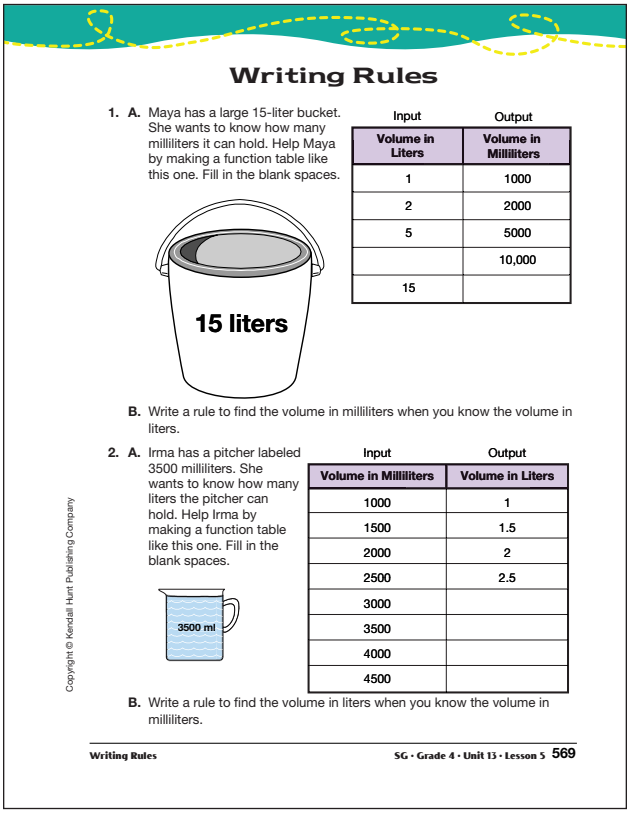

Writing Rules

1. **A.** Maya has a large 15-liter bucket. She wants to know how many milliliters it can hold. Help Maya by making a function table like this one. Fill in the blank spaces.

Input: Volume in Liters	Output: Volume in Milliliters
1	1000
2	2000
5	5000
	10,000
15	

B. Write a rule to find the volume in milliliters when you know the volume in liters.

2. **A.** Irma has a pitcher labeled 3500 milliliters. She wants to know how many liters the pitcher can hold. Help Irma by making a function table like this one. Fill in the blank spaces.

Input: Volume in Milliliters	Output: Volume in Liters
1000	1
1500	1.5
2000	2
2500	2.5
3000	
3500	
4000	
4500	

B. Write a rule to find the volume in liters when you know the volume in milliliters.

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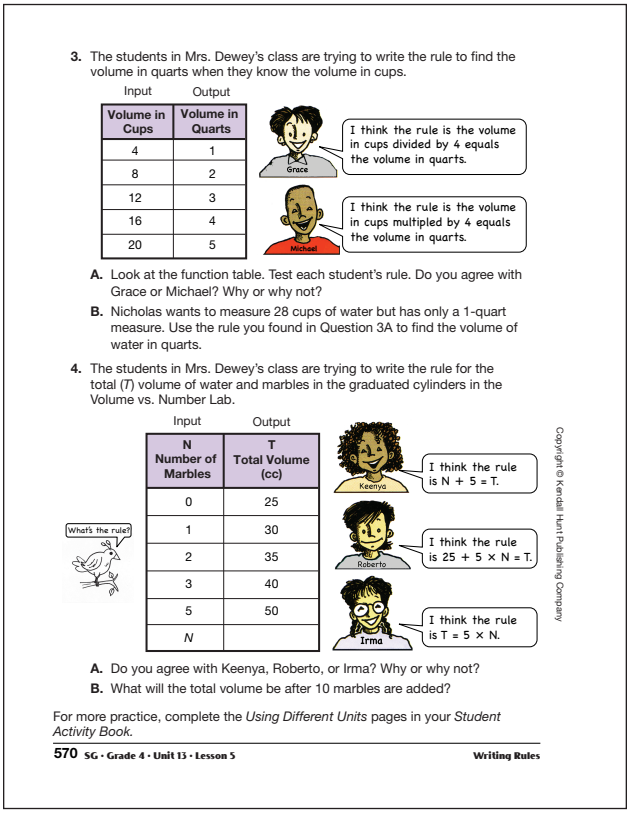

3. The students in Mrs. Dewey's class are trying to write the rule to find the volume in quarts when they know the volume in cups.

Input: Volume in Cups	Output: Volume in Quarts
4	1
8	2
12	3
16	4
20	5

A. Look at the function table. Test each student's rule. Do you agree with Grace or Michael? Why or why not?

B. Nicholas wants to measure 28 cups of water but has only a 1-quart measure. Use the rule you found in Question 3A to find the volume of water in quarts.

4. The students in Mrs. Dewey's class are trying to write the rule for the total (*T*) volume of water and marbles in the graduated cylinders in the Volume vs. Number Lab.

Input: N Number of Marbles	Output: T Total Volume (cc)
0	25
1	30
2	35
3	40
5	50
N	

A. Do you agree with Keenya, Roberto, or Irma? Why or why not?

B. What will the total volume be after 10 marbles are added?

For more practice, complete the *Using Different Units* pages in your *Student Activity Book*.

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Student Guide

Writing Rules

Questions 1–4 (SG pp. 569–570)

1. **A.*** 10 liters = 10,000 milliliters; 15 liters = 15,000 milliliters

   B.* The volume in milliliters equals volume in liters times 1000.

2. **A.*** Input: Volume in Milliliters; Output: Volume in Liters

Volume in Milliliters	Volume in Liters
1000	1
1500	1.5
2000	2
2500	2.5
3000	3
3500	3.5
4000	4
4500	4.5

   B.* The volume in liters equals volume in milliliters divided by 1000.

3. **A.*** I agree with Grace, because when I tested each rule, hers worked. Michael's will not work because I am going from a smaller unit to a larger unit. The number of the larger units should be less than the number of smaller units. If I multiplied the number of cups by 4, the number of quarts would get larger rather than smaller.

   B.* 7 quarts. 28 cups divided by 4 equals 7 quarts.

4. **A.*** Roberto. 25 + 5 × N = T. Keenya's rule does not include the starting water and does not work for all the data in the table; Irma seems to have found the marble size to be 5 cc and that 5 times the number of marbles equals the volume of the marbles, but she forgot the starting water, 25 cc.

   B. 75 cc

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***Answers and/or discussion are included in the lesson.**

Student Activity Book

Using Different Units

Questions 1–10 (SAB pp. 553–558)

1. **A.** 3 quarts = 12 cups, 5 quarts = 20 cups

   B. The volume in cups equals the volume in quarts times four.

   C. 32 cups. If 1 quart is 4 cups, then 8 quarts times 4 equals the volume in cups.

   D. 10 cups. Possible response: 2 quarts is 8 cups and 1 quart is 4 cups, so 0.5 quart is 2 cups. 2.5 quarts equals 8 cups + 2 cups, or 10 cups.

2. **A.**

Input: Volume in Cups	Output: Volume in Fluid Ounces
1	8
2	16
3	24
4	32
5	40
8	64
10	80

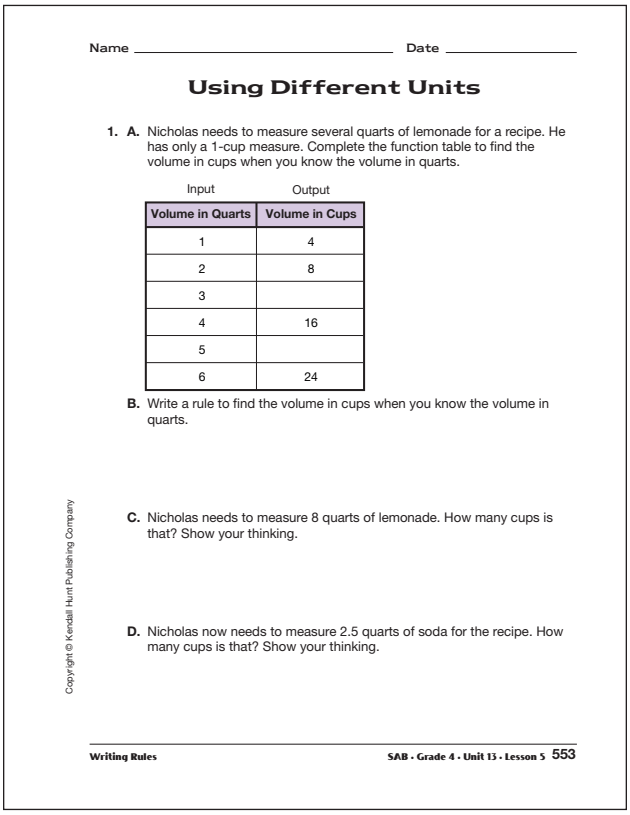
   B. The volume in fluid ounces equals the volume in cups times 8.

   C.* 96 ounces. 10 cups × 8 = 80 ounces, so she needs at least 80 ounces. The smallest bottle she can buy is the 96 ounce bottle.

3. **A.**

Input: Volume in Milliliters	Output: Volume in Cubic Centimeters
10	10
50	50
100	100
250	250
1000	1000
2000	2000

   B. The volume in cubic centimeters is equal to the volume in milliliters.



Name _____ Date _____

Using Different Units

1. A. Nicholas needs to measure several quarts of lemonade for a recipe. He has only a 1-cup measure. Complete the function table to find the volume in cups when you know the volume in quarts.

Input: Volume in Quarts	Output: Volume in Cups
1	4
2	8
3	
4	16
5	
6	24

B. Write a rule to find the volume in cups when you know the volume in quarts.

C. Nicholas needs to measure 8 quarts of lemonade. How many cups is that? Show your thinking.

D. Nicholas now needs to measure 2.5 quarts of soda for the recipe. How many cups is that? Show your thinking.

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Writing Rules SAB • Grade 4 • Unit 13 • Lesson 5 553

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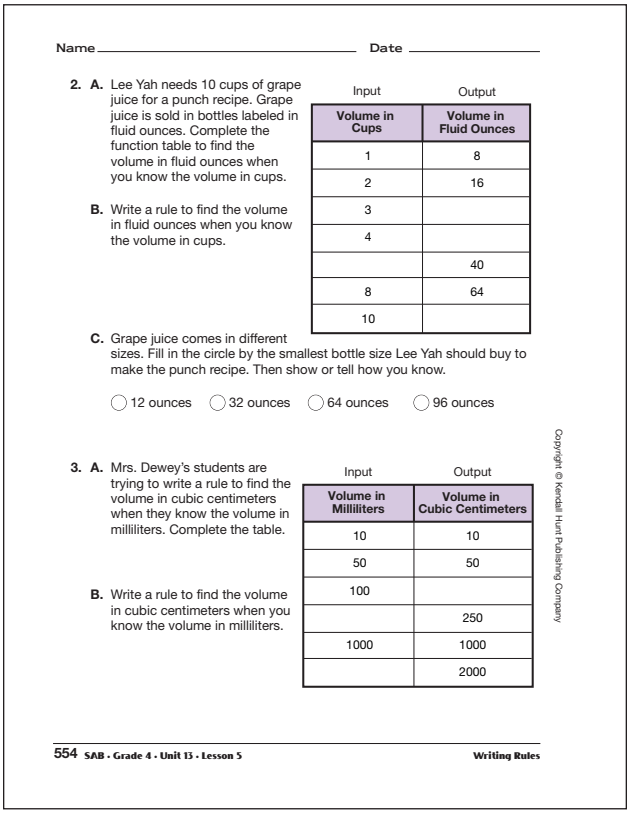

Name _____ Date _____

2. A. Lee Yah needs 10 cups of grape juice for a punch recipe. Grape juice is sold in bottles labeled in fluid ounces. Complete the function table to find the volume in fluid ounces when you know the volume in cups.

Input: Volume in Cups	Output: Volume in Fluid Ounces
1	8
2	16
3	
4	
	40
8	64
10	

B. Write a rule to find the volume in fluid ounces when you know the volume in cups.

C. Grape juice comes in different sizes. Fill in the circle by the smallest bottle size Lee Yah should buy to make the punch recipe. Then show or tell how you know.

◯ 12 ounces ◯ 32 ounces ◯ 64 ounces ◯ 96 ounces

3. A. Mrs. Dewey's students are trying to write a rule to find the volume in cubic centimeters when they know the volume in milliliters. Complete the table.

Input: Volume in Milliliters	Output: Volume in Cubic Centimeters
10	10
50	50
100	
	250
1000	1000
	2000

B. Write a rule to find the volume in cubic centimeters when you know the volume in milliliters.

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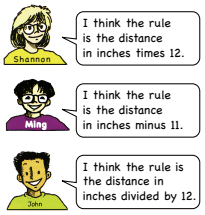
***Answers and/or discussion are included in the lesson.**

Name _____ Date _____

4. A. Look at the function table below. The students in Mrs. Dewey's class are trying to write the rule to find the distance in feet when they know the distance in inches. Complete the function table.

Input / Output

Distance in Inches	Distance in Feet
12	1
24	2
36	3
48	
60	
72	6

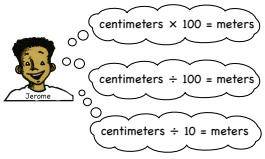


B. Do you agree with Shannon, Ming, or John? Explain.

5. A. Look at the function table below. Jerome is trying to write the rule to find the distance in meters when he knows the distance in centimeters. Complete the table.

Input / Output

Distance in Centimeters	Distance in Meters
100	1
10	0.10
1000	10
1	
500	
5000	



B. Which rule do you agree with? Explain.

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4. A.

Input / Output

Distance in Inches	Distance in Feet
12	1
24	2
36	3
48	4
60	5
72	6

B. I agree with John. Possible response: I tried his rule and it worked for all the data in the table. Shannon's does not work because it takes fewer feet to equal the same distance in inches. Her rule leads to more feet. I tried Ming's and his does not work for all the data in the table. It works when there are 12 inches, but not for the other distances.

5. A.

Input / Output

Distance in Centimeters	Distance in Meters
100	1
10	0.10
1000	10
1	.01
500	5
5000	50

B. The rule is centimeters ÷ 100 = meters. Possible response: Centimeters times 100 gives more meters and that cannot be right—meters are larger so I need less of them to equal the same distance. I tried centimeters divided by 10 and it did not work for the first few examples in the table, so it does not work.

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6. A.

Input	Output
N **Number of 12-packs of soda**	***V*** **Volume (cubic feet)**
1	$\frac{1}{2}$
2	1
4	2
5	$2\frac{1}{2}$
10	5
N	$N \div 2$

B. 30 12-packs of soda. Possible response: $30 \div 2 = 15$; or I know that it takes 10 packs to fill 5 cubic feet. So $5 + 5 + 5 = 15$ cubic feet and that would be three groups of 10 packs. So 30 packs of soda.

7. A.* Table A / Table B

N **Number of Marbles**	***T*** **Total Volume (cc)**
0	50
1	53
2	56
5	65
10	80
N	$N \times 3 + 50$

N **Number of Marbles**	***T*** **Total Volume (cc)**
0	50
1	55
3	65
5	75
10	100
N	$N \times 5 + 50$

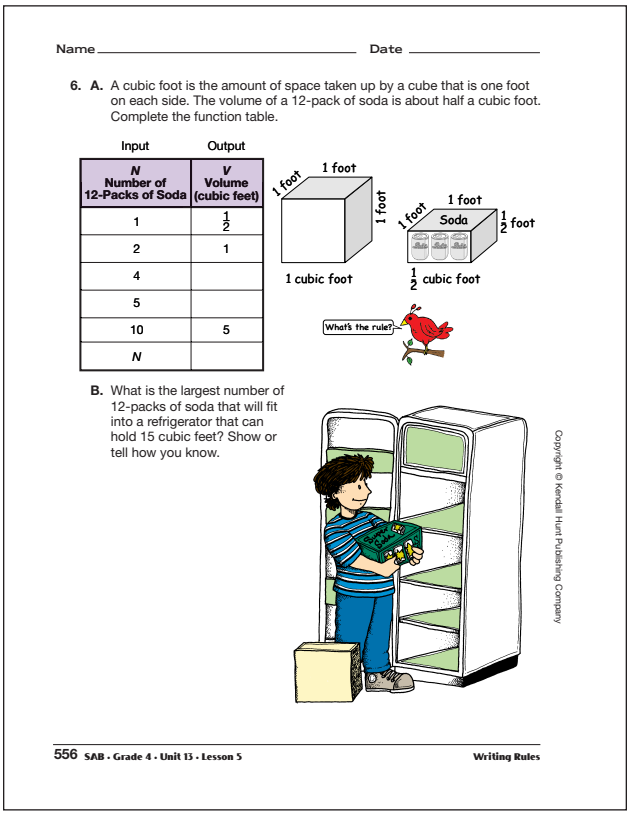
B.* Table B. In Table B, 1 marble is 5 cc and in Table A, 1 marble is 3 cc.

C. $T = N \times (3) + 50$

$T = N \times (5) + 50$

D. The 50 is the volume of water in the graduated cylinder at the start.

E. The total volume is equal to the number of marbles times five plus 50 cc.



Name _____ Date _____

6. A. A cubic foot is the amount of space taken up by a cube that is one foot on each side. The volume of a 12-pack of soda is about half a cubic foot. Complete the function table.

Input	Output
N **Number of 12-Packs of Soda**	***V*** **Volume (cubic feet)**
1	$\frac{1}{2}$
2	1
4	
5	
10	5
N	

B. What is the largest number of 12-packs of soda that will fit into a refrigerator that can hold 15 cubic feet? Show or tell how you know.

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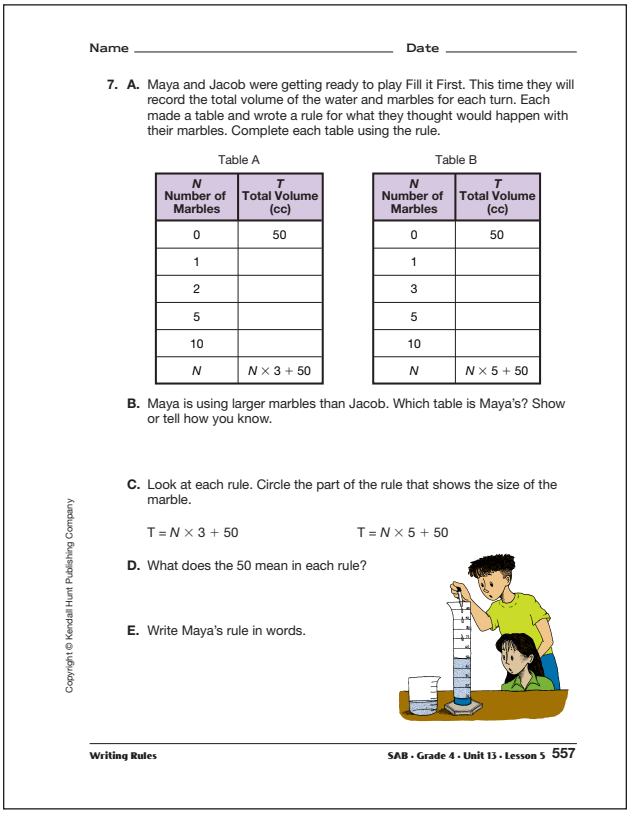

Name _____ Date _____

7. A. Maya and Jacob were getting ready to play Fill it First. This time they will record the total volume of the water and marbles for each turn. Each made a table and wrote a rule for what they thought would happen with their marbles. Complete each table using the rule.

Table A

N **Number of Marbles**	***T*** **Total Volume (cc)**
0	50
1	
2	
5	
10	
N	$N \times 3 + 50$

Table B

N **Number of Marbles**	***T*** **Total Volume (cc)**
0	50
1	
3	
5	
10	
N	$N \times 5 + 50$

B. Maya is using larger marbles than Jacob. Which table is Maya's? Show or tell how you know.

C. Look at each rule. Circle the part of the rule that shows the size of the marble.

$T = N \times 3 + 50$ $T = N \times 5 + 50$

D. What does the 50 mean in each rule?

E. Write Maya's rule in words.

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***Answers and/or discussion are included in the lesson.**

Name _____ Date _____

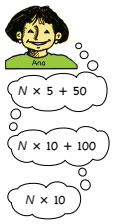
✓ **Check-In: Questions 8-10**

8. Ana is playing Fill it First, so she made a table to help her predict the total volume of water and marbles in the graduated cylinder.

A. Complete the table.

N Number of Marbles	*T* Total Volume (cc)
0	100
1	110
2	120
3	
	140
N	

B. Which rule do you agree with? Explain.



9. Linda is preparing to play Fill it First. She writes a rule. Complete the table using the rule.

N Number of Marbles	*T* Total Volume (cc)
0	100
1	
2	
5	
10	
N	*N* × 6 + 100

10. Look at the function tables in Questions 8 and 9. Who is using the larger marbles, Linda or Ana? How do you know?

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8. A.

N Number of Marbles	*T* Total Volume (cc)
0	100
1	110
2	120
3	130
4	140
N	$N \times 10 + 100$

B. Possible answer: I agree with N × 10 + 100. I tried the others and they did not work. The last one, N × 10, forgot to put the starting volume in the rule.

9.

N Number of Marbles	*T* Total Volume (cc)
0	100
1	106
2	112
5	130
10	160
N	$N \times 6 + 100$

10. Ana has the larger marble. In their rules, they multiplied the number of marbles by the volume of each marble. Ana's marble is 10 cc and Linda's is 6 cc.

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Student Activity Book

Homework

Questions 1–5 (SAB pp. 559–561)

1. A.

Input / Output

Weight in Pounds	Weight in Ounces
1	16
2	32
4	64
5	80
50	800
100	1600
148	2368

B. The weight in ounces is equal to the weight in pounds times 16.

C. 384 ounces. Possible responses: 24 pounds × 16 = 384 oz., or I looked at the table. 50 pounds is equal to 800 oz., so 25 pounds is equal to 400 oz. Then I subtracted the equivalent of 1 pound or 16 oz.; 400 oz. – 16 oz. = 384 oz.

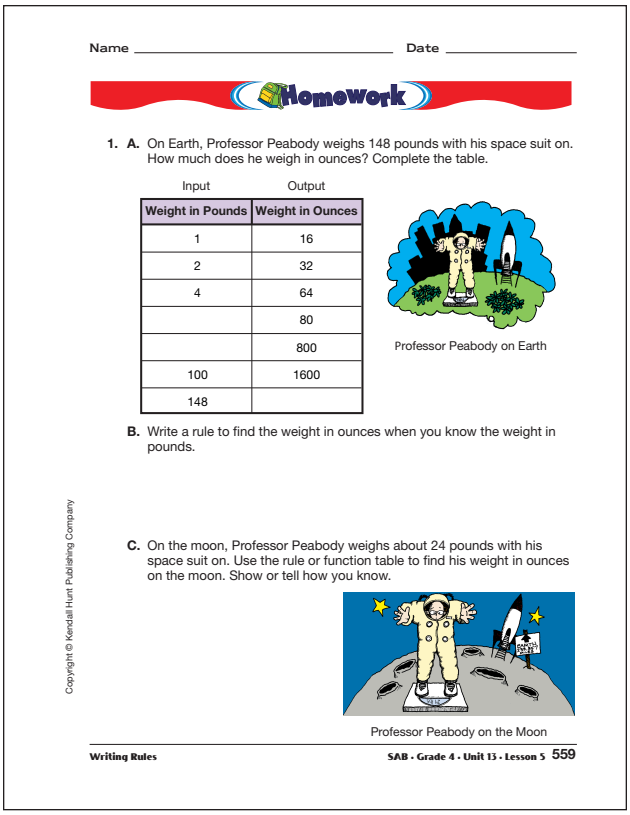
2. 138 pounds or 2208 ounces. Possible responses: 160 oz. = 10 pounds. So, 148 pounds – 10 pounds = 138 pounds; 148 pounds × 16 oz. = 2368 ounces with his boots on. 2368 oz. – 160 oz. = 2208 oz. with his boots off.

3. A.

Input / Output

Mass in Kilograms	Mass in Grams
1	1000
2	2000
3	3000
4	4000
10	10,000
67	67,000

B. The mass in grams is the mass in kilograms times 1000.



Name _____ Date _____

Homework

1. **A.** On Earth, Professor Peabody weighs 148 pounds with his space suit on. How much does he weigh in ounces? Complete the table.

Input / Output

Weight in Pounds	Weight in Ounces
1	16
2	32
4	64
	80
	800
100	1600
148	

Professor Peabody on Earth

B. Write a rule to find the weight in ounces when you know the weight in pounds.

C. On the moon, Professor Peabody weighs about 24 pounds with his space suit on. Use the rule or function table to find his weight in ounces on the moon. Show or tell how you know.

Professor Peabody on the Moon

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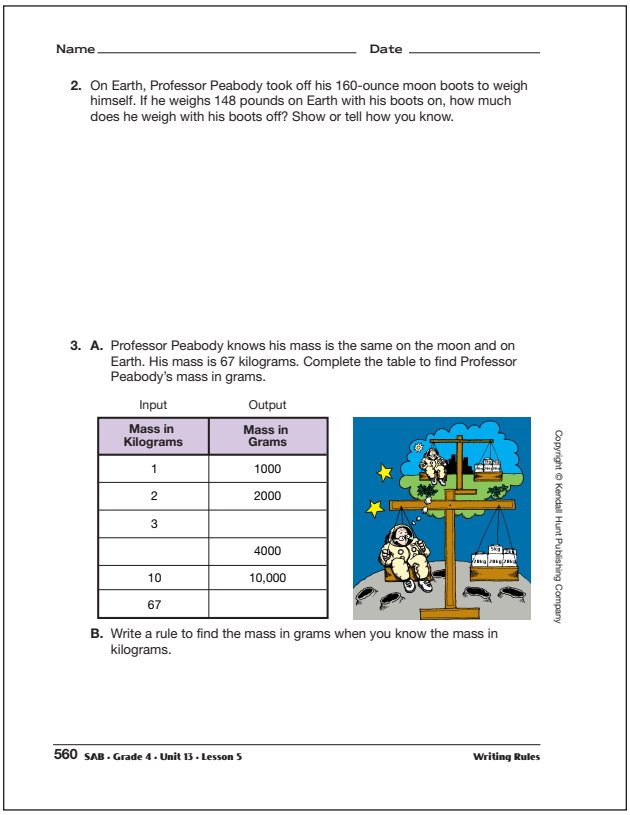

Name _____ Date _____

2. On Earth, Professor Peabody took off his 160-ounce moon boots to weigh himself. If he weighs 148 pounds on Earth with his boots on, how much does he weigh with his boots off? Show or tell how you know.

3. **A.** Professor Peabody knows his mass is the same on the moon and on Earth. His mass is 67 kilograms. Complete the table to find Professor Peabody's mass in grams.

Input / Output

Mass in Kilograms	Mass in Grams
1	1000
2	2000
3	
	4000
10	10,000
67	

B. Write a rule to find the mass in grams when you know the mass in kilograms.

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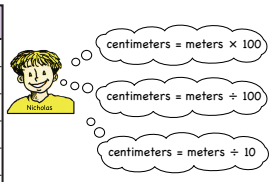
Name _____ Date _____

4. A. Look at the function table below. Nicholas is trying to write the rule to find the distance in centimeters when he knows the distance in meters. Complete the table.

Input Output

Distance in Meters	Distance in Centimeters
1	100
2	
	500
10	1000
100	
1000	



centimeters = meters × 100

centimeters = meters ÷ 100

centimeters = meters ÷ 10

B. Which rule do you agree with? Explain.

5. Nicholas rolled three cars down a ramp. Look at the measurements he recorded for each car. Which car rolled the farthest? Show or tell how you know.

Trial	Distance Car Traveled
Car 1	2 meters and 140 centimeters
Car 2	3.8 meters
Car 3	315 centimeters

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***Student Activity Book* - Page 561**

4. A.

Input Output

Distance in Meters	Distance in Centimeters
1	100
2	200
5	500
10	1000
100	10,000
1000	100,000

B. Centimeters = meters × 100. Possible response: I tried the other rules and they did not work. I know there are more centimeters in each meter, so dividing meters by 100 or 10 does not work.

5. Car 2 traveled the farthest. Possible response: I changed all the measurements into centimeters and Car 2 traveled 380 centimeters. Car 1 traveled 340 cm and Car 3 traveled 315 centimeters.

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