LESSON 9 Subtracting across zeros

A. Here are the steps for subtracting 3-digit numbers across zeros. Complete the example.

$$\begin{array}{r} {\scriptstyle}\ \ {\scriptstyle 9}\ \ {\scriptstyle} \\ {\scriptstyle 7}\ {\scriptstyle 10}\ {\scriptstyle 12} \\ 8\ 0\ 2 \\ -\ 2\ 3\ 8 \\ \hline \\ 4 \end{array}$$

1. Subtract the ones column. 2 − 8 requires regrouping.
2. Borrow 1 from the tens place. But there's nothing to borrow.
3. Borrow 1 from the hundreds place. 8 becomes 7. 0 becomes 10.
4. Now borrow 1 from the tens place. 10 becomes 9. 2 becomes 12.
5. Subtract the ones column. 12 − 2 = 4
6. Write 4 in the ones column.
7. Continue subtracting to the next column.

B. You can also use the box method, as shown below. Complete the example.

$$\begin{array}{r} {\scriptstyle 5}\ {\scriptstyle 9}\ {\scriptstyle 9}\ {\scriptstyle 13} \\ 6\ 0\ 0\ 3 \\ -\ 4\ 7\ 5\ 8 \\ \hline \\ 5 \end{array}$$

1. Subtract the ones column. 3 − 8 requires regrouping.
2. There are no tens. Find the first non-zero digit in the colums to the left of the tens place. Draw a box from that digit to the tens place. The first non-zero digit is 6, so the box goes around 600.
3. Take 1 from 600. 600 becomes 599. 3 becomes 13.
4. Subtract as usual from right to left, column by column.

C. Subtract the numbers across zeros.

505 − 238	700 − 482	802 − 357	900 − 284	400 − 318
900 − 529	604 − 279	800 − 463	502 − 236	300 − 145
7000 − 1650	3000 − 2350	9003 − 5080	4000 − 2710	6005 − 2980

LESSON 9 Practice

A. Subtract numbers up to 1000.

854 − 299	713 − 497	562 − 229	865 − 583	931 − 368
615 − 338	786 − 547	980 − 286	747 − 289	812 − 367
934 − 568	690 − 259	834 − 297	753 − 376	956 − 424

B. Subtract the numbers across zeros.

803 − 298	504 − 276	900 − 454	605 − 257	700 − 319
900 − 393	403 − 227	505 − 238	802 − 445	704 − 229

LESSON 21 Multiplying 2-digit numbers

A. Here are the steps for multiplying a 3-digit number by a 1-digit number with regrouping.

$$\begin{array}{r} {\scriptstyle 4\ \ 6\ \ } \\ 259 \\ \times\quad 7 \\ \hline 1813 \end{array}$$

1. Multiply the ones. 9 x 7 = 63
2. Write 3 in the ones column and carry 6 to the tens column.
3. Multiply the tens and add the carryover. (5 x 7) + 6 = 41
4. Write 1 in the tens column and carry 4 to the hundreds column.
5. Multiply the hundreds and add the carryover. (2 x 7) + 4 = 18
6. Write 1 in the thousands column and 8 in the hundreds column.

B. Here are the steps for multiplying a 2-digit number by a 2-digit number.

$$\begin{array}{r} {\scriptstyle 7\ \ } \\ 38 \\ \times\ 29 \\ \hline 342 \\ +760 \\ \hline 1102 \end{array}$$

1. Multiply 38 x 9 and write the result in the first row.
   1) Multiply the ones. 8 x 9 = 72
   2) Write 2 in the ones column and carry 7 to the tens column.
   3) Multiply the tens and add the carryover. (3 x 9) + 7 = 34
   4) Write 4 in the tens column and 3 in the hundreds column.
2. Multiply 38 x 20 and write the result in the second row.
   1) Write 0 in the ones column.
   2) Multiply 38 x 2 as you did in the step 1. 38 x 2 = 76
3. Add the two products to find the answer. 342 + 760 = 1102

C. Multiply by 1-digit and 2-digit numbers.

87 × 4	24 × 9	659 × 7	523 × 5	856 × 6
93 × 27	48 × 67	73 × 57	87 × 83	43 × 59

A math riddle for you! What occurs twice in a week, once in a year, but never in a day?

LESSON 21 Practice

A. Multiply by 1-digit numbers.

876 × 8	428 × 9	367 × 3	285 × 4	579 × 5
479 × 6	859 × 3	297 × 7	956 × 5	392 × 4

B. Multiply the 2-digit numbers.

52 × 26	88 × 37	39 × 46	63 × 35	80 × 43
10 × 72	48 × 53	26 × 65	29 × 75	86 × 23

LESSON 42 Order of operations

A. When evaluating an expression, you may get different results depending on the order in which you perform the operations. Here is an example that demonstrates this problem.

$3 + 2 \times 5 =$ _____

Do addition first, then multiplication.
What answer do you get?

$3 + 2 \times 5 =$ _____

Do multiplication first, then addition.
What answer do you get?

B. Rules that determine the order of operations are defined to eliminate this confusion. To get correct answers, you must perform operations in the proper order: **Parentheses, Exponents, Multiplication and Division in order from left to right, then Addition and Subtraction in order from left to right**. These order-of-operations rules are often referred to as **PEMDAS**, which you can remember as "Please Excuse My Dear Aunt Sally." Here is an example of applying PEMDAS to determine the order of operations.

$3^2 - 5 \div (3 - 8) \times -3 + 4$	Parentheses
$= 3^2 - 5 \div -5 \times -3 + 4$	Exponents
$= 9 - 5 \div -5 \times -3 + 4$	Division
$= 9 - 1 \times -3 + 4$	Multiplication
$= 9 - 3 + 4$	Subtraction
$= 6 + 4$	Addition
$= 10$	

Order of Operations

Parentheses
Exponents
Multiply or
Divide
Add or
Subtract

C. Use the correct order of operations to evaluate each expression.

$6^2 + 7 \times -4 =$

$(-5 + 1 \times 9) - 8 \times 5 =$

$2 \times (-5 + -8) =$

$-2 \times (3 + 6) \div 3 - 3^2 =$

$2 \times (81 \div 3^2 - 3 \times 3 + 4 \times 6) - 2^3 \times (7 - 4) =$

$-50 \div (-7 + -3) \times 5 - 10 \times -5 \div (5 + -10) + -5 =$

LESSON 42 Practice

A. Evaluate each expression.

$-5 + 2 \times 5^2 =$

$-6 + 2^3 \div 2 \times -4 - 2 =$

$(-5 + 2) \times 5^2 =$

$-6 + 2^3 \div 2 \times (-4 - 2) =$

$3^2 - 3 \div -3 =$

$(-6 + 2^3) \div 2 \times -4 - 2 =$

$3^2 - -3 \div -3 =$

$4^2 + 3 \times -6 + 3 \div -3 =$

$(3^2 - 3) \div -3 =$

$4^2 + 3 \times (-6 + 3) \div -3 =$

$3 + 7 \times 5 + (6 + 8 \times 5 \div 4 - 8) \div 2^2 \times 7 =$

$27 \div (9 - -6 \times -3) \times 3 + 9 + 6 \times (-7 + 4) \div 3^2 =$

$(6^2 \div 9 + 28 \div 7 + 5 \times 8 - 2^3) \div (-9 - 2 \times -2) =$

B. Fill in the missing number in each equation.

$\_\_\_\_\_ \div 3 \times 2 = 12$

$3 \times 8 - \_\_\_\_\_ \times 4 = 16$

$13 \times \_\_\_\_\_ - 9 = 30$

$-2 + 16 \div 2 + \_\_\_\_\_ = 10$

LESSON 47 Finding factors

A. A **factor** is an integer that can evenly divide into another number. You can find all factors of a number in the same way you can find all factor pairs. The difference is that you usually list factors in order from least to greatest, not in pairs. Here are the steps for finding all factors of a number.

B. List all factors of each number.

24 _____

63 _____

76 _____

40 _____

100 _____

140 _____

150 _____

C. Use the clues to solve each riddle.

I am a 2-digit number and a factor of 128. The sum of my digits is divisible by 10. What number am I? _____

I am a 2-digit number and a factor of 60. The product of my digits is positive. I have 4 as a factor. What number am I? _____

I am a 2-digit number and a factor of 99. The sum of my digits is divisible by 3 but not by 9. What number am I? _____

LESSON 47 Practice

A. List all factors of each number.

3		13	
6		15	
8		16	
9		18	
10		20	
56			
30			
96			
84			
72			

B. Fill in the squares such that the products are correct horizontally and vertically.

2		10			21			72
3		12			30			28
6	20		15	42		36	56	

		64			32			0
		18			5			56
48	24		4	40		0	35	

LESSON 58 Simplifying fractions

A. Simplifying fractions means to make the fraction as simple as possible. It is also called reducing since you make the numerator and denominator as small as possible without changing the value of the fraction. In other words, simplifying a fraction is finding an equivalent fraction with the smallest possible numerator and denominator. This equivalent fraction is called the simplest form, simplest terms, or lowest terms.

B. To simplify fractions, divide the numerator and denominator by their greatest common divisor (GCD). Here is an example of using this method. Complete the example.

$$\frac{60}{84} \Rightarrow \begin{matrix} 60 = 2 \times 2 \times 3 \times 5 \\ 84 = 2 \times 2 \times 3 \times 7 \\ \text{GCD} = 2 \times 2 \times 3 = 12 \end{matrix} \Rightarrow \frac{60 \div 12}{84 \div 12} = \frac{\quad}{\quad}$$

C. Another way to simplify fractions is to keep dividing the numerator and denominator by a common divisor until you can't divide them any further. Here is an example of reducing a fraction through this process. Complete the example.

$$\frac{42}{210} \Rightarrow \frac{42 \div 3}{210 \div 3} = \frac{14 \div}{70 \div} = \frac{2 \div}{10 \div} = \frac{\quad}{\quad}$$

D. Simplify (or reduce) each fraction to its lowest terms.

$$\frac{16}{22} = \qquad \frac{12}{16} = \qquad \frac{18}{30} =$$

$$\frac{40}{72} = \qquad \frac{36}{28} = \qquad \frac{15}{45} =$$

$$\frac{24}{108} =$$

$$\frac{315}{405} =$$

LESSON 58 Practice

Write each fraction in its simplest form.

$\frac{8}{18} =$ $\frac{10}{14} =$ $\frac{16}{20} =$

$\frac{9}{15} =$ $\frac{12}{27} =$ $\frac{35}{40} =$

$\frac{6}{20} =$ $\frac{28}{32} =$ $\frac{21}{28} =$

$\frac{9}{36} =$ $\frac{25}{45} =$ $\frac{13}{39} =$

$\frac{7}{42} =$ $\frac{14}{49} =$ $\frac{48}{80} =$

$\frac{90}{315} =$

$\frac{64}{200} =$

$\frac{140}{448} =$

LESSON 102 Dividing decimals by powers of 10

A. To divide decimals by a power of 10, move the decimal point to the left as many places as the number of zeros in the power of 10. The following table shows the place value pattern when decimals are divided by powers of 10. Complete the table.

	8,500	463	10.3	2.6
÷ 10	850		1.03	
÷ 100				0.026
÷ 1000		0.463		

B. Divide the decimals by a power of 10.

$703 \div 10^2 =$ $\qquad$ $2.5 \div 10^2 =$

$22.6 \div 10^3 =$ $\qquad$ $340 \div 10^4 =$

$574.5 \div 10^2 =$ $\qquad$ $6{,}710 \div 10^5 =$

$12{,}800 \div 10^5 =$ $\qquad$ $14{,}203 \div 10^3 =$

C. Fill in the blank with a power of 10 to make each statement true.

$0.42 \div \square = 0.042$ $\qquad$ $\square \div 10^2 = 2.47$

$25.6 \div \square = 0.256$ $\qquad$ $\square \div 10^2 = 0.988$

$7{,}250 \div \square = 0.725$ $\qquad$ $\square \div 10^5 = 0.0306$

D. Solve the word problems.

A roll of 100 stamps costs $49. What's the price of one stamp?

Randy bought 10 stamps with $20. What was his change?

LESSON 102 Practice

A. Divide the decimals by a power of 10.

$8{,}6200 \div 10 =$	$16 \div 10^4 =$
$8{,}6200 \div 10^2 =$	$4.2 \div 10^2 =$
$8{,}6200 \div 10^3 =$	$273 \div 10^3 =$
$8{,}6200 \div 10^4 =$	$5{,}800 \div 10^5 =$
$8{,}6200 \div 10^5 =$	$78{,}253 \div 10^3 =$

B. Fill in the blank with a power of 10 to make each statement true.

$0.64 \div$ _____ $= 0.064$	_____ $\div 10^2 = 3.07$
$50.2 \div$ _____ $= 0.502$	_____ $\div 10^2 = 0.158$
$62.8 \div$ _____ $= 0.0628$	_____ $\div 10^3 = 0.425$
$4{,}300 \div$ _____ $= 0.0043$	_____ $\div 10 = 1.203$
$7{,}029 \div$ _____ $= 0.7029$	_____ $\div 10^4 = 0.764$

C. Solve the word problems.

A local restaurant bought 10 pounds of beef at $53.20. What is the price of beef per pound? _____

A box of 100 pencils sells at $12.00. Jason bought 25 pencils and paid $10. What was his change? _____

A supermarket sells 20 pounds of potatoes at $38.60. How much does 2 pounds of potatoes cost? _____

Joan's car can drive 100 miles on 6 gallons of gas. How many gallons of gas does it use per mile? _____

LESSON 127 Finding unit prices

A. A **unit price** is a price per unit. It is often used to compare the prices of different sizes (or brands) of the same product. One way to find a unit price is to use a proportion.

A 3-pound bag of sugar for $3.60 ⇨ $\frac{\$3.60}{3\ pounds} = \frac{x}{1\ pound}$ ⇨ $x = \frac{\$3.60}{3} = \$1.20$

B. A shortcut method to find a unit price is simply to divide the price by the quantity. Here is an example of comparing unit prices to determine the better buy.

A 2-pound bag of flour for $1.40	or	A 5-pound bag of flour for $2.50
$\frac{\$1.40}{2\ pounds} = \$0.70/pound$		$\frac{\$2.50}{5\ pounds} = \$0.50/pound$

C. Find the unit price of each item. Determine the better buy for each pair.

2 pounds of beef for $10.90	or	4 pounds of beef for $18.80
12 inches of ribbon for $3	or	36 inches of ribbon for $7.20
1 gallon of paint for $26	or	5 gallons of paint for $150
A dozen eggs for $1.80	or	Two dozen eggs for $4.80
6 bottles of soda for $5.40	or	12 bottles of soda for $12.00

LESSON 127 Practice

A. Find the unit price of each item. Circle the better buy between each pair.

2 kilograms of rice for $6.90	or	5 kilograms of rice for $18.00
8 ounces of honey for $5.20	or	16 ounces of honey for $9.60
10 meters of wire for $15	or	50 meters of wire for $80
2 cucumbers for $1.10	or	15 cucumbers for $7.50

B. Go to a grocery store. Write the price and unit price as well as the measurements (for example, 4 ounces) for five different products. At home see if you can take the product price and measurements and come up with the same unit price as the store.

The information on the tag				Your calculation
Product name	Price	Measurements	Unit price	Unit price

LESSON 138 Exponent rules

A. When simplifying expressions with exponents, you can use properties of exponents called "**Exponent Rules**." The following table summarizes the exponent rules. Complete the table with your own examples that demonstrate the rules.

	Rule	Example
Zero exponent	$x^0 = 1, x \neq 0$	
Negative exponent	$x^{-n} = \frac{1}{x^n}, x \neq 0$	
Product of powers	$x^m x^n = x^{m+n}$	
Quotient of powers	$\frac{x^m}{x^n} = x^{m-n}, x \neq 0$	
Power of a power	$(x^m)^n = x^{m \cdot n}$	
Power of a product	$(xy)^n = x^n y^n$	
Power of a quotient	$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}, y \neq 0$	

B. Circle all expressions that are equivalent to the first one in each row.

$4^3 \cdot 4^{-6}$	$4^{-3} \cdot 4^6$	$\frac{4^3}{4^6}$	$(4^{-3})^2$	$4^{-6} \cdot 4^3$	4^{-3}
$(a^{-3}\, b^3)^2$	$\left(\frac{b^3}{a^3}\right)^2$	$(ab)^6$	$\left(\frac{b}{a}\right)^6$	$\frac{a^6}{b^6}$	$a^{-6}b^6$
$\frac{9x^8y^{-1}}{(3xy)^2}$	x^6y^{-3}	$\left(\frac{x^2}{y}\right)^3$	$(x^2y)^{-3}$	$3x^6y^3$	$\frac{x^6}{y^3}$

LESSON 138 Practice

A. Evaluate each expression using the exponent rules.

$5^{-7} \cdot 5^{9} =$

$(7^{-2})^{3} \cdot 7^{5} =$

$3^{8} \cdot 9^{-4} =$

$(4 \cdot 6)^{2} \cdot 4^{-3} =$

$\dfrac{(2 \cdot 7)^{6}}{2^{3} \cdot 7^{5}} =$

$\dfrac{(4 \cdot 5)^{6} \cdot 5^{2}}{16^{3} \cdot 25^{3}} =$

B. Simplify each expression. Write your answers in positive exponents.

$(a^{2})^{3}$

$m^{7}m^{-4}$

$(p^{3}q^{4})^{6}$

$(2n^{-5})^{2}$

$r^{5}r^{-7}r^{6}$

$(3x^{-2}y)^{-3}$

$\dfrac{b^{9}}{b^{5}}$

$\dfrac{k^{5}}{(k^{2})^{5}}$

$\dfrac{8p^{5}q^{2}r^{2}}{4p^{3}q^{7}r^{2}}$

$\left(\dfrac{s^{2}t^{4}}{st}\right)^{3}$

$\dfrac{(5h^{2})^{3}}{5^{4}h^{5}}$

$\dfrac{(9xy^{3}z)^{2}}{9y^{4}z^{3}}$