MATHEMATICS

DBE

SOLUTIONS

MTH–5170–2 | SCI

OPTIMIZATION
IN A FUNDAMENTAL CONTEXT

SOFAD

Photo credits

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COMPLEMENTS

HOW THE LEARNING GUIDE IS STRUCTURED

Welcome to the learning guide for the *Optimization in a Fundamental Context* course. The aim of this course, which is the first in the **Secondary V Science** sequence, is to develop your skills in dealing with situations that require optimal solutions. To achieve this, you will study linear programming, namely:

- systems of first-degree inequalities in two variables;

- the representation of constraints;

- the feasible region;

- the objective or economic function.

You will complete your learning by making potential modifications to the conditions of a situation to make them more efficient.

You will be required to use various solution strategies to understand and model situational problems. You will need to use your mathematical reasoning skills. You will also have to describe how you solved these problems clearly and thoroughly using mathematical language.

You are now invited to complete the learning activities found in the two chapters of this guide and enrich your knowledge of optimization.

Portailsofad.com

Go to portailsofad.com for videos, ICT activities and printable versions of resources that are complementary to the SOLUTIONS series, which you can use throughout your learning journey.
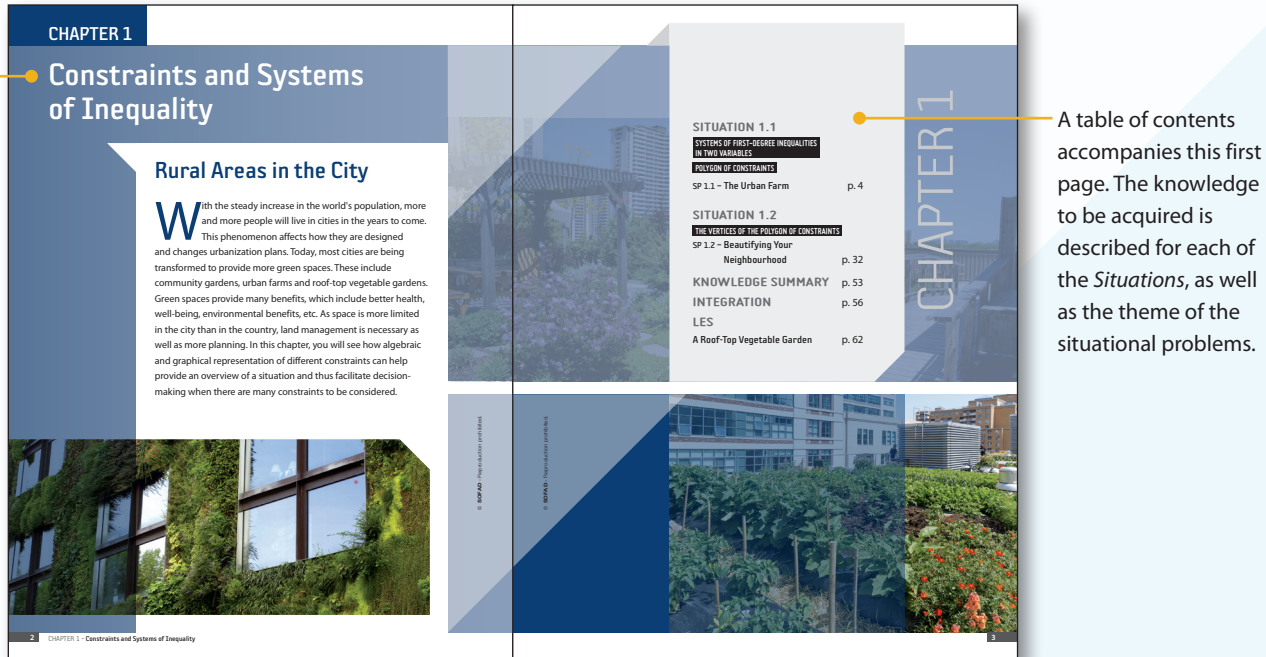
CHAPTER COMPONENTS

The learning process followed in each chapter enables students to progress by building on what they have learned from one section to the next. The following diagrams illustrate this approach and specify the pedagogical intent of each section.

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.

CHAPTER 1

Constraints and Systems of Inequality

Rural Areas in the City

With the steady increase in the world's population, more and more people will live in cities in the years to come. This phenomenon affects how they are designed and changes urbanization plans. Today, most cities are being transformed to provide more green spaces. These include community gardens, urban farms and roof-top vegetable gardens. Green spaces provide many benefits, which include better health, well-being, environmental benefits, etc. As space is more limited in the city than in the country, land management is necessary as well as more planning. In this chapter, you will see how algebraic and graphical representation of different constraints can help provide an overview of a situation and thus facilitate decision-making when there are many constraints to be considered.

CHAPTER 1

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.
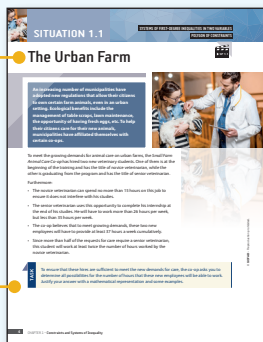
SITUATIONS

In general, there are two learning *Situations* per chapter. The approach taken in these situations makes it possible to acquire new knowledge and develop mathematical skills in real, realistic or purely mathematical contexts.

SITUATION 1.1

The Urban Farm

An increasing number of municipalities have adopted new regulations that allow their citizens to own certain farm animals, even in an urban setting. Ecological benefits include the management of table scraps, lawn maintenance, the opportunity of having fresh eggs, etc. To help their citizens care for their new animals, municipalities have affiliated themselves with certain co-ops.

To meet the growing demands for animal care on urban *Animal Care Co-op* has hired two new veterinary students beginning of the training and has the title of novice other is graduating from the program and has the title

Furthermore:

- The novice veterinarian can spend no more than 1 ensure it does not interfere with his studies.
- The senior veterinarian uses this opportunity to co the end of his studies. He will have to work more t but less than 35 hours per week.
- The co-op believes that to meet growing demands employees will have to provide at least 37 hours a
- Since more than half of the requests for care requi this student will work at least twice the number of novice veterinarian.

TASK To ensure that these hires are sufficient to mee determine all possibilities for the number of h Justify your answer with a mathematical repre

SITUATION 1.2

Beautifying Your Neighbourhood

Some municipalities have programs designed to encourage citizens to participate in beautifying their environment. For example, citizens living in the vicinity of poorly maintained streets have created a healthy and green environment. Among others, the role of municipalities is to provide the equipment required to achieve this objective.

Victor is leading a group of parents who took the initiative to beautify their children's elementary school yard. He has found a municipal aid program that allows them to buy flower boxes for $22 each and shrubs for $50 each. To participate in this program, in total they must buy a minimum of 25 shrubs and flower boxes, but less than 60. In addition, the order must contain at least 5 flower boxes more than the number of shrubs.

In its budget, the parents' group provides for a maximum of $1500 for the purchase of flower boxes and shrubs. Victor asks the person in charge of the group's purchases to find a number of shrubs and flower boxes that would make it possible to use the entire amount budgeted and would include exactly 5 boxes of flowers more than the number of shrubs.

TASK Determine whether Victor's request is possible. If yes, state the number of flower boxes and shrubs that meet Victor's conditions. If not, determine a solution by which the number of flower boxes and shrubs would make it possible to use all of the planned amount while satisfying all the constraints of the municipal aid program. Justify your answer using an appropriate representation.

PHASES OF EACH SITUATION

SITUATIONAL PROBLEM

Linked to the main theme of the chapter, this page briefly describes the context of the situational problem, as well as the information required to solve it.

A box describes the task you will have to perform later in the *Solution* section. This task is the starting point for acquiring new knowledge to solve the situational problem.
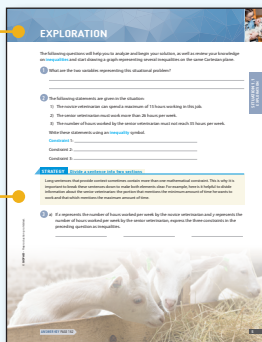
EXPLORATION

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

The questions posed will guide you toward a problem-solving strategy.
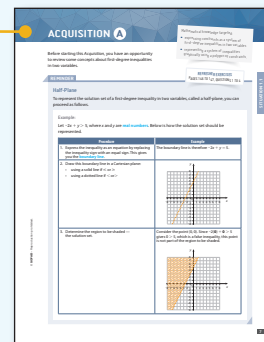
ACQUISITION A

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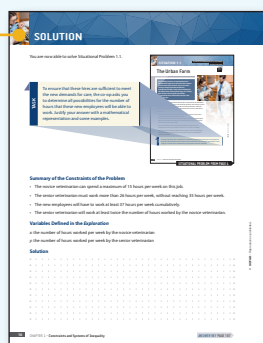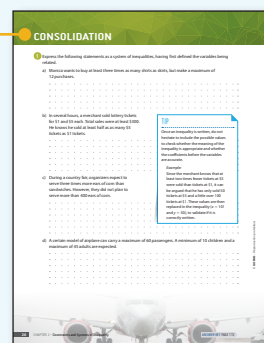
SOLUTION

By the time you reach this section, you should have acquired all the knowledge and strategies that are essential to solving the situational problem described at the beginning of the situation.
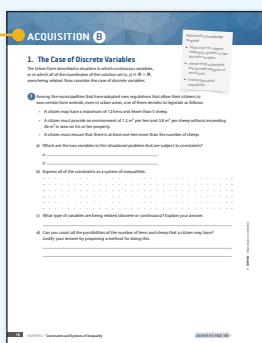
ACQUISITION B

In this second acquisition, you will acquire new knowledge prescribed by the program linked to the knowledge encountered in *Acquisition A*.

CONSOLIDATION

This section will allow you to consolidate the mathematical knowledge acquired in *Acquisitions A* and *B*. Like the *Integration* section, *Consolidation* also helps with 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. We invite you to fill in the missing information.
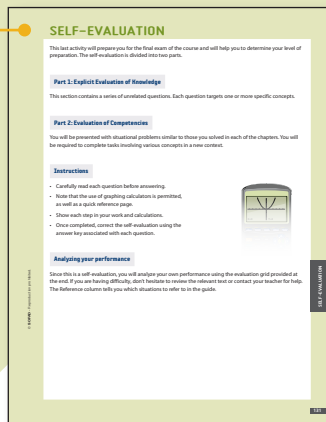
INTEGRATION

In this section, which includes exercises and complex situations, you will have to apply the knowledge seen in this chapter.

LES

The *LES* is a complex task developed according to the certification evaluation model. It is accompanied by a competency evaluation grid.

COMPLEMENTS

SELF-EVALUATION

A *Self-Evaluation* section can be found in the first part of the *Complements* section. It allows you to evaluate your acquired knowledge and the mathematical skills you have developed throughout the course. In this way, you will be able to identify the knowledge that you have mastered and that for which a revision is necessary before moving on to the *Summary Scored Activity*.
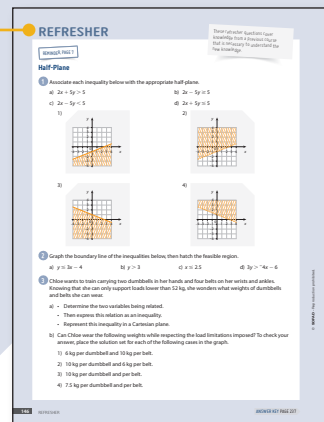
REFRESHER

Throughout the *Situations*, you will come across headings entitled *Reminders*. These sections present concepts seen in a previous course that are necessary to understand the new knowledge or to solve the current situation.

The *Refresher* section allows you to use exercises to review the mathematical rules and concepts that are the subject of a *Reminder*.
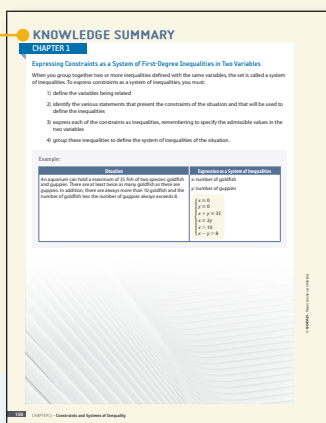
KNOWLEDGE SUMMARY

The full version of the *Knowledge Summary* is found in this section. A printable version is also available online.
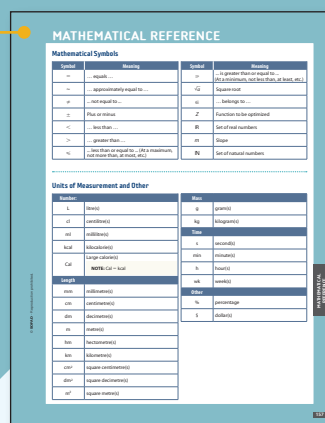
MATHEMATICAL REFERENCE

In this section, we present mathematical symbols used in the guide and some abbreviations of units of measurement. Reminders of mathematical formulas are also provided.

GLOSSARY

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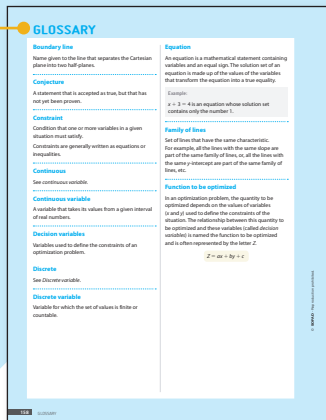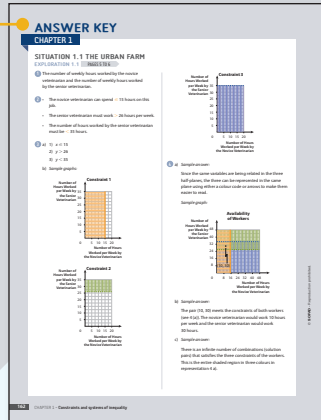
ANSWER KEY

Toward the end of the guide, you will find the *Answer Key*. It is designed not only for checking your answers, but also to complement your learning process. It contains the answers to questions and detailed explanations of the approach to be taken or the reasoning to be used.
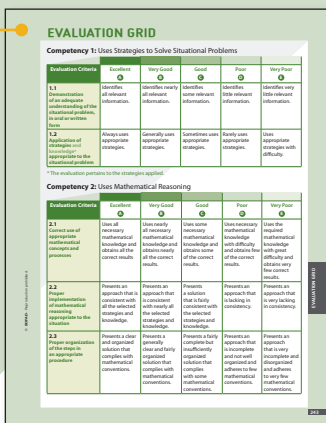
EVALUATION GRID

A competency *Evaluation Grid* is available at the end of the guide. After solving an *LES*, you are asked to evaluate yourself using this grid. You can then complete the abbreviated version at the bottom of each *LES*.
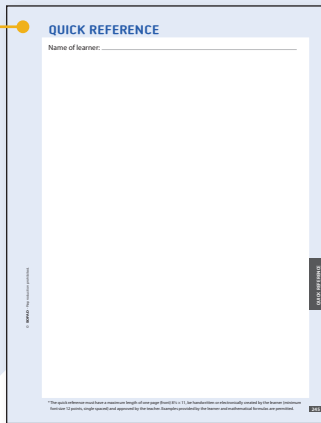
QUICK REFERENCE

You can create your own quick reference guide. A detachable sheet is provided for this purpose at the end of the guide. You may use this quick reference during the final test.

HEADINGS AND PICTOGRAMS

▶ SP 1.1

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

TASK

To ensure that these hires will be sufficient to...

Presents the task to be performed as part of your Situational Problem.

REMINDER

REFRESHER EXERCISES
PAGES 146 TO 147, QUESTIONS 1 TO 4

Half-Plane

To represent the solution set of a first-degree inequality in two variables, named "half-plane", you can proceed as follows.

Refers to knowledge you have acquired in previous courses and refresher exercises related to this *Reminder*.

REMEMBER

Expressing constraints ...

When you group together two or more inequalities defined with the same variables, the set is called a system of inequalities.

Presents the mathematical knowledge you will be required to master. This is the knowledge prescribed by the study program.

STRATEGY   **Subdividing a sentence ...**

Long sentences that provide context sometimes include more than one ...

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

DID YOU KNOW?

In Québec, percentiles are used to compare growth (weight, height).

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

TIP

If a variable of the situation only contains positive values, it must be taken into account in the system of inequalities.

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!

Units of measurement must always be specified when defining the variables of a situation. Also, you must specify ...

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

ICT

ICT Activity 1.2.1 shows you how to use the `zoom` key on the graphing calculator to find replacement points if necessary …

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

SCORED ACTIVITY

You must now complete Scored Activity 1 on Chapter 1. Find it at ...

Indicates that you are ready to complete the *Scored Activity* designed to assess your comprehension as you learn. The *Summary Scored Activity* is completed at the very end of the course. These activities are presented in separate booklets of the guide. You will have to submit each completed activity to your teacher or tutor who will provide you with feedback following correction.

SOLUTIONS

The **SOLUTIONS** series covers all the courses in the Diversified Basic Education Program, including the Secondary V *Cultural, Social and Technical* (CST) and *Science* (Sci) options.

2 VOLUMES

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IN A GENERAL CONTEXT
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IN A GENERAL CONTEXT 2
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VOLUME 2
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VOTE DISTRIBUTION MODELS AND RANDOM EXPERIMENT
IN A GENERAL CONTEXT
IN COMPLIANCE WITH THE NEW PROGRAM OF STUDY
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2 VOLUMES

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SOLUTIONS
MTH–5173–2 | SCI
VOLUME 2
GEOMETRIC REPRESENTATION
IN A FUNDAMENTAL CONTEXT 2
SOFAD

SOFAD

The **SOLUTIONS** learning approach is based on the acquisition of all the prescribed mathematical knowledge in a problem-solving context. The learning sequence that supports this approach is as follows:

PRESENTATION OF A SITUATIONAL PROBLEM

EXPLORATION OF PROBLEM

KNOWLEDGE ACQUISITION

PROBLEM–SOLVING

CONSOLIDATION OF LEARNING

Inductive and deductive questions give meaning to the knowledge and strategies to be acquired. The learning guides offer a multitude of simple exercises and more complex tasks to meet the needs expressed by learners and teachers. Additional resources are also available on portailsofad.com.

Components of the SOLUTIONS series:

- Learning guide: print and PDF versions;
- Teaching guide (PDF);
- Videos on situational problems;
- ICT activities: GeoGebra, graphing calculator;
- Scored activities;
- Answer keys.