Program of Study

Mathematics

Subject Area: Mathematics, Science and Technology

Secteur de la formation professionnelle et technique et de la formation continue

CCBE
COMMON CORE BASIC EDUCATION

Direction de l'éducation des adultes et de l'action communautaire

Québec

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Subject Area: Mathematics, Science and Technology

Mathematics

Courses

Literacy

Numeracy — MTH-B113-3
Orientation in Time — MTH-B114-2
Arithmetic and Money — MTH-B213-4
Basic Geometric Representations — MTH-B214-3

Presecondary

Arithmetic and Personal Finances — MTH-P101-4
Sense of Space and Time — MTH-P102-3
Sets and Statistics — MTH-P103-2
Geometric Representations — MTH-P104-4

Secondary Cycle One

Finance and Arithmetic — MTH-1101-3
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Algebraic Modelling — MTH-2101-3
Geometric Representations and Transformations — MTH-2102-3

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Presentation of the Program of Study

The *Mathematics* program comprises a total of 925 hours of courses divided into three levels: Literacy, Presecondary and Secondary Cycle One. Its aim is the same as that of all the programs in Common Core Basic Education, which is to help adults deal competently with real-life situations.

Mathematics makes it possible to conceptualize and represent quantities and the organization of the environment. It is therefore useful in dealing with many real-life situations that involve the arts, architecture, the natural sciences, the social sciences, technology, computer science, etc. Since mathematics involves many abstract concepts, the Common Core Basic Education courses should involve concrete elements and situations that are meaningful for adults.

In order to make learning meaningful, the *Mathematics* program is centred on classes of real-life situations, each of which deals with common themes that involve mathematics. These situations require adults to solve everyday problems, while building their mathematical knowledge and developing certain operational competencies that are useful for dealing with the real-life situations being examined. The essential knowledge in this program is nonetheless organized according to a series of prerequisites, as is usually the case with mathematics. Adults will be able to appreciate the importance of the different branches of mathematics, pursue their studies in certain fields and expand their overall knowledge.

By encouraging adults to think rationally and use exact language, this program helps them become more confident of their own abilities, committed to learning and more autonomous in applying their knowledge to all types of real-life situations.

Contribution of the Program to the Development of Certain Operational Competencies

The *Mathematics* program is aimed at further developing two operational competencies, namely *Communicates* and *Thinks logically*, that are crucial for dealing with real-life situations that involve mathematics and developing mathematical thinking. These two competencies are compulsory for all the courses in the program.

The operational competency *Communicates* is vital in helping adults understand the numerous mathematical messages conveyed daily by the media or found on product labels, on the Internet, in magazines, etc. The distinctive feature of mathematical communication is that it involves both everyday language and language specific to mathematics. In order to communicate effectively, adults must learn the symbols, notations, rules and modes of representation that characterize mathematical messages. These elements allow adults to accurately interpret the message and grasp its overall meaning. When adults produce a message, they must structure it properly and observe the conventions of the language. Mathematics therefore becomes a valuable communication tool that allows adults to exchange ideas.

The operational competency *Thinks logically* is crucial for understanding, analyzing and explaining the relationships among various mathematical concepts and between these concepts and everyday situations. The development of a logical argument essentially involves using both inductive and deductive reasoning; mathematics is a science that is based on these two types of reasoning. The program encourages adults to use their mathematical knowledge and experimentation to derive laws and properties, thus enabling them to predict and explain a number of phenomena in the world around them. Whether they are using inductive or deductive reasoning, adults are required to make connections and draw conclusions which they must verify and adjust as needed. The competency *Thinks logically* allows adults to go beyond the memorization of rules, algorithms or vocabulary when they learn about mathematics. The multiplicity of problems to be solved in the various classes of situations in the program, the analysis of various possible solutions and the choice of the most appropriate one prompt adults to exercise their ability to use their deductive and inductive reasoning by applying their mathematical knowledge. For instance, logical reasoning may be used to establish a connection between different units of measure, to deduce the unknown measurements in a geometric figure, to induce the properties that are common to a set of data or to select the arithmetic operations that are the most appropriate in a given situation.

While all the courses in the program emphasize the operational competencies described above, two of the courses focus on the operational competency *Exercises critical and ethical judgment*. The real-life situations presented in these courses involve statistical information conveyed by the media that require adults to use their judgment when interpreting this information. Adults develop their critical judgment by learning to carefully assess the opinions of those who comment on statistical representations and to recognize sources of bias.

The Courses of the Program of Study

The table below lists the courses in the *Mathematics* program of study.

Mathematics

Literacy Courses	Duration	Presecondary Courses	Duration	Secondary Cycle One Courses	Duration
Numeracy	75 hrs	Arithmetic and Personal Finances	100 hrs	Finance and Arithmetic	75 hrs
Orientation in Time	50 hrs	Sense of Space and Time	75 hrs	Statistics and Probability	75 hrs
Arithmetic and Money	100 hrs	Sets and Statistics	50 hrs	Algebraic Modelling	75 hrs
Basic Geometric Representations	75 hrs	Geometric Representations	100 hrs	Geometric Representations and Transformations	75 hrs

The courses in the *Mathematics* program must be taken in the order indicated for each level.

The Literacy level courses deal with real-life situations involving basic mathematics. In the first course, *Numeracy*, adult learners acquire number skills and become familiar with addition and subtraction operations involving natural numbers. In the second course, *Orientation in Time*, they are introduced to different units of time and continue to learn about addition and subtraction operations. In the third course, *Arithmetic and Money*, they learn about the four arithmetic operations involving natural numbers and the Canadian monetary system. Lastly, in the *Basic Geometric Representations* course, they learn about simple ratios, basic geometry concepts and different units of measure (i.e. those pertaining to length, capacity and temperature) in order to be able to represent their immediate physical environment.

In the *Arithmetic and Personal Finances* course at the Presecondary level, adult learners continue to build their knowledge of arithmetic by using decimals to calculate and represent amounts of money. In the *Sense of Space and Time* course, they continue to learn about time and are introduced to space-related concepts and whole numbers. The *Sets and Statistics* course deals with the concepts of set and subset and statistical representations. Lastly, the *Geometric Representations* course deals with geometry, ratios and the International System of Units.

In the *Finance and Arithmetic* course at the Secondary Cycle One level, adults learn about rational numbers. This course is followed by *Statistics and Probability* in which adults continue to learn about sets and statistical representations in addition to being introduced to the various data

collections methods (surveys, censuses and studies) and probability analysis. The next course, *Algebraic Modelling*, deals with basic algebra while allowing adults to continue to learn about geometry, particularly with respect to the use of formulas for calculating perimeter, area and volume. Finally, the last course in this cycle, *Geometric Representations and Transformations*, adults learn about ratios, geometric transformations, scale drawings and measures in different systems of units.

Decompartmentalizing the Branches of Mathematics

Dealing with a real-life situation may require the use of a range of mathematical resources. Even though the everyday situations chosen for a given course focus on one or two branches of mathematics, adults will necessarily have to call upon their knowledge of other branches in order to deal with these situations. This is why practically all the courses in the *Mathematics* program cover essential knowledge involving several branches of mathematics.

The teacher can also help to decompartmentalize the different branches of mathematics. In one course, the teacher may suggest learning situations that require the use of knowledge that is not based on compulsory content. For example, while the concepts of sets and subsets are compulsory only in *Sets and Statistics* and *Statistics and Probability*, these concepts may also be covered in other courses. They may be useful particularly for classifying geometric figures in the *Geometric Representations* course.

Progression of Learning

In order to deal with the real-life situations, adults must call upon knowledge from various branches of mathematics. However, since a given concept may be useful in dealing with a number of real-life situations, it may be covered in several courses. The table of essential knowledge is divided into two columns in order to show the range of knowledge covered in the *Mathematics* program, while defining the essential knowledge specific to a given course. The left-hand column shows the essential knowledge that was not covered in previous courses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must increase their knowledge by adapting it to the context of the course in question. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless shown in italics in order to make it easier to identify prior learning and to illustrate progress made in the construction of knowledge.

The following table shows some of the essential knowledge covered in the course *Arithmetic and Personal Finances*.

Essential Knowledge	
New compulsory knowledge	**Knowledge acquired in previous courses**
Whole numbers and decimals ▪ Whole numbers (negative numbers are used only to represent and compare amounts) ▪ Decimals (up to two decimal places in reference to money) ▪ Properties of operations: associative and distributive laws ▪ Comparing decimals (including negative numbers) **Ratios and percentages** ▪ Percentages ▪ Ratios (of two decimals) ▪ Mixed numbers (to express a sum of money)	**Natural numbers** ▪ *Natural numbers* ▪ Property of operations: commutative law ▪ *Comparing natural numbers* **Ratios** ▪ *Ratios (of two natural numbers)* ▪ *Simple fractions (whose denominators are smaller than or equal to 10)* ▪ Everyday vocabulary related to fractions (e.g. half of, one half, one quarter, one third, two thirds)

This approach means that certain types of essential knowledge are compulsory in more than one course. This is the case notably for the concepts and techniques related to fractions. These concepts are covered in *Arithmetic and Personal Finances*, but only in a financial context. In order to develop an in-depth knowledge of this compulsory content, adults will also have to use fractions in the context of time and geometric representations. It is only after completing all the courses that they will have mastered the basic concepts pertaining to ratios.

In the *Mathematics* program, adults make progress not only in terms of essential knowledge, but also with respect to the classes of situations that are the focus of each course, since some of these classes are taken up again at different levels. For instance, this is the case for the class *Dealing with money in everyday situations* at the Literacy level, which becomes *Managing personal finances* at the Presecondary level and *Managing finances* at Secondary Cycle One level. This gives adults in Secondary Cycle One the opportunity to deal in a more complex way with the real-life situations of the classes examined at the Literacy and Presecondary levels. The table below shows this progression.

Classes of situations for courses at the Literacy level	Classes of situations for courses at the Presecondary level	Classes of situations for courses at the Secondary Cycle One level
Representing a quantity and using numbers		
Orienting oneself in time	Orienting oneself in space and time	
Dealing with money in everyday situations	Managing personal finances	Managing finances
Representing one's immediate physical environment	Representing the physical environment	Representing the physical environment and its transformations
	Classifying data	Predicting random events
		Establishing relationships between quantities

Links Between the Program of Study and the Broad Areas of Learning

The *Mathematics* program is related to the four broad areas of learning, with each course in the program contributing in a specific way to one or more of these areas.

Environmental and Consumer Awareness

Using arithmetic or algebraic models that allow them to check financial information prior to making a purchase or a payment, helps adults take responsibility for their own choices as consumers. Likewise, drawing up budgets and financial balance sheets allows them to better reflect on their consumer habits.

The *Mathematics* program also takes the educational aim of this broad area of learning into account when adults situate themselves in their natural environment in time and in space or when they perform calculations related to energy consumption using relationships expressed by means of an algebraic model. An understanding of maps and scale drawings, among other things, allows adults to form a better mental representation of their physical environment. In addition, a knowledge of data collection, sets and statistics enables adults to organize qualitative or quantitative data related to the different species of animals, natural phenomena, pollution, etc.

Health and Well-Being

The *Mathematics* program contributes to the attainment of the educational aim of this broad area of learning by having adults organize lifestyle information in tables, classify foods according to food groups and determine whether two menus are nutritionally equivalent. Adults take their health into account every time they use fractions or proportions to calculate the size of the portions that make up a balanced diet or to check the nutritional value of certain foods. Gambling can lead to a form of addiction that can be harmful to their well-being, but through the study of probability, adult learners become aware of the role that luck and chance play in games so that they can avoid being lured by the promise of easy money.

World of Work

Verifying information related to salaries, determining the expenses associated with going back to school, planning work schedules and making travel plans that take factors such as duration and distance into account are all mathematical situations that help adults choose and carry out a career plan. Statistical distributions and knowledge of sets allow them to make connections between their occupational identity (e.g. interests and aptitudes) and educational possibilities, explore job opportunities in a particular occupation or analyze working world issues such as harassment on the job or work accidents.

Citizenship

Some of the knowledge acquired in mathematics courses contribute to the exploration of different aspects of life in society. For example, statistics helps adults to interpret polls on political issues and a knowledge of sets allows them to better represent the structure of

organizations, institutions and various public systems. Concepts related to arithmetic, time and space will also help adults to understand certain types of information conveyed by the media, to assess economic and financial choices or to situate historical or current events. Lastly, the ability to use road and geographic maps allows adults to better understand how the territory of Québec is laid out and gives them a skill that they can then use to explore the rest of the world.

Contribution of the Program of Study to the Orientations of the *Government Policy on Adult Education and Continuing Education and Training*

This program of study addresses the orientations of the *Government Policy on Adult Education and Continuing Education and Training* by promoting cultural awareness, improvement in the quality of language, the exercise of citizenship rights and responsibilities, and the integration of information and communications technologies.

Cultural Content

The *Mathematics* program helps to improve the cultural content for adults by featuring a variety of real-life situations. These situations involve different topics and lead adults to be receptive to other realities and discover new concepts. The use of resources such as audio-visual documents, Web sites or newspaper articles helps to enrich the learning process. Learners' motivation grows as they realize the importance of mathematics in different fields of human activity. Teachers are encouraged to enhance the learning process by drawing on current events, highlighting regional characteristics or using other sources of information.

Each course in the program refers to historical events and figures that serve to enrich the cultural content. First, adults learn about mathematical geniuses who left their mark on history, such as Euclid or Poincaré. They also learn about the development of mathematics and its different branches such as geometry, arithmetic and statistics. For example, they learn about the history of numbers, currency and pi, the different number systems, ancient documents such as the Rhind Papyrus or the development of methods for performing calculations and solving equations.

Measuring instruments and systems play a prominent role in a number of mathematics courses. For example, adult learners can examine the history of the International System of Units and its advantages compared to the Imperial System, the evolution of measuring instruments or methods of standardizing units of measure. Lastly, adult learners may find it interesting to solve such famous problems as calculating the circumference or the radius of the Earth.

Quality of Language

In the courses that make up the Common Core Basic Education *Mathematics* program, adults develop their ability to express themselves clearly and precisely. They enrich their vocabulary by discovering new mathematical concepts and sharing them with others. Presenting their work, conclusions or justifications clearly and coherently requires the use of appropriate language, both written and spoken. The operational competency *Communicates*, which is essential for dealing with the real-life situations encountered in the program, definitely contributes to the use of precise and rigorous language.

Citizenship

Some of the real-life situations encountered in the *Mathematics* program help adults fulfill their role as citizens. They foster the development of critical judgment, particularly with respect to different statistical studies. For example, the ability to identify bias can help adults judge the credibility of a poll. They will also find arithmetic calculations and the concepts of time and space useful for understanding certain information conveyed by the media, for assessing economic and financial choices or for exercising their rights as tenants or landlords. In addition, a knowledge of sets will help them form a better mental image of the structure of organizations, institutions and public systems.

Integration of Information and Communications Technologies

The *Mathematics* program helps adults learn to use information and communications technologies. They can use these technologies to learn mathematical concepts or to present a solution or the results of a data-collection process. By using spreadsheet software, adult learners can construct graphs or work sheets, calculate the possible values of a variable or check their calculations. Dynamic geometry and image processing software also allows them to visualize certain properties of geometric figures and geometric transformations (e.g. a similarity transformation when enlarging a photograph).

Internet access will certainly make it easier to find road maps, financial information, mathematical formulas, recipes or any other data useful for dealing with the real-life situations in these courses. Learning is enhanced by direct access to a vast array of information sources and resource persons. Adults may also demonstrate their ability to communicate mathematical information via electronic mail or chat room discussions.

Course

Numeracy

MTH-B113-3

Literacy

“The human mind has three keys, which open everything—numbers, letters, notes.”

Victor Hugo

Presentation of the Course *Numeracy*

The course *Numeracy* is designed to help adult learners deal competently with real-life situations in which they must represent a quantity or use numbers.

This course prepares adults to use numbers in their daily lives.

By the end of the course, adults will be able to interpret and convey simple information involving numbers. They will be able to read, write and determine numbers as well as establish a connection with the quantity represented by the number. They will be able to select and perform addition and subtraction operations using concrete materials or a calculator.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Representing a quantity and using numbers*.

This class consists of real-life everyday situations that require adult learners to read, write and determine numbers. In some of these situations, the numbers may be used to represent quantities. This is the case, for instance, when adults must determine a number of people, read a medication label to find out the number of tablets they must take, make a note of food portions, etc. Other situations involve using numbers. Finding an address, keeping score during a game or writing down a telephone number or a social insurance number are examples of these types of situations.

These real-life situations address the needs expressed by adults and take their interests into account. The situations can involve the personal, professional, social or cultural aspects of their lives.

Class of Situations	Examples of Real-Life Situations
Representing a quantity and using numbers	▪ Getting around on a daily basis ▪ Using medications ▪ Using public, private or community services ▪ Taking part in recreational activities ▪ Making a purchase or a sale ▪ Planning a meal ▪ Participating in a training session at school or in the workplace

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Reading numerical information	▪ Reads an address, a number ▪ Recognizes a social insurance number, a credit card number or license plate number ▪ Dials the numbers on a telephone calling card ▪ Reads the number of tablets recommended on the label of a medicine bottle ▪ Recognizes numbers on a board game ▪ Reads the number of portions suggested in a food guide ▪ Consults advertising brochures
▪ Writing numerical information	▪ Writes down an address or a telephone number ▪ Writes a social insurance number on a form ▪ Makes a note of a sum of money ▪ Makes a note of the number of food portions eaten each day ▪ Writes the prices of articles for sale (e.g. flea market, fundraiser)
▪ Interacting orally in cases involving numerical information	▪ Reads the number on a license plate or a credit card aloud ▪ Informs a family member of the dose of a medication to be taken ▪ Informs someone of a change of address ▪ Informs someone of the price of a purchase ▪ Repeats the instructions in a message containing numbers

Categories of Actions	Examples of Actions
▪ Determining a number	▪ Counts the number of tickets sold (e.g. for a raffle, a fundraiser, a show) ▪ Counts the number of compact disks he/she has ▪ Keeps score in a sports activity ▪ Counts the number of school days in a month ▪ Counts the number of people taking part in an activity ▪ Inserts the exact change in a vending machine ▪ Calculates the amount of money in his/her pocket

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Representing a quantity and using numbers

Categories of Actions

- Reading numerical information
- Writing numerical information
- Interacting orally in cases involving numerical information
- Determining a number

Operational Competencies

Thinks logically

- Selects information
- Distinguishes between numbers expressed orally and in writing
- Makes connections among items of information
- Uses pertinent examples

Communicates

- Listens attentively
- Decodes symbols, notations and terms related to basic arithmetic
- Asks for clarifications
- Repeats information to check comprehension
- Uses symbols, notations and terms related to basic arithmetic
- Writes numbers out legibly
- Asks for help, if necessary

Essential Knowledge

- Natural numbers
- Arithmetic operations (addition, subtraction)

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the situations in the class *Representing a quantity and using numbers*, adults learn the basic elements of number literacy as well as how to add and subtract natural numbers. When adults read, write and orally convey numerical information, they decode the symbols, notations and terms of basic arithmetic, understand the numbers they read or hear and make connections with other types of information appropriate to the situation. They are also concerned with communicating effectively. They listen attentively to information containing a quantity or a number. If necessary, they ask for clarifications and repeat what they have heard in order to check their understanding. After ensuring they have selected data that is useful in the context, they classify or compare the numbers and make connections between these numbers and the quantities they represent. When required to determine a number in a given situation, adults count by units or multiples. If necessary, they perform simple additions or subtractions using concrete materials or a calculator. They use examples to validate their work and avoid possible errors. Throughout the learning process, adults attempt to use their understanding of numbers and operations and their number skills. They express themselves by using arithmetic symbols, notations and terms correctly. They make sure they accurately and legibly write numbers and do not hesitate to ask for help if they need it.

Evaluation Criteria

- Interprets numerical information correctly
- Writes numerical information correctly and legibly
- Interacts orally in an appropriate manner in cases involving numerical information
- Correctly determines a number

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners to organize their thinking and guides them in taking action to deal with real-life situations that involve *Representing a quantity and using numbers*.	Adult learners select the information they need in order to form an accurate representation of the real-life situation they are working with, whether it involves deciphering, classifying, comparing or determining numbers. When they use their knowledge of numbers and arithmetic operations, adult learners use this operational competency in order to understand numbers expressed in writing or orally and to establish connections with other types of information that give meaning to numbers. In their calculations, adult learners use relevant examples to validate their work, if necessary.

Contribution of the Operational Competency *Communicates*	
The operational competency *Communicates* makes it possible for adults to exchange meaningful information in their daily lives. It is essential to the effective interpretation and transmission of messages in various real-life situations that involve *Representing a quantity and using numbers*.	In their daily interactions involving numbers, adults must understand others and make themselves understood. They listen attentively to information containing quantities or numbers. They decode symbols, notations and terms related to arithmetic, ask for clarifications and repeat information to make sure they have understood it. They express themselves by using arithmetic language correctly, and make sure they write numbers legibly. If necessary, they do not hesitate to ask for help from someone close to them, a peer or a resource person in order to overcome a difficulty.

Essential Knowledge

Natural numbers

- Digits
- Numbers
- Numbering
- Quantities
- Natural numbers
- Even numbers and odd numbers
- Representing natural numbers (using concrete materials and a base 10 number system)
- Place value of a digit within a number
- Composing and decomposing natural numbers
- Arranging natural numbers in increasing and decreasing order
- Comparing natural numbers
- Counting
- Counting by units
- Counting by multiples
- Everyday vocabulary associated with quantity-related concepts (e.g. none, all, a few, several, little, many)
- Everyday vocabulary associated with comparing quantities (e.g. as many, equal, the same, similar, more, less, less than, greater than, the largest, the smallest)
- Positioning in space (e.g. above, below, to the right, to the left, on top and on the bottom)

Arithmetic operations

- Equality
- Understanding of addition and subtraction
- Everyday vocabulary associated with addition and subtraction (e.g. I add, more, in all, total, sum, I take away, less, remainder, difference, I share, repeated addition)
- Addition and subtraction involving natural numbers (using a calculator and concrete materials)
- Arithmetic tables: additions (0 + 0 to 10 + 10) and the corresponding subtractions

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Confidence in Their Abilities	Perseverance
If they are confident in their abilities, adults spring into action more readily when required by the situation and learn from their mistakes.	Persistent adults make a sustained effort and look for solutions to their difficulties. When needed, they ask for help from a resource person or seek support from a peer.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Public and parapublic organizations ▪ Community organizations ▪ Services provided by the training centre ▪ Commercial establishments (e.g. grocery store, drugstores)	▪ Calculator ▪ Various forms and brochures ▪ Calendar ▪ Clock ▪ Telephone directory ▪ Computer ▪ Government documentation ▪ Fake currency ▪ Various games (e.g. dice, cards, dominoes)

Contribution of the Subject Areas

The contribution of all the subject areas is also useful for dealing with the real-life situations in this course. In the Literacy level courses, the examples of real-life situations are similar in some ways and complement the essential knowledge covered in the *Computer Science* program, which also belongs to the Mathematics, Science and Technology subject area, and in the *English, Language of Instruction* program, which belongs to the Languages subject area. This makes it possible to deal with different aspects of a real-life situation and to create cross-curricular learning situations. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Andragogical Context

It is evident that one must use numbers in everyday life. To help adults deal with a variety of real-life situations, the *Numeracy* course covers concepts that are essential to the use of numbers and the arithmetic operations of addition and subtraction. More specifically, they get adults to read, write and determine numbers, make connections between a number and a quantity, and interact in different real-life situations in which they must apply their knowledge of numbers. In this regard, this course is essential to helping adults become more autonomous.

Adults are encouraged to play an active role in constructing their knowledge of mathematics. However, given the degree of autonomy needed to read task-related information or instructions, the teacher provides constant support in learning activities. Oral and team work is preferred when the context permits. The concrete materials made available to adults facilitate learning and the construction of knowledge. Frequent reflection on what has been learned allows adults to gauge their progress and to make the necessary adjustments. The teacher is concerned with creating an atmosphere of confidence that makes learning enjoyable and fuels the adult learners' determination to persevere. The teacher makes sure adult learners have the necessary resources to explore, understand and organize the data they need in order to plan and take action.

The Literacy level courses are designed to allow for the flexibility needed to adjust to the practical needs of adults. To enable adults to deal competently with real-life situations, the examples examined in the different courses are in some ways similar and involve using what was learned in English, Language of Instruction, Mathematics and Computer Science.

This is how the different facets of a real-life situation can be explored, thereby making it possible to create cross-curricular learning situations. The courses are adapted to adults' level of autonomy with respect to their ability to use written materials.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Consulting Advertising Brochures

The learning situation involves consulting advertising brochures. It belongs to the class of situations *Representing a quantity and using numbers* and, more particularly, the real-life situation *Making a purchase*. Throughout this learning situation, adults use the operational competencies *Thinks logically* and *Communicates*.

In order to provide a context for this learning situation, the adults bring advertising brochures to complement those supplied by the teacher, who selects documents that are appropriate to the needs of adults. The teacher then leads a discussion based on the answers to the following questions: Do you use advertising brochures? If not, why not? If so, for what types of purchases? The discussion should deal with the difficulties associated with consulting advertising brochures, as well as with their advantages and disadvantages.

The teacher then has the adults examine the brochures to determine how they can use them to their advantage. The activity begins with the adult learners reading numbers, in groups or individually, depending on the number of brochures on hand. The teacher first demonstrates by pointing out the equivalences between what is read and what is written. The teacher then names some of the products advertised and the adults must read the amount that accompanies the products. After making the necessary corrections, the teacher writes the amounts on the board to maintain the interest of the class and to make sure that each person has selected the right information. During the activity, the teacher asks questions to get the adults to identify the smallest and the largest numbers. The adults are also asked to comment on the prices of the various products.

Once the reading part of the activity is completed, the teacher reviews the concept of increasing order and has the class arrange the amounts written on the board in this order. Given that the class may have difficulty with decimals, only the digits before the decimal period will be considered. The adult learners must write the numbers legibly. The results may be checked individually or in a group depending on the pace of the exercise. The teacher supports the adults in their learning, motivates them and encourages them to be confident in their abilities to learn and persevere.

The adults continue their exploration by circling other numbers in the brochure that do not represent sums of money. This activity can be done individually or in teams of two. In the class discussion, the teacher first asks the adults to read these numbers and to specify whether they represent the quantity of a product being advertised, a date, an address or another type of information. They then classify the numbers as a “number” or “quantity” and explain why. The adults then identify other common examples in everyday situations.

The teacher takes the opportunity to examine numerical concepts, notably the concepts of number, numbering and quantity. Without going into long explanations about decimals, the teacher discusses them as they pertain to sums of money.

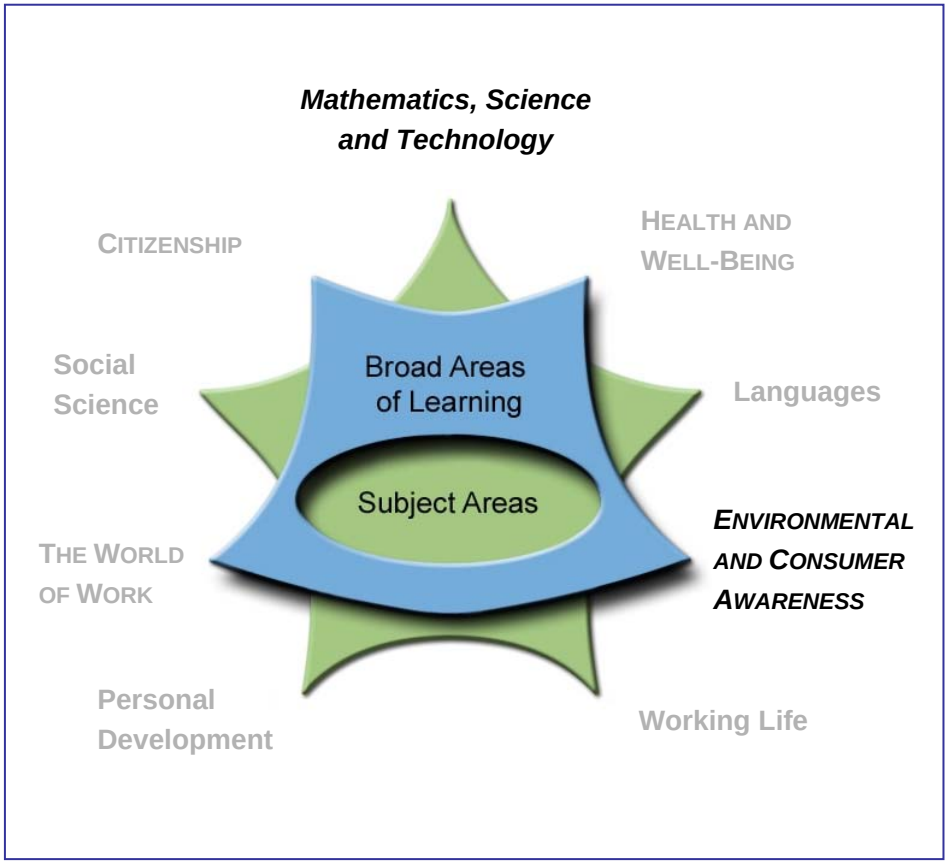
The learning situation ends with a review of the difficulties raised in the initial discussion. The adults exchange ideas on what they have learned, the areas that need more work and the possibility of applying what they have learned in other contexts.

Elements of the Course Addressed by the Learning Situation

Class of Situations
Representing a quantity and using numbers
Learning Situation
Consulting Advertising Brochures
Categories of Actions
▪ Reading numerical information ▪ Writing numerical information ▪ Interacting orally in cases involving numerical information

Operational Competencies	Essential Knowledge
▪ Thinks logically ▪ Communicates	Natural numbers ▪ Concepts of digit, number, quantity and numbering ▪ Representing natural numbers ▪ Place value of a digit within a number ▪ Comparing and classifying numbers

Complementary Resources
▪ Various advertising brochures



Course

Orientation in Time

MTH-B114-2

Literacy

“There are interminable days, months and years where nothing happens. There are minutes and seconds that contain an entire world.”

Jean D’Ormesson

Presentation of the Course *Orientation in Time*

The course *Orientation in Time* is designed to help adult learners deal competently with real-life situations that involve orienting themselves in time.

This course prepares adults to use units of time in everyday situations.

By the end of the course, adult learners will be able to interpret and transmit time-related information expressed orally or in writing. They will be able to read, write and perform calculations involving units of time (e.g. hours, months, years), in addition to recognizing equivalences among these units. They will also be able to select and perform addition and subtraction operations involving units of time using a calculator and written calculation algorithms.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Orienting oneself in time*.

This class consists of real-life situations that require adults to read, write and perform calculations involving units of time. Real-life situations such as using public transportation, preparing a meal or adhering to a work schedule all involve using measures of time. Whether they need to consult a bus schedule, read the best-before date on a food product or make a note of the time spent working, adults are required to orient themselves in time.

These real-life situations address the needs expressed by adults and take their interests into account. The situations can involve the personal, professional, social or cultural aspects of their lives.

Class of Situations	Examples of Real-Life Situations
Orienting oneself in time	▪ Meeting with professionals (e.g. health, social) ▪ Planning to develop a new lifestyle ▪ Using public transportation ▪ Practising recreational activities ▪ Organizing their time on a daily basis ▪ Preparing a meal ▪ Adhering to a work or course schedule ▪ Celebrating a birthday

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Reading time-related information	▪ Reads the hours during which a service is available ▪ Reads a digital clock ▪ Checks the dates of a cultural event ▪ Consults a timetable (course, television, public transportation, film, scheduling of an activity) ▪ Consults a calendar ▪ Reads the cooking time of a prepared food ▪ Reads the best-before date of a food or pharmaceutical product
▪ Writing time-related information	▪ Makes a note of the date of an appointment for themselves or someone close to them ▪ Makes a note of the time spent working ▪ Makes a note of the information required for a follow-up medical visit (e.g. hours of sleep, date on which given symptoms appeared) ▪ Makes a list of the birthdays of family members and friends ▪ Writes a date out in numbers on a form
▪ Interacting orally in cases involving time-related information	▪ Presents events in his/her personal life in chronological order ▪ Indicates the time of an appointment to someone ▪ Informs someone of how long he/she will be absent from work or a course ▪ States his/her date of birth in number form ▪ Repeats a message containing time-related information

Categories of Actions	Examples of Actions
▪ Determining a measure of time	▪ Converts the number of months worked into days ▪ Calculates when the next bus will pass (e.g. every 15 minutes) ▪ Plans his/her daily schedule ▪ Calculates the time elapsed between two events ▪ Starts from a given time, determining when the next dose of medication should be taken (e.g. every four hours) ▪ Estimates the time it will take to get from one place to another ▪ Times a race ▪ Determines an end-of-warranty date (e.g. three-month warranty)

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Orienting oneself in time

Categories of Actions

- Reading time-related information
- Writing time-related information
- Interacting orally in cases involving time-related information
- Determining a measure of time

Operational Competencies

Thinks logically

- Selects information
- Distinguishes between the ways of expressing time orally and in writing
- Compares different indicators of time
- Uses pertinent examples

Communicates

- Listens attentively
- Decodes the symbols, notations and terms associated with basic arithmetic and time
- Asks for clarifications
- Repeats information to check comprehension
- Uses the symbols, notations and terms associated with basic arithmetic and time
- Writes numbers legibly
- Asks for help, if necessary

Essential Knowledge

- Time
- Arithmetic operations (addition, subtraction)
- Natural numbers

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the real-life situations in the class *Orienting oneself in time*, adult learners master basic time measurement concepts and use their knowledge of numbers and of addition and subtraction operations on natural numbers. In real-life situations that involve reading, writing and verbal interaction concerning time-related information, adults decode the symbols, notations and terms associated with basic arithmetic and time. They understand the numbers they read or hear and make connections between these numbers and units of time. In their interactions with others, they are concerned with communicating effectively. They listen to time-related information attentively, ask for clarifications if necessary and repeat information to make sure they have understood it. After making sure that the selected information is relevant to the context, they estimate or determine a measure of time. When the situation requires it, adult learners perform additions or subtractions involving units of time by using a calculator or written calculation algorithms. They recognize equivalences between units of time, thus establishing relationships between periods of time such as days and hours or months and years. If necessary, they use examples to avoid potential errors. The approach to the learning situation is based on their knowledge of timekeeping, numbers and the arithmetic operations of addition and subtraction. Learners express themselves by using the symbols, notations and terms associated with basic arithmetic and time They use measuring instruments such as digital watches and stopwatches. They make sure that their written indications concerning time are accurate and legible. They do not hesitate to ask for help if they encounter difficulties.

Evaluation Criteria

- Interprets time-related information correctly
- Writes time-related information correctly and legibly
- Interacts orally in an appropriate manner in cases involving time-related information
- Accurately determines a measure of time

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners to organize their thinking and guides them in taking action to deal with real-life situations that involve *Orienting oneself in time*.	Learners select the information they need to accurately represent the real-life situation at hand, whether it is a question of recognizing, estimating or determining a period of time. When using their knowledge of time, adults use this operational competency in order to distinguish between time-related information expressed orally or in writing. This competency also allows adult learners to establish relationships between different periods of time, such as days and hours or months and years. In their calculations, adult learners use relevant examples to validate their work, if necessary.

Contribution of the Operational Competency *Communicates*	
The operational competency *Communicates* makes it possible for adults to exchange meaningful information in their daily lives. It is essential to the effective interpretation and transmission of messages in various real-life situations that involve *Orienting oneself in time*.	When referring to periods of time in their communications with others, adults are concerned with understanding others and being themselves understood. They therefore listen attentively to time-related information. They decode symbols, concepts and terms associated with basic arithmetic and time. If necessary, they ask for clarifications and repeat what they have heard in order to check their understanding. They express themselves by using time-related mathematical language correctly, and make sure they write time-related information legibly. If necessary, they do not hesitate to ask for help from someone close to them, a peer or a resource person in order to overcome a difficulty.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with a number of situations in the *Orienting oneself in time* class.

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since it is also required to deal with the situations in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve orienting themselves in time.

Since essential knowledge in arithmetic is dealt with only in a context involving orientation in time, this material is covered only partially. In order to present all the aspects of this essential knowledge in a greater range of contexts, it has been made compulsory in other mathematics courses that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Time • Everyday terms related to time (e.g. yesterday, today, tomorrow, the seasons) • Timing • Reading a digital timepiece (e.g. 2:35) • Rules for writing standard time (e.g. 2:35 p.m.) • Estimating duration • Units of time (e.g. second, minute, hour, day, week, month, year) • Equivalences between units of time (e.g. 1 minute = 60 seconds, 1 week = 7 days, 1 year = 52 weeks) **Arithmetic operations** • Performing calculations involving addition and subtraction of natural numbers (using a calculator and written calculation algorithms)	**Natural numbers** • Natural numbers • Representing natural numbers (using concrete means and the base 10 number system) • Place value of a digit within a number • Composing and breaking down a natural number • Comparing natural numbers • Counting by units • Everyday vocabulary associated with comparing quantities (e.g. as many, equal, the same, similar, more, less, less than, greater than, the largest, the smallest) **Arithmetic operations** • Performing calculations involving addition and subtraction of natural numbers (using a calculator and written calculation algorithms) • Equality

New compulsory knowledge	Compulsory knowledge acquired in previous courses
	Arithmetic operations (cont'd) • Understanding of operations (addition and subtraction) • Everyday vocabulary related to addition and subtraction (e.g. add, plus, in all, total, sum, take away, less, remainder, difference) • Arithmetic tables: additions (0 + 0 to 10+ 10) and the corresponding subtractions

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Confidence in Their Abilities	Perseverance
If they are confident in their abilities, adults spring into action more readily when required by the situation and learn from their mistakes.	Persistent adults make a sustained effort and look for solutions to their difficulties. When needed, they ask for help from a resource person or seek support from a peer.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Public and parapublic organizations ▪ Community organizations ▪ Services provided by the training centre ▪ Commercial establishments (e.g. grocery stores, drugstores)	▪ Calculator ▪ Calendar ▪ Digital clock ▪ Computer ▪ Various types of timetables (e.g. bus, television, film, recreational) ▪ Government documentation ▪ Product labels ▪ School planner ▪ Stopwatch

Contribution of the Subject Areas

The contribution of all the subject areas is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

In the Literacy level courses, the examples of real-life situations are similar in some ways and complement the essential knowledge covered in the *Computer Science* program, which also belongs to the Mathematics, Science and Technology subject area, and in the *English, Language of Instruction* program, which belongs to the Languages subject area. This makes it possible to deal with different aspects of a real-life situation and to create cross-curricular learning situations.

Andragogical Context

It is evident that one must be able to orient oneself in time in everyday life. To help adults deal with a variety of real-life situations, the *Orienting oneself in time* course covers concepts that are essential to timekeeping in addition to continuing to build on learning related to numbers and arithmetic operations. More specifically, this course helps adults to read, write and determine units of time, and to deal with different situations in which they must apply their knowledge of time. In this regard, this course is essential to helping adults become more autonomous.

Adults are encouraged to play an active role in constructing their knowledge of mathematics. However, given the degree of autonomy needed to read task-related information or instructions, the teacher provides constant support in learning activities. Oral and team work is preferred when the context permits. The concrete materials made available to adults facilitate learning and the construction of knowledge. Frequent reflection on what has been learned allows adults to gauge their progress and to make the necessary adjustments. The teacher is concerned with creating an atmosphere of confidence that makes learning enjoyable and fuels the adults' determination to persevere. The teacher makes sure adult learners have the necessary resources to explore, understand and organize the data they need in order to plan and take action.

The Literacy level courses are designed to allow for the flexibility needed to adjust to the practical needs of adults. To enable adults to deal competently with real-life situations, the examples examined in the different courses are in some ways similar and involve using what was learned in English, Language of Instruction, Mathematics and Computer Science.

This is how the different facets of a real-life situation can be explored, thereby making it possible to create cross-curricular learning situations. The courses are adapted to adults' level of autonomy with respect to their ability to use written materials.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

How I Organize My Time

Learning to use a calendar is an example of a learning situation that can be used in this course. It belongs to the class *Orienting oneself in time* and, more specifically, to the real-life situation *Organization of time on a daily basis*. Throughout this learning situation, adults use the operational competencies *Thinks logically* and *Communicates.*

In order to provide a context for this learning situation, the teacher could ask the following question: Do you often find that you do not have enough time? The teacher leads a brief discussion on how people perceive time followed by a discussion on the difficulty of organizing time from day to day and the stress this could cause. The adult learners are then encouraged to explore the different types of information provided by a calendar and to see how this information can be used to organize everyday life.

The teacher checks what the class knows about years, months, weeks and days. Based on this information, the teacher has the class explore the calendar using the school planner. Each person checks the number of weeks and months in a year as well as the number of days in a week. The adult learners are then asked to note which day is generally the first the day in the week on a calendar and how many days there are in a month. The teacher points out that there is one month that differs from the others because of the number of days it has and has the class name this month. Following this exploration activity, the teacher summarizes and completes the information and writes it on the board. The teacher gives explanations if necessary and each person learns the equivalences between the different units of time. The next learning activity consists of a short written exercise on the concepts learned. The teacher reads the instructions and provides explanations. Depending on the adult learners' reading ability, this exercise can be done either individually or in pairs. Checking the results of the exercise provides the teacher with an opportunity to monitor adults more closely throughout the learning process.

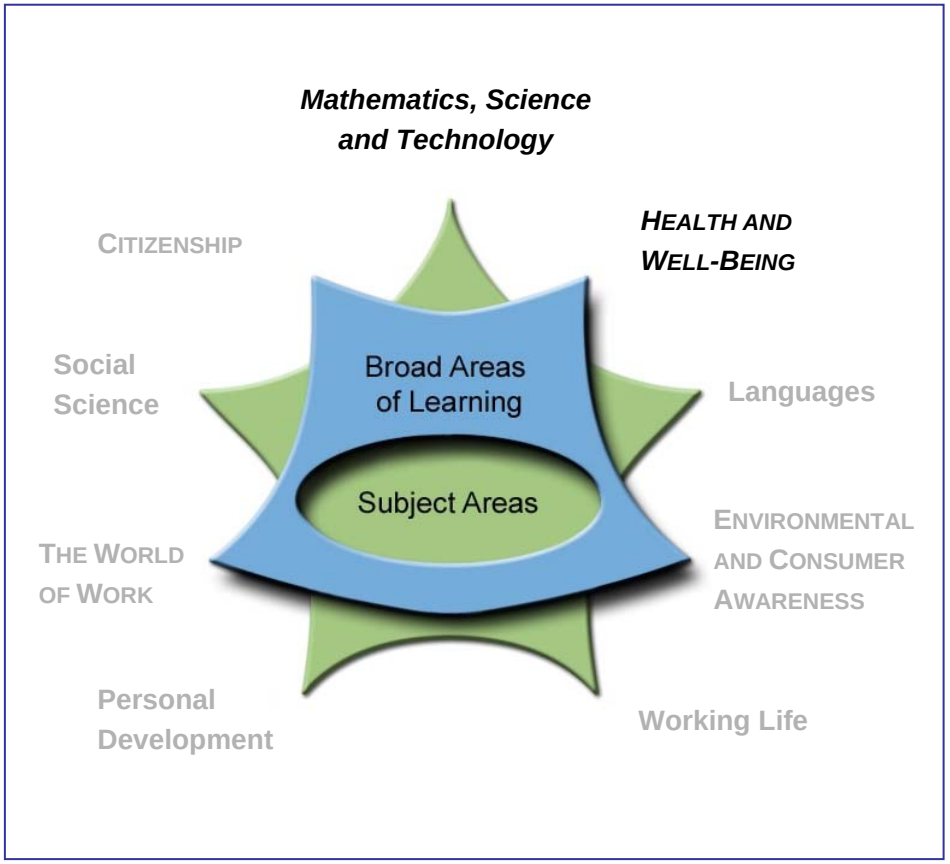
The learning situation also consists in having adult learners write dates out in numerical form. The teacher reviews the number of months in a year and how they are numbered, and then writes dates out in numerical form, giving the current date as an example. To clarify this, the teacher has adult learners think about a date in the current year that is important to them and has them write this date on a piece of paper. The adult learners take turns reading out the given date and writing it on the board. The teacher corrects the dates and repeats explanations, if necessary. Other adult learners can also be called on to participate in the activity. At the end of this learning activity, adult learners spend a few minutes observing the dates written on the board and where they fall within the year. The adult learners discuss the content of the activity and determine the precise order of these dates by using the calendar in their school planners. In a new written exercise, the teacher suggests new dates to be written out in numerical form. The teacher chooses these dates by using the training centre planner, thus making adult learners aware of some important dates which they write in their planners. The teacher checks each person’s work.

In the next learning activity, the teacher gives the adult learners a table showing different instruments for measuring time and the year each one was invented. The teacher leads a discussion on the importance of these measuring instruments in daily life, how these instruments evolved over time and how much time has passed since they were invented. The teacher takes this opportunity to discuss subtraction and has the adult learners calculate how long each instrument has existed. Since this exercise involves subtraction with borrowing and since adult learners may not be fully comfortable with this technique, the teacher takes the time to review it by writing an example on the board. The class corrects this exercise as a group in order to review the subtraction with borrowing algorithm and thereby consolidate their learning.

To conclude the learning situation, the teacher reviews the difficulties of managing time in everyday life. The adults are asked to express their ideas on what they have learned and how they can apply what they have learned in order to better manage their time on a daily basis.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Orienting oneself in time	
Learning Situation	
How I Organize My Time	
Categories of Actions	
▪ Reading time-related information ▪ Writing time-related information ▪ Interacting orally in cases involving time-related information ▪ Determining a measure of time	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	Time ▪ Everyday vocabulary related to the concept of time ▪ Units for measuring time ▪ Equivalences between units for measuring time Arithmetic operations ▪ Addition and subtraction involving natural numbers ▪ Mental estimate of the result of an addition or subtraction involving natural numbers
Complementary Resources	
▪ Day planner for each adult	▪ Table of different instruments for measuring time



Course

Arithmetic and Money

MTH-B213-4

Literacy

“A fortune is better protected in one’s head than in one’s wallet.”

Félix Leclerc

Presentation of the Course *Arithmetic and Money*

The course *Arithmetic and Money* is designed to help adult learners deal competently with real-life situations that require the ability to manage money.

In this course, adults learn about the Canadian monetary system and learn to use basic arithmetic in their daily lives.

By the end of the course, adult learners will be able to interpret and convey money-related information expressed in writing or orally. They will also be able to read, write, estimate and calculate amounts of money. They will be able to select and perform the four operations on natural numbers using written calculation algorithms or using a calculator in the case of monetary amounts containing decimals.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Dealing with money in everyday situations*.

The real-life situations in this class require that adults recognize, write, estimate and determine amounts of money by performing additions, subtractions, multiplications and divisions involving currency. Real-life situations such as buying a consumer product, moving or looking for a paid job require adults to have a certain knowledge of the units of the Canadian monetary system. Adults use the units of this system every time they check their change, compare rents in the classified ads, establish a list of daily expenses or obtain information about the salary offered for a job.

These real-life situations address the needs expressed by adults and take their interests into account. The situations can involve the personal, professional, social or cultural aspects of their lives.

Class of Situations	Examples of Real-Life Situations
Dealing with money in everyday situations	▪ Purchasing a consumer product ▪ Renting a product ▪ Planning personal and family expenses ▪ Practising a sports or a recreational activity ▪ Going on a cultural outing ▪ Paying back a debt ▪ Looking for or occupying a paid job ▪ Moving

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Reading money-related information	▪ Compares the prices of items in the classified ads (e.g. housing, second-hand bicycle) ▪ Reads the cost of cultural or sports activities in ads ▪ Consults advertising brochures before making a purchase ▪ Becomes informed about the salary offered in printed job ads ▪ Examines the cost of items on a list (school materials, recreational equipment)
▪ Writing money-related information	▪ Makes a list of daily expenses ▪ Makes a table of various prices for the same item sold in different stores ▪ Makes a list of foreseeable expenses for a family outing ▪ Writes down each amount received during a fundraiser ▪ Makes a note of the expenses related to tobacco use during a set period
▪ Interacting orally in cases involving money	▪ Asks for the price of an item including the taxes ▪ Recalls information conveyed by the media concerning the cost of gasoline ▪ Obtains information about the salary offered for a job ▪ Suggests an agreement for paying back a debt to a friend or family member ▪ Phones different businesses to compare the price or rental cost of an item

Categories of Actions	Examples of Actions
▪ Performing calculations involving amounts of money	▪ Shares the cost of a meal among several people ▪ Checks his/her change after a transaction ▪ Estimates the cost of renting a tool for a few hours ▪ Calculates the total cost of school supplies for his/her child ▪ Calculates daily expenses ▪ Estimates the cost of a sports activity ▪ Estimates the savings resulting from quitting smoking ▪ Does a quick calculation of his/her purchases before going to the checkout ▪ Pays back a debt in several payments ▪ Writes down each amount collected during a fundraiser

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Dealing with money in everyday situations

Categories of Actions

- Reading money-related information
- Writing money-related information
- Interacting orally in cases involving money
- Performing calculations involving amounts of money

Operational Competencies

Thinks logically

- Selects information
- Distinguishes between monetary amounts expressed orally or in writing
- Makes connections among selected items of information
- Uses pertinent examples

Communicates

- Listens attentively
- Decodes symbols, notations and terms related to money
- Asks for clarifications
- Repeats information to check comprehension
- Uses symbols, notations and terms related to money
- Writes amounts of money legibly
- Asks for help, if necessary

Essential Knowledge

- Natural numbers
- Monetary concepts
- Arithmetic operations (addition, subtraction, multiplication and division)

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the real-life situations in the class *Dealing with money in everyday situations,* adults learn about money-related concepts and use their knowledge of natural numbers and the four arithmetic operations of addition, subtraction, multiplication and division. Adults recognize the units of the Canadian monetary system in situations that involve verbal interactions and reading or writing money-related information. They decode monetary symbols, notations and terms. They distinguish between sums of money they read or hear and make connections with other information that is appropriate in dealing with the real-life situation. In their interactions with others, they are concerned with communicating effectively. They listen attentively to money-related information, ask for clarifications, if necessary, and repeat information they receive to make sure they have understood it. After verifying the relevance of the selected information and taking the context into account, adult learners compare, estimate or determine one or more sums of money. They are able to recognize equivalences for different monetary values. When required by the situation, adult learners perform one or more of the four arithmetic operations by using written calculation algorithms in the case of natural numbers and a calculator in the case of amounts containing decimals. If necessary, they use examples to validate their work. Throughout the learning process, adults try to use their knowledge of monetary concepts and of natural numbers and arithmetic operations. They use the symbols, terms and notations of the Canadian monetary system correctly and are able to conduct transactions involving coins and bank notes. Learners make sure they write out amounts correctly and legibly. They do not hesitate to ask for help if they encounter difficulties.

Evaluation Criteria

- Interprets money-related information correctly
- Writes money-related information correctly and legibly
- Interacts orally in an appropriate manner in cases involving money-related information
- Correctly determines an amount of money

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners to organize their thoughts and guides them in taking action when dealing with real-life situations related to *Dealing with money in everyday situations*.	Learners select the information they need to form an accurate representation of the real-life situation at hand, whether it is a question of recognizing, estimating or determining a sum of money. When using their knowledge of money, adults use this operational competency in order to distinguish between pieces of monetary information whether this information is expressed orally or in writing. This competency also allows them to make connections with other pieces of information, such as the context and the nature of the expense. When calculating amounts of money, adult learners use relevant examples to validate their work, if necessary.

Contribution of the Operational Competency *Communicates*	
The operational competency *Communicates* makes it possible for adults to exchange meaningful information in their daily lives. It is essential to the effective interpretation and transmission of messages in various real-life situations that involve *Dealing with money in everyday situations*.	In their daily interactions involving money, adult learners must understand others and make themselves understood. Thus, they listen attentively to the information provided. They decode symbols, notations and terms related to money, ask for clarifications and repeat information to make sure they have understood it. They express themselves by using money-related mathematical language correctly, and make sure they write monetary amounts legibly. If necessary, they do not hesitate to ask for help from someone close to them, a peer or a resource person in order to overcome a difficulty.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with a number of situations in the class *Dealing with money in everyday situations*.

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since it is also required to deal with the situations in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve money.

Since the essential knowledge pertaining to this course is dealt with only in a monetary context, this material is covered only partially. In order to present all the aspects of this essential knowledge in a greater range of contexts, it has been made compulsory in other mathematics courses that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Natural numbers • Reading and writing natural numbers in word form • Rounding off a natural number to the nearest tenth, hundredth or thousandth • Factors and multiples of a natural number **Monetary concepts** • Units of the Canadian monetary system (cents and dollars) • Converting a dollar amount into an amount expressed in cents and vice versa • Value of coins and banknotes • Equivalences between various coins and bank notes (e.g. one dollar is equivalent to four quarters)	**Natural numbers** • Natural numbers • Representing natural numbers (using concrete materials and the base 10 number system) • Place value of a digit within a number • Composing and breaking down a natural number • Counting • Comparing natural numbers • Counting by multiples • Everyday vocabulary associated with comparing quantities (e.g. as many, equal, the same, similar, more, less, less than, greater than, the largest, the smallest)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Arithmetic operations • Understanding of multiplication and division • Vocabulary related to the multiplication and division (e.g. multiply by, times, how many in all, separate, divide, how much for each one) • Property of operations: commutative law • Arithmetic tables: multiplications (0 x 0 to 10 x 10) and the corresponding divisions • Calculations involving multiplication and division of natural numbers (using a calculator, concrete means and written calculation algorithms) • Calculations involving the four operations on decimals (using a calculator and limited to two decimal places) • Making a mental estimate of the result of an operation involving natural numbers • Multiplication and division of a number by 10, 100, 1000	**Arithmetic operations** • Equality • Understanding of addition and subtraction • Everyday vocabulary associated with addition and subtraction (e.g. add, more, in all, total, sum, take away, less, remainder, difference) • Addition and subtraction involving natural numbers (using a calculator and written calculation algorithms) • Arithmetic tables: additions (0 + 0 to 10 + 10) and corresponding subtractions • Calculations involving the addition and subtraction of decimals (using a calculator and limited to two decimal places

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Confidence in Their Abilities	Perseverance
If they are confident in their abilities, adults spring into action more readily when required by the situation and learn from their mistakes.	Persistent adults make a sustained effort and look for solutions to their difficulties. When needed, they ask for help from a resource person or seek support from a peer.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Public and parapublic organizations ▪ Community organizations ▪ Services provided by the training centre ▪ Commercial establishments (e.g. grocery stores, drugstores)	▪ Coins ▪ Calculator ▪ Information brochures on recreational activities ▪ Classified ads from newspapers ▪ Various ads and advertising brochures ▪ Computer

Contribution of the Subject Areas

The contribution of all the subject areas is also useful for dealing with the real-life situations in this course. In the Literacy level courses, the examples of real-life situations are similar in some ways and complement the essential knowledge covered in the *Computer Science* program, which also belongs to the Mathematics, Science and Technology subject area, and in the *English, Language of Instruction* program, which belongs to the Languages subject area. This makes it possible to deal with different aspects of a real-life situation and to create cross-curricular learning situations. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Andragogical Context

It is evident that one must deal with money in everyday life. In order to help adults deal with a variety of real-life situations, the *Arithmetic and Money* course covers basic concepts related to the monetary system as well as algorithms for the four arithmetic operations (addition, subtraction, multiplication, division). More specifically, the course helps adults read, write and determine amounts of money, and to deal with different situations in which they must apply this knowledge. In this regard, this course is essential to helping adults become more autonomous.

Adults are encouraged to play an active role in constructing their knowledge of mathematics. However, given the degree of autonomy needed to read task-related information or instructions, the teacher provides constant support in learning activities. Oral and team work is preferred when the context permits. The concrete materials made available to adults facilitate learning and the construction of knowledge. Frequent reflection on what has been learned allows adults to gauge their progress and to make the necessary adjustments. The teacher is concerned with creating an atmosphere of confidence that makes learning enjoyable and fuels the adult learners' determination to persevere. The teacher makes sure they have the necessary resources to explore, understand and organize the data they need in order to plan and take action.

The Literacy level courses are designed to allow for the flexibility needed to adjust to the practical needs of adults. To enable adults to deal competently with real-life situations, the examples examined in the different courses are in some ways similar and involve using what was learned in English, Language of Instruction, Mathematics and Computer Science.

This is how the different facets of a real-life situation can be explored, thereby making it possible to create cross-curricular learning situations. The courses are adapted to adults' level of autonomy with respect to their ability to use written materials.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Furnishing a Room

Furnishing a Room is an example of a learning situation that can be used in this course. It belongs to the class of situations *Dealing with money in everyday situations* and, more particularly, the real-life situation *Purchasing a consumer product*. Throughout this learning situation, adults use the operational competencies *Thinks logically* and *Communicates*.

The teacher introduces the learning situation by handing out a list of decorative items to be purchased and an assessment of the costs involved. The adult learners are asked to complete this list by taking into account their own ideas and tastes with respect to home decoration. The teacher then leads a discussion on the value of the items to be purchased and whether these costs are realistic, with a view to determining the total cost of decorating the room.

The adult learners are then encouraged to experiment with a way of arriving at a more accurate estimate of how much it will cost to decorate the room. The teacher provides instructions and hands out a fictitious budget that must be followed as well as two advertising brochures featuring the items to be purchased. Learners work individually or in pairs to find the items they are looking for and write their name and price on a sheet of paper. A discussion of the results of this exercise will make it possible to determine the accuracy of the information collected. The teacher writes this information on the board during the discussion to make sure that the amounts read aloud by individual learners are the same as those written down. Since learners can choose different items, the amounts will not necessarily be the same for everyone.

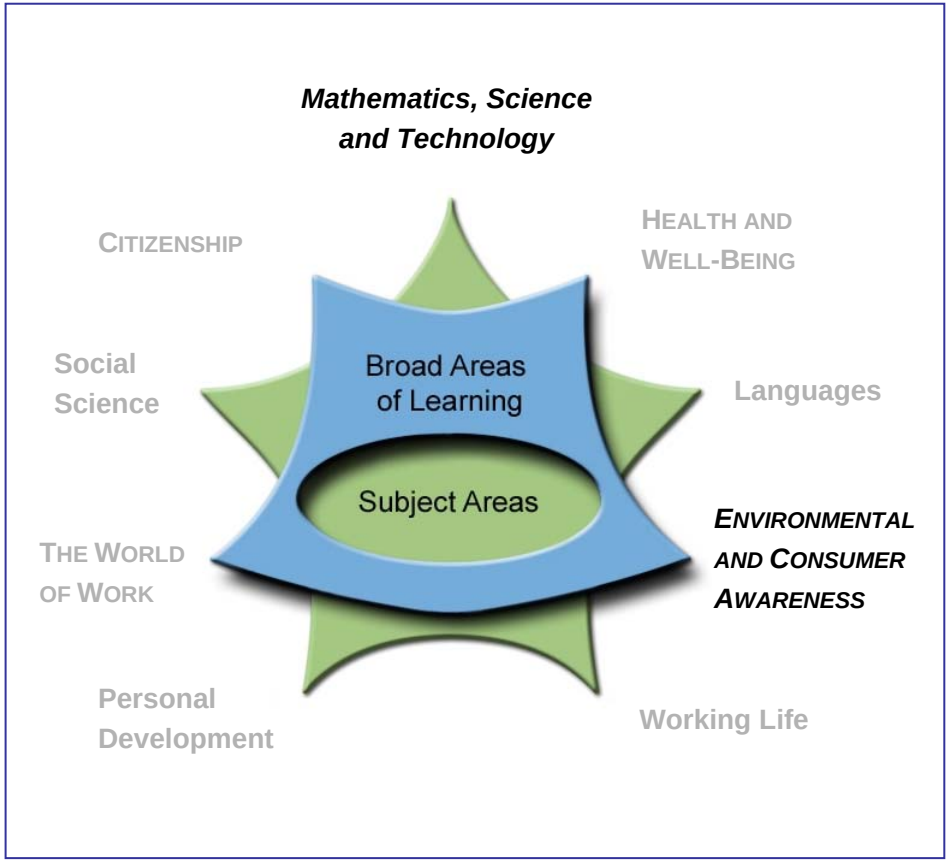
The teacher explains the usefulness of rounding off amounts of money to the nearest dollar in order to make it easier to estimate costs. The teacher demonstrates this by writing a few amounts on the board and asking the adults to participate. Each learner then rounds off amounts that were not dealt with in the demonstration. The teacher walks around the classroom to monitor adult learners more closely, motivate them and encourage them to be confident in their ability to learn and persevere. A final verification of the results provides an opportunity for additional explanations, as needed. Each learner writes the rounded amount on the sheet of paper, beside each item they have chosen to decorate the room.

The next step consists in estimating the cost of decorating the room based on the rounded amounts. As the fictitious budget must be followed, adult learners working either individually or in teams are asked to calculate the difference between the estimated cost and the budgeted amount. The teacher then gets adult learners to use their logic by asking: Which arithmetic operations are appropriate in this context? A discussion on the meaning of the operations may lead to the conclusion that addition and subtraction are the most appropriate operations in this context. The adult learners then work individually: they use their knowledge of written calculation algorithms to perform the necessary operations. The teacher checks each person's work and, if necessary, reviews certain concepts.

To conclude the learning situation, the teacher reviews the completed tasks and steps involved. The adults are asked to comment on this approach and on what they have learned as well as the areas that need more work. They reflect on the possibility of applying what they have learned in other contexts.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Dealing with money in everyday life	
Learning Situation	
Furnishing a Room	
Categories of Actions	
▪ Reading money-related information ▪ Writing money-related information ▪ Interacting orally in cases involving money ▪ Performing calculations involving amounts of money	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	Natural numbers ▪ Representing natural numbers (using concrete materials and the base 10 number system) ▪ Comparing natural numbers ▪ Rounding off a natural number to the nearest tenth, hundredth or thousandth Monetary concepts ▪ Units of the Canadian monetary system (cents, dollars) Arithmetic operations ▪ Understanding of arithmetic operations ▪ Everyday vocabulary related to arithmetic operations ▪ Addition and subtraction involving natural numbers



Complementary Resources

▪ Department store brochures advertising home decoration items	▪ Flyer for a hardware store advertising paint and equipment needed to paint

Course

Basic Geometric Representations

MTH-B214-3

Literacy

“All that geometry teaches is true only for the learner.”

Joseph Joubert

Presentation of the Course *Basic Geometric Representations*

The course *Basic Geometric Representations* is designed to help adult learners deal competently with real-life situations that involve representing their immediate physical environment.

This course prepares adults to use basic concepts related to geometry, measurements and ratios to represent and describe their environment.

By the end of the course, adult learners will be able to interpret and convey information concerning the positioning of objects in space. They will be able to use simple geometric models (squares, rectangles, circles, triangles), representations of simple fractions and the relationships between quantities of objects and units of measurement (metres, litres, degrees Celsius) to represent and describe the characteristics of their immediate physical environment.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Representing one's immediate physical environment*.

This class consists of real-life situations (e.g. getting around in an unfamiliar place, preparing a meal or decorating one's home) in which adults are required to represent elements in their physical environment by using basic concepts related to geometry, measurements and ratios. Whether determining how much of a cleaning product should be used, making a note of the dimensions of a window, following road signs, measuring the ingredients for a recipe or describing the position of a piece of furniture with respect to another, adults use basic concepts related to geometry, measurements and ratios.

These real-life situations address the needs expressed by adults and take their interests into account. The situations can involve the personal, professional, social or cultural aspects of their lives.

Class of Situations	Examples of Real-Life Situations
Representing one's immediate physical environment	▪ Getting around in an unfamiliar place ▪ Decorating one's home ▪ Doing household chores ▪ Purchasing a consumer product ▪ Preparing a meal ▪ Carrying out work-related tasks ▪ Practising recreational activities ▪ Following health-related instructions

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Reading information involving geometry, measurements or ratios	▪ Understands the meaning of geometric shapes on clothing labels and road signs ▪ Reads the quantities of ingredients needed to prepare a recipe ▪ Reads the measurements indicated on the packaging for a tablecloth ▪ Reads the required quantity of a cleaning product ▪ Reads the distance to be covered on a bicycle path
▪ Writing information involving geometry, measurements or ratios	▪ Makes a note of the dimensions of a window ▪ Makes a note of the quantities of ingredients needed for a recipe ▪ Draws a diagram of a house using geometric shapes ▪ Makes a note of the correct dose of a medication ▪ Makes a note of the length of the pieces of wood needed to refurbish a piece a furniture
▪ Orally interacting in cases involving a description of the physical environment	▪ Situates a street with respect to another ▪ Locates a community service in his/her environment ▪ Describes an everyday object by referring to its shape ▪ Describes the position of a piece of furniture with respect to another ▪ Indicates the location of the closest convenience store ▪ Follows road signs ▪ Explains where his/her apartment is located ▪ Indicates the approximate quantity of a liquid remaining in a container (one half, one quarter)

Categories of Actions	Examples of Actions
▪ Determining measurements and ratios	▪ Measures the ingredients for a recipe ▪ Measures a dose of medication ▪ Estimates the distance between his/her house and the closest CLSC ▪ Orders a given amount of wine in a restaurant ▪ Fills a container with water to half its capacity ▪ Checks the temperature on a cooking thermometer ▪ Measures the length of a plank of wood ▪ Estimates the snowfall for one day

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Representing one's immediate physical environment

Categories of Actions

- Reading information involving geometry, measurements or ratios
- Writing information involving geometry, measurements or ratios
- Orally interacting in cases involving a description of the physical environment
- Determining measurements and ratios

Operational Competencies

Thinks logically

- Selects information
- Distinguishes between written or oral information about the physical environment
- Deduces information
- Uses pertinent examples

Communicates

- Listens attentively
- Decodes symbols, terms and notations about the immediate physical environment
- Asks for clarifications
- Repeats information to check comprehension
- Uses the appropriate symbols, terms and notations
- Makes sure that measurements expressed in writing are accurate
- Asks for help, if necessary

Essential Knowledge

- Ratios
- Geometry
- Measurement
- Natural numbers
- Arithmetic operations

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the real-life situations in the class *Representing one's immediate physical environment*, adult learners use basic concepts of geometry, measurements and ratios. When adults read, write or interact with others in an attempt to understand or describe the physical characteristics of their surroundings, they must distinguish between information expressed orally and in writing that refer to concepts of geometry, measurements and ratios. Learners decode symbols, terms and notations related to their immediate physical environment and recognize certain segments, simple fractions and simple geometric shapes as well as units of length, capacity and temperature. In written or spoken language, they identify the information that allows them to situate themselves and to represent the position of objects in space or to recognize the shape of these objects. In interactions that involve representing their physical environment, adults are concerned with communicating effectively. This is why they listen attentively to information that is useful for representing the physical characteristics of their environment. If necessary, they ask for clarifications and repeat the information to make sure they have understood it correctly. After selecting the relevant information, adults form a mental representation of their physical environment and describe it by using concepts of geometry, measurements and ratios. They specify their position or that of objects in space and use the properties of a geometric figure to deduce certain items of information such as the length of a segment. In certain situations, ratios are useful for indicating the relationships between different quantities of objects. In other situations, ratios are useful for representing a part of a whole. Learners use units of measure and the appropriate instruments to estimate or determine length, capacity or temperature. If necessary, they use examples to validate their work. Throughout the process, adult learners must make sure they are representing their physical environment in a plausible manner. They describe their environment by using the appropriate symbols, terms and notations and are concerned with conveying measurements and ratios that are as precise as possible. They do not hesitate to ask for help if they encounter difficulties.

Evaluation Criteria

- Interprets information involving geometry, measurements or ratios correctly
- Writes information involving geometry, measurements or ratios correctly and legibly
- Provides an appropriate verbal description of the physical environment
- Correctly determines measurements and ratios

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically and Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners to organize their thinking and guides them in taking action to deal with real-life situations that involve *Representing one's immediate physical environment*.	In order to describe elements in their immediate physical environment, adult learners select the information they need to construct an accurate representation of the real-life situation examined in the course. When they use concepts of geometry, measurements and ratios, this operational competency allows them to distinguish between pieces of information about these concepts, which are expressed orally or in writing. They also use the properties of a geometric figure to deduce certain information such as the length of a segment. If necessary, when determining a length or a ratio, adult learners use relevant examples to validate their work.

Contribution of the Operational Competency *Communicates*	
The operational competency *Communicates* promotes meaningful exchanges in the daily lives of adults. It is essential to the effective interpretation and transmission of messages in various real-life situations that involve *Representing one's immediate physical environment*.	When attempting to represent their physical environment in their daily interactions, adults ensure that they can understand others and make themselves understood. They therefore listen attentively to information so that they can understand their surroundings. They decode symbols, terms and notations pertaining to their immediate physical environment. If necessary, they ask for clarifications and repeat information they have received in order to check its accuracy. In order to describe the elements in their physical environment, they express themselves by correctly using mathematical language pertaining to the position of people and objects in space, geometric shapes, simple fractions and units of measure. Adults make sure that they accurately convey measurements and ratios in writing. If necessary, they do not hesitate to ask for help from someone close to them, a peer or a resource person in order to overcome a difficulty.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with a number of situations in the class *Representing one's immediate physical environment*.

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since it is also required to deal with the situations in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve representing one's immediate environment.

Ratios (ratios of quantities of objects and simple fractions) are covered only as they pertain to the representation of the physical environment, and therefore are covered only partially. In order to present all the aspects of this essential knowledge in a greater range of contexts, it has been made compulsory in other mathematics courses that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Ratios • Ratios of two natural numbers • Simple fractions (with denominator smaller than or equal to 10) • Numerator and denominator • Representing fractions and ratios between quantities of objects (using the base 10 number system and concrete materials such as blocks and illustrations) • Everyday vocabulary related to fractions (e.g. half, one half, one quarter, one third, two thirds)	**Natural numbers** • Natural numbers • Even and odd numbers • Arranging natural numbers in increasing and decreasing order • Comparing natural numbers • Counting • Counting by multiples • Everyday vocabulary associated with comparing quantities (e.g. as many, equal, the same, similar, more, less, greater than, less than, the largest, the smallest)
Geometry • Everyday vocabulary related to the positioning of objects in space (e.g. above, below, to the right, to the left, inside, outside, on top) • Simple geometric figures (circles, squares, rectangles and triangles)	**Arithmetic operations** • Understanding of the four arithmetic operations (addition, subtraction, multiplication, division)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Geometry (cont'd) • Line segments and curves • Constructing simple geometric figures: squares, rectangles, triangles and circles (using no specific technique) • Constructing acute, obtuse and right angles (using no specific technique) • Properties of squares and rectangles (parallel sides, congruent sides, right angles) • Significant segments (width, height, parallel and perpendicular sides) **Measurement** • Units of measure: milligrams, kilograms, grams, millimetres, centimetres, metres, kilometres, millilitres, litres and degrees Celsius • Measuring and estimating length, mass, capacity (volume) and temperature	**Arithmetic operations (cont'd)** • Vocabulary related to the four arithmetic operations (e.g. add, total, take away, difference, multiply by, times, how much in all, separate, divide, how much for each one) • Calculations involving the four operations on the natural numbers (using a calculator, concrete means and written calculation algorithms) • Mental estimate of the result of an operation involving natural numbers

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Confidence in Their Abilities	Perseverance
If they are confident in their abilities, adults spring into action more readily when required by the situation and learn from their mistakes.	Persistent adults make a sustained effort and look for solutions to their difficulties. When needed, they ask for help from a resource person or seek support from a peer.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Public, parapublic and private organizations ▪ Community organizations ▪ Services provided by the training centre ▪ Commercial establishments (e.g. grocery stores, drugstores)	▪ Bank of images of road signs ▪ Cookbooks ▪ Various labels (e.g. cleaning products, medications) ▪ Instruments for measuring capacity ▪ Thermometer ▪ Measuring instruments ▪ Maps of bicycle paths ▪ Geometry instruments ▪ Calculator, etc.

Contribution of the Subject Areas

The contribution of all the subject areas is also useful for dealing with the real-life situations in this course. In the Literacy level courses, the examples of real-life situations are similar in some ways and complement the essential knowledge covered in the *Computer Science* program, which also belongs to the subject area of Mathematics, Science and Technology, and in the *English, Language of Instruction* program, which belongs to the Languages subject area. This makes it possible to deal with different aspects of a real-life situation and to create cross-curricular learning situations. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Andragogical Context

In different real-life situations, adults are required to describe and represent elements in their immediate physical environment. To help them deal with a range of situations, the *Basic Geometric Representations* course helps them construct this representation through the use of basic concepts related to geometry, measurements and ratios. More specifically, this course helps adults to orient themselves in their physical environment, to read, write and interact in different situations that involve applying their knowledge. In this regard, this course is essential to helping adults become more autonomous.

Adults are encouraged to play an active role in constructing their knowledge of mathematics. However, given the degree of autonomy needed to read task-related information or instructions, the teacher provides constant support in learning activities. Oral and team work is preferred when the context permits. The concrete materials made available to adults facilitate learning and the construction of knowledge. Frequent reflection on what has been learned allows adults to gauge their progress and to make the necessary adjustments. The teacher is concerned with creating an atmosphere of confidence that makes learning enjoyable and fuels the adult learners' determination to persevere. The teacher makes sure adult learners have the necessary resources to explore, understand and organize the data they need in order to plan and take action.

The Literacy level courses are designed to allow for the flexibility needed to adjust to the practical needs of adults. To enable adults to deal competently with real-life situations, the examples examined in the different courses are in some ways similar and involve using what was learned in English, Language of Instruction, Mathematics and Computer Science.

This is how the different facets of a real-life situation can be explored, thereby making it possible to create cross-curricular learning situations. The courses are adapted to adults' level of autonomy with respect to their ability to use written materials.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Getting Ready for a Bicycle Trip

Getting Ready for a Bicycle Trip is an example of a learning situation that can be used in this course. It belongs to the class *Representing one's immediate physical environment* and, more specifically, to the real-life situation *Getting around in an unfamiliar place*. Throughout this learning situation, adults use the operational competencies *Thinks logically* and *Communicates*.

In order to provide a context for this learning situation, the teacher prepares a scenario that requires the adults to determine the route for a one-day bicycle trip. The situation is fictitious, but realistic. To carry out this activity, adult learners will have to become familiar with units of length.

After presenting the scenario, the teacher listens to the adults' reactions and provides more clarifications by answering their questions. The teacher then leads a class discussion on the knowledge needed to carry out this type of project and on the challenges involved, and begins by handing out a questionnaire on what they know about the different units of length. Using this information, the teacher has the class carry out an initial learning activity aimed at providing points of comparison for the smaller units of measure such as metre, centimetre and millimetre. Examples of points of comparison are given for each unit of measure (e.g. a door handle is usually about one metre above the floor). These examples are written on the board. The teacher then names various objects and asks the adult learners to choose what would seem to be the most appropriate unit of measure to represent the object's length. The teacher gives the class a few minutes to come up with objects that can be measured in metres, centimetres and millimetres. An example must be given for each unit of measure. The adult learners then pool all of their examples so that they may be verified. A variety of examples will ensure that these measurements are better represented. If necessary, the teacher provides clarifications and repeats the exercise.

The learning activity continues with an examination of the kilometre, a unit of measure that will be especially useful in preparing for a bike trip. In order to help the adults represent the distance that corresponds to one kilometre, the teacher begins by presenting a point of comparison that is familiar to the adults by telling them the number of kilometres between the training centre and the city pool. The teacher then names a few places with which the adult learners are familiar and asks them whether the distance between those places can be measured in kilometres. In the ensuing discussion, each person gives new examples and the rest of the class comments on how realistic these examples are.

When the teacher feels that the points of comparison are sufficiently clear for illustrating the concept of kilometre, the class can begin planning the bike trip. Each learner is given a map of the bike path in the area where the centre is located. This map contains little information and it is very simply sketched. If necessary, the map can be reproduced by only keeping the minimum amount of information needed for the task at hand. The teacher introduces the learning activity and points out useful symbols such as rest stops or parking areas. The teacher asks the adults to describe the shape of these

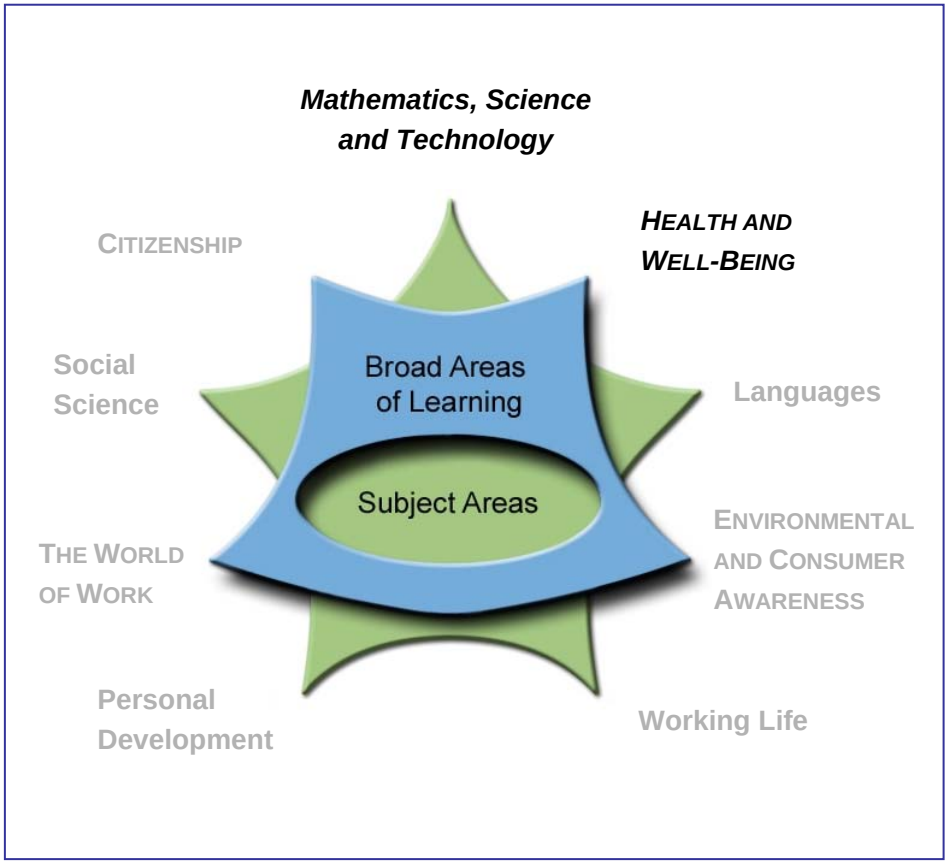
symbols by drawing on their knowledge of geometric figures. Each person clearly marks the start and the end of the path and identifies known places. This is a good time to get the adult learners to locate these places with respect to one another and to use concepts they have already learned about positioning in space.

The adults continue the learning activity by working in teams of two or three. Before they sketch out their route, the teacher has them calculate the total length of the bike path and determine the length of the different segments in kilometres. By taking these distances into account, the adults arrange these segments, from the shortest to the longest. They help each other find the required information by adding and comparing numbers. Each team then presents its results and explains the method used to obtain them. The teacher comments on the work and makes corrections, if necessary. The adults are asked to work in teams to determine a realistic bike route by taking into account what they observed when they were examining the map and the amount of time they have for the trip. They use a highlighter to mark out the route, perform calculations and make a note of the total distance to be covered.

To conclude the learning situation, the teacher reviews the activity with the class. The adults comment on how realistic their route is and what they have learned through the activity. The adults are asked to identify the units of length they studied and to name other real-life situations in which these units of measure could be useful.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Representing one's immediate physical environment	
Learning Situation	
Getting Ready for a Bicycle Trip	
Categories of Actions	
▪ Reading information involving geometry, measurements or ratios ▪ Writing information involving geometry, measurements or ratios ▪ Orally interacting in cases involving a description of the physical environment ▪ Determining measurements and ratios	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	Measurement ▪ Units of measure ▪ Estimating a length Geometry ▪ Simple geometric figures ▪ Positioning objects in space Natural numbers ▪ Classifying and comparing natural numbers Arithmetic operations ▪ Adding natural numbers
Complementary Resources	
▪ Map of bicycle paths	



Course

Arithmetic and Personal Finances

MTH-P101-4

Presecondary

“The hardest arithmetic to master is that which enables us to count our blessings.”

Eric Hoffer

Presentation of the Course *Arithmetic and Personal Finances*

The course *Arithmetic and Personal Finances* is designed to help adult learners deal competently with real-life situations in which they must deal with problems involving their personal finances.

The course prepares adult learners to use basic arithmetic in the day-to-day management of their personal finances.

In Literacy training, adult learners were presented with real-life situations that involved working with money. Through these situations, they became familiar with the four operations on natural numbers and with the basic units of the Canadian monetary system. In the *Arithmetic and Personal Finances* course, adult learners will continue to build on their knowledge of arithmetic through real-life situations that involve financial information and that introduce them to the use of decimals. They will also learn simple concepts involving negative numbers, ratios and percentages as well as directly proportional relationships involving sums of money.

By the end of the course, adult learners will be able to interpret and produce financial information related to their personal finances and perform calculations involving amounts of money. They will make systematic use of arithmetic language and make deductions and inferences based on their understanding of numbers, operations and the properties of operations.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Managing personal finances*.

Many real-life situations involve managing personal finances. To manage their personal finances, adult learners must use arithmetic concepts and basic monetary calculation techniques in order to produce and interpret all types of financial information. In this course, adult learners examine simple or everyday activities that mainly involve the adults themselves and do not require long-term planning. Thus, in dealing with these situations, adult learners are not required to work with too much financial information.

Adult learners may deal with real-life situations in which they are required to verify simple bills and pay the correct amount involved, to determine the payment method when purchasing or leasing a product, to draw up a personal budget in order to better manage their expenses and to be mindful of advertising, among other things. Some real-life situations related to work or training also involve financial matters and can be dealt with using the knowledge acquired in this course. This is the case when adults must check information relating to salaries or assess the expenses associated with going back to school.

Class of Situations	Examples of Real-Life Situations
Managing personal finances	▪ Making a purchase ▪ Renting a product ▪ Paying bills ▪ Planning a personal budget ▪ Taking out a membership at a fitness centre ▪ Choosing housing within one's budget ▪ Financial profit or loss as a result of a sale ▪ Exploring employment options taking salary into account ▪ Personal project involving expenses ▪ Pay ▪ Subscribing to a magazine ▪ Advertising

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Interpreting financial information	▪ Compares the quality-price ratio before making a purchase ▪ Becomes familiar with the discounts offered in an advertisement ▪ Checks the information appearing on a bill ▪ Checks the information appearing on a pay stub ▪ Compares membership fees for different sports centres
▪ Producing financial information	▪ Produces a personal budget for one week ▪ Establishes a one-month personal balance sheet ▪ Writes a cheque ▪ Enters the information required to complete a transaction in an automatic banking machine ▪ Produces a price list ▪ Provides information on his/her personal income orally
▪ Performing calculations involving amounts of money	▪ Calculates weekly housing costs ▪ Pays a bill or invoice with cash ▪ Calculates the portion of expenses devoted to a physical activity ▪ Calculates his/her weekly earnings ▪ Calculates the approximate cost of a grocery bill

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Managing personal finances

Categories of Actions

- Interpreting financial information
- Producing financial information
- Performing calculations involving amounts of money

Operational Competencies

Thinks logically

- Infers the properties and meaning of operations
- Selects relevant financial information and appropriate arithmetic operations
- Classifies decimal numbers and financial data
- Uses proportional reasoning
- Checks the plausibility and consistency of conclusions

Communicates

- Accurately decodes symbols, notations, arithmetic terms and financial terms
- Identifies financial data
- Checks their interpretation with others
- Structures their message appropriately by using arithmetic models
- Uses symbols, notations, arithmetic terms and financial terms rigorously
- Makes sure the message is clear

Essential Knowledge

- Whole numbers and decimals
- Ratios and percentages
- Proportional relations
- Financial concepts

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the situations in the class *Managing personal finances*, adult learners interpret and produce relevant financial information and perform the monetary calculations needed to manage their finances on a daily basis. Adult learners interpret simple financial information pertaining to a bill, a chequing account, a paycheque, a television ad. They do this by accurately decoding the symbols and notations of the Canadian monetary system and arithmetic language such as decimals and percentages contained in explicit information. They also decode basic common mathematical and financial terms (e.g. discount, total, salary, revenue, expense, addition). They are able to identify financial data and select information that is relevant or irrelevant to a real-life situation. Adult learners make connections between financial data and the information that lends meaning to this data. If necessary, they check their interpretation of the message with others. Adult learners classify decimals and financial data in order to make the best choice. They check the plausibility and consistency of their conclusions. Adult learners use simple financial information when they write a cheque, carry out a transaction at an automatic banking machine, write a price list, etc. They systematically use the symbols and notations of arithmetical language and the Canadian monetary system. They make sure to use the appropriate mathematical and financial terms to avoid any ambiguity. Adult learners also make sure their message is clear and consistent. They begin by determining the subject of the message then structure it appropriately using arithmetic models (e.g. equalities, arithmetic expressions) To do this, they make connections between financial data and the information they wish to convey. When adult learners draw up a personal weekly budget or a price list, they classify decimal numbers and financial data. Whether it be to interpret or produce information or to acquire a better understanding of the real-life situation, adult learners perform calculations involving sums of money. If necessary, they solve arithmetic operations involving positive decimals to determine an exact amount or ratio (e.g. taxes, discounts, a portion of a sum of money, total expenses). They are also able to infer the properties and meaning of operations to determine the most appropriate operation in any given context. For example, they know that addition is used to calculate a gain, an addition (such as a tax), a series of amounts, and so on. This allows them to determine the required calculations and to correctly select the arithmetic operations to be performed depending on the situation involved. In the interests of accuracy, adult learners use models that are consistent with specific arithmetic rules such as the order of operations. In addition, they use proportional reasoning when they deduce that an amount is directly related to a variable (e.g. salary based on number of hours worked) and apply the unit-rate method if one of the amounts is unknown. Adult learners take the time to verify whether their result is close to their initial estimate. They also make sure their calculations and conclusions are plausible and consistent.

Evaluation Criteria

- Interprets financial information correctly
- Produces clear and coherent financial information
- Correctly performs calculations involving amounts of money

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners make connections and draw conclusions when dealing with real-life situations related to the class *Managing personal finances*. It consists in using deductive and inductive reasoning based on their understanding of numbers, operations and the properties of operations. Adult learners think logically to derive the properties and meaning of arithmetic operations when they work with situations requiring calculations involving amounts of money. For example, they may come to the conclusion that several amounts can be added in any order to obtain the corresponding sum. They look for examples to check the plausibility of their hypothesis or find counterexamples in order to specify adjust or refute the hypothesis. By using inductive reasoning, they are able to determine the various contexts in which a given operation is appropriate. For example, they know that they can use addition to calculate a gain, an addition (such as a tax) or the total of a series of amounts.	Adult learners make connections between financial data and the information that makes this data meaningful, thus allowing them to choose information (e.g. amount of money, due date for a payment) that is relevant to the situation. When purchasing a product or subscribing to a service, adult learners compare and classify whole numbers, decimals or different products and services, thus allowing them to establish their priorities. When drawing up a personal budget or determining sums of money, adult learners deduce the required calculations and select the appropriate arithmetic operations. In addition, they use proportional reasoning when they see that cost is directly linked to the number of items purchased or when they estimate the percentage of an amount of money. Adult learners check the plausibility and consistency of their calculations and conclusions (e.g. estimates, established priorities).

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* helps adult learners interpret and produce simple messages containing financial information when dealing with real-life situations related to the class *Managing personal finances*. It consists in decoding and rigorously using arithmetic language and basic financial terms.

When interpreting a message, adult learners accurately decode the symbols and notations for representing decimals, percentages and the Canadian monetary system. They are familiar with the basic vocabulary associated with arithmetic operations and the more common financial terms. They can distinguish between the relevant and non-relevant information on a bill, cheque, paycheque, product label or television ad and identify the key information. When in doubt, adult learners make sure they have properly interpreted the financial information conveyed in the message by checking their understanding with others.

When producing a message, adult learners make appropriate use of mathematical language and financial terms. They correctly associate arithmetic symbols and notations with the information they wish to convey. They determine the subject of the message and structure it appropriately by using specific arithmetic models (e.g. tables, arithmetic expressions). When writing a cheque, carrying out a transaction at an automatic banking machine or orally conveying personal financial information, adult learners make sure their message is clear and adapted to the situation and the reader or listener.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with a number of situations in the class *Managing personal finances*.

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to a financial context. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed to make it easier to identify adult learners' previously acquired knowledge.

Since the essential knowledge in this course is used solely in a financial context, it is not dealt with exhaustively. It has therefore been made compulsory in other mathematics courses that deal with non-financial situations to give students the opportunity to apply this knowledge in a greater variety of contexts.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Whole numbers and decimals	**Natural numbers**
• Whole numbers (negative numbers are used only to represent and compare amounts)	• *Natural numbers*
• Decimals (up to two decimal places in reference to money)	
• Order relations involving decimals (including negative numbers)	• *Order relations involving natural numbers*
• Properties of operations: associative and distributive laws	• *Property of operations: commutative law*
• Equality	
• Order of operations (the four operations and parentheses)	
• Representing decimals using the base 10 number system (including negative numbers)	• *Representing natural numbers using the base 10 number system*
• Reading and writing decimals expressed as words (including negative numbers)	• *Reading and writing natural numbers expressed as words*
• Comparing decimals (including negative numbers)	• *Comparing natural numbers*
	Natural numbers (cont'd)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Whole numbers and decimals (cont'd) • Calculations involving the four operations on positive decimals (using a calculator, mental calculation techniques and calculation algorithms) • Solving a sequence of arithmetic operations on positive decimals (The written calculations must be limited to sequences with at most one set of parentheses and four operations. For more complex calculations, adult learners may use a calculator or other appropriate technology.) • Rounding off decimals to the nearest unit or tenth • Mentally estimating the result of an operation or sequence of operations on positive decimals • Representing relations using arithmetic models consisting of positive decimals	• *Understanding the four operations involving natural numbers* • *Everyday vocabulary related to the four arithmetic operations (adding, total, taking away, difference, multiplying by, times, how much in all, separating, dividing, how much for each one, etc.)* • *Rounding off a natural number to the nearest tenth, hundredth or thousandth* • *Mentally estimating the result of an operation or sequence of operations on the natural numbers* • *Representing relations using arithmetic models consisting of natural numbers*
Ratios and percentages • Simple fractions (whose denominators are less than or equal to 10 or equal to 100) • Mixed numbers (to express sums of money) • Ratio (of two decimals) • Percentage • Representing mixed numbers (using the base 10 number system and visual aids: blocks, illustrations, etc.) • Calculating a fraction of a natural number • Determining the fraction corresponding to part of a whole • Calculating the percentage of a number using a calculator • Determining the percentage corresponding to part of a whole	**Ratios** • *Ratios (between two natural numbers)* • *Simple fractions (whose denominators are less than or equal to 10)* • *Everyday vocabulary related to fractions (half, one half, one quarter, one third, two thirds, etc.)* • *Representing simple fractions and ratios between quantities of objects (using the base 10 number system and visual aids: blocks, illustrations, etc.)*

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Situations involving proportions • Unit rate • Directly proportional relations • Unit-rate method **Financial concepts** • Canadian monetary system • Everyday vocabulary related to basic financial concepts (e.g. income, expenses, gain, loss, discount, taxes)	**Financial concepts** • *Value of coins and bank notes* • *Converting an amount expressed in dollars into an amount expressed in cents, and vice versa*

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Vigilance
This attitude involves a concern for using mathematical language by respecting the appropriate codes and conventions, performing accurate calculations and making sure the calculations are plausible.	This attitude involves being attentive when examining bills, checking one's change when making purchases or verifying the amount of one's salary.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Various institutions (e.g. telephone companies, power companies, financial institutions)	▪ Calculator ▪ Spreadsheet ▪ Bills ▪ Cheques ▪ Pay stubs ▪ Advertisements ▪ Price labels ▪ Catalogues

Contribution of the Subject Areas

Essential knowledge from certain subject areas, in particular the Social Sciences, Working Life, Languages and Mathematics, Science and Technology is also useful for dealing competently with the situations in this course. While this knowledge is pertinent, it is not subject to formal evaluation, nor does it constitute a prerequisite.

Subject Area: Social Sciences
Program of Study: *Consumer Habits*
▪ Since several of the everyday situations covered in the *Arithmetic and Personal Finance* course involve consumer habits, adult learners are required to use their knowledge of expenses, incomes, budgets, payment methods, solicitation, purchasing or leasing options, etc.

Subject Area: Working Life
Programs of Study: *Introduction to the World of Work* and *Career Choice*
▪ Some of the situations in this course involve the world of work and career choices, particularly where salary is concerned. Adult learners use their knowledge of incomes, hourly wages, salary deductions, etc.

Subject Area: Languages
Program of Study: *English, Language of Instruction*
▪ All of the situations in the *Arithmetic and Personal Finance* course are likely to require adult learners to communicate orally or in writing. Consequently, a knowledge of the language of instruction is required throughout this course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- In some of the situations examined in this course, adult learners may be able to use computer resources, especially to find financial information or to explore on-line shopping. The ability to use spreadsheets to produce balance sheets and budgets is also an asset.

Program of Study: *Mathematics*

- In addition to the compulsory content of the *Arithmetic and Personal Finance* course, working with complex everyday situations may require adult learners to use the mathematical knowledge they have acquired in other common core education courses. This will be the case, for example, when they use tables to produce budgets or financial balance sheets or their knowledge of time to perform salary-related calculations.

Andragogical Context

The *Arithmetic and Personal Finances* course is relevant to adults at the Presecondary level since personal finances are a constant source of concern. The class of situations *Managing personal finances* provides the appropriate context for the acquisition of mathematical knowledge, especially arithmetic. The topic of personal finance provides an ideal starting point for the study of mathematics as adult learners feel directly concerned by these types of situations and are therefore likely to find them motivating.

Several items of essential knowledge in this course are covered for the first time and in a very limited manner. This is the case for negative integers, various ratios and percentages. Also, other items of essential knowledge such as decimals and proportional relations are used solely in a financial context. In order to be properly integrated, this knowledge will have to be applied in other contexts likely to be of interest to adults. In the table, the right-hand column shows knowledge that was covered in previous courses and that is needed to deal with the real-life situations in this course. This knowledge is therefore compulsory. While this knowledge is a prerequisite, some adult learners have not yet mastered it. The teacher will therefore have to set aside time and perhaps devise simpler learning situations in order to allow adult learners to develop the requisite knowledge.

In this course, the development of the operational competencies *Thinks logically* and *Communicates* allows adult learners to acquire cognitive and metacognitive strategies that can be adapted to almost any real-life situation, while requiring them to use their knowledge effectively. Thus, learning must focus on the ability to use arithmetic in concrete situations rather than on the transmission of complex arithmetic knowledge. For example, the teacher will make sure that adult learners are able to perform short sequences of operations in real-life situations rather than place the emphasis on solving long sequences of operations involving several sets of parentheses. On the rare occasions adult learners will be required to perform such calculations, they can use the appropriate technological tools such as a calculator or a computer. The priority must be the development of an understanding of numbers and operations so that adult learners can deal effectively with real-life situations.

The learning situations in this course are geared to helping adults learn to manage their money on a daily basis. The teacher draws on the real-life experiences of adult learners in order to present them with plausible learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain. However, the main difficulty for teachers consists in suggesting situations that are of interest to adult learners without invading their privacy. A safer approach is to use simulations and models.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Paying a Bill

The real-life situation chosen for the class *Managing personal finances* involves checking and paying a telephone bill. In order to create a learning situation from this everyday situation, the teacher provides adult learners with a copy of a telephone bill (excluding cell phone bills, which are more complicated) and a blank cheque. To make this activity more interesting, adult learners may bring to class a recent telephone bill and a blank personal cheque in order to pay a real bill. In this learning situation, adults continue to build on their knowledge of decimals and the Canadian monetary system which they encountered in other, more basic situations. This situation focuses on learning how to perform calculations involving decimals and on reading and writing decimals expressed as words.

The teacher begins by discussing the need to check current bills and asks adult learners about their respective experiences in this regard. The teacher then verifies and activates the learners' prior learning by going through all the items on the phone bill. The teacher hands out a short quiz on the bill in which adult learners are required to compare and round off sums of money, convert amounts expressed in dollars into amounts expressed in cents, etc. After correcting the quiz and checking their understanding, the teacher provides them with a description of a phone bill issued by a telephone company (e.g. length of calls, dates). Adult learners are then asked to interpret the mathematical information on the bill by answering a few questions in writing and checking their interpretation with a classmate. The teacher explains the operations on decimals or provides clarifications simply by presenting certain concepts that have not yet been covered. Adult learners then check the long-distance calls billed and calculate the cost of two calls and the total amount of the bill. They must select the appropriate arithmetic operations, perform them correctly and check the accuracy of their calculations by rounding off the numbers and roughly calculating the results. They also check the accuracy of the other amounts shown on the bill. If adult learners find it difficult to perform the required calculations, the teacher provides them with a set of exercises and written examples so that they can practise until they have mastered the various calculation techniques.

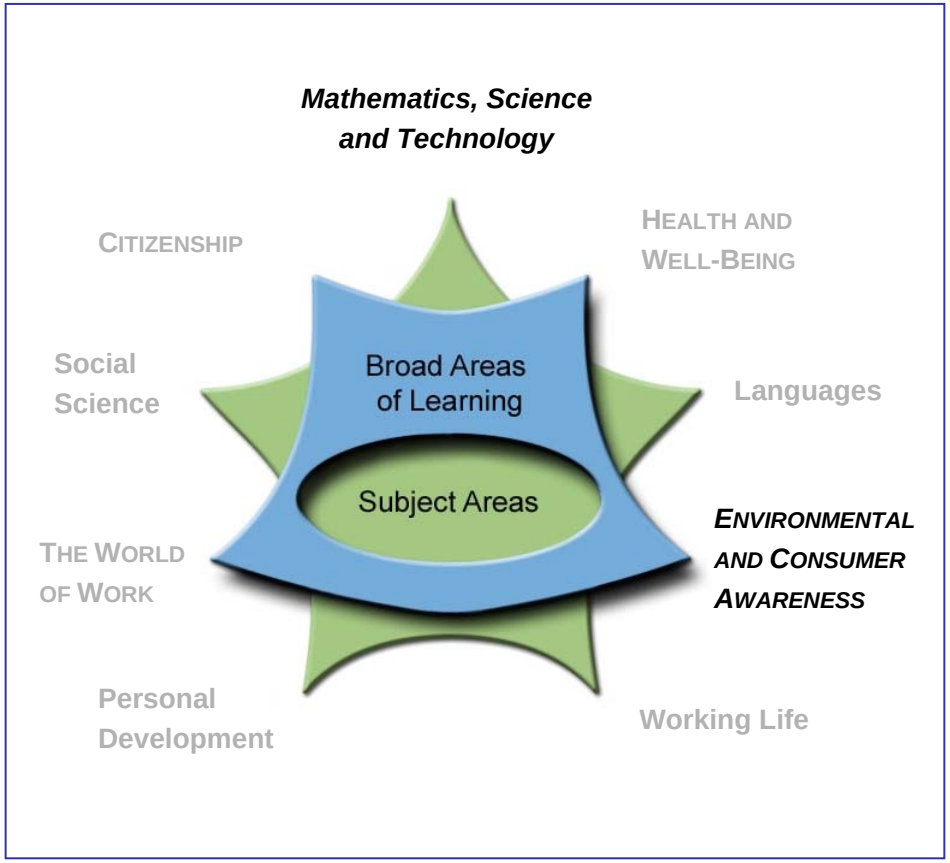
The teacher shows the class how to write a personal cheque (or individual adults if the class is small enough). Adult learners practise writing out cheques of different amounts for various institutions until they are familiar with the information that must be included on a cheque and can write out a cheque on their own. Adult learners are given examples of cheques that have already been made out and the rules for writing out amounts of money in numbers and words. Adult learners then make out a cheque to pay their phone bills and check their work with a classmate.

In the context of evaluation to support learning, the teacher ensures that the cheque has been made out correctly and provides adult learners with appropriate feedback. The teacher has adult learners demonstrate that they are able to perform rough calculations involving decimals by answering questions orally. In order to make adjustments concerning what they have learned and to integrate this knowledge, adult learners also provide two written examples: one of the calculation of the cost of a long-distance call and another of the

total amount of the bill. The teacher can correct these examples and give them back. Lastly, the teacher discusses other contexts in which paying a cheque is necessary or preferable as well as other types of bills that may have to be verified.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Managing personal finances	
Learning Situation	
Paying a Bill	
Categories of Actions	
▪ Interpreting financial information ▪ Producing financial information ▪ Performing calculations involving amounts of money	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	▪ Decimals ▪ Canadian monetary system ▪ Reading and writing decimals expressed as words ▪ Calculations involving the four operations on positive decimals ▪ Solving series of arithmetic operations on positive decimals ▪ Mentally estimating the results of operations or series of operations on positive decimals ▪ Rounding off positive decimals to the next largest integer and to the nearest tenth
Complementary Resources	
▪ Calculator ▪ Photocopy of a cheque	▪ Telephone bill ▪ Description of the items on a telephone bill



Course

Sense of Space and Time

MTH-P102-3

Presecondary

“Time and space are infinite, yet we never seem to have enough of them.”

C. Thomson

Presentation of the Course *Sense of Space and Time*

The course *Sense of Space and Time* is designed to help adult learners deal competently with real-life situations that involve problems associated with orientation in space and time.

Adults will therefore learn to use basic arithmetic and their knowledge of the dimensions of time and space in their daily lives.

The course continues to build on what adults have learned in the Literacy level courses or in their daily lives. Reading time on a digital timepiece and various units of time (e.g. second, minute, week, year) have already been covered in previous courses. Learners already have the basic knowledge required to situate themselves or an object in space (e.g. on top, to the right, inside, above) and they are familiar with certain units of length. The *Sense of Space and Time* course builds on this learning in addition to making connections between concepts related to time and space in the real-life situations that require it. This course allows adults to consolidate what they have learned in *Arithmetic and Personal Finances* and introduces the four operations on negative numbers.

By the end of the course, learners will be able to interpret and produce simple information with respect to time and space and to measure time and length. They will make rigorous use of arithmetic language and use deductive and inductive reasoning to manage time, get around and understand the meaning of arithmetic operations.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Orienting oneself in space and time*.

The ability to orient oneself in time and space is required in many real-life situations. Adults must be able to manage their time, determine what is involved in getting from one place to another, situate themselves or objects in their surroundings, situate an event anywhere in the world, etc. The situations in this class affect the daily lives of adults in very concrete ways and may be related to their training, work or personal life. However, some of the situations may involve social or international issues that will be examined in the course, such as analyzing a historical event, understanding a current event, etc.

Some of the real-life situations in this class refer to the concept of time, which must be understood in order to be able to adhere to a schedule, tell time or situate an event in time. Other situations involve exclusively orientation in space, such as locating an object, a place or an event, describing a route, etc. Lastly, when the situation involves planning a trip or a move or understanding historical, national or international events, the concepts of time and space are considered in the same situation.

Class of Situations	Examples of Real-Life Situations
Orienting oneself in space and time	▪ Planning a schedule ▪ Planning an itinerary ▪ Moving ▪ Travel ▪ Relocating for work reasons ▪ Understanding historical events ▪ Situating local or international events ▪ Planning the layout of a room

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Interpreting information related to time and space	▪ Determines the location of a city based on its geographic coordinates ▪ Follows the direction indicated on a road map ▪ Follows instructions in order to get to a specific place ▪ Interprets information about a bus route ▪ Reads time on a timepiece that uses hour and minute hands (analogue) ▪ Interprets a schedule or day planner ▪ Places historical events in chronological order
▪ Producing information related to time and space	▪ Explains an itinerary orally ▪ Describes an itinerary using a diagram ▪ Describes where a country is located ▪ Describes the location of objects in a descriptive text ▪ Indicates major conquests on a timeline ▪ Produces a work schedule ▪ Explains a travel route

Categories of Actions	Examples of Actions
▪ Determining measures of time and length	▪ Estimates the duration of an activity ▪ Determines the time required to cover a given distance on the basis of the average speed ▪ Determines what time it is in another country ▪ Calculates the time elapsed between two events ▪ Times the duration of an event ▪ Determines the difference in altitude between any two land points ▪ Determines the distance between two cities using a road map ▪ Uses an odometer to measure distance ▪ Measures the distance between two objects

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Orienting oneself in space and time

Categories of Actions

- Interpreting information related to time and space
- Producing information related to time and space
- Determining measures of time and length

Operational Competencies

Thinks logically

- Infers the operations for converting one unit of measure into another
- Selects information on time and space and the appropriate arithmetic operations
- Establishes priorities to organize time and outings
- Uses proportional reasoning
- Checks that his/her conclusions are realistic and coherent

Communicates

- Accurately decodes the symbols, notations and terms associated with arithmetic, space and time
- Identifies information that gives him/her a sense of space and time
- Checks his/her interpretation with other people
- Forms a mental image of itineraries, travel routes and the positioning of objects
- Properly organizes the message using mathematical models
- Accurately uses the symbols, notations and terms associated with arithmetic, space and time
- Makes sure his/her message is clear

Essential Knowledge

- Space
- Time
- Relationship between space and time
- Decimals and ratios
- Proportional relationships

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In dealing with the situations in the class *Orienting oneself in space and time*, adults interpret and produce information related to time and space, determine the measures that allow them to orient themselves and establish a plan that takes both time and space into account. Adults interpret information related to time and space that is provided in a day planner, a calendar, an analogue clock, a timetable or a road map, or that is provided orally. To do this, they accurately decode the symbols, notations and terms associated with arithmetic, space and time such as whole and decimal numbers, units of measure, coordinates, etc. Adults identify information that enables them to orient themselves in space and time and determine which information is appropriate for the real-life situation. This allows them to form an accurate mental image of their itinerary and outings and then select the best travel route. They can also determine the position of an object, a location or an event using a system of coordinates and everyday vocabulary related to position in space. In cases where the information has been provided, they check their interpretation of the message with others and make sure that their conclusions are coherent. Adults produce information related to time and space in order to draw up a personal schedule, sketch an itinerary, describe a trip, etc. They accurately use the symbols, notations and terms associated with arithmetic, space and time such as the time of day, units of measure, geographic coordinates or whole numbers. Planning a schedule or an outing requires adults to establish priorities by making connections between time- and space-related measurements and concepts. Their message is based on mathematical models (e.g. diagrams, timelines). They select the spatial and temporal information that is appropriate to their message, and make sure that their messages are clear and coherent. In situations that involve positioning in space, itineraries or travel, they take the time to form a mental representation of the information to be illustrated or described. Adults determine measures of time and length accurately when interpreting or producing spatial and temporal information or when attempting to better understand the real-life situation at hand. They clearly identify the appropriate units by making rigorous use of the symbols in the International System of Units. They are required to infer operations in order to convert a unit of time and length in situations that deal with these dimensions. Adults select the relevant information and the appropriate arithmetic operations for the real-life situation being examined. The results of their calculations are correct. They take the time to estimate a dimension or a duration and compare the results of their calculations or their measurements with their initial estimates. For example, adults use proportional reasoning when they deduce that distance covered is directly proportional to the time elapsed (when the average speed is constant). This allows them to anticipate the effect of changing one of these quantities. Adults check that their conclusions are plausible and coherent.

Evaluation Criteria

- Interprets information related to time and space correctly
- Produces clear and appropriate information related to time and space
- Accurately determines a measure of time or length

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* makes it possible for adults to make connections, draw conclusions and organize their representations of space and time in the real-life situations in the class *Orienting oneself in space and time.* This competency consists in using deductive and inductive reasoning with respect to the concepts of time, space and arithmetic. Adults who think logically are able to infer the arithmetic operations needed to deal with time- and space-related factors in certain situations. For example, they infer the number by which a unit of time or length must be multiplied in order to convert it into another unit or the calculation required to convert time expressed according to the 24-hour clock into time expressed according to the 12-hour clock. They look for examples to check their conjectures made with respect to their choice of operations or give counterexamples in order to clarify, adjust or refute it.	Adults can therefore deduce the required calculations and select the arithmetic operations appropriate to a given real-life situation. They check that their calculations are plausible and coherent by making connections between their results, initial estimates and the various spatial and temporal aspects to be considered. Furthermore, planning a schedule or a trip requires that adults be able to prioritize their choices by making connections between the measures and concepts of time and space. For instance, they deduce that the distance covered is directly proportional to the amount of time elapsed (if the average speed is constant), which allows them to anticipate how changing one of these quantities will affect the other. Thus, by taking into account various possible routes to get to a given location, they can select the best one. Adults are concerned with ensuring that their conclusions are plausible and coherent (e.g. estimates, choices, expectations).

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* makes it possible for adults to interpret and produce simple messages involving spatial and temporal information when they deal with the real-life situations in the class *Orienting oneself in space and time.* This competency involves decoding and accurately using arithmetic language and terms related to space and time.

Adults who interpret a message correctly decode the notations and symbols related to time, units of measure, geographic and alphanumeric coordinates, timelines, whole numbers, etc. They understand the meaning of basic vocabulary associated with arithmetic operations and that of terms related to time and space, such as time zones, century, altitude, etc. They are able to interpret a timetable, an itinerary, a day planner, a map or any other simple document by recognizing information that enables them to orient themselves in space and time. When in doubt, they check their interpretation with someone else. Learners form a specific mental image of the given itineraries and travel routes.

Adults produce a message by correctly using arithmetic language and the terms related to space and time to formulate explanations, describe a geographic location, draw up a schedule or tell time. They organize their message appropriately by using specific mathematical models (e.g. diagrams, timelines). They take the time to form a mental representation of what they want to describe, for instance, an itinerary, a trip or the position of an object in relation to another. They make sure their message is clear and appropriate to the situation and audience.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with many of the situations in the class *Orienting oneself in space and time.*

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve orienting themselves in space and time. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed to make it easier to identify adult learners' previously acquired knowledge.

Since essential knowledge in arithmetic is dealt with only in a context involving orientation in space and time, this material is covered only partially. In order to present all the aspects of this essential knowledge in a greater range of contexts, it has been made compulsory in other mathematics courses that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Space	**Space**
• Cardinal points	
• Alphanumeric coordinate system (on road and geographic maps)	
• Geographic coordinate system (latitude and longitude in degrees and altitude in metres)	
• Scale	
• Legend	
• Everyday vocabulary related to positioning in space (e.g. towards the northwest, to the south, parallel, transversal)	• *Everyday vocabulary related to positioning in space (e.g. above, below, to the right, to the left, inside, outside, on top)*
• Significant segments (secants)	• Significant segments (parallels and perpendiculars)
• Converting one unit of length to another within the international system (mm, cm, m and km)	• *Units for measuring length (mm, cm, m and km)*
• Reading road and geographic maps	• Measuring and estimating length
• Determining actual distance using a map	

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Time	**Time**
• Units of time (e.g. trimester, semester, decade, century, millennium)	• *Units of time (e.g. second, minute, hour, day, week, month, year)*
• Everyday vocabulary describing the frequency of an event (daily, weekly, monthly, annual)	
• Standard time and daylight savings time	
• Reading time on an analogue timepiece (watch with hands)	• *Reading a digital timepiece (e.g. 07:30 PM)*
• Reading and writing time according to the 24-hour clock (e.g. 19:30)	
• Equivalence between time on the 24-hour clock and time on the 12-hour clock (e.g. 19:30 and 7:30 p.m.)	
• Estimating duration	
• Converting a measurement of time into another	• *Timing*
Decimals	**Decimals**
• Decimals (up to three places)	• *Decimals (up to two places)*
• Positioning decimals on the number line (including negative numbers)	• *Whole numbers*
	• *Comparing decimals (including negative numbers)*
• Rounding off positive decimal numbers to the nearest hundredth	• *Rounding off positive decimals to the nearest whole number and to the nearest tenth*
	• *Sense of the four arithmetic operations*
• Calculations involving the four operations on decimals (e.g. the operations involving negative numbers are performed using visual aids only: timeline, illustrations)	• *Calculations involving the four operations on positive decimals (using a calculator, mental calculation techniques and written calculation algorithms)*
	• *Solving sequences of arithmetic operations on positive decimal numbers (with at most one set of parentheses and four operations)*
	• *Mental estimate of the results of operations or sequences of operations on positive decimal numbers*

New compulsory knowledge	Compulsory knowledge acquired in previous courses
	Decimals (cont'd) • *Expressing relations using arithmetic models that involve positive decimal numbers* **Ratios** (these concepts are examined in the context of reading an analogue timepiece) • *Representing mixed numbers (e.g. using the base 10 number system and visual aids such as blocks, illustrations)* • *Calculating a fraction of a natural number* • *Determining the fraction that corresponds to a part of a whole*
Relationship between space and time • Time zones • Average speed • Relationship between distance and average speed and time • Determining the time of day in various geographic locations	**Proportional relationships** • *Directly proportional relationships* • *Unit-rate method*

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Openness
This attitude allows adults to be precise when measuring time or length and when producing descriptions; it also helps them perform precise calculations and check their plausibility.	This attitude enables adults to take an interest in various geographic locations and different events likely to occur in these places.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Travel agencies ▪ Airline companies, moving companies, car rental companies, bus transportation companies, etc.	▪ Calculator ▪ Geometry instruments ▪ Compass ▪ Odometer ▪ Stopwatch ▪ Clock ▪ Ruler ▪ Tape measure ▪ Globe ▪ Road and geographic maps ▪ Calendar ▪ Day planner ▪ Mapping software

Contribution of the Subject Areas

The contribution of certain subject areas, in particular the Social Sciences, Working Life, Languages and Mathematics, Science and Technology is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences

Programs of Study: *Social and Political Life* and *Community and Culture*

- Learners who are required to plan a trip or situate a current event as part of the *Sense of Space and Time* course may use their knowledge of social and political events, geography, history, etc.

Subject Area: Working Life

Programs of Study: *Introduction to the World of Work* and *Career Choice*

- Some of the real-life situations examined in this course may involve planning work-related travel and schedules. Adults therefore use their knowledge of holidays, deadlines, organizational behaviour, etc.

Subject Area: Languages

Program of Study: *English, Language of Instruction*

- Adult learners will likely be required to communicate orally or in writing in all of the situations examined in this course. Consequently, the language of instruction will be used throughout the course.

Program of Study: *French as a Second Language*

- A number of the real-life situations in this course require the use of a second language. Adults may have to use a second language when they travel, ask for directions or the time, etc.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- Some of the real-life situations in this course could involve the use of computer resources. For example, learners may use spreadsheets or word processing software to produce a timetable or the Internet to find a geographic map or a road map.

Program of Study: *Relationship With the Environment*

- When orienting themselves in space and time, adults must situate themselves in their environment. The knowledge related to this program can therefore be used to deal with the real-life situations in this course. Learners may also use their knowledge of astronomy if they wish to situate themselves on a larger scale or better understand units of time (e.g. days, months, years) that are based on astronomical phenomena.

Program of Study: *Mathematics*

- In addition to the compulsory knowledge for this course, working with some of the real-life situations examined in this course may require knowledge of mathematical content covered in other common core education courses. For example, this applies to situations that involve drawing up or reading plans and using geometric shapes to describe one's surroundings.

Andragogical Context

The *Sense of Space and Time* course will provide the teacher with an opportunity to remind learners that they must take account of the space and time considerations that affect their daily lives. By developing their knowledge of these two dimensions, they can deal with different situations more efficiently.

Although the focus of this course is on space and time, learners continue to build on the arithmetic knowledge they began to acquire in the *Arithmetic and Personal Finances* course. If the learners have not yet mastered certain concepts (shown in the right-hand column of the table of essential knowledge), the teacher will have to allow time and suggest simpler learning situations so that learners may acquire this knowledge.

Geographic coordinates are part of a three-dimensional system and a fairly strong capacity for abstract thinking is required to represent them. Therefore, the teacher may find it useful to use such concrete materials as a globe in order to support learning. This is also why the concept of altitude will be studied separately from the concepts of longitude and latitude. Road maps and geographic maps are also fairly complex for the Presecondary level. For this reason, it would be preferable to refer to an environment with which learners are already familiar. Internet sites or mapping software will no doubt make it easier for learners to understand maps since they provide the option of viewing a given location either from a global or a very detailed perspective and to move from one place to another on the map.

The teacher draws on the real-life experiences of learners in order to present them with realistic learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain. Furthermore, this course provides a good opportunity to help adults develop punctuality and a sense of organization. It may be a good idea to plan for several short learning situations rather than work with complex situations over a long period. Learners at this level will find it easier to assimilate mathematical knowledge if they can use this knowledge in a number of different real-life situations and if these situations are not encumbered by too many non-mathematical details.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Planning a Schedule

The real-life situation in the class *Orienting oneself in space and time* involves planning a schedule. As part of the learning situation, the adults are asked to draw up a one-week timetable, to make sure they can adhere to the timetable and to familiarize themselves with using a day planner.

In a class discussion, the learners talk about their ability to adhere to a schedule, remember an appointment, show up on time, etc. The teaching staff points out that they might find time management useful and presents some examples of schedules that are relevant to them, such as a school schedule. The teacher then presents the conventions associated with reading and writing time on the 24-hour clock as well as equivalences between the 24-hour clock and the 12-hour clock. These concepts may be explored in relation to those already examined in other learning situations such as units of time and reading time on an analogue or a digital timepiece. To help the adults consolidate what they have learned, the teacher asks them a few questions, orally or in writing, using the examples of schedules presented earlier. The teacher provides individual learners with feedback on how well they have mastered these concepts.

In order to help the learners to draw up their own schedules, the teacher suggests a review of the algorithms for the four operations and demonstrates each operation through examples involving minutes. If some adults are still not comfortable with these techniques, the teacher may provide other examples and exercises to be completed either individually or in pairs. To explain the conversion of units for measuring time, the teacher provides the adult learners with a text together with a few examples and exercises. They complete the exercises on their own and check their comprehension in teams of two or three. The teacher provides support, as needed. After they have noted, for instance, that 90 minutes are equivalent to 1 hour and 30 minutes, they may perform calculations involving units of time to determine the duration of a number of activities or the time at which they are expected to end.

The teacher can now help the adults produce their own personal schedules using an eight-column table, that is, one column for the hours and the other seven columns for the days of the week. The adult learners list their activities during the week and indicate the day and time of the activities on the table. An estimate of how long the activities will last will help them determine the time at which the activities should end. Following the instructions provided and working alone, they divide their tables into the number of rows they deem necessary. The length of time indicated in each row will not necessarily be the same for everyone, since the adult learners may consider that certain periods of the day are busier for them and will therefore have more rows in their tables. They make sure their schedules are realistic and comprehensible by having it checked by a classmate.

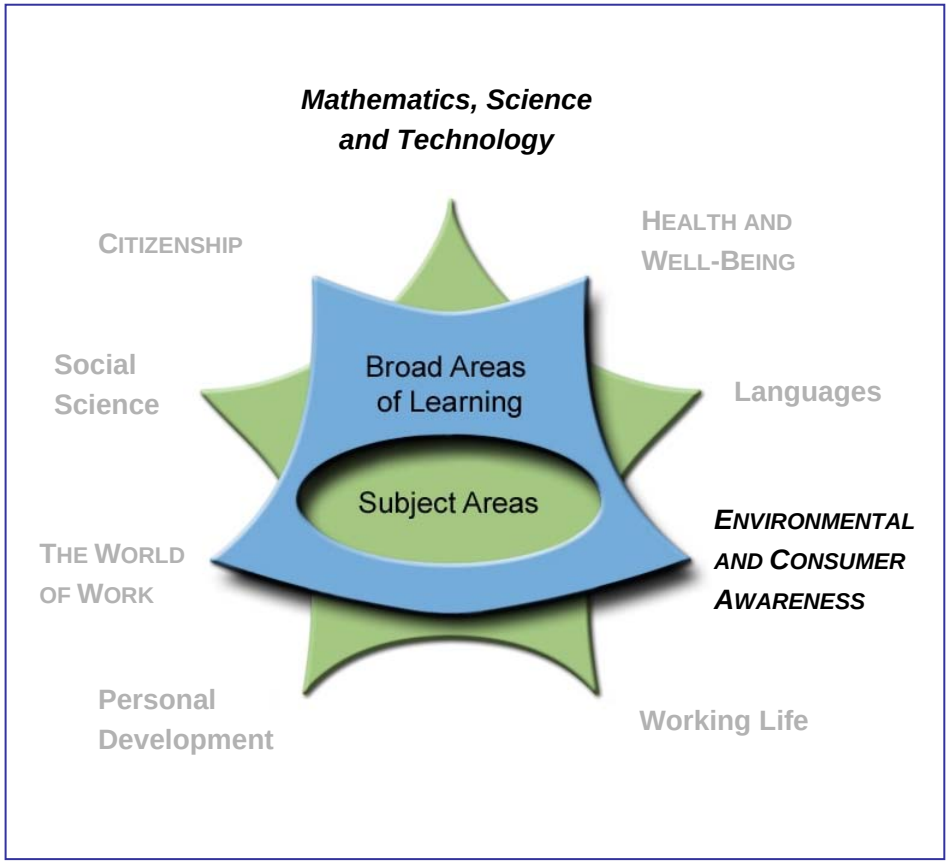
The teacher makes sure that the schedules are clear and accurate. The times and durations indicated must be plausible and written according to mathematical conventions. The adults may also be asked to transfer their schedule to a day planner and be

encouraged to use their school planner to better manage their time and increase their ability to meet deadlines.

The teacher may review the learning situation by asking questions aimed at getting the adult learners to make connections between what they have learned and the operational competency *Communicates.* They see that the various schedules and planners studied are all consistent with the symbols and notations of mathematical language. They too must observe these conventions to make sure that others will understand them.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Orienting oneself in time and space	
Learning Situation	
Planning a Schedule	
Categories of Actions	
▪ Interpreting information related to time and space ▪ Producing information related to time and space ▪ Determining measures of time and length	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	▪ Units of time ▪ Reading time on an analogue timepiece ▪ Reading time on a digital timepiece ▪ Reading and writing time on the 24-hour clock ▪ Equivalence between time on the 24-hour clock and time on the 12-hour clock ▪ Estimating duration ▪ Converting a measurement of time into another ▪ Performing calculations using the four operations on decimals
Complementary Resources	
▪ Calculator ▪ Ruler ▪ Digital or analogue watch	▪ Day planner ▪ Examples of schedules



Course

Sets and Statistics

MTH-P103-2

Presecondary

“Facts are stubborn things, but statistics are more pliable.”

Mark Twain

Presentation of the Course *Sets and Statistics*

The course *Sets and Statistics* is designed to help adult learners deal competently with real-life situations that involve problems related to data classification.

Adults will therefore learn to use basic concepts pertaining to sets and statistics in real-life situations involving large amounts of data that are already classified or that must be classified.

This course introduces learners to the use of statistics and sets through real-life situations. Data classification is carried out using sets and subsets, in concrete contexts. Thus, rather than examine formal set theory, the course will focus on the development of set logic, which is one of the cornerstones of logical reasoning. Among other things, adults will be able to use this logic to classify data in tables and graphs. Although adults will rarely be required to produce statistical graphs in real-life situations, learning how to produce this type of representation will help them better understand those presented in the media or in different types of documents. They will therefore learn about a few simple statistical representations: tables of variables, data tables, frequency tables, pictographs and bar graphs. The classifications will involve data that are easy to understand. The goal is not to emphasize data collection, which will be examined in Secondary Cycle One, but rather the classification, interpretation and representation of data.

After completing this course, learners will be able to interpret and produce set and statistical classifications of all types (e.g. objects, files, concepts, survey results, school results). They will accurately use the various modes of representation to convey these classifications. They will use deductive and inductive reasoning based mainly on set logic. By developing healthy skepticism with respect to persons or organizations involved in producing statistics, adults will be able to interpret these statistics rationally and critically.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Classifying data*.

All the real-life situations in this class involve problems related to data classification. Some situations involve classifying data in set or statistical representations, while others involve interpreting data that are already classified in these types of representations. Adults must be relatively familiar with the real-life situations dealt with in this class and be able to readily transform facts into data.

In order to make informed decisions, adults are often required to process data regarding nutrition or personal, occupational and consumer choices. They may be required to provide information on their lifestyles, classify products according to food groups or group public services in various categories. The real-life situations in this class also require adults to interpret data related to natural resources, social issues or the advertising of goods and services. They may also be required to make connections between their occupational identities (e.g. fields of interest, aptitudes) and training possibilities or to assess job placement possibilities in a given occupation by interpreting classifications of data such as job banks.

Class of Situations	Examples of Real-Life Situations
Classifying data	▪ Planning a balanced meal ▪ Planning a purchase ▪ Choosing a sports activity ▪ Arranging clothes ▪ Managing electronic files ▪ Selecting goods and public services ▪ Establishing a personal budget ▪ Studying various natural resources ▪ Reading polls on voting intentions ▪ Participating in a debate on a societal issue ▪ Analyzing his/her academic performance ▪ Participating in a hockey pool

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Interpreting set and statistical classifications	▪ Determines to which food group a food item belongs ▪ Uses an organizational chart to determine the department to which a person belongs ▪ Compares voting intentions at various times during an election campaign ▪ Determines the nutritional value of a food item ▪ Determines which natural resources are threatened ▪ Determines which hockey players continue to perform well ▪ Calculates the average mark of a class on an exam
▪ Producing set and statistical classifications	▪ Classifies foods according to their nutritional value ▪ Classifies household products according to their use ▪ Classifies mammals according to species ▪ Classifies clothes according to the seasons ▪ Organizes his/her favourite Internet sites ▪ Records total expenses in a data table ▪ Records his/her monthly absences in a frequency table ▪ Using a pictograph, represents the participation rate in various extracurricular activities

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Classifying data

Categories of Actions

- Interpreting set and statistical classifications
- Producing set and statistical classifications

Operational Competencies

Thinks logically

- Infers the characteristics shared by several data values
- Selects the appropriate arithmetic operations
- Makes deductions based on set logic
- Checks that his/her conclusions are realistic and coherent

Communicates

- Accurately decodes the symbols, notations and terms associated with set and statistical representations
- Recognizes information that enables them to have an understanding of the data represented
- Checks his/her interpretation with other people
- Accurately organizes the message using appropriate modes of representation
- Accurately uses the symbols, notations and terms associated with set and statistical representations
- Makes sure his/her message is clear

Exercises critical and ethical judgment

- Compares various sources of information
- Forms an opinion based on facts or data
- Shows an openness to changing his/her opinion

Essential Knowledge

- Sets
- Statistical distributions
- Decimals
- Mixed numbers

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the situations in the class *Classifying data*, adults interpret and produce various types of set and statistical classifications of data. Adults must interpret the set or statistical classifications used in a food guide, a newspaper article or electronic media. To be able to do this, they must accurately decode the symbols, notations and terms related to Venn diagrams, sets described by listing their elements, tables, pictographs or bar graphs. They recognize information that enables them to understand data represented, such as an object quantified in a diagram or the name given to a set. They determine whether an element belongs to a given set or subset. Their deductions are largely based on set logic. They verify the plausibility and coherence of their conclusions. Interpreting statistical representations requires that they compare various sources of information and check their credibility. Adults form an opinion and make choices based on facts or objective data; they are critical of the personal opinions of those who have an interest in influencing them. They are nonetheless open to changing their initial opinion when the various sources of information are consistent. Adults produce set and statistical classifications when they group objects, organize electronic files, analyze their academic performance, etc. They carefully examine the data to be classified and infer a characteristic that is shared by many of the data values. In this way, they create classes, categories, subclasses or subcategories while ensuring that their conjecture with respect to the common characteristic is plausible and coherent. In order to illustrate their data classifications to be able to convey them to others or to use them for their personal needs, they organize these classifications properly by using the appropriate modes of representation. Adults use the symbols, notations and terms (e.g. title, subheading, legend, labelling of axes) appropriately. They make sure that the set and statistical representations are clear. When they must perform calculations in order to deal with a real-life situation (e.g. means, sums of quantitative data, portions of pictographs), adults select and correctly apply the appropriate arithmetic operations and check the plausibility of their results.

Evaluation Criteria

- Interprets set and statistical classifications correctly
- Produces coherent set and statistical classifications

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically*, *Communicates* and *Exercises critical and ethical judgment.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* enables adults to make connections and draw conclusions when dealing with the real-life situations that belong to the class *Classifying data*. This competency consists in using deductive and inductive reasoning, which, in this course, is based mainly on set logic. By determining the characteristics shared by a set of data, adult learners infer categories, classes or groups. They then look for examples in order to verify the given hypothesis with respect to the shared characteristic or find counterexamples to specify, readjust or refute their initial classification. This general rule regarding shared characteristics also applies to a set of quantitative data when adult learners want to produce a statistical representation. This approach enables adults to determine the elements that are quantified in a table or a graph and to establish disjoint subsets in order to avoid having the same elements considered twice.	Adults make connections among the various data values, which makes it possible to classify them in order to study a phenomenon, make a realistic choice, plan, etc. To determine a mean, they first determine the number of data values and select the arithmetic operations that will allow them to calculate it. Many deductions are based on set logic. For example, by knowing to which group a food item belongs, the adult deduces that its nutritional content is similar to other food items in the same group. Similarly, by knowing that a certain cleaning product is acidic, they can deduce the risks associated with using this product. Adults check the plausibility and coherence of their conclusions (e.g. classifications, interpretations, calculations, conjectures).

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* enables adults to interpret and produce messages containing set and statistical representations when dealing with real-life situations belonging to the class *Classifying data.* It consists in decoding and correctly using mathematical language associated with these modes of representation.

When interpreting a message, adults accurately decode the symbols, notations and terms related to Venn diagrams, sets whose elements are listed, tables, pictographs or bar graphs, thereby enabling them to find the information conveyed by these modes of representation. For example, by reading the titles and subheadings of different statistical representations, they will be able to determine which one provides the desired information. They will also be able to find a precise value in these representations by decoding the legend and the axes. Adults recognize information that enables them to understand the data represented as an object quantified in a graph or the name given to a set of data. They can then interpret surveys, information conveyed in the media or any other representation of a data classification. When in doubt, they validate their interpretation with others.

When they produce a message, adults accurately use the appropriate symbols, notations and terms. They organize their messages appropriately by using the most suitable mode of representation for the given situation. They correctly identify a set or a table, graduate the axes in a bar graph, etc. In the event of a fire, they are able to transmit a list of damaged items to the insurance company, by category, or draw up a table of their financial situation. Adults make sure their messages are clear and understandable to their audience.

Contribution of the Operational Competency *Exercises critical and ethical judgment*	
The operational competency *Exercises critical and ethical judgment* enables adults to make judgments and informed decisions when dealing with real-life situations examined in the class *Classifying data*. It allows them to develop a healthy skepticism with respect to statistics and to make objective decisions.	Adults use their critical and ethical judgment when they analyze statistical distributions conveyed by the media or appearing in various documents. It is important that they be careful when considering this type of information. Adults assess the validity of the information that is presented by comparing different sources when possible. They learn that the choice of data in a given representation can be dictated by the interests of those who produced it. The same is true of the comments that accompany statistical representations: adult learners must realize that these comments are coloured by the personal opinions of those who formulated them. They must exercise discernment when forming an opinion or making choices based on facts or data that leave no room for interpretation. They nonetheless retain an element of doubt and are open to changing their position when the various sources of information are opposed to their initial opinion. Thus, when producing a statistical representation, learners try to remain objective. They avoid giving a personal opinion that is gratuitous and unfounded.

Essential Knowledge

All of the knowledge shown in the table below is compulsory since it is essential for dealing with many of the situations in the class *Classifying data.*

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since it is also required to deal with the situations in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve classifying data. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed to make it easier to identify adult learners' previously acquired knowledge.

Since essential knowledge in arithmetic is dealt with only in a context involving orientation in space and time, this material is covered only partially. In order that every facet of this essential knowledge may be addressed in a greater range of contexts, it has been made compulsory in other mathematics courses in this program that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Sets • Sets and subsets (only disjoint sets will be examined as well as their subsets, which are also disjoint) • Membership, inclusion and exclusion relationships • Sets of numbers (natural, whole and rational) • Classifying elements using sets and subsets • Reading representations involving sets and subsets • Describing sets and subsets using words • Representing sets and subsets by listing their elements and using a Venn diagram	**Decimals** • Decimals (up to three places) • Comparing decimals (including negative numbers) • Rounding off positive decimals • Making a mental estimate of the result of an operation or sequences of operations on positive decimals • Positioning decimals on the number line (including negative numbers) • Solving sequences of arithmetic operations on positive decimals (with no more than one set of parentheses and four operations)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Statistical distributions • Discrete quantitative data or qualitative data • Axes • Legend • Mean • Reading statistical representations (tables of variables, frequency tables, bar graphs and pictographs) • Constructing tables of variables and frequency tables • Graphing statistical distributions (bar graphs and pictographs) • Calculating the mean using the data from statistical distributions (the calculations must be simple i.e. adding the data and dividing it by the number of data)	**Mixed numbers (for pictographs)** • Representing mixed numbers (e.g. using the base 10 number system and visual aids: set of blocks, illustrations) • Calculating the fraction of a natural number • Determining the fraction corresponding to a part of a whole

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Vigilance
This attitude enables adults to adhere to the logic of set operations at all times, as well as to be precise and methodical when producing representations.	This attitude enables adults to be critical when they interpret statistics and read the accompanying comments and analyses. Adults must be aware that statistics are subject to different interpretations.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Statistics Canada ▪ Institut de la statistique du Québec ▪ Emploi-Québec ▪ Environment Canada	▪ Calculator ▪ Ruler ▪ Newspapers ▪ Magazines ▪ Government publications ▪ Electronic media ▪ Spreadsheets

Contribution of the Subject Areas

The contribution of certain subject areas, in particular the Social Sciences, Personal Development, Languages and Mathematics, Science and Technology is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences

Programs of Study: *Social and Political Life*, *Community and Culture* and *Consumer Habits*

- When adults produce or interpret statistical or set representations, adults may use their knowledge of social structures (government departments, school boards, centres), politics, the economy, advertising, etc.

Subject Area: Working Life

Programs of Study: *Introduction to the World of Work* and *Career Choice*

- Since some of the real-life situations examined in this course involve working life and career choices, adults may be required to use what they know about trades and occupations, the structure of a company, etc.

Subject Area: Personal Development

Program of Study: *Health*

- As certain life situations examined in this course deal with health, adult learners may be required to use the food groups, compare the number of calories in different foods, list life habits, etc.

Subject Area: Languages

Program of Study: *English, Language of Instruction*

- All of the situations in this course require adult learners to communicate orally and in writing. Consequently, the language of instruction will be used throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- Some of the real-life situations in this course may involve computer resources. For example, this is the case when adults use a spreadsheet to product statistical representations. System software may also be useful for organizing computer files.

Program of Study: *Relationship With the Environment*

- A knowledge of animal and plant species, pollution, natural resources, may also be useful in this course.

Program of Study: *Mathematics*

- In addition to the knowledge that is compulsory for this course, working with some of the real-life situations may require a knowledge of mathematical content covered in other common core education courses. This is the case, for instance, for the mode in qualitative statistical distributions, percentages and other types of tables and graphs that are not compulsory content for this course.

Andragogical Context

Everyday situations that involve large amounts of data are common in the lives of adults, whether these situations involve choosing an occupation or an educational program, registering for an activity, using a service, etc. The teacher draws on the real-life experiences of learners in order to present them with plausible learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain.

Learning achieved through this course will give adults the opportunity to understand that classifying data allows them to dispense with memorization, make better informed decisions and better organize their own knowledge. Likewise, filing documents and storing objects of all kinds, when based on set logic, makes it easier to find them again. Adults will also realize that the interpretation of data classified in statistical and set representations is useful if they must make an informed opinion or look for specific information.

The learning situations should place more emphasis on interpreting representations rather than on producing them. In fact, it is quite rare that adults are required to produce statistical or set representations in their everyday lives. In a learning situation, the purpose of this type of exercise is mainly to get adults to develop a sense of set logic and to better understand how to represent data in order to be able to better interpret them.

Since set classification is a prerequisite to producing statistical representations, certain learning situations in this course may combine these two aspects so that adults may make connections between them. Among other things, they will understand that the subsets chosen for quantified objects must be disjoint if they want to avoid having the same data considered twice.

Although this course focuses on data classification, it continues to build on arithmetic knowledge. If learners do not have certain types of knowledge related to the compulsory content of the prerequisite courses (right-hand column in the table of essential knowledge), the teacher will have to set aside time and assign simpler learning situations to allow adults to acquire this knowledge.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Planning a Purchase

The real-life situation chosen for the class *Classifying data* involves making a purchase.

The teacher begins by presenting the class with a catalogue page or an ad illustrating the wide range of choices offered for a given product. In a class or small-group discussion, the teacher has the adult learners explain how they go about choosing an item. The teacher attempts to point out the advantages of classifying the items in order to make an informed choice. In order to make the learning situation more interesting, the teacher has the adults select an item they would like to purchase in the near future.

Through questions, the teacher leads the adults to determine all the characteristics they consider important in making their purchase, such as identifying the item selected, the brand name, constituent materials, price, durability, guarantee, etc. These characteristics are classified by category by distinguishing the quantitative data from the qualitative data. This step allows the adults to consolidate what they have learned about data and sets in previous learning situations. The adults then learn to make a table of variables by using set-related concepts and techniques. Through a series of questions, the adults discover that a table constitutes a set and that each column represents a subset of characteristics. With the participation of the class, the teacher then demonstrates how to make a table and suggests other examples of tables. Individual exercises are then assigned so that individual learners can assess their understanding of the subject matter.

The adult learners can now prepare a table for recording the characteristics considered for the purchase. The title and subheadings are correctly written and the table is subdivided according to the selected characteristics. The adults can then compare their respective tables and make any necessary corrections. Working alone, they classify the relevant data taken from catalogues or Internet sites. They perform the necessary calculations and deductions in order to determine the costs that are not explicitly indicated (e.g. sum of prices, taxes, discounts). The teacher makes sure that the comparative table contains a choice of five items. The titles, subheadings and all the data must be clearly indicated and consistent with current conventions. Lastly, the adults compare the various characteristics identified, establish their priorities and make a choice that is consistent with their needs and ability to pay. They are asked to present their choice individually to the teacher as well as the reasons for these choices by basing their argument on financial considerations, the quality of the item and their personal needs. If necessary, the teacher intervenes during the presentation to correct inappropriate terms and to get the learners to explain their choices.

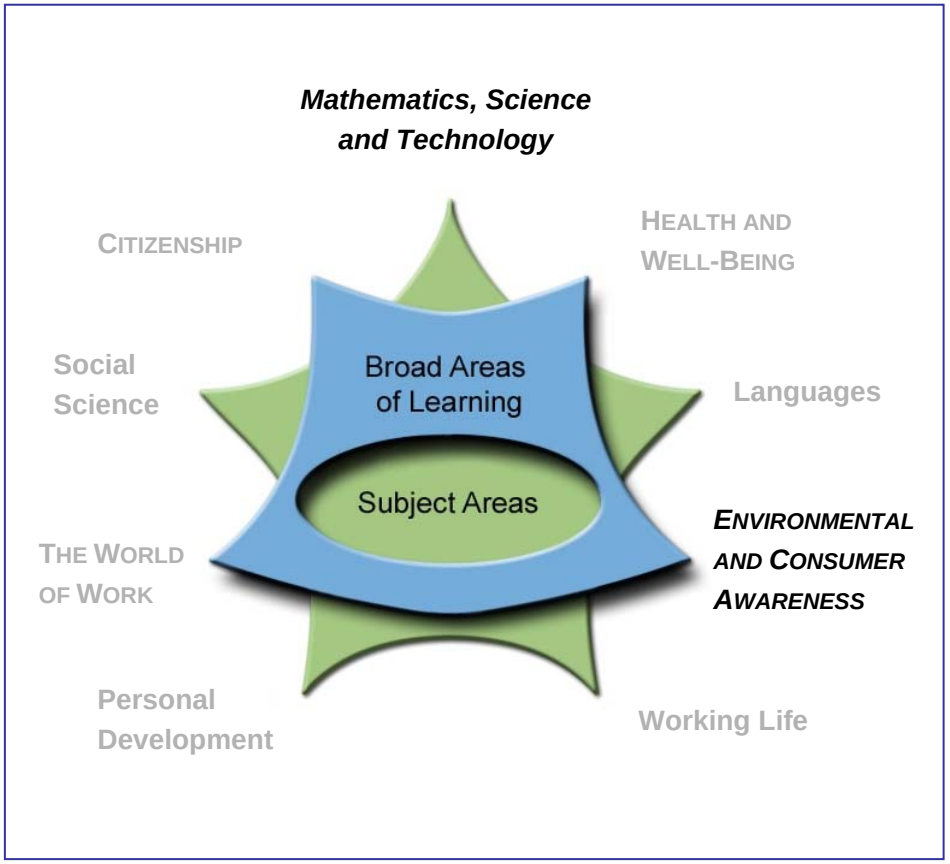
After handing back the tables, the teacher leads a class discussion on what has been learned and on the difficulties encountered. The teacher summarizes the discussion by interacting with the learners. Lastly, each person is asked to identify another real-life situation in which it would be useful to use a data table. The other people in the class express their opinions on the subject.

Elements of the Course Addressed by the Learning Situation

Class of Situations
Classifying data
Learning Situation
Planning a Purchase
Categories of Actions
▪ Interpreting set and statistical classifications ▪ Producing set and statistical classifications

Operational Competencies	Essential Knowledge
▪ Thinks logically ▪ Communicates ▪ Exercises critical and ethical judgment	▪ Relationships of belonging, inclusion and exclusion ▪ Classifying elements using sets and subsets ▪ Quantitative discrete data or qualitative data ▪ Constructing tables of variables ▪ Comparing decimals ▪ Solving sequences of arithmetic operations involving decimals

Complementary Resources
▪ Calculator ▪ Ruler ▪ Page from a catalogue or an advertisement



Course

Geometric Representations

MTH-P104-4

Presecondary

“Nothing is easier to learn than geometry, however useless it may be.”

Sacha Guitry

Presentation of the Course *Geometric Representations*

The course *Geometric Representations* is designed to help adult learners deal competently with real-life situations in which they must solve problems that involve representing the physical environment.

The course prepares adult learners to use basic geometry, measurements and ratios in real-life situations that require them to represent shapes and quantities.

This course continues to build on the knowledge learners have acquired in previous courses or in their daily lives. They already use measurements of time and length and understand space-related concepts. They are also familiar with using fractional notation in certain contexts and with representing simple geometric shapes. In this course, they will explore other measurements such as those related to surface area, capacity, mass and angles. They will also strengthen their understanding of fractional notation by using them to represent parts of objects (simple fractions) as well as the relationship between quantities of objects. The emphasis will be on using such notation to provide a clearer representation of the physical environment rather than on applying calculation techniques, which will be covered in more depth in other courses in the *Mathematics* program. Adults will study geometry in greater detail by using the properties of figures, the calculation of perimeters, angles and certain significant segments in everyday situations.

By the end of the course, adult learners will be able to accurately employ basic geometric language and use deductive and inductive reasoning with respect to the various ratios, arithmetic operations and properties of figures. As well, they will have improved their understanding of shapes and quantities in their physical environment and will be able to describe and illustrate them appropriately. They will also determine the measurements and ratios required to deal with real-life situations. Their ability to represent the ratios between two quantities of objects and to measure mass and temperature will also be useful for representing the physical environment. Although these representations are not geometric in nature, they are part of this course.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Representing the physical environment*.

Representing the physical environment is an important part of the real-life situations in this class. Adults perceive shapes and quantities in their physical environment through direct observation or by interpreting written descriptions or illustrations of this environment. In both cases, their mental representations must be based on geometric models. Often, adults are also called on to produce representations of the physical environment that consist of shapes and quantities and that may take the form of an oral or written description or of an illustration. The real-life situations in this course involve representations of the physical environment that are part of the daily lives of adults. In order to be able to deal with such situations, adults are required to perform some calculations, to use relatively simple geometric figures and to work with the most common types of measurements from the International System of Units.

In situations involving renovations or construction, adults will be able to explain, for instance, that they want a rectangular table, a swimming pool with a certain capacity or wood planks of specific dimensions. They must also be able to take the necessary measurements to carry out the tasks related to these types of situations. Certain real-life situations associated with the arts or literature will also involve some of the elements covered in this course. For example, adults will be better able to visualize a written description of a setting or to illustrate objects in recreational artistic activities. Lastly, other very common real-life situations involve representations of the physical environment. This is the case, for instance, when adults describe an object or a place to someone else or measure quantities of food for a meal.

Class of Situations	Examples of Real-Life Situations
Representing the physical environment	▪ Reading a description ▪ Describing a place or an object to a friend ▪ Assembling a piece of furniture ▪ Preparing a meal ▪ Producing a work of art ▪ Renovating a plumbing system ▪ Building a patio ▪ Making a garment ▪ Controlling body weight ▪ Furnishing a room ▪ Landscaping

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Perceiving shapes and quantities in the physical environment	▪ Perceives shapes and quantities from a written description of a setting ▪ Identifies an object described by someone else ▪ Determines where a tree is to be planted based on a diagram ▪ Visualizes the quantity of food indicated in a recipe in order to choose the right-sized container or the appropriate measuring instruments ▪ Compares the dimensions of two houses ▪ Matches the various parts of a piece of furniture with the figures shown in the installation guide ▪ Matches shapes and measurements with objects observed ▪ Visualizes the known length of an object ▪ Visualizes the surface area that will be covered by a new carpet given the surface's dimensions
▪ Producing representations of the physical environment	▪ Writes a description of a room ▪ Describes his/her house to a friend ▪ Draws a sketch of a patio to be built ▪ Draws a diagram of a mechanical part ▪ Represents an object in a painting

Categories of Actions	Examples of Actions
▪ Determining measurements and ratios	▪ Estimates the daily nutritional value of a food portion ▪ Measures a person's mass ▪ Measures the ingredient amounts for a recipe ▪ Derives the measure of an angle in a mechanical part ▪ Divides a cake into several equal parts ▪ Prunes the recommended portion of a tree or bush ▪ Calculates the perimeter of a fenced-in area ▪ Calculates the amount of fabric needed to make a garment

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Representing the physical environment

Categories of Actions

- Perceiving the physical environment
- Producing representations of the physical environment
- Determining measurements and ratios

Operational Competencies

Think logically

- Infers the properties of simple geometric figures
- Makes connections between figures, measurements, ratios and the objects they represent
- Deduces information that is implicit in representations of the physical environment
- Selects the most appropriate instrument for taking precise measurements
- Makes sure his/her conclusions are realistic and coherent

Communicates

- Accurately decodes symbols, notations and terms associated with arithmetic and geometric language
- Recognizes shapes and quantities
- Checks his/her interpretation with other people
- Structures his/her message appropriately using mathematical models
- Accurately uses symbols, notations and terms associated with arithmetic and geometric language
- Makes sure the message is clear

Essential Knowledge

- Plane figures
- Measurements
- Decimals and ratios
- Proportional relationships

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the situations in the class *Representing the physical environment*, adults perceive the physical environment and produce geometric representations of them. They also determine the measurements and ratios needed to deal with the real-life situation. Adults see the physical environment directly or it is presented to them in a description or an illustration. They are able to analyze a diagram or a sketch, understand the description of a setting, form a precise image of the objects they observe, follow the directions for assembling a piece of furniture. To do this, they accurately decode the symbols, notations and terms of arithmetic and geometric language. Adults make connections among the figures, measurements, ratios and objects they represent in order to form more accurate mental representations. They use their inferences with respect to the properties of simple geometric figures in order to deduce implicit information in the representations of the physical environment (measurements of angles or segments that are omitted or geometric figures that are partially represented). When representations of the physical environment are conveyed to them, adults identify their shapes and quantities (measurements and ratios). In cases where fractional notation is used, they determine whether it represent a fraction of the object or the ratio between the two quantities of objects. When in doubt, they check their interpretation with others. Lastly, they make sure their conclusions are plausible and coherent so that the information they deduce is consistent with reality. Adults produce representations of the physical environment when they describe a park, make a sketch of a patio to be built, sketch a part, etc. They select the geometric shapes that most closely resemble the objects they want to describe or illustrate and construct them using the appropriate techniques. If necessary, they indicate measurements in accordance with SI (International System of Units) notation and correctly use fractional notation. When they wish to convey their representations, they structure their message appropriately by using the correct mathematical models. They make sure their descriptions and illustrations are clear so that others will be able to understand the physical environment. Adults accurately determine measurements and ratios when they produce representations, try to understand the physical environment or acquire a better understanding of the real-life situation in question. For instance, this may involve performing operations on ratios and decimals in order to calculate length, determine a portion or calculate the approximate total mass of a set of objects. A good sense of the units of measure enable adults to estimate the measurement of objects, regardless the type of the measurement involved (e.g. mass, length, capacity, angle). Adults also select the required instrument according to the order of magnitude of the measurement to be taken. They use the instrument with precision and make a note of the measurements by rigorously adhering to the International System of Units. They may also be required to determine ratios or measurements by deducing them directly from a given representation. In all cases, they make sure their results are plausible.

Evaluation Criteria

- Forms an appropriate perception of the physical environment
- Produces clear and appropriate representations of the physical environment
- Accurately determines measurements and ratios

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* allows adult learners to make connections and draw conclusions when dealing with real-life situations in the class *Representing the physical environment*. This competency involves deducing and inferring information from ratios, arithmetic operations and the properties of geometric figures. Adult learners think logically when they infer the properties of simple geometric figures by observing them in different contexts. For example, they infer that the sum of the interior angles of any triangle is 180 degrees. They look for examples to check their conjectures with respect to a property and for counterexamples to clarify, adjust or refute their conjectures. In this way, learners make connections between figures and classify and organize these figures according to their properties.	Adult learners select the geometric figures that are the most suited to the object they wish to describe or illustrate. They deduce certain types of information that are implicit in the representations of the physical environment they analyze. For example, when they study a drawing, a diagram or a sketch, the make connections between plane figures, ratios and measurements and the objects they represent. Learners are therefore able to deduce the angle or segment measurements that have been omitted or the geometric shapes that are partially represented. When using fractional notation, they deduce, according to the context, whether a ratio represents part of a whole or a ratio of quantities of objects. Because they have a good grasp of units of measure, they are able to estimate certain measurements pertaining to the physical environment and select the instrument they need to take a specific measurement. Adult learners check that their conclusions (e.g. estimates, conjectures, calculations) are plausible and consistent by referring to their previous observations.

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* allows learners to interpret and produce simple messages consisting of geometric representations when they deal with real-life situations in the class *Representing the physical environment.* This competency involves decoding and making rigorous use of the mathematical language associated with these representations.

When interpreting a message, adult learners accurately decode the symbols, notations and terms associated with decimal numbers, ratios, the most common measurements and plane figures. For example, this allows them to identify the shapes shown in a diagram and the quantities in a recipe, or to better understand the description of a setting or the instructions for assembling a piece of furniture. Regardless of whether the message is written or spoken, learners are able to clearly perceive the object or environment being represented. When in doubt, they check with others to verify their interpretation of the geometric representation of the physical environment.

Adult Learners produce a message in order to communicate their mental representations of the physical environment. They structure their message appropriately by using the correct mathematical models (e.g. geometric figures, arithmetic expressions). They make accurate use of the symbols, notations and terms of arithmetic and geometric language, the most common measurements, plane figures and the related terms. Thus, they are able to correctly match the symbols and notations with the information they wish to convey in their representations of the physical environment. Adult learners are therefore able to describe an object, communicate measurements or sketch the layout of a room, for instance. They make sure their message is clear and appropriate to the situation or to their audience.

Essential Knowledge

All of the knowledge shown in the table below is compulsory since it is essential for dealing with many of the situations in the class *Representing the physical environment.*

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve representations of the physical environment. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed in italics to make it easier to identify adult learners' previously acquired knowledge.

The various types of ratios (simple fractions, mixed numbers, improper fractions and ratios of quantities of objects) are not dealt with exhaustively, since they are used only in a context involving representations of the physical environment. In order that every facet of this essential knowledge may be addressed in a greater range of contexts, it has been made compulsory in other mathematics courses in this program that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Plane figures	**Plane figures**
• Regular convex polygons	• *Simple geometric figures (circles, squares, rectangles and triangles)*
• Classifying triangles (scalene, equilateral, right and isosceles)	
• Classifying quadrilaterals	
• Properties of simple figures (regular convex polygons and various types of triangles and quadrilaterals)	• *Properties of squares and rectangles*
• Vertically opposite, adjacent, complementary and supplementary angles	
• Significant segments (side, base, diagonal, radius and diameter)	• Significant segments (length, width, secants, parallel and perpendicular lines)
• Perimeter and circumference	
• Area	
• Surface area	

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Plane figures (cont'd) • Constructing angles from 0 to 180 degrees (to the nearest two degrees) • Constructing polygons (squares, rectangles, various types of triangles) • Constructing a circle • Calculating the perimeter or the length of the sides of a convex polygon • Decomposing a complex figure into simpler figures	**Plane figures (cont'd)** • Acute, obtuse and right angles
Measurements (International System of Units only) • Prefixes used in the International System (milli, centi, deci, deca, hecto, kilo) • Units of measure for area, capacity, temperature and mass • Measuring and estimating length • Measuring and estimating capacity • Measuring and estimating the size of an angle • Measuring and estimating area using the tile method • Converting a measurement into another within the SI system (except for area measurements)	**Measurements** • *Measuring and estimating length (mm, cm, m and km)* • *Measuring and estimating capacity (mL and L)* • Measuring and estimating mass (mg, g and kg) • Measuring and estimating temperature (degrees Celsius) • *Converting a length measurement into another within the SI system (mm, cm, m and km)*
Ratios • Improper fractions • Equivalent fractions • Simplifying fractions • Common denominator	**Decimals and ratios** • Mixed numbers • Ratios • Everyday vocabulary associated with fractions (half, one half, one quarter, one third, two thirds, etc.) • Positioning decimals on the number line (including negative numbers)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Ratios (cont'd) • Comparing fractions, improper fractions and mixed numbers (fractional parts with the same denominator, where the denominator of one fraction is a multiple of the denominator of the other, or whose denominators are less than or equal to four) • Representing improper fractions (using the base 10 number system and visual aids: block sets, illustrations, etc.) • Converting a mixed number into a improper fraction and vice versa • Adding and subtracting ratios of quantities of objects • Adding and subtracting positive fractions, improper fractions and mixed numbers using a calculator, visual aids and written calculation algorithms (fractional parts with the same denominator, where the denominator of one fraction is a multiple of the denominator of the other, or whose denominators are less than or equal to four) • Multiplication and division involving a natural number and a positive mixed number (using a calculator, visual aids and written calculation algorithms) • Translating relations into arithmetic models using mixed numbers, improper fractions, positive mixed numbers and ratios of quantities of objects	**Decimals and ratios (cont'd)** • Comparing decimals up to three places (including negative numbers) • Representing mixed numbers and ratios of quantities of objects (using the base 10 number system and visual aids, such as block sets, illustrations, etc.) • Calculations involving the four operations on decimals (in the case of negative numbers, the operations are carried out by using visual aids only: timelines, illustrations, etc.) • Solving sequences of arithmetic operations on positive decimals (with no more than one set of parentheses and four operations) • Making a mental approximation of the results of operations or sequences of operations on positive decimals • *Calculating a fraction of a natural number* • *Calculating the fraction that corresponds to the part of a whole* • Translating relations into arithmetic models using positive decimals **Proportional relationships** • Directly proportional relationships • Unit-rate method

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Curiosity
This attitude helps adult learners to be precise when they take measurements or produce representations of the physical environment. It allows them to estimate measurements, perform accurate calculations and check that they are plausible.	This attitude makes adult learners more inclined to carefully observe the physical environment or its representations so that they are better able to identify plane figures and find the information that will help them improve their representation of the environment.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Various types of companies (e.g. landscaping, construction, interior decoration) ▪ Museums	▪ Calculator ▪ Geometry instruments ▪ Sewing patterns ▪ Scale ▪ Instruments for measuring capacity ▪ Block sets for representing fractions ▪ Home renovation and interior decoration magazines ▪ Instructions for assembling a piece of furniture ▪ Descriptive texts ▪ Dynamic geometry software ▪ Cookbooks

Contribution of the Subject Areas

The contribution of other subject areas, in particular knowledge related to the Social Sciences, Personal Development, Languages and Mathematics, Science and Technology is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences
Program of Study: *Consumer Habits*
▪ When adults purchase building materials or describe an object to a salesperson, they may have to use their knowledge of consumerism (e.g. finding information, assessing possible choices).

Subject Area: Personal Development
Program of Study: *Health*
▪ Since some of the real-life situations in this course may involve planning a meal, adult learners may be required to use their knowledge of some of the basic principles pertaining to healthy nutrition (e.g. nutritional value of foods, recommended portions).

Subject Area: Languages
Program of Study: *English, Language of Instruction*
▪ A number of the real-life situations in the *Geometric Representations* course may require adult learners to produce and interpret written or oral descriptions. Consequently, the language of instruction will be used throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- Some of the real-life situations in this course may involve a knowledge of computers. For example, this is the case when adults use dynamic geometry software to visualize the layout of a room or the Internet to look for building materials or recipes.

Program of Study: *Technology*

- Some of the real-life situations in this course may make reference to construction, renovation or design and therefore may require adult learners to use their knowledge of measuring instruments, various types of materials, measuring, tracing and cutting techniques, safety measures, etc.

Program of Study: *Relationship With the Environment*

- In order to develop a landscape design, adult learners may need to study climatic factors, survival conditions, plant species, etc. As well, when they describe their surroundings, they may have to refer to the various characteristics of the natural environment.

Program of Study: *Mathematics*

- In addition to a knowledge of the content prescribed in the *Geometric Representations* course, dealing with some of the real-life situations in this course may require the use of mathematical knowledge from the other Common Core Basic Education courses. This will be the case, for instance, when adult learners draw up or consult plans, measure or estimate volumes or calculate the area of certain figures. Adult learners may also be required to use their knowledge of sets to classify various plane figures.

Andragogical Context

The *Geometric Representations* course allows adult learners to deal with numerous everyday situations that range from providing a simple description of an object to illustrating the precise layout of a room. They will realize that what they learn will allow them to improve their understanding of the physical environment and to produce much more accurate representations of it.

Although the focus of the course is to help adults learn about geometry, it is also aimed at helping them to continue to construct the knowledge of arithmetic they have acquired in previous courses or in everyday life. If adult learners do not have the appropriate prerequisite knowledge (right-hand column in the table of essential knowledge), the teacher will have to set aside time and assign simpler learning situations to allow them to construct this knowledge. It should be noted that decimals will be especially useful for dealing with measures in the International System of Units and, conversely, learning about this system will help adult learners better understand decimals.

In this course, the emphasis is on the use of ratios (fractions, mixed numbers, improper fractions and ratios between quantities of objects) to help adult learners produce a better representation of the physical environment. In fact, fraction notation is more appropriate than decimal notation for illustrating or describing parts of objects or ratios between quantities of objects. Conversely, the use of objects or geometric representations to illustrate ratios sheds light on the related concepts.

The development of logical reasoning is at the heart of this course. The teacher will ask the adult learners to infer the properties of figures and to classify these figures. Learners will be better able to make the required deductions in the case of unknown measurements in figures or objects if they themselves have inferred the properties of these figures, which serve as the basis for finding these measurements.

The teacher draws on the real-life experiences of learners in order to present them with plausible learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain. This course also provides an opportunity to make adult learners aware of the fact that mathematics may help them better appreciate artistic and literary activities. The interest that many adults have in these types of activities adds to the motivation needed to learn about mathematics.

The course content will be useful in many everyday situations; however, given that the scope of this content is often limited (e.g. describing the shape of a table to a friend), the teacher could suggest learning situations with a theme that is common to a variety of everyday contexts. For example, a learning situation could involve taking precise measurements. This ability is useful in different real-life situations such as preparing recipes, using household products or purchasing materials for a renovation project. Such a learning situation would be aimed at constructing knowledge related to the number line, measurement techniques or notation rules. To make learning meaningful, learners will be asked to give examples of everyday situations in which each measuring instrument is essential. Another learning situation could involve representing the parts of a whole or the ratio between quantities of objects, tasks that are encountered in many everyday situations.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Perception of Portions of Objects

This learning situation applies to several real-life situations in the class *Representing the physical environment*. It deals with the perception of shapes and portions of objects in the physical environment (e.g. one quarter of a round pie, two and a half cups of liquid, two fifths of a rectangular vegetable garden). The learning situation requires adult learners to represent fractions of figures and to associate them with everyday objects.

This learning situation could be assigned at the beginning of the course. The teacher asks the class as a whole to find everyday objects that can be represented by a circle, a square, a rectangle or a triangle. This will allow adult learners to reactivate prior learning, since they are already familiar with these simple geometric figures. The teacher then asks the class to describe an object that is not whole (e.g. three-quarters of a pie), thus making the learners aware of the fact that they need a code to represent such situations. Although adult learners already have some knowledge of simple fractions, the teacher may not want to take anything for granted in conducting this learning situation.

Using an object suggested by the class (e.g. a rectangular cake), the teacher asks learners to represent it (in two dimensions) by drawing it and shading in the part that corresponds to half the cake. The adult learners do this part of the activity in pairs so that they can share their ideas. The teacher then explains the rules for writing simple fractions by introducing the concepts of numerator and denominator, and then discusses other everyday objects by making reference to thirds, quarters, etc. The examples used become increasingly complex but are always related to everyday situations: cutting off one third of a rectangular plank, spreading peat moss over one quarter of a square piece of land, pouring water in a glass until it is two-thirds full, etc. As the activity progresses and by asking questions, the teacher checks the learners' representations and use of fraction notation, and corrects them if necessary. The teacher gets adult learners to define the role of the denominator (number of equal parts that make up a whole) and the numerator (the numbers of parts considered). A number of carefully chosen examples will allow learners to observe the equivalences between various fractions. Throughout the activity, the adult learners are asked to provide other examples of equivalences.

Adult learners master these concepts and techniques through simple problems and exercises. Some of the exercises deal with the representation of ordinary fractions using objects whose shapes are associated with plane figures, while others deal with the equivalence between different fractions.

The teacher introduces mixed numbers and improper fractions by using illustrations and by making connections with everyday objects. Adult learners become familiar with the representation of these mixed numbers and improper fractions by using simple figures. They also learn the rules for writing fractions. They study the equivalence between mixed numbers and the corresponding improper fraction by using figures that represent everyday objects. Through questions, the teacher gets the learners (who work in pairs) to infer the calculation techniques for converting mixed numbers to improper

fractions and vice versa. During a discussion on the techniques identified, the teacher verifies their inferences and demonstrates these techniques.

Once again, learners master these concepts and techniques through simple problems and exercises. Some of these exercises involve representing improper fractions and mixed numbers using geometric figures, while others deal with converting from one notation to another by using calculation techniques. Adult learners can verify their calculations by using figures to represent the resulting mixed numbers and improper fractions.

In order to prepare the adult learners to reapply what they have learned, the teacher has them identify the real-life situations in which they must use simple fractions, mixed numbers or improper fractions. Using a real-life situation of their choice, each adult learner draws up a simple problem in which the use of fractions is necessary and has a peer solve the problem. Adult learners work in pairs to solve the different problems, and the teacher provides feedback to regulate learning.

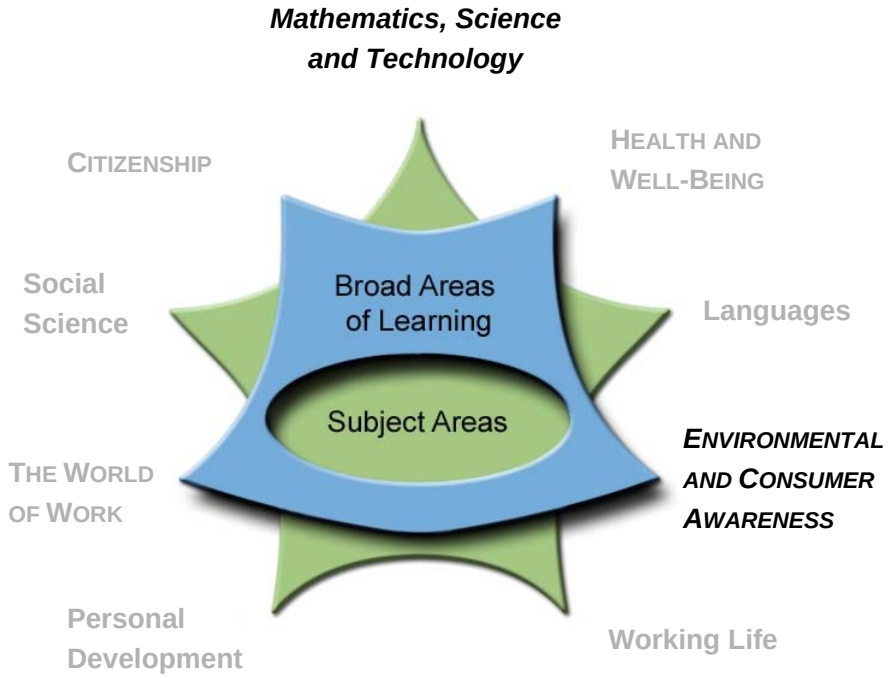
Some of the exercises completed earlier involve figures that the adult learners do not yet recognize. These include the parallelogram, the rhombus, the hexagon, etc. Since many everyday objects have more complex shapes, it may be useful to continue this learning situation by incorporating these new figures as well as complex figures (composed of two or three simple figures). This is how the adult learners will be able to better integrate what they have learned about their perception of ratios in the physical environment in addition to constructing new knowledge pertaining to the simple figures that must be studied in this course.

Elements of the Course Addressed by the Learning Situation

Class of Situations
Representing the physical environment
Learning Situation
Perception of Portions of Objects
Categories of Actions
▪ Perceiving shapes and quantities in the physical environment ▪ Producing representations of the physical environment that involve shapes and quantities ▪ Determining measurements and ratios

Operational Competencies	Essential Knowledge
▪ Thinks logically ▪ Communicates	▪ Simple geometric figures ▪ Ratios ▪ Improper fractions ▪ Mixed numbers ▪ Equivalent fractions ▪ Everyday vocabulary associated with fractions ▪ Representing mixed numbers and ratios of quantities of objects ▪ Representing improper fractions ▪ Converting a mixed number into improper fraction and vice versa ▪ Translating relations into arithmetic models using positive mixed numbers

Complementary Resources
▪ Geometry set



Course

Finance and Arithmetic

MTH-1101-3

Secondary Cycle One

“Money used to flow like water, but now I’m drowning in debt.”

Vincent Roca

Presentation of the Course *Finance and Arithmetic*

The course *Finance and Arithmetic* is designed to help adult learners deal competently with real-life situations that involve solving problems relating to money.

In other words, it prepares adult learners to use arithmetic as a means of managing their everyday finances.

This course enables adult learners to continue on from what they learned about managing their finances at the Presecondary level, where the learning situations allowed them to use their knowledge of decimals and introduced them to whole numbers, simple fractions and percentages. The *Finance and Arithmetic* course provides them with an opportunity to build on their prior learning by constructing a greater amount of more advanced knowledge in a context that requires them to consider a range of factors and, in some cases, implicit data. Their knowledge of arithmetic, including rational numbers, is especially important in this course. In addition to studying direct proportionality, which they saw at the Presecondary level, adult learners will be introduced to inverse proportionality. Basic knowledge of statistics and sets from previous courses will also be required to deal with some of the proposed situations.

By the end of the course, learners will be able to interpret and produce information on everyday finances and perform calculations involving amounts of money. They will make appropriate use of arithmetic language, and will be able to make deductions and inferences based on the meaning of arithmetic operations, the various types of rational numbers, and direct and inverse proportionality relationships.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Managing finances*.

There are many real-life situations that demand the ability to manage money, a task that involves using arithmetic concepts and calculation techniques with rational numbers to produce and interpret different kinds of financial information. The real-life situations targeted in this course comprise straightforward actions relating to the finances of adult learners and their families, including forecasts covering fairly long periods if necessary. Learners must therefore consider numerous factors and certain constraints to deal with these situations appropriately.

Examples of the real-life situations that adults are asked to address include planning for medium- and long-term expenses, preparing a personal or family budget or a budget for a group project, and purchasing or leasing goods, which involves checking different types of invoices, paying bills, comparing purchase or leasing options, and considering different promotional offers. The course also introduces adult learners to debt repayment, and shows them how to calculate annual yields on investments, produce an income tax return and apply for an educational loan or grant. Some real-life situations pertaining to work and education also involve financial aspects, and will be better understood thanks to the knowledge acquired in this course. Examples of this include checking salary-related information, assessing the viability of self-employment and considering the financial implications of returning to school.

Class of Situations	Examples of Real-Life Situations
Managing finances	▪ Purchasing or leasing a commodity ▪ Preparing a financial balance sheet ▪ Planning a family budget ▪ Financing a family project ▪ Carrying out a group project involving expenditure ▪ Conducting a fundraising campaign ▪ Incurring debt ▪ Making a major investment in the region ▪ Making career choices based on financial considerations ▪ Becoming self-employed ▪ Investing money ▪ Subscribing to a telephone service

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Interpreting financial information	▪ Checks the information shown on a cellular telephone bill ▪ Checks the financial information in an insurance contract ▪ Compares the various options to be considered before buying a car ▪ Analyzes an advertisement ▪ Compares different loan options ▪ Examines the financial aspects of a major investment in the region
▪ Producing financial information	▪ Prepares a family budget covering a period of one month ▪ Produces an income tax return ▪ Prepares a personal balance sheet ▪ Completes an application for an educational loan or grant ▪ Completes a benefit application ▪ Explains his/her financial situation to a government officer
▪ Performing calculations involving amounts of money	▪ Calculates the ultimate price of an item, including discounts and taxes ▪ Calculates the total amount paid for a purchase involving financing ▪ Calculates the net earnings from a fundraising campaign ▪ Calculates total recurrent monthly expenses ▪ Calculates the annual yield on an investment ▪ Calculates the approximate amount of a tip ▪ Calculates the approximate amount of interest on a loan

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Managing finances

Categories of Actions

- Interpreting financial information
- Producing financial information
- Performing calculations involving amounts of money

Operational Competencies

Thinks logically

- Infers the meaning of rational numbers
- Selects relevant financial information and appropriate arithmetic operations
- Classifies rational numbers and financial data
- Uses proportional reasoning
- Deduces implicit financial information
- Makes sure his/her conclusions are plausible and consistent

Communicates

- Accurately decodes symbols, notations, arithmetic terms and financial terms
- Identifies financial information
- Checks his/her interpretation with other people
- Uses symbols, notations, arithmetic terms and financial terms rigorously
- Structures a message appropriately by using arithmetic models
- Makes sure that the message is clear

Essential Knowledge

- Rational numbers
- Proportional relations
- Financial concepts
- Sets and statistics

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the situations in the class *Managing finances*, adult learners interpret and produce financial information for themselves or their families, and perform the arithmetic calculations needed to manage money on a regular basis. Adult learners interpret the financial information found in insurance, rental and loan contracts, invoices, and so on. They do this by accurately decoding the symbols and notations of arithmetic language, such as the rational numbers contained in explicit information. They also decode the mathematical and financial terms used in everyday information, including gross salary, net income, deductions, interest and so on. This allows them to identify financial data and select the information needed to deal with the real-life situation concerned. They make connections between the financial data and the information in order to extract meaning. They may also deduce implicit financial information (e.g. related expenses, whether or not taxes or discounts are included in a price) required to interpret a situation. Where necessary, they check their interpretation of the message with other people. During the course, adult learners classify rational numbers by converting them into different forms where necessary, and they also classify financial data in order to make appropriate choices. Lastly, they make sure their conclusions are plausible and consistent. Adult learners produce the financial information required for everyday documents such as income tax returns, family budgets covering different time periods, applications for benefits and so on. They make appropriate use of the symbols and notations used in arithmetic language and in the Canadian monetary system. They use exact mathematical and financial terms to avoid ambiguity and to ensure that their message is clear and consistent. They begin by establishing the purpose of the message, and then structure it appropriately using arithmetic models (e.g. sequence of operations with parentheses, data table, sets). To do this, they make connections between the financial data and the information in order to extract meaning. They include financial information relevant to the purpose of the message. When preparing a budget or explaining a purchasing decision, they classify the related rational numbers and financial data accordingly. Whether interpreting or producing financial information or acquiring a better understanding of the real-life situation with which they are dealing, adult learners perform calculations involving amounts of money. If necessary, they perform sequences of arithmetic operations involving rational numbers to calculate an exact amount or ratio (e.g. discount, net income, portion of an amount of money, total recurring expenses, project costs). They infer the meaning of various types of rational numbers in order to determine the contexts in which it is appropriate to use these numbers. For example, they know that percentages can be used to represent taxes or discounts and negative numbers, to represent expenditures and losses. They may determine the required calculations, correctly select the arithmetic operations that are appropriate to the situation, and build coherent sequences of operations. In the interest of accuracy, they use models that comply with specific arithmetic rules

such as the order of operations when there are parentheses. In addition, they use proportional reasoning when they deduce that an amount is inversely or directly related to a variable (e.g. salary based on the number of hours worked, the number of items that may be purchased with a given amount of money based on the unit price). They apply the unit-rate method if one of the amounts is unknown. They then take the time to make sure that the results of their calculations are close to their original estimates and that their results are plausible with respect to the real-life situation.

Evaluation Criteria

- Provides appropriate, realistic and consistent interpretations of financial information
- Produces clear and coherent financial information
- Correctly performs calculations involving amounts of money

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically h*elps adult learners to make connections and draw conclusions when dealing with real-life situations related to the class *Managing finances*. It involves making deductions and inferences concerning the meaning of different types of rational numbers. Adult learners think logically when they infer the meaning of fractions, ratios, rates and percentages in dealing with sets of situations requiring calculations involving amounts of money. They correctly classify amounts in balance sheets or financial budgets, deciding on the relevant categories (e.g. expenses, earnings, recurrent expenses). They look for examples to verify their conjectures relating to the significance of the various numbers and categories or find counterexamples to clarify, adjust or refute their conjectures. By using inductive reasoning, they are able to determine the various contexts in which it is appropriate to use negative numbers, percentages and other rational numbers. For example, they know that percentages can be used to represent taxes or discounts and negative numbers, to represent expenses, losses and so on.	Adult learners make connections between financial data and the information that makes it meaningful. In doing so, they are able to select the information (e.g. taxes, interest rates, due dates for payments) they need to deal with the situation. When considering purchase and loan options, they compare and classify rational numbers. This enables them to decide on their priorities and make informed choices. When drawing up a family budget or determining amounts of money, they deduce the required calculations and select the arithmetic operations that allow them to construct logical sequences of operations. In addition, they use proportional reasoning when converting rational numbers from one form of notation to another, and when they observe that the quantity of products purchased is inversely proportional to their unit cost. They are also able to deduce implicit financial information from forms and everyday documents, and always check the plausibility and consistency of their calculations and other conclusions (e.g. priorities established, information selected).

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* allows adult learners to interpret and produce fairly simple messages containing financial information when dealing with real-life situations related to the class *Managing finances*. It involves decoding and making rigorous use of arithmetic language and basic financial terminology.

When interpreting a message, adult learners accurately decode the symbols and notations used to represent the Canadian monetary system, as well as rational numbers expressed as decimals, fractions and percentages. They are familiar with the basic terminology of mathematical concepts, including rates, ratios and proportions, and with everyday financial terminology such as gross salary, net income, recurrent expenses and so on. They are able to identify the financial data in financial statements, income tax returns, bank loan applications, purchase options and promotional offers. If in doubt, they ensure that their interpretation is accurate by consulting other people.

When producing a message, adult learners make appropriate use of arithmetic language and financial terminology. This involves correctly associating arithmetic symbols and notations with the financial information they wish to convey. They begin by determining the purpose of the message and then structure it appropriately using specific arithmetic models (e.g. tables, sequences of operations with parentheses). When producing a balance sheet or family budget, preparing an income tax return, completing a benefit application or conveying financial information orally, adult learners must ensure that their message is clear and adapted to both the situation and the audience.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with a number of situations in the class *Managing finances.*

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to a financial context. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed in italics to make it easier to identify learners' previously acquired knowledge.

Calculations that involve performing the four operations and solving sequences of operations pertain to real-life situations only. In addition, since the essential knowledge pertaining to this course is used solely in a financial context, it is covered only partially. In order that every facet of this essential knowledge may be dealt with in a broader range of contexts, it has been made compulsory in other mathematics courses that examine non-financial situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Rational numbers	**Rational numbers**
• Rational numbers	• Properties of operations: commutative, associative and distributive law • Everyday vocabulary associated with fractions (e.g. half of, one half, quarter, one-third, two-thirds)
• Calculations involving the four operations on rational numbers (using a calculator, mental calculation techniques and written calculation algorithms)	• *Calculations involving the four operations on decimals (operations on negative numbers are performed using visual aids only: timeline, diagram, etc.)* • *Calculating fractions or percentages corresponding to a part of a whole* • *Calculating a fraction of a natural number* • *Calculating percentages of numbers using a calculator*

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Rational numbers (cont'd)	**Rational numbers (cont'd)**
	• *Addition and subtraction of fractions, improper fractions and positive mixed numbers using a calculator, visual aids and written calculation algorithms (fractional parts with the same denominator, where the denominator of one fraction is a multiple of the denominator of the other, or whose denominators are less than or equal to four)*
	• *Multiplication and division involving a natural number and a positive mixed number (using a calculator, visual aids and written calculation algorithms)*
• Solving sequences of arithmetic operations on rational numbers (sequence complexity depends on the real-life situation)	• *Solving sequences of arithmetic operations on positive decimals (with no more than one set of parentheses and four operations)*
	• Rounding off positive decimals
• Making a mental estimate of the results of operations or sequences of operations on rational numbers	• *Making a mental estimate of the result of operations or sequences of operations on positive decimals*
	• Reading and writing decimals expressed as words (including negative numbers)
• Comparing rational numbers	• *Comparing decimals, fractions, improper fractions and mixed numbers (fractional parts with the same denominator, where the denominator of one fraction is a multiple of the denominator of the other, or whose denominators are less than or equal to four)*
• Representing rational numbers using the base 10 number system • Converting rational numbers from one form of notation to another (fractions, decimals and percentages)	• *Representing fractions, mixed numbers, improper fractions and decimals (including negative numbers) using the base 10 number system*
• Representing relations using arithmetic models consisting of rational numbers	• *Representing relations using arithmetic models consisting of positive decimals and mixed numbers*

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Proportions • Rates • Inversely proportional relations **Financial concepts** • Everyday vocabulary related to financial concepts (e.g. gross salary, net salary, debt and loan, investment, interest, income tax, deduction, budget and balance sheet) • Converting Canadian dollar amounts into other currencies	**Proportions** • *Unit rate* • Directly proportional relations • Unit-rate method **Financial concepts** • *Everyday vocabulary related to basic financial concepts (e.g. income and expenses, profit and loss, discounts and taxes)* • *Converting dollar amounts into cents, and vice-versa* • The Canadian monetary system **Sets and statistics** • Mean • Data tables

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Vigilance
Adult learners with this attitude are careful about using mathematical language according to the codes and conventions. They also perform accurate calculations and check their plausibility.	Adult learners who are vigilant are careful when checking their invoices and financial statements, and when applying for benefits.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Financial institutions ▪ Banks ▪ Telephone companies ▪ Power company ▪ Insurance companies ▪ Community organizations	▪ Calculator ▪ Spreadsheet programs ▪ Invoices ▪ Pay slip ▪ Income tax form ▪ Benefit application ▪ Student loan application ▪ Insurance contract ▪ Bank form ▪ Employment insurance application ▪ Web sites

Contribution of the Subject Areas

The contribution of other subject areas, in particular knowledge related to the Social Sciences, Working Life, Languages and Mathematics, Science and Technology, is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences
Program of Study: *Consumer Habits*
▪ Since many of the real-life situations examined in the *Finance and Arithmetic* course refer to consumer habits, adult learners may need to use their knowledge of consumer rights and obligations, purchasing and leasing laws, and laws governing the use of services, and so on.

Subject Area: Working Life
Programs of Study: *Introduction to the World of Work* and *Career Choice*
▪ Some of the real-life situations examined in this course involve the world of work and career choices, particularly where salary is concerned. Adult learners may therefore be required to use their knowledge of income, hourly wages, salary deductions and so on.

Subject Area: Languages
Program of Study: *English, Language of Instruction*
▪ All of the situations in the *Finance and Arithmetic* course are likely to require adult learners to communicate orally or in writing. Consequently, a knowledge of the language of instruction is required throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- Some of the situations in this course could involve the use of computer resources. For example, learners may search for financial information to complete an income tax return or for general information on government programs. They may also use spreadsheets to produce balance sheets and budgets.

Program of Study: *Mathematics*

- In addition to the knowledge that is compulsory for the *Finance and Arithmetic* course, working with complex real-life situations may require knowledge of mathematical content covered in other courses in the Common Core Basic Education Program. This will be the case, for example, when they use frequency or relative frequency tables to prepare budgets or balance sheets, and their knowledge of geometry to estimate the cost of a renovation project.

Andragogical Context

The *Finance and Arithmetic* course will be of interest to adult learners in Secondary Cycle One, since financial issues are a constant concern. The class of situations *Managing finances*, with its focus on money-related matters, provides an excellent context in which to start acquiring mathematical knowledge, especially relating to arithmetic. Adult learners are motivated because they are directly affected by the subject.

Teachers should not over-emphasize the complexity of the knowledge acquired by adult learners. Some of the essential knowledge is covered only in a limited manner. This is the case for operations involving mixed numbers and percentages, which are not essential to the sequences of operations examined in this course. Although adults may use fractions and percentages to deal with a given situation, the sequences of operations can be performed using decimals, which are particularly appropriate because the calculations all involve sums of money.

Because the content of this course pertains exclusively to the financial system, the knowledge that adult learners acquire will be applied in other contexts they may find interesting, thereby enabling them to fully assimilate it. For example, percentages will be studied in more detail in the *Statistics and Probability* course, and mixed numbers will be further examined in the *Geometric Representations and Transformations* course.

The concepts shown in the right-hand column of the table of essential knowledge (knowledge from prior courses) are needed to address the real-life situations used in this course, and are therefore compulsory. Although they are prerequisites, some adult learners may not have mastered them. Teachers will therefore have to devote more time to these concepts and may have to design simpler learning situations so that learners can acquire the expected level of proficiency in this regard.

Teachers should also remember that the course is designed to develop the operational competencies *Thinks logically* and *Communicates*. The development of these competencies allows adult learners to acquire cognitive and metacognitive strategies that can be adapted to almost every real-life situation, while requiring them to use the knowledge they have acquired. Thus, learning should focus on the ability to construct and use arithmetic knowledge in context, rather than on the complexities of arithmetic. For example, instead of emphasizing long sequences of operations involving several sets of parentheses, teachers should ensure that learners are able to perform short sequences of operations in real-life situations. On the rare occasions adult learners will be required to perform such complex calculation, they may use calculators or computers. The priority must be the development of an understanding of arithmetic operations and of the different ways of writing rational numbers so that adult learners can deal effectively with real-life situations.

The learning situations in this course are designed to teach adult learners how to manage their finances effectively. The teacher draws on the real-life experiences of learners in order to present them with plausible learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain. The difficulty facing the teacher is to propose learning situations that are relevant to adults without invading their privacy. A safer approach in this regard is to use simulations and models.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

My Monthly Budget

The real-life situation chosen for the class *Managing finances* involves *preparing a balance sheet and producing a personal or family budget*. In the related learning situation, adult learners are asked to prepare a fictional balance sheet based on a set of expenses and earnings provided by the teacher. They then use the same information to draw up a monthly balanced budget based on certain guidelines.

The teacher begins by talking to the class about the need for a balance sheet or budget, emphasizing the specific advantages of each or those they have in common. Adult learners may be hesitant to undertake this task, in part because of the level of difficulty involved. The teacher should reassure them and provide any support they may need.

Adult learners become familiar with the organization of a financial balance sheet by reading the examples handed out by the teacher, who explains concepts such as recurrent expenses, net income, bonuses and so on. The teacher points out that the balance sheet is organized as a data table and ensures that learners are familiar with this concept before asking them to perform some simple calculations using the amounts shown in the balance sheets presented, thereby giving them the opportunity to apply their prior knowledge of decimals.

The teacher then begins a discussion of negative numbers, presenting sample balance sheets that contain negative numbers and others that do not. Adults infer the meaning of the numbers and realize that they are used to represent expenses, losses and so on. They learn how to add negative numbers by doing some simple exercises and listening to an oral presentation by the teacher.

Each learner then prepares a monthly balance sheet. All the necessary amounts, taken from the material provided by the teacher (e.g. invoices, payslips), are entered in a data table and expressed in the units of the Canadian monetary system. Prior knowledge of tables and sets is used to classify the amounts required for the balance sheet. Adult learners identify recurrent expenses and guaranteed income, as well as any expenses and income specific to the month in question. They use negative numbers to represent expenses, losses and so on, before making sure all the amounts are included and calculating whether the balance is positive or negative. They select the operations to be performed on the set of decimals in the balance sheet, write them out as sequences of operations, solve the sequences correctly and check their answers by rounding off the numbers and estimating the results. The teacher supervises each step in the process and asks questions to check individual progress, identify problems and ensure that the procedure is followed correctly. Once the teacher is sure that the information provided has resulted in a deficit, he/she asks adult learners to form teams of three or four and discuss the options available to achieve a positive balance.

Learners are then given new additional data and guidelines (e.g. a wage increase, new expenses) and are asked to produce a fictional balanced budget for a new month, keeping in mind the options discussed in the previous case. The teacher hands out a sample

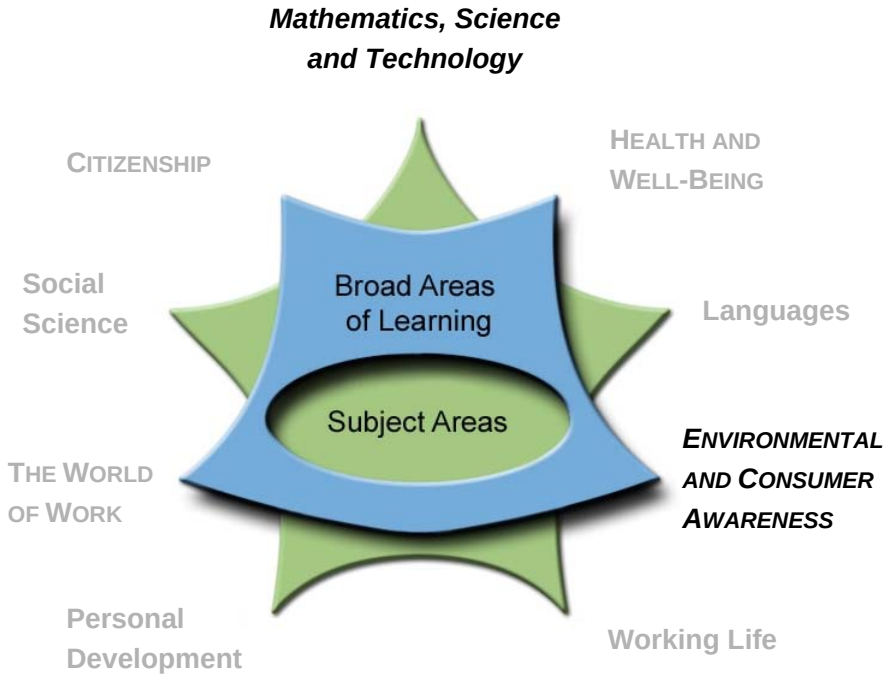
budget and a list of instructions, emphasizing the difference between a balance sheet and a budget. Once again, learners are responsible for selecting the necessary operations, writing them out as sequences of operations, solving the sequences correctly and checking their answers by rounding off the numbers and estimating the results. If the budget is negative, they must start over.

Throughout the learning situation, the teacher provides any help that may be needed, ensuring that calculations are accurate and the tables correctly completed. In the context of evaluation to support learning, the teacher ensures that both the balance sheet and the budget are complete and are presented in table form, as requested, before asking learners to summarize their learning and identify any problems they may have encountered, which they share with the group. The teacher encourages learners to use what they have learned to draw up their own personal balance sheet and budget estimates for the coming month, thereby helping them to become more financially responsible.

Elements of the Course Addressed by the Learning Situation

Class of Situations
Managing finances
Learning Situation
My Monthly Budget
Categories of Actions
▪ Interpreting financial information ▪ Producing financial information ▪ Performing calculations involving amounts of money

Operational Competencies	Essential Knowledge
▪ Thinks logically ▪ Communicates	▪ Whole numbers ▪ Rational numbers ▪ Calculations involving the four operations on rational numbers ▪ Representing relations using arithmetic models consisting of rational numbers ▪ Solving sequences of arithmetic operations on decimals ▪ Making a mental estimate of the result of an operation or sequence of operations on rational numbers ▪ Rounding off positive decimals ▪ Everyday vocabulary related to financial concepts ▪ The Canadian monetary system ▪ Data tables



Complementary Resources

▪ Calculator ▪ Ruler or spreadsheet	▪ Invoices

Course

Statistics and Probability

MTH-1102-3

Secondary Cycle One

“It is one of humanity’s habits to use thought where nature left things to chance.”

Jérôme Touzalin

Presentation of the Course *Statistics and Probability*

The course *Statistics and Probability* is designed to help adult learners deal competently with real-life situations where they must solve problems that require them to predict random events.

It prepares adult learners to use their knowledge of statistics and probability to study random phenomena and to profile past or present random events with a view to predicting others.

The course builds on the knowledge acquired in the presecondary course entitled *Sets and Statistics*, where adult learners became familiar with the use of statistics and sets to deal with relatively familiar real-life situations in which information was always easily available. The *Statistics and Probability* course allows them to expand their knowledge in this regard. They will not only process data (classifying, interpreting and representing it), but also collect and analyze it with a view to making predictions. They learn about data collection (sample survey, census and study), sources of bias and other statistical representation methods, namely relative frequency tables, broken-line graphs and circle graphs. Statistics provide an overview of random phenomena and can be used to calculate the probability that a given event will occur. Conversely, calculating probability makes it possible to predict statistical outcomes to some extent. These two areas of mathematics are used together to deal with many real-life situations in which adult learners must make informed choices based on their predictions of random events. In this course, they will become familiar with a number of new concepts: enumeration, theoretical probability, experimental probability and the various types of events (e.g. probable, certain, impossible, dependent, complementary).

By the end of the course, adult learners will be able to produce statistical distributions (e.g. inventories, sample survey results, academic results, studies of endangered animal species) by collecting data. They will also be able to interpret the results of their data collection as well as statistical distributions produced by other people and organizations. To evaluate the chances that a random event will occur, they will be able to calculate the experimental probability, using statistical data, or to calculate the theoretical probability using simple techniques. They will also use the mathematical language pertaining to statistical representation methods and probability, and will make deductions and inferences based mainly on the logic of sets and probabilities. Lastly, they will have a discerning and objective view of the many statistical and probability forecasts published in the media.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Predicting random events*.

The real-life situations in this class involve predicting certain random events that may occur. To be able to do this, adult learners must develop a general view of random phenomena or experiments, which they acquire by working with statistical and probabilistic representations. The real-life situations addressed in the course are selected for their diversity and significance to adults, rather than for their complexity.

Some of the real-life situations in this class involve social concerns, which are more easily observed using statistical or probabilistic representations. This is the case, for example, when adult learners analyze a sample survey in order to predict the outcome of an election or when they examine the placement rate for graduates in a given field so that they can decide on an occupation. Other real-life situations involve natural phenomena, for example when adult learners examine the weather forecasts to predict the possibility of rain on an outdoor activity day or when they calculate their chances of having three successive children of the same gender. Lastly, this class also includes real-life situations where adults take part in random experiments, such as buying raffle tickets, playing a game of chance or identifying a padlock combination by trial and error.

Class of Situations	Examples of Real-Life Situations
Predicting random events	▪ Taking part in an election ▪ Planning a family budget ▪ Launching a food service at the centre ▪ Studying endangered animal species ▪ Studying natural disasters ▪ Analyzing the student groups in an education centre or the clientele of a business ▪ Collecting food donations for a charity ▪ Taking a position on a social issue ▪ Selecting a career ▪ Planning an outdoor activity ▪ Assessing the risk of an accident ▪ Purchasing insurance coverage

Class of Situations	Examples of Real-Life Situations
	▪ Taking part in a hockey pool ▪ Taking part in a simple game of chance ▪ Taking part in a raffle ▪ Planning a family

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Producing statistical distributions	▪ Uses a broken-line graph to represent changes in voting intentions during the weeks preceding an election ▪ Consults specialists as part of a study on endangered animal species ▪ Produces a sample survey to determine the extent to which neighbourhood residents are interested in having a new park ▪ Collects information on precipitation levels in January ▪ Prepares an inventory of products collected for a food drive ▪ Uses a circle graph to illustrate Québec's various employment sectors
▪ Interpreting statistical distributions	▪ Describes changes in voting intentions on the basis of a broken-line graph ▪ Determines the placement rate for graduates in a given occupation ▪ Identifies the hockey players who performed well offensively throughout the season ▪ Identifies the most popular brand of running shoes among young people on the basis of a bar graph ▪ Becomes familiar with soil contamination levels by studying a circle graph ▪ Determines the average winter temperature in Québec ▪ Determines the age difference between the youngest student and oldest student in the class

Categories of Actions	Examples of Actions
▪ Determining the probability that a random event will occur	▪ Determines the probability that a particular candidate will win the next election ▪ Determines the probability that an earthquake will occur in the region ▪ Determines the probability of snow showers by listening to a weather forecast ▪ Determines the most probable outcome of a game of chance ▪ Compares the probability of dying in a car accident when wearing and not wearing a seat belt ▪ Estimates the chances of winning a draw ▪ Calculates the probability of having three successive children of the same gender ▪ Calculates the probability of randomly finding the correct combination for a padlock

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Predicting random events

Categories of Actions

- Producing statistical distributions
- Interpreting statistical distributions
- Determining the probability that a random event will occur

Operational Competencies

Thinks logically

- Infers the characteristics shared by several data values
- Infers the multiplication techniques required to determine the possible outcomes and the probabilities
- Deduces implicit information
- Decides whether two random events are complementary, compatible or dependent
- Makes sure his/her conclusions are plausible and consistent

Communicates

- Accurately decodes symbols, notations and terms pertaining to statistics and probabilities
- Identifies explicit information that can be used to give meaning to the data
- Structures the message properly using appropriate methods of representation
- Rigorously uses the symbols, notations and terms pertaining to statistics and probabilities
- Ensures that the message is clear

Exercises critical and ethical judgment

- Checks the credibility of information sources
- Identifies sources of bias that may influence data collection results
- Identifies factors that may influence probability predictions
- Forms an opinion or makes choices based on facts or objective data
- Minimizes sources of bias when collecting data

Essential Knowledge

- Data collection
- Statistical distributions
- Probability
- Sets
- Arithmetic

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with situations in the class *Predicting random events,* adult learners produce and interpret statistical distributions and determine the probability that certain random events will occur. Adult learners produce statistical distributions in different contexts, for example when assessing their educational performance, surveying fellow students to determine their interest in having a food service at the centre, testing a theoretical model by conducting an experiment that involves rolling two dice, and so on. To do this, they must choose the most appropriate type of data collection method for the situation and carefully select their data sources. If they are required to produce a data collection form for a census, sample survey or study, they make sure the questions are worded clearly and unambiguously. They try to minimize sources of bias by ensuring that the survey sample or, in the case of a random experiment, the number of trials is representative. They convey the outcome of the data collection process using an appropriate, correctly structured statistical representation method. They infer the characteristics that are common to the data in order to decide which quantified items will appear in their table or graph. They make proper use of the symbols, notations and terms pertaining to statistics and probabilities, correctly identify a legend or sample space, and graduate the axes for a broken-line graph. They also ensure that their message is clear and understood by the target audience. Adult learners interpret statistical distributions when they examine the results of sample surveys and studies, weather forecasts, sports predictions and so on. This involves accurately decoding the symbols, notations and terms pertaining to statistics and probabilities. They also recognize the terms pertaining to data collection. They identify explicit information, such as the titles of representations, and deduce implicit information, such as the mean, in order to determine the meaning of the data. They select the operations required to calculate the mean when dealing with variables, frequencies or relative frequencies. Throughout the process, they check the information by comparing different sources, where possible, and by checking the credibility of the individuals or institutions concerned. They detect any sources of bias that may influence the data collection results. They are also wary of invitations to take part in games of chance, since they know that the probability of losing is generally much greater than the probability of winning. They form opinions and make choices based on facts or objective data. Adult learners determine the experimental probability that a random event will occur by making connections between the data from a statistical distribution. After studying possible events, they are able to deduce whether a given event is impossible, probable or certain. They make connections between two random events to see whether they are complementary, compatible or dependent. They can also predict their chances of experiencing a specific event and make rational decisions based on statistical data relating to social and natural phenomena. They identify the factors that may influence their probabilistic forecasts, such as changes that have occurred since the data were collected. To

calculate theoretical probability, they use representations of possible outcomes and favourable outcomes. For example, they can identify the various possible outcomes of a two-dice game by using a tree diagram. They use inferred multiplication techniques to calculate the exact number of possible outcomes and favourable outcomes for a given event, or the probability that the event will occur. They then check the plausibility and consistency of their conclusions (e.g. calculations, predictions, representations, choices).

Evaluation Criteria

- Produces clear and accurate statistical distributions
- Interprets statistical distributions correctly
- Accurately determines the probability of a random event occurring

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically, Communicate,* and *Exercises critical and ethical judgment.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners to make connections and draw conclusions when dealing with real-life situations related to the class *Predicting random events*. It involves making deductions and inferences that, in this course, are based mainly on the logic of sets and probabilities. Adult learners think logically when they infer the characteristics common to various data values in order to identify the quantified objects in a table or graph, for example. They establish disjoint subsets to avoid overlapping sets of quantified objects. They can also infer the multiplication technique required to calculate the number of possible or favourable outcomes for an experiment divided into several steps. They can also use generalization to decide that the probability of a given outcome may be obtained by multiplying the probabilities of a favourable outcome at each step. They look for examples to verify their conjectures, or counterexamples to clarify, adjust or refute them.	Adult learners make connections between the various data values. In doing so, they are able to interpret and classify the data in order to study a natural phenomenon, analyze a social issue, predict a specific event, and so on. They also deduce implicit information in the statistical or probabilistic representations they must interpret. For example, they can deduce whether a given event is impossible, probable or certain, and select the operations required to calculate the range or the mean when dealing with variables, frequencies or relative frequencies. They also deduce the most appropriate data collection method (sample survey, census or study) for the situation and make connections between the data from different statistical distributions to determine experimental probabilities. They can predict their chances of experiencing a given event and make rational decisions based on statistical data pertaining to social and natural phenomena. They can also make connections between two random events to see whether they are complementary, compatible or dependent. They then check the plausibility and consistency of their conclusions (e.g. calculations, predictions, representations, choices).

Contribution of the Operational Competency *Communicate*

The operational competency *Communicates* allows adult learners to interpret and produce messages that include statistics and probabilities when they deal with real-life situations related to the class *Predicting random events*. It involves decoding and making appropriate use of mathematical language pertaining to statistics and the different kinds of probabilities.

When interpreting messages, adult learners accurately decode the symbols, notations and terms pertaining to statistical and probabilistic representations (e.g. tables, circle graphs, broken-line graphs, tree diagrams, networks). They also recognize data collection terms (e.g. census, population, sample) and probability terms (e.g. random phenomenon, favourable outcome, equiprobable outcomes, probable event, certain event, dependent event). Among other things, they interpret sample surveys, media information, weather forecasts or information on games of chance by identifying the explicit information (e.g. titles of statistical representations or the scale used to graduate the axes for a graph) required to determine the meaning of the data. If in doubt, they ensure that their interpretation is accurate by consulting other people.

When producing messages, adult learners make appropriate use of the symbols, notations and terms pertaining to statistics and probabilities. They structure the message appropriately by using representation methods that are appropriate to the real-life situation. They correctly identify legends, graduate the axes for broken-line graphs, and list the set of possible and favourable outcomes. For example, they may use a broken-line graph to illustrate their academic results over time, or a tree diagram to illustrate the different possible outcomes of a dice game. They ensure that their message is clear and understood by the target audience. When collecting data, they must ensure that their questions are worded properly to avoid ambiguity.

Contribution of the Operational Competency *Exercises critical and ethical judgment*

The operational competency *Exercises critical and ethical judgment* enables adult learners to make judgments and informed decisions when dealing with real-life situations belonging to the class *Predicting random events*. It allows them to be objective and discerning with respect to statistical and probabilistic predictions.

Adult learners use their critical and ethical judgment when they analyze the results of sample surveys or studies, weather forecasts, sports predictions and so on. It is important that they be careful when considering this type of information. Adult learners assess the validity of the information that is presented by comparing different sources, where possible, and by checking the credibility of the people or institutions that provided it. They identify sources of bias that may influence the results of the data collection process, along with the factors that may influence probabilistic predictions, such as changes that have occurred since the data were collected. They learn that the data displayed in a given statistical representation and any related comments may be dictated by the personal opinions and interests of those who produced it. Learners are also wary of invitations to take part in games of chance, since they know that the probability of losing is generally much greater than the probability of winning. They must therefore exercise discernment when forming an opinion or making choices based on facts or objective data.

When producing statistical distributions, adult learners select their data sources carefully and try to be objective. They take care to minimize sources of potential bias so as not to taint their data collection results. They avoid giving a thoughtless and unfounded personal opinion. Similarly, when determining experimental probability from a random experiment, they perform a sufficient number of trials to obtain a representative outcome.

Essential Knowledge

All of the knowledge shown in the table below is compulsory since it is essential for dealing with many of the situations in the class *Predicting random events.*

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve predicting random events.

Since essential knowledge pertaining to arithmetic is dealt with only in a context involving the prediction of random events, this material is covered only in a partial manner. In order that every facet of this essential knowledge may be dealt with in a broader range of contexts, it has been made compulsory in other mathematics courses that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Data collection • Population • Representative sample • Sample survey, census and study • Sources of bias • Sampling methods (random and systematic) • Creating data collection forms • Establishing a representative sample or defining a population • Collecting data **Statistical distributions** • Data (continuous quantitative) • Maximum, minimum, range	**Sets** • Sets and subsets • Membership, inclusion and exclusion relationships • Classifying elements using sets and subsets • Representing sets and subsets by listing their elements and using a Venn diagram • Reading representations involving sets and subsets (Venn diagrams, representations using words, and representations using lists of elements) **Statistical distributions** • Discrete quantitative data or qualitative data • Axes • Legend

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Statistical distributions (cont'd) • Reading statistical representations (relative frequency tables, broken-line graphs and circle graphs) • Constructing relative frequency tables • Graphing statistical distributions (broken-line and circle graphs) • Determining the mode of a statistical distribution involving qualitative data • Calculating the mean using frequencies or relative frequencies from a statistical distribution **Probability** • Chance • Random experiment • Event • Equiprobable and non equiprobable events • Sample space • Favourable outcomes • Theoretical probability and experimental probability • Determining experimental probability • Calculating theoretical probability • Probable, certain and impossible events • Relationship between two events (dependent, independent, complementary, compatible, incompatible) • Calculating the number of possible outcomes and the number of favourable outcomes • Enumeration for an experiment involving no more than three steps, using representation methods (grids, tables, tree diagrams, networks etc.	**Statistical distributions (cont'd)** • Mean • Reading statistical representations (tables of variables, frequency tables, bar graphs and pictographs) • Constructing tables of variables and frequency tables • Graphing statistical distributions (bar graphs and pictographs) • Calculating the mean using the data from statistical distributions (it must be possible to perform the calculation simply by adding up the data values and dividing by the number of values) **Arithmetic** • Converting rational numbers from one form of notation to another (fractions, decimals and percentages) • Rounding off positive decimals • Solving sequences of arithmetic operations on rational numbers • Making a mental estimate of the results of operations or sequences of operations on rational numbers • Representing relationships using arithmetic models consisting of rational numbers • Positioning decimals on the number line

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Vigilance
Adult learners with this attitude are precise and methodical when collecting data, producing representations or determining probability. As a result, their predictions are likely to be more realistic and easier for other people to understand.	Adult learners with this attitude are critical and wary of statistics and related analyses, and of common beliefs about games of chance and lotteries.
Curiosity	
Adults with this attitude want to know more about their surroundings, meaning that they are more interested in predicting random events of all kinds, regardless of whether these predictions are based on the analysis of past events, experiments or theoretical calculations.	

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Statistics Canada ▪ Institut de la statistique du Québec ▪ Emploi Québec ▪ Environment Canada ▪ Community associations ▪ Environmental organizations	▪ Calculator ▪ Ruler ▪ Spreadsheets ▪ Newspapers ▪ Magazines ▪ Government publications ▪ Electronic media ▪ Games of chance (e.g. dice, cards, lottery drum) ▪ Lottery tickets ▪ Web sites

Contribution of the Subject Areas

The contribution of other subject areas, in particular knowledge related to the Social Sciences, Working Life, Personal Development, Languages and Mathematics, Science and Technology is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences

Programs of Study: *Social and Political Life, Community and Culture* and *Consumer Habits*

- When adult learners produce or interpret statistical representations, they may use their knowledge of politics, the economy, advertising and so on. Similarly, when dealing with real-life situations involving games of chance such as lotteries, cards or slot machines, adults may use their knowledge of consumer behaviour, consumer vigilance, debt prevention, consumer incentives and so on.

Subject Area: Working Life

Program of Study: *Introduction to the World of Work* and *Career Choice*

- Since some of the real-life situations examined in this course involve the world of work and career choices, adult learners may be required to use what they know about trades and occupations, business organization, etc.

Subject Area: Personal Development

Program of Study: *Health*

- Adult learners use their health-related knowledge when studying statistics and probabilities, for example to anticipate the health effects of smoking, obesity or anorexia.

Subject Area: Languages

Program of Study: *English, Language of Instruction*

- All the situations in this course are likely to require adult learners to communicate orally and in writing. Consequently, the language of instruction will be used throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- Some of the real-life situations in this course could involve the use of computer resources. For example, adult learners may be required to use spreadsheets to produce statistical representations, or word processing applications to prepare data collection questionnaires. Lastly, it is much easier to search for information using electronic media.

Program of Study: *Relationship With the Environment*

- Knowledge of natural phenomena such as earthquakes, floods and rain or snow showers may also be useful in this course.

Program of Study: *Mathematics*

- In addition to the knowledge that is compulsory for the *Statistics and Probability* course, working with some of the real-life situations may require knowledge of the mathematical content covered in other courses in the Common Core Basic Education Program. This will be the case, for instance, if adult learners use comparative bar graphs or histograms.

Andragogical Context

Situations that involve statistics and probabilities are common in the every day lives of adult learners, whether they are choosing an occupation or educational program, taking part in an election or a game of chance, or adopting a position on an environmental issue. Situations involving social concerns are particularly appropriate for this course, since they involve inventories, sample surveys, studies and probabilities of all kinds.

The teacher draws on the real-life experience of learners in order to present them with plausible learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain. Predictions should also relate to subjects of interest to the adult learners. The teacher should concentrate on providing a range of learning situations, rather than emphasizing their complexity. The purpose of the course is not to study advanced calculation techniques, but rather to help learners develop rational thinking skills so that they can make informed choices and anticipate events.

Adult learners are seldom required to collect data or produce statistical or probabilistic representations in their everyday lives. In a learning situation, the purpose of this type of exercise is mainly to help them develop a sense of set logic and better understand how to present data in such a way that it is easier to interpret. By collecting the data themselves—a process that involves forming a representative sample and minimizing sources of bias—adult learners will realize that studies and sample surveys may not always be carried out objectively. This will make them aware of the importance of being wary of statistics published in the media and teach them to identify sources of bias. The task of producing statistical distributions should therefore be approached from the standpoint of improving their interpretation abilities.

Set theory is a prerequisite to producing statistical representations, since it involves dividing data into disjoint sets and subsets. This type of classification is necessary if the statistical representation is to be unequivocal. Some of the proposed learning situations may combine set theory and statistical representations so that learners will be aware of the connection between the two. Adult learners from the youth sector who have not taken presecondary courses at an adult education centre will not yet have studied sets. The teacher must therefore devote time to this topic and devise learning situations to fill any gaps in their learning. The course also continues to build on learners' arithmetic knowledge. Although percentages have already been studied beforehand, they are incorporated into all the learning situations covered by the course. Teachers should therefore take advantage of the opportunity to consolidate learners' knowledge of percentages.

This course should enable adult learners to appreciate both the usefulness and limitations of statistics and probabilities when it comes to predicting random events. Predictions are based on estimates of the chance that the event will actually occur, and not on absolute certainties. Predictions based solely on statistical data—in other words, on past or present events—do not take all the factors into account. Adult learners must also consider that predictions based on theoretical probability calculations are accurate only if a sufficient number of outcomes are used in the calculation.

In a society where adults are increasingly encouraged to purchase all kinds of lottery tickets, this course provides an excellent opportunity to examine the problems pertaining to games of chance and draws. However, because some adults may already be compulsive gamblers, the teacher should be careful when addressing this topic and therefore give priority to group discussions on the myths and realities of games of chance and lotteries.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Career Choice Predictions

The real-life situation chosen for the class *Predicting random events* involves selecting a career. In the related learning situation, adult learners are invited to explore a trade or occupation of interest to them by using statistics and probabilities, and to present their results to the group.

The teacher begins by presenting a video or text describing the experience of a person who has chosen a career that did not really meet his/her aspirations. This is followed by a group discussion on the most important information to be considered before making a choice, such as placement rates, salary levels, the location of employer companies, the size of companies in the field, and so on. The teacher helps adult learners realize that the chances of obtaining the desired position or salary can be estimated through predictions based on statistics and probabilities.

Adult learners are then invited to indicate which careers they are considering and to select one that is of particular interest to them. The teacher presents three data values that adult learners must predict for that trade or occupation, namely the evolution of the mean starting salary, concentration of jobs by region and graduate placement rates.

The learning activity involves searching for information related to this data on the Web, in employment guides and from other sources. The information may sometimes be presented in tables of variables or frequency tables, meaning that adults must use their prior knowledge in this regard. The teacher begins by making sure the adults have properly constructed this knowledge by handing out a short questionnaire. If some learners do not appear to have the necessary knowledge, the teacher should pay particular attention to them as they search for information, providing the support they need and encouraging them to help one another. Adult learners then compile the information on the mean starting salary in a table of variables, and the information on job concentration by region and graduate placement rates in frequency tables.

Adult learners then construct knowledge of relative frequency tables. The teacher asks them to calculate the percentages for each value. They should be able to do this because they have already calculated percentages in other learning contexts. It should be noted that some statistical distributions compiled during the information search might actually show relative frequencies.

The next learning activity is designed to help adults construct their knowledge of two types of graphs. First, adults use a broken-line graph to show changes in the mean starting salary and placement rate. Second, they use a circle graph to show job concentration by region, although a pictograph or bar graph would be equally appropriate. The teacher asks learners to form “expert teams” to carry out a task that will help them become more proficient at drawing these graphs and develops two separate kits for that purpose. The first kit contains explanations and examples of how to draw a broken-line graph, and the second contains explanations and examples of how to draw a circle graph. The adults divide into groups of four, and the teacher hands out one kit to each team. The team members read the information in the kit, talk about it and make

sure they understand it by filling out a short questionnaire provided by the teacher. Each team is then split into groups of two, and these pairs form new teams of four composed of two members who have studied broken-line graphs and two who have examined circle graphs. Each pair of learners then explains its graph to the other pair of learners, and asks questions to ensure that they have understood the concepts involved.

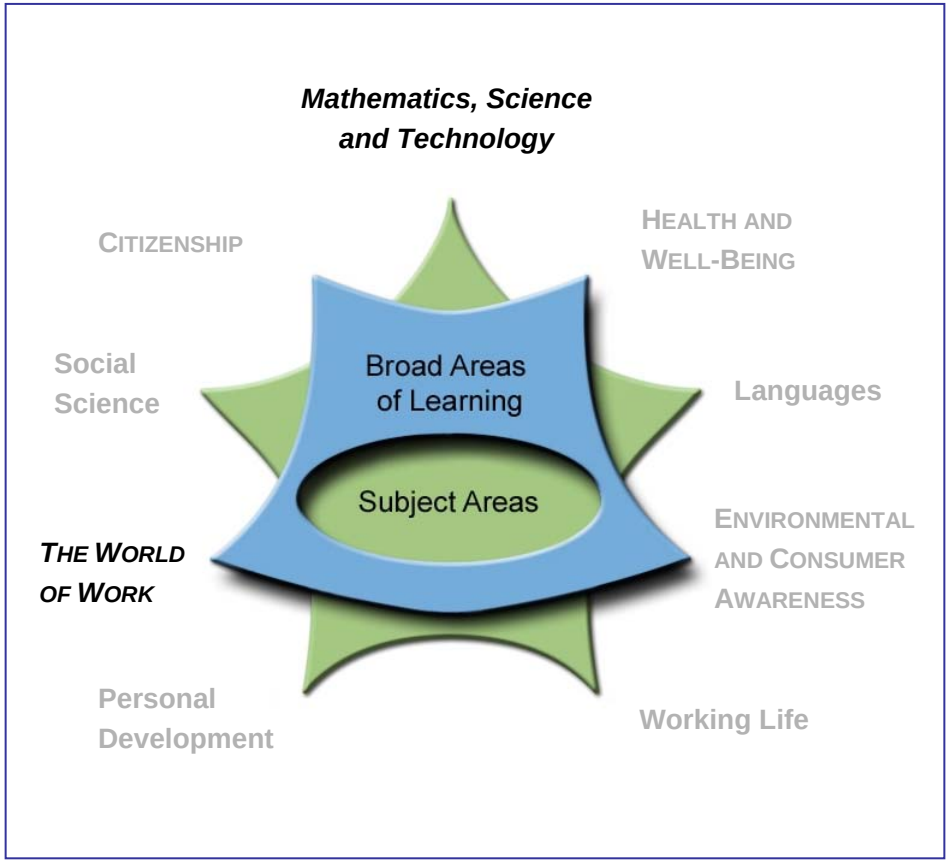
Working individually, adult learners draw graphs showing changes in salaries and placement rates over the last five years, as well as the regions where jobs in their chosen trade or occupation are concentrated. Analyzing the broken-line graphs allows them to anticipate future changes in salaries and placement rates. To help them use a circle graph to determine the probability of finding a job in a given region, the teacher explains that relative frequencies are also experimental probabilities. Having understood the connection between experimental probabilities and relative frequencies, each adult analyzes his/her own circle graph to see whether the chances of finding a job in his/her region are good, and whether he/she is interested in working in the regions where the demand is greatest.

These graphs are used to illustrate the predictions relating to the chosen trade or occupation and to make a short oral presentation to the class. As they share their findings, adult learners are able to observe several different examples of the two types of graphs studied and to explore different trades and occupations, all of which should help them make an informed career choice. They ensure that their graphs are clear and in compliance with mathematical language codes. By launching a group discussion on ways in which information may be incorrectly interpreted or on possible sources of bias, the teacher encourages learners to critically examine the results presented. For instance, the class considers the possibility that the published salary figures are not accurate due to black market work or insufficient data. The teacher also talks to adult learners about the reliability of their predictions and encourages them to exercise their critical judgment by having them identify factors that may alter their findings between now and the time they are ready to join the workforce (e.g. saturation of demand for labour, new company or government policies, company closures and mergers).

Lastly, the teacher and adult learners discuss the usefulness of the two types of graphs studied, with learners identifying the advantages and disadvantages of each. The teacher asks them to select the type of graph they would use for different statistical distributions and to justify their choice. During the discussion, bar charts and pictographs may also be considered, even though they were not used in the exercise.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Predicting random events	
Learning Situation	
Career Choice Predictions	
Categories of Actions	
▪ Producing statistical distributions ▪ Interpreting statistical distributions ▪ Determining the probability that a random event will occur	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates ▪ Exercises critical and ethical judgment	▪ Data ▪ Axes ▪ Legend ▪ Mean ▪ Reading statistical representations ▪ Constructing tables of variables and frequency tables ▪ Constructing relative frequency tables ▪ Graphing statistical distributions ▪ Determining the mode of a statistical distribution involving qualitative data ▪ Determining experimental probability ▪ Converting rational numbers from one form of notation to another



Complementary Resources

▪ Calculator ▪ Ruler or spreadsheet ▪ Employment guides	▪ Statistics Canada ▪ Internet

Course

Algebraic Modelling

MTH-2101-3

Secondary Cycle One

"Time was when all the parts of the subject were dissevered, when algebra, geometry, and arithmetic either lived apart or kept up cold relations of acquaintance confined to occasional calls upon one another; but that is now at an end; they are drawn together and are constantly becoming more and more intimately related and connected by a thousand fresh ties, and we may confidently look forward to a time when they shall form but one body with one soul."

James Joseph Sylvester

Presentation of the Course *Algebraic Modelling*

The course *Algebraic Modelling* is designed to help adult learners deal competently with real-life situations that involve solving problems pertaining to relationships between quantities.

In this way, learners become familiar with using simple algebraic models to represent relationships between quantities.

This course provides an introduction to the field of algebra. In previous mathematics courses, adults have already dealt with real-life situations involving direct and inverse proportionality, using the unit-rate method. In this course, they learn to deal with similar situations using the law of proportions (rule of three). They can also use equations to generalize and improve their understanding of common arithmetic calculations. The material covered in this course will give them the opportunity to manipulate first-degree equations with one unknown and to use simple geometric and scientific formulas. The formulas relating to perimeter, area and volume will form an integral part of this course, allowing adult learners to build on the knowledge they acquired at the Presecondary level concerning the use of geometry as a means of dealing with real-life situations. They will also learn to work with expressions containing the exponents two and three or the corresponding roots in performing sequences of arithmetic calculations and solving equations. They will thereby realize that the fields of geometry, algebra and arithmetic are indeed closely related, as the above quotation suggests.

By the end of the course, learners will be able to use algebraic language correctly, infer relationships between quantities and make deductions based on algebraic models. This will allow them to convert specific relationships into algebraic form where necessary, and to generalize an algebraic model expressing relationships that apply in different cases. They will also interpret various simple models and determine unknown values in concrete situations using models that can be written as equations with a single unknown.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Establishing relationships between quantities*.

This class comprises real-life situations involving relationships between quantities that can be represented using algebraic models. It includes only situations of direct relevance to adults, with relationships that are easy to understand and that do not require complex abstract thinking. The situations must involve relationships that can be represented by first-degree equations with one unknown, or by simple, common formulas. By using equations to represent these relationships, adult learners are better able to understand them and, where necessary, to determine an unknown quantity in the situation concerned.

When purchasing an item, for example, there are relationships between total price, initial price and taxes; when checking a payslip, there are relationships between weekly salary, hourly rate and the number of hours worked; and when driving a car, there are relationships between distance, average speed and time. Simple formulas expressing relationships are also useful when determining the concentration of a domestic cleaning product, calculating energy consumption, understanding the law of levers and so on. The class also includes situations involving landscaping, renovations or construction work that require the use of geometric formulas to calculate perimeters, areas and volumes. Lastly, the law of proportions (rule of three) can also be used in situations that involve adapting recipes to a specific number of people, determining the number of people required to perform a task within the available time or calculating the quantity of water needed to dilute a product.

Class of Situations	Examples of Real-Life Situations
Establishing relationships between quantities	▪ Purchasing a commodity ▪ Leasing a commodity ▪ Subscribing to a service ▪ Conducting a sale to raise funds ▪ Exchanging currency ▪ Seeking employment based on salary ▪ Planning a meal using a recipe ▪ Consuming energy ▪ Using a lever ▪ Driving a car

Class of Situations	Examples of Real-Life Situations
	▪ Installing baseboard heaters or picture frames ▪ Installing ceramic tiles ▪ Maintaining a swimming pool ▪ Landscaping ▪ Building a stair railing ▪ Treating a lawn

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Interpreting algebraic models	▪ Uses a formula to explain the law of levers ▪ Predicts the variation in the amount of an electricity bill due to increased electricity consumption ▪ Determines the increase in volume required to dilute a solution by half ▪ Determines the relationship between the area and width of a rectangular vegetable garden
▪ Producing algebraic models	▪ Expresses the amount spent based on the initial amount and the balance ▪ Expresses the number of spindles required to build a handrail based on the distance between the spindles and the length of the handrail ▪ Expresses the number of tiles needed to cover a surface based on the area of a tile and the area of the surface to be covered ▪ Given the time required for five employees to perform a task, expresses the relationship that makes it possible to calculate the time required for two employees to perform the same task ▪ Expresses the area of a rectangular object based on its length and width ▪ Expresses the cost of renting a car based on the distance driven and the per-kilometre cost ▪ Expresses the total profit from a sale based on the number of items sold and the price of each item ▪ Expresses the distance driven during a trip based on the average speed and the time taken

Categories of Actions	Examples of Actions
▪ Determining unknown values using algebraic models	▪ Determines the quantity of items purchased from the total purchase price and the unit price ▪ Determines the hourly rate from the weekly wage and the number of hours worked ▪ Adjusts a recipe to feed a given number of people ▪ Converts an amount of Canadian currency into another currency ▪ Calculates the volume of a storage tank ▪ Calculates the area of a surface to be painted ▪ Converts degrees Celsius into degrees Fahrenheit ▪ Determines the concentration of a product ▪ Calculates the density of a material

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Establishing relationships between quantities

Categories of Actions

- Interpreting algebraic models
- Producing algebraic models
- Determining unknown values using algebraic models

Operational Competencies

Thinks logically

- Infers relationships between quantities
- Deduces implicit relationships between quantities in an algebraic model
- Uses proportional reasoning
- Selects the appropriate formulas and operations to calculate the value of unknown variables
- Makes sure his/her conclusions are plausible and consistent

Communicates

- Accurately decodes symbols, notations and terms related to algebraic models
- Identifies explicit relationships between different quantities
- Checks his/her interpretation with other people
- Structures the message appropriately by using algebraic models
- Rigorously uses symbols, notations and terms related to algebraic models
- Defines the variables used, so as to make the message clear and unambiguous

Essential Knowledge

- Basic algebra
- Arithmetic
- Perimeter, area, volume
- Proportion

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
The situations in the class *Establishing relationships between quantities* involve interpreting and producing different algebraic models and using these models to determine the unknown values required to deal with real-life situations. Adult learners interpret simple algebraic models expressing relationships between quantities pertaining to different types of data (e.g. financial, scientific, measurements). To do this, they must accurately decode the symbols, notations and terms associated with algebraic models. In doing so, they recognize the meaning of the related constants, variables, exponents and coefficients. They identify the explicit relationships between different quantities in scientific and geometric formulas, and correctly deduce implicit relationships. This allows them to predict how another variable will be affected by a change in the value of a given variable or parameter in the equation. In particular, they correctly interpret the formulas for finding perimeter, area and volume. They check the plausibility and consistency of their conclusions by ensuring that the relationships they have identified reflect the principles, laws or properties with which they are familiar. If in doubt, they check their interpretation by consulting other people. Adult learners produce simple algebraic models, for example to represent the law of levers, the area of a rectangle or a weekly salary according to the number of hours worked. To do this, they correctly infer relationships between quantities in a set of similar cases. They use proportional reasoning to conclude that salaries vary according to the number of hours worked or that the time devoted to a task is inversely proportional to the number of employees involved. They rigorously use the symbols, notations and terms related to algebraic models. When communicating information involving relationships between quantities, they structure their message appropriately by using precise algebraic models. They accurately define the variables used, so as to ensure that their models are presented in a way that is clear and unambiguous for anyone examining them. Adult learners use simple algebraic models to calculate the unknown values required to address a real-life situation. In order to select the proper formula for determining the value of an unknown variable in a given situation, they compare that situation with other similar real-life situations. If they understand the chosen formula, they are able to correctly replace the variables with known values in order to obtain an equation with a single unknown. They correctly perform the necessary simplifications, algebraic manipulations and arithmetic operations on real numbers in order to accurately calculate the unknown value. They correctly apply the law of proportions (rule of three) to find the unknown value in a directly or inversely proportional relationship. They ensure that their calculations and manipulations are consistent, and that their results are plausible.

Evaluation Criteria

- Interprets algebraic models correctly
- Produces clear and unambiguous algebraic models
- Correctly determines unknown values

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* allows adult learners to make connections and draw conclusions when dealing with situations in the class *Establishing relationships between quantities*. It involves inferring relationships between quantities and making deductions based on algebraic models. Adult learners think logically when they infer relationships between quantities by observing a set of similar cases. For example, after observing a number of rectangles, they may conjecture that the perimeter is the sum of twice the base measurement and twice the height measurement. Similarly, after taking several trips in the car, they may conclude that the distance driven is the product of the average speed and the time taken. They use proportional reasoning to conclude that salaries vary according to the number of hours worked or that the time devoted to a task is inversely proportional to the number of employees involved. They look for examples to verify their conjecture concerning the relationships they are attempting to understand, or for counterexamples to clarify, adjust or refute the resulting equation.	Adult learners deduce implicit relationships between quantities by analyzing algebraic models. For example, using the formula A = b x h, they deduce that the base of a rectangle is inversely proportional to its height, provided the area remains unchanged. Among other things, this allows them to predict how another variable will be affected by a change in the value of a given variable or parameter in the equation. They make sure the relationships they have identified reflect the principles, laws and properties with which they are familiar. In order to select the formula for determining the value of an unknown variable in a real-life situation, they compare that situation with other similar situations and make deductions that will allow them to calculate the value of the unknown element. They then check the plausibility and consistency of their conclusions (e.g. calculations, inferred relationships, formulas selected).

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* allows adult learners to interpret and produce simple messages containing algebraic models when they deal with real-life situations related to the class *Establishing relationships between quantities*. It involves carefully decoding and using algebraic language.

When interpreting messages, adult learners accurately decode the symbols, notations and terms associated with algebraic models. In doing so, they recognize the meaning of the related constants, variables, exponents and coefficients. They identify the explicit relationships between different quantities in geometric formulas, especially those relating to perimeters, areas and volumes. For example, when they read the formula A = b x h, they are able to see that the area of a rectangle is the product of its base and height. Similarly, they are able to learn principles and laws from the related scientific formulas. They make sure they have correctly interpreted the information conveyed in messages containing algebraic models by consulting other people.

When producing messages, adult learners make appropriate use of algebraic language to represent relationships between quantities. They structure the message appropriately using precise algebraic models and accurately define the variables in question to ensure that the model is presented in a way that is clear and unambiguous for anyone examining it. For example, they may represent the law of levers, the area of a rectangle or a weekly salary according to the number of hours worked.

Essential Knowledge

All of the knowledge shown in the table below is compulsory since it is essential for dealing with many of the situations in the class *Establishing relationships between quantities*.

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations involving relationships between quantities. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed in italics to make it easier to identify adult learners' previously acquired knowledge.

The formulas and equations used by adult learners should be kept fairly simple and should represent relationships between quantities that learners will encounter in everyday situations. Furthermore, it should be possible to solve these formulas and equations using basic simplification and variable isolation techniques.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Basic algebra • Variable and unknown • Constant and coefficient • Term and similar terms • Degree of an equation • Pattern and invariant • Inverse operation • Equation • Writing a simple equation with variables in order to represent relationships common to several different cases • Solving equations using algebra (using a first-degree equation with one unknown, or simple, common formulas that can be expressed as an equation with only one unknown)	**Arithmetic** • Equality

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Basic algebra (cont'd)	
• Simplifying algebraic expressions (adding and subtracting similar terms, multiplying and dividing by a constant) • Replacing variables with known values in simple, common formulas to obtain equations with only one unknown • Testing a numerical value as a solution to an equation	
Arithmetic	
• Exponent • Exponential notation using exponent 2 and exponent 3 • Square root and cube root • Calculations using exponent 2 and exponent 3, and corresponding radicals • Order of operations (including radicals and exponents) • Solving sequences of arithmetic operations on rational numbers (including radicals and exponents)	• *Order of operations (the four operations and parentheses)* • *Solving sequences of arithmetic operations on rational numbers* • Making a mental estimate of the result of operations or sequences of operations on rational numbers • Representing relations using arithmetic models consisting of rational numbers • Positioning rational numbers on the number line
Perimeter, area and volume	**Perimeter, area and volume**
• Simple solids (cubes, cones, right prisms, right cylinders, right pyramids and spheres) • Using formulas for finding perimeter and area (circle, square, rectangle, parallelogram, triangle, rhombus, trapezoid)	• Classifying triangles and quadrilaterals • Circles • Perimeter and circumference

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Perimeter, area and volume (cont'd) • Using formulas for finding volume, lateral area and total area (cube, cone, right prism, right cylinder, right pyramid and sphere) • Unit of measure of volume • Estimating volume • Converting from one measurement to another within the international system (including area and volume measurements) **Proportions** • Proportion • Law of proportions (rule of three) • Using proportions to express proportional relations • Using the law of proportions (rule of three) to find the unknown value in a proportional relationship	**Perimeter, area and volume (cont'd)** • Area • Significant segments (side, base, height, diagonal, radius, diameter) • Units of measure of length, area and capacity • Measuring and estimating length, area and capacity • *Converting from one measurement to another within the international system (excluding area and volume measurements)* • Breaking down a complex figure into simple figures **Proportional relationships** • Ratio • Directly or inversely proportional relationships

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Curiosity
Adult learners with this attitude are careful about using mathematical language in accordance with codes and conventions, performing calculations or solving equations correctly, and ensuring that their results are plausible and accurate.	Adult learners with this attitude can improve their ability to identify relationships between quantities in everyday life and to devise algebraic models that accurately represent these relationships, with a view to better understanding them.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Different types of companies (e.g. landscape architects, car rental companies, hardware stores, electrical utilities, financial institutions) ▪ Science teachers	▪ Calculator ▪ Geometry set ▪ Measuring instruments (e.g. thermometer, balance, graduated cylinder) ▪ Algebraic tiles ▪ Software applications ▪ Internet ▪ Formulas ▪ Web sites

Contribution of the Subject Areas

The contribution of other subject areas, in particular knowledge related to the Social Sciences, Languages, and Mathematics, Science and Technology, is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences

Program of Study: *Consumer Habits*

- Consumer-related knowledge (e.g. unit price, taxes, discounts) may be required because some of the real-life situations examined in this course involve calculating costs.

Subject Area: Languages

Program of Study: *English, Language of Instruction*

- All of the situations in this course are likely to require adult learners to communicate orally and in writing. Consequently, a knowledge of the language of instruction is required throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- In some of the situations in this course, adult learners may be looking for formulas on the Internet, or using spreadsheets to calculate the possible values of a variable or to produce a graphic representation of a relationship.

Programs of Study: *Technology* and *Relationship With the Environment*

- Adult learners use scientific formulas relating to technology and environment. These formulas require knowledge of various principles and laws in these two subject areas. In some cases, knowledge of the law of levers, energy consumption, watercourse flow and so on may be required.

Program of Study: *Mathematics*

- In addition to the knowledge that is compulsory for the *Algebraic Modelling* course, working with complex real-life situations may require knowledge of mathematical content covered in other courses in the Common Core Basic Education Program. This will be the case, for instance, when drawing plans or using the Pythagorean theorem to find the unknown length of a segment.

Andragogical Context

The *Algebraic Modelling* course serves as a gateway to the world of algebra. Adult learners may be somewhat apprehensive about algebra, since they may feel that the use of letters in mathematics is both abstract and inaccessible. The teacher's role is to make them realize that equations are in fact a specific and rigorous way of formulating relationships between quantities—relationships with which they may already be familiar. To do this, the teacher draws on the real-life experiences of learners. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more they will help demystify algebra.

To ensure that new knowledge is built on the foundations of previously acquired knowledge, the teacher should start with real-life situations that have already been addressed using arithmetic, at least at the beginning of the course. Learners will therefore realize that they already use relationships between quantities in their financial calculations; these same relationships are now expressed algebraically. For example, learners are able to infer that the total price of a purchase is equal to the product of the unit price and the number of units purchased, plus the taxes. They can then examine other relationships between quantities, which can be easily expressed using algebraic models (e.g. the perimeter of a square, distance = speed x time). Once they are familiar with algebraic modelling of known relationships, they will be confident enough to continue their exploration of the subject by examining relationships they have not previously used, such as scientific formulas or certain geometric formulas that may be more difficult for the adults themselves to generalize.

Teachers should also remember that this course is designed to develop the operational competencies *Thinks logically* and *Communicates*. The development of these competencies allows adult learners to acquire cognitive and metacognitive strategies that can be adapted to almost every real-life situation, while requiring them to make proper use of their knowledge of algebra. Thus, learning should focus on the ability to construct and use algebraic knowledge in context, rather than on the complexities of algebra. For example, instead of focusing on the solution of equations with several terms, the teacher should ensure that learners are able to use equations or simple formulas in real-life situations when necessary. As a result, they should not only be able to use the geometric formulas that are compulsory in this course, but should also understand them and, where possible, be capable of inferring them. This course provides an excellent opportunity for learners to develop logical thinking in general, and logical inferences in particular. The formulas used are generalizations of relationships between quantities encountered in many real-life situations and cases. It will be much easier for learners to correctly use formulas in real-life situations if they are able to infer the relationships between the quantities in question, and then express them as equations with variables.

Lastly, given that algebraic models are generalizations that can be used to deal with many different real-life situations, the teacher may find it useful to devise learning situations that address several situations simultaneously. For example, the same formulas for area, perimeter and volume can be used in situations involving renovations, decorating, landscaping, maintenance, and so on. In other words, knowledge of these formulas can be acquired through a learning situation consisting of tasks that are relevant to more than one real-life situation.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Landscape Design

The real-life situation chosen for the class *Establishing relationships between quantities* involves the production of a landscape design. In the related learning situation, adult learners are asked to think of a landscape design that they would like to produce in the near future. They prepare the design, make a list of the alterations required (e.g. a rectangular flower bed, a circular trellis, a new garden table), draw a plan (or sketch) of the design, identify the necessary formulas (some of which they already know, and others that must be inferred) and perform the calculations required to determine material quantities and project costs.

The teacher begins by ensuring that adult learners are interested in this type of project. The learning situation can be changed, for example so that it involves designing a vegetable garden or any other outdoor project, if this would be of greater interest to some learners. Although each learner may be dealing with a different project, the steps in the process are the same, and learning will be enriched through teamwork (e.g. learners help one another with their respective projects).

In the first learning activity, adult learners prepare a sketch of their design, showing all the elements they wish to include. The sketch need not be to scale, but must indicate the shapes of the various elements. Next, adult learners list all the materials and items required for the design. After taking into account the teacher's questions, they realize that the sketch does not yet provide them with the information they need to calculate precise material quantities or project costs, although they may make estimates in this regard. They must also construct new knowledge, so as to avoid unpleasant surprises during the project. To do this, they must first identify the information they need to calculate material quantities and the related costs (e.g. surface area of flower beds, volume of soil required, the number of each different variety of plant, the length of trellis or fencing, the unit prices of each item).

During the next learning activity, adult learners become familiar with the algebraic representation of the relationships involved in this situation. They begin by verbally stating the area of a rectangular or square flower bed in terms of its dimensions. Once they have expressed the area in words, they replace each word by a letter or a symbol representing an operation or equality. They work in teams to compare their resulting algebraic models, and ask the teacher to check them. They then do the same for all the shapes in their plan, inferring geometric formulas (e.g. the perimeter of a polygon, the area of a square or rectangle, the volume of a cube or rectangular prism). They note the lengths, surface areas and shapes for which they are unable to infer formulas.

The teacher reviews the preceding learning activity with the whole class, asking the teams to share the formulas they inferred. One learner from each team is asked to explain a formula and show how it was devised. The teacher points out that inductive reasoning was used and then notes down the various lengths, areas and shapes for which learners were unable to devise formulas, indicating the objects with which they are associated. In some cases, the teacher can explain how to infer the missing formulas, for example by having

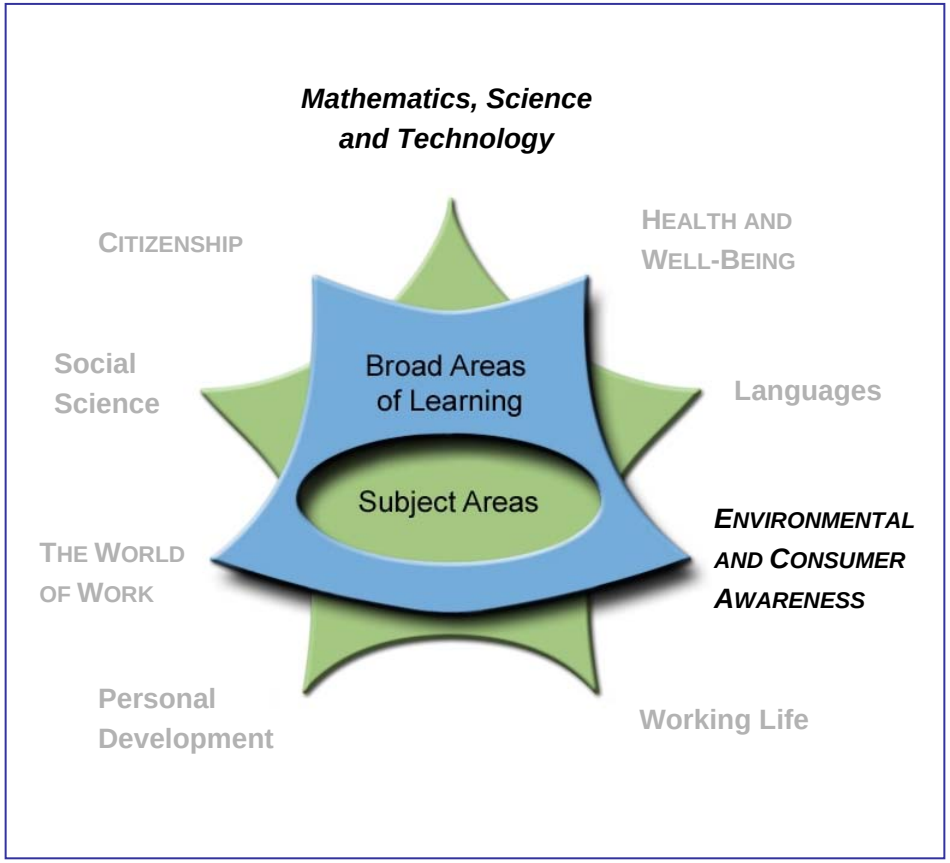
learners measure the circumference and diameter of several circles and conclude that the ratio is virtually always the same. Some learners may be justifiably proud when they realize that they have discovered the constant *Pi* for themselves. For other formulas (e.g. the area of a rhombus or the volume of a cylinder), the teacher can present a proof. It is not necessary for all the formulas to be inferred or proved, because in some cases, this may require knowledge that goes well beyond the scope of this course. Adult learners will nevertheless realize that geometric formulas did not appear magically, and will be able to understand them from the teacher's presentation.

In the subsequent learning activity, adult learners perform the algebraic manipulations and the calculations required to determine the length, area and volume measurements required for their projects. Because this is not the first learning activity in the *Algebraic Modelling* course, they should already be familiar with the techniques for replacing variables with known values and calculating unknown values. They work in teams to review their results, checking with the teacher if necessary. They then determine all the costs associated with their projects by first searching the Internet for the prices of the materials and elements used. They have already learned how to perform the required calculations, either in previous courses or in their everyday lives. On the other hand, they have not yet learned how to produce algebraic models of these relationships. The learning activities used earlier to infer geometric formulas are therefore repeated, this time in order to model the relationships involved in calculating the project costs.

To conclude the learning situation, learners hand their projects in to the teacher, who evaluates them in order to support each person's learning. The teacher then conducts a class discussion during which adults are asked to name other real-life situations for which geometric formulas would be essential.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Establishing relationships between quantities	
Learning Situation	
Landscape Design	
Categories of Actions	
▪ Interpreting algebraic models ▪ Producing algebraic models ▪ Determining unknown values using algebraic models	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	▪ Simple solids ▪ Using formulas for finding perimeter and area ▪ Using formulas for finding volume, lateral area and total area ▪ Units of measure of length, area and capacity ▪ Measuring and estimating length, area and capacity ▪ Units of measure of volume ▪ Estimating volume ▪ Replacing variables with known values in simple, common formulas to obtain equations with only one unknown ▪ Exponential notation using exponent 2 and exponent 3 ▪ Square root and cube root ▪ Writing a simple equation with variables in order to represent



	relationships common to several different cases ▪ Simplifying algebraic expressions ▪ Solving equations using algebra ▪ Testing a numerical value as a solution to an equation

Complementary Resources

▪ Geometry set ▪ Measuring instruments	▪ Calculator

Course

Geometric Representations and Transformations

MTH-2102-3

Secondary Cycle One

"As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality."

Einstein

Presentation of the Course *Geometric Representations and Transformations*

The course *Geometric Representations and Transformations* course is designed to help adults deal competently with real-life situations in which they must solve problems involving representations of the physical environment and its transformations.

In this way, they will learn to use plans, the geometry of transformations and measurements to better understand and represent the world around them and the transformations that occur in it.

This course builds on the knowledge acquired in previous courses. For example, adult learners are already able to convert from one measurement to another within the international system, and to use both the law of proportions (rule of three) and the unit-rate method. They are also familiar with fractional notation in certain contexts and with the representation of geometric shapes. In this course, they will explore different measurement systems, conversion of units from one system into units from another, and scale plans. They will also consolidate their understanding of fractions by using them to represent the scale of a plan, a scale factor or a portion of an object, and will continue their study of geometry by examining solids broken down into simple solids, geometric transformations and the properties of congruent figures and similar figures in everyday situations

By the end of the course, learners will be able to make appropriate use of geometric and arithmetic language. They will also be able to make inferences and deductions pertaining to geometric representations and transformations. They will have a better perception of their physical environment and its transformations, and will be better able to produce appropriate descriptions and illustrations in this regard. Lastly, they will also be able to identify the measures and ratios needed to deal with real-life situations.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Representing the physical environment and its transformations*.

The ability to represent the physical environment and its transformations is required for many real-life situations. Adult learners form perceptions of the physical environment and its transformations through direct observation or by interpreting verbal descriptions or illustrations. In both cases, the pictures they form in their minds are based on geometric models. In addition, adult learners are often required to produce representations of the physical environment and its transformations, which may take the form of an oral or written description or an illustration. Representations may pertain to the physical environment itself (e.g. an object, a place) or to a transformation that takes place in it (e.g. movement, displacement, alteration). However, this class includes only situations involving physical realities that adult learners can easily understand as well as basic geometric concepts.

Many of the real-life situations in this class pertain to representations of the physical environment (e.g. producing a mechanical component shown in a diagram, identifying a location in a building using an evacuation plan, travelling using a map, describing an object or a portion of an object to a third person). Other situations relate more to transformations of the physical environment and their representations. For example, adult learners who organize or renovate a room use plans and units of measure. Learners who adapt a recipe to feed a certain number of people must perform calculations to adjust the ingredient quantities. Isometries and dilatations must also be used to illustrate transformations that occur on a manufacturing production line, the operation of an optical device or the movement of objects during the rearrangement of a room. Adult learners may also refer to descriptions or illustrations of movements when appreciating works art or learning how to use a tool (e.g. lever, hammer).

Class of Situations	Examples of Real-Life Situations
Representing the physical environment and its transformations	▪ Learning about the mechanics of a tool ▪ Renovating an apartment ▪ Rearranging a room ▪ Assembling a piece of furniture ▪ Producing technical drawings ▪ Learning how to use optical equipment ▪ Manipulating a digital image

Class of Situations	Examples of Real-Life Situations
	▪ Building a shed ▪ Sewing ▪ Landscaping ▪ Studying motion in a production line ▪ Travelling ▪ Describing movement during a physical activity ▪ Finding a location in a building ▪ Planning meals ▪ Enjoying works of art

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Forming perceptions of the physical environment and its transformations	▪ Visualizes the movements required to use a tool ▪ Determines the movement applicable to a section of a piece of furniture during its assembly ▪ Identifies pattern repetition in a painting ▪ Follows a plan when building a shed ▪ Observes similarities between two objects ▪ Notes symmetries when cutting pieces of material to make clothing ▪ Visualizes the proposed movements in a physical exercise ▪ Finds his/her location in a building based on a scale plan
▪ Producing representations of the physical environment and its transformations	▪ Draws a diagram of a mechanical component ▪ Uses an isometry to represent the movement of an object ▪ Draws up a plan for renovating part of his/her home ▪ Designs a pattern for a ceramic tile ▪ Draws the mirror image of an object ▪ Alters a digital image to change the size of a picture ▪ Describes leg movements in a choreography

Categories of Actions	Examples of Actions
▪ Determining measurements and ratios	▪ Calculates the actual measurement of one side of a plot of land represented in a plan ▪ Estimates what portion of a plot of land will be occupied by a vegetable garden ▪ Calculates the volume of his/her swimming pool ▪ Converts the measurements in a recipe ▪ Performs calculations related to a photographic enlargement ▪ Determines the measurement of a microscopic object by enlarging it under a microscope ▪ Compares the dimensions of two objects indicated in different units of measure ▪ Calculates the dimensions of the cake pan needed when a recipe is doubled ▪ Adjusts the dimensions of a pattern to make a larger garment

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Representing the physical environment and its transformations

Categories of Actions

- Forming perceptions of the physical environment and its transformations
- Producing representations of the physical environment and its transformations
- Determining measurements and ratios

Operational Competencies

Thinks logically

- Infers the properties of similar and congruent figures
- Deduces implicit information in representations of the physical environment
- Anticipates situations in which it is appropriate to use geometric transformations or plans
- Deduces the transformations that take place in the physical environment
- Selects the instrument required to take accurate measurements
- Makes sure his/her conclusions are plausible and consistent

Communicates

- Accurately decodes symbols, notations and terms pertaining to arithmetic and geometric language
- Identifies shapes, quantities, alterations and movements
- Checks his/her interpretation with other people
- Anticipates situations in which it is appropriate to use geometric transformations or plans
- Structures the message appropriately by using precise mathematical models
- Rigorously uses the symbols, notations and terms pertaining to arithmetic and geometric language
- Makes sure the message is clear

Essential Knowledge

- Plans
- Geometry of transformations
- Plane figures
- Solids
- Measurements
- Arithmetic
- Proportional relationship

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
The real-life situations in the class *Representing the physical environment and its transformations* involve perceiving and producing geometric representations of the physical environment and its transformations, as well as determining the measurements and ratios needed to deal with these situations. Adult learners form perceptions of the physical environment and its transformations through direct observation, or from descriptions or illustrations. They may, for example, understand the instructions for using a tool, form a precise mental image of an observed motion, follow a layout plan or anticipate the result of a transformation that occurs in the physical environment, such as the position of an object that has undergone a rotation or translation. To do this, they must accurately decode the symbols, notations and terms relating to arithmetic and geometric language. They use their inferences with respect to the properties of similar or congruent figures in order to deduce implicit information in the representations of the physical environment and its transformations (e.g. unknown angle or segment measurements, partially represented geometric figures). They may also deduce transformations that take place in the physical environment, such as isometries that result in an object being moved from one position to another. When representations of the physical environment or its transformations are conveyed to them, adult learners identify shapes, quantities (measurements and ratios), alterations and movements. If in doubt, they check their interpretation by consulting other people. Lastly, they check the plausibility and consistency of their conclusions to ensure that the information they have deduced is a true reflection of reality. Adult learners produce representations of the physical environment and its transformations in order to draw up renovation plans, to describe the path of light in an optical device or to describe how a tool works. To do this, they make appropriate use of the symbols, notations and terms pertaining to arithmetic and geometric language. Because they are able to anticipate situations in which it is appropriate to use geometric transformations and plans, they select the geometric figures and transformations that are best suited to the situation they wish to describe or illustrate, and construct them using appropriate techniques. When conveying their representations, they structure their message appropriately by using precise mathematical models (e.g. scale plans, illustrations of isometries, arithmetic expressions). They also make sure their descriptions and illustrations are clear, so that other people are able to clearly perceive the physical environment and its transformations. Adult learners determine measurements and ratios for a number of reasons, whether it is to produce a representation, to form perceptions of the physical environment and its transformations, or to develop a better understanding of the real-life situation concerned. They select appropriate arithmetic operations to convert measurements from one system to another, or to determine unknown measurements (e.g. angles,

segments, volumes), scale factors or similarity ratios, or the scale of a plan. In particular, they determine the actual measurement corresponding to a segment on a scale plan, or conversely, take an actual measurement and determine the length of the corresponding segment on a scale plan. The results of their calculations are accurate. Adult learners also deduce measurements based on the properties of congruent and similar figures. Thanks to their understanding of units of measure, they are able to estimate measurements in the physical environment and select the instrument required to obtain precise measurements of different kinds (e.g. mass, length, capacity, angle). They check the plausibility and consistency of their conclusions (e.g. estimates, measurements) by referring among other things to their previous observations.

Evaluation Criteria

- Forms an appropriate and realistic perception of the physical environment and its transformations
- Produces clear and appropriate representations of the physical environment and its transformations
- Accurately determines measurements and ratios

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically* and *Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners to make connections and draw conclusions when dealing with real-life situations in the class *Representing the physical environment and its transformations*. It involves making deductions and inferences pertaining to geometric representations and transformations. Adult learners think logically when they infer the properties of similar or congruent figures after observing them in different contexts. For example, they may infer that the interior angle measurements of similar figures are identical, or that the original dimensions of a figure remain unchanged after it has undergone a rotation. They look for examples to verify their conjectures, or for counterexamples to clarify, adjust or refute them. In this way, they are able to make connections between geometric transformations, plans and transformations in the physical environment, and are therefore more easily able to determine when it is appropriate to use geometric transformations and plans to represent real-life situations.	Adult learners deduce implicit information from representations of the physical environment and its transformations. For example, when observing or producing a drawing or plan, they are able to deduce that two figures are similar or congruent, and then deduce any unknown angle or segment measurements. They can also deduce transformations that occur in the environment, such as isometries that result in an object being moved from one position to another. Conversely, they can predict the results of a transformation in the physical environment, such as the position of an object that has undergone a rotation or translation. Thanks to their understanding of units of measure, they are able to estimate certain measurements in the physical environment and select the instrument required to take accurate measurements. They then check the plausibility and consistency of their conclusions (e.g. estimates, measurements) by referring among other things to their previous observations.

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* helps adult learners to interpret and produce simple messages containing geometric representations or transformations when they deal with real-life situations related to the class *Representing the physical environment and its transformations*. It involves carefully decoding and using the mathematical language associated with representations.

When interpreting a message, adult learners accurately decode the symbols, notations and terms pertaining to the various measurement systems, geometric figures and transformations, plans and arithmetic. Regardless of whether the message is delivered orally or in writing, adult learners are able to form clear perceptions of the transformation or environment that is represented by identifying shapes, quantities, movements and alterations. This helps them to better understand instructions for using a tool, how to perform a movement during a physical exercise, the layout of a room, and so on. When in doubt, they make sure they have properly interpreted the geometric representation of the environment and its transformations contained in the message by consulting with other people.

When producing a message, adult learners convey their mental representations of the physical environment and its transformations. They structure the message appropriately using precise mathematical models (e.g. scale plans, illustrations of isometries, arithmetic expressions). They make appropriate use of the symbols, notations and terms pertaining to arithmetic and geometric language, correctly associating the symbols and notations with the information they wish to convey in their representations. They use the geometric figures and transformations that most closely reflect the situation or item they wish to describe or illustrate. They may, for example, use isometries to illustrate object displacement, image formation or pattern repetition in a visual representation. Where appropriate, they clearly identify the scale of a plan, the centre of rotation, the line of reflection or the translation vector of a figure. In this way, learners are able to describe an object, convey measurements or produce a scale layout plan. Lastly, they ensure that their message is clear and appropriate for both the situation and the audience.

Essential Knowledge

All of the knowledge shown in the table below is compulsory since it is essential for dealing with a number of situations in the class *Representing the physical environment and its transformations.*

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve representing the physical environment and its transformations. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed in italics to make it easier to identify learners' previously acquired knowledge.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Plans	**Plans**
• Ways of representing a scale on a plan	• *Scale on a map* • Alphanumerical coordinate system (on road maps and geographical maps)
• Determining the actual measurement of a length shown on a plan • Reading scale plans • Producing scale plans	• *Determining an actual distance from a map* • *Reading road maps and geographical maps*
Geometry of transformations	**Plane figures**
• Isometry • Symmetry • Congruent figures and similar figures • Properties of congruent and similar figures • Geometric transformations (dilatation, translation, reflection and rotation)	• Classifying triangles and quadrilaterals • Properties of simple figures (regular convex polygons and different types of triangles and quadrilaterals)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Geometry of transformations (cont'd) • Constructing the image of a simple geometric figure under a dilatation or an isometry • Calculating the scale factor representing the ratio between the segment lengths of a figure and its image • Calculating the similarity ratio of two similar figures • Determining an angle or segment measurement in a figure based on the given measurements of a similar or congruent figure	**Plane figures (cont'd)** • Constructing simple figures (circles and polygons) • Breaking down a complex figure into simple figures • Using the formulas for perimeter and area (circle, square, rectangle, parallelogram, triangle, rhombus and trapezoid)
Solids • Breaking down a complex solid into simple solids • Possible nets of solids (cubes, right prisms, right cylinders)	**Solids** • Simple solids (cube, cone, right prism, right cylinder, right pyramid, sphere) • Using the formulas for volume, lateral area and total area (cube, cone, right prism, right cylinder, right pyramid, sphere)
Measurements • Units of measure of length, angles, area, capacity, volume, temperature and mass • Measuring and estimating length, angle size, area, capacity, mass and temperature • Estimating volume • Converting measurements from one system to another (e.g. centimetres to inches or cups to litres) • Converting from kilograms to pounds, and vice-versa	**Measurements** (international system only) • *Units of measure of length, angles, area, capacity, volume, temperature and mass* • *Measuring and estimating length, angle size, area, capacity, mass and temperature* • *Estimating volume* • *Converting from one measurement to another within the international system*

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Arithmetic • Positioning rational numbers on the number line (to use measuring instruments in the Imperial system)	**Arithmetic** • *Positioning decimals on the number line (including negative numbers)* • Square root and cube root • Exponential notation using exponent 2 and exponent 3 • Comparing rational numbers • Representing rational numbers (using the base 10 number system and visual aids: blocks, illustrations, etc.) • Solving sequences of arithmetic operations on rational numbers • Making a mental estimate of the results of operations or sequences of operations on rational numbers • Representing relations using arithmetic models consisting of rational numbers **Proportional relationship** • Directly and inversely proportional relationships • Finding the unknown value in a proportional relationship

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Curiosity
Adult learners with this attitude are accurate in taking measurements and producing representations of the physical environment and its transformations. They are able to estimate measurements, perform calculations correctly and check the plausibility of their results.	Adult learners with this attitude carefully observe the physical environment, its transformations or their representations in order to identify geometric figures and transformations and seek the information they need to improve their mental representations.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Various kinds of companies (e.g. landscaping, construction, decorating) ▪ Museums ▪ Optical specialists	▪ Calculator ▪ Geometry instruments ▪ Sewing patterns ▪ Balance ▪ Instruments for measuring capacity (e.g. cup, spoon) ▪ Set of blocks to represent fractions ▪ Home renovation and decorating magazines ▪ Furniture assembly instructions ▪ Dynamic geometry software ▪ Image processing software ▪ Recipe books ▪ Works of art (e.g. paintings, sculptures) ▪ Optical instruments (e.g. mirror, microscope, telescope, binoculars) ▪ Cameras ▪ Plans (e.g. evacuation plans, layout plans) ▪ Road maps and geographical maps

Contribution of the Subject Areas

The contribution of other subject areas, in particular knowledge related to Languages and Mathematics, Science and Technology, is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Languages

Program of Study: *English, Language of Instruction*

- In many of the real-life situations addressed by this course, adult learners may be required to produce and interpret written and verbal descriptions. Consequently, a knowledge of the language of instruction will often be required throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- In some of the real-life situations addressed by this course, adult learners may need some knowledge of computers, for example when they use dynamic geometry software to view a layout, image processing software to enlarge pictures based on similarity ratios, or the Web to search for information on construction materials and plans.

Program of Study: *Technology*

- To deal with real-life situations involving construction, renovation, studies of production lines, the use of optical instruments and technical drawing, adult learners use concepts from the *Technology* program (e.g. types of materials, measuring devices, the characteristics of motion, mechanisms that transmit motion or bring about a change in motion, techniques for preparing schematic diagrams or construction drawings).

Program of Study: *Relationship With the Environment*

- When preparing a landscape design, adult learners may need to explore such matters as climate, survival conditions and plant species. Similarly, when describing their surroundings, they may need to refer to the different features of elements from the natural environment.

Program of Study: *Mathematics*

- In addition to the knowledge that is compulsory for the *Geometric Representations and Transformations* course, working with some real-life situations may require knowledge of mathematical content covered in other courses in the Common Core Basic Education Program. This is the case, for instance, when producing representations of three-dimensional figures or using the Pythagorean theorem to find the unknown length of a segment.

Andragogical Context

The *Geometric Representations and Transformations* course allows adult learners to deal with numerous everyday situations ranging from descriptions of the movement of objects to precise illustrations of layout plans. Adult learners will realize that what they have learned has improved their perception of the physical environment and its transformations, allowing them to produce clearer, more accurate representations in this regard. It is recommended that real objects be used in the classroom, so that adults are able to base their work on elements that are familiar to them.

Although the course focuses on geometry, it also builds on the arithmetic knowledge acquired in previous courses and in everyday life. If adult learners do not have the prerequisite knowledge they need (shown in the right-hand column of the Essential Knowledge table), the teacher will have to set aside time and assign simpler learning situations to allow them to construct this knowledge. In particular, learners will probably not be completely comfortable with fractional notation, even though it has been used in previous courses. If they are to deal with situations in the class *Representing the physical environment and its transformations*, they will need to consolidate their knowledge of the different types of ratios and the way they are expressed in fractional notation. They should be able to use this knowledge to represent scale factors, similarity ratios and portions of objects. They may also use it to indicate and calculate measurements in the Imperial system or portions of objects that provide a better description of the physical environment. This course therefore provides an excellent opportunity to ensure that adult learners are comfortable with fractional notation and the four operations on simple and improper fractions as well as mixed numbers.

Since the development of logical reasoning is at the heart of this course, the teacher should foster the ability of adult learners to infer the properties of similar or congruent figures. Learners will find it easier to make the required deductions in the case of unknown measurements in figures or objects if they themselves have inferred the properties of these figures, which serve as the basis for finding these measurements. If emphasis is placed on the meaning of geometric transformations rather than on the techniques for constructing these transformations, adults will also be able to deduce the transformations required to move an object from one position to another.

The ability to communicate should also play an important role in this course. Adult learners must be able to use the correct terms and mathematical models to illustrate or describe the physical environment, pattern repetitions, object movements, alterations to photographs and so on. In particular, the course should focus on the ability to understand and produce plans in accordance with the conventions of mathematical language, since this knowledge is essential in many real-life situations. Plans can be used to reinforce knowledge of other concepts covered in this course, such as proportional relationships and similarity.

The teacher draws on the real-life experience of learners in order to present them with plausible learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will

retain. Since some of the essential knowledge in this course is difficult to apply in everyday life (e.g. nets of solids, dilatations), the teacher should refer to various trades and products of technical work (e.g. technical drawing, architecture, mosaics, photography, optometry, component design and manufacturing). These fields are likely to be of interest to some of the learners in this course and are therefore an excellent means of placing this knowledge in context.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Rearranging a Room

The real-life situation chosen for the class *Representing the physical environment and its transformations* involves rearranging a room because of a change in the adult learner's life (e.g. departure of a roommate, birth of a child, organization of a home office, purchase of new furniture). In the related learning situation, learners are asked to select a location that could be rearranged (e.g. a bedroom, living room, classroom). They then produce a scale plan of the room and its furniture, and accurately describe the changes they want to make, using isometries.

The first step is to select the room. Adult learners then produce the scale plan of the room and furniture. This allows them to consolidate their knowledge of plans, which have already been studied in this course. They then take the necessary measurements and draw a precise plan, clearly showing the scale. The teacher decides on the duration of this learning activity in light of the work to be done at home (i.e. taking measurements).

The next learning activity takes place in the classroom. The teacher moves an object around, asking adult learners to describe each movement and explaining the concepts related to isometry (reflection, rotation and translation). He/she then asks learners to associate isometric transformations with examples from everyday life (e.g. the movement of the hands on a clock, rotation of a globe, pressing the keys of a computer keyboard) in order to check their comprehension. Working alone, each learner can look at these concepts in more depth by answering a set of questions on the association of movements with isometries.

Adult learners then decide on the changes they wish to make to the positioning of the furniture in their room. The teacher asks them to close their eyes and visualize these changes. By doing this, they anticipate the results of moving the furniture around and take into account any constraints such as the location of windows and the aesthetic effect. They then deduce the isometries that correspond to these changes and describe them in writing. They must also ensure that their description refers to at least one translation and one rotation (reflections are not relevant in this case).

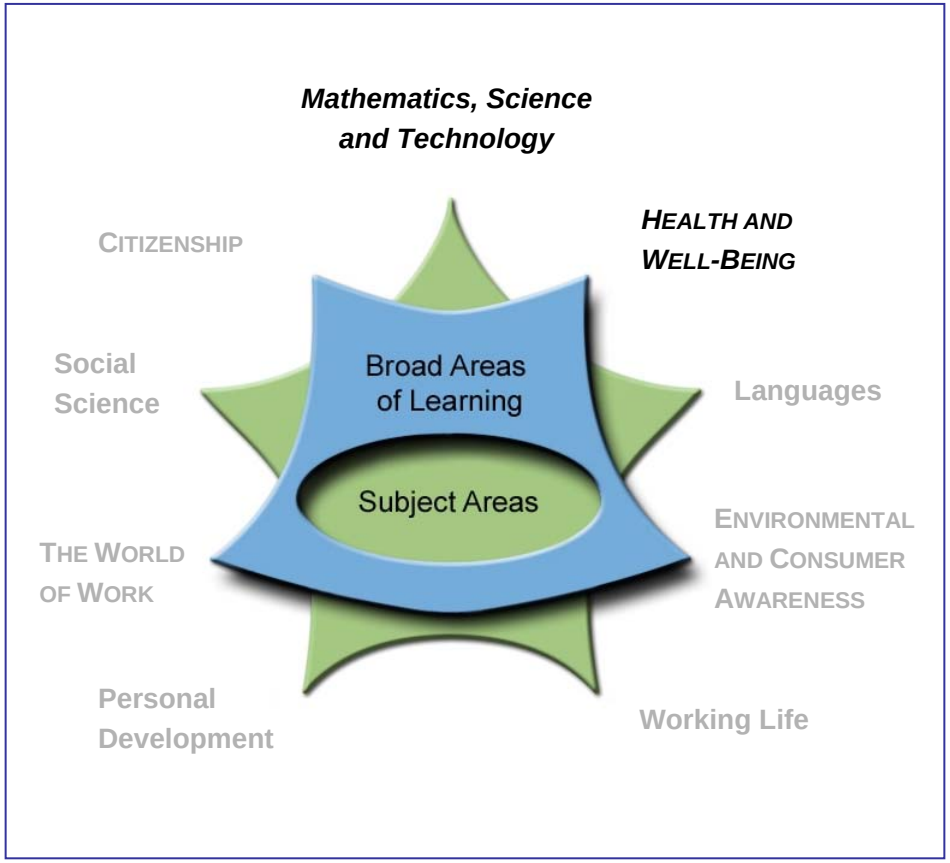
Addressing the whole class, the teacher demonstrates the exact techniques used to construct isometries. Learners perform a number of isometric constructions to ensure that they have understood these techniques, and then apply them to their existing plan by constructing two of the isometries they have determined (one rotation and one translation).

At the end of this learning activity, adult learners form teams of two and exchange their descriptions with their partner. Each learner then makes a drawing based on his/her partner's description. The teacher reminds them of the importance of forming a clear mental picture of what they want to illustrate before beginning to draw. Partners then compare their written descriptions with the drawings, and change either the text or the drawing, as necessary, to ensure that they correspond.

To conclude the learning situation, the teacher hands out a self-evaluation questionnaire to make sure that learners used the appropriate mathematical language (e.g. accurate measurements, centre of rotation and scale clearly indicated) when producing their plans, texts and isometries.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Representing the physical environment and its transformations	
Learning Situation	
Rearranging a Room	
Categories of Actions	
▪ Forming perceptions of the physical environment and its transformations ▪ Producing representations of the physical environment and its transformations ▪ Determining measurements and ratios	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	▪ Scale ▪ Ways of representing a scale on a plan ▪ Producing scale plans ▪ Isometry ▪ Geometric transformations ▪ Constructing the image of a simple geometric figure under an isometry ▪ Units of measure of length and angles ▪ Measuring and estimating length and angle size
Complementary Resources	
▪ Geometry instruments ▪ Home renovation and decorating magazines	▪ Calculator



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