = 24$. Explain how the results of $4.2 \div 0.2$ and $42 \div 2$ are related. Why might someone find it easier to divide 8.8 by 0.2 than 1.1 by 0.3? Explain how the diagram shows that $1.8 \div 0.3 = 6$. <div style="text-align: center;"> </div> |

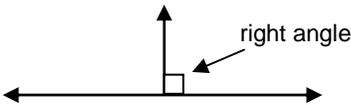
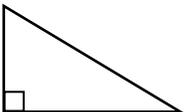
Section 2.4 – Order of Operations (pp. 68-73)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N2 (J) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • use the order of operations with decimal numbers • solve problems using operations on decimals to the thousandths place <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • order of operations <ul style="list-style-type: none"> ➤ brackets first ➤ multiply and divide in order from left to right ➤ add and subtract in order from left to right <p>Literacy Link:</p> <ul style="list-style-type: none"> • Brackets – Brackets are also known as <i>parentheses</i>. <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 70-73: #1-9, 11, 13, 15-17, 21 | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Make sure that students understand why performing the operations in the order that they appear does not give the same answer as following the order of operations. • Some students may benefit from applying the given expression to a real-world situation (<i>e.g.</i>, an entertainer's wages for inflating 120 balloons at a party). • Encourage students to recognize that the order of operations allows an expression to be written in different ways and still give the same correct answer. For example, $6.4 + 1.25 \times 120 = 1.25 \times 120 + 6.4$. • Have students work with a partner and play the range game. This is an estimation game for any of the four operations. First, pick a start number and an operation. The start number and operation are stored in the calculator. Students take turns entering a number and pressing the equal button to try and achieve a result in the target range. The winner is the student who gets the first number that will produce the answer in the target range. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Write a number sentence for the following and solve it, using the order of operations. <ul style="list-style-type: none"> a. Ms. Janes bought the following for her project: 5 sheets of pressboard at \$8.95 a sheet, 20 planks at \$2.95 each and 2 litres of paint at \$9.95 per litre. What was the total cost? b. Three times the sum of \$34.95 and \$48.95 represents the total amount of Jim's sales on April 29. When his expenses, which total \$75.00, were subtracted, what was his profit? • Because the shift key of the keyboard did not work, none of the brackets appeared in these problems. If the student has the right answer to both problems, identify where the brackets must have been. <ul style="list-style-type: none"> a. $4 + 6 \times 8 - 3 = 77$ b. $26 - 4 \times 4 - 2 = 18$ • Explain why it is necessary to know the order of operations to compute $4 \times 7 - 3 \times 6$. Compare the solution of the previous problem with the solution of $4 \times (7 - 3) \times 6$. Are the solutions the same or different and why? |

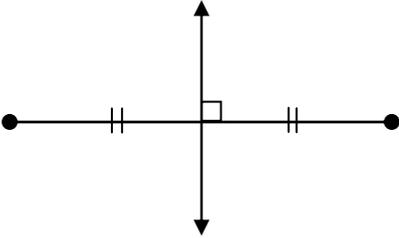
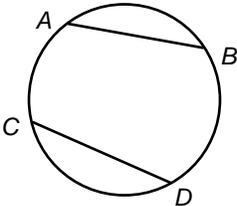
CHAPTER 3
GEOMETRY AND MEASUREMENT

SUGGESTED TIME
15 classes

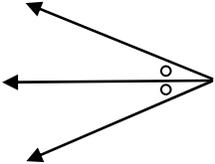
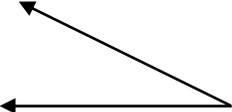
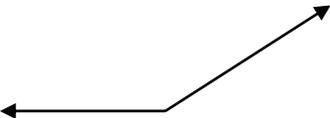
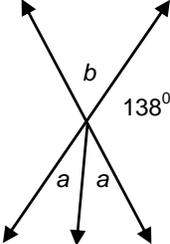
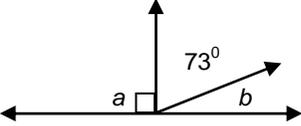
Section 3.1 – Parallel and Perpendicular Line Segments (pp. 82-88)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SS3 (A B C D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> draw line segments that are parallel to each other draw line segments that are at right angles to each other <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> parallel – describes lines in the same plane that never cross, or intersect; they are marked using “arrows” <div style="text-align: center;">  </div> <ul style="list-style-type: none"> perpendicular – describes lines that intersect at right angles (90°); they are marked using a small square <div style="text-align: center;">  </div> <p>Literacy Link:</p> <ul style="list-style-type: none"> Right Triangle – It is called a right triangle because it has an angle of 90°. <div style="text-align: center;">  </div> <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 86-88: #1-13, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Reinforce the differences between the two types of line segments introduced in this section, and the distinctive features of each type. Encourage students to identify parallel and perpendicular line segments in the classroom to consolidate their understanding. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Answer each of the following questions. <ul style="list-style-type: none"> Are the wall and ceiling perpendicular? How do you know? Are the top and bottom edges of the board parallel or perpendicular? How do you know? Find a pattern block that shows: <ul style="list-style-type: none"> parallel sides and no right angles parallel sides and right angles Sue needed to draw a line parallel to the floor so that the wallpaper border was a consistent height. Explain how she might do this if the only tool available was: <ul style="list-style-type: none"> a right triangle and a straightedge a straightedge ruler a straightedge and a protractor a compass and a straightedge |

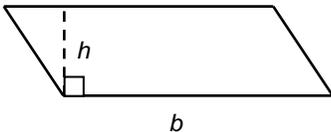
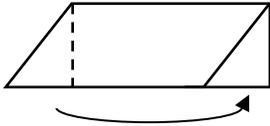
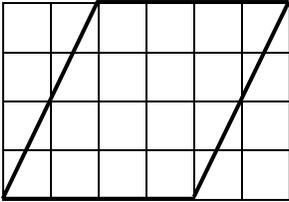
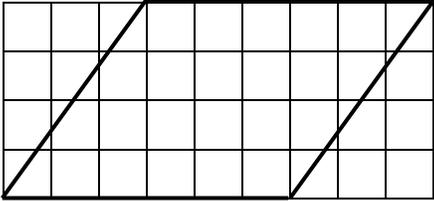
Section 3.2 – Draw Perpendicular Bisectors (pp. 89-93)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SS3 (F) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • draw a line that divides a segment in half and is at right angles to it <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • perpendicular bisector – a line that divides a line segment in half and is at right angles to it; equal line segments are marked with “hash” marks <div style="text-align: center;">  </div> <p>Literacy Link:</p> <ul style="list-style-type: none"> • Bisect – <i>Bi</i> means “two.” <i>Sect</i> means “cut.” So, to bisect means to cut in two. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 92-93: #1-9, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Ask the students questions such as the following. <ul style="list-style-type: none"> ➤ Why do you think the lengths of the two parts of a bisected line segment are equal? ➤ Do you think the angles made by a perpendicular bisector always measure 90°? • Teach students to construct perpendicular bisectors of line segments using a variety of methods, such as paper folding, and the use of Miras and compasses. • Ask students what the difference is between a line bisector and a perpendicular line bisector. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Draw a 16-cm line segment. Label it AB. Draw the perpendicular bisector of this line segment. Label the point where they intersect C. What are the lengths of AC and BC? • Draw a 9-cm line segment. Label it ST. Draw the perpendicular bisector of this line segment. Label the point where they intersect U. What are the lengths of SU and TU? • Arrange two straws with: <ol style="list-style-type: none"> one straw perpendicular to the other straw, but not at its endpoints and not bisecting one straw bisecting the other straw but not perpendicular each straw bisecting the other straw but not perpendicular one straw bisected by the other straw and perpendicular each straw bisecting the other and perpendicular • Write the upper case letters of the alphabet that use only line segments. Find examples of bisectors of segments, perpendicular segments and perpendicular bisectors. • Construct the perpendicular bisectors of lines AB and CD. These bisectors, if done correctly, should meet at the centre of the circle. <div style="text-align: center;">  </div> |

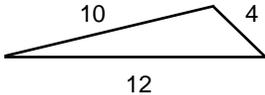
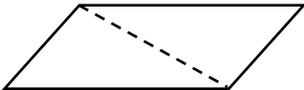
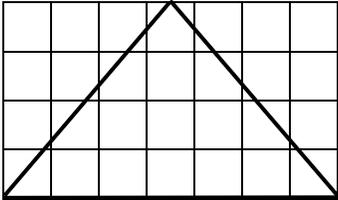
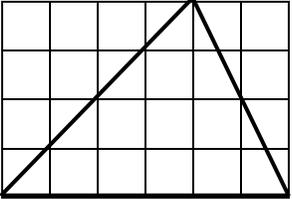
Section 3.3 – Draw Angle Bisectors (pp. 94-99)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SS3 (E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> draw lines that divide angles in half <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> angle bisector – the line that divides an angle into two equal parts; equal angles are marked with the same symbol  <p>Literacy Links:</p> <ul style="list-style-type: none"> Acute Angle – An angle that is less than 90° is called an acute angle.  <ul style="list-style-type: none"> Obtuse Angle – An angle that is greater than 90° and less than 180° is called an obtuse angle.  <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 97-99: Two of #1-9, 11 or 12, 13, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Ask the students questions such as the following. <ul style="list-style-type: none"> Why do you think the angles of the two parts of a bisected angle are equal? Will it make a difference if the angle is obtuse? Teach students to construct angle bisectors of line segments using a variety of methods, such as paper folding, and the use of Miras and compasses. Ask students to determine when an angle bisector and a line bisector are the same thing. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Draw a 120° angle. Construct the angle bisector using a compass. Measure and label the two smaller angles. Draw a 134° angle. Use a protractor to draw the angle bisector. Measure and label the two smaller angles. Find the measure of the missing angles for each of the following. <ol style="list-style-type: none">   |

Section 3.4 – Area of a Parallelogram (pp. 100-107)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SS2 (C D G) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • develop the formula for the area of a parallelogram ($A = bh$) • calculate the area of a parallelogram <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • parallelogram – a four-sided figure with opposite sides parallel and equal in length.  <ul style="list-style-type: none"> • base – a side of a two-dimensional closed figure; common symbol is b • height – the perpendicular distance from the base to the opposite side; common symbol is h  <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 104-107: #1-18, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • If students have difficulty understanding that the area of a parallelogram is equal to the area of a rectangle with the same base and height, you may wish to work backward through the process. In other words, start with a parallelogram, transform it into a rectangle, and then measure the area of the rectangle. This may help reinforce that the two areas are the same. • Have students demonstrate conservation of area so that they know the area remains the same when shapes are rearranged.  <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Use a formula to determine the area of each parallelogram. <ul style="list-style-type: none"> a.  b.  • Determine the height of the following parallelograms. <ul style="list-style-type: none"> a. base = 15 cm; area = 75 cm² b. base = 45 m; area = 360 m² • Draw on grid paper a parallelogram with an area of 24 cm². Create three other parallelograms with the same base length and area. |

Section 3.5 – Area of a Triangle (pp. 108-115)

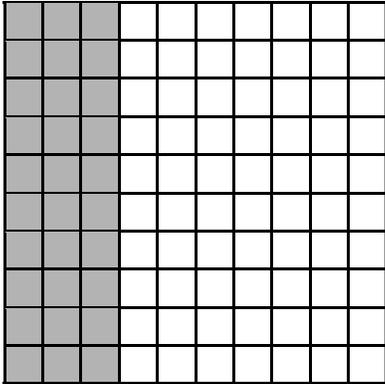
| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SS2 (A B G) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> develop the formula for the area of a triangle $\left(A = \frac{bh}{2} \right)$ calculate the area of a triangle <p>Literacy Links:</p> <ul style="list-style-type: none"> Triangle Area Formula – There is more than one way to write the formula for the area of a triangle: $\frac{bh}{2}$ means the same as $b \cdot h \div 2$. Converting Units – To convert 1500 g to kilograms, divide by 1000. $1500 = \frac{1500}{1000}$ $1500 \text{ g} = 1.5 \text{ kg}$ Perimeter of a Triangle – To determine perimeter, find the sum of all the sides.  $\text{Perimeter} = 10 + 4 + 12$ $= 26 \text{ units}$ <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 113-115: #1-15, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> If students have difficulty understanding that the area of a rectangle is equal to twice the area of a triangle with the same base and height, you may wish to work backward through the process. In other words, start with a triangle, transform it into a rectangle, and then measure the area of the rectangle. This may help reinforce the relationship between the two areas. Consider working backward using parallelograms also. Tell the students that a triangle and a parallelogram have the same height. Explain how their areas compare. Include diagrams in your explanation.  <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Use a formula to determine the area of each triangle. <ul style="list-style-type: none"> a.  b.  Determine the area of the following triangles. <ul style="list-style-type: none"> a. base = 15 cm; height = 5 cm b. base = 45 m; height = 8 m Locate on a geoboard as many triangles as possible which have an area of 2 cm^2. |

CHAPTER 4
FRACTIONS, DECIMALS AND PERCENTS

SUGGESTED TIME

15 classes

Section 4.1 – Connect Fractions, Decimals and Percents (pp. 124-131)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N3 (B C) • N4 (C) • N7 (A B C D E F) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • estimate percents as fractions or as decimals • compare and order fractions, decimals and percents • estimate and solve problems involving percent <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • percent – means “out of 100”; 30% means 30 out of 100 or $\frac{30}{100}$ or 0.30  <p>Literacy Link:</p> <ul style="list-style-type: none"> • Ascending and Descending Order – Ascending order means from least to greatest. Descending order means from greatest to least. <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 129-131: #1-22, 26, 29, Art Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Highlight to students that 75% can be considered as 50% + 25% when using estimation techniques. • Some students may find it useful to use their money skills to think about fractions, decimals and percents. • Encourage students to continue using the loading strip until they feel confident about working with percent. • Ask students to write a variety of numbers on file cards, expressing some as decimals and others as fractions. Place the cards in random order on the board ledge, facing the students. Tell the students the object of the activity is to arrange the numbers from least to greatest. Ask each student to move one card and justify the move. Continue until students are satisfied the numbers are arranged as desired. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Find each of the following. <ul style="list-style-type: none"> a. 50% of \$24.80 b. 25% of \$60 c. 10% of \$136 • Use mental math to find each of the following. <ul style="list-style-type: none"> a. 40% of 70 b. 70% of 140 c. 30% of 120 d. 22% of 310 • Write each list of numbers in ascending order. <ul style="list-style-type: none"> a. 22%, $\frac{1}{4}$, 0.24 b. $\frac{62}{100}$, 0.59, 60% c. $\frac{3}{7}$, $1\frac{1}{3}$, $\frac{5}{9}$, $\frac{13}{12}$, $1\frac{4}{9}$, 0.45, 0.93 • Estimate a whole number value for \square to make each of the following true. <ul style="list-style-type: none"> a. $0.4 < \frac{\square}{8} < 0.7$ b. $0.\square < \frac{1}{4}$ • If 2% of a certain number is 0.46: <ul style="list-style-type: none"> a. what would 10% of the number be? b. what is the number? • If 30 is close to 80% of a number, what do you know about the number? |

Section 4.2 – Fractions, Decimals and Percents (pp. 132-139)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N3 (B C) • N4 (A B D E F G) • N7 (A) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • convert among decimals, fractions and percents • estimate percent values • distinguish between terminating and repeating decimals • relate fractions to terminating and repeating decimals <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • repeating decimal – a decimal with a digit or group of digits that repeats forever; repeating digits are shown with a bar, e.g., $0.777\dots = 0.\overline{7}$. • terminating decimal – a decimal number in which the digits stop; examples include 0.4, 0.86, 0.125 <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 137-139: #1-19, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Students should recognize that only fractions that can be expressed with denominators that are powers of 10 (10, 100, 1000, etc.) will be terminating when written in decimal form. For example: $3\frac{2}{5} = 3\frac{4}{10} = 3.4 \quad \text{or} \quad 2\frac{3}{8} = 2\frac{375}{1000} = 2.375$ • While there are many forms which can be used to express most numbers, certain forms are associated with various contexts or situations. Ask students which form is typically associated with each of the following. <ul style="list-style-type: none"> ➤ a Christmas sale at a clothing store ➤ the batting average of a baseball player ➤ the part of a cup which is used in a typical recipe <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Convert each of the following fractions to a decimal number rounded as indicated. <ol style="list-style-type: none"> a. $\frac{439}{500}$ (hundredths) b. $\frac{1697}{3004}$ (thousandths) • Use a calculator to change each fraction to a repeating decimal. <ol style="list-style-type: none"> a. $\frac{2}{9}$ b. $\frac{1}{27}$ • Estimate each of the following as a percent. <ol style="list-style-type: none"> a. 35 out of 90 b. 538 out of 652 • Change each terminating decimal number to a fraction. <ol style="list-style-type: none"> a. 0.651 b. 0.92 • Chris had a calculator which displayed 2.73737374. Chris concluded that it was not a repeating decimal. Explain why Chris drew this conclusion and whether or not you believe it to be a correct conclusion. • John created a game for his birthday party, with the winner getting a prize. The winner picked from the following list the decimal which simplifies to produce the smallest denominator: 0.135, 0.375, 0.225, 0.250, 0.950, 0.500, 0.125, 0.040, 0.150. Pat won the prize. What decimal did she pick? |

Section 4.3 – Applications of Percents (pp. 140-145)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N3 (A B) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • estimate answers to percent calculations • solve percent problems <p>Literacy Link:</p> <ul style="list-style-type: none"> • GST – GST means Goods and Services Tax (currently 5%). PST means Provincial Sales Tax (currently 10% for P.E.I.). <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 142-145: #1-17, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Work with students to develop an estimating strategy for the total tax charged on P.E.I. • Discounts are estimated in the same way as taxes. You might wish to discuss an example with students, and then find a local sale and calculate the discount. For example, 25% off a \$20 shirt would be $\frac{1}{4}$ off or \$5 off the price. • A number is between 30 and 50. Ask the students to explain how to find what two numbers 20% of that number would fall between. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • The manager of a concert hall indicated that, in order to make a profit, the hall must be filled to at least 70% capacity or else the price of each ticket would increase. The seating capacity is 1200, and advance ticket sales are at 912. Will a profit be made based on the number of tickets sold in advanced sales? • In a flyer the following information is shown: Jeans regularly \$65 now 25% off, leather jackets regularly \$239 now 30% off, watches regularly \$29.99 now 20% off, study lights regularly \$22 now 60% off. How much the sale price is for each item in the flyer? • A jacket is now selling for \$64. The sign above it indicates that the price was reduced by 20%. What was the original selling price? |

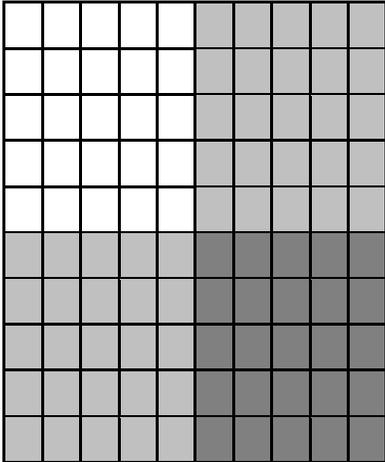
CHAPTER 5
PROBABILITY

SUGGESTED TIME
15 classes

Section 5.1 – Probability (pp. 158-164)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | | | | | | |
|---|--|------------------|---------------|---------------|---------------|---|-----|------|------|------|-----|------------|----------|------------------|--------|---------|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SP4 (A B) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> find the probability of an event in several different ways give answers as probabilities from 0% to 100% <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> probability – the likelihood or chance of an event occurring; can be expressed as a ratio, fraction or percent: $\text{Probability} = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$ outcome – one possible result of a probability experiment favourable outcome – a successful result in a probability experiment <p>Literacy Links:</p> <ul style="list-style-type: none"> Dice – The word <i>dice</i> is the plural form of <i>die</i>. Alphabet – The alphabet has 26 letters. The five vowels are <i>a, e, i, o</i> and <i>u</i>. The other letters are called consonants. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 162-164: #1-7, 8 or 9, 10, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Review benchmarks and how they relate to probability with students: \leftarrow less often \rightarrow \leftarrow more often \rightarrow  <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">$\frac{1}{4}$</td> <td style="text-align: center;">$\frac{1}{2}$</td> <td style="text-align: center;">$\frac{3}{4}$</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.25</td> <td style="text-align: center;">0.50</td> <td style="text-align: center;">0.75</td> <td style="text-align: center;">1.0</td> </tr> <tr> <td style="text-align: center;">impossible</td> <td style="text-align: center;">unlikely</td> <td style="text-align: center;">half of the time</td> <td style="text-align: center;">likely</td> <td style="text-align: center;">certain</td> </tr> </table> <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Letter tiles for the word CANADIAN are placed in a bag. <ol style="list-style-type: none"> What is the probability of drawing a letter A from the bag? What is the probability of drawing a consonant from the bag? Use the scale of $0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1$ to assess the reasonable probability of the events described below and explain your choices: <ol style="list-style-type: none"> The sun will set tomorrow. The next baby born in your town will be a boy. It will snow at least once in the month of June. Find the theoretical probability for each of the following situations which involve a six-faced die: <ol style="list-style-type: none"> the probability of tossing a 4 with your die the probability of tossing an even number the probability of tossing a number greater than 2 What is the theoretical probability: <ol style="list-style-type: none"> of randomly pointing to a prime number on a hundreds chart? that a 2-digit number that ends in 3 is also divisible by 3? Describe an event for each of the following probabilities using a single octahedron (an 8-sided die): <ol style="list-style-type: none"> 0 0.25 50% $\frac{3}{4}$ 1 | 0 | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{4}$ | 1 | 0.0 | 0.25 | 0.50 | 0.75 | 1.0 | impossible | unlikely | half of the time | likely | certain |
| 0 | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{4}$ | 1 | | | | | | | | | | | | |
| 0.0 | 0.25 | 0.50 | 0.75 | 1.0 | | | | | | | | | | | | |
| impossible | unlikely | half of the time | likely | certain | | | | | | | | | | | | |

Section 5.2 – Organize Outcomes (pp. 165-170)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP4 (A B) • SP5 (A B) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • explain how to identify an independent event • determine the outcomes of two independent events • organize the outcomes of two independent events using tables and tree diagrams <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • independent events – the outcome of one event has no effect on the outcome of another event • sample space – all possible outcomes of an experiment • tree diagram – a diagram used to organize outcomes; contains a branch for each possible outcome of an event <p>Literacy Link:</p> <ul style="list-style-type: none"> • Reading Tree Diagrams – Read tree diagrams from left to right. <ul style="list-style-type: none"> ➤ All branches, other than the far right column of the diagram, show the outcomes for each event. ➤ The column on the far right of the diagram lists the combined outcomes. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 168-170: #1-8, 9 or 10, 11, 12, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • When planning lessons, ensure that probability terminology is clarified: <i>sample space, outcomes, events, equally likely outcomes, unequally likely outcomes and trials.</i> • Have students determine the sample space for each of the following: <ul style="list-style-type: none"> ➤ Jesse has three sweaters and two pairs of shorts. How many different outfits can she create? ➤ A menu offers a lunch special of a hot dog or a hamburger with a choice of an apple, a banana or orange for dessert. How many different combinations for sandwich and dessert could be ordered? <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • A loonie is flipped and a six-sided die labelled 1, 2, 3, 4, 5, 6 is rolled. <ol style="list-style-type: none"> a. Use a table to list all the possible outcomes. b. How many possible outcomes are there? c. Write the sample space for this combination of events. • A coin is flipped and a four-sided die is rolled. Use a tree diagram to show all possible outcomes. Write the sample space. • Bill is a 50% free-throw shooter in basketball. That is, he makes his foul shot 50% of the time. He also has a 50% chance of making the second shot. He gets 0 points if he makes no baskets, 1 point for one basket and 2 points for two baskets. An area model for his shots would look like this. <div style="text-align: center;">  </div> <p>Is he more likely to get 0 points, 1 point or 2 points in a two-shot free-throw situation?</p> |

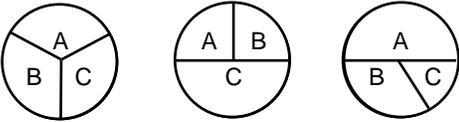
Section 5.3 – Probabilities of Simple Independent Events (pp. 171-176)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP5 (B) • SP6 (A C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • solve probability problems involving two independent events <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • random – an event in which every outcome has an equal chance of occurring <p>Literacy Link:</p> <ul style="list-style-type: none"> • Notation – You can use short forms of words in probability diagrams and tables, such as B, R and G for blue, red and green. You might make up your own abbreviations for an organizer, but write the full words in the final answers. <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 174-176: #1-11, 12 or 13 | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Consider the following strategies when planning lessons: <ul style="list-style-type: none"> ➤ Provide examples and non-examples of independent events to deepen the understanding of independent events for students. ➤ Provide various strategies for creating the sample space and then calculating the theoretical probability of independent events without using multiplication. These strategies may include using tree diagrams, tables and area models. ➤ Provide a variety of manipulatives for illustrating independent events; e.g., coins, dice, spinners, drawing cards from a deck or objects from a bag with replacement. • Build on students' understanding of experimental and theoretical probability focusing on a single action from the previous grade and extend it to include two independent events (e.g., tossing a coin twice). • Have students predict the results of any experiment with independent events by using theoretical probability. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • A coin is flipped and a spinner with four equal sections labelled <i>front</i>, <i>back</i>, <i>left</i> and <i>right</i> is spun. <ol style="list-style-type: none"> a. Create a tree diagram to show all the possible outcomes. b. What is the probability that a student would flip a tail and spin the spinner to land on <i>left</i>? • A coin is flipped and a spinner divided into three equal sections labelled 1, 2, 3 is spun. <ol style="list-style-type: none"> a. Create a table to show all of the possible outcomes when the coin is flipped and a spinner is spun. b. What is $P(H \text{ or } T, 3)$? c. What is $P(H \text{ or } T, \text{odd number})$? • A probability experiment consists of tossing two six-sided fair dice. <ol style="list-style-type: none"> a. Does this experiment describe two independent events? Explain. b. Draw a tree diagram or create a table to show all the possible outcomes for this experiment. c. Find the theoretical probability of obtaining a sum of 5 on the two dice in this experiment. Show all work. |

Section 5.4 – Applications of Independent Events (pp. 177-182)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP5 (B) • SP6 (A C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • use tree diagrams, tables and other graphic organizers to solve probability problems <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 180-182: #1-7, 8 or 9, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Provide students with various games for two players in which two dice are rolled and rules are given that relate the two numbers rolled. Have students predict whether the games are fair. Encourage students to justify their predictions and then play the games with at least 30 trials to explore. Ask students who do well to share their strategy with the class. Discuss each strategy and how well it works. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Predict the probability of randomly guessing all questions correct on a test that had 3 multiple-choice questions with three options for each question. • Describe how you could determine the theoretical probability for getting 3 out of 4 questions correct on a true or false test by guessing alone. |

Section 5.5 – Conduct Probability Experiments (pp. 183-187)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | | | | | | | | | |
|--|--|----|----|----|----|----|----|---|---|---|----|----|----|----|----|----|----|----|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP6 (A B C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • conduct a probability experiment and organize the results • compare experimental probability with theoretical probability <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • experimental probability – the probability of an event occurring based on experimental results • theoretical probability – the expected probability of an event occurring <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 186-189: #1-11 | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Ensure that students understand the difference between experimental probability and theoretical probability. • Discuss how experimental probability and theoretical probability might approach each other if an experiment is conducted enough times. Some students may have difficulty with this concept and may need to see it played out many times. • In conducting an experiment, the following steps are important: <ul style="list-style-type: none"> ➢ The problem and any underlying assumptions should be clearly defined. ➢ A model should be selected to generate the necessary outcomes. ➢ A large number of trials should be conducted and recorded. ➢ The information should be summarized to draw a conclusion. • Give students a Styrofoam cup and ask them to find the probability it will land on its bottom if dropped. They should see that this is an example of where they are unable to find the theoretical probability, and so they have to conduct an experiment. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • A spinner with four equal sections has 3 red sections and 1 blue section. Spin the spinner 100 times. <ol style="list-style-type: none"> What is the experimental probability of landing on a blue section twice in a row? What is the theoretical probability of landing on a blue section twice in a row? Compare the experimental probability with the theoretical probability of landing on a blue section twice in a row? • Design a simulation which can be used to estimate the probability that in a certain family of four children, every child will have at least one sister and one brother. • Match the spinner with the table it would most likely produce, given 50 spins and justify your choice. <div style="text-align: center;">  </div> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>A</th><th>B</th><th>C</th><th>A</th><th>B</th><th>C</th><th>A</th><th>B</th><th>C</th> </tr> </thead> <tbody> <tr> <td>28</td><td>12</td><td>10</td><td>17</td><td>15</td><td>18</td><td>28</td><td>15</td><td>7</td> </tr> </tbody> </table> | A | B | C | A | B | C | A | B | C | 28 | 12 | 10 | 17 | 15 | 18 | 28 | 15 | 7 |
| A | B | C | A | B | C | A | B | C | | | | | | | | | | | |
| 28 | 12 | 10 | 17 | 15 | 18 | 28 | 15 | 7 | | | | | | | | | | | |

CHAPTER 6
INTRODUCTION TO FRACTION OPERATIONS

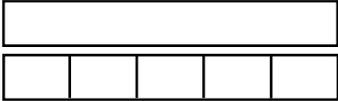
SUGGESTED TIME

13 classes

Section 6.1 – Divisibility (pp. 198-208)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N1 (A B C D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> determine if a number can be divided evenly by 2, 3, 4, 5, 6, 8, 9, 10 show why a number is not divisible by 0 find the factors of a number using divisibility rules write a fraction in lowest terms using common factors <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> divisible – when a number can be divided by another number, with no remainder common factor – a number that two or more numbers are divisible by; 4 is a common factor of 8 and 12 lowest terms – a fraction is in lowest terms when the numerator and denominator of the fraction have no common factors other than 1 <p>Literacy Links:</p> <ul style="list-style-type: none"> Even and Odd – Even numbers are 0, 2, 4, 6, 8, and so on. Odd numbers are 1, 3, 5, 7, 9, and so on. Quotient – A quotient is the result of a division. In $12 \div 2 = 6$, the quotient is 6. Carroll Diagram – A Carroll diagram is a table that shows how numbers are the same and different. Venn Diagram – A Venn diagram shows relationships between groups of numbers. Greatest Common Factor (GCF) – The greatest common factor of two numbers is the largest factor that both numbers are divisible by. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 206-209: #1-21, 23, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Check that students have an understanding of the words <i>divisible</i>, <i>quotient</i>, <i>factor</i>, <i>common factor</i>, <i>lowest terms</i>, <i>even</i>, <i>odd</i> and <i>pair</i> as they work through the section. Organize instruction so that the students develop the divisibility rules themselves through investigations. Have students note that any number divisible by 10 is also divisible by 2 and 5, because 2 and 5 are factors of 10. Also encourage students to recognize that any number divisible by 8 is divisible by 2 and 4, and that any number divisible by 9 is divisible by 3. To help students remember the divisibility rules, create and hang a poster in the classroom that lists these rules. Use a 100 chart to explore patterns of multiples. It is also important to learn how to test for divisibility on a calculator. That is, students should realize that the test for divisibility on a calculator involves dividing to see if the quotient is a whole number. Show numbers at random on the board. Ask students to determine by what numbers they are divisible. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Sort these numbers according to their divisibility by 6 and 9: 78; 132; 342; 711; 9513; 52,272. Determine the greatest common factor of 10 and 20. Write each fraction in lowest terms. <ul style="list-style-type: none"> a. $\frac{4}{6}$ b. $\frac{20}{32}$ Create a 3-digit number that is divisible by both 4 and 5. Is it also divisible by 2 and 8? Chris is filling loot bags for his sister's birthday party. She has 24 strawberry, 36 vanilla and 60 chocolate treats. What is the largest number of bags which can be filled if all the treats are to be used, no treats are left over or subdivided and all children receive the same things in their loot bags? Complete the number filling each blank with a digit. Explain your reasoning in each case. <ul style="list-style-type: none"> a. 1 5 4 █ is divisible by 6 b. 2 6 █ is divisible by 3 c. 1 █ 2 is divisible by 9 d. 1 5 █ is divisible by 4 |

Section 6.2 – Add Fractions with Like Denominators (pp. 210-216)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N5 (A B G H I) • N7 (A B C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • add fractions with like denominators using models, diagrams and addition statements <p>Literacy Link:</p> <ul style="list-style-type: none"> • Fractions Equivalent to 1 – If the numerator and denominator are the same number, the fraction equals 1. $\frac{5}{5} = 1$  <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 213-216: #1-11, 13-15, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • To remind students what the different pattern blocks represent, you may wish to label paper copies of pattern blocks and hang them in the classroom for reference. • Use concrete models to demonstrate the meaning of fractions – the numerator of the fraction counts or tells how many of the fractional parts (of the type indicated by the denominator) are under consideration. The denominator names the type of fractional part that is under consideration (what is being counted). Some students find it challenging to conceptualize what represents the “whole” so it is important to use a variety of materials so their understanding is not associated with a single model. • Estimate sums of fractions before calculating by using benchmarks such as $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1. • Use concrete models and drawings to represent addition problems. Have students solve the problem using the models. As they develop an understanding, students can record the steps symbolically as they work with the operations. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Add using models. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{1}{6} + \frac{5}{6}$ b. $\frac{1}{12} + \frac{1}{12}$ • Add using a diagram. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{1}{5} + \frac{3}{5}$ b. $\frac{1}{10} + \frac{7}{10}$ • Add. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{1}{7} + \frac{3}{7}$ b. $\frac{1}{10} + \frac{3}{10}$ |

Section 6.3 – Subtract Fractions with Like Denominators (pp. 217-221)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N5 (A C G H I) • N7 (A B C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • subtract fractions with like denominators using models, diagrams and subtraction statements <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 220-221: #1-11, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Discuss that it is useful to estimate before subtracting so that you can then compare your answer to the estimate to check that the answer is reasonable. • Connect the subtraction of fractions to the addition of fractions. • Estimate differences of fractions before calculating by using benchmarks such as $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1. • Use concrete models and drawings to represent addition problems. Have students solve the problem using the models. As they develop an understanding, students can record the steps symbolically as they work with the operations. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Subtract using models. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{2}{6} - \frac{1}{6}$ b. $\frac{7}{8} - \frac{1}{8}$ • Subtract using a diagram. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{4}{7} - \frac{1}{7}$ b. $\frac{8}{9} - \frac{2}{9}$ • Subtract. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{9}{11} - \frac{3}{11}$ b. $\frac{4}{9} - \frac{1}{9}$ |

CHAPTER 7
ADD AND SUBTRACT FRACTIONS

SUGGESTED TIME
13 classes

Section 7.1 – Common Denominators (pp. 230-236)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N5 (D) • N7 (A B C D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • find a common denominator for a set of fractions; • compare and order positive fractions <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • common denominator – a common multiple of the denominators of a set of fractions; a common denominator for $\frac{1}{4}$ and $\frac{1}{6}$ is 12 because a common multiple of 4 and 6 is 12 • multiple – the product of a given number and a natural number like 1, 2, 3, and so on; for example, some multiples of 3 are 3, 6, 9, 12 and 15 <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 233-236: #1-15, 18, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Using the paper folding model, make sure that students recognize the pattern between the number of folds each way and the number of boxes in the folded paper. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Determine a common denominator for each of the following pairs of fractions. <ul style="list-style-type: none"> a. $\frac{1}{2}$ and $\frac{1}{3}$ b. $\frac{1}{5}$ and $\frac{1}{4}$ • Answer each the following and justify your responses. <ul style="list-style-type: none"> a. Can an answer be in sixths when you add fourths and thirds? b. Can an answer be in sevenths when you add thirds and fourths? • Use common denominators to answer the following. <ul style="list-style-type: none"> a. Which is greater, $\frac{3}{10}$ or $\frac{3}{8}$? b. Which is greater, $\frac{3}{8}$ or $\frac{7}{10}$? c. Which is greater, $\frac{4}{5}$ or $\frac{3}{4}$? • The least common multiple of two numbers is 24. Find three possible pairs of values for these numbers. |

Section 7.2 – Add and Subtract Fractions with Unlike Denominators

(pp. 237-244)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N5 (A E F G H I) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> add and subtract fractions with unlike denominators solve problems involving the addition and subtraction of fractions check that their answers are reasonable using estimation <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 241-244: #1-14, 16, 17, 18 or 19, 22, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Connect problems applying the addition and subtraction of fractions to similar problems with whole numbers. Include various structures for addition and subtraction such as $\frac{1}{2} + \square = \frac{5}{8}$ or $\square + \frac{1}{4} = \frac{2}{3}$. Begin with problems where only one fraction has to be rewritten and progress to questions where both fractions have to be rewritten to have common denominators. Use diagrams to model addition and subtraction of fractions. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Add. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{1}{2} + \frac{1}{3}$ b. $\frac{1}{5} + \frac{1}{4}$ Subtract. Write the answer in lowest terms. <ul style="list-style-type: none"> a. $\frac{1}{2} - \frac{1}{3}$ b. $\frac{1}{4} - \frac{1}{5}$ John added fractions and found the answer to be $\frac{5}{8}$. What could the fractions have been? How many different answers could there be? Use estimation to answer the following: Susan has 1 cup of brown sugar. One layer of the squares she is making requires $\frac{2}{3}$ of a cup of brown sugar, while the second layer requires $\frac{1}{2}$ of a cup. Does she need to go to the supermarket to get more brown sugar or does she have enough? Justify. Decide whether the answer to each of the following is less than or greater than 1 and to give a reason for each decision. <ul style="list-style-type: none"> a. $\frac{3}{4} + \frac{1}{8}$ b. $\frac{7}{8} + \frac{1}{5}$ |

Section 7.3 – Add Mixed Numbers (pp. 245-251)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N5 (A B D G H I) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> add mixed numbers with like and unlike denominators solve problems involving the addition of mixed numbers check that their answers are reasonable using estimation <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> mixed number – a number made up of a whole number and a fraction, such as $2\frac{1}{3}$ improper fraction – a fraction that has a numerator greater than the denominator, such as $\frac{9}{8}$ <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 249-251: #1-15, 17, 19, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Use many visual examples and manipulatives to help students learn about mixed numbers. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Add. Write the answer in lowest terms. <ol style="list-style-type: none"> $1\frac{1}{4} + 2\frac{3}{4}$ $2\frac{3}{5} + 4\frac{4}{5}$ $1\frac{1}{4} + 2\frac{1}{2}$ $2\frac{4}{5} + 4\frac{2}{3}$ An example of a calculation involving fractions which has an answer of approximately 5 is $2\frac{1}{2} + 2\frac{3}{4}$. Write two other addition problems involving mixed numbers which have an answer of approximately 5. Use estimation to answer the following. <ol style="list-style-type: none"> Jane added $3\frac{3}{4}$ and $4\frac{7}{8}$. Jane's sister in grade eight said the answer was $7\frac{5}{6}$. Jane wanted to determine if her sister's answer was reasonable. Explain how she might go about this. John added $3\frac{5}{6}$ and $\frac{3}{4}$. He obtained an answer which was between 6 and 7. Is this reasonable? Explain why or why not. Decide whether the answer to $1\frac{4}{5} + \frac{7}{8}$ is less than or greater than 2 and to give a reason for the decision. A recipe uses $2\frac{1}{4}$ cups of flour, $1\frac{1}{3}$ cups of sugar and $\frac{1}{4}$ cup of nuts. Al wanted to put all of the dry ingredients into one measuring cup. What size measuring cup would you recommend? |

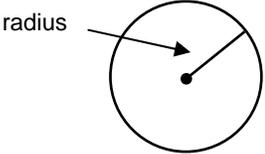
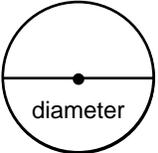
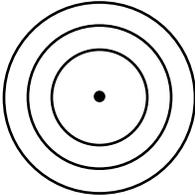
Section 7.4 – Subtract Mixed Numbers (pp. 252-259)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N5 (C D F G H I) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> subtract mixed numbers with like and unlike denominators solve problems involving the subtraction of mixed numbers check that their answers are reasonable using estimation <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 256-259: #1-13, 15-17, 21, 22, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Use many visual examples and manipulatives to help students learn about mixed numbers. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Subtract. Write the answer in lowest terms. <ol style="list-style-type: none"> $2\frac{2}{5} - 1\frac{4}{5}$ $3\frac{1}{6} - 1\frac{5}{6}$ $2\frac{2}{5} - 1\frac{1}{2}$ $3\frac{1}{6} - 1\frac{3}{4}$ An example of a calculation involving fractions which has an answer of approximately 5 is $10\frac{5}{6} - 4\frac{7}{8}$. Write two other subtraction problems involving mixed numbers which have the same answer. |

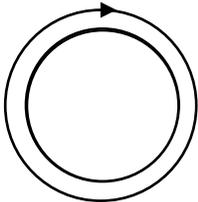
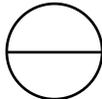
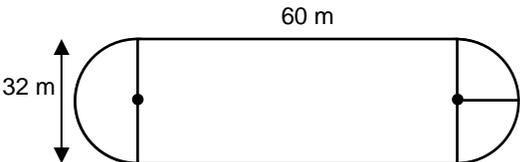
CHAPTER 8
CIRCLES

SUGGESTED TIME
17 classes

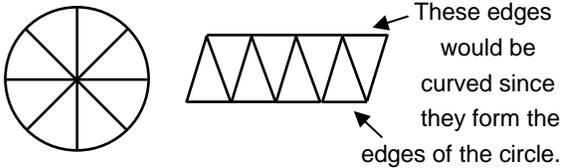
Section 8.1 – Construct Circles (pp. 268-272)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SS1 (A E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • draw a circle with a given radius or diameter • determine the diameter of a circle given its radius • determine the radius of a circle given its diameter <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • radius – distance from the centre of the circle to the outside edge; usually represented by the variable r <div style="text-align: center;">  </div> <ul style="list-style-type: none"> • diameter – distance across a circle through its centre; usually represented by the variable d <div style="text-align: center;">  </div> <p>Literacy Link:</p> <ul style="list-style-type: none"> • Concentric Circles – Concentric circles have the same centre but different diameters. One circle lies inside another. <div style="text-align: center;">  </div> <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 270-272: #1-12, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Emphasize that students connect the concrete, pictorial and symbolic representations as they explore the properties of circles. • Use literature to stimulate students' thinking about circles and their properties. • Ask the students if all circles are similar. • Have students draw and construct circles and discuss a variety of construction options. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Draw a circle with a radius of 4 cm. <ul style="list-style-type: none"> a. Predict the diameter of the circle that you drew. b. Measure the diameter of your circle. Were you correct? Explain why or why not. |

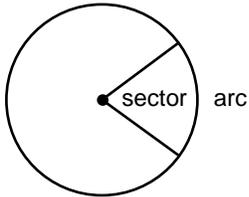
Section 8.2 – Circumference of a Circle (pp. 273-279)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> SS1 (B C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> estimate and calculate the circumference of a circle given its diameter ($C = \pi d$) or radius ($C = 2\pi r$) solve problems involving circumferences of circles <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> circumference – the distance around a circle; usually represented by the variable C; this is a linear measurement  <ul style="list-style-type: none"> pi – the ratio of the circumference of a circle to its diameter, $\frac{C}{d}$; the symbol for pi is π <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 277-279: #1-14, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Use exploratory activities to find the value of π, by measuring and charting the value of $\frac{C}{d}$ for a number of circular objects. Students can bring round containers from home for this purpose. This activity can be done in groups and results reported to the whole class. A piece of string can be used as the measuring tool. It is useful to perform a similar activity using much larger circles as well. Develop the formulas $C = \pi d$ and $C = 2\pi r$ once the value of π has been established. Students should use these formulas to solve application problems. Connect the circumference of circles to perimeters of polygons. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> A circle is 3 m in diameter. <ul style="list-style-type: none"> Estimate the circumference of the circle. Calculate the circumference of the circle to the nearest tenth of a metre. Is your answer reasonable? Estimate and calculate the circumference of each circle to the nearest tenth of a metre. <ul style="list-style-type: none"> radius = 3.25 m radius = 9.1 m Decide which of the following is the best estimate of the circumference of a circle with a radius of 3.5 cm: 10.5 cm, 21 cm or 42 cm. Justify your choice. Estimate how many strokes it would take for Kelsey to swim around the edge of the pool, if it took her 30 strokes to swim across the widest part of the pool.  <ul style="list-style-type: none"> Ali's school has a running track which is semi-circular at each end, as shown. How many times does she have to go around the track to run 2 km?  |

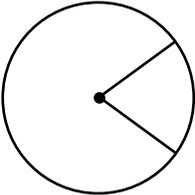
Section 8.3 – Area of a Circle (pp. 280-286)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SS2 (E F G) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • explain how to determine the area of a circle • estimate and calculate the area of a circle ($A = \pi r^2$) • solve problems involving the area of a circle <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 284-286: #1-16, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Have students cut out a circle, fold it in half, and then fold it in half three more times to develop the formula for the area of a circle. Have students draw a dark line around the circle so the circumference will be apparent. Cut out each sector and line up the pieces to form an approximate parallelogram (see below). The radius of the circle represents the height of the parallelogram and the base is represented by half of the circumference, πr. Have them write the formula they have discovered for the area of a circle. <div style="text-align: center;">  </div> <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Estimate and calculate the area of the following circles to the nearest tenth of a square centimetre. <ol style="list-style-type: none"> radius = 12 cm radius = 23.3 cm • Estimate and calculate the area of the following circles to the nearest hundredth of a square metre. <ol style="list-style-type: none"> diameter = 25 cm diameter = 4.8 cm • Estimate the area of a circular plate that has a radius of 10 cm and explain your thinking. Write the formula for the area of a circle. Calculate the area of the plate. Show all your work. |

Section 8.4 – Interpret Circle Graphs (pp. 287-291)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP3 (A B C D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • read circle graphs • use circle graphs to solve problems <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • circle graph – a graph that represents data using sections of a circle • sector – section of a circle formed by two radii and the arc of a circle connecting the radii <div style="text-align: center;">  </div> <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 290-291: #1-8 | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Ask the students the following questions. <ul style="list-style-type: none"> ➤ How does a circle graph show how one part compares to the whole? ➤ What do the percents of a circle graph have to add up to? • Use data that is real and interesting to students. Newspapers, magazines and internet sites, such as www.statcan.ca are good resources for data. • Ask the students to describe a situation for which he or she might use a circle graph instead of a bar graph. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Can the various sections of a particular circle graph be 35%, 25%, 30% and 15%? • In reading a circle graph, Sarah realized that the sections of the graph did not contain any numbers or percents. She decided to use the angle measures to help read it. The section which represented the number of red cars looked as if it represented an angle of about 90°: <ol style="list-style-type: none"> Explain how to find what percentage of the cars are red. It was more difficult to estimate the number of degrees the blue cars represented so Sarah used a protractor and found the angle to be exactly 135°. What percentage of the cars is blue? Suppose the circle graph represents the colours of the cars which pass an intersection during a one-hour period. Based on the information provided, if 400 cars passed this intersection, how many would you expect to be blue and how many would you expect to be red? How many were neither blue nor red? |

Section 8.5 – Create Circle Graphs (pp. 292-297)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SS1 (D F) • SP3 (A B D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • construct a circle graph with and without technology <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • central angle – an angle formed by two radii of a circle; the vertex of the angle is at the centre of the circle  <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 295-297: #1-10 | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Have the students explore the angles of the pattern block pieces using the idea that the sum of the interior angles of a circle is 360°. • Ensure that construction of a circle graph and interpretation of the data are not addressed independently. When students take the time to construct circle graphs, they should be used for interpretation. • Integrate technology after students have experienced making circle graphs with paper and pencil. • Make a “human circle graph.” Have students choose their favourite of four hockey teams and line them up so that students favouring the same team are together. Have students form a circle. Tape the ends of four long strings in the middle and stretch them out to show the divisions. • Have students make bar graphs. When completed, cut out the bars and tape them end to end. Tape the two ends together to form a circle. Estimate where the centre of the circle is, draw lines to the points where different bars meet and trace around the full loop. You can now estimate the percentages. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Jay works part-time in a shoe store. She was involved in completing the spring order. The following were ordered in relation to shoe size: <ul style="list-style-type: none"> ➤ size 5 – $5\frac{1}{2}$: 5% ➤ size 6 – $6\frac{1}{2}$: 15% ➤ size 7 – $7\frac{1}{2}$: 45% ➤ size 8 – $8\frac{1}{2}$: 20% ➤ size 9 – $9\frac{1}{2}$: 10% ➤ size 10 – $10\frac{1}{2}$: 5% <p>Construct a circle graph to display this data. If Jay placed an order for 120 pairs of shoes, how many of each type should she expect to receive?</p> |

CHAPTER 9
ADD AND SUBTRACT INTEGERS

SUGGESTED TIME
12 classes

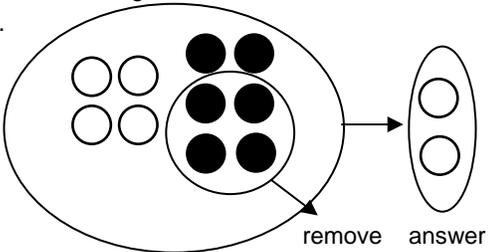
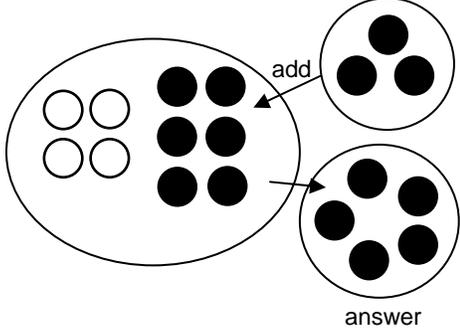
Section 9.1 – Explore Integer Addition (pp. 310-315)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N6 (A C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> add integers using integer chips <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> zero pair – a pair of integer chips, with one chip representing +1 and one chip representing -1; the pair represents zero because $(+1)+(-1) = 0$ <div style="text-align: center;">  <p style="margin-left: 100px;">+1 -1</p> </div> <ul style="list-style-type: none"> opposite integers – two integers with the same numeral, but different signs, for example +2 and -2; two integers represented by points that are the same distance in opposite directions from zero on the number line <p>Literacy Link:</p> <ul style="list-style-type: none"> Writing and Reading Integer Sums – The + or - sign of an integer does not represent addition or subtraction. To avoid confusion, use brackets to distinguish integer signs from operation symbols. For example, write $(+2)+(-2)$, <i>not</i> $+2+-2$. You may find it helpful to read $(+2)+(-2)$ as “positive two plus negative two.” <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 313-315: #1-9, 11-16 | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Emphasize that students begin with concrete to pictorial and finally to symbolic representations for sums of integers. Connect problems involving addition of integers to similar problems with whole numbers. Use a problem-solving context to which students relate. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Add using integer chips. <ul style="list-style-type: none"> a. $(-4)+(-4)$ b. $(-2)+(+4)$ c. $(+2)+(+3)$ d. $(-3)+(+2)$ Use integer chips to explain why: <ul style="list-style-type: none"> a. $-3+8 = 5$ b. $9+(-2) = 7$ Plot points +5 and -5 on a number line. What do you notice about them? Why do you think number pairs such as +5 and -5 are called opposites? Write an integer for each of the following situations: <ul style="list-style-type: none"> a. A person walks up 8 flights of stairs. b. An elevator goes down 7 floors. c. The temperature falls by 7 degrees. d. Sue deposits \$110 in the bank. e. The peak of the mountain is 1123 m above sea level. Represent each of the following using the given number of integer chips. <ul style="list-style-type: none"> a. -4, using six integer chips b. 0, using six integer chips c. +2, using six integer chips Can -3 be represented using six integer chips? Why or why not? What number is represented by the integer chips shown? <div style="text-align: center;">  </div> <ul style="list-style-type: none"> Sandy owes \$4 to his friend, has \$12 in savings, and just received his \$5 weekly allowance. Find Sandy's net worth and explain how it was found. |

Section 9.2 – Add Integers (pp. 316-322)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N6 (B C E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> add integers using a number line <p>Literacy Links:</p> <ul style="list-style-type: none"> Describing Temperatures – Temperatures are described in different ways. For example, the scientific way to read -4°C is “negative four degrees Celsius.” You may also hear -4°C described in everyday speech as “minus four degrees Celsius,” “four degrees below zero” or “four below.” Writing Positive Integers – Positive integers are usually written without the positive sign. Consecutive Numbers – Consecutive numbers follow one after another in order. For example, 1, 2, 3, 4 are consecutive whole numbers. <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 319-322: #1-10, 13-15, 17-19, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Make sure that students have a clear understanding of how to use number lines for addition. Some students may be able to demonstrate how they can use number lines to add integers, but have difficulty describing the process. As students demonstrate, verbalize what they are doing. Help students verbalize what they did and then ask them to record their explanation either verbally or in writing. Have students work in pairs. Ask them to roll two dice of different colours. Assign negative to one colour and positive to the other, and write a number sentence for the sum. Have them roll the two dice again, find the sum mentally, and add the result to their previous score. Have them exchange turns until one person reaches +20 or –20. Ask why it would be fair to accept either +20 or –20 as the winning score. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Add using a number line. <ul style="list-style-type: none"> a. $(-6) + (-6)$ b. $(+3) + (-4)$ c. $(+5) + (+4)$ d. $(-5) + (+5)$ Use rounding to find an estimate and explain the rounding used for the sum of –2392 and 4899. Is the sum of a negative number and a positive number always negative? Explain why or why not. |

Section 9.3 – Explore Integer Subtraction (pp. 323-329)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N6 (D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> subtract integers using integer chips <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 327-329: #1-18 | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> You may wish to have students demonstrate subtracting using integer chips. Have them record how to tell which problems need zero pairs. For example, if they have one negative integer chip, they can't take three negative integer chips away from it. Emphasize that students begin with concrete to pictorial and finally to symbolic representations for differences of integers. Connect problems involving subtraction of integers to similar problems with whole numbers. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Determine each difference using integer chips. <ol style="list-style-type: none"> $(-5) - (+3)$ $(-1) - (+5)$ $(-6) - (-2)$ $(+2) - (-5)$ Use integer chips to explain why: <ol style="list-style-type: none"> $-5 - 3 = -8$ $6 - 4 = 2$ $8 - (-3) = 11$ Explain in words and as a number sentence each of the following: <ol style="list-style-type: none">   |

Section 9.4 – Subtract Integers (pp. 330-335)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | |
|--|---|-----|----|--|--|--|-----|----|----|----|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N6 (B D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> use addition to subtract integers <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 333-335: #1-13, 15-22, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Encourage students to generalize what they have learned to help them develop a method that they understand. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Subtract. <ol style="list-style-type: none"> $(+4) - (+7)$ $(-6) - (+8)$ $(-9) - (-3)$ Use the front-end strategy to find an estimate for $-692 - 460$. Model $(-2) - (-4)$ on a number line. Complete the following Magic Square. <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td></td> <td style="text-align: center;">-7</td> <td></td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">-11</td> </tr> <tr> <td style="text-align: center;">-9</td> <td style="text-align: center;">-1</td> <td style="text-align: center;">-2</td> </tr> </tbody> </table> | | -7 | | | | -11 | -9 | -1 | -2 |
| | -7 | | | | | | | | | |
| | | -11 | | | | | | | | |
| -9 | -1 | -2 | | | | | | | | |

Section 9.5 – Apply Integer Operations (pp. 336-341)

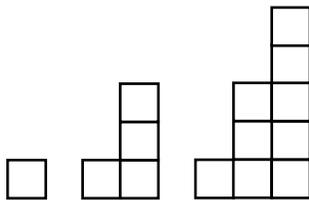
| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | | | |
|--|---|------|-------------|------|-------------|------|-----------|-----|-------------|------|-----------|------|-----------|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> N6 (A B C D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> decide when to add and subtract integers in solving problems <p>Literacy Link:</p> <ul style="list-style-type: none"> Omitting Positive Signs or Brackets – A positive integer can be written without the positive sign or brackets. For example, $(+2) + (+4)$ can be written as $2 + 4$. A negative integer must include the negative sign. The brackets can be omitted from a negative integer that does not follow an operation symbol. For example, $(-3) - (-2)$ can be written as $-3 - (-2)$. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 339-341: #1-5, 9-15, Science Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Ask students to solve and create problems using real-life situations such as time zones, temperatures, heights above and below sea level, and profit and loss. Make a budget that shows income and expenditures for one month. Create some integer problems based on your budget. Find a temperature graph from social studies and create problems which require the use of addition and subtraction of integers. Exchange the problems with a partner and solve. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> John saved \$50 during the fall. He owes \$15 to his friend. Because he had a good term report his father gave him \$20. What is John's net worth? The following is a record of Jerry's change in mass per month: <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>Jan.</td> <td>Lost 4 kg</td> <td>Apr.</td> <td>Gained 2 kg</td> </tr> <tr> <td>Feb.</td> <td>Lost 2 kg</td> <td>May</td> <td>Gained 1 kg</td> </tr> <tr> <td>Mar.</td> <td>Lost 3 kg</td> <td>June</td> <td>Lost 2 kg</td> </tr> </tbody> </table> <p>If Jerry's mass was 65 kg before the diet, what was his mass after the 6-month diet?</p> | Jan. | Lost 4 kg | Apr. | Gained 2 kg | Feb. | Lost 2 kg | May | Gained 1 kg | Mar. | Lost 3 kg | June | Lost 2 kg |
| Jan. | Lost 4 kg | Apr. | Gained 2 kg | | | | | | | | | | |
| Feb. | Lost 2 kg | May | Gained 1 kg | | | | | | | | | | |
| Mar. | Lost 3 kg | June | Lost 2 kg | | | | | | | | | | |

CHAPTER 10
PATTERNS AND EXPRESSIONS

SUGGESTED TIME

14 classes

Section 10.1 – Describe Patterns (pp. 350-357)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • N4 (A) • PR1 (A B) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • describe patterns using words, tables or diagrams • use patterns with repeating decimal numbers <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • pattern – an arrangement of shapes, colours, numbers, letters, words, and so on, for which you can predict what comes next <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 354-357: #1-9, 11-15, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Make a list of strategies for determining a pattern and hang it in the classroom for easy reference. Add to the list as the class works through the chapter. • Ask students to describe patterns and rules orally in writing before using algebraic symbols. • Provide examples of growth patterns that are arithmetic and geometric. • Provide experiences representing the same pattern in multiple ways, <i>i.e.</i>: model, diagram, table of values, graph and expression. Use real-world contexts. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Given the pattern 2, 5, 10, 17, 26, 37, ... <ol style="list-style-type: none"> Continue the pattern for the next three numbers. Describe, in words, how the pattern grows. • Given that $\frac{1}{11} = 0.0\overline{9}$, $\frac{2}{11} = 0.1\overline{8}$, and $\frac{3}{11} = 0.2\overline{7}$: <ol style="list-style-type: none"> Predict the decimals for $\frac{5}{11}$ and $\frac{9}{11}$. Predict the fraction which will have 0.636363... as a decimal. Predict what the decimal for $\frac{8}{11}$ would look like on a calculator display if the calculator is set to display 8 places after the decimal. Have them describe the pattern for decimals with denominator 11. Predict the fraction which will have 0.909090... as a decimal. • Use cubes to copy and extend these shapes to the fifth shape in the pattern. <div style="text-align: center;">  </div> <ol style="list-style-type: none"> Construct a chart to record and reveal the pattern. Predict the total number of cubes needed to make the 10th and 25th shapes in the pattern and explain their prediction. Explain in words how the pattern grows. |

Section 10.2 – Variables and Expressions (pp. 358-364)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|----------------------|-----------------------|----------|-----------------------|----------|--------|--------------------------------|-----|---|----|--|--|--|--|--|-----------|---|---|---|---|------|--------|--------|---------|---------|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • PR1 (C) • PR4 (A B) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • write an expression to represent a pattern • identify and provide examples of variables in expressions • change from a word statement to an expression <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • variable – a letter that represents an unknown number; for example, x, A, n • expression – any single number or variable, or a combination of operations (+, −, ×, ÷) involving numbers and variables; for example, 5, r, $8t$, $x+9$, $2y-7$ • value – a known or calculated amount • constant – a number that does not change; increases or decreases the value of an expression • numerical coefficient – a number that multiplies the variable <p>Literacy Links:</p> <ul style="list-style-type: none"> • Notation – In algebra, $5 \times r$ is written as $5r$. It is read as “five r.” • Choosing Variables – You can choose any letter as a variable. It can be helpful to choose a meaningful variable. For example, C for cost, d for distance and t for time. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 361-364: #1-9, 11-13, 15, 16, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Provide opportunities to connect the concrete and pictorial representations to symbolic representations as well as connecting the symbolic representations to pictorial and concrete representations. • Ask students to create a classroom chart with the following headings: <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #cccccc;"> <th style="padding: 2px 5px;">Algebraic Expression</th> <th style="padding: 2px 5px;">Expression in Words</th> <th style="padding: 2px 5px;">Variable</th> <th style="padding: 2px 5px;">Numerical Coefficient</th> <th style="padding: 2px 5px;">Constant</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px 5px;">$3b-1$</td> <td style="padding: 2px 5px;">One less than 3 times a number</td> <td style="padding: 2px 5px;">b</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">−1</td> </tr> <tr> <td style="padding: 2px 5px;"> </td> </tr> </tbody> </table> <p style="margin-left: 40px;">Begin by filling in a expression like $3b-1$ and have students continue to add examples each day to add to the chart.</p> <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • The cost of renting a Seedoo is \$12 per hour. Find the cost of a rental for 3 hours, 4 hours, 6 hours and h hours. • Find the perimeter for each polygon when the side length is 6, when it is $a(n)$: <ul style="list-style-type: none"> a. pentagon b. hexagon c. heptagon d. octagon • The table shows the relationship between the number of riders on a tour bus and the cost of providing boxed lunches. <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td style="padding: 2px 5px;">Customers</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> </tr> <tr> <td style="padding: 2px 5px;">Cost</td> <td style="padding: 2px 5px;">\$4.25</td> <td style="padding: 2px 5px;">\$8.50</td> <td style="padding: 2px 5px;">\$12.75</td> <td style="padding: 2px 5px;">\$17.00</td> </tr> </tbody> </table> <ul style="list-style-type: none"> a. Explain how the lunch cost is related to the number of riders. b. Write an equation for finding the lunch cost, l, for the number of customers, n c. Use the equation to find the cost of lunch if there were 25 people on the tour. d. How many people were on the bus if the tour bus leader spent \$89.25 on lunch? | Algebraic Expression | Expression in Words | Variable | Numerical Coefficient | Constant | $3b-1$ | One less than 3 times a number | b | 3 | −1 | | | | | | Customers | 1 | 2 | 3 | 4 | Cost | \$4.25 | \$8.50 | \$12.75 | \$17.00 |
| Algebraic Expression | Expression in Words | Variable | Numerical Coefficient | Constant | | | | | | | | | | | | | | | | | | | | | | |
| $3b-1$ | One less than 3 times a number | b | 3 | −1 | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Customers | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | | | | | | | | | |
| Cost | \$4.25 | \$8.50 | \$12.75 | \$17.00 | | | | | | | | | | | | | | | | | | | | | | |

Section 10.3 – Evaluate Expressions (pp. 365-371)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> PR2 (A) PR5 (A) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> model an expression evaluate an expression make a table of values for an expression <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> table of values – a table showing two sets of related numbers <p>Literacy Link:</p> <ul style="list-style-type: none"> Evaluating Expressions – To evaluate means to determine the result or answer of an expression. <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> pp. 368-371: #1-15, 17, 18, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Ensure that students conceptually understand how a model shows an expression with variables and constants. Repeatedly reinforce the terminology and symbols that correspond to a model. This allows students to connect concrete, pictorial and symbolic learning. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Evaluate. <ul style="list-style-type: none"> $a+2$, when $a=2$ and $a=5$ $3b+5$, when $b=1$ and $b=3$ $5+4m$, when $m=4.2$ and $m=1.5$ Consider the following pattern of dots. <div style="text-align: center;">  </div> <p>Figure 1 Figure 2 Figure 3</p> <ul style="list-style-type: none"> Make a table of values for f and $3f$. Use whole numbers from 1 to 7 for f. How many dots are there in Figure 20 of this pattern? Can it be true that $3b-1$ is equal to 5 under some conditions and equal to 29 in other conditions? Explain your reasoning. Make a table to find the length of a rectangle for each value of width m. The length is $4m+5$, where $m=1, 2, 3, \dots, 7$. Evaluate, by creating a table, the expression $5x+(-4)$, where $x=3, 4, 5, 6, \dots, 10$. Create a problem which this set of values might answer. |

Section 10.4 – Graph Linear Relations (pp. 372-381)

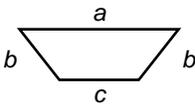
| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | |
|--|--|----------|-----------------------------|------------|-----|-----------|----|-----------|----|-----------|----|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • PR1 (B) • PR2 (A B C D E F) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • graph a linear relation • describe the relationship shown on a graph <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • linear relation – a pattern made by two sets of numbers that results in points along a straight line on a coordinate grid <div style="text-align: center; margin: 10px 0;"> </div> <ul style="list-style-type: none"> • graph – a visual way to show how two sets of numbers relate to each other • relationship – a pattern formed by two sets of numbers <p>Literacy Link:</p> <ul style="list-style-type: none"> • Notation – A break in the y-axis of a graph means the length of the axis has been shortened. The break is shown as: <div style="text-align: center; margin: 10px 0;"> </div> <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 378-381: #1-13, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Assist students in understanding that any straight line on a coordinate grid comes from a linear relation. • In formulating linear relations representing oral or written patterns, encourage students to draw diagrams and create tables of values to assist them in visualizing the relationship. • Provide examples in which students formulate linear relations that are recursive and functional. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • The equation $y = 3x - 1$ describes a pattern. <ol style="list-style-type: none"> a. Identify three points on a line that belong to this pattern. b. Does (8,23) belong to this pattern? Explain why or why not. c. Graph the equation, using a table of values. d. Does (15,40) lie on the line. Is (15,40) a solution to the equation? • The diagram below shows a series of triangular supports for a bridge: <div style="text-align: center; margin: 10px 0;"> </div> <ol style="list-style-type: none"> a. Continue the pattern above for up to seven triangles. b. Create a table showing the number of segments in each shape. c. Describe in writing how the pattern grows. d. Predict the number of line segments for 10 triangles and 20 triangles. e. Write an algebraic expression to show the number of line segments for n triangles. f. Draw a graph to show the pattern. Does it make sense to connect the points? Discuss the shape of the graph. • Bill noted that the temperature was increasing at a very regular rate. From his measurements, he created the following table. <div style="text-align: center; margin: 10px 0;"> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #cccccc;"> <th style="padding: 5px;">Time (h)</th> <th style="padding: 5px;">Temperature ($^{\circ}$C)</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">12:00 noon</td> <td style="padding: 5px;">-10</td> </tr> <tr> <td style="padding: 5px;">1:00 P.M.</td> <td style="padding: 5px;">-7</td> </tr> <tr> <td style="padding: 5px;">2:00 P.M.</td> <td style="padding: 5px;">-4</td> </tr> <tr> <td style="padding: 5px;">3:00 P.M.</td> <td style="padding: 5px;">-1</td> </tr> </tbody> </table> </div> <p>Assuming the pattern continues, graph the values and use the graph to predict the temperature at 7:00 P.M.</p> | Time (h) | Temperature ($^{\circ}$ C) | 12:00 noon | -10 | 1:00 P.M. | -7 | 2:00 P.M. | -4 | 3:00 P.M. | -1 |
| Time (h) | Temperature ($^{\circ}$ C) | | | | | | | | | | |
| 12:00 noon | -10 | | | | | | | | | | |
| 1:00 P.M. | -7 | | | | | | | | | | |
| 2:00 P.M. | -4 | | | | | | | | | | |
| 3:00 P.M. | -1 | | | | | | | | | | |

CHAPTER 11
SOLVING EQUATIONS

SUGGESTED TIME

13 classes

Section 11.1 – Expressions and Equations (pp. 390-394)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> PR4 (A B C) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> identify constants, numerical coefficients and variables in expressions and equations describe the difference between an expression and an equation <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> equation – a mathematical statement with two expressions that have the same value; $x + 2 = 3$, $y - 7 = -4$, $3a - 2 = a + 2$ and $b = 4$ are examples of equations <p>Literacy Link:</p> <ul style="list-style-type: none"> Writing Expressions – An expression can be written using a single constant, a single variable or a combination of operations with constants, variables or numerical coefficients. For example, <div style="text-align: center;"> $2y - 7$ <p>← constant</p> <p>numerical coefficient ← variable</p> </div> <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> pp. 392-394: #1-12, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> Ask students to explain expressions and equations in words. Ask students to give three examples of algebraic equations and three examples of algebraic expressions. Ask them what it is about the expressions that make them algebraic. Ask students to explain what it is that makes the examples they created equations or expressions. Ask whether an algebraic expression or an algebraic equation can be demonstrated using a balance. Ask students to explain or demonstrate. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> Consider the following. <ul style="list-style-type: none"> Use cups and counters to model three times a number plus four equals ten. Write the phrase as an expression or equation. Identify each part of the expression or equation. Show $4p + 2$ using algebra tiles or pictures. Consider the following. <ul style="list-style-type: none"> Use algebra tiles to model $2x - 3 = 5$. What are the two expressions that make up this equation? Below are three expressions and/or equations in algebraic form: $4p - 5 = m \quad 4p - 5 = 55 \quad 4p - 5$ <p>The three expressions and/or equations have some similarities and some differences. List ways in which they are similar and ways in which they differ. Find some possible values for the variables in the three situations. Which are equations and which are expressions. Explain why.</p> Explain how to find the value of f in the equation $154 + 2f = 340$ by using systematic trial. Find the value of p in the following equations using systematic trial: <ul style="list-style-type: none"> $5p + 8 = 63$ $6p - 9 = 81$ <p>How many solutions does each equation have? Justify your answer.</p> Write an expression that is as simple as possible for the perimeter of the following figure: <div style="text-align: center;">  </div> |

Section 11.2 – Solve One-Step Equations: $x + a = b$ (pp. 395-401)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • PR3 (A B) • PR6 (A B C D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • model problems with equations • solve equations and record the process • verify solutions to equations <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • opposite operation – an operation that “undoes” another operation; subtraction and addition are opposite operations; multiplication and division are opposite operations <p>Literacy Links:</p> <ul style="list-style-type: none"> • Solving by Inspection – To solve by inspection means to use mental math. • Inverse Operations – You may sometimes hear opposite operations called “inverse operations.” <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 398-401: #1-18, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Make sure that students have a clear understanding of the importance of balancing an equation. Have students use balance scales to illustrate an equality and then connect the concrete to the pictorial and symbolic representations. • Build understanding of equality by first using number sentences and exploring what happens when something is changed on one side and what has to be done to compensate for the change in order to preserve equality. • Use the pictorial representation of algebra tiles on balance scales to solve equations in which the solution is an integer. • Have students work in pairs to make equations of the form $x + a = b$, where a and b are integers. Try the following criteria: <ul style="list-style-type: none"> ➢ a is negative ➢ both a and b are negative (or positive) ➢ a is positive and b is negative • Using a small envelope, place a number of counters inside. On the outside of the envelope, write a variable such as W. Make an equation such as: $\boxed{W} + 3 = 7,$ <p>where W represents the number of counters inside the envelope. Ask students to guess the number of counters in the envelope to make the equation true and then verify by checking the envelope.</p> <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Use mental math to solve each equation. <ol style="list-style-type: none"> a. $12 = m + 4$ b. $n - 5 = 11$ c. $15 - x = 9$ • Solve each equation by isolating the variable. <ol style="list-style-type: none"> a. $s + 9 = 31$ b. $p - 5 = -8$ • Explain how to find the value of x in the given equations: <ol style="list-style-type: none"> a. $x + 8 = -13$ b. $(-6) - x = 81$ c. $154 + x = 340$ d. $x + 4 = 9$ e. $x - 3 = 8$ |

Section 11.3 – Solve One-Step Equations: $ax = b$, $\frac{x}{a} = b$ (pp. 395-401)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • PR3 (A B) • PR7 (A B C D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • model problems with equations • solve equations and record the process <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 405-407: #1-18, 20, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Have students explain how they know which operations to apply to the left and to the right of an equation to solve it. • Have students work with materials to model and diagram the idea of balancing and preserving equality with the use of manipulatives, such as algebra tiles and balances, with the natural progression to formulating and solving written solutions and substituting. • Have students consider in advance what might be a reasonable solution, and be aware that once they have a solution, it can be checked for accuracy by substitution into the original equation. • Pass out cards to students that have one-step equations that are shown pictorially, symbolically and concretely. Have students match up the corresponding cards. As an extension, have students create their own cards. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Use mental math to solve each equation. <ul style="list-style-type: none"> a. $6x = 36$ b. $\frac{x}{3} = 6$ • Solve the equation by applying the opposite operation. Verify your answer. <ul style="list-style-type: none"> a. $5x = 55$ b. $56 = 8t$ c. $\frac{x}{6} = 4$ d. $9 = \frac{t}{3}$ |

Section 11.4 – Solve Two-Step Equations: $ax + b = c$ (pp. 408-413)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|--|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • PR3 (A B) • PR7 (A B C D E) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • model problems with two-step equations • solve two-step equations and record the process <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 411-413: #1-19, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Ask the students the following questions. <ul style="list-style-type: none"> ➤ How do you know which operation you use to solve an equation? ➤ What order of operations should you follow when solving equations? • Provide a step-by-step pictorial representation of a solved equation. Have students provide the symbolic representation of each step. As an extension, all steps except for the answer can be provided and students will have to solve for the coefficient and represent it both symbolically and pictorially. • Use the “cover-up” method to aid in the initial understanding of the step elimination process. For example, for $4m + 4 = 20$, ask, “What amount added to 4 equals 20?” Since it is 16, ask, “Four times what number equals 16?” We determine that it is 4, therefore $x = 4$. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Solve by modelling the equation. Verify your answer. <ol style="list-style-type: none"> a. $4t + 5 = 29$ b. $5t + 10 = 20$ • Solve the equation by applying the reverse order of operations. Verify your answer. <ol style="list-style-type: none"> a. $5x + 12 = 57$ b. $55 = 8t - 9$ • Write two equations that would be equivalent to $2x + 4 = 6$. • Find the integer represented by \blacksquare for the following balance and explain each step in finding the solution: <div style="text-align: center; margin: 10px 0;">  </div> • Susan was given the equation $5j + 7 = 22$ and was asked to solve for j. She indicated that $j = 15$ but was told that her answer was incorrect. Explain what her misconception was and how you would correct her thinking to correctly solve for j. • The perimeter of a rectangular piece of material is 74 cm with dimensions $3x + 2$ and $2x$. What are actual measurements, in cm, of each side? |

CHAPTER 12
WORKING WITH DATA

SUGGESTED TIME

19 classes

Section 12.1 – Median and Mode (pp. 422-427)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | |
|---|--|--------------------|----|----|----|----|-----------------|---|---|----|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP1 (A) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • determine median and mode of a data set <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • measure of central tendency – a value that represents the centre of a set of data; can be the mean, median or mode • median – the middle number in a set of data after the data have been arranged in order; median of 2, 5, 6, 7, and 9 is 6; median of 1, 3, 6, 8, 9, and 10 is 7 • mode – the most frequently occurring number in a set of data; mode of 3, 5, 7, 7, and 9 is 7; modes of 2, 2, 4, 6, 6, 8 and 11 are 2 and 6; the data 1, 3, 4, and 5 has no mode <p>Literacy Link:</p> <ul style="list-style-type: none"> • Bimodal – When there are two modes, the data are said to be bimodal. The prefix <i>bi-</i> means two. For example, a bicycle has two wheels. <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 426-427: #1-12, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Have a group of 5 students (and then 6 students) line up in increasing order of height to help them understand and visualize the concept of median. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Find the mode and median prices of the T-shirts sold: <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td style="text-align: center;">T-shirt price (\$)</td> <td style="text-align: center;">8</td> <td style="text-align: center;">10</td> <td style="text-align: center;">15</td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">Number of sales</td> <td style="text-align: center;">3</td> <td style="text-align: center;">5</td> <td style="text-align: center;">10</td> <td style="text-align: center;">4</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • For which set of data would it be best to report the median: <ul style="list-style-type: none"> <li style="text-align: center;">{5, 7, 11, 19, 28} <li style="text-align: center;">{1, 4, 11, 24, 95} | T-shirt price (\$) | 8 | 10 | 15 | 20 | Number of sales | 3 | 5 | 10 | 4 |
| T-shirt price (\$) | 8 | 10 | 15 | 20 | | | | | | | |
| Number of sales | 3 | 5 | 10 | 4 | | | | | | | |

Section 12.2 – Mean (pp. 428-433)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP1 (A C D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • determine the mean for a set of data • solve problems by finding the mean <p>After this lesson, students should understand the following concept:</p> <ul style="list-style-type: none"> • mean – a measure of central tendency; the sum of the set of values divided by the number of values in the set; for example, the mean of 6, 8 and 4 is $\frac{6+8+4}{3} = 6$ <p>Literacy Link:</p> <ul style="list-style-type: none"> • Average – You often see the word <i>average</i> used instead of the word <i>mean</i>. <p>Suggested Problems in MathLinks 7:</p> <ul style="list-style-type: none"> • pp. 431-433: #1-14, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Use linking cubes to represent a small set of data values to help students see the mean. For example, with the data set {3, 5, 7}, have students build cube towers so it can be easily seen that if they take 2 cubes off the 7 story tower and put it on the 3 story tower that all three buildings are now all the same size. This will lead to the idea of manipulating the numbers themselves to make them the same. For large sets of data, a calculator should be used. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Calculate the mean of the following set of data: 400, 520, 300, 350, 470 • Suppose the mean of a set of test scores is 85. One of the grades is erased from the report card, and the other four are 90, 95, 85 and 100. <ol style="list-style-type: none"> What do you know about the grade that is missing? Explain a plan that you could use to find the missing grade from the information that is available. Why do you think the grade was missing? • When Mr. Brown gave a science test, he found the following: <ul style="list-style-type: none"> ○ The mean for the test was 72%. ○ The mode for the test was 65%. ○ The median of the test was 65%. <p>When he gave back the test, it was determined that his answer key was wrong, and all of the students had a certain question correct which was valued at 5%. He was then compelled to increase all the marks by 5%.</p> <ol style="list-style-type: none"> How did this affect the mean, median and mode? What things might be concluded about the set of test scores that would account for the mean being so much higher than the mode or the median? Create two possible sets of test scores for ten students which would fit Mr. Brown's new mean, median and mode. |

Section 12.3 – Range and Outliers (pp. 434-439)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES | | | | | | | | | | | | | | |
|--|---|---|---|---|----|----|---|---|---|---|---|---|---|----|----|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP1 (B) • SP2 (A B C D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • determine the range for data sets • identify outliers in data sets <p>After this lesson, students should understand the following concepts:</p> <ul style="list-style-type: none"> • range – the positive difference between the largest and smallest values in a data set • outlier – a value that is much smaller or larger than other data values; a data set may have one or more outliers or no outliers <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 437-439: #1-12, 16, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Ensure that students understand that range refers to the highest and lowest values in a data set. If they were talking about the range of their friends, they might refer to having friends between 5 years old and 85 years old, depending on their social group. This would be a range of 80 years. Encourage students to use a personal example to show range. • Use activities where the outlier is an obvious error to illustrate situations where the outlier would not be used in calculating the averages. If the outlier is not an error it should still be used in calculations but students should recognize that the median is a better measure of central tendency. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • The following data set shows the number of birds at a feeder from Monday to Sunday. What is the range? <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>M</th> <th>T</th> <th>W</th> <th>T</th> <th>F</th> <th>S</th> <th>S</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>4</td> <td>6</td> <td>9</td> <td>2</td> <td>11</td> <td>13</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Identify the outlier(s) in this data set: 24, 30, 26, 54, 28, 19 | M | T | W | T | F | S | S | 3 | 4 | 6 | 9 | 2 | 11 | 13 |
| M | T | W | T | F | S | S | | | | | | | | | |
| 3 | 4 | 6 | 9 | 2 | 11 | 13 | | | | | | | | | |

Section 12.4 – The Effects of Outliers (pp. 440-445)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|---|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP2 (A B C D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • explain the effects of outliers on measures of central tendency • justify whether outliers should be included when determining measures of central tendency <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 444-445: #1-7, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Have students calculate the mean, median and mode for a data set with and without an outlier to see the effect of outliers (by changing just the lowest or highest value to an outlier). They should see that the median is unaffected but the mean gets either much higher or lower. The mode will usually remain unchanged unless the number changed was the mode. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Given the test marks for a student: 89%, 92%, 56%, 90%, 85% <ul style="list-style-type: none"> a. What is the range? b. What are the median and the mean? c. Identify any possible outlier(s). Should the outliers be removed from the data set? Explain why or why not. • Chris received the following test scores at mid-year: 80, 96, 84, 90, 84, 60. <ul style="list-style-type: none"> a. If Chris had a choice of using the mean or the median for his report card, which do you think he would prefer? Why? b. Clearly, one of the scores is quite different from the others. Do you think one low mark has a greater effect on the mean or the median? Why? |

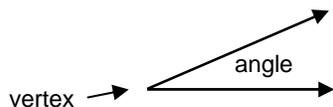
Section 12.5 – Choosing the Best Measure of Central Tendency (pp. 446-451)

| ELABORATIONS & SUGGESTED PROBLEMS | POSSIBLE INSTRUCTIONAL & ASSESSMENT STRATEGIES |
|---|--|
| <p>Specific Curriculum Outcome(s) and Achievement Indicator(s) addressed:</p> <ul style="list-style-type: none"> • SP1 (C D) <p>After this lesson, students will be expected to:</p> <ul style="list-style-type: none"> • determine when to use the mean, median or mode to best describe a set of data • solve problems using mean, median and mode <p>Suggested Problems in <i>MathLinks 7</i>:</p> <ul style="list-style-type: none"> • pp. 449-451: #1-10, Math Link | <p>Possible Instructional Strategies:</p> <ul style="list-style-type: none"> • Make sure that students consider any possible outliers when determining when to use mean, median or mode. <p>Possible Assessment Strategies:</p> <ul style="list-style-type: none"> • Which of mean, median and mode would be most helpful to know in each situation. Justify your choice. <ul style="list-style-type: none"> a. You are ordering bowling shoes for a bowling alley. b. You want to know if you read more or fewer books per month than most people in the class. c. You want to know the “average” amount spent per week on junk food in your class. |

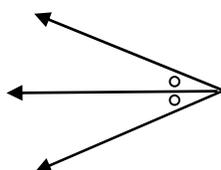
GLOSSARY OF MATHEMATICAL TERMS

A

- **angle** – the figure formed by two lines with a common endpoint called the vertex



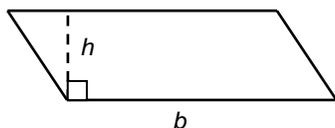
- **angle bisector** – the line that divides an angle into two equal parts; equal angles are marked with the same symbol



- **area** – the number of square units contained in a two-dimensional region

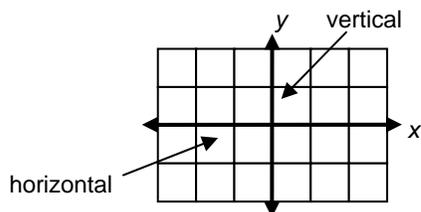
B

- **base (2-D geometry)** – a side of a two-dimensional closed figure; common symbol is b

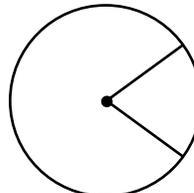


C

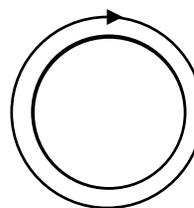
- **Cartesian plane** – the plane formed when a horizontal and a vertical number line cross; also called a coordinate grid



- **central angle** – an angle formed by two radii of a circle; the vertex of the angle is at the centre of the circle



- **circle** – a set of points that are all the same distance from a fixed point called the centre
- **circle graph** – a graph that represents data using sections of a circle
- **circumference** – the distance around a circle; usually represented by the variable C ; this is a linear measurement

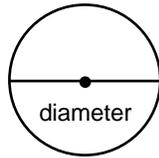


- **common denominator** – a common multiple of the denominators of a set of fractions; a common denominator for $\frac{1}{4}$ and $\frac{1}{6}$ is 12 because a common multiple of 4 and 6 is 12
- **common factor** – a number that two or more numbers are divisible by; 4 is a common factor of 8 and 12
- **constant** – a number that does not change; increases or decreases the value of an expression no matter what the value of the variable; in $2x + 4$, the number 4 is the constant
- **coordinates** – the values in an ordered pair (x, y)

D

- **denominator** – the number of equal parts in the whole or the group; $\frac{3}{4}$ has denominator 4

- **diameter** – distance across a circle through its centre; usually represented by the variable d



- **divisible** – when a number can be divided by another number evenly, with no remainder

E

- **equally likely** – each outcome has the same chance of occurring
- **equation** – a mathematical statement with two expressions that have the same value; $x + 2 = 3$, $y - 7 = -4$, $3a - 2 = a + 2$ and $b = 4$ are examples of equations
- **equivalent fractions** – fractions that represent the same part of a whole or group; $\frac{1}{3}$ and $\frac{2}{6}$ are equivalent fractions
- **estimate** – to approximate an answer
- **experimental probability** – the probability of an event occurring based on experimental results
- **exponent** – the number of factors you multiply; in the expression 5^2 , the number 2 is called an exponent
- **expression** – any single number or variable, or a combination of operations (+, -, ×, ÷) involving numbers and variables; for example, 5, r , $8t$, $x + 9$, $2y - 7$

F

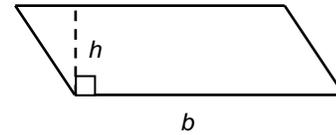
- **factors** – numbers that are multiplied to produce a product
- **favourable outcome** – a successful result in a probability experiment
- **fraction** – a number that represents a part of a whole or a part of a group
- **frequency table** – a table used to show the number of occurrences in an experiment or survey

G

- **graph** – a visual way to show how two sets of numbers relate to each other

H

- **height** – the perpendicular distance from the base to the opposite side; common symbol is h

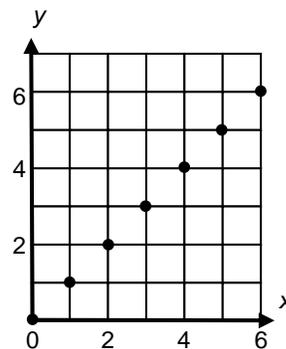


I

- **improper fraction** – a fraction that has a numerator greater than the denominator, such as $\frac{9}{8}$
- **independent events** – a result in which the outcome of one event has no effect on the outcome of another event
- **integer** – any of the numbers ..., -3, -2, -1, 0, +1, +2, +3, ...

L

- **line** – a straight set of points that contains no endpoints
- **line segment** – the part of a line between two endpoints
- **linear relation** – a pattern made by two sets of numbers that results in points along a straight line on a coordinate grid



- **lowest terms** – a fraction is in lowest terms when the numerator and denominator of the fraction have no common factors other than 1

M

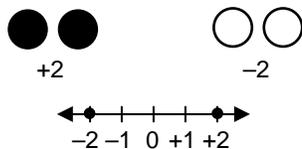
- **mean** – a measure of central tendency; the sum of the set of values divided by the number of values in the set; for example, the mean of 6, 8 and 4 is $\frac{6+8+4}{3} = 6$
- **measure of central tendency** – a value that represents the centre of a set of data; can be the mean, median or mode
- **median** – the middle number in a set of data after the data have been arranged in order; median of 2, 5, 6, 7, and 9 is 6; median of 1, 3, 6, 8, 9, and 10 is 7
- **mixed number** – a number made up of a whole number and a fraction, such as $2\frac{1}{3}$
- **mode** – the most frequently occurring number in a set of data; mode of 3, 5, 7, 7, and 9 is 7; modes of 2, 2, 4, 6, 6, 8 and 11 are 2 and 6; the data 1, 3, 4, and 5 has no mode
- **multiple** – the product of a given number and a natural number like 1, 2, 3, and so on; for example, some multiples of 3 are 3, 6, 9, 12 and 15

N

- **natural number** – any of the numbers 1, 2, 3, ...
- **numerator** – the number of equal parts being considered in the whole or the group; $\frac{3}{4}$ has numerator 3
- **numerical coefficient** – a number that multiplies the variable; in $2x + 4$, the number 2 is the numerical coefficient of x

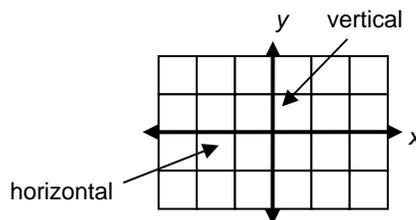
O

- **opposite integers** – two integers with the same numeral, but different signs, for example +2 and -2; two integers represented by points that are the same distance in opposite directions from zero on the number line



- **opposite operation** – an operation that “undoes” another operation; subtraction and addition are opposite operations; multiplication and division are opposite operations

- **order of operations** – correct sequence of steps for a calculation:
 - brackets first
 - multiply and divide in order from left to right
 - add and subtract in order from left to right
- **ordered pair** – a pair of numbers used to locate a point on a coordinate grid



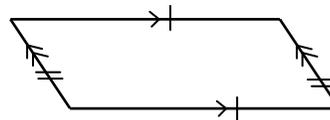
- **origin** – the point where the x-axis and the y-axis cross
- **outcome** – one possible result of a probability experiment
- **outlier** – a value that is much smaller or larger than other data values; a data set may have one or more outliers or no outliers
- **overestimate** – estimate that is larger than the actual answer

P

- **parallel** – describes lines in the same plane that never cross, or intersect; they are marked using “arrows”

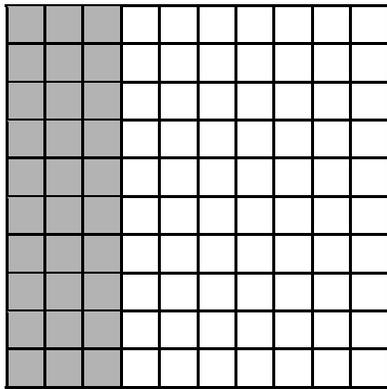


- **parallelogram** – a four-sided figure with opposite sides parallel and equal in length

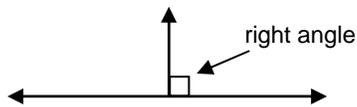


- **pattern** – an arrangement of shapes, colours, numbers, letters, words, and so on, for which you can predict what comes next

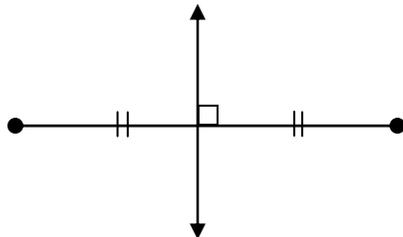
- **percent** – means “out of 100”; 30% means 30 out of 100 or $\frac{30}{100}$ or 0.30



- **perimeter** – the distance around the outside of a two-dimensional shape or figure
- **perpendicular** – describes lines that intersect at right angles (90°); they are marked using a small square



- **perpendicular bisector** – a line that divides a line segment in half and is at right angles to it; equal line segments are marked with “hash” marks



- **pi** – the ratio of the circumference of a circle to its diameter, $\frac{C}{d}$; the symbol for pi is π
- **probability** – the likelihood or chance of an event occurring; can be expressed as a ratio, fraction or percent:

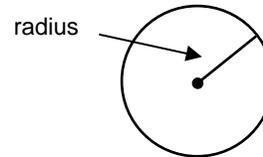
$$\text{Probability} = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$
- **proper fraction** – a fraction that has a numerator less than its denominator, such as $\frac{2}{9}$

Q

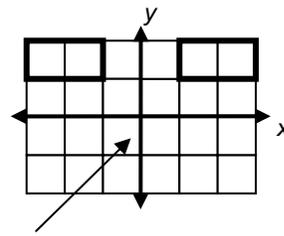
- **quadrants** – the four regions on the coordinate grid

R

- **radius** – distance from the centre of the circle to the outside edge; usually represented by the variable r

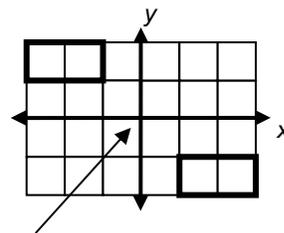


- **random** – an event in which every outcome has an equal chance of occurring
- **range** – the positive difference between the largest and smallest values in a data set
- **reflection** – a flip over a mirror line; a mirror line is called a line of reflection



line of reflection

- **relationship** – a pattern formed by two sets of numbers
- **repeating decimal** – a decimal with a digit or group of digits that repeats forever; repeating digits are shown with a bar, e.g., $0.777\dots = 0.\overline{7}$
- **rotation** – a turn about a fixed point called the centre of rotation

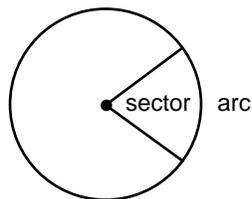


centre of rotation

S

- **sample space** – all possible outcomes of an experiment

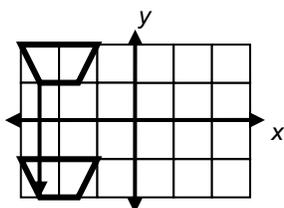
- **sector** – section of a circle formed by two radii and the arc of a circle connecting the radii



- **semi-circle** – half of a circle

T

- **table of values** – a table showing two sets of related numbers
- **tally chart** – a table used to record experimental results or data; tally marks are used to count the data
- **terminating decimal** – a decimal number in which the digits stop; examples include 0.4, 0.86, 0.125
- **theoretical probability** – the expected probability of an event occurring
- **transformation** – moves a geometric figure onto another; examples are translations, reflections and rotations
- **translation** – a slide along a straight line



- **tree diagram** – a diagram used to organize outcomes; contains a branch for each possible outcome of an event

U

- **underestimate** – estimate that is smaller than the actual answer

- **unit fraction** – a fraction with a numerator of 1; $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$, etc.

V

- **value** – a known or calculated amount
- **variable** – a letter that represents an unknown number; for example, x, A, n
- **vertex** – a point where two sides of a polygon meet; plural is vertices



W

- **whole number** – any of the numbers 0, 1, 2, 3, ...

X

- **x-axis** – the horizontal number line on the coordinate grid
- **x-coordinate** – the first number in the ordered pair describing a point on a coordinate grid; the x-coordinate of point $P(2,5)$ is 2

Y

- **y-axis** – the vertical number line on the coordinate grid
- **y-coordinate** – the second number in the ordered pair describing a point on a coordinate grid; the y-coordinate of point $P(2,5)$ is 5

Z

- **zero pair** – a pair of integer chips, with one chip representing +1 and one chip representing -1; the pair represents zero because $(+1) + (-1) = 0$



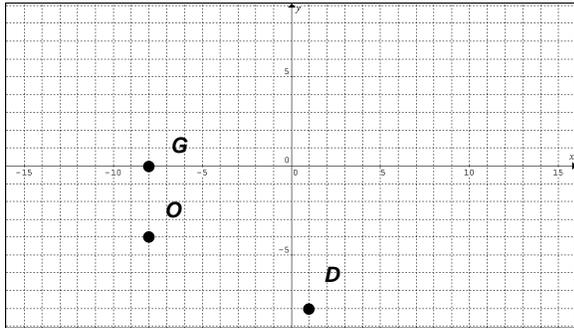


SOLUTIONS TO POSSIBLE ASSESSMENT STRATEGIES

SECTION 1.1

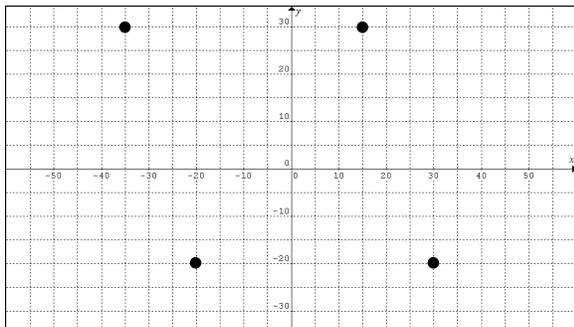
- $A(2,0)$; $B(-1,2)$

•



- Answers may vary. One possible solution is:
 $(-1,-4)$, $(-2,-5)$, $(-3,-6)$
Please note that a second set of solutions exists with all coordinates reversed.

•



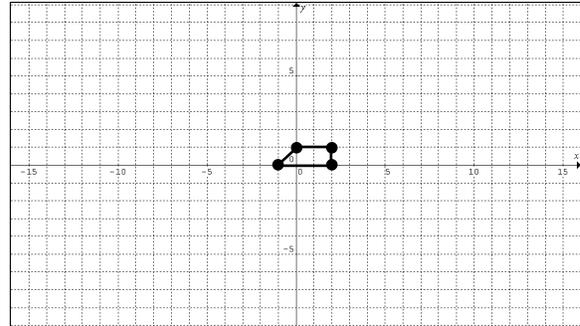
A large enough scale factor is required so that the coordinate grid is not too large.

SECTION 1.2

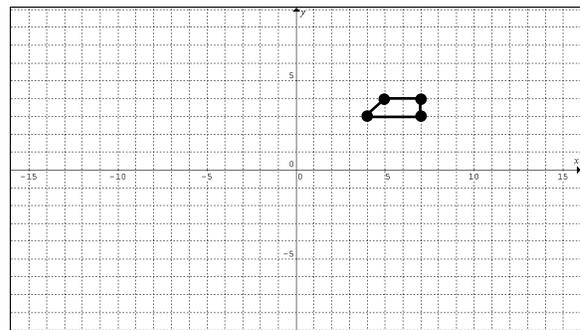
- The points lie on a straight line passing through the origin and going through Quadrants II and IV. We might have expected this pattern because ordered pairs in those quadrants have coordinates which have opposite signs.
- $(1,-2)$

SECTION 1.3

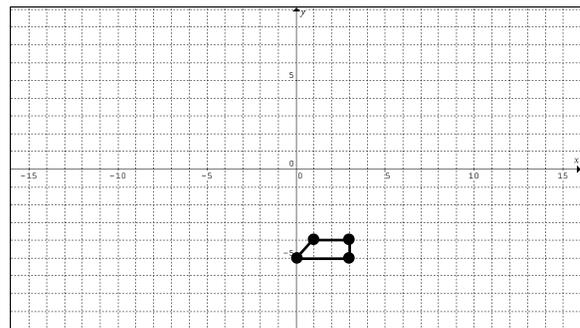
- a.



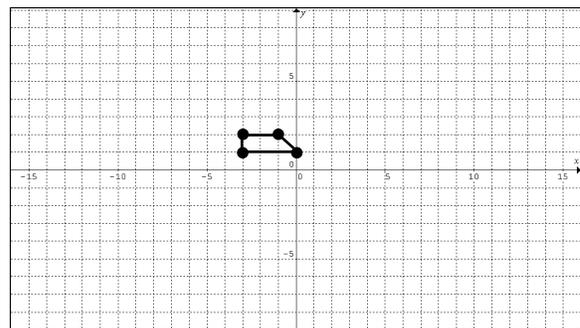
- b.



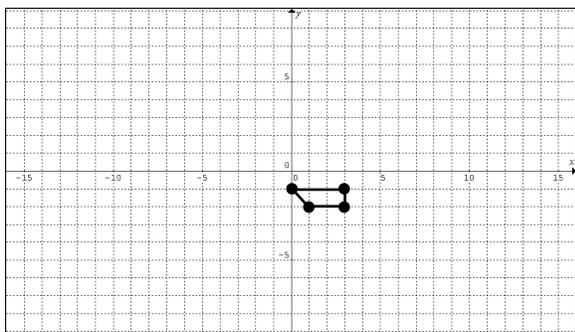
- c.



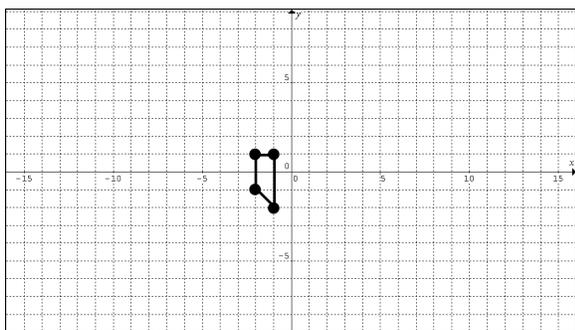
- d.



e.



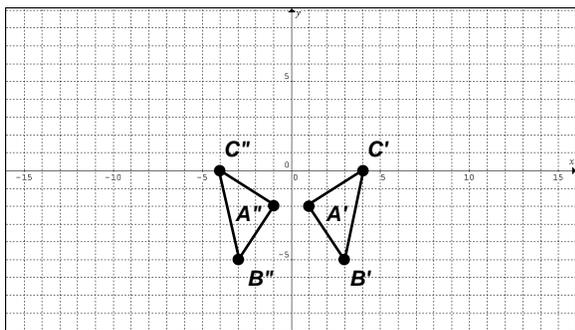
f.



- $P'(3,5)$; $Q'(-3,-6)$; $R'(2,-4)$
 $P(3,5)$; $Q(-3,-6)$; $R(2,-4)$

SECTION 1.4

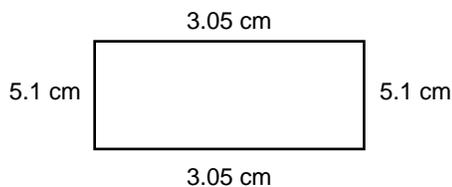
- d. All x -coordinates have been increased by 3 and all y -coordinates have been increased by 2.
- e. All x -coordinates will be decreased by 3 and all y -coordinates will be decreased by 3.
- 5
- a-b.



- c. The transformation of $\triangle A'B'C'$ is congruent to $\triangle A''B''C''$ since the triangles have the same size and shape. However, the orientation has changed, as the transformed triangle is been rotated 180° from the original triangle.

SECTION 2.1

- a. $579.6 - 288.5 = 291.10$
- b. $6.791 + 3.45 + 5.126 = 15.367$
- a. 14.283
- b. 0.97
- Answers may vary. One possible solution is \$110, by rounding both amounts to the nearest \$10, and then subtracting. (Calculated \$115.48)
- \$40 (Calculated \$52.70)
- Answers may vary. One possible solution is 21,000, by rounding all numbers to the nearest thousand, and then adding.
- a. exact answer – the tax is required by the government
- b. exact answer – the total of the bill is precisely what you pay
- c. estimate – a tip is not set at a fixed amount, although many people give approximately 15%
- d. exact answer – the term *accuracy* indicates that John is looking for an exact answer
- Since $\$43 + \$47 = 100$ and $\$0.52 + \$0.48 = \$1$, $\$43.52 + \$57.48 = \$100 + \$1 = \$101$. Adding that to \$24.31, we get a sum of \$125.31.
- Answers may vary. One possible solution is:



SECTION 2.2

- a. $4.9 \times 5.9 = 28.910$
- b. $2.58 \times 0.47 = 1.2126$
- a. 151.2
- b. 243
- Answers may vary. Possible solutions are:
 - a. Estimating the area of the rectangular plot by rounding both numbers to the nearest ten and multiplying, getting an estimate of 250 m^2 . (Calculated 227.976 m^2)
 - b. Estimating the price of the beef by rounding both numbers to the nearest whole number and multiplying, getting an estimate of \$50. (Calculated \$44.52)
- Answers may vary. Possible solutions are:
 - a. Multiplying 24.6 by 100 and dividing by 5, giving a product of 492.

b. Multiplying 144 by 10 and dividing by 2, giving a product of 720.

- Answers may vary. The number 1.25 may be thought of as \$1.25 or a loonie and a quarter. Multiplying by 3 gives us three loonies and three quarters, or \$3.75.

$$\begin{array}{r} 5.43 \\ \times \quad 6 \\ \hline 32.58 \end{array}$$

- Jade is confusing the common rule for placing the decimal in the multiplication of two decimal numbers. She is counting the number of digits before the decimal point in each factor to determine the placement of the decimal in the product rather than correctly counting the number of digits after the decimal point in each factor.
- Answers may vary. One possible solution is $0.6 \times 0.8 = 0.48$.

SECTION 2.3

- a. $20.194 \div 4.6 = 4.39$
- b. $3.5 \div 0.25 = 14.00$
- Answers may vary. One possible solution is considering the problem as $81 \div 9$, which would give an estimate of 9 for an answer.
- This division problem could be solved by asking how many dimes are there in \$2.40.
- Both division problems give an answer of 21 because each number in the second problem is found by multiplying its counterpart in the first problem by ten.
- If we multiply each pair of numbers in each problem by 10, the problems become $88 \div 2$ and $11 \div 3$. The problem $88 \div 2$ is easier to calculate than $11 \div 3$ because 2 is a factor of 88, so it divides evenly, but 3 is not a factor of 11.
- The diagram shows that the number of equal parts of length 0.3 units in a total length of 1.8 units is six. Therefore $1.8 \div 0.3 = 6$.

SECTION 2.4

- a. $5 \times 8.95 + 20 \times 2.95 + 2 \times 9.95 = 123.65$
The total cost was \$126.35.
- b. $3 \times (34.95 + 48.95) - 75.00 = 176.70$
Jim's profit was \$176.70.
- a. $(4 + 6) \times 8 - 3 = 77$
- b. $26 - 4 \times (4 - 2) = 18$

- $4 \times 7 - 3 \times 6 = 10$; $4 \times (7 - 3) \times 6 = 96$

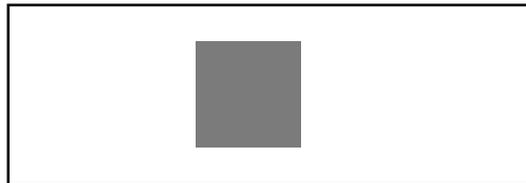
In order to get a consistent response when simplifying expressions, it is necessary to have an agreed-upon rule regarding the order of operations.

SECTION 3.1

- a. The wall and ceiling are perpendicular because the angle formed is 90° .
- b. The top and bottom edges of the board are parallel because they never meet and the distance between them is constant.
- a.



b.



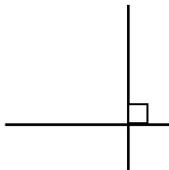
- a. Using the right triangle against the wall with the base on the floor, she can draw points on the wall at the tip of the triangle at regularly spaced intervals. Since all of these points will be at an equal distance from the floor, the line drawn through them will be parallel to the floor.
- b. The ruler can be used to measure a fixed distance from the floor. At regularly spaced intervals, she can draw points. Since all of these points will be at an equal distance from the floor, the line drawn through them will be parallel to the floor.
- c. The protractor can be used to determine how to draw a line that would be perpendicular, or 90° , to the floor. Use the straightedge draw perpendicular line segments with equal lengths at regularly spaced intervals. If the endpoints of these line segments are connected, the line drawn will be parallel to the floor.

- d. The compass can be used to determine the perpendicular bisector of the line segment formed by the floor. Drawing a number of perpendicular bisectors at regular intervals with the same radius on the compass will create a number of perpendicular line segments to the floor that all have the same length. Connecting the endpoints of these line segments will create a line parallel to the floor.

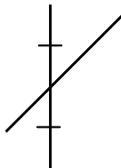
SECTION 3.2

- 8 cm
- 4.5 cm
- Answers may vary. Possible solutions are given below.

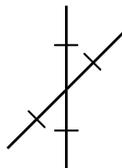
a.



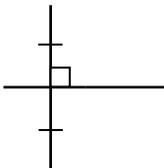
b.



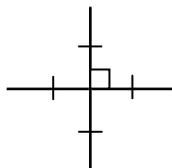
c.



d.

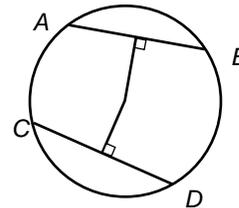


e.



- segment bisectors – A, E, F, H, T, X
- perpendicular segments – E, F, H, L, T, X
- perpendicular bisectors – E, F, H, T, X

Note: Depending on how the letter l is written, it could fit in all three categories. (I)



SECTION 3.3

- 60°
- 67°
- a. $a = 21^\circ, b = 42^\circ$
- b. $a = 90^\circ, b = 17^\circ$

SECTION 3.4

- a. 16
- b. 24
- a. 5 cm
- b. 8 cm
- Answers may vary. Any parallelogram such that the product of its base and height is 24 will work.

SECTION 3.5

- a. 14
- b. 12
- a. 37.5 cm^2
- b. 180 m^2
- Answers may vary. Any triangle such that the product of its base and height is 4 will work.

SECTION 4.1

- a. \$12.40
- b. \$15
- c. \$13.6
- a. 28
- b. 98
- c. 36
- d. 68.2
- a. 22%, 0.24, $\frac{1}{4}$

b. $0.59, 60\%, \frac{62}{100}$

c. $\frac{3}{7}, 0.45, \frac{5}{9}, 0.93, \frac{13}{12}, 1\frac{1}{3}, 1\frac{4}{9}$

- a. 4 or 5
- b. 0, 1 or 2
- a. 2.3
- b. 23
- The number is less than 40. (Calculated 37.5)

SECTION 4.2

- a. 0.88
- b. 0.565
- a. $0.\overline{2}$
- b. $0.0\overline{37}$
- Answers may vary. Possible answers are:
 - a. 40% (Calculated 38.9%)
 - b. 80% (Calculated 82.5%)
- a. $\frac{651}{1000}$
- b. $\frac{23}{25}$
- Chris' conclusion was incorrect because his calculator rounded the answer, $2.\overline{73}$, to eight places after the decimal.
- 0.500

SECTION 4.3

- Yes – he has 76% capacity.
- \$48.75, \$167.30, \$23.99, \$8.80
- \$80

SECTION 5.1

- a. $\frac{3}{8}$
- b. $\frac{1}{2}$
- a. 1 – The sun sets every day.
- b. $\frac{1}{2}$ – Every child has a 50% probability of being born a boy or a girl.
- c. 0 – While it sometimes has snowed in June, this is a very rare occurrence,
- a. $\frac{1}{6}$

b. $\frac{1}{2}$

c. $\frac{2}{3}$

- a. $\frac{1}{4}$
- b. $\frac{1}{3}$
- Answers may vary. Some possible solutions are:
 - a. Rolling a 9
 - b. Rolling a multiple of 4
 - c. Rolling a number less than 5
 - d. Rolling a number greater than 2
 - e. Rolling a number less than 9

SECTION 5.2

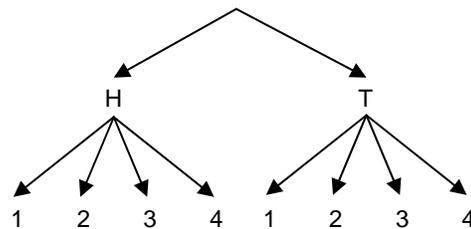
- a.

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| H | H,1 | H,2 | H,3 | H,4 | H,5 | H,6 |
| T | T,1 | T,2 | T,3 | T,4 | T,5 | T,6 |

b. 12

c. $\left\{ \begin{array}{l} (H,1), (H,2), (H,3), (H,4), (H,5), (H,6) \\ (T,1), (T,2), (T,3), (T,4), (T,5), (T,6) \end{array} \right\}$

-

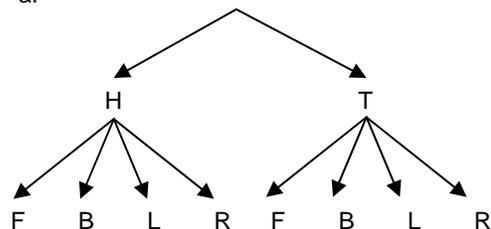


$\left\{ \begin{array}{l} (H,1), (H,2), (H,3), (H,4) \\ (T,1), (T,2), (T,3), (T,4) \end{array} \right\}$

- 1 point

SECTION 5.3

- a.



b. $\frac{1}{8}$

- a.

| | 1 | 2 | 3 |
|---|-----|-----|-----|
| H | H,1 | H,2 | H,3 |
| T | T,1 | T,2 | T,3 |

b. $\frac{1}{3}$

c. $\frac{2}{3}$

- a. The events are independent, since the result on one die is not affected by the other die.

b.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|-----|-----|-----|-----|-----|-----|
| 1 | 1,1 | 1,2 | 1,3 | 1,4 | 1,5 | 1,6 |
| 2 | 2,1 | 2,2 | 2,3 | 2,4 | 2,5 | 2,6 |
| 3 | 3,1 | 3,2 | 3,3 | 3,4 | 3,5 | 3,6 |
| 4 | 4,1 | 4,2 | 4,3 | 4,4 | 4,5 | 4,6 |
| 5 | 5,1 | 5,2 | 5,3 | 5,4 | 5,5 | 5,6 |
| 6 | 6,1 | 6,2 | 6,3 | 6,4 | 6,5 | 6,6 |

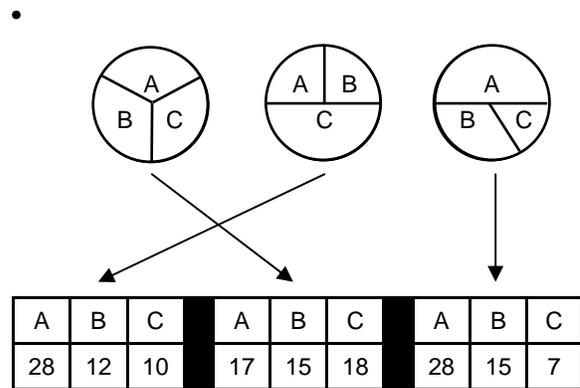
c. $\frac{1}{9}$

SECTION 5.4

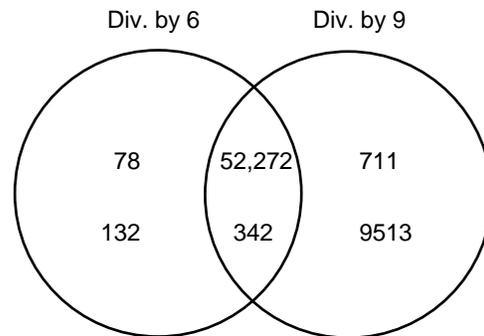
- $\frac{1}{27}$
- $\frac{1}{4}$ – We get this answer by constructing a tree diagram with two options for each question: C for a correct answer and W for a wrong answer. Of the 16 possibilities, 4 have exactly 3 correct and 1 incorrect answer.

SECTION 5.5

- a. Answers may vary.
- b. $\frac{1}{16}$
- Answers may vary. One possible solution is to represent the birth of a child by a coin flip, since the probability of each outcome in both cases is $\frac{1}{2}$. Then a family of four could be modeled by flipping a coin four times.



SECTION 6.1



- 10
- a. $\frac{2}{3}$
- b. $\frac{5}{8}$
- Any multiple of twenty from 100 to 980 will work. The numbers in the list 120, 160, 200, ..., 960 are divisible by 2 and 8.
- 12 bags
- a. 2 or 8
- b. 1, 4 or 7
- c. 6
- d. 2 or 6

SECTION 6.2

- a. 1
- b. $\frac{1}{6}$
- a. $\frac{4}{5}$
- b. $\frac{4}{5}$

- a. $\frac{4}{7}$
- b. $\frac{2}{5}$

SECTION 6.3

- a. $\frac{1}{6}$
- b. $\frac{3}{4}$
- a. $\frac{3}{7}$
- b. $\frac{2}{3}$
- a. $\frac{6}{11}$
- b. $\frac{1}{3}$

SECTION 7.1

- a. any multiple of 6
- b. any multiple of 20
- a. Yes, because 6 is a factor of the common multiples of 3 and 4.
- b. No, because 7 is not a factor of the common multiples of 3 and 4.
- a. $\frac{3}{8}$
- b. $\frac{7}{10}$
- c. $\frac{4}{5}$
- All possible solution pairs are 1 and 24, 2 and 24, 3 and 8, 3 and 24, 4 and 24, 6 and 24, 8 and 24, and 12 and 24.

SECTION 7.2

- a. $\frac{5}{6}$
- b. $\frac{9}{20}$
- a. $\frac{1}{6}$
- b. $\frac{1}{20}$

- Answers may vary as there are an infinite number of solutions. One possible solution is $\frac{1}{4} + \frac{3}{8}$.
- Since $\frac{2}{3}$ is greater than $\frac{1}{2}$, the sum of $\frac{2}{3}$ and $\frac{1}{2}$ must be greater than 1, so she needs to go to the supermarket to get more brown sugar.
- a. Less than 1 – The fraction $\frac{3}{4}$ is equivalent to $\frac{6}{8}$, therefore the sum of $\frac{3}{4}$ and $\frac{1}{8}$ must be less than 1.
- b. Greater than 1 – In order for $\frac{7}{8}$ to become 1, it needs another $\frac{1}{8}$. However, since the denominator of $\frac{1}{5}$ is smaller than the denominator of $\frac{1}{8}$, $\frac{1}{5}$ is larger than $\frac{1}{8}$. Therefore the sum of $\frac{7}{8}$ and $\frac{1}{5}$ is greater than 1.

SECTION 7.3

- a. 4
- b. $7\frac{2}{5}$
- c. $3\frac{3}{4}$
- d. $7\frac{7}{15}$
- Answers may vary.
- a. It can be easily shown that the answer is not reasonable because the sum of $\frac{3}{4}$ and $\frac{7}{8}$ must be greater than one, since each fraction is greater than $\frac{1}{2}$. As a result, the sum must be greater than 8, since $3 + 4 = 7$ and the sum of the fractions is greater than one.
- b. This answer is not reasonable because of the fact that $\frac{3}{4}$ is less than one. This would mean that, at the most, the sum would be 1 more than $3\frac{5}{6}$, or $4\frac{5}{6}$, which is not between 6 and 7.

- The sum is greater than 2, since $\frac{4}{5}$ and $\frac{7}{8}$ are each greater than $\frac{1}{2}$, giving a sum of at least one. When added to the one in the first number of the problem, we get a sum of at least 2.
- One that measures at least 4 cups.

SECTION 7.4

- a. $\frac{3}{5}$
- b. $1\frac{1}{3}$ or $\frac{4}{3}$
- c. $\frac{9}{10}$
- d. $1\frac{5}{12}$ or $\frac{17}{12}$
- Answers may vary.

SECTION 8.1

- a-b. 8 cm

SECTION 8.2

- a. Answers may vary. One possible estimate is 9 m.
- b. 9.4 m
- Answers may vary for the estimates. Calculated answers are given.
 - 20.4 m
 - 57.1 m
- 21 cm – A good estimate for the circumference of the circle is $C = 2 \cdot 3 \cdot 3.5$, which gives an estimate of 21 cm.
- Answers may vary. One possible estimate is 90 strokes. (Calculated answer is 94 strokes)
- 9.07 times

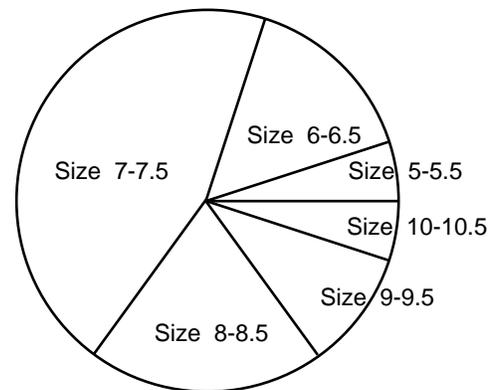
SECTION 8.3

- Answers may vary for the estimates. Calculated answers are given.
 - 452.2 cm^2
 - 1704.7 cm^2
- Answers may vary for the estimates. Calculated answers are given.
 - 490.63 cm^2
 - 18.09 cm^2
- Answers may vary for the estimates. The calculated answer is 314 cm^2 .

SECTION 8.4

- No, because the total of the percentages must equal 100%.
- a. Since the sum of the central angles of a circle graph is 360° , 90° would represent $\frac{1}{4}$ of that total, or 25%.
 - 37.5%
 - 150 blue cars, 100 red cars, 150 other cars (neither blue nor red)

SECTION 8.5



Size 5 – $5\frac{1}{2}$: 6 pairs; Size 6 – $6\frac{1}{2}$: 18 pairs;

Size 7 – $7\frac{1}{2}$: 54 pairs; Size 8 – $8\frac{1}{2}$: 24 pairs;

Size 9 – $9\frac{1}{2}$: 12 pairs; Size 10 – $10\frac{1}{2}$: 6 pairs

SECTION 9.1

- a. -8
- b. 2
- c. 5
- d. -1
- a. Using 3 white chips and 8 black chips, we can create 3 zero pairs, leaving 5 black chips, or +5.
 - Using 9 black chips and 2 white chips, we can create 2 zero pairs, leaving 7 black chips, or +7.
- The numbers +5 and -5 are at equal distances from zero, but on different sides of zero. They are called opposites because, when added, give a sum of zero.
- a. +8

- b. -7
- c. -7
- d. +110
- e. +1123

• a.



b.



c.



- Each zero pair requires two chips, a black and a white one. However, if we begin with six chips, the number of chips left over must be an even number. Since -3 is an odd number, it cannot be represented with six integer chips.
- -3
- $(-4) + (+12) + (+5) = +13$
Sandy's net worth is \$13.

SECTION 9.2

- a. -12
- b. -1
- c. 9
- d. 0
- Answers may vary. Using front-end estimation, we get an estimate of 2000. (Calculation is 2507)
- No, because the sign of the sum of a positive number and a negative number will be the same as the sign of the magnitude of the larger number without the sign.

SECTION 9.3

- a. -8
- b. -6
- c. -4
- d. 7
- a. Start with 5 white chips. We need to remove 3 black chips, so we introduce 3 zero pairs. After removing 3 black chips, we are left with 8 white chips.
- b. Start with 6 black chips. After removing 4 black chips, we are left with 2 black chips.
- c. Start with 8 black chips. We need to remove 3 white chips, so we introduce 3 zero pairs. After removing 3 white chips, we are left with 11 black chips.

- a. Start with 6 black chips and 4 white chips. After removing 4 black chips, we are left with 2 black chips and 4 white chips. Removing 2 zero pairs, we are left with 2 white chips.

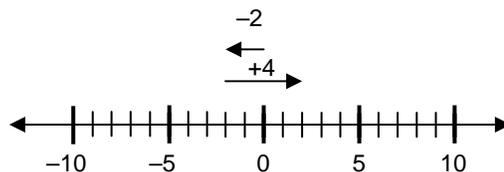
$$[6 + (-4)] - 4 = -2$$

- b. Start with 6 black chips and 4 white chips. After adding 3 black chips, we are left with 9 black chips and 4 white chips. Removing 4 zero pairs, we are left with 5 black chips.

$$[6 + (-4)] + 3 = 5$$

SECTION 9.4

- a. -3
- b. -14
- c. -6
- Answers may vary. One estimate is -1000. (Calculated value is -1152)
- Answer is +2.



•

| | | |
|----|----|-----|
| -6 | -7 | 1 |
| 3 | -4 | -11 |
| -9 | -1 | -2 |

SECTION 9.5

- \$55
- 57 kg

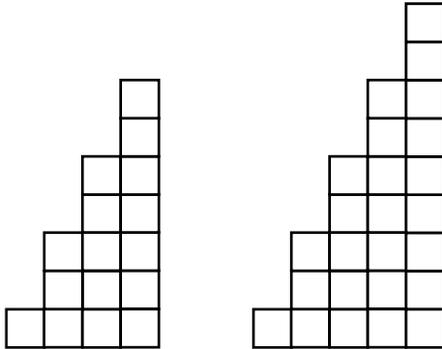
SECTION 10.1

- a. 50, 65, 82
- b. The next term is found by adding two more than was added to find the previous term.
- a. $\frac{5}{11} = 0.\overline{45}$, $\frac{9}{11} = 0.\overline{81}$
- b. $\frac{7}{11}$

c. 0.72727273

To convert a proper fraction with denominator 11 to a repeating decimal, multiply the numerator by 9. That product, written as two digits, will be the repeating part after the decimal.

d. $\frac{10}{11}$



a.

| SHAPE NUMBER | NUMBER OF CUBES |
|--------------|-----------------|
| 1 | 1 |
| 2 | 4 |
| 3 | 9 |
| 4 | 16 |
| 5 | 25 |

b. Shape 10: 100 cubes

Shape 25: 625 cubes

c. The number of cubes in each shape is equal to the shape number multiplied by itself.

SECTION 10.2

- 3 hours: \$36; 4 hours: \$48; 6 hours: \$72;
 h hours: $12h$ dollars
- a. 30
b. 36
c. 42
d. 48
- a. The lunch cost is equal to 4.25 multiplied by the number of riders.
b. $l = 4.25n$
c. \$106.25
d. 21 people

SECTION 10.3

- a. 4; 7
b. 8; 14
c. 21.8; 11

| f | $3f$ |
|-----|------|
| 1 | 3 |
| 2 | 6 |
| 3 | 9 |
| 4 | 12 |
| 5 | 15 |
| 6 | 18 |
| 7 | 21 |

b. 60 dots

- Depending on the value of b , $3b-1$ can equal different numbers. If $b=2$, then $3b-1=5$. If $b=10$, then $3b-1=29$.

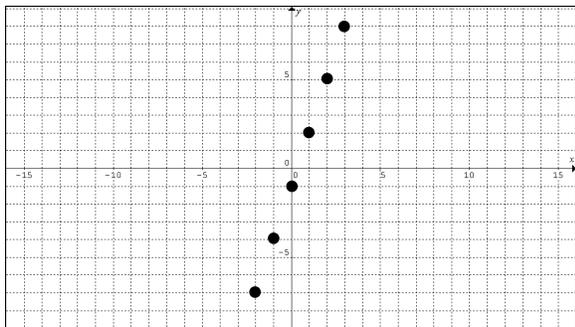
| WIDTH (m) | LENGTH ($4m+5$) |
|---------------|-------------------|
| 1 | 9 |
| 2 | 13 |
| 3 | 17 |
| 4 | 21 |
| 5 | 25 |
| 6 | 29 |
| 7 | 33 |

| x | $5x + (-4)$ |
|-----|-------------|
| 3 | 11 |
| 4 | 16 |
| 5 | 21 |
| 6 | 26 |
| 7 | 31 |
| 8 | 36 |
| 9 | 41 |
| 10 | 46 |

Answers may vary. One possible problem is:
John works part-time at a restaurant with variable hours. Each day he works is he guaranteed a least 3 hours of work, up to a maximum of 10 hours. If he earns \$5 per hour and it costs him \$4 each day to take a taxi to get to work, how much money could he earn each day?

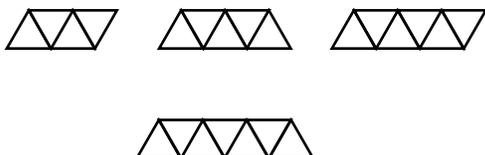
SECTION 10.4

- a. Answers may vary. Possible solutions are $(0, -1)$, $(1, 2)$ and $(2, 5)$.
- b. Yes, because $3 \cdot 8 - 1 = 23$.
- c.



d. No to both questions, because $3 \cdot 15 - 1 \neq 40$.

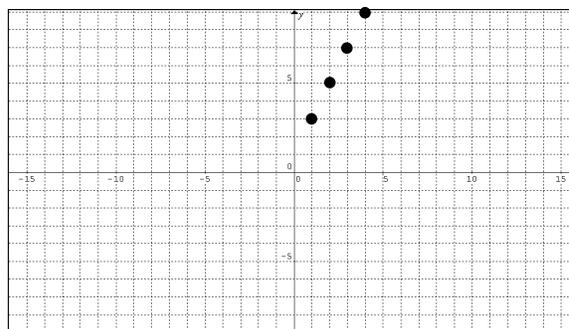
- a.



- b.

| SHAPE NUMBER | NUMBER OF SEGMENTS |
|--------------|--------------------|
| 1 | 3 |
| 2 | 5 |
| 3 | 7 |
| 4 | 9 |
| 5 | 11 |
| 6 | 13 |
| 7 | 15 |

- c. The number of segments in each shape is equal to two times the shape number plus one.
- d. Shape 10: 21 segments
Shape 20: 41 segments
- e. $s = 2n + 1$
- f.

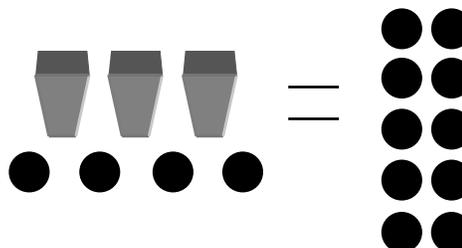


The points should not be connected because n must be a natural number, since it represents the number of triangles. The points on the graph lie on a line. As well, the graph should only be in Quadrant I because n is a natural number.

- 11°C

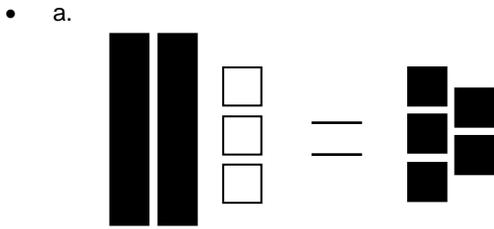
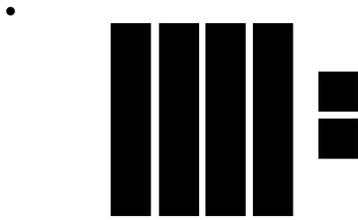
SECTION 11.1

- a.



- b. $3x + 4 = 10$

- c. The first expression is $3x + 4$ and the second expression is 10. The variable is x , the coefficient is 3 and the numbers 4 and 10 are constants.



- b. $2x - 3$ and 5

- $4p - 5 = m$ and $4p - 5 = 55$ are equations since they include an equals sign and $4p - 5$ is an expression since it does not.
- By trying different values of f in the equation, we can determine whether our answer is too high or too low by comparing the value of $154 + 2f$ with 340. By systematic trial, we find that $f = 93$.
- a. $p = 11$
- b. $p = 15$

Each equation only has one answer because they are both linear equations.

- $a + 2b + c$

SECTION 11.2

- a. $m = 8$
- b. $n = 16$
- c. $x = 6$
- a. $s = 22$
- b. $p = -3$
- a. $x = -21$
- b. $x = -87$
- c. $x = 186$
- d. $x = 5$
- e. $x = 11$

SECTION 11.3

- a. $x = 6$
- b. $x = 18$

- a. $x = 11$
- b. $t = 7$
- c. $x = 24$
- d. $t = 27$

SECTION 11.4

- a. $t = 6$
- b. $t = 2$
- a. $x = 9$
- b. $t = 8$
- Answers may vary. Two possible solutions are $2x = 2$ and $x = 1$.
- $2x + 1 = 1 - 4$
 $2x + 1 = -3$ Simplify right-hand side.
 $2x + 1 - 1 = -3 - 1$ Subtract 1 from both sides.
 $2x = -4$ Simplify both sides.
 $\frac{2x}{2} = \frac{-4}{2}$ Divide both sides by 2.
 $x = -2$ Simplify both sides.
- Susan got $j = 15$ by subtracting 7 from both sides of the equation but she forgot to divide both sides by 5. Her answer should have been $j = 3$.
- 14 cm and 23 cm

SECTION 12.1

- Mode: \$15; Median: \$15
- {1, 4, 11, 24, 95}

SECTION 12.2

- 408
- a. It must be lower than 85.
- b. If the mean of five scores is 85, then the total of the five scores must be 425. The total of the four known scores is 370, which means that the fifth score must be 55.
- c. Answers may vary. One possible solution is that the fifth score is very low.
- a. All three quantities increased by 5%.
- b. There were some test scores that were significantly higher than the others.
- c. Answers may vary. Two possible solutions are {70, 70, 91} and {70, 70, 70, 98}.

SECTION 12.3

- 11 birds
- 54

SECTION 12.4

- a. 36%
- b. Median: 89%; Mean: 82.4%
- c. The score of 56% could be an outlier – it should not be removed from the data set unless the teacher did not count all test scores in the calculation of the average.
- a. He would choose the median, because the low score of 60% would have no affect on it.
- b. It has a greater effect on the mean because all scores are included in the calculation, whereas the median value describes the

middle of the data, and is not significantly affected by the extremes.

SECTION 12.5

- a. mode – you want to know which type of bowling shoe is most frequently used
- b. median – you simply want to know if you are in the top or bottom half of the class
- c. mean – you want a calculated average which includes everyone



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