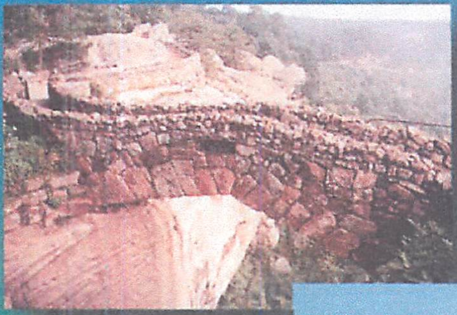
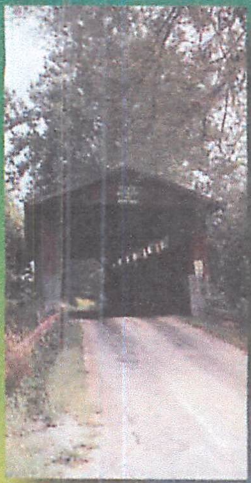
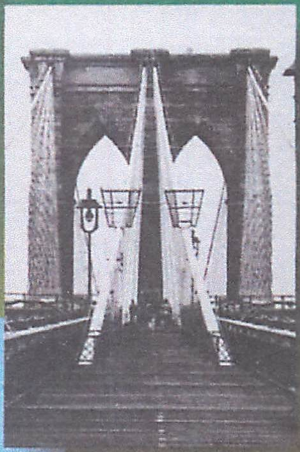
MATH







ALGEBRA I – 1
1097

Name________________________

Date Issued	Test Score

SCHOOL OF TOMORROW®

INSTRUCTIONS

Follow these steps:

1. Read through the entire text to obtain an overview of text content.
2. Study the symbols, objectives, and vocabulary.

ALGEBRA I - 1097

CONTENTS

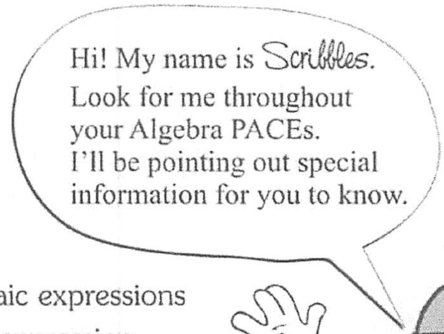
Symbols

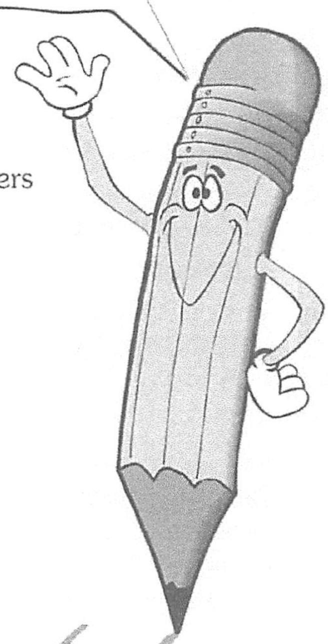
$+$	addition	$\sqrt{}$	radical sign
$-$	subtraction	$\lvert\ \rvert$	absolute value sign
$\bullet$	multiplication	x	an unknown mathematical value represented by a letter, which is termed a variable
$\div$	division	$-x$	negatively signed variable
$/$	division	$+x$	positively signed variable
—	division	x^2	x is multiplied by itself, or squared; the 2 is an exponent
( )	parentheses		
[ ]	brackets		

NOTE: Do your work on separate paper where appropriate. Turn in this separate paper when you request your PACE Test.

OBJECTIVES

To state a definition of algebra
To learn the four basic operations of algebra
To recognize algebraic expressions of one term
To determine the coefficients of a term
To understand exponential notation
To learn about radical signs and roots
To learn the correct order for simplifying algebraic expressions
To assign values to the variables in an algebraic expression
To evaluate algebraic expressions
To review the definitions of positive numbers and negative numbers
To review addition of positive and negative numbers
To subtract positive and negative numbers
To multiply and divide positive and negative numbers
To define polynomials
To identify polynomials as monomials, binomials, or trinomials
To define like terms
To add and subtract like terms
To combine like terms within a given polynomial
To write a polynomial in descending powers of one variable
To multiply monomials
To divide monomials
To simplify fractions containing algebraic terms
To write verbal phrases using algebraic symbols
To consider the Scripture verse and Wisdom Principles relating to the character trait—consistent





Therefore, my beloved brethren, be ye stedfast, unmoveable, always abounding in the work of the Lord, forasmuch as ye know that your labour is not in vain in the Lord.
I Corinthians 15:58

Cover photographs: Mackinac Bridge (St. Ignace Michigan – Chamber of Commerce); Golden Gate Bridge (San Francisco Convention and Visitors Bureau) Photo by Kerrick James; Brooklyn Bridge (New York Convention and Visitors Bureau)

Student: Please memorize the Scripture verse. You will be required to write it on the Self Test and Test.

VOCABULARY

algebraic expression A number expressed using letters and/or numerals.

binomial A polynomial consisting of the sum or difference of exactly two terms.

coefficient Any one factor or product of factors in a given term is the coefficient of the rest of the term.

constant A numeral in an algebraic expression used to represent a value which does not change.

exponent (or power) Small numeral written at the upper right of a base to show how many times the base is used as a factor.

factor Any of the elements, quantities, or symbols that produce a given product when multiplied together.

index of a radical A numeral or letter written above and to the left of the radical sign to indicate the required root.

like terms Terms that have the same variables and the same exponents for corresponding variables.

monomial A polynomial with exactly one term.

polynomial An algebraic expression with one or more terms.

radical sign The sign ($\sqrt{}$) placed over an expression to denote that a root is to be found.

radicand The quantity under a radical sign.

square root For a given number, one of two equal factors whose product is that number.

terms An algebraic expression consisting of a single numeral or letter, or the product or quotient of numerals and/or letters.

trinomial A polynomial consisting of the sum or difference of exactly three terms.

variable A symbol, usually a letter, used to represent an unknown value in a given algebraic expression.

I. INTRODUCTION

Algebra

OBJECTIVE

To state a definition of algebra

What is algebra? Algebra is not an entirely new subject. It is a continuation of arithmetic, using the letters of the alphabet as well as the figures of arithmetic to represent numbers. The letters of the alphabet are used as general symbols of numbers to which any value may be assigned. In any problem, however, a letter is understood to have the same value throughout that problem.

Algebra is very practical in helping to solve common, daily problems in a manner simpler than would otherwise be possible.

In studying algebra, it is very important that you learn to read and understand each process before going to the next. Be sure to read and understand each page before going to the next one. Study each definition until you can repeat it and give an example. Study each example problem that is worked until you understand exactly how to do the work, before you attempt to work the exercises.

Supervisor initial ______ To adequately prepare for the Test, the student **must memorize** the vocabulary words and definitions.

Write the correct answer on each blank.

1. Algebra is a continuation of ______________________, using letters of the ______________________ to represent numbers.
2. In any problem, a letter is understood to have the ______________________ value throughout the ______________________.
3. Algebra makes problem solving ______________________.
4. It is very important to understand each ______________________, each ______________________, each ______________________, and each ______________________ before going further.

Algebraic Operations

OBJECTIVE
To learn the four basic operations of algebra

The operations in algebra are principally the same as in arithmetic. The four basic operations are addition, subtraction, multiplication, and division.

The operation of addition is indicated by the plus sign (+). Each of the numbers to be added is called an **addend,** and the result is the **sum.**

$$4 + 3 = 7$$

In this example, the numbers 4 and 3 are the addends and 7 is the sum.

The operation of subtraction is indicated using the minus sign (–). The first number is called the **minuend,** the second number is the **subtrahend,** and the result is the **difference.**

$$8 - 2 = 6$$

In the above example, 8 is the minuend, 2 is the subtrahend, and 6 is the difference.

The operation of multiplication can be expressed in several different ways. Two of the most common ways are by a raised dot, as in $2 \bullet 3 = 6$, and by the use of parentheses, as in $(2)(3) = 6$. When letters are used in an algebraic expression, multiplication can be indicated simply by placing the numbers and symbols together with nothing between them. $2a$ means "two times a." ab means "a times b."

Using the symbol x to indicate multiplication is avoided in algebra because the letter x is used often as an unknown value. Although using x as a symbol of multiplication is technically correct, we will use the three other forms throughout Algebra I.

In multiplication, the numbers being multiplied are called ***factors,*** and the result is the **product.**

$$3 \bullet 4 = 12$$

In the example above, 3 and 4 are the factors and 12 is the product.

The operation of division is expressed the same in algebra as it is in arithmetic. The division sign (÷) can be used as well as a horizontal or diagonal line.

$$12 \div 2 = 6 \qquad \frac{12}{2} = 6 \qquad 12/2 = 6$$

Each of these equations indicates that twelve divided by two equals six. The first number, 12, is the **dividend.** The second number, 2, is called the **divisor,** and the result, 6, is the **quotient.**

Write the correct answer on each blank.

1. The four basic operations performed in algebra are ______________________,

   ______________________, ______________________, and ______________________.

2. To indicate that "two plus eight equals ten," we write ______________________.

3. "Nine minus six equals three" is written ______________________.

4. In algebra, we can express "four times *a*" in three ways: ______________________,

   ______________________, and ______________________.

5. "Sixteen divided by two equals eight" can also be expressed in three ways:

   ______________________, ______________________, and ______________________.

Match each term with its correct definition.

6. ______ minuend
7. ______ factors
8. ______ quotient
9. ______ addends
10. ______ divisor
11. ______ product
12. ______ subtrahend
13. ______ sum
14. ______ dividend
15. ______ difference

a. numbers being multiplied
b. result of multiplication
c. second number in a division equation
d. answer in an addition equation
e. second number in a subtraction equation
f. first number in a subtraction equation
g. answer in a subtraction equation
h. answer in a division equation
i. numbers to be added
j. first number in a division equation

☐ **Score pages 3 and 4.** ☐ **Correct mistakes.** ☐ **Rescore.**

Algebraic Expressions

OBJECTIVE

To recognize algebraic expressions of one term

It is important to remember that a **number** is an **idea.** In mathematics, symbols or collections of symbols are used to represent numbers. Arabic **numerals** have been used most commonly up to this point.

$$4, \qquad 12-8, \qquad 8 \div 2, \qquad 1+1+1+1$$

Each of these expressions represents the number four. Since numerals have been used, we call these notations numerical expressions.

In algebra, letters as well as numerals are used to represent numbers. When letters and/or numerals are used to express a number, it is called an ***algebraic expression.*** Each of these expressions is an algebraic expression.

$$4 + a, \qquad 6xy, \qquad 23ab \bullet 4cd, \qquad -7$$

A ***term*** is an algebraic expression consisting of a single numeral or letter, or the product or quotient of numerals and/or letters. The elements of a single term may be separated by multiplication or division, but not by addition or subtraction.

$$x, \qquad 5xy, \qquad 2abcd, \qquad \frac{2ab}{cd}, \qquad 7$$

Circle the algebraic expressions that have only one term.

1. $3x$

2. $2x + 5$

3. $\frac{4x}{7}$

4. $4a - 2b$

5. 25

6. $6ab - 3cd$

7. $\frac{x}{2y}$

8. $3xyz$

9. $3x + 4z$

Coefficients

OBJECTIVE

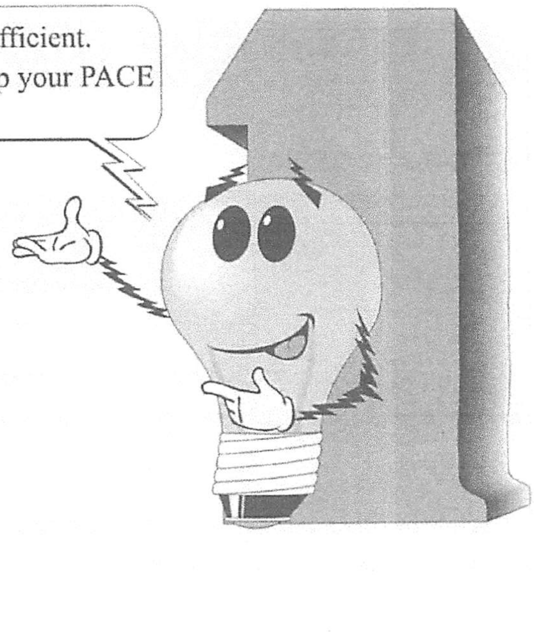
To determine the coefficients of a term

Any factor of a term may be considered as the ***coefficient*** of the remaining factors; that is, the cofactor of the remaining factors. Coefficients expressed by letters are called "literal" coefficients; those expressed by Arabic numerals are called "numerical" coefficients. If no numerical coefficient is written, "1" is understood to be the coefficient.

In $7x$, 7 is the numerical coefficient of x, and x is the literal coefficient of 7.

In ab, a is the literal coefficient of b. Also, b is the literal coefficient of a. 1 is the numerical coefficient of ab.

If no numerical coefficient is written, 1 is understood to be the coefficient.
Oh, by the way, my name is FLASH BULB. I'm going to brighten up your PACE and help you remember important facts about Algebra.



The coefficient can also be a product of factors in a term. Consider the term $3xy$. We can say that

1. 3 is the coefficient of xy.
2. x is the coefficient of $3y$.
3. y is the coefficient of $3x$.
4. $3x$ is the coefficient of y.
5. $3y$ is the coefficient of x.
6. xy is the coefficient of 3.

Write the coefficient of x in the following terms.

1. $24x$ ________
2. abx ________
3. xy ________
4. x ________
5. $3xy$ ________
6. xyz ________

☐ Score pages 5 and 6. ☐ Correct mistakes. ☐ Rescore.

Exponential Notation

OBJECTIVE

To understand exponential notation.

Exponential notation is a special way of indicating that a quantity is to be multiplied by itself a certain number of times. The expression 7^4 is written in exponential notation. It means that 7 is to be used as a factor 4 times.

$$7^4 = 7 \bullet 7 \bullet 7 \bullet 7$$

7^4 is read "seven to the fourth power."

The quantity to be multiplied by itself is called the **base.** The small numeral written at the upper right of the base is the ***exponent.*** The exponent indicates how many times the base is to be used as a factor. The term x^4 is read "x to the fourth power." The base is x and the exponent is 4.

$$x^4 = x \bullet x \bullet x \bullet x$$

When a number or quantity is raised to the second power, the exponent (which is 2) is read "squared." The term 4^2 is read "four squared." The exponent 3 is also referred to in a special manner. It is read "cubed." Therefore, 5^3 is read "five cubed."

*An exponent applies only to the letter or number immediately to the left of it.

$2x^3$—the x only is cubed, not the 2. $2x^3 = 2 \bullet x \bullet x \bullet x.$

xy^3—the y only is cubed, not the x. $xy^3 = x \bullet y \bullet y \bullet y.$

If we wanted to cube the entire term $2x$, we would need to write $(2x)^3$, or 2^3x^3: $(2x)^3 = 2 \bullet 2 \bullet 2 \bullet x \bullet x \bullet x$. Similarly, if we wanted to cube all of xy, we would write $(xy)^3$, or x^3y^3: $(xy)^3 = x \bullet x \bullet x \bullet y \bullet y \bullet y$.

If we wanted to write an exponent beside a fraction, we would need to write the fraction inside parentheses. $\left(\frac{1}{2}\right)^2$ means $\frac{1}{2} \bullet \frac{1}{2}$. Parentheses in mathematics group together numbers that are to be treated as a unit. $\left(\frac{x}{y}\right)^2$ means $\frac{x}{y} \bullet \frac{x}{y}$; whereas, $\frac{x^2}{y}$ means to square the numerator only: $\frac{x \bullet x}{y}$. Brackets, [ ], are also used for grouping in expressions in which parentheses have already been used.

*An exponent immediately to the right of parentheses indicates multiplication of <u>everything</u> inside the parentheses. This rule is also true for brackets.

$(x + y)^2$ means $(x + y)(x + y)$.

$(4x)^2$ means $(4x)(4x)$ or $4x \bullet 4x$ or $4 \bullet 4 \bullet x \bullet x$.

$(7x^2yz)^3$ means $(7x^2yz)(7x^2yz)(7x^2yz)$.

Indicate the meanings of these expressions by writing them with multiplication signs or parentheses. Study these examples before you begin.

$x^2y = x \cdot x \cdot y$ $\quad$ $xy^2 = x \cdot y \cdot y$

$3x^3 = 3 \cdot x \cdot x \cdot x$ $\quad$ $(3x)^3 = 3 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x$ or $3x \cdot 3x \cdot 3x$ or $(3x)(3x)(3x)$

$3 + x^2 = 3 + x \cdot x$ $\quad$ $(3 + x)^2 = (3 + x)(3 + x)$

1. $x^4yz^3 =$ ____________________

2. $\left(\frac{x}{3}\right)^3 =$ ____________________

3. $(7 + y)^2 =$ ____________________

4. $(3y)^4 =$ ____________________

5. $4x^2 + y^3 =$ ____________________

6. $(4 + x)^3 =$ ____________________

7. $xy^3z^2 =$ ____________________

8. $(2x + 3y)^2 =$ ____________________

☐ **Score this page.** ☐ **Correct mistakes.** ☐ **Rescore.**

Radicals

OBJECTIVE

To learn about radical signs and roots

An expression in the form of $\sqrt[n]{x}$ is called a **radical expression,** usually referred to as a **radical.** The symbol "$\sqrt{\quad}$" is called the ***radical sign*** and denotes that a **root,** which is a certain kind of factor, of a number is to be found. The ***index of a radical*** is the numeral or letter, n, written above and to the left of the radical sign to indicate the required root. The quantity, x, under the radical sign is called the ***radicand.***

The radical by itself with no index above it means the square root is desired. The ***square root*** of a given number is one of two equal factors whose product is that number.

$$\sqrt{4} = 2 \text{ because } 2 \cdot 2 = 4.$$

We see that "the square root of 4 equals 2 because 2 times 2 equals 4."

When the index of a radical is 3, the cube root is to be found. In other words, the radicand is to be divided into three equal factors. For example,

$$\sqrt[3]{8} = 2 \text{ because } 2 \cdot 2 \cdot 2 = 8.$$

It is read "the cube root of 8 equals 2 because 2 times 2 times 2 equals 8."

$$\sqrt[3]{64} = 4 \text{ because } 4 \cdot 4 \cdot 4 = 64.$$

The radical sign applies only to the numerals and letters under it. In the expression, $\frac{\sqrt{4}}{2}$, only the square root of 4 is to be found. If the root of a fraction is desired, the entire fraction must be placed under the radical sign. $\sqrt{\frac{9}{16}}$ expresses the square root of nine-sixteenths. Therefore,

$$\sqrt{\frac{9}{16}} = \frac{3}{4} \text{ because } \frac{3 \cdot 3}{4 \cdot 4} = \frac{9}{16}.$$

Find these roots.

1. $\sqrt{100}$ = ______
2. $\sqrt{\frac{1}{16}}$ = ______
3. $\sqrt{121}$ = ______
4. $\sqrt[3]{1{,}000}$ = ______
5. $\sqrt[3]{27}$ = ______
6. $\sqrt{\frac{4}{9}}$ = ______
7. $\sqrt{81}$ = ______
8. $\sqrt[3]{125}$ = ______
9. $\sqrt[3]{\frac{27}{64}}$ = ______

Review

On the blanks, write the correct answers.

10. A/An ______ is a number written with numerals and/or letters.
11. A/An ______ is an algebraic expression consisting of a single numeral or letter, or the ______ or ______ of numerals and/or letters.
12. A small numeral placed at the upper right of a base to show how many times the base is used as a factor is a/an ______.
13. The symbol $\sqrt{}$ is called a/an ______ sign and tells us to find a/an ______ of the number under it.
14. A/An ______ is a numeral or letter written above and to the left of the radical sign to indicate the required root.
15. The quantity under a radical sign is called the ______.
16. Indicate the square root of 25. ______
17. Indicate the cube root of $7x$. ______

Circle the algebraic expressions that have one term.

18. $3a + 4$
19. $2ab$
20. $25abc$
21. $3x - 2y$
22. $\frac{4xy}{9}$
23. $6x^2 + 4y^2$
24. $\frac{x}{3}$
25. $25x$
26. $\frac{13}{x}$

What are the coefficients of x in the following terms?

27. $3x$ ______
28. $2ax$ ______
29. xy^2 ______
30. $280xyz$ ______
31. x ______
32. $\frac{1}{3}x$ ______

Indicate the meaning of these expressions by writing them with multiplication signs or parentheses.

33. a^3b^2 = ______
34. x^5 = ______
35. $(x - 3)^2$ = ______
36. $\left(\frac{x}{y}\right)^3$ = ______

☐ Score this page. ☐ Correct mistakes. ☐ Rescore.