Copyright Pacific Educational Press 2010

ISBN 978-1-895766-53-0

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior written permission of the publisher.

Printed and bound in Canada

Writers
Katharine Borgen, Vancouver School Board and University of British Columbia
Catherine Edwards, Pacific Educational Press
Sheeva Harrysingh-Klassen, J.H. Bruns Collegiate, Winnipeg
Mark Healy, West Vancouver Secondary School, West Vancouver
Craig Yuill, Prince of Wales Secondary School, Vancouver

Consultants
Katharine Borgen, PhD, Vancouver School Board and University of British Columbia
John Willinsky, PhD, Public Knowledge Project
Jordie Yow, Mathematics Reviewer

Design, Illustration, and Layout
Warren Clark
Laraine Coates
Sharlene Eugenio
Five Seventeen

Cover photo courtesy Colin Pickell

Editing
Christa Bedwin
Theresa Best
Diana Breti
Laraine Coates
Barbara Dominik
Catherine Edwards
Leah Giesbrecht
Deborah Hutton
Barbara Kuhne

Developed for the Western and Northern Canadian Protocol Apprenticeship and Workplace Mathematics Program.
Contents continued

2.2 Alternative Ways to Earn Money 99
   Puzzle It Out: A Weird Will 104
2.3 Additional Earnings 105
2.4 Deductions and Net Pay 110
   Reflect on Your Learning: Earning an Income 116
   Sample Chapter Test 119
   Sample Chapter Test: Solutions 123
   Blackline Masters 126
   Alternative Chapter Project: Outdoor Rock Concert 129
   Alternative Chapter Project: Blackline Masters 135

3 Length, Area, and Volume 138
   Introduction 138
   Curriculum and Chapter Overview 140
   The Mathematical Ideas 141
   Planning Chapter 3 144
   Chapter Project:
     Design an Ice-Fishing Shelter 147
3.1 Systems of Measurement 151
3.2 Converting Measurements 164
3.3 Surface Area 170
3.4 Volume 177
   Puzzle It Out: The Decanting Puzzle 179
   Sample Chapter Test 184
   Sample Chapter Test: Solutions 188
   Blackline Masters 193
   Alternative Chapter Project:
     Design and Build a Play Structure 206
   Alternative Chapter Project: Blackline Masters 209

4 Mass, Temperature, and Volume 214
   Introduction 214
   Curriculum and Chapter Overview 215
Contents continued

- The Mathematical Ideas 216
- Planning Chapter 4 217
- Chapter Project: Culinary Competition 219

4.1 Temperature Conversions 223
4.2 Mass in the Imperial System 232
4.3 Mass in the Système International 237
   Puzzle It Out: The Counterfeit Coin 243
4.4 Making Conversions 244
   Sample Chapter Test 252
   Sample Chapter Test: Solutions 255
   Blackline Masters 257
   Alternative Chapter Project: Measuring Snowload 265
   Alternative Chapter Project: Blackline Masters 270

5 Angles and Parallel Lines

   Introduction 273
   Curriculum and Chapter Overview 274
   The Mathematical Ideas 275
   Planning Chapter 5 277
   Chapter Project: Create a Perspective Drawing 280

5.1 Measuring, Drawing, and Estimating Angles 288
5.2 Angle Bisectors and Perpendicular Lines 294
5.3 Non-Parallel Lines and Transversals 299
5.4 Parallel Lines and Transversals 303
   Puzzle It Out: The Impossible Staircase 307
   Sample Chapter Test 310
   Sample Chapter Test: Solutions 318
   Blackline Masters 320
   Alternative Chapter Project: Create a Model of a Tower 327
   Alternative Chapter Project: Blackline Masters 331

6 Similarity of Figures

   Introduction 339
   Curriculum and Chapter Overview 340
   The Mathematical Ideas 341
## Contents continued

Planning Chapter 6 342  
Chapter Project: Design a Community Games Room 345  
**6.1** Similar Polygons 348  
**6.2** Determining if Two Polygons Are Similar 352  
**6.3** Drawing Similar Polygons 359  
Puzzle It Out: Rationing Chocolate Bars 362  
**6.4** Similar Triangles 363  
Sample Chapter Test 369  
Sample Chapter Test: Solutions 375  
Blackline Masters 377  
Alternative Chapter Project:  
Build a Miniature Town 381  
Alternative Chapter Project: Blackline Masters 385  

### Trigonometry of Right Triangles

401  
**Introduction** 401  
**Curriculum and Chapter Overview** 402  
The Mathematical Ideas 403  
Planning Chapter 7 404  
Chapter Project: Design a Staircase for a Home 407  
**7.1** The Pythagorean Theorem 410  
**7.2** The Sine Ratio 419  
**7.3** The Cosine Ratio 426  
**7.4** The Tangent Ratio 431  
**7.5** Finding Angles and Solving Right Triangles 436  
Puzzle It Out: 16 Squares 441  
Sample Chapter Test 446  
Sample Chapter Test: Solutions 452  
Blackline Masters 456  
Alternative Chapter Project:  
Draw a Scale Map of the School Grounds 471  
Alternative Chapter Project: Blackline Masters 476
**INTRODUCTION**

*MathWorks 10* was developed to deliver the curriculum of the Workplace and Apprenticeship Mathematics Grade 10 course.

The Apprenticeship and Workplace Mathematics pathway was designed for students who may want to pursue post-secondary studies in trades, certified occupations, or direct entry into the workforce. Consequently, *MathWorks 10* delivers the curriculum outcomes through projects, activities, and problems set in real-world contexts, enabling students to make connections between school mathematics and the workplace.

**CONCEPTUAL FRAMEWORK**

In keeping with the philosophy of the Common Curriculum Framework for Grades 10-12 Mathematics, the student textbook and teacher resource incorporate the following aspects of learning mathematics:

- communication
- connections
- mental mathematics and estimation
- problem solving
- reasoning
- technology
- visualization
- critical thinking
- cultural considerations
- adapting instruction for diverse student needs

**Communication**

Students are provided with opportunities to learn by reading, listening, doing, and speaking. Solving realistic workplace problems and engaging in a variety of hands-on activities will enable students to gather information and knowledge in various ways, express their learning, and communicate with others. The numerous opportunities for class or small group discussion of contextual problems encourage students to share their experiences and prior knowledge, and thereby develop mathematical understanding. Many features of the textbook are flexible, so teachers can decide which communication mode works best in their classroom.

**Connections**

The student textbook contains a wealth of real-world examples and problems, especially those related to apprenticeship programs and to employment that students can enter after completing secondary school. Connections between mathematical processes and real-world applications of those processes are made explicit. Concrete examples describe how math is used on the job, and word problems and activities are contextualized to ensure that students can make connections between the mathematical ideas and the workplace. In addition, connections are made across the chapters so that students will be able to apply mathematical ideas in different contexts when they encounter them.

**Mental mathematics and estimation**

Mental mathematics and estimation problems appear throughout the student textbook. Realistic problem scenarios show students that mental math and estimation are used in daily life as well as in the workplace.

**Problem solving**

Problem solving is fundamental in this textbook. Students are encouraged to critique given solutions, identify errors in given strategies, and develop their own strategies for approaching problems. They are given many opportunities to develop approaches to problems individually, in pairs, and in small groups. Examples with worked solutions range from simple to multi-step processes that build upon prior knowledge.
and skills. Students are challenged to see familiar mathematics in new scenarios and apply new mathematics to solve the multi-step questions.

**Reasoning**

Hands-on activities, puzzles, and projects in which there is no one set method and no one set solution challenge students to use analytical skills to find a solution. Group discussion of mathematics problems develops students’ ability to make predictions and conjectures and encourages participation by students who have difficulty with rote algebraic mathematics. It also helps students to connect the abstract math to a familiar, concrete workplace situation.

**Technology**

A variety of technologies can be used to complete the projects and solve many of the problems in the textbook. However, technologies are not equally available to all students, so there is flexibility and choice. The use of communications technologies such as the internet, and presentation software such as PowerPoint, will further expand students’ abilities to collect data and to communicate mathematical ideas to others.

**Visualization**

The development of visualization skills, spatial sense, and measurement sense are fostered through the use of technology, graphic organizers, manipulatives, and diagrams. The culminating activities of many of the chapter projects are presented in a visual form, encouraging students to make the connection between abstract mathematical concepts and the physical world. In addition, the strong visual components of the textbook, including illustrations, photographs, graphs, and charts, enrich the presentation of the material.

**Critical thinking**

Critical thinking is key to problem solving. The textbook includes many opportunities for students to develop analytical and critical thinking skills by strategizing solutions to problems and evaluating the options presented.

**Cultural considerations**

To reflect the educational interests of western Canadian students, the images, problems, activities, and projects incorporate realistic western and northern contexts. This text is mindful of the multiethnic composition of Canadian schools. In particular, First Nations, Métis, Inuit, and francophone perspectives are represented.

**Adapting instruction for diverse student needs**

Many students learn best through experiential learning. With a range of hands-on activities and opportunities to adapt teaching strategies, the textbook accommodates these learners. The resources are flexible and adaptable to a variety of learning styles. Hands-on activities, discussion topics, and projects that can be completed by pairs or small groups as well as individually maximize opportunities to customize the course for particular classrooms. Alternative instructional strategies described in the teacher resource support this as well. In some cases, students may not have mastered mathematics from earlier grades. The teacher resource lists essential mathematics students may know from earlier grades and includes review materials, and the teacher can decide whether or not students would benefit from a review.

**ASSESSMENT**

Teachers use assessment as an investigative tool to find out as much as they can about what their students know and can do and what confusions, preconceptions, or gaps in learning they might
have. Workplace Mathematics 10 supports the Workplace and Apprenticeship Mathematics Grade 10 curriculum by incorporating assessment for learning, assessment as learning, and assessment of learning.

Assessment for learning
Teachers use assessment for learning to uncover what students believe to be true and to learn more about the connections students are making and their prior knowledge, preconceptions, knowledge gaps, and learning styles. In this textbook, assessment for learning is addressed through

- ongoing dialogue that allows the student to reflect on his or her work and the teacher to uncover the student's mathematics misconceptions;
- group discussions of math from prior grades as well as the new concepts, which enable the teacher to gauge a student's prior knowledge of the topic and decide how much review is necessary;
- group discussions of applications of mathematics to real-world examples, which enable students to compare the processes they would use to answer the question and see that there are multiple ways to solve a problem. This sharing allows students to clarify confusions they may have about the mathematics.

Assessment as learning
Assessment as learning is an active process of cognitive restructuring that occurs when individuals interact with new ideas. For students to be actively engaged in creating their own understanding, they must become adept at personally monitoring what they are learning, and they must use what they discover from the monitoring to make adjustments, adaptations, and even major changes in their thinking. In this textbook, assessment as learning is addressed through

- student reflection on the information they gather and the decisions they make to complete activities and projects;
- hands-on activities and projects that allow students to learn through discovery, see patterns, make connections, draw conclusions, and make predictions;
- hands-on activities and projects that require students to work with mathematics in a non-algebraic format that challenges their preconceived notions of mathematics, helping them to discover a new way of conceptualizing math;
- puzzles with multiple possible solutions that encourage students to try to find a solution in any manner that suits their needs;
- detailed worked examples that allow students to see a step-by-step algebraic process to solve a problem;
- review and practice questions with an answer key so students can gauge their progress.

Assessment of learning
Assessment of learning includes strategies designed to confirm what students know, demonstrate whether or not they have met curriculum outcomes or the goals of their individualized programs, or certify proficiency and make decisions about students' future programs or placements. It is designed to provide evidence of achievement to parents, other educators, the students themselves, and sometimes to outside groups (such as employers or other educational institutions). In this textbook, assessment of learning is addressed through

- project presentations that give students the opportunity to demonstrate their understanding of the math concepts using visuals, technology, and written or oral reports;
- chapter tests that give students the opportunity to demonstrate their mathematical understanding in written form.
Chapter 1
Unit Pricing and Currency Exchange

Introduction

Each chapter begins with an introduction to the mathematical concepts addressed in the chapter and their relevance to the workplace, the learning outcomes, and the key mathematical terms students will encounter.

Chapter Project

Each chapter contains a project in which students apply the mathematical concepts in a real-world scenario. The project provides students with opportunities to reflect on their learning and draw connections between the mathematical ideas and tools they encounter and real-world applications.

Students will return intermittently to the project as they work through the chapter and will complete a culminating activity at the end that allows them to synthesize the various mathematical concepts they have learned to use.
Math on the Job

Each numbered section within the chapter begins with a Math on the Job scenario that briefly describes a job or workplace and specifically mentions the ways in which mathematics is used in that job. The scenario concludes with a problem to be solved as a class, guided by the teacher.

Explore the Math

The lessons are called Explore the Math and contain a brief explanation of the mathematical ideas being considered and real-world contexts in which the math is applied.

Definitions

Definitions of mathematical terms relevant to the lesson are provided. Definitions are also included in the end-of-book glossary.

Examples

Each lesson includes one to four worked examples that model problem-solving strategies and techniques for students. Where appropriate, the worked examples include alternative solutions.

Hints

In some sections, hints are provided to help activate students’ prior knowledge, remind them of concepts addressed in the chapter, or encourage reflection.
Discuss the Ideas

Once students have some familiarity with the material, they are presented with a contextual problem to consider and solve. Students can work on these in pairs or small groups or the teacher can lead a brief class discussion.

Mental Math and Estimation

Mental math problems are realistic situations in which estimation or mental math is required to arrive at a solution.

Activities

Each chapter contains several hands-on activities that provide opportunities for students to work collaboratively and apply their learning in a realistic context.

Discuss the Ideas

SEASONS AND HOLIDAYS

Dine Hall

The demand for many goods and services varies with the seasons and, as a result, so does the price of these goods and services. Consider summer and winter in different parts of the country. Can you name some goods or services that have higher prices in summer or winter?

Demand for many items also increases around holidays, which may cause an increase in the price. In small groups, discuss the following questions:

1. Consider the price of roses. What time of year are roses most expensive? Why?
2. Consider the price of a litre of gasoline. What time of year is gasoline most expensive? Why?
3. Name two or three other goods or services that have a higher price at certain times. Why do their prices fluctuate?
4. Name two or three products that command higher prices because they are rare or unique.
5. Find two examples where prices are advertised in a way that makes an item seem less expensive. Share your examples with your classmates.

Mental Math

If you see the price of a bike helmet at $40.95 and sell 25, how much less income will your store generate than if you sold the same number at $39.95?

MathWorks 10 Teacher Resource
Build Your Skills

The practice problems in each chapter enable students to build their skills and gain confidence in their ability to strategize solutions. These problems can be used flexibly: they can be assigned as homework, completed in the classroom, or solved by pairs or small groups of students working collaboratively. Answers are included at the back of the student book, providing an opportunity for self-assessment.

Extend Your Thinking

Extension questions are in-depth problems students solve once they have completed the Build Your Skills questions.

Puzzle It Out

Each chapter contains a puzzle or game that reflects the mathematical ideas in the chapter and offers a light-hearted approach to mathematical strategy.
The Roots of Math

Students are introduced to the history of mathematics through this short essay on a topic related to the chapter’s focus. Where appropriate, Canadian history is emphasized.

Reflect on Your Learning

Each chapter concludes with a summary of the concepts learned in the chapter.

Practise Your New Skills

Students complete the chapter by working through a series of problems to review and synthesize their learning.
TIME ALLOTMENT

MathWorks 10 is structured on the assumption that teachers have 90 instructional hours available. The following chart shows the estimated instructional time for each chapter, expressed as a percentage of total instructional time.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Pricing and Currency Exchange</td>
<td></td>
</tr>
<tr>
<td>Earning an Income</td>
<td></td>
</tr>
<tr>
<td>Linear and Area Measurement</td>
<td></td>
</tr>
<tr>
<td>Mass and Temperature</td>
<td></td>
</tr>
<tr>
<td>Angles and Parallel Lines</td>
<td></td>
</tr>
<tr>
<td>Similarity of Figures</td>
<td></td>
</tr>
<tr>
<td>Trigonometry</td>
<td></td>
</tr>
</tbody>
</table>

HOW TO USE THE TEACHER RESOURCE

This teacher resource is a comprehensive resource for both new and experienced teachers. It outlines and discusses the repertoire of instructional and assessment strategies that may be used and identifies the features of the student book and their underlying rationale.

For each chapter in the student book, the teacher resource contains the following.

INTRODUCTION

The chapter introduction locates the chapter within the Apprenticeship and Workplace Mathematics 10 curriculum and maps it to the general and specific outcomes addressed in the chapter.

THE MATHEMATICAL IDEAS

In this section, the “big ideas” of the chapter are described, with examples. This provides some mathematical background for teachers, if needed, and explains the chapter’s mathematical focus. The workplace relevance of the mathematical concepts is summarized under the heading Why Are These Concepts Important?

The section concludes with a list of the prior skills and knowledge that students are expected to bring to the chapter. You may choose to review these concepts with your students, depending on individual classroom needs.

PLANNING FOR INSTRUCTION AND ASSESSMENT

Rubrics have been provided to assist you in allocating class time, preparing materials, and designing your assessment strategy.

The technology icon alerts you to activities in which the students may benefit from using technology such as computers or the internet.

CHAPTER PROJECT

A detailed description of the chapter project provides information on the project’s goals, outcome, prerequisites, and activities. This overview will assist you to plan class time for
The teaching suggestions will assist you with integrating the mathematical concepts into the project. A project assessment rubric is provided, as well as a student self-assessment rubric.

Each chapter includes an alternative chapter project with Blackline Masters and a project assessment rubric, to accommodate different class interests and learning styles and to provide variety from year to year.

**CHAPTER SUBSECTIONS**

For each chapter subsection, the teacher resource follows the format of the student book.

Worked solutions have been provided for all questions, including alternative methods of arriving at solutions and, in some cases, extension activities for students ready for more in-depth work.

Teaching notes include alternative teaching strategies. For example, features such as Math on the Job and Discuss the Ideas can be used as discussion starters in the classroom, and the teacher resource contains numerous suggestions for connecting students’ work and life experiences to the mathematical concepts.

The hands-on chapter activities allow for a range of teaching and learning strategies to be used to meet the needs of students with varying interests, backgrounds, and aptitudes.

**PUZZLE IT OUT**

Puzzles and games provide ample opportunities for students to demonstrate mathematical reasoning and to apply new skills in an engaging way. In addition to solutions to the puzzles that are in the student book, the teacher resource includes alternative puzzles with solutions. Many more spatial puzzles and games are available online, including on the website of the National Library of Virtual Manipulatives. Use the following key word searches: virtual math games; interactive math games; math puzzles; spatial puzzles; spatial games; spatial math games; and virtual math games.

**APPENDIX**

Each chapter concludes with a sample chapter test and worked solutions, graphic organizers and other Blackline Masters for the chapter project and activities, and the alternative chapter project teacher and student materials with Blackline Masters and an assessment rubric.
This is one of two chapters in the student textbook that deliver the outcomes of the Number strand of Apprenticeship and Workplace Mathematics 10. In this chapter, students will be introduced to unit pricing and currency exchange. This outcome comprises part of the Number strand and integrates the Algebra strand. The chart below locates this chapter within the curriculum.

<table>
<thead>
<tr>
<th>NUMBER, GRADES 10–12</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Outcome</td>
</tr>
<tr>
<td>Develop number sense and critical thinking skills.</td>
</tr>
<tr>
<td>Specific Outcome</td>
</tr>
<tr>
<td>It is expected that students will:</td>
</tr>
<tr>
<td>Solve problems that involve unit pricing and currency exchange, using proportional reasoning.</td>
</tr>
<tr>
<td>Demonstrate an understanding of income, including: wages, salary, contracts, commissions, piecework to calculate gross pay and net pay.</td>
</tr>
<tr>
<td>Demonstrate an understanding of compound interest.</td>
</tr>
<tr>
<td>Demonstrate an understanding of financial institution services used to access and manage finances.</td>
</tr>
<tr>
<td>Demonstrate an understanding of credit options, including: credit cards, loans.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Outcome</td>
<td>General Outcome</td>
<td>General Outcome</td>
</tr>
<tr>
<td>Develop number sense and critical thinking skills.</td>
<td>Develop number sense and critical thinking skills.</td>
<td>Develop number sense and critical thinking skills.</td>
</tr>
<tr>
<td>Specific Outcome</td>
<td>Specific Outcome</td>
<td>Specific Outcome</td>
</tr>
<tr>
<td>It is expected that students will:</td>
<td>It is expected that students will:</td>
<td>It is expected that students will:</td>
</tr>
<tr>
<td>Solve problems that involve unit pricing and currency exchange, using proportional reasoning.</td>
<td>Analyze puzzles and games that involve numerical reasoning, using problem-solving strategies.</td>
<td>Analyze puzzles and games that involve logical reasoning, using problem-solving strategies.</td>
</tr>
<tr>
<td>Demonstrate an understanding of income, including: wages, salary, contracts, commissions, piecework to calculate gross pay and net pay.</td>
<td>Solve problems that involve personal budgets.</td>
<td>Solve problems that involve the acquisition of a vehicle by: buying, leasing, leasing to buy.</td>
</tr>
<tr>
<td>Demonstrate an understanding of compound interest.</td>
<td>Critique the viability of small business options by considering: expenses, sales, profit or loss.</td>
<td></td>
</tr>
<tr>
<td>Demonstrate an understanding of financial institution services used to access and manage finances.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demonstrate an understanding of credit options, including: credit cards, loans.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ALGEBRA, GRADE 10**

<table>
<thead>
<tr>
<th>General Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop algebraic reasoning.</td>
</tr>
</tbody>
</table>
Many aspects of our world operate according to proportional rules. In the workplace, the use of proportions can be seen in a wide range of fields, including nursing, pharmacy, construction and other building trades, baking, graphic arts, photography, land surveying, commodity trading, and many others. In this chapter we will examine proportional reasoning through the lens of the workplace.

The lesson structure built into the student textbook introduces students to each topic by first having them read about or listen to a Math on the Job situation that incorporates the concept to be explored. Students then explore how algebra can be used to solve related problems. Once students have worked through the algebraic examples, they will build upon the algebra by discussing a scenario that uses the concept (Discuss the Ideas), trying a mental math question, and by working on hands-on activities. Project activities allow students to synthesize their skills and knowledge and apply them holistically to a real-life situation.

The activities model proportional reasoning in two ways:

• using tables to see patterns; and
• solving algebraic expressions.

Each of these is described in more detail below.

**Using Tables**

In this chapter, students will explore proportional reasoning using tables in the chapter project, and in Activity 1.2: Fruit Drink Taste Tester, Activity 1.3: Which Price Is Right?, Activity 1.4: Taking Advantage of Sales Promotions, and Activity 1.5: What’s Your Ride? Survey. In each activity, students will generate data for their table using patterns, and then use their data to answer questions.

The underlying concept that students will understand is that the multiplicative relationship is always $y = mx$, where $m$ is one of the constants of proportionality. In the following example, you will see that the constant $m$ is 5.

### Example

The scale on a map states that 1 centimetre represents an actual distance of 5 kilometres. The map distance between two towns is 8 centimetres. What is the actual distance?

**Solution**

The students will start the table with the given information, that the ratio between map and real distance is 1:5. They would build the table to 8 cm by following a multiplication pattern, as follows.

$$8 \times 5 = 40$$

The table they would use would be like this one:

<table>
<thead>
<tr>
<th>Finding Actual Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map distance (cm)</td>
</tr>
<tr>
<td>Actual distance (km)</td>
</tr>
</tbody>
</table>

### Algebraic Expressions

Each section in this chapter uses algebra to solve unit cost and currency exchange problems. As detailed below, students have used these algebraic methods in previous grades to solve proportional reasoning questions; however, since the concept is being modelled in new contexts and scenarios, students may have some difficulty setting up the initial proportion.
The important concept that students will learn is that all rate pairs describing a given proportional situation are equivalent. The same statement is true of the reciprocal of these rate pairs. These two constants of proportionality define the multiplicative relationship.

**Example**

If you travel to a foreign country, you exchange Canadian dollars for the currency used there. In England, you could exchange $3.00 CAD for £2.00. How many pounds could you exchange for $21.00?

**SOLUTION**

The students would first set up a proportion between the Canadian dollar and the English pound and then solve for the unknown quantity:

\[
\frac{\text{dollars}}{\text{dollars}} = \frac{\text{pounds}}{\text{pounds}}
\]

or

\[
\frac{21.00}{3.00} = \frac{\text{£} x}{\text{£}2.00}
\]

Multiply each side of the equation by the common denominator, 3.00 multiplied by 2.00, or 6.00.

\[
6.00 \left( \frac{21.00}{3.00} \right) = 6.00 \left( \frac{\text{£} x}{\text{£}2.00} \right)
\]

\[
126.00 = 6.00 \times \frac{\text{£} x}{\text{£}2.00}
\]

Simplify each side of the equation by dividing the numerator by the denominator.

\[
42.00 = 3.00 \times \frac{\text{£} x}{\text{£}2.00}
\]

\[
\frac{42.00}{3.00} = x
\]

\[
14.00 = x
\]

Therefore, you would receive £14.00 for $21.00 CAD.

**WHY ARE THESE CONCEPTS IMPORTANT?**

- Understanding proportionality by using several representations enables students to evaluate problem situations critically and to determine whether the context is proportional or non-proportional.
- Examining the relationships among different representations is important. Different representations highlight different aspects of the situation, each fostering insights and interconnections to the other. This allows students to understand both why and how the strategies work.

**PRIOR SKILLS AND KNOWLEDGE**

Student work in this chapter will build on certain WNCP outcomes from earlier grades. Students will review these mathematical concepts and skills and apply them in a new context to real-life problems involving unit pricing and currency exchange. The following is a list of concepts and mathematics skills to which students have been exposed in grades 8 and 9.

1. **Concepts**
   a) Ratios, rates, proportional reasoning;
   b) Interpolation, extrapolation;
   c) Percents;

2. **Mathematics Skills**
   a) Identifying equivalent ratios;
   b) Using a fractional equation to solve for an unknown.

3. **Technology:** presentation software, basic calculator functions, spreadsheets, and internet search skills. (NB: Some students may not have been exposed to spreadsheets, presentation software, or the internet.)
This chapter will take 2–3 weeks of class time to complete. Class period estimates are based on a class length ranging from 60 to 75 minutes. These estimates may vary depending on individual classroom needs.

### PLANNING FOR INSTRUCTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Lesson Focus</th>
<th>Estimated Time</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduce the chapter project “The Party Planner”</td>
<td>20 minutes for a class discussion on the opening questions about the project</td>
<td>internet, newspapers, flyers, magazines, local stores</td>
</tr>
<tr>
<td>1.1</td>
<td>Math on the job: Northern nurse</td>
<td>40 minutes</td>
<td>Blackline Master 1.2</td>
</tr>
<tr>
<td>1.1</td>
<td>Practise your prior skills: Ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Discuss the ideas: Adapting a recipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Examples 1, 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Activity 1.1: Visualize a proportion</td>
<td>15 minutes</td>
<td>Blackline Master 1.1</td>
</tr>
<tr>
<td>1.1</td>
<td>Activity 1.2: Fruit drink taste tester</td>
<td>45 minutes</td>
<td>Blackline Master 1.5 or spreadsheet software</td>
</tr>
<tr>
<td>1.1</td>
<td>Practise your prior skills: Rate</td>
<td>1 class</td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Discuss the ideas: Cindy Klassen, speed skater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Examples 1, 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Mental math and estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Practise your skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Puzzle it out: Magic proportions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Math on the job: Organic farmer</td>
<td>1 class</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Explore the math</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Examples 1, 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Activity 1.3: Which price is right?</td>
<td>1 class, if students are using the internet at school</td>
<td>internet or local stores</td>
</tr>
<tr>
<td>1.2</td>
<td>Build your skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Math on the job: Construction cost estimator</td>
<td>1 class</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Explore the math</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Examples 1-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Discuss the ideas: Concert promoter; Seasons and holidays</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Mental math and estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Build your skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Lesson Focus</td>
<td>Estimated Time</td>
<td>Teacher Notes</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
<td>----------------</td>
<td>---------------</td>
</tr>
<tr>
<td>1.4</td>
<td>Math on the job: Stone and tile business owner</td>
<td>1 class</td>
<td>internet, newspapers, flyers, magazines</td>
</tr>
<tr>
<td></td>
<td>Explore the math</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examples 1, 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mental math and estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Activity 1.4: Taking advantage of sales promotions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Build your skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project: Research your ideas</td>
<td>1 class</td>
<td>Blackline Master 1.3 or spreadsheet software, internet (if giving time to research project)</td>
</tr>
<tr>
<td>1.5</td>
<td>The roots of math: Canadian currency</td>
<td>15 minutes</td>
<td>internet</td>
</tr>
<tr>
<td>1.5</td>
<td>Math on the job: Agricultural exporter</td>
<td>1 class</td>
<td>internet</td>
</tr>
<tr>
<td></td>
<td>Explore the math</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mental math and estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Activity 1.5: What’s your ride? survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Examples 1, 2</td>
<td>1 class</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Activity 1.6: Calculate foreign exchange</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Build your skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project: Make a presentation</td>
<td>1 class to finish projects</td>
<td>word-processing software, spreadsheet software, internet</td>
</tr>
<tr>
<td></td>
<td>Presentation of projects to class</td>
<td>1–2 classes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reflect on your learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practise your new skills</td>
<td>1 class</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chapter test</td>
<td>1 class</td>
<td></td>
</tr>
<tr>
<td>Purpose</td>
<td>In the Chapter</td>
<td>Teacher Notes</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Assessment for Learning</td>
<td>• Chapter launch</td>
<td>• Make a checklist to keep track of how much work the students have done on their project</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Project discussions (ongoing)</td>
<td>• Observe how students participate during discussions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Math on the job scenarios</td>
<td>• Observe how students work through activities in small groups, pairs, or individually</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Exploration of new concepts</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Discuss the ideas</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mental math and estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Puzzle it out: Magic proportions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Make a checklist to keep track of how much work the students have done on their project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment as Learning</td>
<td>Reflection and Practice</td>
<td>• Check daily homework and provide feedback on questions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Build your skills problems</td>
<td>• Challenge your students to find relationships without always using a formula</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Prompt students’ self-assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Review student work, provide feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reflect on your learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of Learning</td>
<td>Chapter Review</td>
<td>• Have students present their final project to the class and allow students to give feedback to presenters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Chapter project: Planning a party</td>
<td>• Give small quizzes as the chapter progresses to give as much feedback as possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Quizzes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Chapter test</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Review assessment records and add unit results to ongoing records</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Skills/Mathematical Disposition</td>
<td>Observe and record throughout the unit how students are working with new language and concepts</td>
<td>• Keep a log or journal of observations to aid in reporting</td>
<td></td>
</tr>
</tbody>
</table>
GOALS: To use the concept of proportional reasoning to find unit prices, to build skills, and to synthesize learning in this chapter.

OUTCOME: In this project, students will integrate the concept of unit pricing into a real-world scenario in which they create a party concept, plan within a set budget and given parameters, work with technology, and practise and further develop presentation skills.

PREREQUISITES: Students need to understand ratios, proportions, and basic calculator functions. If students want to use a spreadsheet for the pricing calculations, then some prior spreadsheet experience would be an asset. They will also need to be familiar with presentation software if they choose to use it for their presentation. If they are familiar with any layout software, they could use it to make party invitations. Familiarity with internet research may also be helpful in this project.

ABOUT THIS PROJECT: This project is divided into three parts. Initially, students will plan their project and identify areas that they need to research. Partway through the chapter, students will apply what they have learned about unit pricing and cost comparisons to decide on the purchases they will make and work out the costs in several ways. As a final activity, they will develop a presentation for their team or club mates, including a table or a spreadsheet listing all the components of the party and their respective costs. Students will give this presentation to the class. Allow 3–5 minutes for each student.

Students should be given a few class periods to work on this project during the time spent on this chapter. This will allow for questions/feedback from the teacher as well as allowing the teacher to observe the quality of work as it is done, rather than at the end of the chapter. Interim guidance can help students complete the culminating activity more successfully. This project could also be completed by small groups of students. A self-assessment rubric, Blackline Master 1.4 (p. 168), should be handed out to students early in the project. It outlines the criteria for evaluation of their project and suggests some ways to reflect on their learning.

An alternative project, “Food Planning at a Wilderness Lodge,” is included on pp. 70–79. This project can be done by small groups or pairs of students as well as individuals.

1. Start to plan

Introduce the project to your students as you begin this chapter. This initial part of the project allows for group brainstorming as a class. Most students will have attended a party, allowing them to draw upon personal experiences about what activities students enjoy at a party. Suggest that they can make their own choices about the party, but prepare a few suggestions to help them get started.

To begin the project, have students decide on the location they will use. Next, ask them to list the things they will need to consider and buy while planning the party. If they need help with this activity, items to consider (a checklist is included on Blackline Master 1.2, p.66) include the following:

- What decorations will you use?
- What will the invitations look like?
- What activities or entertainment will you plan for the party?
- What kind of music will you play? Do you need to organize a sound system?
- What food do you plan to serve? How will you handle food allergies?
- Will you need to order plates, cutlery, or glasses?
- Where might you purchase supplies?

Emphasize that even though they are planning the party, students must keep the total budget in mind.
Suggest sources of information that students can use, such as magazines, party supply stores, catalogues, flyers, newspapers, and websites. There are a number of online sources of party supplies that students may find helpful. A keyword search string that may generate useful options is “party supplies” plus the place name of your community or a larger centre nearby where such supplies might be found, for example, “party supplies Vancouver.”

2. Research your ideas

This segment of the project requires the largest amount of work on the part of students. Here they are practising both their research and their unit costing skills. Students are expected to develop a cost analysis that is within their budget, including all the supplies they would need to purchase and any other costs, such as venue rental charges. All their work should be recorded in a table (an example is shown in the student book and reproduced on Blackline Master 1.3, p. 67) or on a spreadsheet.

At the end of this segment of the project, discuss progress with your students to ensure that all requirements have been met.

3. Make a presentation

In this segment of the project, students will synthesize their planning and research activities, and practise their presentation skills. Presentations to clients are often done with handouts and other tools, including presentation software or posters. Encourage students to use such tools to enhance their project presentation, which they will give to the class.

ASSESSING THE PROJECT

1. Start to plan
   - Record your observations. Provide students with numeric information on how they will be assessed using a scheme that meets your reporting needs.

2. Research your ideas
   - Have students make a checklist of all items that should be in their project to allow them to reflect on their progress. Blackline Master 1.2 (p. 66) contains a checklist that students may use.

3. Make a presentation
   - Use the following rubric as a gauge to accompany a numerical grading rubric you have created.
   - Ask students to self-assess their project using Blackline Master 1.4 (p. 68).
   - If time doesn’t allow for presentations, have students set up their projects on their desks and allow one row of the class at a time to walk around the classroom to view and comment on all the projects.
   - You might want to take photos of students with their projects to put in their school portfolio.
### PROJECT ASSESSMENT RUBRIC

<table>
<thead>
<tr>
<th></th>
<th>Not Yet Adequate</th>
<th>Adequate</th>
<th>Proficient</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conceptual Understanding</strong></td>
<td>• Explanations show very limited understanding; explanations are omitted or inappropriate</td>
<td>shows partial understanding; explanations are often incomplete or somewhat confusing</td>
<td>shows understanding; explanations are appropriate</td>
<td>shows thorough understanding; explanations are effective and thorough</td>
</tr>
<tr>
<td></td>
<td><strong>Procedural Knowledge</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Accurately:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• writes and evaluates unit costs while adhering to the budget</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• creates tables from the information given using pen/paper or spreadsheets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• calculates total costs, unit costs, and taxes for all items purchased</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• theme, invitations, decorations, style are appropriate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• writes down all sources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• presentation includes handouts, posters or electronic display, listed items, and a cost analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• limited accuracy; major errors or omissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For example:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• item costs are missing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• unit costs are calculated incorrectly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• total cost not within the budget</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• activities and entertainment not appropriate for the event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• sources missing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• presentation poster, handouts, or electronic presentation not created</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• project is incomplete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• generally accurate; few errors or omissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For example:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• items are listed, but the unit costs are not calculated correctly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• may have some needed items missing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• total cost within budget using erroneous unit cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• activities and entertainment are appropriate for the event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• activities and entertainment are appropriate for the event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• sources are listed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• presentation poster, handouts, or electronic presentation are good</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• project could use some more work to ensure calculations are done correctly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• accurate and precise; very few or no errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For example:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• items listed and unit costs are calculated correctly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• total cost within budget</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• sources are listed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• activities are appropriate for the event and show unusual creativity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• has all presentation handouts, poster, or electronic presentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• no calculation errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• adds some extra creativity to the project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Problem-Solving Skills</strong></td>
<td>• uses appropriate strategies to solve problems successfully and explain the solutions</td>
<td>• uses few effective strategies; does not solve problems</td>
<td>• uses some appropriate strategies, with partial success, to solve problems; may have difficulty explaining the solutions</td>
<td>• uses effective and often innovative strategies to successfully solve problems and explain solutions</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>• does not present work and explanations clearly, using appropriate mathematical terminology</td>
<td>• presents work and explanations with some clarity, using some appropriate mathematical terms</td>
<td>• presents work and explanations clearly, using appropriate mathematical terms</td>
<td>• presents work and explanations clearly, using a range of appropriate mathematical terms</td>
</tr>
</tbody>
</table>
Chapter 1
Unit Pricing and Currency Exchange

1.1 Proportional Reasoning

TIME REQUIRED FOR THIS SECTION: 3 CLASSES

MATH ON THE JOB

Start your class with a discussion about Sandra Tuccaro’s nursing position. Have a student read the text aloud to the class. Before presenting the mathematical solution, discuss the fact that drugs are packaged in standard doses but the amount of medication that a person needs is individual. Also mention that in some cases the only medical professional available may be a nurse. Thus, the nurse must be capable of adjusting medications to suit a patient’s size/weight to administer the proper dosage.

SOLUTION

Students have used ratios and proportions in grade 8. Activate their prior knowledge by giving students a few minutes to try to solve the question in this scenario themselves. When presenting the solution, you may want to show students that there is more than one method.

METHOD 1: Set up a ratio by aligning the same units. Students may have seen this method in science class, where it is called dimensional analysis. Show the students that the same units (mg) should cancel each other out, leaving the desired units (mL).

\[
\frac{120 \text{ mg}}{300 \text{ mg}} = \frac{2 \text{ mL}}{x}
\]

To solve for \(x\), multiply both sides of the equation by the common denominator, 300x.

\[
300x \left( \frac{120}{300} \right) = \left( \frac{2 \text{ mL}}{x} \right) 300x
\]

\[
36 000x = 600x
\]

Simplify each side of the equation by dividing by the denominator.

\[
120x = 600
\]

Divide each side by the coefficient of the variable, 120.

\[
\frac{120x}{120} = \frac{600}{120}
\]

\[
x = 5 \text{ mL}
\]

METHOD 2: Find the unit amount of mg/mL first by dividing the numerator by the denominator.

\[
\frac{120 \text{ mg}}{2 \text{ mL}} = \frac{60 \text{ mg}}{1 \text{ mL}}
\]

Then you can ask students how many mg of drugs they need.

Since the nurse wants to give the patient 300 mg of the drug, she can calculate how many 60 mg units she needs. Since each 60 mg of the drug is dissolved in 1 mL of fluid, she will need to give the patient 5 mL of fluid.

METHOD 3: Nurses use this “nursing rule” to figure out the doses they need.

\[
\frac{\text{Drug prescribed}}{\text{Dose per “measure”}} \times \text{Number of measures}
\]

The drug prescribed is the 300 mg in the scenario. The dose per measure is the diluted solution of 120 mg that has been mixed into the solution. The number of measures is the 2 mL in the solution. This could be stated in another way.

\[
\frac{\text{What you want}}{\text{What you’ve got}} \times \text{The amount it comes in}
\]
Substitute in the actual numbers.

\[
\frac{300 \text{ mg}}{120 \text{ mg}} \times 2 \text{ mL} = 5 \text{ mL}
\]

The dose is 5 mL. You may ask students why it would be beneficial for a nurse to memorize such a rule.

**PRACTISE YOUR PRIOR SKILLS**

**RATIO**

**Discuss the Ideas**

Read through the ratio and proportion lesson with your class. Pair students up and have them try the Discuss the Ideas “adapting a recipe” question. Start by asking students if they have ever had to double a recipe. The idea of doubling is represented by the ratio 1:2. In this case, you want to reduce your recipe using the ratio 20:12, which can be simplified to 5:3 or 1.67:1. Consequently, students would have to take \( \frac{2}{3} \) of each amount in the ingredient list to get the same taste. If students make the mistake of multiplying by \( \frac{5}{3} \), you could show that would increase the recipe.

**ACTIVITY 1.1**

**VISUALIZE A PROPORTION**

**BLACKLINE MASTER 1.1**

**GRAPH PAPER**

This activity can be done by pairs or small groups of students. It reinforces the idea that a proportion is a multiplicative relationship and not an additive one.

This activity leads nicely into a discussion about reducing or enlarging pictures. Many students have digital cameras. They may have done some editing or resizing using image editing software and noticed what happens when they “drag” the photo down or across rather than from the corner of the picture. If they do not enlarge or reduce the photo by the same amount on all sides, the photo becomes distorted.

**SOLUTIONS TO VISUALIZE A PROPORTION**

1. See answer on the next page.
2. See answer on the next page.
3. Students should notice that when you multiply or divide the two sides of a triangle by the same amount, the resulting triangle will be proportional to the original. If you add or subtract length, the triangles do not stay proportional.
### Activity 1.2
#### Fruit Drink Taste Tester

In this activity, students could work in small groups to simulate the research teams characteristic of real-life development settings. This activity allows students to visualize proportions in various formats, in this case, algebraically and in tabular form. The activity first builds on patterns, then uses the patterns to solve problems that could be done algebraically or using technology.

Students begin the activity by filling in the table. This is an effective activity to use spreadsheets with because students could use the “edit—fill down” feature to expand the table to as many batches as they like.

The pattern in the table works intuitively since the first batch is the given recipe, 2 batches double each ingredient, 3 batches triple them, and so on.
1. You would need 300 cups of orange concentrate. Students can use algebra or fill down on their spreadsheet (3 cups × 100 = 300 cups).

2. Unit amounts:
   Recipe #1: \(\frac{7}{3} = 2.3\) water/concentrate (cups)
   Recipe #2: \(\frac{5}{2} = 2.5\) water/concentrate (cups)

   Since Recipe #1 has less water per cup of orange concentrate, it would have a stronger orange taste.

3. Proportion:
   \[
   \frac{5}{2} = \frac{2.5}{1}
   \]

   So 2.5 cups of water are needed for 1 cup of concentrate.
Chapter 1  Unit Pricing and Currency Exchange

4. The original recipe makes 10 cups, so 1 batch equals 10 cups.

One way to solve this is first to determine the fraction of a batch that would yield 8 cups.

\[
\begin{align*}
\frac{10 \text{ cups}}{1 \text{ batch}} &= \frac{8 \text{ cups}}{x \text{ batches}} \\
10x &= 8 \\
x &= \frac{4}{5}
\end{align*}
\]

Simplify the fraction to \(\frac{4}{5}\).

To make 8 cups, you need to make \(\frac{4}{5}\) of a batch. To determine the portion of each water and concentrate needed, multiply the amounts for one batch by \(\frac{4}{5}\).

\[
\begin{align*}
\frac{4}{5} \times 3 &= \frac{12}{5} \\
&= 2 \frac{2}{5} \\
\frac{4}{5} \times 7 &= \frac{28}{5}
\end{align*}
\]

To make 8 cups of Recipe #1, you would use \(2 \frac{2}{5}\) cups of concentrate and \(5 \frac{2}{5}\) cups of water.

5. Add all of the cups up first to get total parts (\(2 + 3 + 5 = 10\) cups). Since you only want 4 cups, you need to take \(\frac{4}{10}\) of each ingredient.

- pineapple juice: \(2 \times 0.4 = 0.8\)
- cranberry juice: \(3 \times 0.4 = 1.2\)
- lemon juice: \(5 \times 0.4 = 2\)

Check: \(0.8 + 1.2 + 2 = 4\) cups

**PRACTISE YOUR PRIOR SKILLS**

**RATE**

In this section, you will discuss the concept of rate. Since students are in grade 10, getting their drivers’ licences is a big concern. You could take the opportunity to discuss speed limits and how the posted sign is the maximum rate, that is, 50 km/h, 110 km/h, and so on. The major concept that students need to remember is that a rate compares two different units.

Note that one of the examples of rates refers to the price of lumber for linear foot. Construction materials are measured and sold in imperial units.

Once students have worked out the examples on rate, they could work backwards to check their answers.

For example, Michelle earned $95.00 for working 6 hours at a supermarket checkout. What was her rate of pay?

**SOLUTION**

\[
\text{Rate of pay} = \frac{\text{amount earned}}{\text{time worked}}
\]

\[
\text{Rate of pay} = \frac{$95.00}{6 \text{ h}}
\]

\[
\text{Rate of pay} = $15.85/\text{h}
\]

Check: \($15.85 \times 6 \text{ h} = $95.10\).

**DISCUSS THE IDEAS**

**CINDY KLASSEN, SPEED SKATER**

Cindy’s average speed is a rate comparing her speed to the elapsed time. Students could discuss how speed skaters alter their actual speed as the race progresses, usually culminating with a sprint to the finish line. Thus, an average rate may not always be the best indicator of an athlete’s ability.

Cindy’s average speed is a rate comparing her speed to the elapsed time. The solution is as follows.

\[
\frac{1500 \text{ m}}{115.27 \text{ sec}} = 13.01 \text{ m/sec}
\]
Mental Math and Estimation

This concept of checking leads to the Mental Math, since the mathematics for the pipe straps is the same as the “check.” Have students try the mental math for a set time—about 2 minutes. Then ask the students to share the strategies they used to find the answer.

Show students the actual value using multiplication of the actual values.

$0.0497 \times 50 = 2.49$

Then explain that an estimation technique using rounding would be a better way to aid students that have trouble with mental math. So, have the students round the dollar value to $0.05. Then explain that 5 times 5 equals 25 and 5 times 50 equals 250. Then ask students to look at the decimal value of 0.05 and remind the students that when they multiply, they need to move the decimal over by the place value (hundredths is 2 places). Since the decimal is small, they need to make their answer “250.00” smaller, thus moving the decimal 2 places towards the left to find $2.50.

PRACTISE YOUR NEW SKILLS: SOLUTIONS

1. To simplify, divide the numerator and denominator by 2 to get 4:1.

   Ways to write this ratio include the following.
   8 to 2
   8:2
   $8 \div 2 = 4$ to find the ratio.

2. \[
\frac{55 \text{ words}}{1 \text{ minute}} = \frac{2000 \text{ words}}{x \text{ minutes}}
\]

   Multiply each side by the common denominator, $1x$, or $x$.

   \[
   \frac{55}{1} \times x = \frac{2000}{x} \times x
   \]

   \[
   55x = 2000
   \]

   \[
   \frac{55x}{55} = \frac{2000}{55}
   \]

   \[
   x = \frac{2000}{55}
   \]

   \[
   x = 36.36 \text{ minutes}
   \]

   It will take the secretary 36 minutes, rounded to the nearest minute.

3. Each truck has 4 tires, so 5 trucks have 20 tires.

   To rotate the tires on 5 trucks, use the following proportion.

   \[
   \frac{4 \text{ tires}}{15 \text{ min}} = \frac{20 \text{ tires}}{x \text{ min}}
   \]

   \[
   \frac{4}{15} = \frac{20}{x}
   \]

   The common denominator is 15x.

   \[
   15x \left( \frac{4}{15} \right) = \left( \frac{20}{x} \right) 15x
   \]

   \[
   60x = 300x
   \]

   \[
   4x = 300
   \]

   \[
   x = 75
   \]

   It would take 75 minutes to rotate the tires on 5 trucks.

   Alternatively, you can multiply 15 minutes (time for one truck) by 5 (the number of trucks) to get 75 minutes.
To rotate 2 tires, divide the time for 4 tires in 2.

\[ \frac{15}{2} = 7.5 \text{ minutes} \]

It would take 7.5 minutes to rotate 2 tires.

4. First, calculate what the salesperson sold in the first two days.

\[ 6 + 4 = 10 \text{ cars} \]

Next, calculate what he or she sold on the weekend.

\[ 36 - 10 = 26 \text{ cars} \]

Since he or she sold the same number of cars on each day, calculate what was sold each day.

\[ 2x = 26 \]

\[ 2x = 26 \]

\[ x = 13 \]

x = 13 cars on each day

Alternatively, since the salesperson sold 26 cars in two days and an equal number of cars were sold on each day, divide 26 by 2 to get 13 cars sold on each day.

The proportion of cars sold on Saturday is 13:36.

5. The ratio can be written as \(\frac{6}{6} = \frac{s}{145}\).

Let \(s\) represent Siu’s height.

Use the following proportion to solve for \(s\).

\[ 6 \times 145 \left( \frac{s}{6} \right) = \left( \frac{s}{145} \right) 6 \times 145 \]

\[ 870 \left( \frac{s}{6} \right) = \left( \frac{s}{145} \right) 870 \]

\[ \frac{4350}{6} = \frac{870s}{145} \]

\[ 725 = 6s \]

\[ 725 = \frac{6s}{6} \]

\[ 121 = s \]

To the nearest centimetre, Siu is 121 cm tall.

6. To calculate the profits on 50 DVDs, use a fractional equation.

\[ \frac{2550}{200} = \frac{x}{50} \]

The lowest common denominator is 200.

\[ 200 \left( \frac{2550}{200} \right) = \frac{x}{50} \cdot 200 \]

\[ 2550 = 4x \]

\[ \frac{2550}{4} = \frac{4x}{4} \]

\[ 637.50 = x \]

The total profit on the sale of 50 DVDs is $637.50.

Next, calculate the profit on 900 DVDs.

\[ \frac{2550}{200} = \frac{x}{900} \]

The lowest common denominator is 1800.

\[ 1800 \left( \frac{2550}{200} \right) = \frac{x}{900} \cdot 1800 \]

\[ 22 950 = 2x \]

\[ \frac{22 950}{2} = \frac{2x}{2} \]

\[ 11 475.00 = x \]

The total profit on the sale of 900 DVDs is $11 475.00.
Alternatively, students could find the profit on one DVD and then multiply the number of DVDs sold by this number.

\[
\frac{2550}{200} = \frac{x}{1}
\]

\[
200 \left( \frac{2550}{200} \right) = (\frac{x}{1}) 200
\]

\[
2550 = 200x
\]

\[
\frac{2550}{200} = \frac{200x}{200}
\]

\[
$12.75 = x
\]

$12.75 \times 50 = $637.50

$12.75 \times 900 = $11,475.00

7. The numerator, 15, has been multiplied by 5 to get 75. To keep the fractions equivalent, the denominator, 5, must also be multiplied by 5 to equal x.

\[
5 \times 5 = 25
\]

\[
x = 25
\]

For $75.00, the restaurant could buy 25 kg of olives.

Calculate the cost to buy 20 kg of olives.

\[
\frac{15}{3} = \frac{x}{20}
\]

The lowest common denominator is 20.

\[
20 \left( \frac{15}{3} \right) = (\frac{x}{20}) 20
\]

\[
\frac{300}{5} = \frac{20x}{20}
\]

\[
60 = x
\]

It would cost $60.00 to buy 20 kg of olives.

8. First, determine what the proportion is for each stain.

3 Spanish oak: 4 red mahogany

\[
3 + 4 = 7
\]

So, for Spanish oak, the ratio is 3:7.

For red mahogany, it is 4:7.

Let \( s \) = the amount of Spanish oak needed.

\[
\frac{3}{7} = \frac{s}{12}
\]

The common denominator is 7 multiplied by 12, or 84.

\[
\frac{84 \left( \frac{3}{12} \right)}{12} = \frac{s}{84} \]

\[
36 = 7s
\]

\[
\frac{36}{7} = \frac{7s}{7}
\]

5.14 = \( s \), rounded off

Let \( r \) = the amount of red mahogany needed.

\[
\frac{4}{7} = \frac{r}{12}
\]

Again, the common denominator is 84.

\[
\frac{84 \left( \frac{4}{12} \right)}{12} = \frac{84r}{12}
\]

\[
\frac{336}{7} = \frac{84r}{12}
\]

\[
48 = 7r
\]

\[
\frac{48}{7} = \frac{7r}{7}
\]

6.86 = \( r \), rounded off

For 12 litres, the carpenter needs 6.86 L of red mahogany and 5.14 L of Spanish oak.
9. First, determine how long it would take the bullet train to travel the circumference of the Earth.

\[
\frac{6}{30} = \frac{x}{40,074}
\]

The ratio \(\frac{6}{30}\) can be simplified to \(\frac{1}{5}\).

\[
\frac{1}{5} = \frac{x}{40,074}
\]

The common denominator is 5 multiplied by 40,074.

\[
5 \times 40,074 \left(\frac{1}{5}\right) = \left(\frac{x}{40,074}\right)5 \times 40,074
\]

Each side of the equation can be simplified to give the following equation.

\[
40,074 = 5x
\]

\[
\frac{40,074}{5} = \frac{5x}{5}
\]

\[
8015 = x
\]

The bullet train could travel the circumference of the earth in 8015 minutes.

Now, convert this to days.

\[
\frac{8015 \text{ min}}{60} = 133.58 \text{ hours}
\]

\[
\frac{133.58 \text{ hours}}{24} = 5.57 \text{ days}
\]

Both Keiko and Yuki underestimated how fast the Shinkansen can go!

---

**PUZZLE IT OUT**

**MAGIC PROPORTIONS**

There are many solutions to this puzzle. Here is one strategy to help students get started:

1. Start by drawing one large 3 × 3 square on the board.
2. Have students randomly call out numbers from 0–8 to fill in each square with little regard for the ratio, but not repeating a number.
3. Add up each row and write the sum at the outside of the box of each row.
4. Add up each column and write the sum at the bottom of each column.
5. Check to see if the numbers on the outside of the rows and columns form the 1:2:3 ratio.
6. Most likely, they will not.
7. Then ask students to try moving only one number at a time to make the row proportion work. Once the rows work, then check the impact this had on the column sums.
8. This is where the trial and error comes in. Once you have completed one solution as a class, challenge the students to find another solution.

This would work well as a group activity.

**SOME MORE SOLUTIONS**

![Magic Proportions Solutions](image-url)
TIME REQUIRED FOR THIS SECTION: 2 CLASSES

MATH ON THE JOB

Start the class by having a student read aloud the scenario describing Linda Fogarty, a self-employed organic farmer who has a horticultural technology diploma. Discuss the fact that on a farm growing and selling produce, materials are rarely purchased as single items. Therefore, it’s important for the owner to compute unit prices to establish the lowest unit cost. Also discuss some of the other applications of math that Linda mentions in her work. Ask students if they can think of any other ways that math would be used in this context.

SOLUTION

Calculate the unit price by dividing the total price from each wholesaler by the number of plants.

   Company A: $45.95/20 = $2.30/plant
   Company B: $48.50/24 = $2.02/plant

Company B’s unit price is $0.28/plant less than Company A’s price.

Other factors to consider include the following:

   a) Has Linda bought from this wholesaler before and has she been happy with their products?
   b) Are the plants in stock when she needs them?
   c) Does the wholesaler carry other products that she needs so that she can optimize her buying efficiency?

EXPLORE THE MATH

The application of proportional reasoning to unit costs is new for the students. Explain that the word “unit” means 1. Unit price is thus the cost of one item, and a unit rate is a rate with a denominator of 1 (for example, earnings per hour or cost per kilogram). In order to convert bulk prices or rate values to unit prices and unit rate values, the student must see that the denominator must be 1. Some students, including ESL students, may not realize that the “/” symbol holds the dual purpose of mathematically meaning “divide” and reads also as “per” in a rate question.

Example

A 200 g bag of chips costs $1.00. A 750 g bag of chips costs $2.70. Which size is the better value?

SOLUTION

To find the unit cost per gram, divide the dollar value by the number of grams in the package.

For the 200 g bag

   $1.00
   ______  = $0.005/g
   200 g

For the 750 g bag:

   $2.70
   ______  = $0.0036/g
   750 g

Thus, the best deal is the 750 g bag.
Introduce this activity by having students read the items on the list. Ask the students if they have any of the items in their homes and to think of how the items are packaged. You could prompt the discussion by asking if they buy garbage bags as single items, or as packages of 10, 50, or 100. Then proceed to ask if they (or their family members) buy items based only on price or does brand loyalty, quality, or quantity affect their decisions?

After receiving a few answers, discuss with students the fact that if comparing equally favourable brands, the price does sway customers. But many companies purposely choose to package items in different sizes than their competitors do to make comparison pricing more difficult. Some large stores do put the unit prices (in very small print) next to the price, but that is not necessarily the practice in all regions.

**SAMPLE SOLUTIONS**

### COMPARING DIFFERENT BRANDS — SAME SIZE

<table>
<thead>
<tr>
<th>Item</th>
<th>Items per pkg.</th>
<th>Brand A Unit price</th>
<th>Brand B Unit price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light bulbs</td>
<td>4</td>
<td>$2.29</td>
<td>$0.57</td>
</tr>
<tr>
<td>Paper towels</td>
<td>6</td>
<td>$6.49</td>
<td>$1.08</td>
</tr>
<tr>
<td>Garbage bags</td>
<td>20</td>
<td>$8.79</td>
<td>$0.44</td>
</tr>
<tr>
<td>Sponges</td>
<td>5</td>
<td>$7.95</td>
<td>$1.59</td>
</tr>
</tbody>
</table>

### COMPARING DIFFERENT SIZES — SAME BRAND

<table>
<thead>
<tr>
<th>Item</th>
<th>Smaller size</th>
<th>Price</th>
<th>Unit price</th>
<th>Larger size</th>
<th>Price</th>
<th>Unit price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light bulbs</td>
<td>3</td>
<td>$2.49</td>
<td>$0.83</td>
<td>6</td>
<td>$4.49</td>
<td>$0.75</td>
</tr>
<tr>
<td>Paper towels</td>
<td>3</td>
<td>$3.69</td>
<td>$1.23</td>
<td>6</td>
<td>$6.49</td>
<td>$1.08</td>
</tr>
<tr>
<td>Garbage bags</td>
<td>20</td>
<td>$8.79</td>
<td>$0.44</td>
<td>30</td>
<td>$9.99</td>
<td>$0.33</td>
</tr>
</tbody>
</table>
| Sponges       | 5            | $7.95  | $1.59      | 8           | $11.99 | $1.50      

After this discussion, make sure students understand that the mathematical purpose of the activity is to find unit costs. The business purpose is to compare prices in an effort to keep overhead costs to a minimum and make the most profit.

Assign students to work in pairs to discuss questions 1 and 2.

Ask students to complete the extension activity as a take-home assignment. Alternatively, you could ask students to bring in copies of newspaper ads and compare unit prices for selected goods in the next class.

**Extension**

Find two ads for the same product in your local newspaper and compare the unit prices.
1. **Part A**
   
   For light bulbs, Brand A offers the lowest unit cost.
   
   For paper towels, Brand A offers the lowest unit cost.
   
   For garbage bags, Brand B offers the lowest unit cost.
   
   For sponges, Brand B offers the lowest unit cost.
   
   **Part B**
   
   For light bulbs, the package of 6 is the better buy.
   
   For paper towels, the package of 6 is the better buy.
   
   For garbage bags, the package of 30 is the better buy.
   
   For sponges, the package of 8 is the better buy.

2. The package containing fewer items might have a lower unit cost if that size package was on a special promotion. In that case, the smaller package would be the better buy.

3. You might not choose to buy the product with the lowest unit price if the number of items in the package doesn’t meet your needs, or you prefer the quality of a different brand. You might have a coupon for a different brand that reduces the unit price, or you might belong to a customer loyalty program that gives points for a particular brand.

### BUILD YOUR SKILLS: SOLUTIONS

1. \[
\frac{1053.00}{12} = 87.75
\]
   
   The unit price of each sink is $87.75.

2. **Package A:**
   
   \[
   \frac{19.99}{7} = 2.86/\text{kg}
   \]
   
   **Package B:**
   
   \[
   \frac{35.95}{14} = 2.57/\text{kg}
   \]
   
   **Package C:**
   
   \[
   \frac{50.99}{21} = 2.43/\text{kg}
   \]
   
   Package C has the lowest unit cost.

3. \[
\frac{120.00}{4} = 30.00/\text{lock}
\]

   \[
\frac{192.00}{6} = 32.00/\text{lock}
\]

   The first supplier has the lower cost per lock. When selecting a lock, you should also consider the quality of the locks, since you want them to be secure.

4. **a)**
   
   \[
   \frac{15.49}{2} = 7.75/\text{shirt}
   \]
   
   OR
   
   \[
   \frac{22.99}{3} = 7.66/\text{shirt}
   \]

   b) 2 packages of 3 plus 1 package of 1?
   
   \[
   2(22.99) + 9.98 = 55.96
   \]
   
   Or 1 package of 3 plus two packages of 2?
   
   \[
   22.99 + 2(15.49) = 53.97
   \]

   The best combination is to buy one package of 3 shirts and two packages of 2.

5. First, convert everything to kilograms so all the denominator units are the same.

   \[
   500 \text{ g} = 0.5 \text{ kg}
   \]

   Now, calculate unit price.

   \[
   \frac{7.50}{0.5 \text{ kg}} = 15.00/\text{kg}
   \]

   \[
   \frac{12.50}{1.5 \text{ kg}} = 8.33/\text{kg}
   \]

   So, the second price is the best buy.
Which combination will be the best price for 2.5 kg?

Two of the second price plus one of the first?

\[2 \times (12.50) + 7.50 = 32.50\]

Or 1 of the second price plus one of the third?

\[12.50 + 19.50 = 32.00\]

(You can factor out buying mostly from the first option because it is the most expensive.)

The best price for 2.5 kg of meat can be obtained by buying 1 kg at the second price and 1.5 kg at the third.

6. Convert the denominators to kg.

\[250 \text{ g} = 0.25 \text{ kg}\]

\[500 \text{ g} = 0.5 \text{ kg}\]

Then calculate unit price.

\[\frac{4.25}{0.25} = 17.00/\text{kg}\]

\[\frac{7.95}{0.5} = 15.90/\text{kg}\]

\[\frac{29.50}{2} = 14.75/\text{kg}\]

The last package of meat has the lowest unit price. Nonetheless, the other store has two unit prices that are lower than this, so it would be better to buy your meat at the other store.

**Extend your thinking**

7. There are a couple of ways to solve this problem. Here is one option. First, you need to figure out which kit has the lowest unit price so you can see which kit is the best value. First, calculate the price per worker each kit can cover.

Kit 1:

\[\frac{42.50}{9} = 4.72\]

Kit 2:

\[\frac{58.25}{40} = 1.46\]

Kit 3:

\[\frac{70.50}{75} = 0.94\]

Kit 3 has the best unit value. How many does Jason need?

First, divide the kits needed by the number of workers to see how many kits are needed.

\[\frac{250 \text{ workers}}{75} = 3.34\]

Then calculate how much these 3 kits would cost.

\[3 \times 70.50 = 211.50\]

How many workers still need kits if Jason buys 3 of kit 3?

First, calculate the maximum number of workers these 3 kits will cover.

\[3 \times 75 = 225\]

Then, calculate how many workers still need to be covered by subtracting 225 workers (already covered by 3 of kit 3) from the total number of workers.

\[250 - 225 = 25\]

Kit 1:

\[\frac{25}{9} = 2.78\]

Calculate the total cost of these 3 kits.

\[3 \times 42.50 = 127.50\]

Kit 2:

One kit 2 will cover all 25 workers at a total cost of $58.25, which is a better buy than three of kit 1.

Now, calculate the total cost.

\[211.50 (3 \text{ of kit 3}) + 58.25 (1 \text{ of kit 2}) = 269.75\]

The least expensive combination is 3 large kits and 1 medium kit at a price of $269.75, before taxes.
MathWorks 10 Teacher Resource

1.3 Setting a Price

TIME REQUIRED FOR THIS SECTION: 1 CLASS

MATH ON THE JOB

Start the class with a student reading aloud the scenario describing Maurice, the cost estimator for a construction company. Discuss the number of factors that must be taken into consideration when estimating a job and the ramifications that can occur when done poorly. For example, estimating too little time can lead to labour shortages (for example, when hiring for different aspects of the job, the architects may be on a different time schedule than the stucco installers), cost overruns, disappointed clients, and so on. Furthermore, the cost estimator must ensure that the final price covers all costs plus makes a profit. Remember that building trades use imperial units of measurement.

SOLUTION

What is the cost per square foot for stuccoing?

\[ \frac{30,600.00}{3600} = 8.50/\text{sq ft} \]

EXPLORE THE MATH

The PST rates given in Figure 1.1 were accurate at the time of publication. Ensure that students use current rates in their calculations.

The idea of percent is familiar to students. However, many students are used to calculating percents as a two-step process rather than in one step. Help them to incorporate the one-step method into their repertoire of skills.

Example 1

Franka purchases jeans wholesale for her designer clothing store. She pays $55/pair and charges a markup of 45%. What is the selling price?

SOLUTION

METHOD 1: 2-step process

Convert 45% to a decimal by dividing by 100 to get 0.45. Then multiply.

\[ 55.00 \times 0.45 = 24.75 \]

To find the selling price, add.

\[ 55.00 + 24.75 = 79.75 \]

METHOD 2: 1-step process

The total that Franka charges is the price she pays plus the markup. Therefore, the selling price is 145% of the price she pays (100% plus 45% markup). Convert 145% to a decimal by dividing by 100 to get 1.45. Then multiply.

\[ 55.00 \times 1.45 = 79.75 \]

Example 2

Using the example above, Franka was adding a markup of 145% on the same $55.00 pair of jeans.

METHOD 1: 2-step process

Convert 145% to a decimal by dividing by 100 to get 1.45. Then multiply.

\[ 55.00 \times 1.45 = 79.75 \]

To get the selling price, add.

\[ 55.00 + 79.75 = 134.75 \]

METHOD 2: 1-step process

Convert 145% to a decimal by dividing by 100 to get 1.45. Add the 145% markup to 100% of the original price paid to find 245%. Convert to a decimal and multiply.

\[ 55.00 \times 2.45 = 134.75 \]
Recall that multiplying by 1 adds in the original $55.00 by multiplication rules. Now, changing the 1 to a 2 accounts for the fact that 145% means that you are doubling the original price and adding 45%.

For some students, you may want to show what a markup of 100% looks like first, then proceed to 145%.

**DISCUSS THE IDEAS**

**CONCERT PROMOTER**

This discussion allows students to think about how market forces affect pricing decisions. Sometimes a product’s price has an adverse effect on sales. When that happens, the business owner must make decisions to minimize losses. Students can begin by discussing the many factors that can affect concert ticket sales, such as the popularity of the band, the price, the number of events occurring at the same time, and so on.

Have students discuss the questions in small groups for about 5 minutes. After that, sample answers could be given to the entire class for a wrap-up.

**SAMPLE ANSWERS**

1. Raise the prices, see if you can add another show, limit the number of tickets per person.
2. Lower the prices, increase the promotions/ads, give tickets away as radio prizes.
3. There are not many circumstances, since your goal is to at least break even. However, in some dire circumstances, it may be better to make some money rather than no money.

**DISCUSS THE IDEAS**

**SEASONS AND HOLIDAYS**

This discussion builds upon the Concert Promoter discussion as the change in season and holidays also changes consumer demand. You could begin the discussion by asking students to think of items that they buy or use in each of the four seasons (for example, snow blowers in the winter, leaf blowers in the fall, lawn mowers in the summer, and rakes in the spring). Then discuss how the prices of those items change as the seasons change. For example, in Winnipeg, local summer produce such as strawberries is much cheaper in July than imported produce in December. Furthermore, holidays often mean that demand for items changes. For example, turkey and ham sales usually increase at Thanksgiving.

Moreover, students may have discussions in social studies about the effect natural disasters have on prices. For example, flooding during the rainy season in India can cause rising prices, hurricanes can ruin beaches in Mexico, affecting the tourist industry, and avalanches in BC and Alberta can affect the ski/snowboarding resorts or equipment businesses.

Business owners, therefore, need to prepare for the time of the year and adjust prices to take advantage of consumers’ seasonal demands.

**SAMPLE ANSWERS**

1. Mother’s Day (May), high school graduation (June), and weddings (summer) tend to be a high volume time. Students may think of other events that may cause a demand for roses (for example, Valentine’s Day).
2. Summer: road trips tend to increase. In light of rising gasoline costs, encourage students to talk about trade and economic fluctuations.
3. The price of toys at Christmas: students will be able to suggest many examples.
4. Certain jewellery pieces, such as blue diamonds or real fresh-water pearls, expensive watches like Patek Philippe or Rolex, rare art works, first edition books, certain foods such as caviar.
5. Answers will vary, but students may notice that prices are often set just below a psychological
turning point, such as $39.95 instead of $40.00. Other examples in which goods and services are advertised to seem less expensive than they are include plane fares that do not include taxes and fuel surcharges, one-way trips instead of round trips, hotel prices quoted by one night prices when a minimum stay is three nights. Sometimes manufacturers advertise an old price but have reduced the size of the package. Selling foods using the 100-gram price rather than the price per pound or kilogram also creates the impression that items are less expensive than they are.

Mental Math and Estimation

Ask students to work in pairs to collaborate on strategies. Students should be able to see that the price difference between the two helmets is $5.00 and multiply that by 25 to arrive at $125.00.

BUILD YOUR SKILLS: SOLUTIONS

These solutions were worked out using the tax rates in effect at the time of publication and are included on p. 29 of the student book.

1. As a percentage, the regular price plus the markup is 100% plus 60%, which equals 160%.

\[ 1.60 \times 22.75 = 36.40 \text{ a shirt} \]

2. \$49.95 + (2 \times 129.95) = 309.85

GST is 5%.

\[ \frac{5}{100} = 0.05 \]

0.05 \times 309.85 = 15.49

The total GST paid on the items is \$15.49.

\$309.85 + \$15.50 = 325.34

The total cost of the items, including tax, is \$325.35.

3. \$49.95 + 129.95 = 179.90

As a percentage, the Fort McMurray price plus the markup is 100% plus 10%, which equals 110%.

\$179.90 \times 1.10 = 197.89

As a percentage, the Saskatchewan price with PST and GST is 100% plus 5% GST plus 5% PST, or 110%.

\$197.89 \times 1.10 = 217.68

You would pay \$217.68 for a hard hat and a pair of steel-toed boots in Saskatchewan.

4. As a percentage, the regular price plus the markup is 100% plus 25%, or 125%.

The sink:

\$89.95 \times 1.25 = 112.44

The bathtub:

\$639.95 \times 1.25 = 799.94

2 faucets:

\[ 2 \times 74.95 = 149.90 \]

\$149.90 \times 1.25 = 187.38

Add to find the total she charged her customer, excluding tax.

\$112.44 + 799.94 + 187.38 = 1099.76

5. a) \[ 50 \times 3.50 = 175.00 \]

\[ 175 \times 3.99 = 698.25 \]

\[ 250 \times 2.00 = 500.00 \]

\$175.00 + \$698.25 + \$500.00 = 1373.25

Her total income is \$1373.25.

b) \[ 100 \times 3.50 = 350.00 \]

\[ 100 \times 2.00 = 200.00 \]
She receives $150.00 more income if she sells 100 quarts directly from her farm. Students may suggest that she would sell to a wholesaler because she may receive large orders from wholesalers or she may not be able to sell all her crop directly or at the farmers’ market.

6. a) $2.50 × 1.15 = $2.88

   The new unit price would be $2.88.

   b) First, find the difference in price per person.

   $2.88 − $2.50 = $0.38

   Then, find the difference for 100 people.

   $0.38 × 100 = $38.00

   She would make $38.00.

   c) Student answers will vary but should show they have considered various options such as trying to source less expensive ingredients and supplies; making her portions per person smaller; or trying to find ways she can be more efficient with her time, including perhaps hiring a delivery person.

7. Answers will vary but students may suggest discounts of as much as 50%, since that is a fairly common discount for out-of-season items. Students should recognize that Marie’s profits will be lower, but that some revenue is better than no revenue on those items. Marie’s reasoning would be that she has paid for these items and that it’s best if she tries to recover some of the money she spent.

   **Extend your thinking**

   8. First, convert kilograms to grams.

   $10 \text{ kg} \times 1000 = 10000 \text{ g}$

   Find the unit price per gram.

   $\frac{175.00}{10000 \text{ g}} = \$0.0175/\text{g}$

   Calculate the price for 250 g.

   $250 \text{ g} \times \$0.0175 = \$4.38$

   a) Student answers will vary but they should consider overhead costs such as the rent and utilities for the store, equipment costs such as a display fridge for the cheese and knives or other tools; materials for displaying, storing, and packaging the cheese such as plastic wrap; and staff time for stocking, cutting, and serving the cheese.

   $\$4.38 \times 1.40 = \$6.13$

   It would cost $6.13 for 250 grams.

   b) Since the customer is getting a discount of 15%, they are paying 85% of the original price ($100\% - 15\%$).

   $\$6.13 \times 0.85 = \$5.21$

   The price would be $5.21.

   d) Yes, you would still be making a gross profit.

   $\$5.21 - \$4.38 = \$0.83$

   But you would also need to consider whether this smaller margin would cover your additional costs, as discussed in a).
**On Sale!**

**TIME REQUIRED FOR THIS SECTION: 2 CLASSES**

**MATH ON THE JOB**

Start the class with a student reading aloud the scenario featuring Daniel, the owner of a stone and tile company. Discuss with students how businesses like to keep their stock up-to-date so that customers will want to keep coming back to see what's new and trendy. Discuss the fact that the price of many building items decreases when larger quantities are purchased (such as the price of limestone per square yard or lumber per linear foot, and so on). In order to turn over their stock, businesses tend to have end-of-season sales and clearances. Have students make a connection to sales that they have attended and when they occurred. Students then could discuss whether a purchase they made was needed or an impulse motivated by the “sale” tag.

**SOLUTION**

Imperial measurements are standard in the construction trades. Discuss with students the number of tiles needed. Each tile is 12” × 12” or 1’ × 1’. Calculate using feet since the price is given per square foot. Since 50 square feet of slate are needed, calculate the cost of 50 tiles.

**Note:** Some students may not understand the concept of “square feet.” Draw a square on the board and label each side as 4. Then draw in vertical and horizontal lines within the square to total 16 boxes within the space. Each side measures 4 linear feet. The area within the square becomes the square footage since the area of the square (4 × 4) is 16. In this example, 50 square feet could be represented by a 10’ × 5’ rectangle or a 25’ × 2’ rectangle, or some other shape. Point out that the shape does not have to be a square; remind students that it is area that is being discussed.

**COST METHOD 1:** 2-step process

First find the percent discount on one tile and subtract that amount from the original price. Remember to convert the percent to a decimal.

\[
\begin{align*}
6.99 \times 0.15 &= 1.0485 \\
6.99 - 1.05 &= 5.94 \text{ per tile} \\
5.94 \times 50 &= 297.00
\end{align*}
\]

**COST METHOD 2:** 1-step process

If the discount per tile is 15%, then you can calculate the discount percentage.

\[
100\% - 15\% = 85\%
\]

\[
6.99 \times 0.85 = 5.94 \text{ a tile}
\]

Multiply to find the total cost.

\[
5.94 \times 50 = 297.00
\]

**EXPLORE THE MATH**

Discuss with students some current promotions that they have seen on television or in the local store. Ask them if they think the sales promotions work. Are there cases when a store holds too many sales (for example, some electronics stores have weekly sales flyers)? If so, how might that affect consumer behaviour (customers take the sale for granted, thereby hesitating to buy at full price)?

**Mental Math and Estimation**

Students should be able to round the price up to $1000.00 and realize that 20% is $200.00 so they will pay about $800.00 at the sale price before taxes. Ask students to share their personal strategy with a partner.
ACTIVITY 1.4
TAKING ADVANTAGE OF SALES PROMOTIONS

Ask students to work in pairs for this activity, role-playing roommates in their first apartment. Have them look through flyers or internet sales sites to comparison shop. Remind students that usually first-time homeowners/renters have limited budgets, which is why you need to buy the items on sale.

SAMPLE SOLUTIONS

Sample answers for questions 1 and 2 are shown in the table below.

<table>
<thead>
<tr>
<th>ASSESSING PROMOTIONS</th>
<th>Item</th>
<th>Store name*</th>
<th>Product*</th>
<th>Promotional pitch</th>
<th>Regular price</th>
<th>Sale price</th>
<th>Percent discount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereo</td>
<td></td>
<td></td>
<td></td>
<td>Discontinuing item sale</td>
<td>$699.99</td>
<td>$499.99</td>
<td>29%</td>
</tr>
<tr>
<td>Couch</td>
<td></td>
<td></td>
<td></td>
<td>Pre-holiday sale</td>
<td>$569.99</td>
<td>$484.49</td>
<td>15%</td>
</tr>
</tbody>
</table>

* Students will fill in the exact store and product information from the sources they use.

3. The first store advertised a $200.00 discount. The percent discount is 29%.

The second store advertised a 15% discount. The discount amount is $85.50. The sale price would, therefore, be the original cost minus the discount.

\[
\text{Sale price} = \text{Regular price} - \text{Discount amount}
\]

\[
\text{Sale price} = 569.99 - 85.50 = 484.49
\]

4. The promotions were not misleading but you had to read the fine print on the first store’s sales flyer to see that the reduced price was only in effect for one week.

5. Ask students to compare answers and see who found the best price for each item.

BUILD YOUR SKILLS: SOLUTIONS

1. a) Calculate the price of a package at half price by dividing by 2.

\[
\frac{5.89}{2} = 2.95, \text{ rounded off}
\]

Then calculate the cost of one package at full price and one package at half price.

$5.89 + 2.95 = 8.84

b) First, calculate the total regular price.

\[
2 \times 5.89 = 11.78
\]

Then, calculate the difference between the regular cost and sale costs for the two packages.

\[
11.78 - 8.84 = 2.94
\]

Finally, calculate the percentage.

\[
\frac{2.94}{11.78} = 0.249
\]

This can be rounded to 25%.

This can also be done mentally: one package is 50% off so you are paying 75% of the total price on two packages.

2. a) At Ross’s store, the total price, including GST, can be found by adding 100% and 5%, converting to a decimal, and multiplying the price by 1.05.

\[
49.95 \times 1.05 = 52.45
\]

At Al’s store, subtract the discount percent, 15%, from 100%, and convert to a decimal. Then multiply the price by 0.85 to find the sale price.
$55.95 \times 0.85 = $47.56
Then, calculate the sale price plus GST.
$47.56 \times 1.05 = $49.94
b) Al is right—with the sale, the racquet at his store is less expensive.

3. a) Calculate cost of morning highlights.
Convert 15% to a decimal and subtract that amount from the original price.
$55.00 \times 0.15 = $8.25
$55.00 - $8.25 = $46.75
Calculate cost of mid-afternoon highlights.
$55.00 - $5.00 = $50.00
Morning appointments will get you the lowest price on highlighting.

b) Answers will vary but students should offer reasons for their answers. For example, the discount will appeal more because it allows you to save more money, or the coupon will appeal more because you know immediately how much you are saving without having to do any calculations. The time of day the person is available will also affect his or her choice.

4. First, calculate the roofer’s savings with a 20% discount. Convert 20% to a decimal.
$27.50 \times 0.20 = $5.50
Calculate your cost of materials if he passes on 50% of his discount by dividing by 2.
$5.50 \div 2 = $2.75
Your discount on a square metre is $2.75.
$27.50 - $2.75 = $24.75
Your cost for a square metre would be $24.75.
$24.75/m^2 \times 74 m^2 = $1831.50
Calculate his hourly rate with a 5% discount. Convert 5% to a decimal.
$36.00 \times 0.05 = $1.80
Find the total savings on labour for 16 hours.
$1.80 \times 16 = $28.80
You would save $28.80 on labour.

5. a) Calculate the total cost of 20 fans at each store.
The first wholesaler offers 5% off $157.00.
Calculate the cost of one fan with the discount.
$157.00 \times 0.95 = $149.15
Then, calculate the cost with GST.
$149.15 \times 1.05 = $156.61
Find the cost of 20 fans.
$156.61 \times 20 = $3132.15
The second wholesaler charges $149.00 each for orders of 10 or more. Find the cost of one fan, with GST.
$149.00 \times 1.05 = $156.45
Find the cost of twenty fans.
$156.45 \times 20 = $3129.00
b) The second wholesaler offers a better buy.

6. a) Calculate the percentage of markdown each item has been given.
Shirts:
$31.99 - $19.99 = $12.00 discount
$12.00
$31.99 = 0.375
The discount is 38%, rounded to the nearest percent.
Shorts:
$24.95 - $16.95 = $8.00 discount
$8.00
$24.95 = 0.32
The discount is 32%.
Jacket:
$49.99 - $24.99 = $25.00 discount
The discount is 50%.

b) Add up all the discounts.
   $12.00 + $8.00 + $25.00 = $45.00 total savings
   Or you can calculate the total regular price.
   $31.99 + $24.95 + $49.99 = $106.93
   Calculate the total sale price.
   $19.99 + $16.95 + $24.99 = $61.93
   Find the total savings.
   $106.93 – $61.93 = $45.00
   The most money is saved on the jacket.

Extend your thinking

7. a) 5% GST + 7% PST = 12% total tax
   Calculate the regular price.
   $26.00/h × 55 h = $1430.00
   Add 12% to 100% of the total price to find 112%. Convert to a decimal and multiply.
   $1430.00 × 1.12 = $1601.60
   The total savings are $87.36.
   Then, calculate the difference in what you saved.
   $87.36 − $80.08 = $7.28
   The owners of the second house save $7.28 more than you do.

   b) Similarly, calculate the second person’s savings.
   $26.00 × 60 × 1.12 = $1747.20
   $24.70 × 60 × 1.12 = $1659.84
   $1747.20 − $1659.84 = $87.36
   You total savings are $80.08.
   The owners of the second house save $7.28 more than you do.

SOLUTIONS

1. Answers will vary. In BC, the Tsimshian people used Eulachon oil for trade. Other items used for trade by First Nations people included preserved meats, rare stones, tools, and furs.

2. Answers will vary. Possible factors to consider when determining the value of goods or services include the time spent providing a service, the original monetary value of the item, or the rarity of the item.

3. Answers will vary. Possible answers could include that money is valuable because it can be exchanged for goods or services, or that the value of a country’s currency depends on the strength of its economy.
1.5 Currency Exchange Rates

TIME REQUIRED FOR THIS SECTION: 2 CLASSES

MATH ON THE JOB

Start the class with a student reading aloud about Naomi Coates, the office manager for a potato grower. Have students think about items that they use at home that are not usually from Canada, such as electronics, vehicles, or clothes. Since many items come from international sources, the buyer of the items must convert Canadian dollars to the international currency of the country where the product is being purchased. Then have students think of items that Canada exports, for example, wheat, apples, and buses. Again, the seller must convert the amount received from the buyer to Canadian funds. Sellers must also price the product to minimize losses from the fluctuating dollar.

This discussion can lead into considering the effect that the rise or fall of the Canadian dollar has on manufacturers, agricultural producers, mills, and other businesses that depend on import and/or export of goods. A linked discussion can address the impact currency exchange rates have on consumer prices. Challenge students to think of examples from their own lives and from what they have learned previously from the media or from another source about exchange rates.

EXPLORE THE MATH

After reading the Explore the Math lesson on currency, you may want to try the extension activity on exchange rates. In this extension, students explore the issues that underlie exchange rates and their purpose. Before beginning the activity, you will want to explain a little more about exchange rates and how they are established. Most of the world’s major currencies are flexible in that they rise or fall with changes in the supply and demand for the currency, but nations sometimes intervene to try to manage their currency’s rate of exchange. Changes in exchange rates can affect trade among nations and a nation’s domestic economy. The value of a nation’s currency, and thus its exchange rate compared to other currencies, is influenced by many factors, from the general—a country’s economic and political situation—to the specific—interest and employment rates.

EXTENSION ACTIVITY

EXCHANGE RATES AROUND THE WORLD

In this activity, students are divided into two different groups: country A and country B. The residents of each country participate in two auctions. In the first, students can only buy goods produced in their own countries while in the second, they exchange their currency with foreign currency to buy foreign goods.

MATERIALS: Prepare 2 bags with 100 paperclips in each and 2 bags with 200 beans in each to be used as currency. For the items to be auctioned, there should be 4 of one item (such as pencils) and 2 each of 4 different items (such as 2 postcards, 2 stickers, etc.). Also have 50 to 100 each of 2 different smaller items (such as soft and hard candies). In the following description, specific items are used, but you are free to choose whatever will work best with your class. Now, split these items into two sets so that you have identical sets for auction 1 and 2.
**AUCTION 1:** For this auction, the two countries are not allowed to trade with each other. Country A uses paperclips for money while country B uses beans. Distribute the 100 paperclips among the students in country A and the 200 beans among the students in country B, giving students unequal amounts. This represents the income they earned during the past year.

Both countries produce one good that is the same (the pencils) and other goods that are unique (postcards, bumper stickers, etc.). List each country's goods on the board. For example, country A produces postcards, packs of gum, pencils, and a large supply of soft candy. Country B produces chocolate bars, bumper stickers, pencils, and a large supply of hard candy.

Have students volunteer, or choose leaders for each country. Each leader stands in front of their country's residents with the items their country has produced in the last year—for country A, a postcard, a pack of gum, a pencil, and the soft candy and for B, a chocolate bar, a bumper sticker, a pencil, and the hard candy.

Hold the auctions at the same time. The leader auctions off the three larger goods to the highest bidder within each country. Record the prices they go for. Then students buy the small items with their currency until everyone has something (students may not save their money).

Collect all the currency after the auction. When the auctions are finished:

- Compare the amount of currency paid for the 3 larger items in each country. The country with more currency (beans) probably paid more.
- Compare the price of the same item for both countries. Again, those with beans likely paid more.
- Ask students to discuss whether the people in the country with more currency (the beans) are richer. Students should come to the conclusion that the amount of currency in circulation does not make the country wealthier. What is important is how much the currency will buy in different countries.

**AUCTION 2:** For this auction, trade is allowed between the two countries. Distribute the second set of currency to the students as before and give the leaders the second set of goods.

In order to buy something from another country, you must have the right currency. Before the auction, allow the students to barter with one another to trade currencies. There is no fixed rate and no one has to exchange if they do not want to. When students exchange currency, they must report it on the board, listing how many paperclips were exchanged for how many beans.

Run the auctions for both countries simultaneously as before. Students choose which country's items they want and thus at which auction they will be. Again, record the prices the larger items go for and, when the auction is finished, let the students buy the candies.

When these auctions are complete:

- Compare the number of beans and paperclips paid for auctioned items. Again, the number of beans paid was likely more than paperclips. Popular goods may have higher prices in the second auction because there were more potential buyers.
- Explain that an exchange rate is defined as the price or value of a nation's currency in terms of another nation's currency, and ask students to share their experiences with exchange rates.
- Determine the exchange rate in the auction activity.
- Ask students to suggest reasons why people in one country would want currency from another.

**Mental Math and Estimation**

One strategy for solving this question is suggested here. Students may suggest other methods. Ask students to share their strategy with a partner.

First round €95.00 up to €100.00. Then round 1.644 to 1.5. Add 50% of 100 to 100 to get $150.00, the approximate price of the hotel room.
ACTIVITY 1.5
WHAT’S YOUR RIDE? SURVEY

This activity allows students to discover the difference between buy and sell rates as well as to explore different world currencies. To start this activity, have students look at the chart and the range of prices listed in the column Foreign amount. Ask them to guess which vehicle costs the most in Canadian dollars and which costs the least.

In doing the currency conversions, students will discover that some websites list separate buy and sell rates, while others list mid-market rates or nominal rates. Mid-market rates are derived from the mid-point between the buy and sell rates of large-value transactions in the global currency market. The Bank of Canada currency converter lists a nominal rate, which shows where the bank estimates the market to have been at noon on that day. Since buy rates and sell rates include overhead and profit margins that are set independently by each foreign currency provider, they will vary depending on the provider and will always be different than the mid-market rates and the nominal rates.

SAMPLE SOLUTIONS

The table below gives sample answers for question 1.

The Royal Bank website (www.rbcroyalbank.com) lists both buy and sell rates. This is why it is one of the recommended sites. The site www.XE.com is an alternative site that could be consulted. Note, however, that these are external websites and are not endorsed by either the WNCP or Pacific Educational Press.

Figure 1.2, on p. 45 of the student book, was compiled from two websites, the Royal Bank of Canada and HSBC.

**Extension**

Conduct online research to select two additional vehicles from countries of your choice. Research the models and their prices in the currency of their origin. Using an online currency converter, determine the price in Canadian dollars.

**Comparing Cars**

<table>
<thead>
<tr>
<th>Name of country</th>
<th>Make and model of vehicle</th>
<th>Name of currency</th>
<th>Exchange rate</th>
<th>Foreign amount</th>
<th>Canadian amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>Fiat 500</td>
<td>euro</td>
<td>1.597 95</td>
<td>€10 900.00</td>
<td>$17 427.66</td>
</tr>
<tr>
<td>India</td>
<td>Maruti Gypsy King</td>
<td>rupee</td>
<td>0.024 1358</td>
<td>Rs 537 921.07</td>
<td>$12 983.16</td>
</tr>
<tr>
<td>England</td>
<td>Mini Cooper S</td>
<td>pound</td>
<td>2.029 99</td>
<td>£16 245.00</td>
<td>$32 977.19</td>
</tr>
<tr>
<td>United States</td>
<td>Dodge Ram 3500</td>
<td>US dollar</td>
<td>1.024 88</td>
<td>US$30 420.00</td>
<td>$31 176.85</td>
</tr>
<tr>
<td>Japan</td>
<td>Daihatsu Move Latte L</td>
<td>yen</td>
<td>0.009 48742</td>
<td>¥1 073 380.00</td>
<td>$10 183.61</td>
</tr>
</tbody>
</table>

Rates as of October 10, 2008
2. This question allows students to get engaged in the topic by finding photos and prices of vehicles in different countries. Auto show websites, such as for the Dubai motor show, are a good place to find representative makes and models. However, if time is an issue or if the classroom does not have high-speed internet access, simply ask students to choose one vehicle from the list.

3. The following sample answers use the price of the Fiat 500 as listed in the table.

a) Using the calculator at the Royal Bank website (www.rbcroyalbank.com), you determine that to buy €10 900.00, you will need $17 781.17 CAD. The rate for $1.00 CAD is €0.6130.

b) The Bank of Canada website lists a nominal rate, which is neither a buy rate nor a sell rate. This question requires students to find the sell rate (the bank is selling the euro to the customer), so the Royal Bank sell rate will likely be higher than the nominal rate. On October 24, 2008, the Bank of Canada rate for €10 900.00 was $17 564.26 CAD while the RBC sell rate was $17 781.17 CAD.

4. a) The bank builds a profit margin and overhead into their buy and sell rates. In other words, they do not convert money for free. The buy rate that the bank offers on the euro on this date is €0.6079 for $1.00 CAD compared to a sell rate of €0.6130.

b) Using the currency converter at www.rbcroyalbank.com, you determine that converting €10 900.00 to Canadian dollars will yield $17 146.79 CAD.

\[ $17 781.17 - $17 146.79 = $634.38 \]

The difference between the buy and sell rates is significant when you are converting money at the bank.

**Extension Solution**

You may want to alert students that finding prices in the currency where the car originates can be challenging, especially since some websites will not be in English. Also, many websites will list prices in US dollars.

**Activity 1.6**

**CALCULATE FOREIGN EXCHANGE**

This activity allows students to investigate the impacts of buying items from outside Canada, using the currency exchange skills they have developed. Remind students that the fluctuating dollar can have a big impact on whether this is an effective way to buy things, and that there may be extra costs such as duty and shipping to consider.

**Sample Solutions**

Answers will vary. For question 4, students may suggest that buying from a foreign source could be less expensive and allow a wider choice than buying locally. They may also suggest that buying from a foreign source could take longer, that it is difficult to assess the quality of an item when buying online, and that duty and shipping may eliminate any price differential.
BUILD YOUR SKILLS: SOLUTIONS

1. You would choose the bank selling rate to buy these currencies.
   a) 1.644 814
   b) 0.133 451
   c) 0.019 360

2. You would choose the bank buying rate to sell these currencies.
   a) 0.009 295
   b) 0.950 964
   c) 1.004 350

3. Use bank buying rates because the bank is buying the currency from you.
   a) 4500.00 pesos × 0.083 443 = $375.49 CAD
   b) $25 000.00 Hong Kong × 0.128 451 = $3211.28 CAD
   c) 2200.00 euros × 1.580 814 = $3477.79 CAD
   d) 8545.00 Scottish pounds × 1.996 146 = $17 057.07 CAD

4. Use the bank sell rate because the bank is selling the currency to you.
   $1200.00 CAD ÷ 1.644 814 = €729.37
   Megan will have €729.37 in the local currency for her expenses in Germany.

5. Use the bank selling rate because the bank is selling these currencies to you.
   a) \[
   \frac{\$650.00}{1.644 814} = 395.18 \text{ euros}
   \]
   b) \[
   \frac{\$650.00}{1.017 007} = 639.13 \text{ francs}
   \]
   c) \[
   \frac{\$650.00}{0.175 558} = 3702.48 \text{ kronor}
   \]
   d) 3702.00 kroner × 0.165 558 = $612.98 CAD
   She receives a lower amount back because bank buy and sell rates are different—the banks build in a profit margin for exchanging money.

6. Chris is buying these currencies so he will pay the bank selling rate.
   Pebble Beach:
   $5000.00 × 1.038 650 = $5193.25 CAD
   St. Andrew’s:
   £8500.00 × 2.060 146 = $17 511.24 CAD
   Spring City Golf & Lake Resort:
   ¥26 600.00 × 0.162 600 = $4325.16 CAD
   SAFRA Resort & Country Club:
   S$15 000.00 × 0.762 280 = $11 434.20 CAD
   Leopoldsdorf:
   €4000.00 × 1.644 814 = $6579.26 CAD

<table>
<thead>
<tr>
<th>GOLF VACATION</th>
<th>Country</th>
<th>Golf course</th>
<th>Estimated funds needed</th>
<th>Estimated funds needed in CAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>Pebble Beach</td>
<td>US$5000.00</td>
<td>$5193.25</td>
<td></td>
</tr>
<tr>
<td>Scotland</td>
<td>St. Andrew’s</td>
<td>£8500.00</td>
<td>$17 511.24</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>Spring City Golf &amp; Lake Resort</td>
<td>¥26 600.00</td>
<td>$4325.16</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>SAFRA Resort &amp; Country Club</td>
<td>S$15 000.00</td>
<td>$11 434.20</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>Leopoldsdorf</td>
<td>€4000.00</td>
<td>$6579.26</td>
<td></td>
</tr>
</tbody>
</table>
Extend your thinking

7. a) The answer to this question will depend on when the conversion website was accessed.

\[ \$8.95 \text{ CAD} = \$8.73 \text{ US} \]  
(rate: \( 1 \text{ CAD} = 0.975\, 229 \text{ USD} \))

\[ \$8.95 \text{ CAD} = \$9.39 \text{ AUD} \]  
(rate: \( 1 \text{ CAD} = 1.049\, 05 \text{ AUD} \))

b) Use the bank buy rates for this question because you will be selling the vinegar abroad and thus receiving US or Australian dollars, which you will then convert to Canadian dollars.

**US:**

\[ \$8.95 + \$1.00 = \$9.95 \]

\[ \frac{\$9.95}{1.004\, 350} = \$9.91 \text{ US} \]

**Australia:**

\[ \$8.95 + \$2.00 = \$10.95 \]

\[ \frac{\$10.95}{0.950\, 964} = \$11.51 \text{ AUD} \]

You would have to set the US price at \$9.91 and the Australian price at \$11.51.

**REFLECT ON YOUR LEARNING**

**UNIT PRICING AND CURRENCY**

Ask students to review and reflect on the list of new skills and knowledge they have encountered in this chapter.

**PRACTISE YOUR NEW SKILLS: SOLUTIONS**

1. a) For the first part of this question, you can divide 80 by 2 to find 40 km in half an hour.

For the second part of this question, you multiply 80 km by 2 to get 160 km and then add the 40 km from above to find 200 km in two-and-a-half hours.

b) To find the amount of Canadian dollars for 10.00 euros, multiply the exchange rate by 10 to get \$15.90 CAD.

2. Using proportional reasoning, the bakery would sell 300 loaves of white bread that day.

3. a) \( \frac{30}{4} = 7.5 \text{ m/s} \)

b) \( \frac{\$2.80}{12} = \$0.23/\text{ egg} \), rounded to the nearest cent

4. For the first part of this question, students should demonstrate that the answer is no. They can demonstrate this by converting both sides to a decimal or finding a common denominator to compare the fractions.

\[ \frac{4}{6} \neq \frac{5}{7} \]

\[ \frac{5}{7} \neq \frac{8}{10} \]

\[ \frac{4}{6} \neq \frac{8}{10} \]

These are not proportional.

If you reduce an 8” × 10” photograph, you can make any proportion that is equivalent to 8:10. For example, 4:5 or 2.5:3.125.

5. a) \( \frac{\$1.89}{5 \text{ lbs}} = \$0.38/\text{ lb} \)

\( \frac{\$5.99}{20 \text{ lbs}} = \$0.30/\text{ lb} \)

The 20 lb bag is the better buy.
b) You will want to consider the quality of the potatoes and the quantity that you can use. You would also consider the type of potato and perhaps whether it is organic or not. Students may offer a variety of answers.

c) \[
\frac{\$15.00}{75 \text{ lbs}} = \$0.20/\text{lb}
\]

This is the best buy but you will want to consider whether or not you will use 75 lbs of potatoes.

6. Calculate the price at Krazy Krazy.
\[
\$1299.99 - \$300.00 = \$999.99
\]
Calculate the price at Too Good To Be True.
\[
\$1299.99 \times 0.30 = \$390.00
\]
\[
\$1299.99 - \$390.00 = \$909.99
\]
\[
\$909.99 \times 1.05 = \$955.49
\]

Too Good To Be True offers the best deal.

7. a) The simplest way to solve this problem is to realize that 1 cup of sugar is double the amount called for in the recipe, so you need to double the flour.
\[
2 \frac{1}{2} \text{ cups} \times 2 = 4 \frac{1}{2} \text{ cups}
\]
\[
4 \frac{1}{2} \text{ cups} = 5 \text{ cups of flour}
\]
b) To make this simpler to solve, students may first want to convert the fractions of cups to a decimal.
\[
2 \frac{1}{2} \text{ cups} = 2.5 \text{ cups}
\]
\[
\frac{1}{2} \text{ cup} = 0.5 \text{ cups}
\]
Flour:
\[
\frac{2.5}{12} = \frac{x}{8}
\]
The common denominator is 12 multiplied by 8, or 96.
\[
96 \left( \frac{2.5}{12} \right) = \left( \frac{x}{8} \right) 96
\]
\[
240 = 96x
\]
Each side can be simplified by dividing the numerator by the denominator.
\[
\frac{20}{12} = \frac{20}{12}
\]
\[
\frac{20}{12} = \frac{12x}{12}
\]
\[
1.666 = x
\]
Now, convert 1.666 back to a fraction to get \(1\frac{2}{3}\) cups of flour.
Sugar:
\[
\frac{0.5}{12} = \frac{x}{8}
\]
\[
96 \left( \frac{0.5}{12} \right) = \left( \frac{x}{8} \right) 96
\]
\[
48 = 96x
\]
\[
\frac{48}{96} = \frac{96x}{8}
\]
\[
\frac{4}{12} = \frac{12x}{12}
\]
\[
0.333 = x
\]
Again, convert back to a fraction to get \(\frac{1}{3}\) cup of sugar.

8. a) Let \(x\) be the number of Canadian dollars.
\[
\frac{\€500.00}{x} = \frac{\€1.00}{\$1.59}
\]
\[
\$1.59 \left( \frac{\€500.00}{x} \right) = \left( \frac{\€1.00}{\$1.59} \right) \times 1.59x
\]
\[
1.59(500.00) = x
\]
\[
\$795.00 = x
\]
It will cost her \$795.00 CAD to buy \€500.00.
b) \$795.00 \times 1.005 = \$798.98
The final cost is \$798.98.

9. a) First, calculate the total amount she spent in euros.
\[
15(\€28.92) + 40(\€9.95) = \€831.80
\]
Then, determine the unit rate for 1 euro.

\[
\frac{\$1.00}{€0.6478} = 1.5437
\]

Multiply the unit rate by the total amount she spent.

\[1.5437 \times 831.80 = 1284.05\]

The fabric cost $1284.05 CAD.

10. a) Divide $27.00 by 3 to find $9.00/h.

You have $1.50 unaccounted for, and $1.50 divided by 3 is $0.50. Add this to $9.00 to get $9.50/hr.

b) Copy the following table or use a spreadsheet to make a table showing the number of hours versus dollars earned.

<table>
<thead>
<tr>
<th>HOURS</th>
<th>DOLLARS EARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>$9.50</td>
</tr>
<tr>
<td>2</td>
<td>$19.00</td>
</tr>
<tr>
<td>3</td>
<td>$28.50</td>
</tr>
<tr>
<td>4</td>
<td>$38.00</td>
</tr>
<tr>
<td>5</td>
<td>$47.50</td>
</tr>
</tbody>
</table>

c) Students can plot this using pen and paper or, if using a spreadsheet, they can use the built-in graphing tool and choose the scatter plot feature. Students should extend their original tables first so that they can then extend their graph to answer the following question.

d) Student answers for this question will vary since they are reading their own graph, but the values they determine should be close to the following calculated values.

3.5 hours worked: \[\$9.50(3.5) = \$33.25\]
She will earn $33.25 for working 3.5 hours.

12.5 hours worked: \[\$9.50(12.5) = \$118.75\]
She will earn $118.75 for working 12.5 hours.
Part A: Multiple Choice

Choose the best response to each of the following questions:

1. Jean and her best friend, Verna, want to buy 3 DVDs that are regularly priced at $20.00 each. Today, three stores, A, B, and C, have the DVDs on sale. At which store will the friends spend the least amount of money if they buy 3 DVDs?

   - a) Store A
   - b) Store B
   - c) Store C
   - d) Stores A and C

2. Lisa is managing a popular new band. Each of the songs the band plays is 3 to 5 minutes long. Lisa needs to let the venue where the band will be performing know approximately how many songs they will play in two hours. Which is the best estimate?

   - a) 8 songs
   - b) 12 songs
   - c) 20 songs
   - d) 30 songs

3. Whose rate of pay is the highest?

   - a) Antoine earns $66.00 in 8 hours.
   - b) Laurie earns $72.00 in 5 hours.
   - c) Ken earns $51.00 in 5 hours.
   - d) Sara earns $89.00 in 6 hours.

4. Janine just came home from a vacation in Cancún, Mexico and has 300.00 pesos left over. If the bank buys pesos at $0.083 443 CAD, how much will Janine get back in Canadian dollars?

   - a) $25.03
   - b) $3595.27
   - c) $359.53
   - d) $250.30

5. Adelina will be going to a construction trade show in Paris this year. Her budget is $1200.00 CAD. If the bank sell rate is one euro for $1.644 814 CAD, how many euros will she have to spend in Paris?

   - a) €1973.78
   - b) €729.57
   - c) €731.71
   - d) €1968.00
Part B: Short Answer

1. Find the unit cost of each of the following items. Show your calculations.
   a) a package of 10 wood floor tiles for $69.07  
   b) a package of 25 Richelieu screws for $1.45

2. Write as a unit rate. Show your calculations.
   a) 25 m of tape for $0.95  
   b) 120 words typed in 3 minutes
   c) driving 240 km in 4 hours  
   d) $22.80 for 3 hours of work

Part C: Extended Answer

1. Samir must arrange for catering for a lunch at the office where he works. The caterer tells him that they charge $65.00 for six people and $12.00 for each additional person. There will be between 9 and 15 people at the lunch. Before he can place the order, the accounting office needs Samir to complete a budget form that shows the price for each person.
   a) Find the cost for each person if 10 people attend the lunch. Show your calculations.
b) Fill in the table and show your calculations below.

<table>
<thead>
<tr>
<th>Number of people</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Patrick and Lylah work as lift truck operators in a warehouse. They can unload pallets of goods off transport trucks and shelve them at the same speed. It takes Patrick 1 hour to unload and shelve 17 pallets. How long would it take Lylah to unload and shelve 25 pallets? Show your work.

3. The Winnipeg Harvest food bank has started its semi-annual food drive. To support the drive, local grocery stores have advertised a sale on canned soup. Two different brands of soup are available in large quantities. Tastes Like Homemade is being sold at $18.89 for 12 cans of 284 mL. Savory Soup is being sold at $30.69 for 24 cans of 284 mL.

a) Which is the better deal between these two brands? Justify your answer by showing two different ways to solve this question.
b) If a school raises $500.00 to buy soup for the food bank, how many cans of the lowest-priced soup can the school buy?

4. Stan has a part-time job working 12 hours a week. His gross pay is $110.20 a week. Cecelia has a part-time job working 8 hours a week. Her gross pay is $90.40 a week.
   a) Find the ratio of the number of hours Stan works to the number of hours Cecelia works during a week.
   b) Find Stan's gross hourly rate of pay.
   c) Find Cecelia's gross hourly rate of pay.
   d) Find the ratio of Stan's gross hourly rate of pay to Cecelia's gross hourly rate of pay.

5. You have decided to buy a new car and must choose between a regular model and a hybrid model. The hybrid model uses less fuel since it uses an electric motor to power the car when it is possible.

<table>
<thead>
<tr>
<th>Model</th>
<th>Price including taxes and shipping</th>
<th>Average fuel economy (L/100 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular model</td>
<td>$24,466.00</td>
<td>12.4</td>
</tr>
<tr>
<td>Hybrid model</td>
<td>$25,840.00</td>
<td>10.8</td>
</tr>
</tbody>
</table>

   a) How many litres of fuel will be required to drive each vehicle 24 000 km?
   b) Fuel costs $1.03/litre. How many kilometres would you need to drive to save enough money in fuel to pay for the extra cost to buy the hybrid?
   c) Why might you choose to purchase the hybrid even if you planned to sell the car in 2 years?
SAMPLE CHAPTER TEST: SOLUTIONS

Part A: Multiple Choice

1. Store A:
   \[20.00 + 0.5(20.00) + 0.5(20.00) = 40.00\]
   Store B:
   \[0.35 \times 20.00 = 7.00\]
   \[20.00 - 7.00 = 13.00\]
   \[13.00 \times 3 = 29.00\]
   Store C:
   \[20.00 + 20.00 = 40.00\]
   The answer is b). Store B has the best offer.

2. To estimate how many songs can be played in one hour, use 4 minutes as the average song length and convert 2 hours to minutes.
   \[2 \text{ h} \times 60 = 120 \text{ min}\]
   \[4 \text{ min} = 120 \text{ min} \div x\]
   \[x \left(\frac{4}{1}\right) = \left(\frac{120}{x}\right)\]
   \[4x = 120\]
   \[x = \frac{120}{4}\]
   \[x = 30\]
   The answer is d). They can play about 30 songs in two hours.

3. Students should be able to narrow this down to either b) or d) by looking at the numbers. (Laurie and Sara earn more in less time than either Antoine or Ken.)
   b) \[72.00 + 5 \text{ h} = 14.40/\text{h}\]
   d) \[89.00 + 6 \text{ h} = 14.83/\text{h}\]
   The answer is d).

4. \[
\frac{1.00 \text{ peso}}{0.083443} = \frac{300.00 \text{ pesos}}{x}
\]
   \[0.083433x \left(\frac{1}{0.083443}\right) = \left(\frac{300}{x}\right) 0.083433x\]
   \[x = 0.083433(300)\]
   \[x = 25.03\]
   The answer is a).

5. \[
\frac{1.644814 \text{ CAD}}{1.00 \text{ euro}} = \frac{1200.00 \text{ CAD}}{x \text{ euros}}
\]
   \[1.644814x = 1200\]
   \[x = \frac{1200}{1.644814}\]
   \[x = \text{€729.57}\]
   She will have 729.57 euros to spend. The answer is b).

Part B: Short Answer

1. a) \[\frac{69.07}{10 \text{ tiles}} = 6.90/\text{tile}\]
   b) \[\frac{1.45}{25 \text{ screws}} = 0.06/\text{screw}, \text{rounded to the nearest cent}\]

2. a) \[\frac{0.95}{25 \text{ min}} = 0.04/\text{min}, \text{rounded to the nearest cent}\]
   b) \[\frac{120 \text{ words}}{3 \text{ min}} = 40 \text{ words/min}\]
   c) \[\frac{240 \text{ km}}{4 \text{ h}} = 60 \text{ km/h}\]
   d) \[\frac{22.80}{3 \text{ h}} = 7.60/\text{h}\]
Part C: Extended Answer

1. a) \( 10 - 6 = 4 \) people, in addition to the 6 for $65.00.

\[
\text{\$65.00 + 4(\$12.00) = \$113.00 total cost}
\]

\[
\text{\$113.00 ÷ 10 people = \$11.30/person}
\]

b)

<table>
<thead>
<tr>
<th>Number of people</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$101.00</td>
<td>$113.00</td>
<td>$125.00</td>
<td>$137.00</td>
<td>$149.00</td>
<td>$161.00</td>
<td>$173.00</td>
</tr>
</tbody>
</table>

2. First, find how much time it takes Patrick to unload 1 pallet.

\[
\frac{60 \text{ mins}}{17 \text{ pallets}} = 3.53 \text{ mins/pallet}
\]

Then, multiply the number of pallets Lylah will unload and shelve by this unit rate.

\[
3.53 \times 25 = 88.24
\]

It will take her about 89 minutes to move 25 pallets.

3. a) One way to solve this is to find the unit price of both cans of soup.

\[
\text{\$18.89/12 cans = \$1.57/can}
\]

\[
\text{\$30.69/24 cans = \$1.28/can}
\]

Another way to solve this would be to notice that the price of Tastes Like Homemade can be doubled to get the price of 24 cans so the two brands can be compared.

\[
\text{\$18.89 \times 2 = \$37.78}
\]

Students may suggest other methods.

Savory Soup is the better deal.

b) \[
\frac{\$30.96}{12 \text{ cans}} = \frac{\$500.00}{x \text{ cans}}
\]

\[
12x (\frac{30.96}{12}) = \frac{500}{x}
\]

\[
\frac{30.96x = 6000}{12x = \frac{6000}{x}}
\]

\[
\frac{30.96x = 6000}{\frac{30.96}{30.96} = \frac{6000}{30.96}}
\]

\[
x = 193.80
\]

Because you cannot buy a portion of a can of soup, round up to get 194 cans.

4. a) The ratio of hours worked is 12:8, simplified to 3:2.

b) Stan's gross hourly rate of pay is \( \frac{\$110.20}{12} = \$9.18 \)

c) Cecelia's gross hourly rate of pay is \( \frac{\$90.40}{8} \text{ or } \frac{\$9.18}{12} \approx \$11.30 \).

d) The ratio of Stan's gross hourly rate of pay to Cecelia's gross hourly rate of pay is \( \frac{\$9.18}{\$11.30} \).

5. a) Regular model:

\[
\frac{12.4 \text{ L}}{100 \text{ km}} = 0.124 \text{ L/km}
\]

If the car uses 0.124 L/km and is driven 24000 km, multiply the L/km by 24000.

\[
24000 \times 0.124 = 2976 \text{ L}
\]
Hybrid model:
\[
\frac{10.8 \text{ L}}{100 \text{ km}} = 0.108 \text{ L/km}
\]
If the car uses 0.108 L/km and is driven 24 000 km, multiply L/km by 24 000.
\[
24 000 \times 0.108 = 2592 \text{ L}
\]
The regular model would use 2976 L of fuel, and the hybrid model would use 2592 L if you drove 24 000 km.

b) First find the difference in price between the two models.
\[
$25 840.00 - $24 456.00 = $1384.00
\]
Determine the cost of fuel for 1 km for each car.
Regular:
\[
0.124 \times $1.03 = $0.127 72
\]
Hybrid:
\[
0.108 \times $1.03 = $0.111 24
\]
Then consider the difference in fuel costs per km.
\[
$0.127 72 - $0.111 24 = $0.016 48
\]
If you save 6.596 cents per km, how many km do you need to drive to save $1384.00?
\[
\frac{\$0.065 96}{1} = \frac{\$1384.00}{x}
\]
\[
x \left( \frac{\$0.065 96}{1} \right) = \left( \frac{\$1384.00}{x} \right) x
\]
\[
0.065 96x = 1384.00
\]
\[
x = \frac{1384.00}{0.065 96}
\]
\[
x = 20 982.41 \text{ km}
\]
You would need to drive 20 982.41 km to save enough in fuel costs to pay the extra cost of the hybrid model.

c) Your reasons for buying the hybrid could include:
- you wish to save the environment
- you think the price of fuel will rise
- you think the hybrid will get a better resale price
<table>
<thead>
<tr>
<th>PARTY PLANNING CHECKLIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Where will the party be held?</td>
</tr>
<tr>
<td>☐ Is there a rental fee? If so, how much? Include this expense in your budget.</td>
</tr>
<tr>
<td>☐ What decorations will you choose?</td>
</tr>
<tr>
<td>☐ What will the invitations look like?</td>
</tr>
<tr>
<td>☐ What activities or entertainment will you plan for guests?</td>
</tr>
<tr>
<td>☐ What kind of music will you choose?</td>
</tr>
<tr>
<td>☐ What food and drinks will you need? How will you handle food allergies?</td>
</tr>
<tr>
<td>☐ What items such as plates, cutlery, and glasses do you need? How many will you need?</td>
</tr>
<tr>
<td>☐ Where might you purchase supplies?</td>
</tr>
<tr>
<td>☐ Other notes?</td>
</tr>
</tbody>
</table>
**PARTY SUPPLIES**

<table>
<thead>
<tr>
<th>Purchases</th>
<th>Name of store (if online, include the website address)</th>
<th>Unit cost</th>
<th>Number of items needed</th>
<th>Taxes (GST and PST)</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
To evaluate how well you did on your project, you will want to consider the following:
• the thoroughness of your research
• the accuracy of your calculations and budgeting
• the effectiveness of your use of technology for researching, organizing, and presenting
• the creativity you brought to planning and presenting
• your completion of all the assigned tasks on time

How do you feel you have done overall, given the criteria above? ____________________________

_________________________________________________________________________________

Were you able to complete all aspects of the project? If not, why? Did you allot your time effectively?
_________________________________________________________________________________

_________________________________________________________________________________

In what areas did you excel?
_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

Are there areas in which you could improve?
_________________________________________________________________________________

_________________________________________________________________________________

If you collaborated with a partner or a small group, what strengths did each person bring to the project?
_________________________________________________________________________________

_________________________________________________________________________________

If you had the project to do over again, what would you do differently?
_________________________________________________________________________________

_________________________________________________________________________________
MIXING THE CONCENTRATES TABLE

<table>
<thead>
<tr>
<th>Batches</th>
<th>Recipe #1</th>
<th>Recipe #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Orange concentrate (cups)</td>
<td>Water (cups)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GOALS: To use the concept of proportional reasoning to find unit prices, to build skills, and to synthesize learning in this chapter.

OUTCOME: In this project, students will integrate the concept of unit pricing into a real-world scenario in which they role-play the cook at a wilderness ecotourism lodge, planning a menu for a 3-day trip for a family of four. They will work within a set budget, using technology if appropriate, and practice and further develop their presentation skills.

PREREQUISITES: Students need to understand ratios and proportions and basic calculator functions. If students want to use a spreadsheet for the pricing calculations, then some prior spreadsheet experience would be an asset. They will also need to be familiar with presentation software if they choose to use it for their presentations. If they are familiar with any layout software they could use it to create a menu. Familiarity with internet research will also be helpful in this project. For this project, students will use retail prices for the supplies they need.

ABOUT THIS PROJECT: This project is divided into three parts. Initially, students will create an overall plan for the project using a checklist (Blackline Master 1.2a, p. 76), plan a menu, and identify areas that they need to research. Partway through the chapter, students will apply what they have learned about unit pricing and cost comparisons to decide on the purchases they will make and work out costs in several ways. As a final activity, they will develop a presentation for the manager of their wilderness lodge, including a planned menu for four people for three days, a table or spreadsheet listing all the food items needed for the trip, plus any picnic supplies and their respective costs. Students will give their presentation to the class. Allow 3–5 minutes per student.

Students should be given a few class periods to work on this project during the time spent on this chapter. This will allow for questions/feedback from the teacher as well as allowing the teacher to observe the quality of work as it is done, rather than at the end of the chapter. Interim guidance can help the students complete the culminating activity more successfully.

This project could be completed by pairs or small groups of students acting as co-workers at a wilderness lodge, or by individuals.

An assessment rubric for this project follows. Blackline Master 1.3a (p. 79), which should be handed out to students early in the project, outlines the criteria for evaluation of their project and suggests some ways in which they can reflect on their learning.

1. Start to plan

Introduce the project to your students as you begin this chapter. This initial part of the project allows for group brainstorming as a class. Students may not be familiar with wilderness lodges and ecotourism trips, so be prepared to share some background information with them (see Blackline Master 1.1a (p. 75) for a brief description that you can hand out to students, or do an internet search for an example in your province or territory). Many students will have gone on a picnic, a camping trip, or out on the land following their people’s traditional way of life, so allow them to connect with their own experiences as a starting point for this project.

Explain to students that they will role-play the cook at a wilderness lodge that offers ecotourism trips to families and individuals. In this case, they are to plan the food for a family of four (two adults and two teenagers) for a three-day trip. The family will spend nights at the lodge and will eat breakfast and dinner there. The visitors will spend their days out
on the land and will need a picnic lunch to carry
with them. Tell students that they are to develop
a healthy menu for the family members. A good
starting point for developing a nutritious menu plan
is the Canada Food Guide. This is available online
at www.hc-sc.gc.ca/fn-an/food-guide-aliment/
index-eng.php or may be available in your school
library. Students may need some assistance
navigating through the Canada Food Guide site
to find the information they need. Using the link
for Choose Foods is helpful. Students can click
through to a small chart that lists the number of
servings for each group for children, teens, and
adults by gender that will help them calculate
the number of servings. Students may choose
to include traditional foods on their menus. The
budget for the family’s meals (and any related
expenses) is $600.00.

Students may find Blackline Master 1.2a (p. 76),
which contains a checklist of items to complete in
each segment of the project, useful in organizing
their project. A graphic organizer, Blackline Master
1.3a (p. 77), is provided so students can record
their menu and ensure that each meal is included.

2. Research your ideas

This segment of the project requires the largest
amount of work on the part of students. Here, they
are practising both their research and their unit
costing skills. Students are expected to develop a
cost analysis that is within their budget, including
all the food supplies they would need to purchase,
and any other costs, such as those needed for
the picnic lunches (for example, garbage bags,
preferably biodegradable, for packing garbage off
the land, “green” cloth napkins, insulated re-
usable drink containers, and so on). All their work
should be recorded in a table or on a spreadsheet.
Blackline Master 1.4a (p. 78) will help students
record their research. Remind students that a
wilderness lodge would try to follow “green”
practices in their decision-making.

Suggest sources of information that students can
use for their research, for example, grocery store
flyers in their local newspaper, flyers that are
delivered to their homes, online sites for grocery
stores (most grocery stores chains and some
independent stores now have their own websites,
including weekly flyers with pricing information).

At the end of this segment of the project, discuss
progress with your students to ensure that all
requirements have been met.

3. Make a presentation

In this segment of the project, students will
synthesize their planning and research activities
and practise their presentation skills. Presentations
to a manager or company owner are often
done with handouts and other tools, including
presentation software, posters, or folders
containing several items (in this case, the menu,
the pricing research in a table or spreadsheet,
and the spreadsheets or tables reflecting the cost
analysis). Provide students with copies of Blackline
Master 1.5a (p. 79) to give them an opportunity to
reflect on their learning.

Extensions

1. Some wilderness lodges have a practice of
helping guests turn the results of their berry-
picking activities into sweet treats back at the
lodge. This practice can be used as the basis
of an extension activity in which students use
proportional reasoning to find how many pies
the cook can bake, given a certain quantity
of berries and the amount needed for a pie.
This activity could be adapted for muffins, a
crumble, or other baking that includes berries
as an ingredient.

SCENARIO: The family has spent the day
berry-picking. The father has picked a quart
of blueberries (if necessary, remind students
that a quart contains 4 cups). Each of the two
teenagers has only picked two cups. And the
mother has picked another quart. If it takes
4 cups of blueberries to make a pie, how
many pies will the cook at the lodge be able
to make?
SOLUTION

Students will reason that each of the mother, father, and the two teenagers together have picked the 4 cups needed for a pie. So the cook will be able to bake three blueberry pies. Students might also convert the quart to 4 cups, add all the cups together to find 12, and divide by 3.

2. If you would like to include an activity that requires students to apply their foreign exchange skills, you could develop a related activity in which the wilderness lodge advertises its services in two foreign countries, for example, the United States and England. Students could use a rate of $1000.00 CAD a day/person and convert this rate into US dollars and English pounds. They could then design an advertisement or poster using the converted price.

SOLUTION

Solutions will vary, according to the countries selected and the exchange rates on the day they are researched. Ensure that students use the correct rate. Travellers coming to Canada will be buying Canadian dollars in their local currency and will, therefore, be purchasing at the bank selling rate.
<table>
<thead>
<tr>
<th>Conceptual Understanding</th>
<th>Not Yet Adequate</th>
<th>Adequate</th>
<th>Proficient</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanations show</td>
<td>shows very limited understanding; explanations are omitted or inappropriate</td>
<td>shows partial understanding; explanations are often incomplete or somewhat confusing</td>
<td>shows understanding; explanations are appropriate</td>
<td>shows thorough understanding; explanations are effective and thorough</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedural Knowledge</th>
<th>Not Yet Adequate</th>
<th>Adequate</th>
<th>Proficient</th>
<th>Excellent</th>
</tr>
</thead>
</table>
| Limited accuracy; major errors or omissions | For example:  
- item costs are missing  
- unit costs are calculated incorrectly  
- total cost not within the budget  
- sources missing  
- presentation does not include a menu or cost analysis  
- project is incomplete | Partially accurate; some errors or omissions | For example:  
- items are listed but the unit costs are not calculated correctly  
- may have some needed items missing  
- total cost within budget using erroneous unit cost  
- sources included  
- presentation included a basic menu and cost analysis  
- project could use some more work to ensure calculations are done correctly | Generally accurate; few errors or omissions | For example:  
- items are listed and unit costs are calculated correctly  
- total cost within budget  
- sources are listed  
- presentation includes a detailed menu and thorough cost analysis  
- very few calculation errors  
- project is completed but there is nothing beyond what is listed as a minimum | Accurate and precise; very few or no errors | For example:  
- items listed and unit costs are calculated correctly  
- total cost within budget  
- sources are listed  
- presentation includes an appealing and detailed menu and a thorough cost analysis  
- no calculation errors  
- adds some extra creativity to the project |

<table>
<thead>
<tr>
<th>Problem-Solving Skills</th>
<th>Not Yet Adequate</th>
<th>Adequate</th>
<th>Proficient</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses appropriate strategies to solve problems successfully and explain the solutions</td>
<td>Uses few effective strategies; does not solve problems</td>
<td>Uses some appropriate strategies, with partial success, to solve problems; may have difficulty explaining the solutions</td>
<td>Uses appropriate strategies to successfully solve most problems and explain solutions</td>
<td>Uses effective and often innovative strategies to successfully solve problems and explain solutions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication</th>
<th>Not Yet Adequate</th>
<th>Adequate</th>
<th>Proficient</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presents work and explanations clearly, using appropriate mathematical terminology</td>
<td>Does not present work and explanations clearly; uses few appropriate mathematical terms</td>
<td>Presents work and explanations with some clarity, using some appropriate mathematical terms</td>
<td>Presents work and explanations clearly, using appropriate mathematical terms</td>
<td>Presents work and explanations precisely, using a range of appropriate mathematical terms</td>
</tr>
</tbody>
</table>
START TO PLAN

In this project, you will imagine that you are the cook at a wilderness lodge in the Northwest Territories that offers ecotourism trips to families. The lodge is located on a lake in the barrens. Your project is to plan the menu for a 3-day ecotourism trip for a family consisting of two adults and two teenagers. The family will eat breakfast and dinner in the lodge, but they will need a picnic lunch to take out on the land during the day. You may complete this project on your own or work with a small group to complete the menu plan.

Your budget for food and any other supplies you may need is $600.00 for the family for three days. Your goal is to plan a healthy menu for the family that you can prepare within this budget.

- First, consult the Canada Food Guide to research the daily serving requirements for different food groups. The Canada Food Guide can be found online at: www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php.

- Using the information you found in the Canada Food Guide, prepare a menu plan for three days for this family. For each day, the family members need:
  - breakfast at the lodge;
  - a packed lunch to take out on the land; and
  - dinner at the lodge.

  Remember that you need 4 servings for each family member.

- Next, list the items you will need to research. Are there any non-food items that will be needed for the picnic? Remember that ecotourists need to pack all their garbage out and prefer to use biodegradable or recyclable materials.

RESEARCH YOUR IDEAS

Now you will put your menu plan into action.

- Using local foodstore flyers, the newspaper, or online grocery store sites, research the cost of the food and other items on your menu. Remember to buy enough for 4 people. Make a table or spreadsheet to record your research. Include the item, the amount you need, the unit price, and the total price.

  - Is the amount within your budget? If not, you may have to revise your menu.

  - Once you have done your research, calculate the cost of each meal.

  - Then, work out the cost of the meals for each person.

- Once you’ve met your budget, create a printed menu. You can use graphic design or word processing software or calligraphy, if you know it.

MAKE A PRESENTATION

Your project file will contain the following information:

- the menu for each day of the ecotourism trip;
- a table or spreadsheet listing all the items you plan to buy, along with their unit price and their total cost; and
- calculations showing how much each meal costs (for 4 people) and how much each person’s meals over the three days will cost.
The model used for this project is a real wilderness lodge located on a lake in the barrenlands in the Northwest Territories, where visitors go to see great caribou herds, among other things. The practices of this lodge are similar to those found in many other areas.

Guests stay at the lodge and spend their time out on the land on a variety of activities, including:

- hiking
- mountain biking
- kayaking and canoeing
- fishing (catch and release)
- wildlife viewing
- nature photography
- berry-picking

In the evenings, there are several indoor activities. The cook at the lodge is happy to take the berries that visitors pick and transform them into sweet treats. Guests can learn from local people about the traditions and history of the First Nations and Inuvialuit peoples of the Northwest Territories. On dark nights, guests may be able to view the colourful curtains of light called the aurora borealis, which is Latin for northern lights.

**Protocols**

Guests at a wilderness lodge that specializes in ecotourism should follow safety protocols and show respect for the environment.

**Safety Protocols**

- respect what your guide tells you because he or she is familiar with the area
- don't go out on the land by yourself
- do not approach wildlife closely, particularly potentially dangerous larger animals
- let someone at the lodge know where you are going and when to expect you back again
- take a map and a GPS, if you have one

**Respect for the Environment**

- keep a distance from wildlife so as not to disturb them in their natural habitat
- pack out all garbage from daytrips
- try and use only biodegradable or recyclable items
- don't go out on the land by yourself
### FOOD PLANNING CHECKLIST

- [ ] Have you consulted the Canada Food Guide in order to plan a nutritious menu?
- [ ] Have you planned the menu for breakfast, a picnic lunch, and dinner for a family of 4 people?
- [ ] Have you researched food prices?
- [ ] Did you check your budget and adjust your menu as necessary?
- [ ] Did you create your menu using software or calligraphy?
- [ ] Have you created a table or spreadsheet listing all your purchases?
- [ ] Did you work out the total cost, the cost per meal, and the cost per person?
- [ ] Have you assembled the materials you need? (Your menu and your cost analysis.)
- [ ] Have you planned your presentation?
- [ ] Have you created any materials you wish to use to enhance your presentation, such as a poster or presentation software slide show?
A sample breakfast menu is suggested here to get you started.

**DAY 1**

- orange juice
- oatmeal with berries and milk
- yoghurt
- coffee

**DAY 2**

- [ ]
- [ ]
- [ ]

**DAY 3**

- [ ]
- [ ]
- [ ]
**FOOD PRICE RESEARCH**

Name: ___________________________  Date: ___________________________

### FOOD PRICE CHART

<table>
<thead>
<tr>
<th>Source of item</th>
<th>Item</th>
<th>Amount needed</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>grocery store flyer</td>
<td>chicken breast</td>
<td>2 lb.</td>
<td>$8.97/lb.</td>
<td>$17.94</td>
</tr>
</tbody>
</table>

**TOTAL**
STUDENT PROJECT SELF-ASSESSMENT

To evaluate how well you did on your project, you will want to consider the following:
• the thoroughness of your research
• the accuracy of your calculations and budgeting
• the effectiveness of your use of technology for organizing and presenting
• the creativity you brought to planning and presenting
• your completion of all the assigned tasks on time

How do you feel you have done, given the criteria above?


Were you able to complete all aspects of the project? If not, why? Did you allot your time effectively?


In what areas did you excel?


Are there areas in which you could improve?


If you collaborated with a partner or a small group, what strengths did each person bring to the project?


If you had the project to do over again, what would you do differently?

