Chapter 1

Unit Pricing and Currency Exchange

GOALS

Both in the workplace and in your daily life, you will need to make decisions about what to buy and how to pay the best price for what you need. In this chapter, you will use some familiar mathematics concepts—including fractions, percent, rate, and ratio—in a new context. You will apply these mathematical ideas to

- learn how to determine which purchase is the best buy, considering quality and quantity as well as unit price;

- investigate sales promotions and compare their effects; and

- convert Canadian dollars into a foreign currency and foreign currencies into Canadian dollars.

KEY TERMS

- buying rate
- exchange rate
- markup
- promotion
- proportion

- rate
- ratio
- selling rate
- unit price
- unit rate

START TO PLAN

PROJECT OVERVIEW

Have you ever planned a party? In this chapter, your project will be to plan a wind-up party for the end of the school year for a team, club, or committee at your school.

You will plan the party for 15 guests plus yourself. It will be held on a Saturday evening between 6:00 pm and 11:00 pm.

Each guest will contribute $15.00, and your club, team, or committee will contribute $10.00 per member as well. The total budget for the party will therefore be $400.00. This amount must cover all the expenses of the party.

Students from a North Vancouver high school golf team are practising at a driving range.

GET STARTED

To begin your project, start planning your party. First, make a list of all the things you will need to consider and buy. Keep these questions in mind:

- Where will the party be held?
- What decorations will you choose?
- What activities or entertainment will you plan for the guests?
- What kind of music will you choose?
- What food and drinks will you need?
- Where will you purchase supplies?

FINAL PRESENTATION CHECKLIST

You will make a final presentation to your fellow team, club, or committee members when you have completed this project. Your presentation will include these items:

- a description of the party, its location, and any decorations you plan to use;
- a sample invitation;
- a list of activities and entertainment for the guests;
- a table or spreadsheet itemizing the expenses, suppliers, and the total cost and unit cost of each item; and
- a calculation of the cost per guest and the total cost of the party.

MATH *ON THE JOB*

Sandra Tuccaro is an Inuvialuit nurse originally from Hay River, Northwest Territories. She now works in the Home Care department of Yellowknife Health and Social Services Authority. She has a diploma in nursing and her job encompasses many tasks. As a home care nurse, Sandra provides short- and long-term care to people in their homes. She helps patients with nursing and rehabilitation needs and assists with their nutrition and daily living.

Sandra has to administer 300 mg of a drug that comes in a vial that has 120 mg of the drug dissolved in 2 mL of fluid. How many mL of fluid will she need to give her patient? How can Sandra use proportional reasoning to solve this problem?
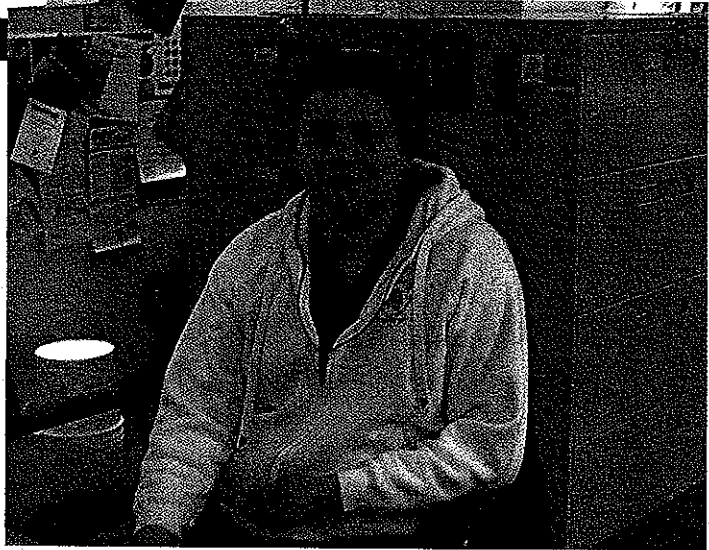
Sandra is shown here in her Yellowknife office.

PRACTISE YOUR PRIOR SKILLS
RATIO

ratio: a comparison between two numbers with the same units

proportion: a fractional statement of equality between two ratios or rates

In this chapter, you will learn to apply your knowledge of **ratios** in new areas.

Remember that a ratio compares two numbers that are measured in the same units. A ratio can be written in several ways. For example, the ratio 20 to 50 can be written as 20:50 or as $\frac{20}{50}$. The notation $\frac{20}{50}$ is often the most useful notation because your knowledge of fractions can be used in calculations.

When working with ratios, simplify them first. For example, the ratio 20:50 can be simplified by dividing each term by 10. To solve calculations using this ratio, you can use 2:5 instead of 20:50.

The two ratios 20:50 and 2:5 are equivalent statements and the fractional equation $\frac{20}{50} = \frac{2}{5}$ is referred to as a **proportion**.

Ratios are often expressed in real-life situations as proportions. For example, you may need to mix a certain shade of paint. The proportion needed is 3 parts blue to 1 part green, or 3:1. You can use this ratio to mix the amount of paint you need in the correct proportions. Mixing 3 parts and 1 part means there are 4 parts in all.

In a ratio, since the units are the same, they essentially cancel each other out. In your calculations, you can omit the units but remember to include them in your solution.

DISCUSS THE IDEAS
ADAPTING A RECIPE

You have invited five friends over to your house and decide to serve them homemade fudge brownies. You found a great recipe that makes 20 large brownies, but you only need 12, two per person. How would you change the recipe to make only 12 brownies and have them taste exactly the same as they do when made from the original recipe?

Example 1

Engines that require you to mix oil with fuel to provide lubrication are called 2-stroke engines. A faller at a logging site needs to refill a chainsaw's fuel can. The ratio of gasoline to oil that is needed is 40 parts of gasoline to 1 part of oil. The chainsaw's fuel can holds 8 litres of gasoline. How much oil should be added to the gasoline to obtain the correct ratio?

SOLUTION METHOD 1

The ratio of litres of gasoline to oil can be written as $\frac{40}{1}$.

Let x represent the amount of oil needed.

The problem can be expressed as a proportion.

$$\frac{40}{1} = \frac{8}{x}$$

The proportion forms an equation involving fractions. To solve this equation, one strategy is to simplify the equation by eliminating the denominators. This can be done by multiplying both sides of the equation by the common denominator.

$$\frac{40}{1}(x) = \frac{8}{x}(x)$$

Multiply both sides of the equation by the common denominator.

The common denominator for $\frac{40}{1}$ and $\frac{8}{x}$ is x.

$$\frac{40(x)}{1} = \frac{8(x)}{x}$$
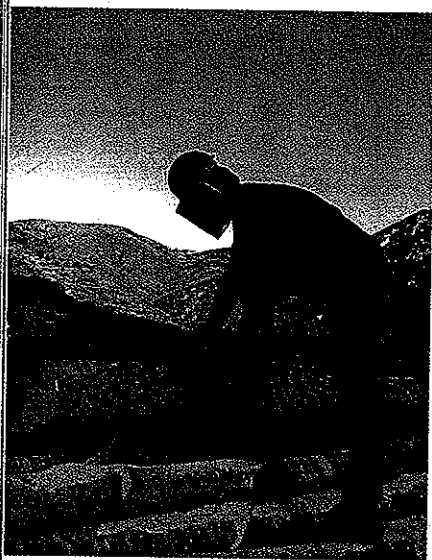
$40x = 8$

The ratio $\frac{8(x)}{x}$ can be simplified to 8 since $\frac{x}{x} = 1$.

$$\frac{40x}{40} = \frac{8}{40}$$

To isolate the variable, divide by its coefficient. Since the coefficient of x is 40, divide both sides of the equation by 40.

$$x = \frac{8}{40}$$

The ratio $\frac{40x}{40}$ equals x since $\frac{40}{40} = 1$.

The answer can be simplified to $\frac{1}{5}$ by dividing both the numerator and the denominator by 8.

The answer could be expressed as a decimal by dividing 8 by 40 to obtain 0.2.

The faller needs to add 0.2 litres of oil to the fuel can.

SOLUTION METHOD 2

$$\frac{40}{1} = \frac{8}{x}$$

The faller reasons that the numerator, 40, has been divided by 5 to equal 8. To keep the fractions equivalent, he must also divide the denominator, 1, by 5 to equal x.

The faller needs to add $\frac{1}{5}$ of a litre of oil to the fuel can.

Example 2

Jean-Luc, a builder, has found that he can arrange the work cubicles of his employees best if the ratio between the length and the width of a room is 3:2. If a room is 6 m long, how wide should the room be?

SOLUTION

The ratio of length to width in metres is $\frac{3}{2}$.

Let w represent the width of the room.

The two ratios can be expressed as the following proportion.

$$\frac{3}{2} = \frac{6}{w}$$

This proportion forms an equation involving fractions. To solve this equation, one strategy is to simplify the equation by eliminating the denominators. This can be done by multiplying both sides of the equation by the common denominator.

$$2w\left(\frac{3}{2}\right) = \left(\frac{6}{w}\right)2w$$

Multiply both sides of the equation by the common denominator. The common denominator for $\frac{3}{2}$ and $\frac{6}{w}$ is $2w$.

$$\frac{6w}{2} = \frac{12w}{w}$$

Simplify both sides of the equation.

$$3w = 12$$

$$\frac{3w}{3} = \frac{12}{3}$$

To isolate the variable, divide by its coefficient. Since the coefficient of w is 3, divide both sides of the equation by 3.
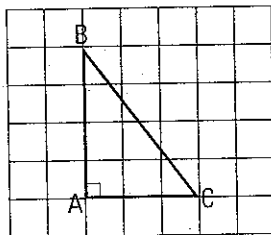
$$w = 4$$

The width of the room should be 4 metres.

ALTERNATIVE SOLUTION

The builder might also reason that since the numerator, 6, is twice 3, that w will be twice 2, or 4 metres.

ACTIVITY 1.1
VISUALIZE A PROPORTION

A right triangle is created by joining the ends of two line segments drawn at 90° to each other, as shown below.

1. Copy the triangle below onto a sheet of 0.5 cm graph paper.

2. For each item, draw the new figure and determine whether the new figure is proportional to the original figure or whether it is distorted.

   a) Double the length of line segments AB and AC.

   b) Add three squares on the graph to the length of each of these segments.

   c) Subtract 2 squares from the length of each of these segments.

   d) Divide the length of each of these segments by 2.

3. What conclusions can you draw from your results?

ACTIVITY 1.2
FRUIT DRINK TASTE TESTER

You are part of a taste tester team for a healthy lifestyle company. Your team is developing some new drinks to put on the market. The company has produced orange concentrate that is packaged in 1-cup portions. Buyers will mix the concentrate with water, and the best proportions of concentrate to water need to be identified.

The company is considering two different recipes. It is your team's job to compare the recipes and produce a taste tester report.

Recipe #1
3 cups of concentrate
7 cups of water

Recipe #2
2 cups of concentrate
5 cups of water

Complete a table like the one below for the company. A batch is one recipe.

MIXING THE CONCENTRATES

Batches	Recipe #1		Recipe #2	
	Orange concentrate (cups)	Water (cups)	Orange concentrate (cups)	Water (cups)
1				
2				
3				
5				
10				

SAMPLE

1. Using the patterns in the table above, how many cups of orange concentrate would be needed to make 100 batches of the orange drink following Recipe #1?

2. Using the raw data in the table, can you tell which of the two recipes has a stronger taste of orange? Explain mathematically how you know.

3. Suppose you had only 1 cup of concentrate. How many cups of water would you need to make Recipe #2? Set up a proportion and solve this question.

4. You only want to make 8 cups of Recipe #1. How many cups of concentrate and how many cups of water will you need? Explain your solution.

5. You have been given a recipe for a completely new fruit drink. The recipe has 3 ingredients as listed below:

> ### Fruit Drink Recipe
> 2 cups pineapple juice
> 3 cups cranberry juice
> 5 cups lemon juice

You need to make 4 cups of juice for the taste test. How much of each ingredient will you need? Explain your solution.

PRACTISE YOUR PRIOR SKILLS

RATE

This carpenter is taking a measurement.

A **rate** is similar to a ratio, but it compares two numbers with different units. Here are some examples of rates:

rate: a comparison between two numbers with different units

- the number of words you can type per minute
- the number of hamburgers a concession stand sells each day
- the price of lumber per linear foot
- the price of stone per kilogram

A rate can be expressed using the same notation as a ratio. Because the units are different in the two terms, they must be used. For example, if you see salmon for sale at $1.89 for 100 grams, you can write the rate in these ways:

$1.89:100 g

$1.89/100 g

$$\frac{\$1.89}{100\ g}$$

A proportion is an equivalent statement between two ratios. You can also think of a proportion as an equivalent statement between two rates.

DISCUSS THE IDEAS

CINDY KLASSEN, SPEED SKATER

Cindy Klassen

At the 2006 Olympic Winter Games in Torino, Cindy Klassen of Winnipeg became the first Canadian athlete to win five medals at a single Winter Olympics. She won gold in the 1500 m speed skating event, silver in the 1000 m, silver in the Team Pursuit, bronze in the 5000 m, and bronze in the 3000 m. Combined with her bronze medal at the 2002 Winter Games, Cindy became the first Canadian to win six Olympic medals.

Cindy finished the 1500 m race in 1:55.27 (115.27 seconds). How would you calculate Cindy's average speed?

Example 1

If salmon costs $1.89 for 100 g, how much will it cost to buy 250 g of salmon?

SOLUTION

Let c represent the cost of 250 g of salmon.

The problem can be expressed as a proportion.

$$\frac{1.89}{100} = \frac{c}{250}$$

The proportion forms an equation involving fractions. To solve this equation, one strategy is to simplify the equation by eliminating the denominators. This can be done by multiplying both sides of the equation by the common denominator.

$$\frac{1.89}{100}(25\,000) = \frac{c}{250}(25\,000)$$ Multiply both sides of the equation by the common denominator. A common denominator for 100 and 250 is 25 000.

$$\frac{(1.89)(25\,000)}{100} = \frac{25\,000c}{250}$$ Simplify both sides of the equation.

$$472.5 = 100c$$ The coefficient of the variable is 100 because 25 000 divided by 250 equals 100.

$$\frac{472.5}{100} = \frac{100c}{100}$$ To isolate the variable, divide by its coefficient. Since the coefficient of c is 100, divide both sides of the equation by 100.

$$4.725 = c$$ Since c represents a value in dollars, it must be rounded off to 2 decimal places.

It will cost $4.73 to buy 250 g of salmon.

ALTERNATIVE SOLUTION 1

Since 250 g is 2.5 times 100 g, the cost of 250 g of salmon would be 2.5 times the cost of 100 grams of salmon.

$$(1.89)(2.5) = 4.725$$ Round the answer to 2 decimal places since it is the cost in dollars.

It will cost $4.73 to buy 250 g of salmon.

ALTERNATIVE SOLUTION 2

Cost of 250 g of salmon.

| 100 g | + | 100 g | + | 50 g | = | 250 g |

| $1.89 | + | $1.89 | + | $\frac{\$1.89}{2}$ | = | $4.73 |

It will cost $4.73 for 250 g of salmon.

HINTS

1. Make sure you are comparing the same unit or units when you set up a proportion.

2. To find a common denominator, you can multiply the given denominators. In the example, 25 000 is obtained by multiplying 100 and 250.

- Are there other common denominators that could have been used?

- How would the choice of 500 as a common denominator affect your calculations?

- The lowest common denominator is the smallest number that all given denominators will divide into evenly.

Example 2

A local plumbing store sells 100 copper-plated pipe straps for $4.97. You have estimated that you require 75 straps. How much will you pay for 75 straps?

SOLUTION

$$\frac{4.97}{100} = \frac{x}{75}$$

Let x represent the cost of 75 straps and create a proportion. The proportion forms an equation involving fractions. To solve this equation, one strategy is to simplify the equation by eliminating the denominators. This can be done by multiplying both sides of the equation by the common denominator.

$$\frac{4.97}{100}(7500) = \frac{x}{75}(7500)$$

Multiply both sides of the equation by a common denominator. One common denominator for 100 and 75 is 7500.

$$\frac{(4.97)(7500)}{100} = \frac{7500x}{75}$$

$$372.75 = 100x$$

The coefficient of the variable is 100, because 7500 divided by 75 equals 100.

$$\frac{372.75}{100} = \frac{100x}{100}$$

To isolate the variable, divide by its coefficient. Since the coefficient of x is 100, divide both sides of the equation by 100.

$$3.7275 = x$$

Since x represents a value in dollars, it must be rounded to 2 decimal places.

It will cost $3.73 to buy 75 pipe straps.

ALTERNATIVE SOLUTION

Since 75 is $\frac{3}{4}$ of 100, you can find the cost of 75 straps by multiplying the cost of 100 straps by $\frac{3}{4}$.

$$(4.97)\left(\frac{3}{4}\right) = 3.73$$

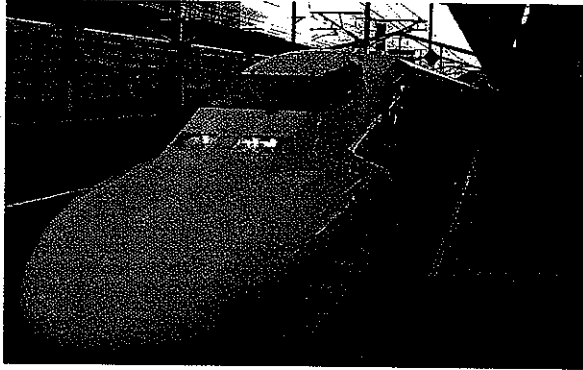It will cost $3.73 to buy 75 pipe straps.

Mental Math and Estimation

The pipe straps in the example above each cost $0.0497. About how much will 50 pipe straps cost?

PRACTISE YOUR NEW SKILLS

1. A computer repair technician fixes 8 printers for every 2 computers she repairs. What is the simplest form of this ratio? What are two ways you can write this ratio?

2. If a secretary types 55 words per minute, how long will it take her or him to type a 2000-word director's report?

3. An apprentice mechanic rotates the 4 tires on a pick-up truck in 15 minutes. How long would it take him to rotate the tires on 5 trucks? How long does rotating 2 tires take?

4. An Edmonton car salesperson sells 4 cars on Thursday, 6 on Friday, and an equal number each on Saturday and Sunday, for a total of 36 cars sold over the four days. How many cars were sold each day on Saturday and Sunday? What proportion of the total sales took place on Saturday?

This vehicle is a hybrid that is powered by either gasoline or electricity.

5. The ratio between Siu's height and the height of her brother Tai is 5:6. If Tai is 145 cm tall, how tall is Siu, to the nearest centimetre?

6. If the Sound Source music store makes a profit of $2550.00 on the sale of 200 DVDs, how much profit would the store make on the sale of 50? On the sale of 900?

7. If a 5-kg jar of olives costs a restaurant $15.00 through a wholesaler, how many kilograms would it get for $75.00? How much would it cost the restaurant to buy 20 kilograms?

8. A carpenter wants to mix a shade of stain for a set of kitchen cabinets he is building. The ratio for the shade he wants is 3 parts of Spanish oak to 4 parts of red mahogany. If he needs 12 litres in all, how many litres of each stain does he need?

The high speed Japanese Bullet Trains run on a network that joins the major cities on the island of Honshu.

Extend your thinking

9. Keiko says that the Japanese Bullet Train (Shinkansen) takes about 6 minutes to travel 30 km. Yuki says that at this rate, he could travel around the world at the equator in less than 8 days. Keiko disagrees; she thinks it will take longer. Who is correct? Justify your response. The circumference of the earth at the equator is approximately 40 074 km.
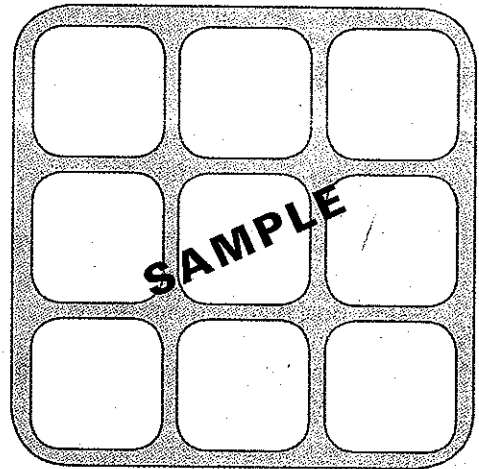
PUZZLE IT OUT

MAGIC PROPORTIONS

In this puzzle, the object is to fill a 3×3 square with the nine numbers from 0 through 8 (using each of them exactly once) in such a way that the numbers in the first, second, and third rows will add up to three numbers in the proportion 1:2:3. Simultaneously, the same proportion has to be achieved for the first, second, and third columns.

One possible solution is shown here.

1	0	5
2	4	6
3	8	7

Can you find other solutions? What strategy did you use?

Linda Fogarty is self-employed as an organic farmer and greenhouse grower. She completed a horticulture technology diploma at Kwantlen Polytechnic University in Langley, BC.

Linda operates The Green Room, a 3.5-hectare farm in Upper Gibsons, BC. She grows tomatoes, peppers, cucumbers, carrots, and many other crops throughout the year. She uses math on the job in many ways: to calculate plant density, to determine production statistics, to calculate sales revenue and expenses, and to handle sales transactions.

Linda wants to buy a species of heritage tomato seedlings from a wholesaler. Company A sells 20 plants for $45.95. Company B sells 24 plants for $48.50. What is the unit price at each wholesaler? What is the unit price difference between the two companies? What factors apart from price might Linda want to consider?

Linda sells her produce at a seasonal farm stand and at farmers' markets.

EXPLORE THE MATH

Products are packaged and sold in various sizes, such as a 1-litre, 2-litre, or 4-litre jug of milk. How do you determine the least expensive choice? Different brands may package their products in different sizes of packages. Brand A may sell a 250 g package of meat, while Brand B may sell a 375 g package. Which is the better buy? Finding the **unit price** will allow you to compare prices, and help you determine the best buy.

Consumer goods, such as pens or rolls of toilet paper, are often bundled together and sold in bulk. To compare the price when the quantity in the package is not the same, it is often useful to look at the unit cost of one item. If you have a business, you may buy items in a bulk purchase that you later want to charge to your customers one item at a time. To do this, you also need to calculate the cost of one item.

A unit price is the cost of one unit. It is sometimes referred to as a **unit rate**. To calculate a unit price, you can use a proportion where the second rate has a denominator of 1. For example, if you buy a package of 4 rolls of Eco-Friendly toilet paper for $2.68, you can calculate the cost of 1 roll by using this proportion:

$$\frac{\$2.68}{4 \text{ rolls}} = \frac{x}{1 \text{ roll}}$$

unit price: the cost of one unit; a rate expressed as a fraction in which the denominator is 1

unit rate: the rate or cost for one item or unit

HINT

To determine the product or brand that is the best value, or the size of purchase that is the best value, shoppers often compare the unit cost of different brands of the same product or different sizes of the same product.

The 1 in the denominator of the second rate is obtained by dividing the denominator of the first rate by 4. Therefore, to find x, you will also divide the numerator by 4.

$2.68 \div 4 = \$0.67$

One roll of toilet paper costs $0.67 or 67¢. Thus, cost per unit or unit price can be determined by dividing the price of a product by the number of units contained in a purchase.

Comparing unit prices can save you money at home and in the workplace. Unit price is not the only factor to consider, however. You may prefer the quality of one product over another. You may also find that there are more items in a large package than you can use. In this case, it may be a better choice to spend more on a per unit basis, and buy only what you need.

Example 1

Rosa buys supplies for the hamlet office in Arviat, Nunavut where she works as a clerk. She wants to buy pens. The supplier sells a box of 12 pens for $6.25. Calculate the unit price of 1 pen.

SOLUTION

In this case, the unit is 1 pen. The cost for 12 pens is $6.25. What is the cost of 1 pen?

$6.25 \div 12$ pens = $0.52/pen, rounded to the nearest cent

Note that $0.52 can also be written as 52¢.

Example 2

Claire picks fresh strawberries at a U-pick farm in Portage la Prairie, Manitoba. If she fills a pint basket (0.5506 litres), it will cost her $1.50. If she fills a 4-litre ice cream pail, it will cost $9.00. Which size of container will give her a better buy?

SOLUTION

Make sure you compare the same units. The pint basket can also be measured as 0.5506 litres.

Find the price per litre if Claire uses the pint basket by dividing the price by the volume.

$1.50 \div 0.5506$ L = $2.724/L or $2.72, rounded to the nearest cent.

It can save you money to pick your own fruit.

Then find the price per litre if she uses the ice cream pail.

$9.00 ÷ 4 L = $2.25/L

Since the unit price if Claire fills the ice cream pail is lower, it is a better buy. However, Claire will also need to consider whether she can use 4 litres of strawberries.

ACTIVITY 1.3
WHICH PRICE IS RIGHT?

You and a partner own a janitorial service. Your janitorial service buys cleaning products for the office buildings that you clean. Before making your purchases, you research prices from local stores or online stores to calculate and compare the unit price of each item. You could record your research on tables similar to the following samples.

Shopping List

Light bulbs
Paper towels
Garbage bags
Cleaning sponges
Paper hand towels
Tissues
Toilet paper
Cleaning cloths
Rubber gloves
Other?

Part A

You may need to compare the unit price charged by different companies for the same size of package. For each item shown in the table, calculate the cost per unit and record it in your notebook.

COMPARING DIFFERENT BRANDS—SAME SIZE

Item	Items per pkg.	Brand A	Unit price	Brand B	Unit price
Light bulbs	4	$2.29		$2.99	
Paper towels	6	$6.49		$9.29	
Garbage bags	20	$8.79		$7.48	
Sponges	5	$7.95		$7.69	

Part B

Sometimes you may need to compare the unit cost of different sizes of packages. For each item shown in the table, compare the cost per unit of two different package sizes. Record in your notebook which size has the lower cost per unit.

COMPARING DIFFERENT SIZES—SAME BRAND

Item	Smaller size	Price	Unit price	Larger size	Price	Unit price
Light bulbs	3	$2.49		6	$4.49	
Paper towels	3	$3.69			$6.49	
Garbage bags	20	$8.79		30	$9.99	
Sponges	5	$7.95		8	$11.99	

SAMPLE

Discuss the following questions with your partner.

1. For each item, which brand and which size of package is the best buy for your janitorial business? Why?

2. Why might a package of 20 garbage bags have a lower cost per unit than a package of 30 in the same brand? Which is the better buy?

3. Why might a person choose to buy the product that does not have the lowest unit price?

BUILD YOUR SKILLS

This horticulture technician mows the lawn prior to fertilizing it.

1. Vikram purchases 12 sinks for his plumbing business at a wholesale price of $1053.00. He wants to sell each sink to a different customer. What is the unit price of one sink?

2. A horticulture technician buys lawn fertilizer for several customers. She finds the following prices: 7 kg for $19.99; 14 kg for $35.95; 21 kg for $50.99. Which package has the lowest unit cost?

3. A locksmith in Winkler, Manitoba is buying locks for a new apartment building. One supplier sells locks at $120.00 for four. Another supplier sells six for $192.00. Which supplier has the lower cost for one lock? What other factors might you consider when selecting a lock?

4. Joel is a salesperson in a department store that sells T-shirts individually and in packages of two or three. One T-shirt sells for $9.98, a package of two sells for $15.49, and a package of three sells for $22.99.

   a) Find the unit price when T-shirts are sold in a package of two. How much is the unit price in a package of three?

   b) Suppose a customer wants to buy seven T-shirts. Which combination of packages will be the least expensive?

5. The meat department at a large supermarket sells boneless steaks at the following prices: $7.50 for 500 g; $12.50 for 1 kg; and $19.50 for 1.5 kg. Which of these packages has the lowest unit price? If a customer needs 2.5 kg, which combination of packages should he or she buy to get the best price but not have leftover meat?

6. A different store sells boneless steaks for the following prices: $4.25 for 250 g; $7.95 for 500 g; and $29.50 for 2 kg. Which of these packages has the lowest unit price? How do these prices compare to those in question 5?

Extend your thinking

7. A uranium mining company in northern Saskatchewan is buying industrial first-aid kits in bulk. First-aid kits are available in three sizes. A small kit costs $42.50 and contains enough supplies to meet the needs of 1–9 workers. A medium-sized kit costs $58.25 and will serve 10–40 workers. A large kit costs $70.50 and will serve 41–75 workers. Jason, the buyer, needs to buy kits for 250 workers. Which combination of kits will be the least expensive? What will the total cost be before taxes?

MATH ON THE JOB

Maurice is a cost estimator for a construction company in Gravelbourg, Saskatchewan. He develops the cost information that the company manager needs to make bids for contracts. First he gathers information about the site and the project; then he prepares a cost summary for the entire project. He includes the costs associated with labour, equipment, architectural plans, materials, and subcontractors as well as the overhead, taxes, insurance, and a markup, as well as any other costs that may affect the project. He presents the final cost in various ways, for example, the cost per square foot or the cost per labour hour.

Maurice is estimating the cost of stuccoing a home. After calculating that the exterior walls are 3600 square feet, he determines the cost of the wire, paper, concrete, and labour. His total cost for the job is $30 600.00. What is the cost per square foot for stuccoing?
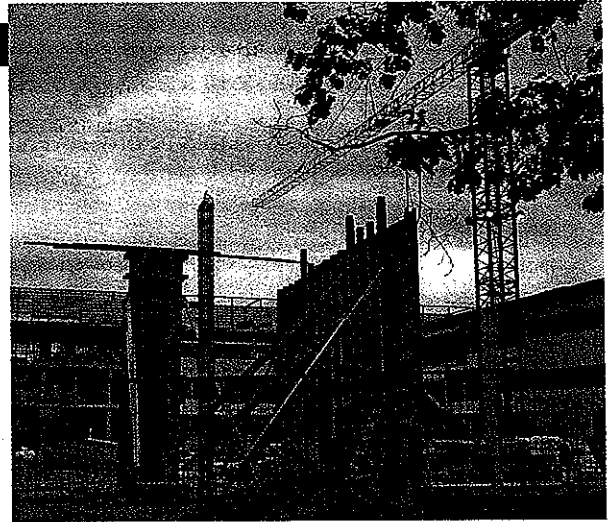
Estimating the costs of construction requires research into the prices of many materials.

EXPLORE THE MATH

markup: the difference between the amount a dealer sells a product for and the amount he or she paid for it

percent: percent means "out of 100"; a percentage is a ratio in which the denominator is 100

The price at which goods and services are sold has an impact on you whether you are a consumer or working in a business.

Prices rise and fall due to consumer demand and supply. If demand rises, suppliers are able to charge more. If demand falls, or if there is a large supply of a product, prices may fall.

Prices also rise and fall according to the cost of the materials and labour that go into the creation of a product or service. An additional amount, called **markup**, is added to these costs so that a profit can be made. For example, when the owner of a retail store buys items to re-sell, he or she buys them at a wholesale price. This price is then marked up and the item is sold at a higher retail price. The markup is usually a **percent** of the wholesale price.

When setting the prices for goods and services, companies consider psychological factors that have an impact on buyers as well as the cost of their products. Have you ever wondered why something costs $39.95 instead of $40.00? If you sell something in your store for $39.95 rather than $40.00, the difference in price, though small, can have a big impact on sales because the item seems less expensive. If you are a butcher, you may advertise a price of $2.39/100 g of meat, because that seems less expensive to consumers than $23.90/kg, even though these prices are equivalent.

Remember that in many cases taxes are added to arrive at the total price. Taxes are calculated as a percentage of the price paid. All Canadians pay the federal Goods and Services Tax (GST), which was 5% at the time of publication (2010). Most of the provinces also charge Provincial Sales Tax (PST), shown in the table below. The northern territories do not charge a Territorial Sales Tax. Copy this table into your notebook to use when solving problems that include taxes. What are the rates today?

FIGURE 1.1
Provincial Sales Tax Rates

	PST
Alberta	0%
British Columbia	7%
Manitoba	7%
Saskatchewan	5%

DISCUSS THE IDEAS
CONCERT PROMOTER
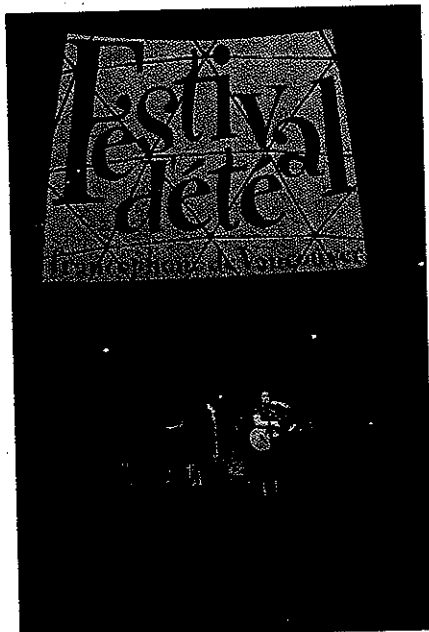
This francophone concert is an annual event.

Imagine that you are a concert promoter. You are responsible for promoting concerts for up-and-coming bands and selling tickets to these concerts. For your next concert, you have set a ticket price based on the amount it will cost you to put on the concert, plus a 30% profit.

Consider the following situations.

1. If ticket sales are high and you realize you are going to sell out quickly, what could you do?

2. If ticket sales are low and you realize you will not be able to sell them all, what could you do?

3. Under what circumstances might you consider selling tickets for a price that would not cover the cost of the concert?

Example 1

Arlene purchases fabric at a wholesale price for her custom sewing business in Dawson City, YT. She pays $46.00/m. She charges a markup of 20% on the fabric. What will Arlene charge her clients per metre?

SOLUTION

When working with percents, it is often simplest to use them in their decimal form. To calculate a 20% markup, convert 20% to 0.2 and multiply.

$46.00/m × 0.2 = $9.20

Add the markup amount to the price.

$46.00/m + $9.20 = $55.20/m

The price Arlene will charge her clients will be $55.20/m.

ALTERNATIVE SOLUTION

You could also find the marked-up price by multiplying $46.00/m by 1.20. You may notice that the new price, $55.20/m, includes both 100% of the original price and the 20% markup, or 120%. To calculate the price, convert the percentage to a decimal, 1.20, and multiply to find the marked-up price.

Example 2

A furniture store in Saskatoon is selling a bedroom suite. The list price for the suite is $1599.00. What will the total cost be, including GST and PST?

SOLUTION

To arrive at the total cost, consider both GST and PST, and use percents to calculate them.

PST in Saskatchewan is 5%.

$1599.00 × 0.05 = $79.95

GST is also 5%.

$1599.00 × 0.05 = $79.95

Find the total cost.

$1599.00 + $79.95 + $79.95 = $1758.90

Another way to calculate the total cost is to add the two taxes together to get 10% and add this to 100% of the price before taxes. Convert this percentage to a decimal and multiply to find the total cost including taxes.

$1599.00 \times 1.10 = 1758.90

Although there are several ways to calculate the final price, a store needs to keep track of the PST and GST amounts.

DISCUSS THE IDEAS

SEASONS AND HOLIDAYS

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?

In many cultures, flowers are a common gift for special occasions.

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.
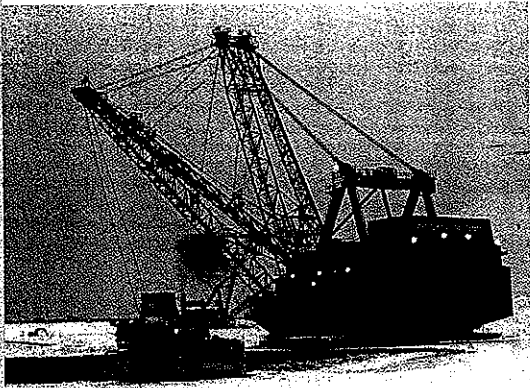
Mental Math and Estimation

If you set the price of a bike helmet at $49.95 and sell 25, how much less income will your store generate than if you sold the same number at $54.95?

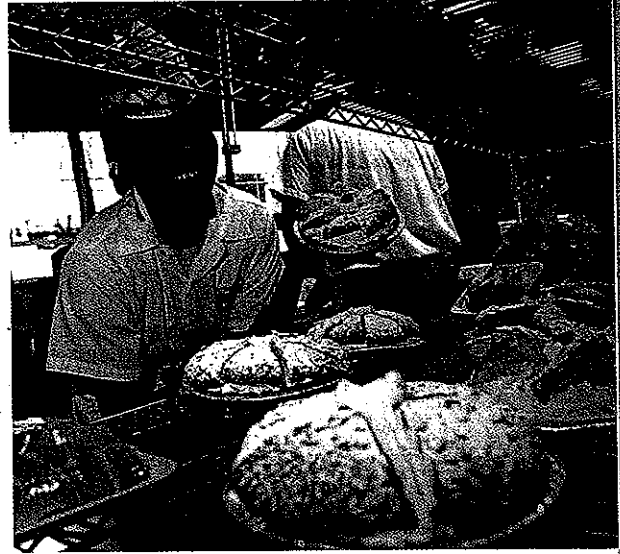1. Max owns a clothing store. He buys an order of shirts for $22.75 per shirt. In order to make a profit, he wants to mark them up 60%. What will the list price of the shirts be for customers?

2. An outfitter in Fort McMurray, Alberta sells full-brim aluminum hard hats for $49.95 and steel-toed work boots for $129.95. If you purchase a hard hat and two pairs of boots, what will your total cost be, including tax? How much GST will you pay on these three items?

3. If the outfitter in question 2 opens a store in Axe Lake, Saskatchewan where exploration for oil is taking place, it may sell hard hats and work boots for 10% more than it charges in Fort McMurray. What would you pay for a hard hat and a pair of steel-toed boots in Saskatchewan, taking into account that PST of 5% applies?

This dragline is located in the Alberta oil sands.

4. Roberta works for a retail hardware store in Dauphin, Manitoba. She buys 3 sinks for $89.95 each, 2 bathtubs at $639.95 each, and 2 faucets for $74.95 each. She sells one sink, one bathtub, and 2 faucets to a customer at a 25% markup. How much does she charge her customer?

5. Parminder runs an organic blueberry farm in the Fraser Valley, BC. She sells her crop in three ways: direct to customers who come to the farm, at $3.50 a quart; at the local farmers' market at $3.99 a quart; and wholesale to organic food stores for $2.00 a quart.

    a) If she sells 50 quarts at $3.50, 175 quarts at $3.99, and 250 quarts at $2.00, what is her total income?

    b) Compare her income from 100 quarts sold directly at the farm to 100 quarts sold to a wholesaler. What is the difference in income? Why would she sell to a wholesaler?

6. When Julie completed the baker apprenticeship program and started her own cake business, her first order was to provide cakes for 100 people at a business luncheon. After calculating the cost of all her supplies and ingredients, her time, and the cost of gas for delivering the cakes, she found that her price of $2.50 per portion did not cover her costs.

   a) If she increased her price by 15%, what would the new unit price be?

   b) How much more would she make on 100 servings at the higher price?

   c) If she thought customers would reject a 15% price increase, how might she lower her costs?

This woman is an apprentice in a baking program.

7. At the end of the summer season, Marie has a lot of unsold $29.99 tank tops left in her Grande Prairie shop. She decides to put the remaining tank tops on sale. What might the sale price be? How will this sale affect her total profits? What reasons might Marie have for doing this?

Extend your thinking

8. You plan to sell imported cheese in your butcher shop and need to set a price. If the wholesale price you pay for a 10 kg wheel of medium Dutch Gouda is $175.00, what is the price for 250 grams if you sell it at cost?

   a) What factors will you consider in setting the retail price?

   b) If you decide on a markup of 40%, what would 250 g of cheese cost?

   c) If you found that your supply of Gouda exceeded the demand for it, you might decide to offer a 15% discount off the regular price. What would a customer now pay for 250 g?

   d) At the discounted price (15% off), would you still be making a profit? Explain your thinking.