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MATHEMATICS PROGRAM

PRESECONDARY LEVEL ADULT EDUCATION

DECEMBER 2001

Québec

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DECEMBER 2001

Direction de la formation générale des adultes
Service de l'évaluation des apprentissages

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Project Leaders at the Direction de la formation générale des adultes (DFGA)
Pierrette Marcotte (since July 1, 1995)
Diane Grimard (until June 30, 1995)
Marc Leduc, Coordinator
Alain Mercier, Director

Production Supervisor
Manon Dupont, Commission scolaire du Sault-Saint-Louis

Production Coordinator for the Preliminary Version
Lise Pouliot, Commission scolaire de Châteauguay

Production Coordinator for the Final Version
Pierrette Marcotte, DFGA

Program Validation
Manon Dupont and the team of teachers from the Centre Clément,
Commission scolaire du Sault-Saint-Louis

Lorraine Meunier, Commission scolaire des Laurentides

Martine Poulin, Commission des écoles catholiques de Québec

Danielle Pouliot, Commission scolaire catholique de Sherbrooke

Members of the mathematics advisory committee:
Régina Lavoie, Commission scolaire des Manoirs
Lucette Plamondon, Commission scolaire de Trois-Rivières
Marie-Reine Rouillard, Commission scolaire Memphrémagog
Louise Beaubien, Commission scolaire Beauport

Translation
Direction de la production en langue anglaise

English Version Consultant
Russel Grocock

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1 List of Courses

The presecondary-level mathematics program for adults consists of seven courses.

Course 1 - Natural Numbers: Numeration and Operations

Course 2 - Measurement: Length, Area, Volume, Capacity, Mass, Time And Temperature

Course 3 - Order of Operations and Problem Solving

Course 4 - Basic Concepts Related to Simple Fractions

Course 5 - Basic Concepts Related to Decimal Numbers and Percents

Course 6 - Prealgebra

Course 7 - Representing the Sets $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$ and their Subsets

These courses replace those that made up the previous program entitled *Functional Arithmetic, Guide for Administrators and Instructors, Programme Document, GAB 201 to GAB 207, Preliminary Edition,1991 (38-2473 A)*.

2 Target Group of Students

The courses listed above are designed not only for students at the presecondary level, but also for students who need to bring their knowledge and skills up to date so they can begin or continue studying secondary school mathematics. The former take all the courses in this program, while the latter take only those courses that meet their specific needs.

3 Structure of the Program

3.1 A set of presecondary-level courses

Although students at the presecondary level should take the courses in the order in which they are listed in the program, other course sequences are possible. The table entitled ***Relationship Between Presecondary-Level Courses*** can be used to determine alternative course sequences.

It should be noted, however, that courses 6 and 7 are meant for students who intend to register for courses in Cycle One of secondary school. If students do not intend to go on to secondary-level mathematics, they can stop after successfully completing the first five courses.

Relationship Between Presecondary-Level Courses

Presecondary-Level Courses		Prerequisites
Course 1 -	Natural Numbers: Numeration and Operations	Step 2 of the mathematics component of literacy training
Course 2 -	Measurement: Length, Area, Volume, Capacity, Mass, Time and Temperature	Course 1
Course 3 -	Order of Operations and Problem Solving	Courses 1 and 2
Course 4 -	Basic Concepts Related to Simple Fractions	Courses 1 and 3
Course 5 -	Basic Concepts Related to Decimal Numbers and Percents	Courses 1, 2, 3 and 4
Course 6 -	Prealgebra	Course 1
Course 7 -	Representing the Sets $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$ and their Subsets	Courses 1, 4 and 5

The previous table shows that:

- course 1 (*Natural Numbers*) is a prerequisite for all the other courses;
- the knowledge acquired in course 2 (*Measurement*) is used in courses 3 and 5 to solve problems involving units of measure;
- the problem-solving strategies developed in course 3 are used in courses 4 and 5;
- course 5 (*Basic Concepts Related to Decimal Numbers and Percents*) is based on topics covered in courses 1, 2, 3 and 4;
- students may take course 6 (*Prealgebra*) at any time once they have successfully completed course 1; course 6 is not a prerequisite for any other course in this program;
- course 7 (*Representing the Sets $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$ and Their Subsets*) covers the sets of numbers studied in courses 1, 4 and 5.

3.2 A bank of courses providing refresher or remedial education

In addition to meeting the needs of students who wish to complete presecondary-level mathematics, this program caters to the specific needs of certain students in Cycle One of secondary school by offering a bank of courses that introduce or review concepts required for high school mathematics. To that end, the program has been divided into a greater number of shorter courses rather than a smaller number of longer courses. Arranging the courses in this way addresses the main difficulties encountered by students in Cycle One of secondary school mathematics. As a result, students who experience a problem during Cycle One of secondary school can go back and take a relevant presecondary-level course or a certain portion of that course without devoting an inordinate amount of time to remedial instruction. Furthermore, the placement test administered when students reach the secondary level can be used to determine the presecondary-level course or courses that meet each student's needs.

The following table shows the relationship between the courses in Cycle One of secondary school and presecondary-level courses. More specifically, it indicates which presecondary-level course should be used to help students

with specific problems they may encounter in each of the courses in Secondary Cycle One.

Relationship Between the Courses in Secondary Cycle One and Presecondary-Level Courses

Course in Cycle One of Secondary School	Problem Areas: Topics to Be Reviewed or Introduced	Presecondary-Level Course
The Four Operations on Integers MTH-1005-2 (GSM 211)	• Numeration and operations in $\mathbb{N}$	Course 1
	• Problem solving	Course 3
	• Representing $\mathbb{Z}$ and its subsets	Course 7
The Four Operations on Fractions MTH-1006-2 (GSM 212)	• Fraction concepts	Course 4
	• Problem solving	Course 3
	• Representing $\mathbb{Q}$ and its subsets on the number line	Course 7
Decimals and Percent MTH-1007-2 (GSM 213)	• Basic concepts related to positive decimal numbers and percents	Course 5
	• Problem solving	Course 3
	• Representing $\mathbb{Q}$ and its subsets	Course 7
Equations and Inequalities I MTH-2006-2 (GSM 221)	• Prealgebra	Course 6
	• Problem solving	Course 3
	• Representing sets of numbers and number line	Course 7
Geometry II (Perimeter, Area and Volume) MTH-3002-2 (GSM 232)	• Concepts of perimeter, area and volume, and converting units of measure	Course 2
	• Problem solving	Course 3

4 Correspondence Between New and Old Presecondary-Level Courses

The related content of the courses in the old presecondary-level mathematics program (*Functional Arithmetic, GAB 201 to GAB 207*) and of course GSM 201 is included in this program. However, this content is now divided up differently and involves new constraints. These changes were made to ensure that these courses could be more easily used in refresher education.

The content of the old and new programs can be compared by examining the table entitled ***Relationship Between New and Old Presecondary-Level Courses***. The following points should be noted:

- The content of the new courses is distributed differently from that of the GAB series of courses.
- Course GSM 201 has been divided into two courses: course 1 covers numeration and operations, while course 3 focuses exclusively on problem solving.
- Courses 6 and 7 cover concepts that had never been studied at this level. These concepts have been defined according to the needs of students who register for Secondary Cycle One courses.
- The content of course GAB 207 (*Functional Arithmetic with the Help of a Calculator*) is not covered in any of the new courses.

Relationship Between New and Old Presecondary-Level Courses

New Courses		Old Courses	
Course 1 Natural Numbers: Numeration and Operations	→	GSM 201	Objectives 1 to 6
Course 2 Measurement: Length, Area, Volume, Capacity, Mass, Time and Temperature	→	GAB 204 GAB 205	Objectives 1, 3b, 3d and 4c
Course 3 Order of Operations and Problem Solving	→ →	GSM 201 Or GAB 203 GAB 206	Objectives 7 to 11 Objective 1 Objectives 2 to 8
Course 4 Basic Concepts Related to Simple Fractions	→	GAB 201	
Course 5 Basic Concepts Related to Decimal Numbers and Percents	→	GAB 202 GAB 203 GAB 206	 Objective 2 Objective 1
Course 6 Prealgebra	→	None	
Course 7 Representing the Sets $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$ and Their Subsets	→	None	
None	→	GAB 207	

5 Guiding Principles

The courses in the presecondary-level mathematics program are based on the three guiding principles outlined in the secondary-level mathematics program for adults. These principles are listed below.

- Ensure that adults acquire that mathematical knowledge they will need for everyday activities, jobs or job training, or admission to secondary-level programs.
- Ensure that adults have access to recognized, high-quality mathematical training.
- Regard adults as the prime architects of their own education by recognizing their past scholastic and experiential achievements and ensuring that they are able to learn at their own pace.

6 Goals

The three guiding principles listed above underlie the following five goals:

- To enable adults to master the basic mathematical concepts and types of computations they will need for secondary school mathematics.
- To help adults learn how to use mathematics in their everyday life.
- To help adults develop efficient work methods that will enable them to organize information, structure their thoughts and sharpen their critical sense.
- To encourage adults to develop positive attitudes towards mathematics and its applications.
- To help adults become more confident in their ability to use mathematics to solve everyday problems.

7 Objectives

7.1 General objectives

Each course has its own general objective. Furthermore, because the courses are interrelated, the material associated with each general objective is studied in greater depth in subsequent courses.

The general objectives are listed below.

1. To expand and apply one's knowledge of numeration and operations involving natural numbers and to master related computational algorithms.
2. To expand and apply one's knowledge about measurements of length, area, volume, capacity, mass, time and temperature.
3. To use different problem-solving strategies.
4. To understand the concepts of fractions, improper fractions and mixed numbers, and to use related computational algorithms.
5. To understand the concepts of decimal numbers and percents, and to apply related computational algorithms.
6. To become familiar with algebraic language and to apply the basic rules of algebra.
7. To understand and use set notation and the different ways of representing sets.

7.2 Intermediate and terminal objectives

Each course has a set of terminal objectives and intermediate objectives. The skills to be acquired are defined with the same degree of precision by these two types of objectives. The objectives are listed in a logical order reflecting the nature of the subject matter in question, with the terminal objectives coming after the related intermediate objectives.

The terminal objectives describe the skill level the students are expected to have achieved by the end of the course. The terminal objectives are in boldface type and their respective numbers are underlined. Furthermore,

there are specifications and constraints associated with some of the terminal or intermediate objectives.

8 Learning Materials

8.1 Basic materials

The information in this section should be kept in mind in designing or choosing learning materials for presecondary-level mathematics courses.

The materials should:

- reflect the way in which the subject matter is divided up among the various courses.
- cover all the subject matter in a course;
- be written in clear, concise language adapted to the students' reading and comprehension level;
- be consistent with the learning process;
- consist of learning sequences arranged in such a way that the knowledge acquired during one sequence can be used in the next sequence.

More specifically, the materials should, among other things, provide:

- a way of determining whether the student has mastered the subject matter required for the course in question;
- an outline of the course content and objectives;
- learning activities organized in a logical and progressive order;
- different types of learning activities that vary in their degree of difficulty;
- learning activities that stimulate the students' interest;
- activities that involve discussion and teamwork;
- appropriate illustrations;
- formative evaluation activities;
- opportunities to acquire and use mathematical vocabulary.

The order in which the objectives are presented in the learning materials may differ from the order in which they are presented in the program.

8.2 Other materials

To facilitate the learning process, it is strongly recommended that concrete materials (e.g. rods, graduated containers, geometry sets, cardboard models) and semi-concrete materials (e.g. drawings, number lines, representations) be used. Depending on their availability, films, videos, computer programs, educational software and other similar types of visual aids should also be used.

8.3 Using a calculator

Although calculators are widely used, it is still important to know traditional algorithms, as they are useful in everyday life and in more advanced mathematics programs. The courses in this program are aimed at helping students achieve an adequate level of mastery of algorithms for mental and written computations. This goal must therefore take precedence over the use of calculators in these courses. Consequently, it is recommended that students use calculators only to solve certain types of problems or to check their calculations.

9 Evaluation of Student Learning

The purpose of evaluation is not only to help students with their schoolwork, but also to gather the information required for the certification of student achievement.

Formative evaluation is part of the teaching and learning process. It influences decisions with regard to learning situations, learning materials and teaching methods. Teachers are responsible for carrying out formative evaluation, and school boards and private schools have policies to this effect. If necessary, the Ministère de l'Éducation can provide conceptual frameworks or examples of formative evaluation instruments.

Summative evaluation is carried out at the end of a course. In this regard, the Ministère provides a *Definition of the Domain for Summative Evaluation* for each course in this program. The information in these documents is prescriptive and must be adhered to in designing summative examinations.

Information on the evaluation of student learning and the certification of studies is found in official documents other than this mathematics program. For the most part, specific information on these subjects is available in the *Definitions of the Domain for Summative Evaluation* and in the *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*.

Course 1

Natural Numbers: Numeration and Operations

NATURAL NUMBERS: NUMERATION AND OPERATIONS

General Objective

To expand and apply one's knowledge of numeration and operations involving natural numbers and to master related computational algorithms.

Intermediate Objectives and Terminal Objectives

This course consists of 27 intermediate or terminal objectives and requires 25 hours of study. The terminal objectives are written in boldface type and their respective numbers are underlined.

1.01 Define the set of natural numbers ($\mathbb{N}$) in familiar terms.

1.02 Determine the place value of digits and groups of digits in natural numbers less than 1 000 000.

1.03 Given sentences describing everyday situations, read and write as a numeral and as a number word a natural number less than 1 000 000.

1.04 Compare two natural numbers less than 1 000 000.

- Students will be comparing numbers related to everyday situations.

<u>1.05</u> Use the less than (<) or greater than (>) signs to compare two natural numbers.

1.06 Arrange natural numbers less than 1 000 000 in increasing order and in decreasing order.

- **Students will be comparing numbers related to everyday situations.**

1.07 Round off a natural number to an order of magnitude that does not exceed one hundred thousand.

- **Students will be rounding off numbers related to everyday situations.**

1.08 Use an appropriate algorithm to add natural numbers less than 100 000.

- **These additions should involve no more than five natural numbers.**

1.09 Use the properties of addition pertaining to natural numbers (associative and commutative laws, identity element) as strategies to develop the ability to do mental computation.

- Students will be adding natural numbers less than 100.

1.10 Translate word problems into arithmetic expressions.

- The problems should deal with situations familiar to the student.
- Each solution should involve only additions.

1.11 Use an appropriate algorithm to subtract two natural numbers less than 100 000, including numbers containing one or more zeros.

- **Each operation should involve at least one instance of borrowing.**

1.12 Translate word problems into arithmetic expressions.

- The problems should deal with situations familiar to the student.
- Each solution should involve only one of the following operations: addition or subtraction.

1.13 Use an appropriate algorithm to multiply two natural numbers, including numbers containing one or more zeros.

- **The product should be less than 100 000.**

1.14 Mentally multiply a natural number by 10, 100 and 1000.

1.15 Use the properties of multiplication pertaining to natural numbers (associative and commutative laws, distributive law of multiplication over addition, identity element and multiplicative property of zero) as strategies to develop the ability to do mental computation.

- Students will be multiplying natural numbers less than 100.

1.16 Translate word problems into arithmetic expressions.

- The problems should deal with situations familiar to the student.
- Each solution should involve only one of the following operations: addition, subtraction or multiplication.

1.17 Use an appropriate algorithm to divide two natural numbers.

- **The dividend should be less than 100 000.**
- **The divisor should be less than 1 000.**
- **The quotient may involve a remainder.**

1.18 Mentally divide a natural number by 10, 100 and 1000.

- The quotient should be a natural number.

1.19 Perform the operation that is the opposite of addition, subtraction, multiplication and division.

1.20 Check the result of an addition, a subtraction, a multiplication and a division using a method suited to the situation.

1.21 Solve word problems that can be translated into arithmetic expressions.

- **The problems should deal with situations familiar to the student.**
- **Each solution should involve only one of the following operations: addition, subtraction, multiplication or division.**

1.22 From a list of natural numbers less than 1000, select the numbers divisible by 2, 3, 4, 5, 6 or 10.

1.23 Write a natural number as a product of prime factors.

1.24 Write a product of identical factors in exponential notation and, conversely, write a number given in exponential notation as a product of identical factors.

- The bases used should be less than or equal to 10, and the exponents should be less than or equal to 5.

1.25 Associate the power of a given natural number with the corresponding exponential notation and vice versa.

1.26 Write a natural number less than 10 000 in expanded form using powers of 10, except for 10^0.

1.27 Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *associative law*, *commutative law*, *distributive law*, *identity element*, *multiplicative property of zero*, *operation*, *total*, *sum*, *to subtract from*, *to take away from*, *difference*, *how much more*, (*how many more*), *more*, *how much less*, (*how many fewer*), *less*, *product*, *factor*, *multiple*, *double*, *triple*, *times as much, times as many*, *quotient*, *divisor*, *divisibility*, *remainder*, *increasing*, *decreasing*, *digit*, *number*, *place value*, *ones*, *tens*, *hundreds*, *thousands*, *ten thousands*, *hundred thousands*, *million*, *prime number*, *even number*, *odd number*, *power*, *base and exponent*, <, >, =, +, −, X and ÷.

Course 2

Measurement: Length, Area, Volume,
Capacity, Mass, Time and Temperature

MEASUREMENT: LENGTH, AREA, VOLUME, CAPACITY, MASS, TIME AND TEMPERATURE

General Objective

To expand and apply one's knowledge about measurements of length, area, volume, capacity, mass, time and temperature.

Intermediate Objectives and Terminal Objectives

This course consists of 42 intermediate or terminal objectives and requires 25 hours of study. The terminal objectives are written in boldface type and their respective numbers are underlined.

Natural numbers will be used throughout this course, except for activities relating to temperature measurements, which will involve the use of integers.

a) Measurement of Length

2.01 Name the unit of measure that should be used in different everyday situations.

- The units to be used are millimetre (mm), centimetre (cm), metre (m) and kilometre (km).

2.02 Locate on geometric figures (squares, rectangles and triangles) the following elements: sides, altitude, base, length, width and diagonals.

2.03 Measure, in millimetres (mm), in centimetres (cm) or in metres (m), the dimensions of objects available to the student.

2.04 Estimate the dimensions of an object in centimetres (cm) or in metres (m).

2.05 Calculate the perimeter of objects and figures, given their dimensions.

- **The calculations should not involve the conversion of units.**
- **The objects and figures to be measured can be regularly or irregularly shaped.**

2.06 Establish relationships between units of length ranging from the millimetre to the kilometre (mm, cm, dm, m, dam, hm and km).

2.07 Express a measurement of length in another unit.

- **Only natural numbers are used.**
- **The following units may be used: millimetre, centimetre, decimetre, metre, decametre, hectometre and kilometre.**

2.08 Solve everyday problems involving measurements of length, perimeter and distance.

- **Each solution should involve no more than two types of operations, including the conversion of a unit of measure, if necessary.**
- **Only natural numbers are used as well as any of the following units: millimetre (mm), centimetre (cm), metre (m) and kilometre (km).**
- **More than one unit of measure may be used in a given problem.**

2.09 Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *height*, *base*, *width*, *length*, *perimeter*, *diagonal*, *distance*, *unit of measure*, *kilometre* (km), *metre* (m), *decimetre* (dm), *centimetre* (cm) and *millimetre* (mm).

b) Measurement of Area

2.10 Name the unit of area that should be used in different everyday situations.

- The units to be used are square centimetre (cm^2), square metre (m^2), square hectometre or hectare (hm^2) and square kilometre (km^2).

2.11 Determine the area of squares, rectangles and right triangles using a unit square and then derive the formula for finding the area of these figures.

2.12 Calculate, in square centimetres (cm^2) or in square metres (m^2), the area of the rectangular faces of an object.

- The dimensions of the objects should be measured by the student.

2.13 Estimate, in square centimetres (cm^2) or in square metres (m^2), the area of the rectangular faces of objects familiar to the student.

<u>2.14</u> Solve everyday problems that involve calculating the area of a square, rectangle or right triangle.

- **Each solution should involve the calculation of only one area and only one unit of measure.**
- **Only natural numbers are used as well as any of the following units: square centimetre (cm^2), square metre (m^2), square hectometre (hm^2) or hectare and square kilometre (km^2).**

<u>2.15</u> Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *area*, *surface*, *unit of area*, *square centimetre* (cm^2), *square metre* (m^2), *square hectometre* (hm^2), *hectare*, and *square kilometre* (km^2).

c) Measurement of Volume

2.16 Name the unit of volume that should be used in different everyday situations.

- The units to be used are cubic centimetre (cm^3), cubic decimetre (dm^3) and cubic metre (m^3).

2.17 Determine the volume of cubes and rectangular prisms using a unit cube and then derive the formula for finding the volume of these figures.

2.18 Calculate, in cubic centimetres (cm^3), in cubic decimetres (dm^3) or in cubic metres (m^3), the volume of objects in the shape of a cube or a rectangular prism.

- The dimensions of the objects are either given or measured by the student.

2.19 Estimate, in cubic centimetres (cm^3), in cubic decimetres (dm^3) or in cubic metres (m^3), the volume of objects in the shape of a cube or a rectangular prism.

2.20 Solve word problems related to everyday situations that involve calculating the volume of a cube or a rectangular prism.

- **Each solution should involve the calculation of only one volume and only one unit of measure.**
- **Only natural numbers are used as well as any of the following units: cubic centimetre (cm^3), cubic decimetre (dm^3) and cubic metre (m^3).**

2.21 Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *depth, volume*, *unit of volume*, *cube*, *rectangular prism*, *cubic centimetre* (cm^3), *cubic decimetre* (dm^3) and *cubic metre* (m^3).

d) Measurement of Capacity

2.22 Name the unit of capacity that should be used in different everyday situations.

- The units to be used are millilitre (ml) and litre (l).

2.23 Estimate the capacity of containers in millilitres (ml) or in litres (l).

2.24 Establish relationships between units of capacity ranging from the millilitre to the kilolitre (ml, cl, dl, l, dal, hl, kl).

2.25 Establish relationships between the units of capacity (ml and l) and the units of volume (cm^3 and dm^3).

2.26 Express a measurement of capacity in another unit.

- **Only natural numbers are used.**
- **The following units may be used: the millilitre (ml), the litre (l), the cubic centimetre (cm^3) and the cubic decimetre (dm^3).**
- **Amounts are converted:**
  from litres to millilitres and vice versa;
  from cubic decimetres to litres and vice versa;
  from cubic centimetres to millilitres and vice versa.

2.27 Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *capacity*, *unit of capacity*, *litre* (l) and *millilitre* (ml).

e) Measurement of Mass

2.28 Name the unit of mass that should be used in different everyday situations.

- The units to be used are milligram (mg), gram (g) and kilogram (kg).
- The situations are related to various everyday activities.

2.29 Estimate the mass of objects and people in grams (g) or in kilograms (kg).

2.30 Establish relationships between units of mass ranging from the milligram to the kilogram (mg, cg, dg, g, dag, hg and kg).

2.31 Express a measurement of mass in another unit.

- **Only natural numbers are used.**
- **The following units may be used: milligram (mg), gram (g) and kilogram (kg).**

2.32 Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *mass*, *unit of masse*, *milligram* (mg), *gram* (g) *and kilogram* (kg).

f) Measurement of Time

2.33 Read and write dates and times using numerals and letters according to the International System of Units.

- The situations are related to various everyday activities.

2.34 Convert a measurement of time into another measurement of time.

- **The units to be used are year (a), month, week, day (d), hour (h), minute (min) and second (s).**

2.35 Add or subtract measurements of time expressed in hours and minutes.

2.36 Solve word problems related to everyday situations involving the measurement of time.

- **Each solution should involve no more than two types of operations, including the conversion of a unit of measure, if necessary.**
- **Only natural numbers are used.**

2.37 Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *measurement of time*, *annual*, *yearly, monthly*, *weekly*, *daily*, *hourly,* s, min, h, d and a.

g) Measurement of Temperature

2.38 Read the temperature indicated on a thermometer in degrees Celsius (°C).

- The temperatures in question are above and below zero.

2.39 Associate degrees of temperature with different everyday situations.

2.40 Using a thermometer, compare temperatures by using the symbols < or >.

2.41 Solve word problems related to everyday situations involving temperature measurements, using a visual aid, if necessary.

2.42 Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *temperature*, *degree Celsius* (°C), *difference in*, *rise*, *warmer*, *drop* and *cooler*.

Course 3

Order of Operations and Problem Solving

ORDER OF OPERATIONS AND PROBLEM SOLVING

General Objective

To use different problem-solving strategies.

Intermediate Objectives and Terminal Objectives

This course consists of 15 intermediate or terminal objectives and requires 25 hours of study. The terminal objectives are written in boldface type and their respective numbers are underlined.

Natural numbers will be used throughout this course.

3.01 Given an arithmetic expression consisting of no more than six operations, find the operation that must be performed first, according to the rules governing the order of operations.

<u>3.02</u> Find the sequence of operations to be performed in an arithmetic expression consisting of no more than six operations and a set of parentheses.

<u>3.03</u> Calculate the result of an arithmetic expression by performing the appropriate operations and following the order of operations.

- **The arithmetic expression should contain between four and eight natural numbers less than 50 and no more than three sets of parentheses and one set of brackets.**
- **Students must show the steps in their solution.**

3.04 Round off the numbers in an arithmetic expression consisting of no more than two types of operations.

- The arithmetic expression should represent a situation familiar to the student.

3.05 Name situations and contexts in which it is appropriate:

- to overestimate
- to underestimate
- not to estimate
- to estimate by rounding off

3.06 Given an everyday situation and different estimates, choose the estimate appropriate to a given arithmetic expression and justify this choice.

3.07 Estimate the value of an arithmetic expression consisting of no more than five natural numbers less than 10 000.

- **The student should estimate this value after estimating each number in the arithmetic expression.**

3.08 Find what is required in a word problem and, if necessary, indicate the appropriate unit of measure.

3.09 Find the relevant information in a word problem by crossing out superfluous information and, if necessary, indicate whether any information is missing.

3.10 Use different ways of representing a word problem: table, drawing, rule of three or any other way of explaining the problem.

3.11 Translate a word problem into an arithmetic expression.

- **The solution should involve no more than three operations and two different types of operations.**

3.12 Estimate the answer for a given problem.

3.13 Calculate the average of no more than ten numbers.

3.14 Solve everyday problems that can be converted into arithmetic expressions.

- **The solution should involve no more than three operations and two different types of operations.**
- **Students are assigned word problems or problems presented in the form of a table.**
- **Students must show the steps in their solution.**

3.15 Understand, in an appropriate context, the meaning of the following terms and expressions: *more*, *more than*, *less*, *times less*, *difference*, *average*, *double*, *half*, *daily*, *weekly*, *monthly*, *annual, yearly*, *hourly*, *straight-time pay, time and a half, double time, discount*, *capital*, *interest* and *tax*.

Course 4

Basic Concepts Related to Simple Fractions

BASIC CONCEPTS RELATED TO SIMPLE FRACTIONS

General Objective

To understand the concepts of fractions, improper fractions and mixed numbers, and to apply related computational algorithms.

Intermediate Objectives and Terminal Objectives

This course consists of 29 intermediate or terminal objectives and requires 50 hours of study. The terminal objectives are written in boldface type and their respective numbers are underlined.

For the sake of brevity, the word *fraction* is used in the broad sense of the term in the title of this course and includes improper fractions and mixed numbers. However, in the objectives listed below, the term *fraction* refers to proper fractions only.

Only positive fractions, positive improper fractions and positive mixed numbers will be used throughout this course.

4.01 Associate a fraction with:

- a part of a whole
- a part of a set
- a ratio
- a quotient of two numbers

<u>4.02</u> Distinguish between the different meanings of a digit depending on whether it is used as a numerator, a denominator or a whole number in a fraction, a mixed number or an improper fraction.

4.03 Read and write fractions, improper fractions and mixed numbers as numerals and as number words.

4.04 Illustrate fractions, improper fractions and mixed numbers whose denominator is less than or equal to 12.

4.05 Identify illustrated fractions, improper fractions or mixed numbers.

4.06 Given a fraction or an improper fraction, find what represents the whole.

4.07 Locate a fraction or a mixed number less than 3 on a graduated line.

- **The denominator used should be less than or equal to 12.**

4.08 Using concrete or semi-concrete materials, compare two fractions that have:

- the same numerator and different denominators;
- the same denominator and different numerators;
- different numerators and denominators.
  - The denominators of the fractions used should be less than or equal to 12.

4.09 Using multiples, produce one or more fractions equivalent to a given fraction.

4.10 Reduce a fraction to its lowest terms.

4.11 Compare two fractions using equivalent fractions.

- **The symbols <, = or > should be used to express the comparison.**
- **The denominators of the fractions to be compared should be less than or equal to 12.**

4.12 Convert an improper fraction into a mixed number and vice versa.

- **The denominators should be less than or equal to 12.**

4.13 Using concrete or semi-concrete materials, add two fractions:

- that have the same denominator;
- such that the denominator of one of the fractions is a multiple of the denominator of the other fraction;
- such that the denominators are relatively prime.

  - The common denominator of the fractions should be less than or equal to 12.
  - The resulting sum should be reduced to its lowest terms.

4.14 Find the least common denominator of two fractions.

4.15 Add two fractions.

- The denominators of the fractions used should be less than or equal to 12.
- The resulting sum should be reduced to its lowest terms.

4.16 Use an appropriate algorithm to add:

- **two fractions;**
- **two mixed numbers;**
- **a fraction and a mixed number;**
- **a fraction and a natural number;**
- **a natural number and a mixed number.**

  - **The denominators of the fractions used should be less than or equal to 12, and the whole numbers should be positive and less than 10.**
  - **The resulting sum should be reduced to its lowest terms.**

4.17 Using concrete or semi-concrete materials, subtract two fractions:

- that have the same denominator;
- such that the denominator of one of the fractions is a multiple of the denominator of the other fraction;
- such that the denominators are relatively prime.

  - The common denominators should be less than or equal to 12.
  - The difference should be positive.

4.18 Subtract two fractions.

- The denominators of the fractions used should be less than or equal to 12.
- The difference should be positive or equal to zero and reduced to its lowest terms.

4.19 Use an appropriate algorithm to subtract:

- **two fractions;**
- **two mixed numbers;**
- **a mixed number and a fraction;**
- **a natural number and a fraction;**
- **a mixed number and a natural number and vice versa.**
  - **The denominators of the fractions used should be less than or equal to 12, and the whole numbers should be positive and less than 10.**
  - **The difference should be positive or equal to zero and reduced to its lowest terms.**

4.20 Using concrete or semi-concrete materials, multiply:

- a fraction by a natural number less than or equal to 10 and vice versa;
- two fractions whose numerators are equal to one;
- two fractions whose product is a natural number less than or equal to 10.
  - The denominator of the fractions used should be less than or equal to 10.

4.21 Multiply two fractions.

- The denominator of the fractions used should be less than or equal to 10.
- The product should be reduced to its lowest terms.

4.22 Use an appropriate algorithm to multiply:

- **two fractions;**
- **a fraction by a natural number and vice versa.**
  - **The denominator of the fractions used should be less than or equal to 10.**
  - **The product should be reduced to its lowest terms and, if possible, expressed as a mixed number.**

4.23 Using concrete materials, divide:

- a fraction by a number greater than 0 but less than 10;
- a natural number less than or equal to 10 by a fraction with a numerator equal to one;
- two fractions with numerators equal to one;
- two fractions whose quotient is a natural number.
  - The denominator of the fractions used should be less than or equal to 10.

4.24 Divide a positive natural number less than or equal to 10 by a fraction with a numerator equal to one and a denominator less than or equal to 10.

4.25 Use an appropriate algorithm to divide:

- **a fraction by a natural number greater than 0 but less than or equal to 10;**
- **a natural number less than or equal to 10 by a fraction with a numerator equal to one;**
- **two fractions between 0 and 1 such that the result is a natural number.**
  - **The denominator of the fractions used should be less than or equal to 10.**

4.26 Estimate the value of a fraction or an improper fraction to the nearest half or the nearest whole number.

4.27 Given concrete situations described using fractions of a whole, choose those situations that make sense and justify this choice.

4.28 Solve word problems that can be converted into arithmetic expressions containing fractions, mixed numbers and natural numbers.

- **Each solution should involve only one operation.**
- **The problems may contain superfluous information.**
- **The result should be reduced to its lowest terms.**
- **The problems should be subject to the constraints indicated for objectives 4.16, 4.19, 4.22 and 4.25.**

4.29 **Understand, in an appropriate context, the meaning of the following terms and expressions: *fraction*, *numerator*, *denominator*, *improper fraction*, *mixed number*, *equivalent fraction*, *fraction reduced to its lowest terms*, *multiple, divisor*, *factor* and *common denominator*.**

Course 5

Basic Concepts Related to

Decimal Numbers and Percents

BASIC CONCEPTS RELATED TO DECIMAL NUMBERS AND PERCENTS

General Objective

To understand the concepts of decimal numbers and percents, and to apply related computational algorithms.

Intermediate Objectives and Terminal Objectives

This course consists of 33 intermediate or terminal objectives and requires 50 hours of study. The terminal objectives are written in boldface type and their respective numbers are underlined.

Positive decimal numbers and whole number percents will be used throughout this course.

In this course, the expression *decimal number* is used in the broad sense of the term and includes decimal fractions. It refers to finite decimal numbers expressed in decimal notation.

a) Decimals

5.01 Read decimal numbers written as numerals and as number words.

- The numbers used should have no more than three digits after the decimal point.

5.02 Determine the place value of digits and groups of digits in decimal numbers.

- The numbers used should have no more than three digits after the decimal point.

5.03 Read and write decimal numbers as numerals and as number words.

- **The numbers used should have no more than three digits after the decimal point.**

5.04 Round off a decimal number to the nearest whole number, to the nearest tenth and to the nearest hundredth.

5.05 Using a millimetric ruler, measure segments whose length is expressed as a decimal number.

5.06 Compare two decimal numbers.

- The symbols <, = or > should be used to express these comparisons.
- The numbers used should have no more than three digits after the decimal point.

5.07 Order decimal numbers that:

- **have the same number of digits after the decimal point;**
- **do not have the same number of digits after the decimal point.**
  - **The numbers used should have no more than three digits after the decimal point.**

5.08 Write a fraction or a mixed number that can be converted into tenths or hundredths as a decimal number and, conversely, write a decimal number as a fraction or a mixed number that can be converted into tenths or hundredths.

5.09 Compare decimal numbers to hundredths with fractions and mixed numbers that can be converted into tenths or hundredths.

- **The symbols <, = or > should be used to express these comparisons.**

5.10 Use an appropriate algorithm to add two decimal numbers to hundredths. These decimal numbers may:

- **have the same number of digits after the decimal point;**
- **not have the same number of digits after the decimal point.**

5.11 Solve word problems that can be converted into arithmetic expressions containing either decimal numbers, or decimal numbers and natural numbers.

- Each solution should involve only additions.
- The numbers to be added should have no more than two digits after the decimal point.
- Students must show the steps in their solution.

5.12 Use an appropriate algorithm to subtract two decimal numbers to hundredths. These decimal numbers may:

- **have the same number of digits after the decimal point;**
- **not have the same number of digits after the decimal point.**

5.13 Solve word problems that can be converted into arithmetic expressions containing either decimal numbers, or decimal numbers and natural numbers.

- Each solution should involve only one of the following operations: addition or subtraction.
- The numbers used should have no more than two digits after the decimal point.
- Students must show the steps in their solution.

5.14 Use an appropriate algorithm to multiply:

- **a decimal number less than 100 by a natural number less than or equal to 12 and vice versa;**
- **two decimal numbers less than 10.**
  - **These products should have no more than three digits after the decimal point.**

5.15 Mentally multiply a decimal number to thousandths by 10, 100 or 1000.

- The multiplications should represent everyday situations, including the conversion of measurements.

5.16 Solve word problems that can be converted into arithmetic expressions containing either decimal numbers, or decimal numbers and natural numbers.

- Each solution should involve only one of the following operations: addition, subtraction or multiplication.
- The numbers used should have no more than two digits after the decimal point.
- Students must show the steps in their solution.

5.17 Use an appropriate algorithm to divide:

– **a decimal number to hundredths by a natural number less than 100;**

- **Each quotient should contain a decimal portion that does not go beyond the hundredths position.**

– **two natural numbers less than 100;**

- **Each quotient should contain a decimal portion that does not go beyond the hundredths position.**

– **Two decimal numbers to hundredths.**

- **The whole number part of the numbers used should be less than 100.**
- **Each quotient should contain a decimal portion that does not go beyond the hundredths position.**

5.18 Mentally divide a positive decimal number by 10, 100 and 1000.

- The divisions should represent everyday situations, including the conversion of measurements.

5.19 Express a measurement in another unit.

- **At least one of the two measurements should be a decimal number.**
- **The following units of measure may be used in the conversions:**

  millimetre (mm), centimetre (cm), metre (m) and kilometre (km);
  milligram (mg), gram (g) and kilogram (kg);
  millilitre (ml) and litre (l).

5.20 To solve word problems that can be converted into arithmetic expressions containing either decimal numbers to hundredths, or natural numbers and decimal numbers to hundredths.

- **The solution should involve no more than two operations and two different types of operations chosen from among the following: addition, subtraction, multiplication or division.**
- **Students must show the steps in their solution.**
- **The problems should be subject to the constraints indicated in objectives 5.10, 5.12, 5.14 and 5.17.**

5.21 Understand, in an appropriate context, the meaning of the following terms and expressions: *decimal number*, *whole number part*, *decimal portion*, *tenth*, *hundredth* and *thousandth*.

b) Percents

5.22 Define a percent as a fraction or an improper fraction whose denominator is 100.

5.23 Convert a percent into a fraction or an improper fraction.

- The percent should not contain a fractional part.
- The fraction or the improper fraction should be reduced to its lowest terms.

5.24 Express as a percent a fraction whose denominator is 2, 4, 5, 10, 20, 25, 50 or 100.

5.25 Express a percent as a decimal number and vice versa.

- The numbers used should have no more than two digits after the decimal point.

5.26 Using the symbols <, = or >, compare percents with fractions or improper fractions that can be converted into hundredths, or compare percents with decimal numbers to hundredths.

5.27 Add two percents.

5.28 Find the difference between 100% and a given percent.

5.29 Given a realistic context, calculate a certain percent of a natural number or a decimal.

- The answer should be rounded off to the nearest hundredth if it has three digits after the decimal point.

5.30 Given everyday situations described using percents, choose those that make sense and justify these choices.

5.31 Estimate the quantity corresponding to a percent in an everyday situation (e.g. the amount corresponding to a tax, a tip, an interest payment, a discount).

5.32 Solve word problems that can be converted into arithmetic expressions containing percents.

- **The solution to these problems involves:**
  - **the calculation of the part of a whole when the ratio is given in percent form;**
  - **or the sum or the difference of percents.**
- **The solution to these problems involves no more than two of the following operations: addition, subtraction or multiplication.**
- **The problem may involve natural numbers or decimal numbers as well as percents, depending on the situation.**
- **Students must show the steps in their solution.**

5.33 **Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *percentage*, *percent* (%), *rate of*, *a whole*, *discount*, *tax*, *interest*, *capital, sticker price*, *net price* and *cost price*.**

Course 6

Prealgebra

PREALGEBRA

General Objective

To become familiar with algebraic language and to apply the basic rules of algebra.

Intermediate Objectives and Terminal Objectives

This course consists of 17 intermediate or terminal objectives and requires 25 hours of study. The terminal objectives are written in boldface type and their respective numbers are underlined.

Only natural numbers less than or equal to 200 will be used in this course.

6.01 Name the operation used between two natural numbers less than 100 in order to obtain a given result.

6.02 Find the missing natural number in an equation involving one addition or one subtraction by writing the inverse operation, if necessary.

- The missing term should be replaced by a symbol: □, ?, … or another symbol.

6.03 Find the missing natural number in an equation involving one multiplication or one division by writing the inverse operation, if necessary.

- The missing term should be replaced by a symbol: □, ?, … or another symbol.

6.04 Find the missing natural number in an equation containing one of the following operations: addition, subtraction, multiplication or division.

- **The missing term should be replaced by a letter.**

6.05 Complete a sequence of objects, numbers or letters and find the pattern in this sequence.

- The pattern should be expressed in simple, everyday language.

6.06 Using symbolic language, express the rule that determines the rank of a number in a sequence.

- The rule should involve no more than two operations.

6.07 Use the rule that determines the rank of a number in a sequence in order to find the number associated with a given rank in the sequence or the rank of a number belonging to the sequence.

- **The rule used should involve no more than two operations.**

6.08 Find expressions equivalent to a fully simplified algebraic expression.

6.09 Illustrate the result of a concrete situation that can be represented by the multiplication of a natural number by a binomial.

- Each term in the binomial should contain only one variable.

6.10 Simplify algebraic expressions that involve the addition of similar terms, the subtraction of similar terms or the multiplication of a natural number by a binomial.

6.11 Translate a verbal statement into a visual, numerical or algebraic representation and vice versa.

6.12 Translate a word problem into a first-degree equation with one unknown.

6.13 Solve simple equations, using concrete or semiconcrete materials.

- The equations should contain only one variable and no more than two operations.

6.14 Check the solution of an equation by substituting the resulting value for the unknown.

6.15 Algebraically solve simple equations, writing out all the steps in the solution.

- **The equation should contain only one variable and no more than two operations.**

6.16 Algebraically solve word problems that can be converted into a first-degree equation with one unknown.

- **The equation should contain no more than two operations.**

6.17 Understand, in an appropriate context, the meaning of the following terms and expressions: *unknown*, *sequence*, *rank*, *rule*, *pattern*, *variable*, *coefficient*, *exponent*, *term*, *similar terms*, *equality*, *equation*, *hypothesis* and *solution*.

Course 7

Representing the Sets $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$ and Their Subsets

REPRESENTING THE SETS $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$ AND THEIR SUBSETS

General Objective

To understand and use set notation and the different ways of representing sets.

Intermediate Objectives and Terminal Objectives

This course consists of 13 intermediate or terminal objectives and requires 25 hours of study. The terminal objectives are written in boldface type and their respective numbers are underlined.

In this course, set-builder notation will simply involve writing one statement in words. By the end of the course, students should be able to write this statement between brackets and, if necessary, use the symbols listed in objective 7.13.

7.01 Recognize the elements of a given set.

7.02 Recognize different ways of describing a set (listing the elements [roster method], set-builder notation, Venn diagram) as well as the symbols used for each type of description.

7.03 Given a set described with set-builder notation or a Venn diagram, describe it by listing its elements.

7.04 Given a set whose elements are listed or described with set-builder notation, describe it with a Venn diagram.

7.05 Describe the set of natural numbers ($\mathbb{N}$) and subsets of $\mathbb{N}$, including $\mathbb{N}^*$, by listing their elements.

- **The subset to be described should be presented as a Venn diagram or described in set-builder notation, with a clear indication, as the case may be, of the properties or limits of the subset.**

7.06 Describe the set of integers ($\mathbb{Z}$) and subsets of $\mathbb{Z}$, including $\mathbb{Z}^*$, $\mathbb{Z}_+$, $\mathbb{Z}_-$, $\mathbb{Z}_+^*$ and $\mathbb{Z}_-^*$.

7.07 Name elements of the set of rational numbers ($\mathbb{Q}$).

7.08 Draw a Venn diagram representing the relationship between $\mathbb{N}$, $\mathbb{Z}$ and $\mathbb{Q}$.

7.09 Locate given numbers in a Venn diagram representing the sets $\mathbb{N}$, $\mathbb{Z}$ and $\mathbb{Q}$.

7.10 Represent a finite subset of $\mathbb{N}$, $\mathbb{Z}$ or $\mathbb{Q}$ on a graduated line

- **The numbers to be represented should be between –10 and 10 inclusive.**
- **The elements of the subsets of $\mathbb{Q}$ should have the same denominator less than or equal to 10 or be decimal numbers expressed in tenths.**

7.11 Given a statement involving two or three constraints, find all the possible solutions.

- **The elements of the set should be listed.**
- **The constraints associated with the previous objectives must also apply here.**

7.12 Recognize the elements of a set and the subsets of that set.

- **The symbols $\in$, $\notin$, $\subseteq$, and $\not\subseteq$ should be used to make this distinction.**

7.13 **Understand, in an appropriate context, the meaning of the following terms, expressions and symbols: *element, is an element of* (∈), *belongs to* (∈), *is not an element of* (∉), *does not belong to* (∉), *set* ({ }), *subset*, *is a subset of* (⊆), *is included or equal to* (⊆), *is not a subset of* (⊈), *is not included or equal to* (⊈), *symbol*, *even number*, *odd number*, *prime number*, *multiple*, *divisor*, *factor*, *less than* (<), *less than or equal to* (≤), *greater than* (>), and *greater than or equal to* (≥).**

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