



# MATHEMATICS 809

## ALGEBRA

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# ALGEBRA

In preparation for algebra in the ninth grade, an introduction of algebra is necessary. This LIFEPAC® covers some essentials of algebra: variables, sentences, and applications.

In algebra the use of variables  $x$ ,  $y$ , and  $z$  solves many equations. Problems very difficult in arithmetic become relatively easy in algebra. Care should be taken to be accurate when working algebra problems.

## OBJECTIVES

**Read these objectives.** The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC.

When you have finished this LIFEPAC, you should be able to:

1. Use the number properties.
2. Work with signed numbers and variables in formulas.
3. Combine variable terms using the distributive property.
4. Solve equations involving addition and subtraction properties.
5. Solve equations involving multiplication and division properties.
6. Solve equations involving combination of terms.
7. Translate words to symbols, and words to equations.
8. Solve number problems, consecutive integer problems, age problems, and proportion problems.

Survey the LIFEPAC. Ask yourself some questions about this study. Write your questions here.

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## I. THE VARIABLE

### OBJECTIVES

When you have completed this section, you should be able to:

1. Use the number properties.
2. Work with signed numbers and variables in formulas.
3. Combine variable terms using the distributive property.

In algebra the letters that are used in place of numbers are called variables. In this section you will study properties of numbers, variables in formulas, and combination of variable terms.

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### PROPERTIES

The commutative properties for addition and for multiplication, and the associative properties for addition and for multiplication are some number properties that need to be reviewed.

Commutative Property for Addition: Numbers can be added together in any order:  
 $3 + 4 = 4 + 3$ , or  $a + b = b + a$ .

Model 1: Show that  $8 + 6 = 6 + 8$ .

Add  $8 + 6$  and  $6 + 8$ :

$$8 + 6 = 14, \text{ and } 6 + 8 = 14;$$

$$14 = 14, \text{ so the statement is true.}$$

Model 2: Fill in the missing variable if

$$a + d = \underline{\quad} + a.$$

Since addition is commutative, the missing variable must be  $d$ . Both sides have the variable  $a$ , but only one side has the variable  $d$ . Therefore, the statement should read  $a + d = d + a$ .

Model 3: Tell whether the following expressions are commutative.

- a.  $9 - 1$
  - b.  $8 + 3$
  - c. opening your eyes first and then seeing
- 
- a. No, because  $9 - 1 = 8$ , and  $1 - 9 = -8$ ;  $8 \neq -8$ .
  - b. Yes, because  $8 + 3 = 11$ , and  $3 + 8 = 11$ .
  - c. No, because opening your eyes first and then seeing is not the same as seeing first and then opening your eyes.

 Show that the following expressions are true.

- 1.1  $5 + 4 = 4 + 5$  \_\_\_\_\_
- 1.2  $10 + 1 = 1 + 10$  \_\_\_\_\_
- 1.3  $18 + 16 = 16 + 18$  \_\_\_\_\_
- 1.4  $47 + 19 = 19 + 47$  \_\_\_\_\_
- 1.5  $146 + 218 = 218 + 146$  \_\_\_\_\_
- 1.6  $814 + 961 = 961 + 814$  \_\_\_\_\_
- 1.7  $2,847 + 1,896 = 1,896 + 2,847$   
\_\_\_\_\_
- 1.8  $37,416 + 51,914 = 51,914 + 37,416$   
\_\_\_\_\_

 Fill in the missing numbers or variable.

- 1.9  $9 + 6 = 6 + \underline{\quad}$
- 1.10  $18 + \underline{\quad} = 4 + 18$
- 1.11  $6 + \underline{\quad} = 10 + 6$
- 1.12  $x + y = \underline{\quad} + x$
- 1.13  $\underline{\quad} + c = c + a$
- 1.14  $14 + p = \underline{\quad} + 14$
- 1.15  $r + 97 = \underline{\quad} + r$
- 1.16  $ab + bc = bc + \underline{\quad}$
- 1.17  $\odot + \square = \square + \underline{\quad}$
- 1.18 Monday + Tuesday =  
                     + Monday

 **Tell whether the following expressions are commutative.**

1.19  $14 - 8$  \_\_\_\_\_ 1.21  $8 + 6$  \_\_\_\_\_

1.20  $16 - 14$  \_\_\_\_\_ 1.22  $100 + 141$  \_\_\_\_\_

1.23 First putting on your socks and then putting on your shoes. \_\_\_\_\_

1.24 First picking up your pencil and then writing. \_\_\_\_\_

1.25 Tying your shoe and then combing your hair. \_\_\_\_\_

1.26 Taking a bath and then eating. \_\_\_\_\_

1.27  $(14 - 2) + (8 - 6)$  \_\_\_\_\_

1.28  $xyz + abc$  \_\_\_\_\_

**Commutative Property for Multiplication:** Numbers can be multiplied in any order:  $a \cdot b = b \cdot a$ .

Model 1: Show that  $9 \cdot 6 = 6 \cdot 9$ .  
Multiply  $9 \cdot 6$  and  $6 \cdot 9$ :  
 $9 \cdot 6 = 54$  and  $6 \cdot 9 = 54$ ;  
 $54 = 54$ , so the statement is true.

Model 2: Fill in the missing number in  $4 \cdot 7 = \underline{\quad} \cdot 4$ . The missing number is 7, so the statement should read  $4 \cdot 7 = 7 \cdot 4$ .

 **Show that the following expressions are true.**

1.29  $5 \cdot 8 = 8 \cdot 5$  \_\_\_\_\_

1.30  $9 \cdot 7 = 7 \cdot 9$  \_\_\_\_\_

1.31  $10 \cdot 6 = 6 \cdot 10$  \_\_\_\_\_

1.32  $14 \cdot 8 = 8 \cdot 14$  \_\_\_\_\_

1.33  $51 \cdot 10 = 10 \cdot 51$  \_\_\_\_\_

1.34  $47 \cdot 26 = 26 \cdot 47$  \_\_\_\_\_

1.35  $106 \cdot 16 = 16 \cdot 106$  \_\_\_\_\_

1.36  $314 \cdot 267 = 267 \cdot 314$  \_\_\_\_\_