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Introduction

Background

The Nova Scotia Department of Education has made a commitment to provide a broad-based, quality education in the public school system and to expand the range of programming to better meet the needs of all students. The Department is working in collaboration with school boards and other partners in education, business, industry, the community, and government to develop a variety of new courses.

New course options draw from, and contribute to, students' knowledge and skills in more than one discipline. Students synthesize and apply knowledge and skills acquired in other courses, including English language arts, social studies, science, arts, mathematics, and technology.

New course options provide increased opportunities for senior high school students to
- earn the credits they require to attain a high school graduation diploma
- diversify their course options
- prepare for varied post-secondary destinations

Course options are designed to
- appeal to all high school students
- assist students in making connections among school, the community, and the workplace
- enable students to explore a range of career options

Rationale

For some students, the scope and sequence of other mathematics courses currently offered do not meet their needs. These courses may not be relevant to a student's life or future plans, they may not hold the interest of the student, or they may be beyond his or her skill level. The Mathematics Essentials 11 course was developed to meet the needs of these students. Often students' taking Mathematics Essentials 11 have had difficulty achieving the outcomes in mathematics throughout their junior high years and is offered as the extension of the Mathematics Essentials 10 course. What students will learn throughout the Mathematics Essentials 11 will help them in their everyday lives. For example, students will have the opportunity to learn about banking, renting and buying a house, and performing mental math techniques for everyday purchasing. The goal of this course is to better prepare students with the mathematics they will need to move into the workforce.

Mathematics Essentials 11 offers students an increased opportunity for success by providing them with more hands-on experiences, real-world applications to mathematics, and skill-building developmental activities. The course will prepare students for the workplace or for post-secondary course options that do not require a mathematics prerequisite.

The typical pathway for students who successfully complete Mathematics Essentials 11 is to go directly to the workforce upon graduation, or to post-secondary institutions upon graduation. With the completion of both Mathematics Essentials 10 and 11, students have completed their two required mathematics credits for graduation. *However, if a student has successfully completed Mathematics Essentials 11 and has demonstrated outstanding performance in relation to the learning outcomes prescribed for Mathematics Essentials 11, he/she may wish to move on to Mathematics 10 or Mathematics Foundations 10. In such a case, a student may count all credits towards graduation; however, only one mathematics course at each of the grade 10 and grade 11 level may count towards the two mathematics credits needed for graduation. The other courses may be considered electives.*

Topics

Mathematics Essentials 11 topics include the following:

- mental math
- data management
- banking
- housing
- measurement and design
- taking a trip

Curriculum Outcomes

Curriculum Outcomes Framework

The mathematics curriculum is based on a framework of outcomes statements articulating what students are expected to know, be able to do, and value as a result of their learning experiences in mathematics. This framework is made up of statements of the essential graduation learnings (EGLs), general curriculum outcomes (GCOs), key-stage curriculum outcomes (KSCOs), and specific curriculum outcomes (SCOs). Foundation for the Atlantic Canada Mathematics Curriculum (APEF 1996) articulates GCOs and KSCOs. Curriculum documents provide SCOs for each course, together with elaborations and suggestions for related instructional and assessment strategies and tasks.

Teachers and administrators are expected to refer to the curriculum outcomes framework to design learning environments and experiences that reflect the needs and interests of the students.

Essential Graduation Learnings (EGLs)

EGLs are statements describing the knowledge, skills, and attitudes expected of all students who graduate from high school. EGLs are cross-curricular in nature and comprise different areas of learning: aesthetic expression, citizenship, communication, personal development, problem solving, and technological competence.

Aesthetic Expression

Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Citizenship

Graduates will be able to assess social, cultural, economic, and environmental interdependence in a local and global context.

Communication

Graduates will be able to use the listening, viewing, speaking, reading, and writing modes of language(s) and mathematical and scientific concepts and symbols to think, learn, and communicate effectively.

Personal Development

Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Problem Solving

Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language and mathematical and scientific concepts.

Technological Competence

Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

See *Foundation for the Atlantic Canada Mathematics Curriculum*, (APEF 1996, pp. 4–6).

General Curriculum Outcomes (GCOs)

General Curriculum Outcomes are statements that identify what students are expected to know and be able to do upon completion of study in mathematics. GCOs contribute to the attainment of the EGLs and are connected to KSCOs. The seven GCOs for mathematics are organized in terms of four content strands: number concepts/number and relationship operations; patterns and relations; shape and space; and data management and probability.

Number Concepts/Number and Relationship Operations

GCO A: Students will demonstrate number sense and apply number-theory concepts.
GCO B: Students will demonstrate operation sense and apply operation principles and procedures in both numeric and algebraic situations.

Patterns and Relations

GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.

Shape and Space

GCO D: Students will demonstrate an understanding of and apply concepts and skills associated with measurement.
GCO E: Students will demonstrate spatial sense and apply geometric concepts, properties, and relationships.

Data Management and Probability

GCO F: Students will solve problems involving the collection, display, and analysis of data.
GCO G: Students will represent and solve problems involving uncertainty.

Key-Stage Curriculum Outcomes (KSCOs)

Key-Stage Curriculum Outcomes are statements that identify what students are expected to know and be able to do by the end of grades 3, 6, 9, and 12 as a result of their cumulative learning experiences in mathematics. This curriculum document lists Key-Stage Curriculum Outcomes for the end of grade 12 (beginning on p. 17). Specific Curriculum Outcomes are referenced to Key-Stage Curriculum Outcomes on these same pages.

Specific Curriculum Outcomes (SCOs)

Specific Curriculum Outcomes are statements that specifically identify what students should know and be able to do upon completion of the *Mathematics Essentials 11* course. The Specific Curriculum Outcomes are directly related to six of the seven General Curriculum Outcomes. GCO G is not covered in Mathematics Essentials 11.

In the table that follows, the Specific Curriculum Outcomes for *Mathematics Essentials 11* are listed beside the corresponding KSCOs.

GCO A: Students will demonstrate number sense and apply number-theory concepts.

Elaboration: Number sense includes understanding number meanings, developing multiple relationships among numbers, recognizing the relative magnitudes of numbers, knowing the relative effect of operating on numbers, and developing referents for measurement. Number-theory concepts include such number principles as laws (e.g., commutative and distributive), factors and primes, and number-system characteristics (e.g., density).

Key-Stage Curriculum Outcomes (KSCO)	Specific Curriculum Outcomes (SCO)
By the end of grade 12, students will have achieved the outcomes for entry–grade 9 and will also be expected to	*By the end of Mathematics Essentials 11, students will be expected to*
KSCO i: demonstrate an understanding of number meanings with respect to real numbers	A1 understand the various savings and investing alternatives commonly available
KSCO ii: order real numbers, represent them in multiple ways (including scientific notation) and apply appropriate representations to solve problems	A2 explore the concepts of risk tolerance vs. reward investing and demonstrate an understanding of how it changes during different life stages
	A3 understand the rights and responsibilities of landlords and tenants
	A4 understand how to read a map

GCO B: Students will demonstrate operation sense and apply operation principles and procedures in both numeric and algebraic situations.

Elaboration: Operation sense consists of recognizing situations in which a given operation would be useful, building awareness of models and the properties of an operation, seeing relationships among operations, and acquiring insights into the effects of an operation on a pair of numbers. Operation principles and procedures would include such items as the effect of identity elements, computational strategies, and mental mathematics.

Key-Stage Curriculum Outcomes (KSCO)	Specific Curriculum Outcomes (SCO)
By the end of grade 12, students will have achieved the outcomes for entry–grade 9 and will also be expected to	*By the end of Mathematics Essentials 11, students will be expected to*
KSCO i: explain how algebraic and arithmetic operations are related, use them in problem solving situations, and explain and demonstrate the power of mathematical symbolism	B1 know the multiplication and division facts B2 extend multiplication and division facts to products of tens, hundreds, and thousands by single-digit factors.
KSCO ii: derive, analyse, and apply computational procedures (algorithms) in situations involving all representations of real numbers	B5 mentally calculate 25%, 33 1/3%, and 66 2/3% of quantities compatible with these percents
KSCO iii: derive, analyse, and apply algebraic procedures (including those involving algebraic expressions and matrices) in problem situations	B7 calculating the cost of a loan using amortization tables B8 determine the cost of using credit, using technology B9 calculate the costs associated with renting and apartment or buying a house B10 determine the expenses related to taking a trip (i.e. gasoline, accommodations, meals, etc.) B11 determine distances using scales on a map
KSCO iv: apply estimation techniques to predict, and justify the reasonableness of, results in relevant problem situations involving real numbers	B3 estimate sums and differences B4 estimate products and quotients B6 estimate percents of quantities

GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.

Elaboration: Patterns and relationships run the gamut from number patterns and those made from concrete materials to polynomial and exponential functions. The representation of patterns and relationships will take on multiple forms, including sequences, tables, graphs, and equations, and these representations will be applied, as appropriate, in a wide variety of relevant situations.

Key-Stage Curriculum Outcomes (KSCO)	Specific Curriculum Outcomes (SCO)
By the end of grade 12, students will have achieved the outcomes for entry–grade 9 and will also be expected to	*By the end of Mathematics Essentials 11, students will be expected to*
KSCO i: model real-world problems using functions, equations, inequalities and discrete structures	C1 interpreting data from amortization tables
KSCO ii: represent functional relationships in multiple ways (e.g., written descriptions, tables, equations, and graphs) and describe connections among those representations	C2 explore the effects of parameter changes on the cost of borrowing money
	C3 determine the effects of compound interest on deposits made into savings accounts using technology
KSCO iv: solve problems involving relationships, using graphing technology as well as pencil-and-paper techniques	C4 explore the growth of savings based on a variety of investment strategies ranging in amounts and time frames using technology

GCO D: Students will demonstrate an understanding of, and apply concepts and skills associated with, measurement.

Elaboration: Concepts and skills associated with measurement include making direct measurements, using appropriate measurement units, and using formulas (e.g., surface area, Pythagorean Theorem) and/or procedures (e.g., proportions) to determine measurements indirectly.

Key-Stage Curriculum Outcomes (KSCO)	Specific Curriculum Outcomes (SCO)
By the end of grade 12, students will have achieved the outcomes for entry–grade 9 and will also be expected to	*By the end of Mathematics Essentials 11, students will be expected to*
KSCO ii: determine measurements in a wide variety of problem situations and determine specified degrees of precision, accuracy, and error of measurements	D3 estimate perimeter and area using estimation strategies D8 estimate the volume and surface area using estimation strategies
KSCO iii: apply measurement formulas and procedures in a wide variety of contexts	D1 demonstrate an understanding of the concept of perimeter and area D2 calculate perimeter and area D4 use perimeter and area to solve a variety of real world problems D5 demonstrate an understanding of volume and surface area D6 calculate surface area and volume of rectangular prisms and cylinders D7 use surface area and volume to solve real world problems D9 calculate scale factors in 2-D scale diagrams and 3-D scale models understand the relationship among the scale factor and the related change in area or volume

GCO E: Students will demonstrate spatial sense and apply geometric concepts, properties, and relationships.

Elaboration: Spatial sense is an intuitive feel for one's surroundings and the objects in them and is characterized by such geometric relationships as (i) the direction, orientation, and perspectives of objects in space, (ii) the relative shapes and sizes of figures and objects, and (iii) how a change in shape relates to a change in size. Geometric concepts, properties, and relationships are illustrated by such examples as the concept of area, the property that a square maximizes area for rectangles of a given perimeter, and the relationships among angles formed by transversal intersecting parallel lines.

Key-Stage Curriculum Outcomes (KSCO)	Specific Curriculum Outcomes (SCO)
By the end of grade 12, students will have achieved the outcomes for entry–grade 9 and will also be expected to	*By the end of Mathematics Essentials 11, students will be expected to*
KSCO iv: represent problem situations with geometric models (including the use of trigonometric ratios and coordinate geometry) and apply properties of figures	E1 understand the meaning and use of square root numbers when determining the dimensions (sides) of a square
	E2 understand and apply the Pythagorean Theorem
	E3 find the missing side measure in a right angle triangle
	E4 create 2-D scale diagrams and 3-D scale models

GCO F: Students will solve problems involving the collection, display, and analysis of data.

Elaboration: The collection, display, and analysis of data involve (i) attention to sampling procedures and issues, (ii) recording and organizing collected data, (iii) choosing and creating appropriate data displays, (iv) analysing data displays in terms of broad principles (e.g., display bias) and via statistical measures (e.g., mean), and (v) formulating and evaluating statistical argument.

Key-Stage Curriculum Outcomes (KSCO)	Specific Curriculum Outcomes (SCO)
By the end of grade 12, students will have achieved the outcomes for entry–grade 9 and will also be expected to	*By the end of Mathematics Essentials 11, students will be expected to*
KSCO i: understand sampling issues and their role with respect to statistical claims	F4 collect, display, and analyze data to draw appropriate conclusions about relevant questions or issues
	F5 use data analysis to describe trends within the context of the data and predict future trends
KSCO ii: extend construction (both manually and via appropriate technology) of a wide variety of data displays	F1 read and interpreting various data displays
	F2 select an effective data display for a given set of data and explain the reasons for the choice
	F3 represent given data in a variety of displays, using spreadsheets or other technology

Program Design and Components

Program Organization

The Mathematics Essentials 11 curriculum is designed to make a significant contribution toward students' meeting each of the EGLs, with the communication and problem-solving EGLs relating particularly well to the curriculums unifying ideas.

Content Organization

Instructional Units

Mathematics Essentials 11 is organized into five instructional units. Mental Math is a skill that you should embed into your teaching of students throughout each of these units. The mental instruction units include the following.

- Unit 1: Data Management
- Unit 2: Banking
- Unit 3: Housing
- Unit 4: Measurement and Design
- Unit 5: Taking a Trip

Mental Math

Embedded within each of the above units is the opportunity for you to provide your students with a variety of appropriate mental math activities. You should establish the reasons why mental math and estimation are important skills to possess. While it is true that many computations that require exact answers are done today on calculators, it is important that students have the necessary skills to be able to judge the reasonableness of the answers. This is also true for computations they will do using pencil-and-paper strategies. As well, many computations in their daily lives will not require exact answers (e.g., If three pens each cost $1.90, can I buy them if I have $5.00?). Students will also encounter computations in their daily lives for which they can get exact answers quickly in their heads (e.g., What is the cost of three pens that each cost $3.00?).

Therefore, students develop a repertoire of mental skills to do calculations in their daily lives, whether or not they have a calculator at their disposal. With a good background in mental math, students become more proficient at estimation and develop a better sense of place value, operations, and number sense. In order for mental math skills to develop adequately, there needs to be 5 to 10 minutes daily of mental math skill building.

In general, each strategy for building mental math skills should be practised in isolation until students can give correct solutions in a reasonable time frame. Students must understand the logic of the strategy, recognize when it is appropriate, explain the strategy, and then integrate it with previously learned strategies. The amount of time spent on each strategy should be determined by your students' abilities and previous experiences.

Contexts for Learning and Teaching

Principles of Learning

The public school program is based on principles of learning that teachers and administrators should use as the basis for the experiences they plan for their students. These principles include the following.

1. **Learning is a process of actively constructing knowledge.**
   Therefore, teachers and administrators have a responsibility to
   - create environments and plan experiences that foster inquiry, questioning, predicting, exploring, collecting, educational play, and communicating
   - engage learners in experiences that encourage their personal construction of knowledge, for example, hands-on, minds-on science and math; drama; creative movement; artistic representation; writing; and talking to learn
   - provide learners with experiences that actively involve them and are personally meaningful

2. **Students construct knowledge and make it meaningful in terms of their prior knowledge and experiences.**
   Therefore, teachers and administrators have a responsibility to
   - find out what students already know and can do
   - create learning environments and plan experiences that build on learners prior knowledge
   - ensure that learners are able to see themselves reflected in the learning materials used in the school
   - recognize, value, and use the great diversity of experiences and information students bring to school
   - provide learning opportunities that respect and support students racial, cultural, and social identities
   - ensure that students are invited or challenged to build on prior knowledge, integrating new understandings with existing understandings

3. **Learning is enhanced when it takes place in a social and collaborative environment.**
   Therefore, teachers and administrators have a responsibility to
   - ensure that talk, group work, and collaborative ventures are central to class activities
   - see that learners have frequent opportunities to learn from and with others
   - structure opportunities for learners to engage in diverse social interactions with peers and adults
   - help students to see themselves as members of a community of learners

4. **Students need to continue to view learning as an integrated whole.**
   Therefore, teachers and administrators have a responsibility to
   - plan opportunities to help students make connections across the curriculum and with the world outside and structure activities that require students to reflect on those connections
   - invite students to apply strategies from across the curriculum to solve problems in real situations

5. **Learners must see themselves as capable and successful.**
   Therefore, teachers and administrators have a responsibility to
   - provide activities, resources, and challenges that are developmentally appropriate to the learners
   - communicate high expectations for achievement to all students
   - encourage risk taking in learning
   - ensure that all students experience genuine success on a regular basis
   - value experimentation and treat approximation as signs of growth
   - provide frequent opportunities for students to reflect on and describe what they know and can do
   - provide learning experiences and resources that reflect the diversity of the local and global community
   - provide learning opportunities that develop self-esteem

6. **Learners have different ways of knowing and representing knowledge.**
   Therefore, teachers and administrators have a responsibility to
   - recognize each learner's preferred ways of constructing meaning and provide opportunities for exploring alternative ways
   - plan a wide variety of open-ended experiences and assessment strategies
   - recognize, acknowledge, and build on students diverse ways of knowing and representing their knowledge
   - structure frequent opportunities for students to use various art forms–music, drama, visual arts, dance, movement, crafts–as a means of exploring, formulating, and expressing ideas

7. **Reflection is an integral part of learning.**
   Therefore, teachers and administrators have a responsibility to
   - challenge their beliefs and practices based on continuous reflection
   - reflect on their own learning processes and experiences
   - encourage students to reflect on their learning processes and experiences
   - encourage students to acknowledge and articulate their learnings
   - help students use their reflections to understand themselves as learners, make connections with other learnings, and proceed with learning

A Variety of Learning Styles and Needs

Learners have many ways of learning, knowing, understanding, and creating meaning. Research into links between learning styles and preferences and the physiology and function of the brain has provided educators with a number of helpful concepts of and models for learning. Howard Gardner, for example, identifies eight broad frames of mind or intelligences: linguistic, logical/mathematical, visual/spatial, bodily/kinesthetic, musical, interpersonal, intrapersonal, and naturalistic. Gardner believes that each learner has a unique combination of strengths and weaknesses in these eight areas, but that the intelligences can be more fully developed through diverse learning experiences. Other researchers and education psychologists use different models to describe and organize learning preferences.

Students ability to learn is also influenced by individual preferences and needs within a range of environmental factors, including light, temperature, sound levels, nutrition, proximity to others, opportunities to move around, and time of day. How students receive and process information and the ways they interact with peers and their environment, in specific contexts, are both indicators and shapers of their preferred learning styles. Most learners have a preferred learning style, depending on the situation and the type and form of information the student is dealing with, just as most teachers have a preferred teaching style, depending on the context. By reflecting on their own styles and preferences as learners and as teachers in various contexts, teachers can
   - build on their own teaching-style strengths
   - develop awareness of and expertise in a number of learning and teaching styles and preferences
   - identify differences in student learning styles and preferences
   - organize learning experiences to accommodate the range of ways in which students learn, especially students for whom the range of ways of learning is limited

Learning experiences and resources that engage students multiple ways of understanding allow them to become aware of and reflect on their learning processes and preferences. To enhance their opportunities for success, students need some of the following.
   - a variety of learning experiences to accommodate their diverse learning styles and preferences
   - opportunities to reflect on their preferences and the preferences of others to understand how they learn best and that others may learn differently
   - opportunities to explore, apply, and experiment with learning styles other than those they prefer, in learning contexts that encourage risk taking
   - opportunities to return to preferred learning styles at critical stages in their learning
   - opportunities to reflect on other factors that affect their learning, for example, environmental, emotional, sociological, cultural, and physical factors
   - a time line appropriate for their individual learning needs within which to complete their work

The Senior High School Learning Environment

Creating Community

To establish the supportive environment that characterizes a community of learners, teachers need to demonstrate that they value all learners, illustrating how diversity enhances the learning experiences of all students for example, by emphasizing courtesy in the classroom through greeting others by name, thanking them for answers, and inviting, rather than demanding, participation. Students could also be encouraged to share interests, experiences, and expertise with one another. Students must know one another in order to take learning risks, make good decisions about their learning, and build the base for peer partnerships for tutoring, sharing, co-operative learning, and other collaborative learning experiences. Through mini-lessons, workshops, and small-group dynamic activities during initial classes, knowledge is shared about individual learning styles, interpersonal skills, and team building. The teacher should act as a facilitator, attending to both active and passive students during group activities, modelling ways of drawing everyone into the activity, as well as ways of respecting and valuing each persons contribution, and identifying strengths and needs for future conferences on an individual basis. Having established community within the classroom, the teacher and students together can make decisions about learning activities. Whether students are working as a whole class, in small groups, in pairs, in triads, or individually, teachers should

- encourage comments from all students during whole-class discussion, demonstrating confidence in and respect for their ideas
- guide students to direct questions evenly to members of the group
- encourage students to discover and work from the prior knowledge in their own social, racial, or cultural experiences
- encourage questions, never assuming prior knowledge
- select partners or encourage students to select different partners for specific purposes
- help students establish a comfort zone in small groups where they will be willing to contribute to the learning experience
- observe students during group work, identifying strengths and needs, and conference with individuals to help them develop new roles and strategies
- include options for students to work alone for specific and clearly defined purposes

Engaging All Students

A supportive environment is important for all learners and is especially important in encouraging disengaged or underachieving learners.

Mathematics Essentials 11 provides opportunities to engage students who lack confidence in themselves as mathematics learners or who have a potential that has not been realized. These students may need substantial support in gaining essential knowledge and skills and in interacting with others.
Students need to engage fully in learning experiences that

- are perceived as authentic and worthwhile
- build on their prior knowledge
- allow them to construct meaning in their own ways
- link learning to understanding and affirming their own experiences
- encourage them to experience ownership and control of their learning
- feature frequent feedback and encouragement
- include opportunities to provide individuals with clarification and elaboration
- are not threatening or intimidating
- focus on successes rather than failures
- are organized into clear, structured segments

It is important that teachers design learning experiences that provide a balance between challenge and success and between support and autonomy. All students benefit from a variety of grouping arrangements that allow optimum opportunities for meaningful teacher-student and student-student interaction. An effective instructional design provides a balance of the following grouping strategies:

- large-group or whole-class learning
- teacher-directed small-group learning
- small-group-directed learning
- co-operative learning groups
- one-to-one teacher-student learning
- independent learning
- partnered learning
- peer or cross-age tutoring
- mentoring

Meeting the Needs of All Learners

An important emphasis in this curriculum is the need to deal successfully with a wide variety of equity and diversity issues. Not only must teachers be aware of, and adapt instruction to account for, differences in student readiness as students begin this course and as they progress, they must also remain aware of the importance of avoiding gender and cultural biases in their teaching. Ideally, every student should find his or her learning opportunities maximized in the mathematics classroom. The reality of individual student differences must be recognized as teachers make instructional decisions. While Mathematics Essentials 11 presents SCOs for the course, it must be acknowledged that not all students will progress at the same pace or be equally positioned with respect to attaining a given outcome at any given time. The SCOs represent, at best, a reasonable framework for helping students to ultimately achieve the KSCOs and GCOs.

Mathematics teachers can reach a variety of learners by using a multi-representational approach. If students experience many ways of connecting with a mathematical concept, they will obtain a deeper understanding of that concept; and students with different learning styles can access the concept with the representation that has the most meaning for them. A classroom environment that balances individual, small-group, and whole-class approaches to activities is recommended when trying to meet the needs of all learners.

Meeting the Needs of All Students

Learners require inclusive classrooms, where a wide variety of learning experiences ensures that all students have equitable opportunities to reach their potential. In designing learning experiences, teachers must accommodate the learning needs of individuals and consider the abilities, experiences, interests, and values that they bring to the classroom. In recognizing and valuing the diversity of students, teachers should consider ways to

- create a climate and design learning experiences to affirm the dignity and worth of all learners in the classroom community
- give consideration to the social and economic situations of all learners
- model the use of inclusive language, attitudes, and actions supportive of all learners
- acknowledge racial and cultural uniqueness
- adapt classroom organization, teaching strategies, assessment practices, time, and learning resources to address learners needs and build on their strengths
- provide opportunities for learners to work in a variety of contexts, including mixed-ability groupings
- identify and utilize strategies and resources that respond to the range of students learning styles and preferences
- build on students individual levels of knowledge, skills, and attitudes
- design learning and assessment tasks that draw on learners strengths
- use students strengths and abilities to motivate and support their learning
- provide opportunities for students to make choices that will broaden their access to a range of learning experiences
- acknowledge the accomplishment of learning tasks, especially those that learners believed were too challenging for them

In a supportive learning environment, all students receive equitable access to resources, including the teachers time and attention, technology, learning assistance, a range of roles in group activities, and choices of learning experiences when options are available. All students are disadvantaged when oral, written, and visual language creates, reflects, and reinforces stereotyping. Teachers promote social, cultural, racial, and gender equity when they provide opportunities for students to critically examine the ideas, concepts, and environments associated with Mathematics Essentials 11 in the classroom, in the community, and in the media. Teachers should look for opportunities to

- promote critical thinking
- recognize knowledge as socially constructed
- model gender-fair language and respectful listening in all their interactions with students
- articulate high expectations for all students
- provide equal opportunity for input and response from all students
- encourage all students to assume leadership roles
- ensure that all students have a broad range of choice in learning and assessment tasks
- encourage students to avoid making decisions about roles and language choices based on stereotyping
- include the experiences and perceptions of all students in all aspects of their learning
- recognize the contributions of men and women of all social, cultural, linguistic, and racial backgrounds to all disciplines throughout history

Social and cultural diversity in student populations expands and enriches the learning experiences of all students. Students can learn much from the backgrounds, experiences, and perspectives of their classmates. In a community of learners, participants explore the diversity of their own and others customs, histories, values, beliefs, languages, and ways of seeing and making sense of the world.

When learning experiences are structured to allow for a range of perspectives, students from varied social and cultural backgrounds realize that their ways of seeing and knowing are not the only ones possible. They can come to examine more carefully the complexity of ideas and issues arising from the differences in their perspectives and to understand how cultural and social diversity enrich their lives and their culture.

The curriculum outcomes designed for Mathematics Essentials 11 provide a framework for a range of learning experiences for all students. Teachers must adapt learning contexts, including environment, strategies for learning, and strategies for assessment, to provide support and challenge for all students, using learning outcomes to plan learning experiences appropriate to students individual learning needs. When these changes are not sufficient for a student to meet designated outcomes, an individual program plan (IPP) is developed. For more detailed information, see *Special Education Policy Manual* (1996), Policy 2.6.

A range of learning experiences, teaching and learning strategies, resources, and environments provides expanded opportunities for all learners to experience success as they work toward the achievement of designated outcomes. Many of the learning experiences suggested in this guide provide access for a wide range of learners, simultaneously emphasizing both group support and individual activity. Similarly, the suggestions for a variety of assessment practices provide multiple ways for students to demonstrate their achievements.

In order to provide a range of learning experiences to challenge all students, teachers may adapt learning contexts to stimulate and extend learning. Teachers should consider ways in which students can extend their knowledge base, thinking processes, learning strategies, self-awareness, and insights. Some learners can benefit from opportunities to negotiate their own challenges, design their own learning experiences, set their own schedules, and work individually or with learning partners.

Some students learning needs may be met by providing opportunities for them to focus on learning contexts that emphasize experimentation, inquiry, and critical and personal perspectives; in these contexts, teachers should work with students to identify and obtain access to appropriate resources.

The Role of Technology

Vision for the Integration of Information Technologies

Within the learning outcomes framework the Nova Scotia Department of Education has articulated five components for the integration of information technology (IT) within curriculum programs

1. **Basic Operations and Concepts**
    Concepts and skills associated with the safe, efficient operation of a range of information technologies

2. **Productivity Tools and Software**
    The efficient selection and use of IT to perform tasks such as
    -   the exploration of ideas
    -   data collection
    -   data manipulation, including the discovery of patterns and relationships
    -   problem solving
    -   the representation of learning

3. **Communications Technology**
    The use of specific, interactive technologies that support collaboration and sharing through communication

4. **Research, Problem Solving, and Decision Making**
    The organization, reasoning, and evaluation by which students rationalize their use of IT

5. **Social, Ethical, and Human Issues**
    The understanding associated with the use of IT that encourages in students a commitment to pursue personal and social good, particularly to build and improve their learning environments and to foster stronger relationships with their peers and others who support their learning.

Integrating Information and Communication Technologies within the Classroom

As information technologies shift the ways in which society accesses, communicates, and transfers information and ideas, they inevitably change the ways in which students learn. Students must be prepared to deal with an information and communications environment characterized by continuous, rapid change, an exponential growth of information, and expanding opportunities to interact and interconnect with others in a global context. Because technologies are constantly and rapidly evolving, it is important that teachers make careful decisions about applications, always in relation to the extent to which technology applications help students to achieve the curriculum outcomes. Technology can support learning for the following specific purposes.

Inquiry

Theory Building: Students can develop ideas, plan projects, track the results of growth in their understanding, develop dynamic, detailed outlines, and develop models to test their understanding, using software and hardware for modelling, simulation, representation, integration, and planning.
Data Access: Students can search for and access documents, multimedia events, simulations, and conversations through hypertext/hypermedia software, digital media, CD-ROM, Internet libraries, and databases.
Data Collection: Students can create, obtain, and organize information in a range of forms, using sensing, scanning, image and sound recording and editing technology, databases, spreadsheets, survey software, and Internet search software.

Communication

Media Communication: Students can create, edit, publish, present, or post documents, presentations, multimedia events, web pages, simulations, models, and interactive learning programs, using word processing, publishing, presentation, webpage development, and hypertext software.
Interaction/collaboration: Students can share information, ideas, interests, concerns, and questions with other through e-mail; Internet audio, video, and print conferences; information servers, Internet news groups, and listservs; and student-created hypertext environments.

Expression

Students can shape the creative expression of their ideas, feelings, insights, and understandings using graphic software; music making, composing, editing, and synthesizing technology; interactive video and hypermedia; animation software; multimedia composing technology; sound and light control systems and software; and video and audio recording and editing technology.

The Role of Technology in Mathematics Essentials 11

Although technology is not essential for the successful completion of the outcomes, the use of graphing calculators, the Excel spreadsheet program, and the use of graphing calculators or banking simulation applets is considered to be necessary for the most effective coverage of some of the outcomes and may enhance the development of the concept in others. The table below shows which outcomes from the Mathematics Essentials 11 are enhanced by the use of specific technology and which outcomes require technology for effective curriculum implementation. Whatever technology is implemented into the classroom, it should be noted that the technology be integrated into the lesson rather than an add-on.

Technology Requirements for Mathematics Essentials 11

Examples of Outcomes Requiring or Enhanced by Technology	TI-83	Internet	Excel
A2	enhanced		enhanced
A3		enhanced	
A4		enhanced	
B7	enhanced		enhanced
B8	required/enhanced		required/enhanced
B9	enhanced		enhanced
B10		enhanced	
B11		enhanced	
C1	enhanced		enhanced
C2	enhanced		enhanced
C3	required/enhanced		required/enhanced
C4	required/enhanced		required/enhanced
F3			required
F4			required

Learning and Teaching Mathematics

What students learn is fundamentally connected to how they learn it. The view of learning mathematics as an integrated set of intellectual tools for making sense of mathematical situations has created a need for new forms of classroom organization, communication patterns, and instructional strategies. The teacher is no longer the sole dispenser of knowledge but is rather a facilitator and educational conductor whose major roles include

- creating a classroom environment to support the teaching and learning of mathematics
- setting goals and selecting or creating mathematical tasks to help the students reach these goals
- stimulating and managing classroom discourse so that the students have a clearer understanding about what is being taught
- analysing student learning, the mathematical tasks, and the environment in order to make ongoing instructional decisions

Effective mathematics teaching and learning take place in a range of situations. Instructional settings and strategies should create a climate that reflects the constructive, active view of the learning process. This means that learning does not occur by passive absorption and imitation, but rather as students actively assimilate new information and construct their own meanings.

Opportunities to learn mathematics are a function of the setting and the kinds of tasks and discourse in which students participate. What students learn about particular concepts and procedures and their own mathematical thinking depends on the ways in which they engage in mathematical activity in their classrooms. Their dispositions toward mathematics are also shaped by such experiences. Consequently, the goal of developing students mathematical powers requires careful attention to pedagogy as well as to the curriculum.

Mathematics instruction should vary and should include opportunities for group and individual assignments, discussion between teacher and students and among students, appropriate project work, practice with mathematical methods, and exposition by the teacher.

Instructional settings should include varied learning environments that encourage the development of specific co-operative behaviours. Students should be expected to work together to help one another and to complete individual projects. Students develop strategies and skills in asking questions, listening, showing and explaining to others how to do things, finding out what others think, and determining the best way to complete a project.

Summary of Changes in Instructional Practices

Research in the way students learn and the best practices for teaching has caused us to move away from

- teacher and text as exclusive sources of knowledge
- rote memorization of facts and procedures
- extended periods of individual practising of routine tasks
- instruction based almost completely on teacher exposition
- a total emphasis on pencil-and-paper manipulative skill work
- the relegation of testing to an adjunct role with the sole purpose of assigning grades

And move toward more effective instructional practices that include

- the active involvement of students in constructing and applying mathematical ideas
- problem solving as a means, as well as a goal, of instruction
- effective questioning techniques that promote student interaction
- the use of a variety of instructional formats (small groups, explorations, peer instruction, whole class, project work)
- the use of computers and calculators as tools for learning and doing mathematics
- student communication of mathematical ideas orally and in writing
- the establishment and application of the interrelatedness of mathematical topics
- the systematic maintenance of student learnings by embedding review in the context of new topics and problem situations
- assessment of learning as an integral part of instruction

Learning Resources

This curriculum guide is the central resource for mathematics teachers with respect to Mathematics Essentials 11. Other teacher resources are ancillary to it. This curriculum guide should serve as the focal point for all daily, unit, and yearly planning, as well as a reference point to determine the extent to which the curriculum outcomes have been met.

Teachers require access to a variety of professional resources as they seek to broaden their instructional and mathematical skills. Students require access to manipulative materials and technological resources to support their learning in Mathematics Essentials 11, as well as to print resources that support the curriculum. The Authorized Learning Resources list includes a wide range of student and teacher resources for mathematics. Both up-to-date printable catalogues in PDF format and a searchable database are available online at http://w3apps.ednet.ns.ca/nssbb. In addition, the Media Library at Learning Resources and Technology includes a range of resources in video, audio, and photographic formats. The searchable online catalogue is available at http://lrt.ednet.ns.ca.

Assessing and Evaluating Student Learning

In recent years there have been calls for change in the practices used to assess and evaluate students' progress. Many factors have set in motion the demands for change, including the following:

- **Expectations for mathematics education as outlined in** *Curriculum and Evaluation Standards for School Mathematics* **(NCTM, 1989) and** *Principles and Standards for School Mathematics* **(NCTM, 2000)**

  Curriculum and Evaluation Standards provides educators with specific information about what students should be able to do in mathematics. These expectations go far beyond learning a list of mathematical facts; instead, they emphasize such competencies as creative and critical thinking, problem solving, working collaboratively, and the ability to manage one's own learning. Students are expected to be able to communicate mathematically, to solve and create problems, to use concepts to solve real-world applications, to integrate mathematics across disciplines, and to connect strands of mathematics. For the most part, assessments used in the past have not addressed these expectations. New approaches to assessment are needed to address the expectations set out in *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) and *Principles and Standards for School Mathematics* (NCTM, 2000).

- **Understanding of the bonds linking teaching, learning, and assessment**
  Much of our understanding of learning has been based on a theory that viewed learning as the accumulation of discrete skills. Cognitive views of learning call for an active, constructive approach in which learners gain understanding by building their own knowledge and developing connections between facts and concepts. Problem solving and reasoning, rather than the acquisition of isolated facts, become the emphases.

  Conventional testing, which includes multiple choice or having students answer questions to determine if they can recall the type of question and the procedure to be used, provides a window into only one aspect of what a student has learned. Assessments that require students to solve problems, demonstrate skills, create products, and create portfolios of work reveal more about the students reasoning and understanding of mathematics. Since students are expected to develop reasoning and problem-solving competencies, teaching must reflect such, and in turn, assessment must reflect what is valued in teaching and learning.

  Feedback from assessment directly affects learning. The development of problem-solving and higher-order thinking skills will be realized only if assessment practices are in alignment with these expectations.

- **Limitations of the traditional methods used to determine student achievement**
  Do traditional methods of assessment provide the student with information on how to improve performance? Methods of assessment need to be developed that provide teachers with accurate information about students academic achievement. As well, information is needed to guide teachers in decision making to improve both learning and teaching.

What Is Assessment?

Assessment is the systematic process of gathering information on student learning. Assessment allows teachers to communicate to students what is really valued–what is worth learning, how it should be learned, what elements of quality are considered most important, and how well students are expected to perform. To assess student learning in a mathematics curriculum that emphasizes applications and problem solving, teachers must employ strategies that recognize the reasoning involved in the process as well as in the product. *Assessment Standards for School Mathematics* (NCTM 1995) describes assessment practices that enable teachers to gather evidence about a students knowledge of, ability to use, and disposition toward mathematics and make inferences from that evidence for a variety of purposes.

Assessment can be informal or formal. Informal assessment occurs during instruction. It is a mindset, a daily activity that helps teachers answer the question. Is what is taught being learned? Its primary purpose is to collect information about the instructional needs of students so that teachers can make decisions to improve instructional strategies. For

many teachers, the strategy of making annotated comments about a students work is part of informal assessment. Assessment must do more than determine a score for the student. It should do more than portray a level of performance. It should direct teachers communication and actions. Assessment must anticipate subsequent action.

Formal assessment requires the organization of an assessment event. In the past, mathematics teachers may have restricted these events to quizzes, tests, or exams. As the outcomes for mathematics education broaden, it becomes more obvious that these assessment methods become more limited. Some educators would argue that informal assessment provides better-quality information because it is in a context that can be put to immediate use.

Why Should Teachers Assess Student Learning?

Teachers should assess student learning in order to
- improve instruction by identifying successful instructional strategies
- identify and address specific sources of the students misunderstandings
- inform the students about their strengths in skills, knowledge, and learning strategies
- inform parents of their childrens progress so that they can provide more effective support
- determine the level of achievement for each outcome

Effective assessment is integral to instruction and will enable effective intervention and support; therefore, it is essential that teachers develop a repertoire of assessment strategies.

Assessment Strategies

The following are some of the assessment strategies that teachers may employ.

Documenting Classroom Behaviours

In the past, teachers have generally made observations of students persistence, systematic working, organization, accuracy, conjecturing, modelling, creativity, and ability to communicate ideas, but often failed to document them. Recording information signals to the student those behaviours that are truly valued. Teachers should focus on recording only significant events–those that represent a students typical behaviour or a situation in which the student demonstrates new understanding or a lack of understanding. Using a class list, teachers can expect to record comments on approximately four students per class. The use of an annotated class list allows the teacher to recognize where students are having difficulties and to identify students who may be spectators in the classroom. However, for summative purposes, grades should reflect the degree to which students achieve the curriculum outcomes.

Using a Portfolio and Student Journal

Having students assemble responses to various types of tasks on a regular basis is part of an effective assessment scheme. Responding to open-ended questions allows students to explore the bounds and the structure of mathematical categories. For example, asking students to prepare a shopping list that stays within a budget of $50 would be preferable to asking students to find the total of a given list of articles. It would allow students to explore the problem in many different ways and give them the opportunity to use many different procedures and skills.

Students should use their journals to monitor their own learning by reflecting on and responding to questions such as
- What is the most interesting thing you learned in mathematics class this week?
- What do you find difficult to understand?
- How could the teacher improve mathematics instruction?
- Can you identify how the mathematics we are now studying is connected to the real world?

In students portfolios and journals, teachers can observe the development of their understanding and progress as problem solvers. Students should be solving problems that require varying lengths of time and represent both individual and group effort. What is most important is that teachers discuss with their students what items are to be parts of a meaningful portfolio and that students have responsibility for assembling the portfolio.

Projects and Investigative Reports

Students will have opportunities to do projects at various times through the year. For example, in the Geometry Unit they will be asked to design a logo; they may do a project by creating a business and explain how the logo relates to the business that they created. Students should also be given investigations in which they learn new mathematical concepts on their own. Excellent materials can be obtained from the NCTM including Student Math Notes (news bulletins that can be downloaded from the Internet).

Written Tests, Quizzes, and Exams

Written tests have been criticized as being limited to assessing students' abilities to recall and replicate mathematical facts and procedures. Some educators would argue that asking students to solve contrived applications, usually within time limits, provides teachers with little knowledge of their understanding of mathematics.

How might teachers improve the use of written tests?

The challenge is to improve the nature of the questions being asked, so that teachers are gaining information about the students understanding and comprehension. Tests must be designed so that questions being asked reflect the expectations of the outcomes being addressed. One way to do this is to have students construct assessment items for the test. Allowing students to contribute to the test permits them to reflect on what they were learning, and it is a most effective revision strategy.

Teachers should reflect on the quality of the test being given to students. Are students being asked to evaluate, analyse, and synthesize information, or are they simply being asked to recall isolated facts from memory? Teachers should develop a table of specifications when planning their tests. In assessing student learning, teachers have a professional obligation to ensure that the assessment reflects those skills and behaviours that are truly valued. Effective assessment goes hand in hand with effective instruction, and together they promote student achievement.

Course Organization

Course Design

This section of the document presents the mathematics curriculum outcomes that students are expected to achieve during this course. Teachers are encouraged, however, to consider what comes before and what follows to better understand how the students learning at a particular course level are part of a bigger picture of concept and skill development.

Mathematics Essentials 11 is organized into five instructional units: Data Management, Banking, Housing, Measurement and Design, and Taking a Trip. Mental Math is a skill that will be incorporated throughout the five units of the Mathematics Essentials 11 course.

The Two-Page Spread

The following pages detail curriculum outcomes. Each two-page spread is dedicated to a small number of SCOs. As much as possible, connections are made through references to other pages of related outcomes or topics.

The unit title is presented at the top of each page, and the appropriate SCO(s) are displayed in the left-hand column. The second column presents the elaboration, which includes instructional strategies and suggestions, as well as some examples that might be used to illustrate achievement of outcomes. The third column includes worthwhile tasks for instruction and/or assessment purposes. While the strategies, suggestions, and examples are not intended to be rigidly applied, they will help to further clarify the SCO(s) and to illustrate ways to work toward the outcome(s), while maintaining an emphasis on problem solving, communication, reasoning, and connections.

The final column is entitled Suggested Resources and will, over time, with your additions, become a collection of useful references to resources that are particularly valuable for addressing the given outcome(s).

Mental Math

Mental Math

Outcomes

SCO

By the end of this course, students will be expected to

B1 Know the multiplication and division facts

Elaboration—Instructional Strategies/Suggestions

B1. In Math Essentials 10, students learned the cluster of multiplication facts involving 2s by relating them to the doubles in addition. These facts account for 17 of the 100 basic facts. The 83 remaining facts should be learned in 7 clusters, each cluster related to a particular strategy. Each cluster should be carefully introduced so students understand the logic of the strategy; each cluster practiced until students have a 3-second, or less, response time; and the cluster added to the previously learned facts for further practice. The seven clusters are:

- **The Nifty Nines Facts** using two patterns in the answers: the tens digit is one less than the variable factor and the two digits sum to 9; or finding the product using 10 instead of 9 and subtracting the extras; 3 x 9 to 9 x 9 and 9 x 3 to 9 x 8 *(13 new facts)*
- **The Fives Facts** using a connection to the minute hand on a standard clock; or noting two patterns: products of even factors and 5 end in 0 and the tens digit of the product is half the even factor, and products of odd factors and 5 end in 5 and the tens digit of the product is half the number before the odd factor; 1 x 5 to 9 x 5 and 5 x 1 to 5 x 9 (with 5 x 2, 2 x 5, 5 x 9, and 9 x 5 having other strategies as well) *(13 new facts)*
- **The Ones Facts** using connections to the meanings (e.g., 6 x 1 means "six 1s" or 1 + 1 + 1 + 1 + 1 + 1; 1 x 6 means "one 6"); 1 x 1 to 9 x 1 and 1 x 2 to 1 x 9 (with 2 x 1, 1 x 2, 5 x 1, 1 x 5 having other strategies); the "no change" facts *(13 new facts)*
- **The Tricky Zeros Facts** using connections to meanings to stress why all the results are zeros (e.g., 6 x 0 means "six 0s" or 0 + 0 + 0 + 0 + 0 + 0; 0 x 6 is much more difficult to conceptualize, but if students are asked to draw 2 sets of 6, then 1 set of 6, and finally zero sets of 6 where they don't draw anything, they will realize why zero is the result); 0 x 0 to 9 x 0 and 0 x 1 to 0 x 9. *(19 new facts)*
- **The Threes Facts** using a "double plus one more set" strategy (e.g., 3 x 7 is thought of as 2 sets of 7 (double) plus 1 set of 7); this strategy will require some discussion of quick addition strategies for the third set *(9 new facts)*
- **The Fours Facts** using a "double-double" strategy (e.g., 4 x 7 is thought of as 2 x 7 (double) to get 14 and then 2 x 14 (double) to get 28; this strategy will also require some discussion of quick mental strategies for the doubles of 12, 14, and 16 *(7 new facts)*
- **The Last Nine Facts** using decomposition and helping fact strategies (e.g., 6 x 6 could be thought of as 5 sets of 6 plus one set of 6; 7 x 6 could be thought of as 5 sets of 6 plus 2 sets of 6, or as 3 sets of 7, doubled; 6 x 8 could be thought of as 5 sets of 8 plus one set of 8, or 3 sets of 8, doubled; 7 x 8 is thought of as 5 x 8 plus two sets of 8; 8 x 8 could be thought of as 4 sets of 8, doubled) *(9 new facts)*

Mental Math

Worthwhile Tasks for Instruction and/or Assessment	**Suggested Resources**

Performance

B1.1 Explain two strategies that could be used to find each of the following facts:
(a) 5×9 (b) 3×4 (c) 5×3 (d) 2×1

B1.2 Jason said, "3×6 is 13 because two times 6 is 12 and one more is 13." Is Jason correct? Why, or why not?

B1.3 Fill in the following multiplication chart in one minute, or less:

x	4	7	9	3	5	2	6
9							
2							

B1.4 With a partner, take turns explaining a strategy that could be used to complete each cell in the web below:
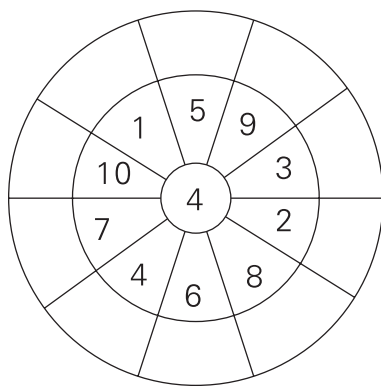
B1.5 Fill in the missing cells in one minute, or less, and then discuss with a partner how you found each one:
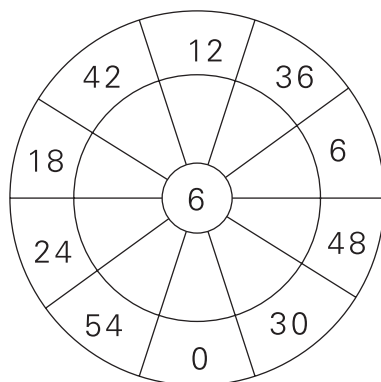
B1.6 You and a partner each roll a 0 – 9 die and take turns stating the product and describing the strategy, scoring 1 point for the correct product and 1 point for the correct strategy. Stay alert and check your partner's answers.

Mental Math

Outcomes	Elaboration—Instructional Strategies/Suggestions

SCO

By the end of this course, students will be expected to

B2 Extend multiplication and division facts to products of tens, hundreds, and thousands by single-digit factors

B3 estimate sums and differences

B4 Estimate products and quotients

B2. After each cluster of multiplication facts, those facts could be applied to the corresponding 10s, 100s, and 1000s. For example, after the *Nifty Nines* are mastered, students could apply them to find products such as: 4×90, 5×900, 7×9000, 9×60, 9×300, and 9×8000. Similarly, after the mastery of the division facts related to a cluster, students could apply those to 10s, 100s, and 1000s. For example, after the division facts related to *Nifty Nines* are mastered, students could apply them to quotients such as: $90 \div 9$, $270 \div 9$, $3600 \div 9$, $8100 \div 9$, $450 \div 5$, and $7200 \div 8$.

If students are shown base-10 blocks, they would see that nine small cubes (9), nine rods (90), nine flats (900), and nine large cubes (9000) are all nine blocks; therefore, 4 sets of nine blocks will be 36 blocks whether they are 30 ones, 36 tens, 36 hundreds, or 36 thousands.

B3. Students should continue to estimate any sums and differences they encounter in their work before carrying out the computations on calculators. "Ball park" estimates that involve simple 1- or 2-digit combinations would be sufficient for these estimates. For example, for \$3 478.32 + \$4 898.67, students would estimate this sum by thinking: \$3000 plus \$5000 is \$8000, so the estimate is around \$8000. Since the mastery of addition and subtraction facts was an outcome in Math Essentials 10, this estimation that is based on rounding numbers to the highest place value and combining the rounded numbers will provide an opportunity to apply those addition and subtraction facts.

B4. After each cluster of multiplication facts, those facts could be applied in estimation situations. For example, after the *Nifty Nines* facts are mastered, students could use those facts to estimate products such as: $3.9 \times \$9$, $6 \times \$8.99$, $9 \times \$3.99$, and $5.1 \times \$9.25$. Similarly, if those facts have also been applied to 10s, 100s, and 1000s, students could estimate products such as: $4.9 \times \$89.50$, $9 \times \$599$, and $6.2 \times \$9025$.

Mental Math

Worthwhile Tasks for Instruction and/or Assessment   **Suggested Resources**

SCO

By the end of this course, students will be expected to

B2.1 Determine each of the following products:
   (a) 6 × $90   (b) 3 × $600   (c) 5 × $7000   (d) 7 × $40

B2.2 List some other products involving 10s, 100s, and 100s that you know because you know 3 x 7 equals 21.

B2.3 Determine each of the following quotients:
   (a) 810 ÷ 9   (b) 1500 ÷ 3   (c) 2800 ÷ 7   (d) 3 500 ÷ 5

B3.4 Give a "ball-park" estimate for each of the following
   (a) $512 + $699   (b) $8 990 - $3 010   (c) 678 km + 512 km

B3.5 The sum of two decimal numbers was estimated by a student to be 16. If one of the decimal numbers was 6.9, what are three possibilities for the other number involved in the sum?

B4.6 Explain how you would estimate 3.78 x $694.89.

B4.7 The estimate for *3 times a mystery number* is 12. What do you know about this mystery number?

B3/4.8 Fill in the cells of the web below with estimates of sums and products of the numbers, using a pencil for sums and a pen for products:

Mental Math

Outcomes

SCO
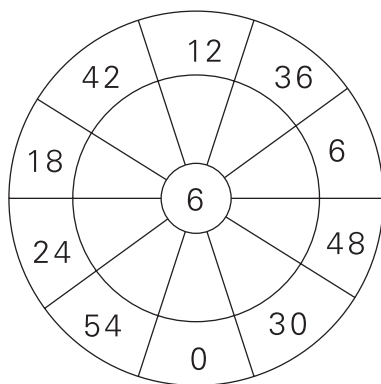
By the end of this course, students will be expected to

B5 Mentally calculate 25%, $33\frac{1}{3}$% , and $66\frac{2}{3}$% of quantities compatible with these percents

B6 Estimate percents of quantitie

Elaboration—Instructional Strategies/Suggestions

B5. In Math Essentials 10, students mentally calculated 1%, 10%, 15% and 50% of compatible numbers; in this case, the compatible numbers are those easily divided by 100, 10, and 2. In Math Essentials 11, students should be able to mentally calculate 25% of numbers that are easily divisible by 4, and $33\frac{1}{3}$% and $66\frac{2}{3}$% of numbers that are easily divisible by 3.

Through some concrete material or paper folding, students should understand that one-fourth and 25% are equivalent, and that both one-fourth of a number and 25% of a number can be found by dividing the number by 4. For example, you can visually show that one-fourth of 240 or 25% of 240 is 60, 240 divided by 4.

| $\frac{1}{4}$ | $\frac{1}{4}$ | $\frac{1}{4}$ | $\frac{1}{4}$ | = 1 |

| 25% | 25% | 25% | 25% | = 100% = 1 |

| 60 | 60 | 60 | 60 | = 240 |

Similarly, the connections among $33\frac{1}{3}$% , $66\frac{2}{3}$% , one-third, two-thirds, and division by 3 of 240 can be shown visually:

| $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | = 1 |

| $33\frac{1}{3}$% | $33\frac{1}{3}$% | $33\frac{1}{3}$% | = 100% = 1 |

| 80 | 80 | 80 | = 240 |

B6. Students should be able to estimate percents of numbers by rounding the percents and numbers to nearby compatibles. For example, to estimate 24% of 37, think: 25% of 36 is 9; to estimate 32% of 66, think: $33\frac{1}{3}$% of 66 is 22; to estimate 9% of 69, think: 10% of 70 is 7.

Mental Math

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources

SCO

By the end of this course, students will be expected to

B5.1 Mentally compute 25% of each of the following numbers:

    (a) 48   (b) 120 (c) 880 (d) 1600 (e) 128 (f) 24 000

B5/6.2 Explain why it would be difficult to mentally calculate $33\frac{1}{3}\%$ of 55.79.

Explain, however, how you could estimate this product.

B5.2 Draw a circle and show 25% of it. If you show 25% of 36 on this same circle, how much of 36 is on your 25% part and how much is on the rest of the circle?

B5.3 Mentally compute $33\frac{1}{3}\%$ of each of the following:

    (a) 24   (b) 120   (c) 69   (d) 240   (e) 1500   (f) 39 000

B5.4 Your friend missed the class when you learned how to find $66\frac{2}{3}\%$ of

a number in your head. Explain to your friend how to find $66\frac{2}{3}\%$ of 27.

B6.5 Terry claims that 35% of $297.50 is $98.25. Use your estimation skills to determine if Terry's answer is reasonable.

B6.6 Estimate each of the following:
    (a) 26% of $360 (b) 34% of $660 (c) 66% of $45 (d) 32% of $315

B6.7 David estimated that 23% of the value of the land was about $3200. What is a reasonable estimate of the full value of the land?

Data Management

Data Management

Outcomes	Elaboration—Instructional Strategies/Suggestions

Outcomes

SCO

By the end of this course, students will be expected to

F1 read and interpret various data displays

F2 analyse graphs to describe patterns within the context of the data and predict future trends

Elaboration—Instructional Strategies/Suggestions

F1. Have students examine a variety of graphs that were found in newspapers, magazines, books and internet.
- bar graphs—single and double
- line graphs—single and double
- circle graphs—pie graphs
- Pictograph

Have students look at the graphs and read the information that is given in the titles, labels, scales, and legends.

Have students distinguish and know the purpose of the horizontal and vertical axis. Make sure students see graphs that have + and - values.

Have students look at the scales and see how large and small numbers are accommodated.

F2. Have the students read information from the display and make predictions or see trends in the graph and/or data.

Discuss issues relating to misleading statistics such as biased sampling, inappropriate data displays, and scales used on data displays.
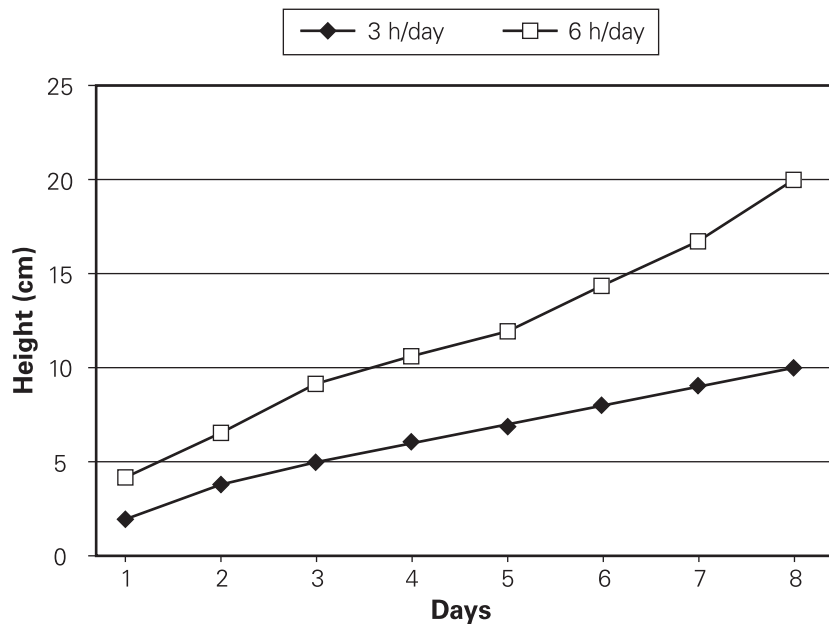
Data Management

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources

Performance

1.

Plant Growth in Sunlight

a) What plants grew faster?
b) Does sunlight affect plant growth?
c) Plot points to represent plants that are in the sunlight for 9 hours a day.
d) At the end of a two-week period, how tall do you things the plants will be?

Data Management

Outcomes	Elaboration—Instructional Strategies/Suggestions
SCO	**F3.** Have students observe that the purpose of:
	▪ a line graph is to track a category over time. The time units are on the horizontal axis.
By the end of this course, students will be expected to	▪ a bar graph is to compare related categories. The categories are listed on the horizontal axis and the frequency (count) is on the vertical axis.
F3 select an appropriate display for a given set of data and explain the reasons for the choice	▪ a circle graph is to display individual categories as a percentage of the whole.
	▪ a frequency (count) is on the vertical axis.
F4 represent given data in a variety of displays, using spreadsheets or other technology	**F4.** Provide data that is relevant to the students via newspaper and internet. A larger amount of data is preferred because this will allow greater possibilities for possible construction of graphic forms. (see internet sources)
	Have access to technology, either spreadsheet or TI-83 graphing technology. Have the students change the scale for the information that they have gathered in order to see how scale affects the graph.

Data Management

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources

Worthwhile Tasks for Instruction and/or Assessment

Performance

Have students download data from one of the suggested websites listed in the Resources column such as weather or vital statistics data. This data can be transferred to an Excel document (or other spreadsheet software) and students can use it to construct appropriate data displays using technology.

Ensure that students show all four forms of graphs that could be used to display the data and discuss which form most accurately represents the information.

Throughout the activity, emphasize the importance of scale and its effect on how the graph displays the data.

Suggested Resources

- Consider using section 1.6 as a culminating activity.

- <www.weathernetwork.com>

- Statistics Canada Website

Data Management

Outcomes	Elaboration—Instructional Strategies/Suggestions
SCO *By the end of this course, students will be expected to* **F5** collect, display, and analyze data to draw appropriate conclusions about relevant questions or issues	**F5.** Have students do a summary project on what they have learned about data management. Students will choose a topic, design and conduct the survey, organize and display their information and draw conclusions based on the data. Have students discuss and address issues related to collecting data such as how to phrase a survey question and bias in sampling.

Data Management

Worthwhile Tasks for Instruction and/or Assessment   **Suggested Resources**

Performance

1. Choose a topic of interest to the class (ie. favourite sport, books, television program, video game, etc.) and indicate numbers that are appropriate. In groups of 2 or 3, have students design and conduct their survey, recording data in a tally chart.

2. Once students have collected and organized their data have them construct an appropriate data display using technology. Have them draw conclusions based on their data and explain how their information could be used in real-life situation or to predict future trends.

   Example: What is your favourite soda?

soda	tally	frequency
pepsi		
coke		
7-up		
orange		
root beer		

Banking

Banking

Outcomes

SCO

By the end of this course, students will be expected to

C1 interpret data from amortization tables

B7 calculate the cost of a loan using amortization tables

B8 determine the cost of using credit, using technology

C2 explore the effects of parameter changes on the cost of borrowing money

Elaboration—Instructional Strategies/Suggestions

You should discuss with your students the various ways of paying for a purchase. These methods are paying cash, paying with a debit card and paying with a credit card. In the discussion, include the advantages and disadvantages of each method.

Students should next be introduced to the most commonly used credit cards (Visa, Mastercard, American Express and store cards). You should refer to the interest rates of each card, what is meant by credit limit and annual fee, and what the requirements are to obtain each card.

You should now move into a discussion about the cost of using the credit card. In this discussion you should include interest rates, previous balances, the meaning of minimum payment and the consequences of not paying the balance in full. At this time the topic of compound interest and what it means in relation to a credit card should be introduced. The formula $A = (1 + i)^n$, where A is the total amount owing, P is the principal (balance owing), i is the interest rate used for the period of time and n is the number of payments, should be presented with examples. Once the students understand this you can introduce the TVM Solver on the TI-83 calculator.

You should now present students with an explanation of the terms related to short-term borrowing. These terms include, loan, line of credit, overdraft protection. Now you can proceed with the cost of a loan and all the factors that determine the total cost. These factors include the amount, the length, the interest rate, and the number of payments of the loan. To allow students to see these factors at work you should provide them with several examples of amortization schedules.

Banking

Worthwhile Tasks for Instruction and/or Assessment

Suggested Resources

1. Page 178-179, #1 to 4 (textbooks).
   re: credit card Application, types of credit cards, etc.
2. Use the Internet to research different types of credit cards. Compare the interest rates charged, annual fees, etc.
3. Have a comparison of when credit card balances are paid to zero and when they are not. You pay interest on the maximum balance of the month, if not paid off.

T.V.M. solver from
Resource Binder

Banking

Outcomes	Elaboration—Instructional Strategies/Suggestions

SCO

By the end of this course, students will be expected to

A1 understand the various savings and investing alternatives commonly available

C3 determine the effects of compound interest on deposits made into savings accounts using technology

C4 explore the growth of savings based on a variety of investment strategies ranging in amounts and time frames using technology

A2 explore the concepts of risk tolerance vs. reward investing and demonstrate an understanding of how it changes during different life stages

A1/A2/C3/C4.
Brainstorm all of the various ways people can save/invest money focusing on—savings account/save at home/savings bonds/mutual funds (stock market/RRSPs/RESPs/Canada Savings Bonds/Payroll Deductions Savings Account).

Bring in brochures for different saving investment plans and construct a chart for students comparing relevant information regarding interest rates, terms, accessibility to money, risk, type of interest (simple/compound). You could also have a banker come in to discuss these plans. The person from the back will be able to answer questions and elaborate on the chart that you have constructed.

Compare various types of savings/investments using the T183 TVM Solver. You should give each student the same amount of money and using the parameters of each plan, have them calculate the final value. You can now discuss the risks involved. Demonstrate through the use of technology, the advantages and disadvantages of early deposits to long-term saving plans (e.g., compare the results of making a deposit of $1000.00 yearly to an RRSP, beginning at the age of 20 with a deposit of $3000.00 yearly starting at age 50).

You should brainstorm with your students when it is necessary for them to borrow and then when it is necessary for their parents to borrow. For both situations you can discuss the advantages and disadvantages as well as any risks/rewards associated with each.

Banking

Worthwhile Tasks for Instruction and/or Assessment   **Suggested Resources**

1. Use the TVM Solver to determine how much money would be accumulated if you invested $2000/year at 6% interest for 10 years when you are 20 years old and left until retirement at age 55. Compare to the amount you will accumulate if you invested $2000/year at 6% interest for 20 years from age 36 to 55.
2. Bobby wants to buy a 4-wheeler. He has $5000 in RRSPs? What should he do? Discuss the pros and cons of cashing in your RRSP's versus taking out a loan.
3. Michelle purchases a $250.00 stereo on her credit card. The annual Interest rate is 18%. If she wants to pay it off in one year, what are her monthly payments?
4. Using TVM Solver on the TI-83 calculator, solve for the indicated part:

N=	2	60	48	120	36
I% =	8.5	?	5	6	4.8
PV =	0	-1000	?	0	0
PMT =	175	-100	-150	?	-150
FV =	5500	7851	10000	20000	?
P/Y =	12	12	12	24	26
C/Y =	12	12	12	24	26
PMT:	END	END	END	END	END

Housing

Housing

Outcomes

SCO

By the end of this course, students will be expected to

A3 understand the rights and responsibilities of landlords and tenants

B9 determine the cost associated with renting an apartment or buying a homecheck the accuracy of a statement of bankbook

Elaboration—Instructional Strategies/Suggestions

A3. Have students read the Nova Scotia Residential Tenancies Act and answer a set of specific questions relating to the rights and responsibilities of landlords and tenants within Nova Scotia.

B9. Have students use the newspapers and the internet to compare prices of housing from region to region within Nova Scotia and Canada. Discuss costs associated with buying a house or condominium as opposed to renting an apartment.

Housing

Worthwhile Tasks for Instruction and/or Assessment	**Suggested Resources**

Performance

1. Using the residential tenancies act, students should be able to answer questions such as:
   a) What is the maximum allowable damage deposit a landlord is to request?
   b) How much notice does a tenant have to give before terminating a lease and is this changed by the type of lease?
2. What is the recommended homeowner's sheltered cost as a percentage of their monthly gross income?
3. List some costs associated with living in a condominium versus a house.
4. Compare the cost of living in a rural versus and urban setting and another province.

Suggested Resources

Nova Scotia Residential Tenancy Act

Real Estate Websites and newspaper classified ads

Measurement and Design

Perimeter and Area

Outcomes

SCO

By the end of this course, students will be expected to

D1 demonstrate an understanding of the concept of perimeter and area

D2 calculate perimeter and area

D3 estimate perimeter and area using estimation strategies

D4 use perimeter and area to solve a variety of real world problems

Elaboration—Instructional Strategies/Suggestions

You should introduce students to the concept of perimeter by discussing the "around" a textbook, a desk, the classroom. Allow the students to use personal benchmarks to estimate the perimeters. Encourage them to record their results. Now you should provide students with a tape, ruler, and metre stick and have them measure the exact perimeter of the same items. Have students record their findings and compare them to the results of their benchmark estimates. You should discuss the perimeter of these rectangles to generalize the formula $P = 2L + 2w$. Have the students discuss examples and applications. Students will select several of their rectangles; record the dimensions (in cm) and calculate the perimeter. Perimeter should be done before area. Discuss the difference in units used to measure area and perimeter.

Have students develop an understanding of the concept of area of rectangles using both non-standard and standard units of measure. Give your students a page of rectangles with different dimensions and areas (see Appendix A). Have the students order the area of the rectangles by looking at the sheet. Record the answers. Then have the students cut out the rectangles and directly compare areas. Record the order. Discuss any changes. Finally students will use non-standard units (e.g. paper clip lengths) of measure provided by the teacher to measure the area of each rectangle. Have them record an estimate before actually measuring.

Students will be given a transparent grid of cm^2 units (see Appendix B). Have students estimate the area of the rectangles first and then determine and record the actual area in cm2. Have the students compare their estimate to their actual measure. Talk about any discrepancies. Determine and record the dimensions of each rectangle using a 1×10 cm transparent ruler (see Appendix C). Record the number of rows and the number of cells in each row for each rectangle in the chart provided. Have students use this information to generalize a formula for the area of a rectangle ($A = l \times w$).

Perimeter and Area

Worthwhile Tasks for Instruction and/or Assessment	**Suggested Resources**

Performance

Toilet Paper Math Project

1. Using benchmarks to estimate perimeter and area and finding percent error.
   Establish the length of your stride. Use your stride to estimate measures for the school hall's length, parking lot, playing field, etc. Then measure accurately and find your percent error.

$$\% \text{ error} = \frac{(\text{real measure} - \text{estimate})}{\text{real measure}}$$

2. Have students go home and sketch the living room, draw a diagram to scale and estimate and calculate the area and perimeter.
   a) How many meters of baseboard would be needed for the room?
   b) What area of hardwood floor would be needed?
   c) How many meters of moulding would be needed?

Perimeter and Area

Outcomes	Elaboration—Instructional Strategies/Suggestions

Outcomes

SCO

By the end of this course, students will be expected to

D1 cdemonstrate an understanding of the concept of perimeter and area of a circle

D2 calculate perimeter and area of a circle

D3 estimate perimeter and area using estimation strategies

D4 use perimeter and area to solve a variety of real world problems

Elaboration—Instructional Strategies/Suggestions

Have students develop an understanding of the area and perimeter (circumference) of circles. You may use a circular geoboard to introduce the terminology of the parts of a circle (diameter, radius, and circumference). The circular geoboard may also be used to explore the ratio of circumference to the diameter of the circle and to serve as a lead into a discussion on Pi and its use in the formula for the area of a circle. Have students draw several circles with varying radii. This can be accomplished by tying a piece of string to a thumb tack and securing the other end to a pencil, or by using a compass. This can establish that a circle has a fixed radius. Have students bring in objects with circular bases. Have them measure, using string or a pipe cleaner, the circumference and the diameter. To find the diameter, discuss strategies. One suggestion would be to trace the circular base, cut it out and fold at least twice to find the centre. Record the circumference and diameter on a chart. Then determine the ratio of the circumference to the diameter. Reinforce the fact that a radius is ½ a diameter and 2 radii are a diameter.

You will have to introduce the students to Pi and its value of 3.14. The formulas of $C = 2\pi r$, and $C = \pi d$ can be introduced to the students. Have students use the formulae $C = 2\pi r$ or $C = \pi d$ to calculate the circumference of the circle given various circular objects or pictures with the radius or diameter given. Once the students understand these formulae, you can move onto calculating the area $A = \pi r^2$. You should remind the students that perimeter is in units and area is in units^2. Have students use the formula $A = \pi r^2$ to determine the area of various circles.

Before students calculate actual perimeter and areas of any circular objects, have them make and record their estimates for the circumference and the area.

Perimeter and Area

**Worthwhile Tasks for Instruction and/or Assessment**   **Suggested Resources**

Performance

1. Draw circles with various radii using string secured to a pencil and a thumb tack (centre of circle). Record the measurements of each circle (radius, diameter, and circumference) in the table below. Use a pipe cleaner or string to measure the circumference.

Circle	Radius	Diameter	Circumference	$\dfrac{\text{circumference}}{\text{diameter}}$
1				
2				
3				
…				

   a) For each circle, calculate the ratio of the circumference to the diameter ratio. What pattern do you notice? What do we call this ratio?
   b) What pattern, if any, do you notice in the relationship between the length of the radius and the length of the diameter?

2. Use the formula $C = 2\pi r$ or $C = \pi d$ to determine the circumference of the following circles. Before actually calculating circumference, record an estimate for each circle.

   1.2 m   8.5 m   30 cm
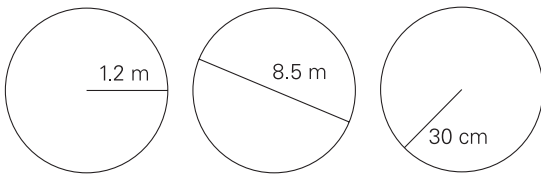
3. Use the formula $A = \pi r^2$ to determine the area of each circle shown below. Estimate the area before actually calculating.

   7 m   4.2 m   14 cm
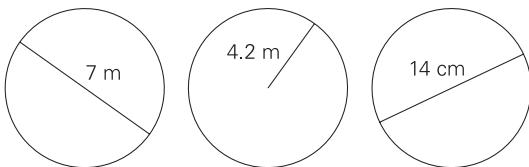
4. A circular garden plot is to be edged with white plastic fencing and the ground covered in landscape fabric. If the diameter of the circular garden is 5 m, determine (a) how many meters of white plastic fencing are required to edge the garden? and (b) how many square meters of landscape fabric are required to cover the garden.

Pythagoras

Outcomes

SCO

By the end of this course, students will be expected to

E1 apply the concepts of squaring numbers and of finding the square root of numbers to determine the length of a side of a right triangle

E2 understand and apply the Pythagorean Theorem

**Elaboration—Instructional Strategies/Suggestions**

Have students understand that a square root number represents the side of a square shape. For example, for a square with an area to 25 square units, the length of the side is 5 (or $\sqrt{25}$) units. Similarly, a square with an area of 56 square units has a side of $\sqrt{56} \approx 7.5$.

Review with students the concept of right angle triangles using different orientations of the triangle. Have the students label the sides of the right angle triangle using formal (hypotenuse, a, and b) and everyday language (little side, big side).
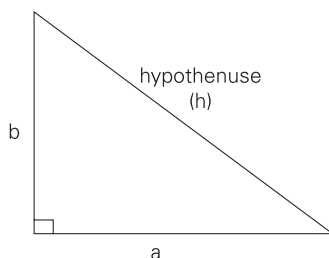
Formal   Everyday
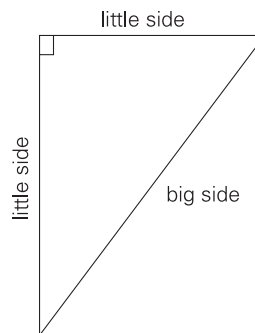
Pythagoras

Worthwhile Tasks for Instruction and/or Assessment	**Suggested Resources**

Performance

Geometer's Sketchpad

E1.1 (a) Draw, on graph paper, three examples of squares: one 3 × 3; one
4 × 4; one 5 × 5.

Understanding Math
Software (demonstrating
Pythagoras's Theorem)

     (b) Draw, on graph paper, three examples of squares: one 3.5 × 3.5; one
4.5 × 4.5; one 5.5 × 5.5.

     (c) Count the squares on the graph paper to find the area of each of square
from parts (a) and (b).

     (d) On your calculator, enter the area of the square (from part (c)) and
press the "square root" ($\sqrt{}$) button. What do you notice? Compare
this number (your answer) to the length of the side of the square.

E1.2 Find the length of the side of a square with an area of
     (a) 27 cm^2 (b) 32 cm^2
     (c) 81 cm^2 (d) 100 cm^2
     (e) 110 cm^2

E2.1 For the following triangles, label/identify the right angle and label the
hypotenuse ((c) or big side), a, and b.
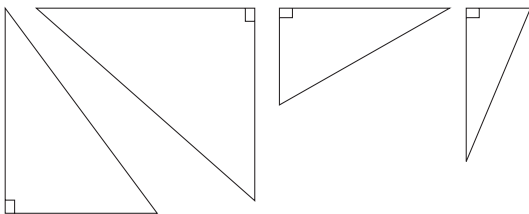
E2.2 Demonstrate the Pythagorean Theorem:
     (a) Draw, on graph paper, a right angled triangle with a = 3 units and
b = 4 units.
     (b) On a new piece of graph paper, draw a square with side = a; a square
with side = b; and a square with side = 5 units. Label the squares
a, b, and c appropriately. Cut out each square.
     (c) Align each square with the matching side of your triangle. What is the
length of the hypotenuse (big side)?
     (d) Cut square a and/or b such that the square covers the are of square c.
What do you notice?
     (e) Which statement is true?
        (i) square a + square b is smaller than square c
        (ii) square a + square b is bigger than square c
        (iii) square a + square b is equal to square c
     (f) Is this true for other triangles? Investigate!

Pythagoras

Outcomes	Elaboration—Instructional Strategies/Suggestions

Outcomes

SCO

*By the end of this course, students will be expected to*

E3 find the missing side measure in a right angle triangle

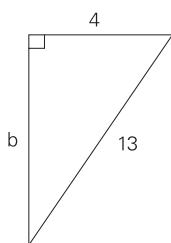**Elaboration—Instructional Strategies/Suggestions**

Have students see the difference between missing a and b sides versus missing a h (or hypotenuse) side. Provide opportunities to express the Pythagorean Theorem in formal and "everyday" language.

formal language formulae:
- $a^2 + b^2 = h^2$
- $h^2 - a^2 = b^2$
- $h^2 - b^2 = a^2$
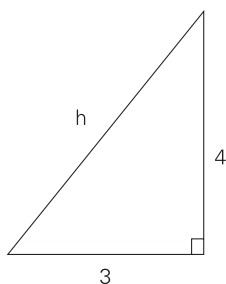
$$c^2 = a^2 + b^2$$
$$c^2 = 3^2 + 4^2$$
$$c^2 = 9 + 12$$
$$\sqrt{h^2} = \sqrt{25}$$
$$c = 5$$

$$b^2 = c^2 - a^2$$
$$b^2 = 13^2 - 4^2$$
$$b^2 = 169 - 16$$
$$\sqrt{b^2} = \sqrt{153}$$
$$b \approx 12.4$$

informal/everyday language formulae:

little side^2 + little side ^{2} = big side ^{2}

big side^2 - little side ^{2} = little side ^{2}
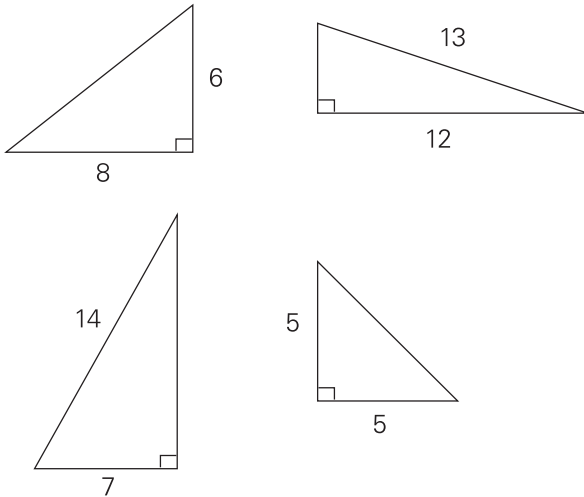
Pythaogras

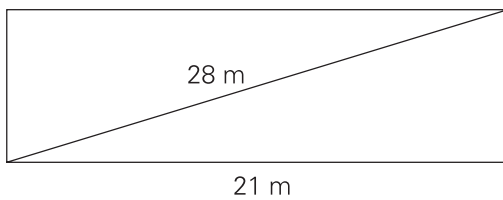| **Worthwhile Tasks for Instruction and/or Assessment**	**Suggested Resources**

Performance

E3.1   Find the missing measurement using the Pythagorean Theorem.

E 3.2   Joe's dad wants to put a fence around his yard. He isn't certain of the amount of fencing he needs but he does have the diagram below. If fencing costs $3.95/m, how much will it cost to fence the yard?

Volume and Surface Area

Outcomes

SCO

By the end of this course, students will be expected to

D5 demonstrate an understanding of volume and surface area

D6 calculate surface area and volume of rectangular prisms and cylinders

D7 use surface area and volume to solve real world problems

D8 estimate the volume and surface area using estimation strategies

Elaboration—Instructional Strategies/Suggestions

You should remind students of the meaning of volume. You could begin by showing students various containers and noting the "amount' of the contents of each container. Students could do the paper activity. Here, students take one piece of 8 ½ × 11 paper and make a tower (cylinder) by rolling it so that the width becomes the height or the length becomes the height of the cylinder. Students can choose either option but you will need to pair the students so that each pair has one of each type. Ensure that the students roll the paper. It should be taped without any overlap. Next, discuss which might hold more cereal. Now, insert the taller cylinder into the other and fill the taller cylinder with cereal. Discuss whether or not, when the taller cylinder is removed, the cereal will fill up the wider cylinder. Remove the taller cylinder and allow the cereal to remain in the other. Discuss the outcome. The taller cylinder should have a smaller capacity/volume.

Students need to understand surface area. You should ask students to bring various cans and boxes into the classroom. To explain the surface area of a cylinder you can remove the outer paper label from the can and show the students the rectangle remembering to relate the circumference of the can to the length of the label. The top/bottom of the can should be traced on paper so that the label and the two circles can clearly be seen as the entire surface area of the can. You should have the students break apart the boxes so that they are open and lying flat. Students should see that the box consists of six rectangles. These rectangles represent the surface area of the box.

Now that your students understand the terms "volume" and "surface area" as they apply to rectangular prisms and surface area, you should introduce net drawings. You can provide students with these drawings as blackline masters or you could have the students draw these on graph/grid paper.

Volume and Surface Area

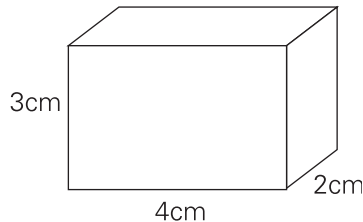**Worthwhile Tasks for Instruction and/or Assessment**

Performance

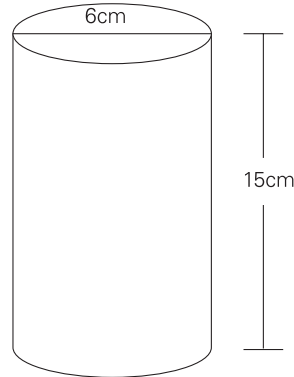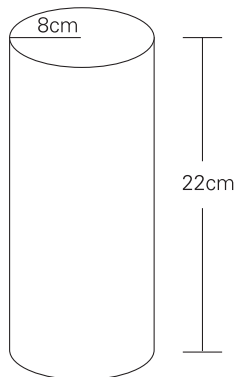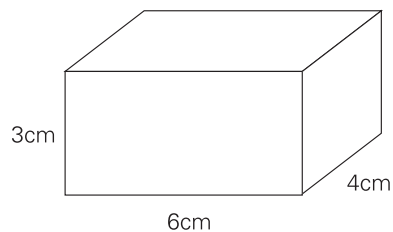D1 Given the following, draw the net diagram for each:

(a) i)

ii)

3cm

4cm

2cm

6cm

15cm

(b) Calculate the surface area of each of the above shapes.

D2 Calculate the volume of each of the following:

(a)

b)

8cm

22cm

3cm

6cm

4cm

D3 Dale is building a wooden box for his garbage. The box is rectangular in shape and is made of pine planks. If the box measures 1.2m ? 0.8m ? 0.6m, how much wood does Dale have to buy to build the box?

D4 Geri has just invented a new dietary drink which he is selling in cans that have a diameter of 14cm and a height of 22cm? Design three different boxes that would hold 24 cans of this new drink. (Hint: 24 cans can be packed in many different ways). Of your designs, which box is the most appropriate? Explain your choice.

Volume and Surface Area

Outcomes

SCO

By the end of this course, students will be expected to

D5 demonstrate an understanding of volume and surface area

D6 calculate surface area and volume of rectangular prisms and cylinders

D7 use surface area and volume to solve real world problems

D8 estimate the volume and surface area using estimation strategies

Elaboration—Instructional Strategies/Suggestions

You should provide students with various boxes and cylinders. Direct the students to consider the volume of each shape and how surface area relates to volume. Encourage the students to measure the bottom of the box or cylinder and the height of each one. You should provide students with net drawings that have measurements and that can be assembled to create a rectangular prism or a cylinder. Allow students the time to calculate the surface area and the volume of each. Direct students to the fact that for any 3-D shape,
Volume = (area of base × height) and for a cylinder $V = \pi r^2 h$.

For the cylinder, develop the surface area formula by finding the area of the base (circle), multiply that by 2, and find the lateral surface area of the cylinder which is equal to the circumference × height. Formula: $SA = 2\pi r^2 + C \times h$ or
$SA = 2\pi r^2 + \pi dh$ or $SA = 2\pi r^2 + 2\pi rh$.

When the students are adept enough at doing these calculations, you can extend their abilities by representing real life scenarios for them to solve.

Provide the students with the measurements of a rectangular swimming pool and have them calculate the volume of water required to fill it.

Perimeter and Area

Worthwhile Tasks for Instruction and/or Assessment   **Suggested Resources**

Performance

1. Have the students calculate the surface area of his/her bedroom for painting. You can then have the student determine the cost of painting the room if a 4.2L can of paint covers 94m^2 and costs $38.95.

2. A water tower in the shape of a cylinder has a height of 10 m and a diameter of 5 m. The tank needs to be painted each year. (1 can of paint covers 94 m^2.)
   a) How much paint is needed?
   b) How many litres of water will the tank hold? (1m^3 = 1000L)

2-D Scale Diagrams and 3-D Scale Models

Outcomes	Elaboration—Instructional Strategies/Suggestions
SCO	Prior Knowledge: Before beginning this unit, students need to understand ratio, fractions, percent, and proportion. Students should review metric units (mm, cm, m, and km). 3-D drawings may be too difficult. It may be advisable to use technology for 3-D drawings.
By the end of this course, students will be expected to	
D9 Calculate scale factors in 2-D scale diagrams and 3-D scale models understand the relationship among the scale factor and the related change in area or volume	**D9.** Introduce to the students the concept of scale drawings and illicit examples from them (e.g. blueprints for a house, scale floor plans, landscaping/paving/school floor plans, etc.). Practice calculating scales by providing them with scale diagrams and actual measurements. Also practice questions like, A scale diagram of a family room has dimensions 4.5cm by 3.5 cm. In the scale diagram 1 cm represents 3m. What are the dimensions of the room.
E2 Create 2-D scale diagrams and 3-D scale models	Discuss with the students how changing the dimensions of any object will effect the area of the object. For example, enlarging or reducing on the photocopier. If you press the 50% reduce button, it is the length and width that is reduced 50% which will reduce the area to 25% of the original. If you increase the size of the picture by 200%, the length and width of the picture will increase by 200% and the area will increase by 400%. By exposing students to a variety of activities involving enlargements and reductions, students will understand the relationships between changing a dimension and the corresponding change in area
	E2. Have students create scale drawings of classroom items until they feel comfortable with the process. For example: Have students measure the length and width of the top of their desks and make a scale diagram on grid paper of it. Make sure they indicate the scale they used.

2-D Scale Diagrams and 3-D Scale Models

Worthwhile Tasks for Instruction and/or Assessment	**Suggested Resources**

Performance

1. Create a dream bedroom or recreational room. Make sure the dimensions are 12 m by 14 m. There is a 1 m door and a 2 m closet. There are 2 ? 1 m windows. You must include at least a bed and 1 bureau in your room. As well you need to include at least 3 other pieces of furniture. Each piece of furniture must be drawn to scale. What is the scale you used and what is the area of the remaining floor space? Use the appropriate unit of measurement.
2. Using a scale of 1 to 10 draw a scale diagram of a window at home or in the classroom.
3. Using a scale of 1 to 10 draw a scale diagram of a circular window with a diameter of 50 cm.
4. You have been given a picture and a reduced copy of the picture.
   a) Measure the length and width of each picture and calculate the area of each.
   b) How many times larger is the original picture, how many times greater is the original area?
5. Complete the table below and the examine it to devise some conclusion(s) as to how area is affected by doubling and tripling the dimensions.

l	w	Area
2	3	
4	6	
6	9	

6. Use pipe cleaners to make a 3-D model of some object in the classroom.
7. Your mother has asked you and your brother Cameron to double the size of the garden. Your plan is to double the length and the width. Cameron said you should only double the length. Who is right? Draw diagrams to support your decision.

Taking a Trip

Taking a Trip

Outcomes

SCO

By the end of this course, students will be expected to

B10 determine the expenses related to taking a trip (i.e. gasoline, accommodations, meals, etc.)

B11 determine distances using scales on a map

A4 understand how to read a map check the accuracy of a statement of bankbook

Elaboration—Instructional Strategies/Suggestions

You should have students complete a detailed plan for a vacation. Students should investigate and research
- Travel routes (reading a map)
- Costs involved in traveling
- Modes of travel
- Currency exchange
- Time zones
- Twenty-four hour clock
- Accomodations/Meals

After students have planned their itinerary, they should find hotels to stay in online and find the cost for each hotel online and find the cost for each night and appropriate taxes. They must estimate how many meals and the cost of those meals. Students would look at different models of transportation and compare costs. Students should be able to compute gas mileage. Include calculations using formula.

Students must be able to solve ratios and proportions.

#L per 100km

$$\frac{\#L}{100km} = \frac{xL}{total\ distance}$$

If their trip takes them out of the country, they must be able to convert gallons to litres (US gallons/L = 1US gallon/3.75L).

Students must be taught to change km to miles and vise versa
(km $\rightarrow$ miles: $\times$ 0.6).

Extension: Explore cost of renting a car and flying, travelling by bus or train, etc. Look at train, bus and flight schedules as well as the cost of attractions etc. Students should be able to interpret the legend of a map and use it. Students should be able to use the map index to find location of places. Students should use a piece of string and rules and using scales be able to calculate distances from place to place.

Perimeter and Area

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources

**Worthwhile Tasks for Instruction and/or Assessment**

Performance

1. Bill flew from Halifax at 7:00 am and arrived in Calgary at 2:00pm Atlantic Time, What time was it in Calgary?
2. Gas costs $0.90 per litre and a car consumes 12 L of gas per 100 km. How much would the gas cost for a 600 km trip?
3. Provide students with a schedule (ie bus, tran, etc.) and answer questions relative to that schedule.
4. Have students describe four different modes of travel for a trip from Halifax to Toronto. Discuss which will cost the most and least and identify why? (ie. Meals, gas etc.)
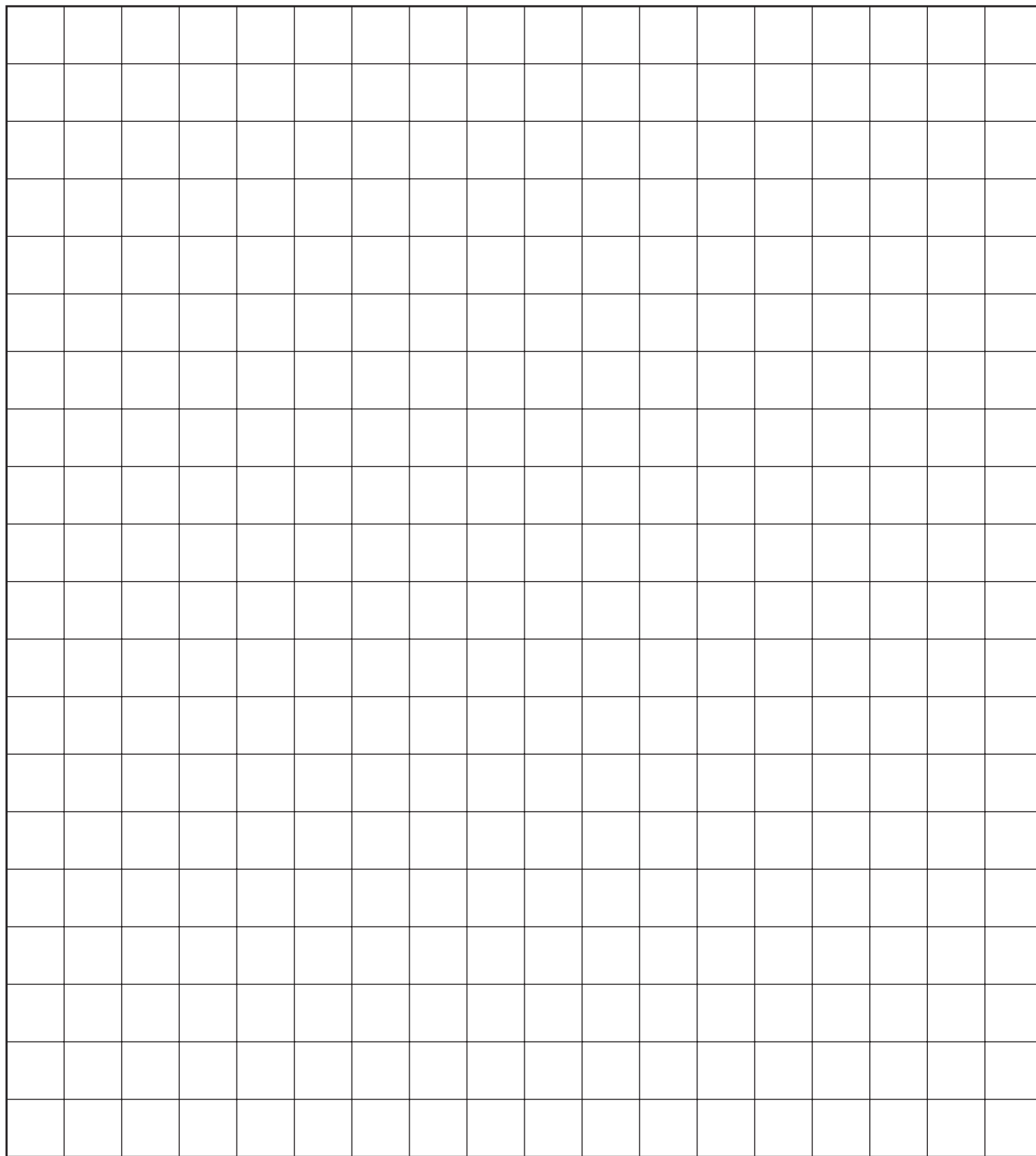
Suggested Resources

<www.mapquest.ca>

Zip codes and postal codes of the world on internet

Appendix

Appendix A: Page of Rectangles (Outcomes D1–D4)
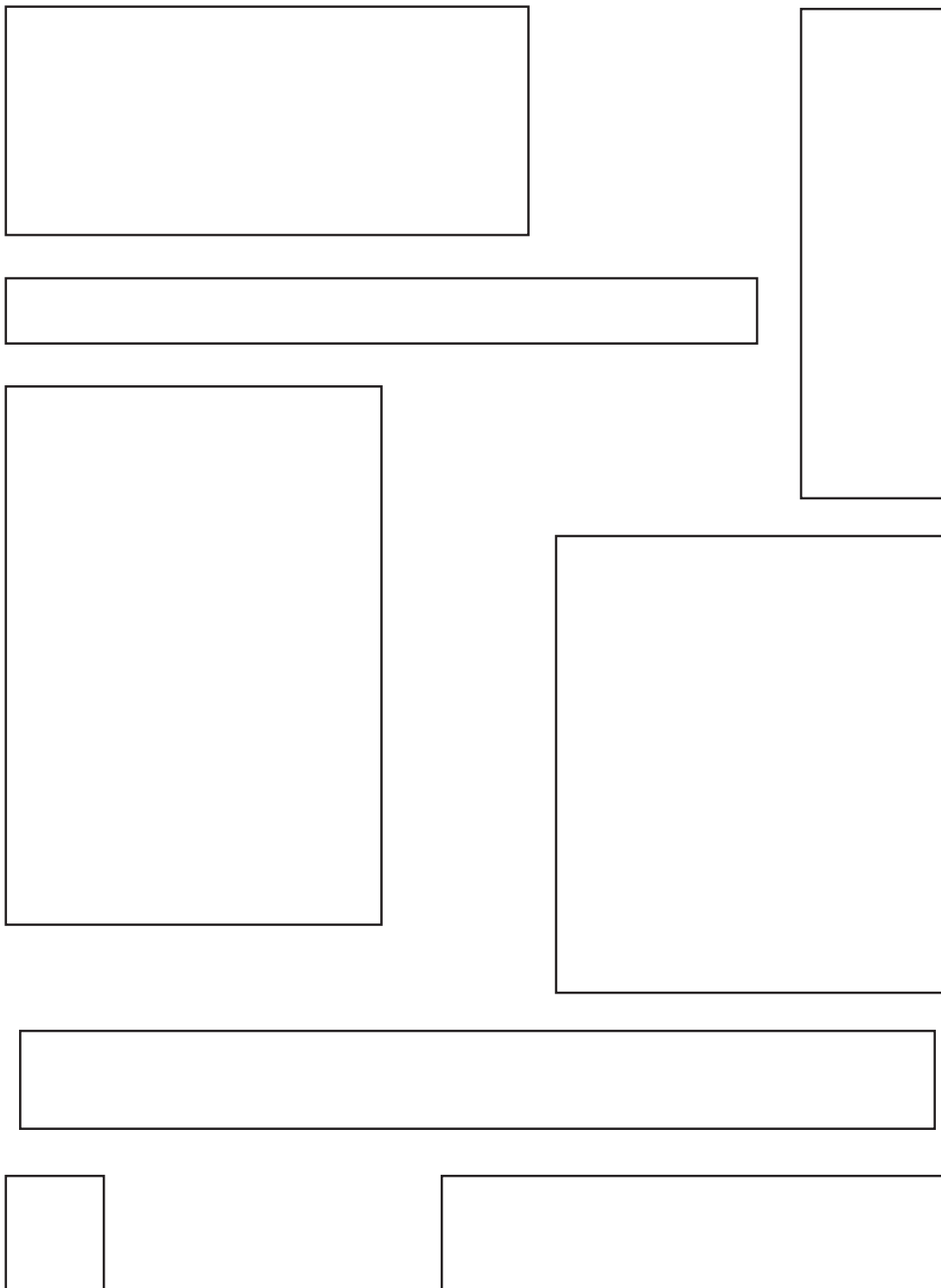
Appendix B: Grid Paper (1.0cm)

Appendix C: Transparent Ruler 1×10