Home Link 5-15

NAME DATE TIME

Investigations in Measurement; Decimal Multiplication and Division

In Unit 6 your child will develop strategies for multiplying and dividing decimals, use measurement data to create line plots, and revisit volume concepts. The first three lessons focus on multiplying and dividing decimals by powers of 10. Students first use calculators to multiply and divide decimals by numbers like 10^2, 10^3, and 10^4, looking for patterns in how the decimal point moves in the answer. Then they find rules that describe these patterns and use them to multiply and divide any number by a power of 10. For additional practice students play the game *Exponent Ball*. They also apply their understanding of multiplication and division by powers of 10 to solve measurement conversion problems in the metric system.

In Lessons 6-4 and 6-5 students collect and analyze measurement data reported in fractional units. They make line plots to organize their data and then use the line plots to solve problems. For example, students measure their own height to the nearest half inch and create a class line plot. They observe which height is most common among classmates, calculate the difference between the smallest and largest measurements, and find the combined height of all students in the class. Students solve similar problems about pencil lengths measured to the nearest quarter inch. These problems require students to practice adding and subtracting fractions with unlike denominators. They also discuss ways to identify a typical measurement. For example, students consider how they might describe the "typical height" of a fifth grader in their class, given the heights of everyone in the class. They use an "evening out" process to find a typical measurement and use these evened-out values to compare the typical height of a fifth grader to animals such as a red kangaroo, an emperor penguin, and a chimpanzee. This work prepares students to learn more formal methods of data analysis in future grades.

Lessons 6-6 and 6-7 revisit the concept of volume. Students begin by estimating the volume of Willis Tower, the tallest building in Chicago. They compare different strategies and discuss how the strategies could be more efficient. Students also explore measuring volume by displacement. They place various objects in water and use the changing level of the water to determine the volume of the objects. Students explore the relationship between milliliters and cubic centimeters and think about which units make sense for the items they are measuring.

The final lessons address decimal multiplication and division. Students develop strategies for multiplying and dividing decimals to hundredths. They use estimation to help them recognize reasonable answers and to place the decimal point in products and quotients. They also learn to use related whole-number problems to solve decimal problems and apply these strategies to solving real-world measurement problems. Finally, in Lesson 6-13 students conduct reaction-time experiments, using individual data to estimate the total reaction time of the class. Students add, subtract, multiply, and divide decimals to analyze data, find typical reaction times, and calculate a class estimate.

Vocabulary

Important terms in Unit 6:

base A number that is raised to a power in exponential notation. For example, in 10^3, the base is 10.

calibrate To divide or mark a measuring tool with graduations, such as the degree marks on a thermometer.

data point A single piece of information gathered by counting, measuring, questioning, or observing.

data set A collection of *data points*.

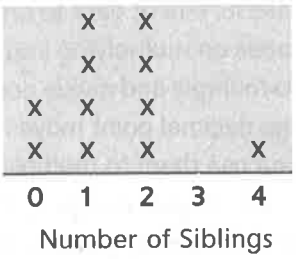
displacement method A way to measure the volume of an object by submerging it in water and then measuring the volume of the water it displaces. The method is especially useful for finding the volume of irregularly shaped objects.

equivalent problems Division problems that have different dividends and divisors but the same quotient. For example, 3.2 ÷ 1.6 and 32 ÷ 16 are equivalent problems because they have the same quotient, 2.

exponent A number used in *exponential notation* to tell how many times the *base* is used as a factor. The exponent is often written as a small, raised number or after a caret. For example, in 10^3, the exponent is 3. An exponent can also be called the *power of a number*, as in "10 to the third power."

exponential notation A way to show repeated multiplication by the same factor. For example, 10^3 is exponential notation for 10 * 10 * 10.

line plot A sketch of data in which check marks, Xs, or other marks above a labeled number line show the frequency of each value.



metric system A measurement system based on the base-10 numeration system. The metric system is used in most countries around the world.

power of 10 A whole number that can be written as a product of 10s. For example, 100 is equal to 10 * 10, or 10^2. 100 is called "the second power of 10" or "10 to the second power."

reaction time The amount of time it takes to react to a stimulus.

scale of a number line The unit interval on a number line or measuring device.

Do-Anytime Activities

To work with your child on the key concepts in this unit, try some of these activities.

1. Help your child find decimals in the everyday world. Point out instances where you might multiply or divide decimals, and prompt your child to estimate products and quotients. For example, if a package of 4 paper towel rolls costs $3.68, about how much does each roll cost? How much would 10 packages, or 100 packages, cost?
2. Have your child pick something to measure, such as the length of books. Help him or her measure several examples and record the data to the nearest $\frac{1}{2}$ or $\frac{1}{4}$ inch. Ask your child to make a line plot of the data and use the line plot to solve problems and answer questions, such as: Which is the smallest book? What is the most common book length? What would be the total length if all the books were laid end to end?
3. Have your child show you how to calibrate a 2-liter bottle. Ask him or her to find the volume of various items by displacement.

Building Skills through Games

In Unit 6 your child will play games to practice strategies for multiplying and dividing decimals by powers of 10 and computing with decimals. Detailed instructions for each game are in the *Student Reference Book*. Many of the games can be played at home with materials you may already have; gameboards can be copied for home use.

Decimal Domination See *Student Reference Book*, page 295. Two players need number cards 0–9 (4 of each), 4 counters, a coin, and a calculator (optional) to play this game. *Decimal Domination* provides practice with predicting decimal products and multiplying decimals.

Decimal Top-It: Addition* or *Subtraction See *Student Reference Book*, pages 298 and 299. Two players need number cards 0–9 (4 of each), 4 counters, and a calculator (optional) to play either of these games. The games provide practice adding or subtracting decimals.

Doggone Decimal See *Student Reference Book*, page 302. Two players need number cards 0–9 (4 of each), 4 index cards, 4 counters, and a calculator to play this game. *Doggone Decimal* provides practice with rounding decimals and estimating decimal products.

Exponent Ball See *Student Reference Book*, pages 303 and 304. Two players need number cards 1–4 (4 of each), two 6-sided dice, a counter, and the *Exponent Ball* Gameboard (*Math Masters*, page G28) to play this game. *Exponent Ball* provides practice multiplying and dividing decimals by powers of 10.

Spend and Save See *Student Reference Book*, page 323. Two players need two *Spend and Save* Record Sheets (*Math Masters*, page G27), number cards 0–9 (4 of each), one coin, and one counter to play this game. *Spend and Save* provides practice with adding and subtracting decimals in a money context.

As You Help Your Child with Homework

As your child brings assignments home, you might want to go over the instructions together, clarifying them as necessary. The answers listed below will guide you through this unit's Home Links.

Home Link 6-1

1. 680 **2.** 0.439 **3.** 2.375 **4.** 52,900

5. 0.0132 **6.** 71,800 **7.** 940,000 **8.** 0.00036

9. Sample answer: I moved the decimal point two places to the left because 43.9 is divided by 10 two times, which is the same as shifting the digits two places to the right.

10. $\frac{17}{24}$ **11.** $4\frac{7}{12}$, or $4\frac{14}{24}$

Home Link 6-2

1. 4,500, Forward 40 yd; 0.035, Forward 20 yd; 0.23, Forward 20 yd

2. Sample answer: For 4.5×10^3, I multiplied 4.5 by 10 three times. I moved the decimal point three places to the right to get 4,500. 4,500 is between 4,000 and 39,999 so the ball should move forward 40 yards.

3. 15.0 **4.** 24.29 **5.** 52.59

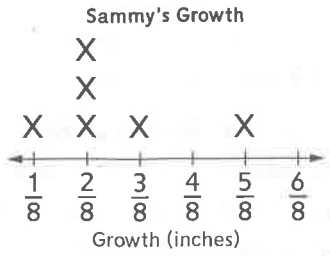
Home Link 6-3

1. 5,600; 300; 0.078; 0.008 **2.** $\div 10^3$

3. 2.235 **4.** 15,200 **5.** $\frac{5}{8}$ **6.** $1\frac{11}{15}$

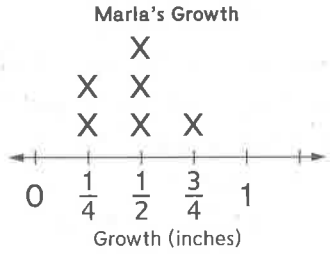
Home Link 6-4

1. a.



b. $\frac{15}{8}$, or $1\frac{7}{8}$

2. a.

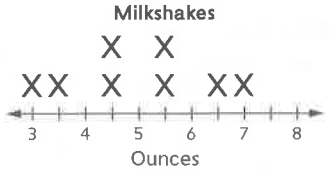


b. $2\frac{3}{4}$ **3 a.** Marla **b.** $\frac{7}{8}$ in.

c. $2\frac{3}{4} - 1\frac{7}{8} = \frac{7}{8}$

Home Link 6-5

1.



2. a. 40 **b.** 8 **c.** $40 \div 8 = m$ **d.** 5

3. 760 **4.** 0.182 **5.** 0.7795 **6.** 812,300

Home Link 6-6

1. 42,754,496; 37,636 * 1,136 = 42,754,496
2. 1,584,000; 5,280 * 20 * 15 = 1,584,000
3. 206,400; 4,800 * 43 = 206,400

4. $22\frac{2}{3}$ **5.** $10\frac{2}{7}$

Home Link 6-7

1. 500; 500 **2.** 10,000; 10,000 **3.** 200; 200

4. Answers vary.

5. $\frac{7}{16}$ **6.** $\frac{25}{54}$

Home Link 6-8

1. Emma: 6.3 **2.** Kyle: 149.6 **3.** Kyle: 31.5

4. Emma: 7,335 **5.** Kyle: 8.5 **6.** Emma: 0.9

7. 30 R16 **8.** 22 R27

Home Link 6-9

1. 3,861.75 **2.** 1,681.68 **3.** 1.71

4. 24,730.05 **5.** $\frac{1}{45}$ **6.** $\frac{1}{24}$

Home Link 6-10

1. 168 pizzas; Explanations vary.

2. 18 **3.** 40

Home Link 6-11

1. 1.8 **2.** 1.74 **3.** 12 **4.** $5\frac{1}{3}$

Home Link 6-12

1. $72 \div 6 = ?$; 12; 12 **2.** $440 \div 5 = ?$; 88; 88

3. $192 \div 16 = ?$; 12; 12 **4.** 15.82 **5.** 27.91

Home Link 6-13

1. 0.15, 0.16, 0.17, 0.18
2. 0.14, 0.15, 0.15, 0.16, 0.16, 0.17, 0.17, 0.18, 0.18, 0.19

3. 0.05 **4.** 0.165

5. Sample answer: I would say that 0.165 is a typical reaction time. The evened-out time is the best time, since there is not a single time that occurred more than the others.

6. 3.44 **7.** 40.27

Multiplying and Dividing by Powers of 10

Home Link 6-1

NAME DATE TIME

Use the ideas below to help you solve Problems 1–9.

SRB 133, 136

- To *multiply* by a power of 10, move the decimal point to the right the number of places indicated by the exponent. For example, to multiply by 10^3, move the decimal point to the right 3 places. This works because the exponent tells the number of times a start number is multiplied by 10. Each time a number is multiplied by 10, the digits shift 1 place to the left, which moves the decimal point 1 place to the right.

  Example: $4.3 \times 10^3 = 4.3 \times 10 \times 10 \times 10 = 4{,}300$

- To *divide* by a power of 10, move the decimal point to the left the number of places indicated by the exponent. For example, to divide by 10^3, move the decimal point to the left 3 places. This works because dividing by 10 is the same as multiplying by $\frac{1}{10}$. Each time a number is multiplied by $\frac{1}{10}$, the digits shift 1 place to the right, which moves the decimal point 1 place to the left.

  Example: $4.3 \div 10^3 = 4.3 \div (10 \times 10 \times 10) = 4.3 \div 1{,}000 = 0.0043$

(1) $6.8 \times 10^2 =$ _____

(2) $43.9 \div 10^2 =$ _____

(3) $237.5 \div 10^2 =$ _____

(4) $5.29 \times 10^4 =$ _____

(5) $13.2 \div 10^3 =$ _____

(6) $71.8 \times 10^3 =$ _____

(7) $9.4 \times 10^5 =$ _____

(8) $3.6 \div 10^4 =$ _____

(9) Explain how you moved the decimal point in Problem 2 and why. Use clear mathematical language.

_____

_____

_____

Practice

(10) $\begin{array}{r} \frac{3}{8} \\ +\ \frac{1}{3} \\ \hline \end{array}$

(11) $\begin{array}{r} 2\frac{5}{6} \\ +1\frac{3}{4} \\ \hline \end{array}$

Playing *Exponent Ball*

Home Link 6-2

NAME DATE TIME

Tony is playing *Exponent Ball*. He wrote down each of his expressions but wasn't sure how far to move the ball on each play.

SRB 122, 133, 136, 303

(1) Complete Tony's record sheet. Use Table 1 to determine the number of yards to move the ball.

Table 1: Runs	
Value of Expression	**Move Ball**
0.0001 to 0.00099	Backward 15 yards
0.001 to 0.0099	Forward 10 yards
0.01 to 99	Forward 20 yards
100 to 3,999	Forward 30 yards
4,000 to 39,999	Forward 40 yards
40,000 and above	Forward 50 yards

Tony's record sheet:

Expression	Value	Move Ball
4.5×10^3		
$3.5 \div 10^2$		
$2.3 \div 10^1$		

(2) Choose one of the expressions. Explain how you found the value and determined how far to move the ball.

Practice

(3)
$$\begin{array}{r} 5.4 \\ +\ 9.6 \\ \hline \end{array}$$

(4)
$$\begin{array}{r} 12.71 \\ +\ 11.58 \\ \hline \end{array}$$

(5)
$$\begin{array}{r} 43.65 \\ +\ 8.94 \\ \hline \end{array}$$

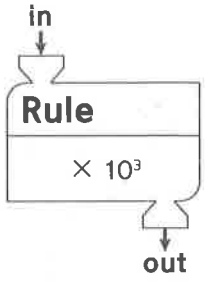
Solving Conversion Problems

Home Link 6-3

NAME DATE TIME

SRB 133, 136, 215–216

(1) Convert between kilograms (kg) and grams (g) to complete the table below.



in (kg)	out (g)
1	1,000
5.6	
0.3	
	78
	8

(2) What rule could you use to convert from grams to kilograms? *Hint*: How can you find the *in* number if you know the *out* number? Use exponential notation. _____

Use the rules from Problems 1 and 2 to help you solve the number stories below. Show your work. Label the units for each step.

(3) Micah has a cat and a parrot. Her cat weighs 2.3 kg and her parrot weighs 65 g. How many more kilograms does the cat weigh than the parrot?

The cat weighs _____ kg more than the parrot.

(4) Jasmine's dog weighs 15 kg. The dog's collar weighs 200 g. How many grams does the dog weigh when it is wearing its collar?

The dog weighs _____ g with its collar.

Practice

Solve.

(5) $\begin{array}{r} \frac{7}{8} \\ -\ \frac{1}{4} \\ \hline \end{array}$

(6) $\begin{array}{r} 3\frac{1}{3} \\ -\ 1\frac{3}{5} \\ \hline \end{array}$

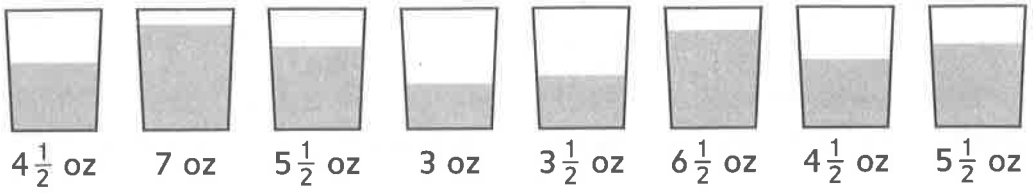
A Milkshake Problem

Home Link 6-5

NAME DATE TIME

Rachel is having a slumber party with 7 friends. Her mom made a big batch of milkshakes. Rachel's little brother tried to help by pouring the milkshakes in glasses, but he had trouble pouring the same amount in each glass

SRB 191, 247–248



(1) Plot the amount of milkshake in each glass on the line plot below.

Milkshakes

Ounces

Rachel wants to even out the servings so that everyone will get the same amount of milkshake. Answer the questions to help you figure out how many ounces Rachel should pour into each glass.

Remember: To even out data, add all the numbers in the data set, and then divide by the number of data points.

(2) **a.** How many total ounces of milkshake did Rachel's mom make? _____ ounces

b. How many glasses of milkshake are needed? _____ glasses

c. Write a number model that represents dividing the milkshake evenly among all the glasses. _____

d. How many ounces of milkshake will each friend get? _____ ounces

Practice

Solve.

(3) $7.6 \times 10^2 =$ _____

(4) $18.2 \div 10^2 =$ _____

(5) $779.5 \div 10^3 =$ _____

(6) $81.23 \times 10^4 =$ _____

Using Volume Formulas

Home Link 6-6

NAME DATE TIME

SRB 233

Formulas for Volume of a Rectangular Prism

$V = l * w * h$ $V = B * h$

Use either of the volume formulas to help you solve the problems below.
Write a number model to show how you found the volume. You may use a calculator.

1. The Aon Center in Chicago is a tall square tower. Its base covers an area of about 37,636 square feet. The building is about 1,136 feet tall. What is the volume of the Aon Center?

   Volume: about _____ cubic feet

   Number model: _____

2. The Great Wall of China is about 20 feet high and about 15 feet wide. What is the volume of a 1-mile section of the wall? (The whole wall is more than 5,000 miles long!)

   Hint: 1 mile = 5,280 feet

   Volume: about _____ cubic feet

   Number model: _____

3. The Cathedral of Notre Dame in Paris, France covers an area of 4,800 square meters. The roof is about 43 meters high. What is the volume of the interior of the cathedral?

   Volume: about _____ cubic meters

   Number model: _____

Practice

Multiply. Show your work.

4. $\frac{2}{3} * 34 =$ _____

5. $72 * \frac{1}{7} =$ _____

Volume in Milliliters and Cubic Centimeters

Home Link 6-7

NAME DATE TIME

Solve the problems below. Use $V = l \times w \times h$ and $V = B \times h$ to help you solve. Record the volumes in cubic centimeters and milliliters. *Remember:* 1 cm^3 = 1 mL

SRB 236, 238

1. The area of the base of a pencil case is 100 square centimeters. The pencil case is 5 centimeters tall. What is the volume of the pencil case?

   _____ cm^3 _____ mL

2. A small aquarium is 20 centimeters long and 25 centimeters wide. The water in the aquarium is 20 centimeters high. What is the volume of the water in the aquarium?

   _____ cm^3 _____ mL

3. Alex has a calibrated bottle. The water level is at the 0 mL mark. When Alex places a baseball under the water, the water level rises to the 200 mL mark. What is the volume of the baseball?

   _____ cm^3 _____ mL

4. For each problem above, which unit of volume makes more sense? Explain your answers.

   a. Problem 1:

   _____

   _____

   b. Problem 2:

   _____

   _____

   c. Problem 3:

   _____

   _____

Practice

Multiply.

5. $\frac{7}{8} * \frac{1}{2} =$ _____

6. $\frac{5}{9} * \frac{5}{6} =$ _____

Estimating Decimal Products and Quotients

Home Link 6-8

NAME DATE TIME

Kyle and Emma came up with different answers on their homework. For each problem, make an estimate. Write a number sentence to show how you estimated. Then circle the student who has the correct answer.

SRB 128

1. 8.82 ÷ 1.4 = ? Estimate: _____

   Kyle: 63 Emma: 6.3

2. 17.6 * 8.5 = ? Estimate: _____

   Kyle: 149.6 Emma: 14.96

3. 2,812.95 ÷ 89.3 = ? Estimate: _____

   Kyle: 31.5 Emma: 315.0

4. 65.2 * 112.5 = ? Estimate: _____

   Kyle: 733.5 Emma: 7,335

5. 209.1 ÷ 24.6 = ? Estimate: _____

   Kyle: 8.5 Emma: 85.0

6. 3.6 * 0.25 = ? Estimate: _____

   Kyle: 9.0 Emma: 0.9

Practice

Make an estimate. Then solve.

7. 526 ÷ 17 = ?

   _____ (estimate)

   Answer: _____

8. 1,963 / 88 = ?

   _____ (estimate)

   Answer: _____

Multiplying Decimals

Home Link 6-9

NAME DATE TIME

Today you learned two different strategies for multiplying decimals. Try to use each decimal multiplication strategy at least once to solve Problems 1–4. Show your work on the back of this page.

SRB 128, 133–135

Estimation Strategy	Shifting the Decimal Point Strategy
Make an estimate. Multiply as if the factors were whole numbers. Use your estimate to insert a decimal point in the product. **Example:** 70.4 * 18.6 = ? *Think:* 70 * 20 is about 1,400. 704 * 186 = 130,944 The product should be close to 1,400, so it must be 1,309.44.	Multiply each factor by a power of 10 to get whole numbers. Multiply the whole-number factors. "Undo" the multiplication by powers of 10. Think about how dividing by the same powers of 10 would shift the decimal point in the answer. **Example:** 70.4 * 18.6 = ? $70.4 * 10^1 = 704$ $18.6 * 10^1 = 186$ 704 * 186 = 130,944 *Think:* Dividing by 10^1 will shift the decimal point 1 place to the left, and dividing by the other 10^1 will shift the decimal point another place to the left. I need to shift it two places in all. So 70.4 * 18.6 = 1,309.44.

① 81.3 * 47.5 = _____

② 7.8 * 215.6 = _____

③ 0.57 * 3.0 = _____

④ 1,094.25 * 22.6 = _____

Practice

Solve. Show your work on the back of this page.

⑤ $\frac{1}{9} \div 5 =$ _____

⑥ $\frac{1}{2} \div 12 =$ _____

Checking Whether My Answer Makes Sense

Home Link 6-10

NAME DATE TIME

SRB 7, 100, 125, 134

(1) Pizza by the Pan sold 4 dozen pizzas in the afternoon. That night, they sold 2.5 times as many pizzas as they did during the afternoon. How many pizzas did they sell in all that day? Show your work and check whether your answer makes sense. Show how you can tell that your answer makes sense.

Practice

Divide. Show your work on the back of this page.

(2) $6 \div \frac{1}{3} =$ _____

(3) $10 \div \frac{1}{4} =$ _____

Dividing Decimals by Whole Numbers

Home Link 6-11

NAME DATE TIME

SRB 128, 137–139

For Problems 1 and 2:

- Make an estimate. Write a number sentence to record your estimate.
- Divide as if the dividend were a whole number. Show your work on the computation grid.
- Use your estimate to place the decimal point. Record your answer.

① 10.8 / 6 = ?

Estimate: _____

10.8 / 6 = _____

② 5.22 / 3 = ?

Estimate: _____

5.22 / 3 = _____

Practice

Multiply. Show your work.

③ $\frac{2}{5} * 30 =$ _____

④ $16 * \frac{1}{3} =$ _____

Dividing by Decimals

Home Link 6-12

NAME DATE TIME

SRB 128, 140–141

For Problems 1–3:

- Rewrite the problem as an equivalent problem that has a whole-number divisor. Be sure to multiply the dividend and divisor by the same number.
- Solve the equivalent problem using any method you wish. If you don't solve the problem mentally, show your work.
- Record your answer to the equivalent problem and the original problem.

One example is done for you.

Example: 2.8 ÷ 0.4 = ?

Think: Multiplying 0.4 by 10 will give me a whole number, so I should also multiply 2.8 by 10 to make an equivalent problem.

(2.8 * 10) ÷ (0.4 * 10) = 28 ÷ 4

Equivalent problem: 28 ÷ 4 = ?

Answer to equivalent problem: 7

2.8 ÷ 0.4 = 7

① 7.2 ÷ 0.6 = ?

Equivalent problem: _____

Answer to equivalent problem: _____

7.2 ÷ 0.6 = _____

② 44 ÷ 0.5 = ?

Equivalent problem: _____

Answer to equivalent problem: _____

44 ÷ 0.5 = _____

③ 1.92 ÷ 0.16 = ?

Equivalent problem: _____

Answer to equivalent problem: _____

1.92 ÷ 0.16 = _____

Practice

Add. Show your work on the back of this page.

④ 6.48 + 9.34 = _____

Estimate: _____

⑤ 15.71 + 12.2 = _____

Estimate: _____

Interpreting Reaction-Time Data

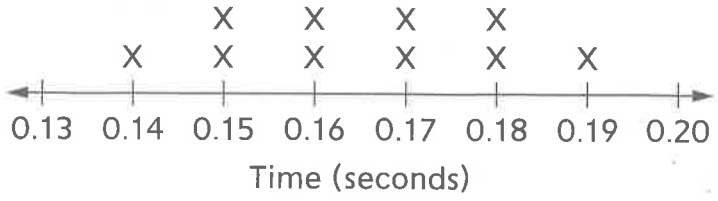
Home Link 6-13

NAME DATE TIME

Garrett tried the Grab-It Gauge experiment with his left hand. He recorded his results on the line plot below. Use the data to answer the questions.

SRB 121, 131, 247–248

Garrett's Left-Hand Reaction Times



1. Which time(s) came up most often for Garrett? _____ sec

2. Write Garrett's reaction times in order from fastest to slowest.

_____

3. What is the difference between Garrett's fastest time and his slowest time?

_____ sec

4. What is Garrett's evened-out reaction time? Record your calculations.

Expression: _____

_____

Evened-out reaction time: _____ sec

5. What would you say is a typical reaction time for Garrett's left hand? Why?

_____

_____

_____

Practice

Subtract. Show your work on the back of this page.

6. $5.63 - 2.19 =$ _____

Estimate: _____

7. $44.12 - 3.85 =$ _____

Estimate: _____