# KNOWLEDGE AND EMPLOYABILITY MATHEMATICS GRADES 8 AND 9

Knowledge and Employability courses provide students who meet the criteria with opportunities to experience success and become well prepared for employment, further studies, citizenship and lifelong learning.

## VISION

Through Knowledge and Employability courses, students become active and responsible citizens, achieve their educational and career goals, improve quality of life for themselves and their families and positively impact their communities.

## PHILOSOPHY AND RATIONALE

The development of the Knowledge and Employability courses was based on input received from consultations with education stakeholders throughout the province. The distinctive sequence of courses was designed to meet the educational needs of students who learn best:

- when focusing on the development and application of reading, writing and mathematical literacy,[1] and on essential employability skills
- through experiential learning activities
- when meaningful connections are made between schooling and personal experiences.

Knowledge and Employability courses assist students in:

- transitioning from school to the workplace and community
- preparing for responsible citizenship
- gaining recognition, respect and value from employers and further education providers.

Knowledge and Employability courses promote student skills, abilities and work ethics, including:

- academic and occupational skills of a standard determined by the workplace to be necessary for success
- practical applications through on- and off-campus experiences and/or community partnerships
- career development skills to explore careers, develop a career-focused portfolio and assess career skills
- interpersonal skills to ensure respect, support and cooperation with others.

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1. Mathematical literacy: Selecting and applying appropriate mathematical operations, problem-solving strategies, tools and technology, and communicating using mathematical vocabulary in home, workplace and community experiences.

**Aboriginal Perspectives and Experiences**

For historical, constitutional and social reasons, an understanding of First Nations, Métis and Inuit (FNMI) experiences and perspectives, and recognition that First Nations, Métis and Inuit students have particular needs and requirements, is necessary to enable all students to be respectful and responsible citizens.

Knowledge and Employability courses serve to facilitate positive experiences that will help Aboriginal students better see themselves in the curriculum and assist non-Aboriginal students to develop a better understanding of Alberta's First Nations, Métis and Inuit peoples.

## GOALS OF KNOWLEDGE AND EMPLOYABILITY COURSES

Knowledge and Employability courses provide students with practical and applied opportunities to develop competencies necessary to meet or exceed the following goals. Knowledge and Employability courses prepare students to:

- earn a senior high school credential
- enter the workplace upon leaving school with employability and occupational skills that meet industry standards
- make successful transitions to other courses or to further education and training
- become responsible and contributing members of society.

## CROSS-CURRICULAR, COMMUNITY AND WORKPLACE CONNECTIONS

Programs of study and resources for Knowledge and Employability courses are distinctive, in part, because they promote cross-curricular, community and workplace connections.

**Cross-curricular Connections**

Knowledge and Employability courses promote the integration of subjects to emphasize their interrelationships and connections to other school subjects. The philosophy of Knowledge and Employability courses is that students learn best when they can clearly recognize, in their course work, connections, applications and relevance to a

variety of everyday experiences. Organizing for instruction may include thematic units, subject integration within units and/or projects in other subjects.

**Community and Workplace Connections**

Knowledge and Employability courses provide students with practical and applied opportunities to develop basic reading, writing and mathematical literacy. Community and workplace connections ensure learning within applied contexts, connecting the school with environments beyond school, and may include tours to local businesses and industries, mentorships, job shadowing and work experience.

Knowledge and Employability courses promote the development of career portfolios that help students connect their school experience to the world beyond school. Each portfolio will include exemplars of the student's on- and off-campus experiences and can be used when the student is seeking employment or further education/training opportunities. Items appropriate for inclusion in career portfolios include résumés, samples of written work, awards and/or their representations, teacher and self-evaluation checklists, workplace assessment tools and employer letters of recommendation.

## SAFETY

Safety is emphasized and relevant information is incorporated throughout Knowledge and Employability courses, including basic safety rules and guidelines and information regarding the safe use of tools, equipment and materials in school, home, community and workplace settings.

## TECHNOLOGY

Because technology is best learned within an applied context, Information and Communication Technology (ICT) outcomes, and the use of computers and other technologies, are included in Knowledge and Employability courses. This technology integration will help students make the transition to the world beyond school.

## ESSENTIAL UNIVERSAL SKILLS AND STRATEGIES

Knowledge and Employability courses emphasize the universal skills and strategies that are essential to all students, including the following:

- Interpersonal skills promote teamwork and respect for, support of and cooperation with others.
- Critical thinking promotes the analysis and appropriate applications of information.
- Creative thinking promotes the identification of unique connections among ideas and insightful approaches to questions and issues.
- Decision-making processes promote the making of timely and appropriate decisions.
- Problem-solving processes promote the ability to identify or pose problems and apply learning to consider the causes and dimensions of, and the solutions to, problems.
- Metacognition[2] enables students to become more aware of, and have greater control over, their own thinking and learning processes.

## RELATIONSHIP TO OTHER COURSES

Each Knowledge and Employability course is consistent with the rationale, philosophy, program foundations and organization of other secondary courses. This consistency enables students, as appropriate, to progress through the Knowledge and Employability course sequence and/or to other secondary courses.

## ENROLLMENT IN KNOWLEDGE AND EMPLOYABILITY COURSES

Students may take one or more courses in the sequence at any time during grades 8 through 12. Students may be enrolled in only Knowledge and Employability courses or in a combination of Knowledge and Employability and other secondary courses.

Information regarding the identification of students for enrollment in one or more courses can be accessed in the *Knowledge and Employability Courses Handbook, Grades 8–12.*

## RATIONALE AND PHILOSOPHY OF KNOWLEDGE AND EMPLOYABILITY MATHEMATICS

Knowledge and Employability mathematics courses focus on developing essential mathematics knowledge, skills and attitudes needed for everyday living at home, in the workplace and in the community.

This sequence is designed for students whose needs, interests and abilities focus on basic mathematical understanding; e.g., literacy. Emphasis is on the acquisition of practical life skills and competency in using mathematics to solve everyday problems, interpret information and create new knowledge within the contexts of the home, the workplace and the community.

Mathematics competencies are developed through a problem-solving, experiential approach, using information and activities that directly relate to students' current and future experiences. A variety of activities and problems, along with community partnerships, help students understand and appreciate the role of mathematics in society. The use of manipulatives and other strategies/tools in Knowledge and Employability mathematics courses assists in addressing the diversity of learning styles and different developmental stages of individual students.

Knowledge and Employability mathematics courses emphasize career/life skills, teamwork, communication skills and thinking processes. Information and Communication Technology (ICT) outcomes, and the use of calculators, computers and other technologies, are integrated into the courses to help provide quick and accurate computation and manipulation and to enhance conceptual understanding.

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2. Metacognition: Learning-to-learn strategies; awareness of processes and strategies one uses when learning.

Knowledge and Employability mathematics courses are derived from *The Common Curriculum Framework for K–12 Mathematics: Western Canadian Protocol for Collaboration in Basic Education* (1995) and *The Common Curriculum Framework for K–12 Mathematics Grade 10 to Grade 12: Western Canadian Protocol for Collaboration in Basic Education* (1996). Outcomes have been created and/or modified as needed.

These courses follow standards set out by the National Council of Teachers of Mathematics (NCTM).

## GOALS OF KNOWLEDGE AND EMPLOYABILITY MATHEMATICS

Students will develop the following mathematics competencies in the context of solving everyday problems. Students will:

- identify the problem and select and apply appropriate problem-solving strategies, mathematical operations and tools
- estimate and calculate solutions accurately
- evaluate processes, results and personal/ group performance
- develop teamwork skills and use appropriate vocabulary to reason and communicate mathematically
- apply mathematical literacy to everyday situations.

## COMPONENTS OF KNOWLEDGE AND EMPLOYABILITY MATHEMATICS

Knowledge and Employability mathematics courses have similarities with, and linkages to, other mathematics courses. However, Knowledge and Employability mathematics courses and resources are distinctive in that they:

- provide students with practical and applied opportunities to develop mathematical competencies

- promote the integration of curriculum and community partnerships to connect mathematics to other school subjects and to other environments.

## CONCEPTUAL FRAMEWORK FOR KNOWLEDGE AND EMPLOYABILITY MATHEMATICS

Within the context and nature of mathematics, the courses include the development of mathematical processes to assist students in achieving their learning goals and to encourage lifelong learning in mathematics.
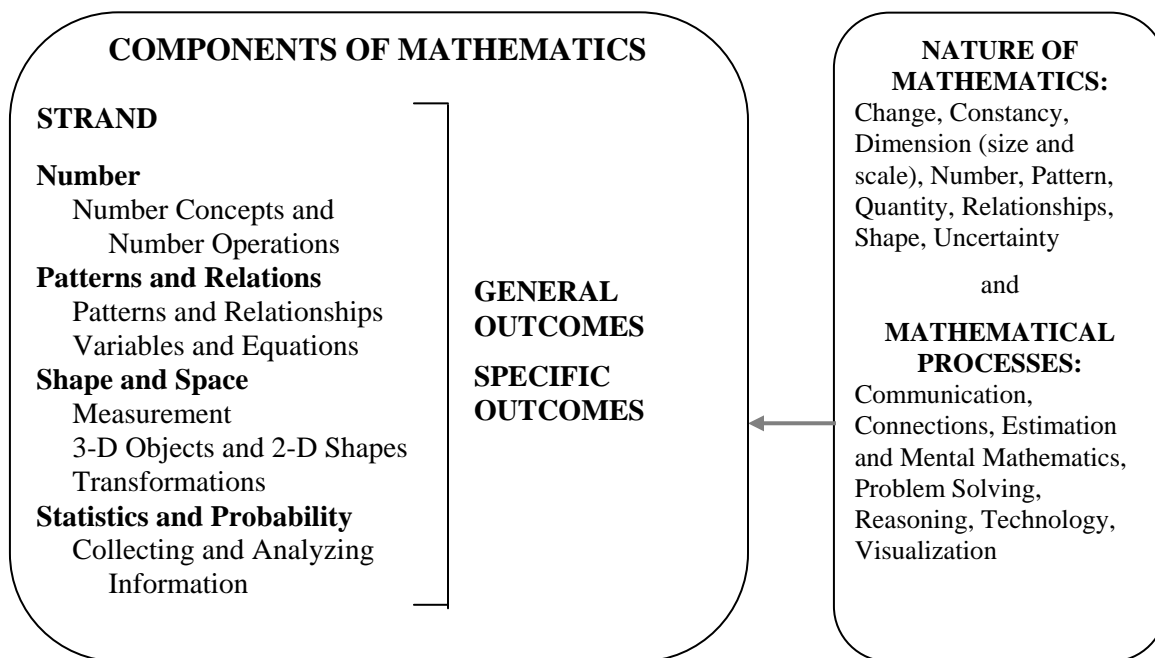
The conceptual framework outlined in this section presents:

- a multifaceted view of mathematics
- the discipline as a set of interwoven skills, procedures and concepts.

The following graphic illustrates how student outcomes are organized by strand and are designed to be influenced by mathematical processes and the nature of mathematics.

# KNOWLEDGE AND EMPLOYABILITY MATHEMATICS

Students use a problem-solving approach to complete calculations and solve word problems in everyday home, workplace and community contexts.

## COMPONENTS OF MATHEMATICS

**STRAND**

**Number**
   Number Concepts and
      Number Operations
**Patterns and Relations**
   Patterns and Relationships
   Variables and Equations
**Shape and Space**
   Measurement
   3-D Objects and 2-D Shapes
   Transformations
**Statistics and Probability**
   Collecting and Analyzing
      Information

**GENERAL OUTCOMES**

**SPECIFIC OUTCOMES**

**NATURE OF MATHEMATICS:**
Change, Constancy, Dimension (size and scale), Number, Pattern, Quantity, Relationships, Shape, Uncertainty

and

**MATHEMATICAL PROCESSES:**
Communication, Connections, Estimation and Mental Mathematics, Problem Solving, Reasoning, Technology, Visualization

## MATHEMATICAL PROCESSES

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and to embrace lifelong learning in mathematics. Students in Knowledge and Employability mathematics courses will build on and apply mathematical processes, using everyday home, workplace and community problems.

This program of studies incorporates the following seven interrelated mathematical processes that are intended to permeate teaching and learning.

### Communication [C]
Students need opportunities to read about, represent, view, write about, listen to and discuss mathematical ideas in everyday and workplace contexts. These opportunities allow students to create links between their own language and ideas and the formal language and symbols of mathematics.

Communication is important in clarifying, reinforcing and modifying ideas, attitudes and beliefs about mathematics. Students should be encouraged to use a variety of forms of communication while learning mathematics. Students also need to communicate their learning using mathematical terminology.

Communication can help students make connections among concrete, pictorial, symbolic, verbal, written and mental representations of mathematical ideas.

### Connections [CN]
Contextualization and making connections to experience are powerful processes in developing mathematical understanding. When mathematical ideas are connected to each other through concrete, pictorial, symbolic, verbal, written and mental representations, or through real-world contexts, students can begin to view mathematics as useful, relevant and integrated.

Learning mathematics within contexts and making relevant connections can validate past experiences and increase student willingness to participate and be actively engaged.

The brain is constantly looking for and making connections. "Because the learner is constantly searching for connections on many levels, educators need to orchestrate the experiences from which learners extract understanding.… Brain research establishes and confirms that multiple, complex and concrete experiences are essential for meaningful learning and teaching."[3]

### Estimation and Mental Mathematics [E]
Students need to know the how and when, and what strategy to use, when estimating. Estimation is a strategy for determining approximate values or quantities, usually by referring to benchmarks, or for determining the reasonableness of calculated values. Estimation is used to make mathematical judgements and develop useful, efficient strategies for dealing with situations in daily life.

Mental mathematics is a combination of cognitive strategies that enhances flexible thinking and number sense and enables students to determine answers without paper and pencil. It improves computational fluency by developing efficiency, accuracy and flexibility. Mental mathematics "is the cornerstone for estimation and leads to better understanding of number concepts and number operations."[4]

### Problem Solving [PS]
Learning through problem solving should be the focus of mathematics at all grade levels. When students encounter new situations and respond to questions like "*How would you ...?*" or "*How could you ...?*", the problem-solving approach is being modelled. A true understanding of mathematical concepts and procedures is developed when the problems are solved in meaningful contexts and when students develop their own problem-solving strategies by being open to listening, discussing and trying alternatives.

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

### Reasoning [R]
Students need to develop confidence in their ability to reason and justify their thinking within and outside of mathematics. Mathematical reasoning helps students think logically and make sense of mathematics.

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

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

3. Renate Numella Caine and Geoffrey Caine, *Making Connections: Teaching and the Human Brain* (Menlo Park, CA: Addison-Wesley Publishing Company, 1991), p. 5.

4. Jack A. Hope et al., *Mental Math in the Primary Grades* (Palo Alto, CA: Dale Seymour Publications, 1988), pp. 161–173.

Calculators and computers can be used to:

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

## Visualization [V]

Visualization "involves thinking in pictures and images, and the ability to perceive, transform and recreate different aspects of the visual-spatial world."[5] The use of visualization in the study of mathematics provides students with opportunities to understand mathematical concepts and make connections among them.

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

## NATURE OF MATHEMATICS

Knowledge and Employability mathematics courses focus on making connections between the components of mathematics and everyday home, workplace and community applications.

## Change

To make predictions, students need to describe and quantify their observations, attempt to build patterns and identify those quantities that remain fixed and those that change.

## Constancy

Students are expected to communicate ideas visually, using diagrams and spoken and written forms, when describing constancy. The most important properties in mathematics and science relate to those properties that do not change when outside conditions do.

Stability, conservation, equilibrium, steady state and symmetry are terms used to describe constancy.

Students need to be aware of the properties that remain fixed so that they can solve problems involving constants; e.g., rates of change, lines with constant slope, direct variation situations or the angle sums of triangles.

## Dimension (size and scale)

The concept of dimension is generally associated with 3-D objects, 2-D shapes or 1-D lines and needs to be developed within an environment of physical objects.

Physical objects can also be described using measurement concepts and pattern recognition, rather than the memorization of formulas.

## Number

Number, number systems and number operations are vital to all mathematics learning. The use of number must include number sense. Number sense includes:

- an intuitive feeling about numbers and their multiple relationships
- the construction of the meaning of number through a variety of experiences
- the development of an appreciation of the need for numbers beyond whole numbers
- an appreciation of, and the ability to make, quick and accurate estimations for computation and measurement

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5. Thomas Armstrong, *Seven Kinds of Smart: Identifying and Developing Your Many Intelligences* (New York, NY: NAL-Dutton, 1993), p. 10.

- the ability to detect arithmetic errors
- knowledge of place value and the effects of arithmetic operations.

Number sense includes the recognition of number patterns that can be used to count, make predictions, describe shapes and make comparisons.

## Pattern

"Mathematics is an exploratory science that seeks to understand every kind of pattern."[6]

Patterns exist in numbers, geometry, algebra and data. Mathematics becomes a useful tool to assist students in their systematic and intellectual understanding of their environment by helping them recognize, extend, create and use patterns as a routine aspect of their lives.

## Quantity

In everyday situations, individuals classify, measure and order. Some outcomes in this program of studies, therefore, address single numbers, numbers attached to units of measure and ordered sets of numbers. Other outcomes address the interpretation of numbers and number systems.

With the growing use of technology to process numerical information, it is essential for students to have a wide range of estimation skills to evaluate whether the numerical output provided by a calculator or a computer is a reasonable solution to a given problem.

## Relationships

The study of mathematics is the development of relationships between and among things. Students should look for relationships among physical things and the data used to describe those things.

things. Relationships will be described visually, symbolically, orally and in written form.

## Shape

Shape in mathematics is central to geometry but also includes:

- geometric representations of algebraic relations
- the geometry of maps
- the creation of networks of plane figures that can be used to construct 3-D objects.

It is very important for students to look for and use similarities, congruences, patterns, transformations, dilatations and tessellations in the solution of a range of everyday problems.

The use of language to describe shapes is an important aspect of mathematics and allows for the classification of objects according to various attributes and for the naming and analysis of objects.
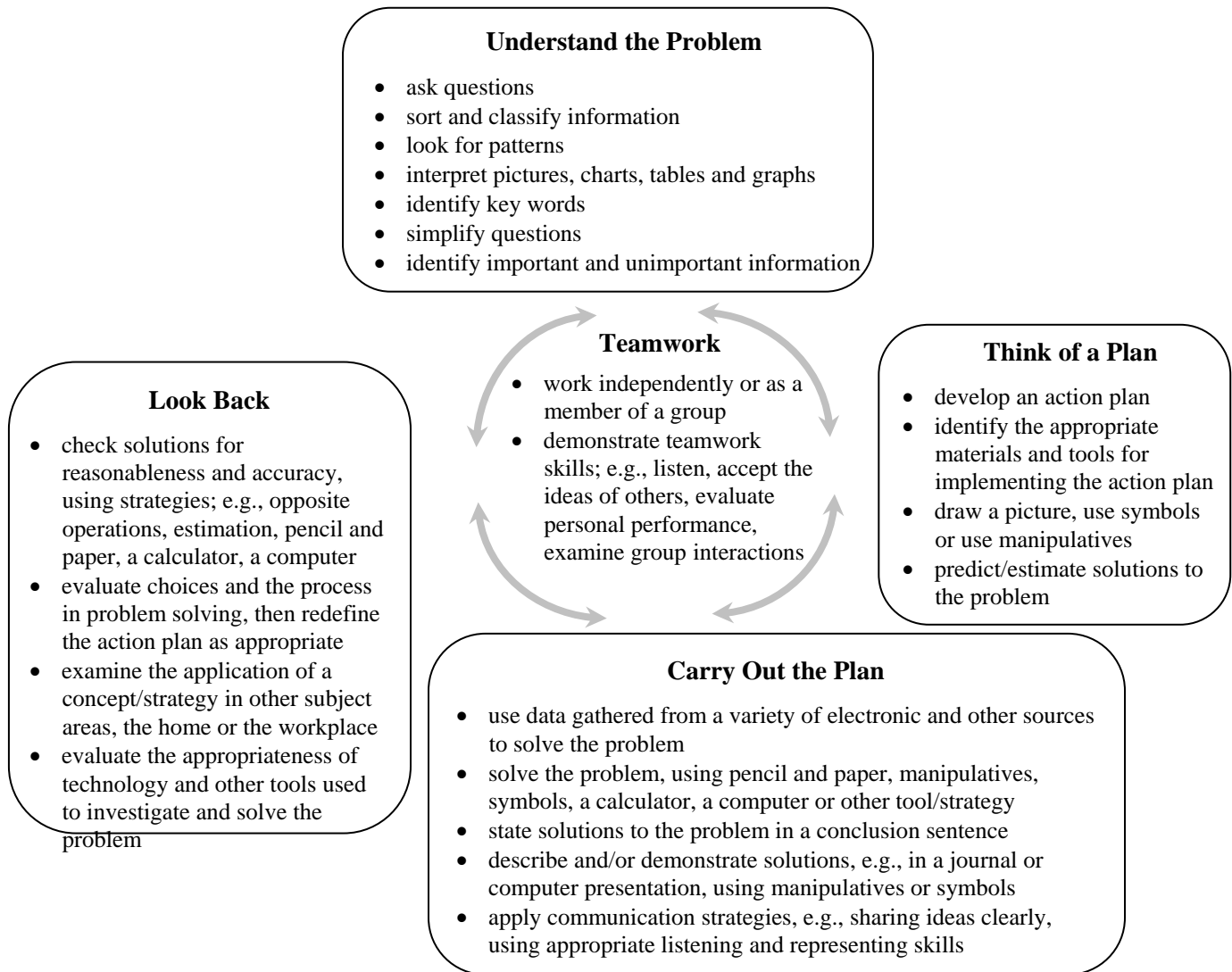
## Uncertainty

Uncertainty involves data, chance, measurements and errors. Problems dealing with data, together with numbers found in various contexts, can be solved within the school mathematics program as long as the data provided and the problems posed have some meaning and relevance to students.

Chance deals with the predictable and the unpredictable outcomes of events. From an early age, students are expected to deal with the concept of chance. As they mature, they use language to describe chance that is more sophisticated and that involves the vocabulary of probability theory.

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Descriptions of the attributes of objects are used to examine symmetry and congruence and to classify

[6] Lynn Arthur Steen, ed., *On the Shoulders of Giants: New Approaches to Numeracy* (Washington, DC: National Academy Press, 1990), p. 8.

# PROBLEM-SOLVING FRAMEWORK FOR
# KNOWLEDGE AND EMPLOYABILITY MATHEMATICS

### Understand the Problem

- ask questions
- sort and classify information
- look for patterns
- interpret pictures, charts, tables and graphs
- identify key words
- simplify questions
- identify important and unimportant information

### Teamwork

- work independently or as a member of a group
- demonstrate teamwork skills; e.g., listen, accept the ideas of others, evaluate personal performance, examine group interactions

### Think of a Plan

- develop an action plan
- identify the appropriate materials and tools for implementing the action plan
- draw a picture, use symbols or use manipulatives
- predict/estimate solutions to the problem

### Look Back

- check solutions for reasonableness and accuracy, using strategies; e.g., opposite operations, estimation, pencil and paper, a calculator, a computer
- evaluate choices and the process in problem solving, then redefine the action plan as appropriate
- examine the application of a concept/strategy in other subject areas, the home or the workplace
- evaluate the appropriateness of technology and other tools used to investigate and solve the problem

### Carry Out the Plan

- use data gathered from a variety of electronic and other sources to solve the problem
- solve the problem, using pencil and paper, manipulatives, symbols, a calculator, a computer or other tool/strategy
- state solutions to the problem in a conclusion sentence
- describe and/or demonstrate solutions, e.g., in a journal or computer presentation, using manipulatives or symbols
- apply communication strategies, e.g., sharing ideas clearly, using appropriate listening and representing skills

**Strand: Number (Number Concepts and Number Operations)**

*Students will:*

- estimate and solve number problems in everyday home, workplace and community contexts, using technology as appropriate
- develop and demonstrate number sense to describe quantities, represent numbers in multiple ways and apply appropriate arithmetic operations
- assess the reasonableness of calculations and problem-solving strategies
- communicate mathematically and investigate the application of number concepts and operations in a variety of career and workplace situations, working individually or as members of a team.

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

| Grade 8 | Grade 9 |
|---|---|
| **General Outcome** | **General Outcome** |
| *Students will:* | *Students will:* |
| demonstrate a number sense for whole numbers, common fractions, decimals and percents and apply arithmetic operations to solve problems with whole numbers, fractions, decimals and percents in everyday contexts. | demonstrate a number sense for whole numbers, common fractions, mixed numbers, decimals, percents and ratios; explore integers; and apply arithmetic operations to solve problems in everyday contexts. |
| **Specific Outcomes** | **Specific Outcomes** |
| *Students will:* | *Students will:* |
| 1. use estimation strategies to estimate quantities and read and write numerals and number words to 1 000 000 [C, CN, E, V]<br>2. compare and order whole numbers [C, CN, R, V]<br>3. represent an understanding of place value to the hundredths concretely, pictorially and symbolically [C, CN, R, V]<br>4. recognize, model and describe multiples, factors, composites and primes to 100 concretely, pictorially and symbolically [C, CN, R, V]<br>5. represent and describe proper fractions, mixed numbers and equivalent fractions concretely, pictorially and symbolically [C, R, V]<br>6. compare and order proper fractions and decimals to the hundredths [C, R,V]<br>7. estimate and apply arithmetic operations to whole numbers and decimals to the hundredths in everyday contexts [CN, E, PS, R] | 1. use estimation strategies to estimate quantities and read and write numerals in the millions [C, CN, E, V]<br>2. round numbers to the nearest unit, tenth and hundredth [E, R]<br>3. recognize, model and describe, concretely, pictorially and symbolically:<br>  &bull; multiples; e.g., lowest common multiple for pairs of numbers less than 10<br>  &bull; factors; e.g., greatest common factor for pairs of numbers less than 25<br>  &bull; composites<br>  &bull; prime factorizations<br>  [C, PS, R, T, V]<br>4. write a whole number:<br>  &bull; as an expanded numeral, using powers of 10<br>  &bull; in scientific notation<br>  [C, CN, V] |

| Grade 8 | Grade 9 |
|---|---|
| **Specific Outcomes** (continued) | **Specific Outcomes** (continued) |
| *Students will:* | *Students will:* |
| 8. estimate and apply arithmetic operations to proper fractions with like denominators concretely, pictorially and symbolically [CN, E, PS, R, T] | 5. estimate and apply arithmetic operations to whole numbers and decimals, e.g., 2-digit whole number multipliers and divisors, in everyday contexts [E, PS, R, T] |
| 9. identify decimal equivalents for commonly used fractions, such as halves, quarters and tenths [C, CN, R,V] | 6. estimate and apply arithmetic operations to proper fractions and mixed numbers with like denominators concretely, pictorially and symbolically [CN, E, PS, T] |
| 10. estimate and apply arithmetic operations to decimals to the hundredths concretely, pictorially and symbolically to solve problems in everyday contexts [C, CN, E, PS, R, T, V] | 7. generate and verify equivalent fractions to solve problems that involve adding and subtracting fractions with unlike denominators [PS, R, T, V] |
| 11. represent and explain the meaning of percentage and the relationship between percentage and decimals concretely, pictorially and symbolically [C, CN, R, V] | 8. convert among fractions**,** decimals and percents concretely, pictorially and symbolically [CN, PS] |
| 12. assess the reasonableness of calculations and problem-solving strategies, using a variety of tools and/or strategies; e.g., estimation, mental mathematics, tables, graphs, calculators and/or computers [CN, E, PS, R, T] | 9. assess the reasonableness of calculations and problem-solving strategies, using a variety of tools and/or strategies; e.g., estimation, mental mathematics, tables, graphs, calculators and/or computers [CN, E, PS, R, T] |
| 13. estimate and measure temperature and use conversion charts and other tools to compare Celsius and Fahrenheit, as appropriate in everyday experiences [CN, E, PS, R, T] | 10. represent and explain the meaning of rates concretely, pictorially and symbolically [C, CN, R, V] |
| 14. identify common uses of positive and negative numbers, including above/below sea level and temperatures [C, CN, R, V] | 11. estimate and calculate mean (average) in relation to everyday contexts [C, CN, E, R, V] |
| | 12. estimate and calculate percents to solve everyday problems [C, CN, E, PS, R, V] |
| | 13. use rates to estimate, calculate and compare prices [C, CN, E, R] |
| | 14. compare and order positive and negative numbers, using appropriate tools; e.g., a number line or a thermometer [R, T, V] |

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| **Strand: Patterns and Relations (Patterns and Relationships)** <br> *Students will:* <br> • recognize that patterns and relationships exist in nature and everyday living <br> • use patterns and relationships to develop a better understanding of their environments and to solve everyday problems at home, in the workplace and in the community, using technology as appropriate <br> • assess the reasonableness of calculations and problem-solving strategies <br> • communicate mathematically and investigate the application of patterns and relationships in a variety of career and workplace situations, working individually or as members of a team. | **C** Communication <br> **CN** Connections <br> **E** Estimation and Mental Mathematics <br> **PS** Problem Solving <br> **R** Reasoning <br> **T** Technology <br> **V** Visualization |

| Grade 8 | Grade 9 |
|---|---|
| **General Outcome** <br><br> *Students will:* <br><br> construct, extend and summarize patterns, including those found in nature and within their environments, using rules, charts, mental mathematics, calculators and other strategies/tools. | **General Outcome** <br><br> *Students will:* <br><br> use relationships to summarize, generalize and extend patterns to understand the environment and solve everyday problems. |
| **Specific Outcomes** <br><br> *Students will:* <br><br> 1. identify and describe, in spoken or written form, patterns and relationships in nature and in everyday contexts [C, CN, R, V] <br> 2. represent a rule for a pattern, make predictions using the rule and extend the rule [C, CN, E, R, V] | **Specific Outcomes** <br><br> *Students will:* <br><br> 1. identify, describe and summarize, in spoken and written form, patterns and relationships [C, CN, R, V] <br> 2. make predictions based on everyday patterns and use patterns to draw conclusions [CN, E, R] <br> 3. create expressions and rules to describe, complete and extend patterns and relationships [C, CN, PS, R] |

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

**Strand: Patterns and Relations (Variables and Equations)**

*Students will:*

- represent algebraic equations in multiple ways to solve everyday problems, using technology as appropriate
- communicate mathematically and investigate the application of variables and equations in a variety of career and workplace situations, working individually or as members of a team.

| Grade 8 | Grade 9 |
|---|---|
| **General Outcome**<br><br>*Students will:*<br><br>use informal and concrete representations of equality and operations to solve problems in everyday contexts. | **General Outcome**<br><br>*Students will:*<br><br>use informal and concrete representations of equality and operations to solve problems in everyday contexts. |
| **Specific Outcomes**<br><br>*Students will:*<br><br>3. describe everyday situations, using variables [C, CN, R]<br>4. represent and explain the meaning of preservation of equality by balancing or using models and diagrams [C, CN, PS, R, V]<br>5. use pre-algebra strategies to solve equations with one unknown and with whole numbers [PS, R] | **Specific Outcomes**<br><br>*Students will:*<br><br>4. demonstrate and explain how to solve simple problems, using informal algebraic methods [C, CN, PS, R, V]<br>5. read and graph relationships and draw conclusions in everyday contexts [CN, R, V] |

**Strand: Shape and Space (Measurement)**

*Students will:*

- estimate and take accurate measurements using everyday metric (SI) and imperial units of measure
- solve problems, using appropriate measuring devices (i.e., metric [SI] and imperial), strategies and technology in home, workplace and community contexts
- communicate mathematically and investigate the application of measurement knowledge and skills in a variety of career and workplace situations, working individually or as members of a team
- assess reasonableness of calculations and problem-solving strategies.

| | |
|---|---|
| **C** | Communication |
| **CN** | Connections |
| **E** | Estimation and Mental Mathematics |
| **PS** | Problem Solving |
| **R** | Reasoning |
| **T** | Technology |
| **V** | Visualizatio( |

| Grade 8 | Grade 9 |
|---|---|
| **General Outcome**<br><br>*Students will:*<br><br>use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts. | **General Outcome**<br><br>*Students will:*<br><br>use measurement concepts, appropriate tools and results of measurement to solve problems in everyday contexts, including:<br><ul><li>perimeter</li><li>area</li><li>surface area</li><li>mass (weight)</li><li>volume (capacity)</li><li>angle measurements.</li></ul> |
| **Specific Outcomes**<br><br>*Students will:*<br><br>1. recognize and explain the meaning of length, width, height, depth, thickness, perimeter and circumference [C, CN, R]<br>2. estimate and use everyday metric (SI) tools and units to take accurate linear measurements; e.g., millimetre, centimetre, metre, kilometre [E, PS, T]<br>3. estimate and use everyday imperial tools and units to take accurate linear measurements; e.g., inches, feet, yards, miles [E, PS, T]<br>4. estimate, measure and calculate the perimeters of quadrilaterals and triangles to solve problems in everyday contexts [CN, E, PS, T] | **Specific Outcomes**<br><br>*Students will:*<br><br>1. use common metric (SI) units and instruments to take accurate measurements of:<br><ul><li>length</li><li>mass (weight)</li><li>volume (capacity)</li></ul>[CN, PS, R, T]<br>2. use conversion charts, calculators and/or other tools to compare and convert a variety of metric (SI) units [CN, T]<br>3. use common imperial units and instruments to take accurate measurements of:<br><ul><li>length</li><li>mass (weight)</li><li>volume (capacity)</li></ul>[CN, PS, R, T] |

| Grade 8 | Grade 9 |
|---|---|
| **Specific Outcomes** (continued) | **Specific Outcomes** (continued) |
| *Students will:* | *Students will:* |
| 5. estimate, measure and calculate the perimeter and area of irregular shapes by dividing them into parts, using manipulatives and diagrams [CN, E, PS, R, T] | 4. use conversion charts, calculators and/or other tools to compare and convert a variety of imperial units of measure [CN, T] |
| 6. demonstrate the relationships among the circumference, radius and diameter of circles [CN, R, V] | 5. develop, verify and apply rules or expressions for the area of rectangles; e.g., $mm^2$, $cm^2$, $m^2$, $km^2$ [CN, PS, R] |
| 7. calculate and solve everyday problems that involve mass (weight) and volume (capacity), using metric and imperial units [CN, PS] | 6. estimate, measure and calculate areas of quadrilaterals and triangles to solve problems in everyday contexts [CN, E, PS, R] |
| 8. use concrete objects to relate $cm^3$ to mL [CN, R, V] | 7. design and construct rectangles when given perimeter or area, or both, using a variety of tools; e.g., grids [PS, R, T] |
| 9. use conversion charts, calculators and/or other tools to compare and convert common metric (SI) and imperial linear units, as required in everyday contexts [CN, PS, T] | 8. estimate, measure and calculate the circumference, radius and diameter of circles to solve problems in everyday contexts [CN, E, R, V] |
| 10. recognize the relationships among seconds, minutes, hours, days, weeks, months, years, centuries and millennia, using a variety of tools; e.g., calendars and technology [CN, R, T] | 9. identify, discuss and classify examples of angles in the environment; e.g., right, acute, obtuse, straight or reflex [C, CN, R, V] |
| 11. estimate and measure time on 12-hour and 24-hour clocks, using digital and analog timepieces [CN, E, T] | 10. estimate, measure and draw angles up to 180°, using a protractor or other tools [CN, E, T] |
| 12. convert between hours and minutes and between minutes and seconds, as required in everyday contexts [CN, R] | 11. add and subtract hours and minutes in everyday applications [CN, T] |

| Strand: Shape and Space (3-D Objects and 2-D Shapes) | |
|---|---|

**Strand: Shape and Space (3-D Objects and 2-D Shapes)**

*Students will:*
- create, examine and manipulate 3-D objects and 2-D shapes, using technology and other tools as appropriate, at home, in the workplace and in the community
- communicate mathematically and investigate the application of shape and space in a variety of career and workplace situations, working individually or as members of a team.

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

| Grade 8 | Grade 9 |
|---|---|
| **General Outcome** | **General Outcome** |
| *Students will:* | *Students will:* |
| use visualization and symmetry to extend their awareness of objects and shapes and solve problems that involve classification and sketching. | use visualization and symmetry to extend their awareness of objects and shapes and solve problems that involve classification and sketching. |
| **Specific Outcomes** | **Specific Outcomes** |
| *Students will:* | *Students will:* |
| 13. identify, classify, describe and construct models of 3-D objects; e.g., rectangular prisms, cubes, cylinders, cones and spheres [C, R, T, V]<br>14. design and construct nets for 3-D objects [CN, V]<br>15. recognize and identify, from everyday observations and experiences, points, lines, parallel lines, intersecting lines, perpendicular lines, vertical lines, horizontal lines and line segments [CN, V]<br>16. identify and illustrate lines of symmetry on quadrilaterals and triangles [V]<br>17. recognize and label the quadrants on a grid [V]<br>18. identify and plot points in the first quadrant of a coordinate grid, using ordered pairs [C, PS, R, V]<br>19. reproduce a given geometric drawing on grid paper [R, V] | 12. classify and construct 3-D objects, using a variety of tools and strategies [C, R, T, V]<br>13. sketch 3-D objects and skeletons with and without grids [PS, T, V]<br>14. sort quadrilaterals and regular polygons according to the number of lines and symmetry [V]<br>15. relate reflections to lines and planes of symmetry [CN, V]<br>16. draw and classify triangles according to the measurements of their angles; e.g., acute, obtuse, scalene [C, CN, V]<br>17. use scale to reproduce a 2-D shape [R, V] |

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|---|---|
| **Strand: Shape and Space (Transformations)** | **C** Communication |
| *Students will:* | **CN** Connections |
| • enhance their understanding of objects, shapes and motion in their everyday lives | **E** Estimation and Mental Mathematics |
| • perform, create and examine transformations to become aware of shapes and objects. | **PS** Problem Solving |
| | **R** Reasoning |
| | **T** Technology |
| | **V** Visualization |

| Grade 8 | Grade 9 |
|---|---|
| **General Outcome** | **General Outcome** |
| *Students will:* | *Students will:* |
| describe motion in terms of slides (translation), turns (rotation) or flips (reflection) and use coordinates to describe and create 2-D shapes, including tessellations. | create and examine patterns and designs that incorporate symmetry, tessellations, translations and reflections. |
| **Specific Outcomes** | **Specific Outcomes** |
| *Students will:* | *Students will:* |
| 20. recognize and describe motion as a slide (translation), a turn (rotation) or a flip (reflection) [C, V] | 18. create, examine and describe designs, using translations (slides), reflections (flips) and rotations (turns) [C, T, V] |
| 21. identify and describe tessellations found in the environment that are created with regular and irregular shapes [C, CN, T, V] | 19. trace a path, given in oral or written instructions, and write or describe instructions for a given path [C, CN, PS, R, V] |
| 22. create tessellations, using regular and irregular shapes [CN, T, V] | 20. draw designs and determine locations in the first and second quadrants of a coordinate grid, using ordered pairs [C, PS, R, V] |

**Strand: Statistics and Probability (Collecting and Analyzing Information)**

*Students will:*

- collect and/or generate and display data and other information related to home, workplace and community applications, using technology as appropriate
- interpret, examine and maintain data, charts, graphs and other records for personal and/or workplace use
- apply probability and chance to make predictions when planning and making everyday decisions.

| Grade 8 | Grade 9 |
|---|---|
| **General Outcome** | **General Outcome** |
| *Students will:* | *Students will:* |
| implement a plan for collecting, displaying and examining information and data gathered from appropriate sources within everyday contexts. | develop and implement a plan for collecting, displaying and examining data and information used in everyday applications. |
| **Specific Outcomes** | **Specific Outcomes** |
| *Students will:* | *Students will:* |
| 1. identify appropriate information/data sources; i.e., first-hand, second-hand and combinations [R] <br> 2. use a variety of strategies to interpret information from prepared graphs and/or charts; e.g., <br> • read axis and column subheadings and text under, beside or above <br> • compare and examine pictures, bars, lines, symbols or markers <br> • find trends or patterns <br> • discuss information with classmates or others for clarification <br> • reread to connect information in graphs and charts to surrounding and/or other information [C, CN, E, PS, R, V] <br> 3. make predictions based on information and data [R] <br> 4. develop and communicate appropriate conclusions and discuss the reasonableness of data and results [C, R] | 1. read, interpret and communicate information represented in graphs, charts and other collection tools [C, CN, R] <br> 2. collect, organize and display data and information, by hand and/or using technology, in a variety of ways; e.g., tables, charts, bar or line graphs, frequency diagrams, broken-line graphs [C, CN, T, V] <br> 3. make conclusions and predictions based on data and information analysis [CN, R] <br> 4. examine sets of data, draw conclusions and make comparisons [C, CN, R] <br> 5. determine trends by identifying and examining extremes, gaps or clusters in a set of data [R] <br> 6. examine the distribution of a set of data, using smallest and largest value, frequency, value in the middle and patterns [CN, PS, R, T] <br> 7. use appropriate vocabulary, related to the home or workplace, to discuss and examine data; e.g., probable/improbable, equally likely/less likely/more likely, best/worst [C, CN] |

| Grade 8 | Grade 9 |
|---|---|
| **Specific Outcomes** (continued) | **Specific Outcomes** (continued) |
| *Students will:* | *Students will:* |
| 5. gather, organize and display information and data, using a variety of organizers/methods; e.g., journals, diagrams, charts, lists, graphs, spreadsheets, rank ordering and/or frequency charts [C, T, V]<br>6. examine and discuss the results of simple probability experiments/experiences [C, E, PS, R]<br>7. demonstrate and/or discuss that different outcomes may occur when repeating the same experiment and/or everyday activity [C, PS, T] | 8. manipulate data in everyday applications, at home or in the workplace, by selecting appropriate tools such as spreadsheets [C, CN, T] |