Name: _____

Summer Math Packet

I know you were incredibly worried about having to spend an entire summer with no math to do, but alas, dry your tears, I have summer math for you! Yaaaaaay!

Practice makes better, so please spend some time over the summer sharpening your math skills so that you are ready to hit the ground running in seventh grade pre-algebra. Many of the concepts we have learned over the course of the school year will be expanded upon in the years to come.

Please complete the math packet provided for you over your summer. Please DO NOT wait until the day before school begins again to start your packet. The goal is to spend around an hour each week honing your math skills. This will be turned in at the start of the next school year where you will receive some extra credit points.

Have a fabulous summer, y'all and happy mathing!

Heidi Schillinger

Name Date

Order of operations

A mathematical expression is any combination of numbers using operation symbols such as +, −, ×, and ÷. To evaluate an expression, simply find its numerical value. When an expression contains more than one operation, it is important to use the order of operations when finding its value. The rules for the order of operations are as follows:

1. Multiply and divide from left to right.
2. Then add and subtract from left to right.

Find the value of $3 + 2 \times 10$.

$3 + 2 \times 10$	Multiply.
$3 + 20$	Add.
23	Final answer.

When there are grouping symbols (parentheses or brackets), simplify within the symbols first and then use the order of operations. Example,

Find the value of $2(8 + 6) - 7 \times 3$.

$2(8 + 6) - 7 \times 3$	Add.	
$2(14) - 7 \times 3$	Multiply.	$2(14)$ means 2×14.
$28 - 21$	Subtract.	
7	Final answer.	

Name the operation you would do first.

1. $8 + 6 - 3$ **2.** $15 \div (7 - 2) - 3$ **3.** $5 \times 4 \div 10$ **4.** $24 - 21 \div 3$

Find the value of each expression.

5. $18 - 12 \div 4$

6. $12 - (4 + 7)$

7. $7 \times (3 + 4)$

8. $12 \div 3 \times 2$

9. $(11 + 4) \div 5$

10. $(10 \times 4) \div (2 \times 2)$

11. $30 \div 6 - 1$

12. $42 \div (5 + 2) \times 3$

Insert parentheses so each expression has the given value.

13. $56 \div 7 \times 2; 4$

14. $12 + 8 \div 4; 5$

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Variables and expressions

Basics of Algebra

An expression that contains a combination of variables, numbers, and at least one operation is called an algebraic expression. A variable is any symbol, such as x, y, or a, that may be replaced with numbers. An algebraic expression can be evaluated by simply replacing the variables in the expression with their assigned values and then finding the numerical value of the expression.

Evaluate each expression if $x = 2$ and $y = 5$.

1. $6x - 2y$ — Notice, $6x$ means 6 times x and $2y$ means 2 times y.
   $6(2) - 2(5)$ — Replace variables with assigned values. Multiply.
   $12 - 10$ — Subtract.
   2 — Final answer.

2. $4x + (5 + 3y) - 13$ — Remember, evaluate within grouping symbols first.
   $4(2) + (5 + 3(5)) - 13$ — Replace variables with assigned values.
   $8 + (5 + 15) - 13$ — Multiply.
   $8 + 20 - 13$ — Simplify by adding within grouping symbols first. Add.
   $28 - 13$ — Subtract.
   15 — Final answer.

Evaluate each expression given the value of its variable.

1. $y + 2;\ y = 4$

2. $\frac{6a}{3};\ a = 3$

3. $\frac{10d}{4} - 8;\ d = 6$

4. $x - 7;\ x = 12$

5. $2c - 4;\ c = 5$

6. $12 - 5z;\ z = 2$

Evaluate each expression if $x = 5$, $y = 2$, and $z = 8$.

7. $2z - 3x$

8. $\frac{6x}{y+z}$

9. $2z - xy$

10. $10x - (4y + z)$

11. $4x - (y + z)$

12. $\frac{7z}{x+y}$

13. $6z + 7y - 3x$

14. $2z + 3x + 4y$

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Symbol translation

Often it is essential to translate words into symbols in order to solve a mathematical problem. Below is a chart with some commonly-used mathematical words and phrases with their possible meanings.

+	−	x	÷
add	subtract	multiply	divide
plus	minus	times	divided by
more than	less than	product of	divided into
sum of	difference	twice	quotient
increased by	decreased by	multiplied by	
added to	subtracted from		

Also, a number can be represented by any variable. It is important to be very careful when arranging the order of terms.

Translate the following phrases into symbols:

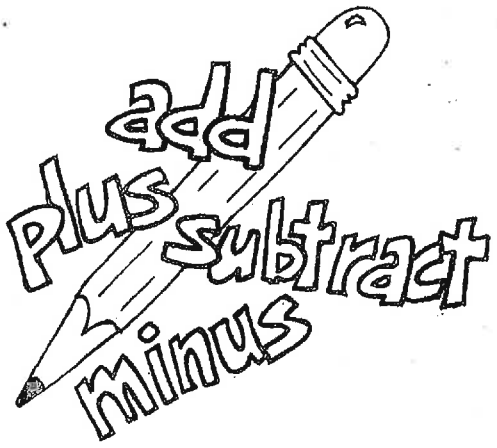
1. four more than a number — $x + 4$
2. five subtracted from a number — $x - 5$
3. subtract a number from nine — $9 - x$
4. eight divided by the sum of a number and ten — $8 \div (x + 10)$

Translate each phrase into an algebraic expression.

1. a number divided by nine
2. five less than a number
3. the sum of a number and ten
4. the product of three and a number
5. twice a number
6. three times a number decreased by two
7. the difference of twelve and a number
8. four more than five times a number

Write a verbal phrase for each algebraic expression.

9. $x + 7$
10. $b \div 9$
11. $13 - a$
12. $2(y + 4)$
13. $8n$
14. $4z - 6$



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Equations and inequalities

Basics of Algebra

An equation is a sentence that uses an equal sign (=). It is used to show that two expressions have the same value. An inequality is a sentence that uses an inequality sign, such as < or >. These are used to show that two expressions do not have the same value.

$2 < 7$ reads: two is less than seven.
$4 + 1 = 5$ reads: four plus one equals (is) five.

Note: Both < and > always point to the smaller number. So, any inequality using < or > can be rewritten using the other symbol.

For example, write a sentence using < to show which number is smaller. Then using the same numbers, rewrite the sentence using >.

1. 4, 8 — $4 < 8$ and $8 > 4$
2. $10 + 2$, 13 — $10 + 2 < 13$ and $13 > 10 + 2$

1. State the difference between an equation and an inequality.

Rewrite each equation or inequality using words.

2. $14 = 11 + 3$ **3.** $2 \times 7 < 15$ **4.** $5x < 30$

5. $12 \div 4 = 3$ **6.** $x - 3 > 7$ **7.** $7 = 7$

Write a sentence using < to show which number is smaller. Then rewrite the sentence using >.

8. 9, 12 **9.** 52, $42 + 8$ **10.** $15 \div 3$, 4

11. 10, 3 **12.** 8(6), 45 **13.** 38, $40 - 12$

14. $5 + 4$, 18 **15.** $14 - 5$, 10 **16.** $16 + 14$, $15 + 18$

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Variables and equations

Equations that contain variables are open sentences. Open sentences can contain one or more variables and are considered neither true nor false. When a value for the variable(s) can be found making the sentence true, this is called the solution of the equation. The process of finding this solution is called solving the equation. For example, the solution to $8 - 2 = x$ is 6 because 6 makes the sentence true.

Which of the numbers 24, 12, and 6 is the solution of $48 - x = 36$?

Replace x with each of the possible solutions and find which one makes the sentence true.

$48 - 24 = 36$	$48 - 12 = 36$	$48 - 6 = 36$
false	true	false

Since 12 makes the sentence true, 12 is the solution to the equation.

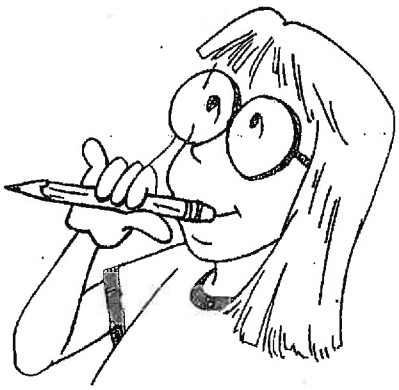
Solve the equation mentally.

$5x = 30$
$5 \times 6 = 30$ Think: What number times 5 is 30?
$x = 6$

Identify the solution to each equation from the list given.

1. $14 - x = 6$; 4, 6, 8

2. $8 = \frac{z}{7}$; 52, 56, 63



3. $12 = \frac{24}{a}$; 1, 2, 3

4. $100 = 142 - t$; 38, 40, 42

5. $a + 35 = 80$; 35, 40, 45

6. $4x + 1 = 21$; 3, 4, 5

7. $10 = 2b + 4$; 2, 3, 4

8. $6 = 12y - 54$; 3, 4, 5

Identify the solution to each equation.

9. $m + 7 = 10$

10. $48 - t = 0$

11. $\frac{40}{z} = 4$

12. $8x = 72$

13. $138 - y = 8$

14. $16 = 2h$

15. Write two different open sentences that have a solution of 4.

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Replacement and solution sets

The set of numbers that can replace a variable in an open sentence is called the replacement set. These numbers can make the sentence either true or false.

The replacement set for the open sentence $x + 8 = 11$ is {1, 2, 3}.

$1 + 8 = 11$	False
$2 + 8 = 11$	False
$3 + 8 = 11$	True

The number 3 is the only number that made the sentence true.

The set of numbers that makes a sentence true is called the solution set. Each number in the solution set is called a solution. Remember, to solve an equation means to find its solution(s). Thus, in the above example, 3 is the solution to $x + 8 = 11$.

Solve $2x > 10$. Use {2, 4, 6, 8}.

$2 \times 2 > 10$	$2 \times 4 > 10$	$2 \times 6 > 10$	$2 \times 8 > 10$
$4 > 10$	$8 > 10$	$12 > 10$	$16 > 10$
False	False	True	True

The solution set is {6, 8}. Thus, 6 and 8 are the solutions to $2x > 10$.

Note: If each of the numbers in the replacement set makes the sentence false, there would be no solution in the given replacement set.

Solve each equation using {0, 1, 2, 3} as the replacement set.

1. $x + 7 = 10$

2. $4x + 2 = 10$

3. $7x + 4 = 11$

4. $t + 8 = 8$

5. $3h = 6$

6. $4a \div 2 = 2a$

Solve using the given replacement set.

7. $6(x - 2) = 6x - 12$; {5, 6, 7, 8}

8. $3x > 2x$; {0, 2, 4, 6}

9. $25 - 5y = 15$; {0, 1, 2, 3, 4}

10. $32 = 4a - 8$; {7, 8, 9, 10}

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Formulas

A formula shows the relationship between certain quantities. It is a rule or principle written as a mathematical sentence. For example, the formula to find the distance a car traveled is $d = rt$, where d is the distance, r is the rate, and t is the time.

How far did the car travel in 6 hours at a rate of 55 miles/hour?

$d = rt$	Write the formula.
$d = 55 \times 6$	Substitute the given values. Multiply.
$d = 330$	
330 miles	Answer to the problem (Be sure to include the unit of measure.)

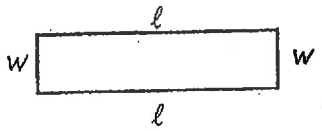
Find the perimeter of a triangle whose sides are $a = 12$ inches, $b = 15$ inches, and $c = 8$ inches. Use the formula: $p = a + b + c$.

$p = a + b + c$	Write the formula.
$p = 12 + 15 + 8$	Substitute the given values. Add.
$p = 35$	
35 inches	Answer to the problem with unit of measure included

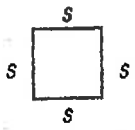
Use the formula $d = rt$ to solve each problem for d.

1. $r = 110, t = 3$
2. $r = 60, t = 5$
3. $r = 75, t = 6$
4. $r = 150, t = 12$

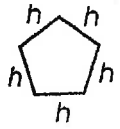
Use the given formulas for perimeter to find the perimeter of each geometric figure below.



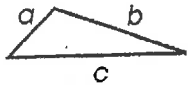
$p = 2(\ell + w)$



$p = 4s$



$p = 5h$



$p = a + b + c$

5. rectangle; $\ell = 40, w = 15$
6. triangle; $a = 8, b = 12, c = 17$
7. regular pentagon; $h = 20$
8. square; $s = 18$
9. What is the distance a car traveled driving 65 miles per hour in 8 hours?
10. The sale price of an item is equal to the list price, ℓ, minus the discount, d. Translate this into a formula. Write your own word problem using this formula and solve.

Name Date

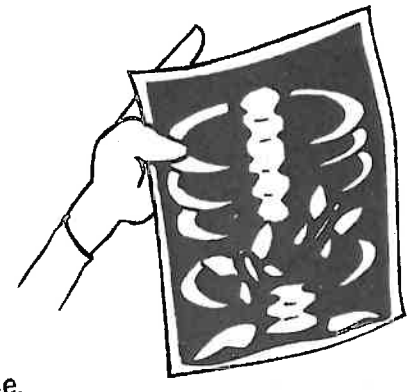
Solving equations using inverse operations

Basics of Algebra

Often equations can be solved using mental math. However, sometimes the solution is not that easy to see. Another way to solve equations is to use inverse operations. Inverse operations have the opposite effect to "undo" what has been done. For example, subtraction would be used to "undo" addition and vice versa. Division is used to "undo" multiplication and vice versa.

Use inverse operations to solve each equation.

1. $x - 10 = 12$
   $x = 12 + 10$ Write the related addition sentence.
   $x = 22$
2. $x + 7 = 21$
   $x = 21 - 7$ Write the related subtraction sentence.
   $x = 14$
3. $8x = 72$
   $x = 72 \div 8$ Write the related division sentence.
   $x = 9$
4. $x \div 10 = 6$
   $x = 6 \times 10$ Write the related multiplication sentence.
   $x = 60$



State the inverse of each operation.

1. subtracting 12
2. dividing 7
3. multiplying 4
4. gaining 13 yards
5. adding 21
6. a deposit of $120

Solve each equation using the inverse operation.

7. $7 + n = 30$
8. $144 = 12h$
9. $b - 12 = 21$
10. $96 = c - 6$
11. $9 = \frac{a}{15}$
12. $8y = 96$

13. Write an addition sentence and then write the related subtraction sentence.

14. Write a problem that could be used to solve the equation: $x + \$10 = \$12$. Solve the equation.

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Review of Unit 1

Topics covered:

- Metric Units of Measure
- Order of Operations
- Variables and Expressions
- Symbol Translation
- Equations and Inequalities
- Variables and Equations
- Replacement and Solution Sets
- Formulas
- Solving Equations using Inverse Operations

1. Name the abbreviation for kilometer.

2. What is the difference between the prefixes *centi* and *hecto*?

3. Explain the order of operations you would use to solve $(7 + 2) \div 3 \times 4$. Solve.

Evaluate each expression if $a = 2$, $b = 5$, $c = 10$.

4. $\frac{ab}{c} + 4$

5. $7b - (2c + a)$

6. Translate "a number multiplied by ten decreased by twelve" into an algebraic expression.

7. Write a verbal phrase describing $3(x + 4)$.

8. Write a sentence using < to show which number is smaller. Then rewrite the sentence using >. Use 45 + 10, 60.

9. If the replacement set is {2, 4, 6, 8}, identify the solution set for $13 = x + 7$.

10. Write two different open sentences that have a solution of 12.

11. Use $p = 2\ell + 2w$ to find the perimeter of a rectangle whose length (ℓ) is 12 and width (w) is 18.

12. Name the inverse operation that you would use to solve $85 = x + 15$. Solve.

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Unit 1 Test

1. Name the most common system of measurement used today.

Give the meaning of each prefix below and give one example using each.

2. kilo
3. centi
4. deka
5. milli

6. Name the order of operations. Solve $16 \div (6 - 2) - 3$ using them.

7. Evaluate $5x - (y + 2z)$ if $x = 6$, $y = 2$, $z = 7$.

8. Write verbal phrases to describe $2x - 7$ and $2x - 7 > 4$.

9. Write a sentence using < to show which number, 35 or 48 – 12, is smaller. Then rewrite using >.

10. Use mental math to solve $\frac{35}{a} = 7$.

11. Solve $4(x - 3) = 4x - 12$ using the replacement set {0, 1, 2, 3}.

12. What is the distance a car traveled driving 70 miles per hour for 5 hours?

13. Write your own word problem to find the miles per gallon, *mpg*, a car gets given the number of miles driven, *m*, and the number of gallons of gas used, *g*. Use the formula $m \div g = mpg$. Solve your problem to show the solution.

14. State the inverse operation to use to solve $121 = 11h$.

15. Write an addition sentence and then write the related subtraction sentence.

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Integer Exploration-

Integers and absolute value

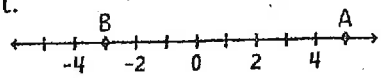
Integers consist of the positive and negative whole values, and the number zero, on a number line. The positive integers are the whole numbers to the right of zero on the number line. The negative integers are the whole numbers to the left of zero. Positive numbers are greater than zero, and negative numbers are less than zero.

3, 5, 22, and 30 are all positive numbers, and therefore, greater than 0.
-2, -7, -25, -50 are all negative numbers, and therefore, less than 0.

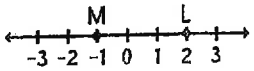
Integers can be graphed on a number line by locating the integer points. The number that corresponds to a point on a number line is called the coordinate of the point.

To graph a number, find its location on a number line and draw a dot. Place its letter above the dot.

Name the coordinates of A and B.



The coordinate of A is 5.
The coordinate of B is -3.
Graph L and M on the number line if L has a coordinate of 2 and M has a coordinate of -1.

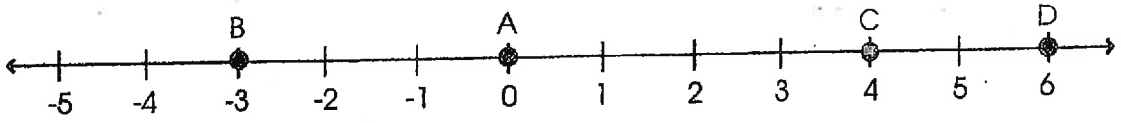


The absolute value of a number is the distance the number is from zero on a number line. The absolute value of a number is always positive. Therefore, $|5| = 5$ and $|-5| = 5$.

Simplify $|8| + |-8|$.

$8 + 8 = 16$ The absolute value of both 8 and -8 is 8. Simply add.

Name the coordinate of each point graphed on the number line.



1. A **2.** B **3.** C **4.** D

5. Graph -4, 2, 5, 7 on a number line.

Write an integer for each situation.

6. a deposit of $500

7. 10° below zero

8. 4 seconds before takeoff

9. a gain of 12 yards

Simplify each.

10. $|-12|$

11. $|0|$

12. $|-14| - |5|$

13. $-|10|$

14. $|-13| + |-12|$

15. $-|-15|$

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Opposites of whole numbers

Integer Exploration

A number and its opposite are the same distance from zero on a number line except in the opposite direction. For example, the opposite of 3 is -3 and both are 3 units from zero.

What is the opposite of 0?
0

Is 0 either positive or negative?
neither

What is the opposite of -10?
10

What is the opposite of 12?
-12

What is the opposite of going up 4 stairs (+4)?
Going down 4 stairs (-4)

Complete the chart by filling in opposites.

	Activity	Integer	Activity	Integer
1.	300 miles north	300		
2.			up 8 floors	8
3.	10 seconds before liftoff	-10		
4.			$1,500 profit	1,500
5.	12 feet forward			
6.			175 feet above sea level	

Name the opposite of each number.

7. 35

8. -12

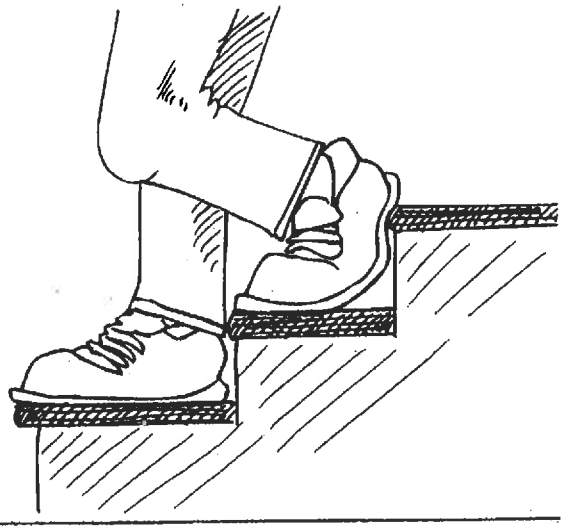
9. -70

10. 0

11. 128

12. 52

13. Name the integer that is neither positive nor negative and is its own opposite.



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Comparing and ordering

Comparing two numbers often involves inequality symbols. Remember, a mathematical sentence involving these symbols is called an inequality.

Compare -6 and 2 by using two inequalities.

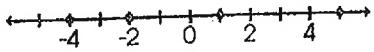
$-6 < 2$ and $2 > -6$ — 2 is greater than -6 because 2 lies to the right of -6.

$|-6| > |2|$ and $|2| < |-6|$ — -6 has the greater absolute value because it lies farther away from zero than 2.

Put the following numbers in order from least to greatest: 33, -2, -10, 43

-10, -2, 33, 43 — Notice: -10 is the least value and 43 is the greatest value.

1. List the integers graphed on the number line from least to greatest.



2. Graph -1 and 3 on a number line. Then write two inequalities that show how the integers are related.

Place >, <, or = in each box.

3. 10 ☐ -12

4. |-3| ☐ |3|

5. -11 ☐ -2

6. 0 ☐ |-2|

7. -5 ☐ 0

8. -8 ☐ -14

9. -4 ☐ -6

10. -6 ☐ -4

Write an inequality to describe each situation.

11. 4 m is shorter than 6 m.

12. $35 is more than $15.

13. The temperature this morning was 23° F. Now the temperature is 41° F.

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Adding integers

Integer Exploration

Two situations are possible when adding integers: adding integers with same signs and adding integers that have different signs. Remember these two rules when faced with these situations:

1. To add integers that have the same sign, simply add their absolute values. Give the result the same sign as the integers.

   $3 + 5$
   $|3| + |5|$
   8 Answer is positive since the integers were both positive.

   $-4 + (-7)$
   $|-4| + |-7|$
   $4 + 7$
   -11 Answer is negative since the integers were both negative.

2. To add integers that have different signs, subtract their absolute values. Give the result the same sign as the integer with the greater absolute value.

   $-7 + 5$
   $|-7| - |5|$
   $7 - 5$ Subtract absolute values.
   -2 Answer is negative because -7 has the greater absolute value.

State whether each sum is **positive**, **negative**, or **zero**.

1. $-3 + 5$

2. $16 + (-16)$

3. $25 + 45$

4. $-150 + 125$

5. $4 + (-11)$

6. $-11 + (-12)$

Find each sum.

7. $17 + (-6)$

8. $-8 + 3$

9. $9 + (-4)$

10. $-13 + (-10)$

11. $-12 + (-8)$

12. $-5 + (-15)$

13. Write an addition sentence for the following situation, then solve. Bob made a profit of $4,500 last year and had a loss of $4,800 this year.

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Subtracting integers

Every integer has an opposite. An integer and its opposite are called additive inverses of each other. For example, 3 has an opposite of -3. If 3 and -3 are added together, their sum is 0. The sum of any integer and its opposite will always have a result of 0.

$3 + (-3) = 0$
$-8 + 8 = 0$

To subtract an integer, simply add its opposite. Thus, change the subtraction problem to an addition problem and solve using the rules already learned for addition of integers.

Subtract $10 - 12$

$10 + (-12)$	Change to addition by adding the opposite of 12.
$\|-12\| - \|10\|$	Subtract absolute values.
$12 - 10$	
-2	Give result a negative sign since -12 has the greater absolute value.

Subtract $6 - (-13)$

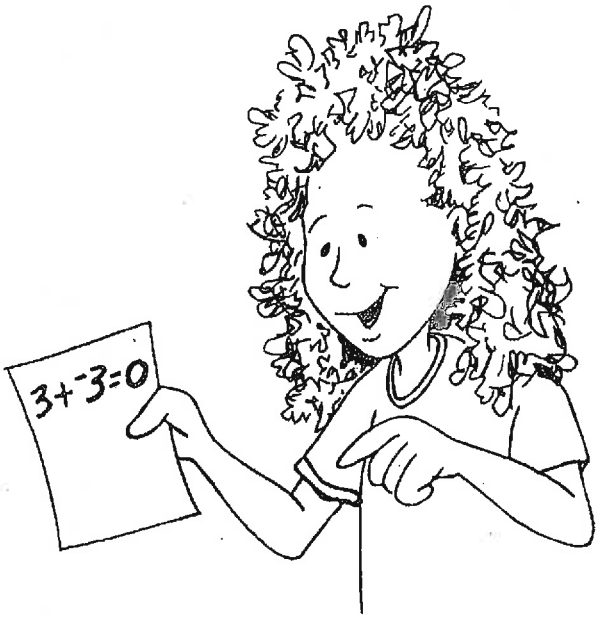
$6 + 13$	Change to addition by adding the opposite of -13.
19	Result is positive since adding numbers with the same positive sign.

Change each problem to an addition problem. Tell whether each answer will be **positive**, **negative**, or **zero**.

1. $1 - 3$
2. $10 - (-5)$
3. $-8 - 14$
4. $-4 - 7$
5. $-2 - (-12)$
6. $20 - 18$

Solve each expression.

7. $-10 - 6$
8. $12 - (-9)$
9. $-13 - (-8)$
10. $7 - 16$
11. $24 - (-26)$
12. $-5 - 15$
13. $-40 - 3$
14. $23 - 30$



15. Explain how the subtraction of integers is related to the addition of integers.

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Name Date

Multiplying integers

Integer Exploration

Multiplying integers is just like multiplying positive whole numbers except there is a possibility of negative numbers. Remember the following rules when multiplying integers:

1. The product of two integers with the same sign is positive.

   Multiply 12 x 2
   24 Result is a positive 24 since both integers were positive.

   Multiply -4 • (-9)
   36 Result is a positive 36 since both integers were negative.

2. The product of two integers with different signs is negative.

   Multiply -5 x 7
   -35 Result is a negative 35 since the integers had different signs.

Look at the following example with multiplying 3 integers.

Multiply -3(-4)(-5)

12(-5)	Multiply -3 and -4 and the result is a positive 12.
-60	Result is negative since multiplying integers with different signs.

State whether each product is **positive**, **negative**, or **zero**.

1. 7 x 4
2. -3 x (-5)
3. -7 x 0
4. 6 x (-8)
5. -9 • 9
6. -2 x (-11)

Solve each expression.

7. -10 x 7
8. -16 • (-2)
9. -12 x (-11)
10. -15 x 0
11. 5 x 8
12. 8 x (-10)
13. 6 x (-20)
14. -3 • 13

15. Multiply (-2)(-3)(4). Multiply (-5)(-6)(-1).

    Looking at the number of negative signs in both problems, write a rule that will help determine the sign of the product if multiplying two or more integers.

Name Date

Dividing integers

Integer Exploration

When dividing integers, it is important to remember the following rules:

1. When dividing two integers with the same sign, the quotient is positive.

   Divide $-10 \div (-5)$

   2 Result is a positive 2 since both integers had the same sign.

   Divide $\frac{60}{5}$

   12 Result is a positive 12 since both integers had the same sign.

2. When dividing two integers with different signs, the quotient is negative.

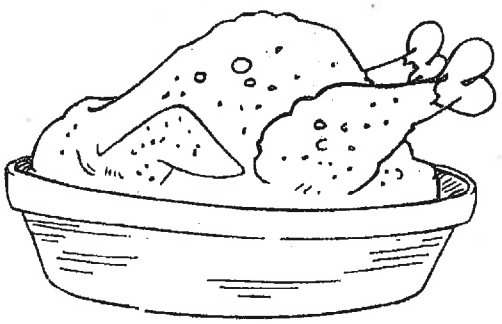
   Divide $-45 \div 9$

   -5 Result is a negative 5 since integers had different signs.

Note: The rules are the same for multiplication of integers as they are for the division of integers.

State whether each quotient is **positive**, **negative**, or **zero**.

1. $9 \div 3$
2. $45 \div (-15)$
3. $-28 \div 4$
4. $\frac{0}{-7}$
5. $-16 \div (-8)$
6. $-26 \div (-13)$



Find the value of each expression.

7. $-121 \div (-11)$
8. $\frac{0}{15}$
9. $100 \div (-20)$
10. $\frac{20}{-5}$
11. $-9 \div 3$
12. $\frac{-38}{-19}$
13. $96 \div 16$
14. $\frac{-21}{-7}$

15. Describe a real-life situation in which negative numbers are used. Write your own word problem involving these negative numbers and division.

Name Date

Solving addition and subtraction equations

Integer Exploration

To find a solution to an equation, the equation must be solved. To solve addition and subtraction equations you must isolate the variable. Simply subtract if it is an addition problem and add if it is a subtraction problem to get the given variable by itself. Remember the following two properties of equality:

1. If the same number is subtracted from each side of an equation, the two sides remain equal.

   Solve $r + 12 = 67$
   $r + 12 - 12 = 67 - 12$ Subtract 12 from each side of equation.
   $r = 55$ Solve for r.

2. If the same number is added to each side of an equation, the two sides remain equal.

   Solve $x - 16 = 32$
   $x - 16 + 16 = 32 + 16$ Add 16 to each side of equation.
   $x = 48$ Solve for x.

Note: It is always a good idea to check each solution by putting it back into the original equation and making sure it creates a true sentence.

State the operation to be used to solve each equation.

1. $x + 7 = 12$ **2.** $b - 14 = 51$ **3.** $24 = h + 3$

4. $6 + a = 15$ **5.** $36 = d - 13$ **6.** $21 + y = 15$

Solve each equation and check your solution.

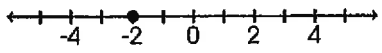
7. $n + 10 = 14$ **8.** $x - 28 = 72$

9. $11 = x - 1$ **10.** $-600 = c - (-400)$

11. $y - 8 = 8$ **12.** $64 + h = 36$

13. $-13 = z + 7$ **14.** $a - 15 = -21$

15. Write an equation whose solution is represented by the number line.



Name Date

Solving multiplication and division equations

Integer Exploration

To solve multiplication and division equations, simply divide or multiply on each side of the equation to get the given variable by itself. Remember the following two properties of equality:

1. If you divide each side of an equation by the same nonzero number, the two sides remain equal.

Solve $4x = 84$

$\frac{4x}{4} = \frac{84}{4}$ Divide each side by 4 to isolate x.

$x = 21$ Solve for x.

2. If you multiply each side of an equation by the same number, the two sides remain equal.

Solve $\frac{x}{21} = 2$

$\frac{x}{21} \times 21 = 2 \times 21$ Multiply each side by 21 to isolate x.

$x = 42$ Solve for x.

Note: It is always a good idea to check each solution by putting it back into the original equation and making sure it creates a true sentence.

1. Explain in your own words the steps you would use to solve $\frac{x}{5} = -7$.

2. Write two equations of the forms $ax = b$ and $\frac{x}{b} = a$, each with a solution of 3.

Solve each equation using the inverse operation.

3. $9x = 63$

4. $-96b = 96$

5. $\frac{a}{-6} = 2$

6. $4t = -36$

7. $-64 = -16y$

8. $-25x = -125$

9. $\frac{b}{40} = -3$

10. $\frac{r}{15} = 20$

11. Write a word problem that can be solved using the equation $3x = 21$.

Name Date

Solving inequalities by adding and subtracting

Integer Exploration

To solve an inequality that involves addition, solve it using subtraction just as you would when solving equations. Likewise, use addition to solve an inequality that involves subtraction. Be sure to always check each solution.

Solve $a + 5 > 11$

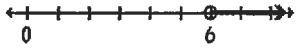
$a + 5 - 5 > 11 - 5$ Subtract 5 from each side of the inequality.

$a > 6$ Solve for the variable.

Check: Choose a value greater than 6 and substitute it into the original inequality.

$15 + 5 > 11$

$20 > 11$ True sentence



Solve $b - 2 \leq 3$ Note: $\leq$ means less than ($<$) or equal to ($=$).

$b - 2 + 2 \leq 3 + 2$ Add 2 to each side of the inequality.

$b \leq 5$ Solve for the variable.

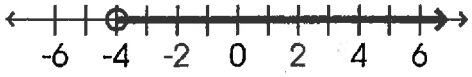
Check: Choose a value less than or equal to 5 and substitute it into the original inequality.

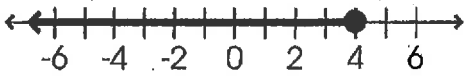
$4 - 2 \leq 3$

$2 \leq 3$ True sentence

To graph each of these solutions, simply draw a number line and draw a dot on the number found in the solution. The dot will be filled in if the inequality is $\leq$ or $\geq$. The dot will be left unfilled if the inequality is $<$ or $>$. Then simply draw an arrow to the right if it is greater than and to the left if it is less than. See the above graphs.

Write an inequality for each solution set graphed below.

1. 

2. 

Solve each inequality and check the solution.

3. $x - 7 < 15$ **4.** $-7 + a < 4$ **5.** $r \leq -15 - 9$ **6.** $n - 15 \geq -12$

7. $f + 10 \geq 22$ **8.** $e - 10 > 5$ **9.** $y + 8 > -12$ **10.** $-30 < x - 6$

Write an inequality and graph the solution.

11. Barbara's class can have no more than 30 kids.

12. The Schmidt's house is more than 150 years old.

Name Date

Integer Exploration

Solving inequalities by multiplying and dividing

When solving inequalities that involve multiplication or division, it is important to remember the two properties of inequality:

1. When multiplying or dividing each side of an inequality by a positive integer, the inequality symbol stays the same.

   Solve $3x > 30$

   $\frac{3x}{3} > \frac{30}{3}$ Divide each side by 3.

   $x > 10$ Solve for x.

2. When multiplying or dividing each side of an inequality by a negative integer, the inequality symbol must be reversed.

   Solve $\frac{x}{-4} \leq 8$

   $\frac{x}{-4} \cdot -4 \leq 8 \cdot -4$ Multiply each side by -4.

   $x \geq -32$ Solve for x and reverse the inequality symbol since multiplying by a negative number.

Note: It is always a good idea to check each solution by putting it back into the original inequality and making sure it creates a true sentence.

1. Write an inequality that can be solved using multiplication where the solution is $x < 12$.

2. Write an inequality that can be solved using division where the solution is $x > 3$.

Solve each inequality and check the solution.

3. $-5y < -35$

4. $7a \leq -84$

5. $\frac{m}{3} \leq -10$

6. $-121 \geq -11z$

7. $\frac{x}{-4} \geq 21$

8. $-72 > 4b$

9. $-12t > 108$

10. $\frac{x}{-2} < -8$

11. The product of an integer and 5 is greater than -32. Find the least integer that makes this true.

12. The quotient of an integer and -3 is less than -18. Find the least integer that makes this true.

Name Date

Solving equations with two operations

Integer Exploration

To solve an equation with two operations, work backward and undo each operation one by one. It is important to remember to undo addition and subtraction first, then undo multiplication and division.

Solve $3x + 9 = 21$

$3x + 9 - 9 = 21 - 9$ Subtract 9 from each side of the equation.

$\frac{3x}{3} = \frac{12}{3}$ Divide by 3 on each side to isolate the variable.

$x = 4$ Solve for x.

Check: $3(4) + 9 = 21$

$12 + 9 = 21$

$21 = 21$ It is a true sentence. Thus, the solution is 4.

Solve $\frac{x}{5} - 10 = 2$

$\frac{x}{5} - 10 + 10 = 2 + 10$ Add 10 to each side of equation.

$\frac{x}{5} \cdot 5 = 12 \cdot 5$ Multiply by 5 on each side of equation.

$x = 60$ Solve for x.

Check: $\frac{60}{5} - 10 = 2$

$12 - 10 = 2$

$2 = 2$ It is a true sentence. Thus, the solution is 60.

Note: It is always a good idea to check each solution by putting it back into the original equation and making sure it creates a true sentence.

State the two steps to use to solve each equation.

1. $4x - 8 = 9$
2. $\frac{b+7}{4} = 9$
3. $52 + \frac{y}{4} = 36$
4. $\frac{a}{2} + 14 = 16$
5. $2x + 12 = 18$
6. $\frac{z}{5} - 6 = 14$

Solve each inequality and check the solution.

7. $75 + 4x = 3$
8. $\frac{z-12}{3} = 4$
9. $6 - 3b = 42$
10. $\frac{s}{-6} - 9 = 2$
11. $-9 + 2y = 13$
12. $\frac{a}{5} - 4 = -6$
13. $-7 = -56 + 7t$
14. $-18 = \frac{-9+d}{-3}$

15. Write a two-step equation using the numbers 3, 4, and 5, in which the solution is 2.

Name Date

Review of Unit 2

Topics covered:

- Integers and Absolute Value
- Opposites of Whole Numbers
- Comparing and Ordering
- Adding Integers
- Subtracting Integers
- Multiplying Integers
- Dividing Integers
- Solving Addition and Subtraction Equations
- Solving Multiplication and Division Equations
- Solving Inequalities by Adding and Subtracting
- Solving Inequalities by Multiplying and Dividing
- Solving Equations with Two Operations

1. Use <, >, or = to make $|-5| \square |8|$ a true sentence.

2. Graph 3, 1, 5, -2, -4 on a number line.

3. Give the opposite of -13. Write a real-world situation to represent each of these numbers as opposites.

Simplify each expression.

4. $|-15| - |8|$

5. $-12 - 13$

6. $40 - 42$

7. $\frac{-55}{-11}$

8. $18 + (-21)$

9. $-9 - (-16)$

10. -15×3

11. $120 \div (-12)$

Solve each equation or inequality and check the solution.

12. $x + 5 = 41$

13. $-10b = 110$

14. $12 + y < 15$

15. $-12h \leq 72$

16. $-4 + t = 16$

17. $\frac{c}{6} = -3$

18. $z - 21 \geq -30$

19. $\frac{k}{13} > -3$

20. Solve $\frac{-5 + f}{4} = 9$. Explain the step-by-step process you used to solve this problem.

Name Date

Unit 2 Test

Integer Exploration

1. Graph two integers on a number line. Then write two inequalities that show how the integers are related.

2. Write a situation to describe -$1,500.

3. Name the opposite situation of 15 seconds before game time. Give the numbers that represent both situations.

4. Name the integer that is neither positive nor negative. What is its opposite?

Solve each expression.

5. $-7 + 17$

6. $13 - (-15)$

7. $75 \cdot -2$

8. $-11 - 8$

9. $\frac{-39}{3}$

10. $(-3)(-2)(-1)(-4)$

11. Explain how the subtraction of integers is related to the addition of integers.

Solve each equation.

12. $x + 15 = -9$

13. $\frac{b}{-5} = 15$

14. $\frac{t}{-2} \leq 17$

15. $x - 12 < 19$

16. $a - 2 = 6$

17. $-32a = -64$

18. $-7y > 63$

19. $29 \geq z + 11$

20. Write a two-step equation using the numbers 4, 5, and 6, in which the solution is 2. State the steps to solve the equation to get this solution.

Name Date

Commutative property

An operation is commutative in mathematics if the order can be changed and the result is still the same. Addition and multiplication both have the commutative property; however, subtraction and division do not. The following states the commutative properties of addition and multiplication:

1. The order in which numbers are added will not change the sum. Thus, for any numbers a and b, $a + b = b + a$.
   $2 + 8 = 8 + 2$ $\quad -9 + 12 = 12 + (-9)$
2. The order in which numbers are multiplied will not change the product. Thus, for any numbers a and b, $a \cdot b = b \cdot a$.
   $9 \cdot 2 = 2 \cdot 9$ $\quad 6 \cdot 7 = 7 \cdot 6$

Note: These properties are extremely useful when wanting to find a sum or a product quickly using mental computation.

State **yes** or **no** to tell if changing the order of the following activities would change the result.

1. putting your pants on; putting your shirt on
2. washing your hands; washing your face
3. putting a stamp on a letter; writing the letter
4. swimming in a pool; filling the pool with water
5. filling your empty tank with gas; driving on a long trip

Use the commutative property on each equation to make a new equation.

6. $6 + y = 12$
7. $a + 17 = 21$
8. $x + 4 = 12$
9. $h \cdot 15 = 75$
10. $56 = t \cdot 7$
11. $11 + k = 32$
12. $3 = r + 8$
13. $39 = 13 \cdot f$

Name Date

Associative property

An operation is associative in mathematics if a set of numbers can be grouped in different ways without changing the result. Addition and multiplication both have the associative property; however, subtraction and division do not. The following states the associative properties of addition and multiplication:

1. The way in which addends are grouped will not change the sum.
   Thus, for any numbers a, b, and c, $(a + b) + c = a + (b + c)$.
   $(3 + 5) + 7 = 3 + (5 + 7)$ $(-2 + -7) + 8 = -2 + (-7 + 8)$
2. The way in which factors are grouped will not change the product.
   Thus, for any numbers a, b, and c, $(a \bullet b) \bullet c = a \bullet (b \bullet c)$.
   $(12 \bullet 13) \bullet 14 = 12 \bullet (13 \bullet 14)$ $(-4 \bullet 5) \bullet 9 = -4 \bullet (5 \bullet 9)$

Use parentheses to group the numbers to make the computation easy.

1. 400 + 60 + 98 **2.** 3 • 20 • 5 **3.** 16 • 25 • 4

4. 2 • 5 • 12 **5.** 18 + 9 + 91 **6.** 250 • 4 • 113

Rewrite each expression using the associative property. Then evaluate the expression.

7. 8 + (2 + 17) **8.** (3 • -4) • 250 **9.** 68 + (32 + 54)

10. (3 • 25) • 4 **11.** (21 + 45) + 55 **12.** (12 • 5) • 20

13. 75 + (25 + 19) **14.** -20 • (50 • -29) **15.** 5 • (10 • 18)

16. Show two different ways you can solve the equation $24 = (2x)4$.

17. Show two different ways you can solve the equation $13 + (6 + x) = 20$.

Name Date

Properties Used in Algebra

Zero and one

Zero and one play important roles in the world of mathematics. The following properties show the relationship between zero and one and the operations of addition and multiplication:

1. Identity Property of Addition: The sum of 0 and any number is that number. Thus, for any number n, $n + 0 = n$.

   $8 + 0 = 8$ $\quad$ $0 + -12 = -12$

2. Identity Property of Multiplication: The product of 1 and any number is that number. Thus, for any number n, $n \cdot 1 = n$.

   $10 \cdot 1 = 10$ $\quad$ $-3 \cdot 1 = -3$

3. Multiplication Property of Zero: The product of 0 and any number is 0. Thus, for any number n, $n \cdot 0 = 0$.

   $2 \cdot 0 = 0$ $\quad$ $-5 \cdot 0 = 0$

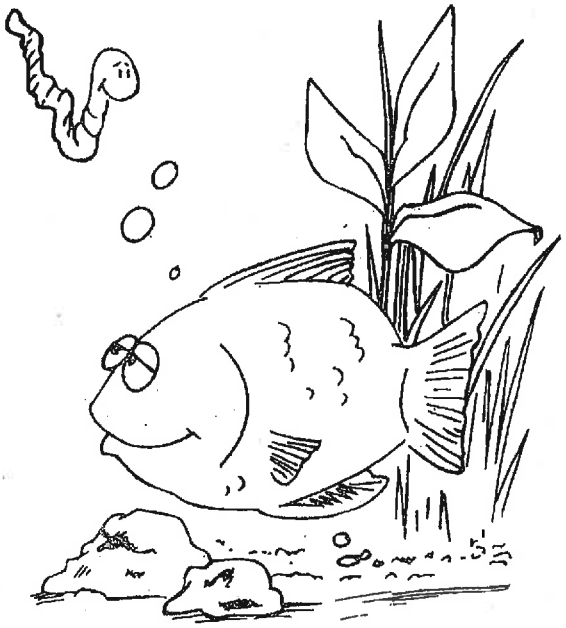
Note: Any nonzero number divided by itself is one. Zero divided by any nonzero number is zero.

Evaluate each expression.

1. $5 \cdot 1$
2. $0 \cdot 45$
3. $1 \cdot 17$
4. $0 + 185$
5. $32 + 0$
6. $0 \div 57$

Evaluate each expression mentally.

7. $33 + (11 - 11)$
8. $18 - (0 \cdot 52)$
9. $482 \cdot (391 - 390)$
10. $26 \cdot [9 - (4 + 4)]$
11. $(24 - 23) \cdot 67$
12. $204 \cdot (19 \cdot 0)$
13. $(43 \cdot 0) \div 1$
14. $(49 - 48) \cdot 411$



15. Write your own statement about multiplying/dividing by 1 and 0.

Name _____ Date _____

Distributive property

The distributive property is used quite often in mathematics. It ties addition and multiplication together and is often called the distributive property of multiplication over addition. It states the following:

Distributive Property: For any numbers a, b, and c, $a(b + c) = ab + ac$ and $ab + ac = a(b + c)$.

In other words, the sum of two addends multiplied by a number is the sum of the product of each addend and the number.

1. $3(7 + 2) = 3(7) + 3(2)$ Distribute the 3.
   $= 21 + 6$ Multiply.
   $= 27$ Add to simplify.

2. $3x + x = 24$
   $x(3 + 1) = 24$ Factor out the x. Note: $x = (1 \cdot x) = 1x$
   $4x = 24$ Add within parentheses.
   $x = 6$ Solve for x to simplify.

3. $17x + 7 + 2x$
   $x(17 + 2) + 7$ Factor out the x to begin simplifying.
   $19x + 7$ Add within parentheses to simplify.

Note: An expression is considered to be in simplest form when it contains no like terms and no parentheses.

State the number to replace the ? in each equation.

1. $4(3 + 7) = (4 \cdot ?) + (4 \cdot 7)$
2. $a + 3a = 1a + 3a = (1 + ?)a$
3. $(10 \cdot 7) + (10 \cdot 6) = 10(7 + ?)$
4. $(6t + 5t) = ?(6 + 5)$

Rewrite each expression using the distributive property. Do not simplify.

5. $4(12 + 15)$
6. $(10 + 13)t$
7. $7r + 8r + 2$
8. $3a + 6b$
9. $x(6 + 8)$
10. $2(5x + 8y)$

Use the distributive property to simplify each expression.

11. $7a + a + 15$
12. $2(b + 4) + 8b$
13. $k + 5 + 7 + 3k$
14. $2c + 6c + 9(c + 3)$

Name Date

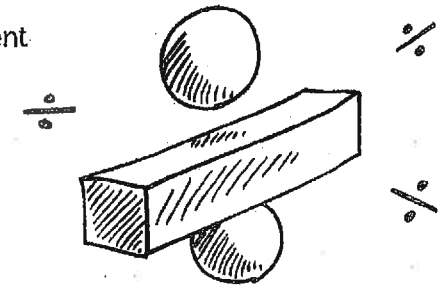
Factors and divisibility

When two or more numbers are multiplied, each is considered to be a factor of the product.

The factors of 12 are 1, 2, 3, 4, 6, and 12.

A number is divisible by each of its factors. To be divisible, the quotient has to be a whole number and the remainder must be 0.

12 is divisible by 1, 2, 3, 4, 6, and 12 because each quotient would be a whole number and each remainder is 0.



Examples:

1. Is 7 a factor of 63?
   $63 \div 7 = 9$ 63 is divisible by 7.
   Thus, 7 is a factor of 63.

2. Is 9 a factor of 28?
   $28 \div 9 = 3$ R1 28 is not divisible by 9.
   Thus, 9 is not a factor of 28.

State the factors of each number.

1. 8

2. 18

3. 16

4. 24

5. 28

6. 35

Write **yes** or **no** to tell whether 4 is a factor of each number.

7. 106

8. 1,236

9. 144

10. 324

11. 906

12. 97

Express each number as the product of two factors other than 1.

13. 36

14. 45

15. 18

16. 54

17. 26

18. 100

Name Date

Prime and composite numbers

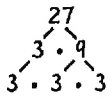
The mathematical world contains whole numbers that are either prime or composite numbers. A prime number is a whole number that is greater than 1 and has only 1 and itself as factors.

The first ten prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23, and 29.

A composite number is a whole number that is greater than 1 and has at least one other factor besides itself and 1. For example, 4 and 15 are composite numbers because they both have more factors besides 1 and themselves.

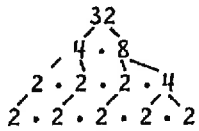
Each composite number can be expressed as a product of prime numbers through a process called prime factorization.

1. Find the prime factorization of 27.



Factor 9.
Prime factorization

2. Find the prime factorization of 32.



Factor 4 and 8.
Factor 4.
Prime factorization

Determine whether each number is prime or composite.

1. 45	**2.** 30	**3.** 19	**4.** 33
5. 17	**6.** 29	**7.** 66	**8.** 51

Find the prime factorization of each number.

9. 48	**10.** 27	**11.** 36	**12.** 51
13. 225	**14.** 81	**15.** 144	**16.** 126

17. Explain, in your own words, the difference between a prime and a composite number. Give an example of each.

Name Date

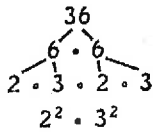
Exponents and powers

Numbers are often labeled as square numbers. A square number is a number that can be written as the product of two equal factors or as a power.

$16 = 4 \cdot 4$ or 4^2 (4^2 is expressed as 4 to the 2nd power, where 4 is the base, 2 is the exponent, and 4^2 is the power.)

Just as square numbers can be expressed in terms of exponents and powers, many other mathematical situations use them to simplify expressions.

1. Write $a \cdot a \cdot a \cdot a$ using exponents.
   a^4 The exponent is 4 since a is multiplied by itself four times.
2. Express 6^3 as a product of factors and find its value.
   $6 \cdot 6 \cdot 6 = 216$ Multiply 6 by itself 3 times since the exponent is 3.
3. Find the prime factorization of 36. Write the answer using exponents.



$2^2 \cdot 3^2$

Factor each 6.
Prime factorization
2 has an exponent of 2 since 2 is multiplied by itself twice, and
3 has an exponent of 2 since 3 is multiplied by itself twice.

Write how you read each expression. Name the base and the exponent.

1. 7^2
2. a^8
3. 9^3
4. 3^6
5. 12^4
6. x^5

Rewrite each expression using exponents.

7. $9 \cdot 9 \cdot 9 \cdot 9$
8. $5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$
9. $b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b$
10. $a \cdot a \cdot a$

Express the prime factorization of each number using exponents.

11. 75
12. 99
13. 148
14. 54

15. Find the squares of 9 and 10.

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Name Date

Greatest common factors

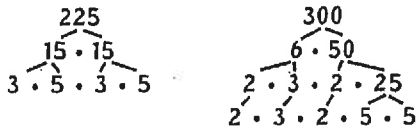
The greatest common factor (GCF) of two or more numbers is the greatest number that is a factor of each number. Many different methods are used to find the GCF of numbers. For example, one method used is to list the factors of each number and identify the greatest factor common to each number.

Find the GCF of 24 and 72.

Factors of 24: 1, 2, 3, 4, 6, 8, 12, 24
Factors of 72: 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

Thus, the GCF of 24 and 72 is 24. Another method used is to find the prime factorization of each number and then find the product of their common factors.

Find the GCF of 225 and 300.



Factor each number to find its prime factorization.

Then find the common factors in these prime factorizations.

$225 = 3 \cdot 3 \cdot 5 \cdot 5$
$300 = 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5$

Thus, the GCF of 225 and 300 is $3 \cdot 5 \cdot 5$ or 75.

1. Explain how to find the GCF of two or more numbers.

2. Name two numbers whose GCF is 12.

Name the GCF of each pair of numbers.

3. $4 = 2^2$
   $16 = 2^4$

4. $12 = 2^2 \cdot 3$
   $20 = 2^2 \cdot 5$

5. $77 = 7 \cdot 11$
   $88 = 2^3 \cdot 11$

6. $9 = 3^2$
   $26 = 2 \cdot 13$

Find the GCF of each set of numbers.

7. 24, 56

8. 32, 128

9. 18, 22, 28

10. 129, 133, 215

11. 25, 85

12. 20, 80, 140

Name Date

Least common multiples

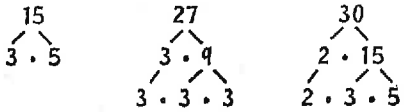
A multiple of a number is a product of that number and any whole number.

Multiples of 4: 4, 8, 12, 16, 20, 24, . . .
Multiples of 6: 6, 12, 18, 24, 30, . . .

Notice two of the multiples shared by 4 and 6 are 12 and 24.
These are called common multiples.

The least of the nonzero multiples of two or more numbers that has each given number as a factor is called the least common multiple (LCM) of the numbers. For example, the LCM of 4 and 6 is 12 because 12 is the least multiple common to both numbers. To find the LCM of two or more numbers, find the largest power of each prime factor and multiply these powers.

Find the LCM of 15, 27, and 30.



Find each prime factorization.

$15 = 3 \cdot 5$ Greatest power of 5 is 1.
$27 = 3 \cdot 3 \cdot 3 = 3^3$ Greatest power of 3 is 3.
$30 = 2 \cdot 3 \cdot 5$ Greatest power of 2 is 1.

Multiply: $2 \cdot 3^3 \cdot 5 = 270$
Thus, the LCM of 15, 27, and 30 is 270.

1. Explain how to find the LCM of two numbers using prime factorizations.

Find the LCM of each pair of numbers.

2. $6 = 2 \cdot 3$, $10 = 2 \cdot 5$

3. $12 = 2^2 \cdot 3$, $18 = 2 \cdot 3^2$

4. $25 = 5^2$, $35 = 5 \cdot 7$

5. $4 = 2^2$, $15 = 3 \cdot 5$

Find the LCM of each set of numbers.

6. 9, 27

7. 30, 50

8. 7, 8, 28

9. 12, 30

10. 3, 5, 6

11. 15, 25, 75

12. Explain how the LCM of a set of numbers can be equal to the greatest number in the set.

Name Date

Multiplying and dividing monomials

Properties Used in Algebra

Remember the parts that make up a power. For example, 4^2 is a power, where 4 is the base and 2 is the exponent. In mathematics, powers that have the same base can be multiplied simply by adding their exponents.

$4^5 \cdot 4^3 = 4^{5+3} = 4^8$ The base is 4 and remains unchanged. Add the exponents.

$n^2 \cdot n^7 = n^{2+7} = n^9$ The base is n and remains unchanged. Add the exponents.

Find the product of $(4x^5)(-3x^7)$.

$-12x^{5+7}$ Multiply 4 and -3. The base x remains unchanged.

$= -12x^{12}$ Add the exponents.

Powers that have the same base can also be divided by simply subtracting the exponents.

$\frac{10^4}{10^2} = 10^{4-2} = 10^2$ The base is 10. Subtract exponents.

Divide $\frac{-9ab^7}{3b^5}$

$= -3ab^{7-5}$ Divide -9 and 3.

$= -3ab^2$ Subtract exponents of base b.

1. Write a division and a multiplication problem, each with a solution of 5^4.

2. Explain the relationship between multiplying and dividing powers.

Find each product or quotient. Leave each answer in exponential form.

3. $11^6 \cdot 11^7$

4. $b^9 \cdot b^4$

5. $\frac{z^9y^5}{z^3y^3}$

6. $x^3 \cdot x^8$

7. $\frac{3^7}{3^2}$

8. $\frac{-12x^{12}}{3x^7}$

9. $4^5 \cdot 4^2$

10. $\frac{10^{12}}{10^8}$

11. $4c^4d \cdot -5cd^3$

Find each missing exponent.

12. $(6^?)(6^4) = 6^{12}$

13. $\frac{r^?}{r^5} = r^8$

14. $a(a^3)(a^5) = a^?$

15. $\frac{13^7}{13^?} = 1$

Name Date

Negative exponents

Any negative exponent can be made positive by simply moving the exponent from the numerator to the denominator, or vice versa.

Write each expression using positive exponents.

1. 12^{-4}

   $= \frac{1}{12^4}$ Move the base 12 and its exponent to the denominator and the exponent becomes positive.

2. xy^{-5}

   $= \frac{x}{y^5}$ Move the base y and its exponent to the denominator. x remains in the numerator because it already has a positive exponent.

Write each expression using negative exponents.

1. $\frac{1}{6^8}$

   $= 6^{-8}$ Move the base 6 and its exponent to the numerator.

2. $\frac{4}{5^6}$

   $= 4 \cdot 5^{-6}$ Move the base 5 and its exponent to the numerator.

Find the product of $(b^3)(b^{-7})$ and express using positive exponents.

$(b^3)(b^{-7}) = b^{3+-7} = b^{-4} = \frac{1}{b^4}$ Move b and its negative exponent to the denominator.

Write each expression using positive exponents.

1. 4^{-2}
2. 7^{-3}
3. b^{-12}
4. xy^{-5}
5. x^{-7}
6. 5^{-10}
7. $15^{-4}f^{-1}$
8. $3(ab)^{-6}$

Write each fraction as an expression using negative exponents.

9. $\frac{1}{6^4}$
10. $\frac{1}{18}$
11. $\frac{2}{4^3}$
12. $\frac{c}{d^5}$
13. $\frac{1}{b}$
14. $\frac{1}{y^7}$
15. $\frac{x}{y^8}$
16. $\frac{4a}{2b^3}$

Find the product or quotient using positive exponents in the answer.

17. $(a^{-7})(a^3)$
18. $\frac{c^4}{c^5}$

Name Date

Review of Unit 3

Topics covered:

- Commutative Property
- Associative Property
- Zero and One
- Distributive Property
- Factors and Divisibility
- Prime and Composite Numbers
- Exponents and Powers
- Greatest Common Factors
- Least Common Multiples
- Multiplying and Dividing Monomials
- Negative Exponents

Name the property represented by each statement.

1. $(4 + 6) + 8 = 4 + (6 + 8)$
2. $12 \cdot a = a \cdot 12$
3. $4 \cdot 1 = 4$
4. $11 + y = y + 11$
5. $3(b + 10) = 3(b) + 3(10)$
6. $ax + bx = x(a + b)$
7. $9 + 0 = 9$
8. $12 \cdot (13 \cdot 20) = (12 \cdot 13) \cdot 20$

9. Name the factors of 48. Express 48 as the product of two of these factors.

10. Identify 92 as a prime or composite number. Give its prime factorization using exponents.

11. Express $12 \cdot 12 \cdot 12 \cdot 12$ using exponents. Name the base and the exponent.

12. Find the GCF of the numbers 18, 36, and 72.

13. Find the LCM of the numbers 4, 8, and 18.

14. Multiply $(b^{10})(b^{-12})(b^{-2})$. Express answer using positive exponents.

15. Find the quotient of $\frac{ab^7}{a^4b^9}$ using positive exponents. Then write as an expression using negative exponents.

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Unit 3 Test

Properties Used in Algebra

1. Write a mathematical sentence to illustrate each of the following properties: commutative property of addition, commutative property of multiplication, associative property of addition, associative property of multiplication, identity property of addition, identity property of multiplication, multiplication property of zero, and the distributive property.

2. Use the distributive property to simplify $8b + 9b + 24$.

3. Name the factors of 54. Express 54 as a product of two of these factors.

4. What is the difference between a prime and composite number? Give an example of each.

5. Find the prime factorization of 360. Express your answer using exponents.

6. Express $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$ using exponents. Write how you read this expression. Name its base and the exponent.

7. Find the GCF and LCM of 4, 8, and 20.

8. Explain the difference between finding a GCF and finding an LCM using prime factorizations. Use examples to help with the explanations.

Find each product or quotient. Leave answer in exponential form using positive exponents. Then write expression using negative exponents.

9. $x^{-2} \cdot x^{-5}$

10. $(7^{10})(7^{15})$

11. $(b^8)(b^{-3})(b^{-6})$

12. $\frac{c^4d^7}{c^2d^9}$

13. $\frac{-12a^7}{4a^3}$

14. $\frac{4m^{-4}n}{m^{-9}n^8}$

Name Date

Simplifying fractions

A fraction is considered to be in simplest form, or lowest terms, if its numerator and denominator have no common whole-number factor other than 1.

Simplify $\frac{8}{36}$ to lowest terms.

8 and 36 have a GCF of 4.

$\frac{8 \div 4}{36 \div 4}$ Divide both by the GCF of 4.

$\frac{2}{9}$ Fraction is in simplest form.

Thus, when simplifying fractions, it is important to find the GCF of the numerator and the denominator and divide each by this GCF.

Simplify $\frac{12}{21}$ to lowest terms.

12 and 21 have a GCF of 3.

$\frac{\cancel{12}^{4}}{\cancel{21}_{7}} = \frac{4}{7}$ An easier way to simplify is to cross out and rewrite numbers after division is completed mentally.

1. What is meant by expressing a fraction in lowest terms? Give an example of a fraction in lowest terms and a fraction that is not.

State the GCF of the numerator and the denominator.

2. $\frac{10}{15}$
3. $\frac{9}{21}$
4. $\frac{12}{24}$
5. $\frac{2}{22}$
6. $\frac{30}{51}$
7. $\frac{33}{77}$

Write each fraction in lowest terms.

8. $\frac{2}{16}$
9. $\frac{33}{54}$
10. $\frac{17}{51}$
11. $\frac{18}{45}$
12. $\frac{25}{40}$
13. $\frac{18}{108}$
14. $\frac{36}{42}$
15. $\frac{22}{99}$
16. $\frac{26}{65}$

Name Date

Multiplying fractions

To multiply fractions, simply multiply the numerators and multiply the denominators. Thus, the product of any two fractions is equal to the product of their numerators over the product of their denominators. If the fractions have common factors in the numerators and denominators, they can be simplified before they are multiplied.

1. $\frac{1}{4} \times \frac{5}{6}$

$\frac{1 \times 5}{4 \times 6}$ Multiply numerators and multiply denominators.

$\frac{5}{24}$ Final answer in simplest form

2. $\frac{4}{5} \times \frac{7}{12}$

$\frac{\cancel{4}^{1}}{5} \times \frac{7}{\cancel{12}_{3}}$ 4 and 12 have a common factor of 4. Divide both by 4.

$\frac{1 \times 7}{5 \times 3}$ Multiply numerators and multiply denominators.

$\frac{7}{15}$ Final answer in simplest form

3. $\frac{9}{21} \times \frac{14}{27}$

$\frac{\cancel{9}^{1}}{\cancel{21}_{3}} \times \frac{\cancel{14}^{2}}{\cancel{27}_{3}}$ 9 and 27 have a common factor of 9. Divide both by 9. 14 and 21 have a common factor of 7. Divide both by 7.

$\frac{1 \times 2}{3 \times 3}$ Multiply numerators and multiply denominators.

$\frac{2}{9}$ Final answer in simplest form

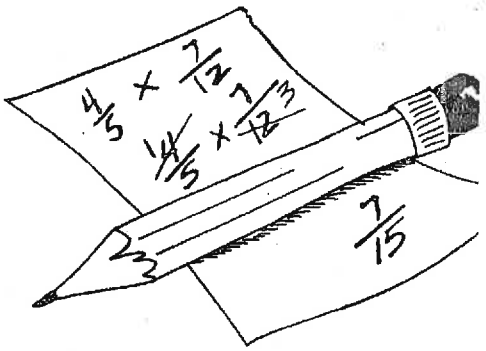
Multiply each expression. Express each answer in lowest terms.

1. $\frac{3}{8} \times \frac{3}{7}$
2. $\frac{3}{10} \times 2$
3. $\frac{1}{12} \times 5$
4. $\frac{2}{5} \times \frac{8}{11}$
5. $\frac{3}{10} \times \frac{2}{13}$
6. $\frac{2}{7} \times \frac{13}{14}$
7. $2 \times \frac{3}{8}$
8. $\frac{1}{2} \times \frac{9}{10}$
9. $\frac{4}{11} \times \frac{3}{4}$
10. $\frac{5}{9} \times \frac{5}{9}$
11. $\frac{3}{5} \times \frac{1}{6}$
12. $\frac{1}{7} \times \frac{1}{6}$

13. Find the product of $\frac{a}{3} \times \frac{4}{5}$.

14. Find $\frac{1}{4}$ of 3 feet.

15. A rope is $\frac{7}{12}$ yards long. How long is $\frac{1}{3}$ of the rope?



Name Date

Mixed numbers

A mixed number is the sum of a whole number and a fraction. It is good to use a mixed number when there is an improper fraction. An improper fraction is a fraction whose numerator is larger than its denominator.

$\frac{9}{4}$ is an improper fraction.

To change an improper fraction to a mixed number, following these steps:

1. Divide the numerator by the denominator.

   $9 \div 4 = 2$ R1

2. Write the whole number answer in step 1 as the whole number and the remainder as the numerator of the fraction with the denominator the same as that in the original improper fraction.

   Thus, the mixed number is $2\frac{1}{4}$.

To change a mixed number to an improper fraction, follow these steps:

Change $3\frac{1}{5}$ to an improper fraction.

1. Multiply the denominator of the fraction times the whole number.

   $3 \times 5 = 15$

2. Add the whole number found in step 1 to the numerator of the fraction in the original mixed number. This is the numerator of the improper fraction.

   $15 + 1 = 16$

3. Write the numerator found in step 2 over the denominator of the original fraction in the mixed number.

   Thus, $\frac{16}{5}$ is the improper fraction.

Express each mixed number as an improper fraction.

1. $3\frac{1}{4}$
2. $6\frac{5}{6}$
3. $2\frac{2}{5}$
4. $1\frac{3}{4}$
5. $4\frac{8}{11}$
6. $5\frac{1}{7}$
7. $8\frac{1}{2}$
8. $5\frac{2}{3}$

Express each improper fraction as a mixed number.

9. $\frac{5}{3}$
10. $\frac{8}{7}$
11. $\frac{17}{7}$
12. $\frac{16}{9}$
13. $\frac{10}{3}$
14. $\frac{26}{5}$
15. $\frac{30}{11}$
16. $\frac{45}{4}$

Multiply. Express answer in lowest terms.

17. $\frac{3}{5} \times \frac{7}{2}$
18. $\frac{5}{4} \times 6$ (Note: first rewrite 6 as $\frac{6}{1}$.)

Name Date

Multiplying mixed numbers

To multiply mixed numbers, change the numbers to improper fractions.

1. Multiply $2\frac{3}{4} \times 5\frac{2}{3}$

$2\frac{3}{4} = \frac{8+3}{4} = \frac{11}{4}$ Change mixed numbers to improper fractions.

$5\frac{2}{3} = \frac{15+2}{3} = \frac{17}{3}$

$\frac{11}{4} \times \frac{17}{3} = \frac{187}{12}$ Multiply improper fractions.

$\frac{187}{12} = 15\frac{7}{12}$ Express answer in mixed number form in lowest terms.

2. Multiply $1\frac{1}{2} \times \frac{1}{2}$

$1\frac{1}{2} = \frac{2+1}{2} = \frac{3}{2}$ Change $1\frac{1}{2}$ to a mixed number.

$\frac{3}{2} \times \frac{1}{2} = \frac{3}{4}$ Multiply fractions and express answer in simplest form.

Name the improper fractions that would replace each whole number or mixed number to be able to multiply the expression.

1. $4 \times 5\frac{1}{2}$
2. $1\frac{1}{6} \times 1\frac{1}{7}$
3. $3 \times 5\frac{2}{9}$
4. $3\frac{1}{4} \times 3\frac{1}{5}$
5. $4 \times 4\frac{3}{4}$
6. $1\frac{3}{7} \times 4\frac{1}{10}$
7. $2\frac{1}{2} \times 2\frac{1}{3}$
8. $6\frac{1}{4} \times 7\frac{3}{5}$
9. $3\frac{1}{3} \times 7$

Multiply each expression. Express each answer in lowest terms.

10. $\frac{7}{3} \times 4\frac{1}{2}$
11. $2\frac{3}{4} \times 1\frac{1}{2}$
12. $5\frac{1}{5} \times 3\frac{2}{3}$
13. $\frac{3}{5} \times 6$
14. $8\frac{1}{4} \times 2\frac{1}{3}$
15. $4 \times 5\frac{1}{3}$

Use the formula for the area of a rectangle, $A = \ell \cdot w$, where ℓ is length and w is width, to find t area of each rectangle below.

16. $\ell = 2\frac{1}{2}$ in., $w = 4\frac{1}{4}$ in.
17. $\ell = 8\frac{3}{5}$ ft., $w = 3$ ft.

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Name Date

Dividing fractions and mixed numbers

To divide any two fractions, multiply by the reciprocal of the divisor. Reciprocal numbers are two numbers whose product is 1. To find the reciprocal of a fraction, invert the numerator and denominator.

1. Divide $\frac{3}{2}$ by $\frac{1}{2}$

$\frac{3}{2} \div \frac{1}{2}$ Invert the divisor and change to multiplication.

$= \frac{3}{2} \times \frac{2}{1}$

$= \frac{3 \times 2}{2 \times 1}$ Multiply.

$= \frac{6}{2} = 3$ Simplify the final answer.

2. Divide $2\frac{1}{4}$ by $4\frac{1}{3}$

$2\frac{1}{4} = \frac{9}{4}$ Change mixed numbers to improper fractions.

$4\frac{1}{3} = \frac{13}{3}$

$\frac{9}{4} \div \frac{13}{3}$ Write problem using improper fractions.

$= \frac{9}{4} \times \frac{3}{13}$ Change to multiplication by inverting second fraction.

$= \frac{27}{52}$ Multiply.

1. What are reciprocals? Give an example.

Name the reciprocal of each number.

2. $\frac{4}{7}$ 3. 5 4. $\frac{3}{10}$ 5. $\frac{1}{2}$

Write each division expression as a multiplication expression. Then solve. Write answers in lowest terms.

6. $\frac{1}{4} \div 4$ 7. $1\frac{1}{6} \div 2\frac{1}{2}$ 8. $\frac{1}{5} \div \frac{1}{6}$

9. $\frac{3}{5} \div \frac{7}{10}$ 10. $2\frac{4}{7} \div \frac{1}{3}$ 11. $3\frac{1}{3} \div 5\frac{1}{2}$

Solve each equation for x. Write answers in lowest terms.

12. $6x = 2\frac{1}{2}$ 13. $2x = 3\frac{1}{4}$ 14. $\frac{3}{4}x = 5\frac{1}{2}$

Name Date

Adding and subtracting like fractions

To add fractions with like denominators, add the numerators and write the sum over the denominator of the original fractions.

$\frac{3}{7} + \frac{1}{7}$

$\frac{3+1}{7} = \frac{4}{7}$ Add the numerators. Simplify final answer.

To subtract fractions with like denominators, subtract the numerators and write the difference over the denominator of the original fractions.

$\frac{8}{9} - \frac{2}{9}$

$\frac{8-2}{9} = \frac{6}{9} = \frac{2}{3}$ Subtract the numerators. Simplify final answer.

To add or subtract mixed numbers, change to improper fractions, add or subtract, and simplify final answer.

$5\frac{1}{3} + 7\frac{2}{3}$

$\frac{16}{3} + \frac{23}{3}$ Change to improper fractions.

$\frac{16+23}{3}$ Add the numerators.

$\frac{39}{3} = 13$ Simplify final answer.

Find each sum or difference. Write answers in simplest form.

1. $\frac{3}{5} + \frac{2}{5}$
2. $4\frac{3}{4} - 2\frac{1}{4}$
3. $7\frac{3}{4} - 3\frac{1}{4}$
4. $2\frac{3}{8} + \frac{5}{8}$
5. $2\frac{7}{12} + 6\frac{11}{12}$
6. $5\frac{2}{3} + 1\frac{2}{3}$
7. $11\frac{7}{9} - 2\frac{4}{9}$
8. $2\frac{5}{6} + 9\frac{1}{6}$
9. $13\frac{2}{7} - 9\frac{5}{7}$

Solve each problem.

10. Kim walked $2\frac{1}{4}$ miles. Joe walked $4\frac{3}{4}$ miles. How many more miles did Joe walk than Kim

11. Jack has a string that is $7\frac{3}{8}$ inches long. He cuts a piece $4\frac{1}{8}$ inches long. How much string does he have left?

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Name Date

Adding and subtracting unlike fractions

To find the sum or difference of unlike fractions, find the least common denominator (LCD) by finding the least common multiple (LCM) of the denominators. Then express each fraction as an equivalent fraction with the least common denominator and add or subtract.

1. Add $\frac{3}{5}$ and $\frac{4}{7}$

LCM of the denominators is 35. Thus, the LCD is 35.

$\frac{3}{5} = \frac{?}{35} = \frac{21}{35}$ $35 \div 5 \times 3 = 21$ new numerator

35 is the LCD.

$\frac{4}{7} = \frac{?}{35} = \frac{20}{35}$ $35 \div 7 \times 4 = 20$ new numerator

35 is the LCD.

$\frac{21}{35} + \frac{20}{35} = \frac{41}{35} = 1\frac{6}{35}$ Add and simplify final answer.

2. Subtract $7\frac{1}{4}$ and $4\frac{1}{3}$

$7\frac{1}{4} = \frac{29}{4}$ $4\frac{1}{3} = \frac{13}{3}$ Change to improper fractions.

$\frac{29}{4} - \frac{13}{3}$

LCM of these denominators is 12. Thus, the LCD is 12.

$\frac{29}{4} = \frac{?}{12} = \frac{87}{12}$ $12 \div 4 \times 29 = 87$. new numerator

12 is the LCD.

$\frac{13}{3} = \frac{?}{12} = \frac{52}{12}$ $12 \div 3 \times 13 = 52$. new numerator

12 is the LCD.

$\frac{87}{12} - \frac{52}{12} = \frac{35}{12} = 2\frac{11}{12}$ Subtract and simplify answer.

Find the missing number to make an equivalent fraction.

1. $\frac{1}{3} = \frac{?}{24}$
2. $\frac{3}{4} = \frac{?}{16}$
3. $\frac{2}{3} = \frac{?}{24}$
4. $\frac{1}{5} = \frac{?}{20}$
5. $\frac{1}{2} = \frac{?}{40}$
6. $\frac{1}{4} = \frac{?}{28}$

Find the LCD of each set of fractions.

7. $\frac{3}{8}, \frac{3}{16}$
8. $\frac{7}{10}, \frac{4}{15}$
9. $\frac{2}{5}, \frac{1}{6}$
10. $\frac{5}{6}, \frac{4}{9}$

Find each sum or difference.

11. $\frac{1}{2} + \frac{3}{4}$
12. $\frac{9}{16} - \frac{1}{4}$
13. $6\frac{2}{5} + 2\frac{3}{4}$
14. $\frac{5}{6} - \frac{3}{8}$
15. $5\frac{2}{7} - 2\frac{3}{8}$
16. $4\frac{7}{10} + 9\frac{1}{2}$

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Name Date

Solving equations and inequalities with fractions

The same steps taken to solve equations and inequalities involving integers are used to solve equations and inequalities with fractions.

1. Solve $\frac{x}{4} + \frac{1}{2} = \frac{3}{4}$

$\frac{x}{4} + \frac{1}{2} - \frac{1}{2} = \frac{3}{4} - \frac{1}{2}$	Subtract $\frac{1}{2}$ from both sides of the equation.
$\frac{x}{4} = \frac{3}{4} - \frac{2}{4}$	Find the common denominator of the fractions.
$4(\frac{x}{4}) = \frac{1}{4}(4)$	Multiply by 4 on both sides of the equation.
$x = 1$	Final answer is 1.

2. Solve $3x - 2 \leq \frac{3}{7}$

$3x - 2 + 2 \leq \frac{3}{7} + 2$	Add 2 to both sides of the inequality.
$3x \leq \frac{3}{7} + \frac{14}{7}$	Find the common denominator of the fractions.
$\frac{3x}{3} \leq \frac{17}{7} \div 3$	Divide both sides by 3.
$x \leq \frac{17}{7} \cdot \frac{1}{3}$	Change to a multiplication problem.
$x \leq \frac{17}{21}$	Final answer in lowest terms is $\frac{17}{21}$.

Solve each equation.

1. $\frac{2}{3}x = 5$
2. $\frac{1}{6}x - \frac{2}{7} = \frac{4}{7}$
3. $\frac{x}{2} + 7\frac{1}{2} = 9\frac{1}{2}$
4. $\frac{3}{4}x + 2 = 5\frac{1}{2}$
5. $\frac{4}{5}x = 6\frac{1}{3}$
6. $\frac{7}{8}x - \frac{3}{4} = 6\frac{1}{4}$

Solve each inequality.

7. $\frac{x}{3} < 5$
8. $\frac{3}{2} + \frac{1}{5}x \leq 2\frac{2}{5}$
9. $\frac{4}{5}x > 3\frac{1}{2}$
10. $\frac{x}{2} + \frac{3}{4} \geq \frac{3}{4}$
11. $\frac{3}{8}x - 4 \leq \frac{1}{8}$
12. $\frac{2}{3}x - \frac{1}{6} < 4\frac{2}{3}$

13. State two ways to solve the equation $\frac{2}{3}x = 12$.

14. Write your own equation and inequality using fractions. Explain the steps to use to solve eac and solve them.

Name Date

Review of Unit 4

Topics covered:

- Simplifying Fractions
- Multiplying Fractions
- Mixed Numbers
- Multiplying Mixed Numbers
- Dividing Fractions and Mixed Numbers
- Adding and Subtracting Like Fractions
- Adding and Subtracting Unlike Fractions
- Solving Equations and Inequalities with Fractions

1. Explain what is meant by expressing a fraction in simplest or lowest terms.

2. State the GCF of the numerator and denominator of $\frac{10}{35}$. Simplify the fraction.

3. Find the product of $2 \times \frac{4}{9}$. Explain the steps to do this.

4. Explain what is meant by a mixed number and an improper fraction. Give an example of each.

5. Express the product of $3\frac{3}{4} \times 2\frac{1}{2}$ in lowest terms.

6. Explain the steps to find the quotient of $3\frac{1}{4} \div 6\frac{1}{2}$. Solve.

7. Find the sum of $2\frac{1}{4} + 12\frac{3}{4}$. Find the difference of $12\frac{3}{4} - 2\frac{1}{4}$.

8. Explain how to find the least common denominator (LCD) of a set of unlike fractions.

9. Find the difference of $4\frac{3}{10} - 2\frac{4}{5}$. List the steps you used. What was the LCD?

10. State two ways to solve $\frac{3}{5}x = 9$. Find the answer.

11. Solve $\frac{2}{3}x + 2\frac{1}{2} = 4\frac{3}{4}$.

12. Solve $\frac{1}{4}x - 5\frac{1}{6} \leq 3\frac{5}{9}$.

13. Write your own equation or inequality using fractions. Explain the steps used to solve it and solve.

Name Date

Unit 4 Test

1. State the GCF of 9 and 21. Write these numbers as a fraction in lowest terms using the GCF.

2. Explain how to multiply two fractions. Give an example.

3. Explain how to divide two fractions. Give an example.

4. Explain how to change a mixed number to an improper fraction. Give an example.

Evaluate each expression.

5. $\frac{3}{10} \times \frac{5}{6}$

6. $4\frac{1}{5} \times 2\frac{2}{3}$

7. $12 \div 3\frac{6}{7}$

8. $4\frac{3}{4} \div 2\frac{1}{3}$

9. Solve $\frac{3}{5}x = 6\frac{1}{2}$ for x. State the steps used to solve it.

10. Explain how to add and subtract like fractions. Give an example of each.

11. Explain how to add and subtract unlike fractions. Give an example of each.

State the two steps to use to simplify each expression.

12. $4\frac{3}{8} + 7\frac{3}{8}$

13. $\frac{3}{5} - \frac{3}{7}$

14. $9\frac{2}{3} - 2\frac{1}{3}$

15. $7\frac{2}{9} + 8\frac{5}{6}$

16. Explain the steps to solve $\frac{2}{3}x + 4\frac{4}{5} \leq 10\frac{3}{10}$ and solve.

17. Write an equation using fractions and state the steps used to solve it. Find the answer.

Name Date

Decimals as fractions and mixed numbers

To change a decimal to a fraction, note the place value of the last digit in the number. For example, to change 0.21 (21 hundredths) to a fraction, look at the place value of the 1, since it is the last digit in the number. The 1 is in the hundredths place so 21 would be written over the number 100. Thus, the fraction would be $\frac{21}{100}$.

1. Change 0.324 to a fraction in lowest terms.

   $0.324 = \frac{324}{1000} = \frac{81}{250}$ — 1,000 is the denominator since 4 is in the thousandths place. Simplify.

2. Change 4.25 to a mixed number. (Hint: This will be a mixed number because this is a decimal that is greater than one.)

   $4.25 = 4\frac{25}{100} = 4\frac{1}{4}$ — The denominator of the fraction is 100 since 5 is in the hundredths place. The whole number is 4. Simplify.

The numbers 10, 100, 1,000, and so on, are called powers of 10, since each can be written using an exponent, (10^1, 10^2, 10^3, and so on). A fraction whose denominator is a power of 10 can very easily be written as a decimal. For example, $\frac{3}{10}$ can be written as 0.3, and $\frac{13}{50}$ can be changed to $\frac{26}{100}$ and written as 0.26.

1. Change $\frac{5}{1000}$ to a decimal.

   $\frac{5}{1000} = 0.005$ — Two zeros are needed before the 5 so the 5 is in the thousandths place.

2. Change $6\frac{52}{100}$ to a decimal.

   $6\frac{52}{100} = 6.52$ — Six is the number written before the decimal, and 52 is written to end in the hundredths place.

Write each decimal in word form. Change each decimal to a fraction or mixed number in lowest terms.

1. 0.3 **2.** 0.05 **3.** 15.8 **4.** 5.45

5. 1.47 **6.** 81.59 **7.** 0.125 **8.** 0.455

Express each number as a decimal.

9. $\frac{225}{1000}$ **10.** $7\frac{9}{100}$ **11.** $\frac{7}{10}$

12. $\frac{7}{1}$ **13.** $4\frac{75}{1000}$ **14.** $41\frac{8}{10}$

Rewrite each fraction with a denominator that is a power of 10. Then rewrite as a decimal.

15. $\frac{3}{5}$ **16.** $5\frac{11}{50}$ **17.** $7\frac{29}{500}$

18. $8\frac{17}{20}$ **19.** $\frac{123}{200}$ **20.** $10\frac{1}{2}$

Name Date

Rounding numbers

When rounding numbers, it is important to remember place values. Look at the chart to the right to help you.

100,000	10,000	1,000	100	10	1	0.10	0.100	0.1000	0.10000	0.100000

Here are the steps to use when rounding numbers.

1. Identify the place value that is going to be rounded.
2. Look at the number to the right of the place value being rounded.
   a. If ≥ 5, replace it and each of the following digits with zeros and increase the place value being rounded by 1.
   b. If < 5, simply replace it and each of the following digits with zeros and stop.

If rounding a place that is to the right of the decimal, drop zeros to the right of this place after you have finished rounding.

1. Round 32,864 to the nearest hundred.

32,8̲64	First, underline place value to be rounded and then identify number to the right.
↑	
32,900	Since 6 ≥ 5, replace 6 and the digits to its right with zeros and increase 8 by 1.

2. Round 41.782 to the nearest one.

41̲.782	First, underline place value to be rounded and then identify number to the right.
↑	
42.000	Since 7 ≥ 5, replace the 7 and the digits to the right with zeros and increase 1 by 1.
42	Drop the zeros to the right of the unit's place unless they are needed as place holders.

Circle the number you would check when rounding to the underlined position. Then round the number.

1. 45,4̲58
2. 7.2̲42
3. 6,12̲5
4. 2,59̲2.29
5. 12.19̲8
6. 23.0̲6
7. 78.3̲5
8. 182.616̲8

Complete the chart by rounding as indicated.

number	one	tenth	hundredth	thousandth
9. 685.3714				
10. 0.0936				
11. 1.4879				

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Estimating sums and differences

Estimating is a great way to find an answer quickly when a precise answer is not necessary. It also can help you quickly figure out if an answer is reasonable or not.

1. Estimate 29.32 + 41.297 + 11.52

   29 + 41 + 12 Estimate each number to the nearest whole number.

   = 82 Simply add the estimated numbers.

   Thus, 29.32 + 41.297 + 11.52 is about 82.

2. Estimate the difference of 153.789 – 53.182

   150 – 50 Estimate each number to the nearest ten.

   = 100 Simply subtract the estimated numbers.

   Thus, 153.789 – 55.182 is about 100.

Note: Round each number to the most convenient place value position. Often the greatest place value position that each of the numbers share is used.

1. Name two examples of numbers that round to a nearest whole number. Show one rounding up and one staying the same.

2. Explain two reasons for using estimation.

Estimate each sum or difference.

3. 13.8 + 49.2

4. 39,415 – 18,918

5. 42 – 39.89

6. 11.25 + 21.92

7. $25 – $19.74

8. 7,604 – 5,142

9. 8.9 + 13.8

10. $9.99 + $4.89

11. 648 – 188

12. 839 + 4,987

13. $315 + $298

14. 77,695 – 42,852

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Estimating products and quotients

When estimating the products and quotients of numbers, it is important to use compatible numbers. Compatible numbers are easy to multiply or divide. These numbers are used to enable mental computation.

1. Estimate 15.52 ÷ 5.72

   15 ÷ 5 — Estimate numbers to 15 and 5 simply because these numbers are easy to divide mentally.

   = 3 — Divide.

   Thus, 15.52 ÷ 5.72 is about 3.

2. Estimate 15.85 x 9.78

   15 x 10 — Estimate numbers to 15 and 10 simply because these numbers are easy to multiply.

   = 150 — Multiply.

   Thus, 15.85 x 9.78 is about 150.

Note: Even though some of the numbers above should have been rounded up, it is important to estimate the numbers to create the easiest computation.

1. Give an example of two numbers that are compatible numbers. State why they are compatible.

Estimate each product or quotient.

2. 14.78 x 9.35

3. 109.81 ÷ 8.26

4. 3.91 x 2.04

5. 32,498 x 3.29

6. 21.42 ÷ 6.98

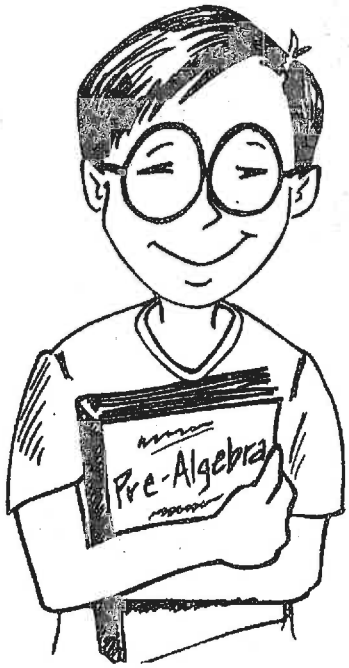
7. 56.319 ÷ 11.46

8. 43.79 ÷ 14.28

9. 122.75 ÷ 7.11

10. 91.65 x 53.42

11. 8.37 x 9.24



12. Is there any way to know if an estimated answer is greater than or less than the actual answer? Explain your answer.

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Adding and subtracting decimals

Adding and subtracting decimals is just like adding and subtracting whole numbers except the following rule must be used: The decimal points must be aligned before adding or subtracting.

1. Find the sum of 2.43 + 12.578 + 0.2

$$\begin{array}{r} 2.43 \\ 12.5768 \\ +\ 0.2 \\ \hline 15.208 \end{array}$$

First, align the decimals by writing the numbers vertically.

Then add, aligning the decimal in the answer with the decimals of the numbers added.

2. Find the difference of 1.56 − 0.03

$$\begin{array}{r} 1.56 \\ -\ 0.03 \\ \hline 1.53 \end{array}$$

First, align the decimals by writing the numbers vertically.

Then subtract, aligning the decimal in the answer with the decimals of the numbers subtracted.

Note: It is sometimes necessary to add zeros to a number to fill in place value positions. For example, 10 − 9.12 would be much easier to compute if zeros were used, making it 10.00 − 9.12. In this case, neither the value of the original problem nor the answer would change.

1. State the rule that must be used when adding and subtracting decimals.

2. Explain the only difference between adding and subtracting decimals and adding and subtracting whole numbers.

Add or subtract each expression.

3. 4.35 + 5.4

4. 52.4 + 0.62 + 2.096

5. 2.55 − 2.05

6. 5.085 − 2.5

7. 16.08 + 3.2

8. 22.3 + 0.89 + 27

9. 12 − 2.73

10. 26.8 − 6.48

Name Date

Multiplying decimals

Multiplying decimals is just like multiplying whole numbers. The only difference is the placement of the decimal point in the product. To figure out the placement of the decimal in a product, count the number of digits after each factor's decimal point. Add these numbers together, and this will be the total number of digits after the decimal point in the product.

1. Multiply 23.6 x 13.79

13.79	2 digits after decimal
x 23.6	1 digit after decimal
325.444	1 added to 2 gives 3 digits total after the decimal in this product.

2. Multiply 3.12 x 100

   To multiply by a power of 10, simply move the decimal point to the right as many places as there are zeros.

   3.12 = 312 Move decimal 2 places to the right since there are two zeros.

Note: When multiplying decimals, estimation is helpful to verify placement of the decimal point in a product.

1. State the rule for placement of the decimal point in a multiplication problem.

To make the statement true, place a decimal point in the factor that is missing a decimal.

2. (82)(.2) = 1.64

3. (4.015)(41) = 16.4615

4. (575)(1.2) = 6.900

5. (0.6)(216) = 12.96

6. (65.7)(25) = 164.25

7. (7.5)(75) = 5.625

Multiply each expression.

8. 7 x 20.2

9. 6.2 x 0.35

10. 0.2 x 0.18

11. 8.5 x 9.1

12. 4.1 x 4.1

13. 5.014 x 5.4

14. John bought a case of soda (24 cans) at the store for $0.31 a can. How much money did John spend at the store?

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Dividing decimals by whole numbers

Dividing decimals by whole numbers, is just like dividing whole numbers with one extra step shown below.

1. Divide 5.4 by 9

$$9\overline{)5.4} = 0.6$$

$$\begin{array}{r} .6 \\ 9\overline{)5.4} \\ -\,5\,4 \\ \hline 0 \end{array}$$

Place the decimal point directly above the decimal point in 5.4.
Divide as done with whole numbers.

2. Divide 2.6 by 3

$$3\overline{)2.600} = 0.8\overline{6}$$

$$\begin{array}{r} .8\overline{6} \\ 3\overline{)2.600} \\ -\,2\,4 \\ \hline 20 \\ -\,18 \\ \hline 2 \end{array}$$

Place the decimal point directly above the decimal point in 2.6.
Divide as done with whole numbers. Add zeros until you see a pattern.
Use a line above the 6 to show that the 6 repeats.

3. Divide 67.891 by 1,000

To divide numbers by a power of 10, simply move the decimal to the left as many places as there are zeros.

67.891 ÷ 1,000 = 0.067891

Move decimal 3 places to the left since there were 3 zeros. A zero needed to be put in the final answer to hold a place value position.

Note: When dividing decimals by whole numbers, sometimes it is necessary to add zeros to a dividend until the remainder is zero or until the answer contains as many digits as one would like or need.

Divide each expression.

1. 0.21 ÷ 6

2. 339.2 ÷ 8

3. 28.35 ÷ 9

4. 9.008 ÷ 4

5. 0.0318 ÷ 6

6. 14.068 ÷ 100

7. 16.8 ÷ 12

8. 6.88 ÷ 16

9. 46.7 ÷ 10

10. If a car uses 16.4 gallons of gas in 4 hours, how many gallons are used per hour?

11. Rob rode his bike 48.3 miles in 3 hours. How many miles did he bike in 1 hour?

Name Date

Dividing decimals by decimals

To divide by decimals, move the decimals of each number in the problem the same number of places to change the divisor to a whole number. (Just as multiplying the numerator and the denominator of a fraction by the same number gives an equivalent fraction, moving the decimal points in a division problem the same number of places also gives the same answer.)

1. Divide 0.84 by 1.2

$1.2 \overline{)\,0.84}$ Move the decimals until the divisor is a whole number.

$12 \overline{)\,8.4}$ Divide using the new numbers.

$\begin{array}{r} .7 \\ 12 \overline{)\,8.4} \\ -\,8\,4 \\ \hline 0 \end{array}$

$= 0.7$ Final quotient

2. Divide 0.024 by 0.002

$0.002 \overline{)\,0.024}$ Move the decimals until the divisor is a whole number.

$\begin{array}{r} 12 \\ 2 \overline{)\,24} \\ -\,2 \\ \hline 04 \\ -\,4 \\ \hline 0 \end{array}$ Divide using the new numbers.

$= 12$ Final quotient

Change each division problem to make the divisor a whole number.

1. $9.2 \div 1.2$ **2.** $16 \div 0.48$ **3.** $0.014 \div 0.005$

4. $10.81 \div 9.1$ **5.** $0.8 \div 2.6$ **6.** $24.75 \div 0.95$

Divide each expression.

7. $16.25 \div 0.5$ **8.** $0.564 \div 1.2$ **9.** $8.704 \div 3.4$

10. $4.848 \div 0.08$ **11.** $0.0448 \div 0.014$ **12.** $10.98 \div 0.02$

13. On Juan's road trip, he spent $15.50 for 12.5 gallons of gas. How much money did he pay per gallon?

Name Date

Solving equations and inequalities with decimals

The same skills learned to solve equations and inequalities with integers can be used in solving equations and inequalities with decimals.

1. Solve $\frac{a}{2.2} = 5.1$

$(2.2)(\frac{a}{2.2}) = 5.1(2.2)$	Multiply both sides by 2.2.
$a = 11.22$	Solve for a.

2. Solve $0.05x = 9.95$

$\frac{0.05x}{0.05} = \frac{9.95}{0.05}$	Divide both sides by 0.05.
$x = 199$	Solve for x.

3. Solve $x + 3.2 = 91.45$

$x + 3.2 - 3.2 = 91.45 - 3.2$	Subtract 3.2 from both sides.
$x = 88.25$	Solve for x.

4. Solve $0.2x - 6.8 \leq 7.2$

$0.2x - 6.8 + 6.8 \leq 7.2 + 6.8$	Add 6.8 to both sides.
$\frac{0.2x}{0.2} \leq \frac{14}{0.2}$	Divide both sides by 0.2.
$x \leq 70$	Solve for x.

1. Explain how to solve the equation $0.4x = 6.8$. Then solve.

2. Write an inequality with decimals. State the steps to use to solve it and then solve.

Solve each equation or inequality. Check each solution.

3. $9y \leq 4.5$

4. $0.3d - 7.2 \leq 5.136$

5. $\frac{z}{3.2} = 5.4$

6. $0.6t > 0.96$

7. $7.5a = 2.25$

8. $\frac{z}{4.9} = 9.1$

9. $2b \geq 5.486$

10. $-3.45 + x \geq 10.12$

11. $x + 0.97 = 2.196$

12. $2.4c + 2 = 14.48$

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