2

Operations on Decimal Numbers

The photo shows a popular attraction for visitors to Prince Edward Island. Have you ever travelled on vacation to another Canadian province or territory? Where did you go? How did you spend your money?

When you travel, it is important to plan ahead to make sure you do not run out of money. It is also important to keep track of your money as you spend it. Estimation and mental math are very valuable skills for travellers.

This chapter will help you become better with money calculations and working with other numbers that involve decimals. It pays to know your math!

What You Will Learn

- to perform and estimate the results of decimal number operations
- to add, subtract, multiply, and divide decimal numbers
- to use a calculator to multiply and divide decimal numbers

Key Words

estimate
overestimate
underestimate
order of operations

MATH LINK

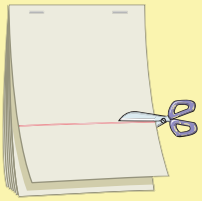
At the end of this chapter, you will plan a week-long dream vacation. Where would you like to go? Why do you want to go there?

FOLDABLES™
Study Tool

Make the following Foldable to organize what you learn in Chapter 2.

Step 1 Staple seven sheets of notebook paper together along the top edge.

Step 2 Make a line 9 cm up from the bottom of the top page. Cut across the entire page at this mark.



Step 3 Make a line 7.5 cm up from the bottom of the second page. Cut across the entire page at this mark.

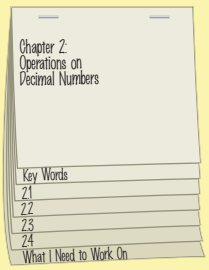
Step 4 Cut across a line 6 cm up from the bottom of the third page.

Step 5 Cut across a line 4.5 cm up from the bottom of the fourth page.

Step 6 Cut across a line 3 cm up from the bottom of the fifth page.

Step 7 Cut across a line 1.5 cm up from the bottom of the sixth page.

Step 8 Label the tabs formed as shown.



Literacy Link

As you work through Chapter 2, take notes under the appropriate tab. Include information about the key words, examples, and key ideas.

2.1 Add and Subtract Decimal Numbers

Focus on...

After this lesson, you will be able to...

- use estimation to check if solutions are reasonable
- use front-end estimation to place the decimal point in a sum or difference
- solve problems using addition and subtraction of two or more decimal numbers

The Trans-Canada Highway from Winnipeg to Prince Rupert is also known as the Yellowhead Highway. How could you estimate or calculate distances between locations along the route?

Did You Know?

The Yellowhead Highway is named after the Métis guide, Pierre Bostonais. Pierre was a well-known trapper and guide in the Yellowhead Pass region of British Columbia. He was nicknamed "*Tête Jaune*" by French voyageurs because of his blond-streaked hair. *Tête Jaune* means "yellow head."

Discuss the Math

How can you make reasonable estimates?

Ashley and her brother Marshall live in Winnipeg. They are travelling with their family along the Yellowhead Highway to Jasper. Their car odometer shows the following readings, in kilometres.

Winnipeg to Minnedosa	Minnedosa to Yorkton	Yorkton to Saskatoon	Saskatoon to Lloydminster	Lloydminster to Edmonton	Edmonton to Jasper
209.5	257.9	341.7	274.3	247.8	360.4

Did You Know?

An odometer is a device for measuring the distance travelled in a vehicle.

Ashley and Marshall each use the odometer readings to **estimate** the distance from Winnipeg to Jasper.

estimate
- to approximate an answer

Odometer Distance (km)	Estimate of Distance Winnipeg to Jasper (km)	
	Ashley	Marshall
209.5	200	200
257.9	300	200
341.7	300	300
274.3	300	200
247.8	200	200
360.4	400	300
Total	1700	1400

1. How do you think Marshall estimated his answer? Explain.

2. It is helpful to know if an estimate is an **overestimate** or an **underestimate** of the actual answer. Is Marshall's estimate more or less than the actual distance from Winnipeg to Jasper? Show how you know, without calculating the total of the distances.

3. How did Ashley get her estimate?

overestimate
- estimate that is larger than the actual answer

underestimate
- estimate that is smaller than the actual answer

Reflect on Your Findings

4. **a)** Whose estimation method do you prefer? Explain why.

b) What are three examples of applications that involve estimates? Is an overestimate or an underestimate better in each case?

c) If you are budgeting for a vacation, would you want to underestimate or overestimate the costs? Why?

Example 1: Use Estimation to Place the Decimal Point

Place the decimal point in the correct position in the answer to make a true statement.

a) $87.85 + 14.60 + 73.52 = 175970$

b) $\$485.20 + \$38.73 + \$20 + \$785.10 = \$132903$

c) $4189.675 - 1501.941 = 2687734$

Solution

a) ***Method 1: Use Front-End Estimation***

The leading digits 8, 1, and 7 all represent tens.
Think: $80 + 10 + 70 = 160$
The answer closest to 160 is 175.970, or 175.97.

Method 2: Use Relative Size

The leading digits are all in the tens position, so estimate each number to the nearest ten.
87.85 is between 80 and 90, and closer to 90.
14.60 is between 10 and 20, and closer to 10.
73.52 is between 70 and 80, and closer to 70.
Think: $90 + 10 + 70 = 170$
The answer closest to 170 is 175.970, or 175.97.

b) The leading digits do not all have the same place values. Arrange the numbers vertically and align the decimal points.
In this case, the 4 and 7 represent hundreds.
Think: $400 + 700 = 1100$.
The answer closest to 1100 is 1329.03, or $1329.03.

$$\begin{array}{r} \$485.20 \\ \$38.73 \\ \$20.00 \\ +\ \$785.10 \\ \hline \end{array}$$

$20 = $20.00

c) ***Method 1: Use Front-End Estimation***

The leading digits 4 and 1 represent thousands.
Think: $4000 - 1000 = 3000$
The answer closest to 3000 is 2687.734.

Method 2: Use Relative Size

4189.675 is between 4000 and 5000, and closer to 4000.
1501.941 is between 1000 and 2000, and closer to 2000.
Think: $4000 - 2000 = 2000$
The answer closest to 2000 is 2687.734.

Literacy Link

Adding zeros

- Adding zeros after the decimal point does not change the value.
  27.83 = 27.830
- When there are no digits for place values before a number or after a decimal, you can add a zero as a placeholder.
  38.73 → 038.73
  This shows there are 0 hundreds in 38.73.

Show You Know

Without calculating the answer, place the decimal point in the correct position. Show your thinking.

a) $423.6 - 107.2 = 31640$ **b)** $7.85 + 2.06 + 4.123 = 14033$

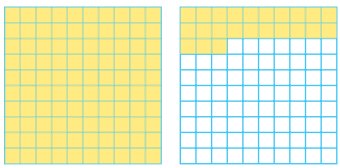
Example 2: Add and Subtract Decimal Numbers

a) Add 1.23 and 1.7.
b) Subtract 0.23 from 0.7.

Solution

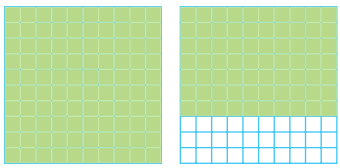
a) ***Method 1: Use Hundreds Grids***

1.23 means 1 and $\frac{23}{100}$.



1.7 means 1 and $\frac{7}{10}$

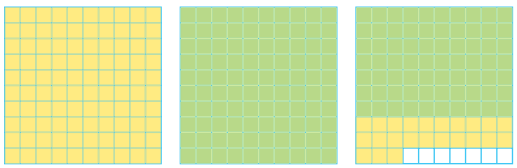
or 1 and $\frac{70}{100}$.



Add the grids.

$1 + 1 + 0.7 + 0.23$
$= 2 + 0.93$
$= 2.93$

So, $1.23 + 1.7 = 2.93$.



Method 2: Use Paper and Pencil

When you add decimal numbers, align the decimal points so that digits with the same place value line up.

$$\begin{array}{r} 1.23 \\ +\ 1.70 \\ \hline 2.93 \end{array}$$

1.7 is the same as 1.70

b) $0.7 - 0.23 = 0.70 - 0.23$

To subtract 3 from 0, you need to regroup or change 1 tenth into 10 hundredths.

Method 1: Use a Place Value Chart

Ones		Tenths	Hundredths
0	•	6	10
0	•	2	3
0	•	4	7

1 tenth (0.1) has the same value as 10 hundredths (0.10)

$0.7 - 0.23 = 0.47$

Method 2: Use Paper and Pencil

$$\begin{array}{r} {\scriptstyle 6\,1} \\ 0.7\not{0} \\ -\ 0.23 \\ \hline 0.47 \end{array}$$

$0.7 - 0.23 = 0.47$

Show You Know

Calculate each answer.

a) $8.04 + 1.839$ **b)** $1.65 - 1.37$

Key Ideas

- There are different ways to estimate the answer to any addition or subtraction question, including front-end estimation and relative size.

Estimate $125 + 476$.

Front-End Estimation:
$100 + 400 = 500$

Relative Size Estimation:
125 is between 100 and 200 but closer to 100.
476 is between 400 and 500 but closer to 500.
$100 + 500 = 600$

- When you add or subtract decimal numbers, align the decimal points, then add or subtract digits with the same place value.

$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 41.65 \\ 9.4 \\ +\ 0.365 \\ \hline 51.415 \end{array} \qquad \begin{array}{r} {\scriptstyle 1\,\;1\,\;7\,1} \\ 24.869 \\ -\ 9.570 \\ \hline 15.299 \end{array}$$

Communicate the Ideas

1. You have $50 to spend on a class party. As you place items in the grocery cart, should you overestimate or underestimate the cost of each item? Explain your thinking.

2. Is the answer to the following subtraction correct? Use hundreds grids or a place value chart to help explain your reasoning.
$1.6 - 0.46 = 1.26$

3. How is relative size estimation similar to methods you have learned in the past for rounding numbers when estimating? How is it different? Discuss which method you prefer and situations where one method or the other might work better.

Practise

For help with #4 to #7, refer to Example 1 on page 46.

4. Place a decimal point in each sum without calculating. Show your thinking.

a) $62.57 + 28.41 = 9098$

b) $75.83 + 37.9 + 28 = 14173$

c) $631.5 + 902.4 + 217.83 = 175173$

5. Show where the decimal point belongs in each answer without calculating. Explain your thinking.

a) $0.458 + 0.319 + 0.2 = 9770$

b) $\$9.14 + \$6.99 + \$0.49 = \$1662$

c) $296\text{ cm} + 38.7\text{ cm} + 429\text{ cm} = 76370\text{ cm}$

d) $324.4 + 57.5 + 126.8 = 5097$

6. Place a decimal point in each answer without calculating. Show your thinking.

a) $68.4 + 26.8 = 952$

b) $\$335.61 - \$240 = \$9561$

c) $4.831 + 2.765 = 7596$

7. Position the decimal point in the answer without calculating. Show your thinking.

a) $28.3 - 5.19 = 2311$

b) $\$3402.50 + \$4102.05 = \$750455$

c) $627 \text{ m} - 580.9 \text{ m} = 461 \text{ m}$

For help with #8 and #9, refer to Example 2 on page 47.

8. Calculate.

a) $46.1 + 13.27$

b) $105.86 + 47.3 + 10.5$

c) $87.49 - 5.13$

d) $7.8 - 0.64$

9. Calculate.

a) $27.689 - 15.471$

b) $0.317 + 1.4 + 0.38$

c) $\$113.99 + \$25.80 + \$100 + \$23$

10. Replace each ▬ with a number to make each of the following statements true.

a)
$$\begin{array}{r} 12.03 \\ +\ \blacksquare \\ \hline 15.13 \end{array}$$

b)
$$\begin{array}{r} \$117.68 \\ +\ \blacksquare \\ \hline \$120.70 \end{array}$$

c)
$$\begin{array}{r} 1.619 \\ -\ \blacksquare \\ \hline 1.407 \end{array}$$

d)
$$\begin{array}{r} \$870.49 \\ -\ \blacksquare \\ \hline \$630.20 \end{array}$$

Apply

11. Twila is looking at two bicycles.

a) Estimate how much more the blue mountain bike costs before tax.

b) Is your estimate higher or lower than the actual difference in price? How do you know?

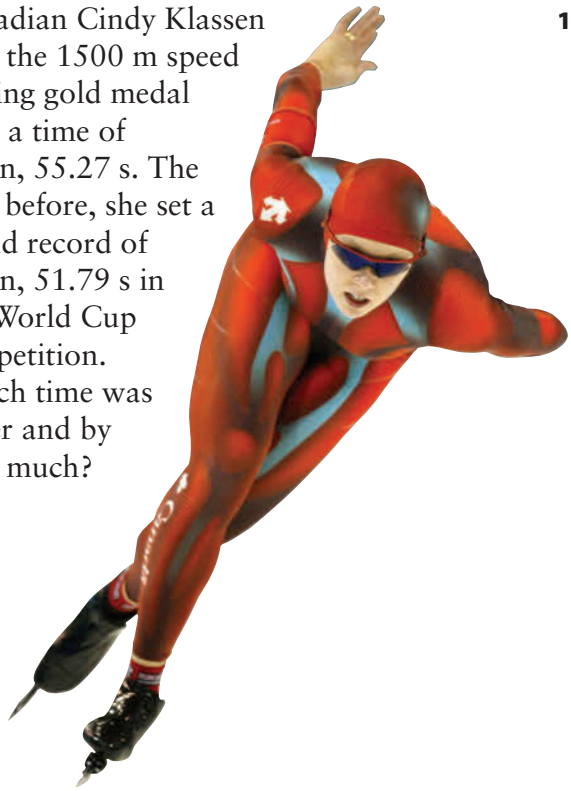
c) How much more does the blue mountain bike cost before tax?

12. At a winter camp, Mary melted three pieces of lake ice for water. The pieces had masses of 5.76 kg, 4.86 kg, and 9.7 kg. How much ice did she melt?

13. A steel bar is cut into five pieces with lengths 37.62 cm, 49.23 cm, 21.5 cm, 76.43 cm, and 45.1 cm. If you ignore the small amount of material that is lost in cutting, how long was the bar?

14. Mechanical pencil leads have widths of 0.3 mm, 0.5 mm, 0.7 mm, or 0.9 mm. How could you lay four leads side by side in order to make a total of exactly 2.0 mm? Give at least three possible answers.

15. Canadian Cindy Klassen won the 1500 m speed skating gold medal with a time of 1 min, 55.27 s. The year before, she set a world record of 1 min, 51.79 s in the World Cup competition. Which time was faster and by how much?



16. In some sports, the lowest score wins. In others, the highest score wins. For each of the following events, which person would win, and by how much? Give a reason for each answer.

Event	Person A	Person B
a) High Jump	1.92 m	1.93 m
b) 100 m Sprint	11.07 s	11.3 s
c) Downhill Skiing	1 min, 46.8 s	1 min, 46 s
d) Decathlon	8454 points	8618 points

17. What number can be added to 23.4 so that the sum is 5.67 less than 51.23?

18. Jason says that $0.75 - 0.5 - 0.25 = 0$. Do you agree? Explain.

19. All of Canada's land area drains into one of four drainage basins. The table shows the approximate sizes of the ocean drainage basins of Canada.

Ocean Drainage Basins in Canada	
Drainage Basin	**Approximate Land Area (in millions of square kilometres)**
Atlantic Ocean	1.52
Hudson Bay, James Bay, Ungava Bay	3.86
Arctic Ocean	3.58
Pacific Ocean	1.03

a) List the drainage basins in order from largest to smallest.

b) Estimate the difference in size between the largest and smallest drainage basin.

c) Estimate the total approximate land area of Canada.

d) Calculate Canada's total land area.

e) Is your estimate larger or smaller than the total? Explain why.

20. Markus purchased three balls for $4.45, $5.99, and $9.60, including tax. He has $20 to pay the bill. Without finding the total, decide whether or not Markus has enough money. Show how you know.

21. Parcel A is heavier than parcel B by 1.5 kg. Parcel C is lighter than parcel B by 2.65 kg. How heavy is parcel A if parcel C is 3.75 kg?

Extend

22. George and Tina go shopping. George has $89.25 and Tina has $96.32. Tina buys a sweater and has $48.17 left. George buys pants and has $33.02 left. Which item was more expensive, the sweater or the pants? How do you know?

23. **a)** Round the difference between 9.83 and 4.18 to the nearest whole number.

b) If you were to use front-end estimation, what would be the new answer?

c) Which answer is more accurate? Explain.

24. You have $25 to spend on school supplies. A flyer shows the following prices.

No tax sale!

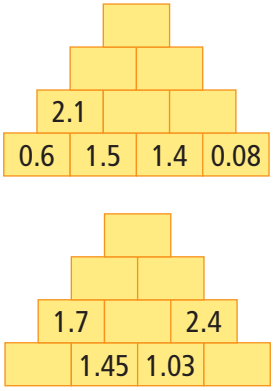
Glue stick	$1.94
Coloured pencils	$7.49
Calculator	$5.77
Pencils	$0.99 per package
Art eraser	$1.87
Ruler	$0.49
3-ring notebook	$1.97
Pencil case	$3.96

a) Show two ways to spend your $25.

b) What is the difference in price between your two plans?

c) Which plan do you prefer? Why?

25. Each square block in the pyramids shown contains the sum of the two square blocks below it.



a) Copy and complete the two pyramids in your notebook.

b) Describe how you filled in the empty blocks in each pyramid. Which blocks did you do first? Which did you do last?

MATH LINK

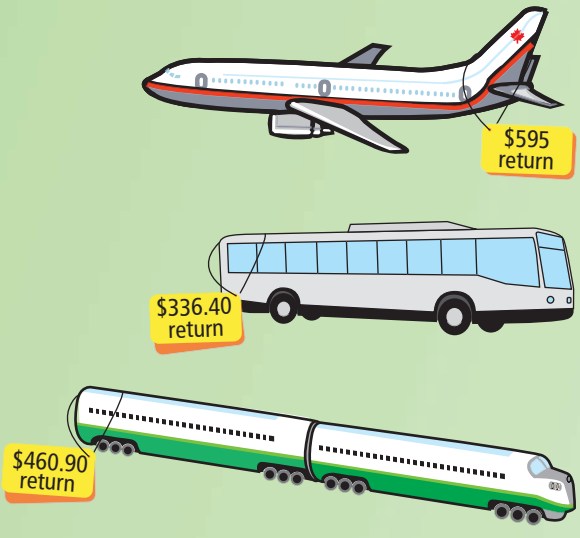
Your grandfather has offered to take you and two of your cousins to the Québec Winter Carnival. You will leave from his home in Brandon, Manitoba.

a) What is the least expensive way to travel to Québec City?

b) What is the difference in cost between that and the most expensive way to travel?

c) What other factors would you think about when you decide how you should travel?

d) What method of transportation do you recommend? How much will it cost for four people to travel this way?



2.2 Multiply Decimal Numbers

Focus on...

After this lesson, you will be able to...

- use estimation to place a decimal point in a product
- multiply decimal numbers with and without a calculator
- solve problems using estimation and multiplication of decimal numbers

Discuss the Math

How can you estimate and calculate products of decimal numbers?

As Ashley and Marshall's family travels along the Yellowhead Highway, they keep busy by solving Sudoku puzzles. During a stop, they look in a convenience store for more puzzles.

Marshall finds Sudoku puzzle books on sale for $1.69 including tax. He wants to buy five books and has $9.00. He asks Ashley to help estimate the total cost of the five puzzle books.

$\$1.69 \times 5 =$ ▬

1. Marshall estimates the total bill as $5.00.

a) How do you think Marshall got his estimate?

b) Is Marshall's estimate over or under the total? How do you know?

2. Ashley estimates the total bill as $10.00.
   a) How do you think Ashley got her estimate?
   b) Is Ashley's estimate over or under the total? How do you know?

Reflect on Your Findings

3. Neither estimate tells for sure whether $9.00 is enough money to buy the five puzzle books.
   a) What is another way to estimate the total bill?
   b) Is $9.00 enough money?
   c) Calculate 1.69×5. How close was your estimate?

WWW Web Link

To learn more about Sudoku puzzles, and to generate some new puzzles to play, go to www.mathlinks7.ca and follow the links.

Did You Know?

Sudoku was invented many hundreds of years ago, and traded around the world by ancient mathematicians!

Each digit from 1 to 9 must occur in
- each row
- each column
- each 3 × 3 square.

		3			7			
		6	1	2	4	3		
2	9			8		1		5
9		5			2			
7			9	4	3			6
			6			9		2
5		8		6			3	4
		4	7	5	1	8		
			4			2		

Example 1: Use Estimation to Place the Decimal Point

Without calculating the answer, place the decimal point in the correct position.

$2.2 \times 1.8 = 3960$

Solution

Use front-end estimation and multiplication.
Think: $2 \times 1 = 2$

The answer closest to 2 is 3.960.

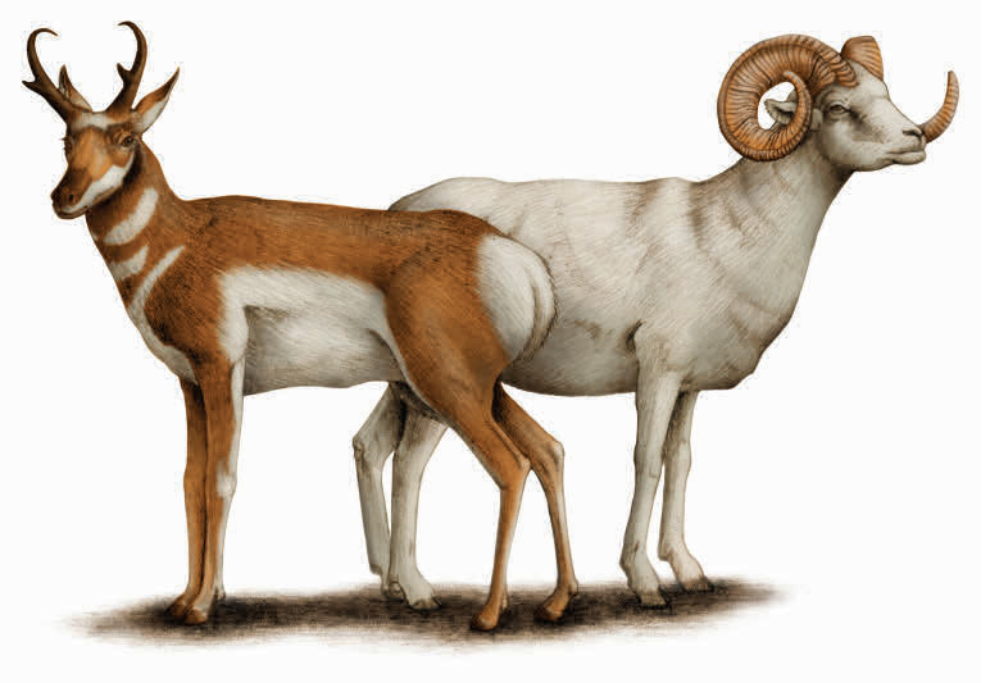
$2.2 \times 1.8 = 3.960$ or 3.96.

Show You Know

Without calculating the answer, place the decimal point in the correct position. Show your thinking.

a) $3.9 \times 5.8 = 22620$
b) $2.57 \times 0.46 = 118220$

Example 2: Multiply Decimals



A pronghorn antelope has a mass of 58 kg. A Dall's sheep has a mass 1.5 times as great as a pronghorn.

a) Estimate the mass of the Dall's sheep.

b) Calculate the mass of the Dall's sheep.

Solution

a) ***Method 1: Use Front-End Estimation***

$1 \times 50 = 50$ underestimate

Method 2: Use Relative Size

1.5 is close to 2.
58 is close to 60.

$2 \times 60 = 120$ overestimate

The mass of the Dall's sheep is between 50 kg and 120 kg.

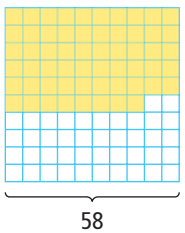
Strategies

Model It

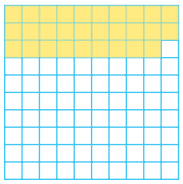
Refer to page xvi.

b) ***Method 1: Use Hundreds Grids***

Model the mass of 1 pronghorn.

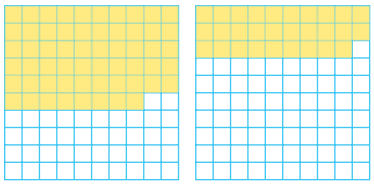


Model the mass of 0.5 pronghorns.

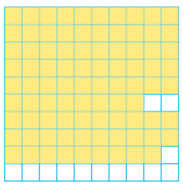


0.5 is the same as $\frac{1}{2}$ or dividing by 2.
50 squares divided by 2 is 25 squares.
8 squares divided by 2 is 4 squares.
Shade 25 + 4 = 29 squares.

Combine the masses of 1 pronghorn and 0.5 pronghorns.



Combine the partially shaded charts.



The mass of the Dall's sheep is 87 kg.

Method 2: Use Paper and Pencil

Multiplying decimal numbers is like multiplying whole numbers and then placing the decimal point using estimation. To multiply 58 × 1.5, first multiply 58 × 15.

$$\begin{array}{r} {\scriptstyle 4} \\ 58 \\ \times 15 \\ \hline 290 \\ 580 \\ \hline 870 \end{array} \quad \begin{array}{l} \\ \\ \\ \leftarrow 58 \times 5 \\ \leftarrow 58 \times 10 \\ \\ \end{array}$$

In part a) the estimate was between 50 kg and 120 kg, so the decimal point must go between the 0 and the 7

The mass of the Dall's sheep is 87 kg.

Show You Know

Estimate, then calculate.

a) 46 × 2.5

b) 64 × 4.5

Example 3: Multiply Decimals Using a Calculator

Tickets to a gala music festival cost $37.50 each. A total of 207 tickets were sold. How much money was collected in ticket sales?

Solution

Estimate 37.50×207.

Front-End Estimation:

$30 \times 200 = 6000$

Relative Size Estimation:

37.50 is between 30 and 40 but closer to 40.

207 is between 200 and 300 but closer to 200.

$40 \times 200 = 8000$

The calculated answer is between the estimates of 6000 and 8000. The answer is reasonable.

Use a calculator.

$37.50 \times 207 = 7762.5$

C 37.50 × 207 = 7762.5

The school made $7762.50 in ticket sales.

Key Ideas

- You can use front-end estimation and relative size to estimate the answer to a multiplication question.

  Estimate 2.65×3.72.

  Front-End Estimation:

  $2 \times 3 = 6$

  Relative Size Estimation:

  2.65 is between 2 and 3, but closer to 3.
  3.72 is between 3 and 4, but closer to 4.
  $3 \times 4 = 12$

- When using a calculator, estimate to make sure your answer is reasonable.

  C 2.65 × 3.72 = 9.85

  The estimates suggest an answer between 6 and 12. The answer 9.858 is reasonable.

- You can multiply decimal numbers the same way you multiply whole numbers and then use estimation to place the decimal point.

  Multiply 1.54×25.

$$\begin{array}{r} {\scriptstyle 1\ \ \ } \\ {\scriptstyle 2\ 2\ } \\ 154 \\ \times\ 25 \\ \hline {\scriptstyle 1\ \ \ } \\ 770 \\ 3080 \\ \hline 3850 \end{array}$$

  $25 \times 1 = 25$
  $25 \times 2 = 50$
  The answer lies between 25 and 50. The decimal point should go between the 8 and the 5.

  The answer is 38.50.

Communicate the Ideas

1. Fancy ribbon sells for $3.20 per metre. You want to buy 2.6 m of the ribbon for a dance costume.

a) Use front-end estimation and one other estimation technique to help find both an underestimate and an overestimate of the cost of the ribbon.

b) Which would be a better estimate of the cost, an underestimate or an overestimate? Explain why.

c) Show how to calculate the actual cost of the ribbon.

2. Michael was putting the decimal in the answer to a multiplication question.

$2.5 \times 4.6 = 115$

He placed the decimal between the two 1s: 1.15. He said that the answer should show hundredths because you are multiplying tenths by tenths. Is his answer correct? Explain your thinking.

Practise

For help with #3 and #4, refer to Example 1 on page 53.

3. Without calculating the answer, place the decimal point in the correct position. Show your thinking.

a) $6.8 \times 12.2 = 8296$

b) $48.6 \times 0.9 = 4374$

4. Without calculating the answer, place the decimal point in the correct position. Show your thinking.

a) $4.7 \times 8.8 = 4136$

b) $11.2 \times 3.4 = 3808$

For help with #5 and #6, refer to Example 2 on pages 54–55.

5. Estimate and then calculate.

a) 1.75×3

b) 12.8×0.2

c) 396×1.5

d) 13.8×2.5

6. Estimate and then calculate.

a) 68×3.5

b) 3.6×2.7

c) 270×0.1

d) 46×8.5

For help with #7 and #8, refer to Example 3 on page 56.

7. Estimate and then use a calculator to determine each answer.

a) 3.89×565

b) $\$13.45 \times 478$

c) 7.05×2.24

8. Estimate and then use a calculator to determine each answer.

a) $\$4.49 \times 194$

b) 2.75×2.62

c) 73.9×25.3

Apply

9. An Alaskan malamute dog has a mass of 39 kg. A Newfoundland dog has a mass 1.8 times that amount. What is the mass of the Newfoundland dog?

10. The cost of tickets for a concert was $16.75. The number of tickets sold for a performance was 468. How much money was collected on ticket sales?

11. Renata runs 5.7 km per day. How far will she run in the month of January?

12. An electrical contractor charges $65 per hour. How much does he earn when he works for 4.75 h?

13. $32 \times 86 = 2752$. Use what you know about place values to find each of the following products without multiplying.

a) $3.2 \times 86 =$ ■

b) $32 \times 8.6 =$ ■

c) $0.32 \times 86 =$ ■

d) $0.32 \times 8.6 =$ ■

e) $3.2 \times 8.6 =$ ■

14. Copy and complete the following pattern. Then describe how the position of the decimal point changes.

$3 \times 100 =$ ■
$3 \times 10 =$ ■
$3 \times 1 = 3$
$3 \times$ ■ $= 0.3$
$3 \times$ ■ $= 0.03$
$3 \times 0.001 =$ ■

15. **a)** Copy and complete each multiplication statement.

$4.65 \times 10 =$ ■
$37 \times 100 =$ ■
$0.58 \times 1000 =$ ■

b) When multiplying by a number greater than 1, should the answer be larger or smaller than the original number?

c) Write a rule that describes how to multiply by 10, 100, or 1000.

16. **a)** Copy and complete each multiplication statement.

$3.0 \times 0.1 =$ ■
$4.5 \times 0.01 =$ ■
$0.345 \times 0.001 =$ ■

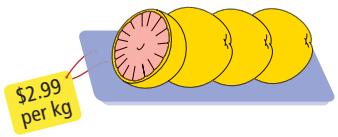
b) When multiplying by a number less than 1, should the answer be larger or smaller than the original number?

c) Write a rule that describes how to multiply by 0.1, 0.01, or 0.001.

17. What is the cost of each purchase before tax?

a) 5 large juice bottles

b) 4 kg of grapefruit

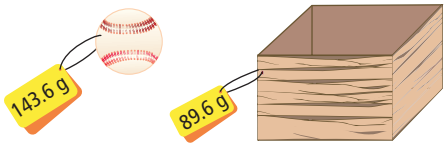


18. A certain golf ball has a mass of 45.4 g. The packaging that holds 12 balls has a mass of 57.1 g.

a) Estimate the total mass of a package with 12 balls. How did you estimate?

b) Calculate the total mass of the package and balls.

19. One baseball has a mass of 143.6 g. The empty shipping box has a mass of 89.6 g. What is the mass of a box of 8 baseballs?



Extend

20. Tamara earns $9.25 per hour at her part-time job in the grocery store. The table gives the times she worked last week.

Day	Hours Worked
Monday	3:30 p.m.–8:00 p.m.
Tuesday	3:30 p.m.–8:00 p.m.
Friday	3:00 p.m.–9:45 p.m.
Saturday	8:00 a.m.–4:00 p.m.

a) How many hours did Tamara work last week?

b) How much did she earn last week?

21. Each side of a square is 13.6 cm long. The length of a rectangle is three times as long as the side of the square. The width of the rectangle is twice as long as the side of the square.

a) Determine the perimeter of the rectangle.

b) Compare your method with a classmate's. What is the shortest way to calculate the answer?

MATH LINK

Your dance group has been asked to perform as part of a cultural festival. Twelve dancers and two dance coaches will attend. Your group will eat lunch at the community centre cafeteria.

Your group has $98 for lunches. How will you spend the money? Show at least two different plans. Include estimates and calculations of the final cost.

Special		**Drinks**	
Stir fry	$5.00	250 mL milk	$0.90
Sandwiches		500 mL milk	$1.75
Egg salad	$2.50	500 mL water	$1.25
Grilled cheese	$3.25	250 mL juice	$1.50
Tuna melt	$3.50	**Other**	
Roast beef	$3.45	Apple or banana	$0.75
Salads		Orange	$0.90
Garden salad	$2.15	Corn chips	$0.95
Caesar salad	$3.50	Fries	$1.95
		Rice and veggies	$2.70

Prices include tax.

2.3 Divide Decimal Numbers

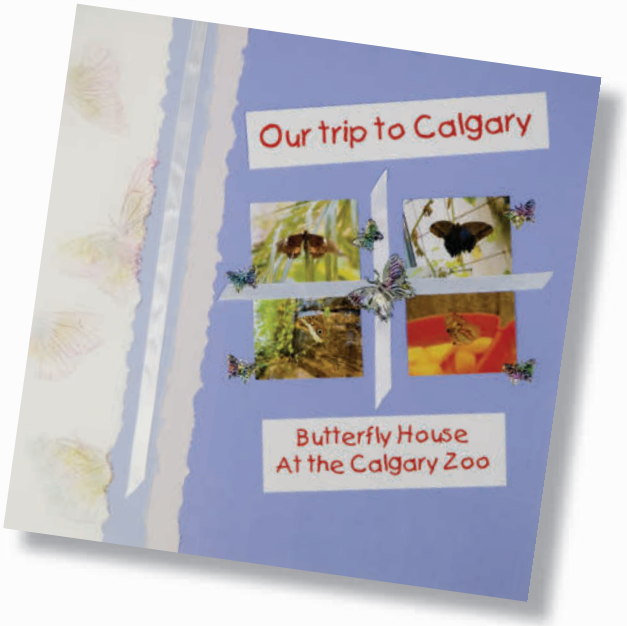
Focus on...

After this lesson, you will be able to...

- ❑ use estimation to place a decimal point in a quotient
- ❑ divide decimal numbers with and without a calculator
- ❑ solve problems using estimation and division of decimal numbers

Scrapbooking is a popular hobby that uses coloured paper, stickers, ribbon, and other decorations to create attractive displays of photographs.

Scrapbookers often buy multiple quantities of certain decorations. How might a scrapbooker decide how many items he or she can afford to buy?



Explore the Math

How can you estimate and calculate quotients of decimal numbers?

Materials

- base 10 blocks or hundreds grids

You and your best friend have entered a scrapbooking competition and are planning what supplies to buy. Glitter pens are $0.40 each. You have $6.

1. How many pens do you think you can you buy with $6?

2. Use base 10 blocks or hundreds grids to model the number of $0.40 pens in $6.

3. How many pens can you purchase?

Reflect on Your Findings

4. a) How can you use estimation to help you divide decimal numbers?
   b) How can a model help you divide decimal numbers?

Example 1: Use Estimation to Place the Decimal Point

Without calculating the answer, place the decimal point in the correct position.

a) $15.4 \div 3.6 = 427778$

b) $4.4 \div 0.42 = 1047619$

Solution

a) Use front-end estimation and division.

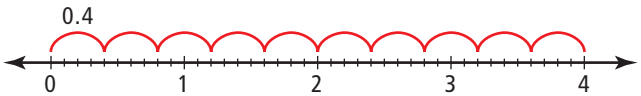
Think: $15 \div 3 = 5$

The answer closest to 5 is 4.27778.

b) Use a number line.

Think: $4 \div 0.4$

Show how many times 0.4 goes into 4.



It takes 10 jumps of 0.4 to reach 4.
The answer closest to 10 is 10.47619.

Literacy Link

Understanding Division

A division statement such as $6 \div 2 = 3$ means that in 6 there are 3 groups of 2.

●● ●● ●●

Show You Know

Without finding the answer, place the decimal point in the correct position. Show your thinking.

a) $20.1 \div 4.7 = 42766$

b) $3.5 \div 0.213 = 164319$

Example 2: Divide Decimals

Four friends buy 1.36 L of pure orange juice and divide it equally.

a) Estimate each person's share.

b) Calculate each person's share.

Solution

a) To estimate, round 1.36 L to a number that is easier to work with.

4 divides evenly into 12 and 16. Round 1.36 to 1.2 or to 1.6.

Try 1.2.
$1.2 \div 4 = 0.3$ underestimate

Try 1.6.
$1.6 \div 4 = 0.4$ overestimate

12 ÷ 4 = 3, so 1.2 ÷ 4 must be 0.3

16 ÷ 4 = 4, so 1.6 ÷ 4 must be 0.4

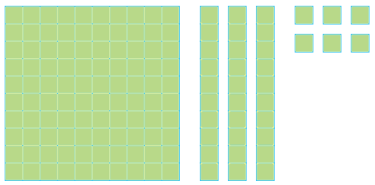
The answer is between 0.3 L and 0.4 L of juice per person.
The answer should be closer to 0.3 because 1.36 is closer to 1.2 than to 1.6.

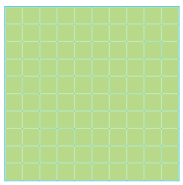
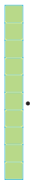
Strategies
Model It
Refer to page xvi.

b) ***Method 1: Use Base 10 Blocks or Diagrams***

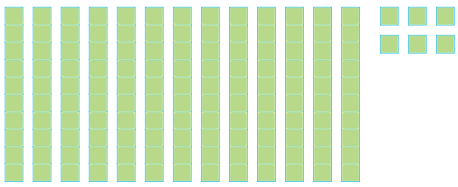
Let a hundreds flat represent 1.

1.36 can be shown as

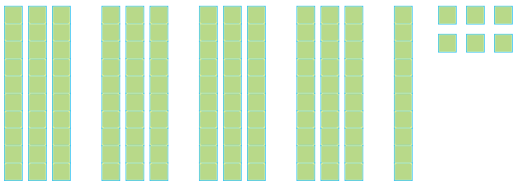


Since  cannot be divided by 4, exchange it for 10  .

1.36 is now represented by 13 tenths + 6 hundredths.

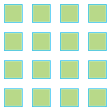


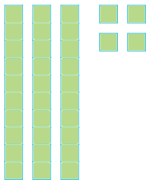
Begin to divide the materials into 4 groups.



Exchange  for 10 .

There are now 16 ones left over.
$16 \div 4 = 4$



Each of the four groups contains 

So, 1.36 L divided by 4 is 0.34 L of juice.
This agrees with the estimate of between 0.3 L and 0.4 L.

Method 2: Use Paper and Pencil

Divide decimal numbers the same way as you divide whole numbers.
Then, use estimation to place the decimal point.

$$
\begin{array}{r}
34 \\
4\overline{)136} \\
\underline{120} \quad \leftarrow 30 \times 4 \\
16 \\
\underline{16} \quad \leftarrow 4 \times 4 \\
0
\end{array}
$$

Each person gets 0.34 L of juice.

In part a) the estimate was between 0.3 and 0.4. The decimal point should go before the 3.

Show You Know

Estimate, then calculate each answer. Show your thinking.

a) $40.5 \div 5$

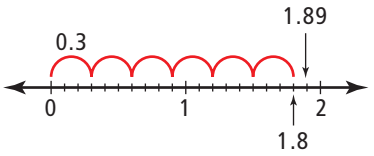
b) $57.9 \div 3$

Example 3: Divide Decimals Using a Calculator

Fran is curious to know how many 0.295 L cans of juice would be in a large bottle containing 1.89 L. Estimate and then calculate the answer.

Solution

The division statement is $1.89 \div 0.295$.
To estimate, place 1.89 on a number line.



0.295 is close to 0.300, or 0.3, so make jumps of 0.3.

It takes 6 jumps to get close to 1.89.
The answer is close to 6 cans of juice.

To calculate, use a calculator.

$1.89 \div 0.295 \approx 6.4$ **C 1.89 ÷ .295 =** 6.406779661

There are approximately 6.4 cans of juice in the 1.89 L bottle of juice.

Literacy Link

Reading ≈
The symbol ≈ means "is approximately equal to."

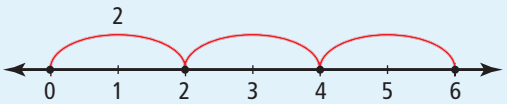
Key Ideas

- There is more than one way to estimate the answer to a division problem.

  Estimate $4.6 \div 2.5$

  Front-End Estimation:
  $4 \div 2 = 2$

  Number Line Estimation:



  $4 \div 2 = 2$ underestimate
  $6 \div 2 = 3$ overestimate

- When using a calculator, estimate to make sure your answer is reasonable.
  C 23.68 ÷ 3.2 = 7.4

  $21 \div 3 = 7$
  $24 \div 3 = 8$
  The estimates suggest an answer between 7 and 8. The answer 7.4 is reasonable.

- You can divide decimal numbers the same way you divide whole numbers, and then use estimation to place the decimal point.

  Divide $26.5 \div 5$.

$$\begin{array}{r} 53 \\ 5\overline{)265} \\ \underline{250} \quad \leftarrow 50 \times 5 \\ 15 \\ \underline{15} \quad \leftarrow 3 \times 5 \\ 0 \end{array}$$

  $25 \div 5 = 5$
  The answer is around 5. The decimal point goes between the 5 and the 3.

  The answer is 5.3.

Communicate the Ideas

1. Donna was asked to place the decimal point in this question:

$76.86 \div 8.4 = 915$

She showed the answer as 91.5.
Did Donna place the decimal point in the correct place? Explain.

2. Jeremy and Bess want to find an overestimate and an underestimate of $5.28 \div 0.3$. Show how they could do this.

3. Make up a problem that involves the division of decimal numbers. Make sure you can solve your problem. Trade problems with a classmate and try to solve each other's problem.

Practise

For help with #4 and #5, refer to Example 1 on page 61.

4. Without calculating the answer, place the decimal point in the correct position. Show your thinking.

a) $36.72 \div 30 = 1224$

b) $5.92 \div 0.4 = 148$

5. Without calculating the answer, place the decimal point in the correct position. Show your thinking.

a) $64.8 \div 0.8 = 810$

b) $5.94 \div 6 = 99$

For help with #6 to #7, refer to Example 2 on pages 62–63.

6. Estimate the answer for each of the following. Then, calculate the answer.

a) $22.5 \div 6$ **b)** $4.56 \div 0.8$

c) $3.4 \div 0.4$ **d)** $3.5 \div 0.5$

7. Estimate the answer for each of the following. Then, calculate the answer.

a) $97.02 \div 7$

b) $59.52 \div 0.8$

c) $36.848 \div 4$

d) $5.958 \div 0.9$

For help with #8 and #9, refer to Example 3 on page 64.

8. Estimate each answer, and then use a calculator to determine each answer.

a) $28.6 \div 5.2$

b) $3.168 \div 0.64$

c) $119.04 \div 128$

9. Estimate each answer, and then use a calculator to determine each answer.

a) $9.18 \div 3.2$

b) $768.4 \div 89.1$

c) $392.94 \div 4.5$

Apply

10. A package of 7 fish hooks costs $17.99. How much will one fish hook cost?

11. Milo wants to find how many 355 mL cans of juice are in a 2-L bottle.
Hint: 355 mL is equal to 0.355 L.

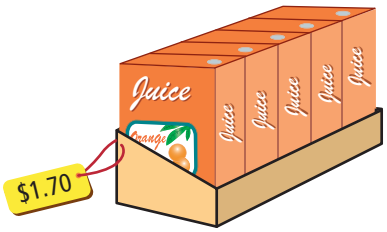
a) Show Milo how to estimate the answer.

b) Show Milo how to calculate the answer.

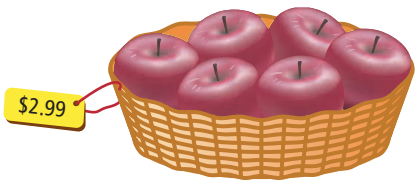
12. A contractor charged $398.75 to move the gravel for a garden. The contractor charges $72.50 per hour. How long did she work? Estimate, then calculate the answer.

13. What is the cost for one item? Round each answer to the nearest cent.

a) 5 juice boxes for $1.70



b) 6 apples for $2.99



14. **a)** Copy and complete the pattern.

$3 \div 100 =$ ■
$3 \div 10 = 0.3$
$3 \div 1 =$ ■
$3 \div 0.1 = 30$
$3 \div 0.01 =$ ■
$3 \div 0.001 = 3000$

b) Describe how the position of the decimal point changes.

15. **a)** Copy and complete each division statement.

$4.65 \div 10 =$ ■
$37 \div 100 =$ ■
$0.58 \div 1000 =$ ■

b) When you divide by a number greater than 1, is the answer larger or smaller than the original number?

c) Write a rule that describes how to divide by 10, 100, or 1000.

16. **a)** Copy and complete each division statement.

$40 \div 0.1 =$ ■
$1.45 \div 0.01 =$ ■
$0.524 \div 0.001 =$ ■

b) When you divide by a number less than 1, is the answer larger or smaller than the original number?

c) Write a rule that describes how to divide by 0.1, 0.01, or 0.001.

17. A package of loon sculptures has a mass of 1.7 kg. The box and wrapping have a mass of 0.5 kg.

a) What is the total mass of the loon sculptures without the box and wrapping?

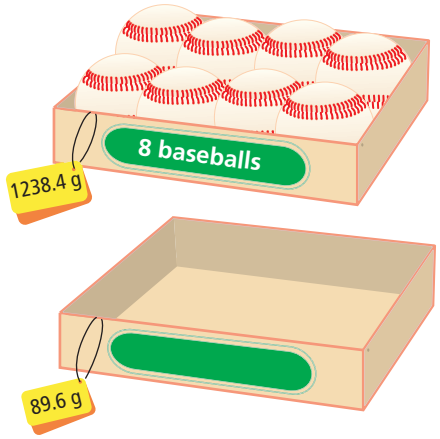
b) There are 12 loon sculptures in the box. What is the mass of each sculpture?

18. An package of 500 sheets of paper has a measured height of 51.5 mm.

a) Estimate the thickness of one sheet of paper.

b) Is the actual thickness of a sheet of paper greater or less than your estimate? Explain how you know.

19. A box of 8 baseballs has a total mass of 1238.4 g. If the empty box has a mass of 89.6 g, what is the mass of one baseball?



Extend

20. How many sheets of paper will it take to form a pad 2 cm thick if each sheet has a thickness of 0.08 mm?

21. The hours of business for a convenience store are displayed on the sign. The total revenue for the week is $10 585.

Store Hours	
Mon.–Tues.	9:30 a.m.–10:00 p.m.
Wed.	Closed
Thurs.–Sat.	9:00 a.m.–10:30 p.m.
Sun.	10:00 a.m.–5:30 p.m.

a) How many hours is the store open in a week?

b) What is the average revenue per hour?

c) What is the average revenue per day?

22. Kyle is entered in a snowmobile race. He has to do 5 laps on a 6.37-km course. His time for each lap is 1.35 min, 1.27 min, 1.23 min, 1.37 min, and 1.22 min.

a) How long does it take him to do the 5 laps?

b) What is his average speed? Round your answers to the nearest hundredth.

MATH LINK

You have saved $70 from work you did for a neighbour and plan to spend it doing some of the following things.

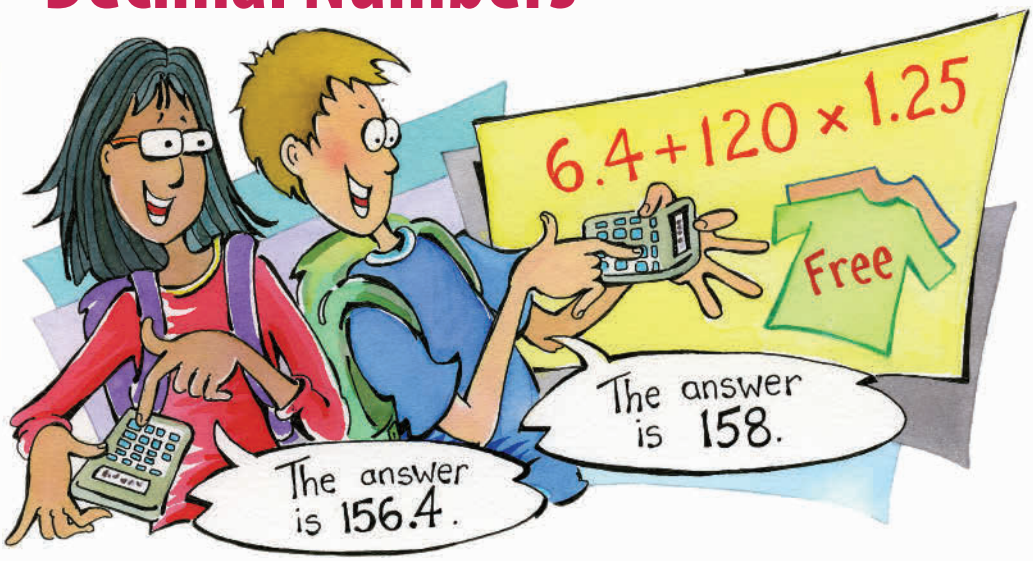
Outline how you plan to spend your $70. Use addition, subtraction, multiplication, and division of decimals to show your plan. Show at least three different ways to spend the money.

2.4 Order of Operations and Decimal Numbers

Focus on...

After this lesson, you will be able to...

- use the order of operations with decimal numbers
- solve problems using operations on decimals to the thousandths place



Carrie and Brendan visit a store in a mall after school. They are each offered a free T-shirt if they can correctly answer a skill-testing question.

Discuss the Math

How can you use the order of operations to solve problems with decimal numbers?

1. Look at the question and what each student answered. Who do you think will win a free T-shirt? Why?

2. Try the skill-testing question yourself. Whose answer do you agree with?

3. In mathematics, there is an agreed upon **order of operations**. Any operations that appear in brackets are performed first. Rewrite the skill-testing question using brackets to show how to get answers of 158 and 156.4.

order of operations

- brackets first
- multiply and divide in order from left to right
- add and subtract in order from left to right

Reflect on Your Findings

4. a) Some scientific and graphing calculators have the correct order of operations built-in, but others do not. Whose calculator follows the correct order of operations, Carrie's or Brendan's?
   b) Why is it important to have a specific order of operations?
   c) Why is it helpful to insert brackets in an expression?

Literacy Link

Brackets are also known as parentheses.

Example 1: Use the Order of Operations

The Edwards family filled up their van with 74.2 L of regular gasoline at a cost of 112.9¢/L. They also bought 4 drinks at $1.69 each and 2 ice-cream bars for $1.39 each.

a) What was the total bill before tax?

b) Write a single mathematical expression to show how to calculate the answer. Use a calculator to find the value of your expression.

To change cents to dollars, divide by 100.
112.9¢ = $1.129

Solution

a) Calculate each cost separately.

Item	Calculation	Cost
Gasoline	74.2 × $1.129	$83.77
Drinks	4 × $1.69	$6.76
Ice cream	2 × $1.39	$2.78
Total		$93.31

Strategies
Use a Table
Refer to page xvii.

b) Total Cost = 74.2 × $1.129 + 4 × $1.69 + 2 × $1.39

C (74.2 × 1.129) + (4 × 1.69) + (2 × 1.39)
= 93.3118

Some calculators do not have the order of operations built-in. Using the bracket keys helps to make sure that the calculation is correct.

Example 2: Apply the Order of Operations

a) This statement is missing a "+" and a "÷" sign. Where should the operations go to make the statement correct?

5.2 ■ 4 ■ 2.1 = 3.4

b) Write a problem that could be solved using your statement.

Solution

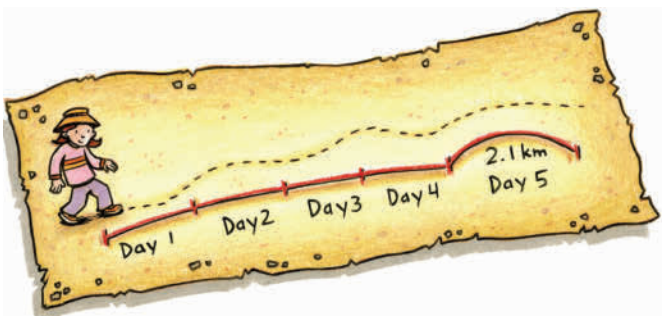
a) There are two possibilities to test.

5.2 + 4 ÷ 2.1	Divide first.	5.2 ÷ 4 + 2.1	Divide first.
= 5.2 + 1.9	Add.	= 1.3 + 2.1	Add.
= 7.1		= 3.4	

Strategies
Guess and Check
Refer to page xvi.

The correct statement is 5.2 ÷ 4 + 2.1 = 3.4.

b) Here is one possible story.
Sangeeta walks the same distance on each of 4 days for a total of 5.2 km.
Then she walks 2.1 km on the fifth day.
How far did Sangeeta walk on days 4 and 5?



Key Ideas

- The order of operations is used with operations that involve decimals.

The order of operations is as follows:
- Do the work in brackets first.
- Multiply and divide in order from left to right.
- Add and subtract in order from left to right.

$$
\begin{aligned}
&(0.75 - 0.5) \times (4.2 \div 0.6) + 7.3 - 1.2 && \text{Brackets.}\\
&= 0.25 \times 7 + 7.3 - 1.2 && \text{Multiply.}\\
&= 1.75 + 7.3 - 1.2 && \text{Add.}\\
&= 9.05 - 1.2 && \text{Subtract.}\\
&= 7.85
\end{aligned}
$$

- Brackets can be used to change the order of operations.

$$
\begin{aligned}
&9.1 \times 2 + 7.5 \div 2.5 && \text{Multiply and divide}\\
&= 18.2 + 3 && \text{Add.}\\
&= 21.2
\end{aligned}
$$

$$
\begin{aligned}
&9.1 \times (2 + 7.5) \div 2.5 && \text{Brackets.}\\
&= 9.1 \times 9.5 \div 2.5 && \text{Multiply and divide.}\\
&= 86.45 \div 2.5\\
&= 34.58
\end{aligned}
$$

Communicate the Ideas

1. Annie has been asked to calculate $1.7 + 6 \div 2$. She claims the answer is 3.85. Do you agree? Explain why or why not.

2. Put brackets in the following expression to get the largest value possible. What problem solving strategy did you use?

$3 \times 2.8 + 6.4 \div 4$

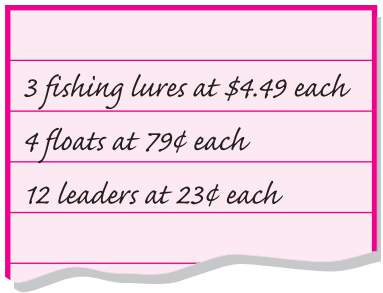
3. Create a problem that could be solved using the following expression.

$2.5 + 1.25 + 5 \times 1.6$

Practise

For help with #4 and #5, refer to Example 1 on page 69.

4. Jens wanted to go fishing. He went to the store and purchased the following items.



a) What was the total bill before tax?

b) Write a mathematical expression to show how to calculate the total bill before tax. Use a calculator find the value of your expression.

5. Sara bought a fruit smoothie each day of the week for one week. She bought a medium smoothie on Tuesday and a large one on Saturday. On each of the other days, she bought small smoothies.

a) How much did she spend on smoothies during the week?

b) Write a mathematical expression that shows how to find the total cost of her smoothies for the week. Use a calculator to solve your expression.

For help with #6 and #7, refer to Example 2 on page 69.

6. Where should the two operations shown in square brackets be placed to make each statement true? Rewrite each statement with the correct operations.

a) 6 ■ 2.5 ■ 0.1 × 3 = 14.7 [−, ×]

b) (4 ■ 1.79) ■ 3 + 1.5 = 3.43 [÷, +]

c) (8.1 ■ 3.2) ■ 2 = 22.6 [+, ×]

d) 4.2 ■ 2 ■ 0.5 = 1.6 [−, ÷]

7. Where should the two operations shown in square brackets be placed to make each statement true? Rewrite each statement with the correct operations.

a) 12.4 ■ 3.1 ■ 1.7 = 2.3 [−, ÷]

b) (4.5 ■ 1.1) ■ 6.7 = 22.78 [−, ×]

c) 23.5 ■ 6.3 − 7.6 ■ 2.5 = 10.8 [+, ×]

d) 4.1 ■ (3.6 ÷ 0.9) ■ 12.4 = 28.8 [+, ×]

Apply

8. a) Make up a problem that could be solved using the following expression.

$3 \times 1.5 - 2 \times 1.25$

b) What is the value of the expression?

9. What are the missing numbers?

a) ■ + 4.8 × 41 = 200

b) 4.5 ÷ 5 + ■ = 3

c) 4 × ■ − 0.6 ÷ 2 = 2.5

10. Fill in the numbers 0.5, 0.1, 1, and 5 to make the statement true. Use each number only once.

■ + ■ − ■ × ■ = 1

11. Ruben wants to earn $155 this week. His part-time job pays $7.75 per hour. How many hours must he work?

12. Joanne travels a total of 5.8 km going to and from school each day. She goes to school for 189 days per year. What is the total distance she travels back and forth to school each year?

13. Charlene bought two items for a total of $56.89 before tax. One of the items cost $21.94. What was the cost of the other item?

14. A tournament volleyball game is sold out. Ticket prices are shown.

Volleyball Admission
Adults: $3.25
Students: $1.50

a) If 80 adults and 120 students attend the game, what is the total admission collected?

b) Show your calculator key sequence for finding the total admission.

c) The expenses for the volleyball game include 3 game officials at $50 each and 2 security guards at $65 each. What are the total expenses for the game?

d) How much profit will the school make?

15. A local store is having a sale on art supplies. Sam bought 4 sheets of posterboard, 3 erasers, and 5 pencils.

a) Estimate Sam's total cost before tax. Is your estimate high or low? Explain how you know.

b) What was the total cost before tax?

16. The table shows how long it takes each planet to orbit the sun.

Planet	Approximate Time to Orbit the Sun
Mercury	0.241 years
Venus	0.616 years
Earth	1.0 year or 365.25 days
Mars	687 days
Jupiter	4332 days
Saturn	29.5 years

a) Which planet takes about 2 years to orbit the sun? Show how you know.

b) How many of our years does it take Jupiter to orbit the sun? Give your answer to the nearest hundredth.

c) How many times does Mercury orbit the sun in a year? Give your answer to the nearest thousandth.

d) Describe how you could estimate the answer in c).

Did You Know?

Earth orbits the sun in approximately 365.25 days. This gives an extra day, February 29, every 4 years. A 366-day year is called a "leap year."

17. In 2005 Bill Gates was the richest man for the eleventh year in a row, with an estimated $46.5 billion U.S. In that same year, Canada's three wealthiest people were:

Kenneth Thompson	$17.2 billion U.S.
Galen Weston	$7.7 billion U.S.
Jeff Skoll	$6.6 billion U.S.

a) What is the sum of the estimated wealth of the 3 top-ranked Canadians?

b) What is the difference in the estimated wealth of Bill Gates and the total of the 3 top Canadians?

c) About how many times as great as Jeff Skoll's is Bill Gates' estimated wealth? Round your answer to the nearest hundredth.

Did You Know?

Jeff Skoll is the Canadian-born co-founder of eBay.

18. Add brackets to make each statement true.

a) $7 + 30 \times 0.5 = 18.5$

b) $6 + 3 \times 0.2 + 0.4 \div 2 - 1 = 2.2$

19. Add brackets to the expression $80 \div 0.4 + 6 \times 0.3$ to get the following answers.

a) 201.8 **b)** 3.75

20. The Eagle Health Club increased its membership this year by 89 people. There were 567 members last year.

a) How many members are there this year?

b) If a membership costs $189.95 per year, estimate this year's revenue from membership fees.

21. Cecil, Kent, and Laura go to the Quickstop for lunch. Cecil orders a chicken burger and a salad. Kent and Laura order small pizzas. Kent also has a salad and Laura has an ice cream.

Chicken burger	$5.49
Side salad	$3.50
Small pizza	$4.59
Ice cream	$1.50

a) How much does it cost each person for lunch?

b) How much does lunch cost altogether?

c) What is the shortest way to determine the total cost?

Extend

22. After a 2005 earthquake, 11 410 kg of rice were distributed in 3260 bags to families in the damaged area.

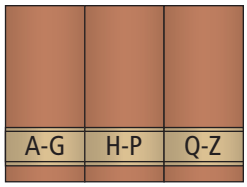
a) How many kilograms of rice were in each bag, if the bags were the same size?

b) If a family used 0.25 kg per day, how many days would 1 bag of rice last?

23. A small car rental company in Saskatoon has four employees: Jeanne, Alice, Fatek, and Larry. The employees are paid by the hour. Each employee is paid a different hourly rate: $7.75, $10.50, $15.25, and $17. This week they worked 50 h, 45 h, 42 h, and 18 h. Use the following clues to match each employee with their hourly wage and the number of hours worked this week. Then, determine each employee's weekly wage.

- This week Larry worked the greatest number of hours.
- Fatek earns the least amount of money per hour.
- Alice worked less than 45 h this week.
- Jeanne earns less than $17 per hour.
- Fatek had the smallest amount of pay for the week.
- The employee who worked 50 h this week worked 59 h last week. Last week, that employee earned $137.25 more than he/she earned this week.

24. Three books stand on a bookshelf as shown. A bookworm starts at page 1 of the first book and chews a straight path to the last page of the third book. If the thickness of each book cover is 3.2 mm and the thickness of each book's pages is 4.5 cm, how far does the bookworm travel?



2 Chapter Review

Key Words

For #1 to #4, choose the letter representing the term that best matches each statement.

1. The accepted order for finding the value of math expressions
2. An estimate that is larger than the answer
3. An estimate that is smaller than the answer
4. To approximate an answer

A estimate
B overestimate
C underestimate
D order of operations
E calculate

2.1 Add and Subtract Decimal Numbers, pages 44–51

5. Without finding the answer, place the decimal point in the correct position. Show your thinking.
   a) $0.8 + 8.8 + 0.88 + 88 = 9848$
   b) $368.2 - 89.57 = 27863$
   c) $29.563 + 13.2 - 8.69 = 34073$

6. Estimate, then calculate.
   a) $4.6 + 2.35$
   b) $8.6 - 3.9$
   c) $7.5 + 1.36$
   d) $9.12 - 3.5$
   e) $2.5 + 6.8 - 4.5 - 2.7$
   f) $6.5 - 3.6 - 0.123$

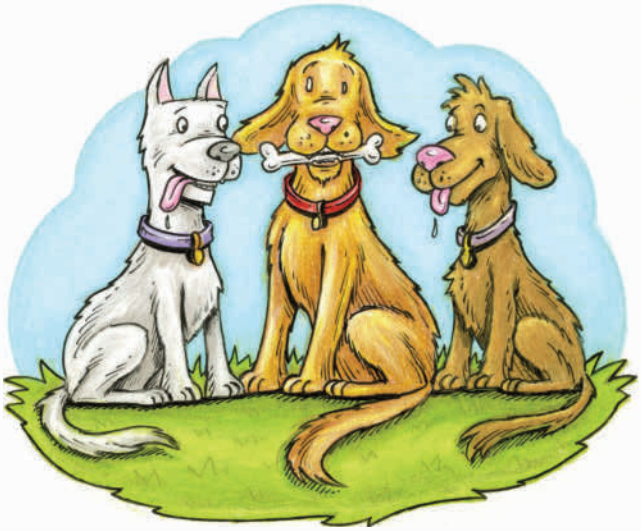
7. Replace each ▬ with a number to make the statement true.

   a) $75.86 - \blacksquare = 36.91$

   b) $\blacksquare + 235.79 = 983.245$

   c) $435.6 + \blacksquare + 32.8 + 179.04 = 703.52$

8. Jordan has three dogs. Max has a mass of 28.2 kg. Sam is 3.15 kg heavier than Max. The smallest dog, Lucy, is 1.8 kg lighter than Max. What is the total mass of the three dogs?



2.2 Multiply Decimal Numbers, pages 52–59

9. Without finding the answer, place the decimal point in the correct position.
   a) $4.5 \times 1.5 = 675$
   b) $4.23 \times 1.9 = 80370$
   c) $29.6 \times 63.8 = 188848$

10. Estimate the answer to 7.56×0.7. Explain how you found your estimate. Then, find the answer correct to 1 decimal place.

11. A kitten has a mass of 1.5 kg. A large cat has a mass 3.8 times that amount. What is the mass of the large cat?

12. Ken shipped 125.4 kg of ice skates to his brother in Nunavut. The shipping company charged $4.25 per kilogram to ship the skates. How much did Ken have to pay in shipping costs?

2.3 Divide Decimal Numbers, pages 60–67

13. Without calculating the answer, place the decimal point in the correct position. Show your thinking.

a) $28.4 \div 0.4 = 7100$

b) $39.75 \div 7.5 = 530$

c) $251.472 \div 9.3 = 2704$

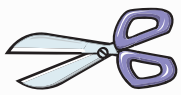
14. Estimate each answer, and then use a calculator to determine each answer.

a) $174.24 \div 3.2$

b) $656.82 \div 17.8$

c) $199.92 \div 8.4$

15. Isobel bought a ball of string. She found that she could cut it into either 5 or 9 equal pieces without a remainder. If she cuts it into 5 equal pieces, each piece is 3.69 m long. What is the length of each piece if she cuts the string into 9 equal pieces?



16. Eight equally spaced holes are to be drilled in a board as shown in the diagram. What is the distance centre-to-centre between adjacent holes? Express your answer to the nearest tenth of a millimetre.

2.4 Order of Operations and Decimal Numbers, pages 68–73

17. What is the value of each expression?

a) $2.4 - 0.6 \div 2 + 0.3 \times 2$

b) $7.64 - 7.15 \div (1.3 \times 5) + 28.67$

c) $85 \div (1.3 + 7.2) + 4.1 \times 3$

18. Where should the two operations shown in square brackets be placed to make each statment true? Rewrite each statement with the correct operations.

a) $3.6 \blacksquare 8.2 \blacksquare 4 = 5.65$ $[+, \div]$

b) $4.9 \blacksquare 7.2 \blacksquare 0.1 = 4.18$ $[-, \times]$

c) $62.32 \blacksquare (10.1 \blacksquare 2.5) = 8.2$ $[-, \div]$

19. Rewrite each statement using brackets to make a true statement.

a) $7.5 + 8.6 \times 9.1 = 146.51$

b) $45.15 \div 0.8 + 1.7 \times 2.2 = 39.732$

c) $12.6 - 3.3 \div 3 + 11.4 = 14.5$

20. A local theatre group is putting on a production of *The Lord of the Rings*. Ticket prices are shown.

Admission	
Adults:	$12.50
Seniors:	$8.25
Students:	$6.25

a) 80 adults, 30 seniors, and 50 students attend the first performance. How much admission is collected?

b) Show your calculator key sequence for finding the total.

2 Practice Test

For #1 to #5, choose the best answer.

1. Calculate $4.85 + 0.5 - 3.2$.

A 215 **B** 21.5 **C** 2.15 **D** 0.215

2. Calculate $98.2 - 4.8$.

A 93.4 **B** 103 **C** 9.34 **D** 934

3. Estimate 64.12×18.1 by front-end estimation. What is the best estimate?

A 600 **B** 650 **C** 1200 **D** 1400

4. Calculate $(39 - 1.7) \div 10$.

A 0.0373 **B** 0.373 **C** 3.73 **D** 37.3

5. What is the product of 8.5×0.7?

A 59.5 **B** 12.14 **C** 5.95 **D** 1.214

Complete the statements in #6 and #7.

6. A 6.65-kg package of clay is divided evenly among 19 campers. Each camper gets _____ of clay.

7. The sum of 65 hundredths and 7 tenths is _____.

Short Answer

8. Without finding the answer, place the decimal point in the correct position. Show your thinking.

a) $0.458 + 0.319 + 0.2 = 9770$

b) $48.31 - 27.65 = 2066$

c) $5.8 \div 0.32 = 18125$

d) $24 \times 0.083 = 19920$

9. What is the value of each expression?

a) $1.45 + 8.9 \times 4 + 2$

b) $3.12 \times 4 + 12 \div 1.5 \times 2$

10. Rewrite each statement using brackets to make a true statement.

a) $4.5 + 7.2 \times 3.1 = 36.27$

b) $1.3 \times 4.5 - 0.9 + 6.2 = 10.88$

c) $7.1 + 3.7 \times 2 \div 0.3 = 72$

d) $7.2 \div 0.8 + 5.6 \times 3.9 = 4.3875$

11. A Yorkshire terrier has a mass of 3.2 kg. A Saint Bernard has a mass 28 times that amount. What is the mass of the Saint Bernard?

12. A tennis ball has a mass of 57.3 g. The packaging that holds three balls has a mass of 85 g. What is the total mass of an unopened package containing three of these tennis balls?

13. Leanne buys 6.2 kg of beef steak at \$18/kg, 0.8 kg of shrimp at \$36/kg, vegetables for a total of \$6.74, and two loaves of French bread for \$2.39 each. How much does she spend altogether?

Extended Response

14. Tom and Michael have collected $22 to fill a shoebox with gifts for a child overseas. Since this is for a charity, the store has agreed not to charge tax. Tom and Michael bring the following items to the cashier.

bag of marbles	$1.69
glider	$3.99
2 toy cars	$0.97 each
bag of candy	$1.79
toothbrush	$1.99
toothpaste	$2.29
facecloth	$1.49
3 fancy pencils	$0.35 each
glow-in-the-dark pen	$2.39
small notebook	$1.98
magnifying glass	$2.25

a) Estimate the total. Do you think they have enough money?

b) Calculate the total. Do they have enough money?

c) Either calculate what change they should get *or* explain what they need to put back and why.

15. Mia claims that the answer to the following skill-testing question is 72.6. Wendy says the answer is 60.8.

$8.2 + 16.4 \div 0.41 + 12.6$

a) Who is correct? Show how you know.

b) What mistake did the other student make?

c) Add brackets to the expression to show how the other answer could be found.

d) Make up a skill-testing question of your own that uses decimal numbers and at least 3 different operations. What is the correct answer to your question?

e) How can you add brackets to your question to produce different answers?

WRAP IT UP!

Plan your own one-week dream vacation. You must plan out your itinerary and budget how much money you will need.

- Where will you go?
- Who will go with you?
- Where will you stay? Research two possible places and compare actual prices.
- What activities will you do? What is the cost of each?
- Where and what will you eat?

Create a travel report with all of your plans. Include daily activities, accommodations, and a budget for your trip. Make sure you outline the mathematics that is needed. Try to include realistic costs and distances travelled. Use pictures, maps, and charts to make your report interesting and realistic.

Math Games

Decimal Delights

59.2	0.2	34.43	1.06	99.9	9.14
22.4	15.2	91	26.2	44.5	16
73.2	58.99	81.3	33.6	37.6	53.1
27	17.9	10.6	5.86	7.05	0.87
0.04	66.6	0.45	47.7	6.41	11.1
70.3	18.03	41.9	3.27	0.09	60.27

Materials

- Decimal Delights addition game board
- Decimal Delights multiplication game board

1. Use a copy of the addition game board to play the following game with a partner.

Use these rules:

- Flip a coin to decide who will play first.
- Each player takes a turn as follows:
  - Choose two numbers from the game board and circle them.
  - Add the two numbers using mental math or paper and pencil.
  - Record the number of points scored for your sum. A sum above 100 scores 0.

0	20	40	60	80	100
1 point	2 points	3 points	2 points	1 point	

- Use mental math or paper and pencil to check your opponent's sum after each turn.
- Choose only numbers that have not yet been circled.
- The winner is the player with the most points when all the numbers have been circled.

2. Use a copy of the multiplication game board to play the following game with a partner.

- The numbers on the game board are the same as in the addition game.
- The rules are the same as in the addition game, except that you can use a calculator to multiply the two chosen numbers.
- The points scored are different than in the addition game. A product above 1000 scores 0.

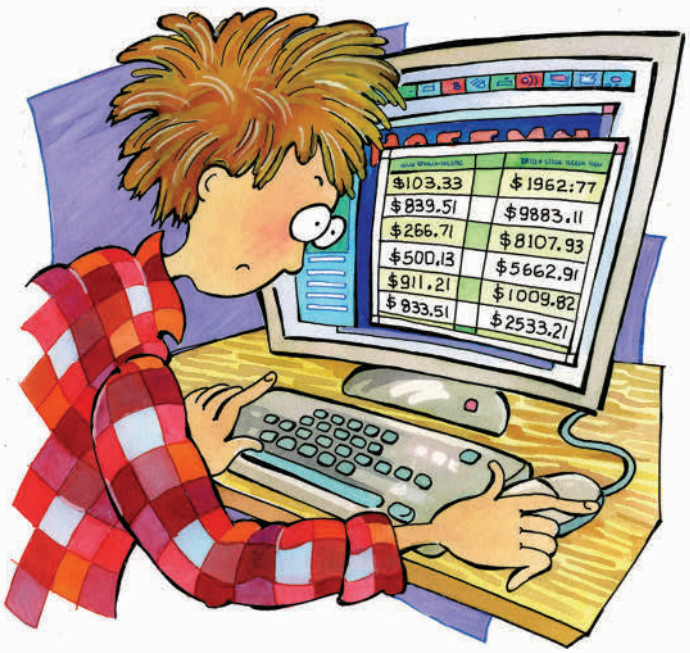
0	0.1	1	10	100	1000
1 point	2 points	3 points	2 points	1 point	

3. Describe how you can increase your chances of winning each game.

Challenge in Real Life

Rounding Digits and High-Tech Crime

Suppose you are employed by a bank to search for high-tech crime. One day you are examining the software used to calculate the interest paid to customers. Millions of dollars of interest are paid out every day to these customers. You notice a line of programming that rounds money amounts to the nearest cent. This is normal.



But then, you notice something strange. Someone has programmed the rounded down amounts (tenths and hundredths of a cent, for example) to be deposited in a secret account. You check on that account and find that someone has deposited, and then withdrawn, several million dollars over the past year.

a) Suppose you collect 1 cent on 20 transactions per day. If you work 20 days a month, how much money would you have at the end of three months? at the end of a year?

b) How would it be possible to collect millions of dollars from depositing only tenths and hundredths of a cent?

c) Why might a customer not realize what was happening?

d) Why would the bank not realize what was happening?

e) Suppose the programmer was caught and put on trial. Work with a partner to develop a case for the prosecution. You may wish to create a table and prepare a presentation for the jury that would show the effect of rounding. What would you say to the jury, who might not know as much about math as you do?