SUMMARY TEACHING GUIDE

MATHEMATICS DBE

SOLUTIONS

Secondary IV *Science* Option

MTH-4171-2 SCI

ALGEBRAIC AND GRAPHICAL MODELLING

IN A GENERAL CONTEXT 1

MTH-4172-2 SCI

DATA COLLECTION

IN A GENERAL CONTEXT

MTH-4173-2 SCI

GEOMETRIC REPRESENTATION

IN A GENERAL CONTEXT

IN COMPLIANCE WITH THE NEW PROGRAM OF STUDY

SOFAD

SUMMARY TEACHING GUIDE

MATHEMATICS DBE

SOLUTIONS

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SOFAD

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SOLUTIONS

INTRODUCTION

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Introduction

The **SOLUTIONS** series is designed to meet the requirements of the ***Mathematics Program of Study, Adult General Education***; Diversified Basic Education (DBE), MEES 2017. The learning approach is focused on developing mathematical competencies by solving rich and meaningful situational problems. Learners are guided in their quest to find solutions to complex problems through the use of questions designed to help them acquire the mathematical knowledge they need.

This teaching guide provides further detail on the components of the **SOLUTIONS** learning guides.

It also offers a reminder of certain requirements of the program:

- Nature of learning activities
- Favoured teaching approach
- Families of learning situations
- Program options
- The three subject-specific competencies
- Prescribed knowledge
- Evaluation criteria targeted in the DBE course.

Lastly, the summary teaching guide contains references and notes for teachers that are relevant to each Secondary IV course.

In summary, this information is provided to guide teachers in preparing and delivering support activities to learners.

Portailsofad.com

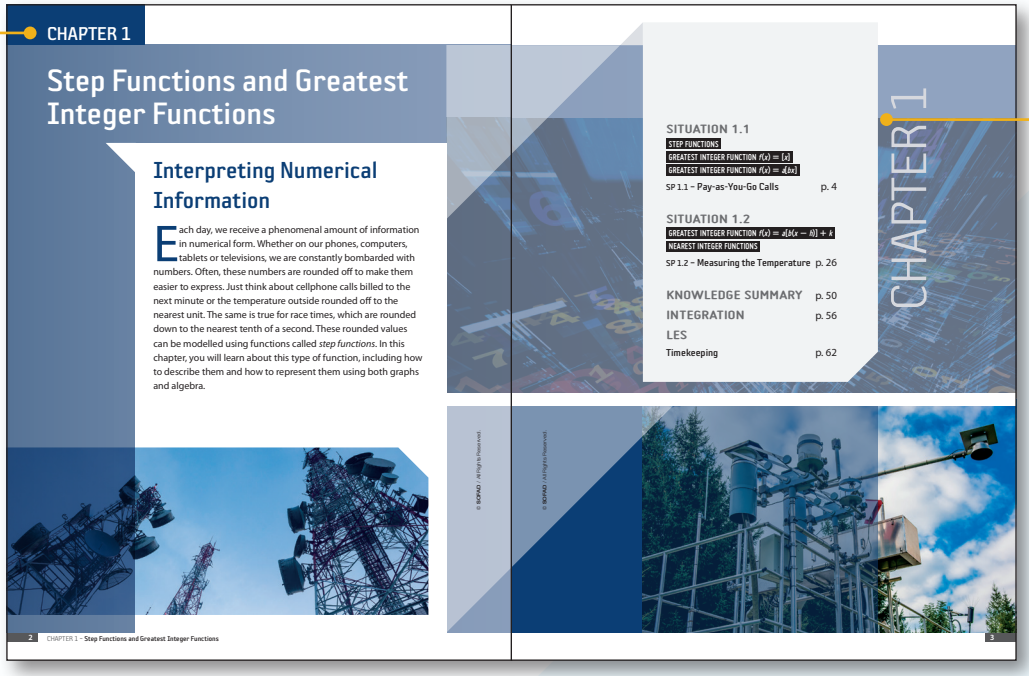
Teachers can find all the material they need to accompany the **SOLUTIONS** series on **portailsofad.com**: the digital version of the summary teaching guide, videos, ICT activiti printable versions of complementary resour answer keys to scored activities and tracking

Chapter Components

The learning process followed in each chapter of the **SOLUTIONS** series for Secondary IV is illustrated below. The pedagogical intent is specified for each section. Learners progress by building on what they have learned from one section to the next.

CHAPTER INTRODUCTION

The first page describes the context and theme that will serve as a backdrop for the acquisition of the new knowledge discussed in the chapter.

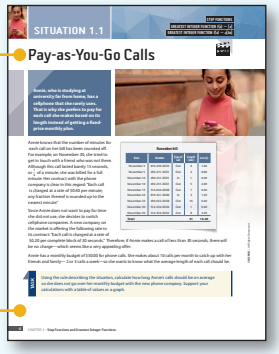


A table of contents accompanies this first page. The knowledge to be acquired is described for each of the *Situations*, as well as the theme of the situational problems.

SITUATIONS

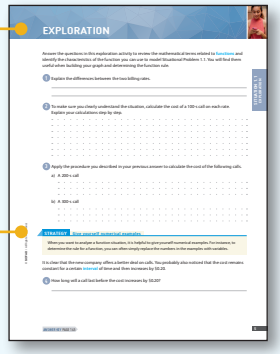
In general, each chapter contains two learning *Situations*. The approach taken in these situations enables learners to acquire new knowledge and develop mathematical skills in real, realistic or purely mathematical contexts.

Phases of Each Situation



SITUATIONAL PROBLEM

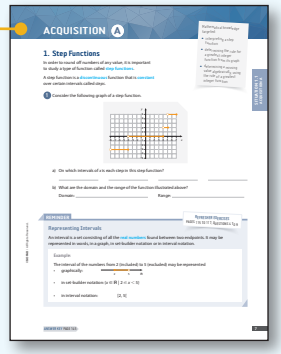
A box describes the task that the learner must perform later in the *Solution* section. This task is the starting point for acquiring new knowledge to solve the situational problem. A video is provided to accompany the situational problem.



EXPLORATION

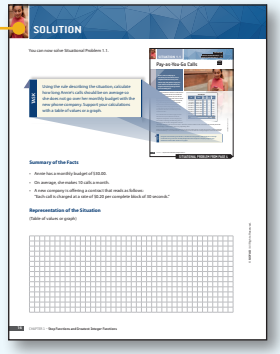
This section invites the learner to analyze the data of a situational problem, and then to identify the knowledge they possess and the knowledge they need to acquire in order to perform the task.

The questions posed will guide them toward a problem-solving strategy.



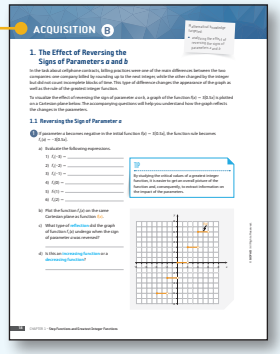
ACQUISITION A

This is where the knowledge needed to solve the situational problem is assimilated. Each *Acquisition* encourages reflection before presenting new mathematical knowledge.



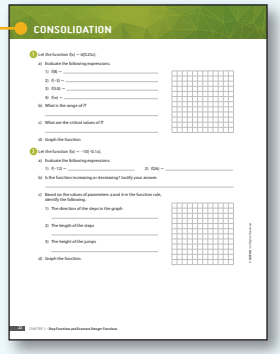
SOLUTION

When they reach this section, the learner should have acquired all the knowledge and strategies that are essential to solving the situational problem described at the beginning of the situation.



ACQUISITION B

In this second acquisition, the learner will acquire new knowledge prescribed by the program linked to the knowledge encountered in *Acquisition A*, but not required to solve the initial situational problem.



CONSOLIDATION

This section allows the learner to consolidate the mathematical knowledge acquired in *Acquisitions A* and *B*. This *Consolidation* also contributes to the development of mathematical skills.

At the End of a Chapter...

KNOWLEDGE SUMMARY

This section summarizes all the knowledge to *Remember* in the form of fill-in-the-blank questions. The learner is invited to fill in the missing information.

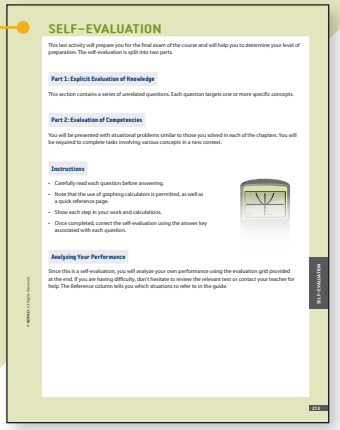
INTEGRATION

In this section, which includes exercises and complex situations, the learner is expected to apply the knowledge seen in this chapter. This *Integration* also contributes to the development of mathematical skills.

LES

The *LES* is a complex task developed according to the certification evaluation model. It is accompanied by a competency evaluation grid, found at the end of the learning guide, which the learner may consult. The list of observable factors is available in the course's summary teaching guide and on portailsofad.com.

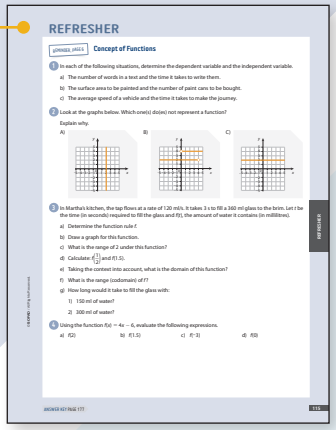
Complements



SELF–EVALUATION

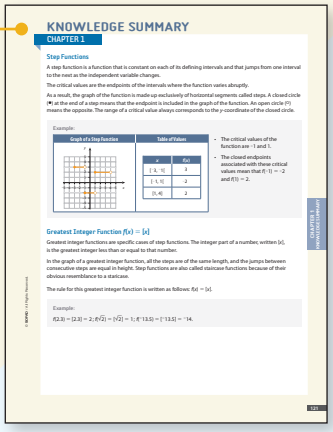
Presented in the first part of the *Complements*, the *Self-Evaluation* allows the learner to evaluate their acquired knowledge and the mathematical competencies they have developed throughout the course. A self-evaluation grid is also provided.

This is a chance for the learner to determine whether a revision is necessary before they move on to the *Summary Scored Activity*.



REFRESHER

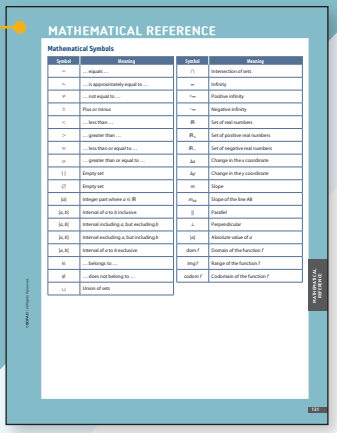
The *Refresher* section uses exercises to review the mathematical rules and concepts that are the subject of a *Reminder*. *Refreshers* may be completed concurrently with learning activities or prior to the course.



KNOWLEDGE SUMMARY

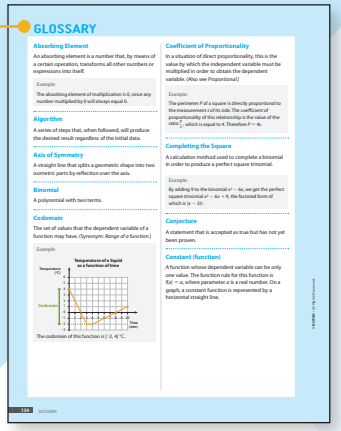
The full version of the *Knowledge Summary* is located in this section.

A printable version is also available online.



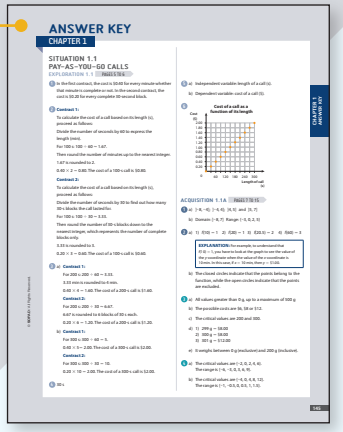
MATHEMATICAL REFERENCE

This section presents the mathematical symbols used in the guide, as well as abbreviations of certain units of measurement and reminders of mathematical formulas.



GLOSSARY

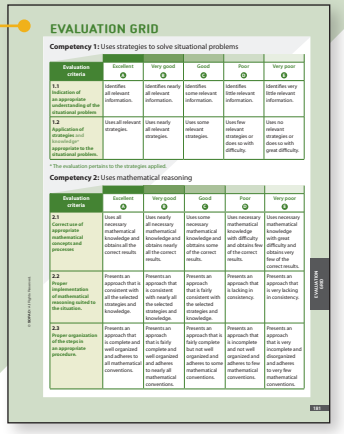
Words and expressions **written in blue** in the current text are defined in the *Glossary*.



ANSWER KEY

The *Answer Key* is designed to allow the learner to check their answers and to complement the learning process.

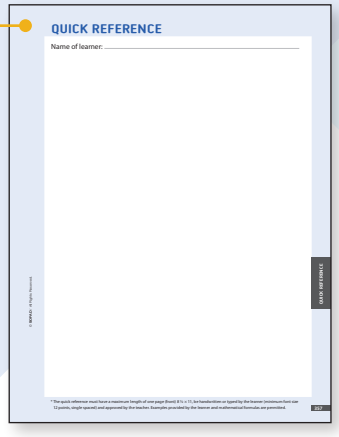
This section contains the answers to questions and detailed explanations of the approach to be taken or the reasoning to be used.



EVALUATION GRID

After solving a *LES*, the learner is asked to evaluate themselves using this grid. Teachers are provided with a list of observable factors on portailsofad.com and in the course teaching guide.

The learner may complete the concise version of the *LES* with their teacher's guidance.



QUICK REFERENCE

A detachable *Quick Reference* page is provided at the very end of the guide. The learner can make notes on this sheet as they progress through the course, and they may refer to it in the certification exam.

Headings

SCATTER PLOT *

Refers, if applicable, to optional knowledge. It is recognizable by its paler background.

Invites the learner to watch a video clip on the situational problem.

TASK

To validate her friend's assessment of the dive, you must determine…

Presents the task to be performed as part of the situational problem.

REMINDER

REFRESHER EXERCISES
PAGE 195, QUESTIONS 1 TO 2

Representation of...

An interval is a set…

Example:

The interval of the numbers 2…

Refers to knowledge that the learner has acquired in previous courses and refresher exercises related to this *Reminder*.

REMEMBER

Step Functions

A step function has the…

Example:

The interval of the numbers 2…

Presents the mathematical knowledge to be mastered, as prescribed by the study program.

STRATEGY Interpret a...

For a good understanding of a graph, it is essential…

Presents problem-solving strategies that can be applied to a variety of situations.

Two triangles are congruent if all their corresponding sides are congruent.

Refers to a geometric statement. A complete list is available in the *Mathematical Reference* section.

DID YOU KNOW?

In reality, a pendulum's oscillations (back-and-forth movements) tend to diminish due to…

Allows the learner to discover historical and cultural information related to the mathematical concepts being studied.

TIP

It is not always possible to determine the precise interval of a cycle from the graduations on the axes of a graph...

Provides a tip that simplifies the task, or offers a different way of dealing with the problem or of applying the concept being studied.

CAUTION!

Make sure that the intervals that define the parts of the function in your rule are…

Warns the learner of traps to avoid or exceptions that may apply to the concept being studied.

ICT

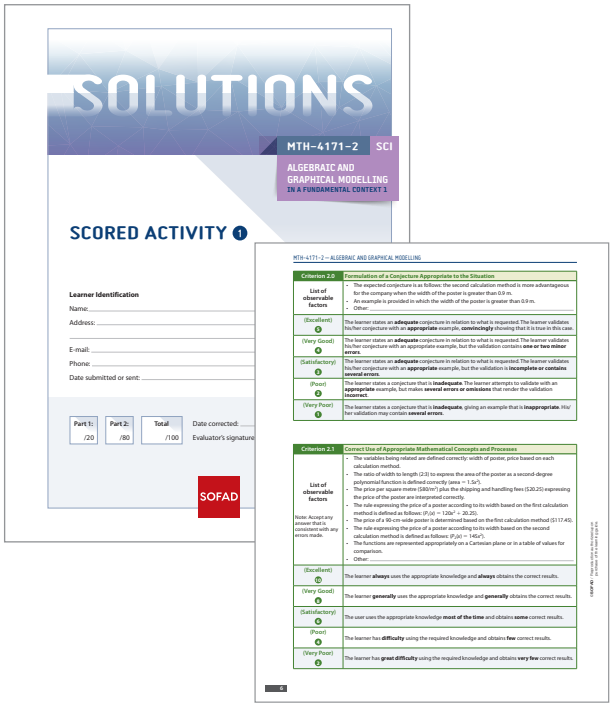
In ICT activity 1.2.1, you can observe the cycles and the period of a periodic function. Find this activity on portailsofad.com.

Prompts the learner to complete an online activity (GeoGebra or graphing calculator) that will encourage them to explore the concept studied using technological tools.

Portailsofad.com for Learners

On **portailsofad.com**, the learner can access:

- A guideline
- Video clips
- ICT activities
  - GeoGebra
  - Graphing calculator
- Printable versions of resources complementary to the **SOLUTIONS** series
  - Scored activities
  - *Knowledge Summary*
  - Complete answer key to the guide in PDF format
  - Lists of observable factors in each *LES*



Scored Activities

The aim of the scored activities is to track the learner's progress. Each learning guide is generally accompanied by two scored activities presented in separate booklets. The learner is expected to complete these scored activities at certain points during the course. These activities make it possible to evaluate the 11 competencies identified by the diversified basic education program. Evaluation grids containing the observable factors are provided with the answer keys. To make it easier to follow, the correction grid contains information about the mathematical knowledge and competencies being evaluated as well as references to the *Situations* in which they were acquired.

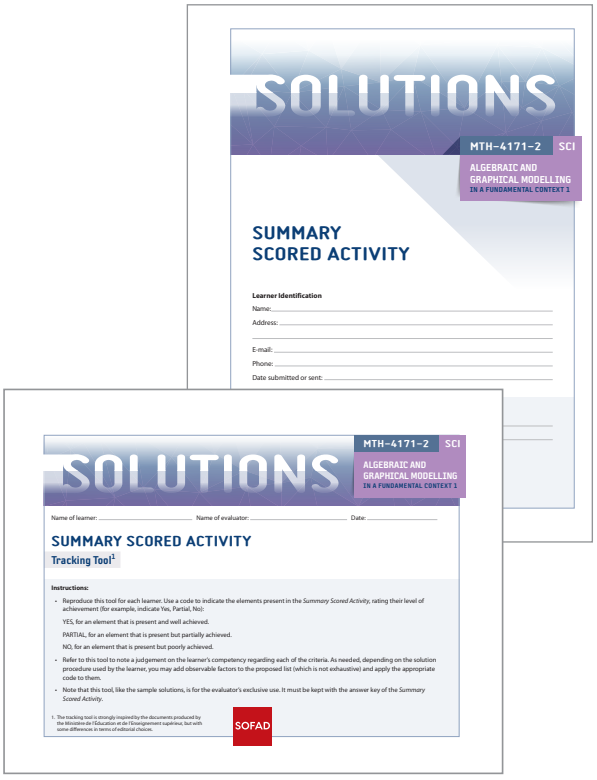
SCORED ACTIVITY

You must now complete Scored Activity 1. It can be found on the course website…

In the learning guide, a text box indicates that a scored activity is to be completed after a certain *Situation*.

Summary Scored Activity

Each learning guide includes a *Summary Scored Activity*. Also presented separately, the summary scored activity must be completed at the very end of the course. This enables the teacher to assess the extent to which each learner has mastered the mathematical knowledge and competencies before the learner's application to take the ministry exam is considered. In addition to the mathematical knowledge, this activity evaluates the five criteria specified in the *Definition of the Evaluation Domain* (DED). The *Summary Scored Activity* is accompanied by an answer key and a tracking tool.

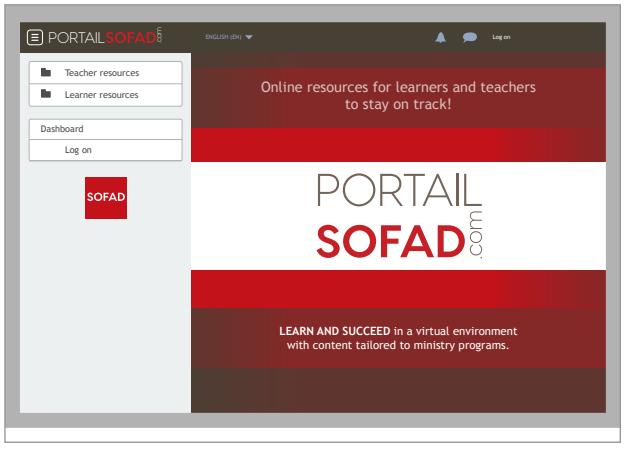


SCORED ACTIVITY

You must now perform the summary scored activity covering all the knowledge of the guide. Find this activity at portailsofad.com.

At the end of the *Self-Evaluation*, a text box indicates that the summary scored activity is to be completed.

All scored activities, and their complements, can be downloaded from the teachers' section of **portailsofad.com**.

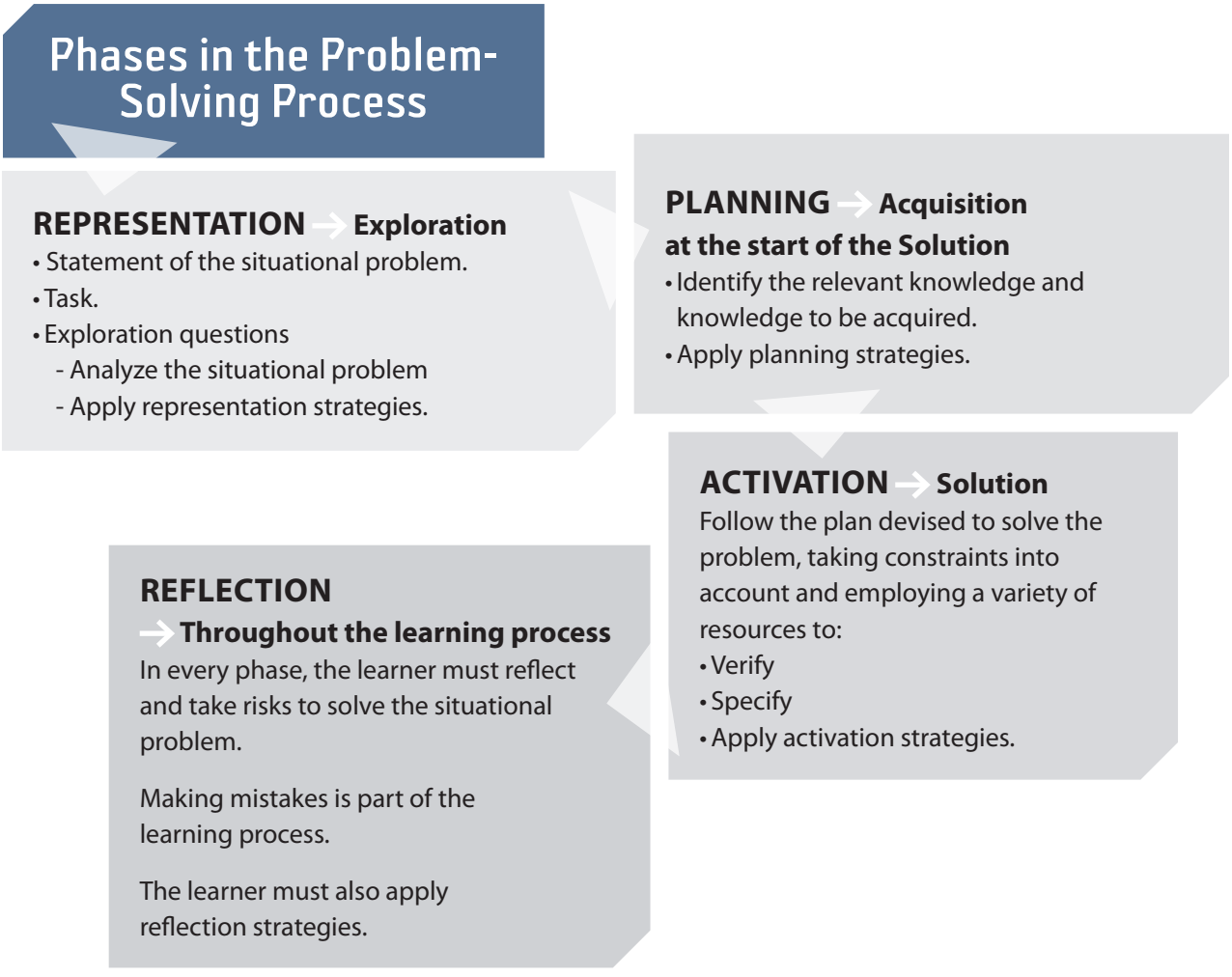


Situational Problems

The *Mathematics Program of Study* defines a situational problem as a complex task that cannot be completed effectively without learning certain concepts or developing problem-solving strategies.

Phases in the Problem-Solving Process

The diagram below illustrates the process of solving a situational problem. These four interrelated phases are described in the program and are echoed in the phases of each *Situation* in the **SOLUTIONS** series.



Nature of Learning Activities

The learner acquires mathematical knowledge and develops subject-specific competencies through the situational problems. Each problem is inspired by a context that is meaningful to the learner, who must apply mathematical knowledge or concepts to solve it or draw a conclusion. Situational problems are chosen according to the nature and complexity of the prescribed knowledge and are drawn from the four learning-situation families as described in the mathematics program. The learner then applies the acquired knowledge using procedures incorporated in each course code. In order to put these integrative processes into practice, the learner must develop and deploy subject-specific competencies.

Families of Learning Situations

Each situation falls into one of the program's four mathematical themes, based on certain characteristics, types of problems, or broad issues common to many situations. The learner must solve real-life situational problems that will enable them to build mathematical knowledge and develop subject-specific competencies.

Measurement and Spatial Representation
Situational problems requiring the learner to provide a geometric representation of an object, a physical space, a transformation or a geometric locus.

Relationship Between Quantities
Situational problems requiring the learner to use a graphical or algebraic model that expresses a relation or a dependency relationship between quantities.

Processing Data
Situational problems requiring the learner to collect, compare and process data.

Optimizing Solutions
Situational problems requiring the learner to maximize a profit, a process, or a number of objects or people, or to minimize costs or losses.

SUBJECT–SPECIFIC COMPETENCIES

The evidence teachers must look for to determine that a learner has developed the three mathematical competencies targeted by the program is presented below.

Subject-Specific Competencies, Key Features and Manifestations

1 Uses Strategies to Solve Situational Problems

1. Defines the problem
- Reformulates the situational problem in his/her own words.
- Identifies the task to be carried out.
- Represents the situational problem mentally or in writing.
- Determines the key elements to be considered and the obstacles to be overcome.
- Selects observation techniques or tools.

2. Searches for possible solutions
- Makes connections.
- Uses lists, tables, diagrams, concrete materials or drawings.
- Refers to the solution of a similar situational problem.
- Uses brainstorming techniques.

3. Chooses a solution
- Takes the constraints into account.
- Takes the consequences into account.
- Takes his/her aptitudes into account.
- Determines the best relationship between the constraints and the consequences.

4. Implements the solution
- Proceeds by trial and error.
- Reviews his/her work.
- Refers to the solutions of a similar situational problem.
- Breaks down a complex situational problem into subproblems.
- Simplifies the situational problem.
- Establishes a plan of action.
- Carries out the plan of action.

5. Validates the solution
- Verifies his/her solution by using examples or counterexamples.
- Compares his/her results to the expected results.
- Compares his/her solution and results to those of others.
- Ensures that his/her solution makes sense.

Source: *Diversified Basic Education Program*, pages 21, 24 and 27.

2 Uses Mathematical Reasoning

1. Explores the situational problem
- Examines the situational problem.
- Describes the characteristics of the situational problem.
- Asks questions about the situational problem.
- Gathers information about the situational problem.

2. Makes a conjecture
- Proposes probable or plausible ideas.
- Predicts the implications of the ideas proposed.
- Uses examples to find invariants.
- Makes a conjecture.

3. Constructs and uses networks of mathematical cognitive resources
- Establishes organized and functional relationships between different types of knowledge (by associating, classifying, ordering, etc.).
- Uses different forms of representation.
- Selects relevant information.
- Refers to similar situational problems.
- Finds additional information.

4. Draws a conclusion
- Finds examples to verify the conjecture.
- Finds counterexamples to clarify, adjust or refute the conjecture.
- Generalizes by deriving laws, rules or properties.
- Deduces a proposition.

3 Communicates by Using Mathematical Language

1. Decodes the elements of mathematical language
- Recognizes codes and rules.
- Recognizes the meaning of symbols, terms and notation.
- Distinguishes between the mathematical and everyday meaning of various terms.
- Consults different sources of information.

2. Interprets a mathematical message
- Makes connections between the elements of the message.
- Distinguishes between elements that are relevant and those that are not.
- Identifies the key elements of the message.
- Identifies the subject of the message.
- Determines the overall meaning of the situational problem.
- Associates images, objects or knowledge with mathematical terms and symbols.
- Switches from one register of representation to another.
- Verifies his/her understanding of the message.

3. Produces a mathematical message
- Determines the subject of the message.
- Observes codes and rules.
- Uses symbols, terms and notation in accordance with their meaning.
- Uses a register of representation.
- Organizes the message.
- Consults different sources of information.

PROGRAM OPTIONS

The diversified basic education program offers three distinct options enabling learners to choose the approach to mathematics that best suits their aspirations, interests and aptitudes.

The three Secondary IV options focus on different needs and relate to the following areas: *Cultural, Social and Technical (CST)*, *Technical and Scientific (TS)* and *Science (Sci)*.

Each of the three options prepares learners for postsecondary studies and may also lead to trades, occupations or technical fields that can be studied at the secondary or college level. The following table profiles the three options offered in the program of study.

Table Describing the Three Secondary IV Options

CULTURAL, SOCIAL AND TECHNICAL (CST)	TECHNICAL AND SCIENTIFIC (TS)	SCIENCE (SCI)
MTH-4151-1, MTH-4152-2, MTH-4153-2	**MTH-4161-2 , MTH-4162-2, MTH-4163-2**	**MTH-4171-2 , MTH-4172-2, MTH-4173-2**
• Intended for learners who like to design objects and activities, develop projects or participate in bringing them to fruition. • Likely to stimulate interest in social causes and develop entrepreneurial spirit.	• Intended for learners who wish to explore learning situations that sometimes involve both manual and intellectual work.	• Intended for learners who want to understand the cause and mechanism of phenomena, and to explain and make decisions about them. • Learners discover how to develop formal proofs in learning situations where there is a need to confirm a truth.
Focused on situations that learners are likely to encounter in their personal and professional lives.	Focused on case studies and learners' ability to identify errors and anomalies in solutions with a view to defining the problem and taking corrective action.	Focused on finding, developing and analyzing models primarily in relation to scientific experiments.
Seeks to bring together aspects of mathematics that will help learners become autonomous citizens who play an active role in society. The content allows learners to build on and enrich their basic mathematical knowledge.	Seeks to enable learners to identify the mathematical concepts and processes associated with the design, operation or use of certain technical instruments.	Seeks to develop learners' capacity for abstract thinking by focusing on the properties of mathematical objects, given the complexity of the algebraic operations they encounter.
Prepares learners more specifically to pursue studies in the arts, communications, humanities and social sciences.	Prepares learners more specifically to work effectively in technical fields related to nutrition, biology, physics, business administration and graphic arts.	Prepares learners to pursue studies in the natural sciences or to specialize in research.

Source: *Diversified Basic Education Program*, page 60.

The tables below describe the prescribed knowledge for the Secondary IV program and indicate the option or options to which they apply.

Algebraic and Graphical Modelling

MATHEMATICAL KNOWLEDGE	MTH-4151-1 (CST)	MTH-4161-2 (TS)	MTH-4171-2 (SCI)
Operations on numerical and algebraic expressions			
Solving one-variable equations and inequalities: second-degree, square root, exponential, logarithmic (including the properties of radicals, exponents and logarithms)		X	X
Operations on numerical and algebraic expressions (multiplying and dividing polynomials, simplifying rational expressions, numbers expressed using rational exponents, radicals and the powers of base 2 and base 10)		X	X
Constructing and interpreting tables of values consisting of positive rational numbers written in base 2 and base 10 (exponential and logarithmic forms)		X	
Expanding, factoring (factoring by grouping and using second-degree algebraic identities, including the perfect square trinomial and the difference of two squares)		X	X
Factoring trinomials using roots			X
Completing the square			X
Relation, function and inverse			
Experimenting with real functions as well as observing, interpreting, describing and representing them (second-degree polynomial, exponential, periodic, step, piecewise)	X		
Experimenting with real functions as well as observing, interpreting, describing and representing them (second-degree polynomial, exponential, square root, periodic, step, logarithmic, greatest integer, piecewise)		X	
Experimenting with real functions as well as observing, interpreting, describing and representing them (second-degree polynomial, step, greatest integer)			X
Describing and interpreting the properties of real functions using a graph	X	X	X
Interpreting the multiplicative parameter		X	
Interpreting multiplicative and additive parameters			X
Solving and graphing two-variable first-degree inequalities		X	
Switching from one form to another in writing second-degree polynomial functions			X
System			
Representing a situation using straight lines	X		
Representing a situation using straight lines or half-planes		X	X
Solving systems of two-variable first-degree equations	X	X	X
Solving system composed of a first-degree equation and a second-degree equation with two variables			X

DATA COLLECTION

MATHEMATICAL KNOWLEDGE	MTH-4152-1 (CST)	MTH-4162-2 (TS)	MTH-4172-2 (SCI)
One-variable distribution			
Determining and interpreting measures of position and dispersion: - Percentile rank - Mean deviation - Standard deviation	 X X	 X X	
Representing statistical data related to a population or a sample (Stem-and-Leaf Plot)	X		
Two-variable distribution			
Constructing and interpreting two-variable distributions	X	X	X
Graphing a scatter plot	X	X	X
Representing the regression line by means of a rule or graph	X		
Representing and determining the equation of the regression line or curves related to the functional models being studied		X	
Representing and determining the equation of the regression line			X
Interpolating or extrapolating using the regression line	X	X	X
Approximating and interpreting the correlation coefficient	X	X	
Interpreting a correlation qualitatively and quantitatively	X	X	X
Interpolating and extrapolating using the functional model most appropriate to the situational problem		X	X
Probability			
Calculating and interpreting mathematical expectation		X	
Calculating probabilities using statistical data		X	
Representing and determining conditional probability		X	
Determining the odds *for* or the odds *against*		X	
Changing the value of parameters or conditions		X	
Distinguishing between mutually exclusive, nonmutually exclusive, independent and dependent events		X	

Geometric Representation

MATHEMATICAL KNOWLEDGE	MTH-4153-1 (CST)	MTH-4163-2 (TS)	MTH-4173-2 (SCI)
Metric and trigonometric relations in triangles			
Determining the slope, measurements and positions using metric and trigonometric relations in triangles	X	X	X
• Angles of a triangle	X	X	X
• Angles in a triangle or in figures that can be divided into triangles			X
• Altitude relative to the hypotenuse	X	X	X
• Projection of the leg on the hypotenuse		X	X
• Sides of a triangle	X	X	X
• Area of a triangle and a quadrilateral	X		
• Area of a triangle		X	
• Area and volume of figures			X
• Coordinates of a point of division	X	X	
• Length of a segment	X	X	X
• Length of a segment resulting from a congruence or a similarity			X
• Perpendicular bisector of a segment		X	
• Distance (between two points)	X	X	X
• Areas of triangles, given the measure of an angle and the lengths of two sides or given the measures of two angles and the length of one side		X	
Representing and interpreting situations using triangles:	X	X	X
• Trigonometric ratios (sine, cosine and tangent)	X	X	X
• Sine law	X		X
• Law of cosines			X
• Heron's formula	X		
• Other relations in triangles, specified in the course's list of principles.	X	X	X
Describing the properties of trigonometric ratios	X	X	X
Similar and congruent triangles			
Determining the minimum conditions required to conclude that triangles are congruent or similar	X	X	X
Equivalent figures			
Determining measurements			X

Evaluation Criteria

The learners' progress in mathematics is evaluated based on targeted criteria. After the scored activities, a co-evaluation with each learner according to the 11 criteria described in the program document is recommended. This joint exercise is a chance for the learner to better understand the criteria used to evaluate the extent to which they have mastered the competencies. With respect to the ministry's evaluation for certification purposes, a smaller number of criteria—generally five—may be used to determine the learner's success. Teachers may consult the document containing the *Definition of the Evaluation Domain (DED)* to find out which criteria are used for each ministerial exam.

EVALUATION CRITERIA FOR THE COMPETENCIES TARGETED BY THE COURSE
Competency 1: Uses Strategies to Solve Situational Problems
Indication of an appropriate understanding of the situational problem
Application of strategies and mathematical knowledge appropriate to the situational problem
Development of an appropriate solution*
Appropriate validation of the steps** in the solution
* The solution includes a procedure, strategies and a final answer. ** The mathematical model, operations, properties or relations involved.
Competency 2: Uses Mathematical Reasoning
Formulation of a conjecture suited to the situation
Correct use of appropriate mathematical concepts and processes
Proper implementation of mathematical reasoning suited to the situation
Proper organization of the steps in an appropriate procedure
Correct justification of the steps in an appropriate procedure
Competency 3: Communicates by Using Mathematical Language
Correct interpretation of a mathematical message
Production of a message in keeping with the terminology, rules and conventions of mathematics, and appropriate to the context

Source: *Diversified Basic Education Program, Mathematics.*

Introduction

The next part of this teaching guide provides important information to be used in planning each course in the mathematics diversified basic education program.

- Summary of the course program
- Introduction to the learning guide
- Integrative processes targeted by the course
- Family of learning situations in the course
- End-of-course outcomes
- Prescribed mathematical knowledge
- Overall structure of the guide
- Structure of each chapter and its situational problems
- Details about each end-of-chapter LES and the tracking tools used
- Strategies for solving situational problems
- Structure of ICT activities
- Structure of evaluation activities

Conclusion

This *Introduction* to the summary teaching guide provides an overview of the program and its requirements. It outlines a structured learning approach based on solving situational problems that are meaningful to learners.

Each section of the teaching guide that refers to a particular course code in the **SOLUTIONS** series contains specific references, notes and a wealth of useful information for teachers. This helps teachers to plan their work accurately and efficiently and to prepare complementary activities that are relevant to each option proposed by the **SOLUTIONS** series, providing guidance throughout the learning process.

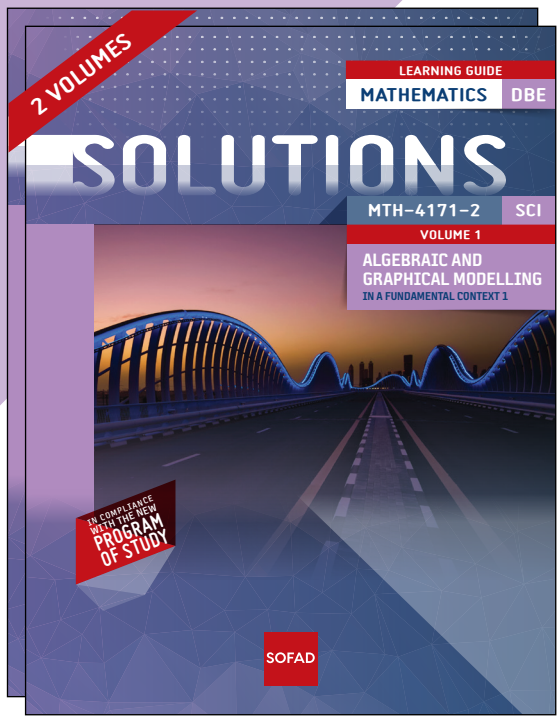
SOLUTIONS

MTH–4171–2 SCI

ALGEBRAIC AND GRAPHICAL MODELLING

IN A FUNDAMENTAL CONTEXT 1

Table of Contents



Introduction

Welcome to the course *Algebraic and Graphical Modelling in a Fundamental Context 1*. In this course, learners will study various situations enabling them to:

- demonstrate their ability to work with algebraic expressions
- learn more about the properties of straight lines on a Cartesian plane
- interpret and describe information to solve systems of equations.

To complete their instruction, learners will also encounter various situations that put the dependency relationships between quantities into context. They will study two new real functions and the meaning behind their parameters. These are:

- second-degree polynomial functions
- step functions.

Integrative Processes

To work through the learning situations effectively, learners will become accustomed to applying three processes that encourage the acquisition of mathematical knowledge and the subject-specific competencies associated with the course *Algebraic and Graphical Modelling in a Fundamental Context 1*.

Integrative Processes

- **Using an algebraic or graphical model to represent a situation**
- **Using an algebraic or graphical model to generalize a set of situations**
- **Interpolating or extrapolating from an algebraic or graphical model**

Family of Learning Situations

In the course *Algebraic and Graphical Modelling in a Fundamental Context 1*, learners encounter learning situations belonging to the ***Relationship Between Quantities*** family. For instance, the situational problems presented in this guide enable learners to:

- establish dependency relationships between quantities
- determine the relationships between the change in the parameters of the rule of a function and the transformation of the corresponding Cartesian coordinate graph
- derive rules
- extrapolate results using an algebraic rule or a graph.

End-of-Course Outcomes

By the end of this course, learners will be able to:

- represent a situational problem using an algebraic or graphical model and real functions
- choose the algebraic model best suited to a situation
- produce accurate mathematical messages in accordance with mathematical rules and conventions
- validate their solutions or intuitions algebraically, sometimes using a graph
- justify all of the steps in their process using mathematical language
- validate their conjectures through interpolation or extrapolation
- find the rule in a rigorous way using the zeros of the function or the characteristics of the step function
- when solving systems of two-variable first-degree equations, generalize results that lead to the properties of different types of lines, be they parallel, perpendicular, coincident or intersecting
- use factoring involving significant identities: perfect square trinomial or difference of two squares
- easily identify the specific characteristics of algebraic fractions.

Knowledge Covered in the MTH-4171-2 Course

MATHEMATICAL KNOWLEDGE	RESTRICTIONS AND CLARIFICATIONS	IN THE *SOLUTIONS* GUIDE	
MANIPULATING ALGEBRAIC EXPRESSIONS		**SECTION**	**PAGES**
Operations on algebraic expressions	Operations on algebraic expressions are limited to: • multiplication • division of polynomials by a binomial (with or without a remainder) • the simplification of rational expressions (rational fractions).	 Acquisition 2.2 A Acquisitions 2.2 A and B Acquisition 2.1 A	 89 to 93 89 to 99 69 to 77
Expanding, simplifying or substituting expressions using special algebraic identities	The special algebraic identities of the second degree are: • perfect square trinomial • difference of two squares.	 Acquisition 2.1 A Acquisition 2.1 B	 69 to 77 80 to 82
Completing the square	Completing the square is used for factoring second-degree polynomial functions and converting from one way of writing them to another.	Acquisition 3.2 A	37 to 43
Factoring trinomials using roots	Trinomials are factored using the roots of the polynomial, if any: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.	Acquisition 3.2 B	46 to 54
Solving first-degree equations and inequalities with one or two variables and second-degree equations and inequalities with one variable	Equations and inequalities are solved: • algebraically • using a graph.	 Acquisition 3.3 A Acquisition 3.3 A	 63 to 71 63 to 71
FUNCTION		**SECTION**	**PAGES**
Experimenting with real functions as well as observing, interpreting, describing and representing them	The real functions studied in this course are: • second-degree polynomials – general form $f(x) = ax^2 + bx + c$ – factored form $f(x) = a(x - x_1)(x - x_2)$ – The standard form $f(x) = a(x - h)^2 + k$ • step functions (greatest integer not greater than x) $f(x) = a[b(x - h)] + k$. Functions can be represented: • verbally • using a table of values • algebraically • using a graph, with or without the use of technology.	 Acquisition 3.2 A Acquisition 3.2 B Acquisition 3.1 B Chapter 1 Chapter 1 Chapter 3	 37 to 43 46 to 54 16 to 26 4 to 49 4 to 49 4 to 59

MATHEMATICAL KNOWLEDGE	RESTRICTIONS AND CLARIFICATIONS	IN THE *SOLUTIONS* GUIDE	
Describing and interpreting the properties of real functions	The properties of real functions covered in this course are: • domain and codomain (range) • increasing and decreasing intervals • extrema • sign • *x*- and *y*-intercepts.	Acquisition 1.1 A Acquisitions 1.2 A and B Acquisition 3.1 B	7 to 15 29 to 44 37 to 43
Interpreting multiplicative and additive parameters		Acquisition 1.1 B	18 to 21
Switching from one form to another in writing second-degree polynomial functions		Acquisition 3.2 B	46 to 54
SYSTEM		**SECTION**	**PAGES**
Representing a situation using straight lines or half-planes	The properties of the following lines are studied: • parallel lines • intersecting lines • coincident lines • perpendicular lines. The equation of a line can be expressed in: • general form $Ax + By + C = 0$ • standard form $y = ax + b$ • symmetric form $\left(\frac{x}{a} + \frac{y}{b}\right) = 1$.	Chapter 4	100 to 142
Solving systems of first-degree equations with two variables	Systems may be solved: • using a table of values • algebraically • using a graph.	Chapter 5	156 to 196
Solving systems containing a first-degree equation and a second-degree equation with two variables			

Source: *Mathematics Adult General Education Program, Diversified Basic Education (DBE)*, MEES 2017, pp. 329-331.

STRUCTURE OF COURSE AND CHAPTERS

SUMMARY TEACHING GUIDE

MTH-4171-2 SCI

ALGEBRAIC AND GRAPHICAL MODELLING

IN A FUNDAMENTAL CONTEXT 1

CHAPTER 1 (Volume 1) — 9 h 30 min

STEP FUNCTIONS AND GREATEST INTEGER FUNCTIONS

Interpreting Numerical Information

Broad area of learning: Environmental Awareness and Consumer Rights and Responsibilities

SITUATION 1.1

pp. 4 to 25

- Step functions
- Greatest integer function $f(x) = [x]$
- Greatest integer function $f(x) = a[bx]$

SP – PAY-AS-YOU-GO CALLS ▸1.1 **p. 4**

EXPLORATION 15 min

ACQUISITION A 90 min

- Interpreting a step function
- Determining the rule for a greatest integer function from its graph
- Determining a missing value algebraically using the rule of a greatest integer function

ICT 1.1.1 **p. 10**

SOLUTION 15 min

ACQUISITION B 45 min

- Analyzing the effect of reversing the signs of parameters a and b

ICT 1.1.2 **p. 19**

CONSOLIDATION 60 min

SITUATION 1.2

pp. 26 to 49

- Greatest integer function $f(x) = a[b(x - h)] + k$
- Nearest integer functions

SP – MEASURING THE TEMPERATURE ▸1.2 **p. 26**

EXPLORATION 15 min

ACQUISITION A 60 min

- Discovering greatest integer functions of the form $f(x) = a[b(x - h)] + k$
- Graphing greatest integer functions of the form $f(x) = a[b(x - h)] + k$
- Determining the rule for a transformed greatest integer function using its graph
- Studying nearest integer functions

ICT 1.2.1 **p. 34**

SOLUTION 15 min

ACQUISITION B 45 min

- Writing a greatest integer function from a table of values
- Interpreting the properties of greatest integer function $f(x) = a[b(x - h)] + k$

CONSOLIDATION 60 min

KNOWLEDGE SUMMARY (**pp. 50 to 55**) 30 min

INTEGRATION (**pp. 56 to 61**) 90 min

LES: Timekeeping (**pp. 62 and 63**) 30 min

CHAPTER 2 (Volume 1) — 9 h 30 min

ALGEBRAIC EXPRESSIONS

Revealing the Secrets of Paranormal Activity

Broad area of learning: Citizenship and Community Life

SITUATION 2.1

pp. 66 to 85

- Rational expressions
- Perfect square trinomials
- Difference of squares

SP – THE PRODIGY ▸2.1 **p. 66**

EXPLORATION 15 min

ACQUISITION A 90 min

- Recognizing rational expressions
- Determining restrictions
- Adding and subtracting rational expressions
- Factoring perfect square trinomials
- Simplifying algebraic fractions through factorization

SOLUTION 15 min

ACQUISITION B 45 min

- Recognizing a difference of two squares
- Factoring using the difference of two squares

CONSOLIDATION 60 min

SITUATION 2.2

pp. 86 to 103

- Multiplying two polynomials
- Dividing a polynomial by a binomial

SP – THE TELEPATH ▸2.2 **p. 86**

EXPLORATION 15 min

ACQUISITION A 60 min

- Multiplying polynomials
- Dividing a polynomial by a binomial without a remainder

SOLUTION 15 min

ACQUISITION B 45 min

- Dividing a polynomial by a binomial with a remainder

CONSOLIDATION 60 min

KNOWLEDGE SUMMARY (**pp. 104 to 107**) 30 min

INTEGRATION (**pp. 108 to 111**) 90 min

LES: The Amateur Mentalists (**pp. 112 and 113**) 30 min

CHAPTER 3 (Volume 2) — 12 h

SECOND-DEGREE POLYNOMIAL FUNCTIONS

Modelling Athletic Performance

Broad area of learning: Health and Well-Being

SITUATION 3.1

pp. 4 to 33

- The standard form $f(x) = a(x - h)^2 + k$

SP – PASSING THE BATON ▸3.1 **p. 4**

EXPLORATION 15 min

ACQUISITION A 60 min

- Discovering functions proportional to the square
- Discovering second-degree polynomial functions of the form $f(x) = ax^2$
- Graphing functions of the form $f(x) = ax^2$
- Determining the rule for a function of the form $f(x) = ax^2$ from its graph
- Finding the independent variable of these functions when the value of y is given

SOLUTION 15 min

ACQUISITION B 60 min

- Discovering the standard form of the second-degree polynomial function $f(x) = a(x - h)^2 + k$
- Determining the function rule from the graph
- Determining the graph from the function rule
- Determining the zeros of second-degree polynomial functions

ICT 3.1.2 **p. 18** ICT 3.1.3 **p. 21**

ICT 3.1.4 **p. 26**

CONSOLIDATION 60 min

SITUATION 3.2

pp. 34 to 59

- The general form $f(x) = ax^2 + bx + c$
- The factored form $f(x) = a(x - x_1)(x - x_2)$

SP – THE WINNING SHOT ▸3.2 **p. 34**

EXPLORATION 15 min

ACQUISITION A 60 min

- Discovering second-degree polynomial functions in general form $f(x) = ax^2 + bx + c$
- Completing the square of algebraic expressions to convert from one form to another
- Solving second-degree polynomial functions
- Discovering the characteristics of second-degree polynomial functions

ICT 3.2.1 **p. 42**

SOLUTION 15 min

ACQUISITION B 60 min

- Discovering the factored form $f(x) = a(x - x_1)(x - x_2)$ of second-degree polynomial equations
- Converting from general form to factored form to determine the zeros of the function
- Factoring using the product-sum method
- Converting from one form to another

ICT 3.2.2 **p. 53**

CONSOLIDATION 60 min

SITUATION 3.3

pp. 60 to 76

- Solving second-degree inequalities

SP – THE FINAL PLAY ▸3.3 **p. 60**

EXPLORATION 15 min

ACQUISITION A 60 min

- Solving second-degree inequalities using a graph
- Solving second-degree inequalities algebraically

ICT 3.3.1 **p. 66**

SOLUTION 15 min

CONSOLIDATION 60 min

KNOWLEDGE SUMMARY (**pp. 77 to 86**) 30 min

INTEGRATION (**pp. 87 to 95**) 90 min

LES: The Hole-In-One (**pp. 96 and 97**) 30 min

Page numbers refer to the MTH-4171-2 learning guide, volumes 1 and 2.

SCORED ACTIVITY 1 Pertains to the knowledge acquired in Chapters 1 to 3.

CHAPTER 4 (Volume 2) — 9 h 30 min

STRAIGHT LINES AND HALF-PLANES

Drawing with Equations and Inequalities

Broad area of learning: Environmental Awareness and Consumer Rights and Responsibilities

SITUATION 4.1	SITUATION 4.2
pp. 100 to 125	**pp. 126 to 142**
• Straight lines in a plane • Linear equations	• Half-planes • Relative position of two straight lines
SP – A CUBE IN PERSPECTIVE ▸4.1 **p. 100**	**SP – PLANNING A VERANDA** ▸4.2 **p. 126**
EXPLORATION 15 min	EXPLORATION 15 min
ACQUISITION A 90 min • Using set-builder notation to describe the set of points of a straight line in a Cartesian plane • Discovering the concept of the slope of a straight line • Determining and interpreting the standard equation of a straight line • Determining the general equation of a straight line	**ACQUISITION A** 75 min • Using inequalities to describe half-planes on a Cartesian plane • Determining the relative position of two straight lines by analyzing their slopes ICT 4.2.1 **p. 133**
SOLUTION 15 min	SOLUTION 15 min
ACQUISITION B 75 min • Interpreting the parameters of the general equation of a straight line • Determining and interpreting the symmetric equation of a straight line • Comparing the different forms of linear equations ICT 4.1.1 **p. 116**	
CONSOLIDATION 60 min	CONSOLIDATION 60 min
KNOWLEDGE SUMMARY (**pp. 143 to 146**) 30 min	
INTEGRATION (**pp. 147 to 151**) 90 min	
LES: **The Treasure Hunt** (**pp. 152 and 153**) 30 min	

CHAPTER 5 (Volume 2) — 9 h 30 min

SYSTEMS OF EQUATIONS

Making Smart Choices

Broad area of learning: Environmental Awareness and Consumer Rights and Responsibilities

SITUATION 5.1	SITUATION 5.2
pp. 156 to 179	**pp. 180 to 196**
• Solving systems of first-degree equations	• Solving systems containing a first-degree equation and a second-degree equation
SP – AN ECONOMICAL CAR ▸5.1 **p. 156**	**SP – THE ECO-HOUSE** ▸5.2 **p. 180**
EXPLORATION 15 min	EXPLORATION 15 min
ACQUISITION A 75 min • Using graphs to represent and solve situations with two unknowns • Solving systems of equations algebraically using the elimination method	**ACQUISITION A** 90 min • Using systems containing a first-degree equation and a second-degree equation to express situations • Using tables of values, graphs or algebra to solve systems of equations • Determining the number of solutions of a system ICT 5.2.1 **p. 184** ICT 5.2.2 **p. 188**
SOLUTION 15 min	SOLUTION 15 min
ACQUISITION B 75 min • Solving systems of equations by substitution • Determining the number of solutions to a system of equations • Choosing a method to solve a system of equations	
CONSOLIDATION 60 min	CONSOLIDATION 60 min
KNOWLEDGE SUMMARY (**pp. 197 to 202**) 30 min	
INTEGRATION (**pp. 203 to 209**) 90 min	
LES: **Solar Panels** (**pp. 210 and 211**) 30 min	

SCORED ACTIVITY 2 Pertains to the knowledge acquired in Chapters 4 and 5.

SELF-EVALUATION Pertains to all the mathematical knowledge acquired during the course, with a self-evaluation grid for the learner's use.

SUMMARY SCORED ACTIVITY Pertains to all the mathematical knowledge acquired during the course, with a tracking tool for the evaluator's use.

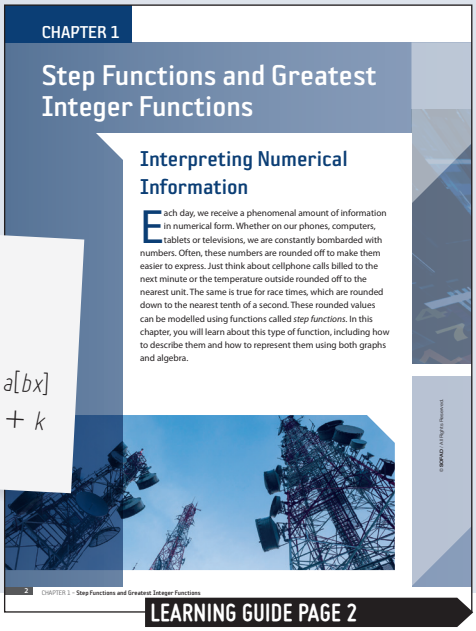
Page numbers refer to the MTH-4171-2 learning guide, volumes 1 and 2.

Step Functions and Greatest Integer Functions

Interpreting Numerical Information

Knowledge to be acquired in this chapter:

- step functions
- greatest integer function $f(x) = [x]$
- greatest integer function of the form $f(x) = a[bx]$
- greatest integer function $f(x) = a[b(x - h)] + k$
- nearest integer functions.


CHAPTER 1

Step Functions and Greatest Integer Functions

Interpreting Numerical Information

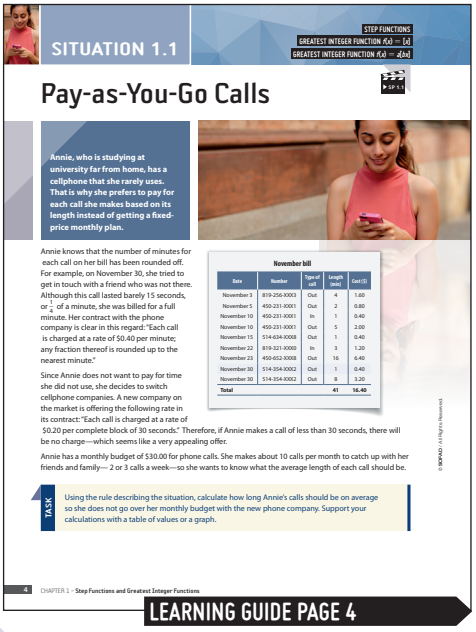
Each day, we receive a phenomenal amount of information in numerical form. Whether on our phones, computers, tablets or televisions, we are constantly bombarded with numbers. Often, these numbers are rounded off to make them easier to express. Just think about cellphone calls billed to the next minute or the temperature outside rounded off to the nearest unit. The same is true for race times, which are rounded down to the nearest tenth of a second. These rounded values can be modelled using functions called *step functions*. In this chapter, you will learn about this type of function, including how to describe them and how to represent them using both graphs and algebra.

LEARNING GUIDE PAGE 2

SITUATIONAL PROBLEM 1.1
Pay-As-You-Go Calls

SITUATION

Annie has a cellphone, but she rarely uses it. That is why she prefers to pay for each call she makes based on its length instead of getting a fixed-price monthly plan. She considers two companies. The first company offers a fixed rate per minute; any fraction thereof is rounded up to the nearest minute. The second company charges per complete block of 30 seconds.


SITUATION 1.1

STEP FUNCTIONS
GREATEST INTEGER FUNCTION $f(x) = [x]$
GREATEST INTEGER FUNCTION $f(x) = a[bx]$

Pay-as-You-Go Calls

Annie, who is studying at university far from home, has a cellphone that she rarely uses. That is why she prefers to pay for each call she makes based on its length instead of getting a fixed-price monthly plan.

Annie knows that the number of minutes for each call on her bill has been rounded off. For example, on November 30, she tried to get in touch with a friend who was not there. Although this call lasted barely 15 seconds, or $\frac{1}{4}$ of a minute, she was billed for a full minute. Her contract with the phone company is clear in this regard: "Each call is charged at a rate of $0.40 per minute; any fraction thereof is rounded up to the nearest minute."

Since Annie does not want to pay for time she did not use, she decides to switch cellphone companies. A new company on the market is offering the following rate in its contract: "Each call is charged at a rate of $0.20 per complete block of 30 seconds." Therefore, if Annie makes a call of less than 30 seconds, there will be no charge—which seems like a very appealing offer.

Annie has a monthly budget of $30.00 for phone calls. She makes about 10 calls per month to catch up with her friends and family— 2 or 3 calls a week—so she wants to know what the average length of each call should be.

November bill

Date	Number	Type of call	Length (min)	Cost ($)
November 3	819-256-XXXX	Out	4	1.60
November 5	450-231-XXXX	Out	2	0.80
November 10	450-231-XXXX	In	1	0.40
November 10	450-231-XXXX	Out	5	2.00
November 15	514-634-XXXX	Out	1	0.40
November 22	819-321-XXXX	In	3	1.20
November 23	450-652-XXXX	Out	16	6.40
November 30	514-354-XXXX	Out	1	0.40
November 30	514-354-XXXX	Out	8	3.20
Total			41	16.40

TASK

Using the rule describing the situation, calculate how long Annie's calls should be on average so she does not go over her monthly budget with the new phone company. Support your calculations with a table of values or a graph.

4 CHAPTER 1 – Step Functions and Greatest Integer Functions

LEARNING GUIDE PAGE 4

TASK

Using the rule describing the situation, calculate how long Annie's calls should be on average so she does not go over her monthly budget with the new phone company.

Support your calculations with a table of values or a graph.

EXPLORATION

Enables learners to review the mathematical terms related to functions and helps to identify the characteristics of the function that can be used to model the situational problem. This is useful for building the graph and determining the function rule.

STRATEGIES

Give yourself numerical examples. (Exploration)

Recognize parameters quickly. (Acquisition A)

SOLUTION

Interpret and represent (with a table of values or graph) the step function by modelling the cost of a call as a function of its length.

Determine the rule of a greatest integer function from its graph.

Use algebra to determine the missing value—that is, the average length of a call—from the rule of the greatest integer function.

SITUATIONAL PROBLEM 1.2
Measuring the Temperature

SITUATION

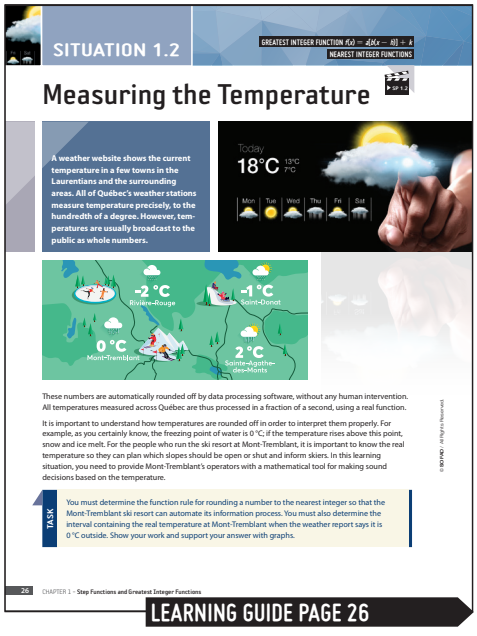
A weather website shows the current temperature in a few towns in the Laurentians and the surrounding areas. All of Québec's weather stations measure temperature precisely, to the hundredth of a degree. However, temperatures are usually broadcast to the public as whole numbers. For the people who run the ski resort at Mont-Tremblant, it is important to know the real temperature so they can plan which slopes should be open or shut and inform skiers.

TASK

Determine the function rule for rounding a number to the nearest integer so that the Mont-Tremblant ski resort can automate its information process.

Determine the interval containing the real temperature at Mont-Tremblant when the weather report says it is 0°C outside.

Show your work and support your answer with graphs.


SITUATION 1.2

GREATEST INTEGER FUNCTION $f(x) = a[b(x - h)] + k$

NEAREST INTEGER FUNCTIONS

Measuring the Temperature

A weather website shows the current temperature in a few towns in the Laurentians and the surrounding areas. All of Québec's weather stations measure temperature precisely, to the hundredth of a degree. However, temperatures are usually broadcast to the public as whole numbers.

Today 18°C 13°C 7°C

Mon Tue Wed Thu Fri Sat

-2 °C Rivière-Rouge

-1 °C Saint-Donat

0 °C Mont-Tremblant

2 °C Sainte-Agathe-des-Monts

These numbers are automatically rounded off by data processing software, without any human intervention. All temperatures measured across Québec are thus processed in a fraction of a second, using a real function.

It is important to understand how temperatures are rounded off in order to interpret them properly. For example, as you certainly know, the freezing point of water is 0 °C; if the temperature rises above this point, snow and ice melt. For the people who run the ski resort at Mont-Tremblant, it is important to know the real temperature so they can plan which slopes should be open or shut and inform skiers. In this learning situation, you need to provide Mont-Tremblant's operators with a mathematical tool for making sound decisions based on the temperature.

TASK

You must determine the function rule for rounding a number to the nearest integer so that the Mont-Tremblant ski resort can automate its information process. You must also determine the interval containing the real temperature at Mont-Tremblant when the weather report says it is 0 °C outside. Show your work and support your answer with graphs.

26 CHAPTER 1 - Step Functions and Greatest Integer Functions

LEARNING GUIDE PAGE 26

EXPLORATION

Enables learners to define the type of rounding used for temperatures so that weather reports are as accurate as possible.

STRATEGY

Compare to establish a rule. (Exploration)

SOLUTION

Study the function for rounding the temperature.

Graph the greatest integer function (of the form $f(x) = a[b(x - h)] + k$) for negative temperatures.

Determine the rule of a transformed greatest integer function using its graph.

Timekeeping

SITUATION

A newspaper describes the results of a Rubik's cube competition. The event was timed to the tenth of a second, and two competitors achieved the same recorded time of 16.8 s. Determine the two competitors' possible real times from their recorded time in order to confirm whether one solved the cube as quickly as the other.

LES1
Sample Procedures and Strategies

REPRESENTATION

Examine the situational problem to identify the context, the problem and the task to be performed.

Use words or symbols to reformulate the dependency relationship between the variables.

Adequately represent the situation using a diagram or examples.

PLANNING

List the main steps of the solution in point form:

- Represent the function modelling the action of the timer using a table of values or a graph.
- Determine the function rule.

Identify the elements needed for the graphical and algebraic representation of the situation: characteristics of the function, graduation of the axes, dependent and independent variables.

ACTIVATION

Follow the plan.

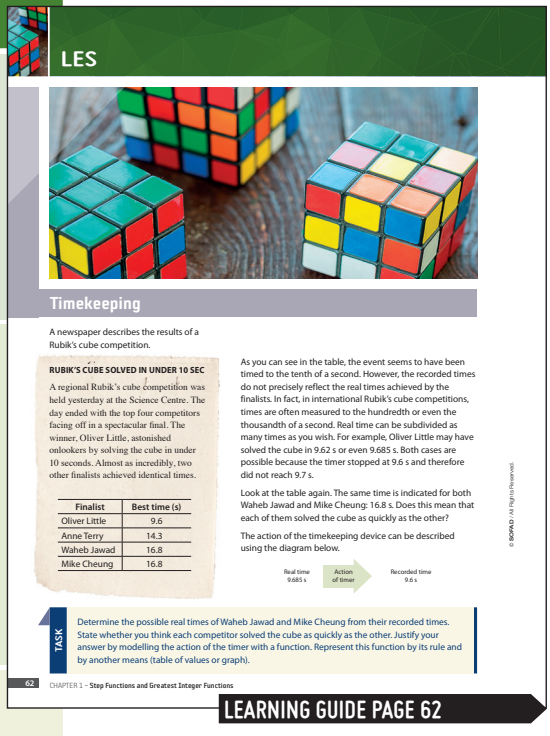
Draw on the mathematical knowledge needed:

- Greatest integer function of the form $f(x) = a[bx]$.
- Nearest integer function (rounding down).

Extrapolate the result using the graphical or algebraic representation.

REFLECTION

Formulate conjectures about particular or special cases (for example, the time recorded when the real time is one hundredth of a second over or under 0.9 s) to validate the result.


LES

Timekeeping

A newspaper describes the results of a Rubik's cube competition.

RUBIK'S CUBE SOLVED IN UNDER 10 SEC

A regional Rubik's cube competition was held yesterday at the Science Centre. The day ended with the top four competitors facing off in a spectacular final. The winner, Oliver Little, astonished onlookers by solving the cube in under 10 seconds. Almost as incredibly, two other finalists achieved identical times.

Finalist	Best time (s)
Oliver Little	9.6
Anne Terry	14.3
Waheb Jawad	16.8
Mike Cheung	16.8

As you can see in the table, the event seems to have been timed to the tenth of a second. However, the recorded times do not precisely reflect the real times achieved by the finalists. In fact, in international Rubik's cube competitions, times are often measured to the hundredth or even the thousandth of a second. Real time can be subdivided as many times as you wish. For example, Oliver Little may have solved the cube in 9.62 s or even 9.685 s. Both cases are possible because the timer stopped at 9.6 s and therefore did not reach 9.7 s.

Look at the table again. The same time is indicated for both Waheb Jawad and Mike Cheung: 16.8 s. Does this mean that each of them solved the cube as quickly as the other?

The action of the timekeeping device can be described using the diagram below.

Real time 9.685 s → Action of timer → Recorded time 9.6 s

TASK

Determine the possible real times of Waheb Jawad and Mike Cheung from their recorded times. State whether you think each competitor solved the cube as quickly as the other. Justify your answer by modelling the action of the timer with a function. Represent this function by its rule and by another means (table of values or graph).

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Timekeeping

CRITERIA	OBSERVABLE FACTORS
COMPETENCY 1: Uses Strategies to Solve Situational Problems	
CRITERION 1.1 Indication of an appropriate understanding of the situational problem	☐ Recognizes the requirement to find the competitors' real times according to their recorded times. ☐ Takes into account the fact that the recorded time is a function of the real time. ☐ Takes into account the fact that the event is timed to the tenth of a second. ☐ Other:
CRITERION 1.2 Application of strategies and mathematical knowledge appropriate to the situational problem	☐ Looks for a model of the relationship between the recorded time and the real time by one of the following means: – Expresses the nearest integer function (rounded down to the nearest tenth value below), in verbal form. – Determines the critical values of the nearest integer function (rounded down to the nearest tenth value below). – Graphs the function. – Represents the function algebraically. ☐ Uses the concept of the greatest integer function. ☐ Other:
COMPETENCY 2: Uses Mathematical Reasoning	
CRITERION 2.1 Correct use of appropriate mathematical concepts and processes	☐ The critical values are determined using the verbal function rule, which is rounding down to the nearest tenth value below. ☐ The image under the function of each critical value is determined from the verbal function rule. ☐ The intervals of real time associated with each possible value of the recorded time are deduced. ☐ The function rule is determined using the graph (or table of values) ($f(x) = 0.1[10x]$). ☐ The interval of possible real times for the two competitors is deduced by observing the pattern ([16.8, 16.9]). ☐ Other:
CRITERION 2.2 Proper implementation of mathematical reasoning suited to the situation	☐ Recognizes that the situation may be modelled by a greatest integer function. ☐ Deduces the characteristics of this function from the context and from the rule expressed in verbal form. ☐ Looks for patterns by representing the function algebraically or using a graph: – Interprets the graph using the information provided. – Determines the function rule. ☐ Extrapolates the function using patterns observed in the table of values, the graph or the rule. ☐ Other:
CRITERION 2.3 Proper organization of the steps in an appropriate procedure	☐ The reasoning steps are presented clearly. ☐ The function is represented, whether using a graph or a table of values and algebra, in accordance with mathematical rules and conventions. ☐ The use of mathematical symbols is appropriate. ☐ The answer is consistent with the procedure. ☐ The answer takes the context into account.

SOLUTIONS

The SOLUTIONS series covers all the courses in the Diversified Basic Education (DBE) program, including the *Secondary IV Science (Sci)* option.

The summary teaching guide presents the learning approach used in the **SOLUTIONS** series, which is based on the acquisition of all the prescribed mathematical knowledge in a problem-solving context.

The summary teaching guide also provides an overview of the three courses offered in the *Secondary IV Science (Sci)* option. Designed as a reference for teachers, this support document provides a summary of the elements of the Diversified Basic Education (DBE) program such as the nature of the learning activities, families of learning situations, subject-specific competencies, program options, prescribed knowledge and evaluation criteria.

Components of the summary teaching guide covering each learning guide in the SOLUTIONS series:

- Summary of the elements of the CCBE or DBE program.
- Table providing an overview of the course structure
- Phases in solving situational problems and LES activities
- List of observable factors for LES activities
- Strategies for solving situational problems
- Structure of ICT activities
- Structure of evaluation activities

SOFAD