CHAPTER 1

Family Letter

Section A

What We Are Learning

The Language of Algebra

VOCABULARY
These are the math words we are learning:

absolute value the distance a number is from zero on a number line

additive inverse a number and its opposite

algebraic expression an expression that may include variables, constants, and operations

constant a value that does not change

irrational numbers numbers that are neither repeating nor terminating decimals

rational numbers numbers that can be expressed in the form $\frac{a}{b}$, where a and b are both integers and $b \neq 0$

real numbers any number on the number line

variable a letter or symbol used to represent a value that can change

Dear Family,

Welcome to Algebra! Throughout this course the student will learn an appreciation for how each new skill builds upon previously-learned concepts. The student initially may not always understand "why" they are learning a particular skill, but each of these skills is necessary for comprehension of the bigger picture.

At the outset of this course, the student will be reviewing and mastering previously-learned skills in preparation for learning algebraic concepts. You can use this table to help the student translate word phrases into math symbols

Operation	Key Word Phrases	Expression
Addition	a number **plus** 4 **add** 4 to a number the **sum** of 4 and a number 4 **more** than a number a number **increased** by 4	$m + 4$ $4 + m$
Subtraction	a number **minus** 4 4 **less** a number the **difference** of a number and 4 a number **decreased** by 4	$m - 4$
Multiplication	4 **times** a number a number **multiplied** by 4 the **product** of a number and 4	$4m$
Division	a number **divided** by 4 4 **divided** into a number the **quotient** of a number and 4	$m \div 4$ or $\frac{m}{4}$

John works *d* days. Tracy works 3 times as many days as John. Write an expression to show how many days Tracy works.

Step 1 Define the variable.
Let d represent the number of days John works.

Step 2 Look for key words.
Tracy works 3 ***times*** *as many days as John.*
Think: "times" ⟶ multiplication.

Step 3 Write the expression: $3d$

Knowing how to evaluate algebraic expressions will prepare the student for solving equations—an algebraic concept covered throughout this text.

To evaluate an expression, substitute a numerical value for the variable(s) in the expression. Then perform the necessary mathematical operation(s).

Evaluate the expression $3d$ for $d = 40$.

$3d$	Write the expression.
$3(\mathbf{40})$	Substitute 40 for d.
120	Multiply.

The student will also be reviewing operations with real numbers. Encourage the student to remember these rules to build competence and confidence and to avoid common errors.

Adding Real Numbers

- When **adding** numbers with the **same sign,** add their absolute values and use the sign of the numbers.

  $3 + 4 = 7$ $\qquad -3 + (-4) = -7$

- When adding numbers with **different signs,** find the difference of the absolute values and use the sign of the number with the greatest absolute value.

  $3 + (-4) = -1$ $\qquad -3 + 4 = 1$

Subtracting Real Numbers

- When **subtracting** a number, add its opposite and follow the rules for adding numbers.

  $$3 - 4 = 3 + (-4) = -1$$

Multiplying and Dividing Real Numbers

- When **multiplying or dividing** numbers with the **same sign,** the product or quotient will be positive.

  $3(4) = 12$ $\qquad (-3)(-4) = 12$ $\qquad -12 \div (-4) = 3$

- When multiplying or dividing numbers with **different signs,** the product or quotient will be negative.

  $(-3)(4) = -12$ $\qquad 12 \div (-4) = -3$

Help the student recognize the importance of these fundamental skills as part of developing a solid mathematical foundation. Please encourage the student to work diligently and complete assignments, as practice will ensure successful comprehension.

Sincerely,

Name _____ Date _____ Class _____

CHAPTER 1

At-Home Practice

The Language of Algebra

Give two ways to write each algebraic expression in words.

1. $5 + t$ **2.** $11 - w$ **3.** $42t$ **4.** $\frac{x}{6}$ **5.** $18 \div h$

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

6. Explain the difference between the two expressions $x - 7$ and $7 - x$.

_____

7. Nina walks 3 miles every day. Write an algebraic expression for the number of miles Nina walks in d days. _____

8. Ling has 372 baseball cards that he needs to put into binders. Write an algebraic expression for the number of binders if each binder holds the same number of baseball cards, b. _____

Evaluate each expression for $a = 4$, $b = 6$, and $c = 10$.

9. $15a + 15c$ _____ **10.** $3b + 18$ _____ **11.** $3a - 2b + 4c$ _____

12. $8b \div 3a$ _____ **13.** $(a - 2)(b + 3)$ _____ **14.** abc _____

Find the value of each expression.

15. $7(-6)$ _____ **16.** $43 - 65$ _____

17. $-15 \div \frac{3}{4}$ _____ **18.** $\left(-\frac{1}{4}\right)\left(-\frac{1}{3}\right)$ _____

Simplify each expression.

19. $(-4)^2$ _____ **20.** $-(4)^2$ _____

21. $\left(\frac{2}{3}\right)^3$ _____ **22.** $\left(-\frac{1}{4}\right)^4$ _____

Find each root.

23. $\sqrt{36}$ _____ **24.** $\sqrt{\frac{4}{49}}$ _____ **25.** $\sqrt{324}$ _____

Answers: 1. 5 plus t and 5 increased by t; **2.** w subtracted from 11 and the difference between 11 and w; **3.** the product of 42 and t and 42 times t; **4.** the quotient of x and 6 and x divided by 6; **5.** 18 divided by h and the quotient of 18 and h; **6.** 7 is subtracted from x and x is subtracted from 7; **7.** $3d$; **8.** $372 \div b$; **9.** 210; **10.** 36; **11.** 40; **12.** 4; **13.** 18; **14.** 240; **15.** -42; **16.** -22; **17.** -20; **18.** $\frac{1}{12}$; **19.** 16; **20.** -16; **21.** $\frac{8}{27}$; **22.** $\frac{1}{256}$; **23.** 6; **24.** $\frac{2}{7}$; **25.** 18

Name _____ Date _____ Class _____

CHAPTER 1

Family Fun

The Smallest Expression

Materials:
Game slips (below)
2 paper bags (or hats)
Paper and pencil

Objective: Evaluate three algebraic expressions using one value. The player with the smallest sum of the three expressions is the winner.

Directions:
1. Cut out the algebraic expressions below and place them in one bag. Cut out the values and place them in the other bag.
2. Each player draws 3 slips from the expression bag and one slip from the value bag.
3. Each player uses the chosen value to evaluate each of the three expressions.
4. Then each player finds the sum of the three answers.
5. The player with the smallest sum is the winner of that round.
6. The game continues until one player wins at least 3 rounds.

Expressions

$x + 5$	$x - 4$	x^2	$100 - x$	$\frac{x}{4}$	$x - 25$
$x + 125$	$50 - x$	$20x$	$x + 12$	$x - 2$	$8 - x$

Values

$x = \frac{1}{2}$	$x = 4$	$x = \frac{3}{2}$	$x = 15$	$x = 32$
$x = 100$	$x = \frac{1}{3}$	$x = \frac{3}{4}$	$x = 25$	$x = 0$

CHAPTER 1

Family Letter

Section B

What We Are Learning

The Tools of Algebra

VOCABULARY
These are the math words we are learning:

coefficient a number multiplied by a variable

counterexample an example that disproves a statement or shows a statement to be false

like terms terms that contain the same variable raised to the same power; constants are also like terms

order of operations tells which operation is to be performed first when an expression contains more than one operation

term parts of an expression that are being added or subtracted

Dear Family,

The student will continue to review properties of real numbers. These properties are important because they reinforce how expressions can be rearranged yet still produce the same result.

Property	Definition	Example
Associative Property of Addition	When adding real numbers, the sum is the same no matter how the numbers are grouped.	For real numbers a, b, and c, $a + (b + c) = (a + b) + c$ $2 + (4 + 6) = (2 + 4) + 6$ $2 + 10 = 6 + 6$ $12 = 12$
Associative Property of Multiplication	When multiplying real numbers, the product is the same no matter how the numbers are grouped.	For real numbers a, b, and c, $a(bc) = (ab)c$ $2(4 \times 6) = (2 \times 4)6$ $2 \times 24 = 8 \times 6$ $48 = 48$
Commutative Property of Addition	Real numbers can be added in any order.	For real numbers a and b, $a + b = b + a$ $3 + 4 = 4 + 3$ $7 = 7$
Commutative Property of Multiplication	Real numbers can be multiplied in any order.	For real numbers a and b, $a + b = b + a$ $3 \times 4 = 3 \times 4$ $12 = 12$
Distributive Property	When multiplying a number by a sum, one can multiply each number in the sum and then add those two sums.	For real numbers a, b, and c, $a(b + c) = ab + ac$ $3(4 + 5) = 3(4) + 3(5)$ $3(9) = 12 + 15$ $27 = 27$

The student will show that these properties are true for only addition and multiplication by providing **counterexamples** that prove that the properties are not true for subtraction and division.

These properties will also aid the student when asked to simplify expressions. The student will use the **order of operations** to simplify and evaluate expressions. The order of operations is a set of rules that tell which operation to perform first when an expression contains more than one operation. When working with the student, use the order of operations listed below to help the student correctly evaluate algebraic expressions.

Simplify: $4 + 3(6 - 2)^2 \div 2 - 3$

1. Perform operations inside grouping symbols.

$$4 + 3\mathbf{(4)}^2 \div 2 - 3$$

2. Evaluate powers.

$$4 + 3\mathbf{(16)} \div 2 - 3$$

3. Perform multiplication and division from left to right.

$$4 + \mathbf{48} \div 2 - 3$$
$$4 + \mathbf{24} - 3$$

4. Perform addition and subtraction from left to right.

$$\mathbf{28} - 3$$
$$\mathbf{25}$$

The order of operations also applies to algebraic expressions. However, when simplifying algebraic expressions, the student must remember to combine **like terms**, terms that have the same variable raised to the same power. When combining like terms, add or subtract **coefficients**, the number being multiplied by a variable.

The Numbers 4, 5, and 9 are coefficients.

Like terms: $\mathbf{4}a + \mathbf{5}a = \mathbf{9}a$
Not like terms: $4a + 5b \neq 9ab$

A variable standing alone has a coefficient of 1.

The coefficient is 1. $a + 3a = 4a$

Remind the student that combining terms is like adding apples and oranges. Only apples can be added or subtracted from other apples, and so on. Fully comprehending this concept will help the student throughout this textbook.

Sincerely,

Name _____ Date _____ Class _____

CHAPTER 1

At-Home Practice

The Tools of Algebra

Name the property that is illustrated in each equation.

1. $3 + 6 = 6 + 3$ _____

2. $4x + (y + 3) = (4x + y) + 3$ _____

3. $10(4 + 2) = 40 + 20$ _____

4. $(8a)b = 8(ab)$ _____

5. $3a + 6 = 3(a + 2)$ _____

6. $6(5x) = 5(6x)$ _____

7. Write a counterexample to disprove the statement "The Associative Property is true for division."

_____

Write each product using the Distributive Property. Then simplify.

8. 12(42) _____

9. 9(504) _____

10. 25(210) _____

11. 6(115) _____

Simplify each expression.

12. $-4(5 + 6)$ _____

13. $8^2 - 6 \div 3$ _____

14. $\frac{(16 - 7)}{3(-1)}$ _____

15. $\frac{15 + 7 \cdot 5}{10^2 - 5^2}$ _____

Simplify each expression by combining like terms.

16. $3 + 8x + 5 + 2x$ _____

17. $6x - 7x + 2x + 9$ _____

18. $-3 - 7x - 12 - 5x + x$ _____

19. $3(4 + b) + 5b - 3$ _____

Answers: 1. commutative; **2.** associative; **3.** distributive; **4.** associative; **5.** distributive; **6.** commutative; **7.** sample $3 \div (6 + 3) \neq (3 \div 6) + 3$; **8.** $12(40 + 2) = 504$; **9.** $9(500 + 4) = 4536$; **10.** $25(200 + 10) = 5250$; **11.** $6(100 + 15) = 690$; **12.** -44; **13.** 32; **14.** -3; **15.** $\frac{2}{3}$; **16.** $10x + 8$; **17.** $x + 9$; **18.** $-11x - 15$; **19.** $8b + 9$

Name _____ Date _____ Class _____

CHAPTER 1

Family Fun

Order Up!

Materials:
deck of cards
pencil
calculator
game sheet
timer

Objective: Using order of operations, create the largest number possible from 5 cards.

Directions:

1. Shuffle the deck of cards.
2. Each player is dealt 5 cards face down. Each card has a number value. Number cards 2 through 10 are face value. Aces equal 1. Kings equal 100. Queens equal 50. Jacks equal 10.
3. Each player must use all five cards to create a number sentence using all 4 number operations: $+$, $-$, $\times$, and $\div$. Each operation may be used only once. One set of parentheses is allowed per number sentence. Players write their number sentences in the boxes below. Operation signs go in the smaller boxes.
4. Players have 5 minutes to create their number sentence.
5. Once the sentence is in place, each player may draw one card from the deck to represent a power. This power card can be placed anywhere on the number sentence, except in the answer.
6. The player then determines the value of his or her number sentence.
7. The player whose sentence has the greatest value is the winner of that round. The player with the most points after 3 rounds is the winner.
8. Any player can challenge another player's calculation. If the challenger wins the challenge, that player receives 500 points. If the challenger loses the challenge, that player loses 500 points.

Game Sheets