SABBATICAL LEAVE REPORT

ACADEMIC YEAR 1977-78

Submitted by

Donald E. Brook
Mathematics Department
October, 1978

TABLE OF CONTENTS

I want to thank the Board of Trustees and staff at Mount San Antonio College for the opportunity to grow in my professional subject matter area. The 1977-78 academic year spent at the University of Montana was a fruitfull and rewarding adventure both professionally and psychologically. The course work completed is listed below and an official university transcript is included in Appendix A.

Fall Quarter (1977-78)

1. Operations Research (Math 314) . . . . 3 units
2. Mathematical Statistics (Math 341) . . . . 3 units
3. Introduction to Programming (Computer Science 101) . . . . 4 units

Winter Quarter (1977-78)

1. Operations Research (Math 315) . . . . 3 units
2. Mathematical Statistics (Math 342) . . . . 3 units
3. Fortran Programming (Computer Science 103) . . . . 3 units

Spring Quarter (1977-78)

1. Operations Research (Math 316) . . . . 3 units
2. Mathematical Statistics (Math 343) . . . . 3 units
3. Computer Simulation (Computer Science 373) . . . . 3 units

EVALUATION OF OPERATIONS RESEARCH

The Operations Research Class gave me an opportunity to study the applications of mathematics in many broad and unrelated disciplines. My previous academic background, both undergraduate and graduate study had focused on mathematical theory. Mathematical applications were motivational sidelights to be mentioned in passing. In contrast, instructors for Math 314 centered around problems taken from business and management disciplines. Mathematics was used as a tool in problem solving. Techniques for mathematical modeling were studied as outlined in Appendix B.

A large percentage of the students who take mathematics at Mount San Antonio College are not math majors, so my exposure to current work in applications of mathematics will enrich my teaching.

Recent developments in mathematics and particularly in its applications have given a strong impetus to graph theory. The type of graphs studied in Math 314 were not the traditional graphs of lines and curves but rather the type of drawings associated with organizational flow, charts, electrical circuits, maps, etc. In fact, the most famous graph problem is the "four color map conjecture" (just recently proved true). Graph theory now makes its appearance in such diverse fields as economics, psychology, and biology.

The second quarter of Operations Research, sometimes called Management Science, centered around the topic of linear programming. This topic is introduced in our College Algebra Course (Math 1 or Math 1-C) currently taught at Mt. San Antonio College so that further, in depth, study has made me a better authority and more up to date on current uses of this topic. The use of computers to aid in the tedious calculations will be beneficial in my instruction when Mt. San Antonio College upgrades its computer system to include terminals for instructional use.

The third quarter of Operations Research, sometimes referred to as Industrial Engineering, developed the probabilistic concepts of Decision Theory, Stochastic Processes, and Queuing Theory. The instructor of the course showed how he has used these concepts to solve such unrelated problems as student registration, school busing, and farming techniques. The interactive computer system at the University of Montana put the solutions to these problems within the realm of possibility. When instructors are working and solving actual problems, it makes the students stop and consider that maybe Math is useful after all.

EVALUATION OF MATHEMATICAL STATISTICS

My previous background in statistics was limited to one lower division course taken in the late fifties, plus what I could pick up from math formulas. When teaching statistics, I felt like a piano teacher teaching beginning piano having only taken beginning piano myself. The theory covered in this course at the University of Montana has given me a broader base and better understanding of what my Math 13 students at Mt. San Antonio College will encounter as they prepare for entrance to a four year college. More than one-half of the topics listed in Appendix C are introduced (minus the theory) in the Math 13 course here at Mt. San Antonio College. Not only will I be a better, more confident teacher of statistics, but textbook selection will be based on a broader understanding of what is now being required at the universities.

It is very likely that emphasis in teaching introductory statistics will switch from descriptive to inferential statistics as more students purchase hand held calculators with preprogrammed statistical subroutines. My work at the University of Montana prepared me for this change and also gave me insight into the more far reaching realm of interactive computing. As more and more companies and corporations go to interactive computing, our students will be expected to interpret the volumes of data organized and stored by computers.

EVALUATION OF COMPUTER SCIENCE COURSES

As an undergraduate in the fifties, I attended four years at an institution of higher learning without having even seen a computer face to face, much less know how to operate one. As a graduate student in the sisties, I continued my studies in pure mathematics still ignorant

of the then blossoming discipline of computer science. As a mathematics teacher in the seventies, I came to the stark realization that I was becoming obsolete. The vast majority of my students were entering non-math disciplines which required them to know something about computer science. Another concern was the fact that I was not prepared to teach the Fortran course offered in my very own Mathematics Department at Mt. San Antonio College.

Humbled by my deficiencies in computer science, I enrolled in "Introduction to Programming" (Computer Science 101) at the University of Montana and started what proved to be a fascinating year of computer involvement. A course outline for Computer Science 101 is in Appendix D. This course would have been more appropriately named BASIC since the whole quarter was devoted to learning the BASIC language. But why learn Basic? The answer is multifaceted. Basic is a problem solving language that is conversational in form and easy to learn. It has wide application in the scientific, business, and educational communities. The Basic language can be used to solve both simple and complex mathematical problems from the user's terminal and is particularly suited for timesharing. I became one of many students from different kinds of academic disciplines who, with no previous computer science background, began commanding results from the computer and getting them. Just as it's not necessary to know mechanical laws for automobile engines to drive one, so too it wasn't necessary to learn the theory of computers to start making a full fledged computer work for us. The anticipated benefits for Mt. San Antonio College as a result of my taking the course depend on what kind of computer system is eventually adopted for student and/or instructional use. But even assuming the worst i. e. I never get to use a computer terminal at Mt. San Antonio College, the

college will benefit from my relating to students that perfection is still a useful goal. Many times students do poorly in algebra because of their carelessness with positive and negative signs and chidings from the instructor only prompt student comments like "I'll never use this anyway." This type of self-fulfilling prophesy can be countered with the fact that a large percentage of them will end up using computers in one way or another and they will quickly learn that a misplaced sign, comma, or any other symbol, will leave them facing a computer error message and a boss that won't understand their backlog of work.

With a mastery of the Basic language under my belt, I was ready to tackle the more advanced language of FORTRAN (Fortran Programming course outline is in Appendix D). FORTRAN is an algorithmic language in common use and most compilers have a FORTRAN compiler. As mentioned earlier in the report, the Mathematics Department at Mt. San Antonio College offers a course in Fortran Programming so my enthusiasm was not only for content but also on teaching techniques. The first two weeks of Computer Science 103 was spent learning how to use the Fortran language in conjunction with a card reader. I experienced the frustration of operating a key punch machine and submitting my program cards to Batch and waiting for results. This process was inevitably followed by the debugging blues and a renewal of the whole demeaning process. After being duly initiated into computer science our instructor gave us the privilege of learning Fortran via an interactive computer system. It felt like the difference between the horse and buggy compared to the automobile. The class progressed much faster and learned more than it could have under the old system. I sincerely hope that by the time I teach Fortran at Mt. San Antonio College that we will be using an interactive computer system rather than the old holey card deck.

After learning two computer languages it seemed worthwhile to learn how computers are used by various disciplines. For this reason I enrolled in "Computer Simulation" (Computer Science 373) and have included a course outline in Appendix D. We studied simulation of physical, social, and mathematical experiments and I had a chance to use the simulation techniques in a statistics experiment related to my Math 343 course. I was able to simulate a probablistic decision theory problem without involving any real deep mathematical theory. This technique would work very well with our lower division students at Mt. San Antonio College. Many of the techniques covered in Computer Science 373 would be very useful for teaching our students in Elementary Statistics (Math 13) taught at Mt. San Antonio College. These simulation techniques have the advantage of not requiring advanced calculus for their formulation but the problems are relevant enough to be considered important.

The remainder of my sabbatical leave obligation involved a direct benefit to the students of Mt. San Antonio College interested in improving their algebra skills. Over the past few years I have written scripts and produced visual material aimed at the creation of video tapes to cover the entire elementary algebra course content. After completing production of these video tapes, I needed time to write a course outline syllabus and worksheets to compliment the video tapes. These documents have been included in Appendix E, F, and G, respectively.

SUMMARY

The sabbatical gave me a chance to build and update my subject matter knowledge as pointed out in the previous paragraphs. But other more subtle benefits should be reported. After returning to the role of student for a year and then coming back to teach, I find myself emphasizing with the

students situations more so than before I went on sabbatical. After having both good and poor professors at the University of Montana, I find myself trying harder to do a better job from the students point of view. I had the opportunity to be an ambassador for junior colleges and Mount San Antonio College in particular. I participated in a colloquim as a speaker on Big Sky versus Big City community colleges and dispelled many misconceptions about California community colleges.

Looking back at a very busy year, how do you put a price tag on the benefits for Mount San Antonio College? Is a better statistics teacher worth X more dollars? Is an informed mathematics instructor, knowledgeable about computers in education worth Y more dollars? Are video worksheet materials worth Z more dollars? What is the value placed on excellence? Mount San Antonio College has built a reputation on excellence that is priceless, so I will not attempt to attach X + Y + Z dollars to the benefits to the college for my sabbatical but rather thank those responsible for making it possible and reassure them that I will continue working to uphold Mount San Antonio College's excellence.

APPENDIX A

SABBATICAL LEAVE REPORT

ACADEMIC YEAR 1977-78

Submitted by

Donald E. Brook
Mathematics Department
October, 1978

Student Number	18200774		
Name	BROOK, DONALD EDWIN	M ☒	
Home Address	2083 SALTO	F ☐	
	HACIENDA HEIGHTS, CA 91745		
Major			

Birth Date and Place	7 JULY 1938	
	LOS ANGELES, CALIFORNIA	
Parent or Guardian	RULON E. BROOK	
Parent's Address	14301 CORNISHCREST	
	WHITTIER, CA. 91745	

Entered	9-26-77	
From:	CALIFORNIA HIGH SCHOOL	
Located at	SHITTIER, CALIFORNIA	
Date Graduated	JUNE 1956 Rank in Class	

☐ resident   ☒ non resident

Degree and Major   Date

GPA   Rank

Completed requirements for regular
standard teaching certificate.

Date   , Major   , Minor

Official if signed and sealed   Honorable dismissal granted

Course & No.	TITLE	CR	GR	PT
ADMIT GRAD NON-DEGREE – FALL 1977				
18200774 BROOK, DONALD EDWIN				
AUTUMN QUARTER 1977				
CS 101	PROGRAMMING	4	A	16
MATH 314	OPERATIONS RES	3	A	12*
MATH 341	MATH STATISTICS	3	A	12*
CUM 4.00 10 40	Q 4.00 10 40			
CR EARNED 10				
18200774 BROOK, DONALD EDWIN				
WINTER QUARTER 1978				
CS 103	FORTRAN	03	A	12
CUM 4.00 13 52	Q 4.00 3 12			
CR EARNED 13				
MISSOULA WINTER 1978				
MATH 342	MATHEMATICAL STATS	3	B	9*
MATH 315	OPERATIONS RESEARCH	3	A	12*
CUM 3.84 19 73				
CR EARNED 19				
18200774 BROOK, DONALD EDWIN				
SPRING QUARTER 1978				
CS 373	COMP SIMULATION	3	A	12
CUM 3.86 22 85	Q 4.00 3 12			
CR EARNED 22				
MISSOULA – SPRING 1978				
MATH 316	OPERATIONS RESEARCH	3	A	12*
MATH 343	MATHEMATICAL STATIST	3	B	9*
CUM 3.78 28 106				
CR EARNED 28				

*GRADUATE CREDIT

OCT 17 1978

Course & No.	TITLE	CR	GR	PT

*GRADUATE CREDIT

APPENDIX B

SABBATICAL LEAVE REPORT

ACADEMIC YEAR 1977-78

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Mathematics Department
October, 1978

<u>OUTLINE FOR OPERATIONS RESEARCH</u>
(Synthesized from class notes)

I. First Quarter (Math 314)

    A. Elements of Mathematical Modeling
       1. Primitive Problem
       2. Simplification and Verbal Model
       3. Translation and Math Model
       4. Solution Techniques
       5. Verification and Interpretation

    B. Graph Theory
       1. Planar and Connected Graphs
       2. Euler and Hamiltonian Paths
       3. Spanning Tree
       4. Matchings (Bipartite and Maximal)
       5. Directed Graphs

    C. Algorithms
       1. Kruskel's - Minimal Spanning Tree
       2. Matching
       3. Dykstra's - Shortest Path

II. Second Quarter (Math 315)

    A. Linear Programming
       1. Geometric Interpretation
       2. Types of Solutions
       3. Simplex Method
       4. Two Phase Method

    B. Integer Programming
       1. Branch and Bound Algorithm
       2. Dakin's Algorithm
       3. Use of Integer Programming in Model Formulation

    C. Use of Computer for Algorithms

III. Third Quarter (Math 316)

    A. Boysian Decision Theory
       1. Laplaces Criterion
       2. Wald Criterion
       3. Hurwicz Criterion
       4. Savages Criterion

B. Stochastic Processes
   1. Discrete Time - finite state
   2. Discrete Time - continuous state
   3. Finite Continuous Time - discrete state
   4. Markov Chains

C. Queuing Theory
   1. Poisson Arrivals
   2. Exponential Service
   3. Deterministic

ARPENDIX C

SABBATICAL LEAVE REPORT

ACADEMIC YEAR 1977-78

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Mathematics Department
October, 1978

OUTLINE FOR MATHEMATICAL STATISTICS
(Synthesized from class notes)

I. First Quarter (Math 341)

   A. Probability
      1. Axioms
      2. Combinatorial Analysis
      3. Conditional Probability and Independence

   B. Random Variables
      1. Discrete
      2. Continuous
      3. Jointly Distributed

   C. Expectation

II. Second Quarter (Math 342)

   A. Limit Theorems
      1. Chebyshev's Inequality
      2. Central Limit Theorems
      3. Law of Large Numbers

   B. Estimation with Normal Models
      1. Maximum Likelihood Estimation
      2. Confidence Intervals
      3. Point Estimation and Functions of Parameters
      4. Regression

   C. Test of Statistical Hypotheses
      1. Wilcoxon Test
      2. Run Test for Randomness
      3. Kolmogorov - Smirnov Goodness of Fit Test
      4. Power of a Statistical Test

III. Third Quarter (Math 343)

   A. Multivariate Distributions
      1. Multivariate Distributions of Continuous Type
      2. Bivariate Normal Distribution
      3. Sampling from Bivariate Distributions
      4. Sample Correlation Coefficient

   B. Chi-Square Tests of Models
      1. Testing Probabilistic Models
      2. Comparisons of Several Distributions
      3. Contingency Tables

APPENDIX D

SABBATICAL LEAVE REPORT

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Mathematics Department
October, 1978

OUTLINE FOR COMPUTER SCIENCE COURSES
(Synthesized from class notes)

I. Introduction to Programming (Computer Science 101)

    A. Computer Components
        1. Buffer
        2. Terminal
        3. Storage

    B. BASIC - (computer language)
        1. Login procedures (Password)
        2. Program Storage
        3. Flow Charts

    C. BASIC - syntax
        1. If statements
        2. Loops
        3. Matrix Format
        4. Files
        5. Astrings
        6. Goto Statements

II. Fortran Programming (Computer Science 103)

    A. Fortran Program Cards

    B. Use of Edit Language

    C. Fortran Programming
        1. Loops
        2. Decision Statements
        3. Subprograms
        4. Declarations
        5. Files

III. Computer Simulation (Computer Science 373)

    A. System Simulation
        1. Monte Carlo Method
        2. Nunerical Computation Techniques for Continuous and
            Discrete Models
        3. Distributed Lag Models
        4. Cobweb Models

    B. Continuous System Simulation
        1. Differential Equations
        2. Analog Computers
        3. Hybrid Computers
        4. Digital - Analog Simulators

C. System Dynamics
1. Exponential Growth and Decay Models
2. Modified Exponential Growth Models
3. Logistic Curves
4. Representation of Time Delays

D. Probability Concepts in Simulation
1. Stochastic Variables
2. Discrete Probability Functions
3. Continuous Probability Functions

APPENDIX E

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October, 1978

COURSE OUTLINE FOR ELEMENTARY ALGEBRA (MATH 51VT)

0. Introduction

I. Operations with Signed Numbers

    A. Addition and Subtraction

    B. Multiplication and Division

    C. Classification of Real Numbers
       1. Counting Numbers
       2. Integers
       3. Rational Numbers
       4. Irrational Numbers

II. Basic Laws of Algebra

    A. Commutative Laws for Addition and Multiplication

    B. Associative Laws for Addition and Multiplication

    C. Distributive Law

    D. Laws for Zero and One

III. Introduction to Algebra

    A. Variables

    B. Like and Unlike Terms

    C. Coefficients

IV. Parentheses and Order

V. Solving Equations

    A. Principles for Solving Equations
       1. Addition Principle
       2. Multiplication Principle
       3. Use of Both Addition and Multiplication Principles
       4. Principle of Zero Products

    B. Equations with Parentheses

    C. Literal Equations

    D. Introduction to Word Problems

VI. Polynomials

    A. Introduction

    B. Arithmetic of Polynomials
       1. Addition and Subtraction
       2. Multiplication
       3. Special Products

    C. Factoring Polynomials
       1. Common Factors
       2. Trinomials
       3. Difference of Squares
       4. Solution of Special Quadratic Equations

VII. Graphs and Systems of Equations

    A. Graphs
       1. Cartesian Plane
       2. Graphs of Lines
       3. Graphs of Parabolas

    B. Use of Graphs
       1. Visual Representation of Solutions
       2. Problem Solving
       3. Solution of Systems of Equations

    C. Systems of Equations
       1. Solutions by Graphing
       2. Addition - Subtraction Method
       3. Substitution Method
       4. Use in Problem Solving

VIII. Review of Polynomials

IX. Fractional Expressions and Equations

    A. Introduction to Algebraic Fractions

    B. Basic Operations
       1. Reducing Fractions
       2. Multiplication and Division
       3. Lowest Common Denominator

    C. Complex Fractions

    D. Division of Polynomials

X. Radical Expressions

XI. Quadratic Equations

APPENDIX F

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Donald E. Brook
Mathematics Department
October, 1978

COURSE SYLLABUS FOR ELEMENTARY ALGEBRA (MATH 51VT)

O. INTRODUCTION

This syllabus is intended to give you, the student, a preview of what Elementary

Algebra is like. It is our hope that this sneak preview will dispell some of the

fears that you may have concerning the illusive topic, titled "Elementary Algebra."

I. ADDITION, SUBTRACTION, MULTIPLICATION, AND DIVISION OF SIGNED NUMBERS

One of the first tasks for you to work on will be to familiarize yourselves with the

rules for operating with signed numbers (positive and negative numbers).

Many students have forgotten some of the necessary arithmetic skills, especially

those related to operations with fractions and decimals, so some time will be

spent reviewing the basic operations while learning how to add, subtract, multiply,

and divide with positive and negative numbers. Emphasis will be placed on intuitive

concepts rather than relying heavily on formal rules. Often times,

what one says is not what one means. The instructor will attempt to overlook

this fault for the sake of performance. Students should concentrate on being

able to add, subtract, multiply, and divide positive and negative numbers rather

than memorize specific rules with unfamiliar terminology. Student constructed flash

cards of problems from the first two homework assignments would make excellent drill

for those who feel they need more practice.

II. BASIC LAWS OF ALGEBRA

The title of this section is a bit deceptive. The eleven basic laws you will study

are really the basis for arithmetic. But since algebra is an abstract extension of

arithmetic we rely heavily on the laws of arithmetic that you have probably taken

for granted. Simple concepts such as "3 + 4 is the same number

as $4 + 3$" are given names so that they can be referred to as the basis for algebraic

operations. As you enter the unfamiliar world of algebraic symbols

you will feel some security in being able to fall back on the simple reliable

laws of arithmetic. Please note the proper spelling of the terminology so that

there will be continuity in classwork and homework papers.

In the past, some students have thought of these exercises as time consuming, hoop jumping routines given by fuddy duddy math teachers. But ignorance of the rules is no excuse, whether it be the tax rules set down by the IRS or the rules of arithmetic applied to algebra.

III. INTRODUCTION TO ALGEBRA

This will be the first real dose of algebra in the course. Not only will you be working with the familiar arabic numerals, but now you will begin to see the illusive letter "x". It is at this point that you should begin to apply the basic rules covered in the previous lessons. Algebra can be thought of as a language and one of the first concepts of a language is a <u>word</u>. Babies learn words before they put them into phrases and then sentences. So you, as algebraic babes, will be exposed to the algebraic equivalent of words before going on to phrases and sentences. The first two lessons will be tied together by the third lesson which will set the pattern for the whole course. Your studies of algebra will be like a spiral i.e. old topics will be an interwoven and necessary part of new topics covered later. You will be constantly seeing previous concepts and lessons as a necessary part of new material.

IV. PARENTHESES AND ORDER

At this point in your education you take for granted the grouping of alphabetical letters to form words and words spaced to form phrases. With practice you will be able to recognize algebraic words and phrases just as easily as their english counterparts. Also there are certain agreements that we will make to avoid confusion much in the same vain that we all agree to drive on the right hand side of the road.

There are ambiguities in the english language that are not tolerable in the language of algebra. For this reason, parentheses will be introduced. Let's illustrate with an example. While shopping for a refrigerator you encounter

the following sign at a country auction:

<div align="center">GUARANTEED USED APPLIANCES</div>

What is meant by this sign? As a prospective purchaser you think the sign means GUARANTEED (USED APPLIANCES). But the auctioneer might think of the sign as meaning (GUARANTEED USED) APPLIANCES. We will avoid this type of confusion in the language of algebra by adopting specific rules for the use of parentheses.

V. SOLVING EQUATIONS

People who have studied algebra remember that they worked with equations even if they don't remember anything else about the subject. The study of equations is the first broad area in the course where algebraic techniques will be used in the solution of practical problems. The knowledge gained from the previous four sections will be focused to give you insight into how deductive reasoning is used in mathematics. We will start with very elementary equations whose solutions you can visualize without algebraic techniques and work up to more complicated forms. Eventually the techniques will be applied to the manipulation of scientific equations.

VI. POLYNOMIALS

At this point the course will change direction somewhat to build up a background for the use of algebra as a broader tool. To use an analogy, up to this point we have been studying the trees but now we want to study forests. You will be asked to think of algebraic expressions as individual entities and learn how to add, subtract, and multiply them. The arithmetic of polynomials would be an appropriate term for this part of the course.

VII. GRAPHS AND SYSTEMS OF EQUATIONS

It has been said that "a picture is worth a thousand words". In the topic of graphs we will exploit this concept to better understand algebraic relationships. Our studies will be restricted to graphs (pictures) of straight lines and one type of simple, smooth curve. The concept of a graph will then help us to understand

systems (more than one) of equations. It will be at this point that we can get more involved with practical applications.

VIII. REVIEW OF POLYNOMIALS

The original introduction to polynomials was restricted to polynomials of one variable (letter like x). This review will incorporate the idea of polynomials with more than one variable (letters like x, y, and z). This section should give students a chance to relate the various algebraic ideas to one another and start to see the interconnections between all the techniques learned so far.

IX. FRACTIONAL EXPRESSIONS AND EQUATIONS

Many students seem to dread the idea of working with fractions because they remember having difficulty working with the concepts. You will be amazed to find how easy fractions are now that you have learned the basic laws which govern numbers. We will first review very simple fractional operations such as:

$$\frac{1}{2} + \frac{3}{4} \ , \ \ \frac{1}{2} \cdot \frac{3}{4} \ , \ \frac{1}{2} \div \frac{3}{4}$$

Once you have remastered these arithmetic fractions, then we can branch out to algebraic fractions and apply the techniques learned to solving fractional equations.

X. RADICAL EXPRESSIONS

Not all numbers are expressible as whole numbers or fractions. This was known as far back as two thousand years ago by the Greeks. Many simple concepts involve the use of radical expressions such as those associated with the square root operation. For example, the length of the diagonal for a square of any integral measure is only expressible as a radical expression. Emphasis will be placed on radicals associated with the square root operation to the virtual exclusion of third, fourth, and fifth roots. As with all the other topics preceding this one, we will rely heavily on the basic laws covered in the first two sections.

XI. QUADRATIC EQUATIONS

Actually you have been solving quadratic equations prior to this section, but they were limited so that the work did not involve radicals. Now that you have completed the section on radicals, it will no longer be necessary to spoon feed you with only non-radical quadratic equations. The practical problems in this section should emphasize the need for the techniques of solving any arbitrary quadratic equation.

XII. CLOSING COMMENTS

The subcategories of the course, as outlined above, will give you a broad enough background for preparation to enter an intermediate algebra course. In intermediate algebra, your knowledge of elementary algebra will be expanded as well as new topics introduced. For example, the idea of an equality (equation) will be expanded to include inequalities. New factoring forms will be introduced and graphs will be expanded beyond straight lines and the smooth curve called a parabola.

APPENDIX G

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October, 1978

Math 51   VIDEO TAPE WORKSHEET

Addition and Subtraction of Real Numbers - Tape 23 (#1)

Name_____

Instructor_____

Class days_____hours_____

(20 minutes)

I. Kinds of Numbers

   1) List the counting numbers _____, _____, _____, . . .

   2) List the integers   . . ., _____, _____, _____, _____, _____, . . .

   3) What are real numbers ?_____

II. Addition of Real Numbers

   1) (+3) + (-4) =   2) (-3) + (+4) =   3) (-3)+(-4)=   4) (+3)+(+4)=

   5) How do you add two negative numbers?_____

   6) (-2)+(   ) =   8) (-2)+(   ) =   10) (+2)+(   ) =

   7) (-2.3)+(   ) =   9) (-2.3)+(   ) =   11) (+2.3)+(   ) =

   12) To add fractions with unlike denominators, you must _____

   _____

   13) $(-\frac{3}{4}) + (-\frac{1}{2})$

   $(-\frac{3}{4}) + (\quad)$

   _____ or _____

   14) $(-\frac{3}{4}) + (+\frac{1}{2})$

   $(-\frac{3}{4}) + (+\frac{1}{2} \cdot \frac{}{})$ Multiply both numerator and denominator by _____

   $(-\frac{3}{4}) + (\quad) =$ _____ or _____

   15) $(-\frac{1}{2} \cdot \frac{}{}) + (+\frac{3}{4})$ Multiply both numerator and denominator by _____?

   $(\quad) + (+\frac{3}{4})$

   _____?

III. Subtraction of Real Numbers

   1) <u>One Rule</u>   Rewrite subtraction as an addition problem by _____

   2) (-1) - (-3) Subtraction Problem

   (-1) + (   ) Addition Problem

   ?

   3) (-1) - (   ) Subtraction Problem

   (-1) + (   ) Addition Problem

   ?

   4) (+1) - (   ) Subtraction Problem

   (+1) + (   ) Addition Problem

   ?

   5) (+3) - (   ) Subtraction Problem

   (+3) + (   ) Addition Problem

   ?

Multiplication and Division of Real Numbers –
Tape 24 (#2)   (20 minutes)

Name _____

Instructor _____

Class days _____ Hours _____

I   Real Numbers

   1) All numbers found on the number line are _____ numbers.

   2) The Rational Numbers are _____

   _____

   3) Pi (π) is <u>an</u> _____ number.

II Multiplication of Real Numbers

   A. Like Signs

      1) A positive number times a positive number is a _____ number.

      2) A negative number times a negative number is a _____ number.

   B. Unlike Signs

      1) A positive number times a negative number is a _____ number.

      2) A negative number times a positive number is a _____ number.

   C. Examples

      1) $(-3)(\quad) =$

      2) $(-3) \cdot (\quad) =$

      3) $(-3) \times (\quad) =$

      4) $(-4)(\quad) =$

      5) $(+4)(\quad) =$

      6) $(-3.1)(\quad) =$

      7) $(+3.1)(\quad) =$

      8) $(+\frac{3}{4})(+\frac{1}{2}) \doteq$

          $\frac{+3 \cdot 1}{+4 \cdot 2} =$

      9) $(-\frac{3}{4})(\quad) =$

III Division of Real Numbers

   A. Three kinds of Division Symbols

   B. Rules for Division are the same as rules for _____ ?

   C. Examples (show work for #4)

      1) $\frac{-12}{-3} =$

      2) $\frac{-12}{\quad} =$

      3) $\frac{+12}{\quad} =$

      4) $\frac{-11.73}{-2.3} =$

      5) $\frac{+11.73}{\quad} =$

      6) $\frac{-\frac{3}{4}}{\quad} = (-\frac{3}{4}) \div (\quad) = (-\frac{3}{4}) \cdot (\quad)$

          $= \underline{\quad}$ or $\underline{\quad}$

      7) $\frac{+\frac{3}{4}}{-\frac{1}{2}} = (+\frac{3}{4}) \cdot (\quad) =$

      8) $\frac{3}{2}$ is an _____ fraction

      9) $1\frac{1}{2}$ is a _____ Number

      10) Is $\frac{3}{2}$ reduced to lowest terms?

Basic Laws of Algebra - Tape 10 (#3)   17 minutes   Instructor: Mr. Brook

Class days_____Hours_____

1. The fact that 3 + 5 = 5 + 3 is an example of the _____Law for Addition

2. The fact that 3(5) = 5(3) is an example of the _____ Law for Multiplicatio

3. The fact that (3 + 5) + 7 = 3 + (5 + 7) is an example of the _____
    Law for Addition.

4. The fact that (2 · 3) · 4 = 2 · (3 · 4) is an example of the _____
    Law for Multiplication

5. Distributive Law: 2(3 + 8) = __?__ · 3 + __?__ · 8

6. The opposite of 2 is _____.

7. The opposite of -2 is _____.

8. The opposite of -3.7 is _____.

9. (Any number) + (Its opposite) = _____.

10. The result of adding opposites is always _____.

11. The reciprocal of 2 is _____.

12. The reciprocal of -3 is _____.

13. (Any number) (Its reciprocal) = _____.

14. (Any number) + 0 = _____.

15. (Any number) (1) = _____.

16. The identity for addition is _____.

17. The identity for multiplication is _____.

Write the FULL name of the law illustrated by the following (these are not on the tape)

18. (3 + 4) + 5 = 5 + (3 + 4) _____

19. 2(3 + 4) = 2 · 3 + 2 · 4 _____

20. 5 + 3 · 1 = 5 + 3 _____

21. (3 + 4) + 5 = 3 + (4 + 5) _____

22. (2 · 3) 4 = 4 · (2 · 3) _____

Name_____

Instructor: Mr. Brook

TERMS - Tape 15 (#4)   16 minutes

Class days_____Hours_____

1. The basic building blocks of Algebra are _____.

2. Numbers and _____ are terms.

3. The combination of numbers and/or _____ with only the operations
    of _____ and _____ are terms.

4. The expression $x \cdot x \cdot x \cdot x = x^?$ because there are four _____ factors of x.

5. The degree of the term $x \cdot x \cdot x$ is _____.

6. The degree of a term is the number of _____ factors in the term.

7. In the term $3x^2$
    a. 3 is the numerical _____ of the term.
    b. The literal factors are _____.
    c. The degree of the term is _____.

8. 7x and -3x are _____ terms.

9. -2x and 5y are _____ terms.

10. -8x and $-4x^2$ are _____ terms.

11. $.6xy^2$ and $-7.2xy^2$ are _____ terms.

12. Combine _____ terms but don't combine _____ terms.

13. $7x + 3x = (? + ?) ? = ?$

14. Combine like terms by adding their _____.

15. How do you combine 4x + 3y?

16. $1 \cdot x = ?$

17. The numerical coefficient of x is _____.

18. $4x + x = 4x + ?$
    $= (? + ?) ?$
    $= ?$

19. How do you combine $-7xy^2 - 3x^2y$?

20. How do you combine $-7x - 3x$?

Name_____

Instructor_____

Class Days_____Hours_____

1. $4 + 4 \cdot 2 = ?$ 2. $4 + (4 \cdot 2) = ?$ 3. $(4 + 4) \cdot 2 = ?$

4. Work multiplication or division before addition and subtraction unless _____ indicate otherwise.

5. $5 \cdot (3 + 2)$ 6. $3 + (2 \cdot 5)$

     $5 \cdot ?$ $3 + ?$

        $?$ $?$

7. $5(2x) = (5 \cdot 2)x$ because of the _____Law for _____.

    $5(2x) = ?$

8. $5(2 + x) = 5 \cdot 2 + 5x$ because of the _____Law.

9. $5 + (2 + x) = (5 + 2) + x$ because of the _____Law for _____.

10. $3[2 - 5(x + 3)] = 3[2 - 5x - 15]$ because of the _____Law.

                    $= 3[-5x - 15 + 2]$ because of the _____Law for _____.

                    $= 3[-5x \quad ? \quad]$

                    $= ? \quad ?$

14. Rules for removing parentheses
    a) Plus sign in front of parentheses
       then _____ parentheses and
       simplify.
    b) Minus sign in front of parentheses
       then _____
    c) Number in front of parentheses then
       _____

11. $\{3[x + (2x + 5)] + 2\} (4 - 8)$

    $\{3[? + ?] + 2\} (?)$

    $\{9x + ? + 2\} (?)$

    $\{9x + ? \} (?)$

         $? \qquad ?$

15. This one is not on the tape. Remove parentheses and simplify. SHOW WORK on back side of this sheet.

    $1 - \{2 - [2(3 + 2 \cdot 4) + 5] \cdot 4\}$

12. Think of $-(2x + 5)$ as $-1(2x + 5)$ then
    distribute -1 to get ___?___ ?___

13. Think of $-(3x - 4)$ as $-1(3x - 4)$ then
    distribute -1 to get ___?___ + ?___

Math 51 Video Tape Worksheet

<u>Solving Equations Using the Addition Principle</u>

    Video Tape 52 (#6) 18 minutes

Name _____

Instructor _____

Class Days _____hours_____

I.   Sentences

    A. Algebra, among other things is a _____.

        1) $-3 + 2 = 5$ is a _____ sentence.

        2) $-3 + 2 = -1$ is a_____ sentence.

        3) $x + 2 = 5$ is an _____ sentence.

    B. The values that make a sentence a true statement are called _____.

    C. An equation is an _____ sentence involving the equal symbol.

    D. A solution for $-3x - 7 = 2(x + 4)$ is _____.

        <u>Check</u> $-3(?) - 7 \overset{?}{=} 2(? + 4)$

                $? - 7 \overset{?}{=} 2(\quad)$

                ___ = ___

II. Addition Principle: If $p = a$ then _____.

III. Solving Equations

    A. Solve $x + 4 = -7$

        $x + 4 = -7$ _____ Why?

        $(x + 4) + ? = -7 + ?$ _____ Why?

        $x + [\quad\quad] = -7 + ?$ _____ Why?

        $x + ? = -7 + ?$ _____ Why?

        $x = -7 + ?$ _____ Why?

        $x = ?$ _____ Why?

        The solution is _____

    B. $x + (-3) = 2 - 7$

        $x + (-3) + ? = 2 - 7 + ?$

        $x + ? = ?$

        $x = ?$ The solution is _____

        <u>Check</u> $(\quad) + (-3) \overset{?}{=} 2 - 7$

              ___ = ___ .

    C. Solve $x + 3/2 = -5/3$

                $x + 3/2 + ? = -5/3 + ?$

                $x =$

                <u>Check</u> $(\quad) + 3/2 \overset{?}{=} -5/3$

Name _____

Instructor _____

Class days _____ hrs. _____

I. Multiplication Principle: If p = a then _____.

$$\frac{-12}{4} = -2 - 1 \quad \text{so} \quad \left(\frac{-12}{4} + 5 = -2 - 1 + 5\right)$$

This is an error on the tape.
This is an example of the additi[on]
principle - not the mult. princip[le]

Correction: $\frac{-12}{4} \cdot 5 = (-2 - 1) \cdot 5$ is an example of the Multiplication Principle.

II. Reciprocal of a Number

Number	Reciprocal
3	
$\frac{1}{3}$	
$\frac{-1}{5}$	

Number	Reciprocal
$\frac{3}{4}$	
$1\frac{1}{3}$	

The reciprocal of a negative number is a _____ number.
                                        (positive or negative)

III. Solving Equations   3x = -51

? (3x) = ? (-51)   _____ Why?
{   } x = ? (-51)   _____ Why?
    ? x = ? (-51)   _____ Why?
    x = ? (-51)   _____ Why?
    x =   _____ Why?
                            _____ Why?

The solution is _____   Check: 3( ) $\stackrel{?}{=}$ -51

                                    ___ = ___

IV. Dividing is _____ by the reciprocal.   3x = -51

V.   21 = -2/3x   _____ Why? $\frac{3x}{?} = \frac{-51}{?}$
   ? (21) = ? (-2/3x)   _____ Why?
   ? (21) = {   }x   _____ Why?   x =
     ? (21) = ? x   _____ Why?
     ? (21) = x   _____ Why?
        ? = x   _____ Why?

The solution is _____   or   _____

VI.   -x = 7   So x = ?
           ? x = 7   The solution is _____
   -1(?x) = -1(7)
        1x = ?   Check: -(?) $\stackrel{?}{=}$ 7

                                          ___ = ___

Solving Equations Using the Addition and Multiplication Principles

Videotape 54 (#8)   20 minutes

Name _____

Instr. _____

Class days _____ hrs. _____

A. When solving equations use the _____ Principle first.

   1.) $-3x + 7 = -29$ _____ Why?

   2.) $(-3x + 7) + ? = -29 + ?$ _____ Why?

   3.) $-3x + \{\quad\} = -29 + ?$ _____ Why?

   4.) $-3x + ? = -29 + ?$ _____ Why?

   5.) $-3x = -29 + ?$ _____ Why?

   6.) $-3x = ?$ _____ Why?

   7.) $? (-3x) = ? (\quad)$ _____ Why?

   8.) $\{\quad\} x = ? (\quad)$ _____ Why?

   9.) $? x = ? (\quad)$ _____ Why?

 10.) $x = ? (\quad)$ _____ Why?

 11.) $x =$ _____ _____ Why?

 12.) The solution is _____

B. Get all x terms on one side and all _____
   terms on the other side.

   1.) $5x - 3 = -8x$

   2.) $-5x + 5x - 3 =$ _____ $-8x$

   3.) $-3 = ?$

   4.) $-1/13 (-3) = ? (?)$

   5.) $?$ _____ $= x$

   6.) The solution is _____

Check: $5 (?) - 3 \overset{?}{=} -8 (?)$

       $? \quad -3 \overset{?}{=} ?$

     _____ $=$ _____

C. Solve the following equation

     $x - 1 = 12 - 3x$

       $4x - 1 = ?$

        $4x = ?$

   $1/4(4x) = ? (?)$ ← Multiply both sides by the _____ of the numerical
               coefficient of x.
      $x =$ _____

Check: $(\quad) - 1 \overset{?}{=} 12 - 3 (\quad)$

       $? - 4/4 \overset{?}{=} 48/4 - ?$

     _____ $=$ _____

Equations with Parentheses   Tape 56(#9) 18 minutes

Name _____
Instructor _____
Class days _____ hours _____

THREE RULES FOR REMOVING PARENTHESES

I. x + (3 - y)

    x + _____

When there is a + sign in front of the parentheses, the parentheses may be removed without any change.

II. x - (3 - y)

    x _____

When there is a - sign in front of the parentheses, we can remove the parentheses provided we _____ the signs of all terms in the parentheses.

III. x + 2(3 - y)

    x + _____

When there is a number in front of the parentheses, we can remove the parentheses provided we _____ each term by the number in front of the parentheses. This is an example of the use of the _____ Law.

EQUATIONS WITH PARENTHESES -- Solve 27 = 3(5x - 2) Remove the parentheses using the _____ Law.

27 = 15x ___?
27 + ? = 15x - ? + ?

Get all x terms on one side and all non x terms on the other side by adding _____ to both sides.

? = 15x

Multiply both sides by the _____ of the coefficient of x.

?( ) = ?(15x)

Reduce by dividing out like factors of _____.

? = x

? = x

CHECK: Is _?_ a solution of 27 = 3(5x - 2)

27 $\overset{?}{=}$ 3[5( ) - 2]

27 $\overset{?}{=}$ 3(? - 2)

27 $\overset{?}{=}$ 3( )

27 $\overset{?}{=}$?

HINTS

1. Remove _____
2. Combine _____ terms.
3. Get all x terms on _____
4. Get all non x terms on _____
5. Multiply both sides by the _____ of the _____ of x.

Solve   3 - (x + 2) = 5 + (x + 2)   First remove _____ using appropriate Laws.

3 - x - 2 = ?

Now combine _____ terms on the left side, then combine _____ terms on the right side.

1 - x = ?
1 - x + ? = ?

Get all x terms on one side of the equation by adding _____ to both sides of the equation.

1 = 7 + ?
? + 1 = ? + 7 + ?

Get all non x terms on the opposite side by adding _____ to both sides of the equation.

-6 = ? x
?(-6) = ?(?x)

Multiply both sides of equation by the _____ of the _____ of x.

Continued on other side!

CHECK: Is -3 a solution of 3 - (x + 2) = 5 + (x + 2)

$3 - [(\ ) + 2] \overset{?}{=} 5 + [(\ ) + 2]$

$3 - (\ ) \overset{?}{=} 5 + (\ )$

$3 + (\ ) \overset{?}{=} ?$

_____ = _____

The following equation is not on the tape. Solve 2 - (x - 5) = 5 + 2(x + 2)

Show At Least Four Steps To Get
The Idiot Equation

_____ = _____

_____ = _____

_____ = _____

_____ = _____

Show your CHECK::

$2 - [(\ ) - 5] \overset{?}{=} 5 + 2 [(\ ) + 2]$

$2 - [? - 15/3] \overset{?}{=} 5 + 2 [? + 6/3]$

$6/3 + (\ ) \overset{?}{=} 15/3 + ?$

_____ = _____

Name _____
Instr. _____
Class days _____ hrs. _____

1.) If the product of two numbers is zero then what are the numbers? _____

2.) <u>Principle of Zero Products</u>   If a b = c then _____ or _____.

3.) If the product of two numbers is one then what are the numbers? _____

4.) (True or False) If the product of two numbers is one then one of the numbers is one. ___

5.) a = 0 is a sentence or equation. b = 0 is a sentence or equation

   a = 0 or b = 0   is a _____ sentence

6.) Solve $(2x - 5)(x + 4) = 0$

   _____ = 0 or _____ = 0 because of the principle of _____

   _____ or _____   Show the rest of the simplification

   _____ or _____

   ┌─────────────────────────────────────┐
   │ <u>CHECK:</u> Is 5/2 a solution?   │
   │ $\{2(\ ) -5\}\{(\ ) +4\} \overset{?}{=} 0$ │
   │ $\{\ \}\{\ \ \} \overset{?}{=} 0$ │
   │ $(\ )(\ \ ) \overset{?}{=} 0$ │
   │ Is -4 a solution?   │
   │ $\{2(\ ) -5\}\{(\ ) +4\} \overset{?}{=} 0$ │
   │ $\{\ \}\{\ \ \} \overset{?}{=} 0$ │
   │ $=$ │
   └─────────────────────────────────────┘

7.) Solve $0 = 5x(5x + 6)$

   _____ = 0 or _____ = 0 because of the principle of _____

   _____ or _____   <u>Show work and check</u>

   _____ or _____

   _____ or _____

   ┌──────────────────────────────┬──────────────────────────────┐
   │ Is 0 a solution?   │ Is -6/5 a solution?   │
   │ $0 \overset{?}{=} 5(\ )\{5(\ ) + 6\}$ │ $0 \overset{?}{=} 5(\ )\{5(\ ) + 6\}$ │
   │ $0 \overset{?}{=} ? \{? + 6\}$ │ $0 \overset{?}{=} ? \{? + 6\}$ │
   │ $0 \overset{?}{=}$ _____   │ $0 \overset{?}{=}$ _____   │
   └──────────────────────────────┴──────────────────────────────┘

8.) The following equation is not on the video tape. Solve $(2x - 3)(3x - 5) = 0$ <u>SHOW WORK AND CHECK</u>

Name _____
Instr. _____
Class days _____ hrs. ___
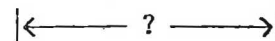
I.   Mathematics among other things is a _____.

II. Let ? = length of one piece
        ? = length of other piece
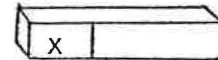
     _____ ÷ _____ = _____   and solve for x
                                    SHOW WORK

     Now answer the question.   Length of 1st piece is _____
                                Length of 2nd piece is _____

III. Let ? = length of one piece
         = length of piece 2' longer

     _____ + (_____) = ?   and solve for x
                  SHOW WORK

     Now answer the question.   Length of 1st piece is _____
                                Length of 2nd piece is _____

IV. Vocabulary

Mathematical Symbol	English Equivalent
1.	equals, is, the result is
2.	_____, add, increased by, more
3.	_____, subtract, decreased by, diminished, less
4.	_____, multiply, times, _____ (Hint: two letter word)
5.	_____, division, divided by, divided into

V.   Integers
                              Let x = 1st integer
     A. Consecutive Integers: ? = 2nd consecutive integer
                                   ? = 3rd consecutive integer

                              Let x = 1st odd integer
     B. Consecutive {even / odd} integers: ? = 2nd consecutive odd integer
                                   ? = 3rd consecutive odd integer

          Solve for x.   SHOW WORK

       x + (   ) + (   ) = ?

     The 3 consecutive odd integers are _____, _____, and _____.

FORMULAS

I. Geometric Figures

A) P of $\triangle$ = _____   P of ☐ = _____

   P of □ = _____   C of ⊙ = _____

B) A of $\triangle$ = _____   A of ☐ = _____

   A of □ = _____   A of ⊙ = _____

C) Volume

D) Sum of angles of triangle = _____ .

II. Distance D = _____

III. Interest I = _____

IV. Temperature $C = \frac{5}{9}$ (   )

THE FOLLOWING PROBLEM IS NOT ON THE TAPE

1) 1) Read the problem   5) Write equation or formula

   2) Re-read the problem   6) Solve equation (SHOW WORK)

   3) Draw a picture   7) Apply solution to the problem.

   4) Label unknowns

   A sixteen foot board is cut into 3 pieces. The 2nd piece is 3 feet longer
   than the 1st piece and the 3rd piece is twice as long as the 1st piece.
   Find the length of the 3rd piece.

Name_____
Instructor_____
Class days_____ hours_____

I. Literal equations are equations with _____.

   A. $F = \frac{9}{5} C + 32$ If the temperature reading is $85^{\circ}C$ then the Fahrenheit reading
      is _____.

   B. $C = \frac{5}{9} (F - 32)$ If the temperature reading is $72^{\circ}F$ then the Centigrade reading
      is _____.

   C. If you remember one of the above equations, you can derive the other.

II. Solving Literal Equations   A. Solve $F = \frac{9}{5} C + 32$ for C

   A. $F + (?) = \frac{9}{5} C + 32 + ?$

        $F - ? = \frac{9}{5} C$

        $\frac{5}{9} (\quad) = \frac{5}{9} (\quad)$

        _____ = C

   B. Solve $C = \frac{5}{9} (F - 32)$ for F

        $C = ? - ?$

        $C + ? = \frac{5}{9} F - ? + ?$

        $?(C + ?) = ? (\frac{5}{9} F)$

        $? + ? = F$

   C. Solve D = rt for t.

     1) What is the coefficient of t? _____

     2) What is the reciprocal of the
        coefficient of t? _____

     3) Multiply both sides by above
        $?(d) = ?(rt)$
          $? = t$

   D. $A = \frac{1}{2} bh$ is the formula for the Area
      of a _____

     1) The coefficient of b is _____.

     2) The reciprocal of the coefficient of
        b is _____

     3) $? (a) = ? (\frac{1}{2} bh)$
        $? = b$

E. The formula for the Volume of a
   box is V = _____. Solve
   for h.

   1) The coefficient of h
     is _____

   2) The reciprocal of the coef-
     ficient of h is _____

   3) Multiply both sides by the
     reciprocal of the coefficient
     of h

     $?(V) = ? (\quad)$

       $= h$

F. The following is not on the tape.

   The formual for the circumference
   of a circle is C = πd.
   Solve for d (Show some work)

Name_____

Instructor_____

Class days_____ hours_____

I. Names of Polynomials

    A. A <u>monomial</u> is a polynomial of _____term(s).

    B. A <u>binomial</u> is a polynomial of _____term(s).

    C. A <u>trinomial</u> is a polynomial of _____term(s).

    D. A polynomial of 4 terms is called a _____.

II. Concept of Term -

    A. $3xy^2$

        The numerical coefficient is _____.

        The 3 literal factors are _____.

        The degree is _____ because

        _____.

    B. Zero exponents

        $2^0 = ?$ $x^0 = ?$

    C. Degree

        $4x^3$ is a _____ degree term because

          there are three _____ factors.

        $4x^2$ is a _____ degree term because

          there are _____.

        $4x$ is a _____ degree term because

          there are _____.

        $4x^0$ is a _____ degree term because

          there are _____.

        4 is a _____ degree term.

        $-2xy$ is a _____ degree term because

          there are _____.

        $\frac{1}{2}x^2y$ is a _____ degree term because

          there are <u>three</u> _____ factors.

        $3x^2y^3$ is a _____ degree term because

          there are _____ _____ factors.

        What is the degree of the binomial

          $-3xy + 2x$? _____.

        What is the degree of the trimonial $4x + 7 - x^3y$? _____.

        The degree of the polynomial $2x^2 - 3x^3 + 2 + 4x$ is _____.

III. The degree of a polynomial is the degree of the _____
_____

IV. Descending & Ascending Order.

    A. Arrange $2x^2 - 3x^3 + 2 + 4x$ in descending order:

        _____

        In ascending order:

        _____

V. A polynomial represents a <u>number</u>

    A. If x = -1 then $2x^2-3x^3+2+4x$

        equals $2(\ \ )^2 - 3(\ \ )^3 + 2$

        $+ 4(\ \ )$

        $2(\ \ ) - 3(\ \ ) + 2 + ?$

               ?

    B. Not on tape:

        What number does

        $2x^2 - 3x^3 + 2 + 4x$ repre-

        sent when x = -2?

        <u>SHOW WORK</u>

Addition and Subtraction of Polynomials   71(#14)
                                            18 minutes

Name_____

Instructor_____

Class days_____hours_____

I. Let $P = 4x^2 - 5$ and $Q = -3x^2 - x + 4$ then

A. Add P + Q horizontally $\longleftrightarrow$ Add vertically

   P + Q = (   ) + (   )

   $\begin{array}{ll} P & 4x^2 + ?\,x - 5 \\ +\ Q & -3x^2\ \ \ - x + 4 \\ \hline \overline{P+Q} & \ ?\ \ \ \ \ ?\ \ \ ? \end{array}$

B. P - Q horizontally $\longleftrightarrow$ Subtract vertically

   P - Q = (   ) - (   )

   P - Q = ?   ?   ?   ?   ?

   P - Q = _____

   $\begin{array}{ll} P & 4x^2 + ?\,x - 5 \\ -\ Q & -3x^2 - x\ + 4 \\ \hline \overline{P-Q} & (?)\ \ \ (?)\ \ (?) \end{array}$

C. P + [Q + T] horizontally

   P + [Q + T] = (   ) + [(   ) + (   )]

   =

D. P + [Q + T] vertically $\longrightarrow$

   $\begin{array}{l} 4x^2\ \ + ?\,x - 5 \\ -3x^2\ \ \ - x + 4 \\ ?x^3 + ?\,x^2 + ?\,x - 7 \\ \hline \ ?\ \ \ \ ?\ \ \ \ ?\ \ \ \ ? \end{array}$

II. The following are not on the tape but use the same polynomials P,Q,T, given on the tape.

A. Find P - [Q - T] =

B. Find [P - Q] - T =

C. Are the results to part A and part B equal? _____

D. Is subtraction of polynomials associative? _____

I Addition

1.) (-2) + (+3) =

2.) (+3) + (+2) =

3.) (-3) + (-2) =

4.) (-3) + (+2) =

5.) (+3) + (-2) =

6.) (-2) + (-3) =

7.) (+2) + (+3) =

8.) (+2) + (-3) =

9.) (-3) + (-6) =

10.) (+23) + (-18) =

11.) (+35) + (-26) =

12.) (+2.09) + (-8.4) =

13.) (+8.5) + (-2.17) =

14.) (-3/4) + (+1/2) =

II Subtraction

1.) (-2) - (+3) =

2.) (+3) - (+2) =

3.) (-3) - (-2) =

4.) (-3) - (+2) =

5.) (+3) - (-2) =

6.) (-2) - (-3) =

7.) (+2) - (+3) =

8.) (+2) - (-3) =

9.) (-3) - (-6) =

10.) (+23) - (-18) =

11.) (+35) - (-26) =

12.) (+2.09) - (+8.4) =

13.) (-8.5) - (-2.17) =

14.) (-3/4) - (+1/2) =

III Fruit Cocktail

1.) (+4) - (-2) =

2.) (-9) + (+4) =

3.) (+17) + (-8) =

4.) (+7) - (+25) =

5.) (-21) + (-13) =

6.) (-1.01) + (+.1) =

7.) (+.1) - (-.01) =

8.) (+1/2) - (-1/3) =

Math 51   Assignment #2

I Multiplication

1.) (+4)(-6)   6.) (-1)(-1)(-1)

2.) (-8)(+5)   7.) (+.1)(-.01)

3.) (-4)(-5)   8.) (-3.12)(+.21)

4.) (-17)(-5)   9.) (+3/5)(-5/7)

5.) (-9)(+4)

II Division

1.) $\dfrac{+16}{-4}$ 7.) $\dfrac{+1}{-1}$

2.) $\dfrac{-12}{+3}$ 8.) $\dfrac{0}{-3}$

3.) $\dfrac{-27}{-9}$ 9.) $\dfrac{-3}{0}$

4.) $\dfrac{+84}{+7}$ 10.) $\dfrac{-.1}{-.1}$

5.) $\dfrac{-63}{+7}$ 11.) $\dfrac{+17.823}{-4.57}$

6.) $\dfrac{+42}{-7}$ 12.) $\dfrac{-1/2}{-3/4}$

III Fruit Cocktail (Unnecessary parentheses and signs have been omitted)

1.) 3 - 1   8.) -28(-7)

2.) 3(-1)   9.) $\dfrac{-28}{-7}$

3.) -3 - 1   10.) -7 · 8

4.) -3(-1)   11.) .1 - 1

5.) $\dfrac{-3}{-1}$ 12.) 1/3 - 1/2

6.) 7 - 28   13.) 1/3(-1/2)

7.) -28 - 7   14.) 1/3 · 0

   15.) $\dfrac{0}{1/3}$

ALGEBRA

I <u>NUMBERS</u>

    A. Real Numbers

    B. Natural Numbers (Counting Numbers)

    C. Integers

II <u>BINARY OPERATIONS</u>

    A. Laws

        i. Commutative Law for Addition

        ii. Commutative Law for Multiplication

        iii. Associative Law for Addition

        iv. Associative Law for Multiplication

        v. Distributive Law

        vi. Opposites

        vii. Reciprocals

        viii. Laws for One and Zero

    B. Addition

        i. Two positives

        ii. Two negatives

        iii. Positive and Negative

    C. Subtraction

    D. Multiplication

        i. Like Signs

        ii. Unlike Signs

    E. Division

$$\longleftarrow \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad \longrightarrow$$
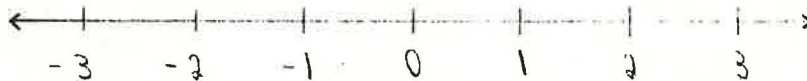
NUMBERLINE

I. Solve $3x + 6 = 28$ _____ Why?

  $3x + 6 = 28$ _____ Why?

  $[3x + 6] + (-6) = 28 + (-6)$ _____ Why?

  $3x + [6 + (-6)] = 28 + (-6)$ _____ Why?

  $3x + 0 = 28 + (-6)$ _____ Why?

  $3x = 28 + (-6)$ _____ Why?

  $3x = 22$ _____ Why?

  $\frac{1}{3}(3x) = \frac{1}{3}(22)$ _____ Why?

  $[\frac{1}{3} \cdot 3] x = \frac{1}{3}(22)$ _____ Why?

  $1x = \frac{1}{3}(22)$ _____ Why?

  $x = \frac{1}{3}(22)$ _____ Why?

  $x = \frac{22}{3}$ _____ Why?

  The solution is $\frac{22}{3}$.   NOW CHECK

Check Example I $3x + 6 = 28$

$3(\ ) + 6 \stackrel{?}{=} 28$

II. Solve $4x - 3 = 6x$

Check Example II

  $4x - 3 = 6x$

  $4(\ ) - 3 = 6(\ )$

III. Solve $x - 1 = 16 - 4x$

Check Example III

  $x - 1 = 16 - 4x$

  $(\ ) - 1 = 16 - 4(\ )$

IV. Solve $4y + 4 + y = 6y + 20 - 4y$

Check Example IV

  $4y + 4 + y = 6y + 20 - 4y$

  $4(\ ) + 4 + (\ ) = 6(\ ) + 20 - 4(\ )$

INSTRUCTIONS: Place the element of the truth set in the properly numbered square at the bottom of this sheet.

1. $2X + 6 = -14$

2. $3X + 20 = 5$

3. $2X + (-8) = 4$

4. $-2X - 3 = 9$

5. $-9 - 3X = -42$

6. $22 = 7X - 13$

7. $2X - 2 = 0$

8. $-X = +1$

9. $8 - 7X = -6$

10. $3 + 2X = 17$

11. $2 - 10 = 2X$

12. $0 = -X$

13. $3X - 7 = -7$

14. $\frac{1}{2}X - (-4) = 3$

15. $2X - 7 = -21$

16. $3X = 30$

17. $-6 - X = -10$

18. $\frac{2}{3}X - 3 = -5$

19. $\frac{2}{3}X - 3 = -1$

20. $\frac{3}{4}X - 6 = 0$

21. $\frac{5}{6}X + 7 = 17$

22. $\frac{1}{2}X + \frac{1}{2} = -4$

23. $\frac{1}{2}X + \frac{1}{2} = 5$

24. $\frac{2}{3}X + \frac{3}{2} = -\frac{23}{6}$

25. $\frac{1}{3}X + \frac{2}{3} = -3$

HINTS------------

1. The sum of the first row is -4.

2. The sum of the third row is -13.

3. The sum of the fifth row is -7.

4. The sum of rows two and four are both positive.

5. The sum of column one is the opposite of the sum of row three.

6. The sum of column two is the same as the answer for problem 22.

7. The sum of column five is the same as the answer for problem 20.

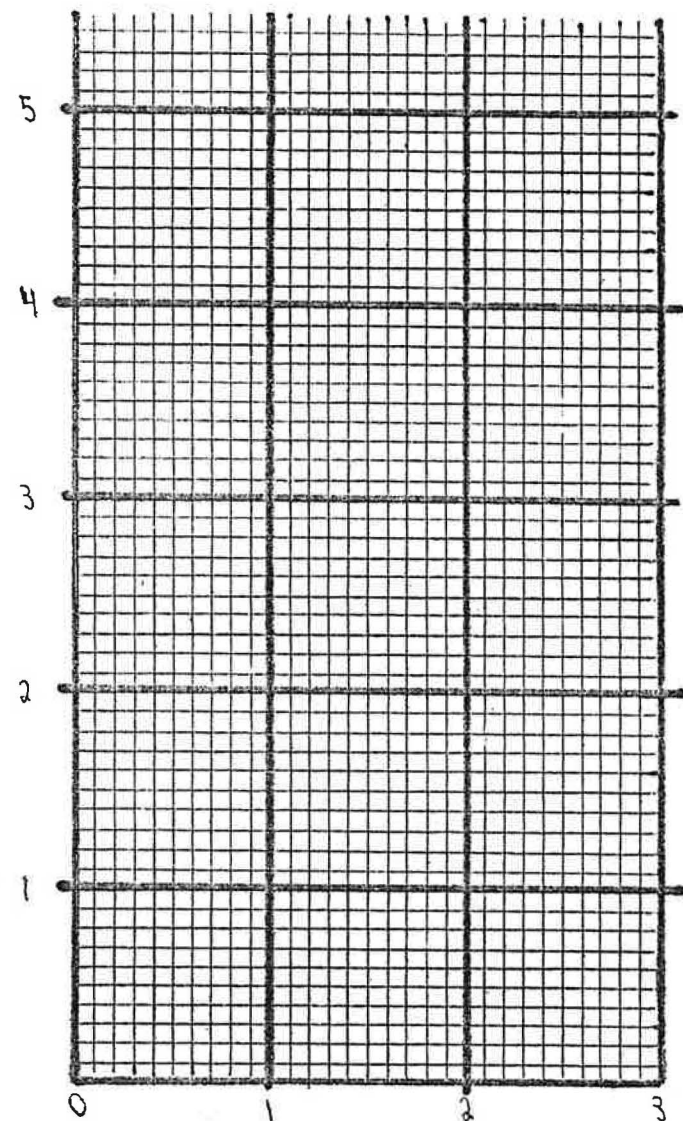8. The sum of column three is the opposite of the sum of column four.

Columns	1.	2.	3.	4.	5.	Sums	
Row 1	1	2	3	4	5		
Row 2	6	7	8	9	10		
Row 3	11	12	13	14	15		
Row 4	16	17	18	19	20		
Row 5	21	22	23	24	25		
Sums							

Total

Worksheet for Video Tape: <u>Introduction To Graphs</u>

Name _____
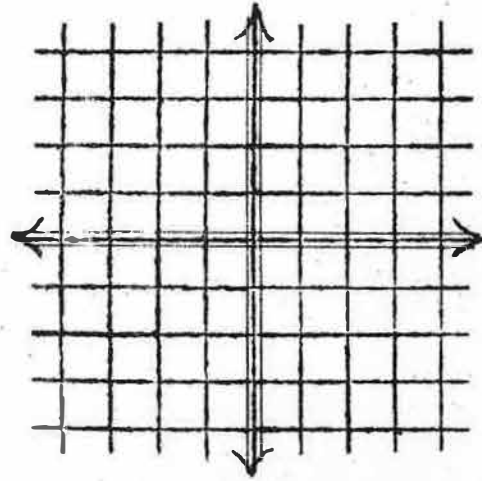Class Days _____ Hours _____
Instructor _____

Instructions: While watching the video tape, fill in the following table. Mr. Brook will help you calculate a few of the values, the rest you must do on your own. Then transfer the tabulated values on to the graph provided. If you have trouble at any time feel free to ask one of the tutors for help. After you have finished filling in the table and plotting the points on the graph draw a smooth curve through your points. What size of cut out square will yield the largest volume?
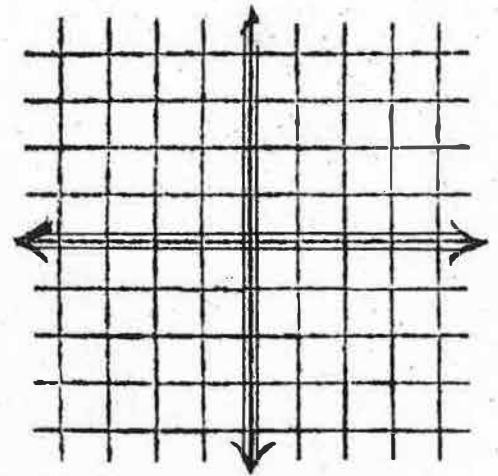
SIZE OF CUT OUT SQUARE	LENGTH OF BASE (L)	WIDTH OF BASE (W)	AREA OF BASE (LW)	HEIGHT (H)	VOLUME (LWH)
0					
.1					
.2					
.3					
.4					
.5					
.6					
.7					
.8					
.9					
1.0					
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
2.0					

1. Cartesian Plane

   a. X axis

   b. Y axis

   c. Origin

   d. Point

   e. coordinates

   f. abscissa

   g. ordinate

   h. quadrant

   i. Graphing points

Sketch and label the points whose coordinates are:

1. (3, 4)

2. (4, 3)

3. (-3, -4)

4. (2, -3)

5. (-3, 2)

6. (0, 2)

7. (-2, 0)
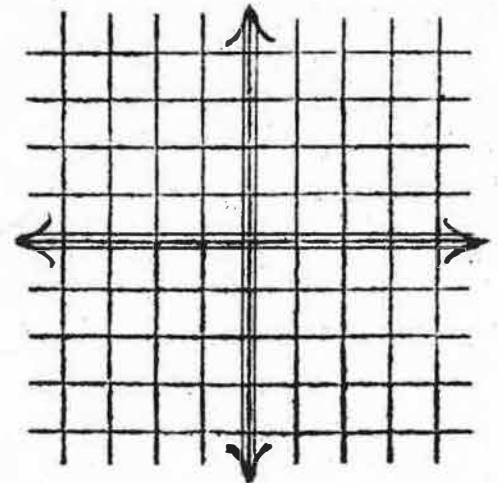
What quadrants are the above points in.

1.   2.   3.   4.   5.   6.   7.

II. Equations in Two Variables

   A. Solutions for equations in two variables.

     1. Is (3, -2) a solution for $y = -2x + 4$?

     2. Is (-2, 3) a solution for $y = -2x + 4$?

     3. Find six more solutions for $y = -2x + 4$.

     4. Graph all six solutions. Label the points!

I. Write in words the method for finding the y-intercept of the graph for $2x - 3y = 7$.

_____

_____

_____

The y-intercept for $2x - 3y = 7$ is (-, -).

II. Write in words the method for finding the x-intercept of the graph for $2x - 3y = 7$.

_____

_____

_____

The x-intercept for $2x - 3y = 7$ is (-, -).

III. Solve $2x - 3y = 7$ for y

IV. Write an equation of a line parallel to the graph of $2x - 3y = 7$.

V. Find the simultaneous solution for:

$2x + 3y = 7$
$3x + 4y = -1$

Hint: Multiply top equation by 3. Multiply bottom equation by -2 then add the corresponding sides together.

VI. Write in words the method for finding an equation whose graph is parallel to $2x - 3y = 7$.

_____

_____

_____

_____

VII. Find the simultaneous solution for:

$2y = 4x - 6$
$3x - 2y = 4$

Hint: Solve the top equation for y and substitute this value into the 2nd equation.