Chapter 1

Unit Pricing and Currency Exchange

Canadian wheat is processed into flour and sold nationally, where most of it becomes baked goods. Canada also exports about 20 million tonnes of its wheat and grain each year.

1.1 Proportional Reasoning

REVIEW: WORKING WITH FRACTIONS

In this section, you will use fractions to solve for unknown values.

Chapter Test

At the end of each chapter, a chapter test is provided for review and assessment of learning.

Definitions

New mathematical terms are defined in the sidebar columns. They are also included in the glossary at the back of the book.

Answer Key

An answer key to this workbook's questions is located at the back of the book.

Glossary

Definitions for mathematical terms are provided here. To increase understanding, some glossary definitions include illustrations.

Example 1

Simplify $\frac{18}{27}$.

SOLUTION

actor: one of two or more numbers that, when multiplied together, form a product. For example, 1, 2, , and 6 are factors of the roduct 6 because:

$1 \times 6 = 6$

$2 \times 3 = 6$

$3 \times 2 = 6$

$6 \times 1 = 6$

To simplify a fraction, state the fraction in its lowest terms. To find the lowest terms, divide the numerator and the denominator by their largest common **factor**.

$\frac{18}{27}$ ← numerator
$\frac{}{27}$ ← denominator

Identify the factors of 18 and 27.

$18 = \{1, 2, 3, 6, 9, 18\}$

$27 = \{1, 3, 9, 27\}$

The largest factor common to both 18 and 27 is 9. Divide both the numerator and the denominator by 9.

$$\frac{18}{27} = \frac{18 \div 9}{27 \div 9}$$

$$\frac{18 \div 9}{27 \div 9} = \frac{2}{3}$$

$$\frac{18}{27} = \frac{2}{3}$$

ALTERNATIVE SOLUTION

he fractions $\frac{18}{27}$, $\frac{}{}$, and $\frac{2}{3}$ are quivalent fractions ecause they epresent the same mount.

Using the largest common factor when simplifying fractions takes the least number of steps, but you can use any common factor.

$$\frac{18}{27} = \frac{18 \div 3}{27 \div 3}$$ Simplify, using the factor 3.

$$\frac{18 \div 3}{27 \div 3} = \frac{6}{9}$$

$$\frac{18}{27} = \frac{6}{9}$$

$$\frac{6}{9} = \frac{6 \div 3}{9 \div 3}$$ Simplify further, again using the factor 3.

$$\frac{6 \div 3}{9 \div 3} = \frac{2}{3}$$

$$\frac{6}{9} = \frac{2}{3}$$

BUILD YOUR SKILLS

1. Simplify these fractions to their lowest terms.

a) $\frac{4}{16} =$ b) $\frac{3}{12} =$ c) $\frac{25}{75} =$

d) $\frac{15}{21} =$ e) $\frac{8}{18} =$ f) $\frac{45}{100} =$

g) $\frac{20}{50} =$ h) $\frac{3}{21} =$ i) $\frac{7}{56} =$

Example 2

Solve for x in this equation containing fractions.

$$\frac{x}{16} = \frac{5}{24}$$

SOLUTION

To solve an equation, the same operation must be applied to both sides of the equation.

Begin by multiplying both sides of the equation by the same number so that you can clear it of fractions (by eliminating the denominators). This will allow you to isolate x.

The simplest multiplier is the lowest common denominator of the two fractions.

Identify the **multiples** of 16 and 24.

16 = {16, 32, 48, 64, 80, . . .}

24 = {24, 48, 72, 96, . . .}

multiple: the product o a number and any other number. For example, 2, 4, 6, and 8 are some multiples of 2 because:

$2 \times 1 = 2$

$2 \times 2 = 4$

$2 \times 3 = 6$

$2 \times 4 = 8$

The lowest common multiple between 16 and 24 is 48, so begin solving the equation by multiplying both fractions by 48.

$$\frac{x}{16} = \frac{5}{24}$$

$48 \times \frac{x}{16} = \frac{5}{24} \times 48$ Multiply by 48.

$\frac{48x}{16} = \frac{240}{24}$ Simplify.

$3x = 10$

$\frac{3x}{3} = \frac{10}{3}$ Divide by 3 to isolate x.

$x = \frac{10}{3}$ or $3\frac{1}{3}$

ALTERNATIVE SOLUTION

You did not need to use 48 as your multiplier. Any common multiple will work, and people often choose to multiply by the product of the denominators.

In this question, the product would be 16 multiplied by 24. You will get the same answer in the end, but you will work with larger numbers.

$$\frac{x}{16} = \frac{5}{24}$$

$(24 \times 16) \times \frac{x}{16} = \frac{5}{24} \times (16 \times 24)$ Multiply both sides by the product of the denominators.

$384 \times \frac{x}{16} = \frac{5}{24} \times 384$ Simplify.

$\frac{384x}{16} = \frac{1920}{24}$

$24x = 80$

$\frac{24x}{24} = \frac{80}{24}$ Divide both sides by 24 to isolate x.

$x = \frac{80}{24}$

$x = \frac{80 \div 8}{24 \div 8}$ Simplify, using the factor 8.

$x = \frac{10}{3}$ or $3\frac{1}{3}$ or $3.\overline{3}$

x is not a whole number, it is best to ave the answer as fraction or in mixed neral form rather an as a decimal cause the decimal swer would often ve to be rounded.

BUILD YOUR SKILLS

2. Solve for x.

a) $\frac{x}{10} = \frac{40}{50}$

b) $\frac{12}{16} = \frac{18}{x}$

c) $\frac{56}{64} = \frac{x}{8}$

d) $\frac{18}{27} = \frac{36}{x}$

e) $\frac{x}{2056} = \frac{3}{4}$

f) $\frac{3}{12} = \frac{15}{x}$

g) $\frac{3}{5} = \frac{x}{460}$

h) $\frac{25}{x} = \frac{40}{200}$

NEW SKILLS: WORKING WITH RATIO AND PROPORTION

tio: a comparison tween two numbers easured in the same its

When a carpenter bonds two pieces of wood with epoxy resin, she must first mix the epoxy with a hardener. She mixes these materials in a **ratio** of 10 to 1, where there are 10 parts of epoxy to 1 part of hardener. This ratio can be written as 10:1 or as a fraction, $\frac{10}{1}$.

If the carpenter wanted to use 150 parts of epoxy, she would need 15 parts of hardener. This would give her a ratio of 150 to 15 between the amount of epoxy and the amount of hardener. You can write this as 150:15 or as $\frac{150}{15}$.

The ratio $\frac{150}{15}$ can be simplified to $\frac{10}{1}$.

$$\frac{150}{15} = \frac{150 \div 15}{15 \div 15}$$

$$\frac{150 \div 15}{15 \div 15} = \frac{10}{1}$$

$$\frac{150}{15} = \frac{10}{1}$$

It is common to express ratios as fractions when doing calculations.

portion: a fractional tement of equality ween two ratios

When you state that two ratios are equal, as they are in the following equation, you have written a **proportion**.

$$\frac{150}{15} = \frac{10}{1}$$

For more information, see page 12 of *MathWorks 10*.

Example 3

Charles works as a cook in a restaurant. His chicken soup recipe contains:

- 11 cups of seasoned broth
- 5 cups of diced vegetables
- 3 cups of rice
- 3 cups of chopped chicken

He wants to make the recipe at home for his parents. To reduce the recipe yield, he needs to know what the ratios are between the quantities of ingredients.

a) What is the ratio of vegetables to chicken?

b) What is the ratio of broth to vegetables?

c) What is the ratio of chicken to rice?

d) What is the ratio of the chicken to the total ingredients in the recipe?

A ratio can have a numerator larger than the denominator. Because a ratio compares two numbers, do not rewrite it as a mixed fraction.

SOLUTION

a) Since there are 5 cups of vegetables and 3 cups of chicken, the ratio of vegetables to chicken is 5:3 or $\frac{5}{3}$.

b) Since there are 11 cups of broth and 5 cups of vegetables, the ratio of broth to vegetables is 11:5 or $\frac{11}{5}$.

c) There are 3 cups of chicken and 3 cups of rice, so the ratio of chicken to rice is 3:3 or $\frac{3}{3}$. This can be simplified to 1:1 or $\frac{1}{1}$.

Although $\frac{1}{1}$ is usually written as the number 1, keep as a fraction when it is a ratio comparing two numbers.

d) There are 3 cups of chicken in the recipe, and a total of 22 cups of ingredients. The ratio of chicken to the total amount of ingredients is 3:22 or $\frac{3}{22}$.

BUILD YOUR SKILLS

3. For a silk screening project, Jan mixes a shade of orange ink. She uses a ratio of red ink to yellow ink of 2:3 and yellow ink to white ink of 3:1.

   a) How many mL of yellow ink would she need if she used 500 mL of white ink?

   b) How many mL of red ink would she need if she used 750 mL of yellow ink?

4. On a bicycle with more than one gear, the ratio between the number of teeth on the front gear and the number of teeth on the back gear determines how easy it is to pedal. If the front gear has 30 teeth and the back gear has 10 teeth, what is the ratio of front teeth to back teeth?

5. Some conveyor belts have two pulleys. If one pulley has a diameter of 45 cm and another has a diameter of 20 cm, what is the ratio of the smaller diameter to the larger diameter?

6. Bank tellers use ratios when converting currencies. If $1.00 CAD equals approximately 1.13 Australian dollars, what is the ratio of Canadian dollars to Australian dollars?

7. What is the ratio of 250 mL of grape juice concentrate to 1 L of water? (Hint: Convert both measurements to the same units. There are 1000 mL in 1 L.)

8. A mechanic mixes oil with gas to lubricate the cylinders in a motorcycle engine. He uses 1 part oil and 32 parts gas. What is the ratio of oil to gas?

Example 4

Tom and Susan make $180.00 from holding a garage sale. Because Tom contributed fewer items to the sale, the money is to be divided between Tom and Susan in the ratio of 1:2. How much money will each person receive?

SOLUTION

Since the ratio is 1:2, this means that for every $1.00 Tom receives, Susan receives $2.00. Stated another way, this means that for every $3.00 earned, Tom gets $1.00 and Susan gets $2.00.

Therefore, Tom receives $\frac{1}{3}$ of the money and Susan receives $\frac{2}{3}$ of it.

$\frac{1}{3} \times 180 = 60$

$\frac{2}{3} \times 180 = 120$

Tom gets $60.00 and Susan gets $120.00.

BUILD YOUR SKILLS

9. The ratio of flour to shortening in a recipe for piecrust is 2:1. If a baker makes 30 cups of piecrust, how many cups of flour and shortening does he use?

10. A compound of two chemicals is mixed in the ratio of 3:10. If there are 45 litres of the compound, how much of each chemical is in the mixture?

11. Cheryl is an automotive repair technician. She mixes paint and thinner to apply to a bus. The instructions say to mix paint with thinner in the ratio of 5:3. If Cheryl needs 24 L of paint/thinner mixture, how much of each will she use?

NEW SKILLS: WORKING WITH RATE

A **rate** is a ratio comparing two numbers measured in different units.

rate: a comparison between two numbers measured with different units

Some examples of rates are:

- \$1.69/100 g or $\frac{\$1.69}{100\text{ g}}$ for the cost of ham at the deli
- 80 km/h or $\frac{80\text{ km}}{1\text{ h}}$ for how fast a car travels
- \$38.00/4 h or $\frac{\$38.00}{4\text{ h}}$ for how much you earn at work

For more information, see page 17 of *MathWorks 10*.

Example 5

The amount of fuel consumed by a vehicle when it is driven 100 km is referred to as the rate of fuel consumption. Write a rate statement that indicates that a car uses 6.3 litres of gas for every 100 km driven.

SOLUTION

6.3 L:100 km, $\frac{6.3\text{ L}}{100\text{ km}}$, or 6.3 L/100 km

BUILD YOUR SKILLS

12. Write a rate statement that indicates that you earned \$65.00 interest on your investment in the last 3 months.

13. Write a rate statement that indicates how much you earn in an 8-hour day if you are paid \$9.25 for each hour you work.

14. Write a rate statement that indicates that 1 cm on a map represents 2500 km in real distance.

Example 6

If you earn \$150.00 in 12 hours, how much will you earn if you work 40 hours?

SOLUTION

$$\frac{\$150.00}{12\text{ h}} = \frac{\$x}{40\text{ h}}$$

$$\frac{150}{12} = \frac{x}{40}$$ In your calculation, omit the units.

$$(12 \times 40) \times \frac{150}{12} = \frac{x}{40} \times (40 \times 12)$$ Multiply both sides of the equation by the product of the denominators.

$$480 \times \frac{150}{12} = x \times 480$$ Simplify.

$$40 \times 150 = x \times 12$$

$$6000 = 12x$$

$$\frac{6000}{12} = \frac{12x}{12}$$ Divide both sides by 12 to isolate x.

$$\frac{6000}{12} = x$$

$$500 = x$$

You will earn \$500.00 in 40 hours.

BUILD YOUR SKILLS

15. If a type of salami at the deli costs \$1.59 per 100 g, how much will you pay for 350 g?

16. As a janitor, Janine makes a cleaning solution by mixing 30 g of concentrated powdered cleanser into 2 L of water. How much powder will she need for 5 L of water?

17. An office has decided to track how much paper it uses to reduce waste. At the end of each month, the secretary records the total number of sheets used and their weight. If paper weighs 4.9 kg for every 500 sheets, how much will 700 sheets weigh?

PRACTISE YOUR NEW SKILLS

1. Find the unknown value in each of the following proportions. Give answers to the nearest tenth of a unit (to one decimal place).

While calculating, omit the units.

a) $\frac{24}{18} = \frac{x}{12}$

b) $\frac{168 \text{ km}}{2 \text{ h}} = \frac{548 \text{ km}}{x \text{ h}}$

c) $\frac{40}{28} = \frac{60}{x}$

d) $\frac{6 \text{ pizza slices}}{2 \text{ people}} = \frac{x \text{ pizza slices}}{21 \text{ people}}$

e) $\frac{87 \text{ blankets}}{x \text{ bundles}} = \frac{24 \text{ blankets}}{8 \text{ bundles}}$

f) $\frac{12}{25} = \frac{25}{x}$

g) $\frac{7}{15} = \frac{x}{1}$

h) $\frac{12}{45} = \frac{16}{x}$

2. A hairdresser mixes brunette hair colouring for a client using 20 mL hair colour, 40 mL colour developer, 15 mL conditioner, and 3 mL thickener. Find the following ratios and simplify them to their lowest terms. Express your answers as fractions.

   a) The ratio of hair colour to thickener.

b) The ratio of thickener to conditioner.

c) The ratio of colour developer to hair colour.

d) If this treatment costs the customer $68.00 and the cost of labour and materials used is $14.20, what is the ratio of customer price to actual cost?

3. If the ratio of yellow pigment to blue pigment in a shade of green paint is 2:3, how many drops of yellow pigment will be needed if 12 drops of blue are used?

4. If 5 cm on a map represents 2.5 km of actual ground, how many centimetres would 15 km of actual ground be on the map?

5. If a can of paint will cover 48 m^2 of wall space, how many cans will you need to paint 220 m^2?

6. The ratio of teeth on a pair of driving gears is 13:6, with the larger gear having more teeth. If the larger gear has 52 teeth, how many does the smaller gear have?

7. If Stephie can type 75 words per minute, how long will it take her to type an 800-word term paper? Is the solution a rate or a ratio? Explain your answer.

8. If the ratio of flour to sugar in a recipe is 3:2, how much flour would you need if you used 1.5 cups of sugar?

9. If a machine can produce 85 parts in 40 minutes, how many parts can it produce in 8 hours?

1.2 Unit Price

NEW SKILLS: WORKING WITH UNIT PRICE

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

When items are sold in quantities of more than 1, the **unit price** indicates how much 1 of the items would cost. For example, if you buy a package of 3 pencils, the unit price is the price of 1 pencil.

For more information, see page 23 of *MathWorks 10*.

Example 1

If a carton of one dozen eggs costs \$3.29, how much are you paying for 1 egg?

SOLUTION

Solve using a proportion. Let x represent the cost of 1 egg.

$$\frac{\$3.29}{12 \text{ eggs}} = \frac{x}{1 \text{ egg}}$$

$\frac{3.29}{12} = \frac{x}{1}$ Omit the units in the calculation.

$12 \times \frac{3.29}{12} = \frac{x}{1} \times 12$ Multiply both sides of the equation by 12.

$3.29 = 12x$ Simplify.

$\frac{3.29}{12} = \frac{12x}{12}$ Divide both sides by 12 to isolate x.

$\frac{3.29}{12} = x$

$0.27 \approx x$

One egg costs approximately \$0.27.

BUILD YOUR SKILLS

1. If 12 apples cost $10.20, how much does one apple cost?

2. Lindsay is the kitchen manager of an Ethiopian café. She purchases a case of 1000 paper coffee cups for $94.83. How much does one cup cost?

3. Frank is a locksmith who owns his own business. He buys a case of 144 bulk brass padlocks for $244.97. He sells each lock for $5.50.

   a) How much does each lock cost Frank?

   b) How much profit does Frank make when he sells one lock?

People often think that larger-sized packages cost less per unit, but this is not always so.

Example 2

Often unit price is used to compare costs.

A 48-oz can of tomatoes costs \$2.99. An 18-oz can costs \$1.19. Which is a better buy?

SOLUTION

Calculate the cost of 1 oz of tomatoes for each size of can.

Calculate the cost of 1 oz from the 48-oz can.

$\$2.99 \div 48 \approx \$0.062$ Divide the total cost by the total number of ounces.

1 oz of tomatoes costs approximately \$0.06.

Calculate the cost of 1 oz from the 18-oz can.

$\$1.19 \div 18 \approx \$0.066$ Divide the total cost by the total number of ounces.

1 oz of tomatoes costs approximately \$0.07.

It costs more for one ounce of tomatoes from the 18-oz can, so the 48-oz can is the better buy.

BUILD YOUR SKILLS

4. *La Boutique du Livre* is a francophone bookstore in St. Boniface, MB. It sells notebooks in packages of 12 for $15.48. Another bookstore sells the same notebooks in packages of 15 for $19.65. Which is the better price?

5. Which is the better buy: 6 muffins for $7.59, or one dozen muffins for $14.99?

6. Johnny can buy two 8-foot pieces of 2″ by 4″ lumber at $2.60 each, or three 6-foot pieces for $1.92 each. Which is the better buy per foot?

Example 3

Shirin is the manager of a fabric store and is training a new employee. Shirin wants to make an easy reference chart that lists the prices of different lengths of a fabric. One metre of the fabric costs $8.42. Fill in the rest of the chart.

FABRIC COST BY LENGTH	
Length of fabric	*Cost of fabric*
0.5 m	
1 m	$8.42
1.75 m	

SOLUTION

You can solve this using proportions. First find the cost of 0.5 m.

$$\frac{\$8.42}{1\text{ m}} = \frac{\$x}{0.5\text{ m}}$$

$$\frac{8.42}{1} = \frac{x}{0.5}$$ Omit the units during calculations.

$0.5 \times 8.42 = \frac{x}{0.5} \times 0.5$ Multiply both sides of the equation by the product of the denominator, 0.5.

$0.5 \times 8.42 = x$ Simplify.

$$4.21 = x$$

The cost of 0.5 m of fabric is $4.21.

Then find the cost of 1.75 m.

$$\frac{8.42}{1} = \frac{x}{1.75}$$

$1.75 \times 8.42 = \frac{x}{\cancel{1.75}} \times \cancel{1.75}$

$1.75 \times 8.42 = x$

$$14.74 = x$$

FABRIC COST BY LENGTH	
Length of fabric	*Cost of fabric*
0.5 m	$4.21
1 m	$8.42
1.75 m	$14.74

ALTERNATIVE SOLUTION

You can use unit rates rather than proportions.

1 m costs \$8.42. Use this unit cost to calculate the cost of the other lengths

$\$8.42 \times 0.5 = \$4.21$

$\$8.42 \times 1.75 = \$14.74$

BUILD YOUR SKILLS

7. Sasha is a landscape gardener. He sees that a 200-foot roll of string trimmer line costs \$18.75. A 150-foot roll of line costs \$15.21.

   a) Which roll of line is the least expensive per foot?

   b) What is the difference in price, per foot?

8. If $2\frac{1}{2}$ kg of tomatoes cost \$8.25, how much will you pay for 7 kg?

9. If Wayne bought 5 litres of gas for his lawnmower for \$5.45, how much would he have to pay to fill his car with 48 litres of gas?

PRACTISE YOUR NEW SKILLS

1. During the summer, Dean works as a cashier in a store near Saskatchewan's Greenwater Lake Provincial Park. The store sells a case of 12 bottles of water for $8.50 and individual bottles of the same brand of water for $1.55.

   a) Approximately how much does each bottle of water in the case of 12 cost?

   b) How much would a customer save by buying a case of water, rather than 12 individual bottles?

2. Maureen purchased enough carpet to cover a rectangular room measuring 7 metres by 12 metres. The carpet costs $8.15 per square metre.

   a) How much carpet did Maureen buy?

   b) How much did the carpet cost?

3. Tyler is a self-employed sheet metal worker. He purchases 25 sheets of aluminum that measure 4 feet by 8 feet. The cost is $4000.00 before tax and shipping.

   a) How much does 1 sheet cost?

   b) What is the price per square foot?

4. A painting business buys 3-inch wide paintbrushes from a supplier in cases of 6. One case costs $31.29.

   a) How much do two brushes cost?

   b) If a customer buys two or more cases, the supplier reduces the price of the case by 10 percent. How much would 3 cases of paintbrushes cost? How much would each brush cost?

5. Which is the better buy: 8 ounces of Brie cheese for $4.95 or 12 ounces for $7.49?

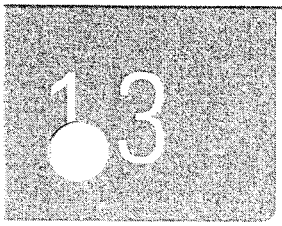
6. Debbie is a cook in a restaurant that is open 6 days a week. She is responsible for recording and monitoring the amount of money she spends on food. In the summer, she uses an average of 9 loaves of bread per day.

   a) On average, how many loaves of bread does Debbie use each week?

   b) If bread costs $1.25 per loaf to buy from a wholesale distributor, how much money should Debbie budget to purchase it, for the month of June? Assume that there are just 4 weeks in June.

7. The cost of a 355-mL can of juice is $1.25 in a vending machine. A 1.89-L carton of the same juice costs $3.89 at the grocery store. How much would you save per mL if you bought juice from the grocery store instead of the vending machine? (Hint: 1 L equals 1000 mL.)

8. Patricio is ordering cartons of detergent for resale in his store. He can order a carton of 12 for $34.68 plus $5.45 for delivery, or a carton of 18 for $51.30 plus $6.25 for delivery. Which is a better buy, and by how much per unit?



Setting a Price

REVIEW: WORKING WITH PERCENTS AND DECIMALS

In this section, you will calculate percentages and convert between percents and decimals.

Example 1

Convert 65% to a decimal.

ercentage: a ratio with denominator of 100; ercent (%) means "out f 100"

SOLUTION

To convert a **percentage** to a decimal, first convert it to a fraction with a denominator of 100, then divide the numerator by the denominator.

65% means 65 out of 100, or, stated as a fraction, $\frac{65}{100}$.

)ivid 100 ives the same esult as moving the lecimal two places o the left. Many eople use this as a hortcut.

Divide 65 by 100 to express 65% as a decimal.

$65 \div 100 = 0.65$

65% is equal to 0.65.

BUILD YOUR SKILLS

1. Convert the following percentages to decimals.

a) 78%

b) 93%

c) 125%

d) 324%

e) 0.5%

f) 0.38%

g) 1.2%

h) 100%

Example 2

Calculate 20% of 45.

SOLUTION

To find a percentage of a number, you can use proportional reasoning.

Let x represent 20% of 45. Use proportional reasoning to solve for x.

$$\frac{20}{100} = \frac{x}{45}$$

$$4500\left(\frac{20}{100}\right) = \left(\frac{x}{45}\right)4500$$ Multiply both sides of the equation by the product of the denominators.

$$45 \times 20 = 100x$$ Simplify.

$$900 = 100x$$

$$\frac{900}{100} = \frac{100x}{100}$$ Divide both sides by 100 to isolate x.

$$9 = x$$

20% of 45 is 9.

ALTERNATIVE SOLUTION

First convert 20% to a decimal.

$$20 \div 100 = 0.20$$

Then calculate 20% of 45 by multiplying 0.20 by 45.

$$x = 0.20 \times 45$$

$$x = 9$$

BUILD YOUR SKILLS

2. Calculate the following percentages.

a) 15% of 300

b) 45% of 1500

If the percentage is larger than 100, ther your answer will be larger than the number you started with.

c) 140% of 70

d) 175% of 24

e) 7.8% of 50

f) 0.3% of 175

g) 200% of 56

h) 135% of 25

Example 3

What percent is 5 of 20?

SOLUTION

To calculate what percent one number is of another means that you need to determine what number out of 100 is equivalent to your ratio.

You can use proportional reasoning to solve the question.

$$\frac{x}{100} = \frac{5}{20}$$

$100 \times \frac{x}{100} = \frac{5}{20} \times 100$ Multiply both sides of the equation by 100.

$x = 5 \times 5$ Simplify.

$x = 25$

5 is 25% of 20.

ALTERNATIVE SOLUTION

5 of 20 is the same as $\frac{5}{20}$. You can find the percent by dividing 5 by 20.

$5 \div 20 = 0.25$

This is 25 hundredths, or 25%.

BUILD YOUR SKILLS

3. Calculate what percentage the first number is of the second (to the nearest tenth of a percent).

a) 65 of 325

b) 135 of 405

c) 68 of 42

d) 13 of 65

e) 1 of 12

f) 625 of 50

NEW SKILLS: WORKING WITH MARKUPS AND TAXES

When a person owns a business, she usually buys merchandise at a wholesale price. She then sells it at a higher price, called a retail price, to make a profit. The retail price is often determined by adding a certain percentage of the wholesale price to the wholesale price. The amount added is referred to as the **markup**.

markup: the difference between the amount a dealer sells a product for (retail price) and the amount he or she paid f it (wholesale price)

Sales taxes are usually added to the retail price. There are three kinds of taxes that you may need to consider when purchasing items: Goods and Services Tax (GST), Provincial Sales Tax (PST), and Harmonized Sales Tax (HST).

For more information, see page 28 of *MathWorks 10*.

Example 4

Melanie owns a clothing store. Her standard markup is 85%. She bought a coat from the wholesaler at $125.00.

a) What would the markup be?

b) How much would Melanie charge her customer for the coat?

SOLUTION

a) Change 85% to a decimal.

$$85 \div 100 = 0.85$$

Multiply the wholesale price by the markup.

$$\$125.00 \times 0.85 = \$106.25$$

The markup is $106.25.

b) Melanie would charge her customer the wholesale price plus the markup.

$$\$125.00 + \$106.25 = \$231.25$$

With a markup of 85%, Marnie would charge her customer $231.25.

BUILD YOUR SKILLS

4. The markup on a bicycle in a sporting goods store is 125%. The bicycle's wholesale price is $450.00. What is the markup in dollars?

5. Marco buys a certain brand of shampoo from a supplier at $7.25 per bottle. He sells it to his customers at a markup of 25%. What would the markup be?

6. A *hanbok* is a formal, traditional outfit of Korean clothing. At a markup of 60%, what would be the retail price for a child's *hanbok* with a wholesale price of $117.45?

7. What should Max charge for a package of paper plates in his store if he bought them for $9.00 and wants to make a 75% profit?

Example 5

Quentin wants to buy a pair of steel-toed boots listed at $179.95. How much will the boots cost if 5% GST and 6% PST are charged?

SOLUTION

Calculate the GST by changing 5% to a decimal and multiplying by the retail price.

$$5 \div 100 = 0.05$$

$$0.05 \times \$179.95 = \$9.00$$

Calculate the PST by changing 6% to a decimal and multiplying by the retail price.

$$6 \div 100 = 0.06$$

$$0.06 \times \$179.95 = \$10.80$$

The final price is calculated by adding the tax amounts to the retail price.

$$\$179.95 + \$9.00 + \$10.80 = \$199.75$$

Quentin will have to pay $199.75.

ALTERNATIVE SOLUTION 1

$5\% + 6\% = 11\%$	Add the two taxes together.
$11 \div 100 = 0.11$	Change to a decimal.
$0.11 \times \$179.95 = \$19.79$	Multiply to find 11% of the retail price.
$\$179.95 + \$19.79 = \$199.74$	Add the total tax to the retail price.

This is different than the first solution because rounding occurs at a different spot.

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ALTERNATIVE SOLUTION 2

You can think about the retail price as 100% of the cost. If you add the two sales taxes (5% plus 6% equals 11%) to this, the total cost is 111%.

Convert 111% to a decimal and multiply this by the initial cost.

$$111 \div 100 = 1.11$$

$$\$179.95 \times 1.11 = \$199.74$$

BUILD YOUR SKILLS

8. What would you have to pay for a jacket that is listed at $99.95 if you live in Nunavut, where the only tax is 5% GST?

9. Find the total cost of a washing machine that is being sold for $944.98 in Saskatchewan, where PST is 6% and GST is 5%.

10. Calculate the HST (12%) on a return flight from Cranbrook, BC to Vancouver, BC that costs $372.00.

11. Saskatchewan charges 5% GST and 6% PST. How much GST and PST would Krista pay on a can of paint priced at $45.89?

12. If the markup is 125% on a certain brand of jeans that have a wholesale price of $30.00, what will the consumer pay, if GST and PST are each 5%?

13. The markup on a restaurant meal is 250%. A meal costs $7.25 to produce. How much will the customer be charged, after markup and 5% GST are applied?

PRACTISE YOUR NEW SKILLS

1. Calculate the following percentages.

   a) 5% of 72

   b) 275% of 8

   c) 152% of 200

   d) $6\frac{3}{4}$% of 700

2. An electrician buys his material at the local hardware store, then charges his customer 20% more. The material for a given project is $253.75 at the hardware store.

Wholesale Price

   a) What is the markup?

   b) How much does he charge the customer for the material?

3. Maria is a florist in a small boutique. If Maria paid her supplier $8.50/doz for roses and sold them for $19.95, what was the percent markup?

4. Garth buys snow tires from a dealer in Thunder Bay, ON. The tires cost $79.00 each. To make a profit, he must mark them up 40%. How much must a customer pay for 4 tires if there is a 12% HST on the final sale?

495.49

5. Because the cost of ingredients has gone up, Maurice has decided to increase the cost of meals in his restaurant by 12%. How much will he now charge for a grilled salmon fillet that used to cost $17.95?

6. The wholesale cost of a certain brand of T-shirts is $132.00/dozen. To cover costs and make a profit, Lorena marks them up by 75%. If GST is 5% and PST is 7%, what will a customer have to pay for 1 T-shirt?

7. An MP3 player that Harry wants to buy sells for $89.95 in BC where there is 12% HST. When he is on holiday in Alberta (where there is only the 5% GST), Harry sees the same MP3 player for $94.89. Which is a better buy and by how much?

1.4 On Sale!

NEW SKILLS: SALE PRICES

When you go shopping, you see signs that advertise **promotions**, such as "For Sale," "Up to 50% Off," and "Discounted Prices," that mean you will pay less than the price on the tag.

promotion: an activity that increases awareness of a product or attracts customers

For more information, see page 34 of *MathWorks 10.*

Example 1

Samantha wants to buy a new TV. The model she likes costs $675.95, but the clerk tells her that it is going on sale next week at 20% off. If Samantha waits one week, how much will she save on the price of the TV?

SOLUTION

The discount is 20%, so find 20% of $675.95 by multiplication.

Convert 20% to a decimal.

$20 \div 100 = 0.20$

Multiply 0.20 by the original price.

$0.20 \times \$675.95 = \$135.19$

The original price will be discounted by this amount, so Samantha would save $135.19.

BUILD YOUR SKILLS

1. How much will Jordon save on the price of a computer listed at $989.98 if it is discounted by 30%?

2. The Midtown Bakery sells Chinese specialties such as pineapple buns and lotus seed buns. Day-old goods at the bakery are sold at a discount of 60%. If the original price of a loaf of sweet bread was $2.98, how much would you save by buying a day-old loaf?

3. If the sale price is 25% off, what will you save if you buy a sofa regularly priced at $999.97?

Example 2

Michelle is a member of the Xat'sull First Nation and is fluent in the Shuswap language. She works as a language instructor and gift shop cashier at the Xat'sull Heritage Village, near Williams Lake, BC.

The gift shop is selling off summer inventory. What will be the cost of a carving that was priced at $149.95 if the sale sign says "Reduced by 60%"?

SOLUTION

Calculate 60% of $149.95 to determine the savings.

First, convert 60% to a decimal.

$60 \div 100 = 0.60$

Multiply the original price by 0.60.

$0.60 \times \$149.95 = \$89.97$

The original price will be reduced by this amount, so subtract $89.97 from $149.95.

$\$149.95 - \$89.97 = \$59.98$

The cost of the carving will be $59.98.

ALTERNATIVE SOLUTION

If the price of the carving is reduced by 60%, that means that the customer will pay only 40% of the cost (100% minus 60% is 40%).

Convert 40% to a decimal.

$40 \div 100 = 0.40$

Multiply the original price by 0.40.

$0.40 \times \$149.95 = \$59.98$

The carving will cost $59.98.

BUILD YOUR SKILLS

4. Sarbjit charges $24.95 for a haircut in her beauty salon, but gives students a 30% reduction on Thursday evenings. How much would you have to pay to have your hair cut on a Thursday evening?

5. Margariet manages a second-hand clothing store in Flin Flon, Manitoba. The store advertises that if you buy 3 items, you will get 15% off the most expensive item, 20% off the second most expensive, and 30% off the cheapest item. You choose three items costing $10.00, $25.00, and $12.00. How much will you pay for the three items?

6. Normally Chiu charges $75.00 to paint a room. However, if he paints 3 or more rooms for you, he gives you a 15% discount. How much will he charge if he paints 4 rooms for you?

Example 3

Lisa specializes in selling products from the Philippines, including rattan, bamboo, and palm baskets. Medium-sized bamboo baskets are regularly priced at $19.98. They are on sale, advertised as "Buy one, get the second at half price." What is the discount rate, as a percent?

SOLUTION

Calculate the regular cost of 2 baskets.

$\$19.98 \times 2 = \$39.96$

In buying 2 baskets, you save half the price of 1 basket.

$\frac{1}{2}(\$19.99) = \$9.99$

Calculate the percent savings by dividing the discount by the regular price, and multiplying by 100.

$\frac{\$9.99}{\$39.96} \times 100\% = 25\%$

The discount rate is 25%.

BUILD YOUR SKILLS

7. What is the percentage markdown if a $175.00 item sells for $150.00?

8. In a store opening promotion, Fred advertises T-shirts: "Buy 4 get 1 free." If the cost of 1 T-shirt is $15.97, what is the discount rate, as a percent?

9. Cameron is buying new computers for his office. Each computer costs $789.00. He is told that if he buys 5 computers, he can get a 6th one free. What will be his percent saving compared to buying all 6 at the regular price?

10. Shelly works as an optician in Whitehorse, YT. Her store is selling last year's glasses frames at a savings of 30%. What will you pay for frames that were originally priced at $149.00 if 5% GST is charged?

GST and PST are paid on the selling price, not the original price.

11. Nicole wants to buy a coat originally priced at $249.95. It is on sale at 25% off. How much will she pay if 5% GST and 5% PST are charged?

12. Yasmin owns a kitchen and bath fitting store. She is selling a kitchen sink at a reduction of 40% because of a scratch in the finish. The original price was $249.95.

    a) Determine the total savings to the customer, including 5% GST and a PST of 8%.

    b) Calculate the percentage of savings.

PRACTISE YOUR NEW SKILLS

1. In Abbotsford, BC, Mack works as a used car salesman. He offers a 15% reduction to repeat customers. If the price marked on a car is $9879.00, how much will it be reduced for a repeat customer?

2. A fishing rod originally priced at $49.98 is reduced by 30%.

   a) How much is the discount?

   b) What will the cost be before tax?

3. Senior citizens are offered a 20% discount on their lunch on Tuesdays in Hay River's local diner. How much will Rita and Dick, both senior citizens, save if they order the teriyaki chicken salad at $14.98 and the pork cutlets at $17.98? (Ignore taxes.)

4. A can of paint costs $59.95. There is a 20% price reduction for contractors. How much will the contractor save if he buys 5 cans?

5. A furniture store offers a "Closing Out Sale: Everything 80% Off."

   a) How much will you pay for a bedroom suite that originally cost $2989.97 if GST is 5% and PST is 7%?

   b) What are your total savings on this purchase?

6. Robert sells bicycles, skateboards, and snowboards at his sporting goods store. A bicycle that was originally priced at $785.00 sold for $553.00. What percent markdown did Robert offer?

7. The wholesale cost of a *tawa*, a griddle used to cook Indian flatbread, is $53.00. A merchant marks it up 65%. At the end of the season, he sells the remaining stock at 60% off.

   a) What was his original asking price?

   b) At the original price, how much would a customer pay with 5% GST and 5% PST?

   c) What was the end-of-season sale price?

   d) How much would a customer pay when it was on sale, including 5% GST and 5% PST?

   e) What would the total savings be if it were bought on sale?

   f) What would be the percentage savings?

1.5 Currency Exchange Rates

NEW SKILLS: EXCHANGE RATES

Different countries use different monetary units and/or different currencies. It is important when travelling to consider **exchange rates**, or the value of one monetary unit compared to another.

exchange rate: the price of one country's currency in terms of another country's currency

For more information, see page 41 of *MathWorks 10*.

Example 1

Lucas is a glazier who operates a window installation business. He regularly travels to the United States to buy supplies. Before travelling, he converts $500.00 CAD into American dollars for personal expenses. If one Canadian dollar is worth 0.94192 of an American dollar, how many American dollars will Lucas receive in exchange for $500.00 CAD?

SOLUTION

Use unit pricing.

$1.00 CAD = $0.94192 USD

$500.00 CAD = $0.94192 USD × 500

$500.00 CAD = $470.96 USD

Lucas will receive $470.96 USD.

Using approximation when working with exchange rates is useful if you want to quickly convert between currencies. You can think of the exchange rate in Example 1 as meaning that for every Canadian dollar, you will lose approximately 6 cents when converting to American dollars.

BUILD YOUR SKILLS

1. Ray purchased $500.00 CAD worth of parts from Hungary for use in his garage. If the exchange rate is one Canadian dollar to 180.0779 Hungarian forints (Ft), how many forints will you receive for $500.00 CAD?

2. If one Canadian dollars is worth 0.5911 British pounds sterling (£), calculate how many pounds sterling you would get for $200.00 CAD.

3. Madeline is attending a trade show in Denmark. She runs short of spending money and must convert $100.00 CAD into Danish kroner (kr). The exchange rate is 5.3541 Danish krone for one Canadian dollar. How many kroner will she receive?

Example 2

One Thai baht is worth 0.023541 of a Canadian dollar. How many bahts would a tourist in Thailand receive for $200.00 CAD?

SOLUTION

1.00 baht = $0.023541 CAD

200 ÷ 0.023541 = 8495.82

For $200.00 CAD, a tourist in Thailand would receive 8495.82 bahts.

BUILD YOUR SKILLS

4. If the exchange rate for converting a Canadian dollar to the euro is 0.7180 on a particular day, how many euros would you get for $300.00 CAD?

5. The exchange rate for converting a Canadian dollar to the Swiss franc (SFr) is 1.0542. How many Swiss francs will you get for $400.00 CAD?

6. Canada imports steel, iron, and organic and inorganic chemicals from Trinidad and Tobago. The exchange rate for converting the Canadian to the Trinidad and Tobago dollar is 6.1805. How many Trinidad and Tobago dollars will you get for $200.00 CAD?

7. Using the following exchange rates, calculate how much foreign currency you would receive for $200.00 CAD.

   a) $1.00 CAD is worth 1.72904 Brazilian reals

   b) $1.00 CAD is worth 8.71137 Moroccan dirhams

   c) $1.00 CAD is worth 7.72277 Ukrainian hryvnia

   d) $1.00 CAD is worth 3.19889 Polish zloty

8. Calculate the value in Canadian dollars of an item that costs $449.75 Singapore dollars. Assume the exchange rate for one Canadian dollar is 0.75529.

9. Henry returns home to Whale Cove, Nunavut, after a trip to Europe. On his travels he purchased a jacket for 125.98 euros. Calculate the value of Henry's jacket in Canadian dollars. Assume that a euro is worth 1.3987 of a Canadian dollar.

10. The exchange rate between the South African rand and the Canadian dollar is 0.138469 (1 rand equals $0.138469 CAD). What is the cost in Canadian dollars of an item priced at 639.00 rand?

Exchanging money is not quite as simple as the transactions here show. Although the calculations will be the same, you have to consider bank buying rate and bank selling rate when exchanging currency. When the bank buys foreign currency from you, they pay you less than they charge when they sell it to you.

Example 3

Anne works for an automotive parts distributor and visits Switzerland to source new products. On a given day, the bank selling rate of the Swiss franc compared to the Canadian dollar is 1.0501 and the buying rate is 1.0213.

a) How many Swiss francs would Anne receive for $400.00 CAD?

b) If Anne sold them back to the bank, how much would she receive?

c) What would her net loss be?

SOLUTION

a) The bank will sell Swiss francs to Anne, so use the selling rate. 1 Swiss franc is worth $1.0501 CAD.

$$\frac{1\ \text{SFr}}{\$1.0501} = \frac{x}{\$400.00}$$

$$\frac{1}{1.0501} = \frac{x}{400.00}$$ Omit the units.

$$(400.00 \times \cancel{1.0501}) \times \frac{1}{\cancel{1.0501}} = \frac{x}{\cancel{400.00}} \times (1.0501 \times \cancel{400.00})$$ Multiply both sides of the equation by the product of the denominators.

$$400.00 = 1.0501x$$ Simplify.

$$\frac{400.00}{1.0501} = x$$ Divide both sides by 1.0501 to isolate x.

$$380.92 = x$$

Anne would receive 380.92 Swiss francs.

ALTERNATIVE SOLUTION

a) 1 Swiss franc is worth $1.0501 CAD.

$1.00 is therefore worth $\frac{1}{1.0501}$ Swiss francs. Multiply this by 400 to calculate what $400.00 CAD is worth.

$$400.00 \times \frac{1}{1.0501} = 380.92 \text{ Swiss francs}$$

b) The bank buys the Swiss francs back at a rate of 1.0213 Swiss francs per $1.00 CAD.

$$\frac{1 \text{ SFr}}{\$1.0213} = \frac{380.92 \text{ SFr}}{x}$$

$$\frac{1}{1.0213} = \frac{380.92}{x} \qquad \text{Omit the units.}$$

$$(1.0213 \times x) \times \frac{1}{1.0213} = \frac{380.92}{x} \times (x \times 1.0213) \qquad \text{Multiply both sides of the equation by the product of the denominators.}$$

$$x = 380.92 \times 1.0213 \qquad \text{Simplify.}$$

$$x = 389.03$$

Anne would receive $389.03 CAD.

ALTERNATIVE SOLUTION

b) 1 Swiss franc is worth $1.0213 CAD.

Multiply 380.92 Swiss francs by 1.0213 to find the value in Canadian dollars.

380.92 × 1.0213 = $389.03 CAD

Unit rates often work best for exchanging currency.

c) Anne's net loss would be $400.00 minus what she received back.

$400.00 − $389.03 = $10.97

Anne would lose $10.97 in the transaction.

When customers exchange money at a bank or other institution, the bank will usually only deal with paper money, not coins.

BUILD YOUR SKILLS

11. If the exchange rate of a country compared to the Canadian dollar is 0.00519, will you get more or less of their currency units when you exchange money?

12. Dianne works as a bank teller in Canmore, AB. A customer wishes to buy 250 British pounds at a rate of 1.5379 $CAD. How many Canadian dollars would the British pounds cost?

13. If the selling rate of a euro (€) is 1.4768 and the buying rate is 1.4287, how much would you lose if you exchanged $1000.00 CAD for euros and then converted them back to $CAD on the same day?

PRACTISE YOUR NEW SKILLS

1. Using the following information, calculate how much of the foreign currency you would get for $500.00 CAD. Round to the nearest unit.

   a) $1.00 is worth 95.4911 Japanese yen

   b) $1.00 is worth 1.41046 Turkish lira

   c) $1.00 is worth 0.680228 euro

   d) $1.00 is worth 6.43033 Chinese yuan

2. Damien is training to become a customer service representative at a credit union in Saskatoon, SK. Given the following exchange rates compared to the Canadian dollar, calculate how much foreign currency Damien would give to a customer who wished to convert $500.00 CAD.

   a) Mexican peso, 0.0818085

   b) Estonian kroon, 0.0939564

   c) British pound, 1.3376

   d) South Korean won, 0.000922277

   e) Indian rupee, 0.0229526

   f) Russian ruble, 0.0352667

3. Using the rates from question #1, calculate the amount you would get in Canadian dollars if you sold the following.

   a) 8750 Japanese yen

   b) 900 Turkish lira

   c) 250 euros

   d) 3000 Chinese yuan

4. Use the exchange rates from question #2. Calculate how many Canadian dollars you would get for each of the following.

   a) 6750 Mexican pesos

   b) 145 British pounds

   c) 15 000 Indian rupees

   d) 750 Russian rubles

5. If the exchange rate is 0.1736 between the Norwegian krone and the Canadian dollar, what would the price be in Canadian dollars of an item that cost 275 kroner?

6. A hand-woven shawl costs 35 Botswana pula. How much does it cost in Canadian dollars if the exchange rate is 0.1515?

7. If the selling rate of the Omani rial is 2.96845 and the buying rate is 2.86145, how much would you lose if you bought and then sold $800.00 on the same day?

CHAPTER TEST

1. When he works as a landscape gardener, Mark sometimes uses a powdered fertilizer. It must be mixed at a rate of 1 part of powder to 14 parts of water. How much water will Mark use for 3 litres of powder?

2. A car uses 5.5 litres of gas when it travels 100 km.

   a) Express this as a rate of fuel consumption.

   b) How much fuel would be needed for a 400-km trip?

3. Loretta works as a surveyor near Burwash Landing, YT. Her map uses a scale of 2.5 cm:100 km. On her map, two sites she must visit are 7.4 cm apart. What is the actual distance between the two sites?

4. If a package of 12 pens cost $38.98, what is the cost of 1 pen?

5. If the wholesale price of 10 packages of smoked salmon is $99.50, what will the cost be for one package after a markup of 45%?

6. The bakery in Lund, BC is selling day-old buns at a 40% reduction. If the regular price is $4.79/doz, what is the reduced price?

7. A sofa in a furniture store was originally $1899.00. The price was "reduced by 35% for quick sale." When it did not sell, the manager offered another reduction of 20%.

   a) What was the final price of the sofa with 5% GST and 7% PST?

   b) Is this the same as a 55% reduction? Show why or why not.

8. A furniture store in The Pas, Manitoba, advertises: "All weekend, no GST and no PST." If GST and PST are usually 5% each, what is the actual saving as a percent on an item that costs $24.97?

9. After prime planting season was over, a horticulturist sold lilac bushes for $15.00. If the original price was $39.00, what is the percentage markdown?

10. Non-profit agencies get a 12% reduction from Polly's Printers. How much will they save on a printing job that regularly costs $865.00?

11. James works for an industrial lighting company. He travels to Hong Kong to attend a trade show. James sees a fluorescent track lighting unit priced at 1295.31 Hong Kong dollars. What is the cost in Canadian dollars if $1.00 CAD is worth 7.3181 Hong Kong dollars?

12. Marian travels to Spain to visit her mother and father.

    a) $1.00 CAD is worth €0.680228. If Marian converts $450.00 CAD into euros, how many euros does she receive?

    b) During her visit, Marian buys a leather purse for €125.00. What is the cost in Canadian dollars?