Name ______________________ Date ____________ Time ____________

LESSON 7•1

Exploring Exponents

The number sentences below contain **exponents.** Find the pattern, and complete the number sentences.

1. $3 * 3 = 3^2$ $3 * 3 * 3 = 3^3$ $3 * 3 * 3 * 3 = 3^4$

2. $5 * 5 = 5^2$ $5 * 5 * 5 = 5^3$ $5 * 5 * 5 * 5 = 5^4$

3. $18 * 18 = 18^2$ $18 * 18 * 18 = 18^3$ $18 * 18 * 18 * 18 = 18^4$

4. $7 * 7 =$ _____ ______________ $= 7^3$ $7 * 7 * 7 * 7 =$ _____

5. $4 * 4 * 4 * 4 * 4 * 4 * 4 =$ _____

6. $2^6 =$ ______________________________

7. If you were going to explain to someone how to use exponents to write a number, what would you say?

____

____

____

____

____

____

____

Try This

Write the repeated-factor expression or the exponential notation.

8. $28^6 =$ ______________________________

9. $309 * 309 * 309 * 309 * 309 =$ ______________________________

10. $2^3 * 2^3 =$ ______________________________

Name ______________________ Date ______________ Time ______________

LESSON 7•1

Patterns with Fibonacci Numbers

1. The sequence of numbers 1, 1, 2, 3, 5, 8, 13, … is called the **Fibonacci sequence.** In the Fibonacci sequence, every number, starting with the third number, is equal to the sum of the two numbers that come before it.

Examples:

Third number: $1 + 1 = 2$ Fourth number: $1 + 2 = 3$

Fill in the next three Fibonacci numbers. 1, 1, 2, 3, 5, 8, 13, ______, ______, ______

2. Study the following pattern:

$1^2 + 1^2 = 1 * 2$
$1^2 + 1^2 + 2^2 = 2 * 3$
$1^2 + 1^2 + 2^2 + 3^2 = 3 * 5$
$1^2 + 1^2 + 2^2 + 3^2 + 5^2 = 5 * 8$

a. Write the next two number sentences in the pattern.

____

____

b. Describe the pattern in words.

____

____

____

3. a. Solve the following problems: $2^2 - (1 * 3) =$ ______ $3^2 - (2 * 5) =$ ______

$5^2 - (3 * 8) =$ ______ $8^2 - (5 * 13) =$ ______

b. Write the next two number sentences in the pattern.

____

c. Describe the pattern in words.

____

____

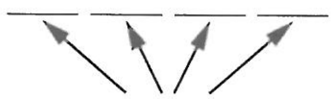
____

Name Date Time

LESSON 7•1

Counting Computer Passwords

The computer at a local library provides a different computer password for every library card. The passwords can include letters, numbers, or a combination of letters and numbers. Both lower-case and upper-case letters can be used. This results in 62 choices for each character in the password.



62 choices for each character

A	a	B	b	C	c	D	d	E	e	F	f
G	g	H	h	I	i	J	j	K	k	L	l
M	m	N	n	O	o	P	p	Q	q	R	r
S	s	T	t	U	u	V	v	W	w	X	x
Y	y	Z	z	0	1	2	3	4	5	6	7
8	9										

1. List three possible 4-character passwords.

a. ______ ______ ______ ______

b. ______ ______ ______ ______

c. ______ ______ ______ ______

2. The total number of possible passwords can be found by using 62 as a factor 4 times.

$$62 * 62 * 62 * 62, \text{ or } 62^4$$

Use your calculator to find the number of different possible 4-character computer passwords. ______

Name Date Time

LESSON 7•2

Powers of 10

Find the patterns and complete the table below. Do not use your *Student Reference Book.*

1,000,000	100,000	10,000	1,000	100	10	1
				hundreds		ones
10[100,000s]			10[100s]			10[tenths]
		10 * 10 * 10 * 10		10 * 10		
	10^5				10^1	10^0

Describe at least three patterns that you see in the table.

1. ______

2. ______

3. ______

Name ______________________ Date ______________ Time ______________

LESSON 7•2

Negative Powers of 10

Our base-ten place-value system works for decimals as well as for whole numbers.

Tens	Ones	.	Tenths	Hundredths	Thousandths
10s	1s	.	0.1s	0.01s	0.001s

Negative powers of 10 can be used to name decimal places.

Example: $10^{-2} = \frac{1}{10^2} = \frac{1}{10 * 10} = \frac{1}{10} * \frac{1}{10} = 0.1 * 0.1 = 0.01$

Very small decimals can be hard to read in standard notation, so people often use number-and-word notation, exponential notation, or prefixes instead.

Guides for Small Numbers

Number-and-Word Notation	Exponential Notation	Standard Notation	Prefix
1 tenth	$10^{-1} = \frac{1}{10}$	0.1	deci-
1 hundredth	$10^{-2} = \frac{1}{10 * 10}$	0.01	centi-
1 thousandth	$10^{-3} = \frac{1}{10 * 10 * 10}$	0.001	milli-
1 millionth	$10^{-6} = \frac{1}{10 * 10 * 10 * 10 * 10 * 10}$	0.000001	micro-
1 billionth	$10^{-9} = \frac{1}{10 * 10 * 10 * 10 * 10 * 10 * 10 * 10 * 10}$	0.000000001	nano-
1 trillionth	$10^{-12} = \frac{1}{10*10*10*10*10*10*10*10*10*10*10*10}$	0.000000000001	pico-

Use the table above to complete the following statements.

1. A fly can beat its wings once every 10^{-3} seconds, or once every one thousandth of a second. This is one ______________ second.

2. Earth travels around the sun at a speed of about one inch per microsecond. This is $10^{\square}$ second, or a ______________ of a second.

3. Electricity can travel one foot in a nanosecond, or one ______________ of a second. This is $10^{\square}$ second.

4. In $10^{\square}$ second, or one picosecond, an air molecule can spin once. This is one ______________ of a second.

Name Date Time

LESSON 7•3

Using Place Value to Rename Numbers

Write the numbers from the name-collection box tag in the place-value chart. Then follow the pattern in Problem 1 to complete each name-collection box.

	Billions			Millions			Thousands			Ones		
	100	10	1	100	10	1	100	10	1	100	10	1
1.									1	3	0	0
2.												
3.												
4.												

Example:

1,300
1,000 + 300
1 thousand 3 hundred
13 hundred
$1\frac{300}{1000}$ thousands
$1\frac{3}{10}$ thousands
1.3 thousands

1.

1,800

2.

1,400,000

3.

1,600,000

Name _______________ Date _______________ Time _______________

LESSON 7•3

Writing in Expanded Notation

A Standard Notation: 325

B Expanded Notation as an addition expression: 300 + 20 + 5

C Expanded Notation as the sum of multiplication expressions: (3 * 100) + (2 * 10) + (5 * 1)

D Expanded Notation as the sum of multiplication expressions using powers of 10: $(3 * 10^2) + (2 * 10^1) + (5 * 10^0)$

Write each number below in the other three possible ways, as shown above.

1. a. 5,314

b. _______________

c. _______________

d. _______________

2. a. _______________

b. 2,000 + 700 + 50 + 6

c. _______________

d. _______________

3. a. _______________

b. _______________

c. (9 * 100) + (8 * 10) + (3 * 1)

d. _______________

4. a. _______________

b. _______________

c. _______________

d. $(7 * 10^3) + (4 * 10^2) + (5 * 10^1) + (2 * 10^0)$

Name Date Time

LESSON 7•4

Reviewing Parentheses

1. Read the following sentence. Mary Grace the lizard ate three crickets.

This sentence could have multiple meanings.

1. The speaker is telling someone named Mary Grace that the lizard ate three crickets.
2. The lizard, named Mary Grace, ate three crickets.
3. The speaker is telling someone named Mary that the lizard, named Grace, ate three crickets.

Without commas, it's hard to tell which meaning was intended. Write the number of the meaning next to each sentence below.

a. ________ Mary Grace, the lizard, ate three crickets.

b. ________ Mary Grace, the lizard ate three crickets.

c. ________ Mary, Grace the lizard, ate three crickets.

By adding commas, the meaning of a sentence becomes clear. In number sentences, parentheses are used to indicate what to calculate first.

2. Insert parentheses in each sentence to make the sentence true.

a. $3 * 4 + 7 = 33$ ____________________

b. $6 + 9 * 5 = 51$ ____________________

c. $27 / 4 + 5 + 6 = 9$ ____________________

3. Insert parentheses in the expressions below, and find their solutions.

a. $7 * 5 - 4 =$ ____________________

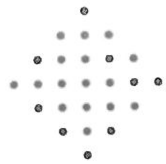
b. $6 + 9 \div 3 =$ ____________________

Name Date Time

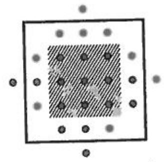
LESSON 7•4

Describing Dot Patterns

The total dots in this dot array can be found by using patterns.

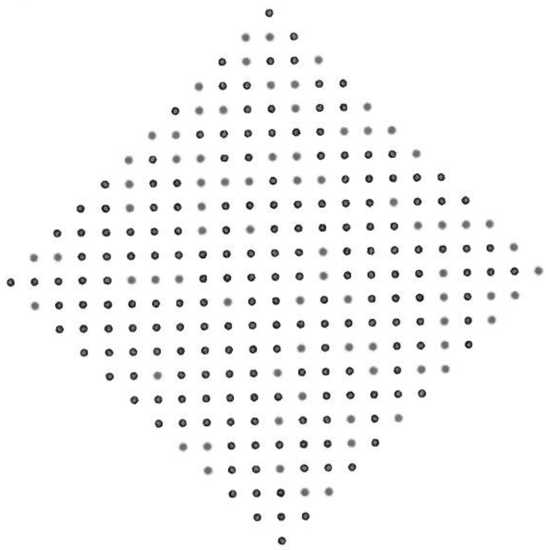


Here is one way to find the total:



((3 * 3) + (4 * 3) + 4)

Use shape outlines or colors to identify a pattern on this dot array. Write a number model for your pattern. Then write a number story that matches your number model.



Number model: ______________________

Number story:

____

____

____

____

____

____

____

Name Date Time

LESSON 7•5

Evaluating Expressions

Janet and Alisha are using their calculators to evaluate expressions. Janet has a four-function calculator, and Alisha has a scientific calculator. They both enter the same key sequence, but their calculator displays are different.

1. Study the key sequence and calculator displays below.

Key Sequence	Janet's Display	Alisha's Display
3 + 5 × 2 =	16	13

2. Decide the order that each calculator used to perform the operations. Use parentheses to write a number sentence that models each order.

   a. Number model for Janet's calculator: ______

   b. Number model for Alisha's calculator: ______

3. Use your number models in Problem 2 to evaluate the following key sequence. Then complete the table for each calculator.

Key Sequence	Janet's Display	Alisha's Display
5 × 3 + 7 − 8 ÷ 2 =		

Try This

4. Write number models that show what each calculator did in Problem 3.

   a. Number model for Janet's calculator:

   ______

   b. Number model for Alisha's calculator:

   ______

Name Date Time

LESSON 7•5

Discovering Exponent Patterns

Look for a pattern in the number sentences below. Then use the pattern to solve Problems 1–3.

$$7^2 * 7^3 = 7^5$$

$$12^7 * 12^3 = 12^{10}$$

$$34^6 * 34^6 = 34^{12}$$

1. $2^2 * 2^3 =$ ______

   Explain how you can prove your answer to Problem 1 is correct.

   ______

   ______

   ______

2. $5^5 * 5^7 =$ ______

3. $94^8 * 94^2 =$ ______

   Describe the pattern you are using to solve the problems.

   ______

   ______

4. Circle the problem below for which the pattern does *not* work.

   $28^5 * 5^3$ $14^8 * 14^9$ $22^5 * 22^2$

Try This

5. What do you think happens when two numbers with the same base are divided?

   ______

   ______

   ______

6. Solve this problem to check your prediction.

   $2^5 / 2^3 =$ ______

Name ______________________ Date ______________ Time ______________

LESSON 7·6

Looking at Line Graphs

Look closely at the graph you have. List each of the following features for your graph. If any of the features are missing from your graph, make up one that is appropriate.

1. Title of the graph: ______________________

2. Label for the horizontal axis: ______________________

3. Label for the vertical axis: ______________________

4. Range of the data: ______________________

5. Write three questions that can be answered by looking at your graph.

____

____

____

____

6. Line graphs are often used to show trends—how things change over time. If your graph shows a trend, describe what it shows. If not, explain what you think the graph tells you.

____

____

____

____

____

Name Date Time

LESSON 7•6

Graphing Sets of Data on a Line Graph

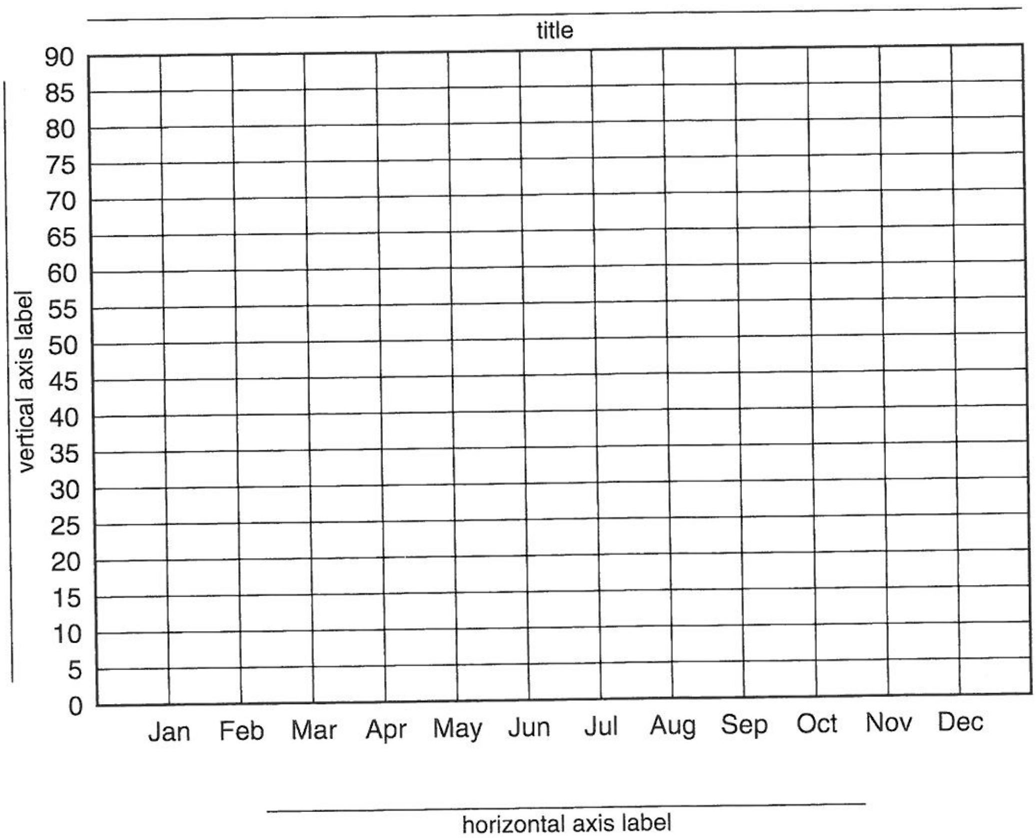
The following table shows the average high and low temperatures (°F) of a city in the Midwest United States.

Average Temperatures (°F)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	33	36	46	59	72	80	85	82	75	62	49	38
Low	20	22	29	39	51	60	65	64	56	45	36	25

Make a line graph for this data using the grid below. Use a different colored pencil to connect the points for each data set.

1. Choose and write a title for the graph.
2. Label each axis.
3. Plot all the points for the high temperatures. Connect the data points. Write the words *High Temperature* above the line formed.
4. Plot all the points for the low temperatures. Connect the data points. Write the words *Low Temperature* under the line formed.



Name ______________________ Date ______________ Time ______________

LESSON 7•7

Change in Price

A local store is changing the price of some popular items. Listed below are the items with the new changes. Complete the table.

Item	Original Price	Change in Price (Fraction)	Change in Price (Dollars)	Price After Change
Gloves	\$5.00	$-\frac{1}{5}$	−\$1.00	\$4.00
Hats	\$7.50	$-\frac{1}{10}$		\$6.75
Belts	\$10.00	$+\frac{1}{4}$		
Socks	\$1.50	$+\frac{1}{2}$		
Pants	\$12.00	$-\frac{1}{20}$		
Shirts	\$8.50	$+\frac{3}{10}$		

1. Which item has the largest price increase? ______________

2. Which item has the largest price decrease? ______________

3. Which item has a 20% change? ______________

4. If you were to purchase a hat and belt after the price change, would you pay more or less than the original price? ______________

   How much more or less? ______________

5. If you purchased one each of the items before the price changes and one of each item after the price changes, what would be the total change in cost? State your answer as a positive or negative number. Explain your solution.

____

____

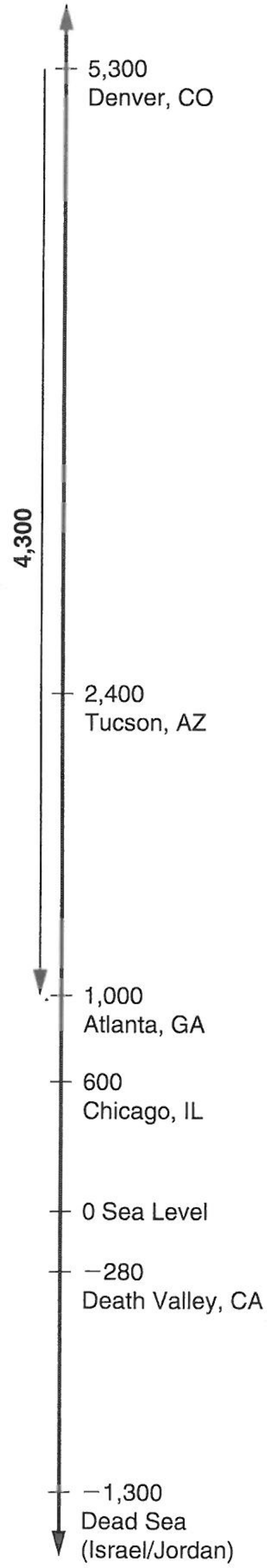
____

____

Name Date Time

LESSON 7•9

Comparing Elevations



This number line shows the elevation of several places. Elevation measures how far above or below sea level a location is. For example, an elevation of 5,300 for Denver means that Denver is 5,300 feet above sea level. An elevation of −280 for Death Valley means that some point in Death Valley is 280 feet below sea level.

Fill in the table below. Use the example as a guide.

Example:

If you start at Denver and travel to Atlanta, what is your change in elevation?

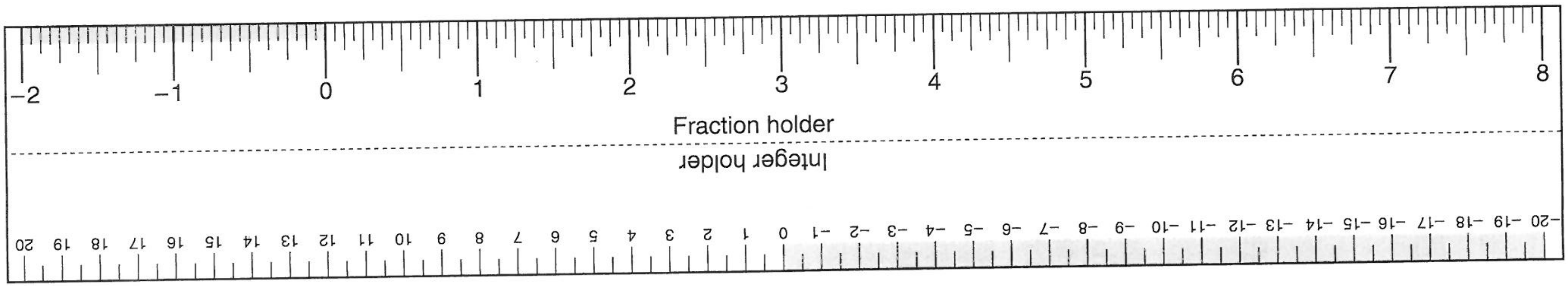
Solution:

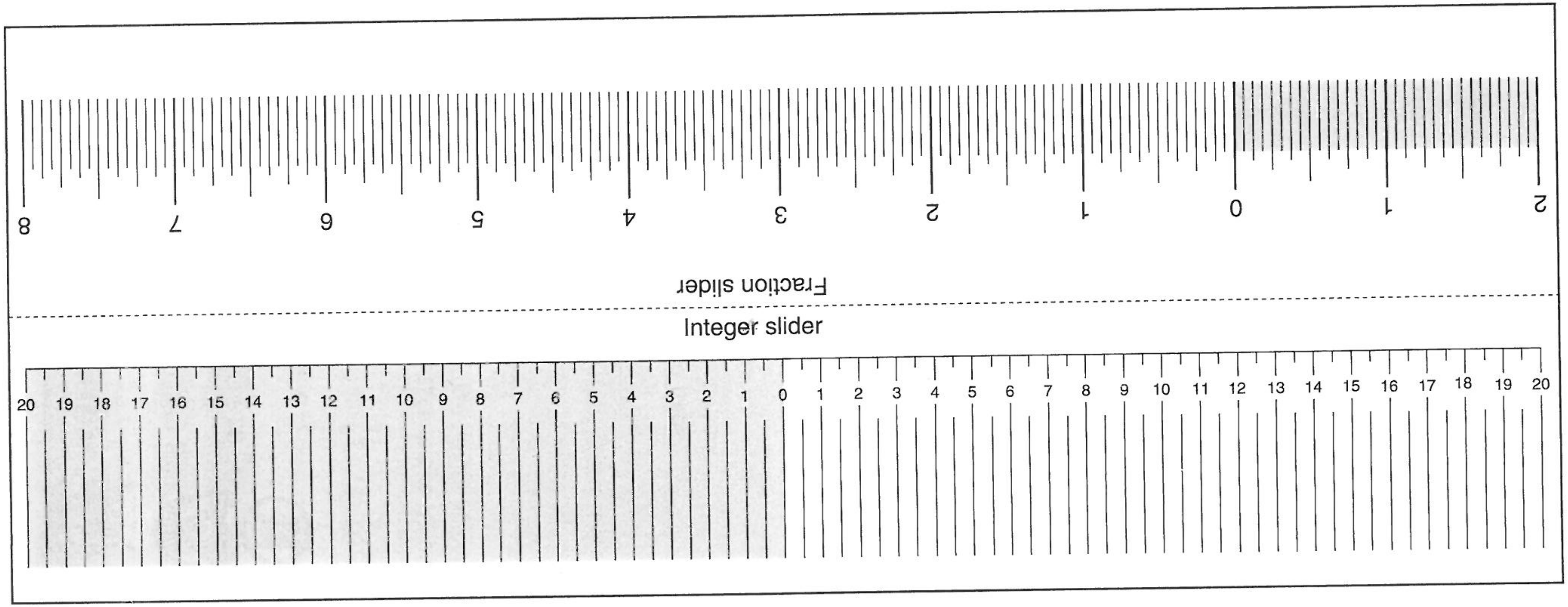
Draw an arrow next to the number line. Start it at the elevation for Denver (5,300 feet). End it at the elevation for Atlanta (1,000 feet). Use the number line to find the length of the arrow (4,300 feet). Your final elevation is lower, so report the change in elevation as *4,300 feet down.* Write a number model for the problem: 5,300 − 1,000 = 4,300.

Start at	Travel to	Change in Elevation / Number Model
Denver	Atlanta	4,300 feet down
		5,300 − 1,000 = 4,300
Chicago	Tucson	_______ feet _______
Death Valley	Dead Sea	_______ feet _______
Dead Sea	Death Valley	_______ feet _______
Tucson	Death Valley	_______ feet _______
Dead Sea	Atlanta	_______ feet _______

LESSON 7·10

Slide Rule





Name Date Time

LESSON 7•10

Using a Slide Rule for Mixed Numbers

Use your slide rule to solve the problems below.

1. $13\frac{1}{2} + 3\frac{3}{4} =$ ______
2. $18 - 1\frac{1}{2} =$ ______
3. $11\frac{5}{8} + (-6\frac{3}{4}) =$ ______
4. $-16\frac{1}{2} - 3\frac{3}{8} =$ ______
5. $12\frac{3}{8} - (-4\frac{3}{4}) =$ ______
6. $-5\frac{1}{8} + (-14\frac{1}{2}) =$ ______

Write an explanation for how to use a slide rule to solve problems with multidigit mixed numbers.

______

______

______

______

Name Date Time

LESSON 7•10

Using a Slide Rule for Mixed Numbers

Use your slide rule to solve the problems below.

1. $13\frac{1}{2} + 3\frac{3}{4} =$ ______
2. $18 - 1\frac{1}{2} =$ ______
3. $11\frac{5}{8} + (-6\frac{3}{4}) =$ ______
4. $-16\frac{1}{2} - 3\frac{3}{8} =$ ______
5. $12\frac{3}{8} - (-4\frac{3}{4}) =$ ______
6. $-5\frac{1}{8} + (-14\frac{1}{2}) =$ ______

Write an explanation for how to use a slide rule to solve problems with multidigit mixed numbers.

______

______

______

______

Name Date Time

LESSON 7•11

Broken Calculator Problems

Change the display in the calculator without using the broken key. *You may only add and subtract negative numbers to reach the ending number.* The first one is done for you.

Starting Number	Ending Number	Broken Key	Keystrokes
38	48	0	38 [−] [(−)] 5 [−] [(−)] 5 [Enter =]
24	70	6	
200	89	1	
351	251	0	
1,447	1,750	3	

Make up five problems of your own. When you have finished, trade papers with your partner, and solve each other's problems. *You may only add and subtract negative numbers to reach the ending number.*

Starting Number	Ending Number	Broken Key	Keystrokes