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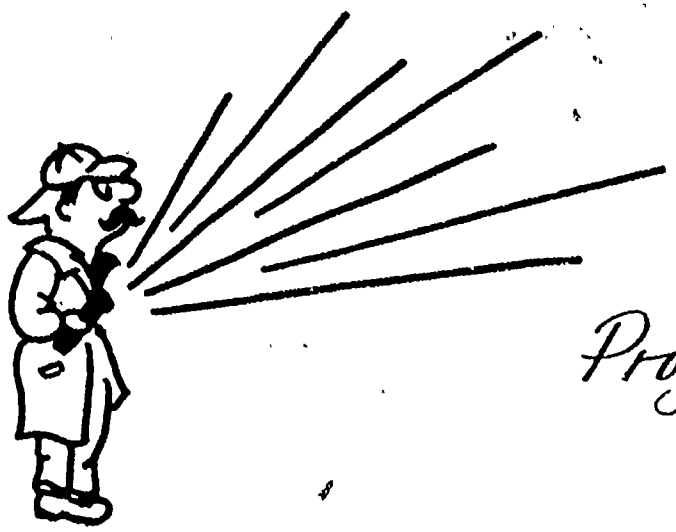
ABSTRACT

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. The objectives listed in this volume are related to the development of set theoretic language, symbolism, and usage. In addition, high school objectives concerning probability and sets related to the definition of functions are included. (SD)

Utica City School District

Articulated Curriculum



Project Search

1975

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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

Sets

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PROJECT SEARCH

ARTICULATED CURRICULUM

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MATHEMATICS

SETS

Language

The student will know:

- the meaning of a set.
- that sets consist of similar and dissimilar objects.
- that equivalent sets can be matched on a one to one correspondence.
- the meaning of equivalent and non-equivalent sets.
- the meaning of an empty set.
- that elements in a set can be counted.
- that there are first, second, middle and last elements in a set.
- that a set is designated by an enclosure.

Grade K

The student will:

- use classroom materials, child will find sets of objects.
- use concrete objects, child will identify sets of similar and dissimilar objects.
- use an equivalent set of boys and girls, children will come together in a one to one correspondence.
- be given two sets of crayons, two sets of pencils, two sets of blocks, two sets of books, child will tell which are equivalent and non-equivalent.
- be given a box of crayons, empty it for an empty set.
- be given a set of ten one-inch cubes, child will count them.
- be given a set of five checkers in a row, child will give teacher first, second, middle and last checker upon request.
- be given a set of pictures, the student will place an enclosure around the set.

Language

- the terms set, numeral, greater than, less than and equal to.
- the cardinal numbers of sets.

Grade 1

- be given pictures and/or concrete objects, child will identify sets, numerals and compare sets to show greater than.
- be given non-equivalent sets, student will be able to construct a union of these sets and will be able to identify sets by cardinal numbers.

Language	Grade 1
- the ordinals and relate to sets.	- arrange and identify sets in ordinal nature.
-the cardinals up to 100 and relate to sets.	- arrange and identify sets in cardinal nature.
Symbols	Grade 1
- the symbols for greater than, less than and equal to.	- be given sets, the child will use appropriate symbols.
Language	Grade 2
- that a set can be divided into ½'s.	- be given a set of objects, student will be able to circle one-half the objects.
- that a set can be divided into 1/3.	- be given a set of objects, student will be able to circle one-third the objects.
- that a set can be divided into 1/4.	- be given a set of objects, student will be able to circle one-fourth the objects.
- that sets can be combined and separated.	- be given a series set, the student will be able to combine and separate sets according to directions.
- that commutative properties of addition can	- be given a series of sets showing communitive properties of an addition fact, student will be able to identify common properties.
Symbol	Grade 2
- that brackets are used in set notation.	- be given specific directions, student will create a set using bracket notations and commas.
Language	Grade 3
- that by grouping sets, statements may be completed properties compared.	- be given a set of objects, child will be able to count and group objects by any given number.

Symbols

- that sets can illustrate commutativity and associativity with the actual objects of a set.
- that by dividing sets, statements may be completed, properties compared.
- that a set can be matched with a common property such as multiplication, division, subtraction and addition.
- the fractional parts by set notation.
- the division of fractional parts by set notation.
- the division of fractional parts by set notation.
- that brackets are used for set notation.
- the concept of a given set.

Language

- the terminology associated with sets such as, set, subset, null set, empty set, numbers of a set.

Grade 3

- be given two or more sets of objects, the child will be able to compare and/or combine the sets in any order.
- be given n-number of objects, child will divide this set so as to write and/or solve an equation to express a numerical comparison of sets.
- be given groups of sets (example 4 sets of 5 elements) child will state a fact for the sets (4 x 5).
- be given two sets of objects that has been divided, child will state what fractional part each set contains.
- be given two sets of objects that has been divided, child will state what fractional part each set contains.
- be given one set of objects, the child will count and divide into appropriate fractional parts to create two or more sets.
- be given two large cardboard-made brackets children will create own sets enclosed on each side by these brackets.
- [illegible] within themselves according to a common property. (ex. (boys), (girls), (blonde hair), (brown hair).

Grade 4

- be given sets A, B, C; D, the child will label that which is an empty set, subset, equivalent set, and null set.

Symbols	Grade 4
- that given a set; subsets can be formed from the original set.	- be given a group of sets, the student will demonstrate his understanding of subset concept by making a subset for each of the sets in the group.
- that sets can be divided into fractional parts.	- be given a pictured number of sets, the student will be able to pick out the fractional parts named in the set.
- the concept of universal set.	- list members of the universal sets.
- the concept of intersection of two sets.	- be given two specific sets, the student will be able to circle the common elements of the sets.
Language	Grade 5
- the vocabulary associated with sets.	- be given two sets students will illustrate the various terms learned.
Symbols	
- that basic symbols are associated with sets such as braces,	- replace the illustrated terms above with proper symbols for the appropriate terms.
- the concepts of equal sets and equivalent sets.	- manipulate objects, pcitorial materials to form equal and equivalent sets.
- the concepts of union and intersection in sets.	- make Venn diagrams illustrating union and intersection of sets.
- that an empty set is a set with no numbers.	- define the empty set and give an example.
- that integers are the set of whole numbers including negative numbers.	- define the set of integers and give an example.

Symbols

- that statements may be translated into number sentences using mathematical symbols.

- that concepts can be considered objects as well. The objects are called elements or members.

the correct set notation including the symbols and usage.

- the different kind of sets, based on the members.

Grade 6

- identify the empty set of a ( ), a subset of , and integers to the left of zero on a number line as negative.

Grade 7

- write the elements or members that may be listed by roster or rule method; ex. (2,4,6,8) or (even whole numbers between zero and ten).

- recognize or name the following symbols:

U - union	E - element of
∩ - intersection	C - subset
∅ - null set	set builder notation
( ) - empty set	u (X:x = a/b aew) ben)

recognize the standard notations for common sets such as natural numbers N

Solve problems in set notation such as (1) Given A= (a,b,c) aEA and (a,b) cA, dEA and (2) definition of Rational numbers = (X:x = a/b, b ≠ o).

- identify and give examples of:
  a) empty or null set - set with no elements.
  b) finite - set containing a definite number of elements.
  c) infinite - set containing an indefinite number of elements.
  d) equal - sets that contain the same elements.
  e) equivalent - sets that contain the same number of elements.
  f) disjoint - sets which contain no members in common.

- that the Universal Sets is the largest set under consideration. That subsets are relationships in which all members of a subset must be contained in the Universal Set under consideration.
- That a null set is a subset of all sets.

- that the union is the set of all elements under consideration, but no elements are listed more than once. The Intersection is the set containing only elements which are common to the sets. The Intersection of disjoint sets are equal to null sets.
- That the concept of union and Intersection may be illustrated through a Venn Diagram.

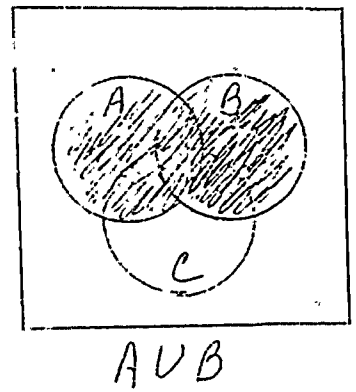
- the terms of set theory.

Grade 7

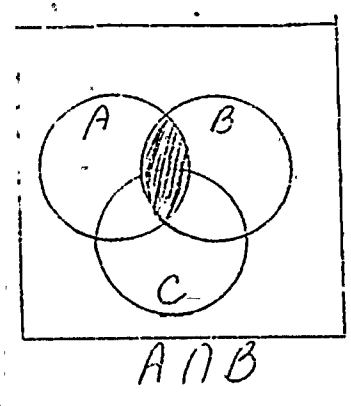
- identify subsets given a particular set:
  Example: A = (a,2,3,), number of subsets= 8
  (1), (2) (3) (1,2) (1,3) (2,3) (1,2,3) $\emptyset$

- determine the Union of sets will be found either by roster method or by Venn Diagrams which are pictorial representations of areas.

Ex. given (A=1,2,3) B=(2,4,6) $A \cup B = \{1,2,3,4,6\}$ $A \cap B = \{2\}$



$A \cup B$



$A \cap B$

Grade 8

- identify the following words, sets and symbols and/or describe them in his own language:

set	union ($\cup$)	roster
member	braces	rule
odd number	patterns	complement
even number	multiples	intersection ($\cap$)
whole numbers	infinite	disjoint
counting numbers	finite	Venn Diagrams
subset (c)	one-to-one correspondence	
empty set ($\emptyset$)	equal sets	
devisible	unequal sets	

the concepts of set theory.

- the meaning of a set.

- set notation by rule and roster method.

- the definition of the following terms: subset, proper subset, equivalent sets, finite, infinite, null set, and universal set.

- that the answer (s) of a equation can be listed as the elements of a set (called the solution set.)

Language & Symbols

- that the means of communicating with a computer is through the computer's symbolic language.

Grade 8

- name the members of a set using braces and form a description.
- state that a set is a collection of things and that each thing in the set is a member.
- distinguish among special sets of numbers such as the following;
  - (i) counting numbers
  - (ii) whole numbers
  - (iii) even numbers
  - (iv) odd numbers
  - (v) numbers divisible by 2,3,5
- distinguish if a set is a subset of another set.
- name the intersection and union of two sets.
- describe the set as disjoint if they don't intersect.

Grade 9

- give the definition of a set in written form.

- change a set, given in rule form, to roster form; and vice versa.

- classify sets as being; a subset, of another a proper subset, equivalent sets, finite, infinite, null or universal.

- give the answer (s) of an equation in set form.

Grade 9 - 12

- explain in writing the meaning (s) of the computer symbols.

Language & Symbols	Grade 9 - 12
- tha. in English, sentences and paragraphs are use to convey thoughts/ideas while in Computer Mat., instructions and programs are utilized to perform calculations.	- write one English sentence which instructs a person to perform a binary operation on a given pair of numbers and one computer math sentence which tells
- tha., as in Reading, sentences are read one after the other, in Computer Math instructions contained in a program are executed in sequential order.	rearrange a given set of instructions so that execution of the program yields the desired result.
	Grade 10
- unions and intersection of points.	- identify and name union and intersection of points.
- set notation by rule, roster and Venn Diagrams.	- describe a set by rule.
Advanced Foundations	Grade 10 - 11
- the set notation	- a. identify a set using roster method. b. identify a set using rule method. c. identify a set using Venn Diagrams.
- the union of sets.	- identify the union of two given sets.
- the intersection of sets.	- identify the intersection of two given sets.
- the proper and improper subset.	- a. identify and name proper subsets of a given set. b. identify and name improper subsets of a given set.
	Grade 11
- tic set notation by rule, roster, and Venn Diagram methods.	- a. describe a set by a rule. b. list the elements of a set by roster. c. draw a Venn Diagram to illustrate a set.
- the definitions of and relationship between sets, variables and open sentences.	- solve an equation over a given set.

Grade 11

- the relationship between sets and graphing on a number line.

- graph a set of numbers on a number line.

Probability & Statisticals

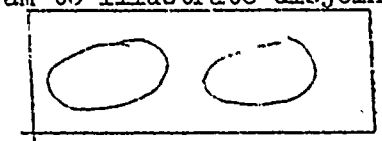
Grade 11 - 12

- that a Venn Diagram may be used to illustrate intersection, union, subsets, and complements

- make a Venn Diagram to illustrate intersection, union, subsets, and complements.

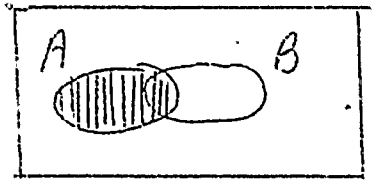
- that a Venn Diagram may be used to illustrate disjoint sets.

- make a diagram to illustrate disjoint sets.



- that a Venn may be used to show properties of sets.

- show properties of sets with Venn Diagrams.



- the

- the formula for the number of subsets of a given set.

- apply the formula for the number of subsets of a given set to a given problem.

Grade 12

- the basic language and symbols that are used in sets notation.

- solve problems utilizing mathematics of sets.

- the basic language of mathematical logic.

- solve problems utilizing mathematical logic.

- the existing correlation between symbols of sets and mathematical logic.

- correlate basic relationship of sets to the foundations of mathematic logic.

- proceed from experience gained in (1) - (3) above to a basic foundation of mathematical logic as it applies to real life problems and situations.

- simple and compound ass[illegible]on, propositions, truth tables, tautolog[illegible], and implicators.

- the student will be able to construct a truth table for $(p \longleftrightarrow g) \longleftrightarrow (g' \longleftrightarrow p')$ and be able to indicate whether or not the statement is a tautology.

- the student will be able to decide whether or not the followi[illegible]sets form a field:

  a. real numbers
  b. rational number
  c. integers.

  and give an explanation for your answer.

- the student will be able to list the members of the set and construct a Venn Diagram for the set.

- whether a set for a group under a given operation and wh[illegible]er a given set of numbers forms a number f[illegible]d.

- the meaning of [illegible]set, proper subset, universal set, infi[illegible]te set, power set, and disjoint sets.

- find the proper subset of A containing the multiple of three when A={odd no. s}

- the meaning of [illegible]ion, intersection, and complementation wi respect to U and give a visual representat[illegible]n either with a Venn Diagram or a roster.

- determine whether the sets are =, =, disjoint, finite, or infinite.

- the uses of th[illegible]ollowing laws in the algebra [illegible]f sets complemnt laws, identity laws, communitive laws, [illegible]Morgan's rules, association laws, and distributive laws.

- use a Venn Diagram to represent (a), (AUB)$'$ $\cap$ (AUB), (b) A $\cap$ (BUC), and (c) (AU(B$\cap$C)) given U= {real numbers}, A= {integers}, B= {even integers}, and C= {odd integers.
- draw a Venn Diagram to illustrate that the relative complement, A-B of a set A is defined or the set A-B = A$\cap$B

- the definition of relation, domain, range and function.

- state the domain and range of the function (X,Y) - $Y = X^2$.)
- decide whether or not a relation is a by the verticle lire test.

A.P. Math	Grade 12
- the various symbols used to express the first derivative, i.e. $\frac{dy}{dx}$, y', $\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x}$, slope of the tangent to the curve at any point, $f'(x)_1$ $D_x y$ etc.	- reorganize and use the various symbols for first derivative.
- that the integral symbol will be followed by $f(x)\,dx$, i.e., $\int f(x)\,dx$ or $\int f(y)\,dy$.	- write the integral symbol correctly.
- the definitions of union and intersection of sets.	- apply the definitions of union and intersection of sets in solving problems.
- the definition of all terms used in the course.	- build a glossary of terms used in the course.
- that mathematical symbols are a universal language.	- translate sentences into mathematical symbols.