DOCUMENT RESUME

ED 125 922 95 SE 021 199

TITLE Mathematics K-12, Operations. Utica City School District Articulated Curriculum: Project SEARCH, 1975.

INSTITUTION Utica City School District, N.Y.

SPONS AGENCY Bureau of Elementary and Secondary Education (DHEW/OE), Washington, D.C.

PUB DATE 75

NOTE 30p.; For related documents, see SE 021 195-200; Light and broken type throughout

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.

DESCRIPTORS Algebra; *Basic Skills; Behavioral Objectives; Curriculum; *Curriculum Guides; *Elementary School Mathematics; Elementary Secondary Education; Mathematics Education; Number Systems; *Objectives; *Secondary School Mathematics

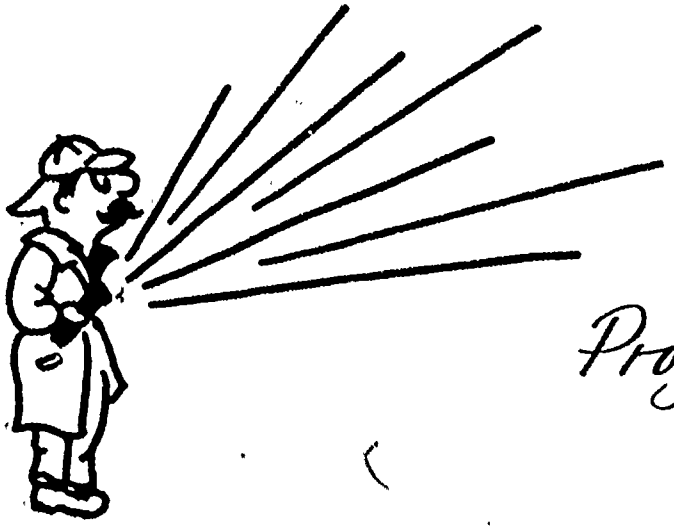
IDENTIFIERS Elementary Secondary Education Act Title III; ESEA Title III

ABSTRACT

This document is one of six which set forth the mathematics components of the Project SEARCH Articulated Curriculum developed by the Utica (New York) City School District. Each volume deals with a broad area of mathematics and lists objectives related to that area for all grades from K through 12. Each objective listed is described first in general terms and then in terms of specific skills which students should exhibit. Computation and properties of operations are addressed in this volume. The objectives posed for the grades K-8 are related to skill and understanding of computation with whole numbers, fractions, and decimals. Algebra is addressed at the upper grade levels (9 through 12). (SD)

Utica City School District

Articulated Curriculum



Project Search

1975

Draft Copy

FORWARD

This Articulated Curriculum is being printed and bound in this manner to provide for on-going revision. This also serves as evidence of work completed during Phase III of Project SEARCH.

MATHEMATICS

K - 12

Operations

ACKNOWLEDGEMENTS

TEAM LEADERS: K - 6 Janet Craig, Pamela Burhyts, Elinor Lampert, Maria Viggiano, Marilyn Wester

TEACHERS: Arpina Amirain, Sheila Asker, Clara Bahr, Vinnie Barratta, Donna Boyle, Audrey Brooks, Mary Canfield, Charron Caparello, Virginia Carmadre, Vincent Cattat, Patricia Crabbe, Pauline Curtis, Maureen Darling, Anthony Diodati, Shirley Donnelly, Peggy Dowling, Violet Echols, Mary Catherine Eck, Elaine Eisenmann, Doug Ervin, Effie Esposito, Nancy Evans, Angela Famolaro, Mary A. Florentino, Patricia Gentile, Bernard Gigliotti, Sandra Glenski, Ann Graziadei, Don Guido, Roslind Haven, Elaine Herman, Jerry Hosel, Helen Humphrey, Mary Judson, Barbara Kates, Lila Klion, Estelle Lewek, Mary Lockwood, Rocco Longo, Cynthia Loughlin, Jeanette Luczko, Nella MacLeod, Catherine Maggio, Vanna Marchetta, Cynthia Martini, Phyllis Matyevich, Karen Mazza, Mary McCall, Patricia Notaro, Sue Ohmann, Ann Paciello, Debbie Payne, Louise Picker, Estelle Plescia, Mark Primack, Palma Rizzo, Francis Roy, Janet Ruhm, Anita Sandler, Michael Sansone, Betty SantaMaria, Francine Scaduto, Randy Schwartz, Richard Soffey, Dorothy Swan, Christine Tylutki, Karen Townsend, Virginia Vancil, Lawrence Ventura, Irene Westig, Genevieve Wojcik, Charlotte Yazewski.

TEAM LEADERS: 7 - 12 David Schmidt, Cornelia Vitagliano, Anna Wright

TEACHERS James Adesak, James Allen, Russell Ayers, Richard Brady, Elizabeth Bonsel, Angela Brooks, Nicholas Cardinale Linda Clark, Richard D'Allesandro, Georgeanne Dage, Richard DePhillips, Dolores Dorozynski Thomas Fletcher, Carol Fox, David Foxx, Ed Freidman, Frank Giotto, Andrew Buzzetti, Igor Hrabinka Janice Huss, Mary Johnson, Donald Jory, Raymond Kolwaite, Lorraine Maneen, Frank Manley Patrick Moccaldi, Adele Nowak, Linda Poccia, Michael Puleo Marilyn Rachin, Mary Rantrona, Carla Visucci Gary Rosato, Barbara Trybalski Ruth Ward, George White, Marina Zdeb.

4

PROJECT SEARCH

ARTICULATED CURRICULUM

EDWARD J. FERRY

Superintendent of Schools

Project Search Administrative Team

BERNADETTE EICHLER: Administrator for Elementary Education

SENATRO D. LABELLA: Administrator for Secondary Education

DR. ANGELA M. ELEFANTE: Coordinator, Project Search

GERARD GRANIERO: Member, Board of Education

UTICA BOARD OF EDUCATION

MR. JOSEPH H. HOBIKA - President

MR. JAMES W. ALLEN - Vice President

MRS. JEANNE ARCURI
MR. THOMAS CARVILLE
MR. GERARD GRANIERO
MRS. FRANCES MARINO
MR. VITO MONTECALVO

August 1975

MRS. ROSE DANELLA and NORMAN I. SIEGEL, both former Board Members deserve special mention for all their efforts on behalf of Project SEARCH.

UTICA CITY SCHOOL DISTRICT
13 Elizabeth Street
Utica, New York 13501

MATHEMATICS	OPERATIONS
Whole Numbers	**Grade K**
The student will know:	The student will:
- the additive counting of numbers through 6.	- use manipulative objects to reproduce addition combinations to sums of 6 eliciting responses of "2 and 1 more makes □ ".
- that sets are identifiable by number when joined together (sums to 10).	- circle the correct numeral when given an equation represented in picture and numeral.
- the simple subtraction process is one of "undoing" addition (inverse operations).	- use manipulative objects to reproduce subtraction facts eliciting responses of "6 take away 1-how many are left? □
Fractions	
- that a whole object can be divided into two equal parts.	- divide an object into two equal parts.
- that sets of objects can be divided into two equal parts.	- divide a set into two equal parts.
- that ½ is the fractional number which represents each of the two equal parts of an object or set.	- write "½" on the two equal parts of an object or a set.
Whole Numbers	**Grade 1**
- the numeral for picture addition and subtraction statements.	- circle the correct numeral for a pictured addition and/or subtraction statement.
- the symbols +, -, and= represent plus or joining sets, minus or taking apart sets, and equal to when writing equations.	- insert the correct symbol (+,-,=) whem given an equation with one symbol missing.
- the addition facts through sums of 10.	- identify sums to 10 given addition equation on timed test.
- that 3 addends can be added to find a sum (to 12)	- compute equation with 3 digits.
- the symbols < and > represent "is less than" and "is greater than" when showing an unequal statement.	- complete equation with symbols < or > (sum to 10).

Whole Numbers	**Grade 1**
- the missing addend or subtrahend in an equation (sum to 10) to make the statement true.	- complete equation correctly with a missing addend or subtrahend.
- the subtraction facts (from 10 e.g. 10-9=?	- complete subtraction statement on timed test.
- that an object can be divided into two, three, or four equal parts.	- divides an object into 2, 3, or 4 equal parts.
Fractions	
- that a set can be divided into two, three or four equal parts.	- divide a set into 2, 3, or 4 equal parts. (limit of 12 objects).
- that 1/2, 1/3, and 1/4 are the fractional numbers which represent the 2, 3, or 4 equal parts of an object or a set.	- write the fractional number (1/2, 1/3, 1/4) on the 2, 3, or 4 equal parts of a divided object or set.
Whole Numbers	**Grade 2**
- the addition facts to sums of 18.	- add sums to 18 on timed test.
- the missing addend or subtrahend in an equation (sum to 18) to make a true statement.	- complete euqation correctly with a missing addend or subtrahend.
- that 3 addends can be added to find a sum.	- compute sum of 3 addends.
- the associative property of addition.	- compute the sum of 3 addends in two different orders or ways to show associative property.
- the algorithm for addition of 1, 2, and 3 digit numbers without regrouping.	- find sums of two given 1, 2, or 3 digit numbers without regrouping.
- the subtraction facts from 18.	- find differences of facts from 18 on timed test.
- the algorithm for subtraction of 1, 2, and 3 digit numbers without regrouping.	- find differences of two given 1, 2, and 3 digit numbers without regrouping.
- that multiplication is repeated addition.	- find the product of two given numbers up to five using repeated addition with picture sets.

Whole Numbers	**Grade 2**
- that "x" is the symbol used to represent multiplication.	- choose "x" for multiplication from a choice of familiar mathematical symbols to complete a given equation.
Fractions	**Grade 2**
- that an object can be divided into halves, thirds or fourths.	- divide a given whole object into halves, thirds, or fourths.
- that an object has been divided into halves, thirds or fourths.	- name the fraction which represents the shaded portion of a given object by circling correct fraction.
- that the numerator represents any one or more of the equal parts and the denominator indicates how many equal parts the whole has been divided into.	- write the correct fraction for the shaded part of an object or a circled part of a set.
- that sets can be divided into halves, thirds or fourths.	- divide a set into halves, thirds or fourths by circling the appropriate parts.
	- name the fraction for the circled portion of a set by circling correct fraction.
- that there are halves on a number line or ruler.	- locate halves on a number line or ruler.
- that fractions 1/2, 1/3, 1/4, decrease in size.	- tell which is largest, smallest and between given the fraction 1/2, 1/3, 1/4.
Whole Numbers	**Grade 3**
- the role of zero in addition (identify factor) When zero is added to a number, the sum is the same as the original addend.	- write an addition sentence of two addends, one being zero, and correctly compute.
- the algorithm for addition of 2 and 3 digit numbers using regrouping.	- find sums of two given addends of 1,2, or 3 digits which require regrouping.
	- find sums of 1,2, or 3 digit numbers which require regrouping given more than two addends.

- the role of zero in subtraction.	- correctly compute the difference given zero subtracted from a number.
- that subtraction is the inverse of addition.	- select 3 numerals and write 4 number sentences, two addition and two subtraction. - check addition or subtraction by using inverse operation.
- the renaming process for ones and tens and 100's	- rename tens as one given developmental algorithm and hundreds as tens.
- the algorithm for subtraction of 2 and 3 digit and 4 numbers using renaming.	- find difference of 2,,3, and 4 digit numbers using renaming.
- that multiplication is repeated addition.	- find the product of 2 given single digit numbers using repeated addition.
- the basic multiplication facts (with 0-9 as a factor).	- respond to drill and timed testing (both oral and written). - record products on a multiplication table and use table to find a product.
- the terms factor and product.	- identify factor and prduct in a multiplication sentence by labeling.
- that multiplication is commutative.	- demonstrate that the factors can be exchanged without changing the product by writing two equal equations using the same factors.
- the distributive property of multiplication.	- uses the distributive property to solve a given equation e.g. $4x9 = 4 \times (6+3)$ $= (4x6) + (4x3)$
- that a 2 or 3 digit number can be multiplied by a 1 digit number.	- solve given examples = 24 + 12 = 36 of 2 and 3 digit numerals multiplied by 1 digit numeral.

Whole Numbers

Grade 3

- that division is repeated subtraction (the inverse operation of multiplication).

- solve division problem using repeated subtraction.
- show two possible related division sentences given a multiplication sentence e.g. $2 \times 6 = 12$, $12 \div 2 = 6$, $12 \div 6 = 2$

- the terms divisor, dividend and quotient.

- designate the divisor, dividend, and quotient given a division sentence.

- the two signs ($\div$ and $)$ for division.

- write a division sentence using either sign and solve. ($\div$ or $)$

- the algorithm for division with 1-digit as divisor and 1 or 2 digits as dividend without remainder.

- solve given division problem with a 1-digit divisor and a 1 or 2 digit dividend without remainder.

Fractions

- that an object can be divided into sixths or eights and that 1/6 and 1/8 represent each part.

- divide an object into sixths or eights and label each part with correct fraction.

- that 1/6. 1/8, 2/3, 2/4 or 3/4 are fractions with numerators representing one or more of the equal parts to be shaded or counted and denominators indicating how many parts the whole object or set is divided into.

- circle or write the fraction for a shaded part of an object.
- circle or write the fraction for the indicated part of a set.
- shade an object given a fraction.
- circle the appropriate part of a set given a fraction.

- the terms numerator and denominator.

- label a fraction with terms numerator and denominator correctly.

- that 1/8, 1/6, 2/4, 2/3 and 3/4 decrease in size.

- rank the fractions 1/8, 1/6, 2/4, 2/3, 3/4 according to size.
- state larger fraction given two or more fractions (1/8, 1/6, 2/3, 2/4, 3/4).

	Grade 4
Whole Numbers	
- the common addition algorithm using regrouping with five or more addends with no digits exceeding the millionth place value.	- solve a given addition problem using regrouping with five or more addends with no numeral exceeding the millionth place.
- that addition and subtraction problem can be checked or verified by the inverse operation.	- check a given addition or subtraction problem using the inverse operation to verify the answer.
- the subtraction algorithm using regrouping of up to five digit numerals.	- solve correctly a given subtraction problem of up to five digits using regrouping.
- the ditributive property of multiplication.	- use the distributive property to solve a multiplication problem e.g. $5 \times 95 = (5 \times \square) + (5 \times \square)$
- the process for finding the average of numbers to 500.	- compute the answer for a problem requiring an average for numbers up to 500.
- the algorithm for multiplication of 3 digit numerals by 2 digit numerals using regrouping if necessary.	- solve correctly a problem of 3 digits multiplied by a 2 digit numeral.
- that division is the inverse operation of	- write 2 equivalent multiplication sentences and 2 division sentences given three numerals.
- the division facts (divisors of 1-9)	- record correct answers to division facts (divisors (1-9) on a timed test.
- the algorithm for division using dividends up to and including 2 digits with and without remainders.	- solve a division problem with a 2 digit divisor and a 3 digit dividend.
- that division can be checked by using multiplication.	- verify the answer of a division problem by using multiplication.
Fractions	
- the meaning of fractions through sixteenths.	- divide a set into sixteenths. - label objects with correct fraction to indicate shaded portion (up to sixteenths).

Fractions

- that fractions are equivalent and can therefore be reduced to lowest terms.
- that a common denominator can be found for two or more fractions having unlike denominators.
- that fractions can be added and subtracted when a common denominator has been found.

Decimals

- that decimals are used in relationship to our system (decimals to hundreths).
- that the four mathematical operations can be performed on numerals denoting monetary values.

Whole Numbers

- the algorithm for multiplication of a 4 digit numeral by a 3 digit numeral with regrouping.
- the division algorithm given a 4 digit dividend and a 3 digit divisor with or without remainder.

Fractions

- that an improper fraction can be changed to a mixed fraction and vice versa.

Grade 4

- reduce a given fraction to lowest terms.
- find a common denominator for two or more fractions and change numerator approximately to equivalent fractions.
- add fractions after finding a common denominator if necessary.
- subtract fractions after finding a common denominator, if necessary.
- read and write dictated numerals denoting monetary value.
- subtract monetary values with up to six digits & insert decimal.
- multiply monetary value (3) digits by a whole number (2) digits & insert decimal.
- divide a monetary value (3) digits by a whole number (2) digits and insert decimal.

Grade 5

- solve multiplication of a given example having a 4 digit factor and a 3 digit factor with regrouping.
- find quotient for a problem having a 4 digit dividend and a 3 digit divisor with or without remainder.
- identify the improper fraction and change it to a mixed fraction in lowers terms.
- change a mixed fraction to an improper fraction.

Fractions

- that fractions are multiplied by multiplying numerators and denominators $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

Decimals

- that a decimal represents a fraction with a denominator of 10 or a multiple of therefore, can be converted to an equivalent fraction.

- that decimals can be added or subtracted following standard algorithm for operations.

Whole Numbers

- that two numbers of the same base and exponent can be added and/or subtracted.

- that two numbers of the same base can be multiplied and/or divided.

Fractions

- that fractions are divided by finding the reciprocal and then multiplying.

Decimals

- that decimals are multiplied using the standard multiplication algorithm for whole number and then, by counting the number of digits to the right of the decimal is placed in the product by counting that number of digits from right.

Grade 5

- multiply given fractions using the algorithm.

- change a decimal to an equivalent fraction and vice versa.

- add or subtract decimal problems up to hundredths and correctly insert decimal in answer.

Grade 6

- add two numbers with the same base and the same exponent.
- subtract two numbers with the same base and the same exponent.

- multiply two numbers with the same base and a positive exponent.
- divide two numbers with the same base and positive exponents.

- divide all fractions using reciprocals.
  e.g. $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

- multiply decimals with factor of hundredths by a factor with tenths and insert decimal correctly.

Decimals

Grade 6

- that decimals are divided by first moving the decimal to the right in the divisor to form a whole number and then moving the decimal the same number of places in the divident. The standard algorithm is followed placing the decimal in the quotient.

- divide decimals with up to hundredths in both divisor and/or dividend annexing zeroes when necessary and then inserting decimal in quotient correctly.

- that decimals can be converted to percents since both are related to 10 or its multiple.

- change decimal to percent and vice versa.

Integers

Grade 6

- that when adding integers which includes negatives that you are finding a total or joining sets. $(-5) + (-2) = -7$ $(+5) + (-2) = +3$

- add two negative integers using number line.
- add a positive and a negative intergers using number line.

- that when subtracting negative integers that you are finding a difference or disjoining sets. $(-5) - (-2) = -3$

- subtract two negative integers using number lines.

- that to subtract negative integers you add its opposite.
  e.g. $(-5) - (-2) = (-5) + (+2) = -3$
  $(+5) - (-2) = (+5) + (+2) = +7$

- subtract a positive and a negative integer using number line.

Whole Numbers

Grade 7

- the correct way to read and write whole numbers.

- write in words, a whole number given in numerical form.
- read a whole number correctly which contains no more than 7 digits.

- the place value of whole numbers.

- write a given number in expanded notation showing place value.
- name the place value for each digit in a given number which contains no more than 7 digits.

- the processes of addition and subtraction of 4, 5, and 6 digit whole numbers.	- find the sum of a group of addends given an addition example. - given an addition problem, find the missing addend in an incomplete addition sentence using knowledge of subtraction as the inverse of addition. - given a subtraction problem, find the difference between two numbers. - given the necessary information, write an open sentence for, and solve a word problem which involves addition and subtraction.
- the process of multiplication of whole numbers and understand the terms used in multiplication. (These terms are: factors and product).	- given numerical examples and using their knowledge of multiplication, find the product of 2,3, and 4 digit numerals. (These examples will contain no more than five factors.) - given a multiplication example, list the factors and the product. - given examples and using short cuts for multiplication by 10, 100, 1000, multiply 1, 2, and 3 digit numbers by 10, 100, 1000. - given a word problem which involves multiplication of whole numbers, write an open sentence for and solve the problem.
- the process of division of whole numbers with at least two-digit divisors and no more than 7-digit dividends.	- list the divisor, dividend, quotient and remainder in a division problem. - divide a dividend of up to 6 digits by a 2 or 3 digit divisor and express the remainder (if any) as a fraction. - apply short cuts for division by 10, 100, and 1,000 in answering division questions and divisors of 10, 100, and 1,000. - given a word problem involving division of whole numbers write an open sentence and find the solution.

- that they can estimate and round whole numbers.

- given a numeral less than 1,000,000 express the numeral to the nearest ten, hundred, or thousand,
- given an addition or subtraction problem, estimate the answer by rounding the addends on the subtrahend and minuend to the nearest 10, 100, or 1,000.
- given a multiplication or division problem, estimate the answer by rounding the factors or the divisor and dividend to the nearest 10, 100, or 1,000.

- that an exponent tells us how many times to use the base as a factor.

- given an expression written in exponential form, rewrite the expression by listing the base as a factor as many times as indicated by the exponent. (i.e. $3^4 = 3x3x3x3$).
- given an exponential expression, find the number equal to it by using multiplication.
- write the powers of 10 correctly up to 10^6.
- write a given numeral in expanded notation using the correct powers of 10.

- that addition and multiplication of whole numbers is commutative and associative.

- given an addition or multiplication example, illustrate the commutative property by first finding the sum or product of the given example, then commuting the addends or factors and finding the sum or product again. (The student will recognize that the sum or product is the same.)
- given the definitions of the commutative property for addition and multiplication, write their own examples illustrating that the property is true for whole numbers.
- given an addition or multiplication example, illustrate the associative property by first finding the sum or product of the given addends or factors, then reassociating the addends or factors and finding the sum or product again. (i.e. $(2+3) + 4 = 5 + 4 + 9$
  $2 + (3 + 4) = 2 + 7 = 9$)
- given the definitions of the associative property for addition and multiplication, write their own examples illustrating that the property is true for whole numbers

- that subtraction and division of whole numbers is neither commutative nor associative.

- given a subtraction or division example, the student will show that the operation is not commutative by commuting the minuend and subtrahend, or the division and dividend and recognizing that the two are not equal. (i.e.: $5 + 2 = 5$, $5 \div 2 \neq 2 \div 5$.)
- given a subtraction or division example, the student will show that the operation is not associative by reassociating the terms of the given example and showing that the two examples are not equal. (i.e. $-6-(2-1) = (6-2) - 1$, $12 \div (4 \div 2) = (12 \div 4) \div 2$)

- that we can apply the distributive property of multiplication over addition of whole numbers.

- given the definition of the distributive property of multiplication over addition, the student will show the validity of the property by using their own examples of whole numbers and substituting these choices for a,b,c. in the sentence below:

$$a\,(b+c) = ab + ac$$
$$(b+c)\,a = ba + ca$$

- given various examples involving multiplication and addition together, the student will apply the distributive property in answering each example.

- that one is the multiplicative identity element and zero is the additive identify element.

- given the following open sentences, the student will find the missing whole number:

$2 + \_ = 2$	$2 \cdot \_ = 2$
$3 + \_ = 3$	$3 \cdot \_ = 3$
⋮	⋮
$n + \_ = n$	$n \cdot \_ = n$

using the above information, the student will define multiplicative identity element and additive identity element in his own words.

Fractions

Grade 7

- the meaning of fractions.	- recognize parts of a whole and express them as fractional parts of a whole. - draw original drawings or cutouts to illustrate the meanings of numerator and denominator.
- how to use fractions in measurements.	- measure different lengths that are subdivided in sixteenth of an inch.
- the kinds of fractions such as proper, improper, mixed numbers and be able to simplify each to its lowest term.	- write examples of each kind.
- how to change the different kinds of fractions.	- express an improper fraction as a mixed or whole number to change a mixed number to an improper fraction.
- that equivalent fractions name the same number and the cross product are equal.	- change fractions to equivalent fractions.
- that the comparison of two numbers by division is called a rate where the units are usually different.	- express a ratio in several ways: (i) division sign example: 2 ÷ 5 (ii) ratio sign 2:5 (iii) a fraction 2/5 (iv) a decimal 0.4
- the proportion is an equality of two ratios which may be expressed as $\frac{a}{b} = \frac{c}{d}$ or $a:b = c:d$.	- perform the necessary operation to find the unknown part if three parts of the proportion are given. Word problems will also be included. ex. $\frac{x}{4} = \frac{12}{7}$ change any fraction to hundredths then to a per cent.
- have a knowledge of the meanings of all the terms used in working with fraction, ratio, rate and proportion.	- define a fraction in writing or orally. - recognize examples of rate, proportion, and ratios.
- the necessary methods to add and subtract like and unlike fractions.	- add and subtract like and unlike fractions using the least common denominator.

	Grade 7
Fractions	
- the necessary methods to multiply and divide all types of fractions.	- multiply fractions including the simplification before multiplying. - divide by the division method and the reciprocal method.
- that all whole numbers are fractions with a denominator of the number one.	- write all numbers as fractions. - recognize that one-half times a number is equal to the number divided by two.
- the methods to perform operations requiring per cent and related problems	- perform the necessary operation to find a per cent of a number is given. - perform the necessary operation to find what per cent one number is of another. - perform the necessary operation to find a number when a percent of it is given. Examples: (a) 36% of 105, 1/2% of 35 (b) What per cent of 10 is 4? (c) 75% of what number is 5%. - apply skills above in solving problems including interest, discount, and sales tax types.
Decimals	
- the conversion methods for decimals.	- recognize the place value of each digit in a decimal numeral through thousandths. - express a decimal in word form, given any decimal through thousandths. - express the decimal in numerical form, given a decimal through thousandths expressed in word form. - express fractions with denominators of 10, 100, or 1000 as decimals. - express fractional numerals of the for $\frac{a}{b}$, where a $\neq$, as decimals. - express fractions of the for $\frac{a}{b}$ that are equivalent to repeating decimals in decimal notation.
- the addition and subtraction methods for decimals	- express a given decimal to the nearest whole number, tenth, hundredth, or thousandth. - read decimal numerals up to hundred thousandths.

Decimals

- the multiplication and division methods for decimals.

Whole Numbers

- renaming, regrouping and spanning multiples.
- the concept of addition in whole numbers.
- the concept of subtraction in whole numbers.
- the concept of multiplication in whole numbers.
- the concept of division in whole numbers.
- the laws of mathematics relating to whole number operations.

Grade 7

- find the sum of five or fewer decimal numerals.
- add decimals through hundred-thousandths.
- find the difference of two decimal numerals.
- subtract decimals through hundred-thousandths.
- solve word problems involving addition and/or subtraction of decimals.
- multiply decimals when one of the factors is a whole number.
- multiply decimals when both factors are decimals.
- divide a decimal by a decimal.
- divide a whole number by a decimal.
- divide whole numbers when the division is a larger number than the dividend.
- solve word problems that require division of a decimal by a whole number.

Grade 8

- rename and regroup numbers to get convenient combinations such as multiples of ten.
- rename addends mentally to find the sum.
- be able to regroup the sums.
- subtract whole numbers by regrouping and renaming.
- multiply factors to find the product.
- be able to use multiples of ten as factors.
- divide whole numbers and write the quotient as a whole number or mixed number answer.
- be able to use multiples of ten as divisors.
- apply the commutative properties for addition and multiplication to find sums, products, missing addends, and missing factors.

Whole Numbers

Grade 8

- apply the associative properties for addition and multiplication to find sums, products, missing addends and missing factors.
- apply the rule for the order of operations: when no parenthesis are given, multiply and divide before adding or subtracting.
- demonstrate the rule for the order of operations by inserting parenthesis in expressions.
- apply the distributive property.
- apply the following properties of one and zero:
  (1) $n + 0 = n$
  (2) $n \times 1 = n$
  (3) $n \times 0 = 0$
  (4) $n - 1 = 0n$
  (5) $0 - n + 0$

Fractions

- the concepts relating to fractions.

- given 4 equivalent fractions, describe in his own words why they are equivalent.
- given a fraction, reduce it to simplest form.
- given a mixed number, convert it to an improper fraction.
- given an improper fraction, convert it to a mixed number.
- given a fraction, name the numerator, the denominator, and describe either in words or by a picture a concrete example in terms of a whole and part of a set it names.
- be able to identify each of the following words and operations by describing in his own words:

denominator	
equivalent fraction	numerator
fraction	rational number
higher terms	reducing to lowest terms
improper fraction	least common denominator
lower terms	mixed numeral
lowest terms	proper fraction
number pair	

Fractions

Grade 8

- the operation of addition on fractional numbers.
  - identify the least common multiple given four products.
  - identify the simplest form of computing the least common multiple given two (2) basic algorisms.
  - add several examples involving fractions, mixed numbers and a combination thereof.
  - illustrate on a number line the addition fractional numbers.
  - convert improper fractions to mixed numbers.

- the operation of subtraction on fractional numbers.
  - identify the least common multiple given four products.
  - identify the simplest form of computing the least common multiple given two (2) basic algorisms.
  - given a mixed number problem where the fractional part of the subtrahend is $<$ the fractional part of the minuend, illustrate borrowing from a whole number to make the fractional part of the subtrahend $>$ than that of the minuend.
  - subtract two fractional or mixed numbers.
  - illustrate subtraction on the number line.

- the operation of multiplication on fractional numbers.
  - convert whole numbers to fractional form.
  - find the product for two or more fractions.
  - multiply two or more mixed numbers after changing them to improper fractions.
  - diagram the product of two fractions.

- the operation of division on fractional numbers
  - convert whole numbers to fractional form.
  - given a whole number or fraction express the reciprocal of that number.
  - given two or more fractions or mixed numbers, compute the quotient by multiplying by the reciprocal of the divisor.
  - given two mixed numbers compute the quotient by changing to improper fractions.

Fractions

- understand how to convert fractions to equivalent decimals.
- understand how to convert decimals to equivalent fractions.

U.E. Foundations

- the addition of whole numbers with two or more digits with/without regrouping.
- the subtraction of whole numbers with two or more digits with/without regrouping.
- the multiplication table.
- the multiplication of whole numbers with two or more digits with/without regrouping.
- the division of whole numbers with two or more digits with/without regrouping.
- the meaning of equivalent fractions.
- the meaning if improper fractions and mixed numbers.
- the addition of proper fractions with like denominators.
- the addition of mixed numbers involving fractions with like denominators.
- the method of finding the least common denominator of two or more fractions.

Grade 8

- convert a fraction to an equivalent decimal by dividing the denominator into the numerator.
- convert decimals to an equivalent fraction by writing the numeral as numerator and the last place value as the denominator.

Grade 9

- compute the sum of whole numbers with two or more digits with or without regrouping.
- compute the difference of whole numbers with two or more digits with/without regrouping.
- construct a multiplication table.
- compute the product of whole numbers with two or more digits with/without regrouping.
- compute the quotient of whole numbers with two or more digits with/without regrouping.
- rename fractions to lower and higher terms.
- rename improper fractions as mixed numbers and vice versa.
- compute the sum of proper fractions with like denominators.
- compute the sum of mixed numbers involving fractions with the denominators.
- compute the least common denominator of two or more fractions.

U.E. Foundations	Grade 9
- the addition of proper fractions with unlike denominators.	- compute the sum of proper fractions with unlike denominators.
- the addition of mixed numbers involving fractions with unlike denominators.	- compute the sum of mixed numbers involving fractions with unlike denominators.
- the subtraction of proper fractions with like/unlike denominators.	- compute the difference of fractions with like/unlike denominators.
- the subtraction of proper fractions from whole numbers.	- compute the difference between a proper fraction and a whole number.
- the subtraction of two mixed numbers with/without regrouping.	-compute the difference of two mixed numbers with/without regrouping.
- the multiplication of two fractions.	- compute the product of fractions.
- the multiplication of a fraction and a whole number.	- compute the product of a fraction and a whole number.
- the multiplication of two mixed numbers.	- compute the product of mixed numbers.
- the division of two fractions.	- compute the quotient of two fractions.
- the division of a whole number and a fraction.	-compute the quotient of a whole number and a fraction.
- the division of two mixed numbers.	- compute the quotient of two mixed numbers.
- the method of "rounding" to an indicated place value.	- round decimal numbers to indicated place value.
- the addition of decimal numbers.	- compute the sum of decimal numbers.
- the subtraction of decimal numbers.	- compute the difference of decimal numbers.
- the multiplication of decimal numbers.	- compute the product of decimal numbers.
- the division of decimal numbers	- compute the quotient of decimal numbers.

- the English phrases in algebraic term.	- write algebraic terms, given English phrases.
- the properties of real numbers and their usage.	- identify sets that are closed under different operations. - identify the reciprocal of a number.
- the properties of equalities and give examples of them.	- identify examples of the reflexive, symmetric, transitive and substitution properties.
- how to perform the four basic operations on monomials.	- add, multiply, subtract and divide monomials.
- how to perform the four basic operations on polynomials.	- add, multiply, subtract and divide polymonials.
- the symbols of inequalities.	- use symbols of inequalities to write true algebraic statements.
- how to perform the four basic operation on algebraic fractions.	- add, multiply, divide and subtract algebraic fractions.
- how to evaluate algebraic expressions.	- evaluate algebraic expressions.
- how to multiply and divide positive integral powers with the same base.	- multiply and divide positive integral powers with the same base.
- how to simplify and combine like radicals.	- simplify and combine like radical.
- how to solve proportions involving monomials and polynomials.	- solve proportions involving monomials and polynomials.
- how to solve linear inequalities.	- solve linear inequalities.
- absolute value.	- define absolute value and write examples.
- how to factor polynomials.	- factor polynomials.

Algebra	Grade 9
- the English phrases in algebraic terms	- write algebraic terms, given English phrases.
- the properties of real numbers and their usage.	- identify sets that are closed under different operations. - identify the reciprocal of a number.
- the property of equalities and give examples of it.	- identify enough of the reflexive, symmetric, transitive and substitution property.
- how to perform the four basic operations on monomials.	- add, multiply, subtract and divide monomials.
- how to perform the four basic operations on	- add, multiply, subtract and divide polynomials.
- the symbols of inequalities.	- use symbols of inequalities to write true algebraic statements.
- how to perform the four basic operation on algebraic fraction.	- add, multiply, divide and subtract algebraic fractions.
- how to evaluate algebraic expressions.	- evaluate algebraic expressions.
- how to multiply and divide positive integral powers with the same base.	- multiply and divide positive integral powers with the same base.
- how to simplify and combine like radicals.	- simplify and combine like radicals.
- how to solve proportions involving monomials and polynomials.	- solve proportions involving monomials and polynomials.
- how to solve linear inequalities.	- solve linear inequalities.
- absolute value	- define absolute value and write examples.
- how to factor polynomials.	- factor polynomials.

Algebra

Grade 9

- the English phrases in algebraic terms.	- write algebraic terms, given English phrases.
- the properties of real numbers and their usage.	- identify sets that are closed under different operations. - identify the reciprocal of a number.
- the property of equalities and give examples of it.	- identify enough of the reflexive, symmetric, transitive and substitution property.
- how to perform the four basic operations on monomials.	- add, multiply, subtract and divide monomials.
- how to perform the four basic operations on polynomials.	- add, multiply, subtract and divide polynomials.
- the symbols of inequalities.	- use symbols of inequalities to write true algebraic statements.
- how to perform the four basic operation on algebraic fraction.	- add, multiply, divide and subtract algebraic fractions.
- how to evaluate algebraic expressions.	- evaluate algebraic expressions.
- how to multiply and divide positive integral powers with the same base	- multiply and divide positive integral powers with the same base.
- how to simplify and combine like radicals.	- simplify and combine like radicals.
- how to solve proportions involving monomial and polynomials.	- solve proportions involving monomials and polynomials.
- how to solve linear inequalities.	- solve linear inequalities.
- absolute value	- define absolute value and write examples.
- how to factor polynomials.	- factor polynomials.

27

- that the set of real numbers are used by computers.

- that computers perform calculations according to a hierarchy of operations.

- that computers utilize the concept of destructive read input non destructive read output.

- that a program must be loaded into the computer in order for the computer to obtain the result.

- that computers store programs and are able to retrieve a program at any time.

- the basic trigonometric functions.

- the meaning of algebraic properties.

Advanced Foundations

- the symbols of inclusion

- the exponents

- the set of directed integers

Grade 9 - 12

- write a program which demonstrates the computer's ability to perform calculations on the set of real numbers.

- compute the value of various expressions which contain (, +, -, X, ÷, and exponents.

- analyze a given program and determine the values stored in various registers.

- load a program into the computer.

- store a program into the computer and call for the program the following day.

Grade 10

- compute the sine, cosine, and tangent of an acute angle of a right triangle.
- find the acute angle when given 2 sides of a right triangle.

- identify a property of real numbers as illustrated in a given statement.

Grade 10 - 12

- solve number sentences that contain symbols.

- solve number sentences that contain exponents.

- a. construct a number line with positive and negative integers.
  b. add and subtract directed numbers.

Advanced Foundations	Grade 10 - 12
- the function	- a. write an equation for a given function. b. construct a graph of a function. c. write an equation for a given number sequence.
- the arithmetic mean	- calculate the arithmetic mean of a given statistical sample.
- the median	- calculate the median of a given satistical sample.
- the mode	- calculate the mode of a given statistical sample.
- the probability of independent events.	- calculate the mathematical probability of given independent events.
- the probability of dependent events	- calculate the mathematical probability of given dependent events.
- the different forms of probability	- express probabilities as fractions, decimals, and percents.
- the techniques of graphing.	- a. graph negative and positive integers on a pair of axis. b. draw a circle graph from given data c. construct bar graphs (single and multiple) d. construct a broken line graph from given data.
- the square root	- calculate the square root of a given number.
	Grade 12
- the standard operations of the computer that serve as counterparts of the normal arithmetic operations of mathematics.	- utilize his knowledge of basic computer arithmetic operations in simple problem solving. - apply in a practical sense his knowledge and understanding of all computer operations, basic as well as advanced toward mathematical problem solving.

	Grade 12
- the special operations that are peculiar to the computer being used.	- correlate his knowledge of computer operations with his understanding of the geometric definitions of conic sections, the purpose being to properly order the flow of computer operations so as to flow chart a computer application to conic section problem solving.
- the arithmetic of functions.	- find $(f+g)\ x$ given $f\ (x)$ and $g\ (x)$ - find $(fg)\ x$ given $f\ (f)$ and $g(x)$
- synthetic substitution, synthetic division, and its application.	- solve a fourth degree equation using synthetic substitution.
- the rules for addition and multiplication of probabilities.	- determine $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ the probability of events given the probability of each event.
A.P. Math	Grade 12
- the limits of polynomial functions.	- find the limit of a polynomial function.
- the techniques needed to dete mine if a relation is a function.	- specify if a given equation is a function.
- the definition of a continuous function.	- classify a function as being continuous or discontinuous.
- the existence, number and location of zeros.	- find the number of zeros and their location.
- the graphic illustration of the representation of the epsilon-delta definition of limit.	- illustrate the epsilon-delta definition of limit.
- the test of a limit by the epsilon-delta definition.	- test a limit by the epsilon-delta definition.